Analysis of the Adequacy of Wetlands and Wildlife Mitigation

Technical Report

Legacy Parkway

September 2005

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Executive Summary

The purpose of this technical report is to provide a detailed analysis of the effectiveness of proposed mitigation to replace wetlands and wildlife functions that would be lost or reduced by the Legacy Parkway from direct and indirect impacts. This report addresses comments regarding wetlands and wildlife mitigation made to the Draft Supplemental EIS by the Environmental Protection Agency, U.S. Fish and Wildlife Service, and Utah Division of Wildlife Resources.

Information is presented on currently proposed wetland and wildlife mitigation measures to compensate for the direct and indirect impacts from Alternative E. If the lead agencies select a different alternative, mitigation measures for that alternative will be developed and analyzed.

The 2004 Draft Supplemental EIS concluded that Alternative E would result in adverse direct and indirect effects to wetlands and wildlife in the study area. However, the Draft Supplemental EIS also concluded that these impacts alone would not likely affect the long-term viability of any wildlife species in the Great Salt Lake ecosystem. The Legacy Nature Preserve would protect and enhance 2100 acres of valuable habitat in the Great Salt Lake Ecosystem for birds and other wildlife species. This report does not present management goals for the Preserve; rather, it discusses proposed measures to effectively mitigate impacts to wetland and wildlife resources that have been identified in the Draft Supplemental EIS.

To address implementation, maintenance, and monitoring requirements for mitigation activities on the Preserve, an overview of the mitigation plan for the Legacy Nature Preserve will be included in the Final SEIS. A Final Mitigation Plan (separate from this report) would be approved by the Corps of Engineers when it takes action on the application for Section 404 permit amendment.

1.0 Introduction

The purpose of this technical report is to provide a detailed analysis of the effectiveness of mitigation proposed to compensate for the wetlands and wildlife functions that would be lost or reduced by the Legacy Parkway from direct and indirect impacts. This report is not an impact analysis, but it does summarize impacts presented in the 2000 Final EIS and 2004 Draft Supplemental EIS to provide a baseline from which to analyze the effectiveness of mitigation.

1.1 Objectives

In order to evaluate the effectiveness of mitigation, this report presents information on currently proposed wetland and wildlife mitigation measures to compensate for the direct and indirect impacts from Alternative E, the alignment on which UDOT has submitted an application for Section 404 permit modification. If the lead agencies select a different alternative, mitigation measures for that alternative will be developed and analyzed. This report accomplishes the following objectives:

- Provide a history of the Legacy Nature Preserve (the Preserve). Although the Preserve concept was presented in the Draft Supplemental EIS, this report supplements existing information.
- Present an evaluation of proposed measures to mitigate impacts to wetland functions.
- Provide an accounting of proposed measures to compensate for impacts to wildlife (beyond the analysis completed for wetlands) in light of the comprehensive wildlife impact assessment conducted for the Draft Supplemental EIS.
- Present additional information requested by the Environmental Protection Agency, U.S. Fish and Wildlife Service, and Utah Division of Wildlife Resources.

In summary, this report presents numerous perspectives for comparing impacts to proposed mitigation such as wetland vegetation cover types, hydrogeomorphic (HGM) classes, HGM functions, wildlife habitat types, and Great Salt Lake level changes.

1.2 Background of the Legacy Nature Preserve

This section provides a brief history of the development of the Legacy Nature Preserve. As described in the Final EIS, the concept of a Preserve was developed through input from resource agencies and other experts familiar with the Great Salt Lake Ecosystem and through consideration of existing programs to protect wetlands and wildlife habitats along the Great Salt Lake (i.e., wildlife refuges, mitigation sites, duck clubs, and conservation groups; see Appendix B-3 in the Final EIS). The amount of land needed for this mitigation was determined by evaluating the impacts of the project. Land was included in three stages.

1. The initial amount of 1,251 acres was determined during the preparation of the Draft EIS. This acreage was based on the amount of land needed to mitigate the impacts to wetlands from the road project. The impacts were measured in terms of loss of wetland functions based on an analysis using wetland functional assessment models based on the hydrogeomorphic (HGM) approach.

2. Next, 317 acres adjacent to the Farmington Bay Waterfowl Management Area (FBWMA) were added during the preparation of the Final EIS to mitigate for impacts to wildlife that the U.S. Fish and Wildlife Service (USFWS) felt were not captured by the original 1,251 acres based on the functional assessment analysis (such as noise disturbance and other indirect effects). The USFWS stated that the area containing the additional 317 acres is important to wildlife during high Great Salt Lake levels; was a major bird use area during the 1985 flood event; and would provide a buffer to FBWMA from future development.

3. Finally, 530 acres were added to the Preserve during the preparation of the Records of Decision by the U.S. Army Corps of Engineers (Corps) and the Federal Highway Administration (FHWA). These parcels addressed concerns raised by the Environmental Protection Agency (EPA).

   The addition of these specific areas (317 acres and 530 acres) involves discrete parcels that the resource agencies felt provided benefits for wetlands and wildlife, including buffering and continuing the length and breadth of the Preserve along the proposed Parkway.

The size of the mitigation area approved by the Corps and FHWA totaled about 2,100 acres. (The calculated areas from parcel descriptions totaled 2,098 acres, but geographic information system [GIS] data currently show the Preserve to be 2,105 acres.) The same 2,100 acres are currently proposed by the Utah Department of transportation (UDOT) as the Legacy Nature Preserve (see Figure 1, Legacy Nature Preserve). These 2,100 acres contain:

- 778 acres of jurisdictional wetlands.
- An additional 8 acres of wetlands (mapped without jurisdictional determination) have been physically restored by removing dumpsites and fill material.
- Currently, the Preserve contains nearly 900 acres of wetland complexes and riparian habitats that include areas delineated as jurisdictional wetlands and non-jurisdictional riparian areas.
- The Preserve also contains over 1,200 acres of upland habitat (croplands, pasture, and desert salt scrub habitats) and about 3 acres of developed land (mainly old fill material that would be removed).

Throughout the process of developing appropriate mitigation for impacts to wetland and wildlife resources from the Proposed Action (Alternative E) described in the Draft Supplemental EIS, the lead agencies, technical consultants and resource agencies developed concepts for the Preserve. The following primary mitigation components were incorporated into the Preserve:

- **Preservation.** Open space in Davis County is being developed at the rate of about 280 hectares (700 acres) per year (Sommerkorn 2004). All mitigation properties would be purchased and deed restricted to protect wetland and upland habitats in perpetuity from encroaching development and to buffer adjacent areas important for wildlife in the Great Salt Lake ecosystem such as FBWMA.
- **Enhancement and Restoration.** Mitigation properties in the Preserve have been subject to years of human activities and disturbances (i.e., draining, filling, dumping, flood irrigation, and grazing) that have caused extensive hydrologic alterations to and degradation of wetland and upland habitats. Restoration measures would increase wetland functions in the Preserve and the overall productivity of wildlife habitats.
- **Creation.** Additional wetlands would be created to provide added functions for wetland mitigation and wildlife use.

The Preserve lands are an integral part of the existing wetland and associated upland habitat complexes along the eastern shore of the Great Salt Lake that

currently provide foraging, nesting, and staging habitat for millions of migratory waterfowl and shorebirds each year. The preservation, enhancement/restoration, and creation of habitats within the Preserve area would provide a regional benefit to wildlife. The Preserve would become a major link in the chain of protected ecological areas along the shoreline of the Great Salt Lake (see Figure 2, Protected Areas).

The development of management goals is not part of this document, but UDOT has recently established a *Collaborative Design Team* (CDT) to provide recommendations to the Corps of Engineers for long-term management options for the Legacy Nature Preserve. This team includes resource agencies and other stakeholders that provide diverse expertise and a regional perspective for wildlife management. Management goals will be discussed in the Final Mitigation Plan that would be approved by the Corps when it takes action on the application for Section 404 permit amendment.

1.3 Summary of Impacts

This section provides a brief overview of wetland and wildlife impacts described in the Draft Supplemental EIS. Detailed information on impacts to these resources is provided in Draft Supplemental EIS Section 4.12, *Wetlands*, and Section 4.13, *Wildlife*, and in the Legacy Parkway Wildlife Impacts Analysis Technical Memorandum (wildlife technical memorandum). For wetland and wildlife resources, 1997 was selected as an appropriate baseline year to compare impacts among the Draft Supplemental EIS alternatives.

1.3.1 Wetland Impacts

Alternative E as described in the Draft Supplemental EIS has a right-of-way width of 312 feet. For purposes of the mitigation analysis, it is assumed that all wetlands within the right-of-way are directly impacted and that wetlands within 1,000 feet of the right-of-way are indirectly affected. Table 1-1 provides an overview of wetland impacts for Alternative E in acres.

Table 1-1. Direct and Indirect Wetland Impacts by Acres

312-ft Right-of-Way	Alternative E
Acres within right-of-way	113
Acres indirectly affected	595

The Legacy Parkway design for Alternative E has been developed and modified to avoid sensitive resources. Although the right-of-way for Alternative E contains 113 acres of wetlands, only 103 acres would be filled. The remaining wetlands

within the right-of-way would be protected. However, the mitigation analysis assumes that all 113 acres of wetlands would be directly impacted.

Table 1-2 below provides an overview of wetland impacts as measured in functional capacity units calculated functional assessment models developed for the project that are based on the hydrogeomorphic (HGM) approach. The HGM approach is a procedure for measuring the capacity of a wetland to perform various functions. First, wetlands are classified based on ecological characteristics (such as landscape setting, water source, and hydrodynamics). Next, reference sites are selected to establish functional ranges. A relative index of function (calibrated to reference sites) is used to assess functions. Finally, to calculate units that describe both quality and quantity of functions, the indices (called functional capacity indices) are multiplied by the wetland area to generate functional capacity units (FCUs). (See Appendix D in the Draft Supplemental EIS for further information on the functional assessment analysis.)

The Legacy wetlands functional assessment team developed low-resolution models based on the HGM approach in which wetland basins were delineated and classified into three broad wetland classes (or HGM categories): *basin depressional*, *lacustrine fringe*, and *groundwater slope*. Delineated wetlands were further described by their wetland vegetation cover type, similar to subclasses under the Cowardin Classification System (Cowardin et al. 1979): *marsh*, *wet meadow*, *playa*, *scrub-shrub*, *forested*, *unconsolidated shore*, and *open water*. However, the models were not designed to capture functional differences among different cover types. For the Final EIS, impacts were quantified in FCUs and, in some instances, totaled across different HGM wetland classes. Since the Final EIS was published, the Corps has clarified how to more appropriately present and analyze HGM calculations. Namely, HGM classes with different reference sites have different calibrations and should not be combined (Corps 2003).In this technical report, no FCUs for different HGM classes (depressional, lacustrine, slope) are combined. FCUs are presented by HGM class for each of the five modeled functions.

The results in Table 1-2 represent a worst-case scenario because the models did not incorporate design features developed for the proposed roadway that would minimize or avoid impacts such as vegetated filter strips and equalization culverts.

Table 1-2. Direct and Indirect Wetland Impacts by Functional Capacity Units (FCUs)

HGM Function	HGM Category	Direct FCUs Impacted[a]	Indirect FCUs Impacted	Total FCUs Impacted
1 – Maintain Wetland Hydrology	Depressional	37	15	53
	Slope	10	19	30
	Lacustrine Fringe	13	54	67
2 – Removal of Dissolved Elements and Compounds	Depressional	38	17	53
	Slope	11	19	30
	Lacustrine Fringe	20	22	45
3 – Particulate Retention	Depressional	37	19	56
	Slope	10	14	24
	Lacustrine Fringe	16	30	46
4 – Habitat Structure	Depressional	23	10	32
	Slope	12	14	27
	Lacustrine Fringe	17	23	40
5 – Habitat Connectivity, Fragmentation, Patchiness	Depressional	30	20	51
	Slope	11	21	32
	Lacustrine Fringe	15	32	47

[a] Assumes direct impacts to 113 acres of wetlands

1.3.2 Wildlife Impacts

In response to the 10th Circuit Court's remand of the Legacy Parkway Final EIS, the federal lead agencies expanded the scope of the wildlife analysis presented in the Final EIS (see Draft Supplemental EIS Section 2.5, *Wildlife Impacts Analysis*). The wildlife technical memorandum was prepared to document the process and analysis for addressing wildlife impacts. Potential impacts evaluated in the wildlife technical memorandum include:

- Direct habitat loss
- Habitat fragmentation
- Changes in habitat quality
- Habitat modification
- Wildlife mortality
- Artificial light disturbance
- Highway noise disturbance

- Human disturbance
- Effects on special-status wildlife
- Cumulative impacts
- Habitat availability in the context of lake level changes

Wildlife habitat within both the project study area and the regional study area was quantified in order to analyze potential impacts to wildlife in the Great Salt Lake ecosystem from the build alternatives for the proposed Legacy Parkway. This report addresses mitigation for Alternative E only. The direct habitat impacts analysis represents a worst-case scenario because it assumed that all wildlife habitats within the 312-foot right-of-way would be totally lost. Calculations of direct habitat losses from Alternative E are provided in Table 1-3.

Table 1-3. Direct Wildlife Habitat Losses from Alternative E

Wildlife Habitat Type	Habitat Loss (acres)
Wetland Complex/Riparian Habitat	129.5
Upland Habitat	458.3
Total Habitat Loss	**587.8**

Notes:

1. Wetland complex/riparian wildlife habitat is not exactly the same as "jurisdictional wetlands" as defined in Draft Supplemental EIS Section 4.12, *Wetlands*. Wetland/riparian wildlife habitat includes jurisdictional areas as well as nonjurisdictional riparian areas and other mesic habitats. This difference is discussed in greater detail in Appendix B of the wildlife technical memorandum.
2. Since publication of the Draft Supplemental EIS, the 1997 habitat mapping was updated based on aerial photographs and field visits (the previous mapping was based primarily on readily available GIS data). The data provided in this table for 1997 are from the revised mapping.

The wildlife technical memorandum concluded that all the Legacy Parkway build alternatives would result in adverse direct and indirect effects (such as fragmentation, noise, and artificial light) and would contribute to cumulative habitat loss, habitat fragmentation, and noise effects on local wildlife populations, including migratory birds. However, the wildlife technical memorandum also concluded that these impacts alone would not likely affect the long-term viability of any wildlife species in the Great Salt Lake ecosystem.

2.0 Mitigation Measures

This section provides information on preservation, enhancement, restoration, and creation measures for the entire 2,100-acre Legacy Nature Preserve, which is proposed as compensation for direct and indirect wetland and wildlife impacts from the proposed Legacy Parkway. As stated above in Note 1 of Table 1-3, wetland complex/riparian wildlife habitat is not exactly the same as jurisdictional wetlands. Some wetland and wildlife functions in the study area are highly interrelated. However, to address how proposed mitigation measures relate to different resource functions and regulations, separate analyses for wetlands and wildlife are presented. The following sections discuss each resource area separately.

