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Advanced Florida Master Naturalist

Contract Number: 34141
Work Order: 4
Encumbrance Number: S010345
Project Name: Grazing Plan for Lake George

Invoice No. 005-2019

Date Submitted: 26 August 2019
Billing Entity: St. Johns River Water Mgt. District
Address: Palm Bay Service Center
525 Community College Parkway, S.E.
Palm Bay, Florida 32909
Contact Person: Peter Henn
Land Management Program Manager
Phone: (321) 984-4942

Description		Acres	Cost Unit	Amount
Lake George Grazing Management Plan	**Total**	**134**		
1. Inventory - improved & semi-improved pasture & grazing mgt. plan.		**92.5**	**Flat-Rate**	
2. Field review native marsh & forest areas & annual grazing mgt. plan.		**41.5**	**Flat-Rate**	
			Total Cost	**$500.00**

Agreement Criteria

1. Cost estimates are based upon the number of acres per land cover/land-use provided by SJRWMD.
2. Any changes to the actual number of acres encountered while completing the Prescribed Grazing Management Plan will reflect a change in the total cost for the project based on the per acre amounts noted above.
3. While conducting field inventory of the grazing land resources, SJRWMD agrees to provide someone familiar with the property to assist our firm with access into and throughout the property.
4. SJRWMD agrees to provide digital aerial coverage of each project property with a minimum of a boundary line delineating the property in a KMZ format that will function within Google Earth.

INSPECTED AND APPROVED:

_____ **Date**: _____

Peter Henn
Land Management Program Manager

Make all checks payable to: *Florida Eco Enterprises, LLC*

"Conservation will ultimately boil down to rewarding the private landowner who conserves the public interest."
Aldo Leopold, Conservation Economics, 1934.

Lake George

Volusia County, Florida

Grazing Management Plan

Prepared By: Greg Hendricks,
USDA-NRCS (Retired)
Rangeland Management Specialist
Advanced Florida Master Naturalist
Merritt Island, Florida

X Greg Hendricks

Greg Hendricks
Range & Pasture Management Specialist
Florida Eco Enterprises, LLC

X _____

Cattle Lessee

X _____

Peter Henn
Project Manager
St. Johns River Water Management District

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General Property Description

The Lake George grazing lease consists of approximately 134 acres located 1.5 miles west of SR-17 and 1.8 miles east of Lake George in Volusia County, Florida. This property formerly consisted of longleaf pine forest in the eastern portion of the property with flatwood pinelands in the western portion and depressional marshes, hardwood hammocks and swamps in small depressional areas.

Presently bahiagrass pasture and hay lands occupy the former flatwood and longleaf pine forested areas. Opportunities exist for inter-seeding legumes into these pastures providing a natural nitrogen source for the grasses and to convert the bahiagrass hay field to perennial peanut hay elevating yield and quality.

Goals & Objectives

The objective of this grazing management plan is to provide guidance and recommendations to SJRWMD land managers and to the grazing lessee on methods and techniques that will support livestock grazing as an effective land management tool on the Lake George property. For this purpose, this plan recognizes the former native plant communities where applicable, historic land use(s), the property's current condition and its potential to support a low-intensity/low-input livestock enterprise. Using recognized grazing management principles this management plan encourages livestock grazing as the principle land management tool with judicious use of supporting practices such as interior cross-fencing, stockwater development and mechanical,

chemical, biological brush and weed management, and where feasible the introduction of legumes to improve soil and forage quality.

To create these opportunities the following goals need to be accomplished:

1. Maintain "cow-tight" fences.

2. Install additional livestock watering facilities.

3. Control herbaceous weeds where applicable.

4. Follow a rest-rotation grazing management strategy.

5. Maintain grazing records to assist with annual grazing plan revisions.

6. Revise the grazing management plan in a timely manner incorporating SRJWMD management and lessee inputs on an annual basis.

Soils

Review of the county-level soil survey for the Lake George property is an important part of inventorying the natural resources and for making forage yield predictions. The USDA - NRCS Soil Survey recognizes 9 different soil map units within the 134 acre parcel. Soils provide valuable information pertaining to the present and former natural ecological communities, their ability to growth forage resources and to provide wildlife habitat.

In **Appendix I,** a soil map of the property followed and "Table 1 - Soils" include the following information:

- Soil Map Symbol
- Soil Map Name
- Soil / Native Plant Community Correlations

Native plant communities are divided into plant communities that are typified by frequent fire, i.e., ***fire dependent***, infrequent fire, i.e., ***fire sub-climax*** and communities that experience rare or no fire, i.e., ***climax communities***.

