# FLORIDA SOUTHEAST CONNECTION PROJECT

## *RESOURCE REPORT 6*

*Geological Resources*

*FERC Docket No. PF14-2-000*

**Pre-Filing Draft**
**March 2014**

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| **Filing Requirement** | **Location in Environmental Report** |
| ☐ For underground storage facilities, how drilling activity by others within or adjacent to the facilities would be monitored, and how old wells would be located and monitored within the facility boundaries. | Not Applicable |
| ☒ Discuss the need for and locations where blasting may be necessary in order to construct the proposed facilities. | Section 6.3 |
| ☒ Identify the location (by milepost) of mineral resources and any planned or active surface mines crossed by the proposed facilities. | Section 6.4 |
| ☒ Identify any geologic hazards to the proposed facilities. | Section 6.5 |
| ☐ For LNG projects in seismic areas, the materials required by “Data Requirements for the Seismic River of LNG Facilities,” NBSIR84-2833 | Not Applicable |

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| Certificate | Certificate of Public Convenience and Necessity |
| FDEP | Florida Department of Environmental Protection |
| FEMA | Federal Emergency Management Agency |
| FERC | Federal Energy Regulatory Commission |
| FGS | Florida Geological Survey |
| FPL | Florida Power & Light |
| FSC Project | Florida Southeast Connection Project |
| FSC | Florida Southeast Connection |
| HCA | High Consequence Area |
| MMcf/d | million cubic feet per day |
| MP | milepost |
| mya | million years ago |
| NGA | Natural Gas Act |
| PHMSA | Pipeline and Hazardous Materials Safety Administration |
| Sabal Trail | Sabal Trail Transmission Pipeline Project |
| USGS | United States Geological Survey |

# 6.0 RESOURCE REPORT 6 – GEOLOGICAL RESOURCES

## 6.1 INTRODUCTION

Florida Southeast Connection, LLC ("FSC"), a subsidiary of NextEra Energy, Inc., is seeking a Certificate of Public Convenience and Necessity ("Certificate") from the Federal Energy Regulatory Commission ("FERC") pursuant to Section 7(c) of the Natural Gas Act ("NGA") authorizing the construction and operation of an approximately 127 mile natural gas pipeline known as the Florida Southeast Connection Project ("FSC Project"). The FSC Project is designed to meet the growing demand for natural gas by the electric generation, distribution, and end use markets in Florida. The FSC Project will also provide additional natural gas supply diversity through a connection to the new Sabal Trail Transmission Pipeline Project ("Sabal Trail") via a new interconnection hub in central Florida ("Central Florida Hub"). The Sabal Trail Project is the subject of a separate, but related, certificate filing to the FERC.

The FSC Project will increase natural gas transportation capacity and availability to southern Florida by adding a new third pipeline in central and southern Florida. Upon the anticipated in-service date of May 2017, the FSC Project will be capable of providing a minimum of 600 million cubic feet per day ("MMcf/d") of natural gas to an existing gas yard at Florida Power & Light Company's ("FPL") Martin Clean Energy Center.

The FSC Project involves the construction and operation of approximately 127 miles of up to 36-inch-diameter pipeline and the construction and operation of one meter station (known as the Martin Meter Station). The FSC Project pipeline will start in Osceola County, Florida at the interconnection with Sabal Trail within the Central Florida Hub. The pipeline will traverse Polk, Osceola, Okeechobee, St. Lucie, and Martin Counties, terminating at the Martin Meter Station located at the Martin Clean Energy Center in Martin County, Florida. In addition, FSC will install a pig launcher at the start of the FSC Project and a pig receiver at the end of the FSC Project. Resource Report 1 provides a complete summary of the FSC Project facilities (Table 1.2-1) and a location map of the FSC Project facilities (Figure 1.2-1).

This Resource Report describes the geologic setting and resources of the FSC Project area for the pipeline facilities and the new aboveground facilities (Section 6.2) and addresses the potential for blasting (Section 6.3), use of mineral resources (Section 6.4), and geological hazards that may affect the construction and operation of these new facilities (Section 6.5). Where appropriate, mitigation measures intended to reduce the impact of the FSC Project on geological resources and/or reduce the impact of geological hazards on FSC Project facilities are identified. A checklist showing the status of the FERC filing requirements for Resource Report 6 is included after the table of contents.

## 6.2 GEOLOGIC SETTING

Rock core samples taken in Florida from thousands of feet below the surface, called basement rocks, show that Florida's geology consists of igneous and metamorphic suites overlain by sandstones and shales (Means, 2012). As land masses converged they created the foundation for the accumulation of vast thicknesses of carbonate (limestone) that would eventually become the Florida Platform (Means, 2012).

### 6.2.1 Geologic History of Florida

The following is summarized from the Florida Department of Environmental Protection ("FDEP") Division of Resource Assessment and Management, Florida Geological Survey ("FGS")website titled Florida's Geologic History (Means, 2012).

Florida took its current shape during the Cenozoic Era, starting 65.5 million years ago ("mya"). Warm oceans covered the state until the Late Oligocene Epoch, 23 to 28 mya, in which limestone comprised of the skeletons of billions of small creatures called foraminifera accumulated. Small patch reefs formed in the warm, clear, shallow waters and a marine current very similar to the Gulf Stream swept across northern Florida and scoured the sea floor. The current deflected sediment that was being eroded and transported from the mainland, as a result limestone from this period is pure (up to 99% calcium carbonate).

At the end of the Oligocene Epoch, sea levels dropped and Florida emerged from the sea. The dissolution of limestone by slightly acidic rain water resulted in the formation of large pore spaces, conduits, and caverns, referred to as karst topography. As the land surface collapsed into these voids, sinkholes formed, which are a prominent feature in the Florida landscape. Other karst features include springs, air caves, and disappearing streams. Throughout the end of the Oligocene and into the Miocene, sea levels fluctuated and clays and sands became common deposits. In the early Miocene, the Appalachians were uplifted and continental siliciclastic sediments filled the Gulf trough, which began encroaching upon the carbonate depositing environments and resulted in large deposits of phosphorite as cool, nutrient-laden ocean water bathed Florida.

The Pleistocene Epoch (2.6 mya to 10,000 years ago), also known as the Ice Age, was characterized by extreme climate and sea level change. During warm periods, sea levels rose as much as 100 feet higher than today and allowed accumulation of limestone. During glacial periods seas dropped as much as 300 feet and allowed dissolution of limestone. Sea level reached its current elevation during the Holocene Epoch (10,000 years ago to present).

### 6.2.2 Physiography

Florida lies within the Floridian section of the Atlantic Coastal Plain physiographic province (USGS, 2003(a)). Physiography within Florida is further subdivided into primary and secondary provinces. The FSC Project area is located within the Atlantic Coastal Lowlands, Intermediate Coastal Lowlands, and the Central Highlands primary physiographic provinces (NRC, 2012). Each of the secondary physiographic provinces within the primary provinces is discussed in detail below (NRC, 2012; FDEP, nd).

#### 6.2.2.1 Osceola Plain

The Osceola Plain physiographic secondary province extends southeasterly through eastern Okeechobee County, extreme southwestern St. Lucie County, and into western Martin County. It is bounded on the west and northwest by the Lake Wales Ridge and the southern ends of the Mount Dora and Orlando Ridges. On the northeast, east, and south it is bounded by an outward-facing erosional ridge. The Osceola Plain reaches approximately 90 to 95 feet (27 to 29 meters) in elevation near its northern edge. It reaches an elevation of 80 feet (24 meters) east and northeast of Lake Kissimmee. Its local relief is very small, with variations of 10 feet (3 meters) across the entire subprovince. The Kissimmee River passes roughly west of the Osceola Plain. The river is confined to a valley for 25 miles (40 kilometers) south of Lake Kissimmee. North of Lake Kissimmee, several lakes occupy most of the Osceola Plain. The Arbuckle Creek on the western side of the Osceola Plain (west of the Bombing Range Ridge) drains Lake Arbuckle into Lake Istokpoga below the southern bounding scarp of the Osceola Plain.

#### 6.2.2.2 Lakes Wales Ridge

The Lakes Wales Ridge physiographic subprovince is a unique mosaic of elevated sandy ridges encompassing an area from about the southern Highlands County boundary 160 kilometers (99 miles) north to near Orlando. The Lake Wales Ridge averages about 7.5 kilometers (4.6 miles) wide. Though the name implies a single physiographic area, the Lake Wales Ridge consists of three elevated sandy ridges that were once the beach and dune systems of Miocene, Pliocene, and early Pleistocene seas. These relict dunes and the deep, sandy, well-drained soils support a number of plant communities that have adapted to xeric conditions over millions of years. Due to the elevation and geologic age of the soils of Lake Wales Ridge scrubs, it has been estimated that the highest hilltops in this area have supported upland vegetation for about 25 million years. On the Lake Wales Ridge, an estimated 200 ancient scrub islands have been identified. Between ridges and at the base of hills, the soils become fine and compacted and often retain surface water, forming wetlands and lakes. Rainfall, seepage, and elevated water tables provide the sources of water for these aquatic systems. Combined with the aquatic and wetland communities that now exist between and within the ridges, this subregion consists of a complex mosaic of habitats, some unique to Florida.

#### 6.2.2.3 Bombing Range Ridge

The Bombing Range Ridge is a small subprovince located east of elongate Lake Wales Ridge. The lakes of the Bombing Range Ridge and the northern Lake Wales Ridge are darker colored with higher nutrients than the lakes found on the southern Lake Wales Ridge. Elevations are 70 to 130 feet (~21 to 40 meters), and there are more extensive areas of poorly drained soils, such as the Satellite and Basinger series. Peaty muck Samsula soils border many of the lakes.

#### 6.2.2.4 Okeechobee Plain

The Okeechobee Plain physiographic subprovince is within Okeechobee County and includes part of Lake Okeechobee. The southern part of this plain abuts the Everglades with Lake Okeechobee bisecting the plain. The Okeechobee Plain is divisible from the Everglades by its slightly better drainage and slightly steeper slope and a higher mineral content in its soils. The Okeechobee Plain slopes gradually south to approximately elevation 20 feet (6 meters) at the northern shore of Lake Okeechobee.

#### 6.2.2.5 Eastern Valley – Lowlands, Gaps, and Valleys

The Eastern Valley physiographic subprovince of central Florida is a broad flat valley. The FSC Project crosses the Eastern Valley in Martin and St. Lucie Counties. The elevation of the Eastern Valley varies from 20 to 30 feet (6 to 9 meters) above sea level. There are relicts of beach ridges that at one time constituted a regressional or progradational beach ridge plain. The head of the St. Johns River consists of a broad swampy valley with lakes. The river flows through each lake along its longest axis. This suggests that at one time there was a standing body of water that has been filled with sediments and vegetation between the upper levels of the lakes that eventually formed the flat, swampy flood plain; the unfilled places became the current chain of lakes in the St. Johns River's headwaters.

Southward of the St. Johns River, the topography has approximately 5 feet (1.5 meters) of local relief throughout the area. This topography is bounded by the headwaters of the St. Johns River at the north, the bounding scarp of the Eastern Valley on the west, the St. Lucie Canal on the south, and Ten Mile and Atlantic Coastal Ridges on the east. The surface of the entire area has elevations close to 25 to 30 feet (7.6 to 9 meters).

### 6.2.3 Topography

Topography along the FSC pipeline route and in the surrounding area is relatively flat. For topographic details along the FSC pipeline route, see the USGS 7.5 minute series topographic quadrangle excerpts located in Appendix 1B of Resource Report 1.

### 6.2.4 Surficial Geology of the FSC Project Area

Surficial geology of the FSC Project area is characterized as Beach Ridge and Dune, Cypresshead Formation, Dunes, Holocene Sediments, Reworked Cypresshead Formation, Shell-Bearing Sediments, and Undifferentiated Sediments. Appendix A shows the surficial geology in the FSC Project area and Table 6.2-1 summarizes surficial geology in the vicinity of the proposed pipeline and aboveground facilities. Each Florida surficial geologic unit that is crossed by or in the vicinity of the FSC pipeline is described below (USGS, 2013)

#### 6.2.4.1 Quaternary Beach Ridge and Dune (Qbd)

Much of Florida's surface is covered by a varying thickness of undifferentiated sediments consisting of siliciclastics, organics and freshwater carbonates. Sediments showing surficial expression of beach ridges and dunes were mapped separately as Qbd, formed during the Pleistocene and Holocene epochs. The siliciclastics are light gray, tan, brown to black, unconsolidated to poorly consolidated, clean to clayey, silty, unfossiliferous, variably organic-bearing sands to blue green to olive green, poorly to moderately consolidated, sandy, silty clays. Organics occur as plant debris, roots, disseminated organic matrix and beds of peat. Freshwater carbonates, often referred to as marls in the literature, are scattered over much of the State. In southern Florida, freshwater carbonates are nearly ubiquitous in the Everglades. These sediments are buff colored to tan, unconsolidated to poorly consolidated, fossiliferous carbonate muds. Sand, silt and clay may be present in limited quantities. These carbonates often contain organics. The dominant fossils in the freshwater carbonates are mollusks.

#### 6.2.4.2 Tertiary Cypresshead Formation (Tc)

The Cypresshead Formation formed during the Pliocene epoch and is composed of siliciclastics and occurs only in the Florida peninsula and eastern Georgia. It is at or near the surface from northern Nassau County southward to Highlands County forming the peninsular highlands. It appears that the Cypresshead Formation occurs in the subsurface southward from the outcrop region and similar sediments, the Long Key Formation, underlie the Florida Keys. The Cypresshead Formation is a shallow marine, near shore deposit equivalent to the Citronelle Formation deltaic sediments and the Miccosukee Formation prodeltaic sediments. The Cypresshead Formation consists of reddish brown to reddish orange, unconsolidated to poorly consolidated, fine to very coarse grained, clean to clayey sands. Cross bedded sands are common within the formation. Discoid quartzite pebbles and mica are often present. Clay beds are scattered and not areally extensive. In general, the Cypresshead Formation in exposure occurs above 100 feet (30 meters) above Mean Sea Level (“MSL”). Original fossil material is not present in the sediments although poorly preserved molds and casts of mollusks and burrow structures are occasionally present. The presence of these fossil "ghosts" and trace fossils document marine influence on deposition of the Cypresshead sediments. The permeable sands of the Cypresshead Formation form part of the surficial aquifer system.

#### 6.2.4.3 Tertiary-Quaternary Dunes (TQd)

These dune sediments are fine to medium quartz sand with varying amounts of disseminated organic matter that formed during the Pliocene and Pleistocene epochs. The sands form dunes at elevations greater than 100 feet (30 meters) MSL.

#### 6.2.4.4 Quaternary Sediments (Qh)

These Holocene sediments in Florida occur near the present coastline at elevations generally less than 5 feet (1.5 meters) MSL. The sediments include quartz sands, carbonate sands and muds, and organics.

#### 6.2.4.5 Tertiary-Quaternary Reworked Cypresshead Sediments (TQuc)

This unit is the result of post depositional reworking of the Cypresshead siliciclastics, formed during the Pliocene and Pleistocene epochs. The sediments are fine to coarse quartz sands with scattered quartz gravel and varying percentages of clay matrix.

#### 6.2.4.6 Tertiary-Quaternary Shell Bearing Sediments (TQsu)

These "formations" are biostratigraphic units that consist of shelly sediments formed during the Pliocene and Pleistocene epochs. The primary rock type is limestone, a sedimentary rock consisting chiefly of calcium carbonate, primarily in the form of mineral calcite. Lithologically these sediments are complex, varying from unconsolidated, variably calcareous and fossiliferous quartz sands to well indurated, sandy, fossiliferous limestones (both marine and freshwater). Clayey sands and sandy clays are present. These sediments form part of the surficial aquifer system.

#### 6.2.4.7 Undifferentiated Quaternary Sediments (Qu)

This surficial expression of undifferentiated sediments is similar to the Pleistocene/Holocene Beach Ridge and Dune (Qbd), except the subdivisions of the Undifferentiated Quaternary Sediments are not lithostratigraphic units but rather utilized in order to facilitate a better understanding of the State's geology.

### 6.2.5 Bedrock Geology of the FSC Project Area

Bedrock in Florida is characterized as the Florida Platform, one of the largest carbonate platform complexes on Earth. Bedrock nearest to the ground surface in Florida is a 2- to 6-kilometer-thick carbonate (limestone, dolomite) and evaporate (salts) sedimentary rock succession punctured by dissolution features and resultant karst terrain expressed at the surface (Hine, 2009). Overburden thickness ranges from 30 to 200 feet thick along the length of the pipeline.

Karst terrain is present in the vicinity of FSC Project facilities and is discussed in Section 6.5.6.

## 6.3 BLASTING

Based on available geotechnical data and the geology described in this Resource Report, FSC anticipates that minimal rock removal will be required during construction of the FSC pipeline.

If bedrock is encountered and requires removal, several conventional (non-explosive) techniques are available including:

- Conventional excavation with a backhoe;
- Ripping with a dozer followed by backhoe excavation; or
- Hammering with a pointed backhoe attachment followed by backhoe excavation.

If it is determined that the bedrock cannot be removed by conventional techniques, blasting options may include:

- Blasting followed by backhoe excavation; or
- Blasting surface rock prior to excavation.

Blasting is not anticipated, however, if blasting is required for the FSC Project, it will be conducted in accordance with Florida blasting codes and any local blasting requirements. The state licensed contractors will meet or exceed all applicable requirements governing the use of explosives. The specific blasting procedures will depend on the relative hardness and volume of the rock to be removed, its fracture susceptibility, and the specifics of the location. If blasting is required, a blasting plan will be developed by FSC, approved and permitted by the appropriate state and local authorities, and submitted to the Commission prior to the initiation of blasting.

## 6.4 MINERAL RESOURCES

Mineral resources in the FSC Project area consist largely of sand and gravel (USGS, 2003(b)) and the FSC pipeline passes near locations used for sand mining. Although the Project does not pass through any mines, it does cross through registered Mandatory Non-Phosphate Sites (Approximate MPs 17.5, 23.8, 29.9, and 30.6) and abuts a Mandatory Non-Phosphate Site at MP 4.5. Mandatory Non-Phosphate Sites are aggregate mining sites that require registration with the FDEP Bureau of Mines in order to conduct extraction. Although the FSC Project crosses these sites, it does so along existing rights-of-way or adjacent to property lines within the 100 ft. required setback and is not located within any areas used for mining operations. Table 6.2-2 lists known mines within 0.5 mile of the FSC Pipeline, and Figure 6.2-1 shows mineral resources in the area.

FSC has conducted on-ground field surveys of the entire pipeline right-of-way and have not identified evidence of oil and gas wells in the vicinity. GIS mapping indicates that there is one oil and gas well more than 700 feet east of the right-of-way near MP 100, but that this well is defined as a “dry hole” (FDEP, 2002) (See Figure 6.2-1). If an oil or gas well is later found along the pipeline route during construction, a proper assessment of the area will be conducted by appropriate engineering and construction staff. Avoidance of the area may be possible by a minor route variation and/or prohibiting equipment from working in this portion of the temporary workspace.

## 6.5 GEOLOGIC HAZARDS

Geologic hazards are natural physical conditions that, when active, can impact environmental features and man-made structures and may present public safety concerns. Such hazards typically include seismicity, soil liquefaction, landslides, subsidence, flooding, and volcanism.

### 6.5.1 Seismic Environment and Risk

Florida is classified as a stable geological area (FGS, 1994). Although Florida is not usually considered to be a state subject to earthquakes, several minor shocks have occurred (USGS, 2014). Additional shocks of doubtful seismic origin also are listed in earthquake documents (USGS, 2014). With respect to probable damage from the largest expected distant earthquake, some areas may experience tremors, with only minor damage, such as broken glass or glassware (FGS, 1994).

The United States Geological Survey (USGS) produces probabilistic Seismic Hazard Maps for the United States with peak ground acceleration values represented as a factor of “g”. The factor “g” is equal to the acceleration of a falling object due to gravity. These USGS Seismic Hazard Maps were reviewed for the Project area with the following results: There is a 2 percent probability of a 0.02-0.04 percent “g” exceedance in 50 years; and, a 10 percent probability of a 0.01-0.02 percent “g” exceedance in 50 years.

Therefore, earthquakes and related seismic hazards are not anticipated to have an impact on the FSC Project. The FSC Project area is not located along a tectonic plate boundary where frequent high energy earthquakes are typically common. Rather, the FSC Project location is an intraplate setting with historically low seismic risk and minimal seismic activity. Seismic provisions are in place within local building codes detailing construction requirements in this seismic environment. To meet the known seismic conditions in the vicinity of the FSC Project, all FSC Project facilities will be built to meet or exceed the seismic design provisions of the Pipeline and Hazardous Materials Safety Administration (“PHMSA”) under the U.S. Department of Transportation Office of Pipeline Safety, the Florida Public Service Commission, and the guidelines of the FERC.

### 6.5.2 Active Faults

Florida is situated on the trailing (or passive) margin of the North American Plate while California, for example, is located on its active margin. The active margin is bounded by faults that generate earthquakes when there is movement along them. Accordingly, Florida has an extremely low incidence of earthquakes. None of the geologic features in Florida are known to have any seismicity associated with them and, therefore, active faults are not anticipated to have an impact on the FSC Project (FGS, 2013a).

### 6.5.3 Tsunamis

The risk of a tsunami striking Florida is considered to be low (FGS, 2013b). The website for the National Oceanographic and Atmospheric Administration lists the following states as being especially vulnerable to tsunamis, in addition to the U.S. Caribbean Islands: Hawaii, Alaska, Washington, Oregon, and California (FGS, 2013b). Due to this low probability and the location of the pipeline well inland of the coast, tsunamis are not anticipated to have an impact on the FSC Project.

### 6.5.4 Areas Susceptible to Soil Liquefaction

Soil liquefaction is a process whereby the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading. The result is a transformation of soil to a liquid state. Severe shaking is most commonly caused by a large earthquake. This factor is limited by the distance from the large earthquake epicenter. That is, liquefaction potential decreases as location increases from the epicenter of a large earthquake. For liquefaction to occur, a relatively shallow water table, rapid strong ground motion, and non-cohesive soils all must be present (University of Washington, 2000).