2.1 Wetland Mitigation

For convenience, wetland mitigation measures are described in terms of the three-step sequencing analysis used in the Section 404 wetlands mitigation program: avoidance, minimization, and compensation.

2.1.1 Avoidance

Wetland impacts associated with this project have been evaluated in accordance with Section 404(b)(1) guidelines. The project reflects a long process of wetland avoidance. The region has long planned for a western roadway, desiring it to be placed as far west as possible to maximize developable land. This desire is reflected in the Western Transportation Corridor MIS (see Final EIS Section 1.1.4, *Description of the North Corridor and Proposed Action*). Five regional roadway corridors were initially considered in the Final EIS. As discussed in Draft Supplemental EIS Section 3.0, *Alternatives*, regional corridors were evaluated at a corridor-planning level and compared by cost, impacts on wetlands, and environmental impacts on existing developed areas. Some regional corridors were eliminated from further consideration to avoid large wetland impacts. Within regional corridors carried forward for further consideration, the location of specific build alternatives were determined, in part, to avoid wetland impacts.

The preferred alternative selected for the Final EIS was a combination of alignments presented in the Draft EIS that was developed to avoid wetlands impacted by the locally preferred alternative identified in the Draft EIS. For the Draft Supplemental EIS, additional wetland impacts were avoided and minimized, as described below.

2.1.2 Minimization

Under all of the proposed build alternatives, measures to minimize impacts on wetlands were incorporated into the design of the alternatives. The Final EIS and Section 404 permit required wetland impact minimization within the project right-of-way. For the Draft Supplemental EIS, the original 328-foot right-of-way was reduced to 312 feet in attempt to minimize wetland impacts (see Section 2.1 in the Draft Supplemental EIS). Other design modifications have further reduced direct wetland impacts from 113 acres to 103 acres.

Impacts to wetlands hydrology (HGM Function 1) will be minimized as described below. The Final EIS identified equalization culverts as the primary method for conveyance of water across the roadway corridor to maintain wetland hydrology. Based on more specific design during the design-build process, the Draft Supplemental EIS identifies various techniques for facilitating the movement of surface and groundwater to maintain wetland hydrology (see Draft Supplemental EIS Section 4.10, *Water Quality*). The specific type of structure would be a design decision, but the following general guidelines would be used:

- To ensure that the natural floodplain values of the study area would not be lost, equalization culverts or their equivalent will be placed within the Corps 100 year floodplain. These culverts would be placed under the Parkway to capture runoff from the upstream side of the roadway and discharge it to the downstream side in a manner to maintain sheet flow characteristics and limit any discharges to less than 5 cubic feet per second (see Draft Supplemental EIS Figure 4.14-2).
- Culverts or bridges would be constructed where streams and rivers intersect the roadway. In addition to minimizing impacts to wetland hydrology, larger culverts and bridges will minimize impacts to HGM Wetland Function 5, Habitat Connectivity, Fragmentation, Patchiness by facilitating wildlife movement.
- Groundwater conveyance structures including French drains, strip drains, synthetic drainage nets, or gravel layers would be constructed for groundwater movement under the road where fill heights exceed about 10 feet.

As described in the Draft Supplemental EIS, in 2001 a network of piezometers was installed parallel to the fill areas to investigate hydrology. Preliminary results of this ongoing study revealed that the groundwater level in the area is very shallow; the shallow groundwater supporting wet meadow and emergent marsh wetlands is derived largely from vertical flow of water from deeper aquifers; irrigation, other surface waters, and precipitation are secondary sources of

hydrology for the shallow groundwater table. Preliminary results of the study suggest that the water supply to the shallow aquifer which in turn supports some wetlands in the project study area is not likely to be seriously affected by highway construction, with the possible exception of areas immediately adjacent to the right-of-way. Wetlands, including many depressional wetlands in the study area, that are mainly supported by surface water flows (rather than groundwater) would be affected by interruptions to surface connections from the project. These effects would be mitigated by the crossing structures discussed above.

Impacts to water quality can affect wetland functions. Section 4.10, *Water Quality*, discuses environmental consequences and mitigation measures with respect to water quality. Mitigation measures for minimizing impacts on water quality from implementation of the roadway were developed in coordination with the Utah Department of Environmental Quality, the Corps, and UDOT. The best management practices (BMPs) identified in the Final EIS and the Corps' Record of Decision would be employed during project construction. These construction BMPs include implementation and maintenance of erosion and siltation controls (such as silt fences and check-dams) and environmental compliance training for construction personal.

Vegetated swales would be used to minimize operational impacts to water quality. Stormwater runoff would be routed into these swales to slow water and permit treatment. The following water quality improvements can be attributed to this type of treatment approach: reduction of nutrient concentrations by soil and vegetative uptake processes, breakdown of hydrocarbons by bacteria degradation, filtering of suspended solids from runoff, and increased settling of solids. Hence, incorporating vegetated swales to treat stormwater would minimize impacts to both HGM Function 2, Removal of Dissolved Elements and Compounds, and Function 3, Particulate Retention.

Design flexibility within the 312-foot right-of-way will likely result in additional minimization of wetland impacts or avoidance of direct wetland impacts. For example, the footprint for the roadway and trail facility can be reduced to 264 feet in some places to avoid or reduce wetland impacts. In other places, extending the footprint to 312 feet could leave more wetlands intact between the roadway and the trail.

2.1.3 Compensation

The Legacy Parkway project proposes to use three forms of compensation for wetland impacts: preservation, restoration/enhancement, and creation. In the Final EIS, HGM credits were calculated to analyze the need for the preservation and restoration/enhancement elements of the original 1,251-acre preserve. The

Final EIS also presented qualitative descriptions of the benefits of the proposed mitigation. During preparation of the FHWA's and Corps' respective Records of Decision, HGM credits were calculated for the remainder of the 2,100-acre Nature Preserve.

After the Corps' Record of Decision was approved, UDOT developed conceptual plans for the third form of compensation—creation of wetlands. These wetlands would be created by using artesian flow to develop additional wetland hydrology for use in the mitigation area. All three of these forms of compensation are described in detail in the following sections.

The effects of implementing the Legacy Parkway adjacent to the mitigation site were also taken into consideration by the functional assessment team and were incorporated into the HGM models. For calculation purposes and based on ecological considerations, the assessment team considered that any wetland that was within 300 meters (1,000 feet) of the highway would have diminished wetland functions (highway influence). The net mitigation FCUs presented for each function were calculated using the following HGM equation:

Net FCUs = (Preservation Credits + Restoration Credits + Creation Credits) – Highway Influence Deductions

Preservation

Favoring preservation over creation was justified as a component of the mitigation plan because wetlands in the study area have been affected by past development and, based on information presented in the Final EIS, are at extreme risk from future development. The Corps may allow compensatory mitigation credit when existing wetlands or other aquatic resources are preserved in conjunction with establishment, restoration, and enhancement activities. In exceptional circumstances the Corps allows preservation as the sole basis for generating mitigation credits; specifically, if protecting and maintaining wetland functions are important to the region and if the wetlands are subject to demonstrable threat of loss or substantial degradation (Corps 2002; EPA 1990).

Based on data presented in the Final EIS and the Draft Supplemental EIS, wetlands in the study area *are* under demonstrable threat of loss or substantial degradation from human disturbance and other land use changes. They face continued threats from projected growth and development in and west of the study area. The Final EIS explained that open space in Davis County is being developed at the rate of about 280 hectares (700 acres) per year, which would lead to most of the study area being developed by 2020. This continued rate of development, which was verified for the Draft Supplemental EIS, would cause direct and indirect impact to wetland resources (Sommerkorn 2004).

Additionally, due to hydrologic modifications such as diking and channelization, natural dynamic processes have been diminished in much of the area along the eastern shoreline of the Great Salt Lake. The Nature Preserve would protect wetland complexes associated with the lake that are regionally important and would maintain a buffer between the lake and developed lands in perpetuity. The Preserve also contains a large amount of lands identified as critical protection areas in the Davis County Wetlands Conservation Plan. All Preserve properties would be deed-restricted and eventually transferred to a conservation oriented third party.

While preservation is an important component of the proposed mitigation package, it does not rely solely on preservation. In fact only 30% of the total mitigation credits generated by the functional assessment models were derived from preservation. Consistent with current guidance, preservation would augment functions of newly established, restored, or enhanced aquatic resources (Corps 2002).

To determine how excluding development from the Preserve benefits wetlands, the Final EIS used a functional assessment model to quantify the difference in wetland quality between two future scenarios; the first scenario being one with the Preserve and the parkway in place, and the second scenario being without the Parkway and the Preserve. A key assumption of a no project scenario was that, in the absence of the Preserve, most of the uplands above the FEMA floodplain boundary (4212') would be developed. It was assumed no development would take place below 4212', because while it is possible to develop below 4212', it rarely happens. Therefore, no credit was given for preventing development below 4212'. A second key assumption was that development would occur next to wetlands but not in wetlands. No wetlands would be filled and therefore no authorization would be needed from the Corps. Under this conservative future development scenario, wetlands in close proximity to development (within 1000') would have their functions reduced by 30-50%. The prevention of this functional loss is the benefit that was quantified. Although called "preservation credit" it is more accurately viewed as credit for excluding development on developable uplands and preventing indirect impacts to wetlands.

Because the Final EIS assumed that the loss of wetland function due to projected development would likely occur over a 20-year period, the modeled HGM results were reduced (discounted) to take into consideration this time effect. As a conservative estimate, the calculated preservation benefits were divided by 2.

Table 2-1 provides the results of this analysis in functional capacity units (FCUs) that were calculated as the benefit wetlands would receive with the entire 2,100-acre Nature Preserve in place.

Table 2-1. Preservation Credits (FCUs) Calculated for the Legacy Nature Preserve

HGM Function	Wetland Acres that Received Credit for Preservation	HGM Category	Net Preservation FCUs – One-Half of Total Credits Calculated
1 – Maintain Wetland Hydrology	777	Depressional	14
		Slope	32
		Lacustrine Fringe	59
2 – Removal of Dissolved Elements and Compounds	777	Depressional	1
		Slope	-7
		Lacustrine Fringe	6
3 – Particulate Retention	777	Depressional	29
		Slope	20
		Lacustrine Fringe	28
4 – Habitat Structure	777	Depressional	12
		Slope	23
		Lacustrine Fringe	35
5 – Habitat Connectivity, Fragmentation, Patchiness	777	Depressional	20
		Slope	35
		Lacustrine Fringe	43

While nearly all of mitigation wetlands received preservation credit to some degree, many wetlands received very little preservation credit, especially those located below 4,212 feet. In comparing the FCU's gained through preservation with restoration/enhancement and creation, preservation only accounts for 30% of total mitigation credits (29% for depressional wetlands, 42% for slope wetlands, and 20% for lacustrine fringe wetlands). The calculated credits for preservation are similar to the amount of credits calculated if 70 acres of high-functioning wetlands were created: 15 acres depressional, 21 acres slope, and 34 acres lacustrine fringe.

Restoration and Enhancement

In addition to preservation, the mitigation plan as approved in the Corps' Record of Decision also included enhancements that would restore some of the wetland functions lost due to past land use changes. These restoration measures include:

- Removing and prohibiting traditional livestock grazing
- Removing trash, debris, fill material, and structures
- Controlling noxious and invasive plants

- Fencing the mitigation boundary to control trespassing
- Removing internal fences
- Removing roads not needed for management, contouring to natural grade, and reseeding
- Filling ditches and plugging tile drains, contouring to natural grade, and reseeding
- Removing buildings not needed for management, contouring to natural grade, and reseeding
- Relocating utilities from mitigation lands to the extent practicable
- Re-establishing the hydrologic connection between the Jordan River and its historic floodplain by constructing water-control structures
- Managing the Jordan River floodplain for wetlands by constructing berms and water-control structures
- Connecting an old channel meander to create an island
- Obtaining water rights to maintain restored wetland hydrology
- Drilling wells for slope wetland mitigation
- Hiring full-time site manager to oversee mitigation activities

In addition to describing the qualitative benefits of these steps, the wetlands functional assessment models were used to quantify the improvements in wetland functions that would result from these measures. There are various definitions for what constitutes enhancement versus restoration. According to Corps regulatory guidance, the proposed measures would largely be considered "rehabilitative restoration":

> The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural or historic functions of a degraded wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres (Corps 2002).

Using this definition, the measures described in the list above fall into the category of "rehabilitative restoration" rather than the current Corps definition for wetland "enhancement":

> The manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or to change the growth stage or composition of the vegetation present. Enhancement is undertaken for specified purposes such as water quality, flood retention, or wildlife habitat. Enhancement results in a change in wetland function(s) and can lead to a decline in other wetland functions, but does not result in a net gain of wetland acres. This term includes

activities commonly associated with enhancement, management, manipulation, and directed alteration (Corps 2002).

While the Final EIS referred to several of the proposed mitigation measures as enhancement, these measures are now more appropriately classified as rehabilitative restoration in accordance with clarification provided by the current definitions presented above. The primary intent of proposed mitigation measures is not is intensify any functions at the cost of another, but to restore all wetland functions to more natural, higher-functioning conditions.

Table 2-2 provides the amount of delineated wetland acres that received restoration/enhancement credits (restoration FCUs) as well as the number of FCUs calculated for each HGM function in the entire 2,100-acre Preserve.

Table 2-2. Restoration Credits Calculated for the Legacy Nature Preserve

HGM Function	Wetland Acres that Received Restoration Credit	HGM Category	Restoration FCUs by HGM Function
1 – Maintain Wetland Hydrology	321	Depressional	24
		Slope	0
		Lacustrine Fringe	70
2 – Removal of Dissolved Elements and Compounds	703	Depressional	36
		Slope	35
		Lacustrine Fringe	116
3 – Particulate Retention	777	Depressional	22
		Slope	23
		Lacustrine Fringe	121
4 – Habitat Structure	777	Depressional	59
		Slope	18
		Lacustrine Fringe	230
5 – Habitat Connectivity, Fragmentation, Patchiness	776	Depressional	44
		Slope	9
		Lacustrine Fringe	152

Almost all of the mitigation wetlands received restoration credit (for at least some functions). Where the most extensive restoration/enhancement measures have been proposed, wetlands received the most credits per wetland acre (wetlands in the Jordan River floodplain restoration area received 38% of total restoration credits). In comparing average functional scores of preservation with restoration/enhancement and creation, restoration accounts for 62% of total mitigation credits (71% for depressional wetlands, 34% for slope wetlands, and 80% for lacustrine fringe wetlands).

