REDUCING HABITAT FRAGMENTATION RELATED TO THE WIDENING OF STATE ROAD 40 IN THE OCALA NATIONAL FOREST AND STATE OF FLORIDA PUBLIC LANDS

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ABSTRACT

The Florida Department of Transportation (FDOT) District Five was tasked with evaluating highway improvements that provided increased transportation capacity and safety along a segment of State Road 40 in Central Florida (SR 40). The evaluation addressed the needs of environmentally sensitive landscapes that serve as vital wildlife habitat and corridors in an increasingly fragmented region of Florida. Beginning in 1988 and continuing through the 1990s, FDOT began multiple Project Development and Environment (PD&E) studies of capacity improvements to SR 40. Each of these efforts was eventually halted due to concerns about the potential for significant environmental impacts. The study included portions of SR 40 from west of Silver Springs in Marion County to US 17 in Volusia County, a distance of approximately 40 miles. SR 40 links Interstate 75, through the center of the State, to Interstate 95 along Florida's east coast. SR 40 traverses public lands owned and managed by the Florida Department of Environmental Protection (FDEP) Office of Greenways and Trails and State Parks, the Florida Division of Forestry, and the United States Forest Service (USFS).

The Ocala National Forest lies at the center of this segment of SR 40 and is the centerpiece of over a half million acres of publicly managed conservation lands in North Central Florida. It is a central component of key conservation corridors designed to protect important wildlife species including the Florida scrub–jay, red-cockaded woodpecker, eastern indigo snake, sand skink, and Florida black bear.

In 2001, FDOT proactively took a new approach to resolving longstanding concerns and initiated a Collaborative Feasibility Study. As a part of that study, FDOT, USFS, FDEP and the Florida Fish and Wildlife Conservation Commission (FFWCC) convened to form the State Road 40 Collaborative Task Force. This group of public and private stakeholders developed a series of "Guiding Principles", which served as a beginning point for a PD&E study. During the PD&E Study, a Wildlife Crossing Committee consisting of public lands managers, non-governmental organizations, FDOT and other interested stakeholders was established. This committee worked together to identify locations and sizes of wildlife crossings along SR 40. The PD&E study culminated in the completion of an Environmental Assessment and a Finding of No Significant Impacts currently being reviewed by the Federal Highway Administration. In 2011, design phases for the first two segments of the SR 40 corridor were initiated. The design teams continued to meet with the Wildlife Crossing Committee that was formed during the PD&E study to gain stakeholder concurrence for the proposed wildlife connectivity enhancements that will be implemented within the project corridor.

The session presenters will discuss the proposed improvements to SR 40, including the process and methods used to establish the location, size, interior and exterior features, fencing, and maintenance of wildlife crossings. In addition, the multiple ancillary benefits of the project, including significant improvement of motorist safety, improved management of public lands, establishment of the Florida Black Bear Scenic Byway, secondary economic benefits of reconnecting wildlife metapopulations, and land acquisition efforts will be detailed.

INTRODUCTION

Beginning in 1988 and continuing through the late 1990s, the Florida Department of Transportation (FDOT) District 5 initiated several Project Development and Environment (PD&E) studies to evaluate possible improvements to SR 40. The purpose of a PD&E study is to provide sufficient information so that FDOT projects can be developed to comply with all Federal and State laws and be uniform in their quality and exactness. Each of those studies was eventually halted because of concerns regarding potential environmental impacts. This led to SR 40 being frequently cited as the example for difficulties associated with making transportation improvements in environmentally sensitive areas.

After nearly 15 years FDOT District Five took a different approach to address concerns about widening SR 40. The FDOT turned to a facilitation team headed by the Center for Urban and Environmental Solutions (CUES) of Florida Atlantic University. In 2001, the facilitation team approached several key stakeholders to explore their willingness to participate. The result was a Memorandum of Agreement (MOA) between FDOT, the USFS, the FDEP, and the FFWCC, referred to as the SR 40 Task Force, to convene a collaborative environmental feasibility study to determine whether improvements to SR 40 would be feasible, given the nature and complexity of the related environmental issues. The feasibility study provided the groundwork needed for a new SR 40 PD&E study initiated by FDOT District Five in 2005. This PD&E studied carried forward the collaboration and recommendations developed during the Task Force feasibility study to complete a PD&E study approved by the stakeholders and ultimately the Federal Highway Administration (FHWA). With the approval and consensus of the stakeholders FDOT District Five initiated the design and permitting phase for two of the three capacity improvement segments of SR 40 covered in the PD&E study.

PROJECT DEVELOPMENT & ENVIRONMENT STUDY

Project Description

In 2005, the FDOT initiated a PD&E Study to identify and evaluate needed improvements to SR 40 from the end of the existing four-lane section which was approximately one mile west of SR 316 to SR 15 (US 17), a distance of approximately 40 miles traversing Marion, Lake and Volusia Counties, Florida. In addition to the no build alternative, several build alternatives were considered for the roadway project. The identification of alternatives for this project began with the identification of needs and deficiencies. The SR 40 Project Development Summary Report (PDSR) showed that there was a need for roadway capacity improvements from the beginning of the project near Silver Springs to SE 183rd Avenue Road (Levy Hammock Road), a distance of approximately 13.5 miles. That portion of SR 40 is referred to as the Widening Section or the Capacity Improvement Area. The portion of the SR 40 corridor between SE 183rd Avenue Road and US 17, a distance of 26.5 miles, was not supported and was therefore referred to as the Non-widening or No Capacity Improvement Area. Proposed alternatives associated with the roadway widening included replacement of the Ocklawaha River bridge, construction of stormwater treatment and floodplain compensation areas. The installation of Habitat Connectivity Structures was also evaluated during the Study.

Agency Coordination/Wildlife Crossing Committee

Early in the PD&E process, it became apparent that developing a comprehensive approach to addressing wildlife-vehicle collisions, reconnecting habitat, species reproductive isolation, and wildlife mortality was critical to successfully developing a capacity improvement project for SR 40. It also became apparent that it would be necessary to bring together a small working group of public land managers, engineers, biologists, and environmental agency staff to develop a science-based approach to a comprehensive wildlife and habitat mitigation plan. Thus, a Wildlife Crossing Committee (WCC) was established early in the PD&E Study process to accomplish this task.

