



**IMC-AGRICO COMPANY  
WETLAND RAPID ASSESSMENT PROCEDURE  
(IMC-WRAP)**

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## PREFACE

The IMC-Agrico Wetland Rapid Assessment Procedure (IMC-WRAP) is an adaptation of the South Florida Water Management District Wetland Rapid Assessment Procedure (SFWMD WRAP) that customizes the assessment procedure to better fit the landform, vegetative cover, hydrology, and water quality issues encountered when regulatory agency applications are being considered for phosphate mining and reclamation sites in central Florida. IMC-WRAP was developed after teams comprised of representatives of the U.S. Army Corps of Engineers, the Florida Department of Environmental Protection, and IMC-Agrico field tested the SFWMD WRAP on lands proposed for phosphate mining in Hardee and DeSoto Counties, Florida. The conclusions reached during these field tests were that: (1) the SFWMD WRAP can be an effective tool to facilitate the regulatory evaluation of functional assessment for phosphate mining applications and mitigation sites; and (2) the usefulness of the SFWMD WRAP for evaluating phosphate-related sites can be improved by focusing the scoring matrix and related instructions upon the conditions found on unmined and reclaimed lands in central Florida instead of the broader set of development and mitigation scenarios found across the entire SFWMD. This manual is the result of a joint agency / IMC-Agrico effort to produce such a customized IMC-WRAP.

It is important for users of this IMC-WRAP manual to recognize that much of the following text is a verbatim reproduction of the SFWMD Technical Publication REG-001 and that wetland evaluators should first fully comprehend REG-001 before attempting to utilize IMC-WRAP. It is also important to credit the efforts of the SFWMD WRAP development workgroup and the authors of SFWMD Technical Publication REG-001 because their work product forms the basis for IMC-WRAP as well.

All parts of the SFWMD WRAP that have been modified are shown in italics.

## **IMC-AGRICO WETLAND RAPID ASSESSMENT PROCEDURE (IMC-WRAP)**

### **FIELD MANUAL**

#### **1.0 INTRODUCTION**

*United States Army Corp of Engineer's (USACOE) representatives responsible for reviewing IMC-Agrico's applications for Section 404 Dredge & Fill (D&F) approvals have concluded that the Wetland Rapid Assessment Procedure (WRAP) developed by the SFWMD in 1997 is the best methodology available for conducting functional assessments of the wetlands present on the Ona and Pine Level tracts. During a week long field test of WRAP at Ona, Pine Level, and other IMC-Agrico wetland mitigation sites, USACOE representatives concluded that the SFWMD WRAP is an effective wetland functional assessment tool, but that the scoring procedure should be customized to improve its precision, accuracy, and, therefore, usefulness during the upcoming project permitting process.*

*This IMC-WRAP field manual is a reproduction of the SFWMD WRAP manual (SFWMD Technical Publication REG-001), edited to incorporate the two key changes made following the August 1998 USACOE field trials held at IMC-Agrico. Specifically, the water quality input and treatment (WQIT) variable scoring procedure (Sections 2.2.6.1 and 2.2.6.2 of SFWMD Publication REG-001) has been rewritten to reflect specific land use related pollutant loading rates for the specific FLUCFCS classifications that exist prior to mining and following reclamation in lieu of the more general land use categories applied by SFWMD in WRAP. Also, water quality treatment is addressed differently in the IMC-WRAP than the SFWMD WRAP.*

*The remaining SFWMD WRAP variables have not been changed, meaning that Sections 2.0 through 2.2.5.2 of the SFWMD WRAP manual remain essentially the same in the IMC-WRAP. However, throughout these sections, the IMC-WRAP manual incorporates additional guidance, explanatory notes, and evaluation considerations specific to the central Florida phosphate region or to reclaimed phosphate land characteristics. Wherever such comments appear or other modification were made, the sentence is in italicized font to indicate to the user that these notations are what distinguish the IMC-WRAP from the SFWMD WRAP.*

*The user is cautioned that the IMC-WRAP may not be the most appropriate tool for performing functional assessments of wetlands in areas outside the central Florida phosphate regional setting and for purposes other than phosphate mine permitting.*



## 2.0 METHODOLOGY

The *SFWMD* WRAP incorporates concepts from the U.S. Fish and Wildlife Service's "Habitat Evaluation Procedures" (HEP, 1980) and the South Florida Water Management District's "Save Our Rivers Project Evaluation Matrix" (SOR, 1992). *The IMC-WRAP likewise incorporates these concepts.*

Ecological communities (i.e., pine flatwoods, wet prairie, cypress dome, etc.) and their associated attributes provide food, cover and breeding sites for a variety of flora and fauna. The holistic concept of HEP is used to evaluate entire systems-both upland and wetland - and their interactive associations. HEP is based on the assumption that the value of a habitat can be evaluated at the species level by using a set of measurable variables that are important for a particular species. The use of HEP is restricted by the number of species models that have been developed and those species chosen for evaluation.

The SOR matrix was developed as a method of evaluating habitats to prioritize the allocation of taxpayer dollars toward acquisition, restoration and management of sensitive lands. The matrix is used to evaluate sites using variables such as water management value, water supply potential, site manageability, habitat and species diversity, connectiveness, rare and endangered species, site vulnerability and human use.

The U.S. Fish and Wildlife Services "Habitat Suitability Index" was utilized in determining specific habitat requirements for the fauna of Florida. This information has been included in Appendix A (Species Habitat Requirement Table) as a resource for evaluating the wildlife utilization variable of the *SFWMD* WRAP; *Appendix A also applies to the IMC-WRAP.* In addition, community profiles for sites to be evaluated using the *SFWMD* WRAP are described in Appendix B. Common freshwater fishes and aquatic insect taxa associated with the specific habitats are found in Appendices C and E respectively. *Appendices A, B, C and E of the SFWMD WRAP appendices have been revised to be applicable to the IMC-WRAP. Appendix D was determined to be applicable in its original form.*

*IMC-WRAP* variables include the following:

- C Wildlife Utilization
- C Wetland Overstory/Shrub Canopy of Desirable Species
- C Wetland Vegetative Ground Cover of Desirable Species
- C Adjacent Upland/Wetland Buffer
- C Field Indicators of Wetland Hydrology
- C Water Quality Input

## 2.1 METHODOLOGY FOR USING IMC-WRAP - OFFICE EVALUATION

The *IMC-WRAP* evaluator completes the following steps before leaving the office:

1. Identify the project site. Acquire an aerial map for field use and delineation of the project boundaries.
2. Identify land uses adjacent to the project site *using the 1985 FLUCFCS codes listed in the Glossary.*
  - a. Identify developmental encroachment and type.
  - b. Identify adjacent natural areas and plant communities using aerial photography.
  - c. Identify roads, canals, and other features (i.e., wellfields, etc.) potentially isolating or impacting the site.
  - d. Identify any water quality pretreatment systems.
3. Identify wetland areas within the project site.
  - a. Label wetland areas for future *IMC-WRAP* scoring.
  - b. Utilize soil maps to verify or identify depressional map units that may not be readily apparent from aerial maps.
  - c. Identify wetland types (i.e., cypress domes, wet prairie, etc.) if possible. This may need to be done at the time of the site visit.
  - d. *Identify type and extent of wetland buffer(s); identify if buffer is a component of a wildlife corridor (FDEP IHN, State Greenways Plans, etc.).*
  - e. Identify access points to wetland areas.
  - f. Identify canals and ditches adjacent to the wetland areas.
  - g. Set up potential transects through wetland ecotypes. Transects would be warranted if a particular wetland exhibited a number of vegetative community types. The transects could then be used for future monitoring events.
  - h. Identify any wildlife studies that have been conducted on the site or on adjacent areas.

In addition, the evaluator should review on-site hydrology, site management, maintenance plans, seasonal variability, droughts, fire and excessive rainfall and any other pertinent information.

### FIELD EVALUATION

1. *Visually inspect 100% of wetland signatures as determined by color infrared aerial photography.*
2. *Field inspect the perimeter of the wetland and conduct pedestrian transects, as necessary, to adequately evaluate each of the six assessment variables.*
3. *Mark the locations of all field pedestrian transects in red on the 1"=200' aerial*

*photograph. Also mark on the aerial photograph points where notations of exceptional importance on the FDEP field data sheets were observed.*

1. ~~Walk a minimum of 50% of the wetland perimeter.~~
2. ~~Visually inspect 100% of the wetland perimeter.~~
  - a. Look for signs of wildlife utilization (tracks, scats, etc.) including direct observations.
  - b. Identify plant community composition (visual estimate) using predetermined transect (if necessary).
    1. Conduct a visual estimate of the plant species coverage and composition (including exotic and nuisance plants) for the wetland and adjacent areas.
    2. Note any shifts in plant communities such as encroachment of upland or transitional plant species into the wetland.
  - c. Identify any hydrologic indicators present (see Glossary for list).
3. Document field observations on field data sheet (Section 2.3.1) to establish baseline information for future reference.

## **IMC-WRAP SCORE**

Score each wetland for the six variables using the guidelines presented below:

### **2.2 METHODOLOGY FOR SCORING AND ASSESSING HABITAT VARIABLES**

Methodology for the Habitat Assessment Variable, is a series of discussions - one for each IMC-WRAP assessment variable. Following each description is a matrix containing a set of calibration descriptions and corresponding score points. A score of 3 is considered the best a system can function and 0 is for a system that is severely impacted and is exhibiting negligible attributes.

Each system must be evaluated on its own attributes and is not to be compared to a different type of system (i.e., wet prairie vs. marsh vs. cypress dome). An evaluator also has the option to score each parameter in half (0.5) increments. This provides the flexibility to score a variable that is not accurately described or fitted by the calibration description. Half increments are utilized on the point scale from 0.5 through 2.5.

If any variable does not apply to the habitat being rated, then the designation “NA” (not applicable) can be applied. When the designation “NA” is used for a specific variable it is omitted from the final calculations used to rate the habitat.

Each applicable variable is scored: the scores are totaled ( $3V$ ) and then  $3V$  is divided by the *total of the Sum of maximum possible scores for the rated variables ( $3V_{max}$ )*. The final rating score for “Habitat Assessment Variables” will be expressed numerically with a number between 0 and



1. The final rating score can be expressed mathematically as follows:

$$\text{IMC-WRAP Score} = \frac{\text{Sum of the scores for the rated variables (V)}}{\text{Sum of maximum possible scores for the rated variables (Vmax)}}$$

Also expressed as: =

$$\frac{3V}{3V_{\text{max}}}$$

### 2.2.1.1 WILDLIFE UTILIZATION

#### Introduction

Wetlands provide many species of wildlife with basic life sustaining needs such as water, food (i.e., macroinvertebrates and other wetland dependent species including plants) and nesting and roosting areas. While some animal species prefer uplands for nesting and rearing of young, their primary food sources are found within wetland systems. Water dependent species such as fish, some amphibians and birds have specific requirements with regard to duration and magnitude of hydrologic inundation in order to complete their life cycles. Not all wetland systems (e.g., hydric pines) provide habitat for extended hydroperiod dependent species.

It is important for the evaluator to understand the basic habitat requirements of fauna *that are or may be present on IMC-Agrico property* to know which species or signs might be observed during site visits. Appendix A lists the habitat requirements for wildlife species *that are or may be present on IMC-Agrico property*. Included are food sources, protective cover, reproductive needs and habitat size. Appendices B (Habitat Community Profiles), C (Common Freshwater Fishes of Southern Florida), and D (Common Aquatic Insect Taxa) list additional wildlife species. In addition to these references, the evaluator should use *the results of the Ona and Pine Level wildlife studies described in Section 2 of the Application Information Document* with regards to the sites or adjacent areas.

Though direct observation of wildlife utilization is ideal, it is not always possible due to the time constraints of the regulatory review process and the secrecy, mobility, habits and seasonality of many species of wildlife. The evaluator must rely on the presence of signs, including scat, tracks, rubs, and nests etc. In some instances an evaluator may have to assume that if habitat needs for a particular species are present then this species probably does frequent the site.

