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REGIONAL STUDY OF LAND USE PLANNING AND RECLAMATION

PREPARED BY THE

CENTRAL FLORIDA REGIONAL PLANNING COUNCIL

UNDER A GRANT SPONSORED BY THE

FLORIDA INSTITUTE OF PHOSPHATE RESEARCH

BARTOW, FLORIDA

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(Plus 5 maps)
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FLORIDA INSTITUTE OF PHOSPHATE RESEARCH

The Florida Institute of Phosphate Research was created in 1978 by the Florida Legislature (Chapter 378.101, Florida Statutes) and empowered to conduct research supportive to the responsible development of the state's phosphate resources. The Institute has targeted areas of research responsibility. These are: reclamation alternatives in mining and processing, including wetlands reclamation, phosphogypsum storage areas and phosphatic clay containment areas; methods for more efficient, economical and environmentally balanced phosphate recovery and processing: disposal and utilization of phosphatic clay; and environmental effects involving the health and welfare of the people, including those effects related to radiation and water consumption.

FIPR is located in Polk County, in the heart of the Central Florida phosphate district. The Institute seeks to serve as an information center on phosphate-related topics and welcomes information requests made in person, by mail, or by telephone.

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REGIONAL STUDY OF LAND USE PLANNING AND RECLAMATION

FINAL REPORT

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The opinions, findings, and conclusions expressed herein are not necessarily those of the Florida Institute of Phosphate Research, nor does mention of company names or products constitute endorsement by the Florida Institute of Phosphate Research.

FINAL REPORT PERSPECTIVE

Florida Institute of Phosphate Research
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The Florida Phosphate Industry owns or controls about 500,000 acres within the Central Florida Phosphate Mining District. Since passage of "The State and Regional Planning Act of 1984", there has been a significant amount of interest on the part of the various planning agencies, regulatory agencies and public impacted by activities of the Industry in the present and future land uses within this Mining District.

In 1985, the Board of Directors of the Institute identified "The Resource as an important area of study in the Institute's Overall research effort. In June of 1988, the Board approved Central Florida Regional Planning Council's proposal to develop a geographical data base for the portions of those counties -- Polk, Hillsborough, Manatee, Hardee and DeSoto -- incorporating the Mining District. The data base was to depict present land use and projected land use to 2010.

Shortly after authorizing the study, the Institute's Board directed CFRPC to incorporate an independent analysis by the Florida Audubon Society of the conservation and environmental opportunities in the current and future land use planning efforts.

This study represents a first effort to bring together in one source document the current and projected land uses for the mining and chemical companies operating within the study area and FLUCCS land use categories for the balance of the land within the same area. The information is presented in color coded map format (1 inch = 4 miles). The information is also available on computer discs on written request to those interested in a more detailed analysis of specific areas.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Florida is and will continue to be a rapidly growing state. The need for growth management and land use planning was recognized by the State Legislature when they passed "The State and Regional Planning Act of 1984". The State plan and all Regional Comprehensive Policy Plans have been completed and adopted. The local government (counties and cities) growth management and land use plans are due to be completed by late 1990.

The study area for this project includes portions of DeSoto, Hardee, Hillsborough, Manatee and Polk Counties. This 1,265,069 acre land area has experienced the same growth and land use pressures as have other non-coastal regions, but because the phosphate industry owns or controls almost 40% of the acreage, its development has been slowed. The majority of these lands will become available sometime in the first part of the 21st century, after the industry has completed mining and reclamation.

Three factors are paramount in determining the use of a particular plot of land; natural, economic and political. Industry decisions on whether or not to mine a given tract, how and when to reclaim the land after mining, and how to meet the political/regulatory requirements are all based on the interplay of these three factors.

Chemical Fertilizer Plants

Over the last 40 years the techniques of mining phosphate rock have not changed substantially in kind, only in magnitude. However, the chemical processing of the phosphate rock has undergone a transition from small normal superphosphate plant operations to large phosphoric acid-based plants producing finished products such as di-ammonium phosphate, triple superphosphate and mono-ammonium phosphate. There are currently 11 fertilizer plants and one animal food supplement plant within the Central Florida study region, producing over 12 million tons of finished products annually.

The technology switch to wet process phosphoric acid based products brought with it an unwelcome by-product, phosphogypsum. Approximately five tons of phosphogypsum (calcium sulfate di-hydrate) are produced per ton of recovered phosphoric acid anhydride (P_2O_5). Phosphogypsum requires sizeable disposal/storage areas. The 11 chemical plants in the study area have four inactive storage piles in addition to the active piles at each site. There are currently 4,872 acres in gypsum storage, 25% of the total plant acreage. It

is estimated that there are over 600 million tons of gypsum stored in Florida with about 30 million tons of production being added each year. Approximately 1,900 acres of land are programmed for additional gypsum storage. The industry and the Institute of Phosphate Research have been trying to develop large tonnage, environmentally benign uses for this by-product to alleviate the problems inherent in reclaiming the acreage used for gypsum storage, but the recent EPA ruling requiring the phosphogypsum to remain on the stacks threatens to undermine these efforts.

Though most of the phosphate rock mining in Polk and Hillsborough Counties will have been completed by the year 2010 as the industry moves southward into Hardee, DeSoto and Manatee, the chemical plants will still be operating. Due to increasing regulatory and environmental concerns and the negative economic impact of relocating, established chemical plants will almost certainly remain at their present location.

Phosphate Mining

The mining of phosphate rock has been carried out within the study area for over 100 years, The industry has grown from small operations which disturbed a few acres of land to its present day size in which the total acreage mined by the industry averages 6000 acres/year, with the production of about 40 million metric tons of rock. The phosphate industry owns 466,440 acres in the study area, over half of which (241,149 acres) is in active mining areas. Industry and the Department of Natural Resources (DNR) figures indicate that a total of 218,229 acres have been mined; 149,130 acres before July 1, 1975 and 69,099 since that date. Ten companies are presently operating 19 mine sites within the study area.

Two main waste products are generated during the beneficiation and processing of phosphate rock: sand tailings and phosphatic clays. Tailings are commonly used to backfill mine cuts, then the overburden stockpiled nearby is spread over the tailings to produce a stable land form with a variety of potential uses. The phosphatic clays are pumped as a 3 to 5% solids slurry to large, diked areas where the clay solids slowly settle and the supernatant water is removed through spillways and reused in the mine operations. The waste clay settling ponds occupy from 20 to 40% of the land area mined, so that a significant portion of mined land will not be available for load-supporting, construction uses. Until recently, these clay ponds required 10 to 15 years to consolidate to a 15-20% solids level and to crust over enough to support cattle. However, due to innovative mechanical dewatering techniques developed by FIPR and the industry, this time requirement has been shortened to three to five years. Another reclamation innovation, sand/clay mixing, has been

used at several mine sites and affords equally short time frames for the completion of reclamation. The 19 operating mines have 57,146 acres of active and inactive clay ponds with a projection of 20,000 additional acres needed for future operations.

Throughout most of the years of phosphate mining in Central Florida there was no requirement that mined lands be reclaimed. A company spent the money to reclaim only where there was demonstrable economic incentive or an overwhelming aesthetic need. The State of Florida mandated that all land mined after July 1, 1975 must be reclaimed and provided some monies through the severance tax program (administered by DNR) to assist in the reclamation of pre-1975 mined lands. Since 1975, phosphate miners have considered land reclamation an integral cost of doing business. Industry and DNR figures confirm that 41% (28,248 acres) of post-1975 mined land have been reclaimed. In addition, 58% (86,624 acres) of pre-1975 land have been reclaimed and released.

Eleven of the 19 operating phosphate rock mines in the study area will have mined out their currently permitted reserves by the year 2000. It is probable that four to six of these companies will still be mining in the study area past the year 2010. Phosphate rock production will peak at about 40 million metric tons, then gradually decline to around 20 million tons by the year 2010. Companies are now planning the utilization or disposition of their land areas which are being reclaimed and released by the permitting agencies. Some firms expect to utilize their reclaimed land themselves in the agricultural area and are planting citrus groves, timber and pasture grasses. All are open to promising industrial projects such as waste treatment facilities, power plants, warehousing and other enterprises which can take advantage of the low residential density and in-place infrastructure (roads, railroads, power lines, deep wells, etc.).

The five-county area will certainly experience population growth pressures and a demand for residential, commercial and recreational land. Proper planning to discourage urban sprawl will necessitate putting mined and reclaimed land into agricultural and recreational uses near the cities. The phosphate industry is in a unique position to contribute to the orderly and environmentally sound development of the five-county area.

1. INTRODUCTION

1.1 BACKGROUND

This is the final report on a program to study the regional land use planning and the reclamation of mined lands conducted by the Phosphate Industry. The study was carried out for the Florida Institute of Phosphate Research under contracts 88-04-041, 88-04-041S, and 88-04-041T by the Central Florida Regional Planning Council.

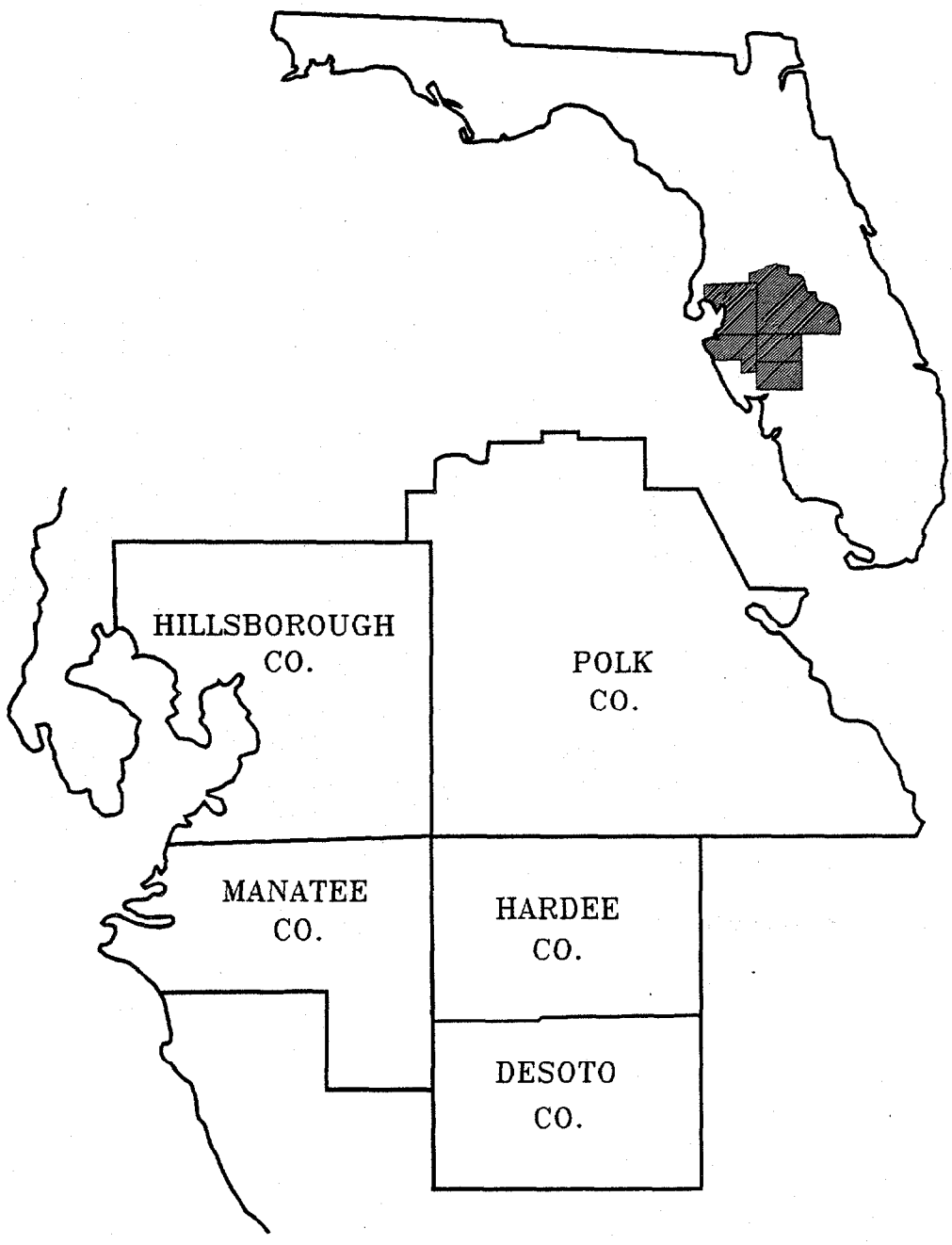
Florida is and will continue to be a rapidly growing state. The need for growth management was recognized by the State Legislature when they passed "The State and Regional Planning Act of 1984". The State Plan and all Regional Comprehensive Policy Plans have been completed and adopted. The local government (counties and cities) growth management and land use plans are due to be completed by late 1990.

The study area for this program includes portions of five counties (Figure 1). This area has experienced the same growth and land use pressures as other portions of the state. However, this area's growth and diverse land use have been somewhat slowed because of large tract ownership by the phosphate industry. Most of this industry owned land will not become available for other land uses until they have mined and reclaimed the land. The availability of the majority of these lands will occur in the early part of the 21st Century.

1.2 OBJECTIVE

In August, 1985, the Florida Institute of Phosphate Research issued a report that analyzed a list of 29 research topics that were considered to be deserving of financial support. This report was entitled "Analysis of Research Priorities".

This report was updated in January, 1987. Within the Resource Research Priorities section of this report, four priorities were listed. Portions of two of these priorities, Geographical Data Base and Land Use Planning are considered in this funded study. It is the objective of this study to prepare a final document that will provide a much needed response to these two research priorities.



GENERAL LOCATION OF STUDY AREA

FIGURE 1

1.3 STUDY AREA

The program study area includes the central and southern portions of the Florida phosphate resource districts. These districts are encircled by an approximate mineable limits line that defines the study area as shown in Figure 2. The study area includes portions of five counties--Polk, Hillsborough, Manatee, Hardee, and DeSoto. The Occidental Chemical Corporation's North Florida mining and chemical operations are not included in the study.

The study area contains about 1,265,000 acres, of which 466,440 acres are owned by the phosphate or related industries. The data displayed in the tables, charts, and maps throughout this report that describe the study area was current as of mid-1989.

1.4 LAND USE AND COVER CLASSIFICATION SYSTEM

The land use and land cover classification system used in this report is the Florida Land Use and Cover Classification System, commonly known as FLUCCS. Using this system, it is possible to differentiate and display a wide range of land uses; from urban to agricultural, from natural to those with a great amount of influence by man.

The FLUCCS system is a modification of the system devised by the U.S. Geological Survey for its 1:250,000 scale land use map series. Some categories of use which do not exist in Florida were dropped entirely, while others were redefined or added in order to more fully reflect conditions in the State.

Both systems use a three-level hierarchy to define land use classification; each level given adds to the description of the land use at that location. For example, a FLUCCS code of "1", "10", or "100" would indicate "Urban or Built-up" land, a very generalized definition. FLUCCS code "11" or "110" narrows that land- use to "Residential" and a FLUCCS code of "111" pinpoints the area as "Single Unit, Low Density (less than 2 dwelling units per acre)." Considering the size of the study area and the scale of the maps provided, all land use categories displayed will be either Level I or Level II.