Soil liquefaction can result in surface settlement in areas where the ground surface is flat, and soil flow or slope instability in areas where the landscape is sloped. Soil liquefaction can lead to the failure of building foundations and other structures that rely on such soils for support. Susceptibility to liquefaction is augmented in areas where overburden stress in loose, saturated sand is increased due to imposition of a surface load (ex, a new building or embankment fill).

The low seismic risk in the FSC Project area is a limiting factor for liquefaction to occur; as a result, the likelihood of naturally occurring soil liquefaction in the FSC Project area is low.

### 6.5.5 Areas Susceptible to Landslides

Landslides occur when rock, sediments, soils, and debris move down steep slopes. Such gravity-induced flow is usually precipitated by heavy rains, erosion by rivers, earthquakes, or human activities (e.g., man-made structures or pilings of rock). The following description of landslides and their occurrence potential in Florida is summarized from the FGS Landslides Hazards website (FGS, 2013c).

Landslides are very rare in Florida, given the state is generally characterized by low topographic relief. Gravity is the force that is responsible for landslides. In areas where there are steep slopes, unconsolidated soils and sediments may move downward. This movement may be too slow to notice, in which case it is called soil creep. If the movement is sudden and catastrophic, it is referred to as a landslide or slump. Landslides may be associated with excessive amounts of rain that lead to saturation of earth materials by water. The steepening of slopes by erosion or construction may also be a factor in the development of landslides.

As there has been only one recorded occurrence of a landslide in Florida over 60 years ago on a very steep slope, and given the low-gradient topography of the FSC Project area, the risk of landslides occurring at or near the FSC Project area is considered very low.

### 6.5.6 Surface Subsidence

#### 6.5.6.1 Karst and Sinkholes

Subsidence is the local downward movement of surface material with little or no horizontal movement. Karst conditions, which are a type of land subsidence, have been identified in the FSC Project area. Previous analyses and experience in the construction and operation of pipeline facilities in Florida’s karst terrain have demonstrated a low potential for damage due to sinkhole collapse.

One known sinkhole is mapped within 0.5-mile of the FSC pipeline, located approximately 1,270 feet southeast of MP 17.1 (see Figure 6.2-2) (FDEP, 2013). Closed topographic depressions, which are defined as areas of very limited or no drainage, are a good indicator of karst regions (FDEP, 2013) and are also shown on Figure 6.2-2. No sinkholes were identified during field surveys of the right-of-way.

During construction in potential sinkhole areas, construction employees will be informed of the potential for sinkholes during routine safety briefings. Craft, safety, and environmental inspectors will be aware of this potential and alert for signs of sinkhole formation. Signs of sinkhole formation and the presence of sinkholes will be immediately and clearly marked. Evaluation of the area will be conducted by appropriate engineering and construction staff. Avoidance of the area may be possible by a minor route variation or by prohibiting equipment from working in this portion of the temporary workspace.

In areas of high sinkhole potential, the following mitigation measures may be undertaken:

- Relocate the pipeline away from existing sinkholes;
- Remediate soil dome, rock cavity or other incipient feature as appropriate;
- During dewatering discharge and hydrostatic testing of the pipeline, take special care to avoid releasing large volumes of water directly onto land that is known to be prone to sinkhole development; and
- Conduct post construction on-site inspections of pipeline facilities. Should a sinkhole or karst terrain area be impacted, the area will be evaluated and remedial action taken immediately.

In the event that after construction a sinkhole develops and creates a void space underneath the pipeline, appropriate site-specific safety and mitigation measures, as approved by the appropriate agencies at the given location, will be undertaken to prevent further collapse of the sinkhole and possible stress damage to the pipeline. Mitigation measures may include backfilling the sinkhole with fill material, injecting grout into the sinkhole to seal the hole and prevent further collapse, or a combination of grouting and backfilling to protect the integrity of the pipeline.

FSC will conduct route surveillance and training during operation of the FSC Project, to monitor the pipeline right-of-way for signs of soil movement and subsidence. Should either be identified, the soil movement or subsidence will be mitigated or the affected pipeline segment will be excavated, repositioned, or replaced, and properly bedded and backfilled to pre-construction contours. Class 1 and 2 segments will be patrolled at least once each calendar year, not to exceed 15 months. Those Class 1 and 2 segments that are highway or railroad crossings will be patrolled at least twice a year not to exceed 7 ½ months. Class 3 segments will be patrolled twice each calendar year, not to exceed 7 ½ months. Those Class 3 segments that are highway or railroad crossings will be patrolled at least four times a year, not to exceed 4 ½ months.

Post construction changes in depth of pipeline cover will be addressed in the Integrity Management Plan for the pipeline. The objective will be to maintain the minimum cover standards outlined in 49 CFR 192.327 and either re-establish suitable cover or make engineering investments to provide addition protection to withstand anticipated external loads. Patrol strategy will be a combination of walking, vehicular, or aerial methods, depending on High Consequence Areas ("HCAs") identified in the Integrity Management Plan. HCAs will get closer and more frequent scrutiny that non-HCA line segments.

#### 6.5.6.2 Underground Mines

Underground mining poses risks to engineered structures because of the potential for the overlying strata to collapse into the void formed by the extraction of minerals. No current or former underground mining activities exist along the FSC pipeline route or at the location of new aboveground facilities based on information from the Active Mines and Mineral Plants in the US list (USGS, 2003(b)). Therefore, no ground subsidence from underground mines is anticipated.

### 6.5.7 Flooding

From 2000 to 2010, Florida has experienced five federally declared disasters due to flooding, and has sustained severe flood damage from a number of major hurricanes and tropical storms (FEMA, 2010). The following describes the types of flooding encountered in Florida, the causes, and impacts (FEMA, 2010):

- Heavy Rains - Hurricanes, tropical storms, and summer thunderstorms have the potential to unload heavy and sustained rainfall, which overwhelms drainage systems and causes flooding.
- Storm Surge and Inland Flooding - Storm surge, the water that is pushed toward the shore by the strong storm winds, can cause severe flooding in coastal areas. Coastal communities are not the only ones impacted. Hurricanes and tropical storms are powerful systems that have the ability to travel far from the initial strike zone. Once inland, they continue to bring powerful and heavy rains. Hurricane Irene (1999) resulted in up to 20 inches of rain on South Florida, and caused severe and inland flooding.
- Flash Flooding - Flash floods caused by sudden, heavy rainfall can occur in just a few hours or less. Moving water from flash floods can lift rocks and debris, and damage homes and buildings.

#### 6.5.7.1 Flooding During Construction

Flood prone areas in Florida are associated with either low-lying coastal areas where the land surface elevation is below 30 feet National Geodetic Vertical Datum of 1929 ("NGVD 29") or with inland rivers, lakes, or depressional areas. Severe coastal flooding problems can result from the storm surge associated with a hurricane. Inland flooding can occur in poorly drained areas such as wetlands or within the floodplains of rivers and lakes. Generally, flooding only poses a problem during pipeline construction, because the pipeline is buried well below the surface once construction is complete.

Project related activities could cause surface drainage patterns and hydrology to be temporarily altered and could increase the potential for the trench to act as a drainage channel, although the potential effect will be minimized by the use of trench plugs and trench breakers. Disturbance of adjacent wetlands could also affect the capacity to control erosion and flooding.

Prior to construction, a Project-specific Storm Water Pollution Prevention Plan ("SWPPP") will be developed to minimize impacts from overland flow. In addition, FSC's contractor will minimize overland flooding by:

- Limiting the time the trench is left open;
- Maintaining natural overland flow patterns by providing breaks in the topsoil and subsoil stockpiles;
- Maintaining flow in drainage systems during construction to prevent ponding in adjacent non-disturbed areas;
- Constructing across wetlands and waterbodies in accordance with the measures set forth in FSC's Plan and Procedures;
- Obtaining consumptive use permits for water withdrawals related to hydrostatic testing and dewatering. Each of these permits will identify the water source and discharge locations for the FSC Project. A standard set of state approved hydrostatic test water discharge best management practices will be included with each permit application. (Additional information on these project activities is provided in Resource Report 2.) It is anticipated that all hydrostatic test water will be discharged overland within or along the edges of the construction area; and
- Installing temporary erosion controls after initial disturbance of the soils, where necessary, to minimize erosion and maintaining those controls throughout construction. All temporary erosion and sediment controls will be installed in accordance with FSC's Plan and Procedures.

#### 6.5.7.2 Flooding During Pipeline Operation

Flooding accounts for less than one percent of all pipeline accidents. The effects of flooding can lead to potential exposure of the pipeline and associated affects. To prevent and mitigate such damage to pipeline facilities, the PHMSA issued an advisory bulletin on July 12, 2013 ("Bulletin"), cautioning all owners and operators of gas and hazardous liquid pipelines to inspect at-risk facilities and take appropriate precautionary measures to prevent or mitigate damage from flooding.

Pipeline safety regulations require pipeline operators to have procedures for surveying their facilities and to take appropriate action when problems arise, such as from "unusual operating and maintenance conditions" (49 C.F.R. § 192.613(a)). The Bulletin makes clear that severe flooding is the kind of unusual operating condition that can adversely affect a pipeline's safety and potentially require corrective action, including shutting down operations if it poses an immediate hazard to persons or property.

Flooding can lead to pipeline damage in a variety of ways. Washouts and erosion caused by flooding increases stress on piping and support structures, which can lead to ruptures. Exposed pipelines are susceptible to the force of water flow and are more likely to be struck, such as by floating debris or boaters involved in rescue operations. Additionally, valves, regulators, relief sets and other facilities normally above ground are also more susceptible to damage when submerged.

The PHMSA's Bulletin urges operators with pipeline facilities in areas affected by flooding to:

1. Evaluate the accessibility of pipeline facilities that may be in jeopardy, such as valve settings, which are needed to isolate water crossings or other sections of a pipeline.
2. Extend regulator vents and relief stacks above the expected flooding level, as appropriate.
3. Provide maps and information about pipeline location and condition to emergency and spill responders.
4. Coordinate with other pipeline operators in the flood area and establishing emergency response centers to act as a liaison for pipeline problems and solutions.
5. Deploy and position personnel to take emergency action, including shut down, isolation or containment.
6. Determine if facilities that are normally above ground (e.g., valves, regulators, relief sets, etc.) have become submerged and are in danger of being struck by vessels or debris and, if possible, mark such facilities with an appropriate buoy and Coast Guard approval.
7. Perform frequent patrols, including appropriate overflights, to evaluate right-of-way conditions at water crossings during flooding and after waters subside. Determine if flooding has exposed or undermined pipelines as a result of new river channels cut by the flooding or by erosion or scouring.
8. Perform surveys to determine the depth of cover over pipelines and the condition of any exposed pipelines, such as those crossing scour holes (including using divers or instrumented detection, as appropriate). Information gathered by these surveys should be shared with affected landowners. Agricultural agencies may help to inform farmers of the potential hazard from reduced cover over pipelines.
9. Ensure that line markers are still in place or replaced in a timely manner. Notify contractors, highway departments, and others involved in post-flood restoration activities of the presence of pipelines and the risks posed by reduced cover.
10. The Bulletin advises that if a pipeline is damaged from flooding, the operator should inform the appropriate PHMSA regional office or state pipeline safety authority before returning the line to service, increasing its operating pressure, or otherwise changing its operating status. Reporting a Safety Related Condition may also be required. See 49 C.F.R. §§ 191.23 and 195.55.

FSC has designed and will operate, and manage its pipeline by adhering to its own operating procedures and in accordance to all local and Federal Pipeline Safety Regulations. As a result, flooding during operation of the pipeline in the FSC Project area is not expected to be a significant concern.

#### 6.5.7.3 Design for Keeping Aboveground Facilities from Flooding

A review of the Federal Emergency Management Agency ("FEMA") Flood Insurance Rate Maps ("FIRM") showed no designated flood zones at the Martin Meter Station, Launcher/Receiver and Mainline Valve Locations. The Launcher/Receiver and Mainline Valve site locations will be designed similar to the Martin Meter Station. During FSC Project construction, the sites will have no impact on the flood storage capacity at these locations because no permanent aboveground structures will be located within the FEMA FIRM boundary and the construction area will be restored to pre-construction grade to the extent practicable.

Based on regional conditions, the potential for flash flooding to significantly impact construction or operation of the FSC Project is low. FSC will monitor local weather conditions during construction to anticipate and plan for significant weather events. Rainfall runoff during construction will be managed through the implementation of the FSC's Plan and Procedures. Post-construction storm water management will be provided through the construction of permanent storm water quality and quantity facilities as appropriate.

### 6.5.8 Volcanism

No active or inactive volcanic features are present near the FSC Project area based on the ages and types of rock mapped by the USGS. Therefore, no impacts from volcanism are anticipated.

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# TABLES

**Table 6.2-1**
**Surficial Geology of the FSC Project**

| County | Starting MP | Ending MP | Linear Distance (Mile) a/ | Map Symbol | Surficial Deposit |
|---|---|---|---|---|---|
| Osceola/Polk | 0.00 | 2.37 | 2.37 | Qu | Undifferentiated Sediments |
| Polk | 2.37 | 2.56 | 0.19 | TQd | Dunes |
| Polk | 2.56 | 2.80 | 0.24 | Qu | Undifferentiated Sediments |
| Polk | 2.80 | 6.30 | 3.50 | TQd | Dunes |
| Polk | 6.30 | 6.92 | 0.62 | Qu | Undifferentiated Sediments |
| Polk | 6.92 | 7.35 | 0.44 | TQd | Dunes |
| Polk | 7.35 | 7.76 | 0.41 | Qu | Undifferentiated Sediments |
| Polk | 7.76 | 8.72 | 0.95 | TQd | Dunes |
| Polk | 8.72 | 9.60 | 0.88 | TQuc | Reworked Cypresshead Formation |
| Polk | 9.60 | 11.28 | 1.68 | Qu | Undifferentiated Sediments |
| Polk | 11.28 | 12.30 | 1.02 | TQd | Dunes |
| Polk | 12.30 | 13.43 | 1.13 | Qh | Holocene sediments |
| Polk | 13.43 | 15.42 | 1.99 | TQd | Dunes |
| Polk | 15.42 | 20.54 | 5.12 | TQuc | Reworked Cypresshead Formation |
| Polk | 20.54 | 21.65 | 1.11 | Tc | Cypresshead Formation |
| Polk | 21.65 | 23.54 | 1.89 | TQuc | Reworked Cypresshead Formation |
| Polk | 23.54 | 25.01 | 1.47 | Tc | Cypresshead Formation |
| Polk | 25.01 | 35.95 | 10.95 | TQuc | Reworked Cypresshead Formation |
| Polk / Osceola / Okeechobee | 35.95 | 87.09 | 51.14 | Qu | Undifferentiated Sediments |
| Okeechobee | 87.09 | 94.94 | 7.85 | Qbd | Beach Ridge and Dune |
| Okeechobee | 94.94 | 95.70 | 0.76 | TQsu | Shell-bearing sediments |
| Okeechobee | 95.70 | 95.82 | 0.11 | Qbd | Beach Ridge and Dune |
| Okeechobee | 95.82 | 95.82 | 0.00 | TQsu | Shell-bearing sediments |
| Okeechobee | 95.82 | 102.31 | 6.49 | Qbd | Beach Ridge and Dune |
| Okeechobee / St. Lucie | 102.31 | 102.67 | 0.36 | TQsu | Shell-bearing sediments |
| St. Lucie | 102.67 | 105.61 | 2.93 | Qbd | Beach Ridge and Dune |
| St. Lucie / Martin | 105.61 | 118.43 | 12.82 | TQsu | Shell-bearing sediments |
| Martin | 118.43 | 122.44 | 4.01 | Qbd | Beach Ridge and Dune |
| Martin | 122.44 | 126.82 | 4.38 | TQsu | Shell-bearing sediments |
| **Aboveground Facilities** | | | | | |
| Launcher Site Osceola | 0.0 | --- | --- | Qu | Undifferentiated Sediments |
| Martin Meter Station Martin | 126.8 | --- | --- | Qmm | Salt Marsh & Estuarine Deposits |
| Sources: USGS, ESRI | | | | | |

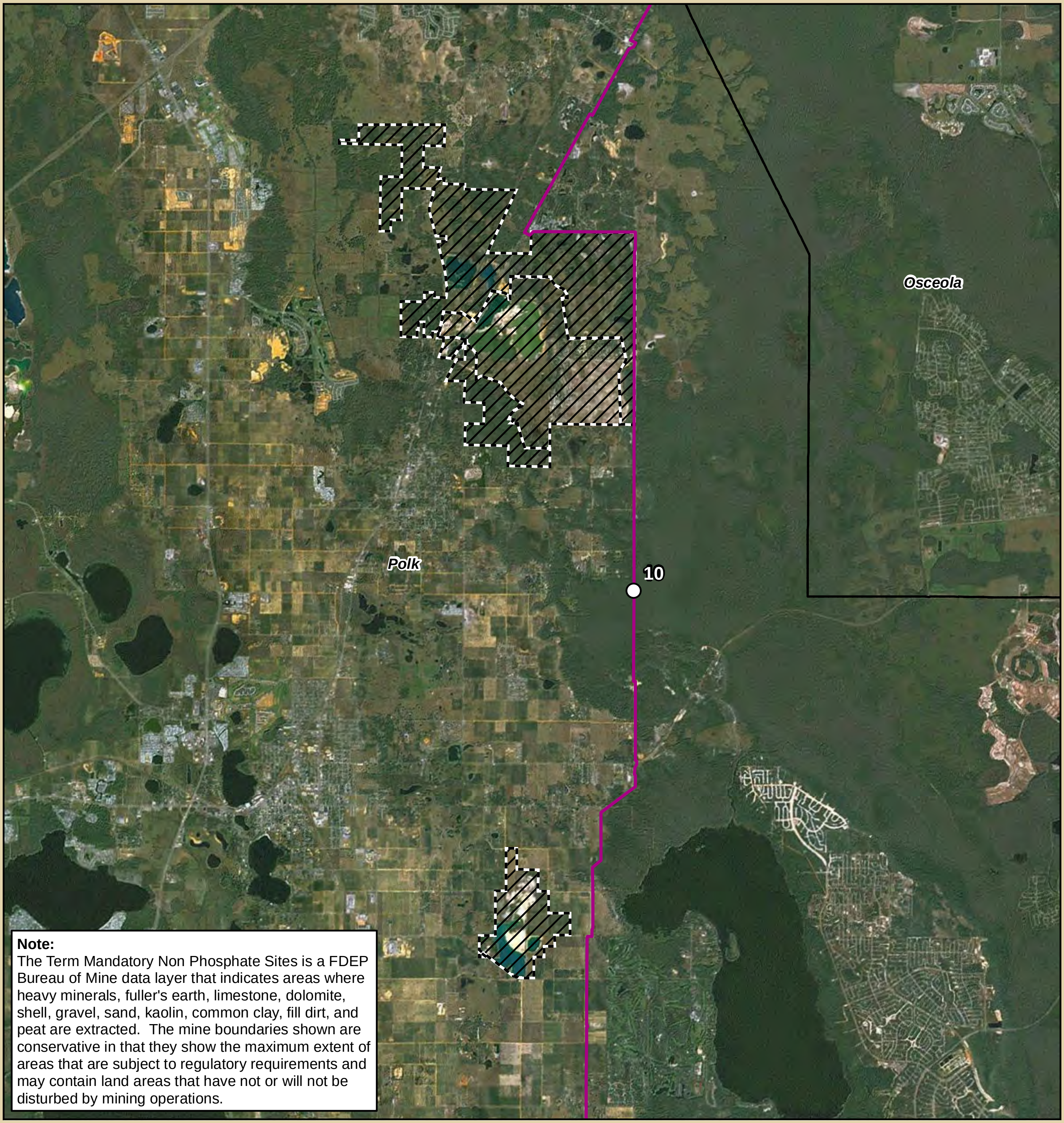
**Table 6.2-2**

**Mandatory Non-Phosphate Sites within 0.5-Mile of the FSC Project**

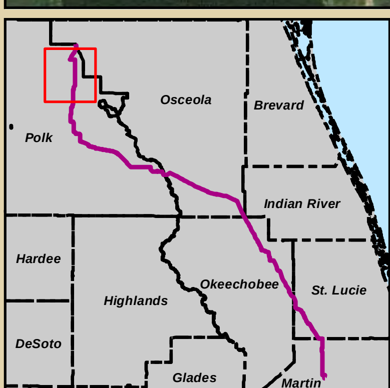
| Approximate MP | Operator | Site Name | Distance from FSC Project (ft.) | Type |
|---|---|---|---|---|
| 4.5 | Standard Sand and Silica Co. | Davenport Mine | Abutting | Sand |
| 7.0 | Cemex Construction Materials Florida | Davenport Sand Mine | 528 | Sand |
| 14.2 | E.R. Jahna Industries, Inc. | Haines City Sand Mine | 1,065 | Sand |
| 17.5 | Holmes Garden Associates, Ltd. | Hatchineha Mine | a/ | Peat |
| 23.8 | C.C. Calhoun, Inc. | St. Helena Road Pit | a/ | Sand |
| 27.9 | Florida Rock Industries, Inc. | Sandland Plant | 1,584 | Sand |
| 29.9 | Florida Rock Industries, Inc. | Diamond Sand Plant | a/ | Sand |
| 30.6 | Cemex Construction Materials Florida | Lake Wales South Addition | a/ | Sand |
| 31.3 | Standard Sand and Silica Co. | Lake Wales Dry Plant | 264 | Sand |
| 96.0 | Horizon Aggregates, LLC | Horizon Aggregates Mine | 528 | Sand |

a/ The FSC Project crosses a mandatory non-phosphate site at this location, but does so along existing rights-of-way or adjacent to property lines within the 100 ft. required setback and is not located within any areas used for mining operations.

# FIGURES




**Note:**
The Term Mandatory Non Phosphate Sites is a FDEP Bureau of Mine data layer that indicates areas where heavy minerals, fuller's earth, limestone, dolomite, shell, gravel, sand, kaolin, common clay, fill dirt, and peat are extracted. The mine boundaries shown are conservative in that they show the maximum extent of areas that are subject to regulatory requirements and may contain land areas that have not or will not be disturbed by mining operations.