A second type of restoration has occurred on the Nature Preserve that was not considered in the Final EIS. This is the unanticipated physical restoration of wetlands, classified by Corps guidance as "re-establishment":

> The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural of historic functions to a former wetland. Re-establishment results in rebuilding a former wetland and results in a gain of wetland acres (Corps 2002).

The functional assessment did not consider the possibility that some of the mitigation measures identified above would restore areas that had lost their wetland characteristics. Physical restoration has occurred in some areas where the removal of fill material and debris has re-established about 8 acres of wetlands. Given these achievements, the planned additional restoration work could re-establish additional wetlands; however, this mitigation analysis does not calculate any such additional wetland restoration.

Creation

Based on decision described in the Corps' Record of Decision, UDOT was required to modify the mitigation plan and develop conceptual plans for drilling artesian wells to create wetlands to adequately mitigate for the loss of groundwater-slope wetlands. The wetland functional assessment models were used to calculate the level of wetland function that would result from the creation of 12 acres of wetlands in which hydrology would be provided by the development of artesian flow. The assessment model calculations initially proposed 12 acres of creation, however, currently calculations show that fewer than 12 acres may be sufficient to adequately mitigate impacts. UDOT will continue planning to create 12 acres as practicable and would be required to create at least enough acres to sufficiently mitigate all functions.

Table 2-3 below provides HGM credits calculated for the creation of 12 acres of groundwater-slope wetlands.

Table 2-3. Creation Credits (FCUs) Calculated for the Legacy Nature Preserve

HGM Function	Wetland Acres To Be Created	HGM Category	Creation FCUs by Function
1 – Maintain Wetland Hydrology	12	Slope	12
2 – Removal of Dissolved Elements and Compounds	12	Slope	12
3 – Particulate Retention	12	Slope	12
4 – Habitat Structure	12	Slope	12
5 – Habitat Connectivity, Fragmentation, Patchiness	12	Slope	12

Relative to other mitigation components, very little credit has been calculated for wetlands creation (8% of total mitigation credits; 24% of mitigation credits for slope wetlands). Again, the majority of the calculated credits are attributed to restoration measures (62%).

Highway Influence

In determining the benefits of the wetland mitigation, the functional assessment team recognized that the construction of the Legacy Parkway would reduce the wetland functions of mitigation areas on parts of the Preserve that were near the Parkway. For calculation purposes based on ecological considerations, the assessment team assumed that was within 300 meters (1,000 feet) of the highway would have diminished wetland functions. (See Appendix D in the Draft Supplemental EIS for an explanation of why 1,000 feet was selected as the distance for evaluating indirect effects.) Accordingly, the wetland functional assessment models calculated a diminished amount of wetland functional benefit for those portions of the proposed mitigation area.

For each wetland basin, the highway deduction (calculated in FCUs) was based on the areal percentage of a 1,000-foot buffer around the wetland basin that would be taken up by the road (the closer a wetland to the roadway, the greater the calculated deduction). Table 2-4 below provides the amount of wetlands in acres assumed to be subject to highway influence (within 1,000 feet of the Alternative E alignment) and the number of HGM deductions (FCUs) calculated for each of the five functions.

Table 2-4. Highway Influence Deductions Calculated for the Legacy Nature Preserve

HGM Function	Wetland Acres that Received Highway Deduction	HGM Category	Highway Deduction in FCUs
1 – Maintain Wetland Hydrology	255	Depressional	-6
		Slope	-9
		Lacustrine Fringe	-24
2 – Removal of Dissolved Elements and Compounds	255	Depressional	-4
		Slope	-4
		Lacustrine Fringe	-17
3 – Particulate Retention	255	Depressional	-8
		Slope	-3
		Lacustrine Fringe	-16
4 – Habitat Structure[a]	255	Depressional	-2
		Slope	-4
		Lacustrine Fringe	-16
5 – Habitat Connectivity, Fragmentation, Patchiness[a]	255	Depressional	-5
		Slope	-9
		Lacustrine Fringe	-21

[a] Deductions for wildlife functions (4 and 5) in the table only models deductions that were incorporated into the HGM wetland functional assessment models. As discussed in Section 2.2 of this report (and in the wildlife technical memorandum), highway noise would affect larger portions of the Preserve than what the HGM models assume and could thereby further reduce wildlife functions (within both wetlands and uplands) in the Preserve.

The HGM functional assessment models assumed that 255 acres of wetlands would be affected by the highway. Note that the average deduction is similar to the amount of debits calculated if 30 acres of high-functioning wetlands were lost by direct fill: 5 acres depressional, 6 acres slope, and 19 acres lacustrine fringe.

Summary Comparison of Wetland Impacts to Mitigation

This report provides two common quantitative methods for comparing wetland impacts to mitigation: (1) wetland acres and (2) functional debits and credits, in terms of HGM functional capacity units. While Alternative E would directly impact 103 acres of jurisdictional wetlands, proposed mitigation would protect 778 acres of jurisdictional wetlands and preserve adjacent uplands in the 2,100-acre Legacy Nature Preserve.

Recall the HGM equation used to calculated net mitigation FCUs:

Net FCUs = (Preservation Credits + Restoration Credits + Creation Credits) – Highway Influence Deductions

Table 2-5 compares calculations for wetland functions impacted (direct plus indirect impacts) versus net mitigation credits.

Table 2-5. Comparison of Net FCUs by HGM Function and Category – FCUs Impacted (FCUs Mitigated by Preserve)

Wetland Type	FCU 1	FCU 2	FCU 3	FCU 4	FCU 5
Depressional	53 (32)	53 (33)	56 (43)	32 (69)	51 (59)
Groundwater Slope	30 (35)	30 (36)	24 (53)	27 (48)	32 (47)
Lacustrine Fringe	67(105)	45 (105)	46 (133)	40 (249)	47 (174)

Table 2-5 shows that proposed mitigation provides excess FCU credits for a majority of the modeled wetland functions. FCU debits (direct and indirect impacts) exceed mitigation credits for depressional wetlands only for functions 1, 2, and 3, while the ratio of FCU credits to debits for the same functions (1, 2, and 3) is about 1.5:1 for slope wetlands and about 2:1 for lacustrine fringe wetlands.

Corps guidance states that wetlands mitigation generally should provide, at minimum, one-to-one functional replacement. Note that this analysis does not include the 8 acres of wetlands that have been re-established; most of these restored wetlands would be classified as depressional. Notwithstanding, functions 1, 2, and 3 for depressional wetlands may appear “under-mitigated”, however, the impacts are overstated because minimization measures, described in Section 2.1.2, would help maintain some degree of function to wetlands adjacent to the project. Some degree of “out-of-kind” replacement is acceptable because the opportunities to restore wetlands are limited. For example, to mitigate for all impacts to hydrology through restoration, one would need to find a 14-mile levee to remove or deep ditch to backfill that is next to the same proportion of different wetland types as the proposed project alignment. Because such opportunities may not exist, it is not practical to always expect strict one-to-one functional replacement when relying on restoration over creation. Hence, the Corps can determine “out-of-kind” replacement appropriate when considered ecologically beneficial to the region (Corps 2002).

The mitigation site characteristics and Preserve location are considered regionally important to the Great Salt Lake ecosystem. However, although HGM FCUs for each of the three HGM classes are not additive, two of the HGM wetland classes are not necessarily very different from one another. A similar range of vegetation cover types (wet meadow, marsh, playa, etc.) is found within both depressional and lacustrine wetland classes, and, in fact, relative proximity

to the Great Salt Lake was the primary factor for deciding whether to classify a wetland basin as lacustrine fringe or depressional. The functional assessment team for the project classified most wetland basins located below the FEMA floodplain line (4,212 feet) as lacustrine fringe wetlands, regardless of whether basins are located entirely or in part below 4,212 feet. Because the Preserve is located to the west of Alternative E, its wetlands are generally lower in elevation and closer to the Great Salt Lake than wetlands found within the right-of-way for Alternative E. The Final EIS states that lacustrine fringe wetlands occur where water flows into a closed contour. Of the three wetland classes, lacustrine fringe may be considered the most ecologically important since it includes a wide diversity of vegetative communities due to the successionary cycle associated with the ebb and flow of the Great Salt Lake (wetlands located from 4,204 feet to 4,212 feet).

Similar to lacustrine fringe wetlands, basin depressional wetlands occur where hydrology (surface and/or groundwater) flows into a closed contour. By definition, the dominant water source for lacustrine fringe wetlands is overbank flow from a lake (EPA 1997). When lacustrine fringe wetlands are not subject to frequent inundation by the Great Salt Lake, these wetlands would function similarly to depressional wetlands. In fact, lacustrine fringe wetlands become indistinguishable from depressional wetlands as hydrologic influence from a lake becomes relatively small (Corps 2005). Low elevation depressions that get flooded occasionally by lake surges should actually be classified by their dominant hydrologic regime. Refer to Section 3.0 of this report to review data on historical inundation within the Preserve. A majority of the Preserve has not been inundated at all during the period for which historical records are available, and most lower portions of the Preserve (below 4,212 feet) have been inundated infrequently. The inundation analysis suggests that the hydrologic influence from the Great Salt Lake on wetlands in the Preserve is very minor; therefore, most of the wetlands classified as lacustrine fringe wetlands in the Final EIS would be more appropriately classified as basin depressional wetlands. In summary, if lacustrine and depressional wetlands are considered similar, mitigation credits would considerably exceed debits calculated for impacts from the Parkway for all of the modeled functions. Additional information for evaluating the adequacy of wetlands mitigation is provided in Section 4.0 of this report.

2.2 Wildlife Mitigation

As described in the wildlife technical memorandum and Draft Supplemental EIS Section 4.13, the federal lead agencies expanded the scope of the wildlife analysis presented in the Final EIS. This section describes the measures that mitigate for direct and indirect wildlife impacts documented in the wildlife technical memorandum that would result from the proposed action. While the measures described above in Section 2.1 for wetlands also provide mitigation for loss of wildlife and their habitat associated with wetlands in the study area, this section provides a summary of all impacts to wildlife described in wildlife technical memorandum and describes measures to mitigate these impacts.

2.2.1 Mitigation for Direct Habitat Loss

Construction of the Legacy Parkway would result in direct loss of wildlife habitat in the project right-of-way. Table 2-6 below compares direct habitat losses for Alternative E to habitats preserved in the Legacy Nature Preserve. Wildlife habitats delineated for the project study area are provided at different years (1997 and 2004) to show that wildlife habitat for both Alternative E and the Preserve remain similar to 1997 conditions in general and to evaluate recent trends in habitat dynamics. Some of the changes in wildlife habitat within the Preserve are the result of its active management since 2001. Other changes in habitat type are consistent with patterns of ecological succession (such as the conversion of areas classified as open water in 1997 to hydric meadow and sedge/cattail communities), whether natural or induced by human activities.

Table 2-6. Comparison of Direct Habitat Loss to Nature Preserve Habitat (acres)

Wildlife Habitat Type	Alternative E 1997 (2004)	Nature Preserve 1997 (2004)
Wetland/Riparian Habitats		
Hydric meadow	75.6 (79.9)	393.6 (474.1)
Sedge/Cattail	24.2 (27.8)	144.1 (119.2)
Mudflat/Pickleweed	16.3 (16.3)	230.3 (230.5)
Open Water	9.6 (1.7)	53.0 (53.2)
Riparian	3.8 (3.8)	23.7 (17.0)
Total Wetland/Riparian Habitat	129.5 (129.5)	844.7 (894.0)
Upland Habitats		
Pasture	201.8 (201.8)	356.7 (323.0)
Cropland	129.3 (129.3)	223.5 (223.2)
Salt Desert Scrub	127.2 (127.2)	675.3 (662.5)
Total Upland Habitat	458.3 (458.3)	1,255.5 (1,208.7)
Developed Land	277.3 (277.3)	5.2 (2.6)

Notes:

1. Wetland complex/riparian wildlife habitat is not exactly the same as "jurisdictional wetlands" as defined in Draft Supplemental EIS Section 4.12, *Wetlands*. Wetland complex/riparian wildlife habitat includes jurisdictional areas as well as non-jurisdictional riparian areas and other mesic habitats. This difference is discussed in greater detail in Appendix B of the wildlife technical memorandum.
2. Since publication of the Draft Supplemental EIS, the 1997 habitat mapping was updated based on aerial photographs and field visits (the previous mapping was based primarily on readily available GIS data). The data provided in this table for 1997 are from the revised mapping.

Many areas in the Legacy Nature Preserve contain habitats that are similar in type and size to those found in the proposed right-of-way. Table 2-6 above shows that the Preserve would compensate for the direct impacts from the project by preserving and restoring more than four times as much wetland complex/riparian habitat and more than twice as much upland habitat as what would be affected by constructing any build alternative. As described above in Section 2.1.2, in the absence of preservation of these mitigation lands, most of this area would be developed in the future, which would result in a regional loss of wildlife habitat that would exceed that caused by the project with the proposed mitigation.

2.2.2 Mitigation for Habitat Fragmentation

Existing habitats in the study area have been extensively fragmented by human activity and development. As described in Draft Supplemental EIS Section 4.13.3, *Environmental Consequences*, constructing any build alternative of the Legacy Parkway project would transect the matrix of wildlife habitats in the project study area.

The Preserve would compensate for many of these fragmentation effects by removing man-made barriers and restoring fragmented habitat within the Preserve area. The Legacy Nature Preserve would be managed to maintain large and contiguous wildlife habitat areas with low levels of human disturbance. Activities to *reverse* fragmentation include:

- **Removing roads** not required for maintenance and contouring the restored area to match adjacent land. Most roads in the mitigation area are minor roads. Road removal has helped to restore local hydrology, improve habitat connectivity, and increase habitat patch size. Road removal will total about 39,000 linear feet (nearly 6 acres).
- **Removing trash and debris.** In some areas, extensive dump sites that include concrete and fill material have fragmented habitats in wetland areas. Over 3,000 truckloads of fill material and debris have been removed from the Preserve.
- **Removing interior fences.** Fences form a network of barbed wire that crisscrosses the Nature Preserve and creates flight barriers to birds. Several species of birds have been found ensnared in such fences. Within the Preserve over 5,500 linear feet, out of a total of about 6,800 feet of internal fencing has been removed (as of April 2005).
- **Reseeding areas** where roads and dump sites have been removed with native vegetation.
- **Providing Wildlife Passages.** Box culverts, natural substrate culverts and bridges will provide passage ways for certain species of wildlife to and from areas east of the Legacy Parkway. See 2.2.4 below, addressing hydrology. For bird species the Parkway is not expected to present a significant obstacle to passage among habitat areas within the region.

2.2.3 Mitigation for Changes in Habitat Quality

To analyze changes in habitat quality from constructing the Legacy Parkway, the wildlife technical memorandum considered air quality and water quality.