It is recommended that the evaluator use a D-frame dip net to determine if macroinvertebrates are present. Several sweeps through the wetland vegetation, in combination with direct observations of surface dwelling species, should provide an indication of the lower trophic levels. The presence and diversity of macroinvertebrates are quite variable depending on environmental factors such as temperature, pH, predation, and seasonality. During the dry season, the evaluator should look for available signs such as crayfish burrows and remnant exoskeletons of crayfish, dragonflies and apple

snail shells. If those signs are not present, the reviewer must utilize the presence of wetland plant species as the primary indicator of on-site hydrology, influencing potential macroinvertebrate populations.

In this procedure, rabbits and rodents are considered small mammals; fox, opossum and raccoon are medium-sized mammals; and bobcat, otter, bear and panther are large mammals. It is recognized that although some species (e.g., raccoon) have adapted well to urban encroachment, they also remain an intricate part of natural communities. Exotic animal species such as feral hogs are considered disruptive to natural systems, but that is not addressed in this procedure.

In order for a score of 3 to be achieved for a wetland site, the system must provide habitat for all levels of the food chain associated with that particular system.

### 2.2.1.2 WILDLIFE UTILIZATION MATRIX

#### Objective

The wildlife utilization variable is a measure of observations and signs (i.e., scat, tracks, etc.) of wildlife, primarily wetland dependent species. In addition, potential wildlife use through the presence of wildlife food sources, nesting areas, roosting areas, den trees and protective cover is also considered.

	<u>Score</u>
EXISTING WETLAND EXHIBITS NO EVIDENCE OF WILDLIFE	0
C    Existing wetland is heavily impacted.	
C    No evidence of wildlife utilization.	
C    Little or no habitat for native wetland wildlife species.	
EXISTING WETLAND EXHIBITS MINIMAL EVIDENCE OF WILDLIFE UTILIZATION	1
C    Minimal evidence of wildlife utilization.	
C    Little habitat for birds, small mammals and reptiles.	
C    Sparse or limited adjacent upland food sources.	
C    Site may be located in <i>active mining areas</i> with frequent human disturbances.	
EXISTING WETLAND EXHIBITS MODERATE EVIDENCE OF WILDLIFE UTILIZATION	2
C    Evidence of wetland utilization by small or medium-sized mammals and reptiles (observations, tracks, scat).	
C    Evidence of aquatic macroinvertebrates, amphibians and/or forage fishes.	
C    Adequate adjacent upland food sources.	
C    Minimal evidence of human disturbance.	

- C Adequate protective cover for wildlife.

EXISTING WETLAND EXHIBITS STRONG EVIDENCE OF WILDLIFE UTILIZATION 3

- C Strong evidence of wildlife utilization including large mammals and/or reptiles.
- C Abundant aquatic macroinvertebrates, amphibians and/or forage fishes.
- C Abundant upland food sources.
- C Negligible evidence of human disturbance.
- C Abundant cover and habitat for wildlife within the wetland or adjacent upland.

### 2.2.2.1 WETLAND OVERSTORY/SHRUB CANOPY OF DESIRABLE SPECIES

#### Introduction

The wetland overstory/shrub canopy variable is a measure of the presence, health and appropriateness of wetland shrub and overstory canopy. Canopy is defined as the plant stratum composed of all woody plants and palms with a trunk four inches or greater in diameter at breast height (4.5'), except vines (Department of Environmental Protection, 1994). Subcanopy (which includes shrubs) is that plant stratum composed of all woody plants and palms with a trunk or main stem diameter at breast height (4.5') between one and four inches, except vines (Department of Environmental Protection, 1994). However, *the* IMC-WRAP does include species of vines that may impact the overall health of the overstory/shrub canopy (air potato, old world climbing fern, grapevine, etc.).

Most of these wetland plant species have adapted to a restricted range of hydrologic regimes (South Florida Water Management District, 1995). Wetland overstory/shrub canopy provides many benefits to wildlife species such as cover, food, nesting and roosting areas. Wetlands can vary dramatically in the composition and density of overstory/shrub canopy species (Appendix B). This variable should be used when there is significant overstory/shrub canopy (i.e., the coverage of canopy/shrub species should exceed twenty percent of the overall wetland acreage). The variable can also be used when there is a potential (i.e., immature) canopy present, for a forested wetland that has been clear cut (silviculture), *or on phosphate mined lands that have been reclaimed with wetland forest species.*

IMC-WRAP categorizes the overstory/shrub canopy species into few, moderate and abundant trees present. Using these categories the reviewer evaluates the areal coverage and density of the overstory/shrub canopy for a particular wetland.

Certain wetland types characterized as deep-water marsh and wet prairie systems may exhibit limited or no canopy or shrub species (Myers, 1990, and Soil Conservation Service, 1987). In such situations, the variable would be designated as "NA" (not applicable) and omitted from the final

calculations.

The overall condition of an overstory/shrub canopy can be evaluated by observing indicators such as the presence of a large percentage of dead or dying trees or shrubs, soil subsidence, little or no seedling regeneration and the presence of an inappropriate understory plant species. Although short-term environmental factors such as flooding, drought and fire (Beever, unpublished) can temporarily impact the health of canopy, human activities such as flooding (i.e., stacking water in retention systems) or draining systems via ground water withdrawal and conveyance canals can permanently damage these systems.

Exotic and nuisance (E&N) and/or undesirable plant species *can* become a serious problem in Florida, outcompeting and replacing native plant communities. Wetlands containing E&N plant species are impacted in various ways depending on the type of wetland and the degree to which it is infested. There are approximately 200 species of exotic plants currently listed by the Florida's Exotic Pest Council's *1995 List of Florida's Most Invasive Species*. IMC-WRAP has identified *the E&N species that most commonly occur on IMC-Agrico property and has categorized these species as undesirable, nuisance, and/or exotic*. The species are listed in Appendix E. Many of the listed species can be found invading Florida wetlands. The predominant E&N species *found in wetlands on IMC-Agrico property are: primrose willow, cattail, water primrose, torpedo grass, dog fennel, sesbanias, southern willow, and climbing hempvine*.

### 2.2.2.2 WETLAND OVERSTORY/SHRUB CANOPY OF DESIRABLE SPECIES MATRIX

#### Objective

The wetland overstory/shrub canopy variable is a measure of the health and appropriateness of the wetland shrub and overstory canopy. The functional assessment of the canopy strata is objectively evaluated based on food resources, cover, nesting potential, and appropriateness of the vegetative community. The canopy stratum is evaluated based on the habitat type. This variable may not be applicable to freshwater marsh and wet prairie habitats where overstory/shrub canopy is typically not present (less than 20%). By definition, undesirable plant species include exotic and nuisance plant species.

	<u>Score</u>
NO DESIRABLE WETLAND OVERSTORY/SHRUB CANOPY TREES PRESENT	0
C    No desirable wetland trees and shrub species.	
C    Negligible or little habitat support (i.e., roosting, nesting and foraging) from seedling trees (if present).	
C    Site subject to recent clear cutting with little evidence of native canopy plant	

- regeneration.
  - C Greater than 75% undesirable plant species (E&N species).
- MINIMAL DESIRABLE WETLAND OVERSTORY/SHRUB CANOPY TREES PRESENT** 1
- C Large amounts (approx. 50%) of undesirable tree and shrub species.
  - C Wetland overstory/shrub canopy immature but some potential for habitat support.
  - C Minimal signs of natural recruitment of native canopy and shrub seedlings.
  - C Snags, if many present, may be an indication of hydrology problems or environmental impacts.
  - C Disease or insect damage in live canopy trees.
- MODERATE AMOUNT OF DESIRABLE WETLAND OVERSTORY/SHRUB CANOPY TREES PRESENT** 2
- C Few (less than 25%) undesirable canopy trees and shrubs.
  - C Wetland overstory/shrub canopy is providing habitat support.
  - C Some evidence of natural recruitment of native canopy and shrub seedlings.
  - C Healthy live canopy trees with minimal evidence of disease or insect damage.
- ABUNDANT AMOUNT OF DESIRABLE WETLAND OVERSTORY/SHRUB CANOPY TREES PRESENT** 3
- C No exotic and less than 10% invasive canopy and shrub species present.
  - C Good habitat support provided by wetland overstory and shrub canopy.
  - C Strong evidence of natural recruitment of native canopy and shrub seedlings.
  - C *Some* snags or den trees.
  - C Healthy live canopy trees with minimal evidence of disease or insect damage.

### **2.2.3.1 WETLAND VEGETATIVE GROUND COVER OF DESIRABLE SPECIES**

#### **Introduction**

The ground cover variable is a measure of the presence, condition and appropriateness of the wetland ground cover. Ground cover will be defined as the plant stratum composed of all plants not found in the canopy or subcanopy, including vines. Ground cover vegetation can provide a refuge for macroinvertebrates, fish fry, reptiles, amphibians, small mammals and also can provide a food source for small mammals, waterfowl and reptiles.

Ground cover vegetation can be classified into herbaceous, graminoid, non-graminoid and woody species. Ground cover can also be characterized according to growth form such as emergent, floating-leaf, submersed and free-floating surface. Most wetland species have adapted to a restricted range of hydrologic regimes (South Florida Water Management District 1995). Species composition of

ground cover varies among ecosystems although many species overlay (Appendix B).

The health and abundance of wetland ground cover (particularly herbaceous) can be significantly affected by extremes in wetland hydrology. Deep water conditions created by improper wetland control elevations or natural variability can drown wetland plant species. Conversely, drawdown of wetlands (due to well fields and adjacent canals) and natural variability can reduce the presence of many wetland species and allow for the encroachment of more upland/transitional species. The health of the vegetation can also be evaluated in terms of plant robustness. If the plants are chlorotic or spindly (provided they aren't just planted), it may be a sign of nutrient deficiency, improper soils or hydroperiod response.

Human activities (including hydrologic impacts and extensive nutrient inputs) can promote significant changes in wetland ground cover. Mowing of herbaceous and graminoid wetlands for aesthetics can interfere with seed production of certain plants. Grazing by cattle can influence the species composition of some wetlands due to the introduction of nuisance species of plants (i.e., torpedo grass and other invasive grasses are tolerant of higher nutrient loads). In addition, cattle grazing and off-road vehicle traffic in wetlands create soil disturbance and compaction, as well as the destruction of native vegetation.

As previously noted, exotic and nuisance plant species *can* become a serious problem in Florida by outcompeting and replacing native plant communities. Exotic and nuisance plant species such as torpedo grass (*Panicum repens*), primrose willows (*Ludwigia species*), and cattail (*Typha species*) can be extremely invasive and disruptive to the ground cover of wetland systems. E&N plant species are to be considered when evaluating this variable.

### 2.2.3.2 WETLAND VEGETATIVE GROUND COVER OF DESIRABLE SPECIES MATRIX

#### Objective

The vegetative ground cover variable is a measure of the presence, abundance, appropriateness and condition of vegetative ground cover within the wetland. By definition, undesirable plant species include exotic and nuisance plant species.

	<u>Score</u>
NO DESIRABLE VEGETATIVE GROUND COVER IS PRESENT	0
C    Ground cover is greater than 75% undesirable vegetation.	
C    Vegetative ground cover is intensively maintained, managed or impacted.	
C    Site a freshly mulched created mitigation area with no evidence of seed germination.	
MINIMAL DESIRABLE VEGETATIVE GROUND COVER IS PRESENT	1
C    Ground cover exhibits large amounts (approx. 50%) undesirable vegetation.	
C    Ground cover routinely managed for either aesthetics or agricultural production.	

- C Site a newly planted mitigation area with low plant biomass density.
- C Site newly mulched with signs of seed germination.

**MODERATE AMOUNT OF DESIRABLE VEGETATIVE GROUND COVER IS PRESENT** 2

- C Few undesirable ground cover plant species are present (less than 25%).
- C Ground cover slightly impacted (human induced effects).
- C Mulched or planted areas established with desirable native plant species.

**ABUNDANT DESIRABLE VEGETATIVE GROUND COVER IS PRESENT** 3

- C Less than 10% nuisance and inappropriate plant species with no exotic plant species.
- C Minimal or no disturbances to ground cover.
- C Area subjected to either managed or natural periodic burns for enhancement of ground cover.

### **2.2.4.1 ADJACENT UPLAND/WETLAND BUFFER**

#### **Introduction**

The adjacent upland/wetland buffer variable is a measure of the adjacent habitat support for the subject wetland. This variable is evaluated based on the adjacent buffer size and the ecological attributes (i.e., sediment removal, nutrient uptake, cover, food source, and roosting areas) the buffer area is providing for the wetland system that is being assessed.

