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Section 1: Introduction

There is a constant competition between the natural and built environments, and the transportation system’s interaction with natural systems is no different. The transportation system moves people and goods, and the natural system moves animals, water, and energy. To explore the potential conflicts between these two systems in Pasco County, two fundamental questions were addressed:

- How is the environment vulnerable to the transportation system?
- How is the transportation system vulnerable to the environment?

Major conflicts are documented in a series of maps and accompanying discussion, followed by potential solutions. An understanding of the effects that the environment and transportation network have on each other is essential to identify creative ways to balance these vitally important but often competing systems.

MOBILITY 2040 recommends strategies to allow the intermingled coexistence of both the environment and the transportation system over the next 25 years and beyond.

How is the Environment Vulnerable to the Transportation System?

The environment typically is thought of as being in mortal peril by increasing development. When the transportation system grows, increased development follows. This is often at the expense of the natural environment, as roads are paved through forests and over wetlands, habitats are fragmented, and water quality is degraded. These negative impacts reduce overall biodiversity and cause a flurry of physical and economic effects.

Poor water quality detracts from potential tourism dollars being spent in natural areas as visitors travel elsewhere. Increased impervious surfaces create more stormwater runoff that swells rivers beyond their capacity, carving more sediment from upland areas and dumping them into estuaries and bays. Degraded water quality stresses aquatic habitats, resulting in problems such as low fish stocks at fisheries. Roads that cut through forests reduce and fragment habitat, forcing a wide variety of organisms to share less resources and learn how to cross roads without being injured or killed. Car emissions pollute the air, and uncontained hazardous materials contaminate groundwater used for drinking water supply.

Figure 1-1
Nutrient Pollution in a Marina on Caloosahatchee River Near Cape Coral, 2005

(Image by John Cassani)
(Image from EPA’s Nutrient Water Quality Standards at http://water.epa.gov/lawsregs/rulesregs/florida_coastal.cfm)
**How is the Transportation System Vulnerable to the Environment?**

Despite its effects on the environment, the transportation system also is affected by the environment. Florida is under constant threat of storm surge and high winds from hurricanes and tropical storms from June through November. As a coastal county, Pasco County must take extra precautions to ensure that the transportation system can adequately handle the evacuation needs of its residents in the event of a hurricane or other major coastal storm.

In addition to major storms, sea-level rise threatens to slowly but surely flood coastal areas. Groundwater movement through the subsurface creates sinkholes that can swallow entire sections of roads. Storms often bring down traffic signs and signals, flood roads, weather away infrastructure, and destroy cultural and historic resources.

**Federal Guidance**

Signed into law by President Obama in 2012, Moving Ahead for Progress in the 21st Century (MAP-21) is the federal transportation legislation that created streamlined, performance-based, multimodal program to address the many challenges facing the nation’s transportation network. MAP-21 promotes accelerated project delivery and encourages innovation through the increased use of Categorical Exclusions, programmatic approaches, and planning and environmental linkages.

Map-21 environmental guidance is contained in the “Environment, Planning, and Realty” section of the legislation. Topics include:

- **Accelerated Decisionmaking in Environmental Reviews** – Improving the transparency, consistency, and predictability of projects running through the National Environmental Policy Act (NEPA) permitting process. Early collaboration among federal agencies, stakeholders, and the public will reduce major adverse impacts to communities and minimize project delays.

- **Congestion Mitigation and Air Quality Improvement (CMAQ) Program** – Improving air quality and relieving congestion. This program was designed to help states and metropolitan areas meet their Clean Air Act obligations in nonattainment and maintenance areas and to prevent new areas from falling into nonattainment. Approximately $2.23 billion annually is authorized nationally to eligible projects.
- **Transportation Alternatives** – Improving pedestrian and bicycle facilities, access to public transportation facilities, and safe routes to school. Approximately $800 million annually is authorized nationally to eligible projects.

- **Categorical Exclusions** – Expanding the use of categorical exclusions for environmental permitting to include projects damaged by a declared emergency or disaster, a project with limited federal funds, and projects in the existing right-of-way.

Section 2: Land-Based Conflicts

The degree of conflict on land between the environment and transportation systems is directly related to how much human development exists in a particular area.