The choice of using the FLUCCS system in this report was based on three factors. First, the Department of Natural Resources mandates that all reclamation plans received from phosphate mining companies include maps showing post-reclamation land use using the FLUCCS system. Secondly, the U.S. Geological Survey has produced a series of land use maps

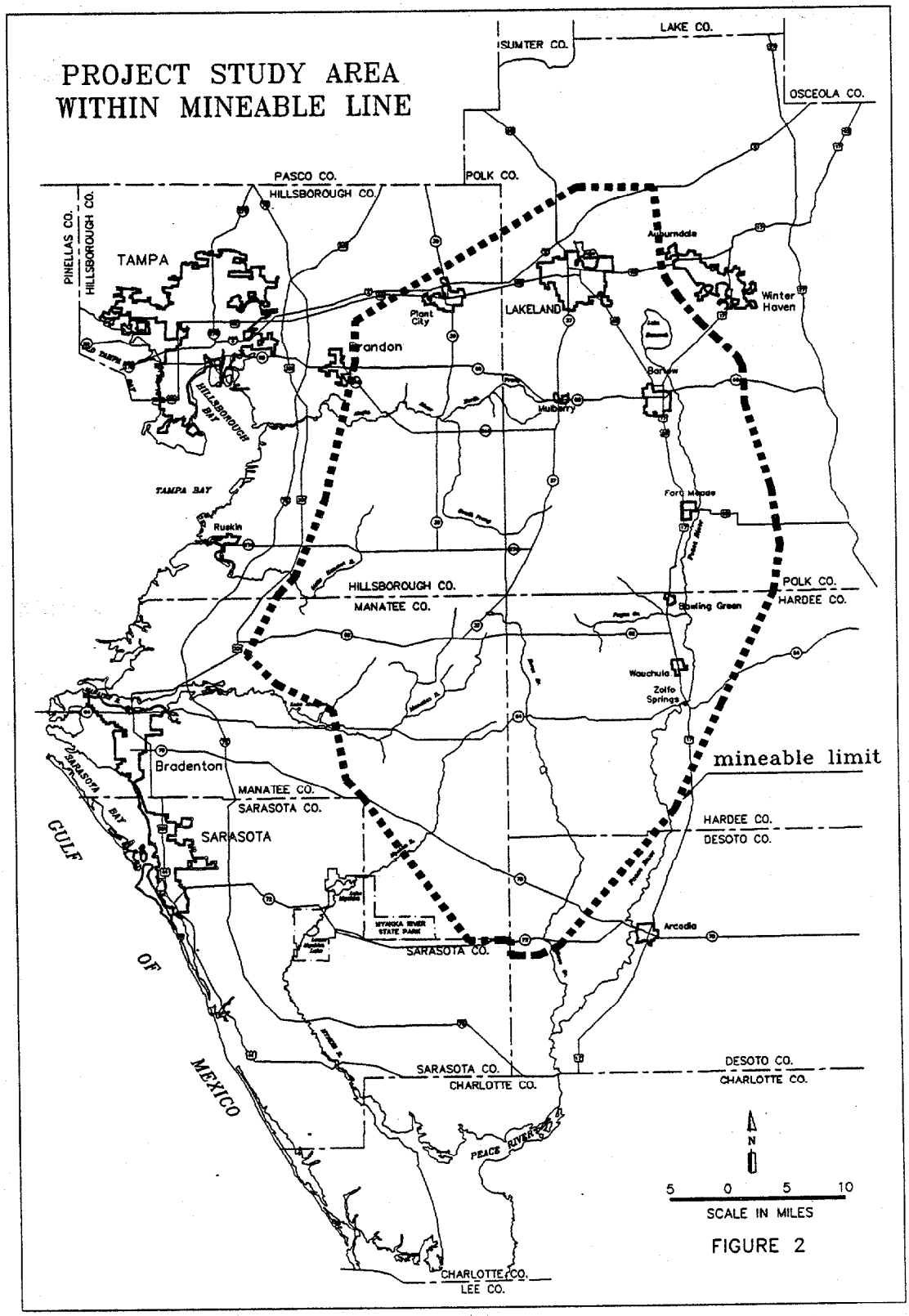

PROJECT STUDY AREA
WITHIN MINEABLE LINE
LAKE CO.
SUMTER CO.
OSCEOLA CO.
PASCO CO.
POLK CO.
HILLSBOROUGH CO.
PINELLAS CO.
HILLSBOROUGH CO.
TAMPA
LAKELAND
Auburndale
Winter Haven
Plant City
Brandon
Bartow
Mulberry
TAMPA BAY
HILLSBOROUGH BAY
Ruskin
Fort Meade
HILLSBOROUGH CO.
MANATEE CO.
POLK CO.
HARDEE CO.
Bowling Green
Wauchula
Zolfo Springs
mineable limit
Bradenton
MANATEE CO.
SARASOTA CO.
SARASOTA
HARDEE CO.
DESOTO CO.
GULF OF MEXICO
MYAKKA RIVER STATE PARK
Arcadia
SARASOTA CO.
DESOTO CO.
SARASOTA CO.
CHARLOTTE CO.
CHARLOTTE CO.
PEACE RIVER
CHARLOTTE CO.
LEE CO.
N
5 0 5 10
SCALE IN MILES

FIGURE 2

for Florida using the "parent" system. Since these two sources provided the basis for both the current and projected land use of the phosphate region, the FLUCCS system was chosen for this study. Thirdly, it is believed that the primary users of this study (the phosphate industry, state agencies, and local planning agencies) would already be familiar with the FLUCCS system. Their use and evaluation of the study and possible incorporation of it into plans of their own would therefore be considerably eased.

While the FLUCCS system uses numbers to indicate different land use/cover categories, it is believed that the scale and complexity of the maps provided demand a simpler system in order to avoid producing a mass of unrecognizable lines and numbers. Colors and cross-hatching have been used in an effort to bring out patterns of land use and make individual areas easier to identify. The following table links the FLUCCS number and description with the appropriate color and cross-hatching used (where necessary) for each category selected for display on the maps. While the choice of color was limited by the method of reproduction, an effort was made to stay as close as possible to the color scheme used on USGS topographic maps. Again, this was done in order to make the maps more easily understood by the reader.

The FLUCCS numbers used in this report are from the 1976 edition of the system, even though a revised edition was published in 1985. The 1976 system was chosen because it has been used throughout the industry as its adoption closely coincided with the mandatory reclamation laws of 1975.

TABLE 1

LAND USE/COVER SYMBOLISM SCHEME

FLUCCS NO.	DESCRIPTION	COLOR	CROSS-HATCH
100	Urban	Red	n/a
130	Industrial (phosphate)	Red	XXXX
200	Agriculture	Yellow	n/a
210	Crop and Pasture	Yellow	/////
230	Citrus Groves	Yellow	Dots
300	Rangeland	Violet	n/a
400	Forested Uplands	Green	n/a
410	Coniferous	Green	/////
420	Hardwood	Green	\\\\\
430	Mixed	Green	XXXX
500	Water	Blue	n/a
600	Wetlands	Magenta	n/a
610/620/630	Swamp	Magenta	/////
640	Marsh	Magenta	\\\\\
700	Barren Land	White	n/a
740	Active Mines	White	n/a
750	Pre-1975 Mining	White	XXXX

The use of color is consistent with Level I classification, while cross-hatching is used to differentiate Level II categories within it. A complete graphic display of the system used can be found in the legend of each land use and cover map.

1.5 LEGISLATION AFFECTING LAND USE AND RECLAMATION

In most cases, several factors are at work in determining the use of a particular plot of land. These factors can be grouped into three primary categories: natural, economic, and political.

Natural factors are those characteristics of the land that exist before any modification by man has occurred, as well as those which remain after man's influence is felt. They include slope and drainage, soil, vegetation, wildlife, climate, and other natural resources such as minerals and ground water. Natural factors play their largest role in rural areas, influencing the location of farms, forests, and mining.

Economic factors often determine how the natural resources of the land are used, if at all. The current price of phosphate rock on the world market coupled with the richness of the deposit in a particular area can decide the question of whether or not that area is to be mined. Economic factors also play a large role in determining the characteristics of the land after it has been mined and reclaimed. Two questions are often asked when determining the landform and land cover a mined area will have when reclamation is complete: a) what function would best be served in this area, and b) how much will it cost to bring the area to a point where it can perform that function? The restoration of wildlife habitats and the restoration of the land's ability to be economically productive are two of the goals of the reclamation planner, and they are often conflicting goals.

The price of reclamation to various land use types cannot be overlooked when the final decision is made. For instance, the restoration of an upland pasture or forest is much more economical than that of a marsh or swamp. The phosphate industry, as are all industries, is in business to make money. While it recognized a responsibility to the public, with only natural and economic factors at work, much of the land mined before 1975 in central Florida was left unreclaimed.

Political factors have played a large role in determining what areas can be mined and how they should be reclaimed. They take the form of local or county ordinances, regional evaluations of the impact of the proposed development, and state reclamation standards. These are an attempt to ensure the wise development of the area while protecting vital resources. The availability of clean water, the sufficiency of wildlife habitats, and the tranquility of residential neighborhoods are good examples of the resources these regulations are meant to protect.

For the Central Florida phosphate region, 1975 proved to be a watershed year for land use planning, as two pieces of legislation came into effect. First, reclamation became mandatory for land mined after July 1, 1975, and a program was established to encourage the reclamation of lands mined before that date as well. Second, recognizing the necessity to control the phenomenal growth the state was experiencing, the "Local Government Comprehensive Planning Act of 1975" was passed.

This act required counties and incorporated cities to develop comprehensive plans for their areas. Several topics or "elements" were to be addressed in each plan, but those most applicable to the phosphate industry concerned future land use, groundwater recharge, air quality, and water quality.

When completed, the plans were to be submitted to the state for "review and comment." However, there was no stipulation in the law requiring the local governments to revise the plan according to the review. This weakness resulted in a jumble of local plans with no overall goal or direction.

In reaction to that and other weaknesses, the state legislature passed into law what is known informally as the "Growth Management Act of 1985." The law amended the 1975 act, shoring up the weaknesses, making the list of required elements more specific and intensive, and requiring the local plans to agree in principle with the plans produced by the applicable regional planning council and the state of Florida. The State Comprehensive Plan became effective in July, 1985. The eleven regional planning councils in Florida were required to produce a plan for their respective region, due July 1, 1987. The regional plans had to be consistent with the overall state plan, and contain elements more directly associated with the phosphate industry, i.e., mining, water resources, hazardous and nonhazardous materials and waste, and the economy. Likewise, the county and local plans (due from July 1, 1988 to November 1, 1990) must have consistency with the regional plan.

While the state and regional plans for the areas covered by the Central Florida phosphate field are complete and approved, the county and local plans are at various stages of development with differing deadlines. Table 2 details the current status of each of these plans.

Of more direct impact to the phosphate industry were the reclamation standards adopted in 1975. As stated earlier, lands mined before July 1, 1975 were not required to be reclaimed. A reimbursement program, funded by phosphate

severance taxes, is in effect to encourage the reclamation of what are known as "old lands". Before the program, some lands were reclaimed by time and "mother nature", and some (about 25,000 ac.) were reclaimed voluntarily by the industry, often as a result of agreements largely driven by economical considerations between the mining companies and nearby municipalities. But the fact remained that the cost of reclaiming mined land is very high, and about 63,000 acres remained disturbed, with little chance for voluntary reclamation.

In order to preserve the integrity of the Florida landscape and protect the remaining natural resources of the region, all lands mined after July 1, 1975 were to be fully reclaimed. Strict reclamation guidelines and standards were adopted, with the Department of Natural Resources and the Department of Environmental Regulation as the main reviewing bodies. The regulations detail the land use and reclamation planning procedures, and put forth several key points:

1. Water quality and flood and erosion control will be ensured by the use of proper slope and vegetation, plus the use of berms or greenbelts to slow down the flow of water to major collectors during storms.

2. Wetlands are to be restored "acre-for-acre, type-for-type", in an effort to provide wildlife habitats and further flood control.

3. The planting of trees is encouraged in upland areas to form "wildlife corridors" for the protection of animals and to prevent topsoil erosion.

4. Wetland fringes around lakes are required for aquatic feeding and breeding, water quality benefits, and shoreline stabilization.

Each mine is required to have a general conceptual reclamation plan. Sections of the mine, or "programs", are required to have individualized plans that are more specific than the conceptual plan, but must agree with it. In this way, the relationship of a program plan to a conceptual plan is similar to that of a county comprehensive plan to the regional or state plan. The program reclamation plans are submitted to the applicable local government agencies as well as to the state. The DNR invites questions and comments from the local agencies when considering the program application for approval. It is the responsibility of the local agencies to see that the reclamation plan is in agreement with their own comprehensive plan. Therefore, the comprehensive plans of

the regions and counties of the Central Florida phosphate field play a part in the future land use of all active mines.

TABLE 2

CURRENT PROGRESS OF COMPREHENSIVE PLANS WITHIN THE CENTRAL FLORIDA PHOSPHATE REGION

PLAN	AGENCY	STATUS	ADOPTED/DUE
State of Florida	Department of Community Affairs (DCA)	Adopted	1985
Central Florida	Central Florida Regional Planning Council	Adopted	1987
Tampa Bay	Tampa Bay Regional Planning Council	Adopted	1987
DeSoto County	Central Florida Regional Planning Council	In draft stage	8/1/90
Hardee County	Central Florida Regional Planning Council	In draft stage	9/1/90
Bowling Green	Central Florida Regional Planning Council	In draft stage	9/1/90
Wauchula	Central Florida Regional Planning Council	In draft stage	9/1/90
Zolfo Springs	Central Florida Regional Planning Council	In draft stage	9/1/90
Hillsborough County	Hillsborough County City-County Planning Commission	Adopted	1989

TABLE 2 (Continued)

CURRENT PROGRESS OF COMPREHENSIVE PLANS WITHIN THE CENTRAL FLORIDA PHOSPHATE REGION

PLAN	A G E N C Y	STATUS	ADOPTED/DUE
Plant City	Hillsborough County City-County Planning Commission	Adopted	1989
Manatee County	Manatee County Planning and Development Department	Adopted	1989
Polk County	Polk County Planning Dept.	In draft stage	9/1/90
Bartow	Central Florida Regional Planning Council	In draft stage	11/1/90
Fort Meade	Central Florida Regional Planning Council	In draft stage	10/1/90
Lakeland	Lakeland Planning Department	In draft stage	11/1/90
Mulberry	Central Florida Regional Planning Council	In draft stage	11/1/90

2. PHOSPHATE INDUSTRY - CHEMICAL FERTILIZER PLANTS

2.1 BACKGROUND

The acidulation of insoluble phosphate rock with sulfuric acid to yield a soluble phosphate fertilizer, normal superphosphate, was first done commercially in England in 1842. Many of these early factories were primitive; with the rock and acid mixed in vats by manual labor. It was not until around 1862 that a process using a continuous mixer was developed.

The production of triple superphosphate, a more concentrated phosphate fertilizer material, on a commercial scale, was started around 1870 in Germany. Lowgrade Bone Phosphate of Lime (BPL) phosphate rock, with a high iron and aluminum content, was acidulated with concentrated phosphoric acid to produce triple superphosphate. Unlike the ordinary normal superphosphate, the triple superphosphate had a higher phosphate content than the phosphate rock from which it was made.

It was not until early 1950 that triple superphosphate became an important fertilizer material. The Florida chemical fertilizer industry shifted from the small normal superphosphate plant production to the large chemical complex production of triple superphosphate at this time. Through the years, the chemical fertilizer industry has expanded its production capacity, variety of products and plant locations. There are now eleven operating chemical fertilizer plants and one plant that produces only animal food supplement located in the Central Florida region producing over 12 million tons per year of major finished products.

2.2 LAND USE/LOCATION

In the production of wet-process phosphoric acid, about five tons (dry basis) of byproduct phosphogypsum (calcium sulfate) is produced per ton of P_2O_5 recovered as phosphoric acid. The disposal and storage of this byproduct, along with the acidic water used for transport, requires relatively large areas. The gypsum is stacked and managed in place, while the transport water reports to a cooling pond area and is recycled back to the plant for various process uses.

There are eleven chemical plants that have active gypsum storage piles and four locations with inactive storage piles.

Of the eleven active plants, eight are located in Polk County, two in Hillsborough County and one in Manatee County. These active plants have a total land ownership of 19,034 acres of which 4,872 acres are in gypsum storage. The four inactive gypsum storage areas have a total land ownership of 2,568 acres with 593 acres of stored gypsum. The animal feed supplement defluorination plant has no gypsum storage, but does have 1,077 acres of land. There is presently over 600 million tons of gypsum stored, and about 34 million tons of additional gypsum produced per year. About 1,964 acres of additional gypsum storage are currently planned for use in the future. The plant locations are shown in Figure 3.

2.3 COMPANIES

There are nine different companies that operate eleven chemical fertilizer plants. One company operates a plant producing only an animal feed supplement that uses a high temperature defluorination of phosphate rock process. Various company data are given in Table 3.

2.4 FUTURE/PROJECTIONS

Most of the eleven active chemical fertilizer plants are located near the active mining operations to reduce transportation costs and have an assured supply of phosphate rock. There are four companies with four chemical plants and one phosphate rock defluorination plant that do not have mining operations, and must purchase phosphate rock from other sources. One of these companies has completed the DRI-EIS process and received local approval, but has not reached the active mining stage. By the year 2010, the majority of mining of phosphate rock in Polk and Hillsborough will have been completed. The mining operations will move into Hardee, DeSoto, and Manatee Counties. Due to public concern, economic considerations and regulatory permitting requirements, the established chemical plants will remain at their present locations, while some companies may seek to establish new chemical plant locations. By the year 2010, most of these plants will still be in operation, but several may close down due to age, location, regulatory or rock supply problems. The companies that cease operation of these plants may be faced with a costly, complex closure plan for their gypsum stacks and cooling water ponds. The potential future development of large tonnage usages of the stockpiled gypsum would help reduce the closure plan problems and costs.

