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2077 Bayside Parkway
Ft. Myers, Florida 33901
USA

The Lee County DR/GR:
Implications for future restoration and
management

Estero Bay Watershed
Public Symposium
Florida Gulf Coast University

September 2009

There is great potential for restoring and sustainably managing wetland and water resources combining wetland management, sustainable agriculture and phased wetland restoration in the midst of a changing global climate.

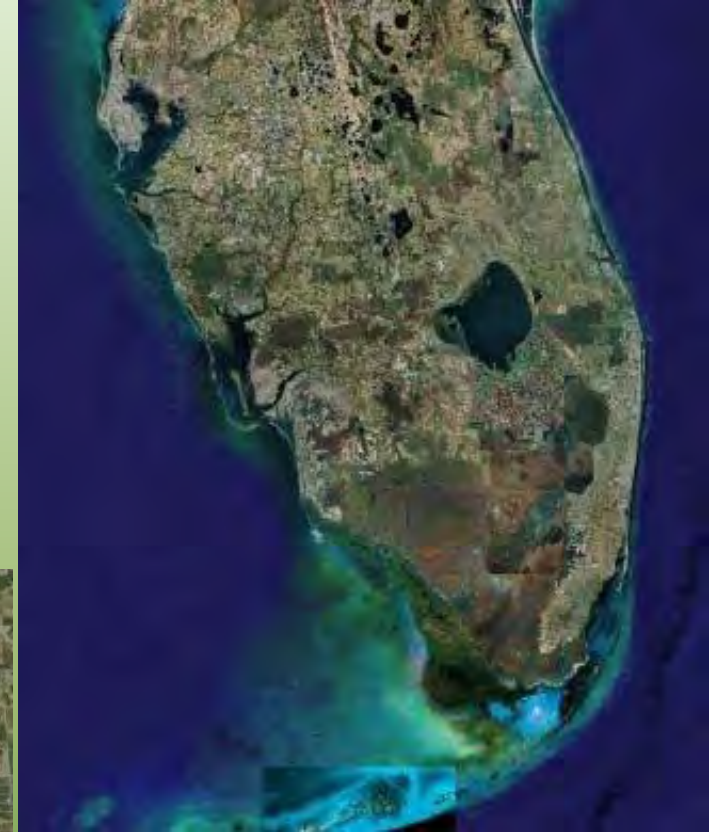
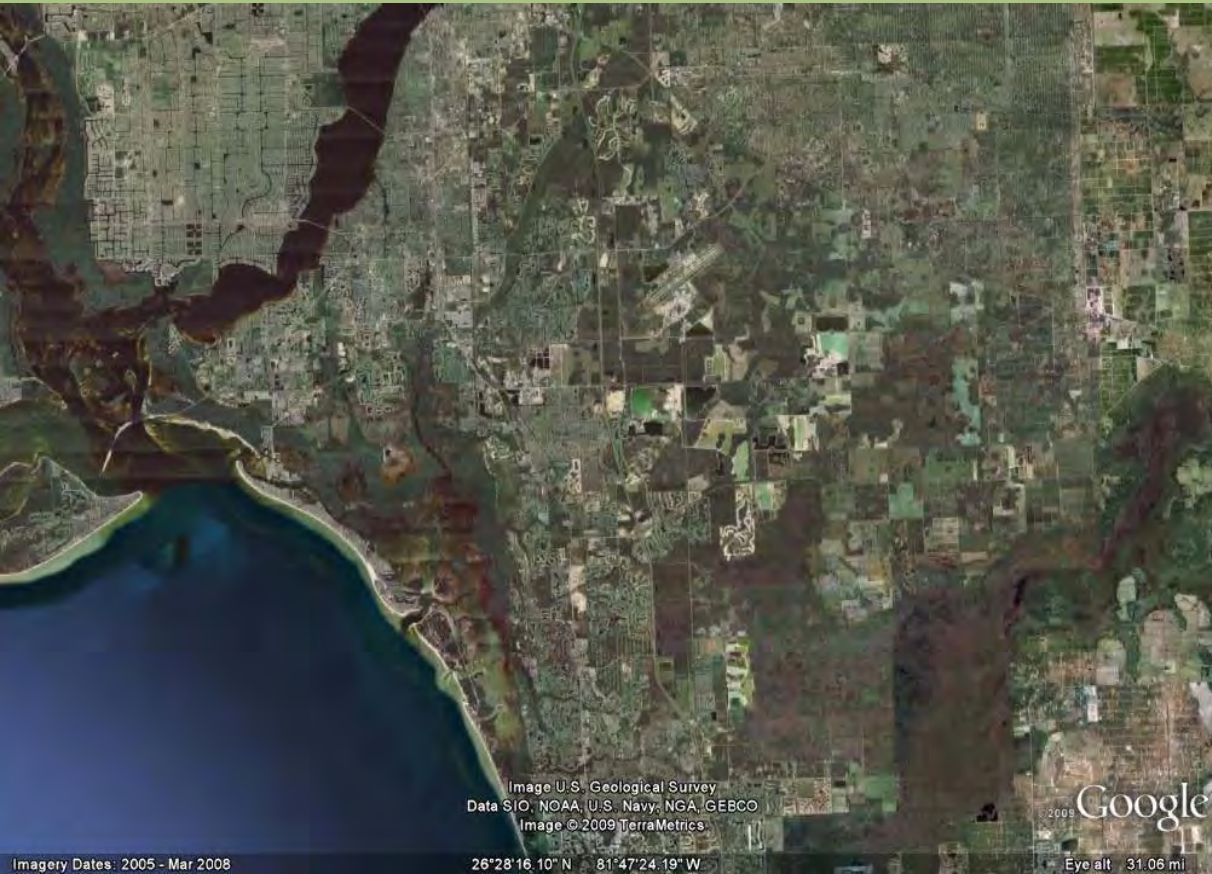
Recommendations

- ✓ Prepare a hydrological model of the study area which includes estimated watershed boundaries.
- ✓ Implement a comprehensive long-term surface and groundwater monitoring network that includes; shallow wells, deep wells, staff, flow and rain gauges.
- ✓ Develop and refine water budgets for each watershed in the DR/GR and conduct a comparative analysis with the estimated historical conditions.
- ✓ Develop detailed restoration plans for each watershed.
- ✓ Initiate discussions with agricultural interests on sustainable agriculture, habitat management and restoration objectives.

Recommendations

- ✓ Conduct limited ground-truthing to improve the accuracy of the existing conditions desktop mapping.
- ✓ Obtain accurate topography for the study area.
- ✓ 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.
- ✓ Develop a working agreement with Collier County on land and water resource management on lands within watersheds shared by Collier and Lee Counties.

Why is the DR/GR important to Estero Bay?

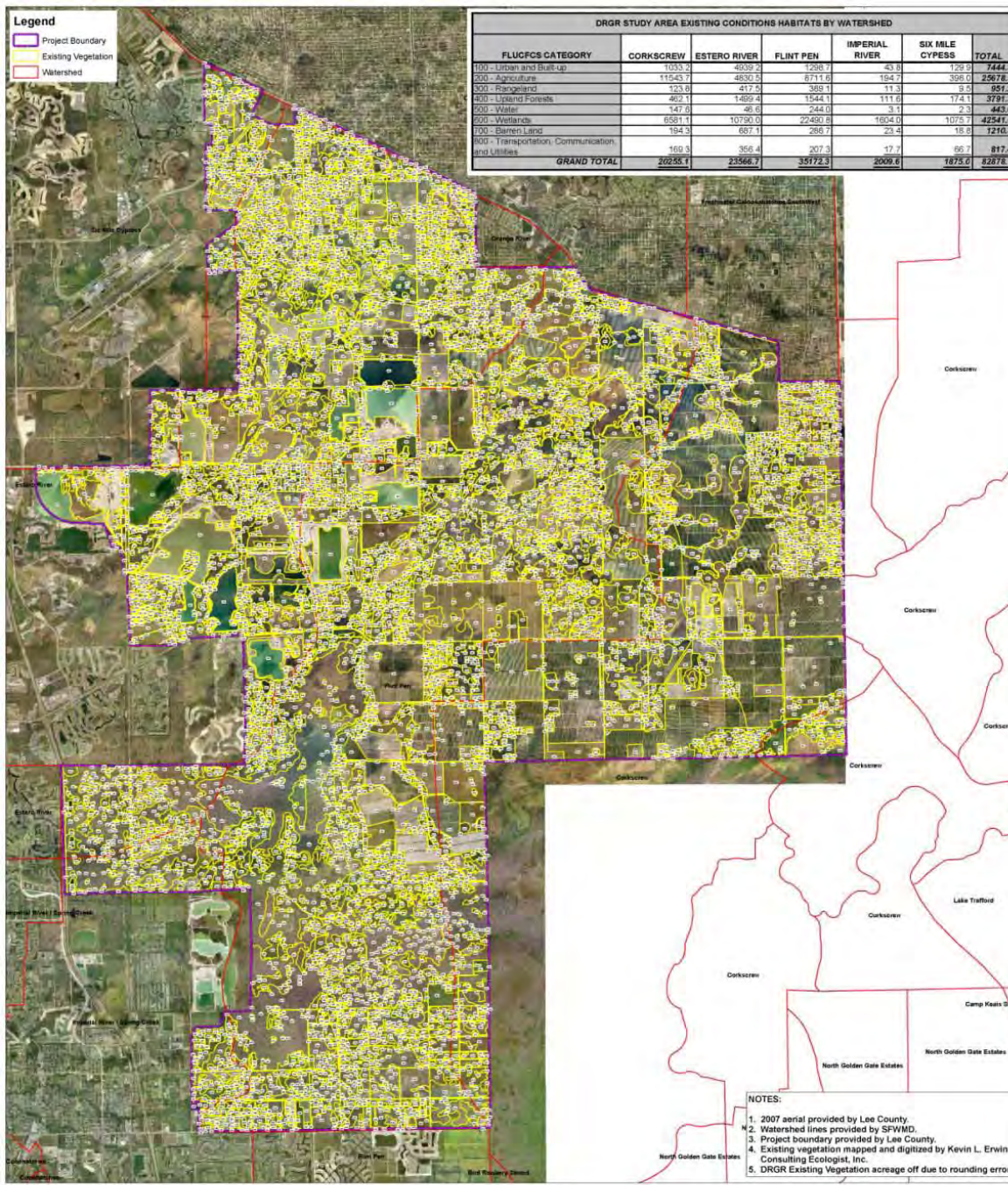


Questions

- 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?

