Inventory, Assessment, and Restoration Potential of Ephemeral Wetlands on FFWCC Wildlife Management Areas

Guana River WMA Final Report

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EXECUTIVE SUMMARY

Ephemeral wetlands are biologically unique systems that serve as focal points of animal and plant diversity in the southeastern United States. Despite their typically small size, these wetlands are extremely valuable in terms of biological diversity and ecological function. Historically, ephemeral wetlands were largely ignored by scientists, regulatory agencies, and land managers. Because of their small size, they were believed to have lower biological diversity and less significant ecological function than larger, more permanent water bodies. Consequently, many smaller, isolated wetlands have been destroyed or their ecological integrity degraded through human activities that include logging, ditching, draining, fire suppression, and mechanical site preparation. After over 20 years of research on hundreds of sites across the country, we now know that ephemeral wetlands are not just subsets of larger wetlands, but rather they hold their own unique and intrinsic biological value.

This pilot project was created to provide the Florida Fish and Wildlife Conservation Commission (FWC) with the site-specific tools and knowledge it needs in order to carry out the long-term ecological management of Florida's ephemeral wetlands by identifying them using remote sensing tools such as GIS, DOQQs, and topographic maps, conducting on-the-ground assessments of ephemeral wetland conditions using quantitative and qualitative metrics, and recommending restoration strategies for each identified wetland or management unit. Seven FWC-lead Wildlife Management Areas (WMAs) were selected for study: Aucilla WMA, Big Bend WMA, Caravelle Ranch WMA, Chassahowitzka WMA, Guana River WMA, Half Moon WMA, and Triple N Ranch WMA.

We used Digital Orthophoto Quarter Quadrangles (DOQQs) and topographic maps to remotely identify potential ephemeral wetlands on each property. We then ground-truthed potential ephemeral wetlands, obtained a GPS location, and conducted a standardized quick assessment of wetland and surrounding upland conditions. The data were entered into a GPS unit on site in order to generate a spatially referenced database for each property. Additional data were collected on a per property basis as requested by WMA personnel. Multiple photographs were taken of each wetland to provide a current "snapshot" of their physical appearance. We made restoration recommendations for each wetland based on wetland concerns identified in the field and the custom needs and challenges of each WMA.

We inventoried at total of 1513 isolated, ephemeral wetlands across the 7 WMA properties. The majority of wetlands (72%) were marshes. Forested swamps accounted for 9% of wetlands visited, shrub swamps 9%, and mixed swamps 8%. Another 2% of wetlands were of another classification such as borrow pits and sinkhole ponds. A total of 424 wetlands (28%) were in excellent condition with no associated wetland concerns. The three most prevalent wetland concerns were woody encroachment, feral hog damage, and roads/firelines.

Woody encroachment was the most ubiquitous wetland concern across all WMAs. A total of 494 wetlands (33%) were affected by woody plant encroachment. The percentage of wetlands impacted by woody plant encroachment varied per property from 3% of inventoried wetlands up to 74%. Half of all wetlands with woody encroachment were marshes. Within marshes, the

majority of woody encroachment was in the form of slash pine and wax myrtle encroaching from the wetland edge. Woody plant establishment in marshes represented a major threat to ephemeral wetlands in many of the visited WMAs and is largely a result of the lack of fire in the wetland basin. Canopies formed by woody plants in a marsh over time will shade out herbaceous marsh vegetation, eventually transforming the marsh into a swamp. To combat woody plant encroachment in marshes, we recommended that land managers remove encroaching woody plants in a single treatment using a variety of techniques depending on the situation, and subsequently implement long-term fire management in the wetland, if it wasn't already in effect.

There were 352 wetlands (23%) that were impacted by some degree of observable past or present feral hog activity. Some properties were more impacted by hogs than others, the percentage of wetlands impacted varied per property from 4% of inventoried wetlands up to 67%. Feral hogs can alter the plant and animal composition of wetlands and damage wetland soils. We made recommendations on feral hog management based on the severity of the damage and, using the generated database, the spatial extent of the damage. We recommended that trapping be used in combination with sport hunting and control hunting as a 3-pronged approach to reduce the impacts to ephemeral wetlands in heavily damaged areas of some properties.

Roads and firelines affected 2-19% of wetlands inventoried per property, a total of 125 wetlands (8%) were impacted project-wide. The placement of firelines and roads through or tangential to wetlands is detrimental to wetland habitat because the swath of exposed soil and denuded vegetation is a direct alteration of wetland habitat, can impact wetland hydroperiod, and can facilitate the spread of invasive species. Most, if not all, observed road-related impacts were created in the past. Now, current land managers must decide how to implement ephemeral wetland restoration of road impacts while balancing the need to access and partition the property for both public and managerial use. We made recommendations on a case-by-case basis.

Cattle grazing was permitted on 3 of the WMAs we visited. Cattle grazing pressure over time can degrade both wetland and upland habitats by altering plant communities and subsequently reducing landscape biodiversity. Furthermore, cattle frequently congregate in ephemeral wetland basins. Impacts to wetlands include nutrient overloading from concentrated urine and feces, trampling, altering plant community structure, facilitating the spread of invasive/exotic species, and soil compaction. We observed varying degrees of cattle impacts to wetlands during this project. Immediate recommended actions varied per property but in general we recommended cattle be phased out of WMAs altogether as part of a longer-term management strategy to maintain long-term ecological health of ephemeral wetlands and their surrounding uplands.

This pilot study has illuminated the need for future scientific research in several areas of ephemeral wetland restoration. There is a paucity of experimental data and peer-reviewed literature relating to the management of ephemeral wetlands. While some experimental data do exist, and we relied on it heavily for this report, most of the information we have compiled was acquired from our field expertise or through personal communications with land managers and other scientists. One major area that needs to be studied is the ecological response of wetlands to woody plant encroachment and the most effective methods for restoring wetlands impacted by woody encroachment. The long term effects of feral hogs on ephemeral wetland biodiversity

and community composition is another area for which there is little research. A final information gap we have identified is the fire ecology of ephemeral wetlands including targeted fire return interval, impacts of dormant versus growing season fires, and community composition response to varying fire regimes.

Although we've identified information gaps, this report is the most comprehensive compilation of knowledge about ephemeral wetland management and restoration to date. Results from this project provide an enormous database of the ecological status of ephemeral wetlands on state managed properties in Florida. This project also supplies baseline data that can be used in future studies of wetland response to management techniques and a template for future studies to identify, inventory, assess, and implement restoration actions for ephemeral wetlands on other properties.

The deliverables for this project include a final report for each of the 7 WMAs (of which this is one report), a spatially-referenced database of wetlands inventoried (in the form of a shapefile per property), and a catalog of wetland photographs. A DVD of reports, shapefiles, and photographs was sent to each of the 7 WMAs and to the AHRES project manager, Beacham Furse. The reports also were posted on, and the shapefiles made available upon request from, Coastal Plains Institute's website: www.coastalplains.org.

ACKNOWLEDGEMENTS

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INTRODUCTION

Ephemeral wetlands are biologically unique systems that serve as focal points of animal and plant diversity in the southeastern United States. Despite their typically small size, these wetlands are extremely valuable in terms of biological diversity and ecological function. For example, at least 12 Florida amphibians, including the federally listed flatwoods salamander (*Ambystoma bishopi, A. cingulatum*) and other candidate species (e.g., striped newt (*Notophthalmus perstriatus)* and gopher frog (*Rana capito*)), breed exclusively in this wetland type (Dodd and Charest 1988, Means and Means 1998, Printiss and Hipes 1999, Enge and Wood 2000, Greenberg et al. 2003). Even small wetlands (<1 ha) can support a high diversity and density of species (Dodd 1992, Semlitsch 2000, Means 2007).

Ephemeral wetlands are usually small and isolated with a cyclic nature of drying and refilling. Termed "hydroperiod," the duration an ephemeral wetland holds water can vary from 1 or 2 weeks to 1 or 2 years, and hydroperiod can vary from year to year and wetland to wetland. The water-holding capacity of a wetland is a function of multiple factors including underlying geology, soil characteristics, rainfall, wetland depth and size, evaporation, evapotranspiration, and tree canopy cover (Williams 1987, Hart and Newman 1995, Blood et al. 1997, Tiner et al. 2002). Bands of herbaceous vegetation around the wetland periphery, known as the littoral zone, move upslope and downslope depending on the water level of the wetland and reflect soil moisture conditions (LaClaire and Franz 1990).

The ephemeral nature and isolation of these wetlands make them unsuitable for fauna requiring longer hydroperiods, such as predatory fish. While some amphibians can breed in the presence of fish, the lack of predatory fish in ephemeral wetlands is essential to the successful reproduction of a large portion of Florida's amphibian species.

Our region's biological diversity is greatly enhanced by the presence of ephemeral wetlands. Ephemeral wetlands provide habitat to a large diversity of plants, invertebrates, reptiles, mammals, and birds (LaClaire 1992, Tiner et al. 2002, Comer et al. 2005, Scheffers et al. 2006, Means 2007). At least 10 federally and state-listed species facultatively or obligately utilize isolated wetlands for some portion of their life cycle (Hart and Newman 1995). These wetlands also serve as water sources for game species such as white-tailed deer (*Odocoileus virginianus*), bobwhite quail (*Colinus virginianus*), and waterfowl. Additionally, the aesthetic value of small wetlands is of great importance to a society that places a major emphasis on the value of water bodies.

The longleaf pine ecosystem, once widespread across the southeastern Coastal Plain, has been reduced to <2.2% of its original extent (Frost 2006). In just the past 50 years, a quarter of Florida's forest and wetland habitats have been cleared (Cox et al. 1994). The cumulative effect of ephemeral wetland destruction in Florida has not been measured, but studies by Semlitsch and Bodie (1998) and Gibbs (1993) illuminate the problems associated with the loss of small wetlands. Small wetlands are crucial for maintaining

regional biological diversity and are important because they support plants, microcrustaceans, and aquatic insects that would be negatively impacted by their loss. From an amphibian metapopulation standpoint, reducing the number of wetlands reduces the amount of young individuals dispersing into surrounding uplands. Ephemeral wetland reduction also increases the dispersal distance among wetlands. While some amphibians can travel up to 2 km (Franz et al. 1988), these dispersal distances appear to be rare. The majority of individuals appear to stay within 1 km of their breeding wetland (Johnson 2003, Rosnik 2007), so increasing dispersal distance could negatively impact amphibian populations. An increase in dispersal distance also may increase the extinction rate of populations of small mammals, turtles, and other less vagile species (Gibbs 1993).

Historically, ephemeral wetlands were largely ignored by scientists, regulatory agencies, and land managers. These wetlands were generally thought to be subsets of larger wetlands. Because of their small size, they were believed to have lower biological diversity and less significant ecological function than larger, more permanent water bodies (Moler and Franz 1987). Studies over the past 20 years have dispelled that notion. We now know that ephemeral wetlands are not just subsets of larger wetlands, but rather they hold their own unique and intrinsic biological value. However, wetland regulations and management plans maintain their focus on larger wetlands. Consequently, many smaller, isolated wetlands have been destroyed or their ecological integrity degraded through human activities that include logging, ditching, draining, and mechanical site preparation. Additionally, fire suppression or improper use of prescribed fire has altered the natural conditions of many ephemeral wetlands.

Coastal Plains Institute (CPI) biologists recently completed a Florida Fish and Wildlife Conservation Commission (FWC) State Wildlife Grant project entitled "Management Strategies for Florida's Ephemeral Ponds and Ephemeral Pond-Breeding Amphibians" (Means 2008). Through that project, CPI identified and prioritized the necessary steps to improve the management of ephemeral wetlands in Florida. Upon completion of that project, the next logical step in the goal of proper ecological management of Florida's ephemeral wetlands was the development of the current project. Proper ephemeral wetland management was given the highest priority at "Ephemeral Pond-Breeding Amphibians: Threats and Research Gaps," a 2007 meeting of amphibian biologists at which research needs of ephemeral wetlands and associated biota were identified and prioritized. The current project will provide FWC with the site-specific tools and knowledge it needs in order to carry out the long-term ecological management of Florida's ephemeral wetlands by:

1) Identifying ephemeral wetlands using remote sensing tools such as GIS, DOQQs, and topographic maps
2) Conducting on-the-ground assessments of ephemeral wetland conditions using quantitative and qualitative metrics
3) Recommending restoration strategies for each identified wetland or management unit

Seven FWC-lead Wildlife Management Areas (WMAs) were selected for study based on FWC-identified restoration potential priorities and the distribution and occurrence of amphibian Species of Greatest Conservation Need, as identified from CPI's geo-referenced database developed as part of the recent CPI project funded by a State Wildlife Grant (Figure 1). This current project serves to assist FWC land managers by identifying, inventorying, and assessing the restoration need of ephemeral wetlands on the following WMAs:

- Aucilla (AWMA)
- Big Bend (BBWMA)
- Caravelle Ranch (CRWMA)
- Chassahowitzka (CWMA)
- Guana River (GRWMA)
- Half Moon (HMWMA)
- Triple N (TNWMA)

This draft report provides an inventory, characterization, and restoration assessment for ephemeral wetlands on GRWMA, the third of the 7 WMA's visited as part of this project.

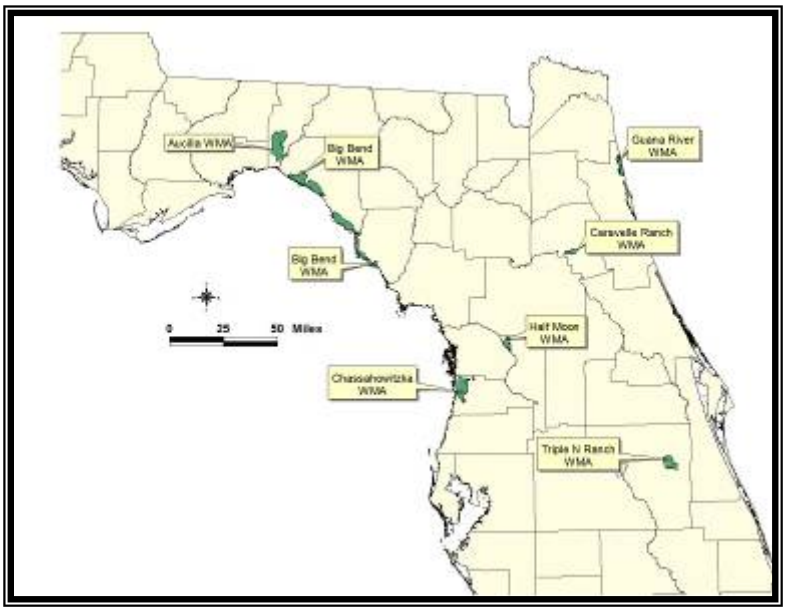

Figure 1. Seven FWC-lead WMAs targeted for this study.

