FINAL
ENVIRONMENTAL IMPACT STATEMENT

Shell Western E&P Inc.
Miccosukee 3-1 Exploratory Well
Miccosukee Indian Reservation, Broward County, Florida

July 29, 1994

Bureau of Land Management
Eastern States
Jackson District
Jackson, Mississippi

Bureau of Indian Affairs
Eastern Area Office
Arlington, Virginia

Miccosukee Tribe of Indians of Florida
Miami, Florida

DAMES & MOORE
Boca Raton, Florida

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206

IN REPLY REFER TO:

July 29, 1994

Dear Interested Party:

This is a copy of the Final Environmental Impact Statement (EIS) for the proposed Miccosukee 3-1 well. The proposed well is on the Miccosukee Indian Reservation in Broward County, Florida. The "Application for Permit to Drill" was submitted to this office by Shell Western E&P Inc. (SWEPI) on January 17, 1991.

The environmental firm of Dames & Moore located in Boca Raton, Florida has prepared the EIS under a third party contract with the Bureau of Land Management (BLM), the Bureau of Indian Affairs (BIA) and SWEPI. The BLM and BIA have been joint lead agencies in directing the preparation of the EIS.

The Draft EIS was released on March 8, 1993 and was available for public comment until August 18, 1993. Considerable oral and written comments were received on the Draft EIS. The Final EIS includes responses to substantive comments with changes in the text of the EIS, as appropriate. Every effort has been made to identify and address all substantive comments.

We thank you for your interest in the analysis of the proposed well. We invite your written comments on the Final EIS. Comments, accepted until August 29, 1994, should be sent to:

Robert V. Abbey
District Manager
Bureau of Land Management
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206

For further information, contact me at (601) 977-5400 or Jim Harriman of BIA at (703) 235-3177.

Sincerely,

Robert V. Abbey
District Manager

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Miccosukee
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FINAL
ENVIRONMENTAL IMPACT STATEMENT

SHELL WESTERN E&P INC.
MICCOSUKEE 3-1
EXPLORATORY WELL
BROWARD COUNTY, FLORIDA

Prepared By

U.S. Department of the Interior
Bureau of Land Management
Eastern States
Jackson District Office
Jackson, Mississippi

U.S. Department of the Interior
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July 29, 1994

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COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT
MICCOSUKEE 3-1 EXPLORATORY WELL
BROWARD COUNTY, FLORIDA

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ABSTRACT

This Final Environmental Impact Statement (FEIS) analyzes the impacts of the Shell Western E&P Inc. proposal to drill an exploratory well and test the potential hydrocarbon bearing formations at a site located in Section 3, Township 50 South, Range 35 East, near the intersection of Interstate Highway 75 and South Florida Water Management District Canal L-28, on the Miccosukee Indian Reservation located in Broward County, Florida, approximately 40 miles west of the City of Fort Lauderdale.

The Bureau of Land Management and Bureau of Indian Affairs have joint lead responsibility for the preparation of the FEIS. The U.S. Geological Survey, Water Resources Division in Miami is participating in the analysis as a Cooperating Agency.

This FEIS provides the documentation of the analysis of the proposed action and alternatives based on significant issues and concerns identified through the scoping process. Interdisciplinary participation has been provided by the environmental consulting firm of Dames & Moore, Inc., under a third party contract. The FEIS has integrated to the fullest extent possible consultation, surveys and studies required under various Federal laws and executive orders including the Endangered Species Act of 1973, the National Historic Preservation Act of 1966 and Executive Order 11990 (Protection of Wetlands).

The FEIS is being circulated for review and comment to appropriate Federal, State and local agencies, the Miccosukee Tribe, Shell Western E&P Inc. and all individuals and organizations wishing to have a copy. Comments on this FEIS will be accepted until August 29, 1994. A Record of Decision will be prepared following review of the comments on the FEIS. The decision regarding the proposal will be made by the Authorized Officer, Bureau of Land Management, as provided by 43 CFR, Subpart 3161 in consultation with the Bureau of Indian Affairs. The analysis does not indicate that the proposed action would require other Federal permits, licenses, or entitlements. The analysis also indicates that Alternatives B and C may require other Federal permits.

FEIS contact:

Questions and comments on this FEIS should be directed to:

Robert V. Abbey
District Manager
Bureau of Land Management
Jackson District Office
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206
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SUMMARY

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S.0 SUMMARY

S.1 Background

This Final Environmental Impact Statement (FEIS) analyzes the impacts of the Shell Western E&P Inc. (SWEPI) proposal to drill an exploratory well and test the potential hydrocarbon (oil and gas) bearing formations at a site located in Section 3, Township 50 South, Range 35 East, near the intersection of Interstate Highway 75 (I-75) and South Florida Water Management District (SFWMD) Canal L-28, on the Miccosukee Indian Reservation located in Broward County, Florida, approximately 40 miles west of the City of Fort Lauderdale (Figures 1-1 and 2-2).

SWEPI, the proponent of the exploratory drilling action, submitted an Application for Permit to Drill (APD) to the Bureau of Land Management (BLM), Jackson District Office, on January 17, 1991. The BLM determined initially that an Environmental Assessment (EA) would be required and proceeded with scoping. Public scoping was conducted from March 1991 through May 1992 to solicit comments on the proposed action. Substantial public concern was expressed regarding the proposal due to the sensitivity of the Everglades and Big Cypress Swamp environments and associated natural resources.

On April 16, 1992, BLM issued a Notice of Intent to prepare an environmental impact statement (EIS). The notice explained that the decision to expand the analysis from an EA to an EIS was not based on any changes in the proposal's anticipated impacts but was made to recognize expressed public concerns and to assure the public that potential environmental impacts of the proposal would be thoroughly analyzed and addressed. The notice further stated that any proposal for additional wells or production would require additional National Environmental Policy Act (NEPA) review and decision documents.

The BLM and Bureau of Indian Affairs (BIA) concluded that an EIS would ensure that the final decision would be based on all relevant factors and that the full NEPA process would result in enforceable mitigation measures, if such were found to be required, through the published Record of Decision (ROD).

The purpose of the FEIS is to provide the agency decision makers (BLM and BIA) with information upon which to base a final decision. It also serves as the means of documenting the analysis, identifying potential environmental impacts and mitigation measures, and informing and involving the public in the analysis process. The BLM and BIA have joint lead responsibility for the preparation of the EIS. BLM has administrative lead responsibility. The U.S. Geological Survey, Water Resources Division (USGS) in Miami is participating in the analysis as a Cooperating Agency.

This FEIS provides documentation of the analysis of the proposed action and alternatives, based on significant issues and concerns identified through the scoping process and public and agency review of

a Draft Environmental Impact Statement (DEIS) completed on March 8, 1993. The evaluation of the proposal and alternatives was accomplished by an interdisciplinary review with representatives from the BLM and BIA. Interdisciplinary participation has been provided by the environmental consulting firm of Dames & Moore, under a third party contract. The FEIS is being circulated for review and comment to appropriate Federal, State and local agencies, the Miccosukee Tribe, SWEPI and all individuals and organizations wishing to have a copy.

The FEIS was prepared following review of the comments on the DEIS. Ninety-five issues were identified and addressed in the FEIS. The decision regarding the APD will be made by the Authorized Officer, BLM, as provided by 43 Code of Federal Regulations (CFR), Subpart 3161 in consultation with the BIA. The ROD is a separate public record that will be issued at least 30 days after the EPA Notice of Availability of the FEIS.

S.2 Proposed Action and Alternatives

S.2.1 Alternative A - Proposed Action

SWEPI Miccosukee 3-1 Well Site and Proposed Access Route

The proposed action includes drill site construction, improvement of existing access roads, exploratory drilling, well evaluation and testing, temporary abandonment (if the well is capable of production) or final abandonment and plugging (if the well is dry) and reclamation.

SWEPI proposes to drill a directional well to a true vertical depth (TVD) of 17,730 feet. The measured depth (MD) of the well would be approximately 18,850 feet, with the bottom hole approximately 4,700 feet east of the surface site. Construction of the drill site would take approximately 30 days. Drilling and evaluation of the well requires an additional 145 days. Testing of oil producing zones (if found) would require up to an additional 30 days. Reclamation would require an additional 120 days.

The proposed drill site is located on pasture land 3 miles east of the Collier-Broward County Line, 1000 feet north of I-75 and immediately west of the L-28 Canal and Water Conservation Area 3A (WCA-3A) (Figure 2-3).

The proposed drill site would occupy approximately five acres of improved pasture. The drilling rig and associated equipment would be located on a specially designed pad. The pad would be constructed of select fill material topped with 18 inches of crushed limerock, compacted to 12 inches. The drill site would include a four-foot perimeter berm which would be constructed with three feet of select fill and one foot of crushed limerock to minimize erosion during rainstorms. The berm would encompass the

complete drill site and would serve to: 1) contain all stormwater and/or any spilled material, and 2) exclude flood waters that could occur during heavy rainstorms or hurricane events.