Questions

- 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?



DRGR STUDY AREA EXISTING CONDITIONS HABITATS BY WATERSHED						
FLUCFCS CATEGORY	CORKSCREW	ESTERO RIVER	FLINT PEN	IMPERIAL RIVER	SIX MILE CYPRESS	TOTAL
100 - Urban and Built-up	1033.2	4832.2	1298.7	43.8	129.7	7444.3
200 - Agriculture	11543.7	4830.5	8711.6	184.7	396.0	25678.5
300 - Rangeland	123.6	417.5	389.1	11.3	5.0	957.2
400 - Upland Forests	482.1	1489.4	1544.1	111.6	174.1	3791.3
500 - Water	147.8	48.6	244.0	3.1	2.3	445.8
600 - Wetlands	8581.1	10790.0	22480.8	1804.0	1075.7	42541.6
700 - Barren Land	194.3	667.1	286.7	23.4	18.8	1270.3
800 - Transportation, Communication, and Utilities	169.3	365.4	207.3	17.7	66.7	817.4
GRAND TOTAL	20255.1	23566.7	35172.3	2009.6	1875.0	82878.7

DR/GR Study Area Existing Conditions

NOTES:
 1. 2007 aerial provided by Lee County.
 2. Watershed lines provided by SFWMD.
 3. Project boundary provided by Lee County.
 4. Existing vegetation mapped and digitized by Kevin L. Erwin Consulting Ecologist, Inc.
 5. DRGR Existing Vegetation acreage off due to rounding errors.

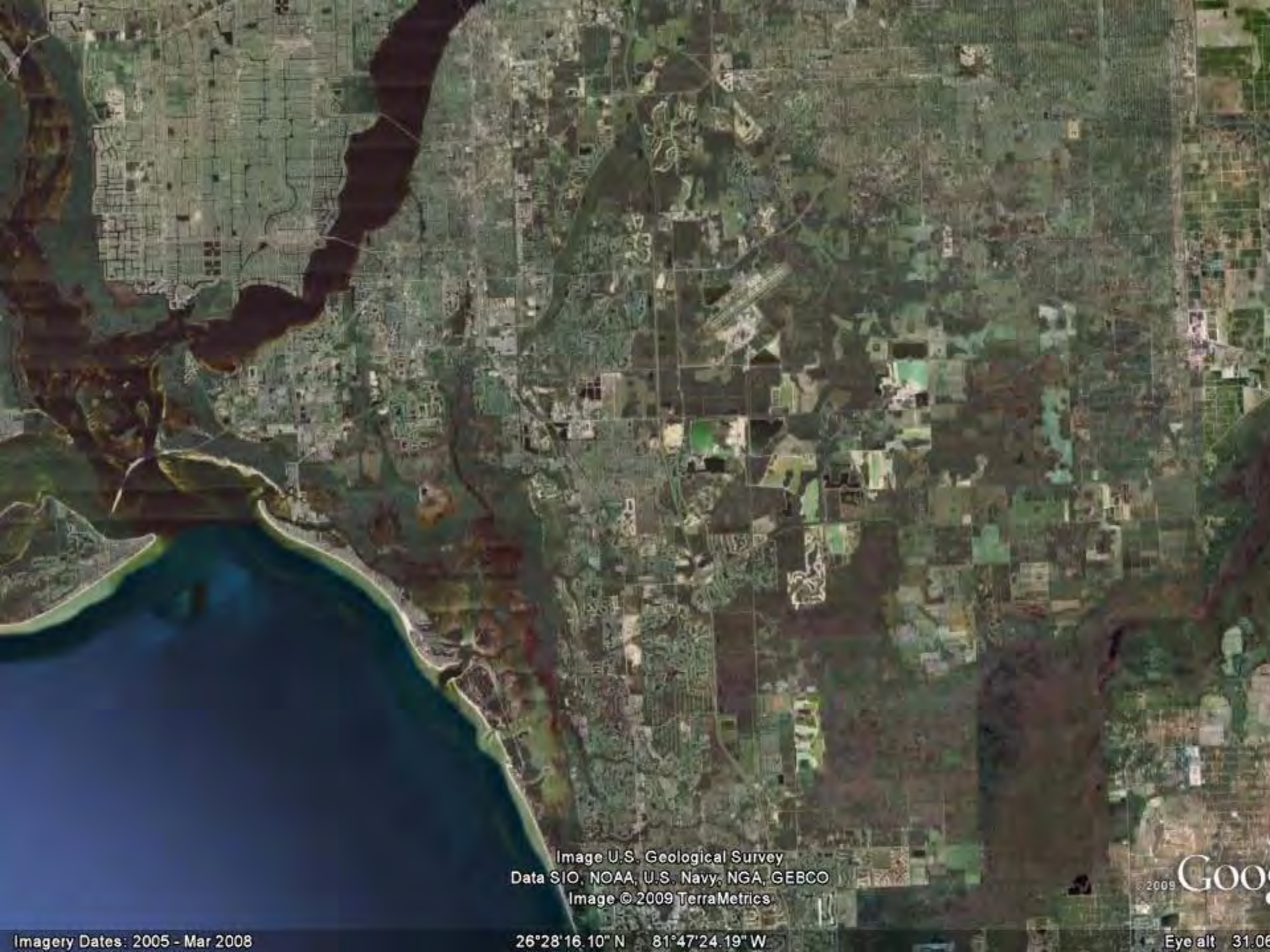


Image U.S. Geological Survey
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2009 TerraMetrics

2009 Google

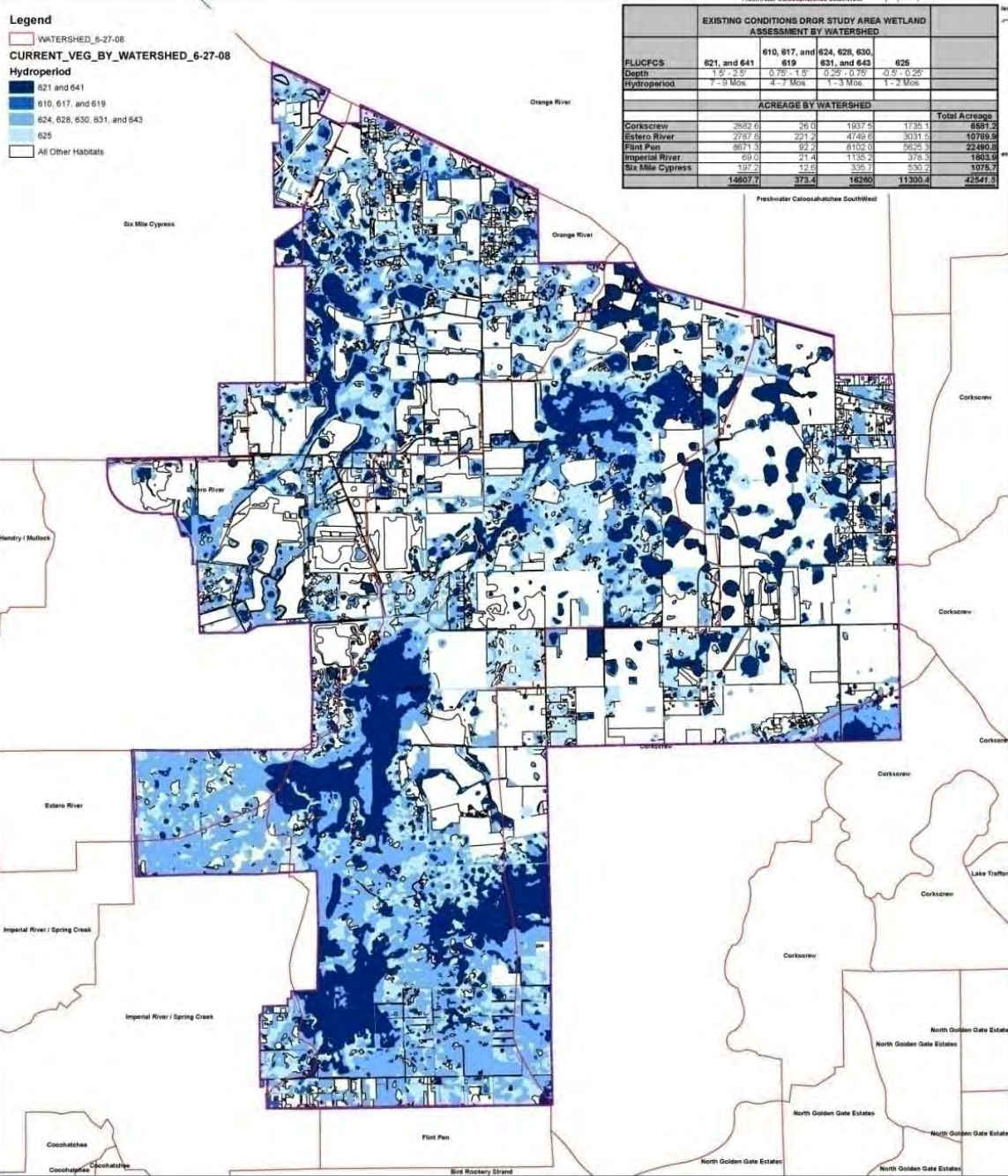
Imagery Dates: 2005 - Mar 2008

26°28'16.10" N 81°47'24.19" W

Eye alt 31.06

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

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' - 3.5'	0.75' - 1.6'	0.25' - 0.25'	0.5' - 0.25'	
Hydroperiod	7 - 9 Mos	4 - 7 Mos	1 - 3 Mos	1 - 2 Mos	
ACREAGE BY WATERSHED					Total Acreage
Corkscrew	2652.6	26.0	1937.5	1735.1	6891.2
Estero River	2787.8	221.3	4749.6	3031.5	10789.9
Flint Pen	8671.3	92.2	8102.9	9625.3	22490.8
Imperial River	69.0	21.4	1136.2	379.3	1803.6
Six Mile Cypress	187.2	12.0	339.7	530.2	1076.7
	14627.7	373.4	16260	11390.4	42547.5