EPHEMERAL WETLAND ECOLOGY AND RESTORATION

Ephemeral wetlands also are known as temporary ponds, isolated wetlands, Carolina bays, seasonal ponds, cypress domes, sinkhole wetlands, seasonal marshes, intermittent ponds, pineland depressions, depressional wetlands, and vernal pools. They can be classified as either marshes, shrub swamps, or forested swamps (Whitney et al. 2004). Marshes are dominated by herbaceous vegetation; grasses and forbs that can be emergent, submergent or floating. Swamps are wetlands dominated by woody vegetation. Shrub swamps are dominated by shrubs and forested swamps are dominated by trees.

Both fire and water residency time (hydroperiod) play major roles in shaping the ecological function and the physical appearance of isolated wetlands in Florida landscapes. In the case of marshes, fire and hydroperiod work in unison to produce open, ephemeral, herbaceous marshes. A marsh is likely to succeed into a shrubby or forested swamp over time if two things occur in the wetland: 1) dry conditions ensue long enough for woody plants to become established in the newly exposed wetland floor; 2) fire is absent in the wetland during the dry period.

Historically, wildfires occurred during dry periods and burned across the Florida landscape. The absence of fire from an ephemeral wetland during a prolonged dry period enables the establishment of woody plants in a marsh. Woody invaders into marshes will create a shading effect over time and eliminate low-lying herbaceous vegetation through competitive exclusion. Succession of a marsh into a swamp can be a natural process but much more often, on lands that have been impacted by humans over the long-term, marshes are succeeding into shrub and forested swamps. Over the last century of human growth and development in Florida, a great many marshes in Florida may have succeeded into shrubby and forested swamps as a result of fire suppression induced by humans. This conversion of wetland type may be a factor in the decline of some ephemeral wetland-breeding species such as the striped newt and the gopher frog.

Just as it is possible for marshes to succeed to swamps, it is also possible for marshes to become too choked with herbaceous vegetation (i.e. sawgrass or maidencane) if they do not burn frequently enough. High densities of a single species in wetlands can eliminate open water pools, create a shading effect, and reduce species diversity. Grass-choked marshes are usually best managed with fire.

Dry periods coupled with lack of fire in an ephemeral marsh will lead to woody encroachment, competitive exclusion of herbaceous vegetation, and subsequent loss of marsh habitat. We have observed significant woody shrub and tree encroachment in many ephemeral marshes and swamps in most of the WMA's visited as part of this project. All wetlands exhibiting signs of fire suppression should be encouraged to burn during landscape level prescribed fires. Various other restoration techniques are available to catalyze restoration of fire-suppressed marshes. These additional techniques are discussed in the Wetland Concerns portion of the Site Assessment section. In the short term, marshes should be given higher restoration priority over swamps. Marshes

will rapidly succeed to swamps if not properly managed, whereas swamps are more enduring, already canopied, wetland habitats.

The most important management strategy for ephemeral wetlands and the surrounding landscape is to actively maintain or restore historic fire regimes. Fire suppression was identified as one of the top 8 threats to amphibian conservation (Means 2008) and frequently is cited as a cause for decline in wetland-breeding amphibian populations (Palis 1997, Franz and Smith 1999, Hipes 2003, Jensen and Richter 2005, Means 2007) as well as other taxa (Stoddard 1931, Mushinsky 1985, Brennan et al. 1998, USFWS 2003). The Florida Comprehensive Wildlife Conservation Strategy ranked "incompatible fire" as one of the highest overall threats across all Florida's terrestrial habitat (FWC 2005). Most land managers recognize the necessity of fire to maintain the longleaf pine ecosystem, but there is debate regarding the importance of fire season versus fire frequency (Bishop and Haas 2005) and as to the appropriate fire frequency (Schurbon and Fauth 2003, Means et al. 2004, Robertson and Ostertag 2004). Additionally, many managers have to contend with managing units or entire properties that have heavy fuel loads resulting from long-term fire suppression. These heavy fuel loads present specific fire safety and ecological concerns.

Regardless of upland burn season and frequency, managers should ensure ephemeral wetland basins burn at least every 1-4 years (Wade et al. 1980, Printiss and Hipes 2000, Ripley and Printiss 2005, Means 2007). Because some wetlands may be severely fire suppressed, several treatments of annual or biennial burns may be necessary to initially suppress the hardwoods (Printiss and Hipes 2000). Historically, fires were ignited by lightning during the spring and early summer and had the potential to burn across large portions of the landscape (Robbins and Myers 1992). Wetlands were often dry during this time and fires were more likely to burn through the wetland basin. Fire reduces hardwood encroachment and buildup of organic matter (Wade et al. 1980). Fire also encourages growth of the herbaceous vegetation around the wetland edge, an area referred to as the littoral zone. This shallow zone is extremely important to adult amphibians for use as breeding and ovipositioning sites and to amphibian larval for food and cover habitat.

We primarily recommend the use of growing season prescribed fires in Florida landscapes in order to mimic the historical fire regimes that occurred here prior to European induced fire suppression. Embedded ephemeral wetlands within upland landscapes should be allowed and encouraged to burn. However, we recognize that dormant season burning may have to be conducted by land managers in many cases, especially in the initial phases of landscape restoration.

From an amphibian conservation perspective, burning of the wetland basin may be as important as the attention given to upland burn frequency and season. The U.S. Forest Service (USFS), in cooperation with Florida State University (FSU), are experimenting with whether dormant season upland burns combined with intentional burning of wetlands will improve conditions for flatwoods salamander populations in the Apalachicola National Forest (C. Hess, USFS/FSU, pers. com.). The uplands

surrounding the wetlands were burned during the USFS's normal winter burning season, but the researchers returned later when the wetland basin was dry and conducted a burn through the wetland basin. Because the fuel load of the surrounding area had been eliminated during recent burns, the researchers were able to conduct a hot, ring fire in the wetland basin. The resulting elimination of woody vegetation and the creation of an herbaceous community in the wetland basin were dramatic and extremely successful (C. Hess, USFS/FSU, pers. comm.). This method can be implemented to improve the ecological condition of ephemeral wetland basins suffering from fire-suppression due to dormant season burning when wetlands are typically filled with water.

The ecological health of an ephemeral wetland is unequivocally connected to that of the surrounding upland habitat (Semlitsch and Jensen 2001, Gibbons 2003, Semlitsch 2003). Wetlands are part of a larger landscape unit comprising a network of energy transfers and chemical interactions among organisms that are directly or indirectly dependent on surface water when it is present (Gibbons 2003). Studies of amphibians in ephemeral wetlands illuminate the enormous wetland-upland biomass exchange. In Florida, 14 amphibian species exclusively or principally breed in ephemeral wetlands and at least a dozen more species utilize the habitat opportunistically (Means 2008). These species spend the majority of their life cycle in the uplands, migrating to wetlands to breed. Travel distances of greater than 400 m have been recorded for many species (Lannoo 2005). The number of individual amphibians entering and exiting a wetland in a given year is often in the thousands (Dodd 1992, Johnson 2001, Means 2007) and even tens of thousands (Semlitsch et al. 1996, Means 2007).

When considering how to properly restore and manage ephemeral wetlands, it is important to note that landscapes typically contain a multitude of ephemeral wetlands that may vary in hydroperiod, floral and faunal species composition, and other ecological characteristics. Whereas some ephemeral wetlands appear quite similar to one another, each is a unique ecological entity possessing unique ecological qualities and processes. Ephemeral wetlands are dynamic ecosystems that constantly undergo ecological succession, responding to abiotic (e.g. climate change, hydroperiod, fire) and biotic (e.g. plant succession, faunal reproductive activity, alteration by humans) factors that are continually ongoing. Whereas in some cases we will recommend how to manage wetlands that need specific attention, the goal of ephemeral wetland management should be to manage at a landscape level for long-term ecological health and biodiversity of the entire ecosystem, including all embedded ephemeral wetlands.

In cases where wetlands can be restored to mimic the natural condition that existed before alteration occurred, we make recommendations on how to accomplish this. We make every effort to tailor our recommendations to the specific needs of each WMA visited. Because little work has been conducted in the field of ephemeral wetland restoration, we may recommend experimenting with different restoration techniques. Any or all of the following techniques may be recommended for the proper, long-term, ecological management of specific ephemeral wetlands or management units that contain multiple similarly impacted wetlands visited within this project:

- Landscape (or ecosystem) management
- Prescribed growing season fire
- Prescribed dormant season fire
- Fireline placement
- Spot use of herbicide on exotic or invasive flora
- Filling or plugging of drainage ditches
- Physical elimination/reduction of damaging exotic wildlife (e.g. hogs)
- Grazing reduction/elimination
- Hand removal of encroaching vegetation
- Mechanical removal of encroaching vegetation
- Mechanical flattening of bedding or windrows
- Re-routing roads

STUDY AREA

Guana River Wildlife Management Area is located in St. Johns County, approximately 2 kilometers north of the city of St. Augustine (Figure 2). This long, narrow stretch of estuarine and brackish marshes, pine flatwoods, scrub, basin marsh and swamp, and maritime hammock is situated between the Atlantic Ocean and the Intracoastal Waterway.

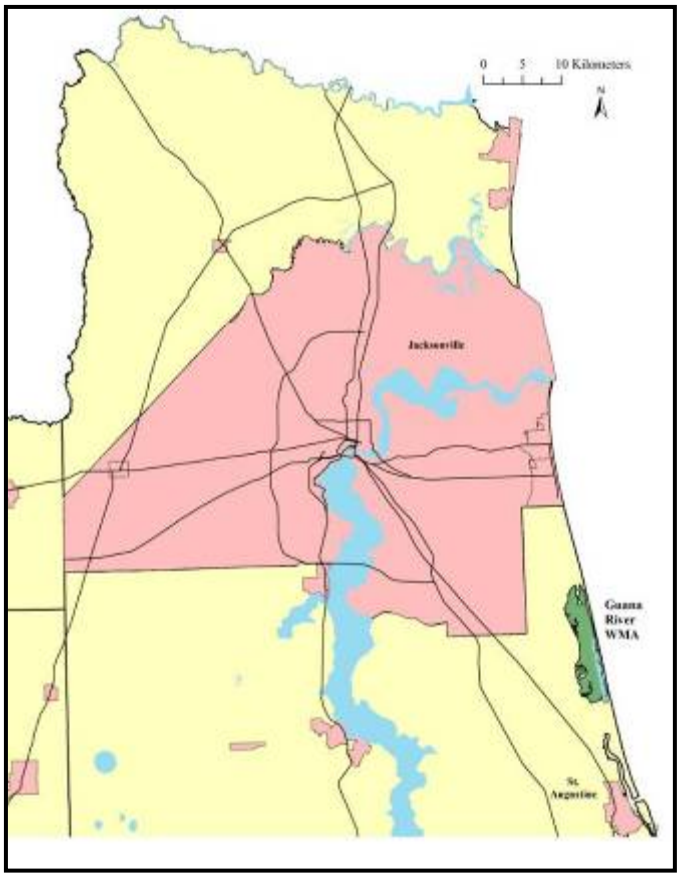

Figure 2. Location of Guana River Wildlife Management Area

The property has a history of intensive human alteration. In some areas, all the pine trees were harvested, ditches were constructed, and the land drained for cattle and hog grazing, and farming. Dikes, levees, and roads also were constructed. A dam was built across the Guana River in the mid 1900s in order to provide waterfowl and fish habitat upstream. Other water control structures were installed elsewhere on the property after the state purchased the land in 1984. Managers currently control the flow of water through these impoundments to achieve various wildlife habitat objectives.

The use of regular, prescribed fire on GRWMA has restored much of the landscape to near natural conditions. Most uplands and wetlands are benefiting from the frequent use

of prescribed fire. Much of the property is either in or nearing the management stage where prescribed fire becomes the only necessary management tool needed to maintain ecological integrity. The exception to this is in the northern quarter of the property, which is bordered by extensive suburban interface making prescribed burning more challenging.

METHODS

We conducted an initial meeting with GRWMA staff Justin Ellenberger, Wildlife Biologist III, to familiarize ourselves with land access, burning schedules, management priorities and concerns, and other pertinent issues.

We used Digital Orthophoto Quarter Quadrangles (DOQQs) and topographic maps to remotely identify potential ephemeral wetlands on the property. We identified and generated maps for 211 potential ephemeral wetlands. For this study, ephemeral wetlands were defined as depressional features containing wetland-indicating vegetation, isolated from much larger and deeper wetland strands, swamps, basins, lakes, or other more permanent wetlands. Unless specifically requested by a land manager, we did not visit wetlands surrounded by swampy lowlands such as hydric hammock and tidal marsh. No minimum or maximum size was required to designate a wetland as an ephemeral wetland, but this study focused on inventorying wetlands that were relatively small in size to assist land managers in potentially discovering wetlands that they formerly did not know existed.

We obtained a GIS location at each wetland using a TDS Recon 400x with a Garmin 10 Bluetooth. A quick assessment of wetland and surrounding upland conditions was conducted and recorded on an ephemeral wetland inventory datasheet (Appendix A) and entered into the Recon datalogger. Multiple photographs were taken of each wetland to provide a current "snapshot" of their physical appearance. Clarification of select data collected follows.

Wetland ID

Wetlands were given an ID that corresponds to the Management Unit (MU) number then the wetland number. For example, 03-02 is the second wetland inventoried in MU 3.

Wetland Type

We placed each wetland into one of 5 generalized categories based on descriptions from Ewel (1990), Kushlan (1990), and Whitney et al. (2004):

Marsh – dominated by herbaceous vegetation rooted in or emergent from shallow water - examples include basin, depressional, swales, and wet prairie
Shrub swamp – dominated by shrub or midstory woody vegetation
Forested swamp – forested or wooded wetland - examples include heads, bogs, domes, strands, and hammocks
Mixed swamp – forested wetland with a heavy shrub midstory
Altered – damaged wetland whose original ecological classification is unrecognizable - examples include drained, logged, or mechanically altered wetlands

Basin Area

Length and width of wetland were measured using a rangefinder, where feasible. Basin area was estimated in hectares using the measure tool and DOQQs in ArcMap.

Hydroperiod

Highly Ephemeral – wetlands with a very short hydroperiod, estimated to have standing water only a few months out of a year. Estimations are based on wetland vegetation and amount of standing water during site visit.

Ephemeral – wetlands with an intermediate hydroperiod, estimated to have standing water for up to 8-10 months out of a year. Estimations are based on wetland vegetation and amount of standing water during site visit.