The area under the rig equipment would be trenched and a plastic liner installed to minimize the possibility of any contaminants leaching into the soil. The plastic-lined section would have a one-foot berm around it, such that all rain water and fluids normally in contact with the rig, including drilling mud and rig wash down water, would drain to this plastic lined area. The collected fluids would then be pumped to a storage tank and used in the drilling fluid.

Major highway access to the drill site would be provided via I-75 from the east and/or west to the Snake Road (a/k/a Josie Billie Road) interchange, located west of the proposed drill site. Local highway access is via Snake Road to a point about 4 miles north of the I-75 interchange where an existing earth and rock-filled road intersects Snake Road from the east. From this point the route runs east approximately one and one-half miles to the L-28 Canal and then south parallel to the canal on an existing farm road for approximately four miles to the proposed drill site.

The proposed access route from Snake Road is an existing earthen berm approximately 15 feet in width, and consists of a one-lane, rock-filled roadbed. The proposed access route would be topped with crushed limerock to create a smooth road surface capable of handling the traffic of rig and testing equipment. The condition of the crushed limerock roadbed would be evaluated and additional material would be added as necessary. The proposed access route would continue to be a one lane route. Limited widening at selected locations would be required for vehicle turnouts to allow the safe passing of opposing traffic. These 100 foot long vehicle turnouts would be constructed at intervals of between 1/2 to 3/4 mile, resulting in the placement of fill on 0.4 acres of improved pasture. Upon completion of the project, the well site and vehicle turnouts would be reclaimed or left in place if desired by the Miccosukee Tribe.

S.2.2 Alternatives to the Proposed Action

As identified through interdisciplinary review, alternatives to the proposed action that meet the stated geologic objectives are limited by environmental considerations and technological constraints. Two alternative access routes known as the West Access Route and East Access Route have been identified. Alternatives to the proposed well site are limited to the "No Action" Alternative.

S.2.2.1 Alternative B - West Access Route

This access route originates from the Snake Road interchange and travels north approximately 400 feet to the Miccosukee Service Plaza. From this point the access route travels east, directly north of the I-75 borrow canal for approximately 1.6 miles to the drill site. Because this alternative access route is

unimproved, approximately 1.6 miles of new road construction is required. Road construction would require several feet of fill to create a one-lane access road (15 feet top width) and vehicle pullouts. Approximately three acres of pasture including 0.25 acres of marsh would be filled. Placement of fill in the marsh would require a Section 404 permit from the U.S. Army Corps of Engineers (COE). Fill would be hauled to the site from a commercial off-site source. After completion of the project, the road would be reclaimed or left in place if desired by the Miccosukee Tribe.

S.2.2.2 Alternative C - East Access Route

The East Access Route originates from I-75 westbound at the exit ramp to the SFWMD S-140 pump station located east of the L-28 Canal. From that point the access route connects to a private road, maintained by the SFWMD, extending north to a point that is directly across from the drill site and separated by the L-28 Canal. The existing exit ramp and SFWMD road appear in good condition and able to handle project traffic and rig equipment weight. However, a vehicular bridge would have to be constructed across the 100-foot wide L-28 Canal to access the drill site. This bridge would most likely be of pre-cast concrete construction similar to the adjacent I-75 bridges. Only one lane would be required. This alternative would require a Section 404 permit from the COE and a right-of-way usepermit from SFWMD and/or the Florida Department of Transportation (FDOT) and approval by the Federal Highway Administration (FHWA). After completion of the project, the bridge could either be dismantled or left in place, if desired by the Miccosukee Tribe. This alternative would not require construction of any new roads or result in additional filled acreage. The FHWA is opposed to use of this access route if other alternatives are practical.

S.2.2.3 No Action Alternative

The third alternative to be analyzed is the No Action Alternative which would result in denial of the APD. This alternative would provide for the continuance of other land management activities presently occurring on the project site.

S.2.2.4 Alternatives Considered But Not Analyzed in Detail

One of the issues identified through scoping was eliminating the need for the project by utilizing alternative energy sources. This alternative to the proposal is not considered practical or feasible for several reasons as follows: The BLM and BIA do not have any means or authorization to require uses of alternate energy sources as an alternative to the proposal. This alternative would not fulfill the purpose or intent of the proposed action, to determine if hydrocarbons are present in the area of the proposed action, within the Miccosukee Reservation. In addition, this alternative would not be consistent with the intent of the Indian Mineral Development Act of 1982 (IMDA); to allow any Indian tribe to enter into

any Minerals Agreement; providing for the exploration of mineral resources. Hence, this alternative is not considered a reasonable alternative to the proposed action and is not within the scope of the analysis.

In addition to Alternatives A, B, C, and the No Action Alternative, other alternatives were considered. However, alternatives that meet the stated purpose and geologic objectives of the proposed action are limited by technological constraints and environmental considerations. Four alternative well sites were identified, but not analyzed in detail for various reasons. These alternatives included:

- Drilling the well from a surface location directly above the Sunniland target. This alternative was eliminated due to the nature of the well as a wildcat exploratory well and the location in WCA-3A.

- Drilling the well from a location 2,000 feet east of the Sunniland target. This alternative was eliminated due to technical limitations of directional drilling (multiple angles in the required directional path) and location of the surface site in WCA-3A.

- Drilling the well from a location 700 feet west, slightly northwest, or slightly southwest of the proposed well site. This alternative was eliminated due to wetland impacts.

- Drilling the well from a location within the circumference of a circle with a radius of 2,600 feet projected from a center located 1,100 feet west of the Sunniland target. This alternative was dismissed due to location in WCA-3A and/or in wetlands, and the nature of the well as a wildcat exploratory well.

S.3 Scope of Analysis

The BLM and BIA have determined that the scope of this FEIS includes the proposed action and reasonable alternatives to the proposed action, including the No Action Alternative and mitigation measures. The FEIS includes analysis of the direct, indirect and cumulative impacts of the proposed action and alternatives.

Production of the single well or field development are not proposed or reasonably foreseeable and are not subject to review in this FEIS. However, Appendix A-1 provides a discussion of well and field development including the probability of discovery, field development operations and facilities, impacts associated with typical development in South Florida and the environmental review process used to analyze hydrocarbon development activities.

Public issues and comments regarding the SWEPI proposal were solicited for incorporation into this FEIS through the scoping process and public and agency review of a DEIS. Scoping for the SWEPI Miccosukee 3-1 well proposal was initiated by BLM on March 22-28, 1991, by a Notice of Request for Comments published in seven Florida newspapers. This notice described the proposed action, announced that an EA would be prepared and requested public comments by May 3, 1991. Approximately 350 letters or petitions were received by the BLM in response to the notice. In response to public comments, the BLM issued a Notice of Intent to Prepare an EA and Notice of Public Meeting. The Notice was published in the Federal Register on December 24, 1991, and in the Tallahassee Democrat, Fort Lauderdale News/Sun Sentinel and Palm Beach Post on January 6, 1992. News releases were sent to the Fort Lauderdale News/Sun Sentinel, Palm Beach Post and Miami Herald.

The public scoping meeting was held on January 23, 1992, at the Fort Lauderdale Airport Hilton in Dania, Florida. Approximately 300 people attended the meeting and were invited to comment orally and/or in writing until February 14, 1992.

In response to this notice and public meeting, approximately 312 additional letters were received.

On April 16, 1992, the BLM issued a Notice of Intent to Prepare an EIS in the Federal Register and in the Tallahassee Democrat, Fort Lauderdale News/Sun Sentinel and the Palm Beach Post. News releases were sent to 25 newspapers and 4 television stations. The notice provided for an additional opportunity to comment until May 18, 1992.

In addition to the public notices and news releases issued by BLM, an interested parties list containing approximately 380 individuals and organizations was maintained by BLM, and those individuals or organizations on the list were informed of scoping activities and provided a scoping document. In addition, news releases issued by SWEPI and the Miccosukee Tribe, and media coverage of the proposal and public meeting further informed the public of the scoping process.

The DEIS was completed on March 8, 1993. The public comment period extended from May 18, 1993 to August 18, 1993. Numerous notices, news releases, and mailed notices to those who participated in the scoping process were issued to advise the public of availability of the DEIS for review and comment. A public hearing and open house was held at the Greater Fort Lauderdale-Broward County Convention Center on April 14, 1993. Fifty-one people provided verbal comments at the hearing. A total of 425 comment letters from individuals, businesses, organizations and government agencies were received by the BLM during the 5 month public comment period.