DR/GR Study Area Current Hydropatterns

DR/GR Study Area Major Land Use Categories Existing Conditions

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

Summary of the Correlation Between Various Land Use Coding Systems and the Hydropatterns in the DR/GR

KLECE Codes (1953)	MIKE SHE Codes	FLUCFCS Codes (2007)	Depth	Hydroperiod	Map Index Color
1, 1M, 1P, 2D	17, 16	621, 641	1.5'-2.5'	7-9 Mos	Dark Blue
2S	18	610, 617, 619	0.75'-1.5'	4-7 Mos	Medium Blue
3	14, 13	262, 630, 631, 643, 624, 628	0.25'-0.75'	1-3 Mos	Medium Light Blue
4	10, 12	625	-0.5'-0.25'	1-2 Mos	Light Blue

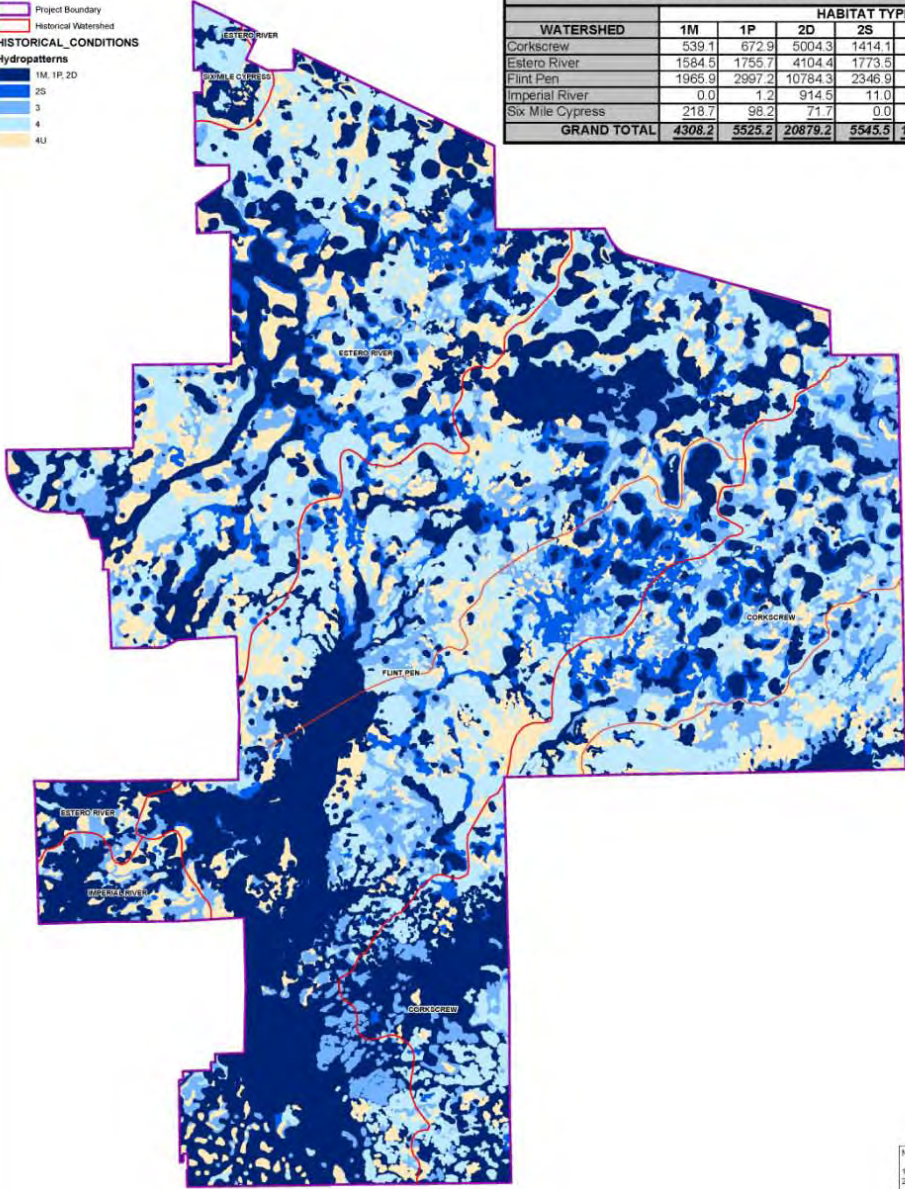
Legend

- Project Boundary
- Historical Watershed

HISTORICAL_CONDITIONS

- Hydropatterns**
- 1M, 1P, 2D
 - 2S
 - 3
 - 4
 - 4U

HISTORICAL CONDITIONS DRGR STUDY AREA HABITAT ASSESSMENT BY WATERSHED								
WATERSHED	HABITAT TYPE						TOTAL	
	1M	1P	2D	2S	3	4U		
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	37194.6
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

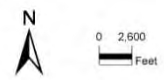


Notes:

1. DRGR Study Limits received from Lee County
2. Historical Conditions prepared by Kevin L. Erwin Consulting Ecologist, Inc.
3. Watershed boundaries prepared by Kevin L. Erwin Consulting Ecologist, Inc.

DR/GR Study Area Historical Hydropatterns

DRGR Study Area Historical Hydropatterns



2077 Bayside Parkway Ft. Myers, Florida 33901 (239) 537-1505		
Date: 1-13-08	File: Historical Hydropatterns	Project No: DRGR181
Revision Date:		
Comments:		

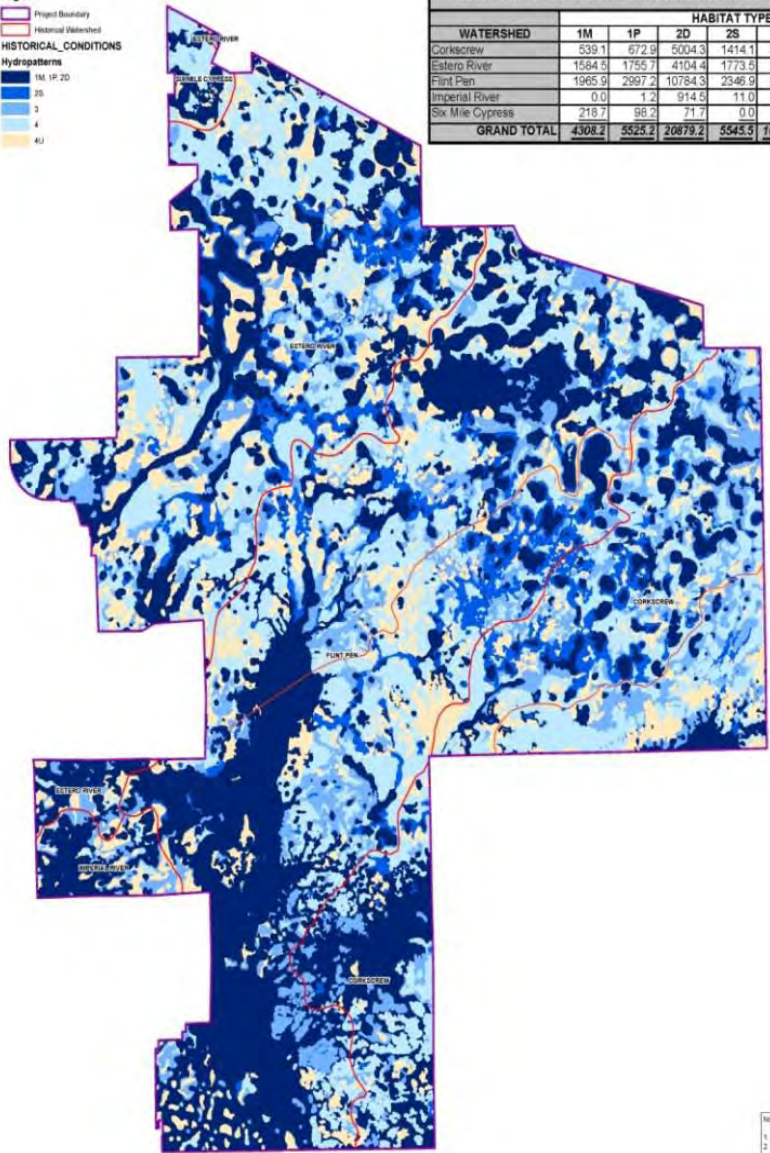
Estimated Acreages of Major Wetland Habitats within the DR/GR in 1953 and 2007

1953		2007		Loss (in acres)
Habitat Type	Acreage	FLUCFCS Code	Acreage	
Marsh, Ponds, Deep Swamp	36,258.1	610, 617, 619, 621, 641	14,981.1	(21,277)/58.7%
Shallow Cypress	10,598.3	624, 628, 630, 631	16,260.0	5661.7/53%
Hydric Pine	24,112.9	625, 643	11,300.4	(12,812.5)/53.1%
Total	70,969.3		42,541.5	28,427.8/40%

Legend

- Project Boundary
 - Historical Watershed
- HISTORICAL_CONDITIONS**
- Hydropatterns**
- 1M, 1P, 2D
 - 2S
 - 3
 - 4
 - 4U

HISTORICAL CONDITIONS DRGR STUDY AREA HABITAT ASSESSMENT BY WATERSHED							
WATERSHED	HABITAT TYPE						
	1M	1P	2D	2S	3	4	4U
Corkscrew	539.1	672.9	5004.3	1414.1	3487.7	6311.9	2326.3
Estero River	1584.5	1755.7	4104.4	1773.5	2268.2	7425.4	4215.5
Flint Pen	1965.9	2997.2	10784.3	2346.9	4504.7	9792.8	4802.9
Imperial River	0.0	1.2	914.5	11.0	326.7	123.5	421.4
Six Mile Cypress	218.7	98.2	71.7	0.0	11.0	459.5	145.0
GRAND TOTAL	4308.2	5525.2	20879.2	3545.5	10598.3	24772.9	11911.1



- Notes:
1. DRGR Study Limits retrieved from Lee County
 2. Historical Conditions prepared by Kevin L. Ecological, Inc.
 3. Watershed Boundaries prepared by Kevin L. Ecological, Inc.