Wetland systems are subjected to disturbances that originate in adjacent upland areas. These disturbances can impact biological, chemical and physical attributes of wetlands (Castelle, et al, 1994). Buffers are vegetated areas located between the jurisdictional wetland line and adjacent areas subject to human disturbance. Adjacent wetlands also serve as wetland buffers. Buffers may consist of areas that are undisturbed native vegetation, areas wholly or partially cleared and revegetated, or areas with varying degrees of exotic, nuisance or undesirable (e.g., *pasture grasses*) vegetation.

The criteria for determining adequate buffer sizes should be partly based on the quality of the wetland and the intensity of the adjacent land use (Castelle, et al, 1992). Smaller buffers are more acceptable when the adjacent land use is low intensity. Larger buffers are necessary when the adjacent land use intensity is high and the quality of the buffer is low. Buffers provide benefits to wetlands through sediment control (Shisler, et al, 1987), removal of excess nutrients and metals from runoff by both physical filtration and plant uptake (Madison, et al, 1992), and maintenance of habitat diversity for animal species that require the adjacent upland buffer to meet specific habitat needs (Naiman, et al, 1988).

Buffers also form a transitional zone between the wetland and the adjacent development. The

edge effect theory proposes that the numbers of plant and animal species increase at the edge, due to overlay of adjacent habitats and the creation of unique edge-habitat niches (Castelle, et al, 1994). Finally, buffers can act to reduce direct human impact by reducing access to the wetland and blocking noise and light pollution.

Castelle, et al, (1994) state that buffers less than 15-30 feet provide little protection for aquatic resources. Buffers should be a minimum of 45-90 feet under most conditions. The lower range (45 feet) is necessary for maintenance of physical and chemical protection, while the upper range (90 feet) is a minimum for the protection of biological components. Habitat Suitability Index models have demonstrated the need for buffers between 10 and 350 feet depending on the resource needs of the particular species.

Buffer quality is also very important. A good buffer might contain a mixture of native tree, shrub and ground cover plant species. This would provide a visual and sound barrier for the wetland as well as a food source, cover and nesting habitat for wildlife species. In addition, the ground cover plant species would act as a filtration system for incoming surface water. An example of a low quality buffer would be a ring of dense Brazilian pepper around the wetland. The dense growth of the pepper allows little wildlife utilization. In addition, little or no ground cover can grow in the dense shade.

Large buffers (greater than 300 feet) consisting primarily of pasture grasses may provide spatial protection and some sediment control for wetlands. However, these types of buffers provide less benefit as cover, food source and roosting areas than a good quality buffer.

This procedure considers high volume traffic roads or highways as a severance to existing buffers. Low volume traffic roads (i.e., dirt maintenance or fire break roads) are considered as a continuation to the existing buffer.

## 2.2.4.2 ADJACENT UPLAND/WETLAND BUFFER MATRIX

### Objective

The adjacent upland/wetland buffer variable is a measure of the area adjacent to the subject wetland and the landscape setting of the wetland. This variable is evaluated based on the adjacent buffer size and the ecological attributes (i.e., cover, food source and roosting areas for wildlife) that this area is providing in association with the wetland that is being assessed.

	<u>Score</u>
NO ADJACENT UPLAND/WETLAND BUFFER	0
C    Buffer non-existent	
ADJACENT UPLAND/WETLAND BUFFER AVERAGES 30 FEET OR LESS,	1



## CONTAINING DESIRABLE PLANT SPECIES

- C Less than 30 feet average width.
- C Mostly desirable plant species which provide cover, food source, and roosting areas for wildlife.
- C Not connected to *designated* wildlife corridors (e.g., *FDEP IHN*).
- C Greater than 300 feet but dominated (greater than 75%) by invasive exotic or nuisance plant species.

## ADJACENT UPLAND/WETLAND BUFFER AVERAGES GREATER THAN 30 FEET BUT LESS THAN 300 FEET, CONTAINING PREDOMINATELY DESIRABLE PLANT SPECIES 2

- C Greater than 30 feet but less than 300 feet average width.
- C Contains desirable plant species which provide cover, food, and roosting areas for wildlife.
- C Portions connected with contiguous offsite wetland systems or, *designated* wildlife corridors.
- C Greater than 300 feet but dominated (greater than 75%) by undesirable *but* noninvasive plant species (e.g., pasture grasses).

## ADJACENT UPLAND/WETLAND BUFFER AVERAGES GREATER THAN 300 FEET CONTAINING PREDOMINANTLY DESIRABLE PLANT SPECIES 3

- C Greater than 300 feet wide average width.
- C Contains predominantly desirable plant species (less than 10% nuisance, and no exotic species) for cover, food, and roosting areas for wildlife.
- C Connected to *designated* wildlife corridor or contiguous with offsite wetland system or areas that are large enough to support habitat for large mammals or reptiles.

### 2.2.5.1 FIELD INDICATORS OF WETLAND HYDROLOGY

#### Introduction

Wetland hydrology can be a difficult variable to evaluate given the limited time frames associated with the regulatory process. Several field indicators enable an evaluator to make inferences with regard to wetland hydrology. The duration and magnitude of inundation within a wetland system can be estimated based on plant morphological responses, plant community structure and soil morphology.

Plant Morphological Responses - Several wetland plant species have developed morphological adaptations that enable them to survive extended periods of inundation. Many wetland tree and shrub species develop adventitious roots as a response to the duration of inundation. Extended periods of inundation promote the development of these secondary roots along the basal stem of the plant.

Adventitious roots are formed when the primary root stock is inundated to the extent that anaerobic conditions severely reduce root oxygen and nutrient transport. In addition, recent cypress tree knee growth is an indication of extended inundation. The bark on the apex of the knee will be spread exposing light brown or tan new growth tissue.

Other indicators include small plant species that colonize on trunks of trees at the seasonal high water line. These hydrologic indicators can be used to assist in the determination of the magnitude of inundation (Hale, 1984). Lichen lines colonize down to the seasonal high water mark. Conversely, moss collars predominantly colonize up to the seasonal high water mark.

Plant Community Structure (PCS) - The plant community structure is a composition of the ground cover and the overstory/shrub canopy. The plant community structure (PCS) can be used to make inferences about hydrologic impacts resulting from an increased or a reduced hydroperiod. The evaluator uses the PCS to assess the plant species for a specific habitat. Plant community profiles associated with specific wetland habitats for use with this procedure are in Appendix B. Although this list is not inclusive, it includes plant species typically associated with a specific wetland system.

Transitional plant species such as slash pine (*Pinus elliottii*), wax myrtle (*Myrica cerifera*) and saltbush (*Baccharis halimifolia*) encroaching into the wetland can be cautiously used as evidence of recent decreases in the hydroperiod (Rochow, 1994, and Mortellaro, et al, 1995). Evaluation of these transitional tree and shrub species allows an observer to make some inference about the wetland hydroperiod over the last 1 - 3 years. When evaluating the ground cover plant community, the evaluator should remember that transitional changes within the plant community can occur within one year (Thibodeau and Nickerson, 1985). Care must be taken to distinguish effects of recent drought from more permanent impacts of hydrology.

Conversely, some wetland systems can be impacted by an increased hydroperiod. For example, an increased hydroperiod for a wet prairie will result in an extensive die-off of St. Johns wort. This particular plant species is then replaced with deeper marsh plants such as maidencane (*Panicum hemitomon*), water lilies (*Nymphaea odorata*) and cattails. In addition, if forested wetland systems are maintaining a proper hydroperiod, then seedling regeneration will be occurring either in openings within the canopy or on the periphery of the systems.

Before making accurate inferences about a reduced or increased hydroperiod, the evaluator should determine that the natural variability (e.g., extended droughts, excessive rainfalls, fires, etc.) is not causing the observed plant community response. Having knowledge of the average annual rainfall for the last 3 - 5 years will assist an evaluator with regard to this variable.

Soil Morphology - Soil morphology is used to evaluate soil development and characteristics. A reduced hydroperiod has a direct impact on organic soil development and can result in soil subsidence due to oxidation (Synder and Davidson, 1994). When significant oxidation occurs there may be tree

falls, excessive tree leanings, exposed roots at trunk bases and gaps beneath cypress knees.

Alteration of Wetland Hydrology - Human induced impacts that can alter the hydrology of wetland systems include roads, drainage canals, levees, well fields and changes to the drainage basin. These alterations typically manifest themselves in a noticeable shift in the wetland vegetative community. Roads can interrupt historical sheetflow patterns and decrease the amount of contributing basin to a wetland system or can block the natural flow and over-inundate the system. Drainage canals and well fields are designed to move volumes of water from one area to another, whether it is for flood control or consumption. Both systems have hydrological cones of influence. The permeability of soils and the underlying geology in the vicinity of the wetland will determine the amount of drawdown these activities will cause in a wetland.

Changes to the contributing drainage basin can include increasing the amount of impervious surface (i.e, roofs, roads, parking lots, etc.) which in turn can increase the amount of water entering the wetland. This increase in hydrological input is sometimes accompanied by large decreases in the delivery time to the system which may result in wide fluctuations in water level thus affecting the survivorship or overall health of the plant species. Conversely, project construction can decrease the size of the contributing basin, thus decreasing hydrological inputs.

Wetland systems in agricultural land use settings are sometimes preserved within retention areas. Adverse impacts can occur to these wetlands through the stacking of water (holding water levels above control elevation) or pumping too much water into the system. Both of these activities can drown or shift the species composition of the wetland.

## **2.2.5.2 FIELD INDICATORS OF WETLAND HYDROLOGY MATRIX**

### **Objective**

This variable is a measure of the hydrologic regime based on observed field indicators for the subject wetland including hydroperiod duration and magnitude. Wetland hydrology is generally interpreted using vegetative indicators. In addition, hydrologic indicators such as lichen lines, algal mats, adventitious roots and basal scarring are also utilized. Signs of altered hydrology may include encroachment of upland and transitional plant species into the wetland.

	<u>Score</u>
HYDROLOGICAL REGIME HAS BECOME SEVERELY ALTERED WITH STRONG EVIDENCE OF SUCCESSION TO TRANSITIONAL/UPLAND OR OPEN WATER PLANT COMMUNITY	0
C    Wetland hydrology severely altered.	
C    Hydroperiod inadequate to support wetland plant species for the particular community	

- type.
- C Strong evidence that upland plants are encroaching into the historical wetland area as a result of a decreased hydroperiod.
- C Die-off of wetland plant species as a result of an increased hydroperiod.
- C In sites with an organic soil substrate, there is substantial soil subsidence.

**HYDROLOGIC REGIME INADEQUATE TO MAINTAIN A VIABLE WETLAND SYSTEM** 1

- C Site hydroperiod inadequate to maintain the system that is being created, enhanced or preserved.
- C Succession of wetland plant species into transitional/upland plant species. Appropriate vegetation stressed or dying from too much or too little water.
- C In sites with an organic soil substrate, there is evidence of soil subsidence.

**HYDROLOGIC REGIME ADEQUATE TO MAINTAIN A VIABLE WETLAND SYSTEM. EXTERNAL FEATURES MAY AFFECT WETLAND HYDROLOGY** 2

- C Wetland hydroperiod adequate, although conditions possibly interfering with or influencing the hydroperiod of site (i.e., canals, ditches, swales, berms, reduced drainage area, culverts, pumps, control elevation and well fields) present.
- C Plants healthy, and exhibit no stress from too little water or too much water.
- C In sites with an organic soil substrate, there is little evidence of soil subsidence.

**HYDROLOGIC REGIME ADEQUATE TO MAINTAIN A VIABLE WETLAND SYSTEM** 3

- C Plants healthy with no stress resulting from an improper hydroperiod.
- C Wetland exhibits a natural hydroperiod.
- C Wetland not adjacent to canals, ditches, swales, berms, well fields or other negative impacts to the wetland within the landscape setting.
- C In sites with an organic soil substrate, there is no sign of soil subsidence.

