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Appendix G

Wetlands Monitoring Plan

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Wetlands Monitoring Plan

Lockheed Martin Tallevast Site

Tallevast, Florida

July 14, 2009

ARCADIS

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Appendix G

Wetlands Monitoring Plan

Lockheed Martin Tallevast Site

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1. Introduction

This *Wetlands Monitoring Plan* (WMP) presents an initial assessment of area wetlands using the Southwest Florida Water Management District (SWFWMD) "Wetlands Assessment Procedure" to be implemented in conjunction with cleanup of environmental impacts from the Lockheed Martin Tallevast Facility (also known as the former American Beryllium Company (ABC) Site) located at 1600 Tallevast Road in Tallevast, Manatee County, Florida.

1.1 Project History

Lockheed Martin acquired ownership of the former ABC Facility through its 1996 acquisition of Loral Corporation, ABC's parent company. Plant operations ended in late 1996. Between 1997 and 2000, Lockheed Martin prepared the property for sale and began Site investigations. In early 2000, Lockheed Martin sold the property and its improvements to BECSD, LLC, which in turn leased the Facility to WPI Sarasota Division, Inc. (WPI), a privately owned manufacturer. In March 2007, WPI was sold to Cooper Industries, Inc., which assumed the Facility lease and continued the same manufacturing processes until ceasing operations in June 2007. Beginning in July 2007, Lockheed Martin has leased the Facility from BECSD, ultimately purchasing it back from BECSD, LLC in June 2009.

From 1962 until 1996, the Facility was owned by Loral Corporation and operated by ABC as an ultra-precision machine-parts manufacturing plant where metals were milled, lathed, and drilled into various components. Some components were finished by electroplating, anodizing, and ultrasonic cleaning. Chemicals used and wastes generated at the Facility included oils, fuels, solvents, acids, and metals. A detailed description of Facility operations is presented in the *Phase I Environmental Assessment* report (Tetra Tech, Inc. [Tetra Tech], 1997a). Additional information can be found in the *Site Assessment Report Addendum* (SARA) (Tetra Tech, 2005a).

Areas of potential environmental concern at the Facility included an underground storage tank/aboveground storage tank (UST/AST) area near the southwest corner of Building 1; an area on the east and northeast side of Building 5, where five sumps were located; a hazardous materials storage yard in the southeast corner of Building 5; and the wastewater treatment pond located south of the buildings. In the UST/AST area, two 1,500-gallon ASTs were historically used for fuel oil storage, a 1,000-gallon AST stored solvents, and a 550-gallon UST stored gasoline.

The Facility is located in Tallevast, Florida a small, unincorporated community between Sarasota and Bradenton, in southwestern Manatee County. Land use in the area is predominantly single-family residential homes and churches, light commercial and industrial development, and heavy manufacturing. The Facility is zoned for heavy manufacturing and is bounded by Tallevast Road to the north; 17th Street Court East to the east; a golf course, undeveloped, and residential areas to the south; and an abandoned industrial facility to the west.

Assessments of the Site indicated the presence of industrial solvent-related chemicals affecting the groundwater and soil. In addition to solvent chemicals, polycyclic aromatic hydrocarbons (PAHs) and metals (arsenic, copper, chromium, and beryllium) were detected in soils at the Facility. In 2006, Lockheed Martin installed an interim groundwater extraction and treatment system at the Facility for contaminant removal from the on-facility source area and to reduce the possibility of further contaminant spread while a more complete solution was investigated and designed. Also in 2006, Lockheed Martin implemented a program to close the private water supply wells at the Site to prevent people from drinking or using impacted groundwater and to eliminate conduits through which contaminants might seep into an uncontaminated part of the aquifer system. An important parallel effort investigated the potential for soil-vapor intrusion impacts from both soil and groundwater. That study confirmed that vapor intrusion exposure was not a concern either on the Facility or in the community.

Submission of a *Remedial Action Plan (RAP) Addendum* is the next step in the remedial process. The first RAP was submitted to the Florida Department of Environmental Protection (FDEP) on May 4, 2007. FDEP provided comments on that RAP in a letter dated July 27, 2007, in which FDEP requested that a RAP addendum be submitted by October 1, 2007. Lockheed Martin requested an extension to the RAP addendum submittal deadline in a September 11, 2007 letter citing the need to conduct additional design-related studies to adequately respond to agency comments. Lockheed Martin proposed to FDEP that interim deliverables could be submitted to demonstrate adequate progress toward compiling the revised RAP. FDEP granted the extension request in an October 2, 2007 letter and required submission of the interim deliverables proposed by Lockheed Martin.

Subsequent to submittal of the interim deliverables, a revised RAP dated August 28, 2008 was submitted to FDEP. FDEP commented on the August 2008 RAP in a letter dated March 16, 2009 (see Appendix A). FDEP requested that a final revised RAP be submitted within 120 days of the March 16 letter (July 14, 2009). The final revised RAP is to reflect the reconsidered aspects of the selected remedy that were outlined in a

February 11, 2009 response letter to stakeholder concerns and in the agency's comments in the March 16, 2009 letter. This WMP is part of the RAP Addendum to satisfy the requirement of the March 16, 2009 FDEP letter.

1.2 Project Area Description

The following is a description of the natural environment, ecology, and water resources influencing the area wetlands.

1.2.1 Location

The Facility is located at 1600 Tallevast Road in the town of Tallevast situated between the cities of Sarasota and Bradenton, in southwestern Manatee County, Florida. Land use in the area is predominantly single-family residential homes, and churches, light commercial and industrial development, and heavy manufacturing. A large percentage of ground cover in the area includes grass fields, a golf course, and residential landscaping. The Facility is located in the northwest quarter of Section 31, Township 35 South, Range 18 East, as shown on the Bradenton, Florida United States Geological Survey (USGS) 7½-minute quadrangle.

1.2.2 Natural Environment

The Tallevast community is located on the Gulf Coastal Lowlands, a gently sloping plain ranging from approximate elevations as high as 30 feet down to 15 feet above mean sea level (msl). The area is approximately 1.5 to 2.0 miles east (inland) of Sarasota Bay and approximately six miles from the Gulf of Mexico. The land surface of the study area has very little relief and slopes gently toward the south-southeast.

The Gulf Coastal Lowlands are situated in the Southwestern Flatwoods Physiographic region consisting of rock and sediment ranging from the Miocene to Pleistocene eras (23.8 million to 11,000 years ago). Landforms are characterized by low plateaus and ridges, flatwoods, prairies, rockland/marl plains, and various relict coastal features. Surface materials are dominated by sand with clayey substrata, limestone, and sumps of accumulated organic deposits.

The Gulf Coastal Lowlands region and flatwoods soils are moderate to poorly drained, fine-grain, acidic sands with low reserves of available nutrients; low organic matter and low clay content (often less than two percent). These soils may contain a spodic (organic) horizon when organic matter is translocated downward by water percolation.

Clay hardpans may also result from transport and accumulation of clays. Many of the soils supporting flatwoods are spodosols, but some variation exists. Soil types in upland areas of the Tallevast Site study area are largely comprised of EauGallie fine sand, while soil types in mapped wetlands include complexes of Canova, Anclote, and Okeelanta soils, as well as fine sands of Floridana-Immokalee-Okeelanta association.

Southwest Florida's aquifers vary in depth, and are divided into two general categories: Surficial and Floridan. The Chokoloskee aquifer is a surficial aquifer covering 3,000 square miles (mi^2) in southwest Florida. Comprised of shallow beds of shells and sand lying less than 100 feet underground, it is recharged by rainfall. Artificial drainage canals are believed to have lowered water levels and increased saltwater intrusion. Several intermediate aquifers comprised of limestone beds occur between the surficial and Floridan aquifers, and a variety of undifferentiated aquifers store approximately 10 percent of Florida's groundwater.

Three aquifer systems underlie the Site — the Surficial Aquifer System, the Intermediate Aquifer System, and the Floridan Aquifer.

The Surficial Aquifer System is recharged locally as the water table fluctuates due to drought or rainfall.

1.2.3 Ecology

The dominant historical habitat of the project area was pine flatwoods. According to the U. S. Department of Agriculture (USDA) Natural Resources Conservation Service (formerly the Soil Conservation Service), such habitats in southwest Florida are characterized by savannas, an ecotone spanning grasslands to forests. This ecosystem is now used extensively as rangeland for cattle grazing.

Once Florida’s most extensive terrestrial ecosystem, these historic pine flatwoods evolved under frequent lightning and human-induced fire, seasonal drought, and flooded conditions. Flatwoods are characterized by low, flat topography, relatively poorly drained, acidic, sandy soil, and pine woodlands. This ecosystem historically had open, park-like understories managed by frequent fires.

The dominant tree species of Tallevast-area flatwoods are limited to south Florida slash pine (*Pinus elliottii var. densa*) and longleaf pine (*Pinus palustris*). Other infrequently occurring trees include cabbage palm (*Sabal palmetto*), and hardwoods including live oak (*Quercus virginiana*), water oak (*Q. nigra*), sweet gum (*Liquidambar*

styraciflua), red maple (*Acer rubrum*), and ash (*Fraxinus* spp.). Commonly occurring understory shrub species include saw palmetto (*Serenoa repens*), wax myrtle (*Morella cerifera*), blueberries (*Vaccinium* spp.), and American beautyberry (*Callicarpa americana*).

The invasive Brazilian pepper tree (*Schinus terebinthofolia*) is identified as locally dominant in both the forest understory and open rangeland scrub strata. According to the University of Florida Center for Aquatic and Invasive Plants, Brazilian pepper tree is native to Argentina, Paraguay, and Brazil. The species was brought to Florida in the middle of the 19th century for use as an ornamental plant. Distribution of Brazilian pepper tree occurs throughout the Tallevast Site. It is an aggressive invader of disturbed habitats; this characteristic has led to its placement on the Florida Exotic Pest Plant Council's list of invasive species. Plant communities such as hammocks and pineland forests are often invaded and dominated by Brazilian pepper tree. Other nonnative and escaped plant species identified in the Tallevast WMP area include camphor tree (*Cinnamomum camphora), punk tree (Melaleuca quinquenervia), common guava (Psidium guajava*), tropical soda apple (*Solanum viarum*), *and Caesar's weed (Urena lobata).*

Evidence of wildlife encountered during the initial surveys to identify transect locations was limited to animals typically found in flatwoods, such as mammals including armadillo (*Dasypus novemcinctus*), eastern cottontail rabbit (*Sylvilagus floridanus*), white-tailed deer (*Odecoileus virginianus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*); birds including, red-shouldered hawk (*Buteo lineatus*), piliated woodpecker (*Drycopus pilatus*), rufus-sided towhee (*Pipilo erthrophthalmus*), red-winged blackbird (*Agelaius phoeniceus*); reptiles including black racer (*Coluber constrictor*); and, amphibians including pinewoods tree frog (*Hyla femoralis*).

Notwithstanding the Florida Department of Transportation's (FDOT) Florida Land Use, Cover, and Forms Classification System (FLUCCS) code description, both target and reference wetlands subject to the Lockheed Martin Tallevast Site WMP are relict flatwoods marshes. Also referred to as seasonal ponds, these freshwater resources occur throughout Florida's pine flatwoods. These shallow marshes (less than a meter deep) occur as slight depressions (10 to a few hundred meters in diameter) in the otherwise flat landscape. The most studied and best-preserved example of these wetlands occurs in eastern Sarasota County. Flatwoods marshes provide important

functions as groundwater recharge areas.[1] Groundwater withdrawal for municipal and agricultural purposes has likely resulted in localized drainage impacts to depressional marsh wetlands throughout the state. The flat topography, soils, and seasonal precipitation of the pine flatwoods strongly influence hydrology. During the rainy season, minimal water runoff results in waterlogged and poorly aerated soils, and standing water may be present for varying periods. During the dry season, high evapotranspiration draws water from upper soil horizons. Water often cannot move upward from lower horizons where there is an impermeable hardpan, frequently resulting in droughty conditions.

1.2.4 Water Resources/Watershed

The study area is located in the Sarasota Bay watershed in Florida's Southern Coastal Watershed. The Southern Coastal Watershed includes numerous estuaries, wetlands, and small coastal streams that are tidally influenced over much of their length, and a few longer stream/canal systems with predominantly freshwater habitats (SWFWMD, 2002). The Sarasota Bay watershed drains more than 200 mi^2 (518 square kilometers (km^2)) within Manatee, Sarasota, and Charlotte Counties (Kish, et al., 2008). Near the Site, the Braden River watershed, a sub-basin of the Manatee River watershed, borders the Sarasota Bay watershed to the east.

The study area is located along the drainage divide between two stream/canal systems, Bowlees Creek and Pearce Canal, within the Sarasota Bay watershed (HUC 03100201). Bowlees Creek, a major tributary of Sarasota Bay, is approximately 1.25 miles northwest of Tallevast. The Pearce Canal is southeast (0.75 mile) and east (one mile) of Tallevast. A ridge (topographical high) runs north-south through the Facility. Surface water on the western portion of the Facility flows west toward the Bowlees Creek and the improved drainage features around the Bradenton-Sarasota airport, both of which drain to Sarasota Bay. Surface water on the easternmost portion of the Facility flows toward the Pearce Canal. The Pearce Canal drains both south into the Sarasota Bay watershed and north into the Manatee River watershed (HUC 03100202). The drainage divide along the Pearce Canal is located about one mile north of the Manatee/Sarasota County line, approximately where the canal crosses US 301 and one mile southeast of the former ABC Facility.