3077 Suzanna Parkway Ft. Myers, Florida 33901 (239) 337-1300			
Date:	7-2-08	Work:	Historical Hydropatterns
Revision:		Drawn:	
Comments:		Project No.:	

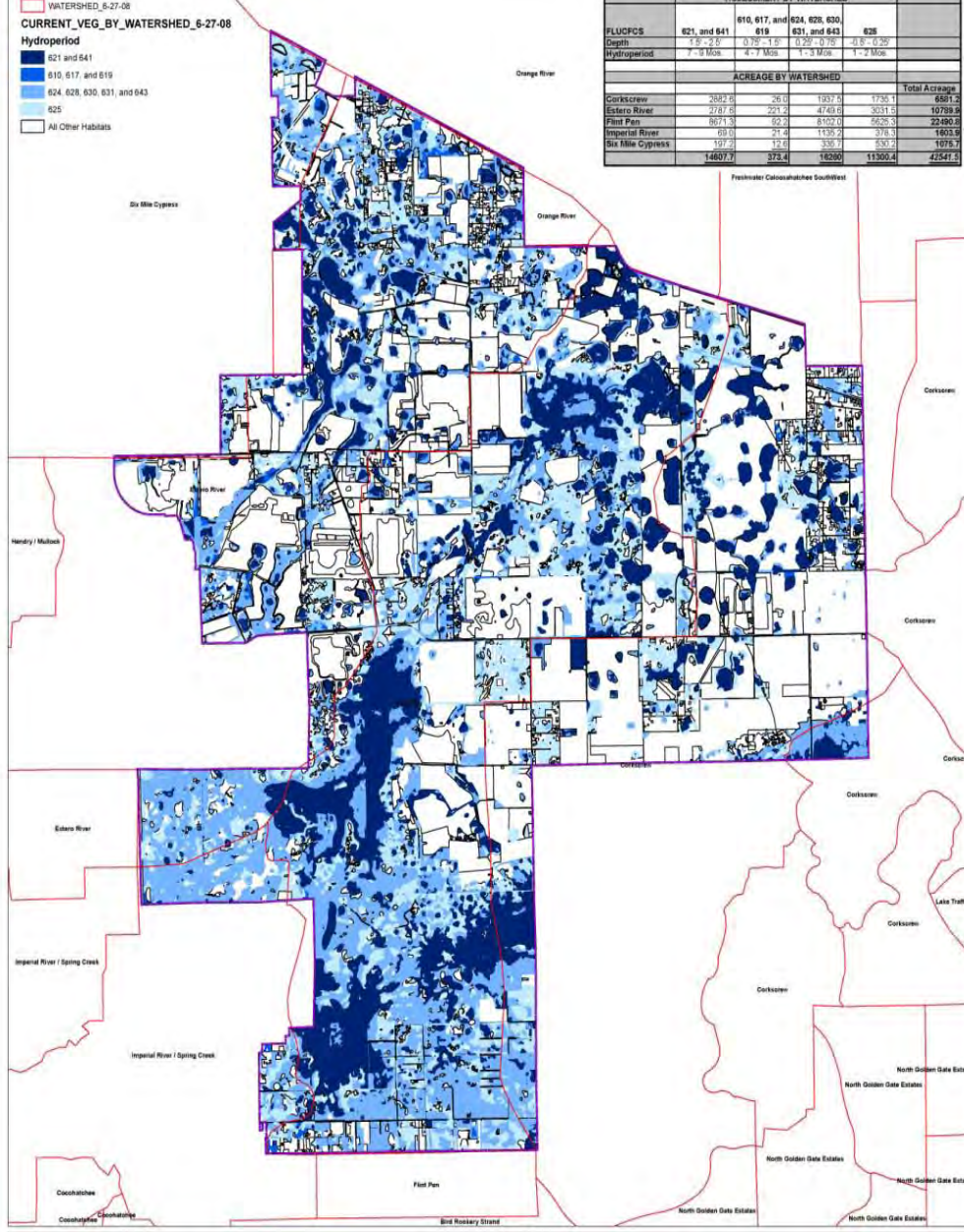


DRGR Study Area Historical Hydropatterns

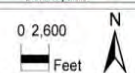
Legend

- 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

EXISTING CONDITIONS DRGR STUDY AREA WETLAND ASSESSMENT BY WATERSHED							
FLUCFPS	621, and 641		610, 617, and 619		624, 628, 630, 631, and 643		625
	1'-9" - 2'	0'-9" - 1'-9"	0'-29" - 0'-78"	0'-8" - 0'-35"	1'-3" Max.	1'-9" Max.	
Hydroperiod	1'-9" Max.	4'-9" Max.	1'-3" Max.	1'-9" Max.	1'-9" Max.	1'-9" Max.	
ACREAGE BY WATERSHED							Total Acreage
Corkscrew	2982.2	26.0	1937.7	1730.1	4507.3	4507.3	
Estero River	2787.6	221.5	4749.6	3031.5	10789.9	10789.9	
Flint Pen	8671.3	65.3	8107.0	5625.3	22480.9	22480.9	
Imperial River	43.0	21.49	1139.2	376.3	1603.5	1603.5	
Six Mile Cypress	191.7	12.8	330.1	53.2	1076.1	1076.1	
	14607.7	378.4	16260	11300.4	42541.3	42541.3	



DRGR Study Area Current Hydropatterns

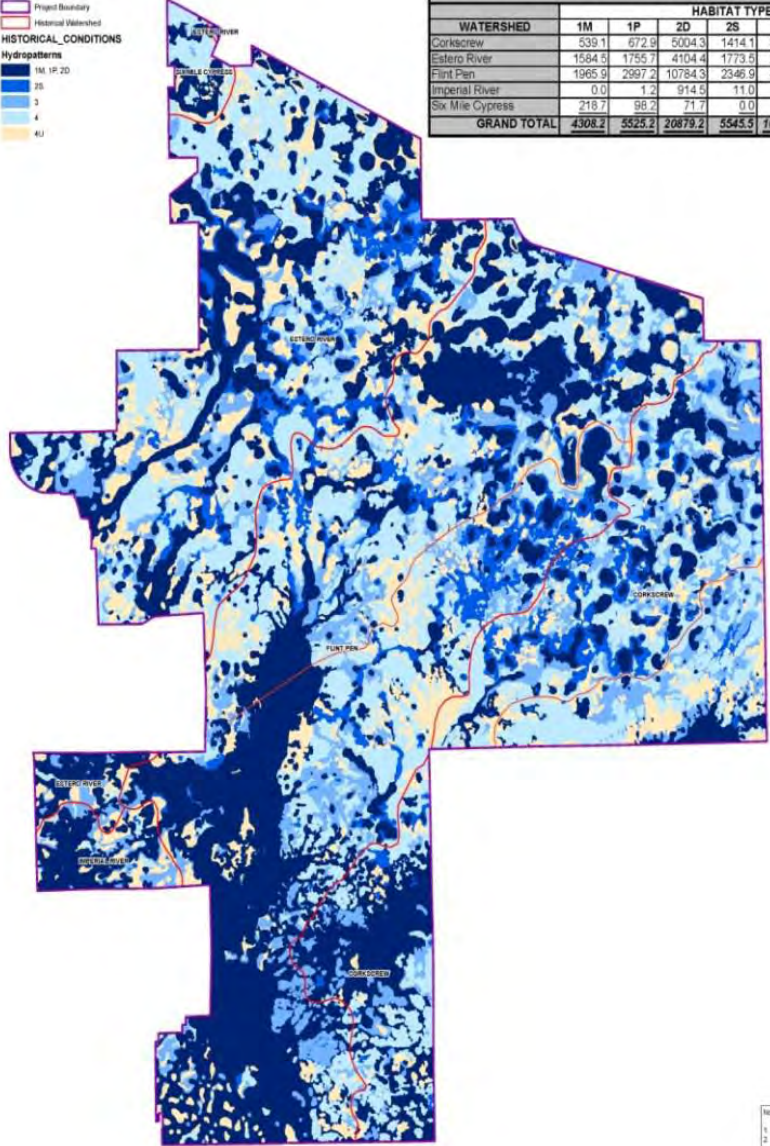


3077 Suzanna Parkway Ft. Myers, Florida 33901 (239) 337-1300			
Date:	7-2-08	Work:	Current Hydropatterns
Revision:		Drawn:	
Comments:		Project No.:	

Legend

- Project Boundary
 - Historical Watershed
- HISTORICAL_CONDITIONS**
- Hydropatterns**
- 1M 1P 2D
 - 2S
 - 3
 - 4
 - 4U

HISTORICAL CONDITIONS DRGR STUDY AREA HABITAT ASSESSMENT BY WATERSHED							
WATERSHED	HABITAT TYPE						
	1M	1P	2D	2S	3	4	4U
Corkscrew	539.1	672.9	5004.3	1414.1	3487.7	6311.9	2326.3
Estero River	1584.5	1755.7	4104.4	1773.5	2268.2	7425.4	4215.5
Flint Pen	1965.9	2997.2	10784.3	2346.9	4504.7	9792.8	4802.9
Imperial River	0.0	1.2	914.5	11.0	326.7	123.5	421.4
Six Mile Cypress	218.7	98.2	71.7	0.0	11.0	459.5	145.0
GRAND TOTAL	4308.2	5525.2	20879.2	3545.5	10598.3	24772.9	11911.1



- Notes**
1. DRGR Study Limits retrieved from Lee County
 2. Historical Conditions prepared by Kevin L. Eganoff, Inc.
 3. Watershed Boundaries prepared by Kevin L. Eganoff, Inc.