Air Quality

The wildlife technical memorandum states that the effects on wildlife habitat from changes in air quality would be similar for all alternatives. Virtually nothing is known about how changes in air quality affect wildlife. Analysis of future (2020) air quality conditions indicate that carbon monoxide and particulate matter will likely be higher along the alignment of the Proposed Action. Ozone is not expected to cause new exceedences of the National Ambient Air Quality Standards, but their effects on wildlife are unknown. Similarly, future concentration of nitrogen dioxide and lead are not expected to change from exitsing conditions in the project study area. According to the regional mesoscale air quality in Section 4.3, *Air Quality*, of the Draft Supplemental EIS, the Legacy Parkway would have a minor impact on overall regional emissions relative to the future conditions (2020) No-Build Alternative.

While overall regional air quality impacts would be minor, there may be temporary air quality impacts from construction. To address this, BMPs in accordance with Utah Division of Air Quality requirements are proposed to reduce any construction impacts on air quality. These measures would mitigate any temporary air quality impacts on wildlife.

Water Quality

The wildlife technical memorandum states that all the build alternatives would cause similar increases in highway runoff contaminants and that wetlands adjacent to the highway would probably be the areas most affected. Additionally, catastrophic spills of hazardous waste or other chemical spills in wetland habitats could potentially have adverse effects on wildlife, particularly when water levels are high. Existing UDOT and FHWA/EPA requirements for safe transport of these materials and emergency spill containment programs would minimize these effects under most conditions. The design of the Legacy Parkway project includes vegetated filter strips in the highway median and on the side slopes. These features would reduce the amount of primary contaminants migrating from the roadway into wildlife habitats adjacent to the highway. In addition, best management practices (BMPs) would be implemented during construction in accordance with stormwater pollution prevention requirements to minimize impacts to water quality from runoff and spills.

Water quality within the Legacy Nature Preserve will benefit from the removal of livestock grazing. Human, horse, and cattle uses that historically constituted sources of wastes and siltation to wetlands and other receiving waters have been removed. Because of the lack of quantitative baseline (measuring fecal coliform or other pollutants), this improvement in water quality is presented in a qualitative manner. These improvements are especially beneficial to jurisdictional waters such as wetlands and streams because animal wastes contain nutrients that can create problems with aquatic vegetation growth, dissolved oxygen levels, and invertebrate mortality.

To ensure that wildlife is not harmed by external water sources brought into the Preserve, UDOT has conducted water quality analyses under the direction of the Corps, USFWS, and Utah Division of Water Quality (see the Hydrology section below for more information). Stormwater drainage from several nearby communities generally flows westward across the Alternative E right-of-way, then through the Preserve. UDOT will ensure that drainage systems treat stormwater sufficiently (with detention/retention basins, vegetated filter strips, etc.) to meet water quality standards for wildlife as it passes through the Preserve.

2.2.4 Mitigation of Habitat Modification

To analyze habitat modification from constructing the Legacy Parkway, the wildlife technical memorandum considered hydrology and highway landscaping.

Hydrology

As discussed in Section 2.1, *Wetland Mitigation*, of this report, a groundwater monitoring study concluded that the wetland hydrology in the project study area is not likely to be seriously affected by highway construction, with the possible exception of areas immediately adjacent to the right-of-way. To maintain groundwater hydrology in areas adjacent to the right-of-way, drainage features including groundwater conveyance structures have been incorporated into the design to allow the westward flow of shallow water beneath the right-of-way and to effectively mimic natural conditions. Equalization culverts or their equivalent will be placed within the Corps' 100-year floodplain. These culverts would be placed under the Parkway to capture runoff from the upstream side of the roadway and discharge it to the downstream side in a way that maintains sheet flow characteristics and limits any discharges to less than 5 cubic feet per second.

Additional structures would maintain the connectivity of flowing surface waters that include several ditches and canals in addition to 11 perennial streams. Wildlife movement would be facilitated by 48-inch culverts at crossings where

this diameter would provide sufficient capacity for 100-year flood events to pass through. Larger structures such as box culverts and conspans (bridges where existing stream channels remain intact) would be constructed for larger waters and would include natural substrates to facilitate wildlife movement.

Although no adverse impacts on local wetland hydrology from the Legacy Parkway are anticipated, extensive measures are proposed by UDOT that will enhance and restore hydrology on the Preserve properties. Much of the natural hydrology of the Great Salt Lake ecosystem has been altered by historic upstream water diversions, diking, flood irrigation, and channelization. These hydrologic alterations have modified the natural timing and quantities of water flowing into and out of wetland complexes, leading to degraded habitats that fall short of providing optimum conditions for resident and migratory birds and other wildlife.

Water management on lands within the Preserve historically involved mostly storm drainage, irrigating crops and pastures, and draining other land to increase the productivity of crops and rangeland. Without implementation of the Preserve, drainage facilities such as unnatural channels would be increased to accommodate development. While wildlife can sometimes derive certain benefits from these human uses, such actions are often detrimental to wildlife. The historic water management activities, which will be eliminated by Preserve management, can cause the following harmful effects to the hydrology of wildlife habitats:

- Altering the natural salinity levels in soil and water (this results in modification of habitat mosaics, such as degradation and reduction of mudflat [saline playa] habitats)
- Encouraging undesirable vegetation and adversely affecting desired vegetation
- Inhibiting the production of insects and other invertebrate food sources
- Incompatibility to timing of both migratory and resident wildlife species' life cycle requirements

In addition to ceasing historic water management actions that have had adverse impacts on wildlife, active water management on the Preserve will enhance wildlife habitat. The complex surface water flows and water rights connected with Preserve hydrology have been evaluated in order to secure sufficient water for managing productive wildlife habitats. To raise the area water table to near natural conditions, drainage ditches have been filled in (over 18,000 linear feet as of April 2005) and tile drains have been plugged to reduce the draining of adjacent lands and raise the water table in the area.

The hydrology of the Jordan River floodplain restoration area located in the southwestern part of the Preserve has been severely altered and largely cut off due to farming and water development practices. Old channels and sloughs of the Jordan River were cut off from the main stem by levees that have prevented the river from flowing into its floodplain. Portions of the old channels were filled in. Since the Jordan River Floodplain was altered, it has received some water from direct precipitation and runoff and from periodic back-flooding from the State Canal at the northern boundary of the floodplain. This situation has resulted in unpredictable and erratic water levels that are not conducive to productive wildlife habitat management. Hydrologic mitigation measures to restore the Jordan River floodplain include:

- Acquiring sufficient water rights and providing a water delivery system into the floodplain
- Reconstructing relict channels to a near-natural state
- Returning water flow into the sloughs
- Controlling where water flows and pools to restore, enhance, and maintain fresh, brackish, and saline playa habitats

Highway Landscaping

The wildlife technical memorandum states that new landscaping could have both beneficial and adverse effects on wildlife species that currently inhabit the project study area. Beneficial effects would include the introduction of vegetation that would provide foraging, roosting, and nesting habitat for birds and other wildlife. Adverse effects would include wildlife mortality due to collisions with vehicles because a variety of species would be attracted to this roadside vegetation for cover and food. In order to deter invasions of undesirable vegetation, UDOT, with input from resource agencies and environmental stakeholders, has developed a landscaping plant list that allows only native vegetation and species that are not considered invasive. As explained below, right-of-way fencing may help reduce wildlife mortality due to collisions.

2.2.5 Mitigation of Wildlife Mortality

The wildlife technical memorandum states that, with increased vehicle traffic in the project study area under all of the build alternatives, road mortality of individuals of some species—particularly birds flying between habitat patches on different sides of the highway and dispersing amphibians, reptiles, and small mammals—is likely to increase. Highway right-of-way fences would help reduce these impacts by forcing birds to take higher flight paths and by deterring cross-

highway movement of many species. The drainage culverts and other crossing structures proposed to be installed under the highway would also facilitate wildlife movement while reducing road mortality. All surface crossings that are designed to pass 100-year flood events would incorporate a natural substrate as described above in Section 2.2.4, *Mitigation of Habitat Modification*.

2.2.6 Mitigation of Artificial Light Disturbance

The wildlife technical memorandum states that all build alternatives would contribute minimally to the cumulative effects on wildlife from increased artificial lighting in the project and regional study areas. During periods of low visibility, the lights at intersections could attract migratory birds that then become disoriented. However, adverse low-visibility weather is infrequent in the project study area.

Although artificial lighting from vehicles would be constantly present on the highway, the roadway itself would be lighted only at the interchanges; most of the roadway would not be lighted. If any lights are incorporated into the Parkway trail system, they will be shielded or directed downward. Overall, the proposed action would add a minimal amount of light to existing conditions, and the effects of light on wildlife also are likely to be minimal. Therefore, no specific mitigation measures are proposed for artificial light disturbance to wildlife. Wildlife benefits derived from habitat improvements in the Preserve would likely offset any effects on wildlife from light disturbance from the project.

2.2.7 Mitigation for Noise Impacts on Wildlife

As described in the wildlife technical memorandum, highway noise is typically neither loud enough nor startling enough to cause marked stress effects on wildlife. However, highway noise can mask important vocal communication and natural sounds important to mate attraction, social cohesion, predator avoidance, prey detection, navigation, and other basic behaviors. Masking of vocal communication occurs when highway noise interferes with signal transmission by swamping out the signal to a point at which it is no longer recognizable to other members of a species. Depending on the degree of masking and the particular species' capacity to adapt (described further in the wildlife technical memorandum), all of these factors could potentially result in reduced survival and reproductive success of affected populations adjacent to the highway.

Evaluating noise impacts on wildlife is imprecise due to limitations in the knowledge about the effects of noise on wildlife and methodologies for measuring noise impacts on wildlife. Based on best available information on biological impacts of highway noise on wildlife, it is likely that noise-sensitive

species adjacent to the proposed roadway would either move away from the disturbance area or remain and adapt to the extent they are able, with some reductions in local population densities and species diversity. More noise-tolerant species could replace noise-sensitive species in some areas. However, the overall impact of noise on wildlife resulting from the proposed action is not expected to jeopardize the long-term viability of any species that currently use the project study area. The following subsections summarize the wildlife noise analysis and discuss mitigation for highway noise impacts on wildlife.

Noise Model Results

The analysis presented in the wildlife technical memorandum utilized the FHWA Traffic Noise Model (TNM) to model noise levels. Although the TNM was developed to assess the effects of traffic noise on humans, it was used as a surrogate tool for lack of a current functional model for wildlife. Table 4.13-11 in the Draft Supplemental EIS provides noise model results of acres of wildlife habitat exposed to noise under the Build Alternatives. Results under Alternative E for different noise level intervals are as follows:

- ≥ 60 decibels (dB): 10,670 acres under Alternative E versus 6,908 acres under existing conditions
- ≥ 55<60 dB: 6,686 acres under Alternative E versus 5,632 acres under existing conditions
- ≥ 50<55 dB: 11,985 acres under Alternative E versus 8,438 acres under existing conditions
- ≥ 45<50 dB: 25,057 acres under Alternative E versus 26,551 acres under existing conditions

It is anticipated that under the future conditions No-Build Alternative, noise in the project study area would increase from that typical of the lower noise levels (for example, rural) to those of higher noise levels, such as urban with heavy traffic.

Bioacoustics Analysis

In order to analyze potential masking effects of highway noise on wildlife, the bioacoustics analysis (Appendix E of the wildlife technical memorandum) focused on three avian species that were chosen to represent the acoustic variation in bird species that occur in the Great Salt Lake ecosystem. The selected species and their general vocalization characteristics are as follows:

- American bittern (intense, low frequencies)
- Black-necked stilt (loud, high frequencies)
- Brewer's sparrow (complex songs of varying frequencies and intensities)

The potential impact on American bitterns (*Botaurus lentiginosus*) modeled represents the greatest distance for possible masking effects: up to 3 miles from the noise source. This species is only a rare summer visitant to the Great Salt Lake Ecosystem, but other species with similar bioacoustic characteristics that are more common in the study area might experience masking effects similar to bitterns. Other species such as black-necked stilts (*Himantopus mexicanus*) would only be minimally affected by traffic noise close to the highway (up to 250 feet). For territorial songbirds such as Brewer's sparrows (*Spizella breweri*), noise would have a potential masking effect at intermediate distances (up to 1,000 feet). It is important to remember that masking effects are highly species-specific and depend largely on the unique bioacoustics characteristics of each species' vocal signals.

Species of Concern

Nine avian species of concern with a potential of occurrence in the study area were identified and analyzed in the wildlife technical memorandum. It is rational to consider possible noise impacts on species of concern, in addition to or in lieu of considering common species or species that are otherwise less significant in the area. Table 2-7 below identifies these species, their potential for occurrence in the study area and the estimated distances presented in the wildlife technical memorandum at which these species might be affected by highway noise.

Table 2-7. Estimated Distances at Which Species of Concern Might Be Affected by Highway Noise

Species	Occurrence in the Study Area	Estimated Distance of Noise Influence (ft)
Bald eagle	Occurs in the study area; nesting pair within 1.4 miles of existing highway.	125
Swainson's hawk	Documented occurrence in the study area, but only one recorded in 5 years of surveys in the Preserve.	125
Peregrine falcon	Occurs in the study area; historical nesting pair (active aerie 2000–2002) not found in study area from 2003–2005.	250–500
Prairie falcon	Documented occurrence in the study area, but not recorded in the last 5 years of surveys in the Preserve.	125–1,000
Burrowing owl	Documented occurrence in the study area, but not recorded in the last 5 years of surveys in the Preserve.	500–1,000
Short-eared owl	Documented occurrence in the study area, but not recorded in the last 5 years of surveys in the Preserve.	1,000
Wilson's phalarope	Occurs in the study area; not recorded over the last 2 years of surveys in the Preserve.	125–2,000
Bobolink	Has not been observed in the study area.	250–3,000
American avocet	Occurs in the study area; recorded annually in the Preserve.	250

Based on the data presented in the wildlife technical memorandum and bird surveys conducted in the Preserve, the American avocet is the most common avian species of concern found the project study area and its estimated distance of influence is 250 feet from the noise source. As presented in Table 2-7 above, the distance estimates at which highway noise might affect additional species of concern whose occurrence has been documented in the project study area range from 125 feet to 2,000 feet. The distance estimates for these species are most frequently estimated less than or equal to 500 feet, and only one estimate for a documented species extends beyond 1,000 feet (Wilson's phalarope).

Application of the Noise Analysis to Wildlife Mitigation

Because the Preserve is in close proximity to the proposed action, highway noise could affect wildlife within the Preserve. Under the existing conditions depicted in the Draft Supplemental EIS (Figure 4.13-14), the Preserve area is subject to

noise levels mostly below 50 dB, with smaller areas closest to I-15 experiencing noise in the 50 to 55 dB range. With implementation of the Legacy Parkway project, areas of the Preserve could experience higher noise levels (up to 60 dB).