[1]Myers, R. L. and Ewel, J.. J., *Ecosystems of Florida*. University of Central Florida Press. Orlando, FL. 1990.

Several small surface-water bodies lie within a half-mile radius of the former ABC Facility. Several shallow swales convey surface runoff to the street and stormwater channels. In addition, FLUCFCS has identified a number of wetlands near the Site (see Figure 2-1).

1.2.4.1 Local Conservation/Management

According to the Manatee County internet site, the Conservation Lands Management Department is continually working to restore, as much as possible, disturbed and degraded areas of county-owned land to their native condition, using natural processes of prescribed fire in combination with mechanical cutting and clearing and select application of herbicide(s) to suppress exotic plant species. However, no county-owned or -managed preserves are located close to the WAP study area.

Nearby Sarasota County takes a multi-discipline approach to water resource management. Through its Integrated Water Strategic Initiative, Sarasota County Environmental Services leverages biologists, chemists, planners, engineers and operational staff together to address comprehensive water conservation issues, with a goal to balance the needs of people with the needs of the environment to manage water resources effectively. According to the Sarasota County Government's Environmental Services internet website, their outcome-based performance measures include fishable and swimmable waters, a safe and sustainable water supply, and an optimal level of flood protection.

1.2.4.2 Regional Conservation/Management

Established in 1961 to operate and maintain several large flood protection projects, the Southwest Florida Water Management District (SWFWMD) is one of five regional agencies directed by state law to protect and preserve water resources within its boundaries. The District's current responsibilities include managing water supply and protecting water quality and natural systems — rivers, lakes, wetlands, and associated uplands. Manatee and Sarasota Counties, including the Tallevast community, are located within the jurisdiction of the District's Manasota Basin Board with its broad regulatory oversight and water resource conservation and management programs.

1.2.4.3 Statewide Conservation/Management

The Florida Fish and Wildlife Conservation Commission's *Comprehensive Wildlife Conservation Strategy* (CWCS) is an action plan for conserving all of the state's wildlife

and vital natural areas for future generations. It outlines what native wildlife and habitats are in need, why they are in need and, most importantly, what the State of Florida is going to do about it. The CWCS was part of a nation-wide effort by all 56 states and U.S. territories to develop action plans and qualifications for federal funding.

As one of the most ubiquitous and widespread wetland types in Florida, the CWCS identifies freshwater marsh and wet prairie habitats as being subject to a wide array of highly ranked threats. Widespread ditching, diking, and hydrologic fragmentation caused by roads in or adjacent to these habitats are important vectors of altered hydrologic regime. Groundwater withdrawal for municipal and agricultural purposes has impacted depressional marsh wetlands in localized areas throughout Florida. Nearly all marsh and wet prairie systems in unprotected lands have suffered from direct habitat conversion and altered landscape context as the surrounding uplands and much of the wet prairie habitat have been converted to other land uses, primarily agriculture and urban/suburban development. Small wetlands are undervalued and frequently altered even though they are the only sites in which certain Florida species either live or reproduce. In south and central Florida, marsh and wet prairie wetlands are particularly vulnerable to and have been seriously impacted by a variety of invasive plants. Many marsh and wet prairie wetlands in both agricultural and urban settings receive nutrients from discharges from stormwater management systems which may lead to substantial changes in plant community composition and associated faunal changes. Very little of the marsh and wet prairie habitat statewide is receiving adequate fire as a result of perceived difficulties in burning these habitats and lack of knowledge of the role of fire in herbaceous wetland ecosystems. Additional threats specific to this habitat include the numerous water control structures affecting marsh and wet prairie habitat, particularly in the Everglades region and in smaller isolated wetlands, statewide.

Actions to abate the threats to freshwater marsh and wet prairie were developed in the CWCS to address threats specific to these habitats. These actions are intended to support the ecological restoration efforts already underway in the Everglades region and include increasing the spatial extent of herbaceous wetlands in the landscape, improving the functionality of existing herbaceous wetlands through both regional and small-scale hydrologic restoration projects, raising awareness of the need for fire in herbaceous wetland systems, preventing harm to wetland ecosystems caused by discharge to and nutrient loading of marshes and wet prairies, and decreasing the amount of wetland acreage converted to other land uses by making development more compatible with wetland habitat conservation.

2. Initial Wetlands Assessment

The following offers a detailed description of the wetlands initially identified near the Site, including a discussion of the selection methodology for the wetlands that will be monitored as part of the remedial action proposed for the Site. A summary of the wetlands selected for this monitoring program is provided in Table 2-1 at the end of this section.

2.1 Project Wetland Selection Methodology

Representatives from FDEP, Lockheed Martin, ARCADIS, and CDM met on June 26, 2008, at which time eight wetland areas were selected for monitoring using the methodology developed by the Southwest Florida Water Management District (Leeper et al., 2001), as part of the 2008 *Revised RAP*. Four of these wetlands were identified as "target wetlands" (TW), and the remaining four were selected as controls, which are described below as "reference wetlands" (RW). The target wetlands were chosen due to their proximity to the area that may be hydraulically influenced (i.e., water table levels may change) by the proposed groundwater treatment system in the 2008 *Revised RAP.* The selected reference wetlands are outside of the zone of hydraulic influence (one foot drawdown), which will allow them to serve as hydraulic controls during remedial action monitoring of wetland groundwater levels.

During the June 26, 2008 meeting, normal pool and seasonal high water levels were established for wetlands TW-1, TW-2, and TW-6. These parameters were assessed for the remaining wetlands during a June 10–12, 2009 field survey using the Wetland Assessment Procedure (WAP) developed by the Southwest Florida Water Management District (2005 Revision), and are discussed in Section 2.2 below. Wetland morphologies for each wetland are described in accordance with FLUCFCS (see Table 2-1 at the end of this section).

2.2 Wetlands Selected for Monitoring

Eight wetland-monitoring sites were originally identified for inclusion in the remediation project's monitoring protocol during the June 2008 meeting. However, the June 2009 field investigation determined that two of the eight wetlands, TW-18 and RW-1, have substantially transitioned to support upland vegetation habitat and are no longer fully functional wetlands pursuant to WAP guidelines. These historic wetland areas are dominated by transitional and upland plant species and have mapped and observed indicators of surficial hydrologic alterations. However, observed indicators of the prior

wetland habitats at TW-18 and RW-1 include wetland floor subsidence, limited presence of wetland vegetation, and evidence of historic wetland hydrology. While conditions at these two locations lack indicators sufficient for assessment under WAP guidelines, they are included in this monitoring plan since they represent the baseline of conditions for assessing the potential affect of proposed pump and treat groundwater remediation.

2.3 Description of Project Wetlands

The eight wetlands chosen for monitoring during the groundwater remediation project are briefly characterized below. Specific details of each project wetland, such as habitat observations along the selected transects, are given on the completed field sheets in Attachment A. Other characteristics of these wetlands are given in Table 2-1 at the end of this section.

2.3.1 Target Wetland TW-1

2.3.1.1 Location

Target Wetland 2 is a triangularly shaped feature north of Tallevast Road, about 800 feet northeast of the Lockheed Martin Facility. TheTW-2 site is positioned within one property parcel, as shown on Figure 2-1.

2.3.1.2 Historical Description

The historic area of TW-1 is estimated to have been 15.15 acres. A review of 2003 aerial photography concludes that the TW-1 site was once divided into three separate, isolated, emergent and shrubby wetland areas. The northern and southern wetland areas appear to have been the most typical, and inundation is obvious within these two locations on the 2003 aerial photography. The wetland area in the central section of TW-1 was likely a small emergent basin. The dominant vegetation surrounding TW-1 consisted of planted slash and longleaf pine trees, with hardwood scrub forest along the southern border. A segment of upland shrub/scrub habitat occurred between the northern and central wetland sites within TW-1. An upland, planted, pine tree stand separated the central and southern wetland sites. Historic hydrological indicators of TW-1 suggest that this wetland was fed by both surficial stormwater sheet flow and a groundwater interface. An obvious hydrological connection existed between TW-1 and the property to its north before this area was developed.

2.3.1.3 June 2009 Field Observations

Target Wetland No. 1 displayed signs of prior and ongoing conversion to upland scrub and prairie habitats. The June 2009 field effort determined that 11.4 acres of the 15.15-acre parcel identified by the June 2008 potential wetland monitoring site location meeting can currently be considered functional wetland habitat (Figure 2-2). No major alteration or conversion of historic land use or vegetative cover types within TW-1 was observed during the June 2009 field investigation. However, transitional and upland floral species are migrating into areas that appear to have been historically dominated by outer deep and deep zone wetland flora. The northern interior sector of TW-1 is dominated by a thick, matted biomass of grasses. The central and southern interiors are now dominated by shrub/scrub species and grasses. Vegetation types surrounding TW-1 consist of planted pine trees and upland hardwood scrub (see Attachment A, field data sheet).

No inundated areas were observed within the established bounds of TW-1. The southern sector of this site exhibited marginal wetland indicators, and is beginning to transition into upland. The central wetland area of TW-1 is no longer a functional wetland and is being invaded by adaptive and upland vegetation. The northern sector of TW-1 possesses more functional wetland characteristics than the other wetland locations within this site, and is where the wetland monitoring transect was established for TW-1. The only terrestrial subsidence observed in TW-1 was in the wetland area of the transect placement. Organic streaking was prevalent in the sandy soils of the wetland interior. Transitional and upland soils consisted of sandy loam.

No obvious hydrological alterations were observed along the surface area in or near the central and southern areas of TW-1. However, a new industrial facility, with an associated 5.25-acre stormwater retention pond, was recently (sometime after 2003) built on the aforementioned property adjacent to the northern boundary of TW-1. Development of this facility and its retention pond may have severed the surficial hydrological connection between these two properties, and could have affected TW-1. Lower than normal precipitation could be another variable that negatively impacts TW-1.

2.3.2 Target Wetland 2

2.3.2.1 Location

Target Wetland 2 is a triangularly shaped feature north of Tallevast Road, about 800 feet northeast of the Lockheed Martin Facility. TheTW-2 site is positioned within one property parcel, as shown on Figure 2-1.

2.3.2.2 Historical Description

The historic area of TW-2 is estimated at 1.87 acres. A review of 2003 aerial photography concludes that the TW-2 site once contained an inundated area fed by a conveyance that appeared to drain stormwater from Tallevast Road and from a commercial/industrial facility southwest of the wetland. The northern boundary of TW-2 also contained a small stormwater conveyance.

Vegetation shown in the 2003 aerial photograph of TW-2 consisted of emergent vegetation in and near the inundated area, and shrub/scrub vegetation dominating the wetland area surrounding the inundated portion. A parcel of disturbed upland and a commercial/industrial facility bordered TW-2 to the west, with upland prairie habitat surrounding the remaining areas of TW-2. Historic hydrological indicators of TW-2 suggest that this wetland was fed both by surficial stormwater sheet flow and by a likely groundwater interface.

2.3.2.3 June 2009 Field Observations

Target Wetland 2 displayed signs of prior and ongoing conversion to upland forested and prairie habitats. The June 2009 field effort determined that 1.66 acres of the 1.87-acre wetland parcel identified in the June 2008 meeting can currently be considered wetland habitat (Figure 2-3). No major alteration or conversion of historic land use or vegetative cover types within TW-2 was observed during the June 2009 field investigation. A thick stand of Carolina willow (*Salix caroliniana*) trees and shrubs lies west and southwest of the historically inundated wetland area. This wooded wetland area is dominated by outer deep and deep zone floral species, but several transitional and adaptive species are growing on the hummock in this area. As much as 20 inches of subsidence was observed in this forested segment of TW-2. Vegetation in the area shown as inundated in the 2003 aerial photograph consists of transitional grass species and a minimal number of small shrubs.

Although no longer inundated, a staff gauge (SG-8) and a sampling well (SW-3) are currently located within the historically ponded area of TW-2. No other evidence of inundation was observed within TW-2, which is likely due to unknown hydrological alterations that may have occurred in the past few years. Lower than normal precipitation could be another variable that negatively impacts TW-2. The most typical wetland area of TW-2 occurs in the area of willow trees, and the wetland portion dominated by grasses is in the final stages of upland transition. Soils of the wetland area are sandy and contain organic streaking, as well as other hydric indicators. Soils of the wetland area exhibiting signs of upland transition consist of loamy upland sands. The monitoring transect established for TW-2 incorporates the existing staff gauge and sampling well.

2.3.3 Target Wetland 6

2.3.3.1 Location

Target Wetland 6 is south of Tallevast Road about 850 feet east of the Lockheed Martin Facility. The TW-6 site is positioned within one property parcel, as shown in Figure 2-1.

2.3.3.2 Historical Description

The historic area of TW-6 is estimated at 3.04 acres. A review of 2003 aerial photography concludes that the TW-6 site contained an inundated area in its southern sector. An associated forested/shrubby wetland occurred north of the ponded area. Historic vegetation types consisted of emergent/shrubby species in the area of inundation and a thick stand of trees/shrubs outside of the inundated area. This wetland appears to receive stormwater draining from Tallevast Road to the north, the residential property to the west, and from the pastureland to the east and south. Historic hydrological indicators of TW-6 suggest that this wetland was fed both by surficial stormwater sheet flow as well as by a likely groundwater interface within the area of inundation.