**Legend**

- Mile Post
- Pipeline Centerline
- Permitted Oil & Gas Wells within 0.5 miles of pipeline
- MSHA Active Mines within 0.5 miles of pipeline
- Mandatory Non-Phosphate Sites within 0.5 miles of pipeline

N

0 1 2
Miles

Sources: FDEP/FGS, Mine Safety and Health Administration (MSHA), ESRI, USGS, FSC, TRC

FLORIDA SOUTHEAST CONNECTION

Figure: 6.2-1
Mineral Resources Within 0.5 Miles of the FSC Project

Sheet 1 of 3

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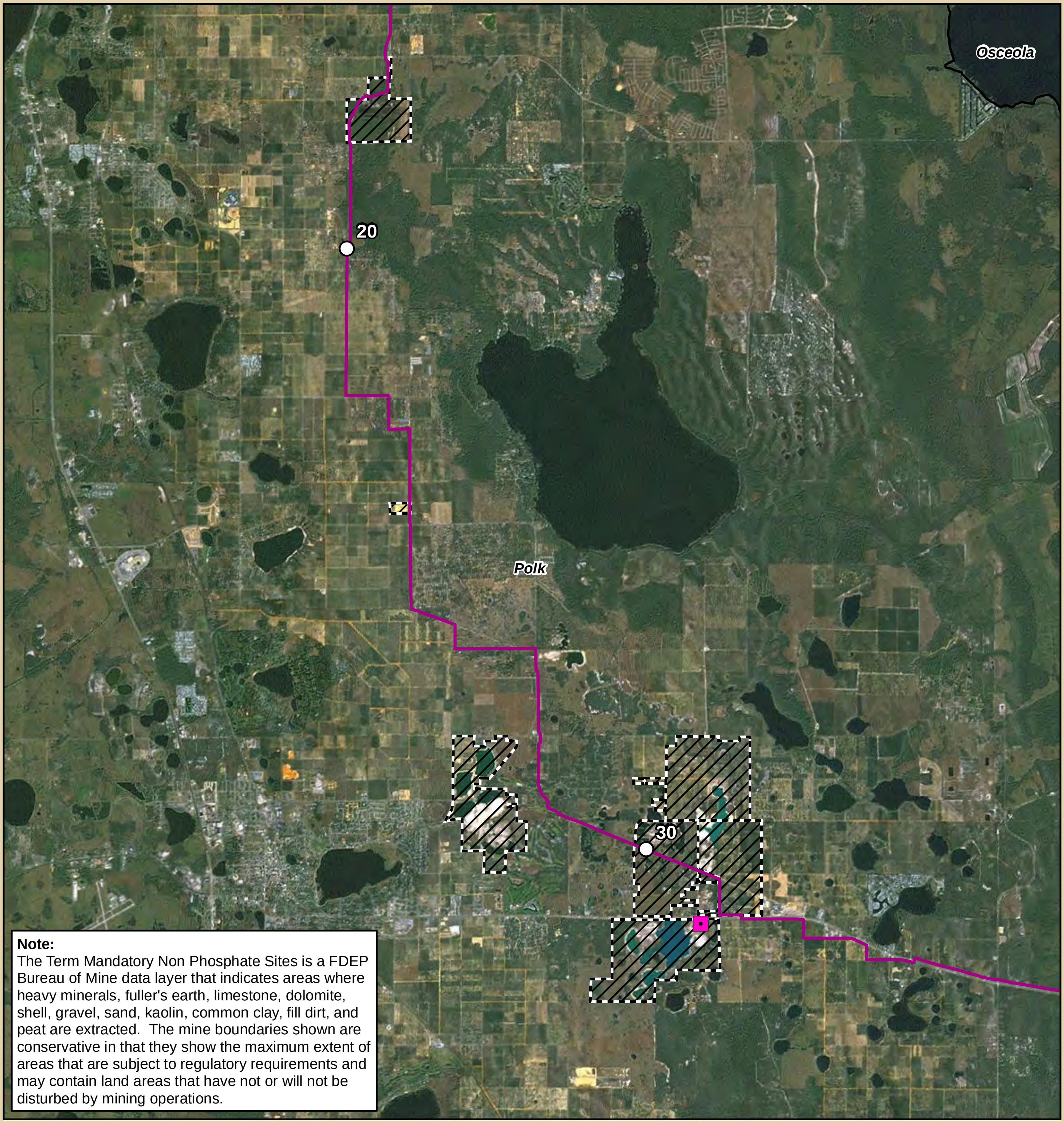


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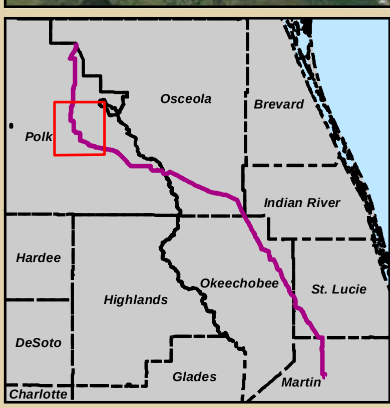


**Legend**

- Mile Post
- Pipeline Centerline
- Permitted Oil & Gas Wells within 0.5 miles of pipeline
- MSHA Active Mines within 0.5 miles of pipeline
- Mandatory Non-Phosphate Sites within 0.5 miles of pipeline

N

0 1 2
Miles

Sources: FDEP/FGS, Mine Safety and Health Administration (MSHA), ESRI, USGS, FSC, TRC

FLORIDA SOUTHEAST CONNECTION

Figure: 6.2-1
Mineral Resources Within
0.5 Miles of the FSC Project

Sheet 2 of 3

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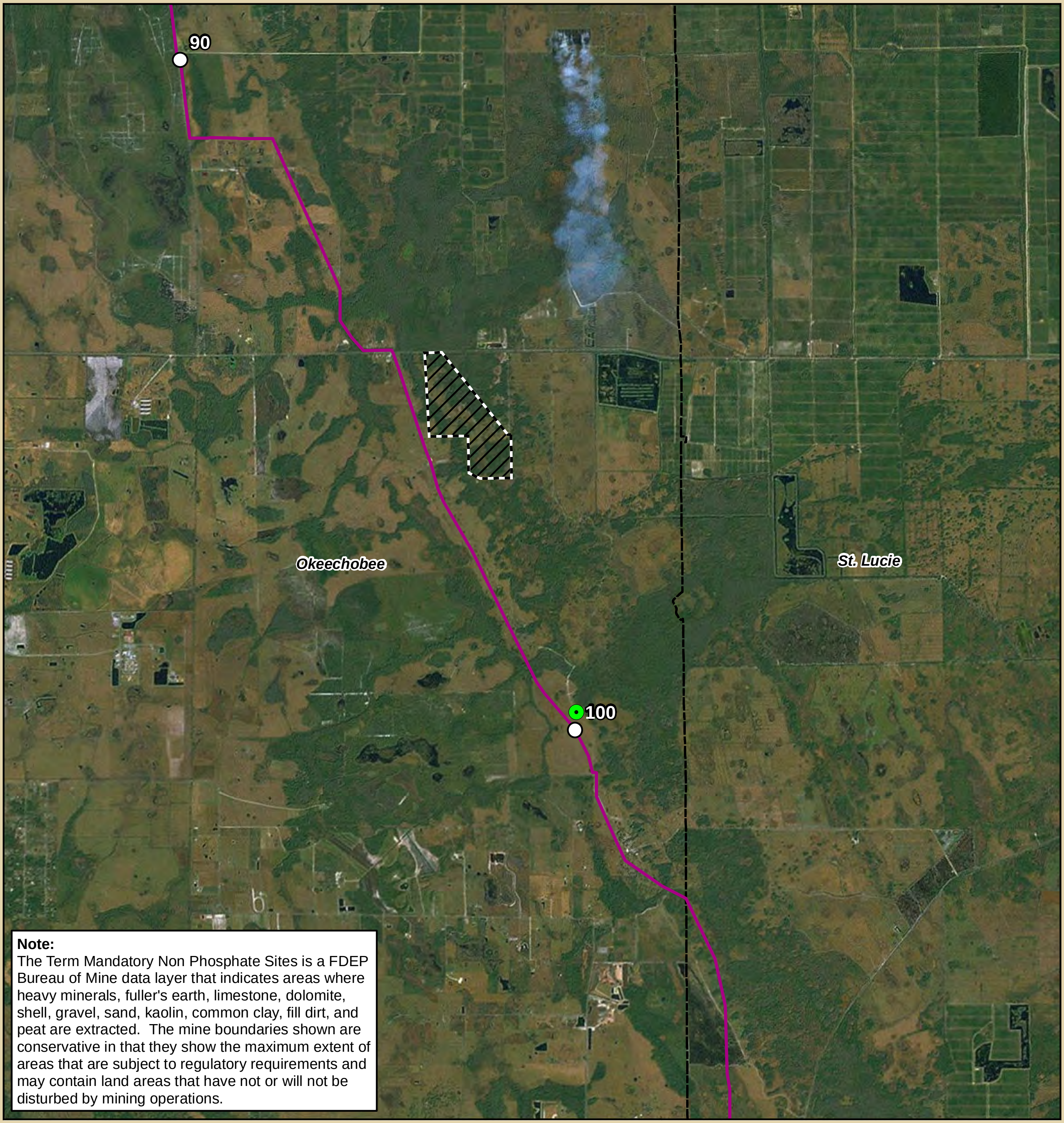


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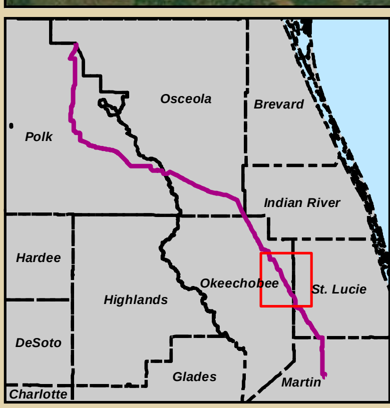


**Legend**

- Mile Post
- Pipeline Centerline
- Permitted Oil & Gas Wells within 0.5 miles of pipeline
- MSHA Active Mines within 0.5 miles of pipeline
- Mandatory Non-Phosphate Sites within 0.5 miles of pipeline

N

0 1 2
Miles

Sources: FDEP/FGS, Mine Safety and Health Administration (MSHA), ESRI, USGS, FSC, TRC

FLORIDA SOUTHEAST CONNECTION

Figure: 6.2-1
Mineral Resources Within
0.5 Miles of the FSC Project

Sheet 3 of 3

Created: 2/7/2014

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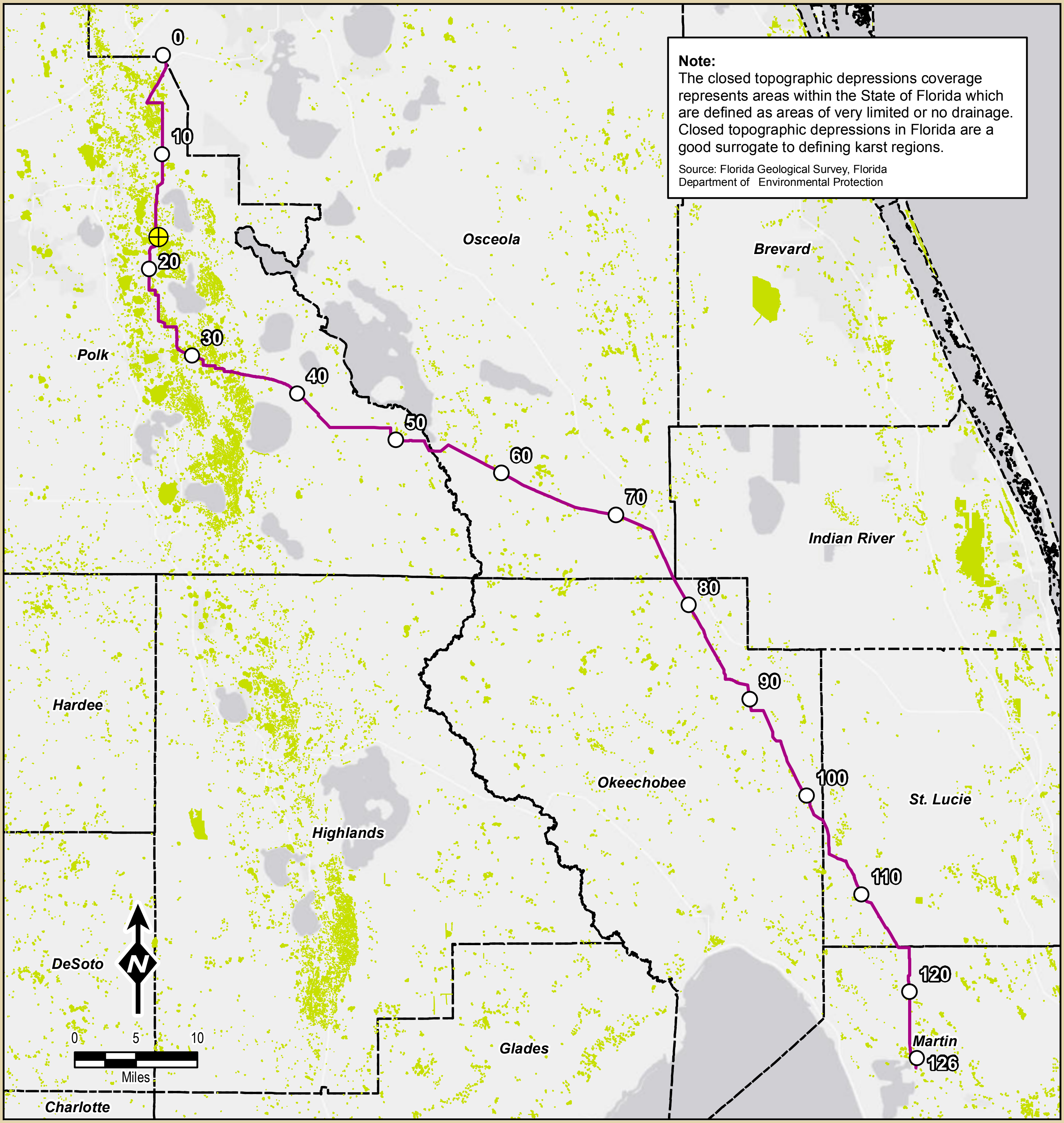


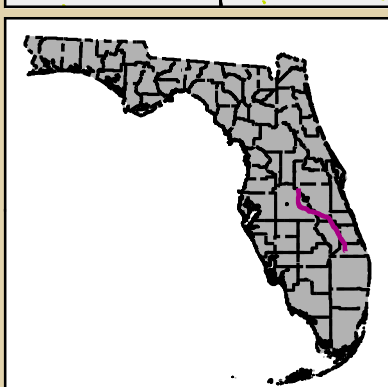

Legend

- Mile Post
- Pipeline Centerline
- Sinkholes within 0.5 mile
- Closed Topographic Depressions
- Counties

Sources: FDEP/FGS, ESRI, USGS, FSC, TRC

FLORIDA SOUTHEAST CONNECTION

**Figure: 6.2-2**
Known Sinkhole Locations Within 0.5 Miles of the FSC Project

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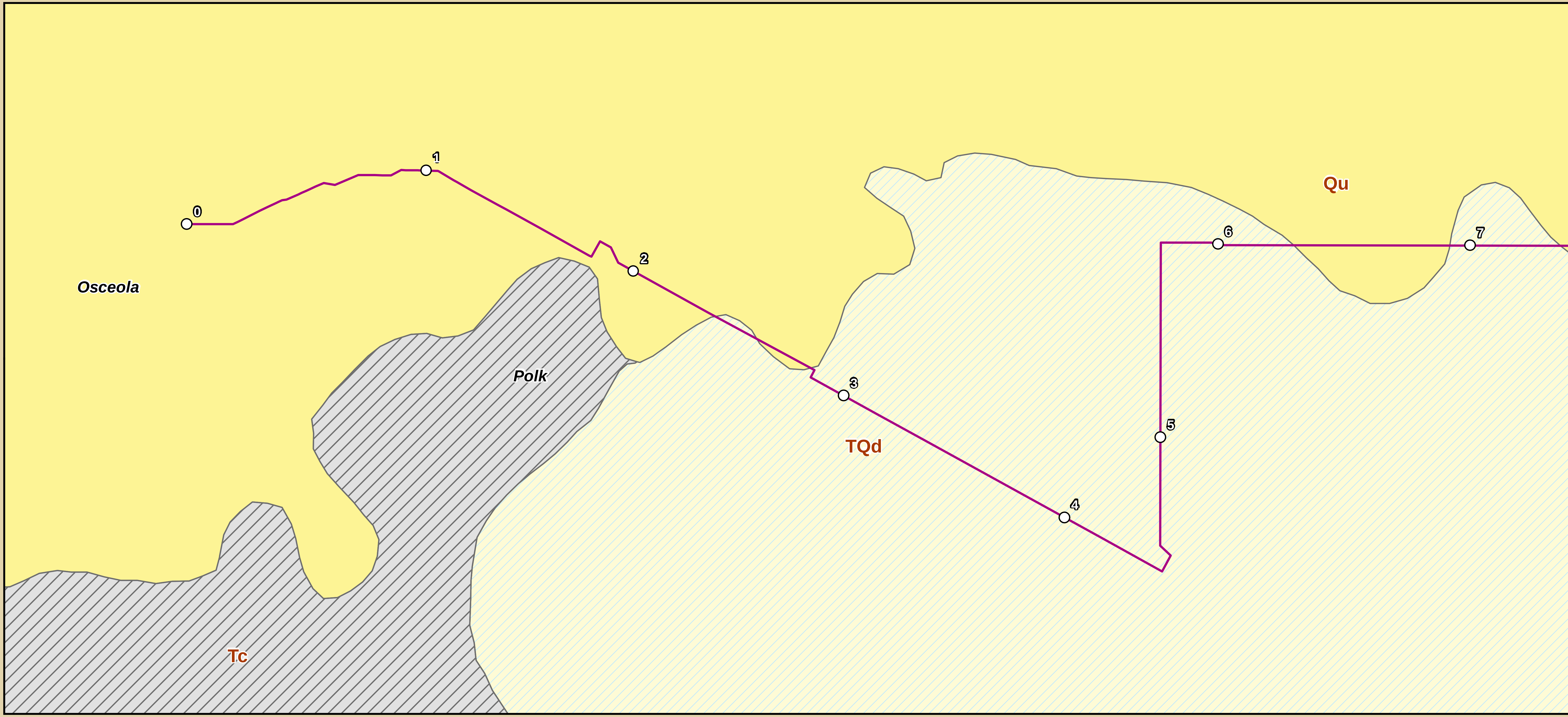
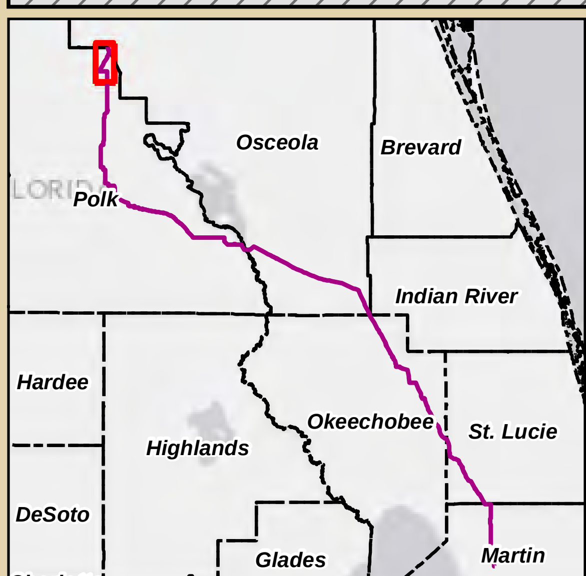
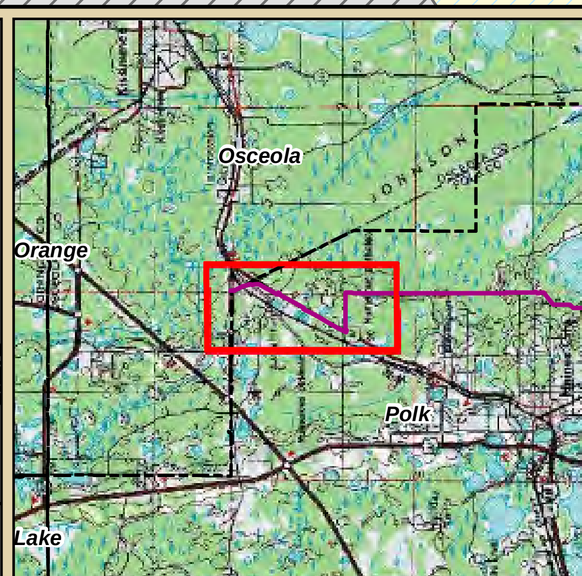
# APPENDICES




**Legend**

- Pipeline Centerline
- Counties
- Mile Post
- Tenth Mile
- Qbd - Beach Ridge and Dune
- Qh - Holocene Sediments
- Qu - Undifferentiated
- Tc - Cypresshead Formation
- TQd - Dunes
- TQsu - Shell-bearing Sediments
- TQuc - Reworked Cypresshead Formation