Forage Suitability Groups

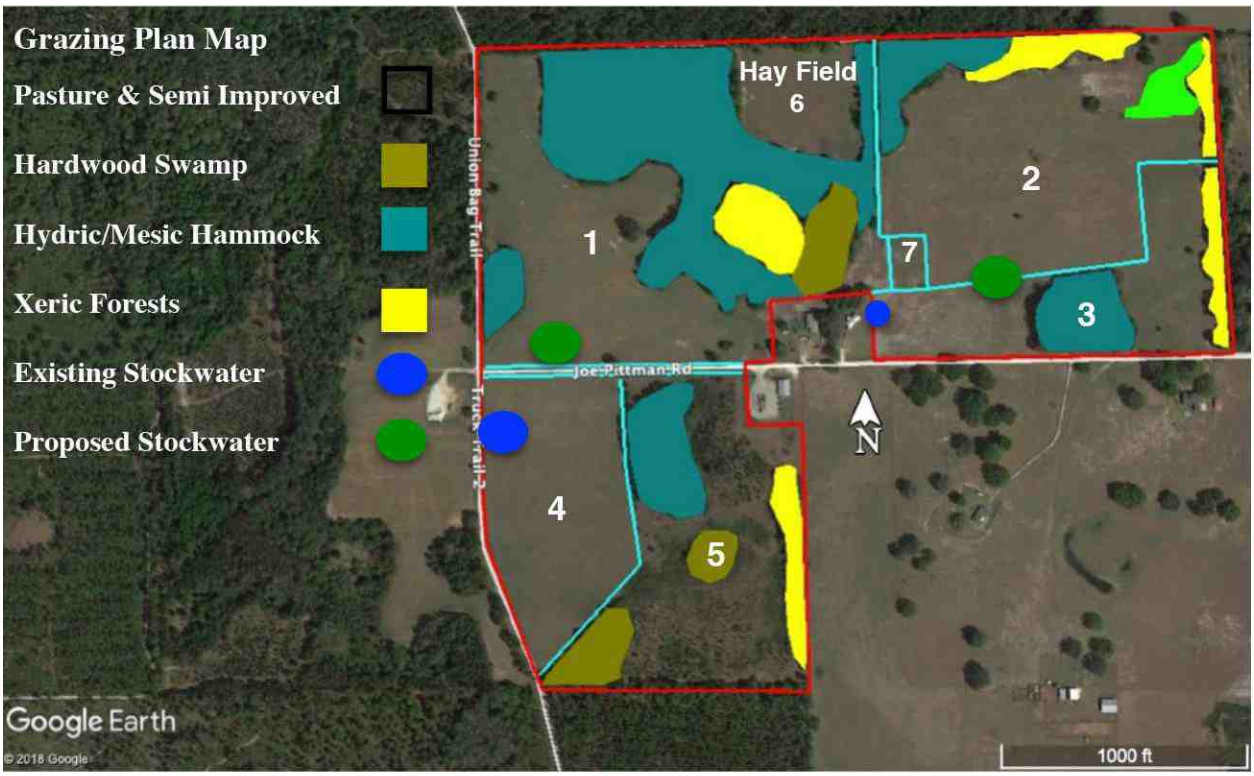
USDA - NRCS combines similar soils to assist in determining recommended forage species and anticipated production yields that assist in making stocking rate recommendations. In **Appendix II,** "FSG - Table 1" group soils by soil map symbols and soil map names into appropriate Forage Suitability Groups (FSG). "FSG - Table 2" provides recommended forage species and their **potential to produce forage yields and livestock carrying capacity**.

"Improved" or non-native forages such as bahiagrass perform best when soil pH is maintained between 5.5 - 6.0 combined with proper levels of annually applied N:P:K fertilizer. However, bahiagrass is the most adapted non-native domesticated forage species capable of sustained production under low stock density without annual fertilization or other soil amendments. It should be noted however, that forage yields and livestock carrying capacity are **at best only about 50%** of what could be obtained if proper soil amendments were applied.

Introducing legumes into bahiagrass pasture and/or the hay field will greatly improve soil health, forage production and forage quality. Three legumes suitable for this property include perennial peanut and carpon-desmodium on better drained soils and aeschynomene on hydric soil areas. Refer to **Appendix 2**, Table 2 for more information on recommended legumes and their yield potential when inter-seeding into bahiagrass pasture or as a stand alone hay crop.

Key Forage Producing Areas

Improved bahiagrass pastures dominate the forage producing areas of this tract in Fields 1 - 4. Field 5 is dominated by semi-improved pasture and native forage species. Field 6 is presently a



bahiagrass hayfield that could be improved by either inter-seeding a legume such as carpon desmodium into the bahiagrass or by converting this grass hayfield into perennial peanut hay.

Natural plant communities present include freshwater marsh, hydric and mesic hammocks, hardwood swamps and xeric upland forested communities.