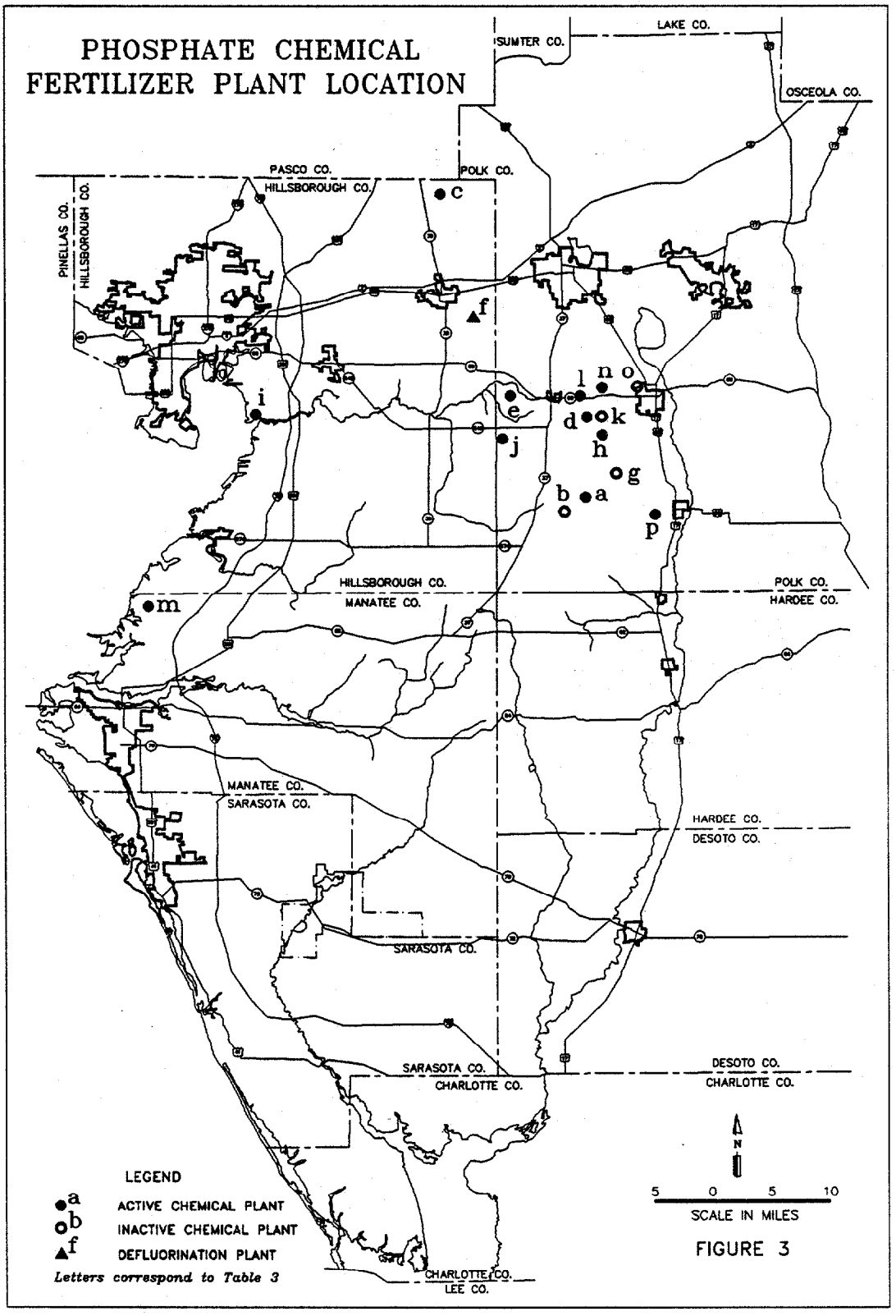

PHOSPHATE CHEMICAL
FERTILIZER PLANT LOCATION
LAKE CO.
SUMTER CO.
OSCEOLA CO.
PASCO CO.
HILLSBOROUGH CO.
POLK CO.
PINELLAS CO.
HILLSBOROUGH CO.
HILLSBOROUGH CO.
MANATEE CO.
POLK CO.
HARDEE CO.
MANATEE CO.
SARASOTA CO.
HARDEE CO.
DESOTO CO.
SARASOTA CO.
SARASOTA CO.
CHARLOTTE CO.
DESOTO CO.
CHARLOTTE CO.
CHARLOTTE CO.
LEE CO.
LEGEND
a ACTIVE CHEMICAL PLANT
b INACTIVE CHEMICAL PLANT
f DEFLUORINATION PLANT
Letters correspond to Table 3
N
5 0 5 10
SCALE IN MILES
FIGURE 3

TABLE 3
PHOSPHATE INDUSTRY
CHEMICAL PLANTS

COMPANY	STATUS[1]	ACRES			AVERAGE ANNUAL TONS OF GYPSUM TO STORAGE
		TOTAL OWNERSHIP	STORED GYPSUM	FUTURE GYPSUM EXPANSION (CURRENTLY PLANNED)	
AGRICO CHEM. CO.					
South Pierce Chemical Works (a)[2]	A	2254	347	100	2,000,000
AMERICAN CYANAMID					
Brewster (b)	I	600	120	0	0
CF INDUSTRIES, INC.					
Plant City (c) Complex	A	1525	435	480	4,500,000
CF INDUSTRIES, INC.					
Bartow Complex (d)	A	2720	415	0	3,000,000
CONSERV					
Nichols (e)	A	815	155	140	1,100,000
CONSOLIDATED MINERALS, INC.					
Plant City (f)[3]	A	1077	0	0	0
ESTECH, INC. (g)	I	165	165	0	0
FARMLAND INDUSTRIES, INC.					
Green Bay (h)	A	2450	300	84	3,000,000

TABLE 3 (Continued)
PHOSPHATE INDUSTRY
CHEMICAL PLANTS

COMPANY	STATUS	ACRES			AVERAGE ANNUAL TONS OF GYPSUM TO STORAGE
		TOTAL OWNERSHIP	STORED GYPSUM	FUTURE GYPSUM EXPANSION (CURRENTLY PLANNED)	
GARDINIER, INC.					
East Tampa (i)	A	1054	341	326	4,000,000
IMC FERTILIZER, INC					
New Wales (j)	A	1730	432	644	7,700,000
(Bonnie) (P-21)(k)	I	145	145	0	0
ROYSTER CO.					
Mulberry (l)	A	1300	150	100	1,400,000
Piney Point (m)	A	660	300	0	2,000,000
SEMINOLE FERTILIZER CORP.					
Bartow (n)	A	1484	1204	0	3,000,000
US AGRI-CHEMICALS					
Bartow (o)	I	480	163	0	0
Ft. Meade (p)	A	575	200	0	2,500,000
TOTAL		19,034	4,872	1,964	34,200,000

1. A - Active
   I - Inactive
2. Letters Correspond to Figure 3.
3. Defluorination (Animal Feed Supplement)

3. PHOSPHATE INDUSTRY - MINING

3.1 BACKGROUND

Within the study area, the mining of phosphate began around 1888. Pebble rock was mined in and along the Peace River by large floating barges. The pebble phosphate was recovered by screening, and the reject material was returned to the river. By 1908, river pebble production was replaced with landward mining production using new technology. The overburden was removed with steam shovels or hydraulic guns. This type mining left pits that were filled with screen reject material, with some of the material piled in mounds above ground.

The industry continued to develop new technology that resulted in increased land disturbances, production and recovery of phosphate material that once was discarded as reject material. The small steam shovel was replaced with large electrically driven draglines that provided the operator with greater digging capacity and the mining of deeper deposits, In 1928, the selective flotation process was introduced and was widely used by 1950. This process completely changed the industry, and provided for product quality and quantity recovery of the fine-grain phosphate from the mined ore. This process also created the need for clay storage pond areas, and disposal of sand tailings.

The history of the Florida phosphate industry is one that has progressed from small acreage disturbance and production operations to present day operations that have the capability to mine about 6000 acres per year and produce about 40 million metric tons of phosphate rock.

3.2 CURRENT STATUS

Within the five county study area, the phosphate industry owns about 466,440 total acres. Of this total, 241,149 acres are in active mining areas and 19,034 are in chemical complex areas. Industry and DNR data indicates that a total of 218,229 acres have beenmined, with 149,130 acres mined before July 1, 1975 and 69,099 acres mined since 1975 (Figure 4 - Appendix).

There are presently ten companies that operate nineteen phosphate mining operations within the study area. The companies and associated mining operations are shown in Table

4 and Figure 5. Projected active mining operations for 2000 and 2010 are shown in Figures 6 and 7, respectively.

Mining is conducted on various surface land forms that range from uplands to wetlands classifications. The reclamation success. of these various land cover classifications has advanced over the years through experience gained, upgraded design considerations, and many research programs. Successful reclamation has been demonstrated for several land cover systems, but some wetland systems such as hardwood swamps may require additional time to prove that success has been achieved. There are several of these type projects that are considered to be in the final years of demonstration success.

Lands that are not scheduled for active mining in the near future and reclaimed lands are usually leased to outside interests for various business ventures. Some of these leases are for cattle grazing, beekeeping, and commercial or private fishing rights.

3.3 DRI-EIS AREAS

The Development of Regional Impact (DRI) program was mandated by Florida's 1972 Environmental Land and Water Management Act, codified in Chapter 380, Florida Statutes. The program creates a process for comprehensive assessment and decision making on developments that substantially affect the citizens of more than one county.

The Environmental Impact Statement (EIS) is the Federal counterpart of the State DRI. If the proposed action is declared a new source as defined in Section 306 of the Federal Clean Water Act, compliance with the National Environmental Policy Act (NEPA) by the determined lead agency is required.

There are two companies, Farmland Industries and Mississippi Chemical Company, that have completed the DRI/EIS process but have not started mining operations. Four companies are in the process of upgrading and amending their original approved DRI/EIS or preparing original submissions for new acreage approval. There are approximately eight areas, mostly in the southern portion of the study area, that will require original DRI/EIS review and approval before mining could commence.

3.4 RECLAMATION

Throughout the years that mining of phosphate rock has been conducted in the survey area, the industry has progressed from a no reclamation attitude to the present day accelerated reclamation schedules. The turning point for required

reclamation was the passage of mandatory reclamation regulations by the Florida Legislature, effective July 1, 1975. Prior to this date, lands that had been mined were not required to be reclaimed. However, some companies did conduct voluntary reclamation on some of their mined properties.

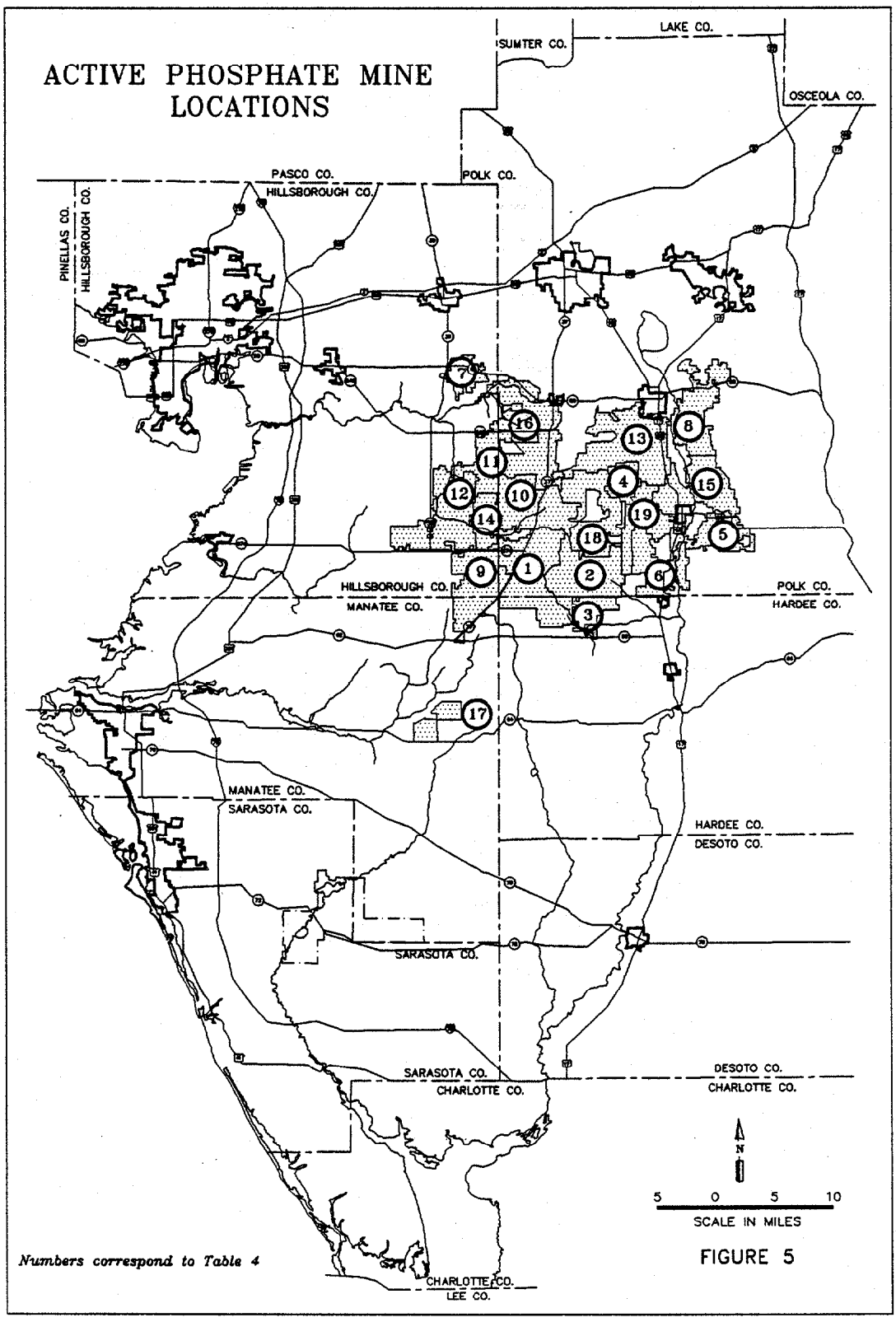
TABLE 4
PHOSPHATE INDUSTRY - MINING
January 1, 1989
OPERATING MINES

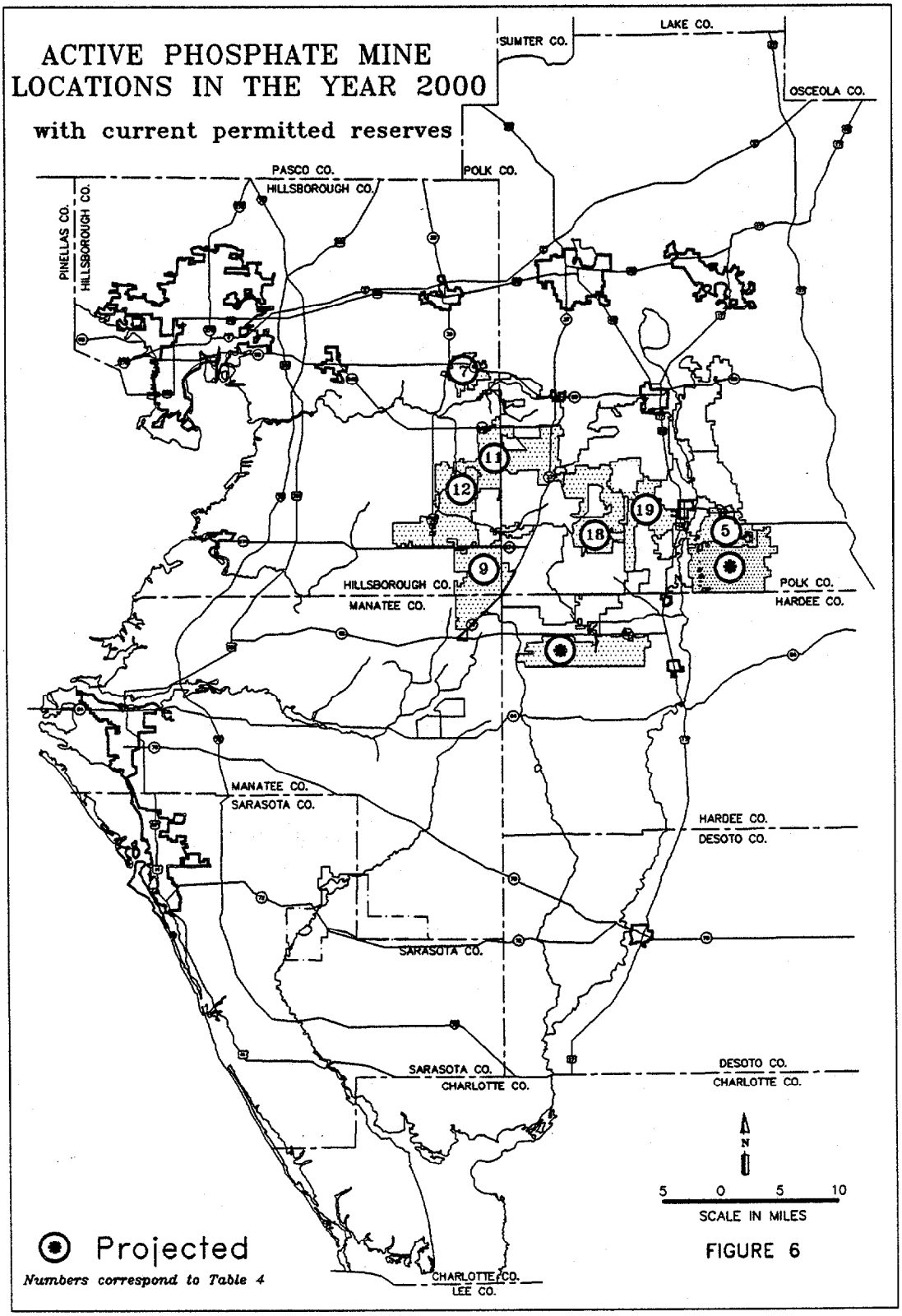
COMPANY	TOTAL ACRES OWNED	ACRES MINED	ACRES RECLAIMED	ACRES NON-MINE	ACRES CLAY PONDS	ACRES FUTURE CLAY PONDS	MINE ACRES/YEAR	CURRENT PERMITTED RESERVES YEAR MINEOUT
Agrico Chemical Co.								
Fort Green(1)*	20,830	8,984	3,595	466	4,586	2,504	800	1995
Payne Creek(2)	14,828	7,922	9,130	308	8,882	850	500	1991
CF Industries,Inc.								
Hardee I(3)	4,559	1,177	247	0	570**	1,483**	119	1998
Estech, Inc.								
Silver City(4)	4,451	3,459	389	0	2,180	80	220	1991
Watson(5)	8,100	5,758	1,474	1,620	3,389	0	210	1989
Gardinier, Inc.								
Fort Meade(6)	16,197	5,685	1,119	100	2,971	--	400	2004
Hopewell Land Corp.* **								
Hopewell(7)	6,500	150	0	4,000	400	1,500	100	2008
IMC Fertilizer, Inc.								
Clear Springs(8)	13,488	6,704	3,792	2,137	1,800	1,530	272	1996
Four Corners(9)	18,685	731	304	6,918	515	3,305	731	2015
Haynsworth(10)****	14,122	10,341	750	627	3,206	985	349	1995
Kingsford(11)	17,351	9,670	3,199	1,554	3,995	2,020	409	2003
Lonesome(12)****	17,980	5,624	1,403	4,706	1,284	400	349	2013
Noralyn/Phosphoria(13)	21,524	17,492	4,858	492	8,488	0	393	1995

TABLE 4 (continued)
PHOSPHATE INDUSTRY - MINING
January 1, 1989
OPERATING MINES

COMPANY	TOTAL ACRES OWNED	ACRES					MINE ACRES/YEAR	CURRENT PERMITTED RESERVES YEAR MINEOUT
		MINED	RECLAIMED	NON-MINE	CLAY PONDS	FUTURE CLAY PONDS		
Mobil Mining and Minerals Co.								
Big Four(14)	6,000	2,335	364	1,177	1,163	533	200	1995
Fort Meade(15)	15,322	11,593	3,288	1,306	6,312	230	400	1990
Nichols(16)	10,663	4,268	252	2,450	2,192	1,159	200	1998
Nu-Gulf Ind								
Wingate Creek(17)	4,302	659	0	0	241	0	100	1998
Seminole Fertilizer Corp.								
Hookers Prairie(18)	14,187	8,057	1,380	260	1,777	1,970	256	2010
US Agri-Chemicals								
Rockland(19)	12,060	5,000	399	3,540	3,195	1,200	300	2000
TOTAL	**241,149**	**115,609**	**35,943**	**31,661**	**57,146**	**19,749**	-	-

*Number corresponds with Figures 5, 6, and 7.
**Sand Clay Mix
***Purchased by IMC 10/89
****IMC Leases 28,482 Acres from American Cyanamid Company, and 3,620 acres from Kerr-McGee.