Land Cover

When divided into four main land cover categories—Wetland/Rivers/Ocean, Agricultural/Light Development, Developed, and Undeveloped—approximately 25% of Pasco County is considered developed. Development is concentrated in western Pasco County, with a secondary area in the southeastern part of the county. Approximately 25% of the county is lightly developed, shown in yellow in Figure 2-1, including farming, cropland, rangeland, recreational land, and other specialty farms. The remaining 50% of the county’s land area is either undeveloped (consisting of upland forests, brushland, or open land) or water (including ocean, swamps, wetlands, lakes, marshes, waterways, wet prairies, and ponds). The distribution of these four land cover types is very intermingled, and many borders exist between the different types. Although the western side of the county along US 19 corridor is developed, water often is intermingled with undeveloped areas, and agriculture/light development dots much of the central and eastern sections of the county.
**Land Conservation**

Land designated as conservation prohibits or limits development within its boundaries and is a very simple way to protect existing environmental resources. Major areas of Pasco County have already been set aside for conservation and comprise 18% of Pasco County (see Figure 2-3). Areas of note include:

- Jay B. Starkey Wilderness Park;
- Cypress Creek Flood Detention Area;
- Conner Preserve;
- Green Swamp; and
- Werner-Boyce Springs State Park.

The quality of the environment is measured by the biodiversity of plant and animal populations. A high biodiversity means that there are many different types of species within the same area. In general, conservation areas have the highest biodiversity and heavily-developed areas have the lowest. In addition, the larger the conservation area, the more opportunity for increased biodiversity.

Physical connections between conservation areas allow wildlife to pass between otherwise disjointed areas. Critical linkages connecting Starkey Wilderness Park to Conner Preserve and Cypress Creek have been identified in Map 2-1. The Hillsborough River Corridor extends south from the Green Swamp in eastern Pasco County as another critical linkage.

The highest potential for conflict between roadway and wildlife exists along the borders of conserved areas and along these critical linkages. FHWA promotes simple solutions to wildlife protection. For example, in Florida, a bridge abutment was revised to incorporate a ledge for improved animal access under a bridge (see Figure 2-2). This modification allows animals to use the ledge instead of trying to cross the road. Additional simple solutions that have been implemented around the country are listed at http://www.fhwa.dot.gov/environment/wildlife_protection/.

**Figure 2-2**

Bridge Abutment Revised to Incorporate Ledge for Improved Animal Access
Map 2-1
Pasco County Environmental Land Map

Legend
- Agricultural
- Primary - Parks
- Primary - Public Lands
- Primary - Conservation Lands
- Critical Linkages

2040 LRTP Pasco County

03.12.15
Not all land, however, can be conserved. As shown in Map 2-1 in yellow, light development allows for a mix of uses between the natural and built environment. Biodiversity is generally not as high in these areas when compared to conservation areas, but not as low as in developed areas. Light development areas, when identified and enhanced, can be used to extend the links between disjointed conservation areas.

**Cultural Resources**

Historic and cultural resources provide a physical record of the recent human past on land today. Structures in existence today that were built more than 100 years ago remind us of our long-term needs, interests, and values. Pasco County has several historical and cultural resources, including the following listed in the National Register of Historic Places:

- Dade City Atlantic Coast Line Railroad Depot;
- Capt. Harold B. Jeffries House (Zephyrhills);
- Charles B. Anderson House (Holiday);
- Hacienda Hotel (New Port Richey);
- Samuel Baker House (Holiday);
- Dade City Woman’s Club;
- Pasco County Courthouse (Dade City);
- Zephyrhills Downtown Historic District;
- Church Street Historic District (Dade City); and
- St. Leo Abbey Historic District.

Map 2-2
Pasco County Cultural Resources Map
Section 3: Water-Based Conflicts

Clean water is essential to our way of life; conflicts involving water in Pasco County exist when sources are either reduced or contaminated. Although water scarcity is a real concern in some parts of the United States, this is not necessarily the case in Florida. Water supplies are adequate in Florida, but water resources still must be managed in a way that preserves water quality for years to come. Water in Pasco County comes in two major forms, surface water or groundwater. Surface water includes wetlands, lakes, and rivers. Groundwater includes aquifers, underground rivers, and springs.

**Surface Water**

Surface water moves around Pasco County according to topography and watershed boundaries. Topography is the result of water concentrating and flowing downhill, carrying with it nutrients, sediment, and potential contaminants. Major topological features include watershed boundaries, and Pasco County has three main watersheds: water in the Upper Coastal Areas watershed in the western part of the county flows mainly west to the ocean; water in the Hillsborough River watershed in the central county flows south towards Tampa; and water in the northeast corner in the Withlacoochee watershed mainly flows north to Ocala. These boundaries are shown in red in Map 3-1.