3077 Suzanna Parkway Ft. Myers, Florida 33901 (239) 337-1300			
Date:	7-2-08	Wdr:	Historical Hydropatterns
Revision:		Project No.:	
Comments:			

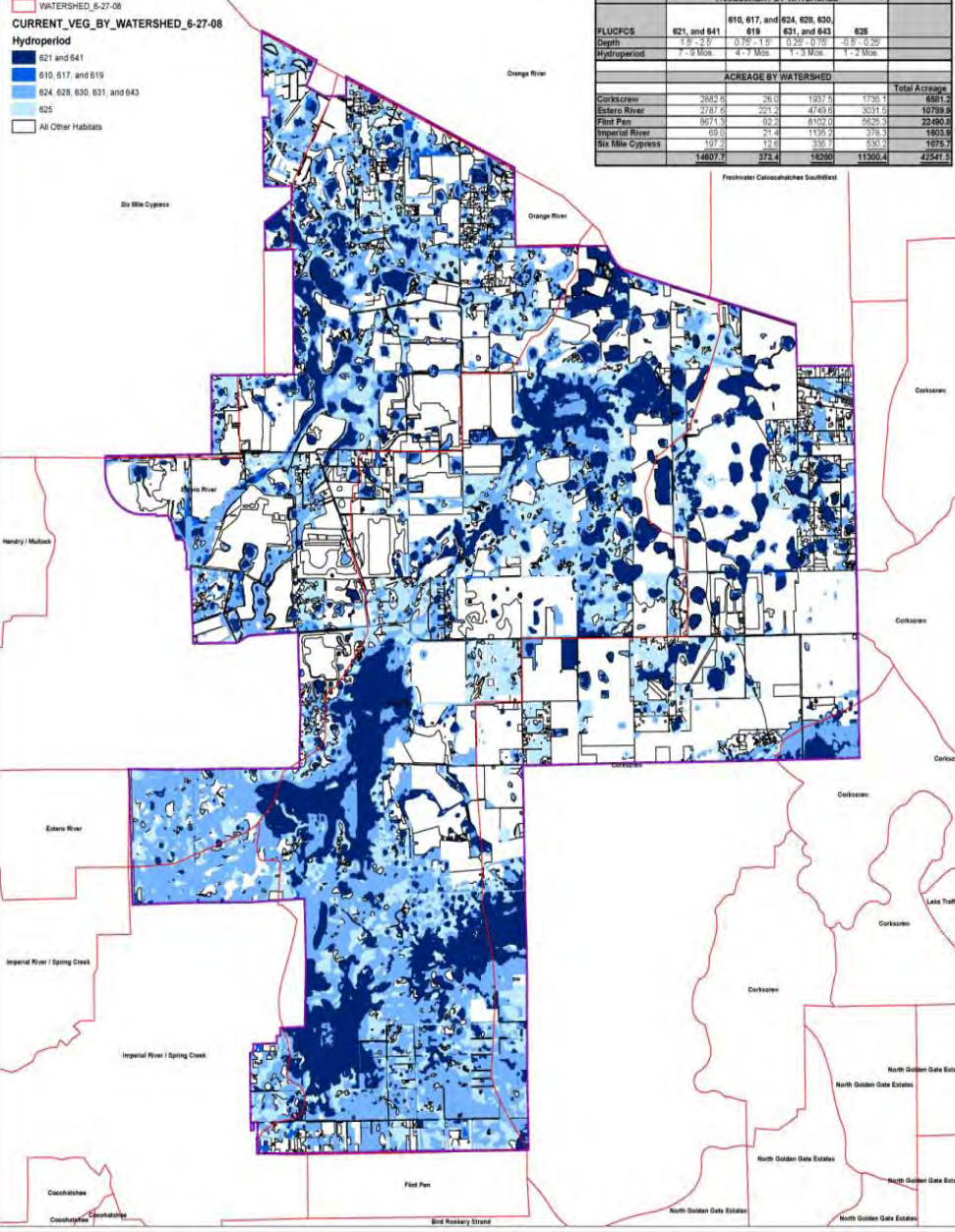


DRGR Study Area Historical Hydropatterns

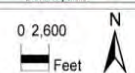
Legend

- WATERSHED_6-27-08
- CURRENT_VEG_BY_WATERSHED_6-27-08**
- Hydroperiod**
- 621 and 641
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 - 624, 628, 630, 631, and 643
 - 625
 - All Other Habitats

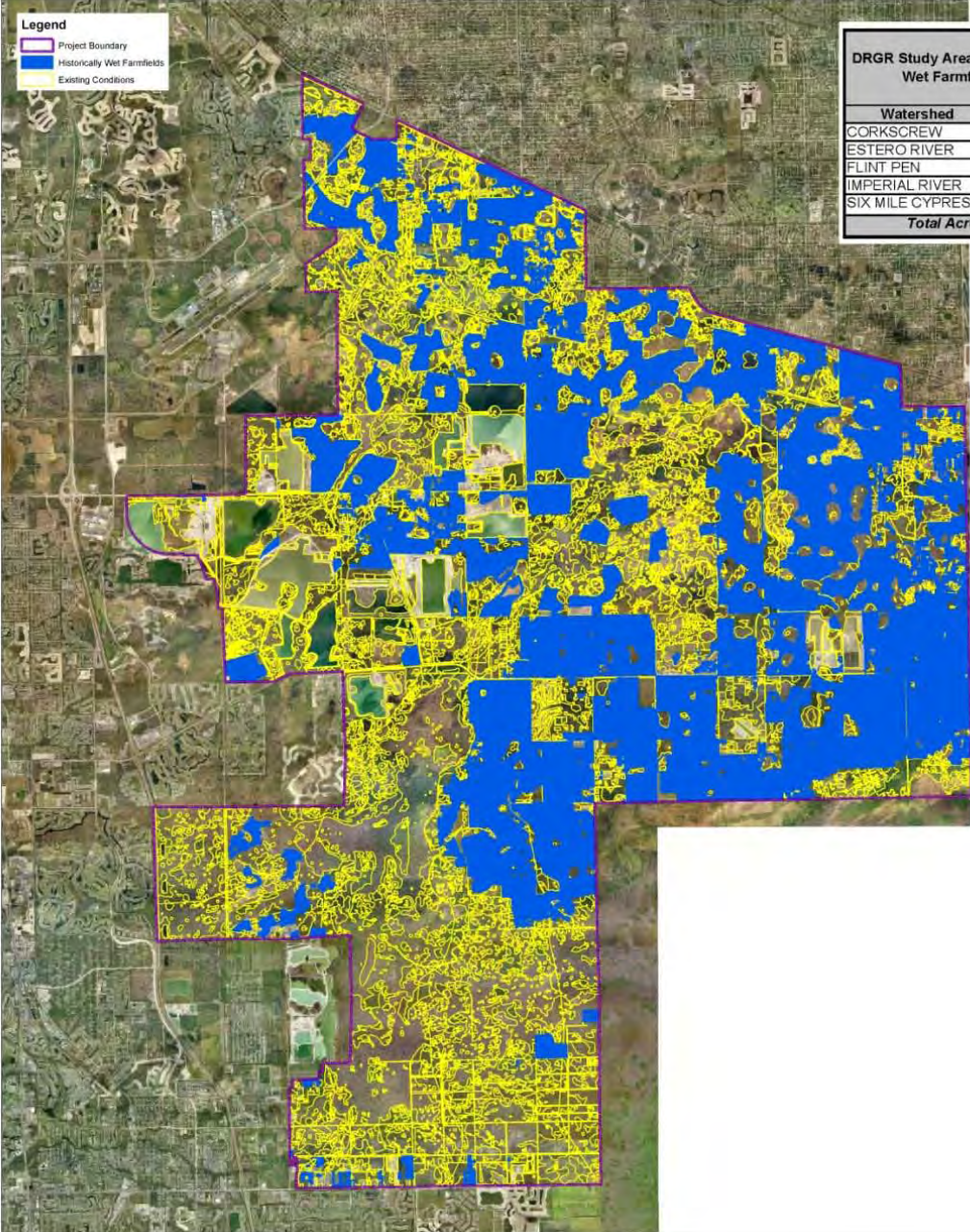
EXISTING CONDITIONS DRGR STUDY AREA WETLAND ASSESSMENT BY WATERSHED					
FLUCFPS	621, and 641	610, 617, and 619	624, 628, 630, 631, and 643	625	
Depth	1'-9" - 2'	0'-79" - 1'-8"	0'-29" - 0'-78"	0'-8" - 0'-25"	
Hydroperiod	1-1-9 Mos	4-1-9 Mos	1-1-3 Mos	1-1-9 Mos	
ACREAGE BY WATERSHED					Total Acreage
Corkscrew	2982.2	26.0	1937.7	1730.1	6676.0
Estero River	2787.6	221.1	4749.6	3031.5	10789.8
Flint Pen	8671.3	65.3	8107.0	5625.3	22469.0
Imperial River	43.0	21.49	1139.2	376.3	1600.0
Six Mile Cypress	191.7	12.8	330.1	53.2	1075.8
GRAND TOTAL	14607.7	376.4	16260	11300.4	42544.5



3077 Suzanna Parkway Ft. Myers, Florida 33901 (239) 337-1300			
Date:	7-2-08	Wdr:	Current Hydropatterns
Revision:		Project No.:	
Comments:			



DRGR Study Area Current Hydropatterns



Legend

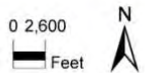
- Project Boundary
- Historically Wet Farmfields
- Existing Conditions

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

DR/GR Study Area Historical Wetlands Converted to Agriculture

DRGR Study Area Historically Wet Farmfields



2077 Bayshore Parkway Ft. Myers, Florida 33901 (239) 337-1565

Date: 7-15-08	File: Historically Wet	Project No: DRPDR101
Revision Date:		
Comments:		