Significant concerns and issues identified during scoping and DEIS review, in addition to concerns and issues identified by agencies and the interdisciplinary team (IDT), are addressed in detail in this FEIS. Significant issues included:

1) Potential impacts to air quality resulting from emissions of process contaminants and/or an oil fire.

2) Potential impacts to archeological sites by the well site or access road construction.

3) Proper analysis of the economic and/or environmental benefits and environmental risks of developing oil resources in the Everglades ecosystem to determine the feasibility of the project.

4) Proper handling and disposal of hazardous material and waste products associated with the project, which may not be directly regulated under the Resource Conservation and Recovery Act of 1976 (RCRA) due to an exemption of certain wastes associated with petroleum exploration and development activities from hazardous waste designation.

5) Potential negative and positive impacts to the lifestyle of the Miccosukee Indians.

6) Contribution of the proposed project to cumulative environmental impacts to the Everglades ecosystem, which has been adversely impacted by agriculture and urbanization.

7) Potential adverse impacts to wildlife, particularly the Florida panther, wood stork, Everglades kite and Everglades mink. Impacts of noise, lights and traffic on fauna.

8) Potential impacts to wetlands and native plant communities from well site and access road construction.

9) Potential pollution of groundwater and surface water by well casing leaks, oil spills, spilled brine water, or emissions caused by hurricane or flood damage to rig facilities. Potential impacts to the Biscayne aquifer, WCA-3A and the Everglades National Park (ENP). Contingency plans and bond coverage for such occurrences.

10) Potential economic loss if a spill occurs (by reduction in tourism resulting from damage to environment/fishing).

11) Cumulative impacts of future actions required for production and/or field development.

12) Adequacy of mitigation, monitoring, reclamation, spill response, containment/cleanup plans for the construction and operation of the proposed well.

13) Potential effects of the release of hydrogen sulfide (H_2S) gas on wildlife and humans.

14) Eliminating the need for the project by utilizing alternative energy sources, developing an energy policy which encourages development of renewable energy resources, and adopting structured energy conservation measures.

15) Impacts associated with transportation and increased traffic.

16) Relationship of the proposal to State and local laws.

17) Safety of technological aspects of the proposal including directional drilling technology and proposed plastic liner under portions of drill site.

Analysis of public and agency comments received during the DEIS review period resulted in the identification of 95 substantive issues. These issues pertain to one of 21 major topics. The major topics and corresponding issues are listed in Section 5.1.4 of the FEIS.

The DEIS was edited to correct errors and omissions noted in the public and agency comments. The FEIS reflects those changes. The response to many of the comments required clarification or expansion of information provided in the DEIS. The response to some comments required corrections or new information. Significant changes which have been incorporated in the FEIS include the following:

- more comprehensive discussion regarding construction of the proposed access route and alternatives (including the no action alternative) has been added.
- discussion of potential air emissions (including mercury) from gas flaring has been added.
- expansion of the discussion of cumulative impacts.
- the location of the Biscayne aquifer has been corrected to 2.8 miles east of the proposed drill site.
- a figure depicting the limits of the Biscayne aquifer in Broward County has been added

- a discussion of EPA's determination that the proposed action and alternatives are not subject to the provisions of the Sole Source Aquifer Program is provided.
- updated information regarding the current status of the diesel fuel spill at the S-140 pump station has been added.
- discussion of an updated wetland jurisdictional determination completed by the Corps of Engineers in March, 1994 is included.
- discussion of additional consultation with SFWMD regarding canal right-of-way issues has been included.
- the discussion of Naturally Occurring Radioactive Material has been expanded to include production water sample results from South Florida oil fields.
- a table listing drilling fluid components and the quantities to be used has been added.
- the Florida panther range map has been replaced with a more recent map from the 1994 report entitled Florida Panther Habitat Protection Plan, South Florida Population.

In addition, the following recommended mitigation measures have been added to the FEIS:

- specific procedures for the testing and disposal of drill cuttings, drilling fluids and produced waters could be conducted and reported to BLM.
- fluids disposal program information could be submitted to BLM prior to fluids disposal. BLM could provide the plans monitoring data, and test results to EPA for its information.
- a site specific SPCC plan could be completed and submitted to BLM prior to site operations.
- the drill site liner could be extended to include the 10 ft. by 200 ft. area which connects the drill rig and cutting storage containment area.
- locking caps could be placed on all water supply and monitoring wells in the event of temporary abandonment.
- testing of monitoring wells for Total Recoverable Petroleum Hydrocarbons could be conducted.

The detailed response to each of the 95 issues can be found in Section 5.1.4 of the FEIS.

S.4 Major Impact Conclusions

Drilling of the proposed SWEPI Miccosukee 3-1 exploratory well would cause short-term disturbance to and displacement of components of the human and natural environments. Potential environmental impacts that could result from implementation of the proposed action or alternatives are detailed in Chapter 4 of the FEIS, with a comparative analysis also included in Chapter 4. Proposed mitigation measures are also presented in Chapter 4. Critical elements of the environment not present or not affected include: wild and scenic rivers; wilderness; farmlands (prime or unique); Areas of Critical Environmental Concern (ACEC); floodplains; and coastal zone management. Summaries of impacts that could occur to elements of the environment are presented in S.4.1 through S.4.13.

S.4.1 Air Quality

Implementation of the proposed action and alternatives would have no significant impact on air quality either in the short or long-term. Impacts on air quality are discussed in greater detail in Sections 3.1 and 4.1.

Possible insignificant impacts could include suspended particulate matter from construction activities, combustion emissions from vehicle traffic and construction machinery, and accidental emissions of pollutants such as H_2S or sulfur dioxide during exploratory drilling or well evaluation and testing activities. No significant impacts would occur, however, with implementation of appropriate prevention and safety measures.

S.4.2 Cultural Resources

No significant impacts to cultural resources are expected to occur from implementation of the proposed action and alternatives. Three archeological sites are known to exist within one mile of the well site. All three areas are located on tree islands (hammocks), as are most archeological sites in the area. All tree islands in the area are avoided by the proposed action and alternatives. If any evidence of archeological artifacts or activity is encountered during site construction, all work would cease and the State Division of Historical Resources (DHR) would be notified. Impacts to cultural resources are discussed in detail in Sections 3.3.2 and 4.3.2.

S.4.3 Geology and Soils

No significant impacts on the geologic environment are expected. Geologic hazards (earthquakes, sinkholes) are not likely to impact the proposed project. The location of the proposed well is important to obtaining adequate information about the target geologic structure to assess potential hydrocarbons. Soil impacts would primarily relate to removal and stockpiling of soil and placing fill material over a five-acre area for well site construction. Additional fill areas for access road construction would amount to 0.4 acres for the proposed access route, and 3.0 acres for the West Access Route. The East Access Route would require placement of piles in the bottom of the L-28 Canal to support a vehicular bridge. Upon project completion, the fill areas would be reclaimed to predisturbance conditions or left in place if desired by the Miccosukee Tribe. No significant impacts to soils are expected to occur from implementation of the proposed action and alternatives. Impacts on the geologic and soils environments are discussed in detail in Sections 3.3.3. and 4.3.3.

S.4.4 Health and Safety

No significant impacts from H_2S exposure or the increase in vehicular traffic are expected, provided that best management precautions, applicable mitigation measures, and requirements of Onshore Oil and Gas Operations regulations (43 CFR, Part 3160) and related guidelines are followed. Impacts to health and safety are described in detail in Section 4.3.4 and in Appendix A-3.

S.4.5 Noise

Significant impacts from noise produced by the proposed action and alternatives are not expected to occur. Since residences are not in the area, noise impacts to humans (other than site workers) are not a concern. Short-term noise would be generated by construction and drilling equipment. Noise levels would be in the range of 80 decibels (dB) near the source and <50 dB at a distance of 800 feet from the source. Some wildlife may be disturbed by the noise, but it should be noted that I-75 and the S-140 pump station are located only 1,000 feet from the drill site. Noise measurements for these facilities are not available, but the types and levels of noises generated by these facilities are expected to be similar to those emitted from the project. Noise impacts would be limited to the duration of the project. The impacts associated with noise are discussed in detail in Sections 3.3.5 and 4.3.5.

S.4.6 Socioeconomics

No significant negative socioeconomic impacts would result from implementation of the proposed action and alternatives. Positive socioeconomic impacts could be realized by the Miccosukee Tribe through the

collection of lease fees and subsequent improvement of Tribal programs. Socioeconomic impacts are discussed in detail in Sections 3.3.6 and 4.3.6.