ACTIVE PHOSPHATE MINE LOCATIONS
LAKE CO.
SUMTER CO.
OSCEOLA CO.
PASCO CO.
HILLSBOROUGH CO.
POLK CO.
PINELLAS CO.
HILLSBOROUGH CO.
HILLSBOROUGH CO.
MANATEE CO.
POLK CO.
HARDEE CO.
MANATEE CO.
SARASOTA CO.
HARDEE CO.
DESOTO CO.
SARASOTA CO.
SARASOTA CO.
CHARLOTTE CO.
DESOTO CO.
CHARLOTTE CO.
CHARLOTTE CO.
LEE CO.
N
5 0 5 10
SCALE IN MILES
Numbers correspond to Table 4
FIGURE 5


ACTIVE PHOSPHATE MINE LOCATIONS IN THE YEAR 2000
with current permitted reserves
SUMTER CO.
LAKE CO.
OSCEOLA CO.
POLK CO.
PASCO CO.
HILLSBOROUGH CO.
PINELLAS CO.
HILLSBOROUGH CO.
7
11
12
19
18
5
9
HILLSBOROUGH CO.
MANATEE CO.
POLK CO.
HARDEE CO.
MANATEE CO.
SARASOTA CO.
HARDEE CO.
DESOTO CO.
SARASOTA CO.
SARASOTA CO.
CHARLOTTE CO.
DESOTO CO.
CHARLOTTE CO.
CHARLOTTE CO.
LEE CO.
N
5 0 5 10
SCALE IN MILES
Projected
Numbers correspond to Table 4
FIGURE 6

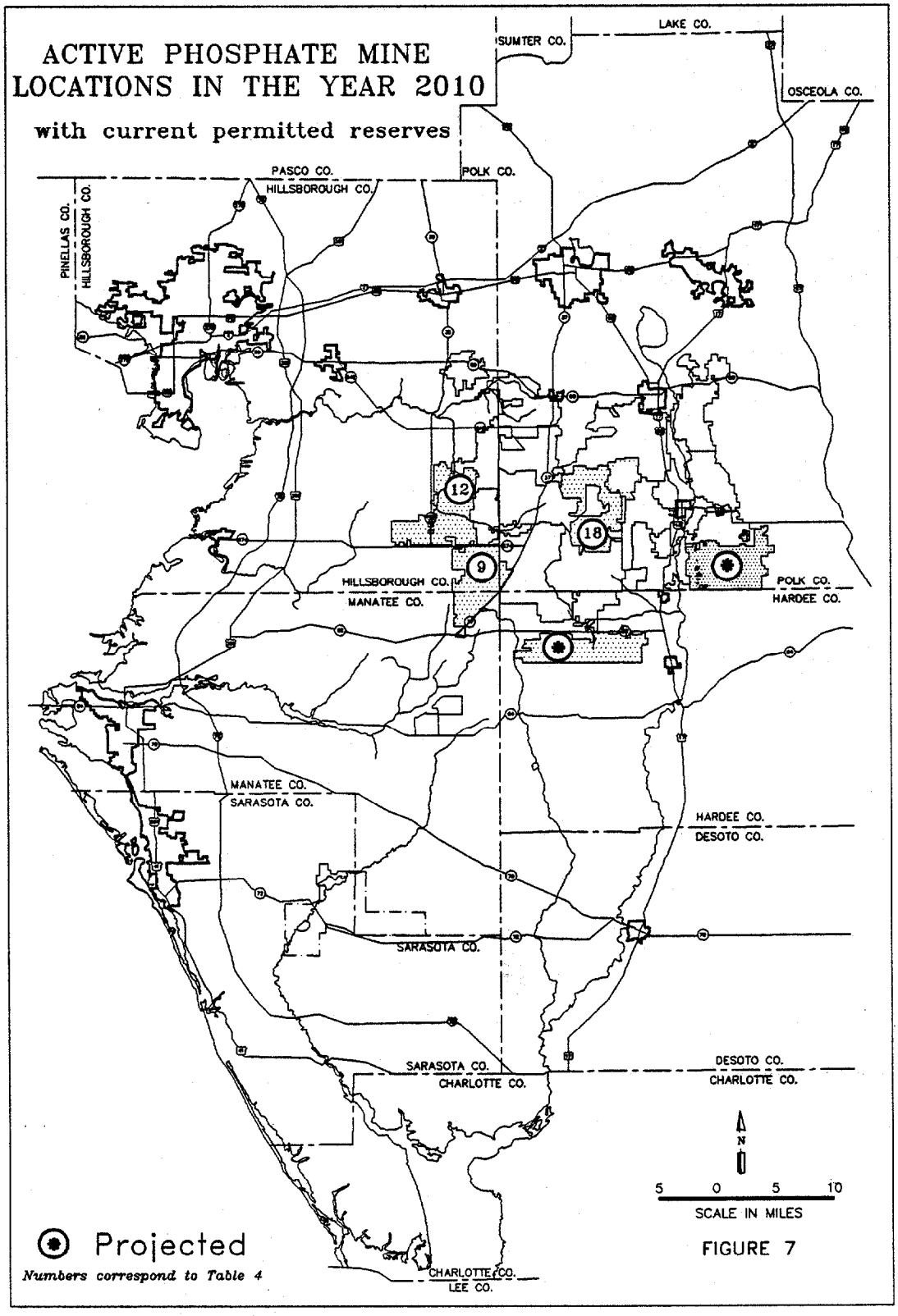

ACTIVE PHOSPHATE MINE LOCATIONS IN THE YEAR 2010
with current permitted reserves
SUMTER CO.
LAKE CO.
OSCEOLA CO.
PASCO CO.
HILLSBOROUGH CO.
POLK CO.
PINELLAS CO.
HILLSBOROUGH CO.
12
18
9
HILLSBOROUGH CO.
MANATEE CO.
POLK CO.
HARDEE CO.
MANATEE CO.
SARASOTA CO.
HARDEE CO.
DESOTO CO.
SARASOTA CO.
SARASOTA CO.
CHARLOTTE CO.
DESOTO CO.
CHARLOTTE CO.
N
5 0 5 10
SCALE IN MILES
Projected
Numbers correspond to Table 4
CHARLOTTE CO.
LEE CO.
FIGURE 7

TABLE 5
PHOSPHATE INDUSTRY - MINING
January 1, 1989
CURRENT LANDOWNERSHIP
NON-OPERATIONAL

COMPANY	TOTAL ACRES OWNED	ACRES				
		MINED	RECLAIMED	NON-MINE	CLAY PONDS	FUTURE CLAY PONDS
Agrico Chemical Co. (Hardee, Manatee, Polk)	32,631,	--	--	--	--	--
American Cynamid Co.* (Polk-Hillsborough)	33,835	14,623	5,098	19,212	--	--
CF Industries, Inc.						
Hardee II	14,994	--	--	--	--	9,083**
Consolidated Minerals						
Pine Level (Manatee - DeSoto)	23,600	--	--	2,838	--	1,020
Farmland Ind., Inc. (Hardee)						
Hickory Creek	14,373	--	--	6,513	--	495
IMC Fertilizer, Inc.						
Hillsborough Co.	18,241	--	--	--	--	--
DeSoto Co.	5,520	--	--	--	--	--
Manatee Co.	26,535	--	--	--	--	--
Hardee Co.	10,583	--	--	--	--	--
Mississippi Chemical Co. (Hardee)	12,006	--	--	--	--	--
Kerr-McGee* (Polk)	3,620	--	--	--	--	--

TABLE 5 (continued)
PHOSPHATE INDUSTRY - MINING
January 1, 1989
CURRENT LANDOWNERSHIP
NON-OPERATIONAL

COMPANY	TOTAL ACRES OWNED	ACRES				
		MINED	RECLAIMED	NON-MINE	CLAY PONDS	FUTURE CLAY PONDS
Mobil Mining and Minerals Co.						
Hardee Co.	10,636	--	--	--	--	--
South Ft. Meade	17,621	194	--	1,414	--	11,335
Texaco Co. (Manatee)	4,486	--	--	--	--	--
Williams Co.						
Saddle Creek (Polk)	8,124	5,756	1,959	1,516	3,672	--
Boyette (Hillsborough)	4,885	800	800	4,085	--	--
TOTAL	**241,690**	**21,373**	**7,857**	**35,578**	**3,672**	**21,933**

*American Cyanamid leases 28,482 acres and Kerr-McGee leases 3,620 acres to IMC at Haynsworth and Lonesome mine sites.
**Sand/Clay mix

There are two main waste products generated during the beneficiation of phosphate rock: sand tailings and phosphatic clays. Tailings are often used to backfill mine cuts, with spoil overburden pushed over the tailings to form a stable land form capable of supporting a variety of uses. The clays are retained within large, diked settling areas where consolidation takes place. Clarified clay transport water is decanted by spillway systems and returned for mine operations reuse. Active clay settling areas are managed as flow through or stage fill systems, with the latter system being preferred by industry. In the past, clay pond reclamation was a long term process, usually requiring 10 to 15 years after the last clay placement in the area. Today, the time period for reclamation has been shortened to around three to five years, due to innovative mechanical dewatering of the systems with floatation tractors to dig the drainage ditches.

Another reclamation technology which has been used at several locations is sand/clay mixing. The sand/clay mix process has been successfully demonstrated to be a viable waste disposal/reclamation alternative. The technique allows for the disposal of waste clays and sand while keeping the topography of the area close to premining conditions. Reclamation of sand/clay areas can be accomplished in three to five years following final filling.

The clay pond systems occupy about 20% to 40% of the mined lands area. The seventeen operating mines have about 57,146 acres of active and inactive clay ponds. It is projected that about 19,479 acres will be required for future clay pond systems. With the addition of new permitted mine areas, future clay pond requirements could more than double from the present projected acreage.

Recent industry and DNR data indicates that the phosphate industry has mined 69,099 acres since July 1, 1975 within the study area. They have reclaimed, through contouring, 28,248 acres or about 41% of the land mined during this period. Pre-1975 mining ("old lands") was conducted on 149,130 acres and about 86,624 acres have been reclaimed and released.

To comply with the present mandatory reclamation regulations or dredge and fill permit requirements requires a business cost that can vary widely based on the final land form specified or proposed. The Florida Phosphate Council conducts an annual survey of the industry and provided the following average cost/acre for mandatory reclamation projects for 1988:

Reclamation Land Type	Average Cost/Acre Dollars
Wetlands	4,600
Uplands	3,500
Sand Tailings	4,000
Clay Ponds	2,360

The costs include administration, mechanical moving of mined spoil material to prescribed contour elevations, grass seeding, vegetational and tree planting. They do not include operational costs such as dam building, clay or sand waste disposal as well as program or permit compliance monitoring. About 90-95% of the reclamation cost is for earthmoving to prescribed contour elevations, which is a very energy intensive process. Completed reclamation program or permit compliance monitoring costs per acre vary according to final land form and program acreage, but can add 25 to 50% of the original reclamation cost/acre to the final cost figure.

The reclamation of pre-1975 mined lands is partially funded through the severance tax program administered by the Department of Natural Resources (DNR). As applications for the nonmandatory program are received, they are placed in a priority list and contracts let when approval for funding is made. The current contract reclamation work is funded at the rate of $2,711/acre for clay ponds and sand tailings and $4,342/acre for mined spoil areas. These figures are adjusted each year by the DNR.

3.5 MINING/FUTURE PROJECTION

The removal of phosphate rock by mining has occurred within the study area for over 100 years and will continue well into the next century. Present day mining operations have the capability to mine over 6000 acres per year. This large, temporary land use disturbance will continue for several years before the mineout of some reserve areas is completed (Figure 8).

The tonnage production of phosphate rock has fluctuated over the years, due to various economic factors. The high was reached in 1980 when 43.0 million metric tons were produced while 1986 was the lowest tonnage production in the last fourteen years, 29.7 million metric tons. Production will increase as closed mines are reopened, and peak around the 40 million figure for a few years before starting to decline to about 20 million metric tons by 2010 (Figure 9).

Of the nineteen operating mines, eleven will have mined out their current permitted reserve land ownership by the year 2000. There are presently 119,331 acres of phosphate company

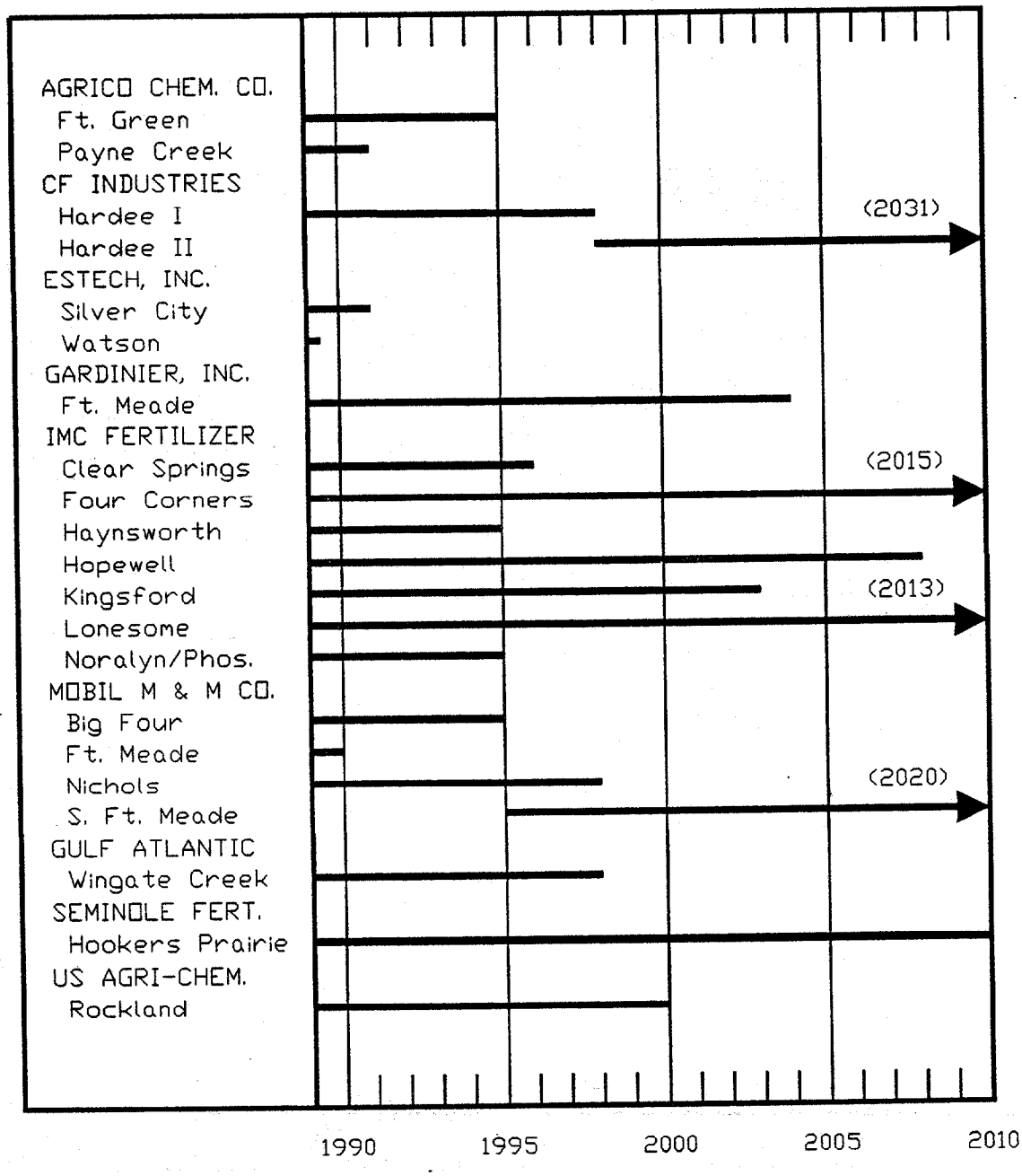


FIGURE 8

PHOSPHATE INDUSTRY MINING OPERATIONS MINEOUT TIMEFRAME

(with current permitted reserves)