In August 2006, the SR 40 WCC held its first meeting. The purpose of the WCC was to determine the location, type, and length of potential wildlife crossing/connectivity structures along SR 40 through the project limits. The WCC was made up of representatives from FDOT, USFS, Florida Division of Forestry, Florida State Parks Silver River State Park, Florida State Parks Office of Greenways and Trails, US Fish and Wildlife Service, FFWCC, St. Johns River Water Management District, Ocala/Marion County Transportation Planning organization, University of Central Florida, The Nature Conservancy, Audubon of Florida, Wildlaw, Smart Growth Coalition and the PD&E consultant team.

Due to the large tracts of contiguous public lands on either side of the existing SR 40 corridor, habitat connectivity improvements were quickly identified as a feasible, cost-effective, and ecologically sound option to provide mitigation for unavoidable, adverse impacts to wildlife and habitat. The first task of the WCC was to focus on making recommendations related to the location, size, length, type, fencing, etc. for potential wildlife crossings and habitat connectivity improvements utilizing the results of previously-conducted corridor studies.

The Project Task Force assembled during the previous studies within the corridor had identified 20 locations for potential crossings. The WCC utilized these locations as the starting point for the development of its own recommendations. By April 2007, the WCC was continuing to refine the crossing recommendations and was starting to move beyond the Task Force's original recommendations as they were based primarily on large animal, primarily black bear, movement within the corridor. The WCC acknowledged the importance of providing permeability for small species as well, and that the sizes and locations of the proposed crossings should consider all types of wildlife. Subsequent WCC meetings made further refinements to the wildlife crossing recommendations, including additional locations and variations in sizes as well as the development of target species lists for each crossing location. These recommendations were finalized in October 2010 and it was agreed that FDOT would continue to involve the WCC during the design and permitting phase of the project. The table below summarizes the recommendations for habitat connectivity improvements made by the WCC. Further refinement, such as interior design, exterior plantings, and fencing type, would be developed and finalized during the design phase of the project.

Roadway Widening Segments

Capacity improvements for SR 40 were divided into three segments, described below and shown in Figure 1:

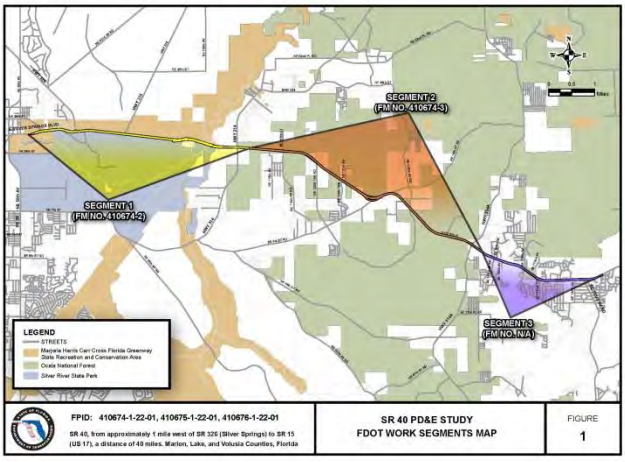

FIGURE 1

Segment 1 – From west of SR 326 to the west side of the Ocklawaha River Bridge, a distance of 3.48 miles;

Segment 2 – From the east side of the Ocklawaha River Bridge to west of CR 314A, a distance of 5.57 miles; and

Segment 3 – From west of CR 314A to Levy Hammock Road, a distance of 4.45 miles.

The evaluation segment limits were developed because of similarities in roadway, right-of-way width and land use characteristics within the evaluation segments. Alternative typical sections and alignments were developed for each segment. The Ocklawaha River Bridge alternatives were considered separately from the roadway improvement alternatives. Wildlife crossing structures were also evaluated separately from the roadway segments.

Ocklawaha River Bridge Replacement Alternatives

Bridge lengths of 1,700 feet, 1,950 feet and 2,200 feet were considered along with the existing 2,700 foot bridge. It was decided to maintain the existing 2,700 foot bridge length due to additional floodplain impacts, wetland impacts, wildlife/habitat connectivity impacts associated with shortening the bridge length, and commitments made to stakeholders during the SR 40 Task Force process.

Overview of Wildlife and Habitat Connectivity Issues

Within the study area, SR 40 bisects large tracts of undeveloped natural habitat important to many species of wildlife; many of which are listed by federal and state governmental entities as endangered, threatened or watch list species. Much of the natural habitat in this region is under public ownership, including the Ocala National Forest, Silver River State Park and Marjorie Harris Carr Cross Florida Greenway State Recreation and Conservation Area. Large areas of contiguous and accessible habitat are important for the health of regional wildlife populations in that they provide access to an array of food resources and other habitat types, allow for migration and dispersal to find mates and establish new territories, and enable escape from areas of dense predator populations and disturbance events like wildfires. Such areas typically sustain larger populations, which can improve genetic variability and fitness.

In its existing condition, SR 40 acts as a semi-permeable barrier to the north-south passage of wildlife, the permeability of which, in general, decreases with smaller, less mobile organisms. Larger mammals such as bears, deer, bobcats and coyotes appear to have higher crossing success rates. Smaller animals such as snakes, lizards, mice and tortoises either are discouraged from attempting to cross or spend more time within the right-of-way when they do attempt to cross, increasing the likelihood of vehicle caused mortality. It appears that SR 40, in its current condition, also impedes surface water flow in some areas, resulting in some degradation of adjacent wetland and aquatic habitat. In the absence of measures designed to better accommodate the north-south passage of wildlife and surface water and control wildlife access onto the right-of-way, the proposed widening of SR 40 is very likely to increase the barrier effect on all size classes of animals. However, traffic projections for the design year are the same whether the proposed improvements are built or not, probably because there are no alternative routes that traffic can take to avoid congestion. As traffic volumes increase over time, the barrier effect on all size classes of animals will very likely increase. Therefore, without wildlife/habitat connectivity improvements, habitat fragmentation will continue to increase.