Grazing Management & Supporting Practices

USDA - NRCS conservation practice Prescribed Grazing - Code 528, is the application of managing the harvesting of vegetation with grazing and/or browsing animals. This practice combined with Brush Management - Code 314, Herbaceous Weed Control - Code 315, Fence - Code 382, Integrated Pest Management - Code 595, Watering Facility - Code 614 and Prescribed Burning - Code 338 should be incorporated within this grazing management plan to ensure healthy livestock, sustainable forage resources and desirable wildlife habitat.

Fencing

No additional fencing appears necessary at this time.

Stockwater Development

Livestock water is currently provided by wells and troughs in fields 3 and 4, however, the troughs are too small for effective livestock management. New troughs should be installed at existing locations that are at least 300 - 500 gallons. Additional water should be provided as described on the Grazing Plan Map above. By installing 300 feet of additional pipeline into field 1 and 450 feet of pipeline along the fence line of fields 2 & 3 water could be provided to service fields 1, 2, 3 and 7 as well as providing a water source for the working pens. Providing this additional water will greatly enhance meeting the minimum daily requirements of 12 - 15 gallons of water per head, improved livestock distribution and facilitate rotational grazing management.

Brush Management

No brush management appears needed at this time.

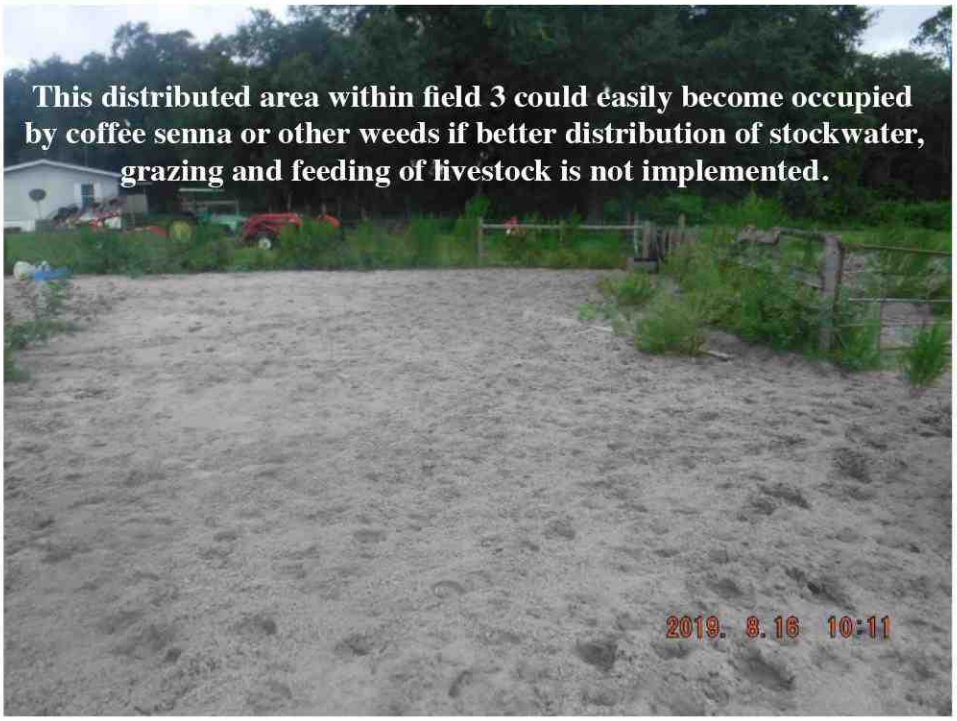
Herbaceous Weeds

In the western end of field 3, due to concentrated grazing, hay feeding and its close proximity to water, forage grasses have been severely impacted resulting in a dense infestation of the exotic weed "coffee senna", (***Senna***

Coffee Senna
On Heavily Disturbed Site in Field 3

occidentalis).
It is imperative that this weedy plant be mowed as soon as possible in an effort to retard its growth before seed shatter. Plant ryegrass in the fall on this ***critical area*** followed by planning bahiagrass next spring. Any emergence from "coffee senna" going forward should be mowed before flower set.

Infestation of coffee senna in the western end of Field 3.



This distributed area within field 3 could easily become occupied by coffee senna or other weeds if better distribution of stockwater, grazing and feeding of livestock is not implemented.

Prescribed Burning

No prescribed burning appears needed at this time.

Grazing Height Tolerances

To optimize forage production and maximize livestock forage intake from both native range and domestic pasture forages it is critical that livestock graze no closer than to the proper stubble height or grazing tolerance of the forage species. Following this guide will ensure rapid recovery and regrowth of forages following grazing, improved animal performance, sustain forage productivity and improved wildlife habitat. To accomplish this it is essential that complete control of livestock grazing be obtained by having interior cross-fencing, gates and adequate stockwater in each pasture. The following table outlines forage species on the Lake George property and their heights in inches to initiate grazing and when grazing should be deferred to allow for regrowth.