### **2.2.6.1 WATER QUALITY INPUT**

#### ***Introduction***

*The SFWMD WRAP was developed to be utilized in nearly all wetlands within the District, including wetlands that receive storm water runoff from single and multi-family residential developments; low, medium, and high intensity commercial uses; golf courses; and a variety of intensive agricultural land uses. The SFWMD WRAP notes that pollutant loading rates from storm water runoff from open space/natural areas is much lower than from commercial and industrial developments and residential areas.*

*Because land uses on phosphate reserve property and reclaimed minesites fall into a much narrower range than the land uses that the SFWMD WRAP must address, together with the fact that storm water treatment systems are rarely found on phosphate reserve property, the IMC-WRAP water quality input variable focuses upon the land use scenarios found on unmined reserve lands and reclaimed lands and excludes treatment as an equally weighted variable. In addition, a “modifier” has been added to reflect that fact that differing levels of human influence can change the storm water pollutant loading rates from different parcels with the same FLUCFCS level III vegetation classification. The following paragraphs describe this approach.*

*Utilizing the same concept that SFWMD applied in developing its WRAP water quality input variable, the IMC-WRAP water quality input establishes a maximum adjacent land use base score of 2.5 for upland and wetland natural systems and a minimum adjacent land use base score of 0.5 for relatively intense land uses with corresponding pollutant loadings such as transportation corridors (e.g., highway and rail), cattle watering ponds, and intensively farmed land with significant chemical inputs (e.g., citrus and row crops). The four vegetative cover classifications found on phosphate company holdings that do not fall within either the intensive agriculture or natural systems categories discussed should be assigned base scores as follows:*

<u>FLUCFCS Code</u>	<u>Description</u>	<u>Base Score</u>
510	Ditch/Canal	1.0
211	Improved Pasture	1.5
213	Woodland Pasture	1.5
520	Lakes	2.0

*In order to recognize that given FLUCFCS codes may be used in different ways that offset water quality, the base water quality input score can be elevated or reduced by 0.5 point. Examples of where the base score should be increased include:*

- C natural upland and wetland systems that have not been altered and are not being used for grazing at all; and*
- C grasslands vegetated with exotic species (e.g., bahia) that are not being used for grazing at all;*
- C groves that have been abandoned;*
- C row crop fields that have been abandoned; and*
- C cattle watering ponds that are no longer being used.*

*Examples of where the base score should be reduced by 0.5 point include:*

- C improved pastures or woodland pastures that are being overgrazed;*
- C groves and crop land where evidence of excessive storm water pollution (e.g., algal blooms or siltation) in the adjacent wetland documents poor management practices;*

- C timber harvesting practices in adjacent flatwoods and forested uplands and wetlands are causing excessive storm water pollutant loadings;*
- C cattle watering ponds that overflow or connect to the wetland; and*
- C wetlands that are being heavily grazed or that have been extensively ditched.*

*It is important for the investigator to note that the base score assumes that an average amount of human activities are influencing storm water input to the wetland being evaluated and that the upward modifier is to be used only when there is evidence of no human impact on natural systems or use of best management practices on agricultural lands. Likewise, the downward modifier should be used only where there is evidence of excessive human impact.*

*There may be occasions where an agricultural or transportation land use has been developed with a state of the art storm water runoff treatment system. In these instances, a 0.5 point upward modifier should be applied, independent of whether the base score has already modified upward or downward because of the human influence factor described above.*

*Testing of the IMC-WRAP for water quality input by representatives of USACOE and FDEP produced better consistency in scoring among reviewers on IMC-Agrico lands than did the SFWMD WQIT variable matrix. For this reason, this alternative technique will be applied at the Ona and Pine Level tracts, as well as other tracts of lands to be mined and reclaimed lands, by IMC-Agrico.*

## **2.2.6.2 WATER QUALITY INPUT VARIABLE MATRIX**

### **Objective**

*The water quality variable of the matrix is a measure of the quality of the surface water flowing into the subject wetland from adjacent land uses. The percent and type of surrounding land uses is the consideration for the base score. The base scores for land use types are as follows:*

<u>FLUCFCS Code</u>	<u>Description<sup>(1)</sup></u>	<u>Base Score<sup>(2)</sup></u>
211	Improved pasture	1.5 <sup>(3)</sup>
212	Unimproved pasture	2.5
213	Woodland pasture	1.5 <sup>(3)</sup>
214	Row crops	0.5 <sup>(3)</sup>
221	Citrus	0.5 <sup>(3)</sup>
310	Herbaceous rangeland	2.5
320	Shrub and brushland	2.5
330	Mixed rangeland	2.5
411	Flatwoods	2.5
420	Upland forest	2.5

510	Streams, canals, and Waterways	1.0
520	Lake	2.0
534	Ponds <10 acres	0.5
600	Wetlands	2.5
800	Transportation	0.5 <sup>(3)</sup>

*Notes:*

- (1) See glossary for complete FDOT FLUCFCS descriptions.
- (2) Modify base score upward or downward by 0.5 point if adjacent land use is experiencing minimal or excessive human impacts (see Section 2.2.6.1 for guidance).
- (3) Increase base score by 0.5 point if a storm water runoff treatment system exists on agricultural (FLUCFCS Series 200) or transportation (FLUCFCS Series 800) land uses; cannot be applied to natural systems.

### 2.3 DESCRIPTION OF IMC-WRAP FIELD DATA SHEETS

When assessing a wetland system using IMC-WRAP, it is important that the evaluator document site information and field observations. Two wetland field data sheets have been developed for this purpose. The following subsections explain how these sheets are to be used by the wetland evaluator.

#### 2.3.1 FDEP QUALITATIVE WETLAND SURVEY DATA SHEET

Form 3-1 is a qualitative analytical work sheet that FDEP has requested IMC-Agrico complete for each wetland community on the Ona and Pine Level tracts. The objective is to provide basic information about each wetland community, including semi-quantitative estimates of percent cover and species dominance in each vegetative stratum, without creating the requirements to perform expensive and time consuming vegetation transects. Independent of the IMC-WRAP being implemented for the USACOE, the qualitative surveys will be used by FDEP to evaluate IMC-Agrico's ERP applications. The FDEP data sheets and qualitative surveys should also be used to document the basis for the IMC-WRAP scores that are prepared for USACOE

##### 2.3.1.1 FDEP DATA SHEET INSTRUCTIONS

The following is a description of the information required when filling out the FDEP field data sheet for qualitative wetland surveys.

**Project Site:** Check whether the wetland being evaluated is located on the Ona or the Pine Level tract. If the data sheet is to be used for wetlands located on other tracts, the master form should be revised to reflect the correct property name.

**Wetland Number:** Prior to leaving the office, each wetland on the project site should already be numbered using the numbering system presented in Chapter 3 of the Ona/Pine Level Application Information Document. These numbers should be verified against maps or aerial photographs.

*Investigator: The name of the individual who performed the evaluation.*

***Date/Time:** The date and time when the field inspection occurs.*

***Photo Roll No.:** If photographs are taken during the inspection, indicate the roll number and exposure number(s) taken at the subject wetland.*

***Wetland Type:** Check the FLUCFCS code that applies to the subject wetland.*

***Vegetation Canopy and Subcanopy:** A qualitative visual estimate of the canopy and subcanopy in the subject wetland. Canopy and subcanopy species present should be listed and their approximate range of dominance should be estimated for both stratum. Use additional space elsewhere on the page if more than nine species of canopy and subcanopy species are identified. Total canopy cover should be estimated and recorded in the notes section.*

***Vegetation Shrub Layer:** A qualitative estimate of the percent cover and species composition within the shrub layer of the subject wetland exclusive of subcanopy species. Shrub layer species present should be listed and their approximate range of dominance should be estimated. Total shrub layer coverage should be estimated and recorded in the notes section.*

***Vegetation Ground Cover:** A qualitative estimate of the present cover and species composition within the ground cover layer of the subject wetland. Ground cover species should be listed and the approximate range of dominance should be estimated visually. Total percent cover for this stratum should be visually estimated and recorded in the notes section.*

***Vegetation Notes:** Field notes that add other descriptive factors and help to explain field ratings (e.g., presence of listed flora species, zonation patterns, high diversity, mature trees, percent canopy cover etc.).*

***Vegetation Disturbance:** Field notes that identify disturbances to the subject wetland that can be natural or man made (e.g., fire, dead or dying trees, logging, heavy cattle grazing, presence of nuisance or exotic species, or encroachment of upland species.)*

***Soils Characteristics:** Check which characteristic best describes the uppermost soil horizon.*

***Soils Depth:** Circle the depth range that best fits the depth of the uppermost soil horizon.*

***Soils Disturbances:** Note any disturbances (e.g., feral hog rooting, subsidence, excessive siltation) that have impacted the uppermost soil horizon. Ditching in and immediately adjacent to the subject wetland should also be noted.*

***Surface Water/Saturation:** Respond to the questions to the extent possible and use “NA” when not applicable or “UNK” when the answer cannot be determined. To the extent practical, consider the annual hydrologic cycle when estimating average depth of water and percent of wetland regularly inundated.*

***Stream Channel Characteristics:** When the subject wetland is associated with a watercourse (i.e., this could be a natural stream or a man-made or man-enhanced ditch/canal), provide estimates of the information requested. Consider the entire annual hydrologic cycle when estimating hydrologic conditions.*

***Ave. Depth of Water:** Estimate the average water depth of the wetland at the time of the assessment. If the depth varies substantially across the wetland, a range of depths may be entered.*

***Estimated Seasonal High Water Depth:** This parameter pertains predominantly to forested*



systems. Estimate the seasonal high water depth by indicators such as lichen lines, moss collars, adventitious rooting, stain lines, recorded data, etc. Indicate whether the subject wetland can best be described as a “depressional”, “flow-through” or “headwater” area by answering “yes” or “no” to the questions presented.

**Nonforested Wetland - Flooding:** Seasonal high water elevations are often more difficult to establish in nonforested wetlands than forested wetlands. Therefore, only the general duration of flooding (i.e., “seasonally flooded”, “semi-permanently flooded” or “permanently flooded”) will be determined. This can often be ascertained by vegetation, rack lines, knowledge of the area, etc. Check on the appropriate line. If the flooding frequency can only be narrowed down to two possibilities, check both lines. If it is not possible to determine at all, enter “UNK” Write N/A if the wetland is forested.

**Hydrology/Topography Disturbance/Alteration:** Use the space provided to briefly describe the disturbances/alterations to the natural hydrology observed. Include examples like ditching, culverts, berms, spoil piles, evidence of modified flow in streams, and note if there are cattle ponds dug out adjacent to a wetland or stream. Be sure to note “none” if there is no evidence of man-made alterations.

**Wildlife Observations:** Use the space provided to make notations of any observations of wildlife utilization, including direct observations or evidence of historical usage (e.g., scat, tracks, etc.).

**Endangered and Threatened Species:** Use the space provided to make notations of any observations of listed wildlife species utilization, including direct observations or evidence of usage (e.g., scat, tracts, etc.). Be sure to note “none” if no evidence is available.

**Other Comments:** Identify the adjacent land uses by estimating the percent of the subject wetland perimeter adjoined by various other vegetative conditions, including wetlands. Use the FLUCFCS level III classification codes, if known. Use the space provided to document the availability and size of a wetland buffer and to document any other relevant observations.

## **2.3.2 USACOE IMC-WRAP SUMMARY SHEET**

Form 3-2 is a summary sheet that has been developed jointly by USACOE and IMC-Agrico for use in the field completing the IMC-WRAP. Used in conjunction with Form 3-1, the IMC-WRAP data sheet provides a condensed version of the scoring matrix for each of the six IMC-WRAP variables described in the preceding subsections. These descriptions of scoring guidance along with the definitions in the Glossary should be referenced to assist in scoring the variables.

### **2.3.2.1 USACOE IMC-WRAP SUMMARY SHEET INSTRUCTIONS**

The following is a description of the information required when utilizing the USACOE IMC-WRAP summary sheet:

**Project Site:** Check whether the wetland being evaluated is located on the Ona or the Pine Level tract. If the data sheet is to be used for wetlands located on other tracts, the master form should be revised to reflect the correct property name.