The proposed SR 40 widening will incorporate certain features intended to enhance local and regional ecological and hydrologic connectivity. Features incorporated into the project to address these objectives will be implemented in a manner that provides public, land management, and emergency access to adjacent public lands. The project will be designed and constructed in a way that is sensitive to the visual appeal of and minimizes additional impacts to area natural resources. After implementation, the wildlife connectivity features and/or structures will be monitored to evaluate the effectiveness of the incorporated features and/or structures. These evaluations will be used to improve the effectiveness of any future connectivity features and/or structures in the SR 40 corridor.

Connectivity areas have been identified where habitat adjacent to either side of the existing roadway appears to represent important connections to relatively large and undeveloped publicly owned land tracts to the north and south of SR 40. These areas were chosen for consideration of new structures that would be built to allow for movement of wildlife and, in some cases, surface water, hence preserving and/or improving local and regional connectivity of natural resources. Connectivity areas evaluated during the PD&E Study were chosen, reviewed and refined over the course of several years by members of the SR 40 Task Force and the WCC, as well as members of various SR 40 PD&E phase committees consisting of representatives from resource agencies, nongovernmental organizations, the interested public, FDOT and their project consultants.

Field Surveys

The project area includes approximately 40 linear miles of right of way (ROW) and proposed stormwater pond and floodplain compensation sites. PD&E species specific surveys were conducted for federal and state listed wildlife species with the potential to be impacted, as well as rare plant surveys along the right-of way and within pond sites and floodplain compensation areas. The field work also focused on identifying and evaluating the feasibility of potential locations for dedicated wildlife crossings along SR 40. This was accomplished through review of record roadkill data and by performing several roadkill studies to identify areas where animals were unsuccessfully trying to cross the highway, and the animal species that are involved. Field work also included verification or modification of land use and habitat classifications, categorized according to the Florida Land Use, Cover and Forms Classification System (FLUCFCS). PD&E field surveys were conducted between April 2006 and April 2008.

Landscape Level Connectivity Objectives

Two main connectivity objectives were identified and addressed by the WCC: 1) improve ecological connectivity; and, 2) improve hydrologic connectivity. Ecological connectivity across a landscape is important for animals because of their need to access food resources, migrate to avoid severe weather, find mates and avoid natural events like wildfires. Young animals also need to disperse into unoccupied territories.

Providing ecological connectivity not only reduces the likelihood of demographic and genetic isolation of wildlife populations, but also has important safety and economic implications by reducing vehicle/wildlife collisions. In 2008, the Federal Highway Administration reported an estimated cost of over eight billion dollars annually related to wildlife vehicle collisions in the United States. Additionally, the Administration estimates that a highway related casualty costs the public, on average, 1.5 million dollars. These costs do not include the future loss of income a family suffers from losing a loved one, or the other ancillary costs incurred by individuals left behind after a fatality. It is not unreasonable to suggest that the initial cost of installing of crossings underneath roadways eventually provides long-term public financial benefit, especially in areas where collisions with large wildlife are likely to occur. A substantial part of Florida's economy depends on a healthy natural environment, with an abundant population of native wildlife for observation and hunting activities. The FDOT acknowledges that ecological connectivity is an important consideration for any transportation project. These combined factors all directly and indirectly impact Florida's economy.

Hydrologic connectivity maintains natural flow paths that transmit water, sediment, and nutrients through watersheds, aquifers, and streams. Ecological connectivity cannot be sustained unless hydrologic processes function properly at a landscape and local site scale. Adequate hydrologic connectivity also has flood control implications. The broad connectivity goal for SR 40 is to reduce its fragmentation impacts on all species and key ecological and hydrologic processes in the project corridor.

Corridor-wide Connectivity Objectives

The WCC developed an overall Project Connectivity Statement to guide the development and selection of wildlife connectivity strategies. The Project Connectivity Statement is as follows:

The proposed SR 40 project will incorporate certain features intended to enhance local and regional ecological and hydrologic connectivity. Specific connectivity objectives include the following:

- Maintain, and where feasible, improve natural hydrologic connections and functions
- Maintain, and where feasible, improve gene flow for all wildlife species
- Maintain, and where feasible, improve highway permeability to wildlife
- Reduce highway-associated wildlife mortality
- Base the design of wildlife connectivity features and/or structures on the best available scientific information at the time of design

Features incorporated into the project to address these objectives will be implemented in a manner that provides public, land management, and emergency access to adjacent public lands. The project will be designed and constructed in a way that is sensitive to the visual appeal of and minimizes additional impacts to area natural resources. After implementation, the wildlife connectivity features and/or structures will be monitored to evaluate the effectiveness of the incorporated features and/or structures. These evaluations will be used to improve the effectiveness of any future connectivity features and/or structures in the SR 40 corridor.

Design Alternative Assumptions and Considerations

When evaluating the proposed alternatives at each Wildlife Crossing Area, a number of assumptions were made and applied to each in order to allow for reasonable, consistent and equal evaluation. Assumptions for each alternative are as follows:

- Appropriate fencing for the location would be designed and installed as part of the alternative.
- All proposed structures would be designed using the best available science.
- Classes of structure would be consistent between the alternatives. For example, small animal crossings would be designed appropriate to the target species and consistent in terms of size, lighting, material composition, etc., between alternatives within each given area.

The evaluation of the effectiveness of each alternative was weighted heavily on the spacing of the proposed crossing structures and the location of those structures with regard to adjacency to appropriate habitat. Considerations for appropriate spacing were based on the review of available wildlife crossing literature. As such, high mobility species like the Florida black bear were recognized as having the ability to travel much greater distances, up to a mile, between crossings. For moderate to low mobility species, crossing intervals varied, but 500 to 1000 foot spacing between structures appears to provide the permeability needed for these species to have the opportunity to cross successfully.

Recommended Wildlife/Habitat Connectivity Structures

A suite of preferred Habitat Connectivity alternatives was determined based on the PD&E phase investigation conducted for the SR 40 Project. This preferred plan was developed by the FDOT in regular consultation with the WCC. The decision was made to limit construction of connectivity structures to areas occurring within the primary project impact area, i.e. the proposed widening section between the western project terminus and 183rd Avenue. The WCC unanimously approved and recommended the wildlife crossing alternatives described below.