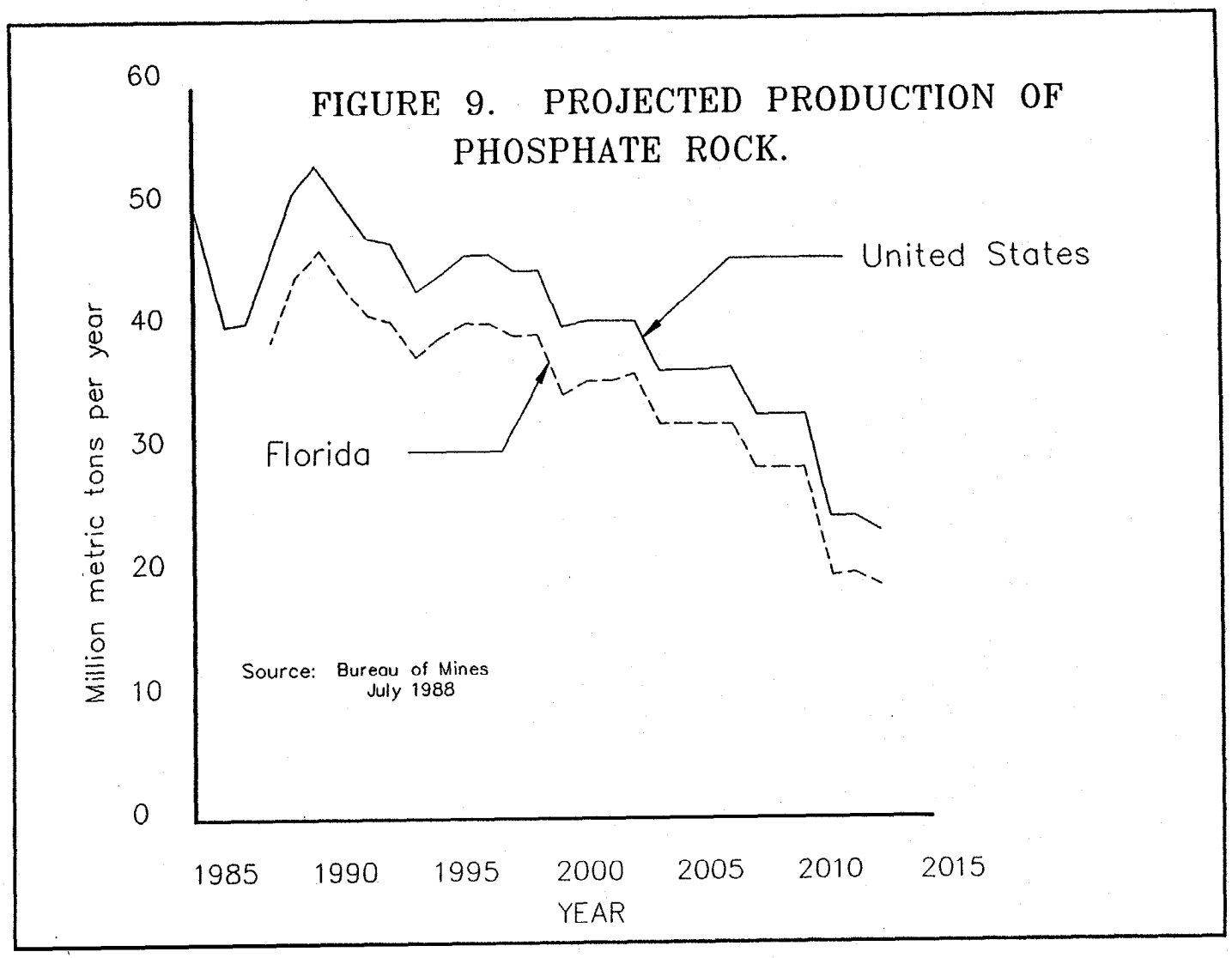


FIGURE 9. PROJECTED PRODUCTION OF PHOSPHATE ROCK.

owned land that have received development approval for mining or for which the companies are in the process of completing Development of Regional Impact documents for final review and approval (Table 6). There are 104,038 acres of company owned land that could, at some future date, be permitted for mining through the DRI process (Table 7). It is projected that from four to six companies will still be mining within the study area well past the year 2010.

There are several private ownership parcels of land, mostly in the southern portion of the study area, that are potential purchase sites for mining companies. For these lands to have phosphate mineral value, the price of phosphate rock would have to increase to $40 to $60 per ton.

TABLE 6

PHOSPHATE INDUSTRY LANDOWNERSHIP

Complete or In Progress
Development of Regional Impact Areas
to be Mined

Company	Location	Total Acres	Years From Start to Mineout
Agrico Chemical Co.	Hardee	11,473	16
CF Industries, Inc. (II)	Hardee	14,994	35
Consolidated Minerals, Inc.	DeSoto Manatee	23,600	24
Farmland Industries, Inc.	Hardee	7,860	20
Gardinier, Inc.	Hardee	5,400	10
IMC Fertilizer, Inc.	Hillsborough	9,163	11
IMC Fertilizer, Inc.	Polk	6,143	7
IMC Fertilizer, Inc.	Polk	4,212	6
Mississippi Chemical Corp.	Hardee	12,006	20
Mobil Mining & Minerals Co.	Polk	17,621	32
Seminole Fertilizer Corp.	Polk	6,859	10
TOTAL		119,331	

TABLE 7

PHOSPHATE INDUSTRY LANDOWNERSHIP

Possible Development of Regional Impact Areas

Company	Location	Acres
Agrico Chemical Co.	Hardee	15,000
	Manatee	2,800
Farmland Industries, Inc.	Hardee	6,513
IMC Fertilizer, Inc.	Hillsborough	18,241
	DeSoto	5,520
	Hardee	10,583
	Manatee	26,535
Mobil Mining & Minerals Co.	Hardee	10,636
Stauffer Chemical Co.	Hardee	3,724
Texaco, Inc.	Manatee	4,486
TOTAL		104,038

TABLE 8
STATEWIDE PRODUCTION DATA
FOR THE
FLORIDA PHOSPHATE INDUSTRY

Year	Employees	P_2O_5 Production Million Short Tons Phosphoric Acid Total at Filter	Phosphate Mined Million Metric Tons	Acres Mined
1970	7563	*	25.6	4202
1971	6662	*	27.6	4400
1972	7869	*	29.0	4100**
1973	8660	*	30.8	4599
1974	9926	*	31.7	4734
1975	11115	*	35.4	5765
1976	10877	*	35.8	5675
1977	11075	*	38.1	5673
1978	11651	*	36.3	6347
1979	12847	*	41.0	6442
1980	14600	4.8	43.0	7125
1981	13975	4.5	42.8	6522
1982	12600	3.4	30.2	4541
1983	11540	4.9	33.4	4862
1984	12500	6.5	37.9	6253
1985	11666	6.1	39.0	6811
1986	9773	5.2	29.7	4989
1987	9398	6.4***	30.0	5131
1988	9797	7.4	34.6	5867
1989	9783	7.0	38.2	5791

*P_2O_5 production not requested prior to 1980
**Projected, not actual.
***Fiscal Year 10/1/86 - 9/30/87

TABLE 9

STATEWIDE DATA FOR THE
FLORIDA PHOSPHATE INDUSTRY

Economic Contributions - Direct and Indirect, 1989

Phosphate Rock Mined	38,200,000	metric tons
Acres Mined	5,791	
Acres Owned or Controlled	524,241	
Finished Chemical Products	17,972,211	short tons
Employment	9,783	
Payroll	over $377	million
Capital Investment	over $10	billion
Taxes (state)	$28,421,234	
(ad valorem)	$29,751,725	
(severance)	$56,384,093	
Equipment and Supplies	$1.30	billion
Services	$260.9	million
Expansion/Construction	$119.0	million

4. PRESENT AND FUTURE LAND USE, BY COUNTY

4.1 PRESENT LAND USE

The present land use and cover for the study area is presented on the map "Land Use and Cover, 1989" (Figure 10, in the appendix). The map was produced by the interpretation of habitat data from Landsat imagery provided by the Florida Game and Fresh Water Fish Commission, the locating of citrus groves through data provided by the U.S. Geological Survey and the Polk Co. Planning Department, and delineating the urban extent of the incorporated areas within the study area.

The study area can be divided into three generalized sections:

1. Urban areas, north of S.R. 60,
2. Mining areas, south of S.R. 60 and north of S.R. 62, and
3. Agricultural areas, south of S.R. 62.

A more detailed description of the present land use and cover of the study area can be accomplished by examining each county individually.

4.1.1 Polk County

The study area within Polk County is both large and diverse. One-third of the entire study area is within the county, as well as most of the surface water, urban areas, and mined lands. Eight of the twelve active chemical plants operated by the phosphate industry are within this area, as well as the vast majority of "old lands" areas mined prior to July 1, 1975. Much of these old lands have been fully reclaimed and thus appear on the present land use map as the current land cover and not as actively mined areas.

Almost half of the land owned by the phosphate industry in central FLorida lies in Polk County, most of which lies south of State Road 60. Except for the urban areas of Bartow, Mulberry, Bradley Junction, and Fort Meade and those areas that are environmentally sensitive, most of the area south of S.R. 60 and west of the Peace River has been mined or is in

active mining. Other areas that have been mined include acreage along S.R. 37 between Lakeland and Mulberry, a strip of land east of the Peace River from Lake Hancock south to Ft. Meade, and an area in northeast Lakeland near I-4 and U.S. 92. Many of the lands have been fully reclaimed, and now support a variety of uses ranging from agricultural to residential.

The northern portion of the study area within Polk County is dominated by the urban center of Lakeland. Some citrus is still grown north of I-4, but it is quickly being displaced by the growth of the urban area. This phenomenon is evident along U.S. 98, which is becoming increasingly developed near the Lakeland Square Mall. The only large areas north of S.R. 540A which are not dedicated to urban or agricultural pursuits are a block of upland forest near S.R. 540 north of Lake Hancock and the Tenoroc/Saddle Creek area between Lakeland and Auburndale. The potential for development of the upland forest area is limited by the floodplain area of Saddle Creek, while the Tenoroc/Saddle Creek area is an "old lands" phosphate zone which supports wildlife and recreational uses, and as such is not likely to be developed.

Just west of Lake Hancock is Highland City, and a large area of citrus. Further west beyond the citrus is the southern extent of the Lakeland urbanized area, centered on S.R. 37. South of the Highland City citrus belt lies the most extensively mined area in Florida. The southwest corner of Polk County is in a constant state of flux, as mining and reclamation activities continually change the land use pattern. As a result, the mines that are now active in this area and in the other counties as well are presented on the land use maps as a single land use, even though they may be partly mined, partly reclaimed, and partly undisturbed. Also, since areas within the mine borders that are reclaimed are often used to some extent by the operator (as access to unreclaimed or unmined areas, as reclamation research, or as agricultural leasing), the current land use for those areas may be ambiguous. Therefore, a single "active mine" classification has been used.

The hydrologic pattern of Polk County differs significantly from that of the other counties in the study area. Many lakes have been formed from sinkholes in the county, the largest of which are Lake Parker and Lake Hancock. Green Swamp in the northern portion of the county acts as a recharge area for the groundwater of the region, which in turn feeds the lakes. Saddle Creek flows south from Lake Hancock, and joins with Peace Creek just north of Bartow to form the Peace River. The floodplain of the river is classified as a forested wetland until it passes through Fort Meade to the south where its classification changes to forested upland. The other main hydrological feature in the area is Hookers

Prairie, which lies just east of S.R. 37 south of Bradley Junction and is the source of the South Prong of the Alafia River.

4.1.2 Hillsborough County

The land use pattern for the portion of Hillsborough County within the study area is very diverse. No single land use is conspicuous by its existence or absence, as all land use categories are represented somewhere in the area and none are dominant.

The northernmost portion of the area is centered on Plant City. Urban land uses stretch along the I-4/U.S. 92 corridor, and south along S.R. 39. Much of the non-developed land in the area is cropland, most notably strawberry fields. To the southeast of the city is the only phosphate-related chemical plant in the area, Consolidated Minerals, Inc. defluorination plant. The other two chemical plants in Hillsborough County (Central Phosphates, Inc. in Zephyrhills and Gardinier, Inc. in East Tampa) are outside the study area.

The unincorporated area of Brandon lies to the southwest of Plant City. Though most of Brandon lies just outside the study area, the development taking place along S.R. 60 extends into it. Lying between Plant City and Brandon is a band of "old lands" which were mined and reclaimed by American Cyanamid Co.

Almost all the land in the area south of S.R. 60 is undeveloped, with rangeland, cropland and pasture, and citrus groves taking up most of the area. Three active phosphate mines and portions of four other active mines are located within Hillsborough County, mainly south of S.R. 60 and east of S.R. 39, along the Polk County line. These active mines plus other industry holdings make up about 11 percent of the county.

The main hydrologic feature in the area is the Alafia River. Most of the study area in the county is in the Alafia River watershed, which includes both the south and north prongs of the river. The floodplain of the Alafia is fairly thin, and is classified as forested wetland. In the southern portion of the area lies a portion of the Little Manatee River, most of which is south of S.R. 674. Both the Little Manatee and Alafia river floodplains have the potential to be adversely affected by the discharge of water from adjacent phosphate activities.

4.1.3 Manatee County

The study area within Manatee County is generally flat, and contains the sources of the south fork of the Little Manatee River, the Manatee River, and the Myakka River. There are considerable stretches of forested wetlands and uplands along these water courses, but the area is dominated by cropland and pasture and open rangeland.

Some of the acreage' is in citrus production, but it is small in comparison to the acreage for that use in Hardee, Hillsborough, and Polk counties. There are no urban centers within the study area for Manatee County. There are three east-west highways in the area (State Roads 62, 64, and 70) but no main north-south road. These roads act as the arteries between Hardee and DeSoto counties and the cities of Bradenton and Sarasota on the Gulf coast. State Road 37 meets with S.R. 62 in the northeast corner of the county, providing a link with Polk County.

The study area within the county comprises roughly one-half of the area of Manatee County. It consists primarily of grazing lands with some forested areas along the major streams. Phosphate mining has occurred in the county on a small scale, as only the Nu-Gulf, Ind. Wingate Creek Mine and IMC Fertilizer, Inc. Four Corners Mine are in operation at this time. Much more extensive areas (roughly ten percent of the county) are currently owned by the industry, and are being held as reserves.

4.1.4 Hardee County

The land use pattern for the study area within Hardee County is fairly complex. Encompassing more than half the county, it includes the cities of Wauchula, Bowling Green, and Zolfo Springs, as well as most of the Peace River floodplain that lies within the county. Running north to south through the center of the county, the Peace River has historically been the primary land use control for Hardee County, influencing first the locations of the cities then consequently the main land transportation route, U.S. 17.

The northern half of the Peace River, as well as its tributary Payne Creek, are classified as forested uplands and not as forested wetlands as might be expected. This is due to the narrow floodplain created by the natural topography and the encroachment of agricultural activities, mainly citrus groves, into the floodplain.

At Wauchula, the band of natural vegetation becomes wider as the topography flattens and the floodplain expands. Here

the classification changes to forested wetlands. There are large citrus groves to the west of the river, while cropland and pasture is more predominant east of the river, especially south of Zolfo Springs.

Centered between U.S. 17 and the Manatee County line is the Brushee Creek area, which contains some cropland and pasture but is mostly open rangeland and forested wetlands. The pattern is broken in the northern part of the county by Payne Creek and the citrus groves flanking it on the north and south, and by an area of cropland and pasture with some citrus groves along the Manatee County line near Horse Creek and State Road 64.

In general, the portion of Hardee County within the study area contains large parcels of most of the major land use categories, including forested wetlands, citrus groves, rangeland, cropland and pasture, and forested uplands, with a few sizable urban areas along U.S. 17. Phosphate mining has occurred in the northern section of the county, by Agrico Chemical Co. (Fort Green and Payne Creek mines), CF Mining Corp. (Hardee I Complex), and U.S. Agri-Chemicals (Rockland Mine). There are extensive industry holdings within the county (close to one-fourth the total county area) at this time, and they are expected to support the phosphate industry of central Florida in the early part of the next century.

4.1.5 DeSoto County

DeSoto county has the least amount of land within the study area, about 69,000 acres. The main topographical feature is Horse Creek, a tributary of the Peace River that runs north to south down the center of the area. The floodplain of the creek is forested wetland, flanked by cropland and pasture with some rangeland and citrus groves.

Along the Manatee County line is a wide band of rangeland. Near this band is the only residential area within the study area, and the only forested upland as well.

No phosphate mining has occurred in DeSoto County. IMC Fertilizer, Inc. and Consolidated Minerals have separate reserves in the county which total about 23,000 acres.

4.2 FUTURE LAND USE

The‘ projected future land use and cover for the study area is presented on Figure 12, in the appendix. The map, "Land Use and Cover Projected to 2010", is a compilation of the data on the 1989 land use and cover map, projected expansion of urban areas, and approved conceptual mining and reclamation plans for the phosphate mines.