S.4.7 Transportation

Significant impacts to transportation are not expected. Impacts to the existing transportation network in the vicinity of the proposed project would be limited to a temporary increase in vehicle traffic. Because project traffic is anticipated to be only 10 to 25 vehicles per day (VPD), significant increases in traffic volumes would not occur. I-75 and Snake Road are considered lightly traveled relative to their designed level of service (LOS). Truck weights and sizes would be confined to limitations established by FDOT. Impacts to transportation are described in more detail in Sections 3.3.7 and 4.3.7.

S.4.8 Vegetation

Significant impacts to vegetation are not anticipated. The clearing of vegetation, the disturbance of soils, and the deposition of fill during construction of the five-acre drill site and access road alternatives would directly impact the specific site vegetation. The reduction of areal cover of the affected vegetative community types would be a negligible impact since the communities have a widespread distribution and occur with high frequency within the project area. Vegetation impacts would for the most part be confined to five to eight acres of improved pasture areas. The exception is the impact to 0.25 acres of marsh that would result from access Alternative B. Areas disturbed by construction would be reclaimed to support the preconstruction vegetation or left as fill areas if desired by the Miccosukee Tribe for other purposes. Impacts on vegetation are described in more detail in Sections 3.3.8 and 4.3.8.

S.4.9 Visual Resources

The short-term impacts associated with the construction of the drill site and erection of the drill rig at the drill site would be considered insignificant by most viewers due to the limited viewpoint of the project site from I-75 and the existence of other obstructions including billboards and microwave towers.

The construction and use of access roads would produce additional minor impacts to the visual resource. The impact of the proposed action would not be considered significant due to existing conditions and the temporary nature of the project. Impacts to visual resources are described in detail in Sections 3.3.9 and 4.3.9.

S.4.10 Waste Management

The Plan of Operations for the proposed well extensively outlines the management and containment of generated wastes. Produced wastes would include stormwater runoff, drilling muds, drill cuttings, brine water, oil and solvents, solid waste, and domestic waste. If the well is successful (hydrocarbons are discovered), oil spills or oil/brine spills are additional potential wastes. Proper management and disposal of wastes would minimize the risk of environmental contamination by wastes associated with the proposed action. An accident or catastrophic occurrence could disperse wastes, resulting in impacts to the surrounding area. The SWEPI Spill Prevention, Control and Countermeasure Plan (SPCC) (Appendix A-10) would be implemented to minimize the impacts. Impacts related to waste management are discussed in detail in Sections 3.3.10 and 4.3.10.

S.4.11 Water Resources

No significant impact to water resources is expected. Construction and operation of the proposed access road or Alternative B access road could contribute to minor increased sediment input to canals which parallel its route. The potential exists for contamination of surface water by spilled fuels, lubricants, hydraulic fluids, and oil which may be obtained during production testing. Local freshwater aquifers may be contaminated by leakage of drilling fluids or produced oil and by mixing of groundwater between aquifers. The implementation of SWEPI's proposed construction and operational safeguards, best management practices, and the requirements of Onshore Oil and Gas Operations regulations (43 CFR, Part 3160) and related guidelines would greatly reduce the probability of these conditions from occurring.

Important potable groundwater sources such as the Biscayne aquifer, and sensitive surface waterbodies (WCA-3A), are sufficiently protected by distance and/or physical barriers to potential contaminant migration so as to be unaffected by the proposed drilling.

Water use at the site would be approximately 7,500 gallons per day obtained from two shallow on-site wells. Impacts to water resources are discussed in detail in Sections 3.3.11 and 4.3.11.

S.4.12 Wetlands

Significant wetland impacts resulting from the proposed action and alternatives are not expected to occur. The well site and proposed access route would not impact wetlands. The West Access Route (Alternative B) would require placement of fill in 0.25 acres of marsh. The East Access Route (Alternative C) would require placement of a vehicular bridge and associated pilings across the L-28 Canal. Wetland impacts are discussed in detail in Sections 3.3.12 and 4.3.12.

S.4.13 Wildlife

Significant direct impacts to wildlife in general are not anticipated for the proposed action and alternatives. Well construction would occur within only five acres of existing disturbed area (pasture). The well site does not support significant populations or taxa of wildlife. Important habitat areas (willow heads, marsh, cypress heads, and hammocks) are avoided by the proposed action and Alternative C. The West Access Route (Alternative B) would impact 0.25 acre of marsh habitat and approximately three acres of pasture area.

Negative impacts to threatened or endangered wildlife species are not anticipated for the proposed action and alternatives. An alligator nest has been known to occur along the west side of the L-28 Canal approximately one mile north of the well site. The nest was utilized in 1989 and 1990 but did not occur in 1991, 1992, or 1993. Construction of the proposed access road would not likely affect the nest area unless activity occurs during critical nesting phases, including nest building and egg laying. Other Federal-listed species that exist in the region but are not known to or expected to utilize the site of the proposed action and alternatives for foraging and/or nesting. These include the Florida panther, Florida black bear, Florida Everglades mink, Everglades snail kite, bald eagle, Eastern indigo snake, Audubon's crested caracara, wood stork, and Southeastern American kestrel. Wildlife impacts are discussed in detail in Sections 3.3.13 and 4.3.13.

S.5 Mitigation and Monitoring

Mitigation measures and monitoring requirements have been identified through the analysis of potential impacts in Chapter 4. These measures and requirements are summarized in Section 4.4. The measures and requirements describe how construction, drilling operations, and reclamation should be managed to assure compliance with the applicable resource limitations identified during the interdisciplinary analysis.

S.6 Agency Preferred Alternative

Alternative B (West Access Route) is the Agency Preferred Alternative.

The BLM authorized officer is authorized and directed to require compliance with lease agreement terms, regulations under 43 CFR and all other applicable regulations; and to require that all lease operations be conducted in a manner which protects natural resources, environmental quality, life and property. It is the opinion of the BLM, in consultation with BIA, that the analysis presented in this FEIS shows that Alternative A, the Proposed Action, as well as Alternatives B and C, with recommended mitigation, comply with the terms of the lease agreement and all applicable regulations, and assures protection of

natural resources, environmental quality, life and property. Hence, the No Action Alternative is not warranted.

The DEIS identified Alternative A as the Preferred Alternative. However, Alternative B was identified as a second choice, if jurisdictional conflicts relating to access along the berm road west of the L-28 Canal prohibit selection of Alternative A. Following completion of the DEIS, additional consultation was initiated with the SFWMD and the Miccosukee Tribe concerning this issue. This jurisdictional conflict, documented by letters found in Appendix A-12, can be summarized as follows:

> The SFWMD asserts a right-of-way for the L-28 component of the Central and Southern Florida Flood Control Project. On May 13, 1993, the Governing Board of the SFWMD adopted Resolution 93-18 opposing the construction of exploratory wells in, adjacent to, or under any Water Conservation Area (WCA) within the Everglades. The Resolution states that the Governing Board is against the use of District's property for the access or transportation facilities that may be required. By letter dated February 18, 1994, SFWMD claims authority to require SWEPI to apply for a permit to utilize any portion of the asserted L-28 right-of-way.
>
> The Miccosukee Tribe disputes the SFWMD position. The Tribe maintains that neither the Tribe nor any of its lessees, including SWEPI, need to obtain a permit from SFWMD for use of the western berm road, as proposed by SWEPI (Alternative A). The Tribe's position is documented in a letter from the law firm Hobbs, Straus, Dean & Wilder dated March 24, 1994.

Based on the conflicting positions of the SFWMD and the Miccosukee Tribe, a jurisdictional conflict exists between two governmental entities concerning the access route under Alternative A. This conflict cannot be resolved through the NEPA process.

The Tribe recommends that the BLM and BIA consider Alternative B (West Access Route) as the Preferred Alternative since this route provides an acceptable route without any jurisdictional conflict.

Alternative B considers construction of the West Access Road from Snake Road to the well site. Since Alternative B requires construction of a new access road, the DEIS noted that impacts associated with this alternative would be greater than impacts associated with Alternatives A and C. However, the impacts associated with Alternative B were not found to be significant.

SUMMARY

The Agencies' selection of this alternative would be subject to the following conditions:

(a) If a discovery of commercial quantities of hydrocarbons is made, further exploration, production and development in the area of the well would not be considered until an EIS of field development has been completed. In this event, the applicant would be required to submit a conceptual field development plan to the BLM. The conceptual field development plan must describe the extent, location, duration and timing of additional wells and other facilities.

(b) All mitigation measures and monitoring requirements identified in Chapter 4 would be required.

(c) SWEPI would provide a road design plan to BLM prior to construction.