2.3.3.3 June 2009 Field Observations

The section of TW-6 north of the historically inundated area displayed evidence of conversion to upland forested scrub. Soils in this area are comprised of sand and loamy sand, with marginal hydric indicators. The inundated portion of TW-6 was field verified to be an excavated pond, and this feature was not holding water at the time of

observation. Though not currently inundated, the soils within the bounds of the excavated pond were saturated and had a deep organic, mucky horizon. The June 2009 field effort determined that 1.1 acres of the 3.04-acre wetland parcel identified by the June 2008 meeting are currently functional wetland habitat (Figure 2-4).

No major alteration or conversion of historic land use or vegetative cover types in TW-6 was observed during the June 2009 field investigation. Vegetation in the excavated pond predominantly consists of outer deep and deep zone species. Vegetation of the wetland area north of the pond is dominated by outer deep and transitional species, but migration of adaptive and upland species was noted. A minimal amount of subsidence was observed within the wetland area outside of the pond, and no subsidence was observed within the bed of the pond.

Observed hydrology suggests that the pond has a groundwater interface, but is also fed by rainfall. An eroded, north to south oriented stormwater conveyance channel lies along the western boundary of TW-6. This eroded channel is likely a hydrological remnant of the historic stormwater flow path that fed the pond. Normal and capacity pool events in the pond are likely due to elevated groundwater in the areas of TW-6 to the north. These elevated groundwater events could have created the wetland conditions apparent in the northern section of TW-6. A small berm exists at the northern edge of the pond, which could also have served as a means of slowing stormwater sheet flow into the pond enough to create wetland conditions outside of the pond boundary. Lower than normal precipitation could be another variable that negatively impacts TW-6.

The TW-6 monitoring transect was established at the historic wetland edge and follows a southerly path, terminating in the pond's wetland interior. No feasible evidence of a historic normal pool elevation was observed outside of the excavated pond within TW-6.

2.3.4 Target Wetland 18

2.3.4.1 Location

Target Wetland 18 is a small, oblong forested depression located approximately 400 feet north of the northern terminus of 19th Street East and about 1,200 feet northeast of the Lockheed Martin Facility. TheTW-18 site is positioned within one property parcel, as shown in Figure 2-1.

2.3.4.2 Historical Description

The historic area of TW-18 is estimated at 4.08 acres. A review of 2003 aerial photography concludes that the TW-18 site once contained an inundated area fed by a conveyance that appeared to drain stormwater from Tallevast Road and from a commercial/industrial facility southwest of the wetland. The northern boundary of TW-18 also contained a small stormwater conveyance.

Vegetation shown in the 2003 aerial photograph of TW-18 consisted of emergent vegetation in and near the inundated area, and shrub/scrub vegetation dominating the wetland area surrounding the inundated portion. A parcel of disturbed upland and a commercial/industrial facility bordered TW-18 to the west, with upland-prairie habitat surrounding the remaining areas of TW-18. Historic hydrological indicators of TW-18 suggest that this wetland was fed both by surficial stormwater-sheet-flow and by a likely groundwater interface.

2.3.4.3 June 2009 Field Observations

Vegetation within the historic wetland interior of TW-18 consists of a forested upland hammock of 15 to 20-year-old oak/hardwood and introduced mature punk trees (*Melaleuca quinquenervia*). Due to the species' elevated evapotranspiration rate, which is hypothesized to "dry out" wetlands, the occurrence of punk trees within TW-18 may serve as an indicator of prior habitat alteration. A minimal number of relict obligate-wetland ferns, including royal fern (*Osmunda regalis*) and Virginia chain fern (*Woodwardia virginica*), occur on hummocks within the historic wetland interior. A dense saw palmetto (*Serenoa repens*) thicket is encroaching along the northern, western and southern borders of the historic wetland edge.

Subsidence up to 12 inches was observed within TW-18 and relict wetland vegetation is restricted to hummocks that protrude above the historic wetland floor following exposure by erosion. Soils at the TW-18 site consist of a loamy-sand matrix typical of upland forested habitats in this region of Florida. TW-18 no longer contains hydrological indicators consistent with a functional wetland. The wetland habitat at TW-18 likely began transitioning to upland more than 20 years ago; and is now devoid of active wetland characteristics. Lower than normal precipitation could be another variable that negatively impacts TW-18. The June 2009 field effort determined that 0.39 acres of the 4.08-acre wetland parcel identified by the June 2008 meeting are currently functional wetland habitat (Figure 2-5).

2.3.5 Reference Wetland 1

2.3.5.1 Location

Reference Wetland 1 is approximately 2,200 feet south of Tallevast Road, about 200 feet west of U.S. Highway 301 and 0.7 mile southeast of the Lockheed Martin Facility. The RW-1 site is positioned across two property parcels, as shown in Figure 2-1.

2.3.5.2 Historical Description

The historic area of RW-1 is estimated at 8.22 acres. A review of 2003 aerial photography concludes that this site consists of a historically inundated area, with a scrub-shrub and emergent wetland core below the deep zone. Presently, upland prairie habitat borders the historic wetland boundary, while a dense thicket of invasive Brazilian peppertree is ubiquitous throughout the historic transition and innermost deep zones of RW-1.

Hydrological indicators observed in the 2003 aerial photograph of RW-1 suggest that this wetland was historically fed by a groundwater interface, but also received stormwater runoff from adjacent agricultural lands and nearby U.S. 301. In the 2003 aerial, less than ten-percent of the site was inundated and inundation was limited to the interior of the southern half of the site where indicators of a formerly scrub-shrub and thinly forested wetland habitat were observed during the June 2009 site visit.

2.3.5.3 June 2009 Field Observations

Vegetation of RW-1 is dominated by a 20-year-old stand of Brazilian pepper (*Schinus terebinthifolius*) shrubs and small trees. Brazilian pepper is an adaptive zone species, which is a facultative wetland or upland species as defined by the FDEP. Within the historic wetland interior, only relict outer deep zone species occur and are limited to a few mature Carolina willow (*Salix caroliniana*) and red maple (*Acer rubrum*) trees . Because these species were visibly more-mature than the dominant Brazilian peppertree, which suggest the historic nature of flatwood wetlands at this site.

Subsidence up to 14 inches was observed within RW-1 and relict herbaceous wetland vegetation (i.e., Virginia chainfern) is restricted to hummocks that protrude above the historic wetland floor following exposure by erosion Soils observed within RW-1 consist of a loamy-sand matrix typical of more-upland forested habitats within this region of Florida. Empirical hydrologic indicators at RW-1 are no longer consistent with

those typical of a functional wetland. This wetland likely began its transition to upland more than 20 years ago due to undetermined impacts. However, USGS 7.5 minute topographic quadrangle mapping depicts the presence of a surface conveyance draining southeast to the nearby Pierce Canal. The overall character of observed hydric (wetland) indicators at RW-1 is indicative of a transition to a successively more-mesic habitat. Lower than normal precipitation could be another variable that negatively impacts RW-1. Of the 8.22-acre wetland parcel identified in the June 2008 meeting, 3.42 acres are currently functional wetland habitat (see Figure 2-6).

2.3.6 Reference Wetland 2

2.3.6.1 Location

Reference Wetland 2 is located south of Tallevast Road about a half mile southeast of the Lockheed Martin Facility. The RW-2 site is positioned within one property parcel, as shown on Figure 2-1.

2.3.6.2 Historical Description

The historic area of RW-2 is estimated at 8.20 acres. A review of 2003 aerial photography concludes that this site consisted of a thick canopy of trees, with small areas of shrubby and emergent vegetation scattered inside of the eastern and southern boundaries. Active pastureland surrounds the historic wetland boundaries. The only evidence of probable inundation was noted in the southwestern section of RW-2.

Hydrological indicators observed on the 2003 aerial photograph of RW-2 suggest that this wetland was primarily fed by two linear stormwater conveyance features that enter RW-2 at the eastern and western corners of its northern historic wetland boundary. Other historic hydrological evidence suggests that RW-2 likely had a conveyance that drained the wetland area at its southeastern corner.

2.3.6.3 June 2009 Field Observations

No major alteration or conversion of historic land use or vegetative cover types in RW-2 was observed during the field investigation. Several deep zone floral species occur in the interior of RW-2, but vegetation of this wetland is dominated by outer deep and transitional zone species. Evidence of prior conversion of RW-2 to upland forest was observed during the field investigation. Of the 8.20-acre wetland parcel identified

in the June 2008 meeting, 4.9 acres are currently functional wetland habitat (see Figure 2-7).

The area of RW-2 most typical of wetland habitat occurs in the upper central sector of the historic wetland boundary, and the monitoring transect was established there. This area is dominated by outer deep and deep zone floral species, but adaptive and upland species are migrating into the wetland area. The transitional and adaptive wetland floral species in the section of RW-2 south of the transected wetland are limited to an area that was excavated and dammed many years ago. According to the landowner, this excavated area was once used to collect and hold stormwater for his livestock. The small weir constructed to dam this excavated area has failed and is no longer functional, which has allowed most of this wetland to return to upland habitat.

Up to 20 inches of subsidence was observed within RW-2. The subsidence of this wetland area is likely due to hydrological alterations of both surface and groundwater. Livestock appear to frequent this area of RW-2 and have increased the rate of subsidence through soil compaction. Lower than normal precipitation could be another variable that negatively impacts RW-2. The RW-2 transect location was established in the northwestern section of the wetland and follows a northeasterly path.

2.3.7 Reference Wetland 3

2.3.7.1 Location

Reference Wetland 3 is south of Tallevast Road about 400 feet west of RW-2 and 0.30 mile southeast of the Lockheed Martin Facility. The RW-3 site is positioned within one property parcel, as shown on Figure 2-1.

2.3.7.2 Historical Description

The historic area of RW-3 is estimated at 10.45 acres. A review of 2003 aerial photography concludes that this site primarily consisted of an emergent wetland that was frequently inundated. Upland pasture and scrub habitat bordered the wetland boundary of RW-3. The outer perimeter of the southern half of RW-3 was bordered by thick shrub and tree vegetation.

Hydrological indicators from the 2003 aerial photograph of RW-3 suggest that this wetland was primarily fed by a groundwater interface, but also received stormwater. The 2003 aerial photograph shows that three-quarters of the wetland area was

inundated, and the interior of the northern boundary displayed obvious hydrology and vegetative patterns of a shrubby wetland. Floating vegetation was prevalent within the upper portion of RW-3 and rooted vegetation appeared to be depressed or absent within the lower sections, indicating that this wetland was historically inundated throughout much of the growing season. The 2006 aerial photograph of RW-3 also shows this area as inundated.

2.3.7.3 June 2009 Field Observations

No major alteration or conversion of historic land use or vegetative cover types within RW-3 was observed during the field investigation. Evidence of prior and ongoing conversion of RW-3 to upland prairie was observed. Of the 10.45-acre wetland parcel identified in the June 2008 meeting, 6.3 acres are currently functional wetland habitat (Figure 2-8). The lower half of RW-3 is rapidly transitioning to upland.

The northern wetland segment of RW-3 displayed the most typical wetland habitat, and the monitoring transect was established there. This area is dominated by outer deep and deep zone floral species, but adaptive and upland species are migrating into the outer limits of the wetland. Adaptive and upland species now dominate the prairie vegetation of areas outside of the wetland area identified by the June 2009 field investigation. Soils of the wetland interior are consistent with sandy wetland soils, and the soils of the transitional and upland areas are comprised of upland loamy sands.

A small amount of subsidence was observed in the interior of the western wetland boundary. No obvious evidence of surficial hydrological impacts was observed, but lower than normal precipitation could be another variable that negatively impacts RW-3.

2.3.8 Reference Wetland 5

2.3.8.1 Location

Reference Wetland 5 is south of Tallevast Road about 200 feet west of U.S. Highway 301 and 0.60 mile southeast of the Lockheed Martin Facility. The RW-5 site is positioned within one property parcel, as shown on Figure 2-1.

2.3.8.2 Historical Description

The historic area of RW-5 is estimated at 0.86 acre. A review of 2003 aerial photography concludes that this site primarily consisted of a frequently inundated area, with an emergent wetland along the inundation boundary. Upland prairie habitat bordered the wetland boundary of RW-5.

Hydrological indicators observed in the 2003 aerial photograph of RW-5 suggest that this wetland was primarily fed by a groundwater interface, but also received stormwater. The inundated area of RW-5 appeared to be at full pool, and was bordered by emergent and shrubby vegetation. Floating and rooted vegetation were absent in the inundated wetland area. The area of inundation appeared to be within the confines of an excavated pond, and did not display hydrological indicators typical of a palustrine emergent wetland.

2.3.8.3 June 2009 Field Observations

No major alteration or conversion of historic land use or vegetative cover types in RW-5 was observed during the field investigation. Evidence of the upland conversion of the immediate area outside of the excavated pond was observed. Approximately 0.4 acres of the 0.86-acre wetland parcel identified in the June 2008 potential monitoring location proceedings is currently functional wetland habitat (see Figure 2-9). The pond displayed evidence of a reduced pool elevation and upland floral species are migrating into the historic wetland area.

The wetland interior was inundated and had rooted deep zone floral species along the perimeter of the pool elevation. No rooted vegetation occurred in the inundated area, but small duckweed (*Lemna valdiviana*) dominates the water surface. A small area of outer deep zone and transitional species were growing northward from the edge of the normal pool elevation of the inundated area, which is where the monitoring transect was established. The remaining perimeter of the normal pool elevation abruptly transitions to upland, which is typical of excavated ponds. The upland areas surrounding RW-5 consist of thick, matted upland grasses. Soils of the wetland interior are mucky and have a sulfidic odor, which is indicative of anoxic soils. Upland sandy soils surround the wetland area.

