Ecological Memorandum

Of

The Density Reduction/Groundwater Resource Area (DR/GR)

Prepared for:

Dover, Kohl & Partners

July 2008

Prepared by

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2077 Bayside Parkway
Fort Myers, FL 33901

This technical memorandum presents the detailed ecological mapping and evaluation of the DR/GR area as described on page 1.7 of "Prospects for Southeast Lee County" by Dover, Kohl & Partners.[i] This memorandum also refines the conceptual restoration plan that was introduced in Chapter 4 of that report.

Since January 2008, Kevin L. Erwin Consulting Ecologist, Inc. (KLECE) ecologists and GIS specialists have been conducting an exhaustive mapping effort of current and historic land uses across 82,880 acres of land in southeast Lee County whose predominant land-use designation is Density Reduction-Groundwater Resource (DR/GR).

Existing land-uses have now been mapped on the Lee County 2007 color aerial photographs and converted to digital geographic files for use with GIS software (Geographic Information Systems). A much more difficult effort consisted of taking unrectified black-and-white 1953 aerial photos from the Soil Conservation Service and mapping the historic hydropatterns.

These products will prove to be extremely useful to Lee County planning staff, the public and policy makers. The data and information derived from this evaluation method represents an important first step in providing insights into a number of important issues concerning the DR/GR area including:

1. What was the DR/GR like prior to recent alterations? What types of habitats had been predominant and what were the surface hydrologic characteristics (hydropatterns)?

2. What is the nature and extent of existing land uses, habitat types, location and conditions of remaining wetlands (hydropatterns), agricultural lands, and watersheds?

3. How wet was the DR/GR then and now and what is the extent of wetland loss?

4. What proportion of converted wetlands remains in agricultural use?

5. What are the similarities between wetlands and agricultural lands in the DR/GR?

6. What is the potential for restoring and sustainably managing these resources?

The work now completed and discussed here is an important step towards developing data, plans, and policies that will protect and restore the DR/GR's natural resources. These results represent a significant undertaking that was necessary in order to reasonably characterize the historic and existing conditions

of the DR/GR landscape. Up to this point we did not know the extent of wetlands conditions prior to alteration or the extent of wetland losses and changes in hydropatterns. We can now better understand the present day condition of the DR/GR and future opportunities for managing its resources and propose a water management restoration concept that protects wetlands and agricultural lands while restoring the water-storage capabilities of this vital part of Lee County.

This effort represents the first comprehensive analysis for a significant area in Lee County since the Lee County Coastal Study which evaluated 104,593 acres (220,148 acres including water area) in 1988.

1. What was the DR-GR like prior to recent alterations? What types of habitats had been predominant and what were the surface hydrologic characteristics (hydropatterns)?

In order to understand the present day condition of any large landscape it is important to know its ecological history. In the case of the 82,880-acre DR/GR area, it was historically part of a larger area that consisted of the intact watersheds of the Six Mile Cypress Swamp, Estero River, Imperial River, and Corkscrew Swamp. Our analysis is limited to those lands within the DR/GR which still include the majority of the historic headwater areas for these watersheds. Elevations range from 30 feet at the upper end of the DR/GR south of State Road 82 to 15 feet at the lower end. Historic headwater areas for the watersheds are located north of present day Corkscrew Road with slopes often less than 1 foot per mile. Ground slopes typically increase dramatically south of this breakpoint until leveling off again in Flint Pen Strand, Bird Rookery Strand and Corkscrew Swamp.

1953 aerial photographs from the Soil Conservation Services (now the National Resource Conservation Service), which are the clearest reliable representation of historic conditions, were scanned and plotted for mapping by experienced ecologists to determine the approximate historic hydrological conditions for the entire study area. This habitat mapping of historic conditions is more general than mapping of existing conditions due to the types of aerial photography available in 1953 (unrectified black-and-white contact prints) and rectified 1":300', true-color photographs available for 2007.

The major habitat associations identified relate to specific hydroperiod and water depth conditions (hydropatterns), with each being color-coded in Figure 1 to illustrate the historical hydropatterns in the DR/GR. Table 1 provides the estimated relationships between the major habitat association and hydropatterns. The estimated depths of inundation and hydroperiods are typical ranges of conditions for unaltered wetland systems in southwest Florida. The coding system of the 1953 conditions was developed by KLECE for this project to

capture the most critical data from the 1953 aerials in a format that can align with later analytical efforts within the DR/GR.

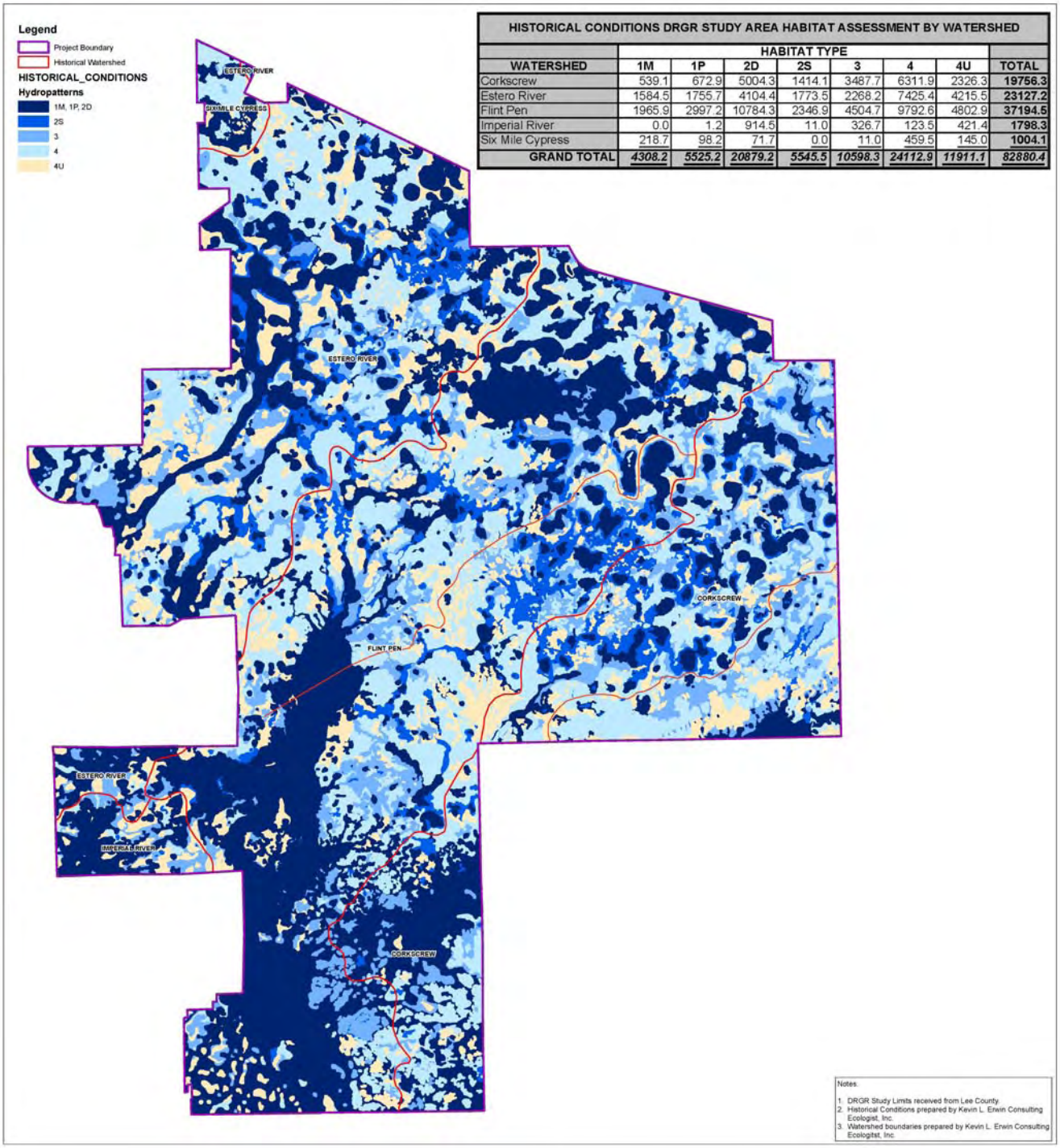
Table 1. Summary of the Correlation Between Various Land Use Coding Systems Used on This Project and Hydropatterns in the DR/GR

Codes (1953 Aerials)	FLUCFCS Codes (2007Aerials)	Wet Season Water Depth	Wetland Hydroperiod	Map Index Color
1, 1M, 1P, 2D	621, 641	1.5 - 2.5'	7-9 mos	dark blue
2S	610, 617, 619	0.75 - 1.5'	4-7 mos	medium blue
3	262, 630, 631, 643, 624, 628	0.25 - 0.75'	1-3 mos	medium light blue
4	625	-0.5 - 0.25'	1-2 mos	light blue

Approximately 71,000 acres or 85.7% of the study area was wetland, comprised of: ponds, freshwater marshes and deep cypress swamp (30,713 acres/ 37.1%); shallow cypress swamp (5,545 acres/6.7%); cypress-pine (10,597 acres/12.8%); and hydric pine prairie (24,113 acres/29.1%). Less than 12,000 acres (11,911acres/14.4%) of the study area was comprised of uplands, mainly pine flatwoods that during wet years would often flood periodically during the wet season. The habitat mapping of historic conditions will be very useful to staff when evaluating proposed projects within the DR/GR.