Historic water level



Drained wetland in
eastern Ontario



Restoring wetlands in Florida +50 years
after conversion to Agriculture

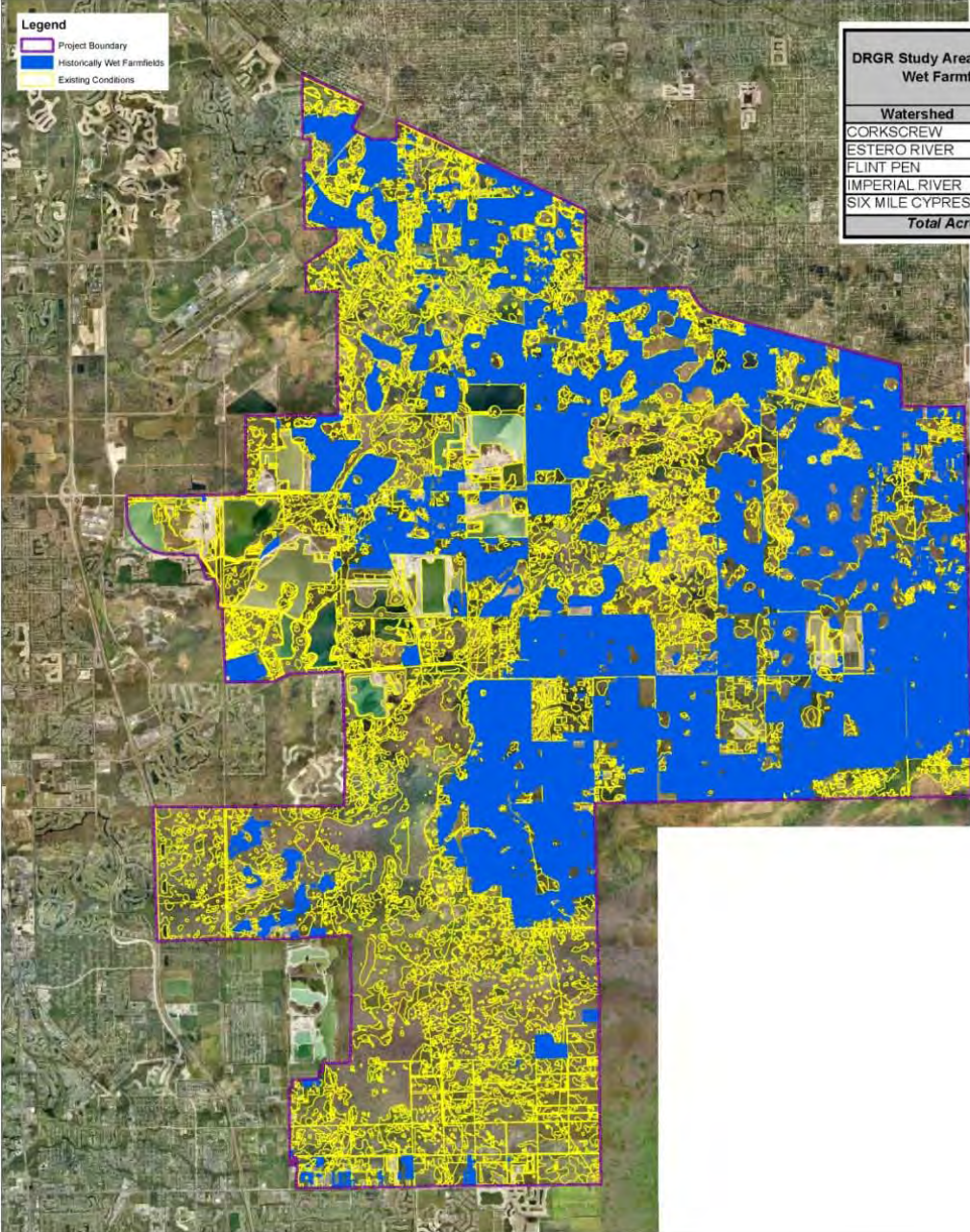


1. Digital copy of 1944 aerial received from SFWMD.
2. Property boundary is an approximation based on TKW survey. Lines shifted to match visually identified landscape features.
3. Blue circle located by southern property boundary is an artifact







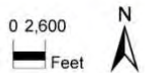


Legend
 Project Boundary
 Historically Wet Farmfields
 Existing Conditions

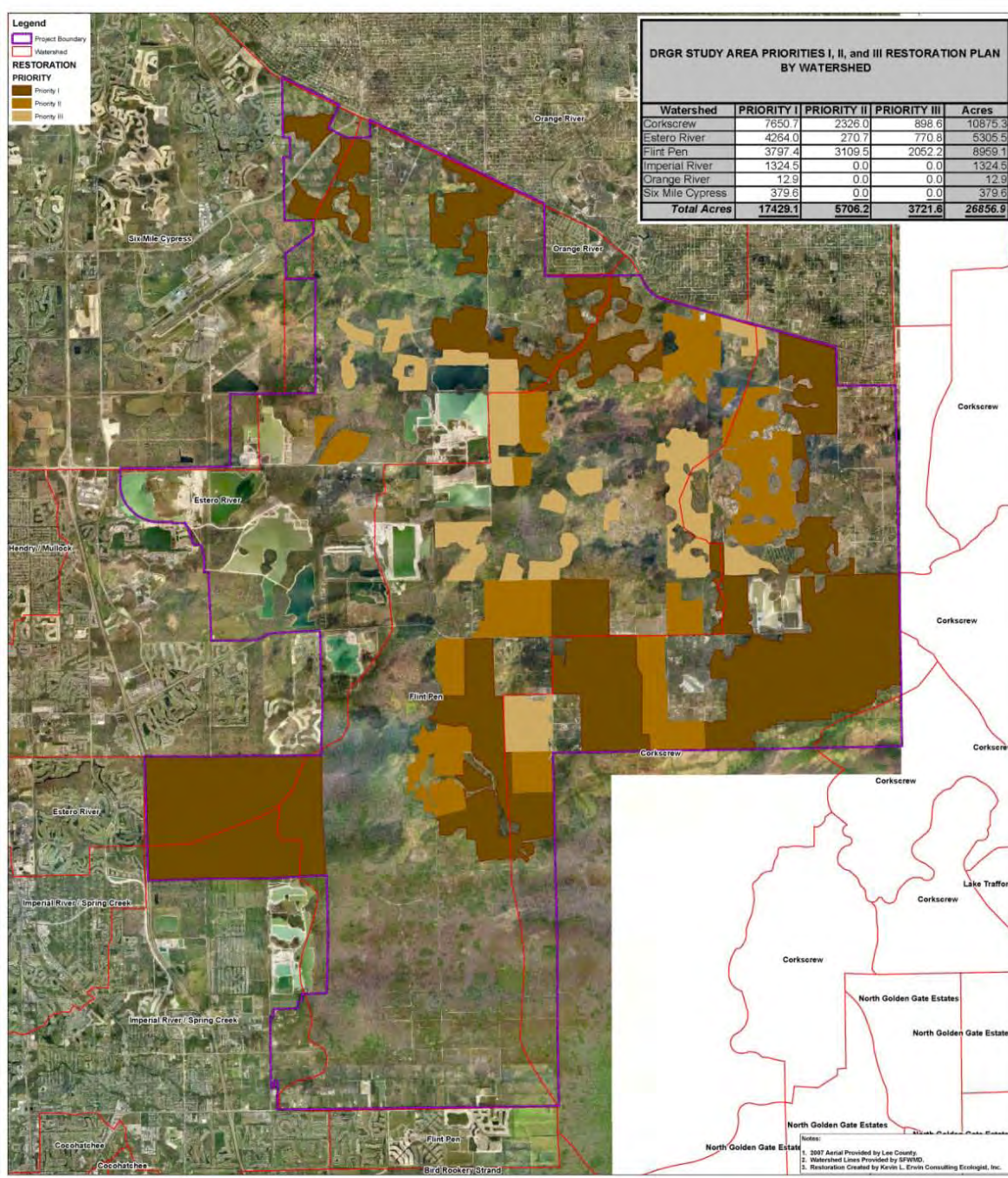
DRGR Study Area Historically Wet Farmfields	
Watershed	Acres
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SIX MILE CYPRESS	364.3
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DR/GR Study Area Historical Wetlands Converted to Agriculture

DRGR Study Area Historically Wet Farmfields



2077 Bayside Parkway Ft. Myers, Florida 33901 (239) 337-1565		
Date: 7-10-08	File: Historically Wet	Project No: DRPDR101
Revision Date:		
Comments:		