Forage Species	*Begin Grazing*	*Begin Resting*
Bahiagrass	6 - 8 inches	2 - 3 inches
Torpedograss	12 - 14 inches	6 - 8 inches
Maidencane	24 - 30 inches	10 - 14 inches
Carpon Desmodium	8 - 10 inches	4 - 6 inches
Perennial Peanut	12 - 16 inches	6 - 8 inches

Restricting grazing pressure in accordance to these forage use tolerances will determine the success of the livestock enterprise and this overall grazing management plan.

Animal Unit Equivalents (AUE's)

Animal Unit Equivalents are used to develop a unit of measure across multiple classes of livestock based upon the animal's body weight. AUEs assist in preparing livestock forage inventories and estimates of livestock carrying capacity based upon the ability of each pasture to produce forage. Animal unit day (AUD), animal unit month (AUM) and animal unit year (AUY) estimates the amount of forage available to the class or type of livestock for 1, 30 and 365 days respectively.

Livestock Class	Average Weight (pounds)	Animal Unit Equivalent	Forage Consumed * (Pounds) AUD	AUM	AUY
Cow w/ calf **	1000	1.0	26	790	9490
Dry Cow	900	0.9	24	730	8760
Bull	1500	1.5	39	1187	14,235
Horse	1200	1.2	31	943	11,315

* Forage consumed based upon daily intake of 2.6% of livestock body weight.

** AUY assumes calf-at-side is restricted to 6 months.

Livestock Forage Inventory

The livestock forage inventory estimates the current livestock carrying capacity for the Lake George property. Within the following table each pasture is described by their forage yield potential based upon the amount of pasture available to livestock. In columns 3, 4 and 5 are carrying capacity estimates in AUM's per acre, AUM's per pasture and total AUY's or the number of livestock that can be supported within each pasture over a 12 month period is provided. At the present time the overall carrying capacity on the Lake George grazing lease is estimated at **19 animal units**.

Pasture	Acres	AUM's/Ac.	Total AUMs	Total AUYs
Pasture 1 Pasture Hydric & Mesic Hammock Hardwood Swamp Xeric Forest	20.8 20.4 2.0 2.3	3.0 0 0 0	62	5.2
Pasture 2 Pasture Marsh Hydric & Mesic Hammock Xeric Forest	23.0 1.3 2.5 2.3	2.5 0 0 0	58	4.8
Pasture 3 Pasture Hydric & Mesic Hammock Xeric Forest	11.7 2.6 1.2	2.5 0 0	29	2.4
Pasture 4 Pasture	14.5	3.0	44	3.6
Pasture 5 Semi Improved Hydric & Mesic Hammock Hardwood Swamp Xeric Forest	15.6 3.0 2.4 1.5	1.0 0 0 0	16	1.3
Hayfield 6 Bahiagrass	6.1	3.5	9 tons of hay 21 AUMs	1.8
Crevice/Holding Pasture 7	0.8	0	0	0
Total	134			19

Annual Grazing Plan

For effective grassland management, animal health and livestock performance it is imperative that a rest-rotation grazing system be implemented to effectively manage key grazing land resources. Livestock forages, both native and introduced provide the essential resources critical to the health and productivity of the livestock. The interaction of the cattle upon the landscape, i.e., grazing, trampling, trailing, controlling of invasive plant species and cycling of nutrients will benefit the health and ecological functions of the property.

The following grazing schedule is provided as a guide to the lessee to management livestock within the projected carrying capacity and to provide strategic rest-periods or deferments to ensure adequate recovery of grazed pastures. During the wet-season or active growing period for warm-season forages, it is recommended that the **Herd - 1** grazing rotation accelerate to every 10 - 15 days through this 3 pasture system taking advantage of higher forage quality and productivity that occurs during this period. During the shorter day, cooler night/dry-season, January through April, grazing-periods for each pasture should be lengthen 30 days and supplemented with hay and protein. **Herd - 2** should be maintained on the 2 pasture system as follow's; rotate grazing every 20 - 30 days during the growing season and provide for two 60 days grazing periods in each pasture during the winter with supplemental hay and protein.

Close watch of the livestock needs to be observed during this period to ensure adequate stockwater and forage is available. Supplement hay will be required during this period along with a protein supplement feed in a liquid or dry-ration formula. A complete mineral mix should be available to the livestock year-round.