During a significant part of any year, with normal rainfall much of the DR/GR had historically been flooded or had groundwater levels close to the surface. The deeper ponds, cypress swamps, and marshes have been assigned dark blue on Figure 1 with progressively shallower, shorter hydroperiod (shorter duration of inundation) wetlands being assigned lighter shades of blue. This representation illustrates the location of historic flow ways and headwater sheet flow areas and allows us to roughly calculate the historic capacity for water storage in the DR/GR during an annual cycle.

During years of normal rainfall certain types of wetlands will remain inundated for predicted lengths of time at depths that vary during the course of the wet season. As surface water pools in the wetlands it typically maintains a fully saturated groundwater table, thus significantly adding to the quantities of water stored on and below the land's surface. The addition of historic watershed boundaries then allows the estimation of flow conditions of the various streams discharging this ground and surface water into the estuary and an assessment of general comparisons with the present day, post-development conditions.



HISTORICAL CONDITIONS DRGR STUDY AREA HABITAT ASSESSMENT BY WATERSHED

	HABITAT TYPE							
WATERSHED	1M	1P	2D	2S	3	4	4U	TOTAL
Corkscrew	539.1	672.9	5004.3	1414.1	3487.7	6311.9	2326.3	**19756.3**
Estero River	1584.5	1755.7	4104.4	1773.5	2268.2	7425.4	4215.5	**23127.2**
Flint Pen	1965.9	2997.2	10784.3	2346.9	4504.7	9792.6	4802.9	**37194.5**
Imperial River	0.0	1.2	914.5	11.0	326.7	123.5	421.4	**1798.3**
Six Mile Cypress	218.7	98.2	71.7	0.0	11.0	459.5	145.0	**1004.1**
GRAND TOTAL	***4308.2***	***5525.2***	***20879.2***	***5545.5***	***10598.3***	***24112.9***	***11911.1***	***82880.4***

Figure 1

The flat contours, extreme ponding, and sheet flow conditions make it very difficult to accurately determine the location of watershed boundaries solely by examining surface characteristics of the landscape interpreted from historic aerial photos. The application of a three-dimensional surface and groundwater model, which is being created as part of the current planning effort using this new mapping and available historic USGS survey data, may provide some greater degree of watershed definition.

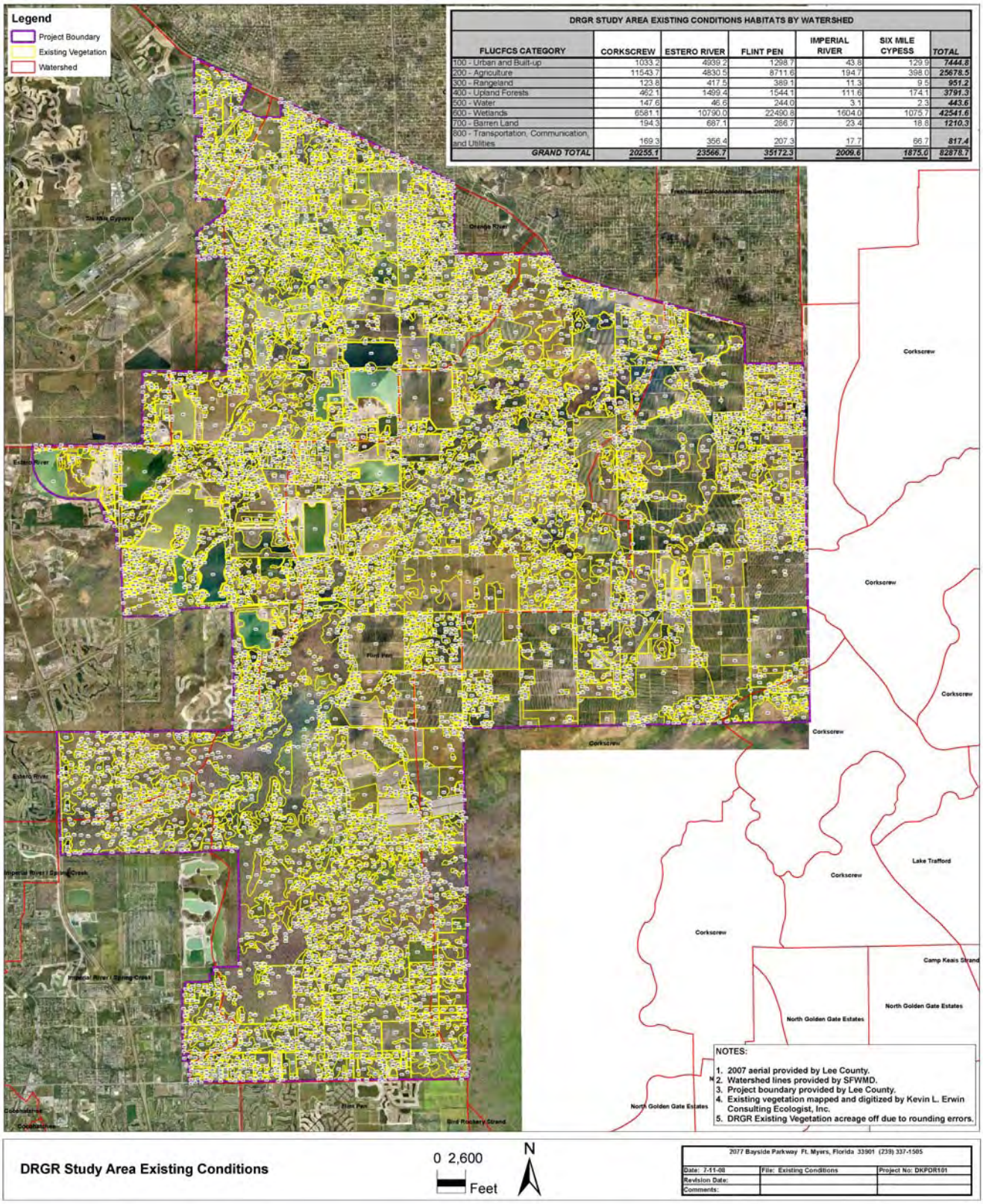
Future attempts to quantify historic and present day hydropatterns including base flow conditions for the rivers and creeks discharging to Estero Bay should be done with the modeling and Light Detection and Ranging (LIDAR) data and be expanded to include all appropriate areas outside the DR/GR. For example, the portion of the historic DR/GR watershed that extended north of SR. 82 and now drained to the Orange River could be included in such an examination, with a potential outcome of restoring some of the flows north of SR. 82 to the south once again.

Figure 1 illustrates the historic watershed boundaries based on our careful interpretation of the aerial photography used in this study. What is apparent is the very wet nature of this landscape containing hundreds of interconnected wetlands. The correlation between this vast wetland area being drained by a few small streams which discharge to Estero Bay means that most of the water in the DR/GR stayed on or under the landscape, thus providing evenly metered, deliberate pulses of ground and surface water discharging to the estuary.

2. What is the nature and extent of existing land uses, habitat types, location and conditions of remaining wetlands (hydropatterns), agricultural lands, and watersheds?

The 2007 Lee County aerial photographs were desktop mapped by locally-experienced ecologists. The result is a comprehensive ecological map of existing conditions within the DR/GR (Figure 2). This map is based on the standard methodology known as the Florida Land Use, Cover and Forms Classification System (FLUCFCS, Level III, FDPT 1999).[ii] No ground-truthing was conducted during this exercise.

The acreages for all land-uses in the study area and individual watersheds are contained in Appendix 1. Table 2 provides the acreages for major land use categories. Figure 3 shows the level of mapping detail on a single section (square mile) of land within the Corkscrew Watershed. The watershed boundaries shown on Figure 2 were provided by the South Florida Water Management District; the methodology used to create the boundaries is not known.



DRGR STUDY AREA EXISTING CONDITIONS HABITATS BY WATERSHED

FLUCFCS CATEGORY	CORKSCREW	ESTERO RIVER	FLINT PEN	IMPERIAL RIVER	SIX MILE CYPESS	TOTAL
100 - Urban and Built-up	1033.2	4938.2	1298.7	43.8	129.9	***7444.8***
200 - Agriculture	11543.7	4830.5	8711.6	194.7	398.0	***25678.5***
300 - Rangeland	123.8	417.5	389.1	11.3	9.5	***951.2***
400 - Upland Forests	462.1	1499.4	1544.1	111.6	174.1	***3791.3***
500 - Water	147.6	46.6	244.0	3.1	2.3	***443.6***
600 - Wetlands	6581.1	10790.0	22490.8	1604.0	1075.7	***42541.6***
700 - Barren Land	194.3	687.1	286.7	23.4	18.8	***1210.3***
800 - Transportation, Communication, and Utilities	169.3	356.4	207.3	17.7	86.7	***817.4***
GRAND TOTAL	***20255.1***	***23566.7***	***35172.3***	***2009.6***	***1875.0***	***82878.7***

Figure 2

Table 2. DR/GR Study Area Major Land Use Categories Existing Conditions Acreages by Watershed