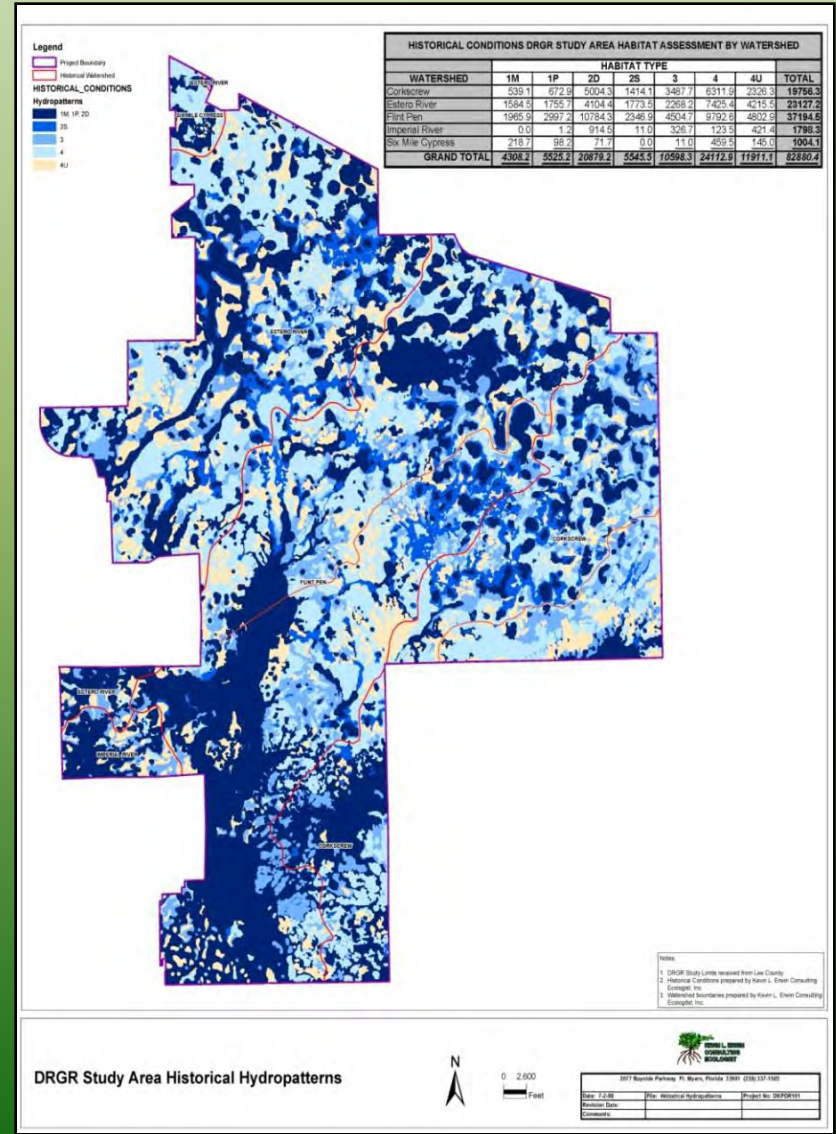
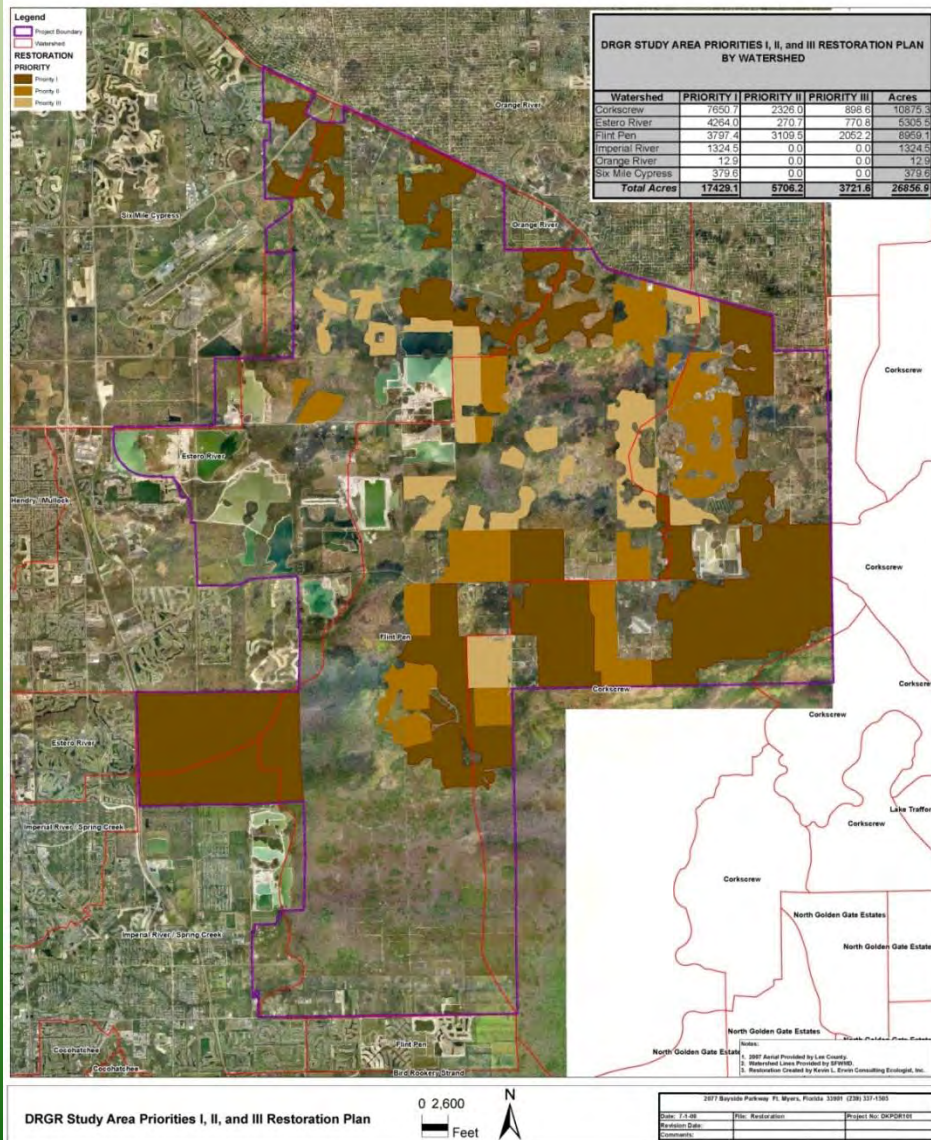
DRGR STUDY AREA PRIORITIES I, II, and III RESTORATION PLAN BY WATERSHED

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	2062.2	8969.1
Imperial River	1324.5	0.0	0.0	1324.5
Orange River	42.9	0.0	0.0	42.9
Six Mile Cypress	379.6	0.0	0.0	379.6
Total Acres	17429.1	5706.2	3721.6	26856.9

DR/GR Study Area Priority I, II, and III Restoration Plan

Notes:
 1. 2007 Aerial Provided by Lee County
 2. Watershed Lines Provided by SWFWMD
 3. Restoration Created by Keith L. Erwin Consulting Ecologist, Inc.

Restoration Recommendation and the Historical Hydropatterns



NATURAL RESOURCE STRATEGIES FOR SOUTHEAST LEE COUNTY

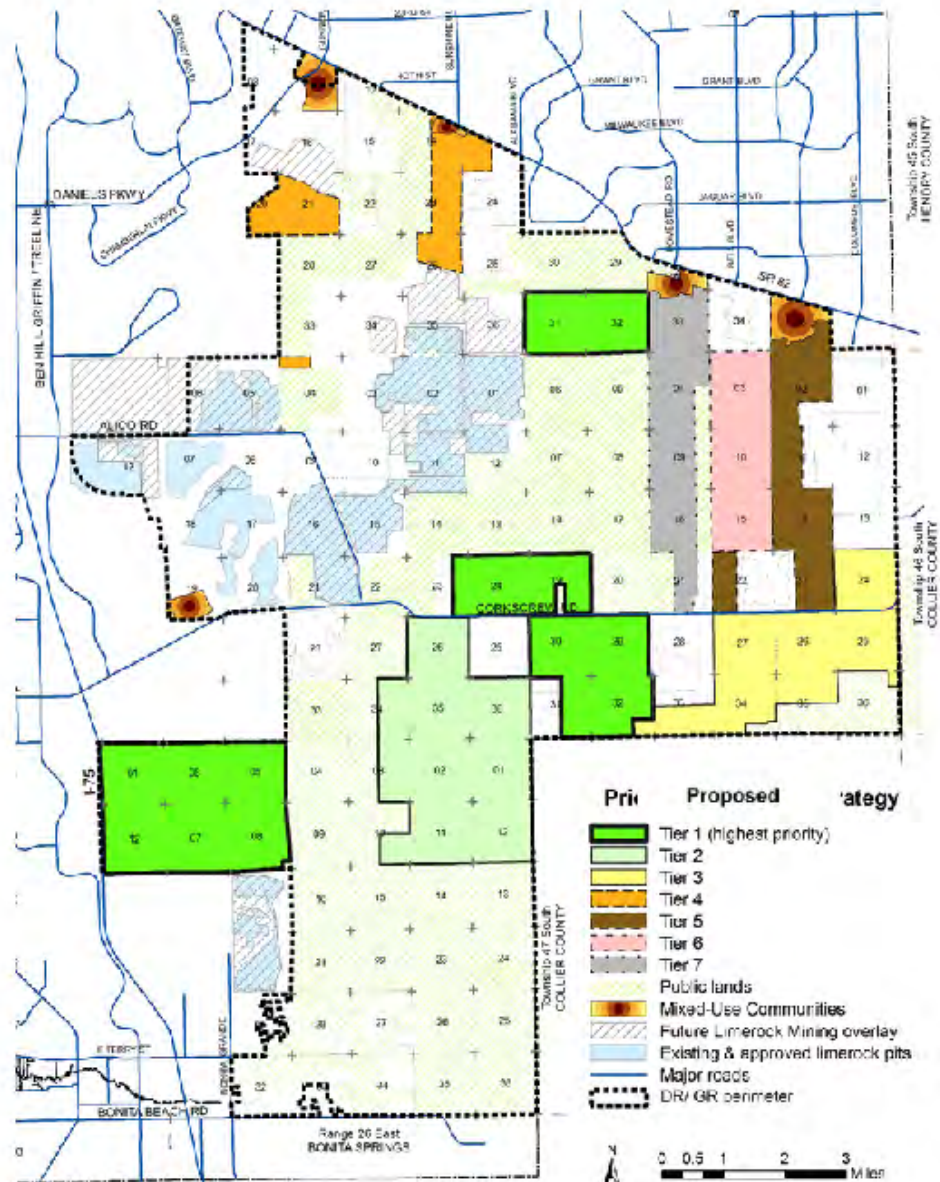


Figure 1

3.6 DRAFT 7-20-09

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%

LEVEL I FLUCFCS CATEGORY						
	CORKSCREW	ESTERO RIVER	FLINT PEN	IMPERIAL RIVER	SIX MILE CYPRESS	TOTAL
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
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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
GRAND TOTAL	20,255.1	23,566.7	35,172.3	2,009.6	1,875.0	82,878.7