Because masking effects are highly species-specific, the Preserve would provide varying amounts of habitat outside species-specific zones of potential masking effects. For several of the species of concern analyzed, the Preserve would provide a greater amount of habitat outside estimated masking zones than the total amounts of habitat within respective masking zones. For the species with the greatest potential masking effects (Wilson's phalarope and bobolink), the Preserve would provide lesser amounts of habitat outside of masking zones in comparison to the total amount of habitat within respective masking zones. For example, if a particular species is affected by noise up to 250 feet from the roadway, a total of 759 acres of wildlife habitat would be impacted within this distance buffer. The Preserve would still provide 1,976 acres of wildlife habitat farther than 250 feet from the roadway. There are 1,831 acres of wildlife habitat in the Preserve beyond 500 feet from the Parkway, 1,549 acres beyond 1,000 feet, 951 acres beyond 2,000 feet, and 575 acres beyond 3,000 feet.

It is important to note that, because assessing noise impacts on wildlife is complicated and imprecise, this analysis has adopted the following reasonable but conservative assumptions:

- Noise impacts were conservatively modeled under traffic conditions that would produce the greatest noise levels. These occur at LOS C operating conditions when the greatest volume of traffic can travel at the roadway's design speed. During the peak travel times of the day, reduced speeds would produce lower noise levels compared to those occurring under LOS C conditions. When these noise levels decrease, the masking effects due to highway noise would be less than the modeled results.
- The noise impact analysis was based on quiet environmental conditions. During conditions with increased noise levels (e.g. wind, airplanes), masking effects of highway noise would be reduced.
- The bioacoustics analysis identifies the potential for noise masking to avian vocalizations. Specific effects of highway noise on wildlife ecology (breeding, nesting, mating, territorial identification and defense) have not been quantified.

Areas in the Legacy Nature Preserve would be affected by increased noise levels to varying degrees, depending primarily on distance from the highway. It would be a mistake to conclude that acreage within an area of noise influence lacked wildlife benefits. While some noise-sensitive species might leave the area, many

species of wildlife can acclimate and adapt (for example, call during quiet periods or change their call frequency) to noise impacts and individuals within a species may tolerate noise impacts to varying degrees. Even if specific calls are masked and certain ecological processes (nesting, breeding, etc.) are interrupted, these habitats could still serve as territories for resting and foraging for wildlife.

Initiation of Noise Monitoring Study

As discussed in this section and the wildlife technical memorandum, it is not known exactly how highway noise would affect the local density and reproductive capacity of individual species of concern currently using habitats in the project study area. Highly noise-sensitive species may leave the affected areas; others may experience reduced reproductive success due to poor communication or reduced ability to detect predators and potential prey. In attempt to gain a better understanding of the impacts of highway noise on wildlife, UDOT is collaborating with UDWR and USFWS to implement field studies to measure effects on highway noise on bird species.

2.2.8 Mitigation for Human Disturbance

The wildlife technical memorandum states that increased access of humans and domestic pets to wildlife habitats adjacent to the highway could result in some level of habitat degradation and wildlife mortality. However, the Corps' 404 permit required UDOT to restrict human access to activities consistent with managing the Preserve for wildlife. The existing design for the Legacy Parkway project includes fences that would restrict access to sensitive wildlife areas and should reduce effects caused by human disturbance. Fencing the highway right-of-way and protecting the Legacy Nature Preserve would reduce human impacts.

Historic use of the Preserve included many human activities that are incompatible with or disruptive to wildlife. These human disturbances often interfere with the ability of wildlife to successfully nest, rest, or forage. In order to reduce disturbance and repair damage resulting from historical uses in the Preserve, about 5,500 linear feet of internal fencing and over 8,000 linear feet of dirt roads have been removed as of April 2005. Total interior fence and road removal are estimated at 6,800 and 39,000 linear feet respectively. Perimeter fencing has been installed around the majority of accessible Preserve properties, and over 3,000 dump truck loads of debris and fill material have been removed.

Construction and maintenance of major utilities within the Preserve properties is another historical source of human disturbance. UDOT has coordinated with multiple entities to reduce human disturbance in the Preserve:

- **South Davis Sewer District.** UDOT negotiated with the South Davis Sewer District to relocate a major trunk line that feeds a treatment plant to a location outside the Preserve. Two small sections of other trunk lines would remain. UDOT will negotiate a maintenance protocol for these two lines that minimizes disturbance to wildlife.
- **Questar.** UDOT has negotiated with Questar to relocate two major high-pressure gas lines to a location outside the Preserve. Wildlife will benefit because utility personnel will no longer need to enter the preserve for maintenance or to construct connection lines for expanding infrastructure.
- **PacifiCorp.** UDOT completed a maintenance, operation, and construction agreement with PacifiCorp that defines access points and maintenance/construction protocol to minimize disturbance while still allowing PacifiCorp to maintain a major regional power line located primarily along the eastern edge of the Preserve. Negotiated access points would protect more sensitive areas from disturbance. Annual maintenance activities will be scheduled around seasonal restrictions to minimize disturbance to wildlife.
- **City and County Drainage.** Historically, municipalities have created channels (ditches and canals) to transport drainage water westward into the Great Salt Lake. As discussed in Section 2.2.4, these practices can have adverse impacts on wildlife habitats. UDOT will continue to coordinate with the Corps and municipalities adjacent to the Preserve to ensure adverse effects of drainage are avoided.

Extensive cattle grazing and other agricultural practices have also contributed to wildlife disturbance and habitat degradation on mitigation properties. Traditional livestock grazing is prohibited within the Nature Preserve. An estimated 60% to 70% of all Preserve properties were subject to or used for grazing prior to being incorporated into the Preserve. Because controlled grazing can be an effective tool for habitat management, this option has been retained in the mitigation plan and will be evaluated by the Preserve's *Collaborative Design Team* and the Corps of Engineers. No motorized vehicles except those needed for maintenance will be allowed within the Preserve. The reduction of extensive human disturbance and its disruption to nesting, foraging, and resting birds is a critical factor in increasing the viability and production of the mitigation properties for wildlife.

2.2.9 Mitigation of Effects on Special-Status Wildlife

Several species analyzed in the wildlife technical memorandum that occur in the study area are protected under one or more federal or state wildlife protection laws. Table 4.13-1 in the Draft Supplemental EIS summarizes the seasonal occurrence and abundance, migratory and breeding status, and habitat use patterns of these species within the Great Salt Lake ecosystem and the project study area. The proposed action would result in direct habitat loss for all special status species known to occur in the study area. However, the Nature Preserve would provide enhanced/restored habitat for special-status wildlife. The bald eagle (*Haliaeetus leucocephalus*) is the only special-status species that is federally listed as threatened/endangered and is currently known to occur in the study area.

Bald Eagle

In 1996, a pair of bald eagles began nesting in an old heron nest in a cottonwood snag in the current Preserve area. In 2001, strong winds blew over the dead tree. UDOT partnered with the Utah Division of Wildlife Resources (UDWR) to place a large wooden pole with an artificial nesting platform near the fallen nest site. Since 2001, a pair of eagles has nested successfully each year in the artificial nest. UDWR and Tree Utah have planted cottonwood trees near the nest site to provide future nesting habitat.

Draft Supplemental EIS Section 4.15, *Threatened and Endangered Species*, outlines the commitments to protect the bald eagle from being impacted during construction. Successful nesting during the original construction period and adoption of an artificial nesting structure demonstrate the success of the commitments and the adaptability of the eagles. Bald eagle nesting and winter roosting will be monitored during construction, and construction near the sites will stop immediately if any sign of disturbance is observed. The USFWS will be consulted before construction resumes.

2.2.10 Mitigation of Cumulative Wildlife Impacts

The wildlife technical memorandum describes how historic land use changes within the Great Salt Lake ecosystem have significantly reduced available wildlife habitat for migratory birds and other species, both around the Great Salt Lake and in the project study area.

Although any proposed build alternative would contribute to cumulative effects on wildlife habitat loss, the area of wildlife habitat affected by direct habitat loss is small—about 0.1% of the total amount of wildlife habitat available throughout the regional study area. Highway noise could affect a larger area. However, these

impacts alone are not likely to affect the long-term viability of any wildlife species in the Great Salt Lake ecosystem.

In this instance, projected regional growth and other known and expected regional projects would be the sources of cumulative impacts. Despite potential impacts from future cumulative actions, the Legacy Nature Preserve would be sustainable over the long-term. All Preserve properties will be deed-restricted for conservation and wildlife management in perpetuity. UDOT will continue to acquire any necessary water rights to sustain existing and enhanced/restored hydrology on the Preserve. About 36% of Preserve wildlife habitats will be adjacent to high population densities, and a majority of habitats will be near high to moderate population densities. The Preserve provides a large enough area of contiguous wildlife habitat to remain viable despite its proximity to expected population growth.

Because cumulative impacts are, by definition, caused by actions other than the proposed project, mitigation of the impacts of these other projects is not a responsibility of the proposed project, (the Legacy Parkway). For the purposes of this mitigation analysis, it is worth noting the regional value of the Preserve. By establishing a western boundary for development, the Preserve would help reduce future cumulative impacts through preservation of wetland complexes and upland wildlife habitat by preventing future development from occurring within the Preserve area. In addition, the amount of protected wildlife habitat available at high lake levels surrounding the Great Salt Lake is relatively small. The Preserve would increase protected habitat at higher elevations in comparison to other protected areas and the Great Salt Lake floodplain.

3.0 Inundation by the Great Salt Lake

The study area is subject to natural cyclic inundation from changes in the water level of the Great Salt Lake. Inundation is a natural, dynamic process that causes habitat types to shift as lake levels rise and fall. This natural flux in the lake level has, in part, helped create and maintain the valuable Great Salt Lake ecosystem, such that the types and quantity of wetlands and wildlife habitat available in the study area depend on the prevailing level of the lake. Simple calculations were performed to analyze the effects of changes in the lake level in the Legacy Nature Preserve. These calculations represent "snapshots in time" that describe wetland functions and wildlife habitat availability in the Preserve under various inundation scenarios.

Three data sources were used to estimate Great Salt Lake water level elevations: the FEMA floodplain, 4-foot contours interpolated from a U.S. Geological Survey (USGS) 10-meter digital elevation model (DEM), and elevation interpolations from 0.5-meter contours obtained from aerial photography taken in 2004. Table 3-1 below compares the amount of habitat remaining in the Preserve above the inundation zones for each of the three elevation data sources. Figure 3, Comparison of Available Data Sources for Inundation Zones, depicts the contour lines within the Preserve where each of the three available data sources predicts an elevation of 4,212 feet.

Table 3-1. Comparison of Available Elevation Data Sources to Estimated Lake Level Inundation Zones

Inundation Zone (elevation in feet)	Historical Inundation[a]	Probability of Lake Elevation Occurrence within Zone[b]	Wildlife Habitat Remaining in Preserve Above Inundation (acres)		
			FEMA Floodplain (4,212 feet)	USGS 10-Meter DEM	0.5-Meter Aerial (Taken 2004)
4,188 – 4,192	100% – 99.2%	1.4%	NA	2,103[c]	2,103[c]
4,192 – 4,196	99.2% – 85.4%	7.6%	NA	2,103[c]	2,103[c]
4,196 – 4,200	85.4% – 62.0%	23.0%	NA	—[c]	2,103
4,200 – 4,204	62.0% – 22.6%	33.0%	NA	2,024	2,103
4,204 – 4,208	22.6% – 10.2%	24.0%	NA	1,657	2,065
4,208 – 4,212	10.2% – 0%	8.3%	1,410	741	1,314
4,212 – 4,216+	0% – 0%	1.7% (4,216+)	NA	118	600
4,216 – 4,220	0% – 0%	< 1%	NA	0	31

[a] Based on historical Great Salt Lake stage data obtained from Utah State University and the USGS. The historical maximum lake elevation is 4,211.8 feet and occurred in 1986. Vertical datum information was not readily available. Note that if vertical datums vary among calculations for historical inundation and data sources estimating elevations on the Preserve, estimated geographic locations from these sources could be subject to discrepancies (Omer 2005).

[b] Log normal probability of annual peak lake elevations. The probability of the historical data indicates the percent of time the lake elevation would be in each zone (UDNR 2000).

[c] Contours were not interpolated for these inundation zones. However, based on elevations found in the Preserve, all habitat would remain available at lower lake level elevations.

Figure 3, Comparison of Available Data Sources for Inundation Zones, shows differences in where the three data sources estimate the horizontal location of 4,212 feet above sea level on the Preserve. The contour at 4,212 feet is an important elevation to consider because it is the FEMA 100-year floodplain for the Great Salt Lake, and 4,211.8 feet is the historical maximum lake elevation recorded. The contour at 4,216 feet is also considered because it is near the Corps' 100-year floodplain line, which is 4,217 feet. This line is higher in elevation than the FEMA floodplain because the Corps' floodplain incorporates potential wind and wave action.

The USGS 10-meter DEM data place the 4,212-foot line farther east than both the FEMA floodplain line and the 0.5-meter 2004 aerial photography data. For the FEMA floodplain line and the 2004 aerial photography data, the horizontal location of 4,212 feet appears quite similar in the southern portion of the Preserve, but varies between these sources across the northern portions. Data from the 0.5-meter 2004 aerial photography are considered the most accurate data from which to estimate elevation in the Preserve. According to the results in Table 3-1 above, using the 2004 contour data, there are 1,314 acres of wildlife habitat available above 4,212 feet and 600 acres available above 4,216 feet.

Note that the 2004 data were not used in the study area inundation analysis in the wildlife technical memorandum. Contours from the USGS 10-meter DEM were used in the study area analysis because the 2004 aerial photography data do not cover the entire project study area. Nevertheless, Table 3-1 shows that the general trend identified in the inundation analysis in this technical report is similar to the results described in the wildlife technical memorandum—as the lake level increases, less wildlife habitat (other than open water) remains available above the lake.

In Table 3-2 below, data from the 2004 aerial photography are used to compare habitat availability in the Preserve at different Great Salt Lake inundation zones to habitat within Alternative E. Figure 4A and Figure 4B, Great Salt Lake Inundation Zones, depict various inundation scenarios.