**Wetland Number:** Prior to leaving the office, each wetland on the project site should already be

*numbered using the numbering system presented in Chapter 3 of the Ona/Pine Level Application Information Document. These numbers should be verified against maps or aerial photographs.*

*Investigator: The name of the individual(s) who performed the evaluation.*

*Date/Time: The date and time when the field inspection occurs.*

*Wetland Group ID: Enter a wetland grouping number or other code for wetlands that are in the same FLUCFCS level III classification, in the same setting and conditions. This grouping is to allow the evaluation of only one of more wetlands where the evaluation will apply equally to two or more wetlands, so as to simplify the field efforts.*

*Wildlife Utilization: A measure of the wildlife utilization within the subject wetland. Noted signs and observations should be documented within the “Wildlife Observations Comments” section of Form 3-1 to support the wildlife utilization assessment.*

*Wetland Canopy: A measure of the overstory/shrub canopy for the subject wetland. Field observations should be documented in the “Vegetation Canopy and Subcanopy” section of Form 3-1 to substantiate the assessment of the wetland canopy variable.*

*Wetland Ground Cover: A measure of the wetland ground cover for the subject wetland. Field observations should be documented in the “Ground cover” section of Form 3-1 to substantiate the assessment of the wetland ground cover variable.*

*Habitat Support/Buffer: A measure of the habitat buffer for the subject wetland. Field observations should be documented in the “Other Noteworthy Comments” section of Form 3-1 to substantiate the assessment of the habitat support/buffer variable.*

*Field Hydrology: A measure of the field indicators of hydrology for the subject wetland. Field observations should be documented in the “Hydrology and Topography” section of Form 3-1 to substantiate the assessment of the field hydrology variable.*

*WQ Input and Treatment: A measure of the water quality input and surface water pretreatment for the subject wetland. Field observations should be documented in the “Other Noteworthy Comments” section of Form 3-1 to substantiate the assessment of the water quality variable.*

*IMC-WRAP Score: The overall functional score for the subject wetland. Each variable score is summed and then divided by the total possible maximum score for the variables (See Section 2.2). The final WRAP score is expressed as a number between zero and one (to two significant figures e.g. 0.xx).*

## GLOSSARY

**Agriculture** - The science or art of cultivating the soil, producing crops, or raising livestock.

**Anthropogenic activities** - Relating to, or resulting from the influence of human beings on nature.

**Appropriate plant species** - Plant species which are appropriate for a given community type (i.e., *Rhynchospora tracyii* in a wet prairie, *Nymphaea odorata* in a deepwater marsh).

**Canopy** - The plant stratum composed of all woody plants and palms with a trunk four inches or greater in diameter at breast height (4.5') except vines.

**Decreased hydroperiod** - A decrease in the annual period of inundation, resulting in a change in the plant community composition and structure. The effect is usually an increase of transitional and upland plant species.

**Desirable plant species** - Native plant species that are appropriate for a specific community type and provide benefits to wildlife in the forms of food, cover, and nesting potential.

**Direct impacts** - Physical acts such as dredging or filling wetlands.

**Design protocol** - The design of a scientific experiment or treatment.

**Dry detention areas** - Created impoundments with a bottom elevation of at least one foot above control elevation of the area.

**Duration of inundation** - Period of time inundation occurs on an annual basis.

**Exotic plant species** - Plant species that are non-native, purposefully or accidentally introduced by humans to a geographic area. Many are invasive in nature and disrupt native plant communities.

**Florida Land Use, Cover and Forms Classification System (FLUCFCS)** - *Published in 1985 by the Florida Department of Transportation as Procedure no. 550-010-001-A, this methodology should be used by wetland evaluators to classify land uses and vegetative cover when completing the IMC-WRAP. Evaluators should carry a copy of this procedure in the field.*

**Freshly mulched created mitigation area** - The spreading of hydric soils (with viable native seed bank present) across a graded, newly constructed mitigation area.

**Grass swales** - A linear depression, usually designed to capture, store, and convey storm water runoff.

**Ground cover** - The plant stratum composed of all plants not found in the canopy or subcanopy.

**Heavily impacted** - Impacted by human activities to such a degree as to reduce significantly the functionality of a system.

**High intensity commercial** - Land uses consisting of commercial with high levels of traffic volume. Traffic is constantly moving in and out of the area; including downtown areas, commercial office sites and regional malls.

**High intensity land use** - Intensive agricultural operations such as dairy farming (including feedlots), and high intensity commercial projects. These land uses are significantly disruptive to wetland systems through direct and indirect impacts.

**Highways** - Major road systems such as interstate highways, major arteries and thoroughfares.

**Hydroperiod** - Annual period of inundation.

**Hydrological indicators** - Indicators that may be used as evidence of inundation or saturation when evaluated with meteorological information, surrounding topography, and reliable hydrological data. Indicators include algal mats, aquatic mosses, aquatic plants, aufwuchs (microscopic attached organisms), basal scarring, drift lines, elevated lichen lines, evidence of aquatic fauna, morphological plant adaptations, secondary flow channels, sediment deposition, vegetated tussocks and water marks.

**Hydrology** - Water depth, flow patterns, and duration and frequency of inundation as influenced by precipitation, surface runoff and ground water.

**Impervious surface** - Surface which does not allow for the percolation of water (e.g. asphalt parking lots and roads, rooftops).

**Improved pasture** - Rangeland comprised mostly of introduced pasture grasses. The recommended stocking density for improved pasture is one cow for every five acres of rangeland.

**Inappropriate plant species** - Plant species which are not usually considered nuisance species, however may be indicative of other problems (i.e., improper hydrology) and may dominate a particular stratum (e.g., *Rubus* sp. in a cypress forested wetland). These plant species are not considered appropriate for a particular habitat.

**Increased hydroperiod** - Increase in the annual period of inundation, resulting in a change in the plant community composition and structure, and which can include an increase in the duration and magnitude of inundation.

**Indirect impacts** - Impacts to wetlands such as increased nutrient loading, altered hydrology, impacts to wetland buffer, development of adjacent areas or disturbances by air, light or noise pollution.

**Industrial** - Manufacturing, shipping and transportation operations, sewage treatment plant facilities, water supply plants and solid waste disposal.

**Infiltration trench** - Impoundment in which incoming runoff is temporarily stored until it gradually leaves the basin by infiltrating into the soils.

**Institutional** - Schools, churches, libraries, etc. Runoff concentrations are similar low intensity commercial.

**Intensively maintained** - Mowed, disced or similarly impacted on more than a semi-annual basis.

**Invasive exotic plant species** - Exotic plant species (e.g., punk tree, Australian pine, Brazilian pepper, old-world climbing fern, etc.) that are invading and disrupting native plant communities in Florida.

**Landscape setting** - The type of land use that surrounds a wetland (i.e., agriculture, residential, commercial/industrial, undeveloped.)

**Mining** - Includes mining excavation, lake construction, and site development activities, resulting in the removal or clearing of vegetation.

**Moderately intensive commercial** - Areas that receive moderate amounts of traffic volume for a portion of the day, such areas include small shopping centers and plazas.

**Moderately intensive land use** - Includes single-family residential, multi-family residential, golf courses and golf course residential communities, industrial projects, highways and agricultural activities such as pasture and row crops.

**Multi-family residential** - Residential land use consisting primarily of apartments, condominiums and cluster homes.

**Non-invasive exotic plant species** - Exotic plant species which have not yet been shown to be invasive to natural communities.

**Nuisance plant species** - Plant species which have the potential to dominate disturbed or created plant communities and form large vegetative colonies (e.g., cattails, spatterdock, primrose willow).

**Open space/natural undeveloped area** - Areas that are not developed and exhibit minimal human impact, such areas include parks and passive recreational areas.

**Overstory** - Vegetation stratum consisting of woody plants and palms with a trunk > 4" dbh.

**Pretreatment or MSSW systems** - Constructed systems designed to pretreat water (i.e., remove suspended solids and reduce nutrient concentrations) prior to discharge. Systems can range in simplicity from grass swales and dry retention to secondary treatment and polishing ponds.

**Proc GLM** - Procedure General Linear Model.

**Recreational** - Areas which have been developed for active recreational use (e.g., ballfields, soccer fields, tennis and volleyball courts, etc.). These areas typically have intensive ground maintenance programs.

**Routinely maintained** - Mowed or similarly impacted on an annual basis.

**Row Crops** - Agricultural practice of crops planted and harvested on an annual basis, excluding sugar cane (i.e., vegetable farms and plant nurseries).

**ShrubLayer** - Vegetation stratum consisting of vines and woody plants with a main stem diameter  $\leq 4$ " dbh.

**SAS** - Statistical Application Software.

**Secondary productivity** - Macroinvertebrates, fishes and wildlife.

**Single-family residential** - Detached dwelling units with lot sizes less than one acre and dwelling unit densities greater than one dwelling per acre; duplexes constructed on one-third to one-half acre also included.

**Subcanopy** - The plant stratum composed of all woody plants and palms with a trunk or main stem diameter at breast height (4.5') between one and four inches, except vines.

**Undesirable plant species** - Exotic, nuisance or undesirable plant species for a given habitat.

**Unimproved pasture** - Comprised mostly of native rangeland. The recommended stocking density is one cow per twenty-five acres of rangeland.

**Wet detention areas** - Impoundments in which storm water runoff is temporarily stored until it gradually leaves through an outflow control structure. A pool of water remains after a specific bleed-down period.

## APPENDIX A

### SPECIES HABITAT REQUIREMENT TABLE

(IMC-Agrico Revised)

<b>Species</b>	<b>Food</b>	<b>Cover</b>	<b>Reproduction</b>	<b>Habitat Size</b>
Great blue heron ( <i>Ardea herodias</i> )	Water is less than 50 cm deep, fish, reptiles, and macroinvertebrates	Not a limiting factor	Trees 5-15 m. high. Riparian swamp tree islands	0.4 ha - 4.6 ha
Bullfrog ( <i>Rana catesbeiana</i> )	Fish, reptiles, macroinvertebrates, amphibians	Ground cover, understory, stumps, logs, and banks	Continuous standing water	Not a limiting factor
Barred owl ( <i>Strix varia</i> )	Small mammals, reptiles, fish, and macroinvertebrates	Dense forested wetlands, deciduous riparian woodlands	Trees are larger than 50 cm dbh. Nest cavity greater than 7.5 cm from ground	Greater than 10 ha
Wood duck ( <i>Aix sponsa</i> )	Aquatic plants, fruits, insects, acorns, and macroinvertebrates	Downed timber, dense shrub, canopy riparian forest	50-75% cover (tree cavities, shrubs). 25-50% open water	Greater than 4 ha
Eastern cottontail ( <i>Sylvilagus floridanus</i> )	Grasses, herbs, flowers (usually not a limiting factor)	Shrubby cover adjacent to field edges, savanna prairie, forbs, brambles	Grasses are less than 20 cm high	Greater than 4 ha
Alligator ( <i>Alligator mississippiensis</i> )	Small mammals, large mammals, birds, reptiles, fish, and macroinvertebrates	Palustine emergent, estuarine emergent vegetation	Sloping banks, with available vegetation	Greater than 5 ha
Sandhill crane ( <i>Grus canadensis</i> )	Insects, macroinvertebrates, reptiles, amphibians, roots, small mammals	Roosting site typically within large wetlands (cover typically not a limiting factor)	Large marsh complexes. Scattered marshes, bogs (isolation)	Dependent on isolated wetland
White-tailed deer ( <i>Odocoileus virginianus</i> )	Seeds, fruits, twigs, acorns, shoots, buds, broadleaved herbaceous plants, grasses	Swamps, thickets, broken mixes of forest and agricultural land, forested area with limited tree canopy	See cover	Greater than or equal to 40 ha
Bobcat ( <i>Felix rufus</i> )	Large, medium and small mammals, reptiles, and birds	Thickets, hollow stumps, logging debris, bottomland hardwood, mixed grassy areas	Thickets, hollow stumps, logging debris	Minimum is greater than 1 km Optimum is greater than 20 km