Due to the numerous shallow lakes and wetlands in Pasco County, conflicts between surface water and transportation infrastructure often take the form of wetland infill. New roads require a continuous level or specifically sloping surface, and impacts to wetlands cannot always be avoided. Much of the western side of the Upper Coastal watershed is developed along US 19. The Hillsborough River watershed is developing extensively, especially near Wiregrass and southern sections of I-75. This development will impact the watershed as it drains south towards Tampa.
Map 3-1
Pasco County Watersheds, Surface Water and Groundwater Resources

Legend
- Watershed Boundaries
- Critical Linkages
- Primary - Parks
- Primary - Public Lands
- Primary - Conservation Lands
- Secondary - Karst Areas
- Lake / Pond
- Reservoir
- Swamp / Marsh
- Wellhead Protection Areas

Notes:
- "Wellhead Protection Areas are groundwater areas from which public drinking water is derived. They are regulated by the Safe Drinking Water Act."
- "Surface water bodies are the lines that separate the direction in which surface water flows."

Data Source: Pasco County GIS. Staff/MDG, The National Map.

03.12.15

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**Wetlands**

Wetland impacts are one of many regulated activities in the Environmental Resource Permitting (ERP) Program. Permits for residential and commercial impacts to wetlands (including transportation facilities) in Florida are generally issued by one of the Water Management Districts. Pasco County is located within the Southwest Florida Water Management District (SWFWMD).

A meeting was held with environmental resource staff at SWFWMD on August 25, 2014, to determine the potential impacts to regulated environmental systems that the cost feasible roadway projects might have. As a result of this meeting, it was determined that the most common impacts by the transportation system in Pasco County are to wetlands.

Wetlands that may be impacted by transportation projects should be identified by:

- The watershed in which they are located (e.g., Upper Coastal Areas, Hillsborough River, or Withlacoochee);
- Approximately how much land would be impacted, in square feet or acres; and
- Type of wetland being impacted (e.g., forested, herbaceous, sawgrass, etc.).

The presence of wetlands is determined by areas having three criteria: hydric soils, hydric vegetation, and wetland hydrology. A wetland delineation professional assesses land for these three criteria and makes a determination of the size and extent of the wetland, if any. This determination is generally good for five years, after which another site visit is required.

This step is normally completed well past the planning stage of a transportation project. Although this assessment is already in place for State roadway projects, it is not in place for County roadway projects prior to the preliminary engineering step. This can cause the planned implementation of County roadway projects to have unforeseen environmental costs.

To quickly assess county projects for unknown environmental costs, two main remote mapping resources are available for determining the probability of the existence of a wetland: the National Wetlands Inventory (maintained by U.S. Fish and Wildlife, USFWS) and the Hydric Soil Mapper (maintained by the Natural Resources Conservation Service, NRCS). These maps are complied by each federal agency for use in GIS, have data for most of the United States, and are free to the public. When transportation projects are overlaid with these maps, conflicts between projects and the major wetlands systems are easily identified. This allows for mitigation costs to be included when project costs are developed or alternative alignments to be considered early in the project planning and development phases.
Map 3-2
Pasco County Hydric Soils and Potential Wetlands

Pasco County Hydric Soils (NRCS SOIL DATA)

The presence of hydric soils does not necessarily indicate wetlands. Any potential wetland must be confirmed on site by a wetland delineation professional.

Pasco County Potential Wetlands (NWI Wetland Data)

This data is compiled using aerial imagery. Any potential wetland must be confirmed on site by a wetland delineation professional.
Groundwater

Groundwater generally travels through the subsurface as a subdued approximation of surface topography. For example, if the ground surface elevation is 40 meters above sea level and the groundwater is 10 meters below the surface, the groundwater at this location would have an elevation of 30 meters above sea level. This trend is easy to see in western Pasco County, as groundwater elevations drop in similar fashion to land elevations towards the ocean. Protected groundwater areas are shown on the map in Map 3-2 in dark blue and generally correspond to locations of wellfields used to pump drinking water or water used for irrigation of agriculture. Although pumping has affected some areas, most groundwater elevations generally follow the topography.

However, this trend does not hold true at the north end of the Hillsborough River watershed just south of SR 52. In this area, groundwater is as much as 10 meters lower than surrounding contours. Map 3-3 shows this as a green contour line of 60 meters encircling the wellhead protection area in central Pasco county. Maintaining adequate water levels in this area will protect this important fresh water source for years to come.