A brief explanation is needed on the production of the map. First, urban service areas are shown. Urban service areas are those areas where public facilities such as roads, water and sewer lines, and electrical power are predicted to be in place to accommodate further development. There has been no attempt made to project the expansion of actual city limits. The areas depicted as "Urban" are within the extent of urban services anticipated by the cities or counties serving them, and include undeveloped areas. With the exception of Lakeland, Plant City, and Brandon, the urban extents do not differ significantly from the present land use map to the future land use map. The primary purpose of depicting these areas on the maps is to identify areas where mining activities may be restricted. No restrictions to the reclamation of mined lands to urban uses is implied. However, most of the lands within currently active mines are classified as agricultural or open under the local comprehensive plans.

Second, the conceptual reclamation plan for each mine was used for mines expected to be exhausted by the year 2010. Certainly, some programs within the mine boundary will still be in the process of reclamation, particularly clay settling areas. Third, only currently approved mining and reclamation plans were considered. Other mines may be permitted by the year 2010, or areas may be added to existing mines to extend their periods of operation.

4.2.1 Polk County

Of all the counties in the study area, Polk County will feel the greatest effect of the land use changes on phosphate industry owned lands through 2010. Only two mines and a small portion of a third are expected to be in operation in Polk County at that time. Hookers Prairie mine will be approaching mine-out, and Mobil's South Fort Meade Mine, projected to begin operations in 1995, will represent the last large-scale mining to occur in the county. Most of the lands mined in Polk County will have been reclaimed, and the full impact of phosphate mining in Polk County, long proclaimed by the industry as a temporary land disturbance, may then be evaluated.

Though the reclamation plans for the mines are separate, some generalizations can safely be made on the impact of reclamation on the county as a whole. The DNR regulations guaranteeing "type-for-type, acre-for-acre" reclamation of mined and disturbed wetlands ensures the quantity of marsh and swamp will not be diminished. In fact, most mining companies plan to create more wetlands than they destroy. The success of reclamation of wetlands to the quality of the original varies from site to site, and has been a source of much debate between the industry and environmental groups.

Much of the mined land will be reclaimed to upland pasture (FLUCCS 210). Depending on the reclamation technique used, this land has the potential for a large number of uses. If sand fill or overburden fill has been used, the reclaimed land will have the same flexibility of use as any other uplands in Polk County. While most of this land will initially be put to agricultural uses, such as grazing or citrus production, the soil should be stable enough to support many types of urban development.

Some of the pasture that will be created will be on soils less suited for development. These areas have been identified on Figure 13 as "Areas of Limited Development Potential" and include gypsum stacks, clay settling areas, or sand/clay mix sites. Polk County contains most of the phosphate chemical plants in central Florida, and therefore most of the gypsum stacks and associated cooling pond systems. The environmentally acceptable closure plans for the stacks and water systems may be very costly unless a large volume use for the gypsum is found.

In December, 1989 the Environmental Protection Agency prohibited the use of and research with phosphogypsum, citing radionuclide emissions. This "ban" is now being reconsidered and may be modified. A full discussion of phosphogypsum use and the problems associated with it is not included in this paper, as it would be outside the scope of this study.

Clay settling areas take up more total acreage than gypsum stacks, but their development potential is less limited. These locations are most often reclaimed as wetlands or upland pasture, and contain highly unstable, fertile soils. Formed mainly by the consolidation of waste clays, they will not be capable of supporting urban land uses. Their greatest potential lies in agriculture. Research has been done on the suitability of these areas for producing row crops and alfalfa, and the results are promising. Polk County can expect to see hundreds of acres of clay settling areas reclaimed during the next twenty years.

There are, however, possible negative side effects to the reclamation of the clay areas. While in their active state, clay ponds serve some useful purposes apart from normal mining operations. Many migratory waterfowl use the ponds as temporary habitat during their migration. As the expansion of urban areas spoil more and more natural lakes and wetlands, these birds have been forced to rely on the clay ponds for feeding areas. Many small lakes and wetlands will be created on phosphate lands through land-and-lakes reclamation, but it is not known whether they will provide enough habitat when the clay ponds are reclaimed.

Second, active clay settling areas are also important for possible flood control. As the clays consolidate, clear water is decanted away through the use of spillways. When a large storm or hurricane is approaching, the spillway levels could be raised, providing a temporary holding facility for the rainwater which falls upon the settling area. After the storm passes, the water could be gradually released, decreasing the possibility of flooding both on the minesite and downstream. Once the clay settling areas are reclaimed, the pressure of flood control from reclaimed uplands will fall primarily on the reclaimed marshes and swamps adjoining natural water systems. The reclaimed wetland systems may not be as effective or dependable as the active clay settling areas are in controlling flooding after severe rainfall events,

The use of active clay settling areas for flood control is an important consideration when choosing sites for development downstream from the mines. Regulations require the surface hydrology of the mine to be as close as possible to the pre-mining conditions, with regard to watershed sizes and flow directions. Downstream sites should be developed with the pre-mining flood conditions in mind, not those that exist while the clay settling areas are active.

A major change to the land use and cover pattern of the study area within Polk County independent of the phosphate industry is the expansion of the Lakeland urban area. As with most of the urban centers of Florida, much population growth is expected to occur in the next twenty years. There are already instances of urban development on mined land in and around Lakeland, such as ImperiaLakes. More development of this nature can be expected to occur as Lakeland grows. The comprehensive plans of Polk County and its incorporated areas should recognize those areas where the development potential is limited due to specific mining operations.

4.2.2 Hillsborough County

The future land use and cover for the study area within Hillsborough County is very similar to that for Polk County, but on a smaller scale. IMC Fertilizer Four Corners and Lonesome Mines are the only mines expected to be in operation in 2010, and there is only one large tract owned by the industry which would extend mining in Hillsborough County if permitted.

There are no gypsum stacks within the study area in the county, and there are far fewer acres dedicated to clay settling than in Polk County. Hillsborough County has designated most of the study area as agricultural in their long range development plans, though urban uses will encroach upon it near Brandon, Plant City, and the westernmost edge of

the study area along Highway 301. The major restriction to urban types of development in the area is not the reclaimed landform or soil type, but the Hillsborough County Comprehensive Plan. The county recognizes that most of the reclaimed areas will be well-suited for agricultural uses, and has adopted policies to preserve the area for those uses as Tampa, Brandon, and Plant City absorb the urban growth of the county.

4.2.3 Manatee County

There is little difference between present land use and future land use for the study area in Manatee County related to the phosphate industry. Wingate Creek Mine will be shut down in the interval, and should be fully reclaimed by 2010. Four Corners Mine will be the only operating site in the county, unless other resource areas are permitted. The phosphate industry owns over 30,000 acres of unpermitted land in Manatee County, so there is the potential for mining there well past 2010.

4.2.4 Hardee County

Over the next twenty years, Hardee County is expected to displace Polk County as the center of mining in central Florida. The industry owns large tracts of land in the western half of the county, though only a few operations currently have mining permits. All of the mining in the county so far has been along the Polk County line. That will change before 2010, as CF Industries, Inc.'s Hardee II Complex is currently permitted. Mining is expected to begin south of Highway 62 between 1996 and 2000.

By 2010, the mines which are presently permitted and active will all have been mined out and reclamation will be complete or near completion. There will be relatively few clay settling areas in the area, due in part to the commitment CF Industries has made to the sand/clay mix waste disposal technique. The sand/clay mix process allows the sand and clay materials to be combined and placed in existing mine cuts below low dams. The result is a soil with enhanced agricultural properties that is at or near the original contours of the area. The stability of the areas, though greater than that of straight clays, is not sufficient to support normal construction activities. The mix process addresses the local government concern for the use of reclaimed land to support and maintain the agricultural base of the county.

4.2.5 DeSoto County

There are no differences in the present and future land use maps in this study, because there has been no mining in the county to date. Consequently, there are no reclamation plans to project.

The current status of phosphate mining in DeSoto County may change soon, as Consolidated Minerals is in the application stage for a power generation, chemical and mining development on their holdings in DeSoto County. IMC Fertilizer also owns a portion of the county, but there are no plans for mining it at this time.

4.3 PREMINING AND POST-RECLAMATION COMPARISON

Table 10, "Premining and Post-Reclamation Land Use" compares conceptual land use acreage totals for conditions before mining and after reclamation for twenty-three phosphate mines. As conceptual plan boundaries are amended, maps such as those which display contours, waste disposal sites, and post-reclamation land uses are also amended. Since premining conditions are not affected by the changes in future mine plans, the premining vegetation maps are not required to be updated. As a result, the totals for premining and post-reclamation are not equal. However, the table does provide a rough idea as to what natural vegetation groups were mined and disturbed, and what they have been or will be replaced with by reclamation activities.

Several of the mines were active both before and after July 1, 1975, when reclamation became mandatory. For these mines, "premining" can be defined as those conditions which existed on July 1, 1975, and not as conditions existing prior to the start of mining on the property. Because of this fact, there are 30,644 acres of extractive lands in the premining total.

TABLE 10
PREMINING AND POST-RECLAMATION LAND USE

	ACRES		
FLUCCS #	PRE	POST	CHANGE
100	1,324	1,271	- 53
130	1,221	2,728	+ 1,507
200	2,667	299	- 2,368
210	47,799	116,676	+ 68,877
230	10,238	547	- 9,691
300	48,453	8,907	- 39,546
400	3,960	7,391	+ 3,431
410	26,754	5,299	- 21,455
420	29,538	9,116	- 20,422
430	9,333	12,100	+ 2,767
500	2,920	15,162	+ 12,242
600	306	452	+ 146
610/620/630	15,666	17,400	+ 1,734
640	14,864	20,870	+ 6,006
700	1,066	0	- 1,066
740	1,528	18	- 1,510
750	28,050	15,990	- 12,060
TOTAL	245,687	234,226	- 11,461

There are a number of conclusions which may be drawn based on the data presented in Table 10.

1. The sum of the conceptual plan areas will decrease by 11,461 acres from premining to post-reclamation, as a result of the sale of lands or deletion of undisturbed areas or non-mandatory reclamation areas from the conceptual plan.

2. The wetland reclamation goal of "type-for-type, acre-for-acre" will be surpassed by the industry. All three wetland categories will grow in amount, with a total wetland increase of 7,886 acres. As previously stated, this is a quantitative comparison only.

3. Surface water acreage will be increased by more than 12,000 acres, providing valuable wildlife and recreational values to the reclaimed sites.

4. Citrus groves will decrease by almost 10,000 acres, as the mine operators choose to reclaim the groves to other uses.

5. **The land use category with the biggest increase is pasture and cropland, while the largest declining category is rangeland. Both categories are used primarily for grazing, so the major economic impact amounts to trading natural palmetto prairie for improved pasture. Agricultural pursuits benefit, at the expense of native wildlife habitat.**

6. **The amount of land covered with upland forest is tremendously impacted. Mining companies are required to reclaim ten percent of upland acres with trees, to prevent wind and water erosion. Even if ten percent of the pasture and cropland is assumed to be forested, the table shows that there will be about 24,000 fewer upland forest acres within the mine boundaries after reclamation than there was before mining. The upland forest group of land use categories suffers the greatest loss, as mine operators have found it both difficult and expensive to reforest. The addition of surface water and wetlands will be achieved in exchange for a depletion of upland forests.**

7. **Urban and industrial land uses will increase by some 1,500 acres. Most of the increase will be in gypsum stacks, but some will be in potential industrial sites, roads, and railroads.**

8. **"Oldlands", disturbed lands, and other extractive land uses will decrease by 14,636 acres from premining to post-reclamation. The remaining 16,008 acres will remain in non-mandatory reclamation programs. Much of this total will be reclaimed or will be in the process of being reclaimed in the year 2010.**

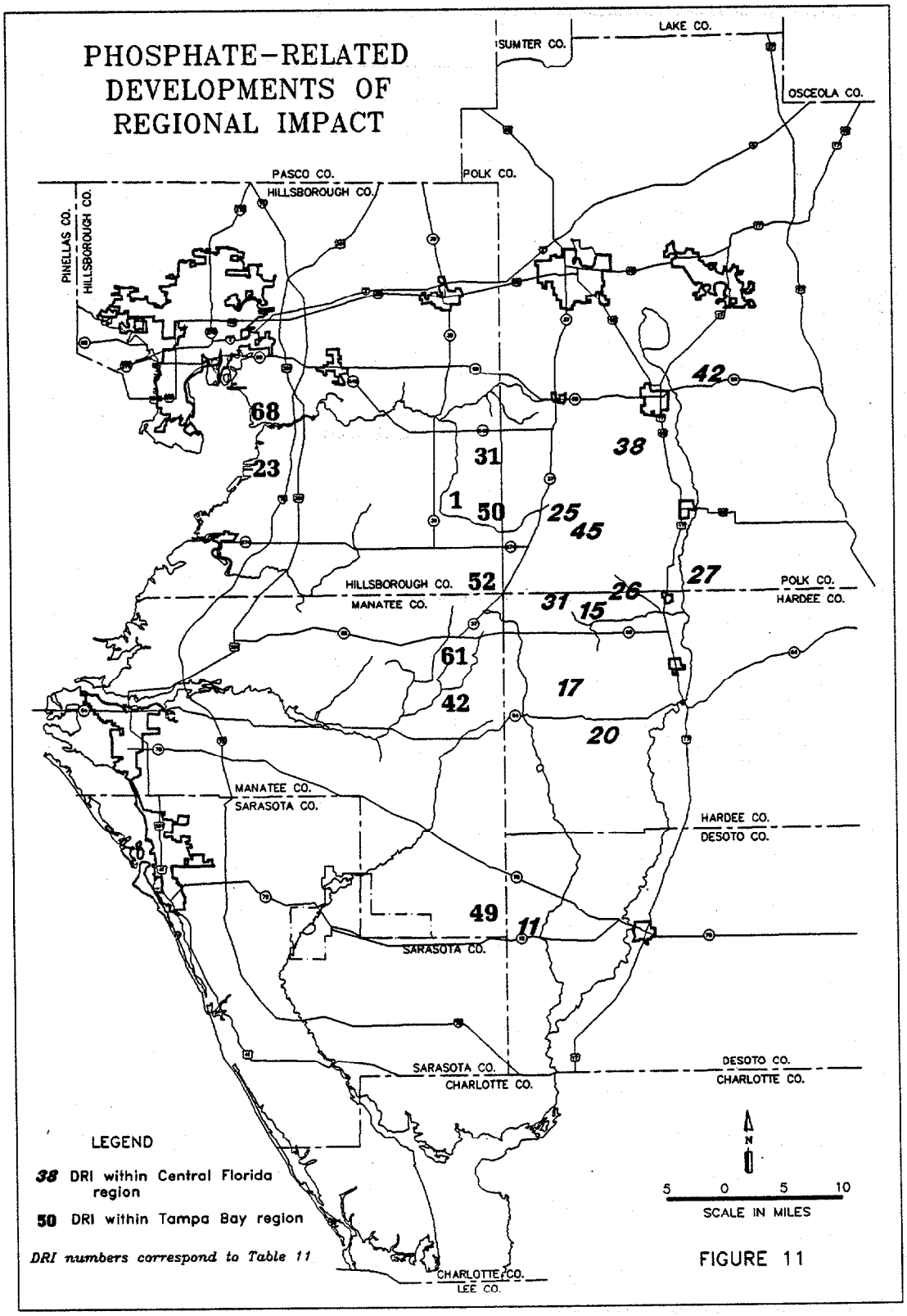

PHOSPHATE-RELATED DEVELOPMENTS OF REGIONAL IMPACT
LAKE CO.
SUMTER CO.
OSCEOLA CO.
PASCO CO.
HILLSBOROUGH CO.
POLK CO.
PINELLAS CO.
HILLSBOROUGH CO.
68
23
31
1
50
25
45
38
42
HILLSBOROUGH CO.
MANATEE CO.
52
31
26
15
27
POLK CO.
HARDEE CO.
61
42
17
20
MANATEE CO.
SARASOTA CO.
HARDEE CO.
DESOTO CO.
49
11
SARASOTA CO.
SARASOTA CO.
CHARLOTTE CO.
DESOTO CO.
CHARLOTTE CO.
CHARLOTTE CO.
LEE CO.
LEGEND
38 DRI within Central Florida region
50 DRI within Tampa Bay region
DRI numbers correspond to Table 11
N
5 0 5 10
SCALE IN MILES

FIGURE 11

TABLE 11

DEVELOPMENTS OF REGIONAL IMPACT

DRI #	EXTENSION OR SUBSTANTIAL DEVIATION #	COMPANY	ACRES
CFRPC			
11	n/a	Phillips Petroleum	15,200
15	n/a	C.F. Mining Corp.	19,553
17	n/a	Mississippi Chem. Corp.	14,850
20	n/a	Farmland Industries	14,300
25	n/a	Brewster Phosphates	2,600
26	n/a	USS Agri-Chemicals	3,283
27	n/a	Mobil Chemical Co.	15,194
31	n/a	Agrico Chemical Co.	5,677
38	n/a	IMC Fertilizer, Inc.	4,212
42	n/a	IMC Fertilizer, Inc.	6,143
45	n/a	Seminole Fertilizer	6,859
TBRPC			
1	85	Brewster Phosphates	18,367
23	47	Agrico Chemical Co.	216
31	120	IMC Fertilizer, Inc.	6,933
42	95	Gulf Atlantic Corp.	10,971
49	n/a	Phillips Petroleum	6,500
50	80	Mobil Chemical Co.	5,720
52	198	IMC Fertilizer, Inc.	18,685
61	n/a	Swift Ag. Chem. Corp.	10,394
68	76	Gardinier, Inc.	10

TABLE 12
PHOSPHATE INDUSTRY LANDOWNERSHIP
WITHIN STUDY AREA

County Area	Acres		Percent		
	Total Area*	Area Within Study Area	Study Area By County	County Within Study Area	Industry Owned Within Study
DeSoto	409,043	68,937	5.4	16.9	32.8
Hardee	408,480	245,553	19.4	60.1	41.0
Hillsborough	698,950	264,262	20.9	37.8	28.8
Manatee	511,603	269,317	21.3	52.6	20.5
Polk	1,286,611	417,000	33.0	32.4	50.8
TOTAL	3,314,687	1,265,069	100.0	38.2**	36.9***

*Florida County Atlas and Municipal Fact Book, 1988.
**Percent of five-county area within study area.
***Percent of study area owned by the phosphate industry.