Semi-permanent – wetlands with a long hydroperiod, estimated to have standing water for more than a year. Estimations are based on wetland vegetation and amount of standing water during site visit.

SITE ASSESSMENT

We began our inventory of wetlands on 16 April 2009 and completed the assessment on 17 May 2009. We ground truthed 211 potential wetlands and inventoried and assessed those determined to be ephemeral wetlands. We identified 134 ephemeral wetlands on GRWMA located in 21 of the 58 management units (Figure 3).

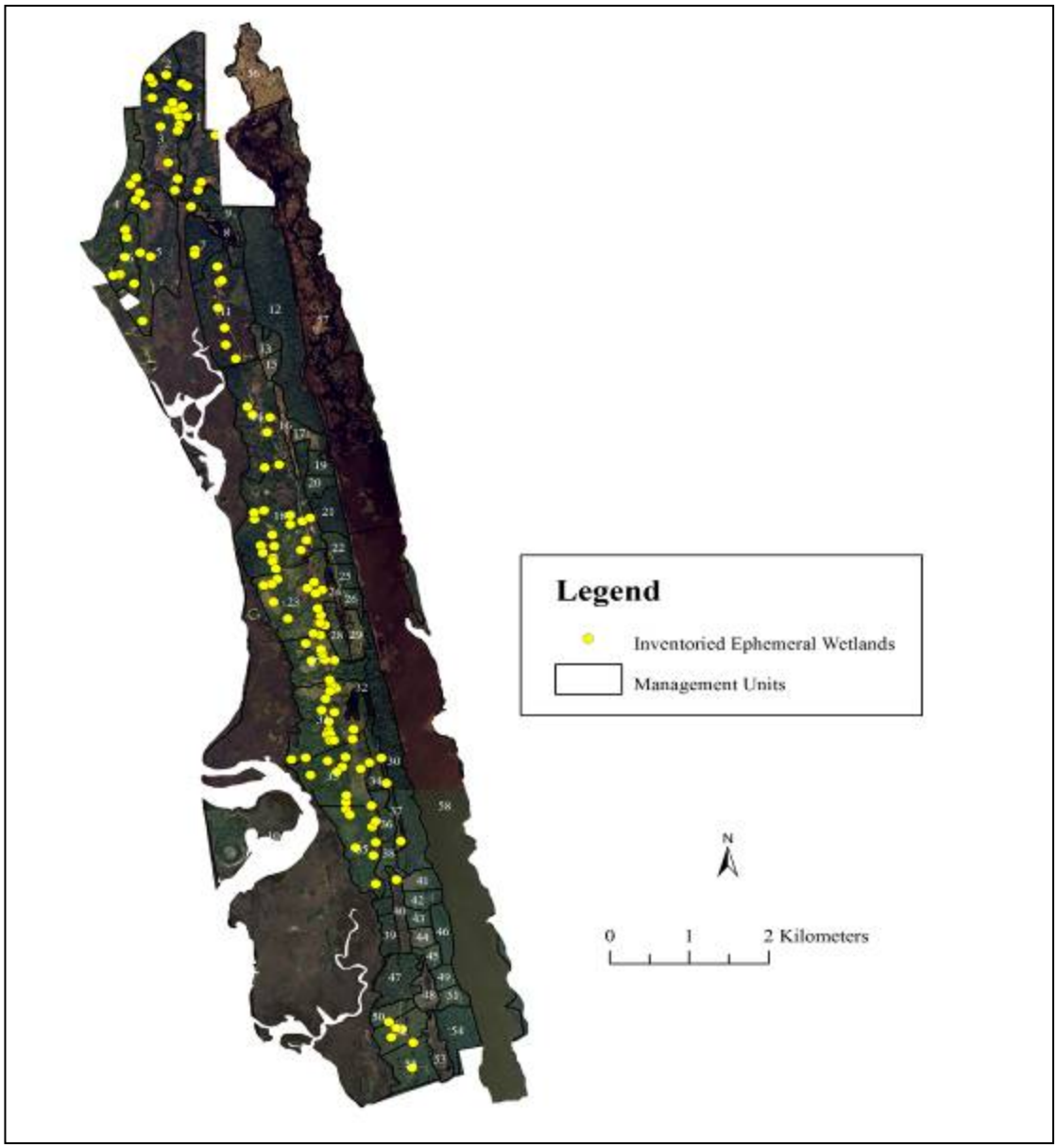

Figure 3. Map depicting the 134 ephemeral wetlands inventoried on GRWMA.

Overall, the ephemeral wetlands on GRWMA were in very good condition; there were no Wetland Concerns for 65% of wetlands on the property. Woody encroachment was the greatest concern and affected 21% of the wetlands. However, few of these wetlands were severely encroached and almost all were in the beginning stages of encroachment. The other most prevalent Wetland Concerns identified on the property were firelines (9 wetlands) and feral hog damage (5 wetlands). Berms, culverts, ditching, and dugouts also were noted but these disturbances affected ≤2 wetlands each.

Wetland Concerns

Wetland Concerns were identified for each wetland to highlight areas that may need to be addressed. When deciding what concerns to address, we first recommend using a landscape perspective. The condition of an individual wetland is not as important as the condition of the wetlands as a whole over the landscape. In addition, there is no universally-accepted target condition for every wetland. A mosaic of different wetland conditions is desirable and increases the diversity of the property. For example, if only 1 or 2 wetlands in an area are impacted by woody encroachment, WMA personnel may decide to address this concern by using general landscape management techniques such as periodic, prescribed fire. However, if multiple wetlands are impacted, it may signify a larger issue that may need to be addressed and/or the affected wetlands may need to be custom managed through vegetation removal, burning when the wetland is dry, removing fire breaks, etc. We provided a database for each property to facilitate the use of GIS to spatially identify problem areas (see Database section below).

Depending on resource constraints, landscape conditions, the presence of focal species, or other factors it may be more advantageous to manage at an individual wetland level. Therefore, we also provided restoration actions for each individual wetland. These actions may need to be prioritized (see Restoration Prioritization section below).

Below we detail the impacts of each Wetland Concern and how it pertains to GWMA. Not all Wetland Concerns were identified on each property but we included them as a reference for WMA personnel. Occasionally we note a Wetland Concern because it has the potential to become a problem in the future, not because it is a current issue (e.g. woody encroachment in Wetlands 35-02, 35-05)

Bedding

Historically, much of Florida's flatwoods were bedded in order to provide higher, less water-logged sites on which to plant pine trees. Sometimes bedding was constructed through the edge or center of wetlands. Typically this practice occurred with smaller wetlands. We generally recommend allowing bedding to erode over time. However, more severely damaged wetlands, such as those with severe feral hog damage or altered hydrology, may provide a good experimental situation for mechanically flattening bedding in or around a wetland basin when the wetland is dry. If bedding removal proves successful (i.e. retention of native wetland plants, maintenance of hydroperiod), the method could be used on other, less severely damaged wetlands to restore bedding impacts. In some cases we may recommend specific wetlands where

experimental bedding removal could be undertaken. All mechanical activity must be conducted when the wetland is completely dry to minimize soil damage and rut formation.

We encountered no wetlands impacted by bedding on GRWMA.

Cattle

Impacts of cattle grazing to a natural landscape in both wetlands and uplands include nutrient overloading from concentrated urine and feces, trampling, altering plant community structure, facilitation of invasive/exotic species colonization, and soil compaction. We recommend that cattle-grazing be phased out of WMAs altogether as part of a longer-term management strategy to maintain long-term ecological health of ephemeral wetlands and their surrounding uplands. Due to their affiliation with water sources, cattle are a danger to the ephemeral wetland community. If cattle cannot be removed from the property, we recommend continuing the current management practice of keeping them on habitat already degraded by past land use practices. Grazing densities should be kept as low as possible, particularly in MUs with ephemeral wetlands. The use of excluder fencing may be needed for severely damaged wetlands or wetlands with SGCN or other target species.

Cattle grazing is not permitted on GRWMA and we identified no wetlands affected by cattle.

Drainage Ditching, Culverts, Berms, and Roadside Ditching

Ditches have been used in Florida to drain wetlands for decades. Drainage ditches alter the hydrological regime, and therefore the ecological character, of a wetland over time. Culverts associated with wetlands generally are constructed for flood control and/or to drain the wetland or maintain the connectivity of a bisected wetland system. Culverts can allow for unnatural wetland floods or fish inoculations to occur within isolated wetlands. Berms are linear, earthen raised rows usually running parallel to a ditch. These features sometimes run near, through, or around wetlands Berms can alter wetland hydrology and provide a platform for the establishment of upland plant species through a wetland. Many times berms are created during road-building. The result is an elevated road with ditches on one or both sides of the road. In many cases, access roads run tangent to wetland edges, and have associated roadside ditches of varying depth and hydroperiod. Roadside ditches along wetland edges can provide an unnatural avenue for connectivity to other wetlands located along the road. Roadside ditches may also become refuges for fish if they are deeper with longer hydroperiods than the affected wetland.

It is important to break the connection between ditches and wetlands. We typically recommend filling in all drainage ditches, because it is likely that ditches affect the long-term hydrological regime of a wetland. If filling in the ditch is not an option, the ditch should be plugged as close to the wetland edge as possible.

In the case of roadside ditches tangent to isolated wetlands, we suggest experimental restoration of 1 or 2 wetlands. In order to preserve the drainage functionality of the ditches as well as sever the connectivity between ditches and wetland, 2 culverts could be employed to divert all water to the ditch on the opposite side of the road. The recipient ditch may need to be expanded to

accommodate the increase in flow. The modified ditch and culvert system would need to be monitored during heavy rains and, if successful, the method could be used property-wide. An explanatory diagram is provided as Appendix B.

Sometimes ditches themselves are ephemeral and the wetland does not appear to be hydrologically impacted by the ditch. Although priority should be given to filling/plugging deep ditches, we still recommend filling ephemeral ditches because there may be unseen effects difficult to ascertain in a short period of time without ecological monitoring.

We encountered 2 wetlands with berms, 1 wetland with a drainage ditch, and no wetlands affected by roadside ditching. We encountered 2 culverts on GRWMA that were functioning to drain the associated ephemeral wetland. We also encountered some culverts that that were functioning to maintain the connectivity of an ephemeral wetland to a larger wetland system, but we did not note them as Wetland Concerns. GRWMA personnel have restoration plans for many wetlands with associated culverts.

Dug-outs

Dug-outs are features that were created primarily to serve as watering holes for cattle. These structures commonly were excavated within already existing wetland basins. Dug-outs alter the original hydrology of the surrounding wetland by providing a deep, permanent water body that may harbor predatory fish in wetlands that otherwise would not support fish. The unnatural presence of fish in ephemeral wetlands makes them unsuitable for certain rare amphibian species to breed such as the striped newt, gopher frog, and ornate chorus frog (*Pseudacris ornata*).

We recommend that deep dug-outs within ephemeral wetland basins be filled and leveled with the surrounding wetland bottom in order to restore the natural topography and hydrology of the original wetland basin. Existing earthen mounds can be the fill material source. Established permanent wetland animals (e.g. fish, turtles, alligators) could be trapped and moved to other suitable natural wetlands prior to filling the dug-out. Wetland vegetation should quickly reestablish over the filled area.

We encountered 1 dug-out on GRWMA. The dug-out was eroding and did not appear to impact the ephemeral wetland.

Feral Hog Damage

Feral hogs (*Sus scrofa*) have occupied Florida for almost 500 years (Belden and Frankenberg 1977) and have been recorded in all 67 counties of the state (Layne 1997). Among exotic mammals in Florida, feral hogs have the most destructive impact on natural habitats (Layne 1997). The list of these impacts is long and includes preventing the natural regeneration of native plants such as the longleaf pine (Lipscomb 1989), facilitating the spread of exotic species (Jensen and Vosick 1994), adversely affecting soil microarthropods (Vtorov 1993), transmitting disease (Forrester 1991, Maffei 1997), destroying the nests of birds, turtles, and snakes (Maffei 1997), and affecting species composition (Randall et al. 1997). Habitat damage by feral hogs is most pronounced in wet environments (Choquenot et al. 1996). From an amphibian

conservation perspective, rooting and subsequent habitat alteration can destroy amphibian breeding habitat as well as upland refugia (Printiss and Hipes 2001, Means and Travis 2007). Foraging by feral pigs during amphibian breeding events has been observed and could result in the consumption of significant numbers of breeding adults (Jolley 2007).

Most land managers, biologists, and conservationists agree that feral hog reduction and removal should take place to reduce the many impacts hogs have on the natural environment. However, the removal of feral hogs from a property is problematic from both a political and ecological standpoint. The main political obstacle to hog removal often is a strong sport hunter's lobby. Even if managers decide to reduce or remove hog populations, it is extremely difficult to fully eradicate them due, in part, to their high fecundity and the substantial resources required for total eradication. However, it is possible to significantly reduce hog populations and their impacts on a landscape with the use of certain removal techniques.

Sport hunting and direct culling have been used with varied success (Belden and Frankenberger 1977, Ferriter et al. 1997, Engeman et al. 2007). Other possible techniques include fencing of wetlands or wetland clusters (Hone and Atkinson 1983, Lipscomb 1989) and immunocontraception (Killian et al. 2006). Trapping hogs in baited pen traps is one of the most successful techniques to reduce feral swine in a landscape (Engeman et al. 2007; D. Printiss, The Nature Conservancy, pers. com.).
In a study on Eglin Air Force Base, hogs were trapped and control hunted on a portion of the property closed to sport hunting where hog populations were relatively high (Engeman et al. 2007). In this study, hog populations and impacts to seepage slopes were dramatically reduced within the closed-to-hunting zone in the first year of hog removal and reduced further in subsequent years. Furthermore, reductions of hogs and impacts also occurred property-wide where hunting has taken place for decades. The researchers calculated economic valuations of seepage slopes and demonstrated substantial benefit-cost ratios to application of swine removal over a three-year period.

Funding to manage feral swine and restore habitat is finite and must be carefully managed to optimize the positive impact on the protected resources (Engeman et al. 2007). In spite of the difficulties encountered with feral hog removal, trapping and hunting can be used to successfully reduce hog populations and their impacts on a given property (e.g., Engeman et al. 2007).

On WMA's where hog populations are dense, sensitive areas that are sustaining heavy hog damage and areas with SGCN could be identified through ecological monitoring. Once identified, these areas could be targeted for hog removal as in the Engeman et al. (2007) study. Benefits mostly would occur in the targeted area, adjoining areas likely would also profit.