Species	Food	Cover	Reproduction	Habitat Size
Large mouthed bass ( <i>Micropterus salmoides</i> )	Insects, macroinvertebrates, crustaceans, fish, and amphibians	Some standing water at all times, riverine-sufficient pools of less than 6 cm per second flow. Lacustrine and lakes with greater than 25% area less than 6 m depth. Optimal cover 40-60% of logs, brush, and debris, in littoral areas or pools	Nesting area: gravel, vegetation sand, mud, roots, cobble, 0.15-7.5 m depth	No minimum habitat size established
Belted kingfisher ( <i>Ceryle alcyon</i> )	Fish, crayfish, frogs, and insects	Roosts on single limbs about 6-7m above ground. Bare branches, wires for fishing	Shrub cover (brooding), nesting borrows in steep banks devoid of vegetation	Greater than 1.0 km of lake shore or stream
Bald eagle ( <i>Haliaeetus leucocephalus</i> )	Birds, medium to small mammals, fish, reptiles and amphibians, and macroinvertebrates	Sheltered timber stands	Old-growth and second-growth timber. Mature trees, open forest structure within 162 m of a lake or fishable body of water	8 ha of water surrounded by 1.5 km strip of land
Fox squirrel ( <i>Sciurus niger</i> )	Seeds, mast, buds, insects, roots, and bird eggs	Hardwood or pine flatwoods with little understory. Stands of large trees interspersed with agricultural lands, well-drained bottomlands	Leaf nests, tree cavities	2 ha
Gray squirrel ( <i>Sciurus carolinensis</i> )	Mast, fruit, buds, seeds, bark, roots, fungus, and animal matter	Mature hardwood forest with dense well developed understory. Saw time trees greater than 22.8 cm in dbh, trees greater than 22.8 cm in db.	Hardwood stands greater than 60 years old, den trees, leaf nests	Greater than 0.4 ha
Redear sunfish ( <i>Lepomis microlophus</i> )	Juvenile-algae microcrustaceans, adults-zooplankton, macroinvertebrates, and crustaceans	Lacusirine, palustine, slow moving riverine, vegetated shallow areas with brush, stumps and logs	Depth of water at nest varies 5 cm to 6 m. Vegetative free substrate. Sandy clay, gravel, limestone, shells and mud	No minimum size established
Bluegill ( <i>Lepomis macrochirus</i> )	Zooplankton, aquatic and terrestrial insects, and plant material	Lacustrine, palustrine and slow moving riverine. Fertile waterbodies with submerged vegetation, logs, brush	Vegetated areas and unvegetated areas. Substrate-fine gravel, sand, sandy-clay, mud, limestone and shells - 1-3 in in water depth	No minimum habitat size established



<b>Species</b>	<b>Food</b>	<b>Cover</b>	<b>Reproduction</b>	<b>Habitat Size</b>
Pine warbler ( <i>Dendroica pinus</i> )	Insects, pine seeds, wild fruit, berries	Pure stands of seral pine trees. 35-100 years old, mature conifers	Horizontal branches in needles at end of a branch or in a clump of cones. Nests at heights greater than 8 m	Usually greater than 10 ha
Pileated woodpecker ( <i>Dryocopus pileatus</i> )	Ants, beetles, wild fruit	Foraging: dense canopies with numerous snags, stumps and logs Cover: dense forests, mesic habitats	Cavity nesters. Tall snags, nests at greater than 51 m off ground	Greater than 130 ha
Eastern wild turkey ( <i>Meleagris gallapavo</i> )	Grasses, acorns, seeds, fruits, tubers, bulbs, insects, amphibians, crustaceans	Open mature woods, mixture of forests and open lands	Nests on ground concealed by dense brush, mayfields, fence rows, and utility rights-of-way	Greater than 900 ha



**APPENDIX B**  
**HABITAT COMMUNITY PROFILES**  
(IMC-Agrico Revised)

<b>Habitat Type</b>	<b>Wildlife Utilization</b>	<b>Overstory/Shrub Spp.</b>	<b>Ground Cover Spp.</b>	<b>Hydrology</b>
<b>Cypress Swamp</b>	Cricket frog ( <i>Acris gryllus</i> )	Bald/pond cypress ( <i>Taxodium spp.</i> )	Royal fern ( <i>Osmunda regalis</i> )	Hydroperiod 3-12 months
	Little grass frog ( <i>Limnaoedus ocularis</i> )	Coastal plain willow ( <i>Salix caroliniana</i> )	Cinnamon fern ( <i>Osmunda cinnamomea</i> )	Depth of inundation +2' (wet)
	*American alligator ( <i>Alligator mississippiensis</i> )	Blackgum ( <i>Nyssa sylvatica var. biflora</i> )	Swamp fern ( <i>Blechnum serrulatum</i> )	Depth of inundation -4' (dry)
	Aquatic turtle guild	Red maple ( <i>Acer rubum</i> )	Chain fern ( <i>Woodwardia spp.</i> )	
	Pig frog ( <i>Rana grylio</i> )	Button bush ( <i>Cephalanthus occidentalis</i> )	Shield fern ( <i>Thelypteris spp.</i> )	
	*Barred owl ( <i>Strix varia</i> )	Myrsine ( <i>Myrsine guianensis</i> )	Arrow arum ( <i>Peltandra virginica</i> )	
	*Heron guild ( <i>Ardea spp., etc.</i> )	Virginia willow ( <i>Itea virginica</i> )	Lizard tail ( <i>Saururus cernuus</i> )	
	Limpkin ( <i>Aramus guaruana</i> )	Wax myrtle ( <i>Myrica cerifera</i> )	Pickereel weed ( <i>Pontederia cordata</i> )	
	Great horned owl ( <i>Bubo virginianus</i> )	Fetterbush ( <i>Lyonia lucida</i> )	Sphagnum moss ( <i>Sphagnum spp.</i> )	
	Woodstork ( <i>Mycteria americana</i> )			



Habitat Type	Wildlife Utilization	Overstory/Shrub Spp.	Ground Cover Spp.	Hydrology
	*Wood duck ( <i>Aix sponsa</i> ) *Bobcat ( <i>Lynx rufus</i> ) *Deer ( <i>Odocoileus virginianus</i> ) River otter ( <i>Lutra canadensis</i> ) Raccoon ( <i>Procyon lotor</i> )			
<b>Bayhead</b>				
	Opossum ( <i>Didelphis virginiana</i> )	Sweet bay magnolia ( <i>Magnolia virginiana</i> )	Cinnamon fern ( <i>Osmunda cinnamomea</i> )	Wet season
	Southeastern shrew ( <i>Sorex longirostris</i> )	Loblolly bay ( <i>Gordonia lasianthus</i> )	Dichanthelium ( <i>Dichanthelium spp.</i> )	Saturated soil
	Short-tailed shrew ( <i>Blarina carolinensis</i> )	Swamp red bay ( <i>Persea palustris</i> )	Virginia chain fern ( <i>Woodwardia virginica</i> )	Dry season (-) 3 ft
	Marsh rabbit ( <i>Sylvilagus palustris</i> )	Red maple ( <i>Acer rubrum</i> )	Netted chain fern ( <i>Woodwardia areolata</i> )	
	Raccoon ( <i>Procyon lotor</i> )	Sweet gum ( <i>Liquidambar styraciflua</i> )	Shield ferns ( <i>Thelypteris normalis</i> & <i>T. dentata</i> )	
	Bobcat ( <i>Lynx rufus</i> )	Virginia willow ( <i>Itea virginica</i> )	Sphagnum moss ( <i>Sphagnum sp.</i> )	



Habitat Type	Wildlife Utilization	Overstory/Shrub Spp.	Ground Cover Spp.	Hydrology
	Warbler guild (Various genera and species)	Fetterbush ( <i>Lyonia lucida</i> ) Maleberry ( <i>Lyonia ligustrina</i> )		
	Cricket frog ( <i>Acris gryllus dorsalis</i> )	Dahoon holly ( <i>Ilex cassine</i> )	Nutrush ( <i>Scleria</i> spp.)	
	Chorus frog ( <i>Pseudacris nigrita</i> )	Red chokeberry ( <i>Aronia arbutifolia</i> )		
	Diamond back rattlesnake ( <i>Crotalis adamanteus</i> )	Saw palmetto ( <i>Serenoa repens</i> )		
	Hawk guild ( <i>Buteo</i> spp.)	Slash pine ( <i>Pinus elliotii</i> )		
	Cotton rat ( <i>Sigmodon</i> sp.)	Laurel oak ( <i>Quercus laurifolia</i> )		
	Black racer ( <i>Coluber constrictor</i> )	Gallberry ( <i>Ilex glabra</i> ) Swamp azalea ( <i>Rhododendron viscosum</i> )		
<b>Wet Flatwoods</b>	Oak toad ( <i>Bufo quercicus</i> )	Highbrush blueberry ( <i>Vaccinium corymbosum</i> ) Slash pine ( <i>Pinus elliotii</i> )	Blue maidencane ( <i>Amphicarpum mulhenbergianum</i> )	Wet season: Hydroperiod 1-4 months/yr Depth of inundation 1'-2' above the surface



Habitat Type	Wildlife Utilization	Overstory/Shrub Spp.	Ground Cover Spp.	Hydrology
	Chorus frog ( <i>Pseudacris nigrita</i> )	Sabal palm ( <i>Sabal palmetto</i> )	Wire grass ( <i>Aristida spp.</i> )	Dry season: Depth of inundation -3' below the surface
	Cricket frog ( <i>Acris gryllus dorsalis</i> )	Dahoon holly ( <i>Ilex cassine</i> )	Beak rush ( <i>Rhynchospora spp.</i> )	
	Black racer ( <i>Coluber constrictor</i> )	Red bay ( <i>Persea palustris</i> )	Maidencane ( <i>Panicum hemitomon</i> )	
	Diamondback rattlesnake ( <i>Crotalus adamanteus</i> )	Wax myrtle ( <i>Myrica cerifera</i> )	Nut rush ( <i>Scleria spp.</i> )	
	Pygmy rattlesnake ( <i>Sistrurus milliaris</i> )	Saw palmetto ( <i>Serenoa repens</i> )	Redroot ( <i>Lachnanthes caroliniana</i> )	
	Hawk guild ( <i>Buteo spp.</i> )		Yellow eyed grass ( <i>Xyris spp.</i> )	
	Bobwhite quail ( <i>Colinus virginianus</i> )		Pickereel weed ( <i>Pontederia cordata</i> )	
	Opossum ( <i>Didelphis virginiana</i> )		Colic root ( <i>Aletris lutea</i> )	
	Cotton rat ( <i>Sigmodon spp.</i> )		Sundew ( <i>Drosera spp.</i> )	
	Raccoon ( <i>Procyon lotor</i> )		Milkwort ( <i>Polygala spp.</i> )	
	Striped skunk ( <i>Mephitis mephitis</i> )		St. Johns wort ( <i>Hypericum spp.</i> )	
	*Bobcat ( <i>Lynx rufus</i> )		Marsh pink ( <i>Sabatia spp.</i> )	



Habitat Type	Wildlife Utilization	Overstory/Shrub Spp.	Ground Cover Spp.	Hydrology
Wet Prairie**	*Deer ( <i>Odocoileus virginianus</i> )		Hatpins ( <i>Eriocaulon spp.</i> )	
	*Cottonrail rabbit ( <i>Sylvilagus floridanus</i> )			
	Leopard frog ( <i>Rana sphenoccephala</i> )	*Slash pine ( <i>Pinus elliotii var. densa</i> )	Wire grass ( <i>Aristida spp.</i> )	Duration of inundation +0.7' for 2-5 months/yr
	Cricket frog ( <i>Acris gryllus dorsalis</i> )	*Wax myrtle ( <i>Myrica cerifera</i> )	Beak rush ( <i>Rhynchospora spp.</i> )	
	Black racer ( <i>Coluber constrictor</i> )	Dahoon holly ( <i>Ilex cassine</i> )	Maidencane ( <i>Panicum hemitomon</i> )	
	Aquatic turtle guild	*Groundsel bush ( <i>Baccharis halimifolia</i> )	Blatterwort ( <i>Utricularia spp.</i> )	
	Pygmy rattlesnake ( <i>Sistrurus miliarius</i> )		St. Johns wort ( <i>Hypericum fasciculatum</i> )	
	Hawk guild		Marsh pink ( <i>Sabatia spp.</i> )	
	Heron and egret guild		Hatpins ( <i>Eriocaulon spp.</i> )	
	White ibis ( <i>Eudocimus albus</i> )		Sundew ( <i>Drosera capillaris</i> )	
	Killdeer ( <i>Charadrius vociferus</i> )		Yellow eyed grass ( <i>Xyris spp.</i> )	
	Red winged blackbird ( <i>Agelaius phoeniceus</i> )		Water drop-wort ( <i>Oxypolis filiformis</i> )	
	Marsh rabbit ( <i>Sylvilagus palustris</i> )		Queen's delight ( <i>Stillingia aquatica</i> )	