0 1,000 2,000
Feet

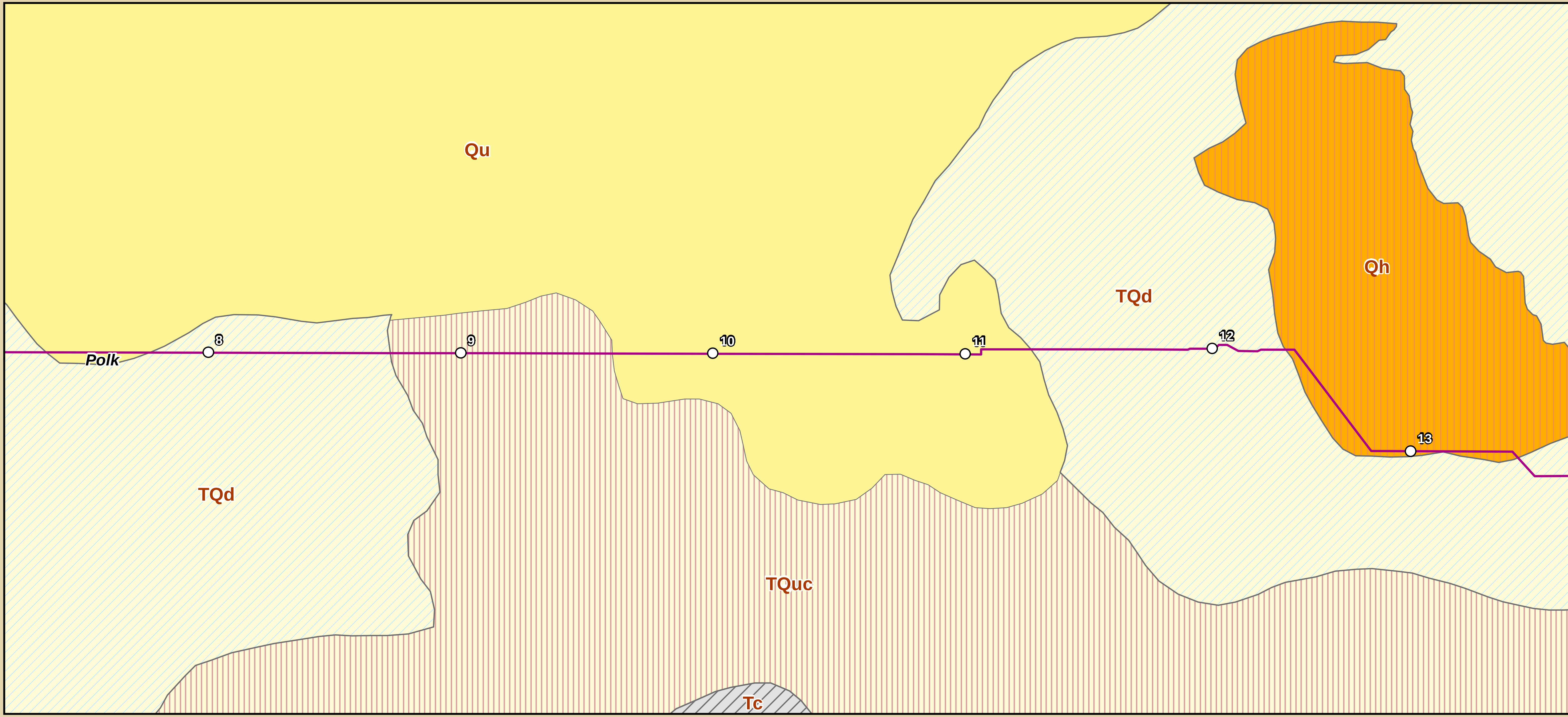
Sources: USGS, ESRI, FSC, TRC

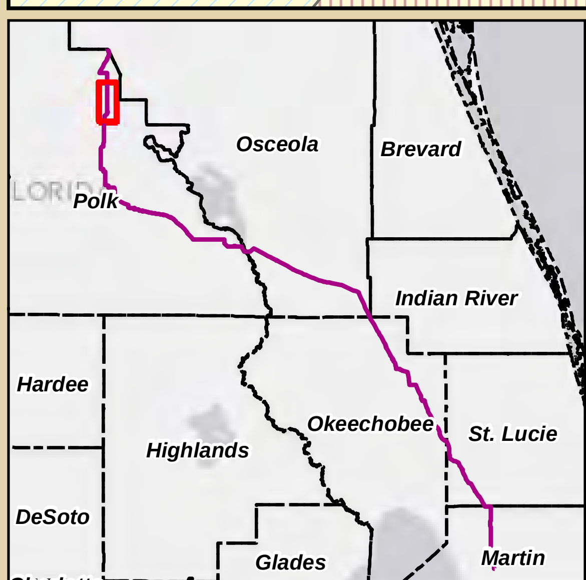
FLORIDA SOUTHEAST CONNECTION

Figure: A-1
Surficial Geology

Sheet 1 of 20

Created: 2/10/2014





**Legend**

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0 1,000 2,000
Feet

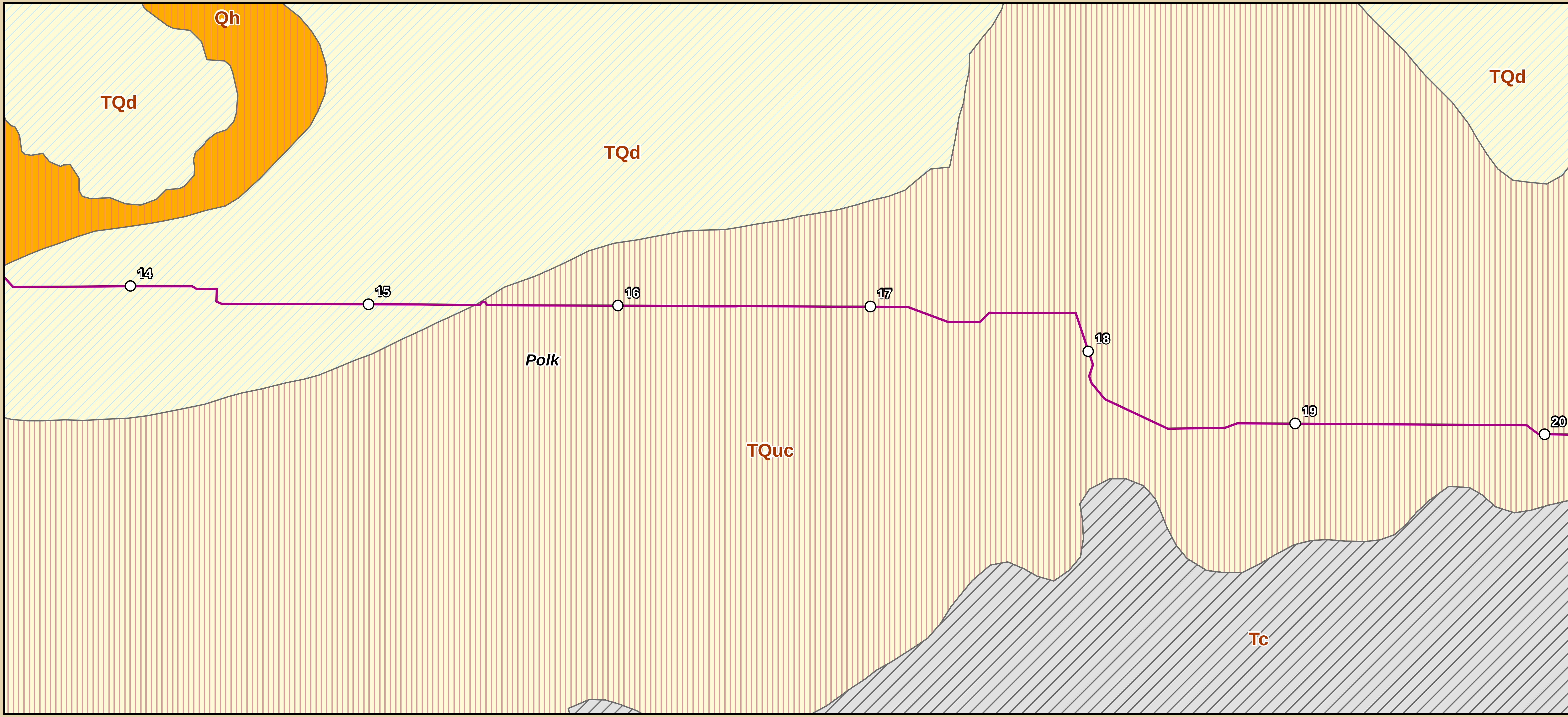
Sources: USGS, ESRI, FSC, TRC

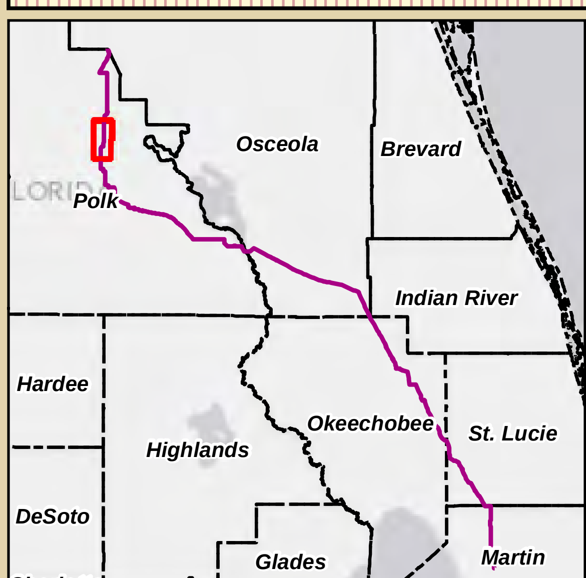
FLORIDA SOUTHEAST CONNECTION

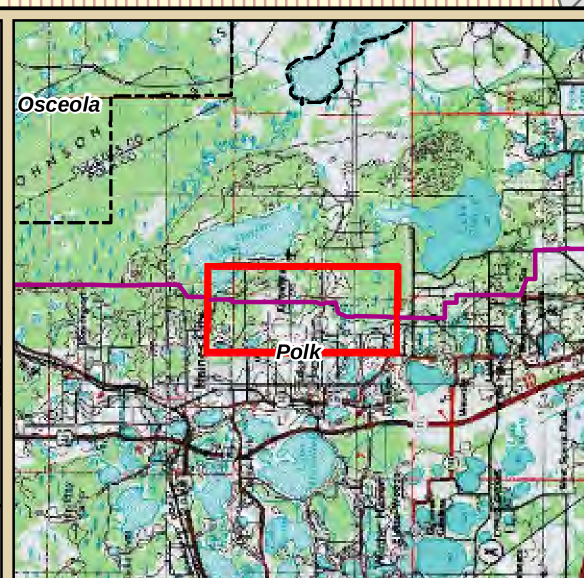
Figure: A-1
Surficial Geology

Sheet 2 of 20

Created: 2/10/2014




**Legend**

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- TQuc - Reworked Cypresshead Formation

0 1,000 2,000
Feet

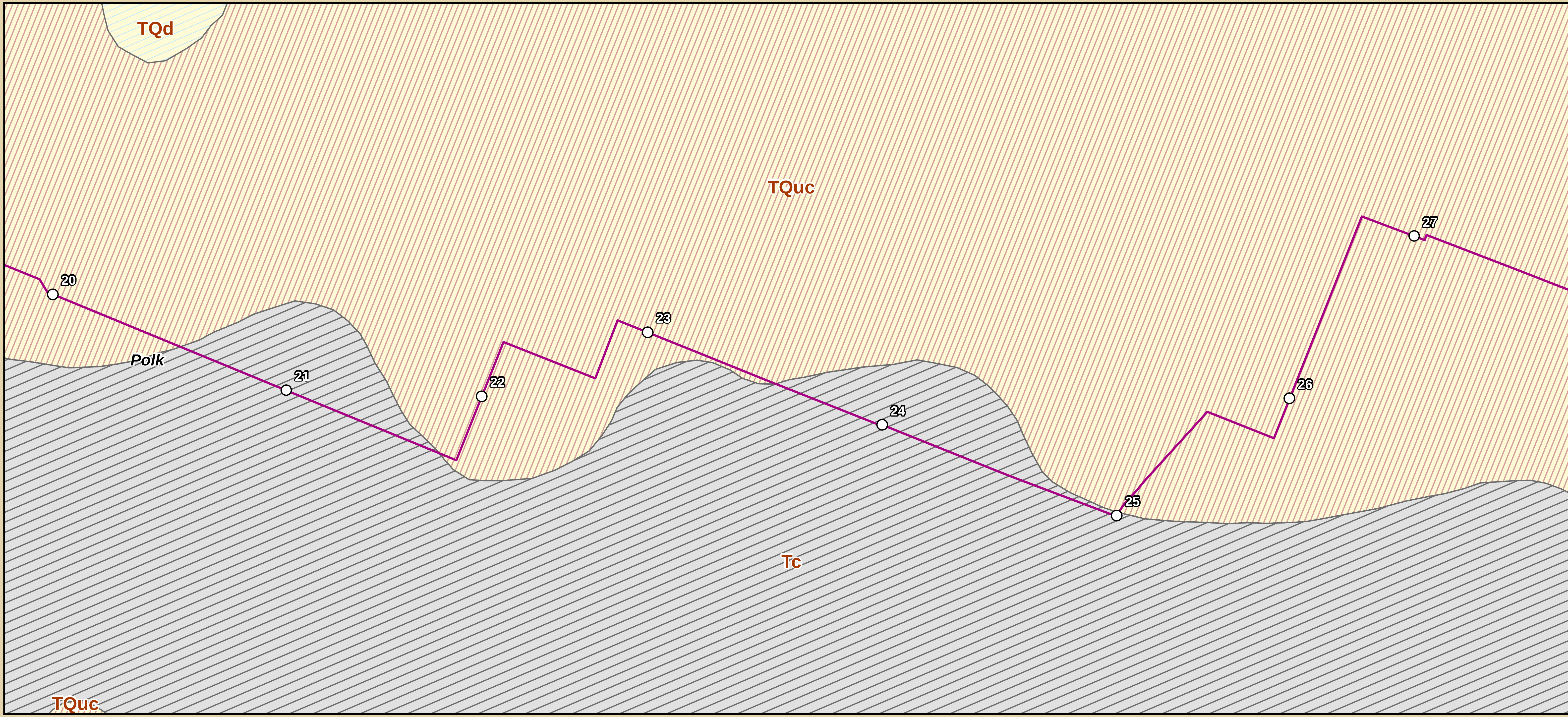
Sources: USGS, ESRI, FSC, TRC

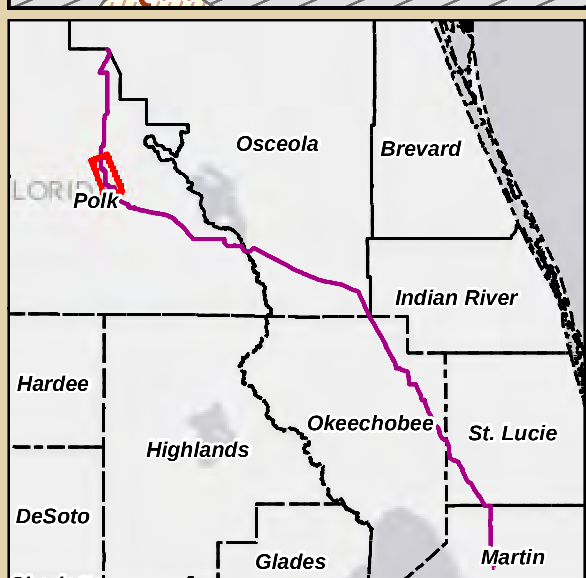
FLORIDA SOUTHEAST CONNECTION

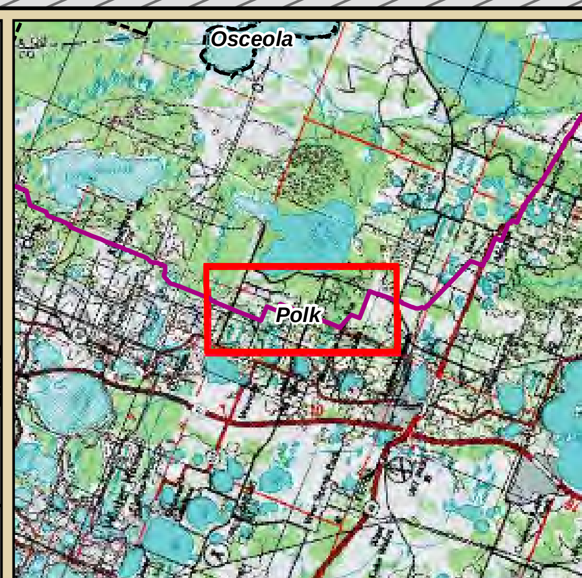
Figure: A-1
Surficial Geology

Sheet 3 of 20

Created: 2/10/2014




**Legend**

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0 1,000 2,000
Feet

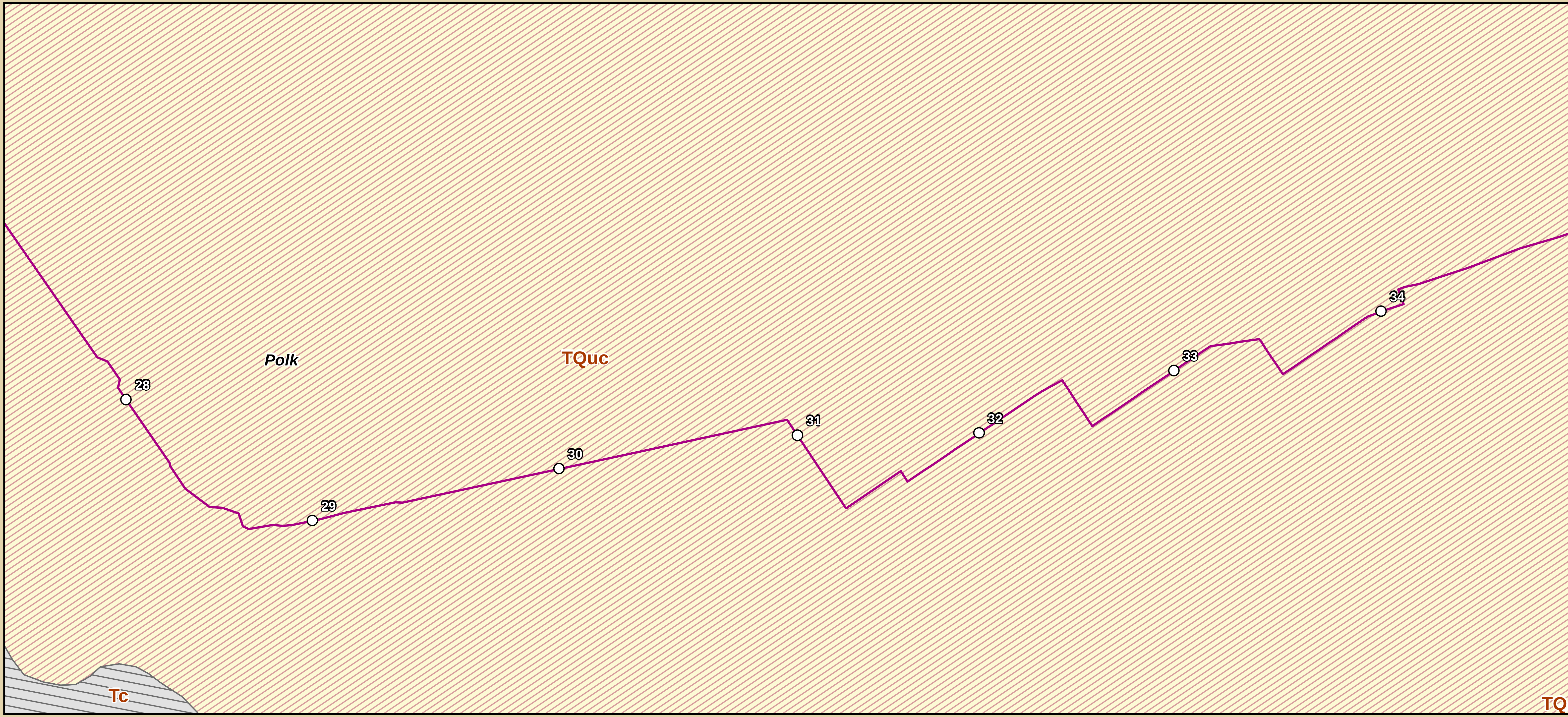
Sources: USGS, ESRI, FSC, TRC

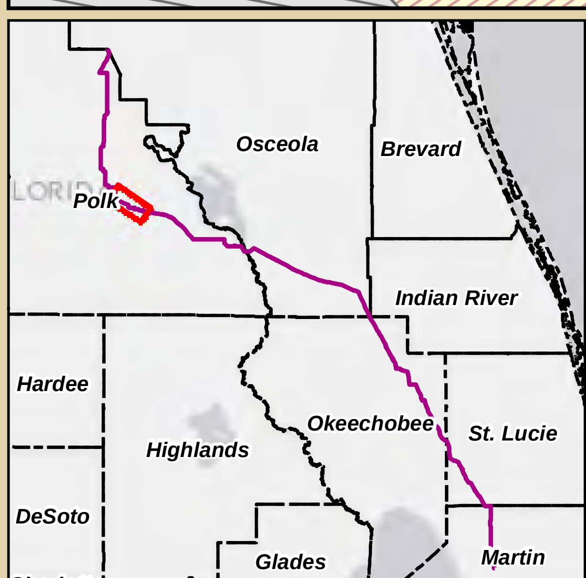
FLORIDA SOUTHEAST CONNECTION

Figure: A-1
Surficial Geology

Sheet 4 of 20

Created: 2/10/2014





**Legend**

- Pipeline Centerline
- Counties
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0 1,000 2,000
Feet