TABLE 13

POPULATION BY COUNTY

COUNTY	1970	1980	1990	2000	2010
DeSoto	13,060	19,039	24,300	28,300	30,700
Hardee	14,889	20,357	23,000	25,700	27,300
Hillsborough	490,265	646,939	872,500	1,046,000	1,157,700
Manatee	97,115	148,445	196,400	236,300	260,000
Polk	227,222	321,652	419,300	497,000	540,400

NOTE: Figures for 1970 and 1980 are from the U.S. Bureau of Census; figures for 1990, 2000, and 2010 are from the Bureau of Economic and Business Research, Univ. of Florida; Vol. 22, No. 2, Bulletin No. 88, March 1989.

5. CONSERVATION/ENVIRONMENTAL

Note: The authors would like to thank the staff of the Florida Audubon Society for supplying the conservation section of this report.

5.1 OVERVIEW

It is easy to forget in these urbanized times when money, goods, factories, and materially successful people are concentrated in our cities, that it is the productivity of the land that is the ultimate source of both our essentials and our luxuries. Moreover, unlike the millions of other species with which we share our planet, we have become dependant not only upon the renewable, living resources that the land provides, but also upon the non-renewable (albeit sometimes recyclable) mineral wealth that lies below the surface of the land -- a dependence that is directly connected with our high numbers and irrepressible tendency to cluster into cities of ever-increasing size. Food, water, wood for construction, natural fibers and skins for clothes, and beasts of burden for transport serve for primitive or low-density man, but metals, fuels, and other non-renewable resources become essential once man reaches a certain density. A Faustian bargain is struck; living standards and opportunities increase enormously, but at the price of sustainability.

When mankind was few, land was not the limiting factor. Man was limited instead by the energy that he could bring to bear to harvest or concentrate resources. But with the liberation of the concentrated energy of wood, coal, oil and ultimately (another Faustian bargain!) nuclear fuels, an exponential increase in human numbers and density, wealth and opportunity became possible. And so it happened. But, as man's populations expanded to cover the land, the land could not grow to accommodate him. Good caves, good hunting territory, fertile valleys became scarce resources, subject to challenge and worth defending. Ultimately land achieved a cash value and ownership or proprietorship was recorded formally, until the point was reached where, in the most densely inhabited countries, land of any kind has become beyond the means of the average citizen.

In Florida, as we approach the end of the millennium, land values vary tremendously. In no area of human commerce does the law of supply and demand operate more spectacularly. While land may remain relatively inexpensive in remote areas

of the Panhandle, seafront lots on the Atlantic coast, or prime residential or business lots in the larger cities of the peninsula, have become priced by the linear or square foot rather than by the acre. These are limited commodities, the first naturally so and the second artificially so, and both are in high demand. People began to have different views as to what would be the best use of "desirable" land tracts or of land adjacent to their own holdings. The stage was set for zoning laws, DRI's, and land use disputes between those with different value systems or different prioritizations of society's needs.

A familiar icon of the eighties has been a LANDSAT photograph of the state of Florida -- an extraordinary, false color photograph of the actual face of the land of the entire state. The technology to produce such a picture would have been beyond imagination even a generation ago. But it takes only a little more imagination to convert that picture back to its natural colors, and to display it on a video screen with an additional component incorporated -- the dimension of time. Let us pursue this adventure of the imagination.

The machine has a "fast reverse" as well as "fast forward" control, and we set the image back to indicate the Florida of a million years ago. "Florida" is reduced to a chain of small, rounded or elongated islands, corresponding to the highest areas in the state today. We set the machine on to "forward". Five years per second, let's say. The islands gradually enlarge, and coalesce into a slender peninsula. We speed up the motion, and the narrow land expands as water levels drop, then contracts, expands again - passing briefly through a rough facsimile of the Florida of today, before widening dramatically into the Gulf of Mexico to twice its present width. The land contracts again, expands, oscillates, then approaches its modern form again.

The land appears almost entirely green, but not uniformly green. Cypress swamps and mangrove shorelines occur in the south, hardwood forests throughout much of the peninsula and the panhandle, and prairies and flooded savannas here and there, and each has its own shade and texture of green. It is the peculiar wavelength of light of trillions of molecules of chlorophyll, reaching into space to impact the sensors of our imaginary, stationary satellite, that dominates virtually the entire face of the land -- only the waters themselves, and the occasional section of hurricane disturbed shoreline or wide beach interrupt the subtly shaded green blanket.

The screen flickers, as summers and winters pass before our eyes, their cycles of rainfall and temperature affecting the colors and textures, subtly in the south but quite boldly in the north. Occasionally, a savanna is momentarily

blackened by a great fire, but it quickly returns, greener than ever. Rounded lakes open instantly as solution caverns collapse. Hurricanes hit every few seconds, and shorelines are rearranged slightly each time. Passes between barrier islands shift southwards with dizzying speed, ultimately closing and opening like hungry mouths. Whole little islands disappear, and new ones form.

As our picture story reaches the last few thousand years, man enters the land. We do not see the impact of the Native American on our screen: he was "ecosystem" rather than "biosphere" man; he adapted to his world rather than inflicting drastic change upon his environment. But he did have an impact. He had to fish, and hunt deer and other elusive or cryptic animals. Individual animals were taken, but species survived.

Ultimately, we see tiny settlements appearing around the coast. The Spanish have arrived, and Florida will never be the same again. We recognize the location of St. Augustine, of Pensacola, of Key West - little cancerous nodules of development, seemingly tempting surgical removal before they metastasize - but no surgery is forthcoming. The rate of change speeds up, and we have to adjust the controls to bring things down to a reasonable speed. More settlements appear, tiny on our picture, but growing in size and number. Then we start to see straight lines on our picture where before there were only the soft curves and gradations of nature; man has started to dig ditches to drain wetlands and alter water flow patterns for his convenience. The green of the land remains, but changes in texture: Wilderness is becoming agricultural and ranch land. Railroads appear in the north peninsula and panhandle, finally reaching south to Punta Gorda.

Suddenly, like a surgical slash, Mr. Flagler's railroad slices through the wilderness of eastern Florida, right to the southern tip - a slash that goes septic fast as the railroad becomes a corridor of development, a phenomenon re-enacted constantly as highways through wilderness become strip developments. We are forcibly reminded of Friedrich Nietzsche's bleak maxim, "The earth has a skin, and that skin has diseases. One of those diseases is called Man." Development in South Florida, safe from intrusion for so long, sets in like a fast-growing tumor. We fine-tune the focus on our instrument, and see that few areas of Florida are totally remote from roads or highways, and that drainage ditches have now become. the norm rather than a rarity. The great sheet-flow over the southern shores of Lake Okeechobee, in that unique ecosystem, the Everglades, changes as the lake is diked, agriculture becomes established on vast tracts of land south of the lake, and the surviving grasslands severely impacted by the interruption of the southward water flow. The

greatest of all Florida wetlands is passively and disastrously managed by getting only the water that Miami does not need in time of drought, and abruptly being a dumping ground for all the water that Miami cannot handle in times of flood.

Even this flow is brutally altered by not one but two east-west highways that slice redundantly from the Atlantic to the Gulf of Mexico. And elsewhere man's impact upon Florida waters becomes evident even from our Apalachicola River in the far north of the state; later, huge geometric cooling ponds, miles long, appear beside a power plant at Turkey Point, south of Miami. And, plumb in the middle of the state, Lake Apopka has started to turn a bad color. Later, Lake Okeechobee starts to do the same.

As all this is happening, at exponentially increasing speed, a strange blight seems to have gained a foothold inland from Tampa Bay, mainly in the area of Polk County. It seems different from the land scarring caused by urbanization --it goes deeper, gulps huge areas at a time, yet ultimately seems to evolve into ponds and green landscapes rather than into irreversible urbanization. The area involved is huge, and we focus our attention in fascination as we slow down the flickering screen. Phosphate has been discovered.

Thus far, our machine has shown our past. We can run it at any speed we wish, but when we reach the present, we hit an unshiftable "freeze frame" however we manipulate the controls. The future will have to be shown on a different, more complex computer video system, where we must program-in the variables of population pressure, national and state law, and the resolve of the people of Florida to plan their future rather than just to let it happen. We have had a spectrum of planning commissions, construction setback lines, comprehensive state and county development plans, zoning laws, and so on for years - good intentions galore, but too often the results are undetectable, even in an enlarged, fine-focused image.

We can program our machine for "business as usual", and watch the effects of a daily net influx of 800 people to the state -- a million every three years, with their demands for watered, rarely trodden lawns, pools rarely used for actual swimming, air conditioning to keep out the climate that they never really liked anyway, broadcast use of pesticides to control "creepy crawlies" (a term used by newcomers to characterize the entire fauna of Florida) and roads and super-markets to supply their insatiable material needs. As the decades of the future unfold, we see urbanization and land alteration proceeding apace, the Panhandle lagging but finally getting the idea, until only a few areas of natural contours and colors are left. All is not lost, of course; Florida has

a great, albeit flawed, national park in the south, with the adjacent Big Cypress reserve, and scattered throughout the state are the state parks, and the natural areas acquired during the seventies and eighties, under the state's EEL and CARL programs, their value increasing annually as they become ever scarcer commodities. The great National Forests -- Osceola, Ocala, Apalachicola -- remain clearly defined, but are increasingly scarred by "multiple uses", ranging from timber cutting to bombing practice, which are legally permitted in such areas.

But, back to the phosphate mining areas of Polk, eastern Hillsborough, Hardee, and DeSoto Counties. Here, we have unique opportunities to do better than we did elsewhere. Once the phosphate rock is mined and processed, the land becomes available for other uses, and we have a clean slate. It can be restored to a close semblance of wilderness if that is society's choice: or it can be developed into urban, industrial, or residential land, if that is the preference. Rarely, in life, do we have such a chance to start all over again.

Of course, the slate is not entirely clean. After the mining is over, the fine clay silt takes years to settle or dehydrate, and the settling ponds are a feature of the landscape for a long time to come. And those strange man-made mountains peculiar to the mining area, the vast heaps of slightly radioactive calcium sulphate, known in the trade as "gyp stacks", stand as an apparently permanent memorial to the chemical plants long after they have been closed. The former -- the settling ponds, formerly known as "slime ponds" until the public relations people got to work -- may end up with significant wildlife value, as the ducks, fish, turtles and gators establish a foothold. On the other hand, the gyp stacks remain, feebly vegetated on their summits with dog fennel or mostly exotic vegetation, towering, uncompromising, challenging anyone to come up with a use for them.

But with the land itself, many things can be done. In the old days ("old" in these fast moving times being pre-1975), the mined land was generally simply abandoned. Nature gradually established a foothold, and after a decade or two some acceptably productive ecosystems resulted, if one could forgive the distinctly unfloridian topography, with deep water often adjacent to high earthen mounds - paradise, perhaps, to gators or softshell turtles.

Abandonment is now no longer legal; the land must be reclaimed. But how, into what, and for whom? Must it be restored to its condition before man came on the scene, or to the immediate pre-mining condition? The latter may not have been particularly spectacular; much of the land was cattle

pasture before it was mined. On the other hand, much was wetlands, and the reclamation rules of the Florida Department of Natural Resources require that wetlands be restored after mining, acre for acre, with new wetlands created to compensate for those destroyed. The rules are good; they mandate elimination of steep slopes (steeper than one in four); topsoil or other growing medium must be brought in; and restored wetlands must incorporate a variety of emergent habitats, a balance of deep and shallow water, fluctuating water levels, and a variety of shoreline slopes. Waste clays must be disposed of in a way that minimizes downstream water pollution, and all reasonable means must be taken to hasten the settling of the clay and the reclamation of the areas utilized for settling ponds. Land must be revegetated, in appropriate ways: and endangered and threatened species must be provided for. The rules are strict but not rigid; they encourage close coordination between the operator and the Department, and the negotiation of agreement on special situations or experimental techniques. But can they be improved upon? What is really the best goal to seek for reclaimed land?

Looking at all options, it is essential that the sometimes competing needs of people and of wildlife be addressed. The options for a given mined area run the gamut from industrial development to residential development to "green" uses like golf courses or cattle pasture, to wildlife habitat. Which of these makes the best economic sense? It may not be the answer one would expect: nor is it necessarily best to dedicate most of the land to wildlife habitat even if one's motives are purely environmental; it may force development into virgin habitats, which would be worse.

1. Industrial Development. This is an option often favored by County Commissions, on the grounds that it is likely to yield the highest tax revenues. It is not necessarily opposed by environmentalists: industry is essential for the economic. health of the state and the nation. But what kind of industry? Will it pollute the air or the water? If pollution control is necessary, who will pay for it? How many employees will there be? Will they be drawn from the existing local population, or from other areas? And perhaps the key question: if the new industry is going to be built somewhere, come what may, is it better to build it on reclaimed land or on unmineralized land? Will the latter alternative require the destruction of new ecosystems already re-created and in the process of maturing on the mined land?

2. Residential Development. Again, this may be a popular option with County Commissions; it generates tax revenues, and provides accommodation for the great annual inflow of new residents into Florida. But the tax revenues may have to be spent on new public facilities, so that actual tax levels go up rather than down to provide for the escalating new services required. Impact fees may be required, but they are not always popular, and are rarely sufficient. Limiting the promotion of Florida as a good place to live may be one good way of reducing the influx of new residents; the market place alone may not take care of this until Florida has become another Los Angeles or New York.

   There are also environmental problems. Much of the reclaimed land in the Bone Valley area generates a certain level of radon gas. Whether or not this constitutes an actual health hazard is open to debate, and depends greatly upon the architectural style and the ventilation of the residence in question. But, to a significant degree, the perception of a problem may be as effective a constraint to home sales as an actual problem.

3. Golf Courses and Cattle Range. These uses of reclaimed land have their merits; golf courses can be utilized not only as income-generating facilities but also as disposal sites for treated sewage waters. Cattle pasture too offers some cash return for keeping the land green. But both types of altered habitats have little wildlife value, and both are liable to cause downstream water pollution as fertilizer, treated sewage, or cattle wastes enter natural drainage systems.

4. Agricultural Crops. With the impending loss of agricultural lands in the Everglades Agricultural area - a result of progressive oxidation and loss of topsoil - the potential demand for croplands may increase in central Florida. However, such crops as" sugar cane - grown intensively south of Lake Okeechobee - may not grow well much further north than this, and withdrawal of price supports could make sugar cultivation uneconomic overnight. Moreover, urbanizing economies have a dangerous habit of simply eliminating agricultural areas, becoming dependent upon food grown at great distances. But more than one phosphate company in Florida has initiated important research into agricultural options and techniques for reclaimed lands.

5. **Wilderness Restoration. Wetlands can be re-created, and conditions established for the proliferation of desirable vegetative species, be they cattails, sawgrass, or a mixed community of emergents and submergents. Ultimately cypress trees can be reintroduced; in a century they will be big. Many species of vegetation will reinvade on their own; others will need to be helped. Again, many wildlife species can be counted upon to reinvade when the habitat is there for them: others, particularly those that live in isolated colonies or in fragmented habitat separated by inhospitable or untraversable areas (ranging from subtly different natural habitat, to interstate highways) may need to be helped. Experiments are currently under way to determine the feasibility of re-introducing gopher tortoises to reclaimed habitat; and once the tortoises are established, attention must be paid to the gopher frogs, snakes, and almost three dozen species of specialized arthropod and other invertebrate commensals that share their burrows.**

Wilderness restoration is technically feasible, but how will it be economically feasible? And how will the reclamation plans for the complex mosaic of mines, on lands owned by a spectrum of companies of differing financial strength and reclamation philosophy, be integrated? These are the big questions, whose solutions will require that rare entity - a good, integrated technical plan that has political force behind it. If biologists, industry representatives, local concerned citizens, state agencies, and politicians combine their talents, such a plan becomes feasible and may actually happen. This will depend upon all parties realizing that such a plan is in the greater public interest, both economically and environmentally.

It is a basic tenet of wildlife management that large reserves are better than smaller ones. Mini-reserves may be better than total urbanization in city environments, but they are unlikely to harbor wildlife species any more demanding than raccoons or gray squirrels. Larger mammals require extensive contiguous home ranges, and top predators -- the Florida panther always springs to mind -- require hundreds of thousands of acres to maintain even a minimal population in perpetuity, in equilibrium with its prey species. If the habitat is inadequate, the cats will disappear as surely as if they had been shot, either by wandering across altered habitat until they are killed on highways, or simply by failing to find enough food to survive or to raise young.