Wildlife Crossing Area A

The preferred Wildlife Crossing Alternative for Area A consists of a 100-foot long structure at Half Mile Creek; three 36 inch by 58 inch culverts; three eight-foot by eight-foot box culverts; a 50-foot long bridge structure; and fencing on both sides of SR 40.

The 100-foot bridge over Half Mile Creek is to provide for a minimum 50-foot wildlife passage above the seasonal high water table. The bottoms of the eight-foot by eight-foot box culverts are to be buried approximately two feet below the natural grade of the adjacent areas to provide a natural ground surface within the box culverts and approximately six feet of vertical clearance within the box culvert. It should be noted that the 10-foot shoulder can be used by bicyclists.

Fencing will be included to help guide wildlife to the wildlife crossing structures. The fence consists of eight-feet of game fence and two strands of barbed wire placed at one-foot increments above the game fence. A three strand barbed wire arm is provided along the top of the fence. Options to contain smaller species, such as a stainless steel mesh, are currently under evaluation and consideration by the FDOT. Effectiveness of such mesh, long term maintenance, as well as drainage factors will be considered prior to a final recommendation. The fence will likely be buried 1 foot below the ground surface to prevent animals from going through or under the wire fence. Animal escape features are to be provided along the roadway. These features consist of a mound of fill material on the roadway side of the fence to allow the animal to leap over the fence. The fence will be aesthetically pleasing in color and will consider conformity to the landscape and vegetation enhancement.

The estimated cost for Wildlife Crossing Area A is $10,910,000.

Wildlife Crossing Area B

The preferred Wildlife Crossing Alternative for Area B consists of two eight-foot by eight-foot box culverts; two 36 inch by 58 inch culverts; a 50-foot; and fencing on both sides of SR 40. The 50-foot structure, the box culverts, smaller culverts and fencing are as described for Area A. The estimated cost for Wildlife Crossing Area B is $6,919,000.

Wildlife Crossing Area C

The preferred Wildlife Crossing Alternative for Area C consists of bridge replacement structures that match the length of the existing Ocklawaha River Bridge Crossing but will be lowered to a 25-foot height. The estimated cost for Wildlife Crossing Area B is $53,821,000.

Wildlife Crossing Area D

The preferred Wildlife Crossing Alternative for Area D consists of a 50-foot structure; two 36-inch by 58-inch culverts; and fencing on both sides of SR 40. The 50-foot structure, smaller culverts and fencing are as described for Area A. The 50-foot structure will be located where the Florida National Scenic Trail crosses SR 40 and will serve both wildlife and trail users. The estimated cost for Wildlife Crossing Area D is $3,401,000.

Wildlife Crossing Area E

The preferred Wildlife Crossing Alternative for Area E consists of a modified eight-foot by eight-foot box culvert. The box culvert is to be modified to provide for two-foot wide shelves on both sides of the inside of the box culvert. These shelves are to be connected to the surrounding terrain to provide for small animal wildlife crossings. Hydraulic conveyance between Church Lake on the south side of SR 40 and the wetland on the north side of SR 40 is to be maintained in the trough between the shelves. The estimated cost for Wildlife Crossing Area E is $904,000.

Wildlife Crossing Area F

The preferred Wildlife Crossing Alternative for Area F consists of three 400-foot structures; one 50-foot structure; and five 36-inch by 58-inch culverts. A 24-inch crossdrain would also be provided to reconnect the wetlands on the north and south side of the roadway. Fencing would be provided on both sides of SR 40 and gates would be provided at two locations. The estimated cost for Wildlife Crossing Area F is $20,997,000.

SR 40 DESIGN PHASE

Project Description

Upon completion of the SR 40 PD&E study, the FDOT advanced two segments of the PD&E Study for final design and permitting in 2010. The first segment approximately 4.9 miles long starts at the end of the four-lanes near Silver Springs State Park and extend to just east of the Ocklawaha River Bridge. The second segment approximately 6.0 miles long extends from east of the Ocklawaha River Bridge near County Road 314 (CR 314) to east of CR 314A in Marion County. The segments moving forward to design included recommendations from the WCC for 26 total wildlife crossing structures and consisted of 36x58-inch arch pipes, 8x8-foot box culverts, 50-foot brides, 100-foot bridges, 400-foot bridges, and the replacement of the 2,700-foot Ocklawaha River Bridge. During the design phase specific details for each of the wildlife crossing structures not addressed during the PD&E were carried forward for design-level detail. Design details for each proposed crossing location such as substrate, lighting, debris/cover materials, fencing and plantings would be provided to the WCC for comment.

Agency Coordination/Wildlife Crossing Committee

The design for Segments 1 and 2 began in July 2011. A WCC meeting was held in September 2011 to begin the design/permitting phase of the project, to review the recommendations made during the PD&E study, and to make additional changes to the current set of concept plans as it pertains to the location, size, and type of crossings proposed. Following this meeting, it was decided to base the design of the structures by concentrating on linking “like” habitat types that are separated by the roadway.

In January 2012, the first of three individual agency meetings were held with Florida Department of Environmental Protection Division of State Parks/Office of Greenways and Trails, FFWCC, and USFS. These meetings were intended to give each agency an opportunity to provide input and to express any concerns they may have regarding the project. During these meetings, additional concerns regarding maintenance of the structures, current versus anticipated land management practices, access points, and pre- and post-construction monitoring of the crossings was discussed. The concerns identified by each agency were considered and incorporated into the plans, where feasible. Each agency reviewed the concept plans and agreed with the size and location of each proposed crossing.

In October 2012, each agency and individual stakeholders involved in the WCC were notified by the FDOT that, following the approval of the line and grade plans for the SR 40 widening, the location and size of each crossing had been finalized. The next phase of the design would include the development of the interior design details of the crossings, exterior planting plans, fencing details, and maintenance documentation. This information would be included in permit application packages prepared for submittal to the St. Johns River Water Management District and the US Army Corps of Engineers and would be the result of the original intent of the WCC which was to assist in determining and overall mitigation plan for the widening of SR 40.