Habitat Type	Wildlife Utilization	Overstory/Shrub Spp.	Ground Cover Spp.	Hydrology
<b>Emergent Fresh Water Marsh, Ponds and Ditches</b>	Cotton rat ( <i>Sigmodon spp.</i> )		Mermaid weed ( <i>Proserpinaca spp.</i> ) Giant plumegrass ( <i>Erianthus giganteus</i> )	Period of inundation 7-10 months/yr
	Cricket frog ( <i>Acris gryllus</i> )	Carolina willow ( <i>Salix carolinana</i> )	Pickereel weed ( <i>Pontederia cordata</i> )	
	Leopard frog ( <i>Ranasphenocephala</i> )	Elderberry ( <i>Sambucus canadensis</i> )	Cattail ( <i>Typha spp.</i> )	
	*Bullfrog ( <i>Rana catesbeiana</i> )	Cypress ( <i>Taxodium spp.</i> )	Arrowhead ( <i>Sagittaria spp.</i> )	
	Aquatic turtle guild	Dahoon holly ( <i>Ilex cassine</i> )	Fire-flag ( <i>Thalia geniculata</i> )	
	Banded water snake ( <i>Natrix fasciata</i> )	Blackgum ( <i>Nyssa sylvatica var. biflora</i> )	Bulrush ( <i>Scirpus spp.</i> )	
	Cottonmouth ( <i>Agkistrodon piscivorus</i> )	Buttonbush ( <i>Cephalanthus occidentalis</i> )	Maidencane ( <i>Panicum hemitomon</i> )	
	*American alligator ( <i>Alligator mississippiensis</i> )		Ludwigia ( <i>Ludwigia spp.</i> )	
	*Heron and egret guild		St. Johns wort ( <i>Hypericum spp.</i> )	
	Florida duck ( <i>Anas fulvigula</i> )		Beak rush ( <i>Rhynchospora spp.</i> )	
Raccoon ( <i>Procyon lotor</i> )		Sawgrass ( <i>Cladium jamaicense</i> )		



Habitat Type	Wildlife Utilization	Overstory/Shrub Spp.	Ground Cover Spp.	Hydrology
			Spike rush ( <i>Eleocharis spp.</i> )	
			Soft rush ( <i>Juncus spp.</i> )	
			Lake rush ( <i>Fuirena spp.</i> )	
			Water drop wort ( <i>Oxypolis filiformis</i> )	
			Sedges ( <i>Cyperus spp.</i> )	
			Smartweed ( <i>Polygonum spp.</i> )	
<b>Mixed Hardwood Swamps</b>	Cricket frog ( <i>Acris gryllus</i> )	Bald/pond cypress ( <i>Taxodium spp.</i> )	Royal fern ( <i>Osmunda regalis</i> )	Hydroperiod 4-11 months
	Little grass frog ( <i>Limnaoedus ocularis</i> )		Cinnamon fern ( <i>Osmunda cinnamomea</i> )	Depth of inundation +2.5' (wet)
	*American alligator ( <i>Alligator mississippiensis</i> )	Blackgum ( <i>Nyssa sylvatica var. biflora</i> )	Swamp fern ( <i>Blechnum serrulatum</i> )	Depth of inundation -5' (dry)
	Aquatic turtle guild	Red maple ( <i>Acer rubum</i> )	Chain fern ( <i>Woodwardia spp.</i> )	
	Eastern mud snake ( <i>Farancia abacura</i> )	Button bush ( <i>Cephalanthus occidentalis</i> )	Shield fern ( <i>Thelypteris spp.</i> )	
	Cottonmouth ( <i>Agkistrodon piscivorus</i> )	Water ash ( <i>Fraxinus caroliniana</i> )	Arrow arum ( <i>Peltandra virginica</i> )	

Habitat Type	Wildlife Utilization	Overstory/Shrub Spp.	Ground Cover Spp.	Hydrology
	*Barred owl ( <i>Strix varia</i> )	Slash pine ( <i>Pinus elliotti</i> )	Lizard tail ( <i>Saururus cernuus</i> )	
	Swallow-tailed kite ( <i>Elanoides f. forficatus</i> )	Wax myrtle ( <i>Myrica cerifera</i> )	Pickerel weed ( <i>Pontederia cordata</i> )	
	*Pileated woodpecker ( <i>Dryocopus pileatus</i> )	Fetterbush ( <i>Lyona lucida</i> )	Sphagnum moss ( <i>Sphagnum spp.</i> )	
	Great horned owl ( <i>Bubo virginianus</i> )	Virginia willow ( <i>Itea virginica</i> )	Sawgrass ( <i>Cladium jamaicense</i> )	
	Woodstork ( <i>Mycteria americana</i> )	Carolina willow ( <i>Salix caroliniana</i> )	Poison ivy ( <i>Toxicodendron radicans</i> )	
	*Wood duck ( <i>Aix sponsa</i> )	American elm ( <i>Ulmus americana</i> )		
	*Deer ( <i>Odocoileus virginianus</i> )	Swamp laurel oak ( <i>Quercus laurifolia</i> )		
	River otter ( <i>Lutra canadensis</i> )	Sweet bay ( <i>Magnolia virginiana</i> )		
	Raccoon ( <i>Pyocyon lotor</i> )	Swamp bay ( <i>Persea palustris</i> )		
	Black bear ( <i>Ursus americanus</i> )			
	*Bobcat ( <i>Lynx rufus</i> )			

Notes:

\* = See Appendix A.

\*\* = This term is used to describe shallow-depressional wetlands with sandy soils typically found in pine flatwoods communities.

Other have used “wet prairie” to describe several different wetland communities in south Florida (e.g., Lodge, 1996).





**APPENDIX C**  
**COMMON FRESH WATER FISHES OF CENTRAL FLORIDA**

Original list compiled by Dr. Alex Marsh, Department of Biological Science,  
Florida Atlantic University, Boca Raton, Florida

(IMC-Agrico Revised)

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<b>Scientific Name</b>	<b>Common Name</b>
<i>Amia calva</i>	Bowfin
<i>Anguilla rostrata</i>	American Eel
<i>Erymizon sucetta</i>	Lake Chubsucker
<i>Esox niger</i>	Chain Pickerel
<i>Etheostoma fusiforme</i>	Scalyhead Darter
<i>Fundulus chrysotus</i>	Golden Topminnow
<i>Fundulus seminolis</i>	Seminole Killifish
<i>Gambusia affinis</i>	Mosquitofish
<i>Heterandria formosa</i>	Least Killifish
<i>Ictalurus natalis</i>	Yellow Bullhead
<i>Jordanella floridae</i>	Flagfish
<i>Labidesthes sicculus</i>	Brook Silverside
<i>Lepisosteus platyrhincus</i>	Florida Gar
<i>Lepomis gulosus</i>	Warmouth
<i>Lepomis macrochirus</i>	Bluegill
<i>Lepomis marginatus</i>	Dollar Sunfish
<i>Lepomis microlophus</i>	Redear Sunfish
<i>Lepomis punctatus</i>	Spotted Sunfish
<i>Lucania goodei</i>	Bluefin Killifish
<i>Micropterus salmoides</i>	Largemouth Bass
<i>Notemigonus crysoleucas</i>	Golden Shiner
<i>Noturus gyrinus</i>	Tadpole Madtom
<i>Poecilia latipinna</i>	Sailfin Molly
<i>Tilapia aurea</i> *	Spotted Tilapia

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(\* Exotic Species)

## **APPENDIX D**

### **COMMON AQUATIC INSECT TAXA**

List compiled by Dr. Alex Marsh, Department of Biological Science,  
Florida Atlantic University, Boca Raton, Florida

Order	Plecoptera	Stoneflies
Order	Ephemeroptera	Mayflies
Order	Odonata	
	Suborder Anisoptera	Dragonflies
	Suborder Zygoptera	Damselflies
Order	Hemiptera	
	Family Hebridae	Velvet water bugs
	Family Hydrometridae	Water measurers
	Family Mesoveliidae	Water treaders
	Family Gerridae	Water striders
	Family Veliidae	Broad-shouldered water striders
	Family Notonectidae	Backswimmers
	Family Pleidae	Pigmy backswimmers
	Family Naucoridae	Creeping water bugs
	Family Nepidae	Water scorpions
	Family Belostomatidae	Giant water bugs
	Family Corixidae	Water boatmen
Order	Megaloptera	
	Family Sialidae	Alderfly
	Family Corydalidae	Hellgrammite
Order	Neuroptera	Spongilla flies
Order	Trichoptera	Caddis flies
Order	Lepidoptera (Pyrallidae)	Aquatic caterpillars
Order	Coleoptera	
	Family Haliplidae	Crawling water beetles
	Family Dystiscidae	Predaceous diving beetles
	Family Gyrinidae	Whirligig beetles
	Family Hydrophilidae	Water scavengers
	Family Psephenidae	Water pennies
	Family Elmidae	Riffle beetles
	Family Helodidae	Marsh beetles
	Family Noteridae	Burrowing water beetles
	Family Chrysomelidae	Leaf beetles
	Family Dryopidae	Long-toed water beetles

Order	Diptera	
	Family Blepharoceridae	Net-winged midges
	Family Tipulidae	Crane flies
	Family Ptychopteridae	Phantom crane flies
	Family Psychodidae	Moth flies
	Family Dixidae	Dixa midges
	Family Culicidae	Mosquitoes, phantom midges
	Family Simuliidae	Blackflies
	Family Tendipedidae	Midges
	Family Ceratopogonidae	Biting midges
	Family Stratiomyidae	Soldierflies
	Family Tabanidae	Horseflies, deerflies
	Family Rhagionidae	Snipe flies
	Family Syrphidae	Rat-tailed maggots
	Family Tetanoceridae	Marsh flies
	Family Ephydriidae	Shore flies

**APPENDIX E NUISANCE OR UNDESIRABLE PLANT SPECIES  
FOUND IN WETLANDS IN CENTRAL FLORIDA**

Common Name	Scientific Name	Nuisance or Undesirable
air-potato	<i>Dioscorea bulbifera</i>	N
alligator weed	<i>Alternanthera philoxeroides</i>	N
Australian pine	<i>Casuarina equisetifolia</i>	U
bahia grass	<i>Paspalum notatum</i>	U
balsam apple	<i>Momordica charantia</i>	U
Bermuda grass	<i>Cynodon dactylon</i>	U
bittermint	<i>Hyptis mutabilis</i>	U
Brazilian pepper	<i>Schinus terebinthifolius</i>	N
Caesar's weed	<i>Urena lobata</i>	U
cattail	<i>Typha spp.</i>	N
Chinese tallow	<i>Sapium sebiferum</i>	N
climbing ferns	<i>Lygodium spp.</i>	U
climbing hempvine	<i>Mikania scandens</i>	N
cogon grass	<i>Imperata sp.</i>	N
coinwort	<i>Centella asiatica</i>	U
crabgrass	<i>Digitaria ciliaris</i>	U
cuphea	<i>Cuphea carthagenensis</i>	U
day-flower	<i>Commelina diffusa</i>	U
dog fennel	<i>Eupatorium capillifolium</i>	U
false pimpernel	<i>Lindernia grandiflora</i>	U
grass	<i>Axonopus affinis</i>	U
guava	<i>Psidium guajava</i>	U
melaleuca	<i>Melaleuca quinquenervia</i>	N
murdannia	<i>Murdannia nudiflora</i>	U
para grass	<i>Brachiara mutica</i>	N
primrose willow	<i>Ludwigia peruviana</i>	N
sedge	<i>Cyperus rotundus</i>	U
sesbania	<i>Sesbania spp.</i>	U
sorrel	<i>Oxalis corniculata</i>	U
southern willow	<i>Salix caroliniana</i>	U
sword fern	<i>Nephrolepis cordifolia</i>	U
taro	<i>Colocasia esculenta</i>	U
torpedo grass	<i>Panicum repens</i>	N
tropical soda apple	<i>Solanum tampensis</i>	U
Vasey-grass	<i>Paspalum urvillei</i>	U
water primrose	<i>Ludwigia octovalvis</i>	N
water hyacinth	<i>Eichornia crassipes</i>	N
water lettuce	<i>Pistia stratiotes</i>	N
wedelia	<i>Wedelia trilobata</i>	U
wild Boston-fern	<i>Nephrolepis exaltata</i>	U

N = Nuisance - native or exotic plants which have the capability to severely alter the diversity and/or structure of a wetland ecosystem.