In the Florida of the 1990s and beyond, such large mammals as panthers and bears will survive only if we can establish the largest possible areas of contiguous wilderness or near-wilderness habitat for them, and also connect such areas by corridors of habitat that the animal can traverse without disturbance or trauma. Their future as part of the fauna of the state will depend upon our ability to provide these "wildlife corridors" that will permit occasional breeding contact between animals whose habitual home ranges are in large and widely separated blocks of habitat, and who may need to venture forth from such territories at times when, for various reasons, local prey populations may be depleted.

Such terrestrial corridors may be of relatively minor relevance to the phosphate-mined areas, to the extent that the area being mined and to be reclaimed as the phosphate industry phases itself out in the decades to come is not sandwiched between national parks or great tracts of prime wildlife habitat. But the aquatic corridors are of inestimable importance. The Peace River, whose wilderness character has been recognized by its inclusion in the State of Florida Canoe Trail System, arises in the heart of the phosphate lands of Polk and adjacent counties. The preservation of the contiguity of these habitats will require an advanced degree of integration of reclamation plans by the various mining companies operating in the drainage system. We will need a system of reclamation that progresses beyond the "eye for an eye" or "acre for an acre" wetland rule, and that considers the overall needs of the aquatic and riverine forest corridors. This will not only ensure the preservation of the water quality of the Peace River system, but will also provide essential wildlife habitat and corridors -- as wide as possible, and with extensive buffer zones -- along the banks. This is one of our greatest challenges.

Reclamation law has long placed a special value on large connected wetlands - a concept inherent in the wetlands rating system described by Brown and Starnes (1983). Yet the special value of small, isolated wetlands has been ignored in the reclamation regulations of the Corps of Engineers and, until recently, by the conservation community as well. Moler and Franz (1987) have recently demonstrated that such small wetlands have special values for numerous wildlife species, especially amphibians and wading birds. Many species of amphibians cannot successfully reproduce in large wetlands with their, attendant predators. Ten of the 29 anuran (frog and toad) species in the southeastern coastal plain breed primarily or exclusively in small, often ephemeral wetlands, where fish predators are eliminated by annual drying, and productivity enhanced by the dieback of the seasonally inundated terrestrial vegetation. Among birds of ecological importance, sandhill cranes usually nest beside ponds of 4.1

hectare or less. Woodstorks, and even snail kites, may find their most successful feeding in small pond or marsh ecosystems. In trophic and energetic terms, it has been estimated that a one-hectare pond may generate enough amphibians to sustain the number of hognosed snakes normally supported by 1,000 hectares of terrestrial habitat.

The question may be raised as to how the preservation of reclaimed habitats will be ensured in perpetuity; it would be tragic to restore land to a good facsimile of, say, a Florida scrub, tend it and replenish the various displaced species of fauna and flora, and then have the land sold and bulldozed for development. And if the land generates no income because of it being dedicated to wildlife rather than human needs, the threat of development will be a constant one. The concept of sale or transfer of development rights may be an important tool in the preservation of such reclaimed areas.

The assumption that land dedicated to wildlife is economically idle is a wrong one. Figures have demonstrated that an alternative, supposedly "commercial" use of the land, such as cattle-raising, may produce only marginal profits, whereas hunting and recreational fishing leases may generate substantial income and provide a strong stimulus to maintenance of the land in a naturally productive condition. Timothy King and Wayne Marion (1989) have calculated that there are already 12 state, county, and municipal parks and reserves on mined lands, totaling 11,295 acres, even though there was no statutory requirement to establish such reserves. These same authors found that some of the highest hunting lease values in the state occur near the mining district, and fishing leases too may be highly profitable for the landowner. At one recently closed mine, the corporate landowner is leasing 1400 acres of former mine pits for bass fishing at a rate comparable to local grazing leases, and two or three times greater than the average hunting lease return. The lessee, in turn, is making good profit offering the fishing public access to the site.

There is much that is yet to be solved. Reclamation is being undertaken to state-mandated standards. These standards can be changed as we learn more about the technology of wilderness reclamation, and as new ideas from all sides are shown to make good sense. Even so, the signing-off on a reclamation job as "finished to Department satisfaction" remains a judgmental matter; ecology and wilderness management have not yet reached the point at which one can predict all the successional stages through which reclaimed habitat, especially wetlands, will pass. Terrestrial ecosystems too may need some level of permanent management -- fire exclusion or inclusion, removal of exotic species, and so on. These will cost money, and will take expertise to do well. But the

demonstrated economic value of intact, contiguous wetlands and terrestrial systems, and our growing ability to re-create habitat close to -- perhaps ultimately identical with -- natural systems, means that the job can be done.

5.2 NATURAL AREAS, WILDLIFE, AND RECLAMATION

The identification and designation of certain types of lands to meet the future needs of wildlife and human recreation is an important element of land use planning in the region. In the case of endangered and threatened species of wildlife it is vital to inventory their populations and distributions and to determine their critical habitat needs. For example, we need to inventory the old-growth pine flatwoods inhabited by Red-cockaded Woodpeckers, and the scrub habitat in which live numerous endangered and threatened species of plants and animals. Then, we need to designate sanctuaries of suitable size and distribution to insure the survival of these species in the future.

Recreational lands for hunting, fishing, athletics, and passive activities--hiking, bird watching, picnicking, camping, and swimming--need to be identified and, if necessary, acquired before they become committed to other uses or become too expensive to purchase.

The first step in this process of planning at a regional scale is to determine what exists and what is already relatively secure in both the private and public sectors. Secondly, we need to determine what lands and how much are wanted and needed in the future, and where they should be located.

River and stream systems, including their major and minor tributaries, and associated wetlands are vital hydrological features that provide wildlife and recreational values in addition to their functions as water supply, purification, and flood control, etc. These should be considered as core preservation areas, with reclamation directed to the enhancement of these systems. Reclamation of surrounding mined lands should include corridors of habitat connecting these core areas. It is important to identify and inventory these systems and to designate those segments to be preserved, and where the tributaries have been mined, how their natural functions can be restored.

All of this will necessitate planning at the basin, subbasin, and intersubbasin levels. Currently, there are no comprehensive plans for any of these systems. Each mining company and municipality, for the most part, is planning independently of each other, and of the systems and natural features that extend beyond their boundaries.

Clay settling ponds whose rich productivity attracts tremendous numbers of migrating wintering waterfowl and shorebirds are ephemeral habitats and will disappear as mining closes out. Yet, the clay settling ponds of Central Florida in the 1960s, 70s, and 80s are simply replacement sites for former habitats along the Gulf coast from Tampa Bay southward and interior wetlands that have been lost to human development. We have moral, if not economic, obligation to provide comparable habitat for these birds in the future, before the last settling pond dries out. There may be high economic value in maintaining some of the clay settling ponds as permanent type shallow water pools for wildlife utilization. These could also function as basins for temporary water storage during periods of unseasonably high rainfall or hurricanes.

We already know that some of the old unreclaimed mines with their waterholes and upland peaks provide a rich wildlife habitat as they are and become vegetated. These need to be identified, and where desirable preserved as is. Likewise, some of the post 1975 mines, which by law must be reclaimed, should be closely examined to see if it would be more worthwhile to reclaim these as land and lakes for fish and wildlife resources instead of for housing subdivisions or pastureland.

5.3 CONCLUSIONS

The foregoing section is primarily a discussion of needs and a plea for more comprehensive and integrated planning on a basin-wide basin and not by property line or municipality boundary. To accomplish this the following actions should be undertaken:

1. Regional land use plans should be reviewed in greater detail in relation to future needs and wants and should be based on (a) an Endangered and Threatened Species Plan that provides for habitat inventory and sanctuary designations: (b) a regional recreation plan that provides for a variety of parks, refuges, preserves, etc.; and (c) a forest industry plan that provides for forest restoration and utilization.

2. Comprehensive planning involving reclamation should be based on hydrological systems, which can be treated as preservation cores. Rules covering stream design should be reviewed to insure that they are adequate to accomplish this.

3. Care must be taken to insure that preservation areas--hydrological systems, parks, preserves, etc., do not become overly fragmented or isolated.

4. A review of nonmandatory unreclaimed mined lands should be conducted to assess their current fish and wildlife values and future suitability as preserves, parks, or wildlife management areas with minimal or no additional reclamation.

6. REGULATORY

The Florida phosphate industry has been, from the early 1960's, progressively regulated in their day to day operation by a multitude of various federal, state, and county environmental or operational regulations. Most of the regulations are now in place but some portions are being constantly revised and updated. The revisions create problems for the industry as to keeping updated on the proposed revisions and compliance after adoption.

It is not within the scope of this project to provide a detailed study of each regulation and how it affects the phosphate industry. However, lists of the various regulations are provided in Tables 14, 15, and 16.

TABLE 14
FEDERAL LEGISLATION AFFECTING
ENVIRONMENTAL REVIEW AND/OR PERMITTING

- Clean Air Act
- Clean Water Act
- National Environmental Policy Act
- Atomic Energy Act
- Resource Conservation and Recovery Act
- Surface Mining Control and Reclamation Act
- Comprehensive Emergency Response, Compensation and Liability Act
- Superfund Amendments and Reauthorization Act
- Emergency Planning and Community right-to-Know Act
- Toxic Substances Control Act
- Rivers and Harbors Act of 1899
- Ports and Waterway Safety Act
- Deepwater Ports Act

TABLE 14 (continued)
FEDERAL LEGISLATION AFFECTING
ENVIRONMENTAL REVIEW AND/OR PERMITTING

- Marine Protection Research and Sanctuaries Act of 1972
- Coastal Zone Management Act of 1972
- Marine Mammal Protection Act of 1972
- Fish and Wildlife Coordination Act
- Endangered Species Act of 1973
- Wild and Scenic Rivers Act
- Soil and Water Resources Conservation Act
- Noise Control Act of 1972
- National Historic Preservation Act of 1966

TABLE 15
STATE LEGISLATION PERTAINING TO THE LICENSING
OF FLORIDA PHOSPHATE OPERATIONS

Agency	Florida Statute	Florida Administrative Code
Florida Game and Freshwater Fish Commission	372 (Wildlife)	39 (Wildlife Code) 39-4 (General Prohibition) 29-25 (General Provisions Reptiles) 39-27 (Endangered Species)
Department of Health and Rehabilitative Services	290 (Fla. Nuclear Code and Southern Interstate Nuclear Compact Law) 387 (Pollution of Water) 404 (Radiation)	10D-56 10D-91 (Control of Radiation Hazards)
Southwest Fla. Water Management District	373 (Water Resources)	40D-2 (Consumptive Use Permitting) 40D-3 (Regulation of Wells) 40D-4 (Management and Storage of Surface Waters) *Interagency Agreement 40D-5 (Artificial Recharge) 40D-6 (Works of the District) 40D-8 (Water Levels and Rates of Flow)

TABLE 15 (continued)
STATE LEGISLATION PERTAINING TO TEE LICENSING
OF FLORIDA PHOSPHATE OPERATIONS

Agency	Florida Statute	Florida Administrative Code
Department of Natural Resources	211-Part II (Tax on Severance of Solid Minerals) 378 (Land Reclamation)	16C-16 (Mandatory Phosphate Mine Reclamation) 16C-17 (Master Reclamation Plan for Land Disturbed by the Severance of Phosphate Prior to July 1, 1975) 3A-44 (Nonmandatory Land Reclamation Trust Fund)
Regional Planning Councils	380 (Environmental Land and Water Management)	9J-2 (Rules of Procedure and Practice) 27F-2 (Land Planning) 28 (Clerks of the Circuit Courts)
	186 (State and Regional Planning)	9J-5 (Minimum Criteria for Review)
Department of Environmental Regulation	403 (Environmental Control)	

TABLE 15 (continued)
STATE LEGISLATION PERTAINING TO THE LICENSING
OF FLORIDA PHOSPHATE OPERATIONS

Agency	Florida Statute	Florida Administrative Code
Department of Environmental Regulation		17-103 Rules of Administrative Procedures Non-rulemaking
		17-140 Permitting - General Procedures
		17-141 Permit Fees
		17-150 Requirements for Reporting Releases of Hazardous Substances
		17-220 thru 17-249 Air Pollution Control
		17-301 Surface Waters of the State
		17-303 Surface Water Quality Standards
		17-309 Fish Values
		17-310 thru 17-320 Wetland Resource Management

TABLE 15 (continued)
STATE LEGISLATION PERTAINING TO THE LICENSING
OF FLORIDA PHOSPHATE OPERATIONS

Agency	Florida Statute	Florida Administrative Code
Department of Environmental Regulation		17-325 Stormwater Management
		17-329 Phosphate Dams
		17-520 Ground Water Standards
		17-522 thru 17-530 Ground Water Requirements & UIC
		17-531 Water Well Construction
		17-532 Water Wells
		17-550 thru 17-699 Wastewater Facilities
		17-701 thru 17-729 Solid Waste
		17-730 Hazardous Waste
		17-734 Polychlorinated Blphenyls (PCBs)
		17-761 Stationary Tanks

TABLE 16

COUNTY REGULATIONS

County	Ordinance
Polk	Ordinance No. 88-19 (Phosphate Mining Ordinance)
DeSoto	Ordinance No. 1984-17 (Phosphate Mining Operations)
	Section 7-27 (County Zoning Ordinance)
	27-M-1 (Phosphate Mining and Earth Moving District)
Hardee	Section M-l (Mining District) Article IV (Mining Regulations)
Manatee	Ordinance No. 81-22 (Mining and Reclamation Ordinance)
Hillsborough	Ordinance No. 87-27 (Phosphate Mining Ordinance)

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

This project was the first attempt to provide an indepth study of the phosphate industry land use and reclamation activity along with land use of non-industry holdings within portions of a five county area.

As the study progressed, it became apparent that the golden era of mining in Polk and Hillsborough counties would end during the first quarter of the 21st century. As reserves are exhausted, mining activity will be moved south into Hardee, DeSoto and Manatee counties. The focus in Polk and Hillsborough counties will shift to reclamation, which must be completed within five years of the closure of each mine site. Some of the reclaimed acreage may be placed on the real estate market. Growth pressures will require new land use and reclamation alternatives be developed to accommodate changing social and economic needs of the region. Final land use concepts found in existing reclamation plans are inadequate to respond to the changing market.

Phosphate rock production in Florida is expected to drop from the high of over 40 million metric tons/year to around 20 million metric tons/year by the year 2010. The reduction will occur because the industry cannot find enough new land to replace present mines, and because deposits in the south are not as good as those already mined.

Because of public opposition and regulatory pressure, it is unlikely new chemical plants will be permitted. Existing operating chemical plants will remain in production at their present locations. Certain existing operating plants will cease operations as the rock production dwindles. These plants face costly closure plans because of required reclamation of the phosphogypsum stack and cooling pond water systems. One company, Consolidated Minerals, Inc., is an exception to the trend as they are in the preliminary stage of requesting permits for a mine and chemical complex at their DeSoto County land holdings.

The Tampa Bay Regional Planning Council and the Central Florida Regional Planning Council Comprehensive Regional Policy Plans have been completed and adopted. All local plans (cities and counties) within Manatee and Hillsborough Counties have been completed and adopted. The plans within Polk,

DeSoto, and Hardee Counties are in progress and must be completed by November 1, 1990. A review of the proposed or adopted land use plan elements for the study area indicate that the phosphate industry would not be in conflict with the plans.

The coastal areas are quickly becoming over populated. Increasing land costs and regulation are forcing new residents and businesses to consider locating inland. The present and future mining area may become prime targets for acquisition by the land developers or coastal counties which would place the land into agricultural or water appropriation areas as a means to support increasing coastal populations. This could lock out forever the higher tax revenues associated with residential, commercial, and industrial assessments. The counties and the industries within the study area should work together to prevent this type of land takeover.

7.2 RECOMMENDATIONS

This document has provided an objective, non-regulatory study of phosphate industry land use and reclamation practices. The study covers a period of activity up to January 1, 1989, and projects future activity to the year 2010. The final document contents have been stored on several computer disks for easy access. All drawings have been developed so that portions can be retrieved and plotted without producing the entire drawing. This allows site specific areas to be called up and enlarged to some degree for greater detail.

In the past, major changes occurred because technical innovations improved efficiency, opened new resource areas, and increased production capacity. The mining and chemical industry will change significantly in the next ten to twenty years as it adjusts to declining resources, management of reclaimed land, and promotion of land development. This transition era will not have its main focus on technical or production improvements, but on the management of its land holdings for real estate development. Some companies will mine out their present holdings and shut down operations, while other companies will change ownership or seek more acreage to assure that mining will continue. Many companies will have to file DRI/EIS documents to establish new areas for future mining.

The following are recommendations for future consideration on updating or expanding portions of the present study document.

1. With the final document contents retained on computer disks, it would be relatively easy and

cost effective to update or expand portions of the study. A five year update increment is suggested.

2. The study area consisted of portions of five counties, and the scale of the land use maps necessarily restricted the level of detail. It is suggested that FIPR contact the five counties, G&FWFC, DNR, DER, water management districts and DOT to determine if they would consider a joint funding project that would provide greater detail maps for their areas of interest.

3. Phosphate companies would benefit by, and should support, the funding of a project which would maintain a data base of land ownership, a display of detailed conceptual plans, company plans that border their property, and land use changes. This data base would be active with continual updating.

4. Industry personnel have expressed a desire for highly detailed, accurate maps which display property ownership. Government agencies must continually update mining and reclamation maps. A central mapping system designed to update the map "Current Status of Phosphate Lands" while including reclamation data would prevent duplication of effort in both the private and public sector.

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