Feral hog damage was only evident in 5 of the 134 wetlands (4%) on GRWMA. All affected wetlands were concentrated on the north side of the property, in MUs 3, 4, and 6 (Figure 4). All the wetlands on the property were hydrated during the time of our visit; feral hog damage could have been more extensive. Based on our inventory, feral hogs do not appear to be a problem on this property at this time. We recommend monitoring feral hog damage in wetlands in this area to identify if more severe problems occur in the future.

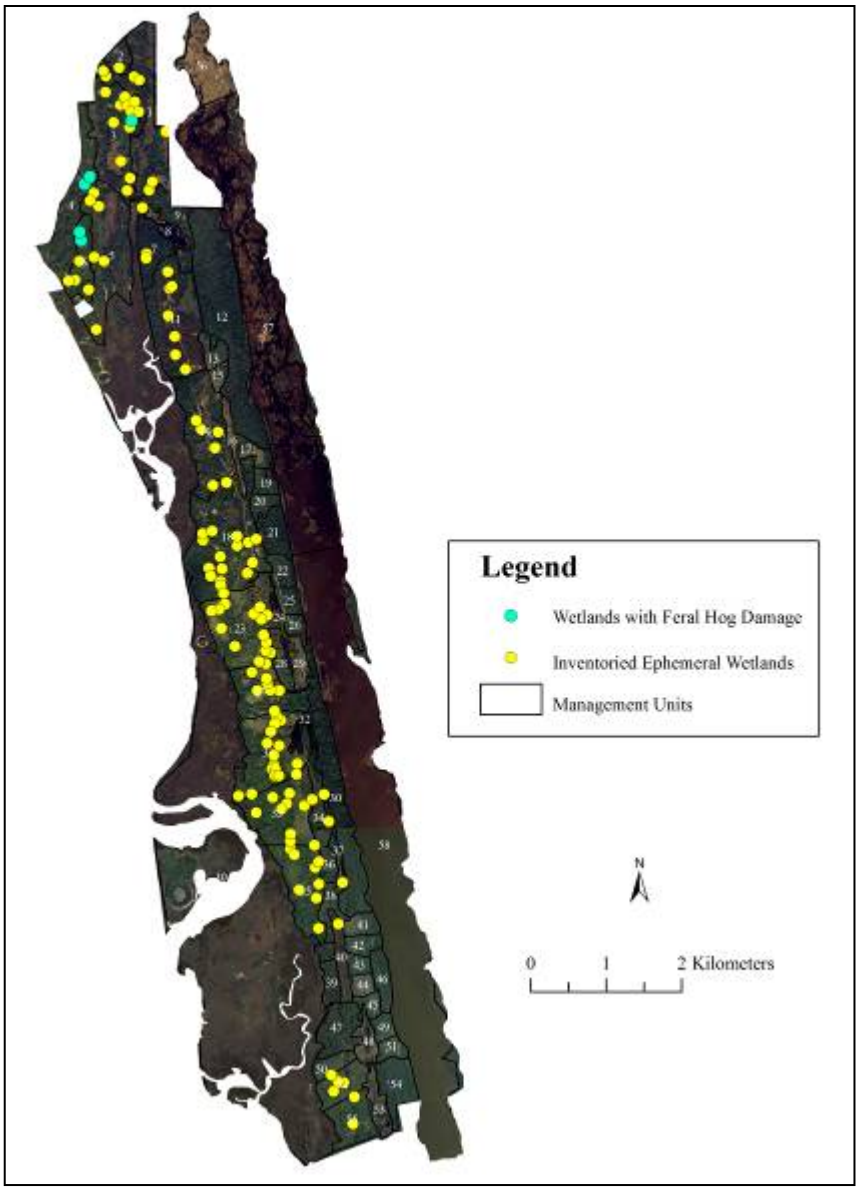

Figure 4. Map depicting the spatial extent of feral hog damage on GRWMA.

If feral hog damage increases, it may be necessary to take aggressive action in target areas. We recommend that trapping be used in combination with sport hunting and control hunting as a 3-pronged approach to reduce the impacts to ephemeral wetlands on these MUs. Hog-trapping can be conducted using WMA personnel or by soliciting the services of the US Department of Agriculture Wildlife Services, the federal agency responsible for managing conflicts with wildlife (Engeman et al. 2007, US Department of Agriculture 1997). To simultaneously provide hunting opportunities and reduce hog impacts to sensitive areas, hunting could take place year-round and in management units (MU's) that have fewer sensitive areas and SCGN while the most sensitive areas are targeted for hog removal.

Firelines/Management Unit Boundaries/Roads

The placement of firelines and roads through wetlands is detrimental to wetland habitat because the swath of exposed soil and denuded vegetation is a direct alteration of wetland habitat and can impact wetland hydroperiod. We recommend firelines and roads be rerouted at least 15m from a wetland edge to prevent damage to the wetland littoral zone. For wetlands that are located adjacent to MU boundaries, we recommend delineating the wetland edges with flagging or some other method so the machine operators will be alerted to diverge from their straight line paths.

We typically recommend allowing abandoned firelines to fill in with vegetation over time. However, WMA personnel have employed mechanical treatments to rework and restore fire plow lines in and around wetlands. Using a low-ground pressure bulldozer and disc for minimal ground disturbance, old wildfire suppression plow lines have been rehabilitated on CRWMA. WMA personnel have observed a more natural hydroperiod and the ability to reintroduce fire into the wetland basin (J. Slater, CRWMA, pers. com.). Firelines bisecting wetlands also have been reworked on GRWMA to address hydrological impacts (J. Ellenberger, GRWMA, pers. com.).

In some instances, a road does not appear to be negatively impacting a wetland and we do not recommend moving the road. In these cases, the action of re-routing a road might be more destructive than leaving it in place. Additionally, we recognize that there are cases where firelines and roads in or near wetlands cannot be rerouted. If firelines/roads cannot be moved, the affected wetlands can be monitored to ensure they burn periodically and do not become impacted by encroaching woody vegetation, sand run-off, or other disturbances. Firelines can be plowed and maintained when wetland is completely dry to prevent large ruts from developing. Vehicular traffic should be discouraged along these firelines.

Where MU boundaries mark a property line with a private landowner, we recommend contacting the private landowner to see if the MU boundary can be moved to encompass the entire wetland. If the wetland is of particular interest (surrounded by intact uplands, potential breeding location for striped newt, etc.), a land swap may be an option to acquire ownership of the entire wetland.

If the road cannot be re-routed, it may be appropriate to experiment with filling in a roadside ditch where it connects to the wetland (see Ditching section). More severely damaged wetlands provide a good opportunity for such an experiment. If successful at these wetlands, the method could be used on other, less severely damaged wetlands to restore ditch impacts. All activity must be conducted when the wetland is completely dry to minimize soil damage and rut formation.

Firelines and roads were not a widespread problem on GRWMA. We encountered 5 wetlands affected by firelines/MU boundaries and no wetlands affected by a road. See individual wetland characterization pages for details.

Herbaceous Plant Density

The herbaceous community within a wetland is in constant ecological flux. Between fire and inundation, the density of herbaceous vegetation changes over time. For example, immediately following a fire, standing crop biomass of herbaceous vegetation is almost or completely eliminated; however, roots, rhizomes, and seeds of these plants remain resident in the soil and regenerate quickly following fire. Over time, herbaceous vegetation grows back and, if too much time passes between fires or inundation, becomes extremely dense. Wetlands with dense herbaceous vegetation have low plant species diversity and often are completely dominated by one species, usually maidencane or sawgrass. Additionally, these wetlands provide poor habitat for amphibian reproduction and for other species.

For any given WMA property that has a multitude of isolated ephemeral wetlands, the optimum ecological condition is a mosaic of wetlands in different stages of flux. Unless multiple wetlands in an area exhibit dense herbaceous vegetation, long-term ecological fire management of the landscape is sufficient to favor ecological health of a single wetland. We highlight these wetlands so that WMA personnel can monitor their condition. If the condition becomes more severe over time, the wetland may need to be custom burned by waiting until the wetland is dry or intentionally lighting the wetland if a firebreak is present. Prescribed burning of a choked herbaceous marsh reduces vegetation density, increasing sunlight into the wetland ecosystem, and increases overall ecological productivity of the wetland.

We encountered no wetlands affected by dense herbaceous vegetation.

Logging

Old tree stumps or stump hummocks were observed in many ephemeral wetlands on multiple properties during this project, direct evidence of past logging practices. Most of the stumps appeared to be cypress. Sometimes, old logging stumps became hillocks or hummocks onto which woody shrubs established. This process was particularly prevalent on AWMA.

In most cases, stumps and hummocks were observed within swampy ephemeral wetlands that currently are forested by cypress trees. This indicates that the original plant community of the wetland reestablished after logging within the wetland basin. In some wetlands, dense brush established on the old stump hummocks and the cypress canopy did not reestablish. These wetlands became mixed shrub swamps or marshes.

We did not report logging as a Wetland Concern in the Wetland Characterization section because all the logging we encountered occurred long ago and most logged wetlands we observed had reforested. We did describe the presence of stumps or hummocks in the wetland description paragraph in an effort to be as descriptive as possible. In general, we do not recommend that any action be taken to remove old stumps or hummocks, unless they exist within a densely brushy wetland that is a candidate for experimental brush removal, or otherwise needs some other restoration attention. If a wetland becomes densely brushy, and this process is facilitated by the presence of stump hummocks, periodic fire should keep brush in check and stump hummocks should oxidize.

Planted Pine Trees

Public lands previously owned by timber companies often have evidence of past silviculture practices. Pine trees were planted through small wetland basins, often associated with bedding. Both the shade from the tree canopy and the needle duff can eliminate the herbaceous vegetation vital to the ecological health of a marsh. In most cases, we recommend removing the planted pines in an ephemeral wetland.

We encountered no wetlands impacted by planted pine trees on GRWMA

Push Piles

Push piles are earthen mounds commonly formed during the process of land clearing. Heavy machinery is used to scrape clean the harvested landscape. After tree removal, remaining limbs, branches, small trees and shrubs often are pushed into piles and prepared for elimination by burning. Sometimes push piles are not burned, but left behind. In either case, an earthen hillock usually is created in the process, and logged landscapes can have these so-called "push piles" present for decades. Push piles can be several feet high and dozens of feet in diameter. During logging operations of the 20th century, it was not uncommon for land clearing personnel to create push piles within dried ephemeral wetland basins.

Push piles in wetlands can alter the original wetland ecology in at least 2 ways. First, there is the issue of direct reduction of wetland habitat. Second, a raised pile of dirt in a wetland favors establishment of small upland habitats where upland plants and trees can grow. If allowed to grow to maximum height, upland trees (most frequently pines) can create a canopy over a potentially large portion of a wetland. If the wetland in question originally was a marsh, the problem mirrors that of woody encroachment into a marsh, namely the shading and subsequent exclusion of native herbaceous wetland vegetation.

Push piles are unnatural and undesirable structures in wetlands. Depending on severity, push piles in ephemeral wetlands should be removed mechanically or be allowed to erode over time, depending on the size and impact of a given pile. Small piles having little impact on a given wetland should be allowed to erode over time. Large push piles in wetlands that are significantly impacting a given wetland should be mechanically removed when the wetland basin is dry. The dirt and any established trees can be removed and distributed in nearby uplands in such a way as to not damage uplands. Alternatively, dirt from push piles could be used for other purposes such as road and ditch fill, etc. A pile should be removed down to the level of the rest of the wetland basin.

We encountered no wetlands affected by a push pile on GRWMA.

Slash

Slash is a term used to describe the treefall and brush byproducts of logging operations. After tree removal, slash is scraped into piles for burning or left to decompose, or the slash is scattered across the ground to decompose. Sometimes slash is left in a wetland. Unless it is a minor

amount, we do not recommend slash be left in a wetland. The slash we encountered within wetlands was usually a byproduct of recent mechanical tree thinning or brush removal as part of the restoration process. Depending upon the amount of brush left in a wetland, we recommend two different approaches to eliminate slash within wetlands.

If a significant portion of the wetland is covered with slash, the slash pile is dense, and/or mechanical treatment is needed for some other restoration concern, we recommend removal by root rake or mechanical means when the wetland is completely dry. Slash can be distributed in the uplands and should decompose and/or burn during the next prescribed fire. If the slash amount is minor and is not covering significant proportion of a wetland basin, we recommend encouraging fire in the wetland basin to eliminate the slash.

We encountered no wetlands affected by slash on GRWMA.

Upland Condition

Discussing upland management is beyond the scope of this project. However, we briefly characterized the uplands around each visited wetland. We used the phrase "Upland Condition" to identify wetlands surrounded by altered uplands or uplands needing restoration attention. When managing for the long-term ecological health of ephemeral wetlands, the ecological condition of surrounding uplands and upland corridors connecting multiple wetlands is equally important. For more information about wetland buffer zones, upland corridors and managing the uplands surrounding wetlands see Semlitsch and Jensen 2001, Semlitsch 2003, and Means 2008.

Upland condition was not an issue on GRWMA. The uplands were generally in fire-maintenance condition and appeared to be healthy, functioning flatwoods.

Vehicular Damage

Vehicles as a wetland concern usually are related to either recreational use or a result of mechanical activity related to vegetation clearing. Vehicles can impact ephemeral wetlands by compacting soil, destroying the wetland littoral zone, creating ruts that can alter hydrology, and/or facilitating the spread of invasive species. Additionally, the open soil left from vehicular damage can encourage further damage from feral hogs. In the case of recreational vehicles, gates, fencing, and road closures may be needed to reduce access and have been used successfully in some areas (C. Petrick, U.S. Forest Service, pers. com.).

In general, ruts and tracks can be left to erode and revegetate over time. If a wetland is highly damaged and mechanical activity is recommended for another reason, the vehicular damage could be treated mechanically. We acknowledge that some minor vehicular ruts may be created along the edge of wetlands while personnel are working to mechanically remove dense vegetation for the purpose of habitat restoration. To keep rut formation and soil damage to a minimum, all mechanical activity should be conducted when the wetland is completely dry.

We encountered no wetlands on GRWMA with vehicular damage.

Woody Vegetation Encroachment

Throughout the evolutionary history of the longleaf pine-wiregrass ecosystem, wildfires frequently occurred during the growing season and were common across the Florida landscape, particularly during dry periods (Means, 1996, Platt 1999). Since European colonization, humans have altered the natural fire regime in Florida by suppressing fire during the hot, dry growing season or, more recently, by prescribe burning during the dormant season. Suppressing fire during the growing season allows for dried, exposed wetland soils to be colonized by encroaching woody shrubs and trees. The practice of prescribed dormant season burning, while frequent, corresponds to the time when wetlands typically hold water, a condition which prevents thorough burning of wetlands. During this project, we have observed many ephemeral wetlands with dense, encroaching woody vegetation. This change in community structure has altered the fire feedback mechanism necessary to maintain a fire-adapted wetland community (Martin and Kirkman 2009).