No subsidence was observed within RW-5. Lower than normal precipitation could be another variable that negatively impacts RW-5.

Table 2-1. Summary of Project Wetlands

Wetland ID	TW-1	TW-2	TW-6	TW-18	RW-1	RW-2	RW-3	RW-5
Wetland Type	Emergent	Emergent/ Forested	Emergent/ Forested	Forested	Emergent/ Forested	Forested	Emergent	Emergent
Estimated Historic Acreage	15.15	1.87	3.04	4.08	8.22	8.20	10.45	0.86
June 2009 Field Verified Acreage	11.4	1.66	1.1	0.39	3.42	4.9	6.3	0.4
Historically Inundated	Yes	Yes	Partially	Partially	Yes	Partially	Yes	Yes
Presently Inundated	No	No	No	No	No	No	No	Yes
Degree of Upland Transition	High	Moderate	Moderate	High	High	High	Moderate	Low
Evidence of Groundwater Interface	Yes	Yes	Yes	No	No	No	Yes	Yes
June 2008 Meeting FLUCFCS Codes	6300;6410; 6430	6300;6430	6440	6300	6300/6430	6210;6300	6300;6440	6300;6440
June 2009 Field Verified FLUCFCS Codes	6430;6440; 6310	6300;6430; 6440	6160;6300; 6310;6440	6300;4220	6300;6430; 4270	6160;6300; 6310	6160;6430; 6440	6160;6440
Staff Gauge Installation	Not Proposed	Existing	Proposed	Not Proposed	Not Proposed	Not Proposed	Proposed	Proposed
Sampling Well Installation	Proposed	Existing	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed

Notes Supporting Table 2-1

1. The degrees of upland transition are defined as follows:
   - High – greater than 50 percent of the wetland has converted, or exhibits cues of converting, to upland
   - Moderate – 25 to 50 percent of the wetland has converted, or exhibits cues of converting, to upland
   - Low – less than 25 percent of the wetland has converted, or exhibits cues of converting, to upland

2. Definitions of the FLUCFCS Codes of Table 2-1 are as follows:
   - 6160 – Inland Ponds and Sloughs: wetland communities associated with depressions and drainage areas that are not associated with streams or lakes
   - 6210 – Cypress: community that is pure or predominately comprised of pond or bald cypress trees
   - 6300 – Wetland Forested Mixed: mixed wetland forest communities in which neither hardwoods or conifers achieve a 66 percent dominance of the crown canopy composition
   - 6310 – Wetland Scrub: community associated with topographic depressions and poorly drained soils
   - 6410 – Freshwater Marsh: communities dominated by vegetation consisting of sawgrass, cattail, arrowhead, maidencane, buttonbush, cordgrass, giant cutgrass, switchgrass, bulrush, needlerush, common reed and/or arrowroot
   - 6417 – Freshwater Marsh With Shrubs, Brush and Vines: freshwater marsh community as described above, with the inclusion of woody brush and vines
   - 6430 – Wet Prairie: community dominated by grassy vegetation on hydric soils and is usually distinguished from marshes by having less water and shorter herbage
   - 6440 – Emergent Aquatic Vegetation: category of wetland flora that includes floating vegetation and vegetation which is found either partially or completely above the surface of water

3. Wetland Monitoring Plan

The objective of the WAP is to collect information on vegetation, hydrology, soils, and other pertinent variables in monitored wetlands to accurately characterize the ongoing biological condition and health of each wetland. This information may be used for a variety of water management purposes, including well-field management, development of minimum flows and levels, and assessment of recovery in areas that have experienced historic hydrologic and biologic impacts due to groundwater withdrawals. Note that although the WAP seeks to document and monitor many aspects of wetland health, many of these aspects are beyond the procedure's focus. Many wetlands are also subject to negative ecosystem health caused by surrounding land management and drainage practices, encroaching development, cattle operations, introduction of exotic plant species, disease, and other variables. However, the WAP focuses on collecting data that can be used to assess biologic changes caused by the hydrologic effects of groundwater withdrawals.

3.1 Target Wetlands

Four target wetlands (TW-1, TW-2, TW-6, and TW-18) were identified for monitoring based on initial June 26, 2008 site visits with representatives from FDEP, CDM, ARCADIS, and Lockheed Martin (see Figure 2-1). During the initial site visit, normal pool, and seasonal high water levels were field located in TW-1, TW-2, and TW-6. Due to site characteristics, normal pool and seasonal high water levels were not able to be located for TW-18, although a transect was established for this wetland. Based on FLUCFCS types, these wetlands are comprised of mixed forest, non-forested vegetated freshwater marsh and wet prairie, and emergent aquatic vegetation.

3.2 Reference Wetlands

Four wetlands (RW-1, RW-2, RW-3, and RW-5) were designated reference resources for gauging effects to Target Wetlands (see Figure 2-1). Based on FLUCFCS types, these wetlands are a combination of mixed forest, coniferous forest, non-forested vegetated freshwater marsh and wet prairie, and emergent aquatic vegetation (see Table 2-1). Normal pool and seasonal high water level will be set for reference wetlands during the initial wetland setup.

3.3 Transect and Monitoring Locations

Pursuant to the WAP manual (SWFWMD 2005), one transect was established in each wetland from the historic wetland edge to the wetland interior. Estimated historic normal pool elevations were also identified during transect establishment. Siting each transect was based on factors including site access, minimal need to disturb existing vegetation, clear line-of-sight, and ability to assess all aspects representative of the transition zone along a straight line.

Placing permanent monuments in the field to identify these transects will be necessary during baseline monitoring of wetland conditions. Monuments comprised of steel rebar fitted with a sleeve of polyvinylchloride (PVC) pipe will be installed at elevations 6 inches and 12 inches below the historic normal pool, NP-6, and NP-12, respectively. Monument locations will be recorded using a Global Positioning System (GPS) unit with submeter accuracy. Vegetative, hydrologic, and soil indicators used to establish the historic normal pool elevation will be documented. Subsequently, the historic normal pool elevation at each wetland will be located by a professional surveyor and mapper registered in the State of Florida.

Pursuant to the WAP manual, the area to be assessed from the transect should be referred to as the assessment area. The assessment area will be approximately 10 meters wide (including 10 meters beyond the wetland interior). Subsequent to baseline monitoring, evaluators should remain on the established transect as much as possible to avoid unnecessary trampling of vegetation, but can walk throughout the wetland if critical for an accurate evaluation of the assessment area.

3.3.1 Staff Gauges and Monitoring Well Installation and Sampling

Groundwater monitoring wells and staff gauges will be installed in the four target wetlands and four reference wetlands. One monitoring well and one staff gauge will be

installed in the deep zone of each wetland, with consideration given to placement along the WAP transect, or at least within the assessment area. While an upland monitoring well is traditionally required under WAP procedures, because of the small size of the wetlands, an upland monitoring well will not be installed at the historic wetland edge. The ground elevation will be surveyed at the well and staff gauge locations and water levels will be recorded in the deep zone monitoring well by a professional surveyor and mapper registered in the State of Florida. These data will be used to estimate water table elevation at the outer deep zone, transition zone, and wetland edge.

Field studies identified one well (Stilling Well-3) and staff gauge (Staff Gauge-8) at TW-2, which were incorporated into the location of the proposed, transect and assessment area. However, these devices are located in the outer transition zone, rather than the wetland's deep zone. Existing wells and staff gauges were not found at the other wetlands.

3.3.1.1 Groundwater Monitoring Wells

For all monitoring wells, SWFWMD well construction standards, promulgated in F.A.C. Chapter 40D-3, will be met. All monitoring wells will be 2-inch Schedule 40 PVC and installed to a depth of 8 feet below ground surface (bgs) using the mud rotary method (ASTM Method D-5092) or sonic drilling method. Monitoring well placement and installation will be managed by a qualified wetland scientist. The screened interval in the monitoring wells will be five feet long and 3 to 8 feet bgs with 0.0l0-slot, 2-inch PVC screen. A 20/30 sand filter pack will be placed in the annular space from the bottom of the well to one foot above the top of well screen. The annular space will then be grouted with neat cement from 2 feet bgs to the surface. Once well construction is complete, the land surface and top of casing elevations will be surveyed by a professional surveyor and mapper registered in the State of Florida, using horizontal and vertical control.

Wellhead completion will consist of a 2-foot by 2-foot 4-inch thick concrete pad with a 2.5 foot high riser with a lockable well cover. Monitoring wells will be developed by the well driller, and any development water will be contained for off-site disposal. All wells will be developed according to U.S. Environmental Protection Agency (EPA) guidance and meet the following standards: pH ±0.1 standard units (SU), specific conductivity ±3%, oxidation reduction potential (ORP) ±10 millivolt (mV), turbidity <10 nephelometric turbidity units (NTUs), DO ±0.3 milligrams per liter (mg/L), for three consecutive readings no less than one minute apart. If the well purges dry, development will continue once the well has recharged. Development will be complete

once the turbidity is less than 10 NTU. If these parameters cannot be reached, the drilling of a new well will be considered. Lithologic logs, permits, and well completion reports will be prepared for each monitoring well.

3.3.1.2 Staff Gauges

Staff gauges will be installed adjacent to each monitoring well. At each staff gauge location, a porcelain-enameled iron Style C staff gauge will be attached to a 2-inch by 4-inch by 8-foot pressure-treated post. The staff gauges will measure stage heights in feet and tenths of feet. A hand level will be used to ensure that the post and gauge are plumb. The pressure-treated post will be driven into the mudline to the point of refusal or suitable stability. Each post will be embedded at least two feet. Once the staff gauge has been installed, it will be surveyed by a professional surveyor and mapper registered in the State of Florida.

3.3.1.3 Data Loggers

To facilitate monitoring frequency and accuracy, an automatic water level measurement device (mini Troll pressure transducer or equivalent) with data loggers will be used to collect real-time water level data in each of the target and reference wetland monitoring wells. Data loggers will collect water level readings hourly. Seven days after installation, the data loggers will be checked and data downloaded to verify that they are working correctly. The data loggers will be downloaded approximately every 30 days the first three months and every 90 days thereafter. The 90-day schedule should coincide with existing quarterly groundwater monitoring downloads. Quarterly battery life and data storage space shall be confirmed before deploying the equipment. During data downloads, manual measurements of groundwater level will also occur in each monitoring well to confirm the accuracy of the data collected by the automatic water level recorders. Data will be transferred as soon as possible after quality assurance/quality control (QA/QC) and validation along with preparation of a spreadsheet and a chart of precipitation totals taken daily from the National Oceanic and Atmospheric Administration (NOAA) climate history. During any replacement of the transducer, the manual water level recording should be used to calibrate continuous recording.

3.3.2 Monitoring Frequency, Parameters, Criteria, and Data Evaluation

3.3.2.1 Annual Monitoring

Initial monitoring of the wetlands' water levels will take place after the monitoring wells and staff gauges have been installed. Subsequent annual monitoring will take place in May or June of each successive year. Monitoring will take place along the transect in the assessment area, as defined in the WAP (2005). Data for each wetland will be recorded on the 2009 WAP Field Form (Attachment B) and will include photo documentation, water level data from the staff gauge, and downloaded data from the monitoring well. Wetland photo-documentation will include digital photographs taken at the staff gauge, an NP-6 marker, and an NP-12 marker in each cardinal direction. Changes in wetland characteristics, wildlife and wildlife activity, and the vegetation composition and zonation will also be documented.

3.3.2.2 Soil Assessment/Five-Year Monitoring

Soil conditions will be assessed during the initial wetland evaluation and every five years thereafter. In addition to assessing water levels along the established transects, soil conditions will be carefully assessed throughout the wetland and the assessment area. Evidence of subsidence including compaction, tree root exposure, fire, and soil fissures will be documented in addition to signs of soil oxidation.

4. Reporting

This document serves as the baseline evaluation and monitoring plan for the subject wetlands, in conjunction with groundwater remedial activities at the Lockheed Martin Tallevast Site. Locations of monitoring well and staff gauge implements have been determined, and these monitoring instruments will be installed once this document is approved. As stipulated by FDEP, this WMP will initially be conducted over a five-year period. An annual wetland-monitoring report will be prepared following the annual wetland monitoring events, which will occur in May or June each year through 2014.

ARCADIS

Attachments

ARCADIS

Attachment A

Complete WAP Data Forms

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Data Owner	Data Source	Personnel	Date	Start/End	
TW-1			A. Levy & B. Sawyer - ARCADIS	11 June 2009	13:00	15:30

PHOTO-DOCUMENTATION

Frame	Description	Photo Pt.	Direction

WATER LEVEL INFORMATION

Dry?	Elevation (ft)	Device	Well/Gage ID
Yes	N/A		

Description

Please enter Yes (Y), No (N), or Not Sure (NS) for the following questions and provide comments/explanations.

WETLAND IMPACTS

Wetland edges filled or disturbed?	No
Excessive dumping or trash in wetland?	No
Hog disturbance?	No
Signficant impact from cattle (trampling)?	No
Vehicles through wetland (includes bicycles)?	No
Insect damage?	No
Disease?	No

Explanation(s)

WETLAND DRAINAGE

Augmentation equipment in place?	No
Augmentation occurring at time of WAP?	No
Clear evidence of direct stormwater inflow?	No
Clear evidence of direct drainage from wetland?	No
Other drainage activities in area?	No
Borrow pit/retention pond in wetland vicinity?	No

Explanation(s)

Fire

Signs of Fire? No

Explanation (year, expanse, intensity)

Lakes / Docks

Docks completely out of water
Docks touching water or with <50% of dock over water
Docks >50% out of water
Not Applicable

Is the littoral zone stranded? ☐

Comments

Soil Subsidence

New signs of oxidation/subsidence? Yes

Explanation

Some soils within the historic wetland area lack hydric indicators. Up to 18 inches of subsidence within the wetland interior was observed. Mound of the subsided soils slightly eroded, which suggests subsidence is moderately recent.