CONSERVATION LANDS

State of Florida Park/Recreation Lands

Silver River State Park

This park's almost 5,000 acres (2,035 hectares) is comprised of more than 10 distinct natural communities, dozens of springs, and miles of trails. This diversity of habitats provides a home for many different species of mammals, reptiles and birds. Frequent wildlife sightings include armadillo, deer, turkey, fox, Sherman's fox squirrel and gopher tortoise. Less frequently seen are coyote, bobcat and Florida black bear.

Marjorie Harris Carr Florida Cross Greenway State Recreation and Conservation Area

The Marjorie Harris Carr Cross Florida Greenway (CFG) is a unique conservation and recreation project. Traversing Citrus, Levy, Marion and Putnam Counties, the 110-mile (177 kilometer) long greenway occupies much of the land that was formerly the Cross Florida Barge Canal, which Congress deauthorized in 1990. Florida's premier greenway, the CFG stretches from the Gulf of Mexico to the St. Johns River, encompassing a variety of habitats and ecosystems that was expanded when the State recently bought 5,000 acres (2,035 hectares) just above Silver Springs.

The wildlife and habitat types found within each of these conservation areas are located along much of the project corridor, with the exception of the scattered human communities and development that has arisen. Within the area of the SR 40 project, primary habitats types include:

- Dry Prairie
- Shrub and Brushland
- Pine Flatwoods
- Hardwood – Conifer Mixed Upland
- Coniferous Plantations
- Stream Swamps

- Mixed Wetland Hardwoods
- Freshwater Marsh
- Wet Prairie
- Mixed Forested Hardwoods

OCALA NATIONAL FOREST LANDS

Established in 1908 by Theodore Roosevelt, the Ocala National Forest is the oldest national forest east of the Mississippi River. Encompassing 607 square miles (388,500 acres / 1,570 square kilometers), the forest extends into three central Florida counties; Marion, Lake, and Putnam (see **Figure 2**). Multiple natural habitat types, ranging from dry xeric upland forests to cypress and mixed hardwood swamps, are found within the forest. Within the area of the SR 40 project, primary habitats types include:

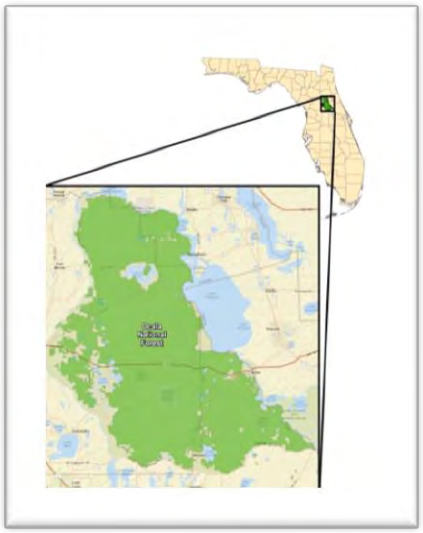

FIGURE 2 Ocala National Forest

- Pine Flatwoods
- Longleaf Pine – Xeric Oak
- Hardwood – Conifer Mixed Upland
- Freshwater Marsh
- Wet Prairie
- Mixed Forested Hardwoods

In addition, large tracts of the forest are planted in pine plantation, primarily slash pine (*Pinus elliottii*).

Due to its size and diverse habitats, the Ocala National Forest is also known to provide habitat for multiple federal and state listed protected species, including:

- Eastern Indigo Snake (federal – threatened)
- Florida Pine Snake (state – species of special concern)
- Short-tailed Snake (state – threatened)
- Gopher Tortoise (state – threatened)
- Sherman's Fox Squirrel (state – species of special concern)
- Florida Mouse (state – species of special concern)

STATE ROAD 40 WIDENING PROJECT

Proposed Improvements

As a result of the PD&E study conducted by the FDOT, it was determined that improvements to two segments of the SR 40 roadway would be needed. The first segment approximately 4.9 miles long starts at the end of the four-lanes near Silver Springs State Park and extend to just east of the Ocklawaha River Bridge. The second segment approximately 6.0 miles long extends from east of the Ocklawaha River Bridge near County Road 314 (CR 314) to east of CR 314A in Marion County (see **Figure 3**).

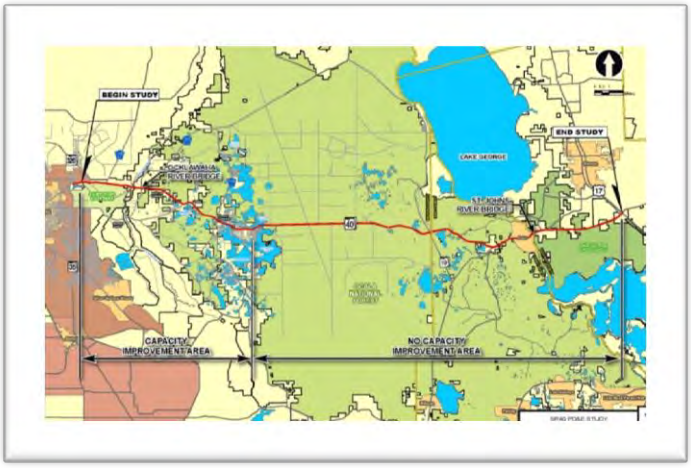

FIGURE 3 SR 40 from CRF 314 to CR 314A

Improvements to these segments of roadway include the widening of the existing two lane rural road to a four lane rural road comprised of two 12-foot wide travel lanes in each direction with 10-foot outside shoulders and 6-foot inside shoulders. East and west travel lanes will be separated by a 36-foot wide grassed median, and 5-foot sidewalks will be constructed outside of the roadway clear zone along both the north and south side of the roadway. The proposed typical section will require 192 feet of right-of-way. The existing and proposed SR 40 typical sections are provided as Figures 4 and 5, respectively.