Table 3-2. Preserve Habitat Availability at Different Lake Inundation Zones

Wildlife Habitat (by Type)	Current Lake Elevation (4195 feet in spring 2005) Alternative E (acres)	Current Lake Elevation Nature Preserve (acres)	4204 feet (historically inundated 22.6% of the time) Alternative E (acres)	4204 feet Nature Preserve (acres)	Habitats not	4208 feet (historically inundated 10.2% of the time) Alternative E (acres)	4208 feet Nature Preserve (acres)	4212 feet [1] (historically inundated 0.0% of the time) Alternative E (acres)	4212 feet Nature Preserve (acres)
Wetland Complex / Riparian									
Hydric meadow	80	474	80	474		80	474	68	188
Sedge/Cattail	28	119	28	119		28	118	28	7
Mudflat/pickleweed	16	231	16	231		16	230	14	118
Open water	2	53	2	53		2	20	0	0
Riparian	4	17	4	17		4	17	3	7
Total	***130***	***894***	***130***	***894***		***130***	***859***	***113***	***320***
Upland									
Pasture	202	323	202	323		202	322	198	268
Cropland	129	223	129	223		129	222	128	183
Salt desert scrub	127	663	127	663		127	663	127	543
Total	***458***	***1209***	***458***	***1209***		***458***	***1207***	***453***	***994***
TOTAL Wildlife Habitat	**588**	**2103**	**588**	**2103**		**588**	**2066**	**566**	**1314**

Wildlife Habitat (by Type)	4216 feet (historically inundated 0.0% of the time) Alternative E (acres)	4216 feet Nature Preserve (acres)	4220 feet (historically inundated 0.0% of the time) Alternative E (acres)	4220 feet Nature Preserve (acres)	4232 feet (historically inundated 0.0% of the time) Alternative E (acres)	4232 feet Nature Preserve (acres)
Wetland Complex / Riparian						
Hydric meadow	45	84	24	4	0	0
Sedge/Cattail	4	1	3	0	0	0
Mudflat/pickleweed	8	47	0	0	0	0
Open water	0	0	0	0	0	0
Riparian	2	0	1	0	0	0
Total	***60***	***131***	***28***	***4***	***0***	***0***
Upland						
Pasture	114	58	87	4	0	0
Cropland	118	107	68	9	0	0
Salt desert scrub	106	305	35	14	0	0
Total	***338***	***469***	***190***	***27***	***0***	***0***
TOTAL Wildlife Habitat	**398**	**600**	**218**	**31**	**0**	**0**

[1] 4211.8 feet is the historical high lake level elevation (Omer 2005).

The inundation data provided in Table 3-2 above indicate that areas of the Preserve will likely experience future inundation. These potential future scenarios (presented in Table 3-2 and Figure 4A and Figure 4B, Great Salt Lake Inundation Zones) would likely vary in the degree and the extent (both temporal and spatial) to which existing habitats would be converted to open saline water habitat. At 4,212 feet, about 37% of the Preserve would be subject to inundation by the lake. At 4,217 feet, about 71% of the Preserve would be inundated. (Note that areas up to 4,217 feet could experience some inundation from wind and wave effects under the Corps' modeled 100-year flood conditions.) Inundated areas would temporarily provide open water habitat that is important to many wildlife species. Even if saline open water habitat is not considered (as in Table 3-2), the Preserve would still provide mitigation-habitat to direct-habitat-loss ratios that range from 3.6:1 to 0.1:1 unless the lake rises above 4,220 feet (well above the recorded historical maximum lake elevation of 4,211.8 feet).

Table 3-3 through Table 3-7 below present the mitigation credits, as calculated in functional capacity units, for each Preserve wetland basin remaining above the Great Salt Lake under various inundation scenarios, based on contours from the 2004 aerial photography data. This analysis does not model any predictions with respect to changes in HGM functions as a result of inundation. These calculations represent "snapshots in time" that describe the credits when certain areas are inundated (flooded) and assume that the existing functions would cease and no different functions would emerge. The calculations do not consider what functions the wetlands converted to open water would perform.

Table 3-3. Credits in Functional Capacity Units (FCUs) Affected by Inundation at Various Lake Levels in the Legacy Nature Preserve – Function 1, Wetland Hydrology Maintenance

Wetland Class	Total FCUs	Contour Level up to 4,212 ft*	Contour Level up to 4,216 ft	Contour Level up to 4,220 ft
Lacustrine Fringe	105.5	9.7	0	0
		(90.8%)	(100%)	(100%)
Depressional	32.0	30.6	22.7	0.4
		(4.3%)	(29.1%)	(98.8%)
Slope	22.8	19.4	8.8	0.5
		(14.9%)	(61.4%)	(97.8%)
Total	**160.4**	**59.7**	**31.5**	**0.9**
		(62.8%)	**(80.4%)**	**(99.4%)**

Notes:

X = FCU credits available on Legacy Nature Preserve lands at each lake level.

(Y%) = Percentage of FCU credits affected by inundation at each lake level.

* Elevations based on contour data generated from 2004 aerial photography.

Note: These calculations do not include the 12 acres of slope wetlands created because their location on the Preserve has not yet been determined.

Table 3-4. Credits in Functional Capacity Units (FCUs) Affected by Inundation at Various Lake Levels in the Legacy Nature Preserve – Function 2, Dissolved Elements and Compounds Removal

Wetland Class	Total FCUs	Contour Level up to 4,212 ft*	Contour Level up to 4,216 ft	Contour Level up to 4,220 ft
Lacustrine Fringe	104.8	5.5	0	0
		(94.8%)	(100%)	(100%)
Depressional	33.1	30.3	16.8	0.3
		(8.5%)	(49.2%)	(99.1%)
Slope	24.2	20.4	9.4	0.5
		(15.7%)	(61.2%)	(97.9%)
Total	**162.2**	**56.2**	**26.2**	**0.8**
		(65.3%)	**(83.8%)**	**(99.5%)**

Notes:

X = FCU credits available on Legacy Nature Preserve lands at each lake level.

(Y%) = Percentage of FCU credits affected by inundation at each lake level.

* Elevations based on contour data generated from 2004 aerial photography.

Note: These calculations do not include the 12 acres of slope wetlands created because their location on the Preserve has not yet been determined.

Table 3-5. Credits in Functional Capacity Units (FCUs) Affected by Inundation at Various Lake Levels in the Legacy Nature Preserve – Function 3, Particulate Retention

Wetland Class	Total FCUs	Contour Level up to 4,212 ft*	Contour Level up to 4,216 ft	Contour Level up to 4,220 ft
Lacustrine Fringe	132.8	11.4	0.1	0
		(91.4%)	(99.9%)	(100%)
Depressional	43.0	41.3	24.7	0.4
		(4.0%)	(42.6%)	(99.1%)
Slope	40.8	35.2	17.7	1.1
		(13.7%)	(56.6%)	(97.3%)
Total	**216.5**	**87.9**	**42.5**	**1.5**
		(59.4%)	**(80.4%)**	**(99.3%)**

Notes:

X = FCU credits available on Legacy Nature Preserve lands at each lake level.

(Y%) = Percentage of FCU credits affected by inundation at each lake level.

* Elevations based on contour data generated from 2004 aerial photography.

Note: These calculations do not include the 12 acres of slope wetlands created because their location on the Preserve has not yet been determined.

Table 3-6. Credits in Functional Capacity Units (FCUs) Affected by Inundation at Various Lake Levels in the Legacy Nature Preserve – Function 4, Habitat Structure

Wetland Class	Total FCUs	Contour Level up to 4,212 ft*	Contour Level up to 4,216 ft	Contour Level up to 4,220 ft
Lacustrine Fringe	249.5	25.1	0.4	0
		(89.9%)	(99.8%)	(100%)
Depressional	69.6	65.6	35.9	1.0
		(5.7%)	(48.4%)	(98.6%)
Slope	36.1	31.1	15.5	1.0
		(13.8%)	(57.1%)	(97.2%)
Total	**355.2**	**121.8**	**51.8**	**2.0**
		(65.7%)	**(85.4%)**	**(99.4%)**

Notes:

X = FCU credits available on Legacy Nature Preserve lands at each lake level.

(Y%) = Percentage of FCU credits affected by inundation at each lake level.

* Elevations based on contour data generated from 2004 aerial photography.

Note: These calculations do not include the 12 acres of slope wetlands created because their location on the Preserve has not yet been determined.

Table 3-7. Credits in Functional Capacity Units (FCUs) Affected by Inundation at Various Lake Levels in the Legacy Nature Preserve – Function 5, Habitat Connectivity, Fragmentation, and Patchiness

Wetland Class	Total FCUs	Contour Level up to 4,212 ft*	Contour Level up to 4,216 ft	Contour Level up to 4,220 ft
Lacustrine Fringe	174.0	13.3	0.2	0
		(92.4%)	(99.9%)	(100%)
Depressional	59.1	56.4	33.3	0.7
		(4.6%)	(43.6%)	(98.8%)
Slope	35.2	30.1	14.3	0.8
		(14.5%)	(59.4%)	(97.7%)
Total	**268.2**	**99.8**	**47.8**	**1.5**
		(62.8%)	**(82.2%)**	**(99.4%)**

Notes:

X = FCU credits available on Legacy Nature Preserve lands at each lake level.

(Y%) = Percentage of FCU credits affected by inundation at each lake level.

* Elevations based on contour data generated from 2004 aerial photography.

Note: These calculations do not include the 12 acres of slope wetlands created because their location on the Preserve has not yet been determined.

It is important to remember that the FCU values shown above in Table 3-3 through Table 3-7 represent snapshots in time and not permanent changes in FCUs. The greatest FCU changes are for extremely rare events according to historical data. This analysis shows that most lacustrine fringe FCUs for each of the five modeled functions would be affected by inundation at 4,212 feet (ranging from 90% to 95% for each function). Nearly all calculated lacustrine FCUs would be affected at 4,216 feet (nearly 100%). A small percentage of FCUs associated with basin depressional wetlands would be affected at 4,212 feet (4% to 9%), while about one-third to one-half of the total FCUs for depressional wetlands in the Preserve would be affected by inundation at 4,216 feet (29% to 49%). About 14% to 16% of the FCUs calculated for groundwater slope wetlands would be affected by inundation at 4,212 feet. FCUs for slope wetlands affected by inundation at 4,216 feet range by function from about 57% to 61%.

While inundation would affect existing wetland functions in the Preserve, it is an important and natural process of ecosystem dynamics for the Great Salt Lake. As lake waters recede from inundated areas, nutrients and fines may be deposited, providing a rich nutrient source for wildlife and vegetation. Ecological community succession may begin anew (depending on the period and duration of inundation) providing a robust mosaic of wetlands and other habitats important to a myriad of wildlife species.

4.0 Adequacy of Mitigation

During the Record of Decision process, the 2,100-acre Legacy Nature Preserve was found to provide adequate mitigation for wetland and wildlife impacts identified in the Final EIS. The Corps' Record of Decision presented information that reflected two quantitative methods of measuring adequacy. The first method is to compare the acres of wetlands impacted to the acres of wetlands mitigated. The second method is to compare the calculated wetland functions impacted to the wetland functions mitigated. The Corps also applied its professional judgment and knowledge of regional wetlands to determine adequacy. In addition to these methods, this section addresses the adequacy of currently proposed mitigation in light of supplemental information from analyses prepared for the Draft Supplemental EIS, including analyses described in the wildlife technical memorandum.

An important qualitative element of the mitigation has not been captured by the quantitative analysis. Normally mitigation requirements are imposed at the time of permit issuance (or ROD) and implemented thereafter. Regulators sometimes seek mitigation increases to account for temporal loss (the time between impacting the resource and the time the mitigation is functional) or to account for uncertainties about the possible success of mitigation. The Legacy Nature Preserve, in contrast, has been under active development and management since 2001. While wetland impacts have occurred, they are substantially less than the total project impacts. The net result of this has been a temporal gain (mitigation has proceeded impacts) in mitigation success. The fact that restoration activities have resulted in the physical restoration of about 8 acres of wetlands exemplifies this success. While these circumstances resulted from litigation, they cannot be ignored in evaluating the adequacy of mitigation. At a minimum, the reasons (possible temporal loss and uncertainty of mitigation success) often raised to increase mitigation ratios do not apply in this instance.

4.1 Wetlands

4.1.1 Area of Wetland Impacted Compared to Area of Wetland Mitigated

Wetland mitigation can be determined by comparing the amount of jurisdictional wetlands directly impacted to the amount of wetlands mitigated. Ratios greater than 1:1 (wetlands mitigated to wetlands directly impacted) are often used depending on the type of mitigation (creation, enhancement, etc.) and to account for uncertainty with regard to mitigation success. Indirect impacts are typically mitigated with best management practices. These practices included considerations such as:

- Assuring that hydrology to wetlands would not be disrupted by the project
- Assuring that runoff from the project would not be discharged to wetlands

Table 4-1 below compares the amount of jurisdictional wetlands directly and indirectly impacted by the proposed action to the amount of jurisdictional wetlands included in the entire Legacy Nature Preserve. In Table 4-1, the HGM wetland classes have been broken down by wetland type (vegetative cover class) to provide additional ecological context. Characteristics of the wetland cover types are described in Appendix D of the Supplemental EIS.

Table 4-1. Mitigation by Area Impacted

Wetland Type	Wetland Class	Alternative E Impacts in hectares (acres)			
		Direct	Indirect[a]	Total	Mitigated[b]
Forested Wetland	Depressional	0 (0)	0 (0)	0 (0)	0 (0)
	Slope	0 (0)	0 (0)	0 (0)	0 (0)
	Lacustrine Fringe	0 (0)	0 (0)	0 (0)	0 (0)
Shrub-Scrub	Depressional	0 (0)	0 (0)	0 (0)	0 (0)
	Slope	0 (0)	0 (0)	0 (0)	0 (0)
	Lacustrine Fringe	0 (0)	0 (0)	0 (0)	0 (0)
Marsh	Depressional	1 (3)	5 (12)	6 (15)	0 (1)
	Slope	1 (3)	13 (33)	14 (36)	3 (6)
	Lacustrine Fringe	7 (18)	23 (57)	31 (77)	57 (140)
Wet Meadow	Depressional	17 (42)	47 (113)	64 (158)	30 (74)
	Slope	6 (14)	45 (111)	51 (125)	40 (99)
	Lacustrine Fringe	4 (9)	32 (80)	36 (90)	73 (179)
Playa	Depressional	5 (12)	16 (40)	21 (52)	33 (81)
	Slope	1 (2)	2 (5)	3 (7)	15 (36)
	Lacustrine Fringe	2 (4)	9 (23)	11 (27)	43 (107)
Unconsolidated Shore	Depressional	0 (0)	0 (0)	0 (0)	0 (0)
	Slope	0 (0)	0 (0)	0 (0)	0 (0)
	Lacustrine Fringe	0 (0)	19 (47)	19 (47)	19 (47)
Open Water	Depressional	0 (0)	1 (3)	1 (3)	0 (1)
	Slope	0 (0)	0 (0)	0 (0)	0 (0)
	Lacustrine Fringe	3 (7)	19 (47)	22 (54)	3 (6)
Totals by HGM Class	Depressional	*23 (57)*	*69 (170)*	*92 (222)*	*63 (157)*
	Slope	*8 (19)*	*60 (149)*	*68 (169)*	*58 (141)*
	Lacustrine Fringe	*15 (38)*	*102(254)*	*119(318)*	*195 (481)*
Grand Total		**46(113)**	**241 (595)**	**287 (709)**	**315 (778)**

[a] This does not include the creation of 12 acres of slope wetlands using artesian wells or the 8 acres of wetland physically reestablished by restoration.