General Comments/Observations

TW-1 has experienced moderate to severe hydrological alterations since 2003, as evidenced by 2003 aerial photography. Observed impacts primarily due to recent industrial development north of this wetland.

Future users of this data may not want to analyze / compare this data with other wetlands due to the extensive level of:

- ☐ non-groundwater withdrawal-related disturbance
- ☐ soil subsidence

WILDLIFE

Wildlife	Count	Evidence	Wildlife	Count	Evidence	Wildlife	Count	Evidence

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

GROUNDCOVER

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), % cover (5% or 10-100% in increments of 10%), count (1-4), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Eupatorium capillifolium	T	25		T

OUTER DEEP ZONE

outer deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
A. muhlenbergianum	OD	10		T
Euthamia caroliniana	AD	<5		T
Urena lobata	U	20		T
Centella asiatica	T	<5		T

DEEP ZONE

deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Mikania scandens	T	20		T
Eupatorium capillifolium	T	10		T
Polygonum hydropiperoides	OD	<5		T

Groundcover Comments

ZONATION

Zonation Score: 3 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

Upland and transitional groundcover species dominate the outer deep and deep zones

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

SHRUB / SMALL TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Cephalanthus occidentalis	D		2	T

OUTER DEEP ZONE

outer deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Acer rubrum	OD		2	E
Cephalanthus occidentalis	D	<5		T

DEEP ZONE

deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Shrub/Small Tree Comments

ZONATION

Zonation Score: 4 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate shrubs and small trees (include dead species)

(Few/None)
Noticeable
Significant
Not Applicable

Signs of stress of inappropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ☑
check if no trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Tree Comments

ZONATION

Zonation Score: NA Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate trees (do not include dead species)

(Few/None) Noticeable Significant Not Applicable	Subsided soils at base of trees, resulting in some leaning trees

Signs of stress of inappropriate trees (include dead species)

Few/None Noticeable Significant Not Applicable	

RECOVERY

Dead or leaning trees (include standing dead trees and dead trees on ground that are appropriate)

Few/None (Noticeable) Significant	

Signs of tree recovery

Yes (No) Not Sure	

Inappropriate vine death suggesting recovery

Yes (No) Not Sure	

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Data Owner	Data Source	Personnel	Date	Start/End	
TW-1			A. Levy & B. Sawyer - ARCADIS	11 June 2009	13:00	15:30

PHOTO-DOCUMENTATION

Frame	Description	Photo Pt.	Direction

WATER LEVEL INFORMATION

Dry?	Elevation (ft)	Device	Well/Gage ID
Yes	N/A		

Description

Please enter Yes (Y), No (N), or Not Sure (NS) for the following questions and provide comments/explanations.

WETLAND IMPACTS

Wetland edges filled or disturbed?	No
Excessive dumping or trash in wetland?	No
Hog disturbance?	No
Signficant impact from cattle (trampling)?	No
Vehicles through wetland (includes bicycles)?	No
Insect damage?	No
Disease?	No

Explanation(s)

WETLAND DRAINAGE

Augmentation equipment in place?	No
Augmentation occurring at time of WAP?	No
Clear evidence of direct stormwater inflow?	No
Clear evidence of direct drainage from wetland?	No
Other drainage activities in area?	No
Borrow pit/retention pond in wetland vicinity?	No

Explanation(s)

Fire

Signs of Fire? No

Explanation (year, expanse, intensity)

Lakes / Docks

Docks completely out of water
Docks touching water or with <50% of dock over water
Docks >50% out of water
Not Applicable

Is the littoral zone stranded? ☐

Comments

Soil Subsidence

New signs of oxidation/subsidence? Yes

Explanation

Some soils within the historic wetland area lack hydric indicators. Up to 18 inches of subsidence within the wetland interior was observed. Mound of the subsided soils slightly eroded, which suggests subsidence is moderately recent.

General Comments/Observations

TW-1 has experienced moderate to severe hydrological alterations since 2003, as evidenced by 2003 aerial photography. Observed impacts primarily due to recent industrial development north of this wetland.

Future users of this data may not want to analyze / compare this data with other wetlands due to the extensive level of:

- ☐ non-groundwater withdrawal-related disturbance
- ☐ soil subsidence

WILDLIFE

Wildlife	Count	Evidence	Wildlife	Count	Evidence	Wildlife	Count	Evidence

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

GROUNDCOVER

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), % cover (5% or 10-100% in increments of 10%), count (1-4), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Eupatorium capillifolium	T	25		T

OUTER DEEP ZONE

outer deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
A. muhlenbergianum	OD	10		T
Euthamia caroliniana	AD	<5		T
Urena lobata	U	20		T
Centella asiatica	T	<5		T

DEEP ZONE

deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Mikania scandens	T	20		T
Eupatorium capillifolium	T	10		T
Polygonum hydropiperoides	OD	<5		T

Groundcover Comments

ZONATION

Zonation Score: 3 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

Upland and transitional groundcover species dominate the outer deep and deep zones

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

SHRUB / SMALL TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Cephalanthus occidentalis	D		2	T

OUTER DEEP ZONE

outer deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Acer rubrum	OD		2	E
Cephalanthus occidentalis	D	<5		T

DEEP ZONE

deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Shrub/Small Tree Comments

ZONATION

Zonation Score: 4 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

Signs of stress of inappropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ☑
check if no trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Tree Comments

ZONATION

Zonation Score: NA Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate trees (do not include dead species)

Few/None
(Noticeable)
Significant
Not Applicable

Subsided soils at base of trees, resulting in some leaning trees

Signs of stress of inappropriate trees (include dead species)

(Few/None)
Noticeable
Significant
Not Applicable

RECOVERY

Dead or leaning trees (include standing dead trees and dead trees on ground that are appropriate)

(Few/None)
Noticeable
Significant

Signs of tree recovery

Yes
No
Not Sure

Inappropriate vine death suggesting recovery

Yes
(No)
Not Sure

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Data Owner	Data Source	Personnel	Date	Start/End	
TW-1			A. Levy & B. Sawyer - ARCADIS	11 June 2009	13:00	15:30

PHOTO-DOCUMENTATION

Frame	Description	Photo Pt.	Direction

WATER LEVEL INFORMATION

Dry?	Elevation (ft)	Device	Well/Gage ID
Yes	N/A		

Description

Please enter Yes (Y), No (N), or Not Sure (NS) for the following questions and provide comments/explanations.

WETLAND IMPACTS

Wetland edges filled or disturbed?	No
Excessive dumping or trash in wetland?	No
Hog disturbance?	No
Signficant impact from cattle (trampling)?	No
Vehicles through wetland (includes bicycles)?	No
Insect damage?	No
Disease?	No

Explanation(s)

WETLAND DRAINAGE

Augmentation equipment in place?	No
Augmentation occurring at time of WAP?	No
Clear evidence of direct stormwater inflow?	No
Clear evidence of direct drainage from wetland?	No
Other drainage activities in area?	No
Borrow pit/retention pond in wetland vicinity?	No

Explanation(s)

Fire

Signs of Fire? No

Explanation (year, expanse, intensity)

Lakes / Docks

Docks completely out of water
Docks touching water or with <50% of dock over water
Docks >50% out of water
Not Applicable

Is the littoral zone stranded? ☐

Comments

Soil Subsidence

New signs of oxidation/subsidence? Yes

Explanation

Some soils within the historic wetland area lack hydric indicators. Up to 18 inches of subsidence within the wetland interior was observed. Mound of the subsided soils slightly eroded, which suggests subsidence is moderately recent.

General Comments/Observations

TW-1 has experienced moderate to severe hydrological alterations since 2003, as evidenced by 2003 aerial photography. Observed impacts primarily due to recent industrial development north of this wetland.

Future users of this data may not want to analyze / compare this data with other wetlands due to the extensive level of:

- ☐ non-groundwater withdrawal-related disturbance
- ☐ soil subsidence

WILDLIFE

Wildlife	Count	Evidence	Wildlife	Count	Evidence	Wildlife	Count	Evidence

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

GROUNDCOVER

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), % cover (5% or 10-100% in increments of 10%), count (1-4), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Eupatorium capillifolium	T	25		T

OUTER DEEP ZONE

outer deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
A. muhlenbergianum	OD	10		T
Euthamia caroliniana	AD	<5		T
Urena lobata	U	20		T
Centella asiatica	T	<5		T

DEEP ZONE

deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Mikania scandens	T	20		T
Eupatorium capillifolium	T	10		T
Polygonum hydropiperoides	OD	<5		T

Groundcover Comments

ZONATION

Zonation Score: 3 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

Upland and transitional groundcover species dominate the outer deep and deep zones

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

SHRUB / SMALL TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Cephalanthus occidentalis	D		2	T

OUTER DEEP ZONE

outer deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Acer rubrum	OD		2	E
Cephalanthus occidentalis	D	<5		T

DEEP ZONE

deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Shrub/Small Tree Comments

ZONATION

Zonation Score: 4 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate shrubs and small trees (include dead species)

(Few/None)
Noticeable
Significant
Not Applicable

Signs of stress of inappropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ☑
check if no trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Tree Comments

ZONATION

Zonation Score: NA Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate trees (do not include dead species)

(Few/None) Noticeable Significant Not Applicable	Subsided soils at base of trees, resulting in some leaning trees

Signs of stress of inappropriate trees (include dead species)

Few/None Noticeable Significant Not Applicable	

RECOVERY

Dead or leaning trees (include standing dead trees and dead trees on ground that are appropriate)

(Few/None) Noticeable Significant	

Signs of tree recovery

Yes No Not Sure	

Inappropriate vine death suggesting recovery

Yes No Not Sure	

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Data Owner	Data Source	Personnel	Date	Start/End	
TW-1			A. Levy & B. Sawyer - ARCADIS	11 June 2009	13:00	15:30

PHOTO-DOCUMENTATION

Frame	Description	Photo Pt.	Direction

WATER LEVEL INFORMATION

Dry?	Elevation (ft)	Device	Well/Gage ID
Yes	N/A		

Description

Please enter Yes (Y), No (N), or Not Sure (NS) for the following questions and provide comments/explanations.

WETLAND IMPACTS

Wetland edges filled or disturbed?	No
Excessive dumping or trash in wetland?	No
Hog disturbance?	No
Signficant impact from cattle (trampling)?	No
Vehicles through wetland (includes bicycles)?	No
Insect damage?	No
Disease?	No

Explanation(s)

WETLAND DRAINAGE

Augmentation equipment in place?	No
Augmentation occurring at time of WAP?	No
Clear evidence of direct stormwater inflow?	No
Clear evidence of direct drainage from wetland?	No
Other drainage activities in area?	No
Borrow pit/retention pond in wetland vicinity?	No

Explanation(s)

Fire

Signs of Fire? No

Explanation (year, expanse, intensity)

Lakes / Docks

Docks completely out of water
Docks touching water or with <50% of dock over water
Docks >50% out of water
Not Applicable

Is the littoral zone stranded? ☐

Comments

Soil Subsidence

New signs of oxidation/subsidence? Yes

Explanation

Some soils within the historic wetland area lack hydric indicators. Up to 18 inches of subsidence within the wetland interior was observed. Mound of the subsided soils slightly eroded, which suggests subsidence is moderately recent.

General Comments/Observations

TW-1 has experienced moderate to severe hydrological alterations since 2003, as evidenced by 2003 aerial photography. Observed impacts primarily due to recent industrial development north of this wetland.

Future users of this data may not want to analyze / compare this data with other wetlands due to the extensive level of:

- ☐ non-groundwater withdrawal-related disturbance
- ☐ soil subsidence

WILDLIFE

Wildlife	Count	Evidence	Wildlife	Count	Evidence	Wildlife	Count	Evidence

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

GROUNDCOVER

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), % cover (5% or 10-100% in increments of 10%), count (1-4), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Eupatorium capillifolium	T	25		T

OUTER DEEP ZONE

outer deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
A. muhlenbergianum	OD	10		T
Euthamia caroliniana	AD	<5		T
Urena lobata	U	20		T
Centella asiatica	T	<5		T

DEEP ZONE

deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Mikania scandens	T	20		T
Eupatorium capillifolium	T	10		T
Polygonum hydropiperoides	OD	<5		T

Groundcover Comments

ZONATION

Zonation Score: 3 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

Upland and transitional groundcover species dominate the outer deep and deep zones

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

SHRUB / SMALL TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Cephalanthus occidentalis	D		2	T

OUTER DEEP ZONE

outer deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Acer rubrum	OD		2	E
Cephalanthus occidentalis	D	<5		T

DEEP ZONE

deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Shrub/Small Tree Comments

ZONATION

Zonation Score: 4 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate shrubs and small trees (include dead species)

(Few/None)
Noticeable
Significant
Not Applicable

Signs of stress of inappropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ☑
check if no trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Tree Comments

ZONATION

Zonation Score: NA Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate trees (do not include dead species)

(Few/None) Noticeable Significant Not Applicable	Subsided soils at base of trees, resulting in some leaning trees

Signs of stress of inappropriate trees (include dead species)

Few/None Noticeable Significant Not Applicable	

RECOVERY

Dead or leaning trees (include standing dead trees and dead trees on ground that are appropriate)

(Few/None) (Noticeable) Significant	

Signs of tree recovery

Yes (No) Not Sure	

Inappropriate vine death suggesting recovery

Yes (No) Not Sure	

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Data Owner	Data Source	Personnel	Date	Start/End	
TW-1			A. Levy & B. Sawyer - ARCADIS	11 June 2009	13:00	15:30

PHOTO-DOCUMENTATION

Frame	Description	Photo Pt.	Direction

WATER LEVEL INFORMATION

Dry?	Elevation (ft)	Device	Well/Gage ID
Yes	N/A		

Description

Please enter Yes (Y), No (N), or Not Sure (NS) for the following questions and provide comments/explanations.