Sources: USGS, ESRI, FSC, TRC

FLORIDA SOUTHEAST CONNECTION

Figure: A-1
Surficial Geology

Sheet 5 of 20

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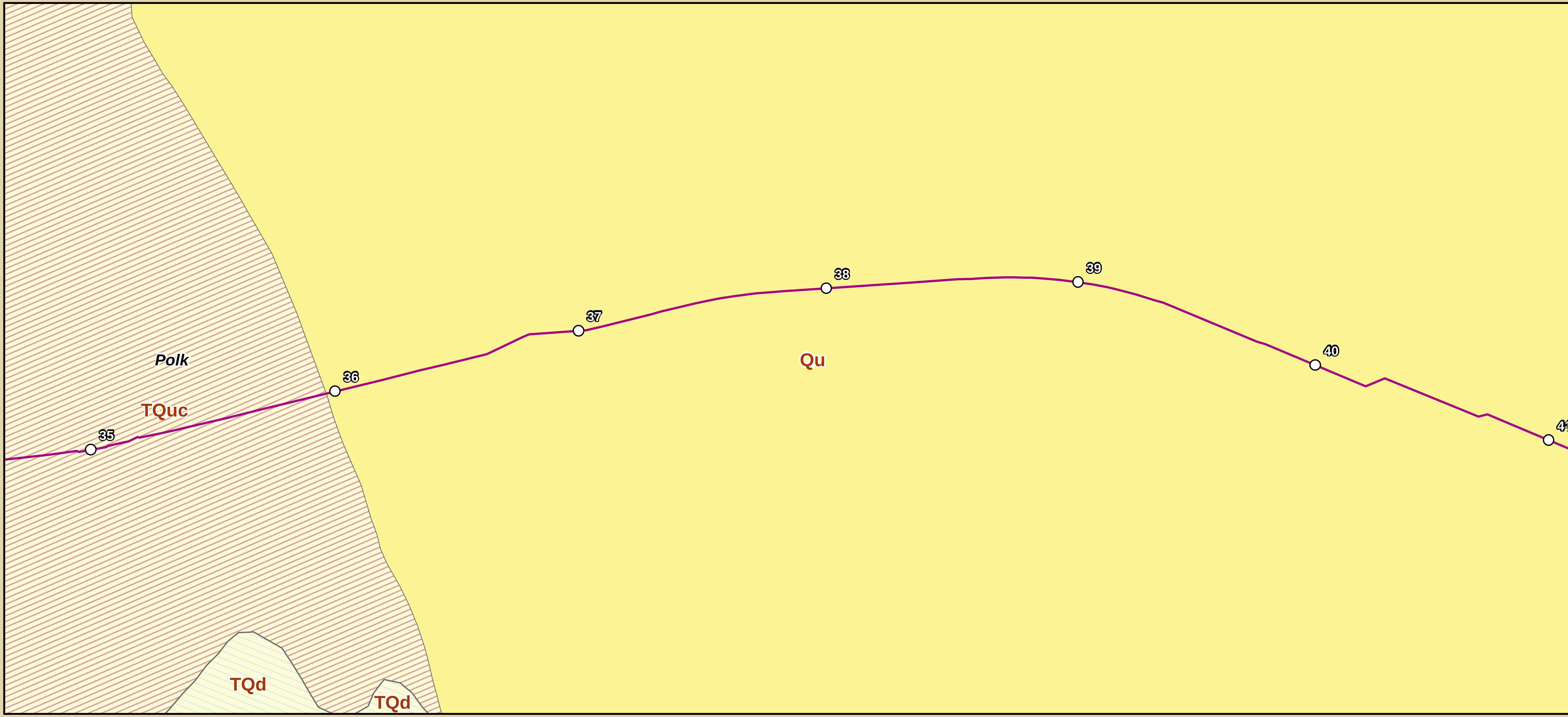
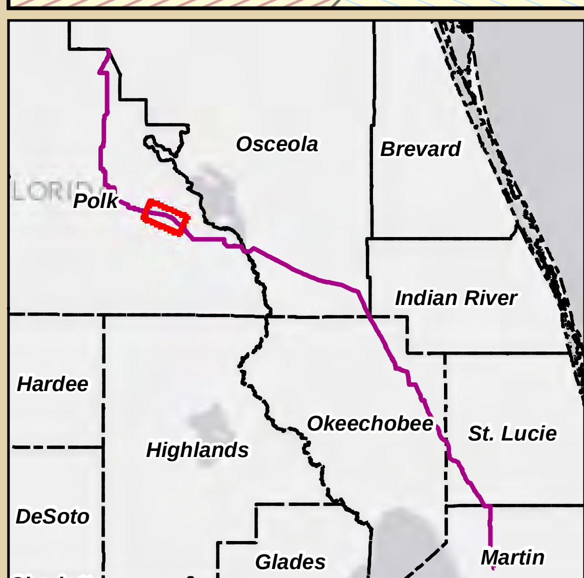
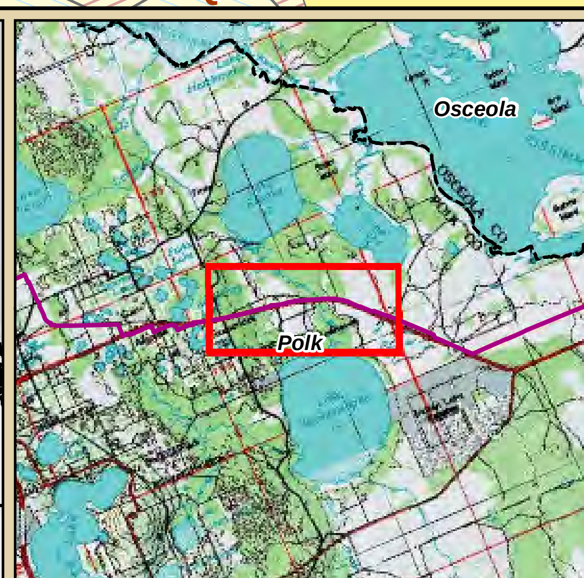



**Legend**

- Pipeline Centerline
- Counties
- Mile Post
- Tenth Mile
- Qbd - Beach Ridge and Dune
- Qh - Holocene Sediments
- Qu - Undifferentiated
- Tc - Cypresshead Formation
- TQd - Dunes
- TQsu - Shell-bearing Sediments
- TQuc - Reworked Cypresshead Formation

0 1,000 2,000
Feet

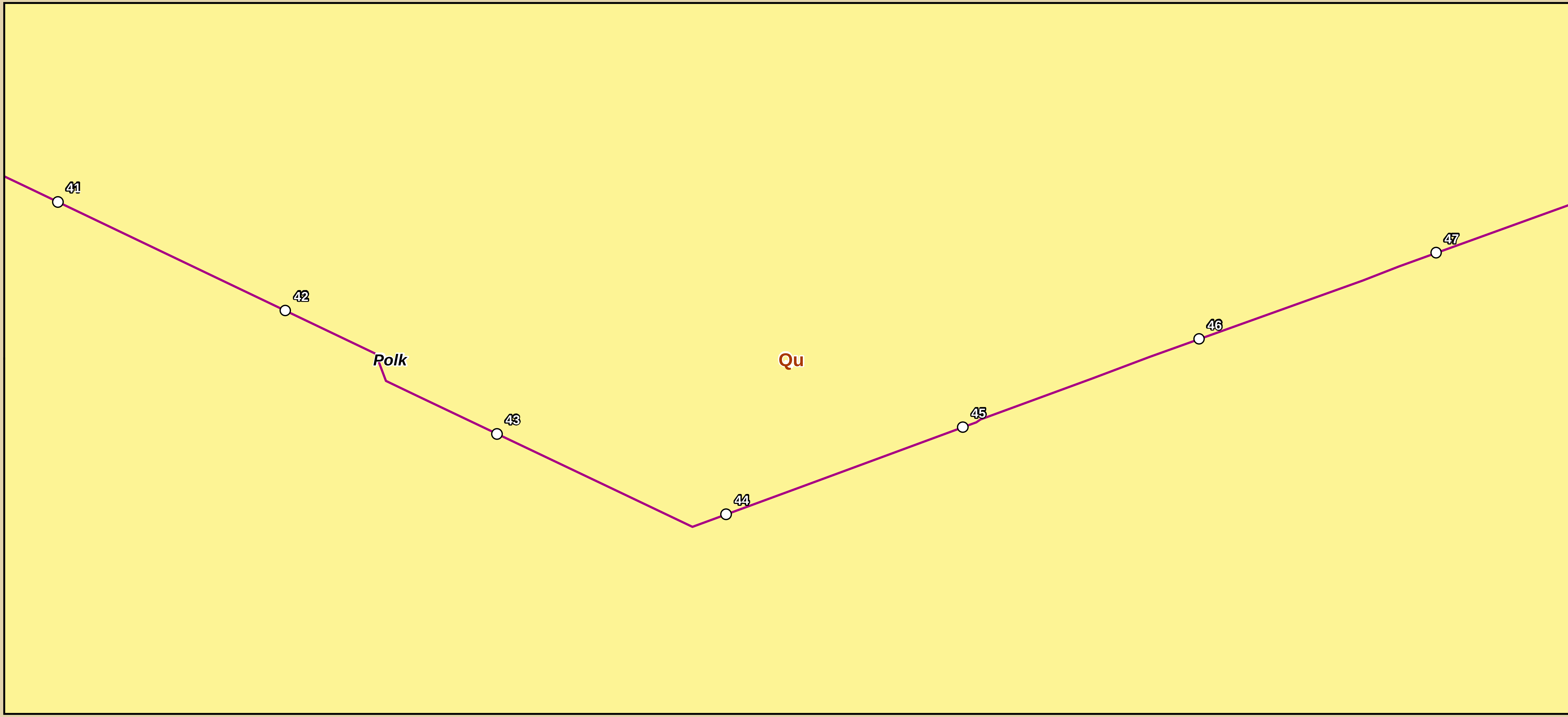
Sources: USGS, ESRI, FSC, TRC

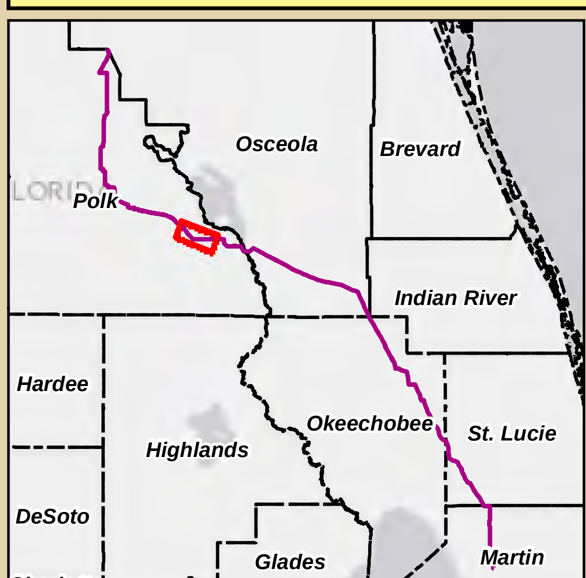
FLORIDA SOUTHEAST CONNECTION

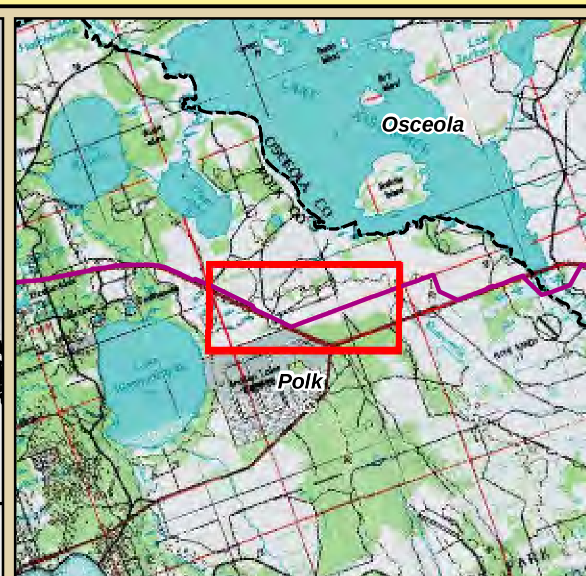
Figure: A-1
Surficial Geology

Sheet 6 of 20

Created: 2/10/2014




**Legend**

- Pipeline Centerline
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N

0 1,000 2,000
Feet

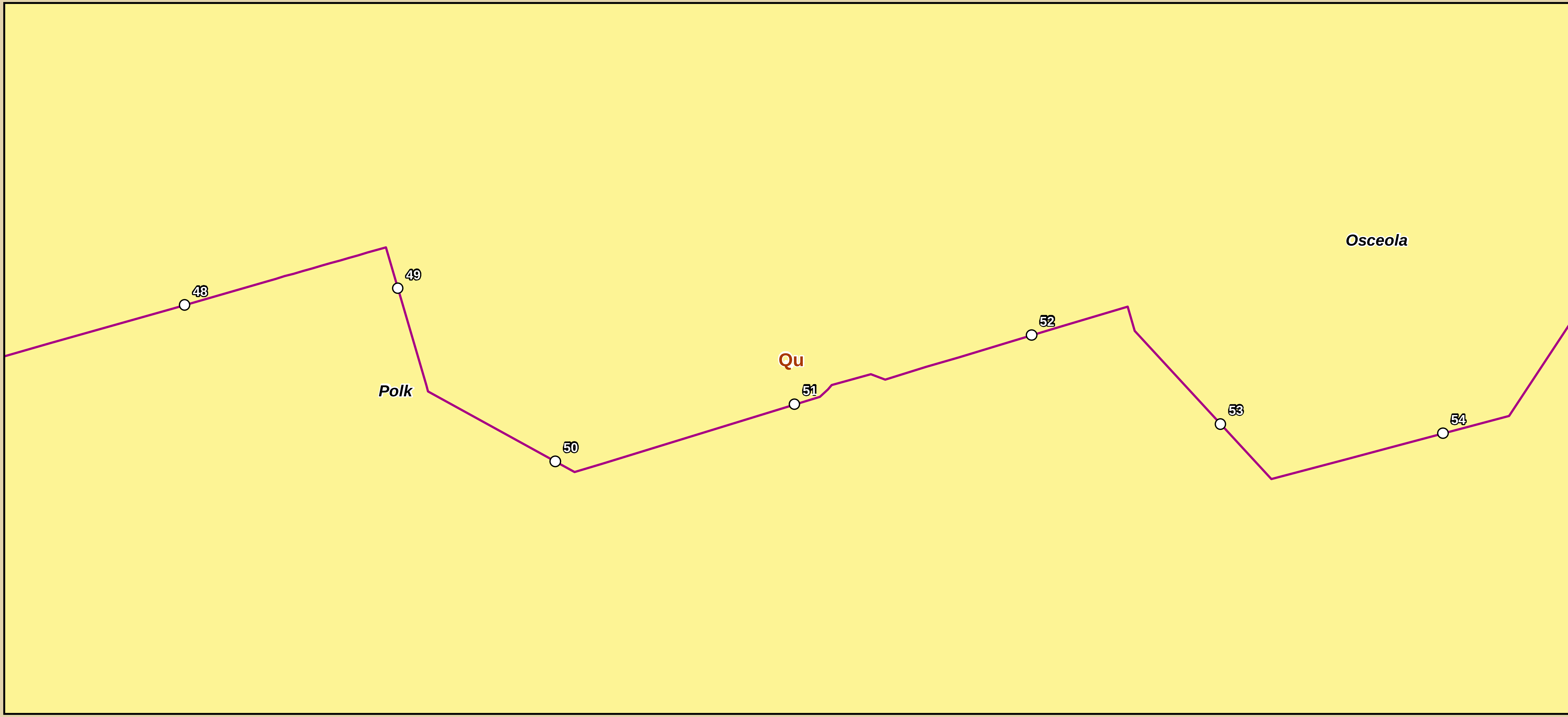
Sources: USGS, ESRI, FSC, TRC

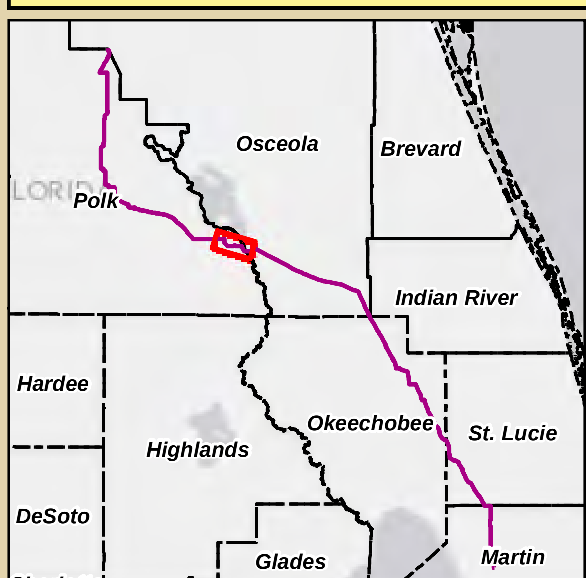
FLORIDA SOUTHEAST CONNECTION

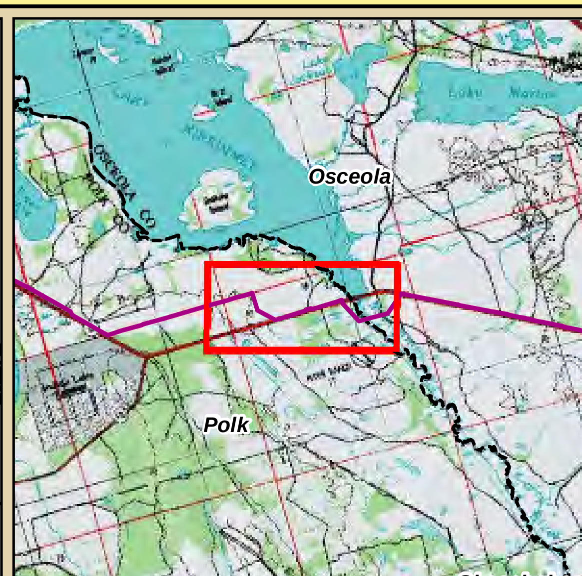
Figure: A-1
Surficial Geology

Sheet 7 of 20

Created: 2/10/2014




**Legend**

- Pipeline Centerline
- Counties
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- Tenth Mile
- Qbd - Beach Ridge and Dune
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N

0 1,000 2,000
Feet

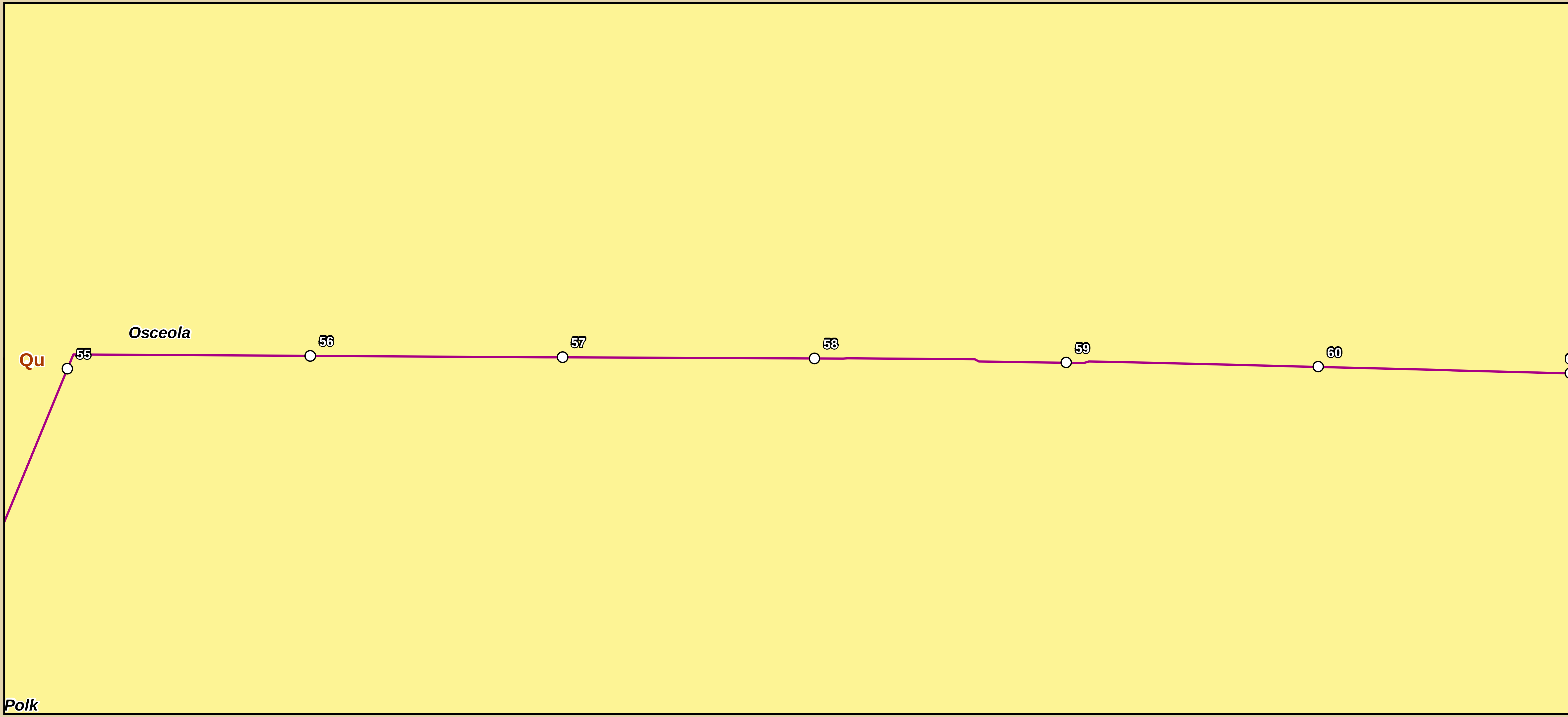
Sources: USGS, ESRI, FSC, TRC

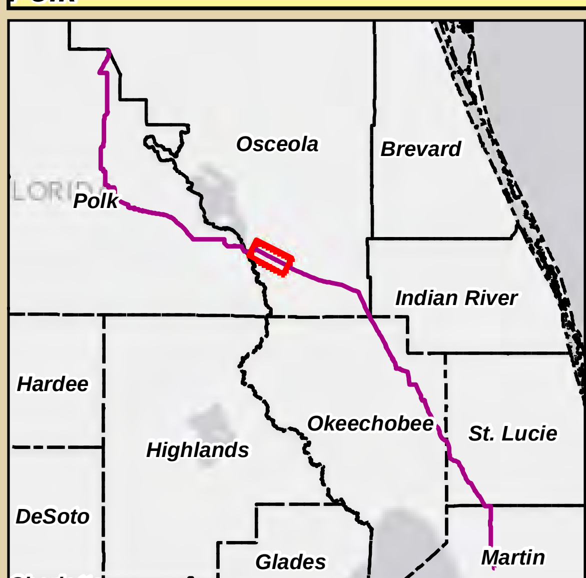
FLORIDA SOUTHEAST CONNECTION

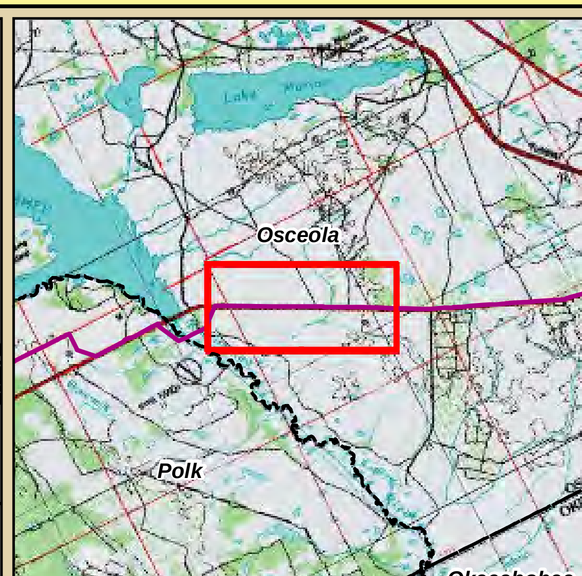
Figure: A-1
Surficial Geology

Sheet 8 of 20

Created: 2/10/2014




**Legend**

- Pipeline Centerline
- Counties
- Mile Post
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- Qbd - Beach Ridge and Dune
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N