Annual Grazing Schedule

Pasture	AUM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	62					Rotate Herd 1 (14 AU's) every 10 - 15 days							
2	58												
3	29												
4	44					Rotate Herd 2 (5 AU's) every 20 - 30 days							
5	16												
* Supplements	X - Protein Y - Mineral H - Hay	X Y H	X Y H	X Y H	X Y H	Y H	Y	Y	Y	Y	Y	Y	Y

G = Grazing Periods

*** Recommended livestock supplements.**

Monitor key forages on each pasture throughout the year. Adhere to grazing tolerances noted above to ensure key forage species are not over grazed. Consequences of weather, markets and other unexpected factors may cause the lessee to deviate from the grazing schedule for short periods of time. However, the overall concept of applied grazing management by providing periodic resting of pastures to promote desirable grassland health and vigor should always be part of the overall grazing management philosophy.

Conservation Practice Schedule:	**Location**	**Approximate Date**
Mowing	All Pastures	As Needed
Invasive Species Control	All Pastures	On-Going
Prescribed Grazing	All Pastures	On-Going

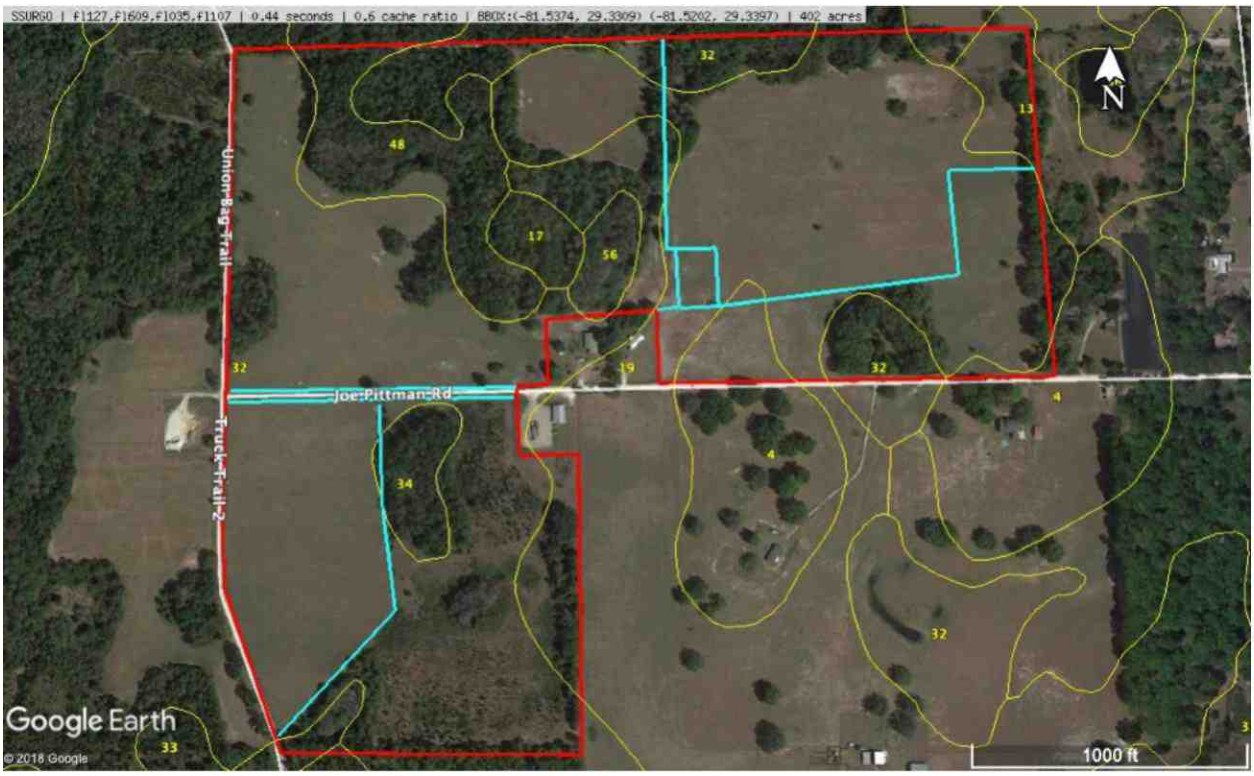
Monitoring Plan

Evaluation of this annual grazing management plan should be performed in coordination with the lessee and SJRWMD land management staff. This annual evaluation should be conducted following the completion of the summer growing season in the fall or early winter. These evaluations should focus upon the total animal unit days per pasture, condition and trends of key forage resources, grazing use intensity and other issues pertinent to the management of livestock under this annual grazing plan.

To facilitate collection of grazing records it is recommended that the lessee use the USDA-NRCS FL-ECS-3 form located in **Appendix IV** for each pasture unit within this annual grazing management plan. Adjustments to stocking rates or movement of livestock should be implemented on an as needed basis to address any issues or concerns during the year.

To assist in evaluating the grazing management plan, vegetative transects should be established in areas that can best reflect forage utilization, condition and trends of both domestic and native forages. See **Appendix V** for more details on monitoring methods and techniques.