The encroachment of woody vegetation usually manifests as a dense brush ring around the wetland edge, gradual encroachment from the wetland edge, and/or the colonization of plants throughout the wetland basin. Slash pine and wax myrtle are the two most predominant encroaching species into marshes we observed. These native Florida plant species normally occur in the upland/wetland ecotone and along the edge of wetlands and are maintained at low densities under a natural fire regime. However, during drought and fire suppression, these species can vigorously colonize open wetlands in unnaturally high densities along the edge and across the wetland basin. Once established, these species can shade out and exclude herbaceous vegetation, particularly in marshes.

Woody encroachment in marshes is considered on a case by case basis but generally we define it as having greater than 5% of the wetland basin covered by off-site, encroaching species that clearly have become established across the wetland basin during a dry period and fire suppression. Woody-encroached marshes should be managed in the short-term both by fire and other techniques that focus on the direct thinning of invading species. Encroaching woody vegetation in marshes, particularly slash pine and wax myrtle, should be addressed as soon as possible because succession and subsequent exclusion of marsh habitat can happen relatively quickly. Woody encroachment in a forested swamp is defined by having greater than 50% of the wetland midstory covered by shrubs.

There are some woody species that naturally grow in parts of marshes. Buttonbush, for example, is a wetland shrub that often becomes established in deeper sink depressions within marshes where a natural fire shadow exists in the wetland because of increased hydroperiod. Deep areas are less likely to burn over time because they are usually water-filled. These deep areas will and should burn during dry periods. Any native shrubs or trees that become established in the deepest part of a marsh should not be removed—prescribed fire alone is the proper management tool.

Our primary recommendation to reduce encroaching woody vegetation is the use of prescribed fire. If upland burning occurs during a period of wetland inundation, fire crews can return later in the year when the wetlands are dry and provide fire to any unburned wetlands. Because the

surrounding uplands will have little to no fuel load, a hot, ring fire can be ignited around the wetland basin, thereby improving chances the entire basin burns. This technique has been successful in restoring an herbaceous community to hardwood-encroached wetlands (C. Hess, USFS/FSU, pers. com.) and has been used successfully as a management technique (N. Dwyer, HMWMA, pers. com.). Sometimes specific attention to lighting fire at the edges or center of a wetland during regular upland burns may be all that is needed. If a fire shadow exists around the wetland, a combination of mowing and chopping of shrubs can be very effective to get fire into the wetland and change the vegetation composition, particularly with saw palmetto (J. Ellenberger, GRWMA, pers. com.).

We recognize that some wetlands are dominated by deciduous hardwoods that will not readily burn and there are cases with larger wetlands where hardwood encroachment is too extensive and/or budget or logistical constraints prevent the use of prescribed fire alone. Some of these wetlands provide a good experimental situation for mechanically removing the vegetation. If the desired results are achieved, the method could be used to restore other wetlands.

Below we provide alternative restoration recommendations for each of the 3 woody encroachment scenarios. These alternative recommendations should be used as a tool to return the wetland to a restored state, after which the wetland can be managed by fire alone. Martin and Kirkman (2009) were able to re-establish the herbaceous community-fire feedback mechanism in hardwood dominated wetlands by removing hardwoods and taking advantage of a persistent seed bank. Their paper is an important reference and represents one of the only published experiments on hardwood removal in southern ephemeral wetlands.

In cases where there is uncertainty about how to manage an impacted ephemeral wetland, we recommend acting on the side of caution and simply manage the surrounding landscape and associated wetlands with frequent prescribed fire. Assuming that everything else in the landscape is functioning close to naturally, frequent fire and periodic inundation will ultimately restore wetland function.

Dense brush rings occur when fire is not allowed to burn to the wetland edge, usually due to the presence of a fireline or because burning occurs when the wetland contains water. Mechanical removal can be used to reduce a thick and potential hazardous fuel load, after which the use of regular, growing-season fire can be used to maintain the natural ecology and prevent re-sprouting. Where mechanical treatment prior to burning is necessary, we recommend using a gyrotrack or bushog (mower). Single pass, single drum roller-chopping, followed by burning, also has successfully been used around wetland edges to reduce the midstory component while allowing grasses and herbs to germinate (J. Slater, CRWMA, pers. com.). All mechanical activity must be conducted when the wetland is completely dry to minimize soil disturbance and rut formation.

Woody vegetation encroaching from the wetland edge occurs during a dry period when the wetland is dry for an extended period of time. Woody vegetation (primarily pine and wax myrtle) from the surrounding uplands then has an opportunity to encroach and establish if fire is not allowed to burn into the wetland. Sometimes, there are large, mature slash and loblolly pines established around the outer wetland margin or in slightly elevated regions that connect multiple

depressions within a single large marsh. Large pines should be thinned and harvested using the least disruptive techniques to the wetland. Similarly, wax myrtle shrubs encroaching from the wetland edge can be thinned by chopping or bush hogging, depending on severity of encroachment. We recommend a single thinning of encroaching woody species per marsh in the short-term. After the thinning event, a marsh could be managed solely by periodic prescribed fires over the long-term.

Establishment of woody vegetation in a wetland basin also occurs during a dry period when the wetland is dry for an extended period of time accompanied by a lack of fire. In this scenario, woody vegetation (primarily slash pine trees and wax myrtle) sprouts and colonizes across the entire wetland basin, not just along the wetland edge. There are cases where simply hand chopping young slash pine trees will suffice in small wetlands. Very small pine trees and wax myrtle likely would be killed by the next inundation or fire. If the marsh is large, there are hundreds of invading slash pine trees or wax myrtle, and/or the dbh of the woody vegetation is too large then a bush hog or shredder may be more suitable.

As part of the restoration of a hydrologically modified wetland on GRWMA, approximately 12 ha of willow and wax myrtle were successfully treated using a shredder followed by the reintroduction of fire into the wetland basin (J. Ellenberger, GRMWA, pers. com.). On AWMA, where heavily encroached titi swamps were also impacted by hummocks and old push piles, a low ground pressure track hoe and dozer combination was used to remove the titi and thick organic material down to the mineral soil. The herbaceous vegetation response was variable but generally positive (M. Wilbur, AWMA, pers. com.). In severely disturbed wetlands with dense shrub encroachment Martin and Kirkman (2009) successfully used an industrial mower to remove all small saplings (up to 10 cm dbh) from wetland basins. Large trees can be removed by hand or girdled. Spot herbicide may be necessary on some tree species to prevent re-sprouting (Martin and Kirkman 2009).

All mechanical and herbicide treatments must be conducted when the wetland is completely dry to minimize soil damage and rut formation and to reduce the risk of herbicide entering the aquatic system. We were unable to locate any sufficient references that unequivocally show herbicides are safe in wetlands. We did find references related to the toxicity of herbicides to amphibians (Berrill et al. 1994, Cheek et al. 1999, Relyea 2005a, Relyea 2005b) as well as the long-term persistence of herbicides in soil (Bell 1997). Herbicide treatments should be selected as a last resort and used with extreme caution. Some general guidelines to follow include: minimizing non-target vegetation spread, using chemicals only on one patch of the site at a time and evaluating the impact, conducting treatments when the wetland during the dry season when the wetland is completely dry and not expected to hydrate, and using the chemical with the least impact. We found 3 publications that may be useful if herbicide is selected as a management tool: Langeland 2006, Ferrell et al. 2006, Langeland et al. 2009.

We encountered 28 wetlands (21%) on GRWMA impacted by some degree of woody encroachment. The majority of these wetlands are in the beginning stages of encroachment and just need to be monitored to ensure the next fire or inundation eliminates the encroaching vegetation. Over half of the 28 wetlands are in the 7 northern MUs that are closest to suburban development.

Restoration Prioritization

Because resources are finite, not all recommended restoration actions can be employed immediately. Ultimately, the prioritization of wetland restoration is up to the land manager and their objectives, resource availability, and logistical constraints. However, we provide here some general ideas to assist managers in prioritizing restoration of wetlands:

- Conduct biological surveys for rare species, particularly amphibians and other species dependent on ephemeral wetlands. Prioritize restoration actions based on the results of these surveys (i.e. feral hog control or other aggressive actions).
- Prioritize the filling of ditches that are either permanent or connect to permanent water sources over the filling of ephemeral ditches that connect to ephemeral water sources.
- Address woody encroachment in marshes before swamps because succession and subsequent exclusion of marsh habitat can happen relatively quickly.
- Consider resources required and condition of the uplands

Database

In addition to this report, a shapefile was provided that includes all the wetlands inventoried on the property. The shapefile includes an attribute table with fields associated with the following information:

- Wetland ID
- Wetland type
- Basin area
- Hydroperiod
- Canopy coverage (%)
- Dominant canopy species
- Midstory coverage (%)
- Dominant midstory species
- Herbaceous coverage (%)
- Dominant herbaceous species
- Herbaceous distribution
- Wetland concerns
- Upland community type
- Upland conditions

This database provides a quick reference for land managers to not only locate ephemeral wetlands on each property, but to know wetland attributes associated with each location and spatially identify major wetland concerns (e.g. Figure 4).

Wetland Characterizations and Descriptions

The following pages provide photographs and descriptions of the 134 ephemeral wetlands assessed on GRWMA. The MUs are organized numerically. The wetland nomenclature uses the MU number and the wetland number. For example, 01-03 is the third wetland inventoried in MU 1. Additional photographs were provided on the accompanying CD.

Wetland ID: 01-01

Description: This wetland is a 0.3 ha semi-permanent forested swamp. Gum trees dominate the canopy, and cover 50-75% of the wetland. The midstory is dominated by a mixture of wax myrtle, willow, and buttonbush, and covers 50- 75% of the wetland. Sawgrass grows throughout the wetland, and covers 50-75% of the basin. The vegetation in this swamp is diverse. The adjacent uplands are mesic hammock.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 01-02

Description: This wetland is a 1.0 ha ephemeral forested swamp. Gum and maple trees dominate the canopy, and cover 50-75% of the wetland. The midstory is dominated by wax myrtle and buttonbush, and covers 25-50% of the wetland. Sedges/grasses grow in scattered patches, and cover 5-25% of the wetland basin. This wetland was likely a marsh at one time but has succeeded to an open forested swamp. The adjacent uplands are mesic hammock.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 01-03

Description: This wetland is a 0.3 ha ephemeral marsh. There is no tree canopy or midstory cover. A diverse array of sedges/grasses grow throughout the wetland, and cover >75% of the wetland basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic and scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 01-04

Description: This wetland is a 0.2 ha ephemeral marsh. Small maple trees dominate the canopy, and cover 25-50% of the wetland. There is no midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This wetland is starting to show signs of the encroachment of woody vegetation. The adjacent uplands are mesic flatwoods and hammock.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure maple trees are killed with the next fire or inundation. If they become established, the trees will need to be removed from the wetland.

Wetland ID: 01-05

Description: This wetland is a 0.3 ha ephemeral marsh. Maple trees dominate the canopy, and cover 50-75% of the wetland. The midstory is dominated by small maple trees, and covers 25-50% of the wetland. Sedges/grasses grow throughout, and cover >75% of the wetland basin. Maple trees likely established in the wetland as a result of fire suppression and/or a long dry period. The adjacent uplands are mesic flatwoods and hammock.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure small maple trees are killed with the next fire or inundation. If they become established, the trees will need to be removed from the wetland. The larger trees likely are large enough to resist fire and will need to be removed.

Wetland ID: 01-06

Description: This wetland is a 0.2 ha ephemeral marsh. Small pine, sweet gum, and maple trees are beginning to encroach and cover 5-25% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are mesic flatwoods and hammock.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure trees are killed with the next fire or inundation. If they become established, the trees will need to be removed from the wetland.

Wetland ID: 01-07

Description: This wetland is a 0.3 ha ephemeral marsh. Small pine trees are beginning to encroach and cover 5-25% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure pine trees are killed with the next fire or inundation. If they become established, the trees should be removed from the wetland.

Wetland ID: 01-08

Description: This wetland is a 0.1 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses and redroot grow in scattered patches, and cover 5-25% of the wetland basin. This elongated wetland has been extensively damaged by feral hogs. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Feral hog damage

Restoration Action Recommended:

Wetland ID: 01-09

Description: This wetland is a 0.5 ha semi-permanent shrub swamp. Maple trees dominate the canopy, and cover 25-50% of the wetland. The midstory is dominated by small maple trees and wax myrtle, and covers 50-75% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This wetland appears to have been a marsh that is now succeeding to a maple-hardwood swamp. The adjacent uplands are a mixture of mesic and scrubby flatwoods and hammock.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Encourage periodic fire in the wetland to reduce the woody encroachment.

Wetland ID: 01-10

Description: This wetland is a 0.9 ha semi-permanent forested swamp. Maple and gum trees dominate the canopy, and cover >75% of the wetland. The midstory is dominated by wax myrtle and buttonbush, and covers 50-75% of the wetland. Sedges/grasses and emergent vegetation are sparse, and cover 5-25% of the wetland basin. The wetland appears to be a healthy, isolated swamp. The adjacent uplands are mesic flatwoods and hammock.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 01-11

Description: This wetland is a 0.8 ha ephemeral marsh. Willow grows in a deeper hole in the wetland center, and covers 25-50% of the wetland. Rush grows throughout the wetland, and covers >75% of the basin. This needle rush marsh appears to be a freshwater isolated wetland, but it may receive some brackish influence. The adjacent uplands are hardwood hammock.

Wetland Disturbance: None

Restoration Action Recommended: Monitor this wetland to ensure willow do not encroach into the wetland basin.

Wetland ID: 01-12

Description: This wetland is a 6.4 ha semi-permanent marsh. A mixture of wax myrtle, willow, buttonbush, and maple trees cover 5-25% of the wetland. Sedges/grasses and emergent vegetation grow throughout the wetland, and cover >75% of the basin. While this very large prairie marsh is in good condition, woody vegetation is beginning to encroach. The adjacent uplands are hammock.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure woody vegetation, especially maple trees, is killed with the next fire or inundation. If they become established, the shrubs will need to be removed from the wetland.

Wetland ID: 01-13

Description: This wetland is a 3.6 ha semi-permanent marsh. Small maple and gum trees are beginning to encroach, and cover 5-25% of the wetland. Sedges/grasses and rush grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are hammock.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Burning in the wetland is likely difficult due to the proximity of houses. If fire is not likely in the next year or two, the small trees could be hand-chopped from the wetland. Encourage fire to burn in the wetland basin, when conditions permit, to prevent further encroachment of woody vegetation.