INTRODUCTION

CHAPTER 1

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1.0 INTRODUCTION

1.1 Introduction

1.1.1 Project Background

This FEIS has been prepared to analyze the potential impacts of an exploratory well proposed by SWEPI, a subsidiary of Shell Oil Company. SWEPI submitted an APD to the BLM on January 17, 1991. SWEPI proposes to drill and test an exploratory well to assess hydrocarbon potential on the Miccosukee Indian Reservation (Miccosukee Reservation) located in Broward County, Florida, approximately 40 miles west of the City of Fort Lauderdale. The proposed well, identified as SWEPI Miccosukee 3-1, is located in Section 3, Township 50 South, Range 35 East, near the intersection of I-75 and SFWMD Canal L-28.

The proposed project involves construction of a five-acre well site, improving approximately 5.5 miles of existing road, drilling of a single exploratory well; production testing of hydrocarbon bearing formations (if encountered); and temporary abandonment (if hydrocarbons are found), or permanent abandonment and reclamation (if the well is a dry hole).

The 17,730 foot TVD well is proposed to be directionally drilled to a measured depth of approximately 18,850 feet, with the bottomhole approximately 4,700 feet east of the surface site. Construction of the drill site would take approximately thirty days. Drilling and evaluation of the well would require an additional 145 days. Production testing would require up to an additional 30 days. Abandonment and reclamation would require up to 120 days.

1.1.2 Environmental Analysis Process

The hydrocarbon rights on the Miccosukee Reservation were leased to SWEPI by the Miccosukee Tribe of Indians of Florida (Miccosukee Tribe) in 1989 through a lease agreement that was authorized through the IMDA and approved by the BIA.

Further implementation of the IMDA requires the BIA to provide oversight for lease management and the BLM to review all operational activities carried out within the context of the lease. Operational oversight is conducted in compliance with Public Lands Regulations promulgated in 43 CFR, Part 3160.

The APD is an operational activity subject to compliance with 43 CFR. By definition, the APD is a proposed action requiring Federal (BLM) approval. As such, the APD must be reviewed for compliance with various statutes, laws and regulations including NEPA, implemented through regulations in 40 CFR, Parts 1500-1508.

The vehicle for compliance review of NEPA and other applicable Federal regulations is an EA or EIS. Upon receipt of the APD, BLM determined that an EA would be required. The decision to prepare the

more detailed EIS was subsequently made by BLM and BIA during the initial scoping process. The decision to prepare an EIS was not based on any changes in the proposal or anticipated impacts, but was made in order to demonstrate the agencies' recognition of the public concerns and to assure that the potential environmental impacts of the proposal would be thoroughly addressed.

The purpose of the EIS is to provide the agency decision makers (BLM and BIA) with information upon which to base a final decision that is fully informed and based on factors relevant to the proposal. It also serves as the means of documenting the analysis of the proposed action and alternatives; identifying potential environmental impacts and mitigation measures. The BLM and BIA have joint lead responsibility for the preparation of the EIS. BLM has administrative lead responsibility. The USGS in Miami is participating in the analysis as a Cooperating Agency as provided in 40 CFR, Part 1501.6. The USGS has special expertise concerning surface and groundwater resource considerations and is designated as the Federal authority concerning such resources.

The DEIS provided documentation of the analysis of the proposed action and alternatives. The analysis was based on significant issues and concerns identified through the scoping process. The DEIS was circulated for review and comment to appropriate Federal, State and local agencies, the Miccosukee Tribe, SWEPI, and all individuals and organizations wishing to have a copy. The FEIS was prepared following review of comments received regarding the DEIS.

The decision regarding the APD will be made by the Authorized Officer, BLM, under the 43 CFR, Subpart 3161 as provided by 25 CFR, Part 225 in consultation with the BIA.

1.1.3 Issues and Concerns

On March 22, 1991, the BLM published a Notice of Request for Comments in seven local newspapers announcing the proposed project and inviting public comment until May 5, 1991. Approximately 350 letters or petitions were received in response to the notice. On December 24, 1991, Notice of Intent to prepare an EA was published in the Federal Register. The notice also announced a public scoping meeting. On January 6, 1991, legal notices were published in the Tallahassee Democrat, Fort Lauderdale News/Sun Sentinel and the Palm Beach Post. News releases were sent to the Fort Lauderdale News/Sun Sentinel, Palm Beach Post and the Miami Herald. On January 23, 1992, the public scoping meeting was held in Dania, Florida. The meeting was attended by approximately 300 citizens. An additional 312 letters were received in response to this second notice. Many of the comments urged the agencies to require an EIS instead of an EA, to assure that potential environmental impacts of the proposed project would be fully addressed. In response, a Notice of Intent to prepare an EIS was published in the Federal Register on April 16, 1992. This notice was also published in the Tallahassee Democrat, Fort Lauderdale News/Sun Sentinel and the Palm Beach Post with news releases to 25 newspapers and 4 television

stations. This notice provided for comment until May 18, 1992. Approximately eight additional letters were received in response to this third notice.

Comments made at the public scoping meeting and in letters received by the BLM during the three comment periods included several significant issues. The comments were analyzed and organized as follows:

1) Potential impacts to air quality resulting from emissions of process contaminants and/or an oil fire.

2) Potential impacts to archeological sites by the well site or access road construction.

3) Proper analysis of the economic and/or environmental benefits and environmental risks of developing hydrocarbon resources in the Everglades ecosystem to determine the feasibility of the project.

4) Proper handling and disposal of hazardous material and waste products associated with the project, which may not be directly regulated under the RCRA due to an exemption of certain wastes associated with petroleum exploration and development activities from hazardous waste designation.

5) Potential negative and positive impacts to the lifestyle of the Miccosukee Indians.

6) Contribution of the proposed project to cumulative environmental impacts to the Everglades ecosystem, which has already been adversely impacted by agriculture and urbanization.

7) Potential adverse impacts to wildlife, particularly the Florida panther, wood stork, Everglades kite and Everglades mink. Impacts of noise, lights and traffic on fauna.

8) Potential impacts to wetlands and native plant communities from well site and access road construction.

9) Potential pollution of groundwater and surface water by well casing leaks, oil spills, spilled brine water, or emissions caused by hurricane or flood damage to rig facilities. Potential impacts to the Biscayne aquifer, WCA-3A and the ENP. Contingencies plans and bond coverage for such occurrences.

10) Potential economic loss if a spill occurs (by reduction in tourism resulting from damage to environment/fishing).

11) Cumulative impacts of future actions required for production and/or field development.

12) Adequacy of mitigation, monitoring, reclamation, spill response, containment/cleanup plans for the construction and operation of the proposed activity.

13) Potential effects of the release of H_2S gas on wildlife and humans.

14) Eliminating the need for the project by utilizing alternative energy sources, developing an energy policy which encourages development of renewable energy resources, and adopting structured energy conservation measures.

15) Impacts associated with transportation and increased traffic.

16) Relationship of the proposal to State and local laws.

17) Safety of technological aspects of the proposal including directional drilling technology and proposed plastic liner under portions of drill site. .

1.1.4 Scope of Analysis

The scope of this analysis consists of the range of actions, alternatives and impacts to be considered in the EIS. The evaluation of this proposal and alternatives was developed through an interdisciplinary review with representatives from BLM, BIA, SWEPI, and Dames & Moore, a third party contractor working under the direction of and in cooperation with the BLM and BIA. The analysis used is an accepted process and format for evaluating and describing the potential environmental impacts of the proposed action and alternatives. The process requires an interdisciplinary analytical approach to determine, define, and compare impacts of alternatives.

1.1.4.1 Proposed Action and Alternatives

Under NEPA regulations, the scope of an EIS is determined by the agencies considering 1) connected, cumulative and similar actions, 2) alternatives including the no action alternative, other reasonable courses of action and mitigation measures, and 3) direct, indirect and cumulative impacts.

The BLM and BIA have determined that the scope of this FEIS includes the proposed action of: construction of the well site, improvement of existing access roads, drilling the single exploratory well, evaluation of the well, production testing of the well, temporary abandonment or plugging and abandonment of the well and reclamation. The scope also includes reasonable alternatives to the proposed action, including the No Action Alternative and mitigation measures. The EIS includes analysis of the direct, indirect and cumulative impacts of the proposed action and alternatives. The specific elements analyzed in the EIS are based on significant environmental issues identified through scoping.

The APD for the Miccosukee 3-1 does not propose or contemplate a single well production scenario nor would such scenario automatically occur as a result of the drilling of the proposed well. The drilling and testing of the Miccosukee 3-1 is an independent action with independent utility and is not an interdependent part of a larger action.

1.1.4.2 Well and Field Development Considerations

During the public scoping process, the need to address "field development" in the EIS was raised. It was suggested that this study should attempt to analyze the potential environmental effects that would follow if SWEPI discovered hydrocarbons and proceeded with field development on the Miccosukee Reservation.