The incorporation of Low Impact Development (LID) for transportation improvements inside or within a few miles of the wellfield extent could provide an additional source of water that would help maintain groundwater elevations. Instead of piping stormwater directly to a stream, low impact design directs stormwater into the ground, which recharges the groundwater below. Although design of LID structures requires some expertise and is more expensive than traditional design, it is cost-effective to construct, reducing the amount of stormwater pipes needed for projects. In addition, future coordination with Pasco County’s Planning and Development Department could encourage site developments to adopt similar stormwater infrastructure incentives for this area.
Map 3-3
Pasco County Water: Groundwater Elevations

Environmental Map - Groundwater elevations

Legend

<table>
<thead>
<tr>
<th>2011 Groundwater Elevation (meters)</th>
<th>41 - 60</th>
<th>61 - 90</th>
<th>91 - 120</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 - 20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 - 40</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Watershed Boundaries
Wellhead Protection Areas
Lake / Pond
Reservoir
Swamp / Marsh

2040 LRTP Pasco County

03.12.15

Path: G:\150803-06_13_Pasco2040\LRTP_Scopes\MOBILITY\Environmental\3-3_Groundwater.eidc
Section 4: Ocean-Based Conflicts

Pasco County’s entire western border is shared with the Gulf of Mexico. Conflicts between transportation infrastructure and the ocean take two major forms: storm surge and sea-level rise. Despite its vulnerability to conflict, the margin between land and sea is a highly-sought-after location for residences, businesses, and tourism. Transportation systems allow people access to these desirable places, and people often will visit them regardless of cost or conflict.

Hurricane Evacuation Routes

The main routes away from the coast during a hurricane or other severe weather event are designated as Hurricane Evacuation Routes. These are mapped for each county in Florida, and signs label the actual roadways. Efficient movement of people along these routes is essential for the safety of the people in Pasco County. Map 4-1 shows Pasco County’s designated hurricane evacuation routes.

Storm Surge

Storm surge is the greatest threat to people and infrastructure during hurricanes. Distinct from flooding associated with rain or other precipitation, storm surge is caused by the ocean waves swelling into coastal areas. Storm surge zones are designated by individual counties and compiled by the Florida Division of Emergency Management and are generally categorized into five zones, with Zone 1 being the most vulnerable. Storm surge zones in Pasco County are shown in Map 4-2. The following table summarizes the percent of the county affected by different levels of storm surge with present day (2014) mean sea level.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Acres of county affected</th>
<th>Percent of county affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014 Category 1 Storm Surge</td>
<td>13,393</td>
<td>2.74%</td>
</tr>
<tr>
<td>2014 Category 2 Storm Surge</td>
<td>23,820</td>
<td>4.87%</td>
</tr>
<tr>
<td>2014 Category 3 Storm Surge</td>
<td>36,140</td>
<td>7.38%</td>
</tr>
<tr>
<td>2014 Category 4 Storm Surge</td>
<td>50,030</td>
<td>10.2%</td>
</tr>
<tr>
<td>2014 Category 5 Storm Surge</td>
<td>63,828</td>
<td>13.04%</td>
</tr>
</tbody>
</table>
Map 4-2
Pasco County Storm Surge Areas
**Types of Storm Surge Damage**

Damage to transportation infrastructure from the ocean can consist of the following:

- Temporary roadway flooding;
- Prolonged inundation and waves from large storms;
- Roadside stormwater system backup from heavy rains;
- Wind damage to other roadside utilities such as power lines;
- Structural damage to road beds from groundwater increases;
- Sand deposition on roadways;
- Wave damage to low-elevation bridges; and
- Erosion of boat launches and accompanying unpaved parking lots.

**Storm Surge Mitigation Strategies**

Mitigation strategies are based on resilience. Resilient transportation infrastructure bounces back quickly when planners and designers anticipate potential problems and know to change tactics when a strategy is not working. Appropriate selection of a mitigation strategy balances the cost of implementation to maintain continued use of the area. Mitigation strategies include:

- *Accommodation* – Prepare and recover quickly, or program inundation-friendly materials and uses;
- *Protection* – Build barriers such as seawalls, plant trees to hold soil/beaches in place; and
- *Relocation* – Monitor existing uses, eventual retreat of unsustainable uses.