[b] This does not include reduction of impacts by incorporating design features described in Section 2.1.2.

The Alternative E right-of-way contains 113 acres of jurisdictional wetlands; however, only a maximum of 103 acres of jurisdictional wetlands would be filled. According to Table 4-1, total of 708 acres of direct (113 acres) and indirect (595 acres) jurisdictional wetlands would be impacted. In this instance, 778 acres of delineated jurisdictional wetlands would be preserved, enhanced and restored—primarily wet meadow, marsh, and playa in wetland basins classified as lacustrine fringe. An additional 20 acres of wetlands are accounted for by physical restoration and creation measures. Actual direct impacts for Alternative E would be reduced from 113 acres to 103 acres. The area ratio of total mitigation wetlands (798 acres) to direct wetlands impacted (103 acres) would be 7.7:1. The area ratio of total mitigation wetlands (798) to wetlands directly and indirectly impacted is 1.1:1.

In Table 4-1, wetland areas are classified by HGM wetland class and wetland type, then totaled by HGM class. The ratios of wetland acres provided as mitigation to wetlands indirectly and directly impacted by HGM class are: 0.70:1 for depressional wetlands, 0.83:1 for slope wetlands, and 1.51:1 for lacustrine wetlands. By wetland class acreage, it appears that some of the mitigation is "out-of-kind" (some depressional and slope wetland impacts are mitigated with lacustrine wetlands). However, as discussed in Section 2.1, relative proximity to the Great Salt Lake was the primary factor for deciding whether to classify a wetland basin as lacustrine or depressional. Most wetland basins located below the FEMA floodplain line (4,212 feet) were classified as lacustrine fringe wetlands, regardless of whether basins are located entirely or in part below 4,212 feet. Because the Preserve is located to the west of Alternative E, its wetlands are generally lower in elevation and closer to the Great Salt Lake than wetlands found within the right-of-way for Alternative E. When lacustrine fringe wetlands are not subject to frequent inundation by the Great Salt Lake, these wetlands would function similarly to depressional wetlands. According to the inundation analysis presented in Section 3.0, most of the wetlands in the Preserve have not historically experienced frequent inundation.

By comparing wetland areas categorized by both wetland type and HGM wetland class, it again appears that for some categories, some of the mitigation is "out-of-kind" (for example, wet meadow depressional). In this instance, it is important to note that while the HGM approach is intended to facilitate evaluation of wetland functions, it is not meant to replace other wetland classification systems (Schneider and Sprecher 2000). When evaluating wetlands by acreage (as opposed to modeled functions), wetland cover types alone are commonly used to compare different "kinds" of wetlands. It is important to note that many wetland cover types change over time due to factors such as the successionary cycle associated with the ebb and flow of the Great Salt Lake, fluctuations in annual

precipitation, and active management. In fact, according to Table 2-6, Comparison of Direct Habitat Loss to Nature Preserve Habitat (acres), presented in Section 2.0, from 1997 to 2004 there was a 20% increase in wet meadow wetlands and a 17% decrease in emergent marsh wetlands on the Preserve. Table 4-2 compares acres of wetland impacts versus mitigation by wetland cover type as classified when the jurisdictional wetlands delineation was completed.

Table 4-2. Wetland Cover Types: Mitigation by Area Impacted

Wetland Type	Alternative D/E Impacts in Acres			
	Direct	Indirect	Total	Mitigated [a]
Forested Wetland	0	0	0	0
Shrub-Scrub	0	0	0	0
Marsh	24	102	128	147
Wet Meadow	65	306	373	352
Playa	18	68	86	224
Unconsolidated Shore	0	47	47	47
Open Water	7	50	57	7
Total	**113**	**595**	**709**	**778**

[b] This does not include the creation of 12 acres of slope wetlands using artesian wells or the 8 acres of wetlands physically restored.

As presented in Table 4-2, wet meadow and marsh wetlands have the greatest impacts by acres. The ratio of mitigation area to direct wetland impacts is at least 1:1 for each wetland type. As noted previously, indirect impacts are often mitigated with BMPs. Nevertheless, in comparing total impacts calculated (direct plus indirect), this ratio is less than 1:1 for areas delineated as wet meadow (0.9:1) and open water (0.1:1). This ratio is 1:1 for unconsolidated shore, slightly greater than 1:1 for marsh wetlands (1.1:1), and 2.6:1 for playa wetlands.

In considering both indirect and direct impacts, it appears that mitigation impacts to wet meadow and open water cover types are being mitigated partially “out-of-kind” with excess playa mitigation wetlands. Corps guidance states that “out-of-kind” replacement can be appropriate when considered ecologically beneficial to the region (Corps 2002). The mitigation site characteristics (Jordan River floodplain, a large mosaic of different wetland and upland habitats, and an abundance of playa wetlands) and the Preserve’s location are considered regionally important to the Great Salt Lake ecosystem. The Preserve is located within the appropriate watershed: the Ogden Hydrologic Unit. The Ogden Unit has lost a greater percentage of its historical wetlands than the Jordan River Hydrologic Unit. Some of the alkaline playas in the Preserve are considered

unique to the region. Playa wetlands provide foraging habitat that is especially important to shorebirds. Numerous human activities have destroyed or degraded many historic playa habitats in the region. These alterations include dikes, ditches, tile drains, and pond developments.

4.1.2 Wetland Functions Impacted Compared to Wetland Functions Mitigated

A second method for determining the adequacy of wetland mitigation is to compare the impacts to the functions of the wetlands impacted to the benefits to the functions of the wetlands within the mitigation area; that is, wetland functions lost due to the proposed action would be mitigated through preservation, enhancement, and restoration of wetlands in the Legacy Nature Preserve. This method of functional assessment can be done qualitatively or quantitatively. The Legacy Draft EIS and Final EIS set forth a quantitative method to determine the adequacy of the mitigation. The Corps also relied upon its knowledge and professional judgment concerning the qualitative functions of the regional wetlands.

Table 4-3 through Table 4-7 below present information on direct and indirect wetland impacts, in functional capacity units (FCUs), to each wetland function for Alternative E, as well as the amount of FCUs calculated for proposed mitigation. FCUs for each function are presented by hydrogeomorphic category (wetland class) and wetland cover type (subclass). As with Table 4-1 and Table 4-2, the calculated wetland functions are included for the entire 2,100 acres of mitigation property.

As in Table 4-1, Table 4-3 through Table 4-7 list the HGM wetland classes by wetland type (vegetative cover) to provide additional ecological context. However, each table is totaled for comparisons by wetland class (depressional, slope, and lacustrine) because the functional assessment models used on this project are low-resolution; they are designed to capture functional differences among classes, but not among various cover types (see Appendix D in the Draft Supplemental EIS). For creation measures, all mitigation credits (in FCUs) calculated have been assumed for and assigned to slope wet meadow wetlands.

Table 4-3. Mitigation by Wetland Function 1 – Maintain Wetland Hydrology (FCUs)

		Alternative E					
		Impact	Mitigation				
Wetland Type	Wetland Class	Direct (Indirect)	Preserve	Restore	Create	Highway Influence	Net Mitigation
Forested Wetland	Depressional	0 (0)	0	0.00		0.00	0.00
	Slope	0 (0)	0	0.00		0.00	0.00
	Lacustrine	0 (0)	0	0.00		0.00	0.00
Shrub-Scrub	Depressional	0 (0)	0	0.00		0.00	0.00
	Slope	0 (0)	0	0.00		0.00	0.00
	Lacustrine	0 (0)	0	0.00		0.00	0.00
Marsh	Depressional	1 (1)	0.05	0.04		0.04	0.05
	Slope	1 (4)	1.43	0.00		0.00	1.43
	Lacustrine	5 (16)	13.91	13.12		3.93	23.10
Wet Meadow	Depressional	30 (11)	6.76	9.49		2.86	13.40
	Slope	8 (14)	22.10	0.00	12.00	8.82	25.29
	Lacustrine	4 (13)	27.29	32.77		7.52	52.54
Playa	Depressional	6 (3)	7.57	13.75		3.07	18.25
	Slope	1 (1)	8.19	0.00		0.07	8.13
	Lacustrine	2 (3)	14.31	22.57		1.86	35.02
Unconsolidated	Depressional	0 (0)	0.00	0.00		0.00	0.00
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	0 (18)	2.81	0.76		10.32	-6.75
Open Water	Depressional	0 (0)	0.03	0.24		0.00	0.27
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	2 (4)	0.68	0.89		0.00	1.58
HGM Totals	***Depressional***	**38(15)**	**14**	**24**	**0**	**- 6**	**32**
	Slope	**11(19)**	**32**	**0**	**12**	**- 9**	**35**
	Lacustrine	**13(54)**	**59**	**70**	**0**	**- 24**	**105**

Table 4-4. Mitigation by Wetland Function 2 – Removal of Dissolved Elements and Compounds (FCUs)

		Alternative E					
		Impact	Mitigation				
Wetland Type	Wetland Class	Direct (Indirect)	Preserve	Restore	Create	Highway Influence	Net Mitigation
Forested Wetland	Depressional	0 (0)	0.00	0.00		0.00	0.00
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	0 (0)	0.00	0.00		0.00	0.00
Shrub-Scrub	Depressional	0 (0)	0.00	0.00		0.00	0.00
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	0 (0)	0.00	0.00		0.00	0.00
Marsh	Depressional	2 (2)	0.00	0.17		0.04	0.14
	Slope	2 (2)	-0.28	1.58		0.00	1.31
	Lacustrine	10 (6)	5.26	28.07		3.93	29.40
Wet Meadow	Depressional	30 (13)	-0.01	17.54		2.29	15.24
	Slope	8 (16)	-5.39	24.56	12.00	4.41	26.76
	Lacustrine	4 (3)	-1.35	51.92		1.95	48.62
Playa	Depressional	6 (2)	1.29	18.07		1.89	17.47
	Slope	1 (1)	-0.89	9.10		0.03	8.18
	Lacustrine	2 (1)	-0.34	28.32		0.92	27.06
Unconsolidated	Depressional	0 (0)	0.00	0.00		0.00	0.00
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	0 (12)	2.58	5.62		10.32	-2.12
Open Water	Depressional	0 (0)	0.02	0.30		0.09	0.24
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	4 (0)	0.24	1.67		0.00	1.91
HGM Totals	***Depressional***	**37 (16)**	**1**	**36**	**0**	**- 4**	**33**
	Slope	**11 (19)**	**- 7**	**35**	**12**	**- 4**	**36**
	Lacustrine	**21 (24)**	**6**	**116**	**0**	**- 17**	**105**

Table 4-5. Mitigation by Wetland Function 3 – Particulate Retention (FCUs)

		Alternative E					
		Impact	Mitigation				
Wetland Type	Wetland Class	Direct (Indirect)	Preserve	Restore	Create	Highway Influence	Net Mitigation
Forested Wetland	Depressional	0 (0)	0	0.00		0.00	0.00
	Slope	0 (0)	0	0.00		0.00	0.00
	Lacustrine	0 (0)	0	0.00		0.00	0.00
Shrub-Scrub	Depressional	0 (0)	0	0.00		0.00	0.00
	Slope	0 (0)	0	0.00		0.00	0.00
	Lacustrine	0 (0)	0	0.00		0.00	0.00
Marsh	Depressional	1 (2)	0.06	0.00		0.04	0.03
	Slope	1 (3)	0.91	1.06		0.00	1.97
	Lacustrine	7 (9)	-1.48	36.27		3.40	31.39
Wet Meadow	Depressional	30 (12)	14.16	9.00		3.74	19.41
	Slope	8 (10)	14.02	16.37	12.00	2.94	39.45
	Lacustrine	5 (6)	21.01	46.42		3.27	64.16
Playa	Depressional	6 (5)	14.73	12.74		4.42	23.04
	Slope	1 (1)	5.34	6.07		0.02	11.39
	Lacustrine	2 (1)	11.83	28.88		0.80	39.92
Unconsolidated	Depressional	0 (0)	0.00	0.00		0.00	0.00
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	0 (14)	-3.72	7.89		8.95	-4.77
Open Water	Depressional	0 (0)	0.20	0.26		0.09	0.37
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	2 (0)	-0.04	1.99		0.00	1.95
HGM Totals	***Depressional***	**37 (19)**	**29**	**22**	**0**	**- 8**	**43**
	Slope	**10 (14)**	**20**	**23**	**12**	**- 3**	**53**
	Lacustrine	**16 (30)**	**28**	**121**	**0**	**- 16**	**133**

Table 4-6. Mitigation by Wetland Function 4 – Habitat Structure (FCUs)

		Alternative E					
		Impact	Mitigation				
Wetland Type	Wetland Class	Direct (Indirect)	Preserve	Restore	Create	Highway Influence	Net Mitigation
Forested Wetland	Depressional	0 (0)	0	0.00		0.00	0.00
	Slope	0 (0)	0	0.00		0.00	0.00
	Lacustrine	0 (0)	0	0.00		0.00	0.00
Shrub-Scrub	Depressional	0 (0)	0	0.00		0.00	0.00
	Slope	0 (0)	0	0.00		0.00	0.00
	Lacustrine	0 (0)	0	0.00		0.00	0.00
Marsh	Depressional	1 (2)	0.03	0.21		0.04	0.20
	Slope	2 (3)	1.03	0.79		0.00	1.82
	Lacustrine	8 (8)	10.47	70.30		3.14	77.63
Wet Meadow	Depressional	18 (7)	5.94	28.34		1.54	32.74
	Slope	9 (10)	15.96	12.28	12.00	4.41	35.84
	Lacustrine	4 (5)	14.53	81.40		3.42	92.51
Playa	Depressional	4 (1)	5.58	30.17		0.50	35.24
	Slope	1 (1)	5.92	4.55		0.03	10.44
	Lacustrine	2 (1)	6.72	52.86		0.74	58.84
Unconsolidated	Depressional	0 (0)	0.00	0.00		0.00	0.00
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	0 (9)	2.58	21.86		8.26	16.18
Open Water	Depressional	0 (0)	0.07	0.54		0.00	0.61
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	3 (0)	0.48	3.40		0.00	3.87
HGM Totals	***Depressional***	**22 (10)**	**12**	**59**	**0**	**- 2**	**69**
	Slope	**13 (14)**	**23**	**18**	**12**	**- 4**	**48**
	Lacustrine	**17 (23)**	**35**	**230**	**0**	**- 16**	**249**