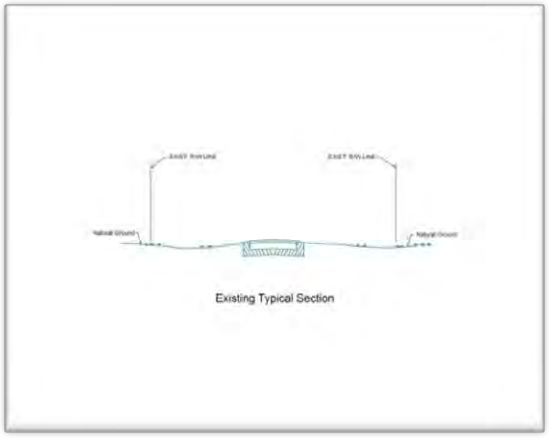

FIGURE 4 SR 40 Existing Typical Section

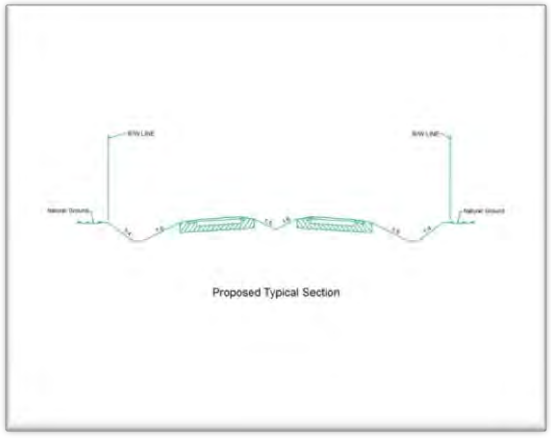

FIGURE 5 SR 40 Proposed Typical Section

Environmental Issues

During the PD&E process, it was determined that widening of the SR 40 roadway would result in both direct and indirect impacts to the natural habitats and wildlife. Direct wetland impacts included the loss of approximately 17.5 acres (7.08 hectares) of primarily forested habitat in Segment 1 and eight acres (3.2 hectares) of forested and herbaceous habitat in Segment 2. Direct upland impacts included 163.5 acres (66.17 hectares) of forested and herbaceous habitat in Segment 1 and 50 acres (20.2 hectares) of natural forested habitat in Segment 2. In addition, widening of the roadway would contribute to habitat

fragmentation, reduce wildlife movement and impact the ability of the USFS and FDEP to manage public lands. To address the loss of habitat, the FDOT proposed to provide mitigation in the form of habitat replacement. To reduce impacts to wildlife movement and improve habitat connectivity across the SR 40 roadway corridor, 26 wildlife crossings were proposed.

Proposed Wildlife Crossings

As part of the PD&E commitments, the FDOT agreed to construct 26 wildlife crossings along the SR 40 corridor within the two roadway segments proposed for widening. These crossings included: twelve 36-inch x 58-inch elliptical pipes, six 8-foot x 8-foot box culvert, three 50-foot bridge structures, one 100-foot bridge structure, three 400-foot bridge structures, and the 1,270-foot bridge replacement at the Oklwaha River crossing. During the design phase of the project, the 36-inch x 58-inch elliptical pipes were replaced with 45-inch x 73-inch arch pipes. This replacement allowed for the placement of 0.75 feet of natural substrate within the bottom of the pipe, while maintaining a 3-foot high vertical clearance in the pipe and maximizing the diameter of the pipe opening. In addition to the wildlife crossings, directional fencing and escape ramps were proposed to be constructed throughout much of the public lands. Figure 6 shows the location of the proposed wildlife crossings.

FIGURE 6 Wildlife Cross Locations

As discussed previously, selection of crossing sizes and locations were accomplished through extensive coordination with project stakeholders. Selection of specific target species for the crossings utilized information collected from roadkill, trap, and pedestrian surveys and track studies conducted during spring 2011. From this data, target species identified included:

- Florida Black Bear
- White-tailed Deer
- Bobcat
- Grey Fox
- Gopher Tortoise
- Florida Mouse
- Sherman's Fox Squirrel
- Gopher Frog
- Reptiles/Amphibians

CROSSING DESIGN ISSUES

Lighting within Pipe and Box Culvert Structures

Design of a four-laned rural roadway resulted in the need to construct pipe and box culvert crossing structures approximately 150 feet (46 meters) in length. In general, in order to provide light within a crossing structure a drainage inlet is typically placed near the middle of the crossing. However, due to the length of the SR 40 crossings two FDOT standard index 4-foot x 8-foot Ditch Bottom Inlets (DBI) were used. These inlets were placed along the inside shoulder of both the east and west bound travel lanes (see Figure 7). Asphalt pavement was then extended from the paved shoulder around the inlets to prevent erosion and minimize maintenance requirements. In addition, to prevent runoff from the roadway and shoulder from entering the inlet, the paved shoulder directly adjacent to the inlet was crowned to divert runoff around the inlet (see Figure 8).

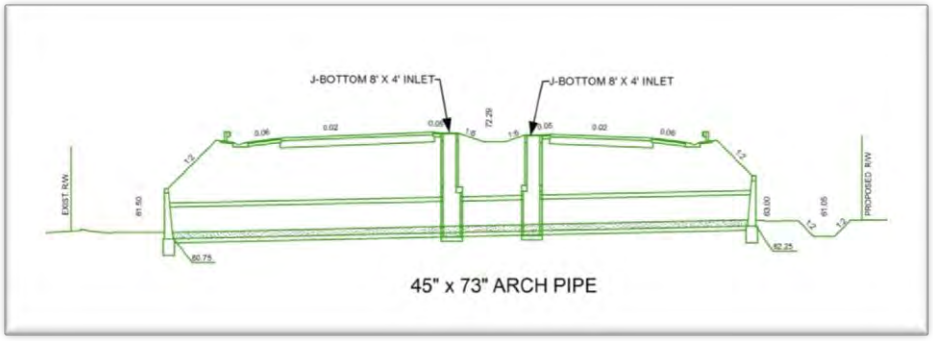

FIGURE 7 Arch Pipe Showing Ditch Bottom Inlets

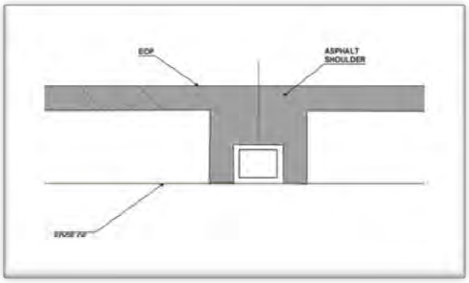

FIGURE 8 Ditch Bottom Inlet Plan View

Drainage and Diversion of Storm Events

When SR 40 was originally constructed in the early 1900s, little thought was given to maintaining existing drainage patterns and flows. As a result, in many areas along the existing roadway, roadway construction resulted in significant alterations in historic flow patterns. In addition, the hydrology of many of the wetlands found along the roadway was significantly altered. Over the past 75 years, both the natural and human environments has adapted to these alterations to the point where they are now considered natural conditions.