Appendix I: Soils



Soil Map Symbol	Soil Map Name	Fire Dependent (Frequent Fire)	Fire Sub-Climax (Infrequent Fire)	Climax Rare or No Fire)
4	Astatula Fine Sand	Xeric Pine	Xeric Mixed Pine	Xeric Hammock
13	Cassia Fine Sand	Xeric Pine	Xeric Mixed Pine	Xeric Hammock
17	Daytona Sand	Xeric Pine	Xeric Mixed Pine	Xeric Hammock
19	Deland Fine Sand	Xeric Pine	Scrubby Flatwoods	Xeric Hammock
32	Myakka - Myakka Wet F.S.	Flatwoods	Mixed Pine Hydric Forest	Hydric Hammock
33	Myakka Fine Sand	Flatwoods	Mixed Pine Mesic Mesic Forest	Mesic Hammock
34	Myakka-St Johns Complex	Flatwoods	Mixed Pine Mesic Mesic Forest	Mesic Hammock
48	Placid Fine Sand (Frequently Ponded)	Marsh	Mixed Pine/ Hydric Forest	Hydric Hammock
56	Samsula Muck	Marsh	Cypress Swamp	Hardwood Swamp

Appendix II: Forage Suitability Groups

FSG Table - 1 Soil Map Symbol	Soil Map Name	Forage Suitability Group
4	Astatula Fine Sand	FSG - 111
19	Deland Fine Sand	
17	Daytona Sand	FSG - 121
13	Cassia Fine Sand	FSG - 131
33	Myakka Fine Sand	FSG - 141
32	Myakka - Myakka Wet F.S.	FSG - 145
34	Myakka-St Johns Complex	
48	Placid Fine Sand , Frequently Ponded	
56	Samsula Muck	FSG - 645

FSG Table - 2 Forage Suitability Groups	Forage Species	lbs/acre [1]	AUM/acre [2]
FSG - 111	Bahiagrass (0# N)	3,000	1.9
	Perennial Peanut	8,500	5.5
FSG - 121	Bahiagrass (0# N)	3,750	2.4
	Perennial Peanut	10,625	6.8
FSG - 131	Bahiagrass (0# N)	3,375	2.2
	Carpon Desmodium/ Bahia	5,650	3.6
FSG - 141	Bahiagrass (0# N)	4.500	2.9
	Carpon Desmodium/ Bahia	7,500	4.8
	Perennial Peanut	11,000	7.1
FSG - 145	Limpograss	10,500	6.7
	Aeschynomene	2,500	1.6
FSG - 645	Limpograss (400# N)	10,500	6.7
	Aeschynomene	2,500	1.6

[1] Average forage production yields

[2] Average carrying capacity in animal unit months (AUMs) per acre based upon 50% grazing efficiency & 2.6% body weight daily of forage intake per animal.

Appendix III: Pasture, Semi-Improved Pasture, Range & Forest Ecological Communities

Bahiagrass Pasture - (*Paspalum notatum*) This non-native forage grass is located throughout the property and is the primary forage resource. It is anticipated that these forages will continue to be managed without soil amendments, therefore control wax myrtle and other weedy species will be required. Some herbaceous weedy species such as broomsedge, carpetgrass and torpedograss should not be view as a weed needing control as cattle will find these species palatable and will control them by grazing.

Marsh - This native herbaceous wetland plant community is scattered throughout the Ft Drum South property. The dominant forage species is maidencane and cutgrass which provide excellent spring and summer forage. Infestations of sand cordgrass and wax myrtle can result as a consequence to draining and over grazing. However, when implementing sound grazing management invasive species such as torpedograss and West Indian marsh grass that are commonly found within these ecological communities are effectively controlled. Along with valuable amounts of livestock forage that can be produced within marshes, these site provide valuable habitat for a variety of species and excellent nesting habitat for sandhill cranes.

Hydric & Mesic Hammock - This native poorly drained plant community are typically dominated by evergreen hardwood species such as live oak, water oak cabbage palms and slash pines. These ecological communities due to its closed forest canopy limits the amount of light reaching the forest floor, thus minimizing the amount of forage production. These forest plant communities provide excellent habitat and mast production supporting a variety of important wildlife species such as wild turkey, deer and important predator species.

Hardwood Swamp - These seasonally inundated forested swamps are typically found within fire-dependent communities such as dry and wet prairies or mesic and wet flatwoods. They are dominated by red maple, bay trees, water ash, swamp dogwood and occasional cypress. These ecological communities due to its closed forest canopy limits the amount of light reaching the forest floor, thus minimizing the amount of forage production. These forest plant communities provide excellent habitat and mast production supporting a variety of important wildlife species such as wild turkey, deer and important predator species.