Table 4-7. Mitigation by Wetland Function 5 – Habitat Connectivity, Fragmentation, Patchiness (FCUs)

							Alternative E
		Impact		Mitigation			
Wetland Type	Wetland Class	Direct (Indirect)	Preserve	Restore	Create	Highway Influence	Net Mitigation
Forested Wetland	Depressional	0 (0)	0	0.00		0.00	0.00
	Slope	0 (0)	0	0.00		0.00	0.00
	Lacustrine	0 (0)	0	0.00		0.00	0.00
Shrub-Scrub	Depressional	0 (0)	0	0.00		0.00	0.00
	Slope	0 (0)	0	0.00		0.00	0.00
	Lacustrine	0 (0)	0	0.00		0.00	0.00
Marsh	Depressional	1 (2)	0.05	0.13		0.04	0.13
	Slope	2 (4)	1.58	0.40		0.00	1.98
	Lacustrine	7 (9)	12.32	42.52		3.53	51.31
Wet Meadow	Depressional	24 (15)	9.97	19.97		2.73	27.21
	Slope	8 (16)	24.56	6.14	12.00	8.82	33.88
	Lacustrine	4 (8)	18.25	58.83		6.35	70.73
Playa	Depressional	5 (3)	9.77	23.30		2.11	30.96
	Slope	1 (1)	9.10	2.28		0.07	11.31
	Lacustrine	2 (2)	8.37	37.15		1.53	43.99
Unconsolidated	Depressional	0 (0)	0.00	0.00		0.00	0.00
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	0 (12)	3.28	11.12		9.29	5.11
Open Water	Depressional	0 (0)	0.07	0.48		0.00	0.55
	Slope	0 (0)	0.00	0.00		0.00	0.00
	Lacustrine	2 (1)	0.53	2.22		0.00	2.75
HGM Totals	***Depressional***	**30 (21)**	**20**	**44**	**0**	**- 5**	**59**
	Slope	**11 (21)**	**35**	**9**	**12**	**- 9**	**47**
	Lacustrine	**15 (32)**	**43**	**152**	**0**	**- 21**	**174**

Similar to Table 4-1 and Table 4-2, the wetland impact FCUs presented in Table 4-3 through Table 4-7 above were calculated assuming direct impacts to all 113 acres within Alternative E; actual impacts to wetland functions would be less than the numbers shown. It should also be noted that the functional assessment models did not incorporate proposed design features to minimize or avoid wetland impacts. Therefore, the results of the assessment represent a worst-case scenario (see Appendix D in the Draft Supplemental EIS for further explanation).

Table 4-3 through Table 4-7 show that depressional wet meadow wetlands are "undermitigated," but depressional playas are "overmitigated." All vegetation cover types in lacustrine fringe wetlands are "overmitigated." This is because wet meadow is the most common type of wetland cover type within the Alternative E alignment, whereas the Preserve has proportionally more playa wetlands Additionally, the 2004 vegetation mapping for the Preserve shows a 20% (81 acres) increase in wet meadow wetlands (refer to Table 2-6,Comparison of Direct Habitat Loss to Nature Preserve Habitat (acres).

As discussed in Section 2.1, Corps guidance states that wetlands mitigation generally should provide, at minimum, one-to-one functional replacement (Corps 2002). The proposed mitigation provides excess FCU credits for a majority of the modeled wetland functions for each HGM wetland class. FCU debits (direct and indirect impacts) exceed mitigation credits for depressional wetlands only for functions 1, 2, and 3, while the ratio of FCU credits to debits for the same functions (1, 2, and 3) is about 1.5:1 for slope wetlands and about 2:1 for lacustrine fringe wetlands. By functional averages, credit-to-debit ratios for depressional wetlands are nearly 1:1, for slope wetlands about 2:1, and for lacustrine fringe wetlands about 3:1. Note that this analysis does not include the 8 acres of mainly depressional wetlands that have been re-established.

It is important to note that the wetland basins in the Preserve classified as depressional and lacustrine are generally similar to one another. Table 4-8 below compares functions among the three HGM wetland classes.

Table 4-8. HGM Wetland Functions (FCUs)

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	+	+	+
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

According to Table 4-8, "particulate retention" is the only function performed to a substantial degree by depressional wetlands but not by lacustrine wetlands. Because lacustrine wetlands in the Preserve generally have closed topographic contours, differences in functional performances from depressional wetlands would likely occur only during or around active lacustrine influence (inundation or ebb and flow from the lake). By definition, the dominant water source for lacustrine fringe wetlands is overbank flow from a lake (EPA 1997). The inundation analysis suggests that most Preserve wetlands have not been subject to frequent inundation, and lacustrine fringe wetlands become indistinguishable from depressional wetlands as hydrologic influence from a lake becomes relatively small (Corps 2005). In fact, for National Wetlands Inventory mapping (USFWS 1981), nearly all of these wetlands were classified as "palustrine," which is the Cowardin Classification System level for wet areas that are not considered directly or frequently influenced by hydrology from a lake (lacustrine), river, or ocean (Cowardin et al. 1979).

4.1.3 Summary of Wetlands Mitigation Adequacy

The Legacy Parkway Final EIS presented information using two quantitative methods for determining adequate mitigation. The first quantitative method compared ratios of wetland acres directly impacted to wetland acres mitigated. As described above, indirect impacts are often mitigated with best management practices. The Final EIS identified a wide range of ratios that have been used historically. Wetland mitigation ratios (mitigation wetland acres to direct wetland impact acres) for projects permitted by the Corps were examined for Salt Lake and Davis Counties for the past 12 years. During this period, the Corps issued 15 individual permits in Davis County and 28 individual permits in Salt Lake County. The mitigation ratios for these permits ranged from 0:1 to 7.1:1. The average creation ratio for Davis County was 1.9 acres of wetlands creation for 1 acre of wetland impacted (1.9:1). For Salt Lake County, this ratio was 1.5:1. Mitigation ratios are generally smallest for restoration mitigation, relatively small for creation, and larger if mitigation consists of enhancement. Credit for preservation is rare. Proposed mitigation for the Legacy Parkway is a combination of preservation, enhancement, restoration, and creation, with the majority the mitigation credits attributed to restoration (62%). The overall mitigation ratio for Alternative E is approximately 7.7:1 (798 acres of mitigation wetlands to 103 acres of direct wetland impacts).

The HGM-based analysis was the second quantitative method used to determine adequate mitigation was to compare calculations of wetland function at the impacted wetlands and the wetlands proposed within the Nature Preserve. By this HGM analysis, all functions for depressional wetlands are not mitigated at a one-to-one ratio. However, these functional assessment calculations did not take into account that depressional wetlands and lacustrine wetlands in the project study area are similar. Additionally, the debits calculated in FCUs for indirect effects were overstated because they were not reduced to take into account design features that would reduce impacts (see Section 2.1.2).

Wetland functions can also be evaluated qualitatively. Some of the qualitative elements described below are captured in the quantitative numbers listed in the above tables, but others are not captured. The right-of-way does not contain any unique wetland types or wetlands that perform unique functions within the region, particularly when compared to the wetland types and functions performed within the Preserve. The wetlands within the right-of-way and Preserve are under immediate threat of adverse impacts from ongoing development of uplands. Absent the Project and Preserve, the quality of wetland functions in the region would decline.

The Preserve offers an opportunity to enhance and restore degraded wetlands. Removal of animals, trash, and human uses will improve water quality and natural vegetation. Removal of berms and ditches has restored and will continue to restore natural hydrology. The wetlands within the Preserve will be a higher quality of wetland habitat than exists without the Preserve. The size and continuity of the Preserve and other lands to the west of the Parkway contribute to the mitigation benefits of this package in clear but perhaps non-quantifiable ways. The temporal element—managing the Preserve in advance of full project impacts—has confirmed the feasibility of this mitigation.

4.2 Wildlife

Historically, wildlife mitigation has been based on mitigation of direct impacts as measured by acres of habitat impacted and acres of habitat mitigated. Also, roadway projects often do not include specific wildlife mitigation recommendations (Gorton 2005). The Legacy Nature Preserve includes over 1,200 acres of uplands in addition to the nearly 900 acres of wetland complex/riparian habitat. This compares to 458 acres of direct impact to uplands that serve some wildlife habitat functions. Of the 458 acres of direct impacts, 129 acres are cropland and 202 acres are pasture, each of which is limited in its wildlife value. Section 4.13 of the Draft Supplemental EIS provides further information on wildlife habitat within the project right-of-way.

Table 4-9 provides a summary accounting of measures to compensate for impacts to wildlife functions.

Table 4-9. Summary Accounting of Wildlife Impacts versus Mitigation Measures

Wildlife Function Analyzed	Impacts	Mitigation
Direct Habitat Loss	588 acres	The 2103-acre Preserve provides about a 3:1 acre ratio of mitigation habitat to direct habitat loss.
Habitat Fragmentation	Parkway would transect the matrix of wildlife habitats in a study area where existing fragmentation is generally considered extensive.	Culverts crossing beneath the Parkway are designed as wildlife crossings. Preserve would compensate for fragmentation effects by restoring or enhancing degraded and fragmented habitat in the Preserve. Mitigation for HGM Function 5 (Habitat Connectivity, Fragmentation, Patchiness) exceeds total wetland impacts for this function by 139 FCUs.

Wildlife Function Analyzed	Impacts	Mitigation
Habitat Quality	Without mitigation measures, the project would cause increases in highway runoff contaminants and potential for catastrophic spills; no significant air quality impacts identified.	Design of the Legacy Parkway includes vegetated filter strips in the highway median and on the side slopes. These features would reduce the amount of primary contaminants in wildlife habitats adjacent to the highway. Additionally, BMPs would be implemented during construction to minimize impacts to water quality.
Habitat Modification	No adverse impacts on hydrology; highway landscaping could result in both beneficial and negative effects to wildlife.	Parkway design includes groundwater conveyance structures and extensive measures to enhance and restore hydrology in the Preserve. Right-of-way fencing would reduce wildlife mortality associated with landscaping.
Wildlife Mortality	Road mortality of individuals of some species is likely to increase.	Right-of-way fencing would help reduce wildlife mortality.
Artificial Light Disturbance	Effects would likely be minimal.	BMPs would minimize nighttime lighting during construction. Any lighting along trail facilities would be shielded or directed downward.
Highway Noise Disturbance	Potential masking effects from highway noise and highly variable and species-specific; modeled distances range from less than 100 feet to nearly 3 miles. Noise-sensitive species adjacent to the highway would likely either move away from the disturbance area or remain and adapt to the extent they are able, with some reductions in local population densities and species diversity.	Preserve would provide a variety of enhanced and restored habitats preservation, restoration, and enhancement, outside of noise masking zones for many avian species. UDOT is collaborating with UDWR and USFWS to implement field studies to measure effects on highway noise on bird species.
Human Disturbance	Increased access for humans and domestic pets could result in habitat degradation and wildlife mortality.	Right-of-way fencing would help reduce disturbance, extensive mitigation measures are proposed to repair degraded habitats in the Preserve.
Special-Status Wildlife	Several protected species occur in the study area and could be impacted by the proposed action.	Through proposed mitigation including habitat preservation, restoration, and enhancement, the carrying capacity of many of these species would likely increase, thereby offsetting in part any population declines of species caused by the project.
Cumulative Impacts	The proposed action would contribute to cumulative effects on wildlife habitat loss, but these effects would not likely affect the long-term viability of any wildlife species.	The Preserve would help mitigate future cumulative impacts by preventing future development from occurring within the Preserve area. The Preserve would be sustainable in light of future cumulative actions.

In addition to the mitigation information provided to account for specific wildlife impacts, Table 4-10 summarizes mitigation activities in the Preserve such as road removal, ditch removal, and fill areas that have been cleaned up.

Table 4-10. Summary of Legacy Nature Preserve Mitigation Activities

Mitigation Activity	As of April 2005	To Be Completed
Removing roads	Over 8,000 linear feet of dirt roads have been removed and revegetated, resulting in the conversion of these areas to 2.3 acres of improved wildlife habitats and adjacent habitat connectivity.	Over 31,000 linear feet of roads in the Preserve remain that are slated for removal (estimated 3.4 acres).
Removing fill, debris, and structures	Over 3,000 dump truck loads of debris and fill material removed (over 900 tires, extensive cement piles, five car frames); 5 large structures removed.	Additional areas containing fill and debris have been identified for future cleanup.
Filling in drainage ditches	To restore the natural water table, over 18,000 linear feet of ditches have been filled in with spoils contoured back to natural topography.	Only a few smaller sections of ditches remain.
Removing internal fences	80% of the 6,800 linear feet of fences within the Preserve have been removed.	Approximately 1,200 linear feet of internal fences still needs to be removed.
Installing perimeter fence	About 70% of the Preserve perimeter fencing has been installed to reduce human disturbance.	The perimeter of remaining accessible Preserve areas will be fenced (where not adjacent to other protected areas).
Prohibiting livestock grazing	60 to 70% of the 2,100-acre Preserve was previously subject to grazing.	Complete. Controlled grazing may be considered for managing habitat.
Relocating utilities	Two major utility lines have been relocated outside the Preserve.	Ongoing coordination with PacifiCorp to minimize wildlife disturbance.
Hydrologic restoration	Extensive restoration activities for the Jordan River floodplain and adjacent areas have been completed and include: designing and constructing a water delivery and control system, obtaining water rights, and filling in ditches and drains.	Develop and implement adaptive plan in order to manage Preserve hydrology to benefit wildlife.
Controlling noxious weeds and invasive species	Preliminary surveys estimate that about 20% of the Preserve is contains noxious or invasive species.	Preliminary surveys and treatment will be used to develop and implement an appropriate control plan.

In summary, the Legacy Nature Preserve would mitigate impacts to wildlife functions resulting from the proposed action through habitat preservation, restoration, and enhancement. By improving habitat conditions, the carrying capacity of many of these species (including special-status species) would likely increase, thereby offsetting in part any potential population declines of species caused by the project. Preventing development in this area would also create a buffer for some habitat areas west of the proposed highway from local noise sources and human disturbance, including wildlife-sensitive areas such as parts

of FBWMA and areas west of the project that are managed by local duck clubs. Establishing this mitigation area in perpetuity would prevent any further development that would otherwise result in multiple future cumulative effects to wildlife.

An overview of the mitigation plan for the Legacy Nature Preserve will be included in the Final SEIS. The Corps would approve a Final Mitigation Plan when it takes action on the application for Section 404 permit amendment. To ensure achievement of mitigation goals that would provide a regional benefit to wildlife, an adaptive approach will be developed by the *Collaborative Design Team* and incorporated as approved by the Corps into a long-term plan to manage the Preserve.

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