0 1,000 2,000
Feet

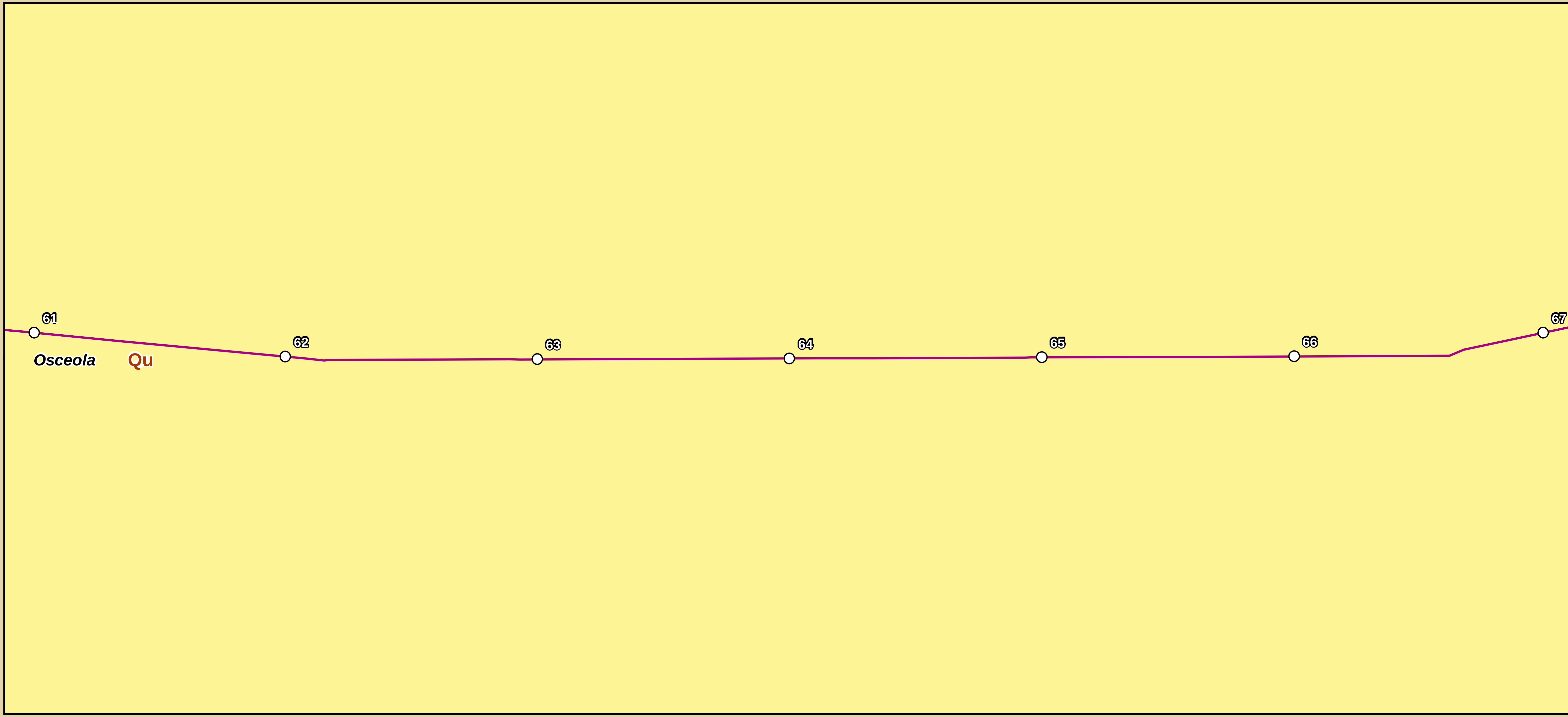
Sources: USGS, ESRI, FSC, TRC

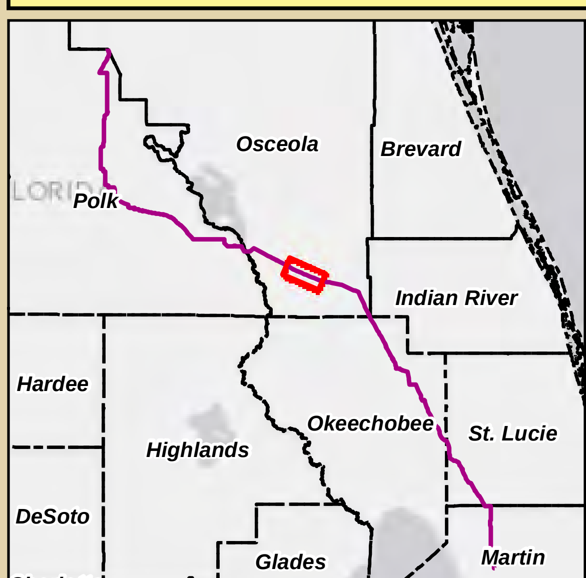
FLORIDA SOUTHEAST CONNECTION

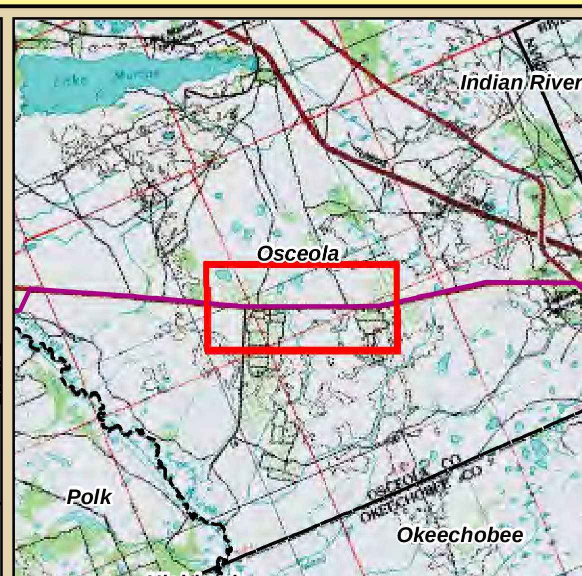
Figure: A-1
Surficial Geology

Sheet 9 of 20

Created: 2/10/2014




**Legend**

- Pipeline Centerline
- Counties
- Mile Post
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- TQuc - Reworked Cypresshead Formation

N

0 1,000 2,000
Feet

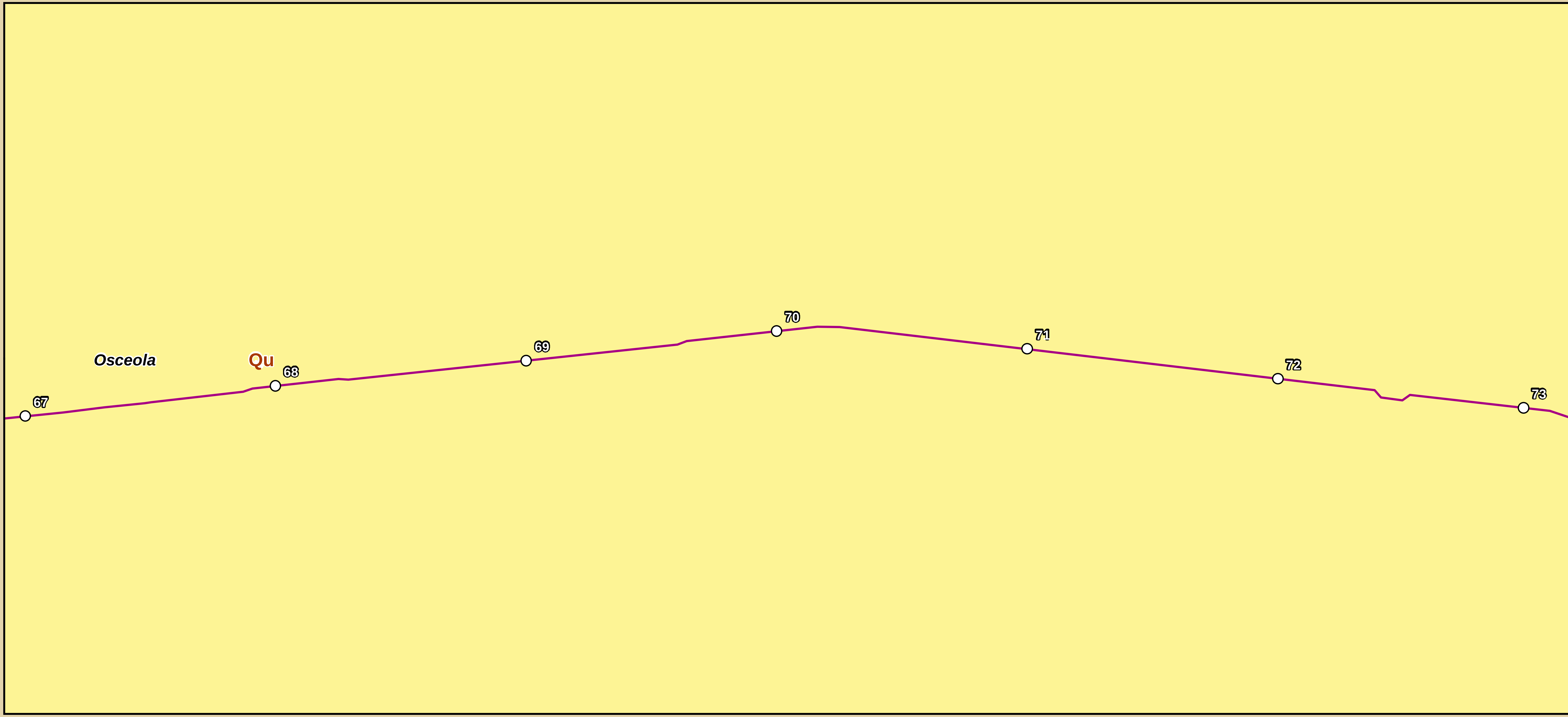
Sources: USGS, ESRI, FSC, TRC

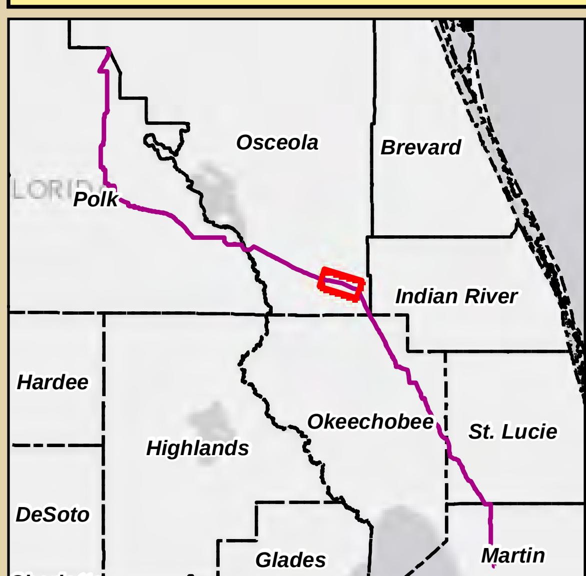
FLORIDA SOUTHEAST CONNECTION

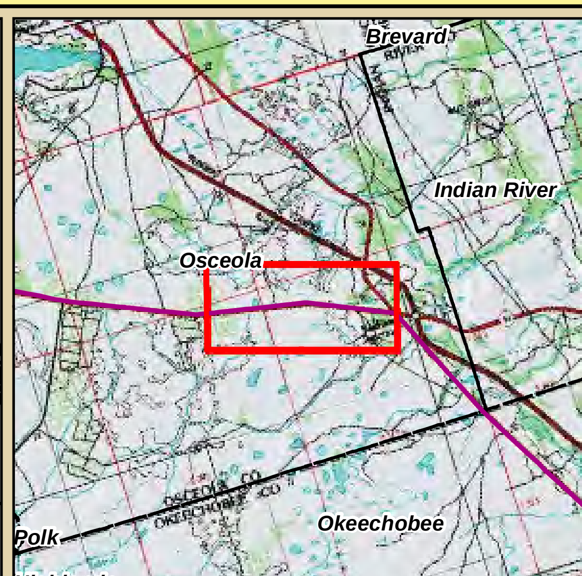
Figure: A-1
Surficial Geology

Sheet 10 of 20

Created: 2/10/2014




**Legend**

- Pipeline Centerline
- Counties
- Mile Post
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- TQuc - Reworked Cypresshead Formation

N

0 1,000 2,000
Feet

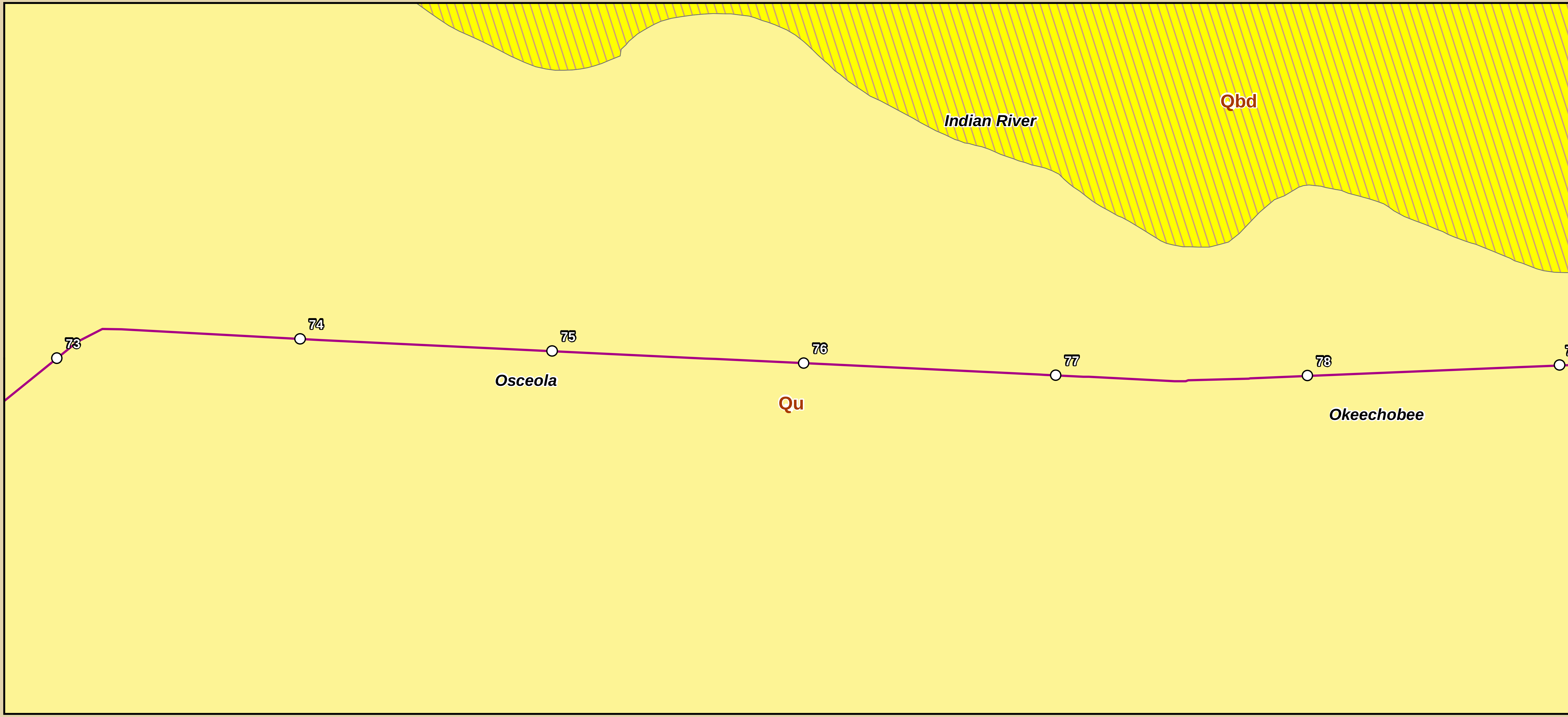
Sources: USGS, ESRI, FSC, TRC

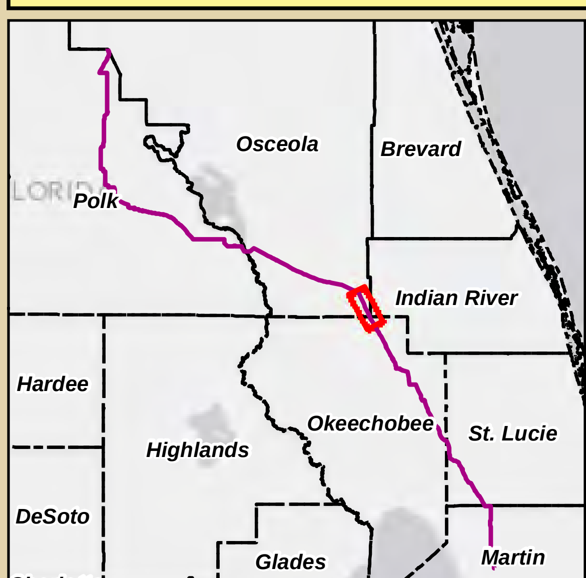
FLORIDA SOUTHEAST CONNECTION

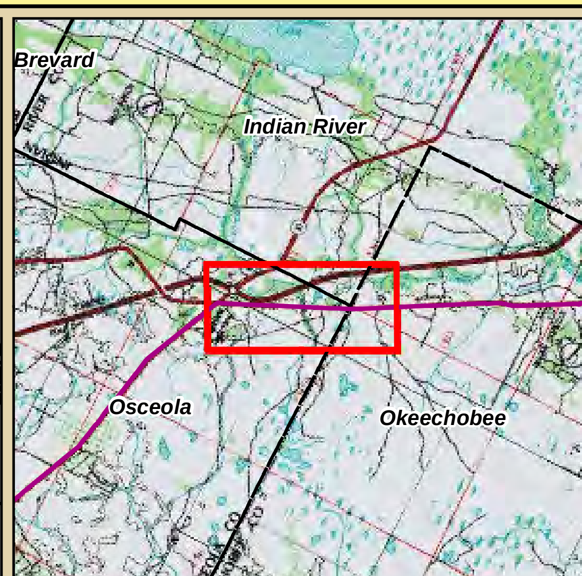
Figure: A-1
Surficial Geology

Sheet 11 of 20

Created: 2/10/2014




**Legend**

- Pipeline Centerline
- Counties
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0 1,000 2,000
Feet