Xeric Forests - These well drained, high position plant communities formerly consisted of open savannas of longleaf pine and diverse ground vegetation of native grasses, forbs and grass-likes plants while under frequent fires from lightening and indigenous peoples. As fire frequency diminished, turkey oak, sand post oak, sand pines and other less fire tolerant species encroached upon this site forming woody thickets and with lesser amounts of ground vegetation. As fire became excluded, dense xeric hammocks often developed effectively eliminating most of the ground vegetation.

Appendix IV Grazing Records

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ECS-3
9/2000

RANGELAND AND PASTURELAND STOCKING ASSESSMENT RECORDS

PASTURE NO. : _____ **ACRES:** _____ **YEAR:** _____

1. Date In: _____ Date Out: _____ Animal Units:_____ Animal Unit Days_____	8. Date In_____ Date Out_____ Animal Units_____ Animal Unit Days_____
2. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	9. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____
3. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	10. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____
4. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days_____	11. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____
5. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	12. Date Out _____ Animal Units _____ Animal Unit Days_____
6. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	13. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____
7. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	14. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____

Animal Unit Days (AUD) = No. Days x Animal Units TOTAL AUD(s): ___

Animal Units Month(s) (AUM) = $\frac{\text{AUD(s)}}{\text{30(days)}}$ TOTAL AUM(s) ___

AUM(s) per Acre = $\frac{\text{Total AUM(s)}}{\text{No. Acres}}$ AUM(s) per Acre ___

Dates and Amounts of Fertilizer: _____

Date of: First Frost: _____ Last Frost _____

Monthly Rainfall: J :____F ____M ____A ____M ____J ____J ____A ___S ____O ____N ____D ___
Yearly Rainfall Total ___

Appendix V Monitoring Methods

This monitoring plan consists of two components:

Vegetative Transects: A T-Post is placed in the ground to establish a permanent reference point. From the T-Post a line intercept transect is established for 50 - 100 meters depending on the site location. At 1 - 2 meter intervals, the nearest rooted plant is tallied to assess the plant composition of the pasture. This data should be collected at the end of the growing season in October - November of each year.

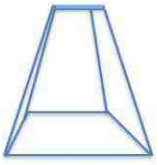
Grazing Utilization: Grazing exclosure cages provide an opportunity to evaluate the forage utilization levels in the pasture. Placing 2 - 3 cages in each pasture will be evaluated periodically during the year. Cages need to be placed over good examples of forage at the beginning of a pasture's grazing period. Once cattle are removed from the pasture, forage species within the exclosure cage are compared to forage outside the cage that has been grazed. The percent difference in plant height or weight of the vegetation outside the cage compared to forage inside the cage provides an estimate of utilization by the livestock. The rule-of-thumb for proper grazing utilization is to never grazing more than 50% of available forage. This ensure enough leaf-area to support regrowth and maintain forage plant vigor.

Below is a recommended grazing exclosure cage design that has worked well for us in Florida.

Grazing Exclosure Monitoring Cage

This grazing exclosure provides ~ 1 square meter of grazing protection to allow grazing intensity utilization determinations. Exclosure Cages are made from welded woven-wire fencing material and held down by tent-like stakes.

Tee-pee ~ 4.5 ft. tall



"The tee-pee" design provides the greatest height within the cage for optimum plant growth between monitoring sessions.

This design minimizes livestock rubbing which can damage the cage and the integrity of plant data.

Appendix VI - Barbwire Fence Guidance

This information should be used as guidance or for reference purposes, unless USDA-NRCS cost-sharing is a consideration. Please refer to SJRWMD performance measures and construction specifications for all practices under consideration.

This sheet lists the minimum requirements to meet Florida Fence Standard (FL 382) for barbwire fence *if USDA Food Security Act costing-sharing is a consideration*. Variances in fence design may be allowed if requested. All variances requests shall be submitted to the State Rangeland Management Specialist or an individual with proper job approval authority for approval. All barbed wire fences will be installed using braces that meet Florida NRCS specifications for braces. Please note, SJRWMD may have standards that exceed the following.

Wire and Spacing
Use only new wire composed of two twisted strands of minimum class 3 galvanized 15.5 gauge high tensile steel barbwire.

Number of Wires
Interior cross fence - 3 wires (minimum) to manage movement of larger livestock such as cattle and horses.
Boundary fence - 4 wire (minimum) are required for boundary fences and next to highways.

Fence and Wire Height and Placement
Cattle and Horses-

- The minimum top wire height for 4 and 5 wire fences is 42 inches above ground level.
- The minimum top wire height for 3 wire fences is 38 inches above ground level.
- Install wires with a minimum of 10-12 inches spacing between the top 2 wires.

Note: Inline fence wire spacing shown below are recommendations only.