Well and field development are not part of the proposed action. Onshore Oil and Gas Order No. 1, issued by the BLM, provides instructions for the submittal of APD's on Federal and Indian oil and gas leases. This Order requires the applicant to submit specific plans for drilling and surface use. Under Order No. 1, submittal of plans for production facilities is not required if such plans are not known and cannot be accurately presented. This is typically the case with exploratory drilling proposals. However, under these circumstances, if a permit to drill is issued and hydrocarbons are found, the installation of production facilities is not authorized and must be subjected to complete NEPA review and approved prior to installation.

Neither approval of the proposed action nor selection of any of the alternatives considered in this FEIS would commit the BLM or BIA to approval of any future actions including additional drilling, well production or field development.

The proposed well is classified as a wildcat well. This type of well is an exploratory well drilled in a geologically unproven area. Such wells are highly speculative. Appendix A-1 includes a discussion of the probability of a exploratory well resulting in a discovery. The information and facts contained in that section clearly show that the probability of the proposed well resulting in a discovery is low. The analysis concludes that the probability of a discovery is less than seven percent. Only one previous well has been attempted in Broward County; the Miccosukee No. 32-1 located approximately two miles west-

northwest of the proposed well. This well tested the Sunniland Formation and was completed in 1985 as a dry hole. The Sunniland Formation is the only productive formation known to exist in South Florida. The proposed well is a deep wildcat test (15,000 feet and below). The well would test the Sunniland Formation and targets below the Sunniland. Only a few deep tests of this type have been attempted in South Florida and none have proven successful.

In addition, if the proposed test resulted in a discovery, commercial production of the well as a single well field is not likely to be economically feasible. SWEPI has stated that the proposed well would not be placed in production as a single well field, regardless of the test results. The well would be temporarily abandoned (if capable of production) or plugged and abandoned (if dry).

The scope of the FEIS is consistent with the NEPA regulations in that production and field development are not a "connected actions" to the proposed action (exploration well drilling, evaluation and testing). 40 CFR, Part 1508.25(a)(1) states that connected actions (which means that the actions are closely related and, therefore, should be discussed in the same EIS) are described as being connected if they: 1) automatically trigger other actions that may require environmental impact statements, 2) cannot or would not proceed unless other actions are taken previously or simultaneously, and 3) are interdependent parts of a larger action and depend on the larger action for their justification. Appendix A-1 shows that production and field development rarely occur as a result of wildcat drilling tests, so that approval of the proposed action clearly would not "automatically trigger" other actions (i.e., production and field development) that may require an EIS: The proposal is not dependent upon other previous or simultaneous actions before it can proceed; and it is not dependent upon production or field development for its justification. The drilling of a wildcat well is fully justified on the basis of its purpose and intent; to test for the possible presence of hydrocarbons. Given the low probability of a wildcat well being completed as a potential producer, this type of operation would not occur if it was contingent upon, or depended on, production or field development for its justification. Hence, the proposed action has independent utility and does not "depend" on well production or field development for its justification.

The proposed action is not a "cumulative action." It would not occur simultaneously with other proposed actions (e.g., other drilling activities, field development) having cumulatively significant impacts. Field development actions are not reasonably foreseeable (i.e., likely or expected), particularly in light of the fact that wildcat drilling is highly speculative.

Without acquiring information regarding the characteristics and quantity (if any) of hydrocarbon reserves in the Reservation, scenarios of future development would, at this time, be completely speculative.

The BLM and BIA have authority over all further operational activities associated with development of the lease. Any additional plans for field development or commercial production must be approved by

BLM before such development or production can commence. Field development would depend upon SWEPI's ability to obtain further authorization from BLM and any development plan would be subject to environmental review under NEPA.

If the SWEPI Miccosukee 3-1 well is drilled and commercial quantities of hydrocarbons are discovered, an EIS would then be completed on all aspects of reasonably foreseeable field development and production activities on the area of the proposed action before any further action can be taken on additional APD's.

While field development is not proposed, probable or reasonably foreseeable, it is possible; otherwise the SWEPI Miccosukee 3-1 well would not be proposed. For this reason, and in response to this issue, Appendix A-1 provides for informational purposes a discussion of field development and production which has occurred in South Florida. Appendix A-1 describes the operations at the Raccoon Point Field. If field development and production occurs on the Miccosukee Reservation, operations may be similar to those at Raccoon Point.

1.1.5 Opportunities

Opportunities that may be derived from the drilling proposal include:

1) The drilling proposal would provide SWEPI the opportunity to evaluate a portion of the lands covered by their Miccosukee Reservation lease for hydrocarbon potential.

2) The drilling proposal and related support activities may provide economic benefit to the Miccosukee Tribe and nearby communities. Revenues from activities and development on the Reservation are an integral component of the Tribe's plans for self sufficiency and self determination.

1.2 Purpose and Need for Action

1.2.1 Purpose and Need

The purpose of the proposed action is to determine if hydrocarbons are present beneath the surface of the Miccosukee Reservation in the area of the proposed action. The Miccosukee Tribe entered into a minerals agreement with SWEPI in accordance with IMDA. The agreement is based on the right and desire of the Tribe to allow for the exploration and development of a potentially valuable natural resource that may occur on Tribal property. The gain from the proposed activity would be greater knowledge as

to the presence or absence of hydrocarbons at the geologic targets. Such knowledge is needed in order to evaluate development potential.

The SWEPI Miccosukee 3-1 well has been designed to penetrate the entire sedimentary column to basement rock at 17,730 feet TVD. In order to successfully evaluate all hydrocarbon potential, geologic objectives within this column must be penetrated in particular locations. Two subsurface targets have been identified and are further discussed in Section 2.1.

1.2.2 Authority

The lease obtained by SWEPI is authorized by the IMDA. This Act permits any Indian tribe to enter into any "Minerals Agreement," subject to the approval of the Secretary of the Interior, providing for the exploration for, or extraction, processing, or other development of mineral resources including oil, gas, uranium, coal, geothermal, or other energy or nonenergy mineral resources in which such Indian tribe owns a beneficial or restricted interest. The regulations pertaining to mineral leasing actions on tribal lands are contained in 25 CFR, Part 225.

Regulations pertaining to hydrocarbon operations on Federal and Indian lands are contained in 43 CFR, Part 3160.