WETLAND IMPACTS

Wetland edges filled or disturbed?	No
Excessive dumping or trash in wetland?	No
Hog disturbance?	No
Signficant impact from cattle (trampling)?	No
Vehicles through wetland (includes bicycles)?	No
Insect damage?	No
Disease?	No

Explanation(s)

WETLAND DRAINAGE

Augmentation equipment in place?	No
Augmentation occurring at time of WAP?	No
Clear evidence of direct stormwater inflow?	No
Clear evidence of direct drainage from wetland?	No
Other drainage activities in area?	No
Borrow pit/retention pond in wetland vicinity?	No

Explanation(s)

Fire

Signs of Fire? No

Explanation (year, expanse, intensity)

Lakes / Docks

Docks completely out of water
Docks touching water or with <50% of dock over water
Docks >50% out of water
Not Applicable

Is the littoral zone stranded? ☐

Comments

Soil Subsidence

New signs of oxidation/subsidence? Yes

Explanation

Some soils within the historic wetland area lack hydric indicators. Up to 18 inches of subsidence within the wetland interior was observed. Mound of the subsided soils slightly eroded, which suggests subsidence is moderately recent.

General Comments/Observations

TW-1 has experienced moderate to severe hydrological alterations since 2003, as evidenced by 2003 aerial photography. Observed impacts primarily due to recent industrial development north of this wetland.

Future users of this data may not want to analyze / compare this data with other wetlands due to the extensive level of:

- ☐ non-groundwater withdrawal-related disturbance
- ☐ soil subsidence

WILDLIFE

Wildlife	Count	Evidence	Wildlife	Count	Evidence	Wildlife	Count	Evidence

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

GROUNDCOVER

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), % cover (5% or 10-100% in increments of 10%), count (1-4), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Eupatorium capillifolium	T	25		T

OUTER DEEP ZONE

outer deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
A. muhlenbergianum	OD	10		T
Euthamia caroliniana	AD	<5		T
Urena lobata	U	20		T
Centella asiatica	T	<5		T

DEEP ZONE

deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Mikania scandens	T	20		T
Eupatorium capillifolium	T	10		T
Polygonum hydropiperoides	OD	<5		T

Groundcover Comments

ZONATION

Zonation Score: 3 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

Upland and transitional groundcover species dominate the outer deep and deep zones

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

SHRUB / SMALL TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Cephalanthus occidentalis	D		2	T

OUTER DEEP ZONE

outer deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Acer rubrum	OD		2	E
Cephalanthus occidentalis	D	<5		T

DEEP ZONE

deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Shrub/Small Tree Comments

ZONATION

Zonation Score: 4 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate shrubs and small trees (include dead species)

Few/None (circled)
Noticeable
Significant (circled)
Not Applicable

Signs of stress of inappropriate shrubs and small trees (include dead species)

Few/None (circled)
Noticeable
Significant
Not Applicable

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ☑
check if no trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Tree Comments

ZONATION

Zonation Score: NA Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate trees (do not include dead species)

Few/None
Noticeable
(Significant)
Not Applicable

Subsided soils at base of trees, resulting in some leaning trees

Signs of stress of inappropriate trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

RECOVERY

Dead or leaning trees (include standing dead trees and dead trees on ground that are appropriate)

Few/None
(Noticeable)
Significant

Signs of tree recovery

Yes
(No)
Not Sure

Inappropriate vine death suggesting recovery

Yes
(No)
Not Sure

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Data Owner	Data Source	Personnel	Date	Start/End	
TW-1			A. Levy & B. Sawyer - ARCADIS	11 June 2009	13:00	15:30

PHOTO-DOCUMENTATION

Frame	Description	Photo Pt.	Direction

WATER LEVEL INFORMATION

Dry?	Elevation (ft)	Device	Well/Gage ID
Yes	N/A		

Description

Please enter Yes (Y), No (N), or Not Sure (NS) for the following questions and provide comments/explanations.

WETLAND IMPACTS

Wetland edges filled or disturbed?	No
Excessive dumping or trash in wetland?	No
Hog disturbance?	No
Signficant impact from cattle (trampling)?	No
Vehicles through wetland (includes bicycles)?	No
Insect damage?	No
Disease?	No

Explanation(s)

WETLAND DRAINAGE

Augmentation equipment in place?	No
Augmentation occurring at time of WAP?	No
Clear evidence of direct stormwater inflow?	No
Clear evidence of direct drainage from wetland?	No
Other drainage activities in area?	No
Borrow pit/retention pond in wetland vicinity?	No

Explanation(s)

Fire

Signs of Fire? No

Explanation (year, expanse, intensity)

Lakes / Docks

Docks completely out of water
Docks touching water or with <50% of dock over water
Docks >50% out of water
Not Applicable

Is the littoral zone stranded? ☐

Comments

Soil Subsidence

New signs of oxidation/subsidence? Yes

Explanation

Some soils within the historic wetland area lack hydric indicators. Up to 18 inches of subsidence within the wetland interior was observed. Mound of the subsided soils slightly eroded, which suggests subsidence is moderately recent.

General Comments/Observations

TW-1 has experienced moderate to severe hydrological alterations since 2003, as evidenced by 2003 aerial photography. Observed impacts primarily due to recent industrial development north of this wetland.

Future users of this data may not want to analyze / compare this data with other wetlands due to the extensive level of:

- ☐ non-groundwater withdrawal-related disturbance
- ☐ soil subsidence

WILDLIFE

Wildlife	Count	Evidence	Wildlife	Count	Evidence	Wildlife	Count	Evidence

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

GROUNDCOVER

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), % cover (5% or 10-100% in increments of 10%), count (1-4), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Eupatorium capillifolium	T	25		T

OUTER DEEP ZONE

outer deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
A. muhlenbergianum	OD	10		T
Euthamia caroliniana	AD	<5		T
Urena lobata	U	20		T
Centella asiatica	T	<5		T

DEEP ZONE

deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Mikania scandens	T	20		T
Eupatorium capillifolium	T	10		T
Polygonum hydropiperoides	OD	<5		T

Groundcover Comments

ZONATION

Zonation Score: 3 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

Upland and transitional groundcover species dominate the outer deep and deep zones

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

SHRUB / SMALL TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Cephalanthus occidentalis	D		2	T

OUTER DEEP ZONE

outer deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Acer rubrum	OD		2	E
Cephalanthus occidentalis	D	<5		T

DEEP ZONE

deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Shrub/Small Tree Comments

ZONATION

Zonation Score: 4 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate shrubs and small trees (include dead species)

Few/None
Noticeable
(Significant)
Not Applicable

Signs of stress of inappropriate shrubs and small trees (include dead species)

(Few/None)
Noticeable
Significant
Not Applicable

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no trees ■

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ■
check if no trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Tree Comments

ZONATION

Zonation Score: NA Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate trees (do not include dead species)

Few/None
Noticeable
(Significant)
Not Applicable

Subsided soils at base of trees, resulting in some leaning trees

Signs of stress of inappropriate trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

RECOVERY

Dead or leaning trees (include standing dead trees and dead trees on ground that are appropriate)

Few/None
(Noticeable)
Significant

Signs of tree recovery

Yes
(No)
Not Sure

Inappropriate vine death suggesting recovery

Yes
(No)
Not Sure

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Data Owner	Data Source	Personnel	Date	Start/End	
TW-1			A. Levy & B. Sawyer - ARCADIS	11 June 2009	13:00	15:30

PHOTO-DOCUMENTATION

Frame	Description	Photo Pt.	Direction

WATER LEVEL INFORMATION

Dry?	Elevation (ft)	Device	Well/Gage ID
Yes	N/A		

Description

Please enter Yes (Y), No (N), or Not Sure (NS) for the following questions and provide comments/explanations.

WETLAND IMPACTS

Wetland edges filled or disturbed?	No
Excessive dumping or trash in wetland?	No
Hog disturbance?	No
Signficant impact from cattle (trampling)?	No
Vehicles through wetland (includes bicycles)?	No
Insect damage?	No
Disease?	No

Explanation(s)

WETLAND DRAINAGE

Augmentation equipment in place?	No
Augmentation occurring at time of WAP?	No
Clear evidence of direct stormwater inflow?	No
Clear evidence of direct drainage from wetland?	No
Other drainage activities in area?	No
Borrow pit/retention pond in wetland vicinity?	No

Explanation(s)

Fire

Signs of Fire? No

Explanation (year, expanse, intensity)

Lakes / Docks

Docks completely out of water
Docks touching water or with <50% of dock over water
Docks >50% out of water
Not Applicable

Is the littoral zone stranded? ☐

Comments

Soil Subsidence

New signs of oxidation/subsidence? Yes

Explanation

Some soils within the historic wetland area lack hydric indicators. Up to 18 inches of subsidence within the wetland interior was observed. Mound of the subsided soils slightly eroded, which suggests subsidence is moderately recent.

Future users of this data may not want to analyze / compare this data with other wetlands due to the extensive level of:

- ☐ non-groundwater withdrawal-related disturbance
- ☐ soil subsidence

General Comments/Observations

TW-1 has experienced moderate to severe hydrological alterations since 2003, as evidenced by 2003 aerial photography. Observed impacts primarily due to recent industrial development north of this wetland.

WILDLIFE

Wildlife	Count	Evidence	Wildlife	Count	Evidence	Wildlife	Count	Evidence

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

GROUNDCOVER

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), % cover (5% or 10-100% in increments of 10%), count (1-4), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Eupatorium capillifolium	T	25		T

OUTER DEEP ZONE

outer deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
A. muhlenbergianum	OD	10		T
Euthamia caroliniana	AD	<5		T
Urena lobata	U	20		T
Centella asiatica	T	<5		T

DEEP ZONE

deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Mikania scandens	T	20		T
Eupatorium capillifolium	T	10		T
Polygonum hydropiperoides	OD	<5		T

Groundcover Comments

ZONATION

Zonation Score: 3 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

Upland and transitional groundcover species dominate the outer deep and deep zones

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

SHRUB / SMALL TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Cephalanthus occidentalis	D		2	T

OUTER DEEP ZONE

outer deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Acer rubrum	OD		2	E
Cephalanthus occidentalis	D	<5		T

DEEP ZONE

deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Shrub/Small Tree Comments

ZONATION

Zonation Score: 4 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

Signs of stress of inappropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ☑
check if no trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Tree Comments

ZONATION

Zonation Score: NA Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate trees (do not include dead species)

Few/None Noticeable Significant Not Applicable	Subsided soils at base of trees, resulting in some leaning trees

Signs of stress of inappropriate trees (include dead species)

Few/None Noticeable Significant Not Applicable	

RECOVERY

Dead or leaning trees (include standing dead trees and dead trees on ground that are appropriate)

Few/None Noticeable Significant	

Signs of tree recovery

Yes No Not Sure	

Inappropriate vine death suggesting recovery

Yes No Not Sure	

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Data Owner	Data Source	Personnel	Date	Start/End	
TW-1			A. Levy & B. Sawyer - ARCADIS	11 June 2009	13:00	15:30

PHOTO-DOCUMENTATION

Frame	Description	Photo Pt.	Direction

WATER LEVEL INFORMATION

Dry?	Elevation (ft)	Device	Well/Gage ID
Yes	N/A		

Description

Please enter Yes (Y), No (N), or Not Sure (NS) for the following questions and provide comments/explanations.

WETLAND IMPACTS

Wetland edges filled or disturbed?	No
Excessive dumping or trash in wetland?	No
Hog disturbance?	No
Signficant impact from cattle (trampling)?	No
Vehicles through wetland (includes bicycles)?	No
Insect damage?	No
Disease?	No

Explanation(s)

WETLAND DRAINAGE

Augmentation equipment in place?	No
Augmentation occurring at time of WAP?	No
Clear evidence of direct stormwater inflow?	No
Clear evidence of direct drainage from wetland?	No
Other drainage activities in area?	No
Borrow pit/retention pond in wetland vicinity?	No

Explanation(s)

Fire

Signs of Fire? No

Explanation (year, expanse, intensity)

Lakes / Docks

Docks completely out of water
Docks touching water or with <50% of dock over water
Docks >50% out of water
Not Applicable

Is the littoral zone stranded? ☐

Comments

Soil Subsidence

New signs of oxidation/subsidence? Yes

Explanation

Some soils within the historic wetland area lack hydric indicators. Up to 18 inches of subsidence within the wetland interior was observed. Mound of the subsided soils slightly eroded, which suggests subsidence is moderately recent.

General Comments/Observations

TW-1 has experienced moderate to severe hydrological alterations since 2003, as evidenced by 2003 aerial photography. Observed impacts primarily due to recent industrial development north of this wetland.