During design of the crossings, it was discovered that the existing roadway acted as a dam to direct flow during major storm events and maintain water levels within existing wetlands. To ensure that the

construction of the wildlife crossings did not alter these conditions, thereby, draining wetlands or diverting large storm events, care had to be taken in determining the elevations of the crossings. In the case of the proposed arch pipe crossings, raising the bottom elevation (i.e., invert elevation) of the pipe above the seasonal high water (SHW) elevation of the adjacent wetland, or above the 100 years flood elevation, prevented alterations in existing drainage patterns. However, due to the location of one 8-foot x 8-foot box culvert structure and one 400-foot bridge structure, this was not possible.

In the case of the box culvert, the existing SR 40 roadway works as a "dam" to maintain the SHW elevation in an adjacent lake (i.e., Church Lake) located on the south side of the road at an elevation approximately four feet higher than the SHW elevation in a wetland on the north side of the road. As a result, construction of the box culvert could have resulted in both the draining of the lake and the diversion of major storm events to the north. To prevent this from occurring, a concrete lintel set at the SHW elevation of the lake was designed (see Figures 9 and 10). This lintel will maintain the SHW elevation of the lake and the natural flow patterns during major events.

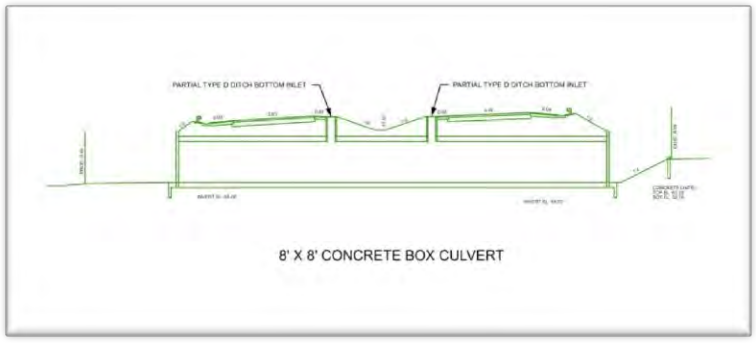

FIGURE 9 8' x 8" concrete Box Culvert

FIGURE 10 Concrete Lintel

In the case of the 400-foot bridge structure, it was discovered that the existing roadway controlled the 100-year storm event by preventing flow from the south side of the roadway to the north side of the roadway. Construction of the 400-foot bridge structure, and removal of the existing roadway at this location, could result in the diversion of the 100-year event from the south to the north. To prevent this from occurring, a 420-foot long poured in place gravity wall will be constructed along the northern edge of the bridge structure. This wall will be approximately two feet in height and will be covered with earth to form a berm (see Figures 11 and 12). This gravity wall and earthen berm will maintain existing flow patterns, while not impeding wildlife movement under the bridge structure.

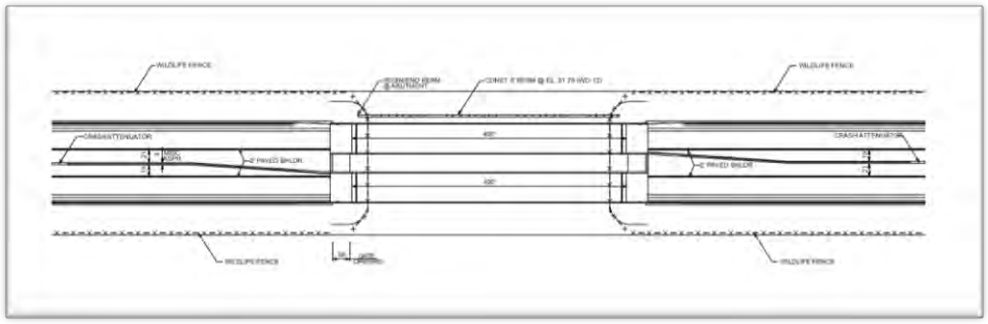

FIGURE 11 400-Foot Bridge Structure

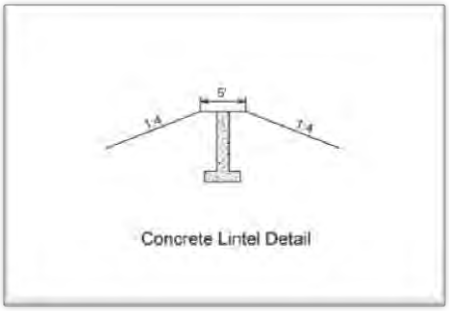

FIGURE 12 Concrete Lintel Detail

Present and Future Conditions in Area of Crossings

As is the case with many national forests, lands within the Ocala National Forest and adjacent to SR 40 have been converted to pine plantations in order to generate revenue to maintain the forest. However, during coordination with the USFS it was discovered that the existing pine plantations are planned for removal and these areas will be returned to longleaf pine and mixed slash pine / longleaf pine communities. In addition, the USFS intends to reestablish the red cockaded woodpecker (*Picoides borealis*) within the existing and restored pine communities. To achieve this goal, management of targeted areas will require short interval controlled burns. These changes in the management of the forest will result in significant changes in the vegetative communities that will be present at the time of project construction. Development of planting plans for the wildlife crossing approaches had to address these changes in USFS land management.