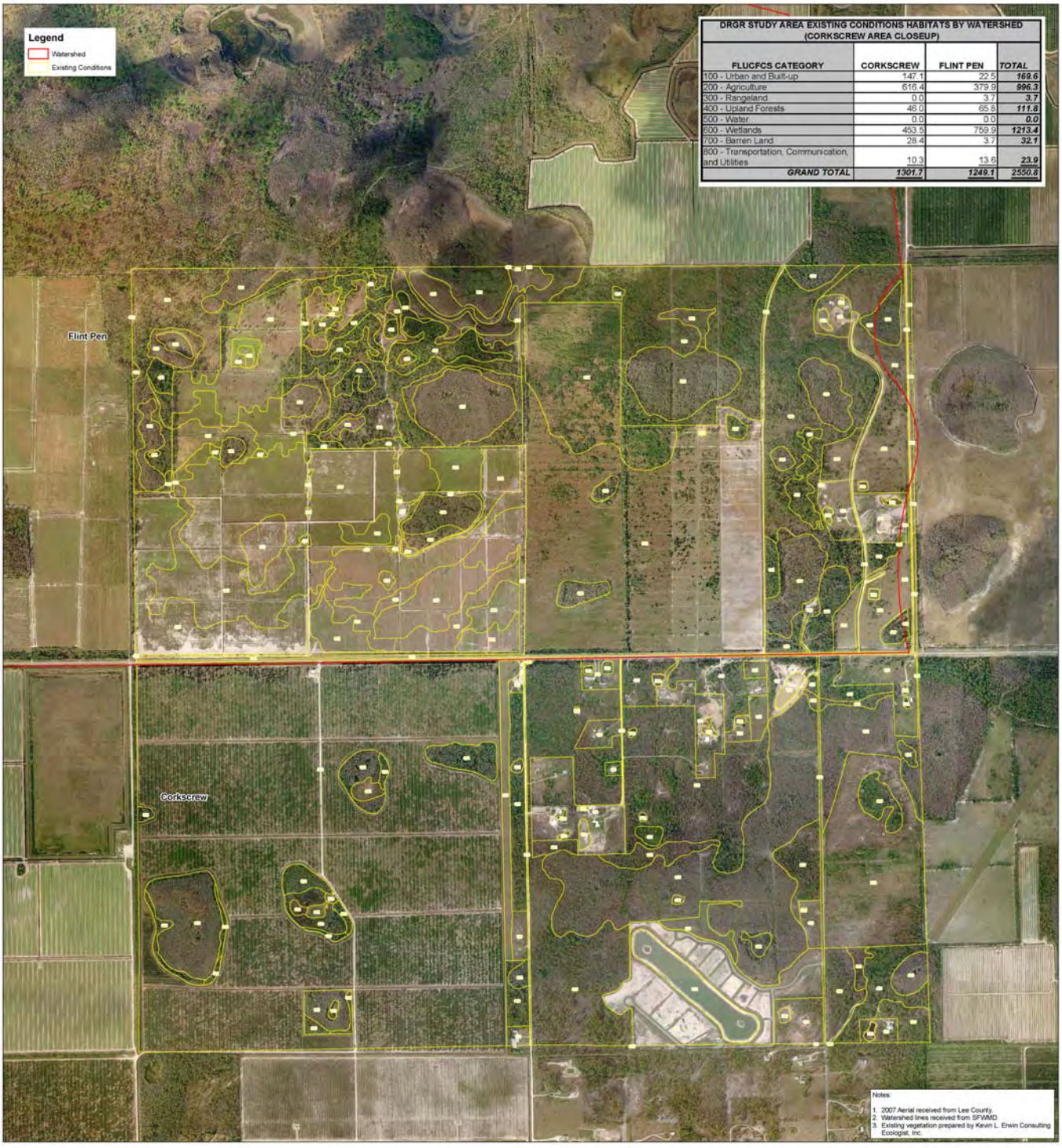
LEVEL I FLUCFCS CATEGORY	CORKSCREW	ESTERO RIVER	FLINT PEN	IMPERIAL RIVER	SIX MILE CYPRESS	*TOTAL*
100 - Urban and Built-up	1,033.2	4,939.2	1,298.7	43.8	129.9	***7,444.8***
200 - Agriculture	11,543.7	4,830.5	8,711.6	194.7	398.0	***25,678.5***
300 - Rangeland	123.8	417.5	389.1	11.3	9.5	***951.2***
400 - Upland Forests	462.1	1,499.4	1,544.1	111.6	174.1	***3,791.3***
500 - Water	147.6	46.6	244.0	3.1	2.3	***443.6***
600 - Wetlands	6,581.1	10,790.0	22,490.8	1,604.0	1,075.7	***42,541.6***
700 - Barren Land	194.3	687.1	286.7	23.4	18.8	***1,210.3***
800 - Transportation, Communication, and Utilities	169.3	356.4	207.3	17.7	66.7	***817.4***
GRAND TOTAL	***20,255.1***	***23,566.7***	***35,172.3***	***2,009.6***	***1,875.0***	***82,878.7***

Physical alterations within the DR/GR, including the construction of roads and drainage canals, has in some areas redirected flows of surface water from their historical pathways. Therefore, the level of accuracy of the acreages by watershed should be considered approximate. This data can be modified readily once accurate watershed boundaries are defined. Using the GIS files provided. LIDAR elevation data, ground-truthing, and possibly modeling will be required to accurately delineate the current watershed boundaries.

The estimated current hydropatterns within the DR/GR are provided in Figure 4 and illustrated using the same color-code system applied to the historic hydropatterns drawing, Figure 1.

3. How wet was the DR-GR then and now and what is the extent of wetland loss?

The estimated acreages of major wetland habitats in 1953 and 2007 are provided in Table 3. The appropriate Level III categories were combined for comparison with the wetland classifications applied to the historical conditions mapping. This allows for a reasonable comparison of quantitative changes in acreage and also changes in hydropatterns. One limiting factor is that there is no precise way to estimate the depth of inundation and hydroperiods that reflect existing conditions until appropriate gauges are installed and monitored.



DRGR STUDY AREA EXISTING CONDITIONS HABITATS BY WATERSHED (CORKSCREW AREA CLOSEUP)

FLUCFCS CATEGORY	CORKSCREW	FLINT PEN	TOTAL
100 - Urban and Built-up	147.1	22.5	***169.6***
200 - Agriculture	616.4	379.9	***996.3***
300 - Rangeland	0.0	3.7	***3.7***
400 - Upland Forests	46.0	65.8	***111.8***
500 - Water	0.0	0.0	***0.0***
600 - Wetlands	453.5	759.9	***1213.4***
700 - Barren Land	28.4	3.7	***32.1***
800 - Transportation, Communication, and Utilities	10.3	13.6	***23.9***
GRAND TOTAL	***1301.7***	***1249.1***	***2550.8***

DRGR Study Area 2007 Aerial (Corkscrew Close-up)

N

0 400 Feet

KEVIN L. ERWIN CONSULTING ECOLOGIST

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Date: 1-21-08	File: Veg Map 4-15-08	Project No: DKPDR101
Revision Date:		
Comments:		