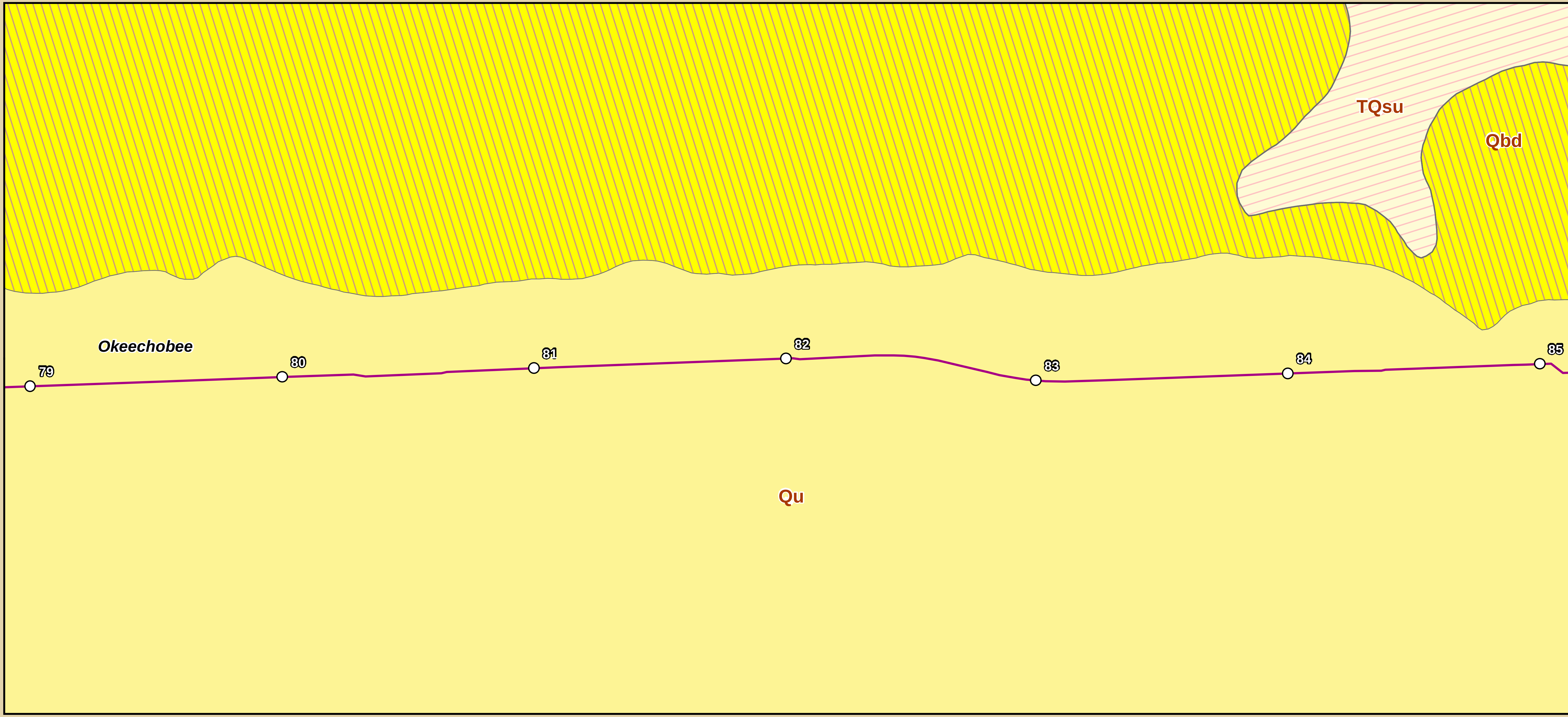
Sources: USGS, ESRI, FSC, TRC

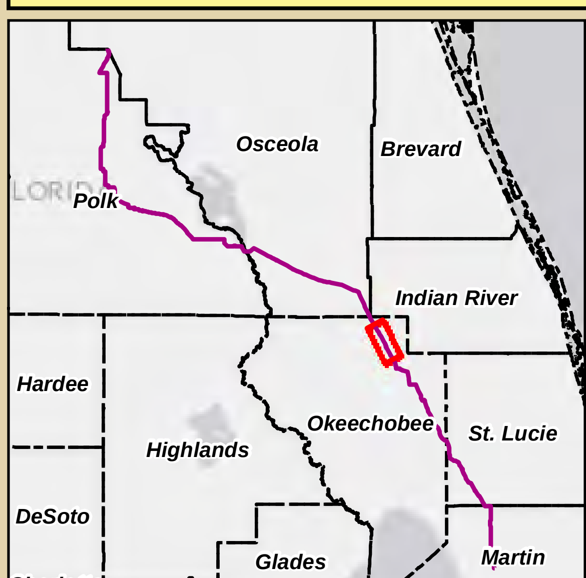
FLORIDA SOUTHEAST CONNECTION

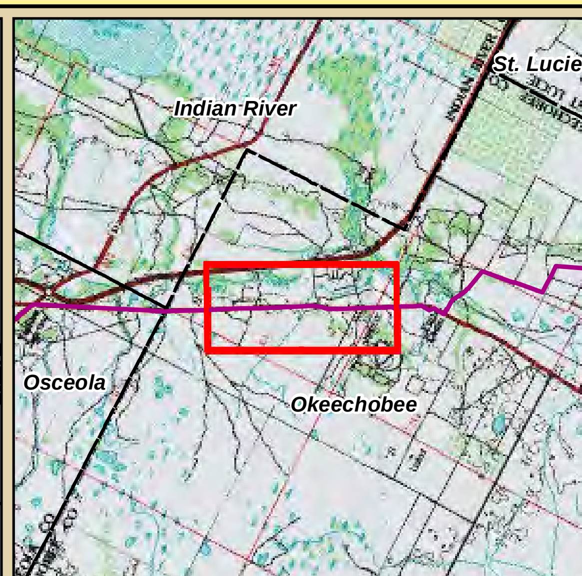
Figure: A-1
Surficial Geology

Sheet 12 of 20

Created: 2/10/2014




**Legend**

- Pipeline Centerline
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0 1,000 2,000
Feet

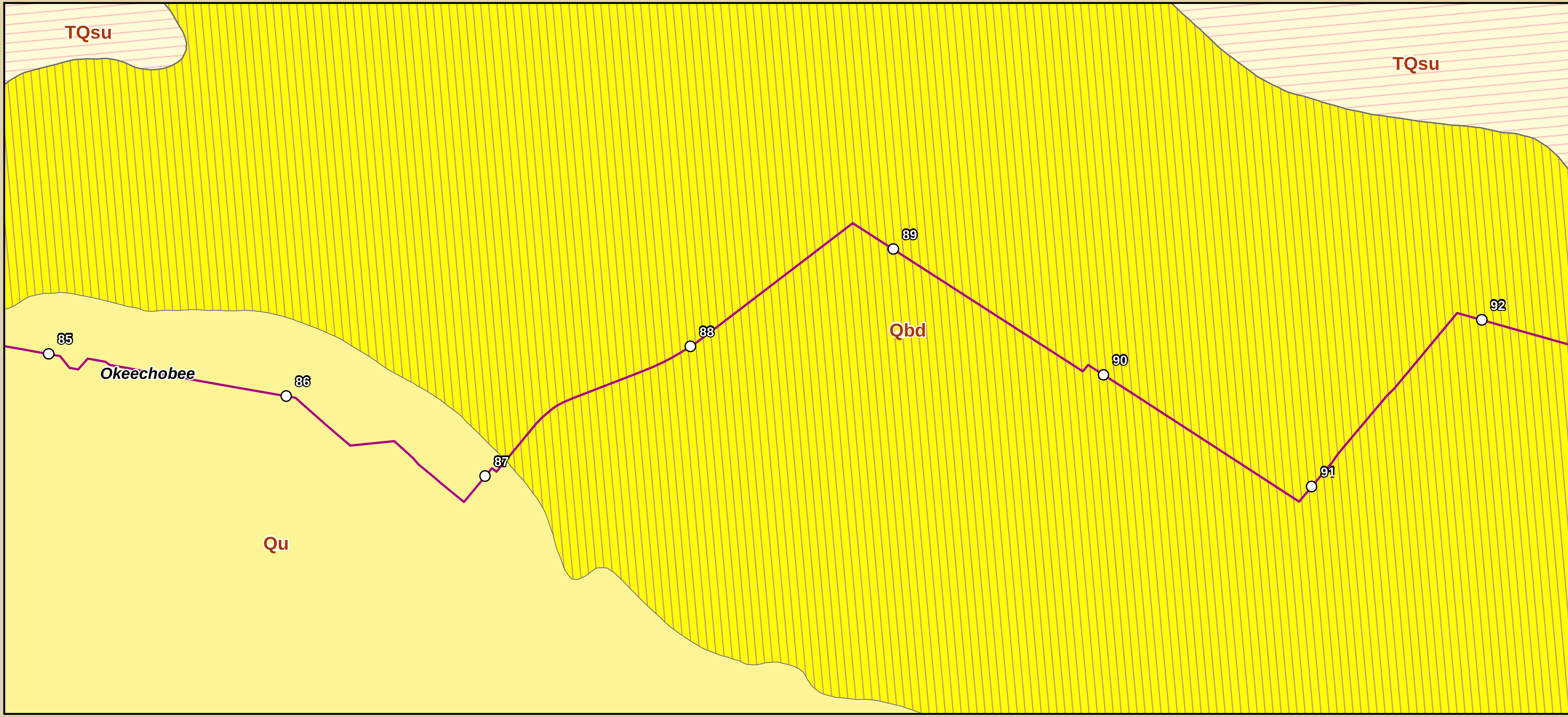
Sources: USGS, ESRI, FSC, TRC

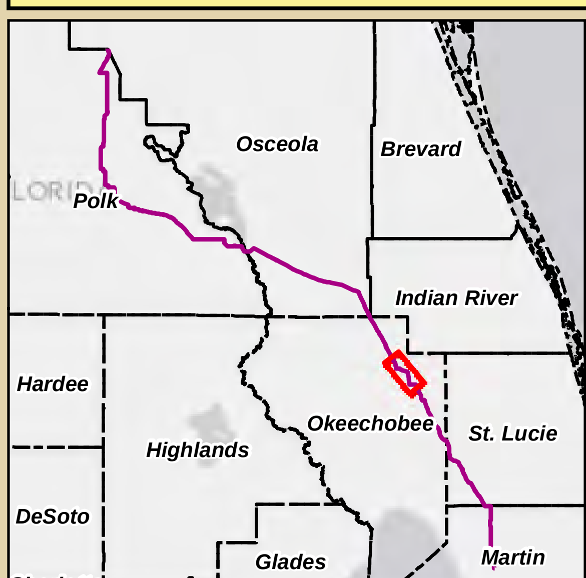
FLORIDA SOUTHEAST CONNECTION

# Figure: A-1
## Surficial Geology



Created: 2/10/2014





**Legend**

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0 1,000 2,000
Feet

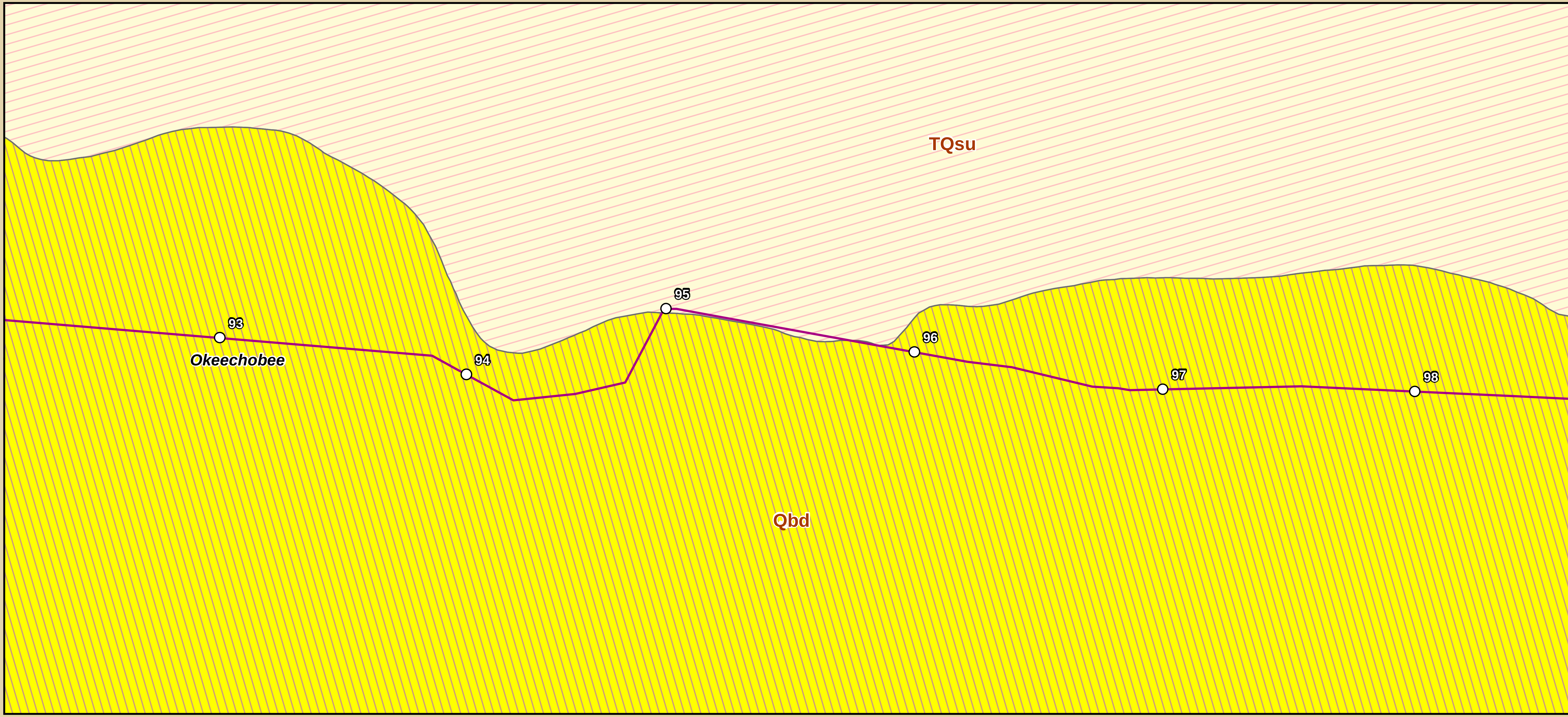
Sources: USGS, ESRI, FSC, TRC

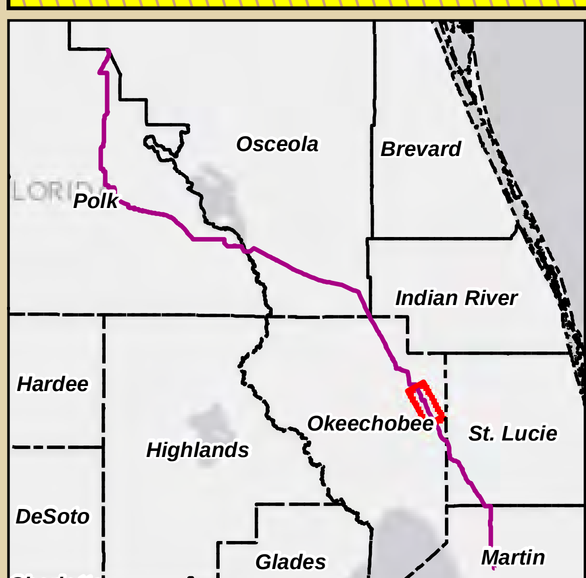
FLORIDA SOUTHEAST CONNECTION

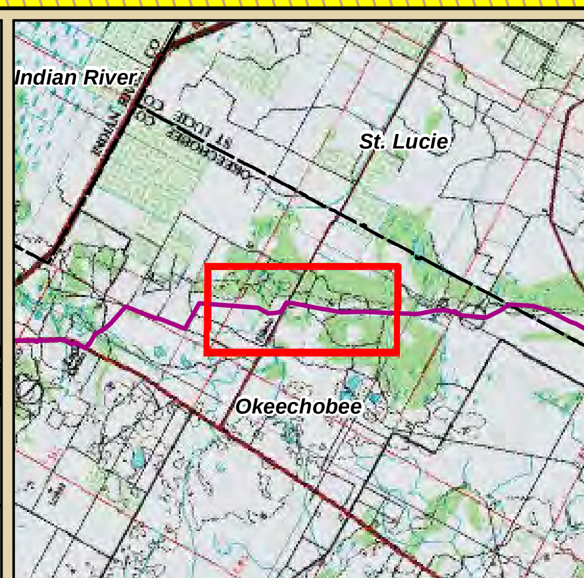
Figure: A-1
Surficial Geology

Sheet 14 of 20

Created: 2/10/2014




**Legend**

- Pipeline Centerline
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0 1,000 2,000
Feet

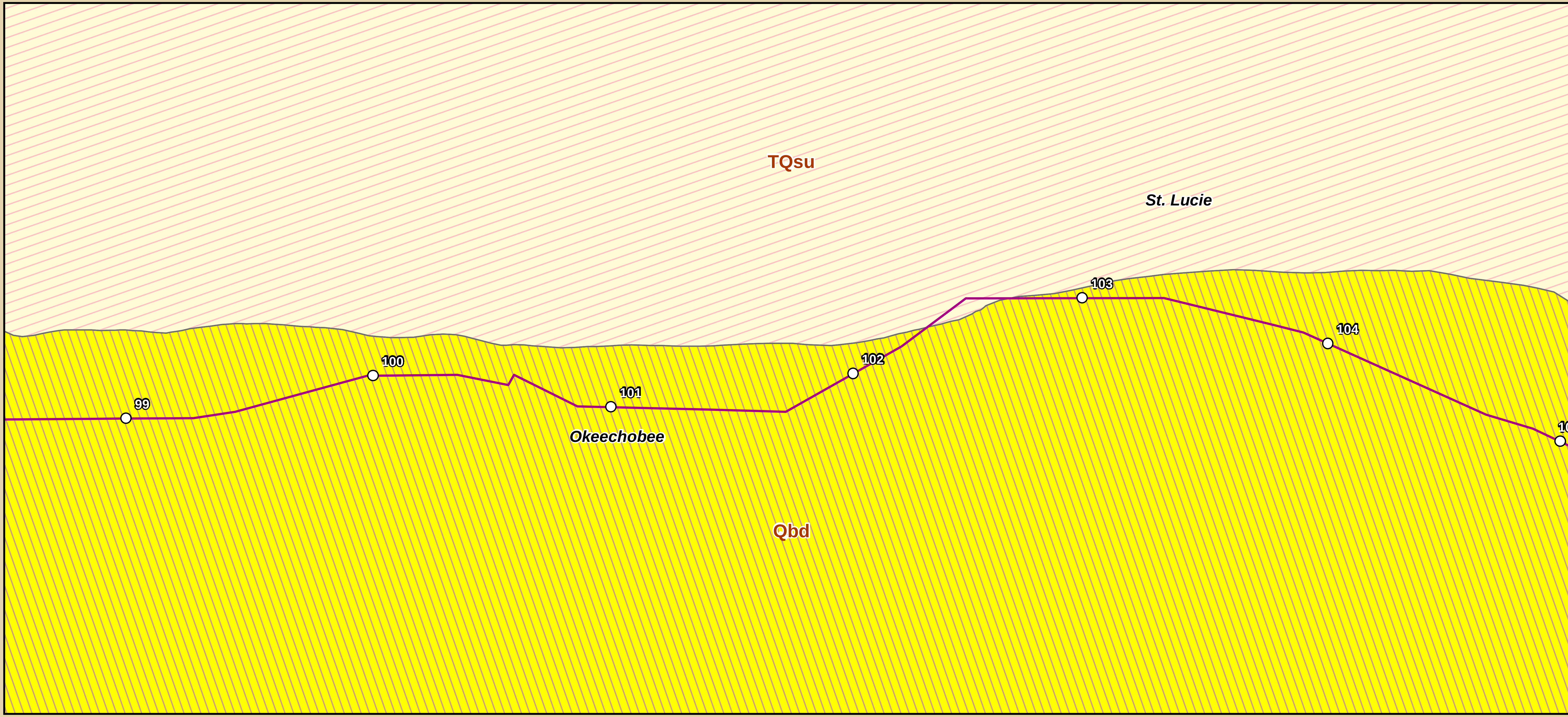
Sources: USGS, ESRI, FSC, TRC

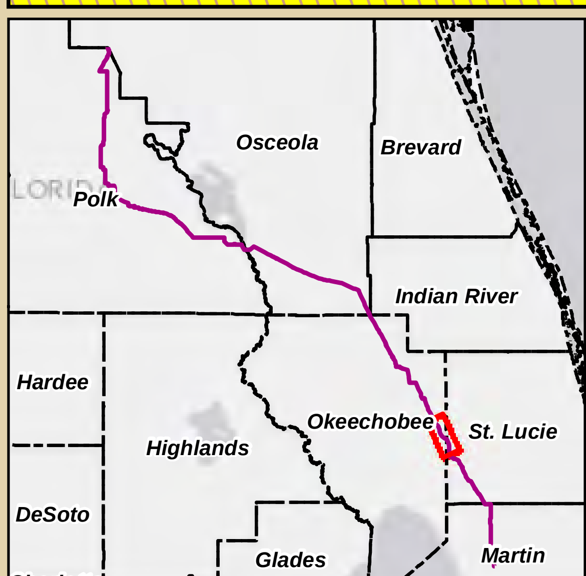
FLORIDA SOUTHEAST CONNECTION

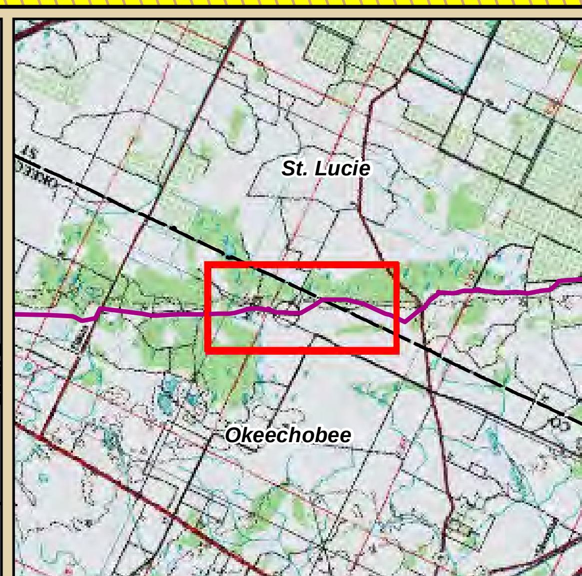
Figure: A-1
Surficial Geology

Sheet 15 of 20

Created: 2/10/2014




**Legend**

- Pipeline Centerline
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0 1,000 2,000
Feet