U = Undesirable - inappropriate species but not usually severely disruptive to wetland diversity and/or structure.





Edited 11-2-98

<b>IMC-AGRICO - QUALITATIVE WETLAND SURVEY</b>		Page 1 of 2
Project Site: Ona ___ Pine Level ___ Other _____		Wetland No. : _____
Investigator: _____		(Linked with Wetland No. _____)
Date: _____ 199__ Time: _____ am./pm.	Photo: Roll # _____, Photo #s _____	

**JURISDICTIONAL AREA VEGETATION COVER TYPE**

( ) (200, 300, 400) Other _____	
<b>Water</b>	
( ) 511 - Natural Streams, Waterways	( ) 616 Inland Ponds and Sloughs
( ) 512 - Ditches, canals	( ) 617 Mixed Wetland Hardwoods
( ) 520 - Lakes	( ) 621 Cypress
( ) 534 - Reservoirs, < 10 Ac.	( ) 630 Wetland Forested Mixed
<b>Forested</b>	
( ) 611 - Bay Swamp	( ) 641 Freshwater Marshes
( ) 613 Gum Swamp	( ) 643 Wet Prairies
( ) 615 Stream and Lake Swamp - Bottomland	( ) 644 Emergent Aquatic Vegetation
	( ) 646 Shrub Marsh

**VEGETATION**

CANOPY AND SUBCANOPY*	>=1"dbh % Comp.	SHRUB LAYER* (WOODY PLANTS <1" DBH)	% Comp.
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
Total % Cover			
GROUND COVER*	% Comp.		
1			
2			
3			
4			
5			
6			
7			
8			
9			
Total % Cover		Total % Cover	

**VEGETATION DISTURBANCE**

<b>Describe type of alteration and effects:</b> _____		
<input type="checkbox"/> none <input type="checkbox"/> logging/clearcutting <input type="checkbox"/> ditching/draining <input type="checkbox"/> eutrophication/pollution	<input type="checkbox"/> debris/dumping <input type="checkbox"/> disease <input type="checkbox"/> filling <input type="checkbox"/> roads/trails <input type="checkbox"/> damming/flooding	<input type="checkbox"/> other _____ <input type="checkbox"/> spoil banks <input type="checkbox"/> cropland <input type="checkbox"/> hog rooting <input type="checkbox"/> pasture/grazing
<b>DEGREE OF IMPACT</b>		
<input type="checkbox"/> minor <input type="checkbox"/> moderate <input type="checkbox"/> high <input type="checkbox"/> severe		

Miscellaneous notes regarding vegetation (variability, ave. dbh, zonation, etc. _____)

\* Dominance and Cover Classes: 0-5%, 5-25%, 25-50%, 50-75%, 75-95%, 95-100%

Edited 11-2-98	<b>SOILS</b>	Page 2 of 2
Characteristic:		
Peat or Muck?	Yes _____ No _____	Estimated Muck Depth _____ (<1", 1-3", 3-6", >6" )
Organic ?	Yes _____ No _____	<b>Soil Disturbance / Alteration :</b> _____ _____ _____ _____ _____
Dark Sands?	Yes _____ No _____	
Light sands?	Yes _____ No _____	
Clays?	Yes _____ No _____	
Sulfide Odor?	Yes _____ No _____	

HYDROLOGY AND TOPOGRAPHY		
<b>SURFACE WATER AND / OR SATURATION</b>		
Is the ground surface inundated?	Yes _____ No _____	Range of water depth: _____ ft. to _____ ft.
Is the soil saturated ?	Yes _____ No _____	<b>Est. Seasonal High ( at J.D. line):- Check one.</b>
Are seepage slopes present?	Yes _____ No _____	At or above the surface _____
		0" to -6" below surface _____
		>6" below surface _____
<b>STREAM CHANNEL CHARACTERISTICS</b>		
Ave. width bank-to-bank:	_____ ft.	
Ave. height of banks above bottom:	_____ ft.	
Is flow present?	Yes _____ No _____	
Ave. water depth:	_____ ft.	
Number of stream channels:	_____	
<b>Hydrology / Topography Disturbance / Alteration:</b>		
_____		
_____		

WILDLIFE SIGNS AND / OR OBSERVATIONS	
<input type="checkbox"/> NONE	
<input type="checkbox"/> DIRECT OBSERVATION	Species: _____
<input type="checkbox"/> INDIRECT OBSERVATION	<input type="checkbox"/> burrow <input type="checkbox"/> rubs <input type="checkbox"/> tracks <input type="checkbox"/> nests <input type="checkbox"/> scat <input type="checkbox"/> other _____

ENDANGERED AND THREATENED SPECIES	
<b>PLANTS:</b> <input type="checkbox"/> None present <input type="checkbox"/> Present Species: _____ Species: _____ Species: _____	<b>ANIMALS:</b> <input type="checkbox"/> None present <input type="checkbox"/> Present Species: _____ Species: _____ Species: _____

OTHER NOTEWORTHY COMMENTS	
Adjacent Land Use - % Perimeter _____ % _____ % _____ % _____ % _____ %	Other Notes: _____ _____ _____ _____





Project Name \_\_\_\_\_

Wetland No. \_\_\_\_\_

Reviewer(s) \_\_\_\_\_

Date \_\_\_\_\_ 199\_\_

Wetland Group ID \_\_\_\_\_

**FORM 3-2**

**IMC-Agrico  
WETLAND RAPID ASSESSMENT  
PROCEDURE  
Evaluation Matrix  
(IMCWRAP)**

**WARNING**

**THIS FORM IS MEANT TO BE A  
FIELD AID AND NOT AS A  
SUBSTITUTE FOR THE GUIDANCE  
PROVIDED IN THE IMC-WRAP  
DOCUMENT**

<b>WILDLIFE UTILIZATION</b>	<b>Select Score</b>	<b>WETLAND OVERSTORY/SHRUB</b>	<b>Select Score</b>	<b>WETLAND GROUNDCOVER</b>	<b>Select Score</b>
<b>No Evidence of Wildlife Use</b> Existing wetland heavily impacted No evidence of wildlife utilization Little/no habitat for native wildlife	0.0	<b>No Desirable Overstory / Shrub</b> No desirable tree & shrub species Negligible or little habitat support from seedling trees Recent clear cutting w/ evidence of canopy revegetation >75% undesirable plant species	0.0	<b>No Desirable Groundcover</b> Groundcover > 75% undesirable species Groundcover intensely maintained, managed or impacted Freshly mulched mitigation site with no evidence of seed germination	0.0
	0.5		0.5		0.5
<b>Minimal Evidence of Wildlife Use</b> Minimal evidence of wildlife use Little habitat for birds, small mammals, and/or reptiles Limited adj. upland food sources In area of frequent human disturbance	1.0	<b>Minimal Desirable Overstory / Shrub</b> Approx. 50 % undesirable trees & shrubs Overstory and Shrub immature but potential for habitat support Natural recruitment of trees & shrubs Snags due to hydrologic or environmental problems Disease or insect damage to live canopy	1.0	<b>Minimal Desirable Groundcover</b> > 50% undesirable vegetation Groundcover routinely managed Newly planted mitigation site Newly mulched site, signs of germination	1.0
	1.5		1.5		1.5
<b>Moderate Evidence of Wildlife Use</b> Use by small/med. mammals, and/or reptiles Aquatic macroinvertebrates, amphibians, and/or forage fish Adequate adjacent upland food sources Minimal human disturbance Adequate wildlife cover/habitat in wetland or adjacent upland	2.0	<b>Moderate Desirable Overstory / Shrub</b> < 25% undesirable canopy trees & shrubs Wetland overstory and shrub providing habitat support Some natural recruitment of native overstory and shrub seedlings Healthy canopy trees, minimal disease/insect damage	2.0	< 25% undesirable species Slight human induced impacts Mulched or planted areas w/ established desirable species	2.0
	2.5		2.5		2.5
<b>Strong Evidence of Wildlife Use</b> Use by large mammals and/of reptiles Abundant aquatic macroinverts, amphibians and /or forage fish Abundant upland food sources Negligible human disturbance Abundant cover/habitat for wildlife within the wetland or adj. upland	3.0	<b>Abundant Desirable Wetland Overstory / Shrub</b> < 10% invasive canopy & midstory species Good habitat support by overstory and shrub Strong evidence of natural recruitment of native trees & shrubs Some snags or den trees Healthy live canopy, minimal disease or insect damage	3.0	<b>Abundant Desirable Groundcover</b> < 10% nuisance plants, no exotic plants Minimal/no disturbance to groundcover Managed or natural periodic burns	3.0
<b>Variable Scores</b>					
<b>NOTES:</b>					



ADJ. UPLAND/WETLAND BUFFER	Select Score	HYDROLOGIC INDICATORS	Select Score	WATER QUALITY INPUT & TREATMENT	Select Base Score
<b>No Adj. Buffer</b> Buffer nonexistent	0.0	<b>Hydrology Severely altered, Succession to Transitional/ Upland or Open water</b> Hydrology severely altered Hydroperiod inadequate to support particular community type Upland plants encroaching into historic wetland area Wetland plant die-off <b>Substantial soil subsidence</b>	0.0	<b>Land Use Category</b> FLUCFCS Code    Description 211    Improved Pasture    1.5 212    Unimproved Pasture    2.5 213    Woodland Pasture    1.5 214    Row Crops    0.5 221    Citrus    0.5 310    Herbaceous Rangeland    2.5 320    Shrub and Brushland    2.5 330    Mixed Rangeland    2.5 411    Flatwoods    2.5 420    Upland Forest    2.5 512    Ditch/canal    1.0 520    Lake    2.0 534    Ponds < 10 ac.( & cattle)    0.5 600    Wetlands    2.5 800    Transportation (RR & ROW)    0.5	<b>Base Score*</b>
	0.5		0.5		
<b>Buffer ≤ 30' average width w/ desirable species</b> < 30' ave. buffer width Mostly desirable plants that provide cover, food, roosting for wildlife Not connected to wildlife corridors  > 300' wide, but > 75% exotic/nuisance invasive species plants	1.0	<b>Hydrology Inadequate to maintain viable wetland</b> Hydroperiod inadequate to maintain particular community type Succession to transitional/upland species, wetland veg. Stressed Evidence of soil subsidence	1.0	* Base LU score can be adjusted per on site specific conditions as follows: No influence    +0.5 Mod. Influence    +/- 0.0 Sign. Influence    - 0.5	<b>Pretreatment Modifier**</b> Berms, lakes, wet detention with swales, wet detention with dry retention,    0.5 No treatment    0.0
	1.5		1.5		
<b>Buffer 30'-300' wide, predom. desirable plants</b> Buffer 30'-300' wide Desirable plants provide cover, food, roosting for wildlife Portions connected to offsite wetland system/ <b>designated</b> wildlife corridor Buffer > 300', but predom. Undesirable non-invasive plant species	2.0	<b>Hydrology Adequate, Poss. External Influences</b> Hydroperiod adequate, possible interfering conditions  No plant stress from too little/too much water  Little soil subsidence	2.0	**use only when specific treatment is provided	
	2.5		2.5		
<b>Buffer &gt; 300', Predom. Desirable Plant Species</b> Buffer width > 300' average < 10% nuisance/exotic species Connected to offsite wetlands or <b>designated</b> wildlife corridor	3.0	<b>Hydrology Adequate</b> Plants healthy, no stress Natural hydroperiod  Not adj. To negative impacts No soil subsidence	3.0		
<b>Variable Scores</b>					
<b>Total Variable Scores</b>			<b>0.0</b>		
<b>Total Variable Maximum</b>			<b>#DIV/0!</b>		
<b>IMC-WRAP SCORE</b>			<b>#DIV/0!</b>		
<b>Notes:</b>					