For example, the use of an “accommodation” strategy would be appropriate for areas in Pasco County that are only vulnerable to storm surge. Storm surge affects transportation infrastructure both infrequently and temporarily, and preparations include evacuating people and recovery includes cleanup after the storm passes. This strategy “accommodates” the temporary increase in water levels because the costs are minimal when storm events occur infrequently. Storm surge-affected areas also are quite large, so it would not be cost-effective to employ other strategies over such a large area.

The “protection” strategy would be appropriate for mitigating storm surge conflicts with critical infrastructure such as hurricane evacuation routes, truck routes, other major roads, bridges, seaports, and airports. When these main arteries of the transportation system are temporarily threatened, they still need to function during hurricanes, and absorb additional loads when minor streets are impassible. Barriers built to “protect” critical transportation infrastructure would be less costly than replacing the infrastructure after the storm.

The “relocation” strategy would be appropriate for infrastructure that is damaged by most storms. When the expense of repeated repair outweighs the benefit the infrastructure provides, it is more cost-effective to relocate the affected infrastructure.
Sea-Level Rise

Pasco County is a coastal Florida county that will be affected by sea-level rise in the future. Sea-level rise is occurring at a much slower rate than storm surge, but its effects are more permanent. Areas exposed to the risk of sea-level rise are small compared to the size of the county, since only the 20-mile western edge of the county borders the Gulf of Mexico. Land elevations from the coast headed east 3 miles increase to about 25 feet and max out at almost 100 feet on the eastern edge of the county, 40 miles from the coast.

The Florida Sea Level Scenario Sketch Planning Tool, developed by the University of Florida GeoPlan Center in 2012 with funding from the FDOT Office of Policy Planning, was run for Pasco County. The “worst case scenario” used input values of (1) USACE “high rate” of sea-level rise and (2) “higher” high tide for 2020, 2040, and 2100. The resulting three surfaces show the maximum potential areas of Pasco County that would be affected by sea-level rise by 2100. Areas potentially affected by 2040 are shown in Figure 4-3 in dark blue and turquoise, and areas potentially affected by 2100 are shown in light green. Locations not identified are not likely to be affected by sea-level rise by 2100.

Using the scenarios described above, only 1% (2,644 acres) of Pasco County would be affected by sea-level rise by 2040, and only 2.38% (11,665 acres) of Pasco County would be affected by sea-level rise by 2100. As shown in Map 4-3, the areas mostly affected by 2040 are very low in elevation. By 2100, a more dramatic effect is seen, as inundated areas start to mirror Category 1 storm surge. However, even in the USACE high sea-level rise projection, inundated areas are mostly limited to areas west of US 19. Effects in these areas include flooding during high tides, beginning with the highest high tides and increasing in frequency as the years approach 2100. Effects also include impacts to the water supply distribution system, the sewer system, and maintenance of the solid waste systems. Rising sea levels also increase the likelihood of saltwater intrusion into groundwater aquifers. It may be of benefit to adjust land use designations in affected areas, relocating critical infrastructure or engineering retrofits to non-critical buildings to accommodate potential intermittent inundation. Future land use conflicts can also be avoided by encouraging the location of new critical buildings or infrastructure away from these areas.

As a region more directly affected by sea-level rise in a shorter timeframe, Southeast Florida is taking initial steps to prepare. Lessons learned from Southeast Florida can help guide Pasco County to adequately prepare and adapt in the future. In July 2013, Miami-Dade County formed the Sea Level Rise Task Force, a group of people of varying expertise charged with reviewing data and conducting a realistic assessment of storm surge and sea-level rise over time. A report with the group’s recommendations was issued July 1, 2014 (see http://www.miamidade.gov/planning/boards-sea-level-rise.asp#2).
Map 4-3
Pasco County Maximum Sea-Level Rise Areas by 2020, 2040, and 2100
Section 5: Conclusion

The transportation infrastructure decisions made today directly affect the transportation system of tomorrow. There is an opportunity and responsibility when planning for new transportation infrastructure to identify current issues and offer cost effective solutions to mitigate conflicts between the environment and transportation systems. Time spent preparing for both short- and long-term problems will ensure an efficient, uninterrupted, and resilient movement of people and goods throughout Pasco County.

Additional references not described specifically in text include the following:

- Florida Planning and Development Lab, Department of Urban and Regional Planning, Florida State University, “Taking the High Road: Integrating Hazard Mitigation into Long-Range Transportation Planning,” September 2010