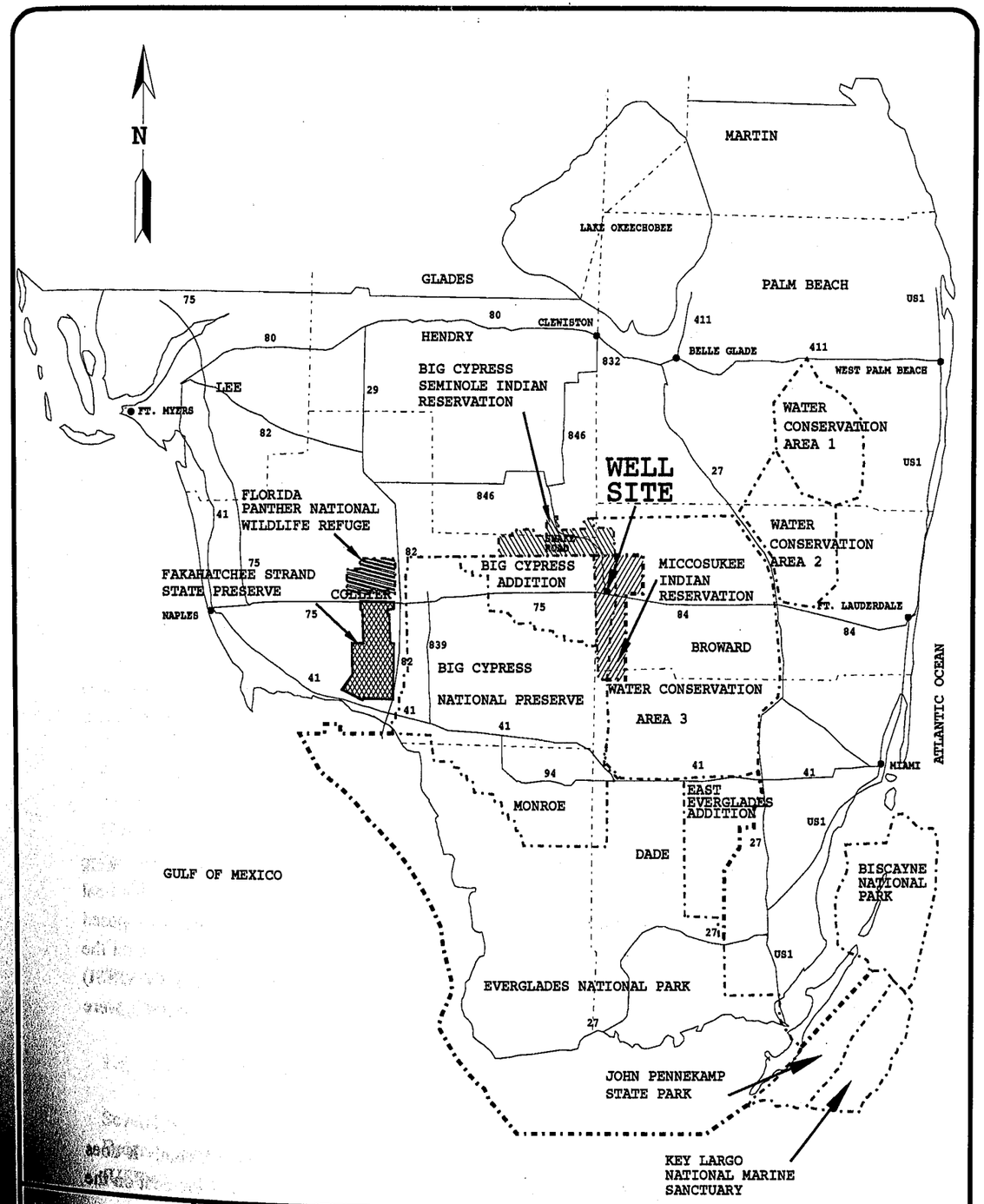
1.3 General Location

The proposed SWEPI Miccosukee 3-1 well is located on the Miccosukee Indian Reservation in Western Broward County, Florida. The project area is approximately 40 miles west of Fort Lauderdale, Florida and 60 miles east of Naples, Florida. The Miccosukee Reservation is bounded by the Big Cypress National Preserve (BCNP) on the west, the Big Cypress Seminole Indian Reservation (BCSIR) on the north, and WCA-3A on the east and south. A portion of WCA-3A is located within the Miccosukee Reservation. Figure 1-1 depicts the general location of the proposed project.

1.4 Relationship to BLM, BIA and Tribal Policies, Plans and Programs

1.4.1 Land Status

In 1984, title to the Miccosukee State Indian Reservation was transferred to the United States to be held in trust for the sole use and benefit of the Miccosukee Tribe, and the area became a Federal Indian reservation. The United States is Trustee for the Tribe and all of its reservation lands. The Secretary of the Interior is the primary Federal official responsible for discharging the Federal trust responsibility. BLM and BIA, parts of the Interior Department, administer the surface and mineral rights on reservation



lands. No other land ownership is included in the proposed project area. The proposed well site, the proposed bottomhole location and the surface above the bottomhole locations are entirely within Miccosukee Tribal Lands. The SFWMD has a flowage easement for flood control purposes over those portions of the Reservation within the boundaries of WCA-3A.

1.4.2 Discussion of Lease

The hydrocarbon rights on the Miccosukee Reservation were leased to SWEPI by the Miccosukee Tribe on July 20, 1989, through a lease agreement that was authorized under the IMDA and approved by the BIA. The lease is a legal contract that grants the exclusive right to SWEPI to explore for, drill, and develop all hydrocarbons from the 70,359 acre lease area. The leasing decision and leasing action represent a commitment to allow exploration and development of potential hydrocarbon resources on the property. Hence, drilling activity on the leased acreage constitutes a valid contract right. SWEPI has executed a Nationwide Oil and Gas Lease Bond in the sum of $150,000. In the event of any default under the lease or a subsequent permit, BIA may prosecute a claim against the bond.

1.4.3 Lease Stipulations

The IMDA prohibits disclosure of the oil and gas lease contracts and their terms to third parties.

The Miccosukee Tribe and SWEPI have disclosed that the SWEPI/Miccosukee oil and gas lease provides that "[i]f there is a conflict between the various state, federal or tribal regulations, rules, laws or orders, SWEPI shall comply with the more stringent regulation, rule, law or order...."

1.4.4 Previous Plans, NEPA Documents and Decisions to Lease

In December, 1981, an EA titled Environmental Assessment, Oil and Gas Leasing Program, Miccosukee State Indian Reservation, Florida was prepared for the Miccosukee Tribe and the BIA by the National Park Service (NPS), Denver Service Center. This document was prepared for the purpose of a proposed competitive leasing action and to address the impacts associated with hydrocarbon development on the Reservation. Subsequent to public review and comment, a Finding of No Significant Impact (FONSI) was issued in March, 1982. Oil and gas leases, including the SWEPI/Miccosukee oil and gas lease, were subsequently executed. Only the SWEPI lease is currently in effect.

1.4.5 Plan Conformance

The 1981 EA was not prepared specifically for the proposed action being considered herein. It does provide substantial data and analysis germane to the specific subject of hydrocarbon development on the

Miccosukee Reservation, including a general description of the direct, indirect and cumulative impacts associated with typical hydrocarbon drilling and development in the area.

The March, 1982, FONSI statement was based in part on the assumption that surface operations may be prohibited in areas of special concern where significant environmental impacts may occur. Based upon the analysis presented in this FEIS, the proposed action does not occur in areas identified as areas of special concern and is, therefore, consistent with the 1982 finding. Site specific environmental concerns were not addressed and are, therefore, subject to further investigation. In this case, site specific environmental concerns are being evaluated through an EIS.

The Miccosukee Tribe does not have specific regulations or policies regarding hydrocarbon development. The proposed project is in accordance with the Miccosukee Wildlife Management Plan, Transportation Plan, and Land Use Plan which indicates the project area is in an area appropriate for future development and is, therefore, not designated as a wildlife conservation area as is most of the Reservation. The Tribal Council has reviewed the SWEPI APD and is in full support of the plan, provided that it meets applicable environmental regulations.

1.5 Relationship to Non-BLM, BIA and Tribal Policies, Plans and Programs

Activities associated with the proposed action and project alternatives would occur entirely on the Miccosukee Indian Reservation and, therefore, are not subject to the requirements established in environmental regulations and land use plans adopted by either the State of Florida or Broward County. The civil regulatory laws of states or their political subdivisions are not applicable on Indian reservations. California v. Cabazon Band of Mission Indians 480 U.S. 202 (1987); Bryan v. Itasca County, 426 U.S. 373 (1976); Seminole Tribe of Florida v. Butterworth, 658 F 2d 310 (5th Cir. 1981), Cert. denied, 455 U.S. 1020(1982). The Federal government has totally pre-empted the field of regulation of oil and gas leasing and development on Indian land. See Indian Mineral Development Act, 25 USC § 2101, et seq; 25 CFR, Part 225.

The SWEPI/Miccosukee oil and gas lease provides that "[i]f there is a conflict between the various State, Federal or tribal regulations, rules, laws or orders, SWEPI shall comply with the more stringent regulation, rule, law or order...."

1.6 Authorizing Actions

Several regulatory agencies have jurisdiction over various aspects of the proposed action and alternatives. Federal agencies with direct regulatory authority include the BIA, BLM, U.S. Fish and Wildlife Service (USFWS), the Environmental Protection Agency (EPA) and the COE.

As previously explained, state and local regulations are not applicable on Indian Reservation lands. However, the SFWMD has asserted a 600 foot wide operations and maintenance (O&M) easement for L-28 levee, a component of the SFWMD flood control system. Portions of the proposed action or alternatives may be located within the easement. Accordingly, portions of the proposed action and alternatives may require a right-of-way use permit from the SFWMD. In addition, transport of oversize or heavy equipment to the drill site via I-75 would require FDOT transport permits. Required authorizations and applicable regulations are discussed in the following sections.

1.6.1 Bureau of Indian Affairs - Leasing

The IMDA provides the authority for any Indian tribe, subject to the approval of the Secretary of the Interior, to enter into any "Minerals Agreement" providing for the exploration for, or extraction, processing, or other development of mineral resources including oil, gas, uranium, coal, geothermal, or other energy or nonenergy mineral resources in which such Indian tribe owns a beneficial or restricted interest. This Act also provides for the sale or other disposition of the production or products of such mineral resources.

1.6.2 Bureau of Land Management - Operations

Drilling of the exploratory well would be subject to all applicable BLM onshore oil and gas procedures. The BLM's review of the APD includes assuring compliance with all applicable oil and gas procedures. Such procedures are established for exploration of Federal and Indian oil and gas reserves in a series of Onshore Oil and Gas Orders, which are authorized by 43 CFR, Part 3160, and in a series of Notice to Lessees and Operators of Federal and Indian Oil and Gas Leases (NTLs). These orders and notices detail uniform national standards for minimum levels of performance required from lessees and operators when conducting oil and gas activities on Federal and Indian lands. Four orders and one notice are particularly relevant to determine the potential for environmental impacts associated with the proposed action and project alternatives (except the No Action Alternative). Because of their direct bearing on SWEPI's proposal, these orders are briefly discussed below:

Onshore Oil and Gas Order No. 1. Onshore Order No. 1 provides guidelines for filing an APD. The Order requires lessees and operators to conduct their exploration, development, production and construction operations in a manner which:

- Conforms with applicable Federal laws and regulations and with State and local laws and regulations to the extent that such State and local laws are applicable to operations on Federal or Indian leases;

- Conforms with the lease terms, lease stipulations and conditions of approval;
- Results in diligent development and efficient resource recovery;
- Affords adequate safeguards for the environment;
- Results in proper reclamation of disturbed lands;
- Conforms with currently available technology and practice;
- Assures that underground sources of fresh water would not be endangered by any fluid injection operation; and
- Otherwise assures the protection of the public health and safety.