Figure 3

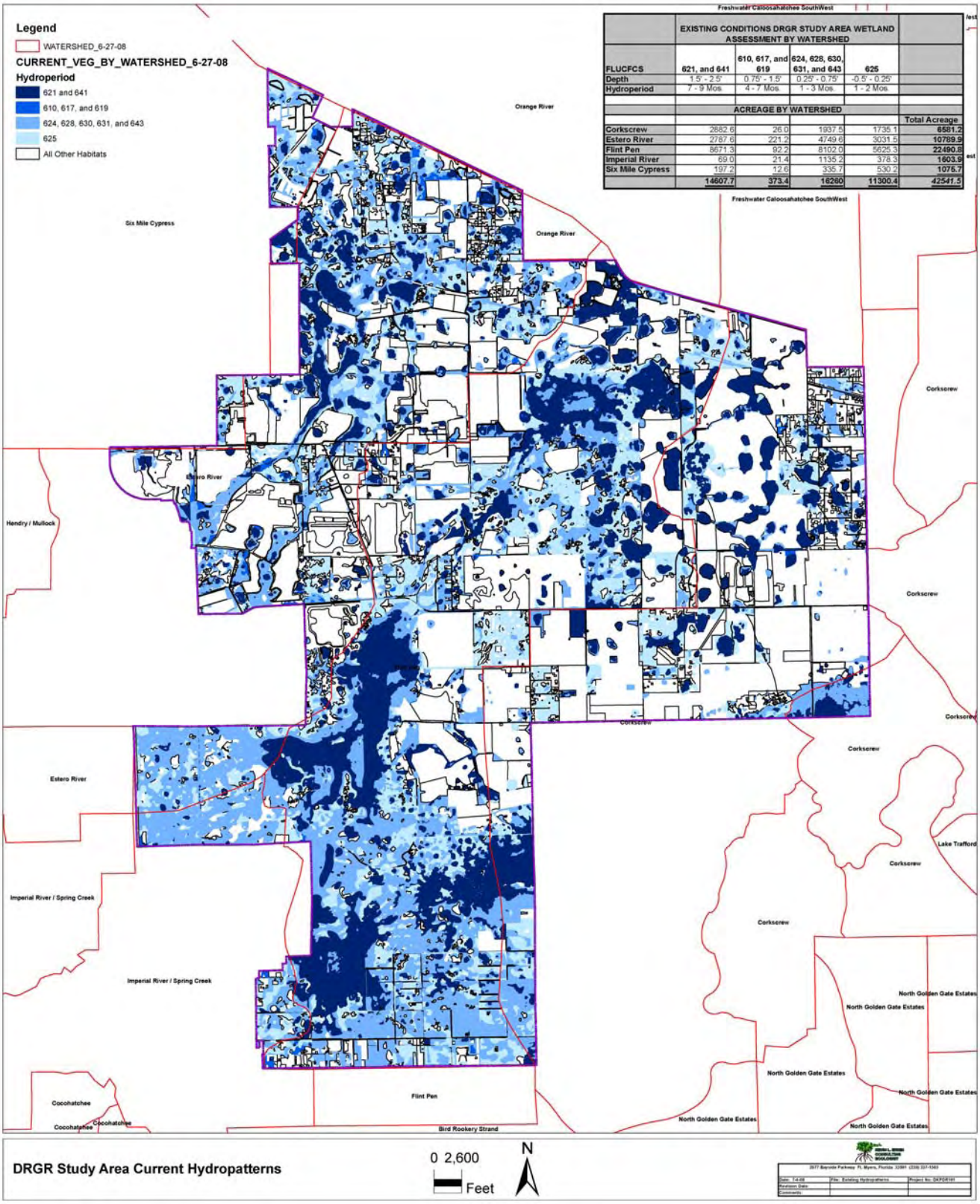

Legend
WATERSHED_6-27-08
CURRENT_VEG_BY_WATERSHED_6-27-08
Hydroperiod
621 and 641
610, 617, and 619
624, 628, 630, 631, and 643
625
All Other Habitats
Freshwater Caloosahatchee SouthWest
EXISTING CONDITIONS DRGR STUDY AREA WETLAND ASSESSMENT BY WATERSHED
FLUCFCS | 621, and 641 | 610, 617, and 619 | 624, 628, 630, 631, and 643 | 625
Depth | 1.5' - 2.5' | 0.75' - 1.5' | 0.25' - 0.75' | -0.5' - 0.25'
Hydroperiod | 7 - 9 Mos. | 4 - 7 Mos. | 1 - 3 Mos. | 1 - 2 Mos.
ACREAGE BY WATERSHED
Total Acreage
Corkscrew | 2682.6 | 26.0 | 1937.5 | 1735.1 | 6581.2
Estero River | 2787.6 | 221.2 | 4749.6 | 3031.5 | 10789.9
Flint Pen | 8671.3 | 92.2 | 8102.0 | 5625.3 | 22490.8
Imperial River | 69.0 | 21.4 | 1135.2 | 378.3 | 1603.9
Six Mile Cypress | 197.2 | 12.6 | 335.7 | 530.2 | 1075.7
14607.7 | 373.4 | 16260 | 11300.4 | 42541.5
Orange River
Six Mile Cypress
Corkscrew
Estero River
Hendry / Mullock
Imperial River / Spring Creek
Flint Pen
Bird Rookery Strand
Cocohatchee
North Golden Gate Estates
Lake Trafford
DRGR Study Area Current Hydropatterns
0 2,600
Feet
N

Figure 4

Table 3. Estimated acreages of Major Wetland Habitats within the DR/GR in 1953 and 2007

1953		2007		Loss (in acres)
Habitat Type	Acreage	FLUCFCS Code	Acreage	
1M, 1P, 2D, 2S	36,258.1	610, 617, 619, 621, 641	14,981.1	(21,277)/58.7%
3	10,598.3	624, 628, 630, 631	16,260.0	5661.7/53%
4	24,112.9	625, 643	11,300.4	(12,812.5)/53.1%
Total	**70,969.3**		**42,541.5**	**28,427.8/40%**

We estimate that drainage within the study area has resulted in significant lowering of the water table during both wet and dry seasons and a shortening of wetland hydroperiods. Comparison of the two mapping products shows that 40% of the DR/GR's wetlands have been lost over the past 50 years. A comparison of hydropatterns shows the degree of wetland habitat fragmentation, which is most pronounced north of the east-west Lee-Collier County line. Approximately 60% of the deepest wetlands with the most extended hydroperiods (ponds, freshwater marshes, deep and shallow cypress) have been lost, with the hydrology of an unknown percentage of the remaining wetlands impacted by drainage.

The DR/GR is clearly drier today with fewer wetlands on the landscape and shorter hydroperiods. The implementation of a surface and shallow groundwater monitoring system would provide data needed to assess the existing hydropattern conditions in the study area. This lack of water represents additional potential water storage capacity that exists within the DR/GR if appropriate management and restoration techniques are implemented.

4. What proportion of converted wetlands remains in agricultural use?

The location and extent of all existing agricultural lands is provided in Figure 5. Approximately 25,679 acres or 31% of the DR/GR consists of active and abandoned agricultural lands mainly consisting of row crops, citrus groves and pasture. Approximately 21,952 acres or 85% of the existing agricultural lands were developed by clearing and draining wetlands. Figure 5 was produced by comparing the 1953 and 2007 GIS files to illustrate the nature and extent of agricultural converted wetlands within the DR/GR. The majority of the converted habitats were cypress, cypress-pine, freshwater marsh, and hydric pine prairie.

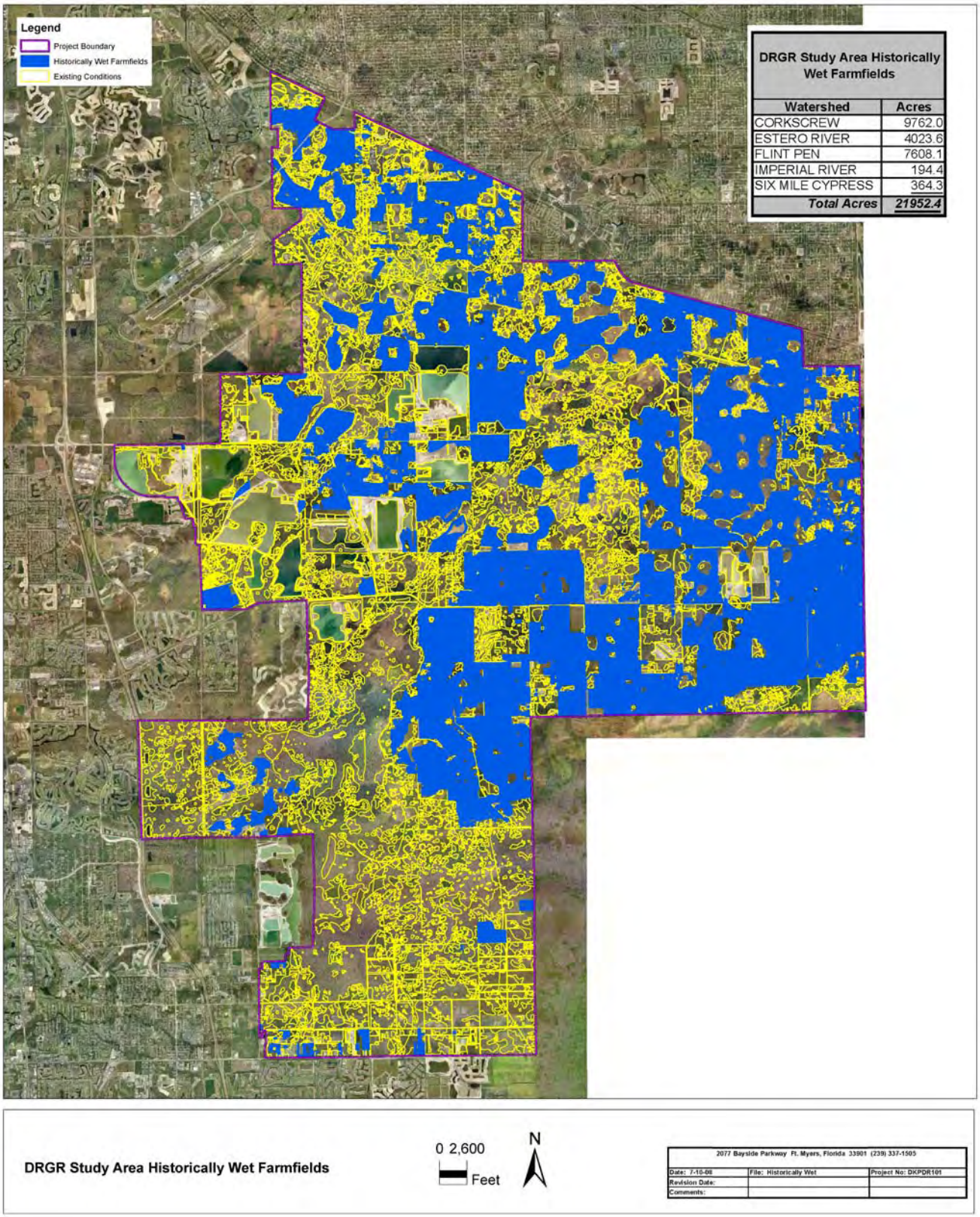

Legend
Project Boundary
Historically Wet Farmfields
Existing Conditions
DRGR Study Area Historically Wet Farmfields
Watershed | Acres
CORKSCREW | 9762.0
ESTERO RIVER | 4023.6
FLINT PEN | 7608.1
IMPERIAL RIVER | 194.4
SIX MILE CYPRESS | 364.3
Total Acres | 21952.4
DRGR Study Area Historically Wet Farmfields
0 2,600
Feet
N
2077 Bayside Parkway Ft. Myers, Florida 33901 (239) 337-1505
Date: 7-10-08
File: Historically Wet
Project No: DKPDR101
Revision Date:
Comments:

Figure 5

5. What are the similarities between wetlands and existing agricultural lands in the DR/GR?

The conversion of wetlands to agricultural lands is a common practice worldwide. In southwest Florida, shallow flat freshwater marshes and swamps were cleared of vegetation and drained/irrigated to support row crops and groves. This type of habitat or land-use alteration is not permanent and in many instances the process of restoring farmland to native wetland habitat can be fairly straightforward.