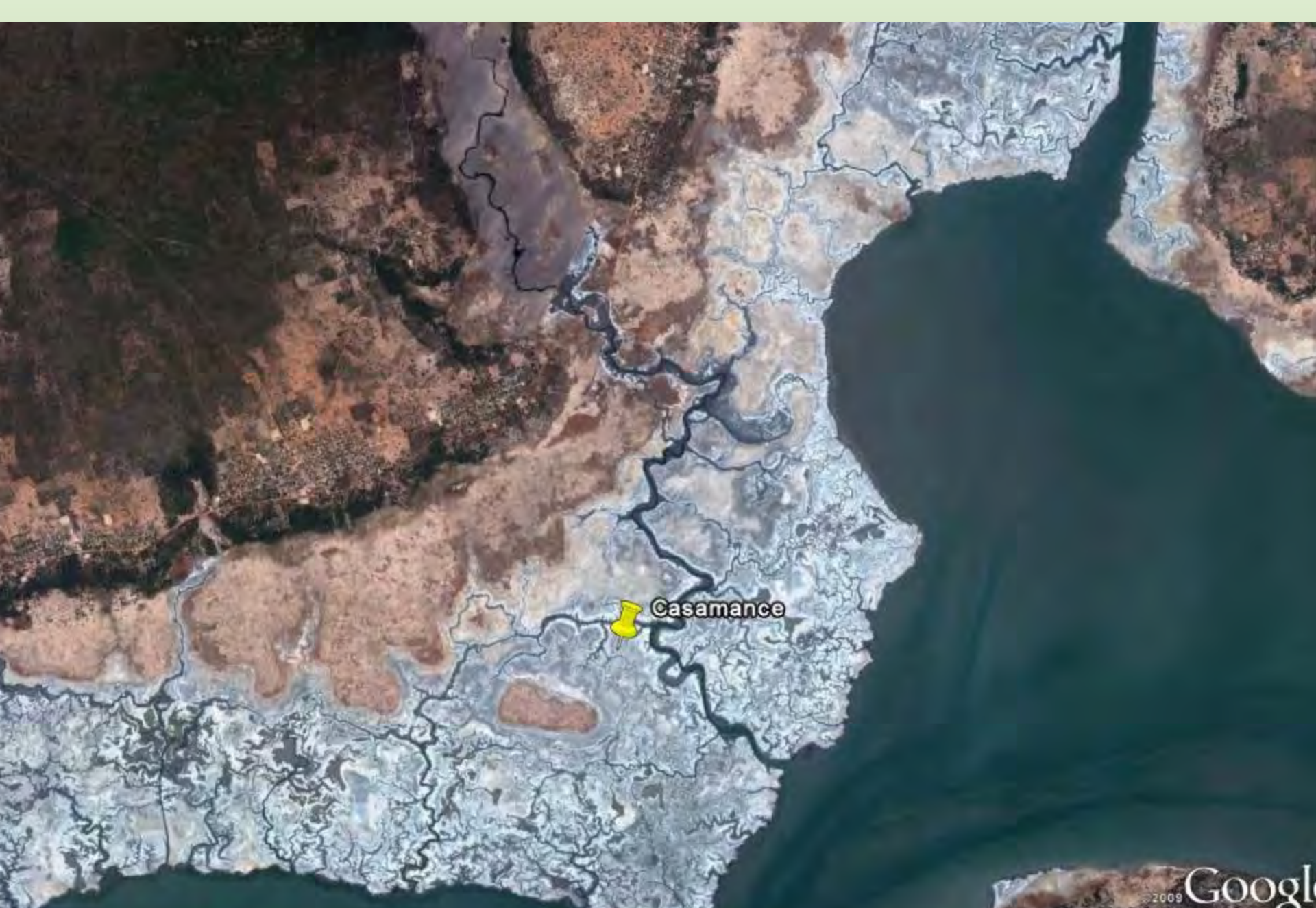
Image U.S. Geological Survey

©2009 Google

Imagery Date: 2005

26°27'40.59" N 81°53'37.15" W

Eye alt 1481



Casamance

2009 Google

Imagery Date: Feb 10, 2005

Image © 2009 DigitalGlobe

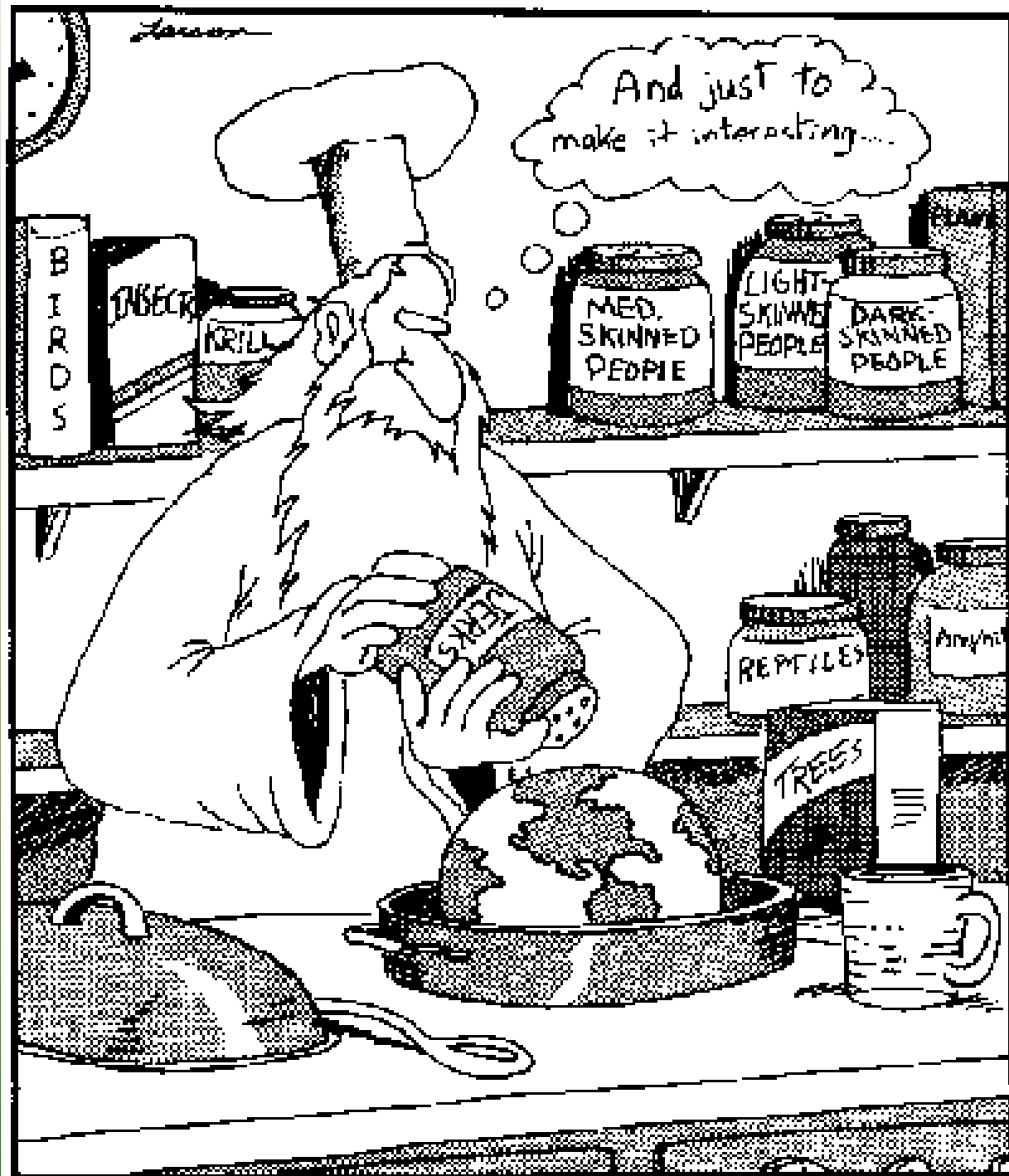
12°40'10.73" N 16°03'28.78" W

Eye alt 39815 ft











Senegal

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

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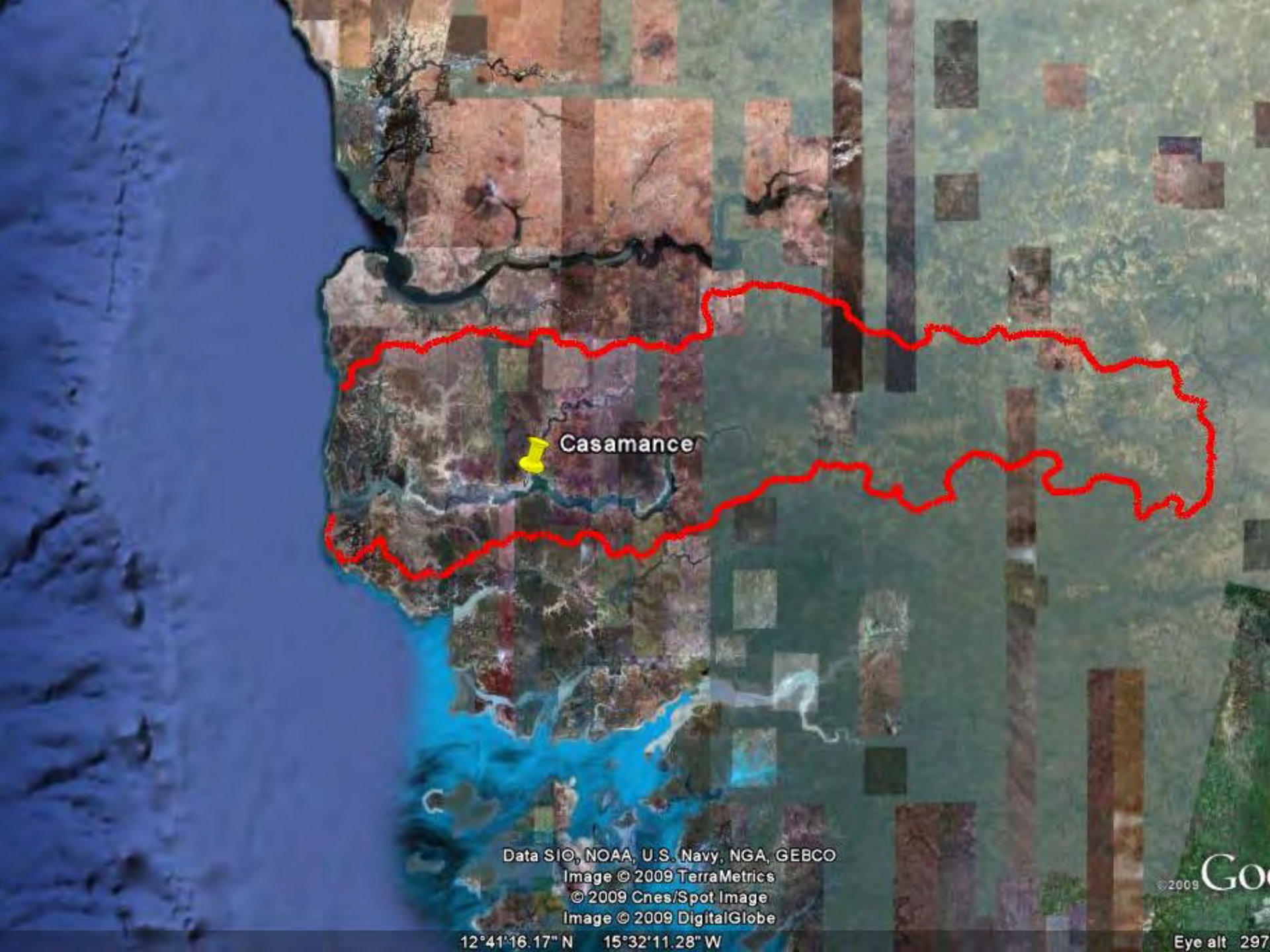
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12°48'12.44" N 11°46'16.19" W

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