Wetland ID: 02-01

Description: This wetland is a 1.2 ha ephemeral mixed swamp. Maple trees dominate the canopy, and cover 25-50% of the wetland. The midstory is dominated by willow and small maple trees, and covers 25-50% of the wetland. Sedges/grasses grow in scattered patches, and cover 25-50% of the wetland basin. Old berms and dug out areas are present in and around the wetland, but do not appear to be affecting the wetland health. The adjacent uplands are mesic flatwoods that were converted to a pine plantation. The uplands have been thinned and burned in order to restore them to a more open flatwoods community.

Wetland Disturbance: Berm, Dug-out

Restoration Action Recommended: None

Wetland ID: 02-02

Description: This wetland is a 0.2 ha ephemeral marsh. Small maple trees are beginning to encroach, and cover 5-25% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are mesic flatwoods that were converted to a pine plantation. The uplands have been thinned and burned in order to restore them to a more open flatwoods community.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure maple trees are killed with the next fire or inundation. If they become established, the trees will need to be removed from the wetland.

Wetland ID: 02-03

Description: This wetland is a 0.1 ha ephemeral marsh. Gum trees dominate the canopy, and cover 25-50% of the wetland. The midstory is dominated by small gum trees, and covers 25-50% of the wetland. Sedges/grasses grow in scattered patches, and cover 50-75% of the wetland basin. This marsh will likely succeed to a gum pond if fire remains absent from the wetland. The adjacent uplands are mesic flatwoods that were converted to a pine plantation. The uplands have been thinned and burned in order to restore them to a more open flatwoods community.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Encourage fire to burn in the wetland during the next prescribed burn to prevent further encroachment of gum trees.

Wetland ID: 03-01

Description: This wetland is a 0.1 ha ephemeral marsh. An unidentified shrub is the dominant woody vegetation, and covers 25-50% of the wetland. Grass clumps grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are mesic flatwoods that were converted to a pine plantation. The uplands have been thinned and chopped in order to restore them to a more open flatwoods community.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Encourage fire to burn in the wetland during the next prescribed burn to reduce shrub encroachment

Wetland ID: 03-02

Description: This wetland is a 1.0 ha semi-permanent marsh. Buttonbush is the dominant woody vegetation, and covers 5-25% of the wetland. Sedges/grasses and emergent vegetation grow throughout the wetland, and cover >75% of the basin. This large marsh has a high diversity of herbaceous vegetation. The wetland just burned during the recent prescribed fire treatment and appears to be in great ecological condition. The adjacent uplands are a mix of scrubby flatwoods and an old pine plantation.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 03-03

Description: This wetland is a 0.2 ha ephemeral marsh. There is no tree canopy or midstory cover in the wetland, although a few small trees are beginning to encroach. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are mesic flatwoods and hammock. The uplands recently were mowed in preparation for a prescribed burn.

Wetland Disturbance: None

Restoration Action Recommended: Monitor this wetland to ensure the small trees are killed with the next fire or inundation. If they become established, the trees may need to be removed from the wetland.

Wetland ID: 03-04

Description: This wetland is a 0.2 ha ephemeral marsh. Small gum trees cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. A recent fire burned into the wetland edges. The adjacent uplands are mesic and scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: This wetland is in the very early stages of succeeding to a gum swamp. To maintain this wetland as a marsh, monitor to ensure gum trees do not become established. The trees could be removed from the wetland if they are not killed by the next fire.

Wetland ID: 03-05

Description: This wetland is a 0.4 ha semi-permanent marsh. There is no tree canopy or midstory cover. Sedges/grasses and emergent vegetation grow throughout the wetland, and cover >75% of the basin. A culvert drains the wetland under the adjacent road to the east side. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Culvert

Restoration Action Recommended: It appears this culvert is functioning to drain the wetland rather than maintaining connectivity to a larger system. We recommend removing the culvert to restore the wetland's hydrology.

Wetland ID: 03-06

Description: This wetland is a 6.2 ha semi-permanent marsh. Buttonbush and small maple trees are the dominant woody vegetation, and cover 5-25% of the wetland. Sedge/grass, sawgrass, and emergent vegetation grow throughout the wetland, and cover >75% of the basin. This very large prairie marsh has diverse herbaceous vegetation. A recent fire burned into the wetland basin. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 04-01

Description: This wetland is a 0.7 ha ephemeral marsh. Persimmon is beginning to encroach, and covers 5-25% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. There is some feral hog damage in the wetland. The adjacent uplands are mesic and scrubby flatwoods.

Wetland Disturbance: Feral hog damage, Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure persimmons are killed with the next fire or inundation. If they become established, the trees should be removed from the wetland.

Wetland ID: 04-02

Description: This wetland is a 0.3 ha ephemeral marsh. Buttonbush is the dominant woody vegetation, and covers 5-25% of the wetland. There is moderate feral hog damage in the wetland. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. There is a moderate amount of hog rooting in the wetland. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Hog damage

Restoration Action Recommended:

Wetland ID: 05-01

Description: This wetland is a 0.2 ha ephemeral marsh. There is no tree canopy or midstory cover. Rushes grow throughout the wetland, and cover >75% of the basin. This healthy, isolated marsh may have some brackish influence. This wetland is in fire-maintenance condition. The adjacent uplands are mesic flatwoods and hammock.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 05-02

Description: This wetland is a 0.6 ha semi-permanent shrub swamp. Maple and willow dominate the canopy, and cover 5-25% of the wetland. The midstory is dominated by willow, buttonbush, and small maples, and covers >75% of the wetland. Rushes, sedge/grass, and emergent vegetation grow in scattered patches, and covers 25-50% of the wetland basin. This wetland may once have been a marsh but has succeeded to a shrub swamp. During times of high rainfall, this wetland will connect to Wetland 05-03. The adjacent uplands are mesic flatwoods and hammock. Fire in the uplands is less frequent here than in most other management units.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: None. We believe that this wetland was once a marsh; however, it has succeeded to a healthy looking shrub swamp. Because there are so many healthy marshes on the GRWMA landscape, it would be an inefficient use of resources to restore this wetland. Fire will no longer carry easily through this wetland basin so mechanical removal of woody shrubs/trees would be necessary in order to restore this wetland back to a marsh. We recommend nothing here beyond simply keeping the wetland and surrounding landscape fire-maintained.

Wetland ID: 05-03

Description: This wetland is a 0.9 ha semi-permanent shrub swamp. Maple trees dominate the canopy, and cover 25-50% of the wetland. The midstory is dominated by willow, buttonbush, wax myrtle and small maples, and covers >75% of the wetland. Sedges/grasses grow in scattered patches, and cover 5-25% of the wetland basin. This wetland may once have been a marsh but has succeeded to a shrub swamp. During times of high rainfall, this wetland will connect to wetland 05-02. The adjacent uplands are scrubby flatwoods and hammock.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: None. We believe that this wetland was once a marsh; however, it has succeeded to a healthy looking shrub swamp. Because there are so many healthy marshes on the GRWMA landscape, it would be an inefficient use of resources to restore this wetland. Fire will no longer carry easily through this wetland basin so mechanical removal of woody shrubs/trees would be necessary in order to restore this wetland back to a marsh. We recommend nothing here beyond simply keeping the wetland and surrounding landscape fire-maintained.

Wetland ID: 05-04

Description: This wetland is a 1.2 ha semi-permanent forested swamp. Maple trees dominate the canopy, and cover >75% of the wetland. The midstory is dominated by buttonbush and small maples, and covers 5-25% of the wetland. Sedges/grasses and sawgrass grow in scattered patches, and cover 5-25% of the wetland basin. This wetland may once have been a marsh but has succeeded to a forested swamp. The adjacent uplands are hammock.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: None. We believe that this wetland was once a marsh; however, it has succeeded to a healthy looking shrub swamp. Because there are so many healthy marshes on the GRWMA landscape, it would be an inefficient use of resources to restore this wetland. Fire will no longer carry easily through this wetland basin so mechanical removal of woody shrubs/trees would be necessary in order to restore this wetland back to a marsh. We recommend nothing here beyond simply keeping the wetland and surrounding landscape fire-maintained.

Wetland ID: 05-05

Description: This wetland is a 0.1 ha ephemeral marsh. There is no tree canopy or midstory cover. Rushes and sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is located at the head of a tidal strand that becomes brackish to the south. This wetland is in fire-maintenance condition. The adjacent uplands are hammock.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 05-06

Description: This wetland is a 0.2 ha ephemeral marsh. There is no tree canopy or midstory cover. Rushes and sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are hammock.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 06-01

Description: This wetland is a 0.2 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 06-02

Description: This wetland is a 0.2 ha ephemeral marsh. Persimmon is the dominant woody vegetation, and covers 5-25% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure persimmons are killed with the next fire or inundation. If they become established, the trees should be removed from the wetland.

Wetland ID: 06-03

Description: This wetland is a 0.2 ha ephemeral marsh. There is no tree canopy or midstory cover. Grasses grows throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 06-04

Description: This wetland is a 0.4 ha ephemeral marsh. There is no tree canopy or midstory cover. Grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic and scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 06-05

Description: This wetland is a 0.9 ha ephemeral marsh. Gum trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. Hog damage is light around the wetland edge. This marsh is in fire-maintenance condition. The adjacent uplands are mesic and scrubby flatwoods.

Wetland Disturbance: Hog damage

Restoration Action Recommended:

Wetland ID: 06-06

Description: This wetland is a 0.6 ha ephemeral marsh. There is no tree canopy or midstory cover. Grasses grow throughout the wetland, and cover >75% of the basin. Hog rooting is fairly widespread between the grass clumps. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby and mesic flatwoods.

Wetland Disturbance: Hog damage

Restoration Action Recommended:

Wetland ID: 07-01

Description: This wetland is a 0.1 ha ephemeral marsh. Pine trees grow in a ring around the wetland, and cover 5-25% of the basin. The midstory is dominated by buttonbush, and covers 5-25% of the wetland. Sedges/grasses grow in scattered patches, and cover 50-75% of the wetland basin. The adjacent uplands are mesic hammock. The mesic hammock in this area looks to have once been a pine forest that has succeeded to more hammock conditions in the absence of fire. The wetland appears to be quite healthy despite upland fire-suppression.

Wetland Disturbance: None

Restoration Action Recommended: The uplands around this wetland do not appear to burn regularly. This wetland may need to be custom burned to prevent woody vegetation from encroaching.

Wetland ID: 07-02

Description: This wetland is a 0.1 ha highly ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. The midstory is dominated by young pine trees, and covers 5-25% of the wetland. Sedges/grasses grow in scattered patches, and covers 25-50% of the wetland basin. We observed old pine stumps in the wetland. The adjacent uplands are mesic hammock. The mesic hammock in this area looks to have once been a pine forest that has succeeded to more hammock conditions in the absence of fire.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Encourage periodic fire in the wetland to prevent further encroachment of woody vegetation. Alternatively, the pine trees can be hand-chopped from the wetland interior.

Wetland ID: 09-01

Description: This wetland is a 0.4 ha ephemeral marsh. Buttonbush, willow, and wax myrtle are the dominant woody vegetation, and cover 5-25% of the wetland. Sedges/grasses and rush grow throughout the wetland, and cover >75% of the basin. This wetland may occasionally have some brackish influence. The adjacent uplands are mesic hammock. The uplands around this wetland do not appear to burn as frequently as in other MUs on the property.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Because the adjacent uplands burn infrequently, custom burning of this wetland may be necessary to prevent further woody encroachment. Alternatively, the woody vegetation could be hand thinned.

Wetland ID: 11-01

Description: This wetland is a 0.4 ha ephemeral marsh. Gum trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 11-02

Description: This wetland is a 1.4 ha semi-permanent marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedge/grass, rushes, and emergent vegetation grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 11-03

Description: This wetland is a 0.2 ha ephemeral marsh. Pine trees grow in a ring around the wetland, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 11-04

Description: This wetland is a 0.3 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 11-05

Description: This wetland is a 1.6 ha ephemeral marsh. Pine trees dominate the canopy, and cover 25-50% of the wetland. There is no midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. A culvert under the adjacent road connects this wetland to a larger swamp to the east. It appears this culvert maintains connectivity that was severed when the road was built. There is an old fireline/ditch on the south side of the wetland and evidence of past mechanical activity around this wetland. The wetland may have been enhanced decades ago by prior landowners. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor the pine trees in the wetland. If they begin to shade out the herbaceous vegetation, the pine trees should be thinned. Allow the old fireline/ditch to continue to erode.

Wetland ID: 11-06

Description: This wetland is a 0.3 ha semi-permanent man-made wetland. Pine trees grow in a ring around the wetland, and cover 5-25% of the basin. There is no midstory cover and no herbaceous vegetation. This man-made circular pond is ringed with a 4 foot high berm. The pond likely dates back to cattle ranching days, created as a water source. It currently functions as an ephemeral, isolated wetland, with a fairly long hydroperiod. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Berm

Restoration Action Recommended: There are several management/restoration options. First, this wetland could be left alone to function as it is currently. However, if the management objective for the property is to return the landscape to the most natural condition, then we recommend either of the following additional restoration options. A more ephemeral wetland could be created by dozing the berm flat and pushing much of the dirt inward to partially fill the pond basin while still leaving an upland strip between 11-05 and 11-06. Or, the berm could be totally removed and this wetland could be allowed to connect with nearby 11-05.

Wetland ID: 11-07

Description: This wetland is a 0.3 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover 50-75% of the basin. This wetland likely was human-enhanced but it currently functions as an ephemeral wetland. There are many signs of past mechanical activity and pine thinning. It appears these disturbances were associated with restoration activities. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None.

Wetland ID: 14-01

Description: This wetland is a 1.5 ha semi-permanent marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedge/grass, fern, and emergent vegetation grow throughout the wetland, and cover >75% of the basin. A recent fire burned through the wetland basin. The adjacent uplands are mesic and scrubby flatwoods that were converted to a pine plantation. The uplands have been thinned and burned to restore them to a more open flatwoods community.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 14-02

Description: This wetland is a 0.1 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover 50-75% of the basin. There is a dirt berm on the east side of the wetland. A recent fire burned through the wetland basin. The adjacent uplands are mesic and scrubby flatwoods that were converted to a pine plantation. The uplands have been thinned and burned to restore them to a more open flatwoods community.

Wetland Disturbance: Berm

Restoration Action Recommended: The berm could be removed, eliminating a potential movement barrier for amphibians and other small animals.