Today's farmers carefully regulate water to provide drained soils and irrigation for row crops during their growing season, which is typically the late fall through winter months. During this time water is pumped into fields for irrigation. Most drainage occurs via a pump and ditch network during the early part of the growing season when the fields are being prepared. When proper care is taken not to over-drain a farm field, the shallow groundwater table remains close to the surface, often between one and three feet. The remainder of the year (non-crop growing season) coincides with the wet season, when it is too warm and wet for cropping. During these months the farmer does not actively manage water levels, which then often inundate fallow fields and all abandoned cropland (pasture). An exception is within citrus groves where wet season water levels are managed to prevent damaging root systems. Therefore, agricultural lands in the DR/GR have an enormous capacity to store additional water when properly managed.

6. What is the potential for restoring and sustainably managing wetland and water resources in the DR/GR?

Currently, approximately 72,962.6 acres or 88% of the DR/GR remain natural or in some form of agricultural use (Table 2). A combination of wetland management, sustainable agriculture, and phased wetland restoration is possible and necessary within the DR/GR to meet the goals and objectives of Lee County. Figures 6, 7, 8 and 9 show three priorities of wetland restoration within the DR/GR developed by focusing on three potential phases of restoration within agricultural areas. These figures refine and replace the conceptual restoration plan that was introduced on pages 4.10 through 4.13 of "Prospects for Southeast Lee County."

Farm fields are most appropriate for wetland restoration since their soils remain relatively intact and it is possible to restore some or all of an area's hydrology, depending upon the nature and extent of the adjacent land-uses. Further study will be require to develop specific plans, however the basic elements of these restoration plans will include developing a water budget for each watershed and sub-basin, monitoring ground and surface water levels, designing structures to increase water levels and extend hydroperiods, controlling exotic plant species, and replanting native species.

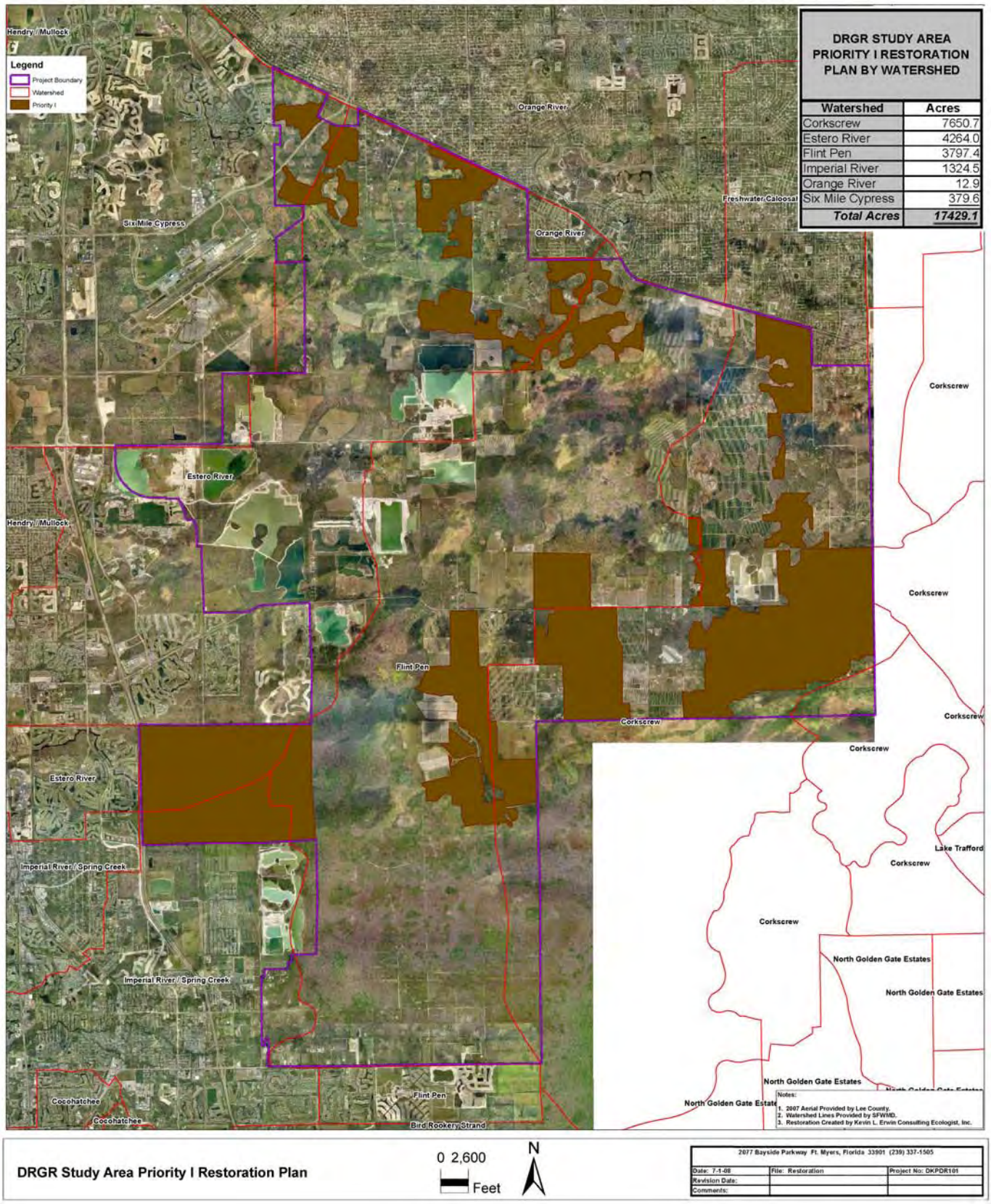

DRGR STUDY AREA
PRIORITY I RESTORATION
PLAN BY WATERSHED
Watershed | Acres
Corkscrew | 7650.7
Estero River | 4264.0
Flint Pen | 3797.4
Imperial River | 1324.5
Orange River | 12.9
Six Mile Cypress | 379.6
Total Acres | 17429.1
Legend
Project Boundary
Watershed
Priority I
Hendry / Mullock
Orange River
Six Mile Cypress
Freshwater Caloosa
Corkscrew
Estero River
Flint Pen
Imperial River / Spring Creek
Lake Trafford
North Golden Gate Estates
Cocohatchee
Bird Rookery Strand
Notes:
1. 2007 Aerial Provided by Lee County.
2. Watershed Lines Provided by SFWMD.
3. Restoration Created by Kevin L. Erwin Consulting Ecologist, Inc.
DRGR Study Area Priority I Restoration Plan
0 2,600
Feet
N
2077 Bayside Parkway Ft. Myers, Florida 33901 (239) 337-1505
Date: 7-1-08
File: Restoration
Project No: DKPDR101
Revision Date:
Comments:

Figure 6

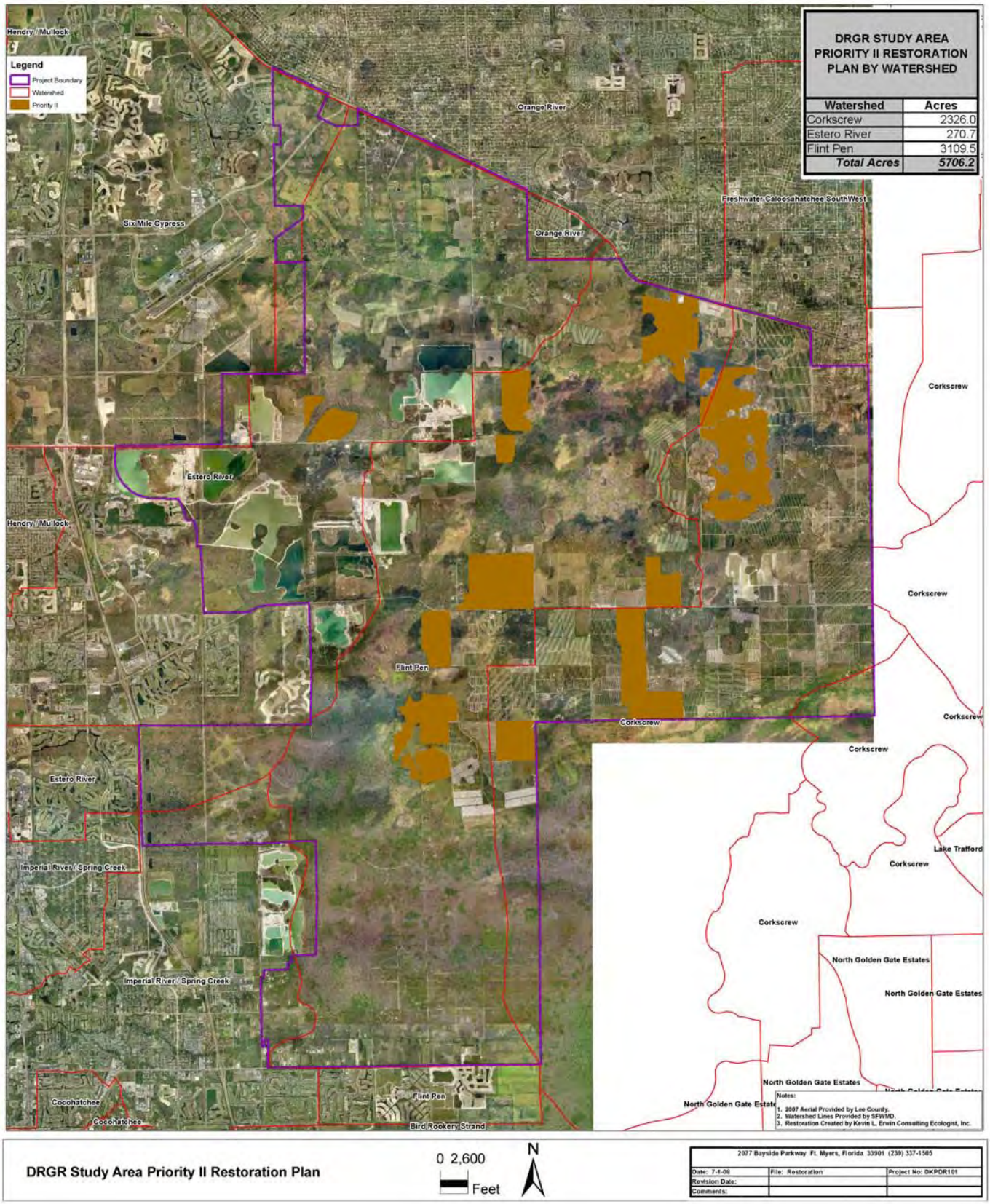
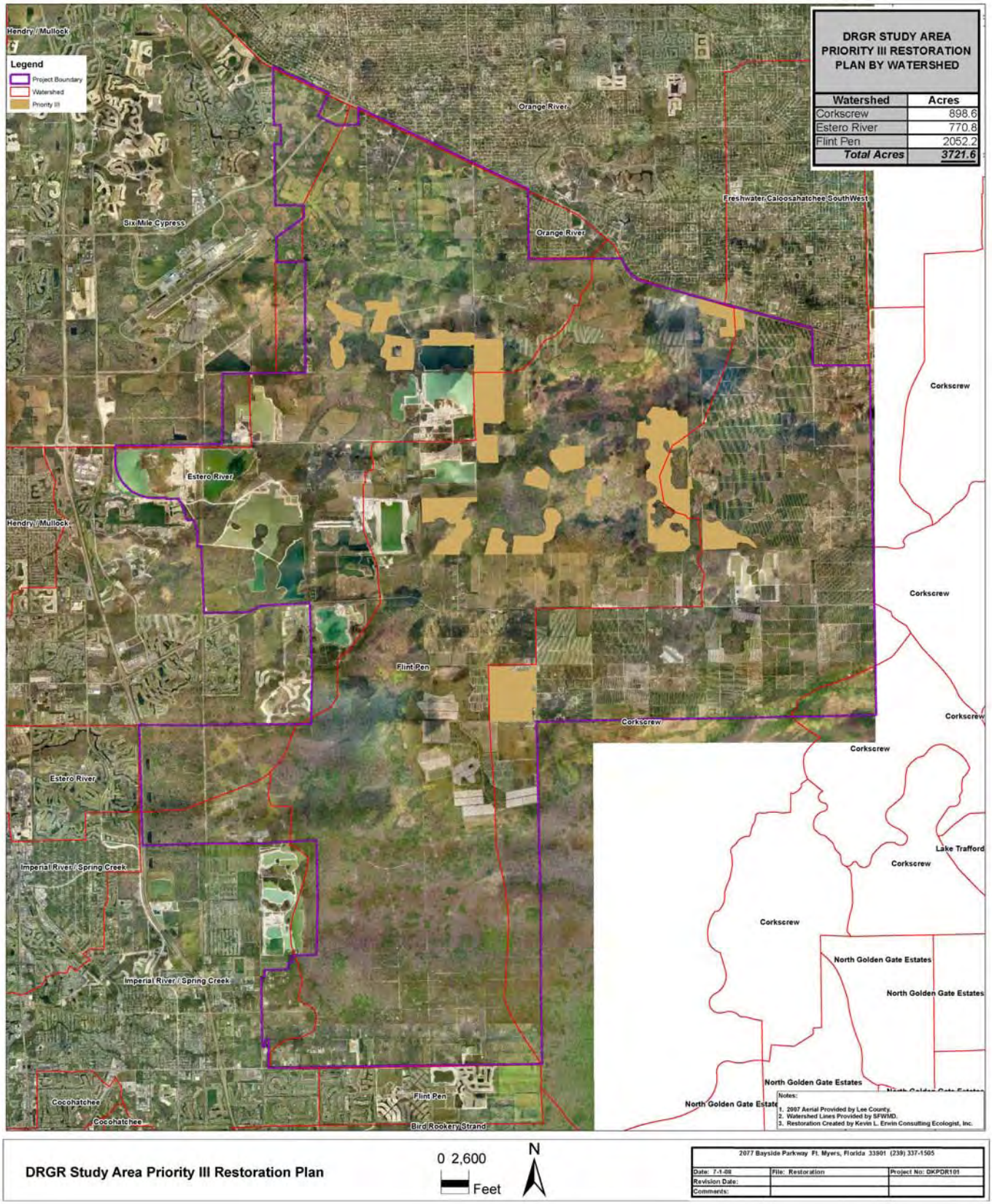

DRGR STUDY AREA
PRIORITY II RESTORATION
PLAN BY WATERSHED
Watershed | Acres
Corkscrew | 2326.0
Estero River | 270.7
Flint Pen | 3109.5
Total Acres | 5706.2
Legend
Project Boundary
Watershed
Priority II
Hendry / Mullock
Six Mile Cypress
Orange River
Freshwater Caloosahatchee SouthWest
Corkscrew
Estero River
Flint Pen
Imperial River / Spring Creek
Cocohatchee
Bird Rookery Strand
Lake Trafford
North Golden Gate Estates
Notes:
1. 2007 Aerial Provided by Lee County.
2. Watershed Lines Provided by SFWMD.
3. Restoration Created by Kevin L. Erwin Consulting Ecologist, Inc.
DRGR Study Area Priority II Restoration Plan
0 2,600
Feet
N
2077 Bayside Parkway Ft. Myers, Florida 33901 (239) 337-1505
Date: 7-1-08
File: Restoration
Project No: DKPDR101
Revision Date:
Comments:

Figure 7


DRGR STUDY AREA
PRIORITY III RESTORATION
PLAN BY WATERSHED
Watershed | Acres
Corkscrew | 898.6
Estero River | 770.8
Flint Pen | 2052.2
Total Acres | 3721.6
Legend
Project Boundary
Watershed
Priority III
Hendry / Mullock
Orange River
Six Mile Cypress
Freshwater Caloosahatchee SouthWest
Corkscrew
Estero River
Flint Pen
Lake Trafford
North Golden Gate Estates
Imperial River / Spring Creek
Cocohatchee
Bird Rookery Strand
Notes:
1. 2007 Aerial Provided by Lee County.
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DRGR Study Area Priority III Restoration Plan
0 2,600
Feet
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2077 Bayside Parkway Ft. Myers, Florida 33901 (239) 337-1505
Date: 7-1-08
File: Restoration
Project No: DKPDR101
Revision Date:
Comments:

Figure 8

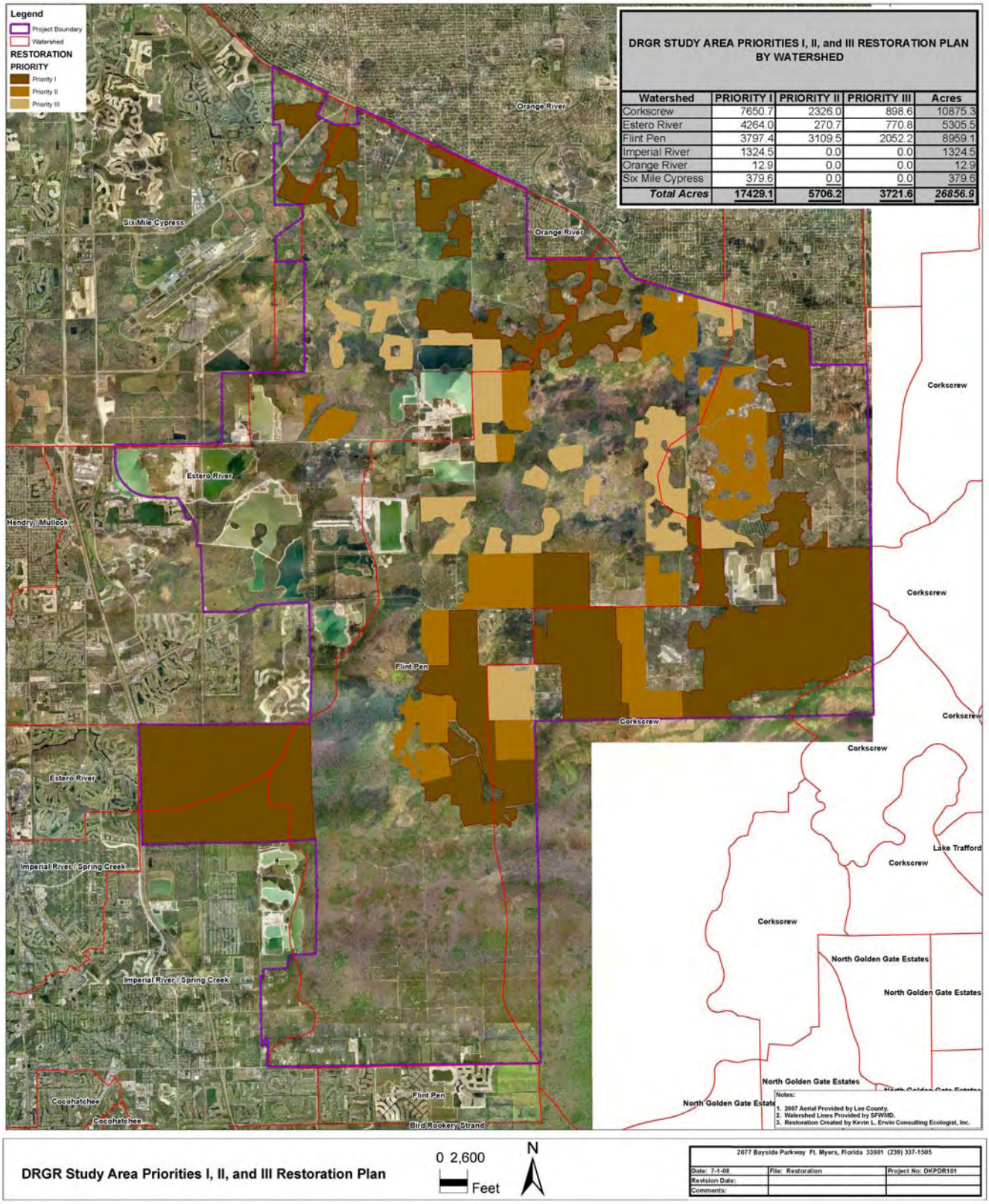
Legend
Project Boundary
Watershed
RESTORATION PRIORITY
Priority I
Priority II
Priority III
DRGR STUDY AREA PRIORITIES I, II, and III RESTORATION PLAN BY WATERSHED
Watershed | PRIORITY I | PRIORITY II | PRIORITY III | Acres
Corkscrew | 7650.7 | 2326.0 | 898.6 | 10875.3
Estero River | 4264.0 | 270.7 | 770.8 | 5305.5
Flint Pen | 3797.4 | 3109.5 | 2052.2 | 8959.1
Imperial River | 1324.5 | 0.0 | 0.0 | 1324.5
Orange River | 12.9 | 0.0 | 0.0 | 12.9
Six Mile Cypress | 379.6 | 0.0 | 0.0 | 379.6
Total Acres | 17429.1 | 5706.2 | 3721.6 | 26856.9
Orange River
Six Mile Cypress
Orange River
Corkscrew
Estero River
Hendry / Mullock
Corkscrew
Flint Pen
Corkscrew
Corkscrew
Corkscrew
Estero River
Lake Trafford
Corkscrew
Imperial River / Spring Creek
Corkscrew
North Golden Gate Estates
Imperial River / Spring Creek
North Golden Gate Estates
North Golden Gate Estates
Cocohatchee
Flint Pen
Cocohatchee
Bird Rookery Strand
Notes:
1. 2007 Aerial Provided by Lee County.
2. Watershed Lines Provided by SFWMD.
3. Restoration Created by Kevin L. Erwin Consulting Ecologist, Inc.
DRGR Study Area Priorities I, II, and III Restoration Plan
0 2,600
Feet
N
2077 Bayside Parkway Ft. Myers, Florida 33901 (239) 337-1505
Date: 7-1-08
File: Restoration
Project No: OKPDR101
Revision Date:
Comments:

Figure 9

The highest priority restoration areas (Priority 1) are typically large intact areas of native lands or farm fields that have strategic importance due their location (Figure 6). These high priority restoration areas provide necessary reconnections of fragmented hydropatterns and native habitat corridors with a secondary but very important benefit to wildlife. The development of accurate watershed and sub-basin boundaries and site specific elevation data will be required to refine priorities and provide additional details for a future restoration planning effort.

Priority II areas are predominantly in agricultural use and would add additional water storage capacity and habitat values to previously restored priority I areas. Priority III areas are non-strategic lands, some near existing active mines where drainage impacts may be an issue on adjacent properties.

Maintaining high quality, low-impact, relatively sustainable agriculture will allow for successful restoration of water and wetland resources in the DR/GR. When farmers in the DR/GR become willing sellers at some future time it will be important for them to partner with Lee County as part of a previously identified mechanism for the land to be purchased, transferred into public ownership, and eventually restored to native habitat.

These work products were designed to be useful tools for staff, policy makers, and the public when considering projects within the DR/GR. The mapping of existing wetlands provides clues to the location of remaining habitats and human activities. The historic hydropattern provides insight into where wetlands historically existed, flowpatterns, depths and hydroperiods in addition to where opportunities for restoration exist. Herein lies the value in conducting an ecological history of a study area, like the DR/GR, along with a separate examination of the existing conditions. Understanding the historical context of wetlands and other land use types provides the means for developing appropriate standards for resource management and protection. The historic and existing land use maps produced here will be used to calibrate the MIKE SHE model now being created by DHI Water & Management, Inc.

Future Activities and Information Gaps

During our work it became readily apparent that there was very limited information on the DR/GR. As a result of the detailed mapping and analysis, it is now possible to identify historic and existing conditions within the study area. However there is a significant need for collecting and evaluating new information, to be used for planning and management purposes. The lack of hydrological data is the most significant information gap requiring immediate attention in the DR/GR and heads the following list of recommended future activities and data collection. Understanding the dynamic nature of the ecosystems and the consequences of human activity is essential for making management decisions,

aimed to maintain, enhance or restore the ecological integrity of the DR/GR and to avoid, minimize or mitigate ecological threats to the system.

1. Prepare a hydrological model of the study area which includes estimated watershed boundaries.
2. Implement a comprehensive long-term surface and groundwater monitoring network that includes; shallow wells, deep wells, staff, flow and rain gauges.
3. Develop and refine water budgets for each watershed in the DR/GR and conduct a comparative analysis with the estimated historical conditions.
4. Develop detailed restoration plans for each watershed.
5. Initiate discussions with agricultural interests on sustainable agriculture, habitat management and restoration objectives.
6. Conduct limited ground-truthing to improve the accuracy of the existing conditions desktop mapping.
7. Obtain accurate topography for the study area.
8. Maintain and improve existing policy regulations requiring site and project specific hydrological data collection and analysis, including surface and groundwater monitoring, water budget, and water quality monitoring.
9. Develop a working agreement with Collier County on land and water resource management on lands within watersheds shared by Collier and Lee Counties.

This Technical Memorandum completes the contracted planning and ecological studies conducted by KLECE for Dover, Kohl & Partners on behalf of the Lee County Board of County Commissioners.

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[i] "Prospects for Southeast Lee County: Planning for the Density Reduction / Groundwater Resource Area (DR/GR)," Dover, Kohl & Partners, submitted July 2008.

[ii] "Florida Land Use, Cover And Forms Classification System," Florida Department Of Transportation Surveying And Mapping Office, January 1999.

Appendix

Watershed	Level III FLUCFCS Code	Acreage	Description
Corkscrew	110	486.5	Residential, Low Density
Corkscrew	111	5.0	Fixed Single Family Units
Corkscrew	112	3.5	Mobile Home Units
Corkscrew	119	2.5	Low Density under Construction
Corkscrew	129	54.3	Medium Density Under Construction
Corkscrew	133	7.7	Multiple Dwelling Under Construction
Corkscrew	141	1.2	Retail Sales and Services
Corkscrew	142	0.1	Wholesale Sales and Services
Corkscrew	160	206.9	Extractive (Non-Lake), Mineral Processing
Corkscrew	163	265.6	Rock Quarries (Lake)
Corkscrew	210	1.4	Cropland and Pastureland
Corkscrew	211	129.7	Improved Pasture
Corkscrew	212	6.7	Unimproved Pasture
Corkscrew	213	175.2	Woodland Pastures
Corkscrew	214	1298.0	Row Crops
Corkscrew	221	7386.4	Citrus Groves
Corkscrew	240	1.5	Nurseries & Vineyards
Corkscrew	241	24.8	Tree Nurseries
Corkscrew	242	1.0	Sod Farms
Corkscrew	243	5.2	Ornamentals
Corkscrew	247	36.7	Agriculture Buildings
Corkscrew	254	6.5	Aquaculture
Corkscrew	261	293.5	Fallow Crop Land
Corkscrew	262	2177.1	Wet Pasture
Corkscrew	310	1.2	Herbaceous (Dry Prairie)
Corkscrew	320	3.8	Shrub and Brushland
Corkscrew	321	118.8	Palmetto Prairie (often has 643 inclusions)
Corkscrew	411	311.9	Pine Flatwoods
Corkscrew	414	45.9	Pine-Mesic Oak
Corkscrew	422	5.3	Brazilian Pepper
Corkscrew	427	6.1	Live Oak
Corkscrew	428	92.5	Cabbage Palm (often has hydric 643 inclusions)
Corkscrew	429	0.4	Wax Myrtle-Willow
Corkscrew	510	8.6	Streams and Waterways
Corkscrew	512	70.6	Ditches and Canals
Corkscrew	530	28.3	Reservoirs
Corkscrew	533	40.1	Reservoirs (10-100ac)
Corkscrew	619	26.0	Exotic Wetland Hardwoods
Corkscrew	621	2142.5	Cypress
Corkscrew	624	951.4	Cypress/Pine/Cabbage Palm
Corkscrew	625	1735.1	Hydric Pine Flatwoods/Savannah
Corkscrew	628	13.0	Hydric Cabbage Palm
Corkscrew	630	204.7	Wetland Forest Mixed
Corkscrew	631	369.1	Wetland Shrub/ Shrubby Wetlands (BP, willow etc)
Corkscrew	641	740.1	Freshwater Marshes
Corkscrew	643	399.4	Freshwater Prairie/ Treeless Hydric Savannah
Corkscrew	740	93.0	Disturbed Land
Corkscrew	742	71.8	Borrow Areas
Corkscrew	743	22.8	Spoil Areas
Corkscrew	747	6.7	Dikes & Levees
Corkscrew	811	21.6	Airport
Corkscrew	814	143.8	Roads & Highways
Corkscrew	821	1.5	Transmission Towers
Corkscrew	832	2.4	Power Transmission Lines
Corkscrew Total		**20255.1**	