To anticipate what vegetative community would be appropriate for the wildlife crossing approaches, existing soils within the areas of the approaches were first determined. This was done using the US Department of Agriculture, Natural Resource Conservation Service, *Soil Survey of Ocala National Forest Area, Florida* and field reviews of the project area. Using existing soils information, it was then possible to determine soil and water table conditions and separate the crossing approaches into project habitat types (e.g., xeric, flatwoods, hydric, etc.). Herbaceous and shrub species adapted to the specific soil and water conditions were then selected. Selection of appropriate herbaceous and shrub species was done using knowledge of the project area and existing plant community reference materials. Those species adapted to frequent burns were then selected for use.

Land Management and Control Burns

During coordination with project stakeholders, it was agreed that directional fencing associated with the wildlife crossings would not consist of the standard "silver" fencing but would be designed to "blend into" the surroundings. To achieve this goal, multiple fence coating alternatives were reviewed. However, these alternatives either called for the painting of the fences or the use of vinyl coatings on the fence. Due to the use of control burns as a management tool in the forest, these alternatives were determined to be inappropriate for use in the project design.

One product that did achieve the project goal and would not be damaged by frequent control burns was Natina©. When placed on galvanized metal, this product oxidizes the outer layer of the metal turning it brown (see Photo 1). Because this is a chemical reaction, it is not affected by burning and will not fade or crack as a result of long-term exposure to the sun.

Photo 1 Natina Fence Treatment

Through coordination with the product's maker, it was also discovered that there are additional Natina products that could be used on concrete and rock. Use of these products in the area of crossing headwalls and wingwalls, and bride abutments, as well as rock secondary structures placed in the crossing approaches and inside the crossings, has been specified in the project design. Photo 2 shows the Natina treatment on rock.

Photo 2 Natina Rock Treatment

Forthcoming Environmental Related Project Activities and Benefits

It is anticipated that both segments currently under design will submit both state and federal environmental permit applications to the St. Johns River Water Management District and US Army Corps of Engineers by the end of 2013. Because so many commenting agencies will be involved in the review of these permits, a standard application template (sections, exhibits, etc.) will be developed to assist the regulatory agencies in finding information within the packages, once they are submitted. It is anticipated that the Department will receive mitigation credit for the installation of the wildlife crossing structures, fencing, and other ecological measures that will be installed as part of this project.

The final design (interior and exterior), shape, and details of the structures is also underway. Perhaps the most challenging activity for the FDOT will be the development of an efficient and feasible maintenance plan for areas within the right-of-way limits leading to the structures. FDOT District Five is currently developing a maintenance handbook for structures on SR 40 and throughout the District. Scientists who work for the FDOT recognize the importance of coordination with their maintenance staff, to ensure proposed activities are both feasible and cost effective. The FDOT will also look for assistance from the USFS and FDEP for maintaining areas that directly border FDOT right-of-way, to ensure the successful use of these crossings.

Although project challenges lie ahead, the FDOT is committed to delivering projects in highly sensitive habitats which demonstrate respect for the environment. The SR 40 project is a profound example of how motorist safety, economic benefit, capacity improvement, and environmental benefit culminate together into a success story that fulfills the mission of multiple agencies within the State of Florida.

BIOGRAPHICAL SKETCHES

Tom Roberts is a Sr. Scientist and Office Manager for E Sciences, Inc. in DeLand, Florida. He has over 22 years of ecological permitting experience for numerous public and private clients throughout the state of Florida. He has extensive experience with the assessment and mitigation of environmental issues associated with transportation and private land development projects, and he has managed the environmental portion of these projects, including Florida Department of Transportation (FDOT) Project Development and Environment (PD&E) Studies, arterial investment studies, roadway and bridge design projects, and trails projects. He is a graduate of Stetson University from which he received a Bachelor's degree in Biology. In his spare time he enjoys visiting state parks and historic sites and spending time with his kids.

Mark Easley is a Sr. Project Manager for Environmental Services at Kisinger, Campo & Associates, Inc. in Tampa, Florida. He has over 30 years of experience in protect species assessment, environmental permitting and habitat restoration. As a consultant for the Florida Department of Transportation, he participated in the development of the FDOT's Efficient Transportation Decision Making (ETDM) process and supporting handbooks, revisions to the Project Development and Environment (PD&E) Manual and development of the FDOT's Wildlife Crossing Guidelines. He has worked extensively in the development of National Environmental Policy Act (NEPA) documents for multiple federal agencies and in the assessment of Cumulative Impacts associated with proposed actions. Mr. Easley is a graduate of the University of South Florida where he holds a Bachelor of Science degree in Biology. In his spare time he enjoys fly fishing, hunting, and camping.

Jason Houck, GISP, PWS currently serves as the Ecological Services Manager for Inwood Consulting Engineers, Inc. located in Oviedo, Florida. He holds Bachelors and Masters degrees in environmental science from the University of Tennessee. Professional certifications include GIS Professional and

Professional Wetland Scientist. Prior to his current position, Jason served in the US Marine Corps and worked on several collaborative projects including the USGS National Biological Information Infrastructure and the American Chestnut Foundation's American Chestnut Restoration Program in the southern Appalachian Mountains. In his current position, he manages Inwood environmental staff and subconsultants in matters of wetland and wildlife ecology, regulatory agency coordination, environmental documentation, and environmental permitting. In his spare time, Jason enjoys kayak fishing, golf, and spending time with his wife and two sons.

Hannah Hernandez is the current District Permit Coordinator for The Florida Department of Transportation, District Five. In this role, she manages environmental compliance matters, environmental resource permitting, and the mitigation program for wetland and protected species impacts. Ms. Hernandez oversees environmental permitting for the majority of The Wekiva Parkway, Sunrail, and the I-4 Corridor in District Five. She has recently participated in developing streamlined regulation language for the Florida Statewide Environmental Resource Permit (SWERP) initiative. Prior to her current position, Ms. Hernandez served as a consultant in private industry. Her consulting experience includes protected species surveys and monitoring, state and federal permitting, and Development of Regional Impacts. Ms. Hernandez is a graduate of the University of Florida, where she earned a Bachelor of Science degree in Wildlife Ecology and Conservation. In her spare time, Hannah enjoys fishing, running, and spending family time with her husband and son.

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