Wetland ID: 14-03

Description: This wetland is a 0.5 ha ephemeral marsh. There is no canopy cover. Muscadine grape dominates the midstory, and covers 25-50% of the wetland. Sedges/grasses and emergent vegetation grow in scattered patches, and cover 25-50% of the wetland basin. A recent fire burned through the wetland basin. This wetland may have formed from a mechanically formed dug-out. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Encourage periodic fire in the wetland to reduce the dense brush.

Wetland ID: 14-04

Description: This wetland is a 0.1 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 14-05


Description: This wetland is a 6.5 ha semi-permanent marsh. Willow is the dominant woody vegetation, and covers 5-25% of the wetland. Sedges/grasses and emergent vegetation grow throughout the wetland, and cover >75% of the basin. This elongated wetland contains multiple ephemeral depressions that all connect during high water. There is a culvert leading under the road on the south side of the wetland. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: We discussed with GRWMA personnel their plans to replace the culvert draining the wetland with flash boarding. The flash boarding could then be lowered to drain the wetland as needed for burning or other management purposes. We agree with these plans but caution that the wetland could become more permanent if the flash boarding remains in place for a long time.

Wetland ID: 18-01

Description: This wetland is a 0.5 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-02


Description: This wetland is a 3.1 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. Young pine trees around the wetland edge form the midstory, and cover 5-25% of the wetland. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. A fireline bisects the top lobe of the wetland. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Fireline

Restoration Action Recommended: Re-routed the fireline around the top of the marsh. The old fireline should restore over time.

Wetland ID: 18-03

Description: This wetland is a 1.3 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses and maidencane grow throughout the wetland, and cover >75% of the basin. A fireline bisects the northern tip of the marsh. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Fireline

Restoration Action Recommended: Consider re-routing the fireline if it is a necessary attribute to the property. If the fireline cannot be re-routed, the wetland may need to be custom burned in if the fireline prevents fire from burning the wetland during an upland burn. This does not appear to have been a problem thus far, but is something to keep in mind in the future.

Wetland ID: 18-04

Description: This wetland is a 0.4 ha semi-permanent forested swamp. Cypress trees dominate the canopy, and cover >75% of the wetland. The midstory is dominated by wax myrtle, and covers 5-25% of the wetland. There is no herbaceous vegetation. This swamp connects to a much larger swamp to the north and east. The adjacent uplands are mesic flatwoods and hammock.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-05

Description: This wetland is a 0.3 ha ephemeral marsh. Pine trees grow in a ring around the wetland, and cover 5-25% of the basin. There is no midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods and hammock.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-06

Description: This wetland is a 0.4 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-07

Description: This wetland is a 0.3 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. Young pine trees are beginning to encroach, and cover 5-25% of the wetland. Sedges/grasses grow throughout, and cover 50-75% of the wetland basin. This pineland marsh has nice, open water areas with herbaceous vegetation. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure encroaching pine trees are killed with the next fire or inundation. If they become established, the trees will need to be removed from the wetland.

Wetland ID: 18-08

Description: This wetland is a 0.1 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. Young pine trees and an unidentified shrub are beginning to encroach, and cover 5-25% of the wetland. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure encroaching pine trees are killed with the next fire or inundation. If they become established, the trees will need to be removed from the wetland.

Wetland ID: 18-09

Description: This wetland is a 0.4 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-10

Description: This wetland is a 0.8 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic and scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-11

Description: This wetland is a 1.5 ha semi-permanent marsh. There is no tree canopy or midstory cover. Sedges/grasses and emergent vegetation grow throughout the wetland, and cover >75% of the basin. This wetland appears to be human-enhanced, or was a borrow pit, but is now a functioning ephemeral wetland with diverse herbaceous vegetation. The adjacent uplands are scrubby flatwoods and lowland.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-12

Description: This wetland is a 1.5 ha ephemeral forested swamp. Cypress and pine trees dominate the canopy, and cover >75% of the wetland. The midstory is dominated by wax myrtle, and covers 5-25% of the wetland. Fern grow throughout the wetland, and cover >75% of the basin. The pine needle duff is thick on the wetland floor. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-13

Description: This wetland is a 0.2 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-14

Description: This wetland is a 0.2 ha ephemeral marsh. Buttonbush is the dominant woody vegetation, and covers 5-25% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods that were converted to a pine plantation. The uplands have been thinned and burned to restore them to a more open flatwoods community.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-15

Description: This wetland is a 0.9 ha semi-permanent marsh. Gum trees dominate the canopy, and cover 5-25% of the wetland. The midstory is dominated by buttonbush, and covers 5-25% of the wetland. Sedge/grass, maidencane, and emergent vegetation grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods that were converted to a pine plantation. The uplands have been thinned and burned to restore them to a more open flatwoods community.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 18-16

Description: This wetland is a 0.1 ha ephemeral shrub swamp. Pine trees dominate the canopy, and cover 5-25% of the wetland. Gallberry is encroaching into the wetland, and covers 50-75% of the basin. Sedges/grasses and fern grow throughout the wetland, and cover 50-75% of the basin. It appears this wetland was human-enhanced on the north side; an old dig hole or scrape is still evident. The adjacent uplands are mesic flatwoods that were converted to a pine plantation. The uplands have been thinned and burned to restore them to a more open flatwoods community.

Wetland Disturbance: Mechanical activity; Woody encroachment

Restoration Action Recommended: Allow the old scrape hole to erode. Encourage periodic fire to reduce the encroaching gallberry.

Wetland ID: 18-17

Description: This wetland is a 0.6 ha ephemeral marsh. Cypress and pine trees dominate the canopy, and cover 25-50% of the wetland. The midstory is dominated by wax myrtle and small pine trees, and covers 25-50% of the wetland. Sedges/grasses and fern grow throughout, and cover 50-75% of the wetland. The north side of the wetland is marsh and the southern half if forested swamp. Pine trees are beginning to encroach in the marsh basin. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Encourage periodic fire in the wetland to prevent further encroachment of woody vegetation. Alternatively, the pine trees can be hand-chopped from the wetland interior.

Wetland ID: 23-01

Description: This wetland is a 0.2 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover 50-75% of the basin. This marsh may be a human created depression but now it is functioning as an ephemeral wetland. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 23-02

Description: This wetland is a 0.5 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 23-03

Description: This wetland is a 0.7 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 23-04

Description: This wetland is a 0.4 ha ephemeral marsh. Small pine trees are beginning to encroach into the wetland, and cover 5-25% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure pine trees are killed with the next fire or inundation. If they become established, the encroaching pine trees will need to be removed from the wetland.

Wetland ID: 23-05

Description: This wetland is a 1.2 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. Small pine trees are beginning to encroach into the wetland, and cover 5-25% of the basin. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor this wetland to ensure pine trees are killed with the next fire or inundation. If they become established, the encroaching pine trees will need to be removed from the wetland.

Wetland ID: 23-06

Description: This wetland is a 0.7 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. Small pine trees are beginning to encroach into the wetland, and cover 5-25% of the basin. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: If the next fire or inundation does not kill the encroaching pine trees, they may need to be hand-chopped from the wetland interior.

Wetland ID: 23-07

Description: This wetland is a 0.4 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 23-08

Description: This wetland is a 0.3 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Fern grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 23-09

Description: This wetland is a 2.8 ha semi-permanent marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 23-10

Description: This wetland is a 3.2 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. The midstory is dominated by buttonbush and fetterbush, and covers 5-25% of the wetland. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. A previous fire killed the large pines growing in the wetland. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 23-11

Description: This wetland is a 0.7 ha semi-permanent shrub swamp. Buttonbush and fetterbush are the dominant woody vegetation and cover >75% of the wetland. Emergent vegetation is sparsely distributed, and covers 5-25% of the wetland. This wetland has a long hydroperiod and therefore does not burn frequently. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 23-12

Description: This wetland is a 0.3 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. There is a fireline around the north side of the wetland. The fireline does not appear to be affecting the fire return interval at this wetland. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Fireline

Restoration Action Recommended: If the fireline is a necessary attribute to the property, re-route it away from the wetland.

Wetland ID: 23-13

Description: This wetland is a 0.3 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses and maidencane grow throughout the wetland, and cover >75% of the basin. This marsh will connect to Wetland 23-12 during periods of high water. This wetland is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 23-14

Description: This wetland is a 0.3 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This wetland is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 27-01

Description: This wetland is a 1.3 ha ephemeral marsh. Pine trees dominate the canopy, and cover 25-50% of the wetland. There is no midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby and mesic flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor the pine trees in the wetland. If they begin to shade out the herbaceous vegetation, the pine trees should be thinned from the wetland interior.

Wetland ID: 27-02

Description: This wetland is a 0.9 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby and mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 27-03

Description: This wetland is a 0.5 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby and mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 27-04

Description: This wetland is a 0.5 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby and mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 27-05

Description: This wetland is a 0.1 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover 50-75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby and mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 27-06

Description: This wetland is a 0.3 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby and mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 27-07

Description: This wetland is a 0.7 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 27-08

Description: This wetland is a 0.3 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-01

Description: This wetland is a 0.4 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses and sawgrass grow throughout the wetland, and cover >75% of the basin. A recent fire burned through the wetland basin and new herbaceous shoots are sprouting. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-02

Description: This wetland is a 0.1 ha ephemeral borrow pit. Pine trees dominate the canopy, and cover 25-50% of the wetland. There is no midstory cover. Sedges/grasses are sparsely distributed, and cover 5-25% of the wetland basin. This man-made pond is functioning as an ephemeral wetland. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: If GRWMA personnel wish to improve this borrow pit, the pine trees could be removed from the wetland interior. The removal of trees will reduce the shading effect and encourage the grow of more herbaceous vegetation.

Wetland ID: 31-03

Description: This wetland is a 0.1 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are densely stocked mesic and scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-04

Description: This wetland is a 0.3 ha ephemeral marsh. There is no tree canopy or midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. There is a fireline along the northern edge of the wetland. The wetland basin of this marsh burned recently and has new herbaceous shoots sprouting. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Fireline

Restoration Action Recommended: Re-routed the fireline away from the wetland.

Wetland ID: 31-05

Description: This wetland is a 0.2 ha ephemeral marsh. There is no tree canopy or midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. A recent fire burned through the wetland basin and killed the encroaching slash pine saplings. The adjacent uplands are mesic and scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-06

Description: This wetland is a 0.2 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-07

Description: This wetland is a 0.2 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sawgrass grows throughout the wetland, and covers 50-75% of the basin. An old fireline is still evident along the west side of the wetland. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Fireline

Restoration Action Recommended: None. Allow the old fireline to fill in with vegetation over time.

Wetland ID: 31-08

Description: This wetland is a 0.5 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sawgrass and maidencane grow in scattered patches, and cover 50-75% of the wetland basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic and scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-09

Description: This wetland is a 0.3 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sawgrass grows throughout the wetland, and covers 50-75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic and scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-10

Description: This wetland is a 0.1 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses, fern, and pickerelweed grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-11

Description: This wetland is a 0.7 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. A fireline bisects the north end of the wetland. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Fireline

Restoration Action Recommended: Re-route the fireline away from the wetland.

Wetland ID: 31-12

Description: This wetland is a 0.4 ha ephemeral marsh. There is no tree canopy or midstory cover. Some small pines are beginning to encroach on the south side of the wetland but cover <5% of the wetland basin. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are mesic and scrubby flatwoods

Wetland Disturbance: None

Restoration Action Recommended: Continue ensuring that fire burns in the wetland basin to prevent young pine trees from establishing.

Wetland ID: 31-13

Description: This wetland is a 0.2 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. A recent fire burned through the wetland and killed some established pine trees. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-14

Description: This wetland is a 0.2 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses and fern grow throughout the wetland, and cover >75% of the basin. The area appears to have been fire-suppressed but recent burns are restoring the wetland and eliminating encroaching pines. The adjacent uplands are mesic and scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-15

Description: This wetland is a 0.1 ha ephemeral marsh. There is no tree canopy or midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. This wetland is directly adjacent to the brackish Tolomato River (Intracoastal Waterway). This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 31-16

Description: This wetland is a 0.4 ha ephemeral marsh. Wax myrtle is the dominant woody vegetation and covers 5-25% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. A recent fire burned entirely through the wetland, killing some large, encroaching wax myrtles. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 33-01

Description: This wetland is a 0.4 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. This wetland is half in MU 33 and half in MU 35. This marsh is in fire-maintenance condition. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 33-02

Description: This wetland is a 0.3 ha ephemeral marsh. There is no tree canopy or midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. A recent fire burned entirely through the wetland, killing some small, encroaching shrubs and pine trees. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 33-03

Description: A <0.1 ha ephemeral shrub swamp. Loblolly bay trees dominate the canopy, and cover 25-50% of the wetland. The midstory is dominated by fetterbush, and covers >75% of the wetland. There is no herbaceous vegetation. Fire does not appear to have burned in this wetland for a long time. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Custom burn this to reduce the dense brush.

Wetland ID: 33-04

Description: This wetland is a 0.1 ha highly ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sedges/grasses grow throughout the wetland, and cover 50-75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 33-05

Description: This wetland is a 0.2 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sawgrass and maidencane grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 33-06

Description: This wetland is a 0.4 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. There is a fireline along the north side of the wetland. A fire recently burned through the wetland basin. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Fireline

Restoration Action Recommended: The fireline obviously is not impacting the fire periodicity of this wetland. However, we recommend firelines be routed away from wetlands.

Wetland ID: 33-07

Description: This wetland is a 0.1 ha ephemeral shrub swamp. Pine trees dominate the canopy, and cover 5-25% of the wetland. The midstory is dominated by fetterbush, and covers >75% of the wetland. There is no herbaceous vegetation. Fire does not appear to have burned in this wetland for a long time. The adjacent uplands are mesic flatwoods. The uplands show no signs of fire suppression.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Custom burn this wetland to reduce the dense brush.

Wetland ID: 33-08

Description: This wetland is a 0.2 ha ephemeral marsh. There is no tree canopy or midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. A fire recently burned through the wetland basin. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 33-09


Description: This wetland is a 0.1 ha ephemeral marsh. Pine trees dominate the canopy, and cover 25-50% of the wetland. There is no midstory cover. Sedges/grasses are sparsely distributed, and cover 5-25% of the wetland. A fireline bisects the wetland. A fire recently burned through the wetland. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Fireline, Woody encroachment

Restoration Action Recommended: The fireline obviously is not impacting the fire periodicity of this wetland. However, we recommend firelines be routed away from wetlands. The pine trees in the wetland interior could be removed to reduce shading and allow for the growth of more herbaceous vegetation.