WIRE HEIGHT AND SPACING OF WIRES IN INCHES (“)			
Number of Line Wires	**5 Strand**	**4 Strand**	**3 Strand**
Boundary Fence Top Wire Height (minimum)	46	46	**Not Acceptable**
Boundary Fence Bottom Wire Height (minimum)	6	12	**Not Acceptable**
Recommended Inline Fence Wire Spacing (inches)			
Cattle and Horses	6, 16, 26, 36, 46	16, 26, 32, 44	16, 26, 38
To Allow For Wildlife Movement	**Not recommended**	18, 24, 30, 42	18, 26, 38

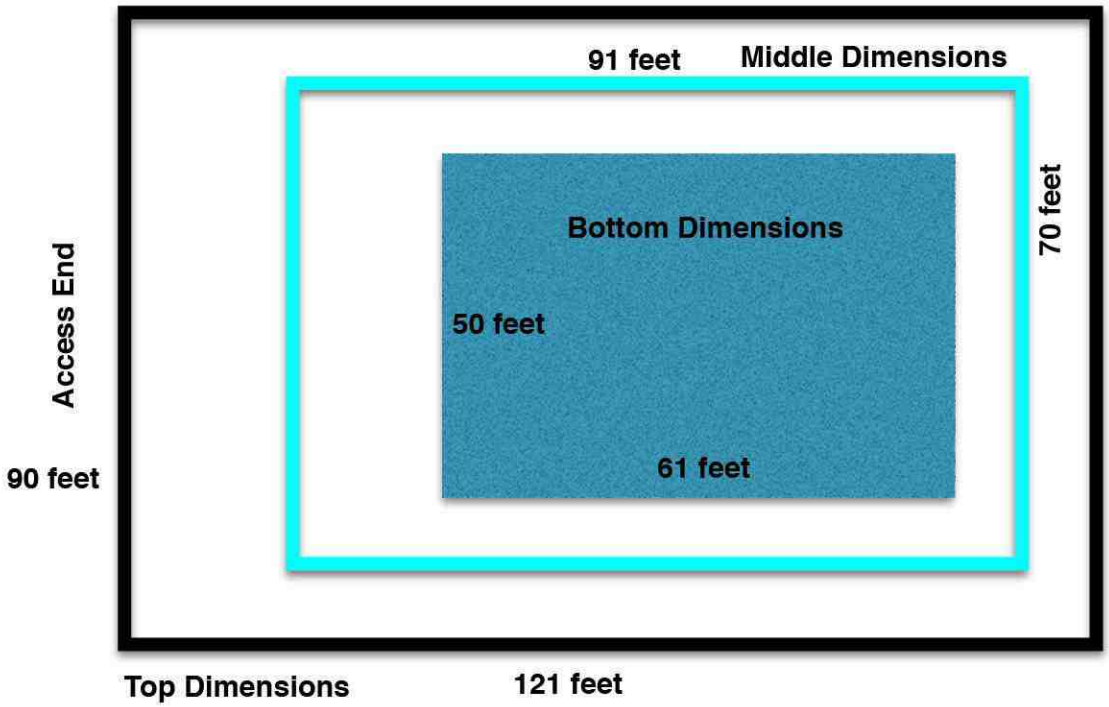
LINE POSTS MATERIALS, POST SPACING AND INSTALIATION DEPTH

- **Steel -** Use only new, painted or galvanized T or U posts.
- **Wood-** Treated with 0.4 lbs/ft3 of chromate copper arsenate (CCA type A, B or C or equivalent). Minimum size, 3" top-diameter X 6.5' length.
- **Post Spacing -** The maximum distance between line posts is 16 feet without the use of stays, or 30 ft. with a minimum of 1 stay between posts.
- **Installation -** Drive or bury wood posts at least 24 inches into the ground in sandy or loamy soils. Install posts to a 42 inch depth in muck soils. If post holes are dug, backfill by tamping the soil around the post at every 4 in. depth.
- **Fastening -** Attach wires to the side of the post receiving the most livestock pressure. Drive staple diagonally to the wood's grain and at a slight downward angle (upward if the pull is up) such as in low places to avoid splitting posts and loosening of staples. Space should be left between staple and post to permit free movement of wire.
- **Wood posts -** Use 1.5 inch (minimum), 9 gauge (minimum), class 3 galvanized staples.
- **Steel posts -** Use manufactured clips or wire posts.

Appendix VII - Stockwater Development Alternatives

Stock Pond Design (1/4 Acre)

Access end sloped 4:1
Other sides sloped 2:1
Total volume excavated: 2,433 yds ^{3}



Solar stockwater systems with large troughs positioned on a level, solid foundation provides the best quality water for livestock. Solar submersible pumps are cost-effective and can deliver water from shallow wells.

Automatic shutoff valves maintain desired water levels in the trough while keeping water readily available for the animals. Having an overflow outlet directing water away from the trough and its foundation is important to minimize washouts around the trough and its base.