Future users of this data may not want to analyze / compare this data with other wetlands due to the extensive level of:

- ☐ non-groundwater withdrawal-related disturbance
- ☐ soil subsidence

WILDLIFE

Wildlife	Count	Evidence	Wildlife	Count	Evidence	Wildlife	Count	Evidence

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

GROUNDCOVER

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), % cover (5% or 10-100% in increments of 10%), count (1-4), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Eupatorium capillifolium	T	25		T

OUTER DEEP ZONE

outer deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
A. muhlenbergianum	OD	10		T
Euthamia caroliniana	AD	<5		T
Urena lobata	U	20		T
Centella asiatica	T	<5		T

DEEP ZONE

deep zone assessed? ☑ *check if no groundcover* ☐

SPECIES	ZONE	%	#	DIST
Mikania scandens	T	20		T
Eupatorium capillifolium	T	10		T
Polygonum hydropiperoides	OD	<5		T

Groundcover Comments

ZONATION

Zonation Score: 3 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

Upland and transitional groundcover species dominate the outer deep and deep zones

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

SHRUB / SMALL TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Cephalanthus occidentalis	D		2	T

OUTER DEEP ZONE

outer deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Acer rubrum	OD		2	E
Cephalanthus occidentalis	D	<5		T

DEEP ZONE

deep zone assessed? ☑
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Shrub/Small Tree Comments

ZONATION

Zonation Score: 4 Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

Signs of stress of inappropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type
H. Boothe (P-52)	Target Wetland 1	Emergent

Wetland ID	Area Assessed	Zone Assessment Notes
TW-1		

TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no trees ☑

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ☑
check if no trees ☐

SPECIES	ZONE	%	#	DIST
Salix caroliniana	OD	100		T

Tree Comments

ZONATION

Zonation Score: NA Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate trees (do not include dead species)

Few/None Noticeable Significant Not Applicable	Subsided soils at base of trees, resulting in some leaning trees

Signs of stress of inappropriate trees (include dead species)

Few/None Noticeable Significant Not Applicable	

RECOVERY

Dead or leaning trees (include standing dead trees and dead trees on ground that are appropriate)

Few/None Noticeable Significant	

Signs of tree recovery

Yes No Not Sure	

Inappropriate vine death suggesting recovery

Yes No Not Sure	

ARCADIS

Attachment B

2009 WAP Data Form

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type

Wetland ID	Data Owner	Data Source	Personnel	Date	Start/End

PHOTO-DOCUMENTATION

Frame	Description	Photo Pt.	Direction

WATER LEVEL INFORMATION

Dry?	Elevation (ft)	Device	Well/Gage ID

Description

Please enter Yes (Y), No (N), or Not Sure (NS) for the following questions and provide comments/explanations.

WETLAND IMPACTS

Wetland edges filled or disturbed?	
Excessive dumping or trash in wetland?	
Hog disturbance?	
Signficant impact from cattle (trampling)?	
Vehicles through wetland (includes bicycles)?	
Insect damage?	
Disease?	

Explanation(s)

WETLAND DRAINAGE

Augmentation equipment in place?	
Augmentation occurring at time of WAP?	
Clear evidence of direct stormwater inflow?	
Clear evidence of direct drainage from wetland?	
Other drainage activities in area?	
Borrow pit/retention pond in wetland vicinity?	

Explanation(s)

Fire

Signs of Fire?

Explanation (year, expanse, intensity)

Lakes / Docks

Docks completely out of water
Docks touching water or with <50% of dock over water
Docks >50% out of water
Not Applicable

Is the littoral zone stranded?

Comments

Soil Subsidence

New signs of oxidation/subsidence?

Explanation

General Comments/Observations

Future users of this data may not want to analyze / compare this data with other wetlands due to the extensive level of:

- ☐ non-groundwater withdrawal-related disturbance
- ☐ soil subsidence

WILDLIFE

Wildlife	Count	Evidence	Wildlife	Count	Evidence	Wildlife	Count	Evidence

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type

Wetland ID	Area Assessed	Zone Assessment Notes

GROUNDCOVER

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), % cover (5% or 10-100% in increments of 10%), count (1-4), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no groundcover ☐

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no groundcover ☐

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ☐
check if no groundcover ☐

SPECIES	ZONE	%	#	DIST

Groundcover Comments

ZONATION

Zonation Score: ☐ Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type

Wetland ID	Area Assessed	Zone Assessment Notes

SHRUB / SMALL TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ☐
check if no shrubs/small trees ☐

SPECIES	ZONE	%	#	DIST

Shrub/Small Tree Comments

ZONATION

Zonation Score: ☐ Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

Signs of stress of inappropriate shrubs and small trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

WETLAND ASSESSMENT PROCEDURE

Wellfield / Property	Wetland Name	Wetland Type

Wetland ID	Area Assessed	Zone Assessment Notes

TREES

For each zone assessed, please document the following: species abbreviation, WAP zone (U, AD, T, OD, or D), percent cover (5% or 10-100% in increments of 10%), count (1-50 or ">50"), and distribution (E=edge, B=beyond a few feet, or T=throughout).

TRANSITION ZONE

transition zone assessed? ☐
check if no trees ☐

SPECIES	ZONE	%	#	DIST

OUTER DEEP ZONE

outer deep zone assessed? ☐
check if no trees ☐

SPECIES	ZONE	%	#	DIST

DEEP ZONE

deep zone assessed? ☐
check if no trees ☐

SPECIES	ZONE	%	#	DIST

Tree Comments

ZONATION

Zonation Score: ☐ Please assign a score of 1 - 5 or 0 and provide an explanation.

Zonation Score Explanation

STRESS

Signs of stress of appropriate trees (do not include dead species)

Few/None
Noticeable
Significant
Not Applicable

Signs of stress of inappropriate trees (include dead species)

Few/None
Noticeable
Significant
Not Applicable

RECOVERY

Dead or leaning trees (include standing dead trees and dead trees on ground that are appropriate)

Few/None
Noticeable
Significant

Signs of tree recovery

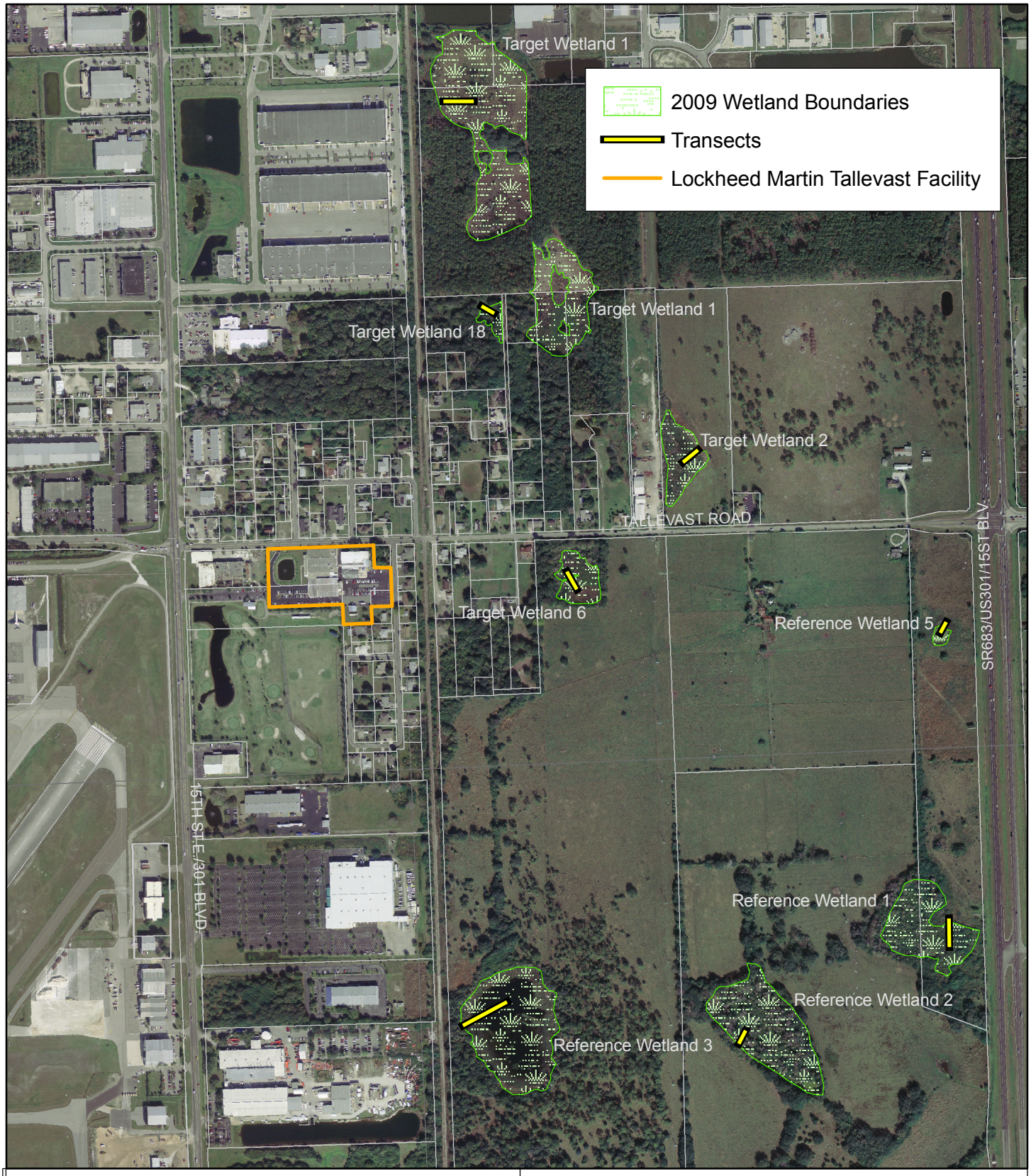
Yes
No
Not Sure

Inappropriate vine death suggesting recovery

Yes
No
Not Sure

ARCADIS

Figures



N

0 250 500 1,000

Scale in Feet

Area Location

FLORIDA

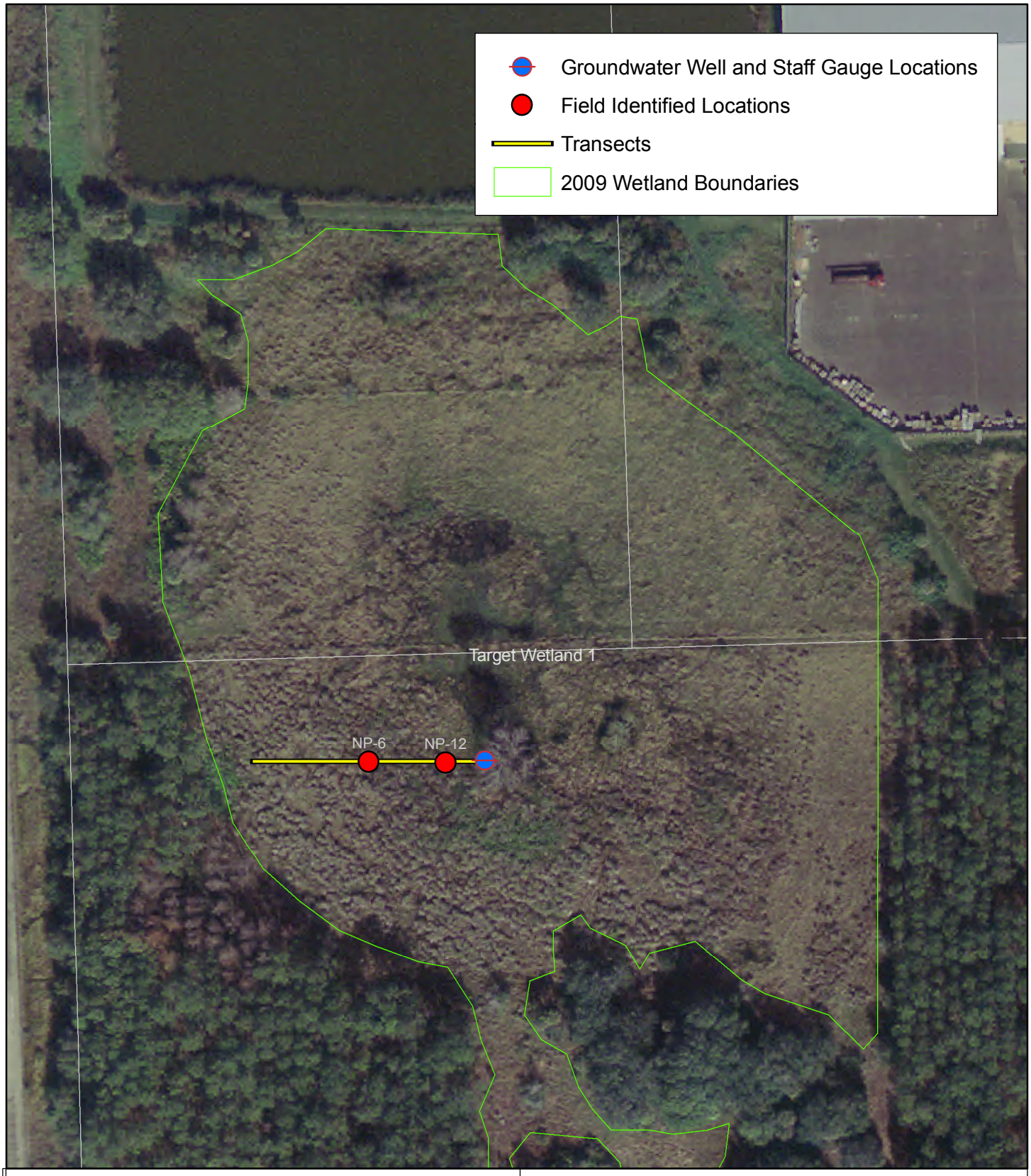
LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA
WETLANDS MONITORING PLAN