Watershed	Level III FLUCFCS Code	Acreage	Description
Estero	110	386.8	Residential, Low Density
Estero	119	205.5	Low Density under Construction
Estero	140	9.8	Commerical and Services
Estero	142	3.8	Wholesale Sales and Services
Estero	150	79.2	Industrial
Estero	160	1244.7	Extractive (Non-Lake), Mineral Processing
Estero	163	2956.5	Rock Quarries (Lake)
Estero	190	52.9	Open Land
Estero	211	1357.8	Improved Pasture
Estero	213	66.2	Woodland Pastures
Estero	214	1606.3	Row Crops
Estero	241	94.4	Tree Nurseries
Estero	243	9.2	Ornamentals
Estero	247	13.1	Agriculture Buildings
Estero	261	374.5	Fallow Crop Land
Estero	262	1308.9	Wet Pasture
Estero	320	90.5	Shrub and Brushland
Estero	321	318.6	Palmetto Prairie (often has 643 inclusions)
Estero	330	8.5	Mixed Rangeland
Estero	411	1373.0	Pine Flatwoods
Estero	414	36.1	Pine-Mesic Oak
Estero	421	2.3	Xeric Oak
Estero	422	69.4	Brazilian Pepper
Estero	424	10.1	Melaleuca
Estero	427	1.6	Live Oak
Estero	428	6.9	Cabbage Palm (often has hydric 643 inclusions)
Estero	510	0.1	Streams and Waterways
Estero	512	46.4	Ditches and Canals
Estero	610	25.3	Wetland Hardwood Forests
Estero	619	195.9	Exotic Wetland Hardwoods
Estero	621	1873.1	Cypress
Estero	624	2942.7	Cypress/Pine/Cabbage Palm
Estero	625	3031.5	Hydric Pine Flatwoods/Savannah
Estero	628	9.0	Hydric Cabbage Palm
Estero	630	166.9	Wetland Forest Mixed
Estero	631	431.8	Wetland Shrub/ Shrubby Wetlands (BP, willow etc)
Estero	641	928.1	Freshwater Marshes
Estero	643	1199.3	Freshwater Prairie / Treeless Hydric Savannah
Estero	740	563.2	Disturbed Land
Estero	742	96.5	Borrow Areas
Estero	743	5.5	Spoil Areas
Estero	747	21.9	Dikes & Levees
Estero	811	0.2	Airport
Estero	814	267.1	Roads & Highways
Estero	831	3.1	Electric Power Failures
Estero	832	60.3	Power Transmission Lines
Estero	833	12.0	Water Supply Plants
Estero Total		**23566.6**	

Watershed	Level III FLUCFCS Code	Acreage	Description
Flint Pen	110	219.7	Residential, Low Density
Flint Pen	112	29.7	Mobile Home Units
Flint Pen	119	26.0	Low Density under Construction
Flint Pen	140	20.2	Commerical and Services
Flint Pen	150	20.0	Industrial
Flint Pen	160	378.4	Extractive (Non-Lake), Mineral Processing
Flint Pen	163	506.9	Rock Quarries (Lake)
Flint Pen	182	97.9	Golf Courses
Flint Pen	210	1.0	Cropland and Pastureland
Flint Pen	211	518.8	Improved Pasture
Flint Pen	213	29.7	Woodland Pastures
Flint Pen	214	3174.4	Row Crops
Flint Pen	221	709.1	Citrus Groves
Flint Pen	241	25.6	Tree Nurseries
Flint Pen	242	284.4	Sod Farms
Flint Pen	243	27.9	Ornamentals
Flint Pen	247	26.0	Agriculture Buildings
Flint Pen	261	638.7	Fallow Crop Land
Flint Pen	262	3276.0	Wet Pasture
Flint Pen	320	63.6	Shrub and Brushland
Flint Pen	321	323.4	Palmetto Prairie (often has 643 inclusions)
Flint Pen	330	2.1	Mixed Rangeland
Flint Pen	411	1489.3	Pine Flatwoods
Flint Pen	414	7.6	Pine-Mesic Oak
Flint Pen	422	47.1	Brazilian Pepper
Flint Pen	510	0.0	Streams and Waterways
Flint Pen	512	153.2	Ditches and Canals
Flint Pen	530	44.8	Reservoirs
Flint Pen	533	45.9	Reservoirs (10-100ac)
Flint Pen	610	3.6	Wetland Hardwood Forests
Flint Pen	617	3.3	Mixed Wetland Hardwoods
Flint Pen	619	85.3	Exotic Wetland Hardwoods
Flint Pen	621	6508.3	Cypress
Flint Pen	624	5087.4	Cypress/Pine/Cabbage Palm
Flint Pen	625	5625.3	Hydric Pine Flatwoods/Savannah
Flint Pen	628	10.1	Hydric Cabbage Palm
Flint Pen	630	768.0	Wetland Forest Mixed
Flint Pen	631	1177.6	Wetland Shrub/ Shrubby Wetlands (BP, willow etc)
Flint Pen	641	2163.0	Freshwater Marshes
Flint Pen	643	1058.9	Freshwater Prairie / Treeless Hydric Savannah
Flint Pen	740	212.7	Disturbed Land
Flint Pen	742	60.7	Borrow Areas
Flint Pen	743	9.0	Spoil Areas
Flint Pen	747	4.4	Dikes & Levees
Flint Pen	814	180.3	Roads & Highways
Flint Pen	821	0.7	Transmission Towers
Flint Pen	833	26.3	Water Supply Plants
Flint Pen Total		**35172.2**	

Watershed	Level III FLUCFCS Code	Acreage	Description
Imperial River	110	35.8	Residential, Low Density
Imperial River	112	3.6	Mobile Home Units
Imperial River	119	4.3	Low Density under Construction
Imperial River	213	14.7	Woodland Pastures
Imperial River	262	180.0	Wet Pasture
Imperial River	320	3.6	Shrub and Brushland
Imperial River	321	7.7	Palmetto Prairie (often has 643 inclusions)
Imperial River	411	111.6	Pine Flatwoods
Imperial River	512	3.1	Ditches and Canals
Imperial River	619	21.4	Exotic Wetland Hardwoods
Imperial River	621	65.1	Cypress
Imperial River	624	863.2	Cypress/Pine/Cabbage Palm
Imperial River	625	378.3	Hydric Pine Flatwoods/Savannah
Imperial River	630	68.8	Wetland Forest Mixed
Imperial River	631	12.5	Wetland Shrub/ Shrubby Wetlands (BP, willow etc)
Imperial River	641	3.9	Freshwater Marshes
Imperial River	643	190.7	Freshwater Prairie (often has 321 inclusions)/ Treeless Hydric
Imperial River	740	10.6	Disturbed Land
Imperial River	742	12.9	Borrow Areas
Imperial River	814	17.7	Roads & Highways
Imperial River Total		**2009.7**	
Six Mile Cypress	160	94.3	Extractive (Non-Lake), Mineral Processing
Six Mile Cypress	163	35.6	Rock Quarries (Lake)
Six Mile Cypress	211	5.0	Improved Pasture
Six Mile Cypress	262	393.1	Wet Pasture
Six Mile Cypress	320	0.6	Shrub and Brushland
Six Mile Cypress	321	8.9	Palmetto Prairie (often has 643 inclusions)
Six Mile Cypress	411	167.7	Pine Flatwoods
Six Mile Cypress	422	6.3	Brazilian Pepper
Six Mile Cypress	428	0.1	Cabbage Palm (often has hydric 643 inclusions)
Six Mile Cypress	512	2.3	Ditches and Canals
Six Mile Cypress	619	12.6	Exotic Wetland Hardwoods
Six Mile Cypress	621	83.4	Cypress
Six Mile Cypress	624	101.6	Cypress/Pine/Cabbage Palm
Six Mile Cypress	625	530.2	Hydric Pine Flatwoods/Savannah
Six Mile Cypress	630	30.9	Wetland Forest Mixed
Six Mile Cypress	631	51.6	Wetland Shrub/ Shrubby Wetlands (BP, willow etc)
Six Mile Cypress	641	113.9	Freshwater Marshes
Six Mile Cypress	643	151.6	Freshwater Prairie / Treeless Hydric Savannah
Six Mile Cypress	740	18.2	Disturbed Land
Six Mile Cypress	742	0.6	Borrow Areas
Six Mile Cypress	814	66.3	Roads & Highways
Six Mile Cypress	832	0.4	Power Transmission Lines
Six Mile Cypress Total		**1875.0**	