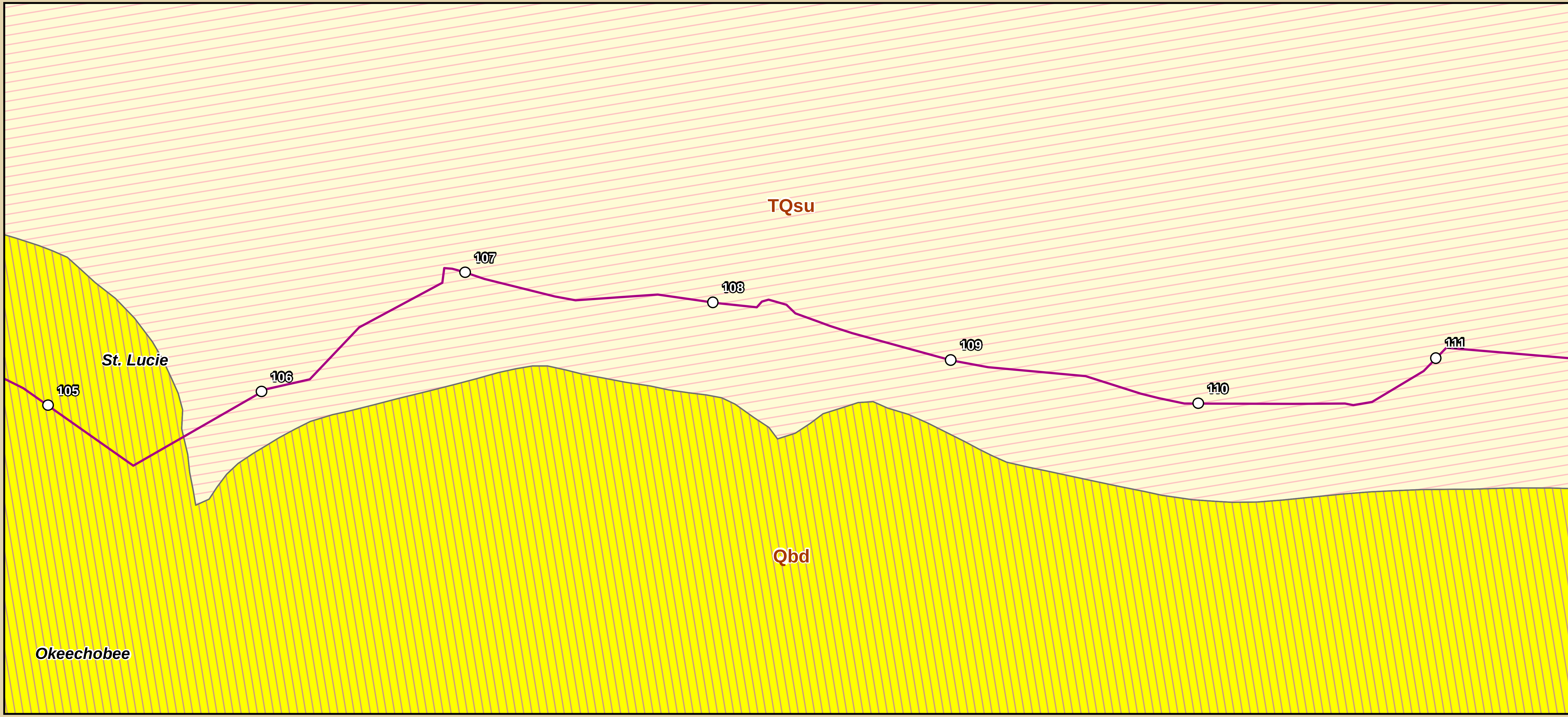
Sources: USGS, ESRI, FSC, TRC

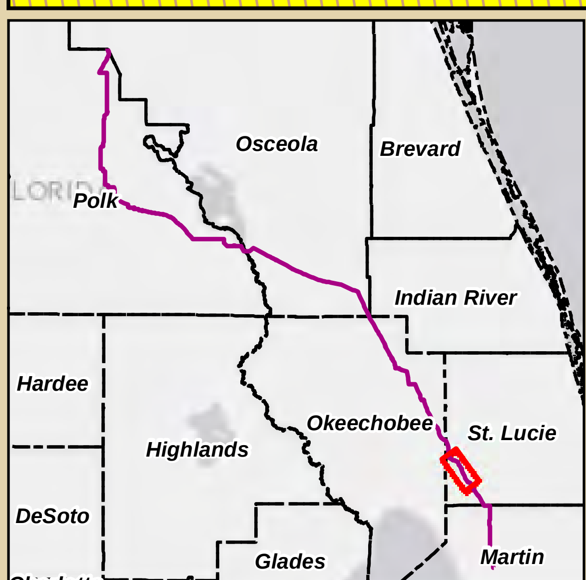
FLORIDA SOUTHEAST CONNECTION

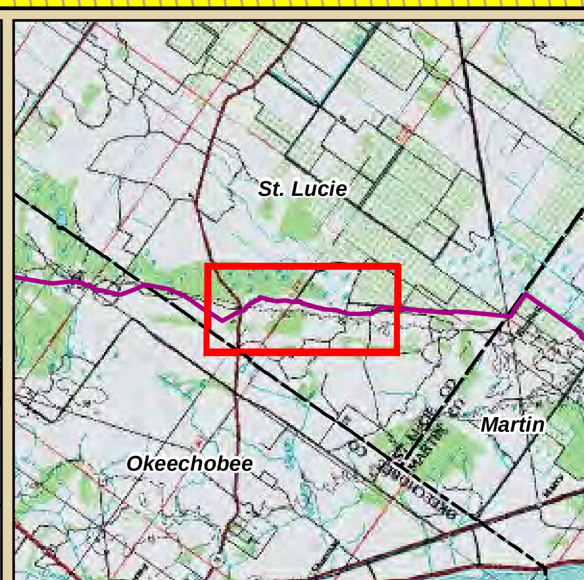
Figure: A-1
Surficial Geology

Sheet 16 of 20

Created: 2/10/2014




**Legend**

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0 1,000 2,000
Feet

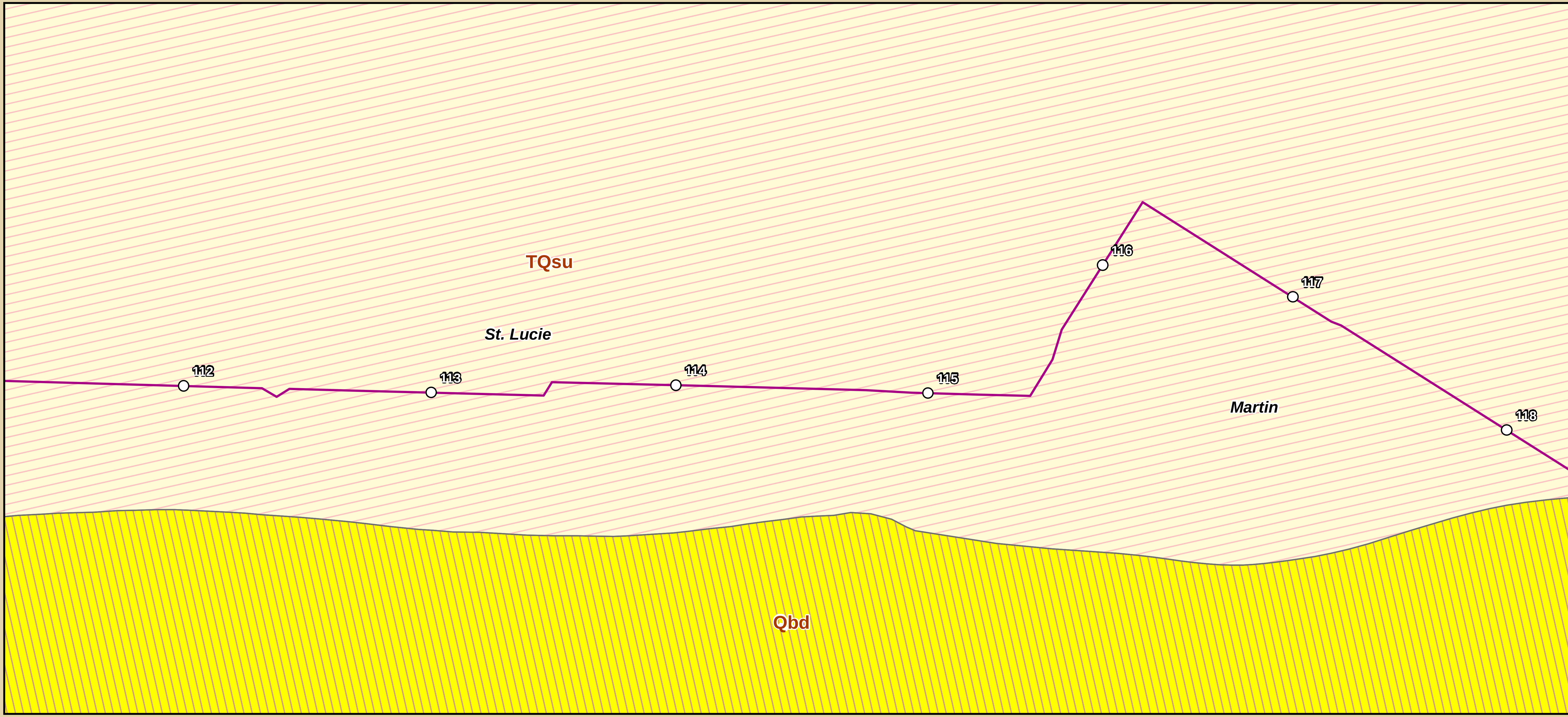
Sources: USGS, ESRI, FSC, TRC

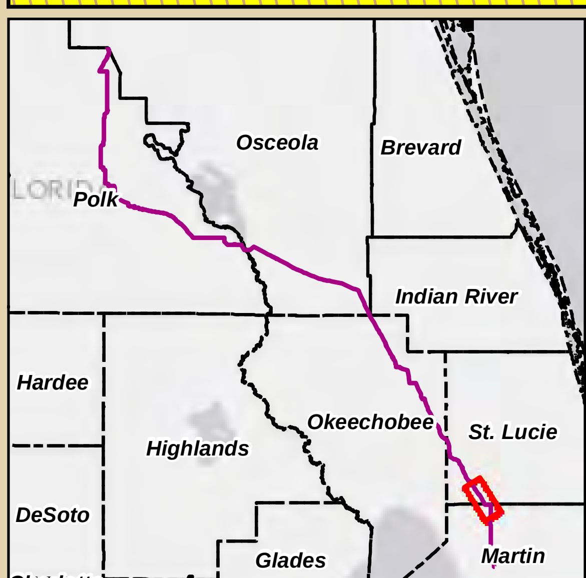
FLORIDA SOUTHEAST CONNECTION

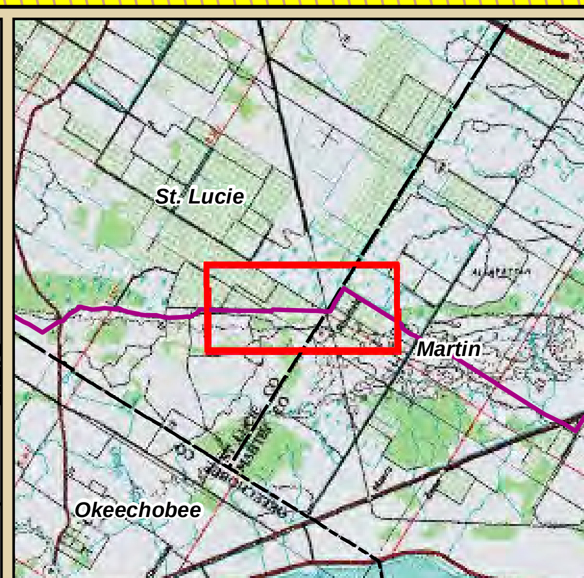
Figure: A-1
Surficial Geology

Sheet 17 of 20

Created: 2/10/2014




**Legend**

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0 1,000 2,000
Feet

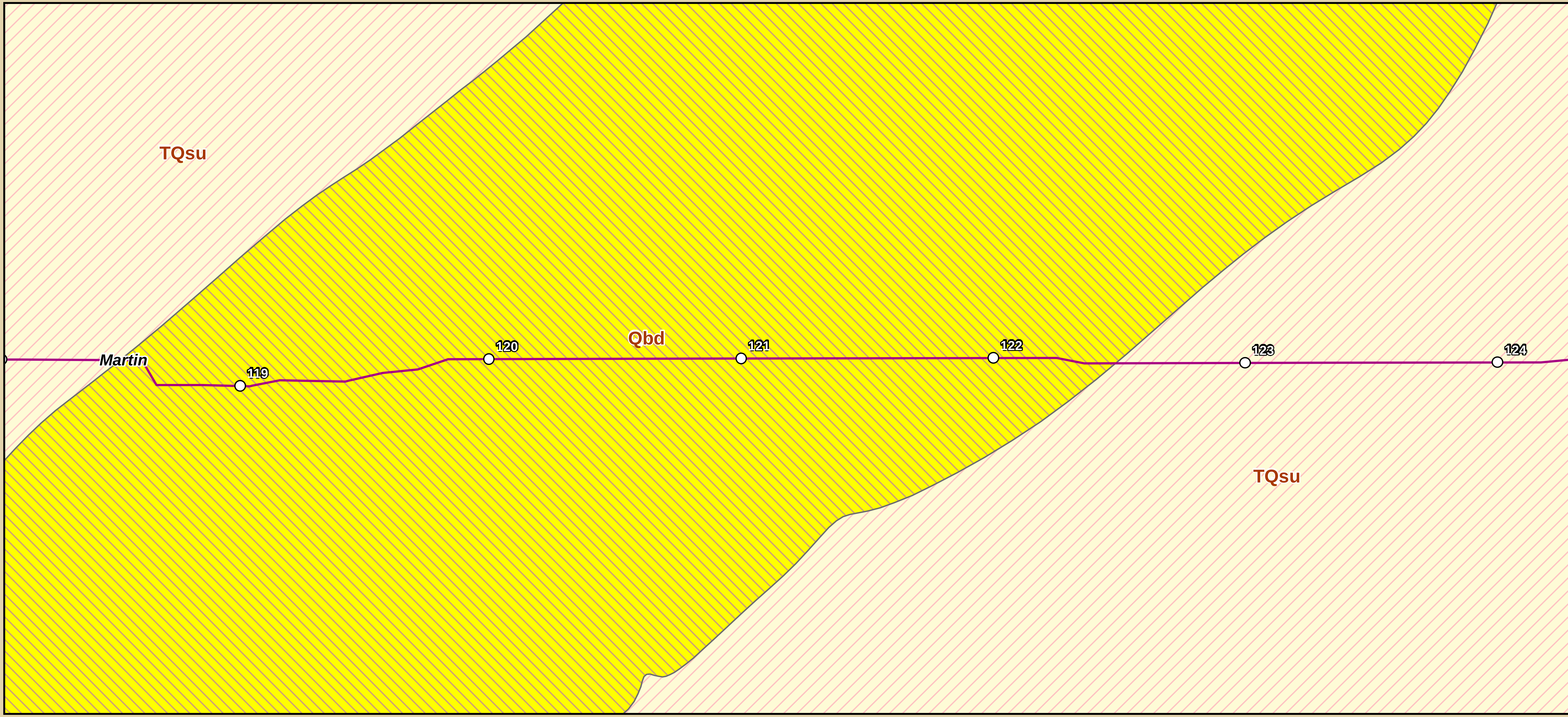
Sources: USGS, ESRI, FSC, TRC

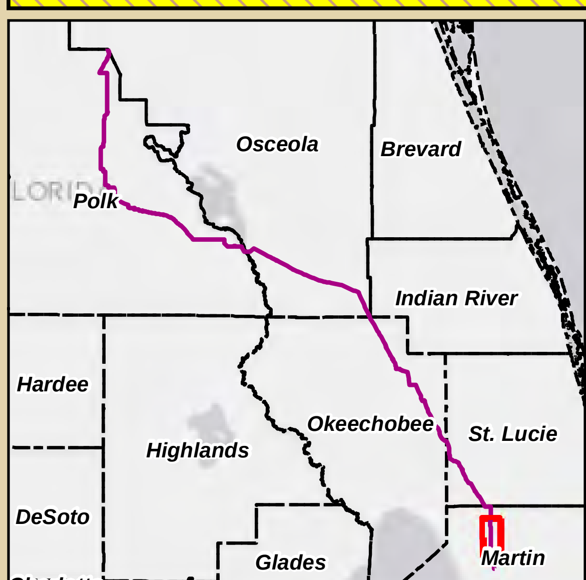
FLORIDA SOUTHEAST CONNECTION

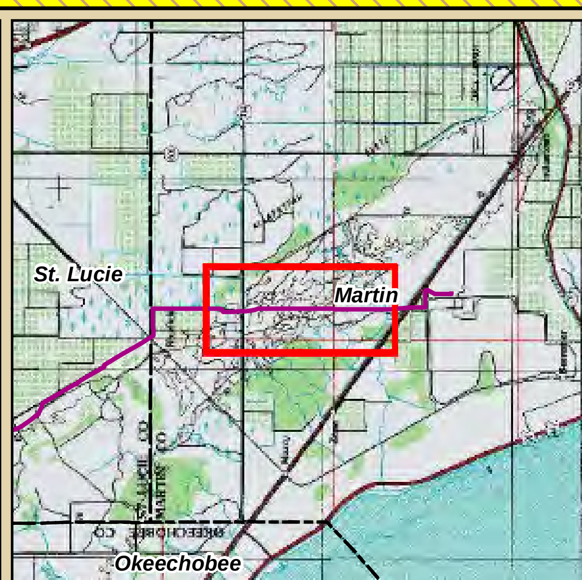
# Figure: A-1
## Surficial Geology

Sheet 18 of 20

Created: 2/10/2014




**Legend**

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N

0 1,000 2,000
Feet

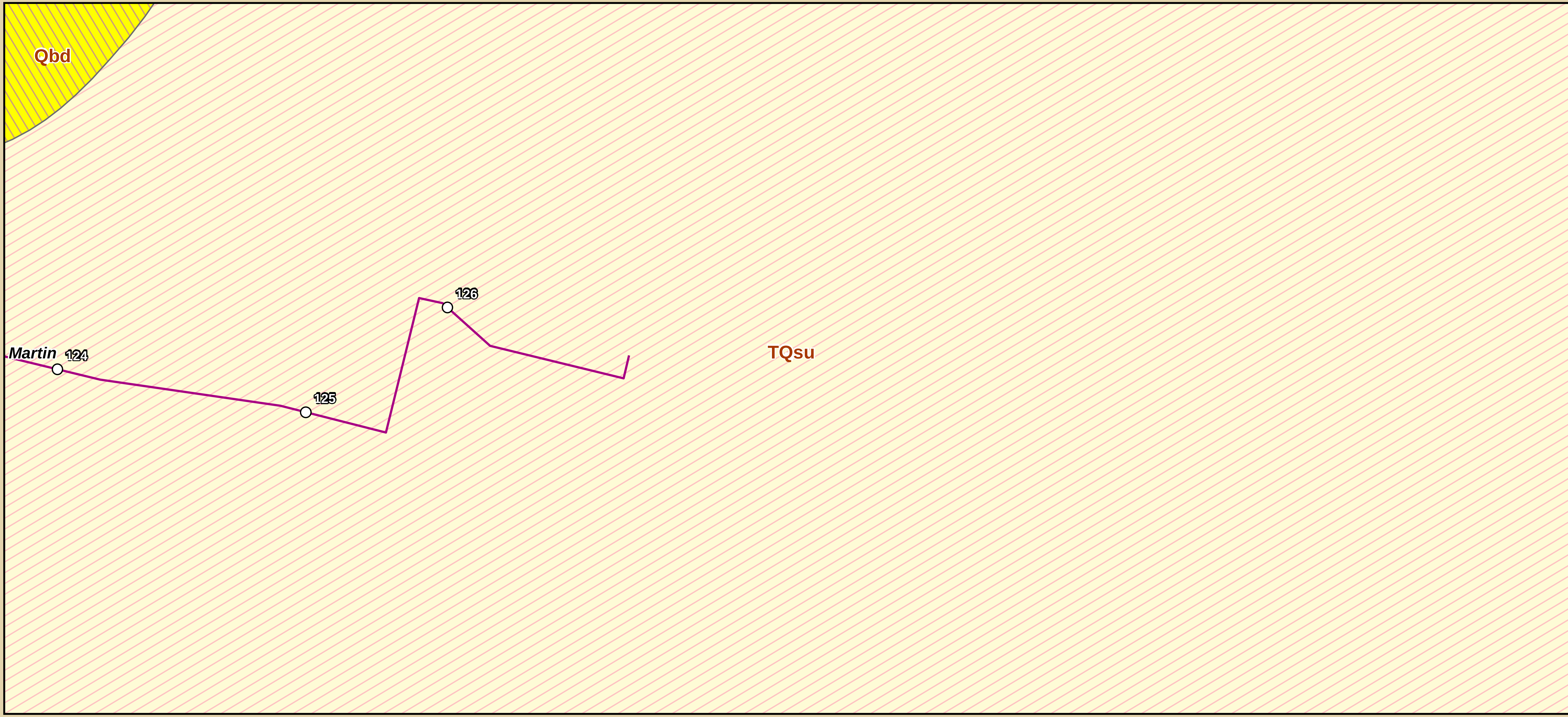
Sources: USGS, ESRI, FSC, TRC

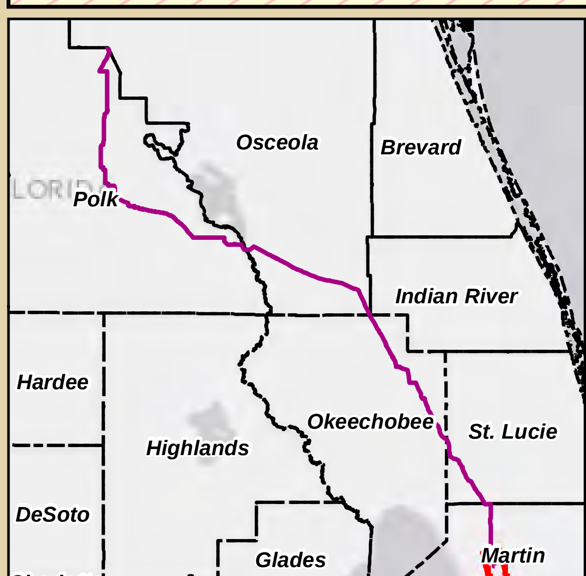
FLORIDA SOUTHEAST CONNECTION

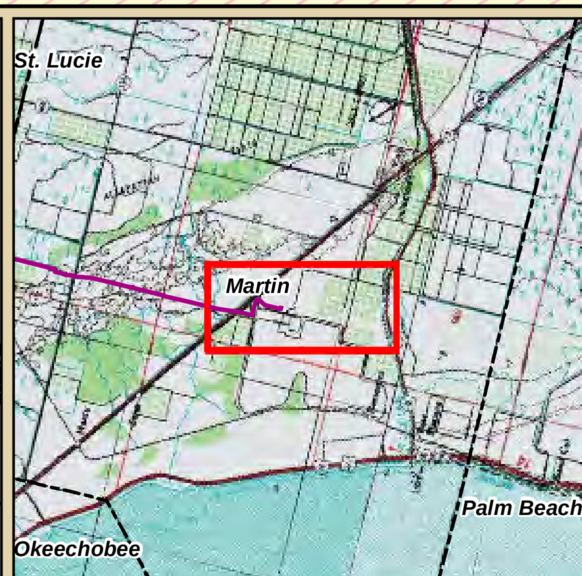
Figure: A-1
Surficial Geology

Sheet 19 of 20

Created: 2/10/2014




**Legend**

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0 1,000 2,000
Feet

Sources: USGS, ESRI, FSC, TRC

FLORIDA SOUTHEAST CONNECTION

# Figure: A-1
## Surficial Geology

Sheet 20 of 20

Created: 2/10/2014