Wetland and Transect Location Map

ARCADIS

Figure 2-1

R625-EDC-001217-0



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0 40 80 160

Scale in Feet

Area Location

FLORIDA

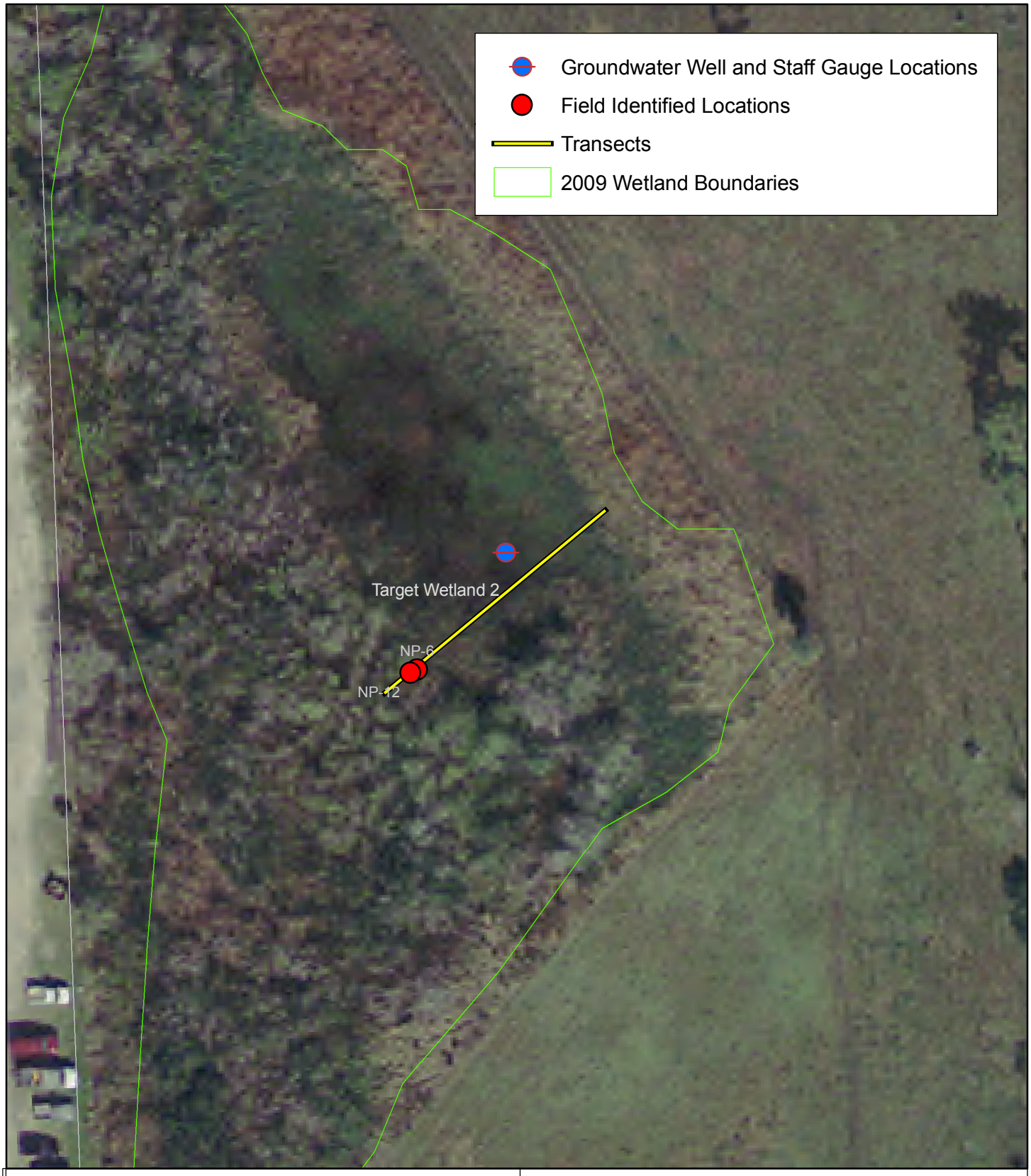
LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA
WETLANDS MONITORING PLAN

Target Wetland 1 Transect

ARCADIS

Figure 2-2

R625-EDC-001217-0



N

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Scale in Feet

FLORIDA

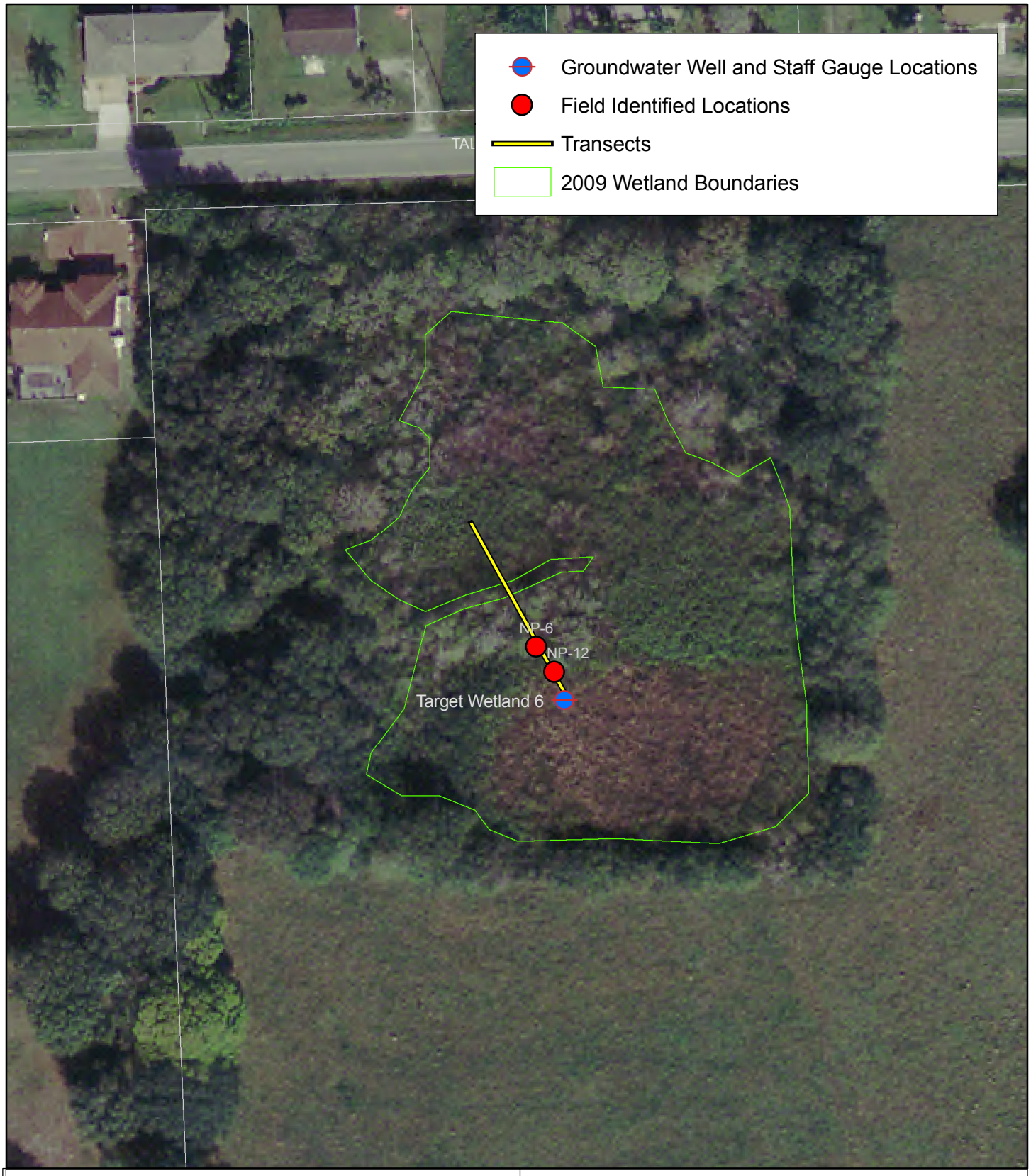
LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA
WETLANDS MONITORING PLAN

Target Wetland 2 Transect

ARCADIS

Figure 2-3

R625-EDC-001217-0



N

0 35 70 140

Scale in Feet

FLORIDA

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA
WETLANDS MONITORING PLAN

Target Wetland 6 Transect

ARCADIS

Figure 2-4

R625-EDC-001217-0

N

0 15 30 60

Scale in Feet

FLORIDA

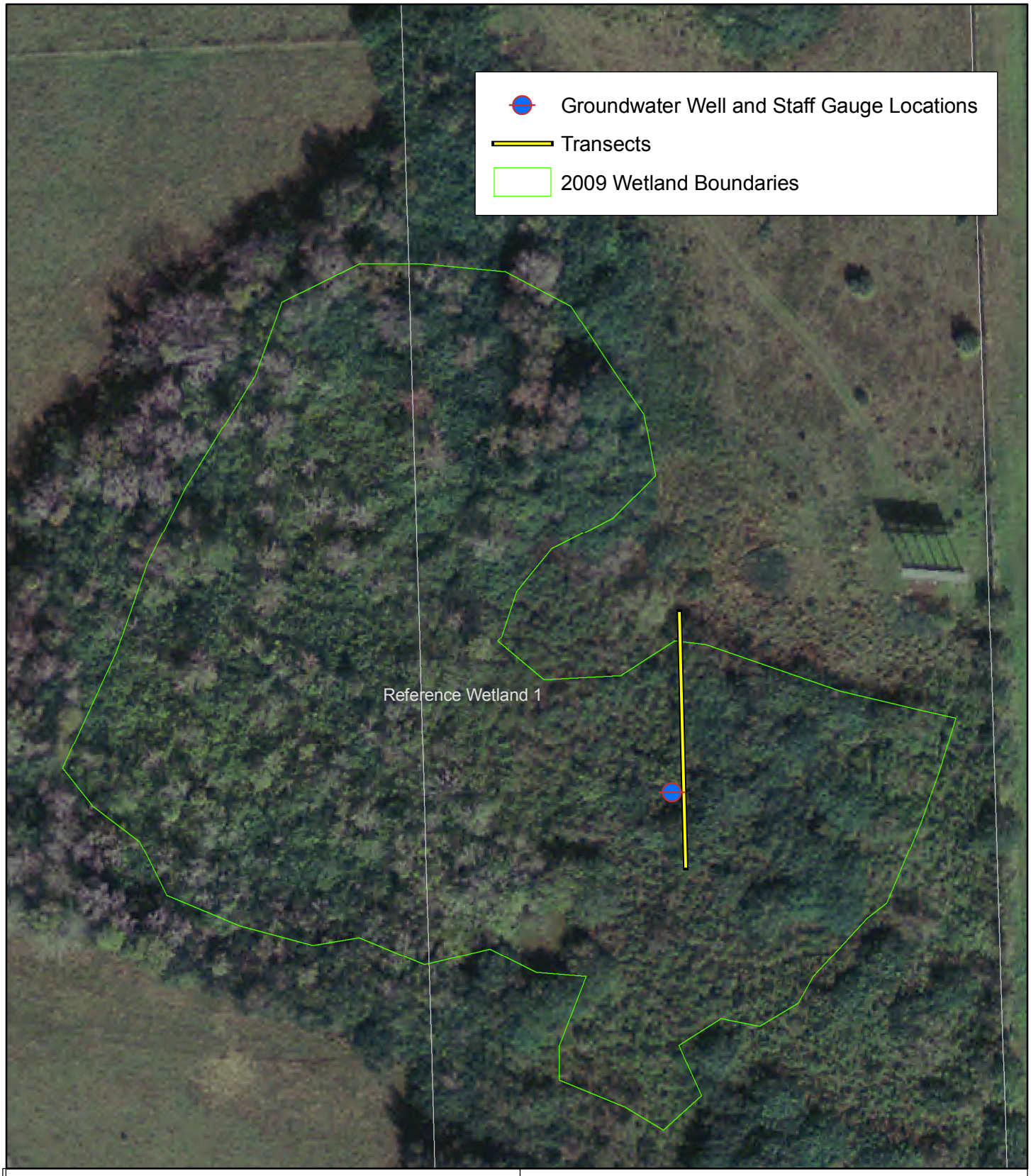
LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA
WETLANDS MONITORING PLAN

Target Wetland 18 Transect

ARCADIS

Figure 2-5

R625-EDC-001217-0



N

0 35 70 140

Scale in Feet

FLORIDA

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA
WETLANDS MONITORING PLAN

Reference Wetland 1 Transect

ARCADIS

Figure 2-6

R625-EDC-001217-0

N

0 35 70 140

Scale in Feet

Area Location

FLORIDA

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA
WETLANDS MONITORING PLAN

Reference Wetland 2 Transect

ARCADIS

Figure 2-7

R625-EDC-001217-0

N

0 37.5 75 150

Scale in Feet

FLORIDA

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA
WETLANDS MONITORING PLAN

Reference Wetland 3 Transect

ARCADIS

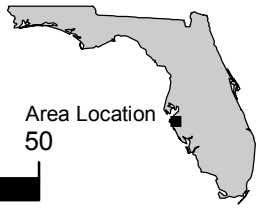
Figure 2-8

R625-EDC-001217-0

N

0 12.5 25 50

Scale in Feet



LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA
WETLANDS MONITORING PLAN

Reference Wetland 5 Transect

ARCADIS

Figure 2-9

R625-EDC-001217-0