Wetland ID: 33-10

Description: This wetland is a 0.5 ha semi-permanent shrub swamp. Gum and pine trees dominate the canopy, and cover 5-25% of the wetland. The midstory is dominated by buttonbush and fetterbush, and covers 50-75% of the wetland. Sawgrass grows in scattered patches, and covers 5-25% of the wetland basin. This wetland has areas of thick brush and areas of open marsh. A recent fire burned through half of the wetland basin. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 35-01

Description: This wetland is a 0.6 ha ephemeral marsh. Wax myrtle is the dominant woody vegetation and covers 5-25% of the wetland. Rush, sedges/grasses, and sawgrass grow throughout the wetland, and cover >75% of the basin. A recent fire burned through the wetland, and killed the encroaching wax myrtle. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 35-02

Description: This wetland is a 1.0 ha ephemeral marsh. Pine trees dominate the canopy, and cover 25-50% of the wetland. There is no midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. This wetland connects with Wetland 35-03 during periods of high water. A fire recently burned through the wetland and new sawgrass shoots are sprouting. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor the pine trees in the wetland. If they begin to shade out the herbaceous vegetation, the pine trees should be thinned from the wetland interior.

Wetland ID: 35-03

Description: This wetland is a 0.2 ha ephemeral marsh. There is no tree canopy or midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. This wetland connects with Wetland 35-02 during high water periods. A fire recently burned through the wetland and new sawgrass shoots are sprouting. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 35-04

Description: This wetland is a 1.8 ha semi-permanent marsh. Buttonbush is the dominant woody vegetation, and covers 5-25% of the wetland. Sedges/grasses and sawgrass grow in scattered patches, and cover 50-75% of the basin. This long, strand wetland has lily pads in the center. A fire recently burned through the wetland. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 35-05

Description: This wetland is a 0.4 ha ephemeral marsh. Pine trees dominate the canopy, and cover 25-50% of the wetland. There is no midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. This wetland connects with Wetland 35-06 during periods of high water. A fire recently burned through the wetland and new sawgrass shoots are sprouting. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: Monitor the pine trees in the wetland. If they begin to shade out the herbaceous vegetation, the pine trees should be thinned from the wetland interior.

Wetland ID: 35-06

Description: This wetland is a 1.4 ha semi-permanent marsh. There is no tree canopy or midstory cover. Sawgrass, maidencane, and sedges/grasses grow throughout the wetland, and cover >75% of the basin. This wetland connects with Wetland 35-05 during periods of high water. A fire recently burned through the wetland and new herbaceous shoots are sprouting. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 35-07

Description: This wetland is a 0.5 ha ephemeral marsh. There is no tree canopy or midstory cover. Sawgrass grows throughout the wetland, and covers >75% of the basin. A fire recently burned through the wetland and new sawgrass shoots are sprouting. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 35-08

Description: This wetland is a 0.7 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. There is no midstory cover. Sawgrass and maidencane grow throughout the wetland, and cover >75% of the basin. A fire recently burned through the wetland and new herbaceous shoots are sprouting. The adjacent uplands are mesic flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 37-01

Description: This wetland is a 0.5 ha semi-permanent marsh. There is no tree canopy or midstory cover. Sedges/grasses, maidencane, and emergent vegetation grow throughout the wetland, and cover >75% of the basin. This deeper wetland is the southern-most depression in a long, elongated strand. During periods of high water, all 3 of the wetlands identified in this MU will connect. The adjacent uplands are scrubby flatwoods and hammock.

Wetland Disturbance: None

Restoration Action Recommended: J. Ellenberger informed us that it was difficult to get a fire into the wetland because it is surrounded by scrub, which is burned every 6 years. Currently, the wetland appears to be very healthy. In the future, the wetland may need to be custom burned if the upland burn cycle is too long and woody vegetation encroaches.

Wetland ID: 37-02

Description: This wetland is a 0.5 ha ephemeral marsh. Pine trees dominate the canopy, and cover 5-25% of the wetland. Small pines trees are beginning to encroach, and cover 5-25% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This wetland is the northern most depression in a long, elongated strand. During periods of high water, all 3 of the wetlands identified in this MU will connect. The adjacent uplands are scrubby flatwoods and hammock.

Wetland Disturbance: Woody encroachment

Restoration Action Recommended: J. Ellenberger informed us that it was difficult to get a fire into the wetland because it is surrounded by scrub, which is burned every 6 years. This depression has burned in the past, but is encircled by a dense brush ring and pine trees are beginning to encroach. In the future, the wetland may need to be custom burned if the upland burn cycle is too long and woody vegetation encroaches.

Wetland ID: 37-03

Description: This wetland is a 1.3 ha semi-permanent marsh. There is no tree canopy or midstory cover. Sedges/grasses and emergent vegetation grow throughout the wetland, and cover >75% of the basin. During periods of high water, all 3 of the wetlands identified in this MU will connect. The adjacent uplands are scrubby flatwoods and hammock.

Wetland Disturbance: None

Restoration Action Recommended: J. Ellenberger informed us that it was difficult to get a fire into the wetland because it is surrounded by scrub, which is burned every 6 years. Currently, the wetland appears to be very healthy. In the future, the wetland may need to be custom burned if the upland burn cycle is too long and woody vegetation encroaches.

Wetland ID: 40-01

Description: This wetland is a 0.7 ha ephemeral marsh. The area is managed for turkeys and is burned annually. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. There are numerous pine stumps across the wetland. There is a ditch on the south end of the wetland that has a water control box. A recent fire burned through the wetland basin. The adjacent uplands are scrubby flatwoods. The area is managed for turkeys and is burned annually.

Wetland Disturbance: None

Restoration Action Recommended: We acknowledge the water in this wetland is controlled for wildlife management purposes.

Wetland ID: 50-01

Description: This wetland is a 0.6 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. A fireline bisects the middle of the wetland. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: Fireline

Restoration Action Recommended: Re-route the fireline away from the wetland.

Wetland ID: 52-01

Description: This wetland is a 2.5 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 52-02

Description: This wetland is a 0.3 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. A recent fire burned through the wetland basin, and killed some encroaching slash pine trees. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 52-03

Description: This wetland is a 1.5 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

Wetland ID: 55-01

Description: This wetland is a 2.7 ha ephemeral marsh. Wax myrtle, fetterbush, and small redbay are the dominant woody vegetation, and covers 5-25% of the wetland. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: Monitor this wetland to ensure the shrubs do not become established and further encroach.

Wetland ID: 55-02

Description: This wetland is a 0.5 ha ephemeral marsh. There is no tree canopy or midstory cover. Sedges/grasses grow throughout the wetland, and cover >75% of the basin. This marsh is in fire-maintenance condition. The adjacent uplands are scrubby flatwoods.

Wetland Disturbance: None

Restoration Action Recommended: None

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Appendix A. Wetland Survey Form.

Management Area:_____ Date:_____ Wetland ID:_____ Photos:_____

Wetland Basin Assessment

Wetland Type:
___Marsh ___Shrub swamp ___ Forested swamp ___Mixed swamp
___Altered ___Other:

Basin area:_____

Hydroperiod: ___Highly Ephemeral ___Ephemeral ___Semi-Perm

% Canopy Cover:
___<5% ___5-25% ___25-50% ___50-75% ___>75%

Dominant Canopy:
___N/A ___Cypress ___Gum ___Pine ___Cypress/gum
___Holly ___Cypress/pine ___Cypress/holly ___Gum/pine ___Gum/holly
___Holly/pine ___Other:

Sub-canopy Cover:
___<5% ___5-25% ___25-50% ___50-75% ___>75%

Dominant Sub-canopy:
___N/A ___Wax Myrtle ___Willow ___Titi ___Buttonbush ___Fetterbush
___Gallberry ___Holly ___Other:

% Herbaceous Cover:
___<5% ___5-25% ___25-50% ___50-75% ___>75%

Dominant Herbaceous Groundcover:
___N/A ___Maidencane ___Sphagnum ___Rush ___Sedge/Grass
___Sawgrass ___Emergents ___Fern ___Redroot ___Other:

Herbaceous Distribution:
___Sparse ___Ring around edge ___ Scattered patches ___Throughout ___Other:

Wetland Restoration Concerns:
___Hog damage ___Logging ___Slash ___Ditching ___Woody Encroachment
___Choked w/herb. ___Fireline ___Cattle ___Invasive Species ___Push Piles
___Bedding ___Desiccation ___Vehicular ___Other:

Comments:

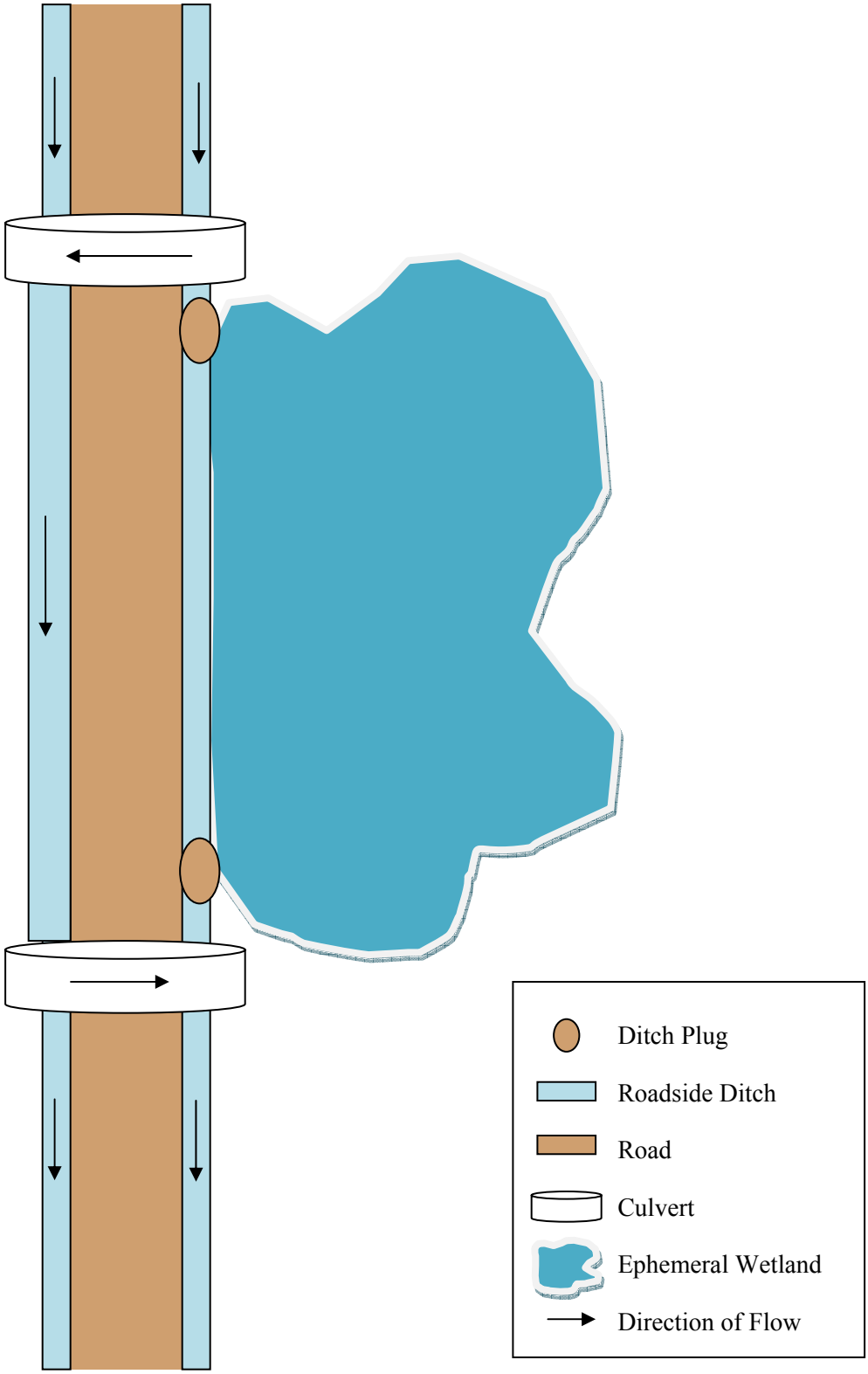
Upland Assessment

Surrounding Community Type:
___Mesic flatwoods ___Wet flatwoods ___Scrubby flatwoods ___Upland pine forest
___ Wet prairie ___Pasture ___Old field ___Sandhill ___Other:

Upland Condition:
___Fire suppressed ___Has burned ___Old bedding ___Pine plantation
___Hog damage ___Invasive species ___Grazing ___Other:

Comments:

Appendix B. Suggested method to break connectivity between an ephemeral wetland and tangent roadside ditch. This method is recommended as an experimental approach to restore the hydrology of wetlands connected to permanent ditches.



Appendix C. Scientific names of common plants encountered during this project, listed alphabetically by common name.

Bahia grass	*Paspalum notatum*
Black gum	*Nyssa sylvatica*
Broomsedge	*Andropogon sp.*
Buttonbush	*Cephalanthus occidentalis*
Cogongrass	*Imperata cylindrica*
Cordgrass	*Spartina sp.*
Corkwood	*Leitneria floridana*
Dog fennel	*Eupatorium capillifolium*
Fetterbush	*Lyonia lucida*
Gallberry	*Ilex glabra* (short gallberry), *Ilex tomentosa* (tall gallberry)
Hackberry	*Celtis sp.*
Japanese climbing fern	*Lygodium japonicum.*
Laurel oak	*Quercus laurifolia*
Lizard's tail	*Saururus cernuus*
Loblolly bay	*Gordonia lasianthus*
Maidencane	*Panicum hemitomon*
Muscadine grape	*Vitis rotundifolia*
Myrtle-leaved holly	*Ilex myrtifolia*
Persimmon	*Diospyros virginiana*
Pickerelweed	*Pontederia cordata*
Pond cypress	*Taxodium ascendens*
Red bay	*Persea borbonia*
Redroot	*Lachnanthes caroliniana*
Sawgrass	*Cladium jamaicense*
Sand pine	*Pinus clausa*
Slash pine	*Pinus elliottii*
Smartweed	*Polygonum hydropiperoides*
St. Johns wort	*Hypericum spp.*
Sweet gum	*Liquidambar styraciflua*
Sweet bay magnolia	*Magnolia virginiana*
Titi	*Cliftonia monophylla* (black titi), *Cyrilla racemiflora* (swamp titi),
Torpedograss	*Panicum repens*
Wax myrtle	*Myrica cerifera*