In addition, the Order holds SWEPI "fully accountable for their contractors' and subcontractors' compliance with the requirements of the approved permit and/or plan."

Onshore Order No. 1 specifically requires submittal of a drilling plan which includes a drilling program and a surface use program. These programs provide specific details on the technical design of the well and well site. The drilling program includes the following: well casing, cementing, pressure control, circulating medium, testing and bottomhole pressures, temperatures and any geologic hazards. The surface use program includes details on the access to the site, well pad design, location of water supply and construction materials, methods for handling waste and plans for reclamation.

The Order also requires cultural resource survey work and a related report if the surface management agency (SMA) (in this case the BIA) has reason to believe that properties listed, or eligible for listing, on the National Register of Historic Places (NRHP) are present in the area of potential effect. The Order also requires the SMA to identify any threatened and endangered species and/or critical habitat conflicts and other environmental concerns (e.g., wetlands, land use conflicts, known or potential surface geologic hazards, etc.).

Onshore Oil and Gas Order No. 2. Onshore Order No. 2 establishes specific and detailed requirements along with minimum standards for the following: well control during drilling, casing and cementing, drilling mud and the circulating system, drill stem testing, special drilling operations, related surface use and the abandonment of drilling operations. In some instances, the order relies on existing standards prepared by the American Petroleum Institute (API), Occupational Safety and Health Administration (OSHA) and other agencies.

Onshore Order No. 2 requires that blowout prevention equipment (BOP) be installed, used, maintained and tested necessary to assure well control. BOP is used to prevent the uncontrolled release of formation fluids to the surface. BOP must be in place and operational prior to drilling the surface casing shoe unless otherwise approved by the BLM. Well control equipment must be capable of complete closure of the well bore.

Onshore Oil and Gas Order No. 6. This order provides minimum standards for operating in a sour gas (H_2S) environment. The rule was designed to establish minimum standards necessary to protect public health and safety, the environment and to maintain control of the well to prevent waste of Federal mineral resources. Hydrogen sulfide may be encountered, but is highly unlikely in South Florida geologic formations. Because this is a wildcat well, compliance with this order is required. SWEPI has submitted an H_2S Drilling Operations Plan as part of the APD (See Appendix A-3).

Onshore Oil and Gas Order No. 7

This order establishes requirements for handling, storage, and disposal of water produced from oil and gas wells on Federal and Indian oil and gas leases. Produced water must be disposed of by injection into the subsurface, in lined pits or by other acceptable methods. The order further establishes criteria for constructing, operating, monitoring and reporting disposal activities.

NTL-3A Reporting Undesirable Events

This notice requires operators of onshore Federal and Indian oil and gas leases to report spills, discharges, or other undesirable events. The operator/lessee must report the following events to the BLM District Manager as soon as practical but within a maximum of 24 hours:

- Spills of 100 or more barrels of oil, saltwater, and toxic liquid spills.
- Equipment failures resulting in the venting of 500 or more Mcf of gas.
- Any fire which consumes 100 or more barrels of oil or 500 or more Mcf of gas.
- Any spill, gas venting or a fire, regardless of the volume involved which occurs in a sensitive area.
- Any blowout or any accident that involves a fatal injury.

Undesirable events other than those listed above must be reported in writing within 15 days of occurrence.

1.6.3 Endangered Species Act

Any areas potentially affected by surface-disturbing activities that provides habitat for Federal threatened or endangered species are protected by the Endangered Species Act of 1973 (ESA).

The ESA obligates Federal agencies to ensure that actions which they authorize or permit "are not likely to jeopardize the continued existence of any endangered species" [42 USC 1536(a)(2)]. The ESA is designed to protect endangered species in two ways: 1) prohibiting activities that may jeopardize their continued existence, and 2) prohibiting adverse modification of their critical habitat. The BLM is prohibited from authorizing or permitting any activity which would result in either of the two effects. The USFWS defines jeopardize as follows:

> "to engage in any activity or program which reasonably would be expected to reduce the reproduction, number or distribution of a listed species to such an extent as to appreciably reduce the likelihood of the survival and recovery of that species in the wild" (50 CFR, 420.02).

If the BLM determines that a proposed action under its jurisdiction may affect Federal-listed threatened or endangered species or critical habitat, then the BLM must consult with the USFWS.

1.6.4 Executive Order (EO) 11988 (Floodplains)

This EO (42 FR 26951) was mandated in 1977 and was designed to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare and to restore and preserve the natural and beneficial values of floodplains. The EO defines a floodplain as the "lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year."

The BIA and BLM are required by EO 11988 to restore and preserve the natural and beneficial values of floodplains in all activities conducted by the agencies which affect land use, including regulating and licensing activities. The potential effects of agency actions (such as approval of the APD) on floodplains must be evaluated. If construction would occur in a floodplain, the agencies are required to consider alternatives to avoid adverse effects and incompatible development in the floodplain. If the agencies determine that the only practicable alternative requires citing in a floodplain, the agencies are required to design or modify the project in order to minimize the potential harm to or within the floodplain.

1.6.5 Executive Order 11990 (Wetlands)

This EO (42 FR 26961), also mandated in 1977, was designed to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct and indirect support of new construction in wetlands wherever there are practicable alternatives. To the extent provided by law, BLM is prohibited from undertaking or providing assistance for new construction located in wetlands unless the agencies find: 1) that there is no practicable alternative to the construction, and 2) that the action includes all practicable measures to minimize harm to the wetland. The EO provides guidelines which support regulatory authority provided to the COE as further described in Subsection 1.6.12.

1.6.6 Council on Environmental Quality (CEQ) Memorandum on Prime or Unique Farmland Soils

An August 11, 1980, memorandum from the CEQ requires Federal agencies to assess the effects of their actions on soils classified by the Soil Conservation Service (SCS) as prime or unique farmlands.

1.6.7 National Historic Preservation Act of 1966

As required by Section 106 of the National Historic Preservation Act, the BLM must coordinate with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation, in accordance with the Council's regulations (36 CFR, Part 800). The SHPO is given copies of proposed plans of operations for hydrocarbon development and the subsequent environmental analyses for review and comment.

Cultural resources affected by a proposed action must be evaluated to determine their eligibility for inclusion on the NRHP.

All plans of operations for hydrocarbon development must be reviewed to ensure their compliance with the provisions of the National Historic Preservation Act.

1.6.8 Executive Order 11539 (Protection and Enhancement of the Cultural Environment)

Any actions that could affect archeological resources must be cleared by an archeologist to ensure that such resources would not be inadvertently damaged or destroyed. Any sites would be evaluated in consultation with the SHPO to determine their eligibility for listing on the NRHP.

1.6.9 American Indian Religious Freedom Act of 1978

The American Indian Religious Freedom Act (PL 95-341) establishes Native Americans' rights to access and use traditional sacred resources for traditional ceremonials. Miccosukee ceremonial and habitation sites that are within the Reservation must be accessible for use in accordance with the American Indian Religious Freedom Act.

1.6.10 Clean Air Act

The Clean Air Act is the Federal law that regulates air quality. The Clean Air Act establishes standards for ambient air quality and establishes emission thresholds for various emission producing activities and facilities.

1.6.11 Resource Conservation and Recovery Act of 1976

The RCRA is the Federal law that regulates generators and transporters of hazardous waste.

The RCRA provides an exclusion [from the definition of hazardous waste] for certain wastes associated with the exploration, development, or production of crude oil, natural gas or geothermal energy.

According to 40 CFR, Part 261 (b)(5)1990 wastes such as drilling fluids, produced waters, or other wastes associated with the exploration, development, or production of crude oil are excluded from the definition of hazardous waste. According to the regulation these drilling wastes do not have to be disposed of in a permitted hazardous waste disposal facility.

1.6.12 Clean Water Act

The Federal Water Pollution Control Act (33 U.S.C. 466 et seq.), commonly referred to as the Clean Water Act establishes quality standards and regulations for discharge to ground and surface waters.

The COE regulates the discharge of dredged or fill material related to construction of roads, well site and ancillary project components in waters of the United States, which includes adjacent wetlands, pursuant to Section 404 of the Clean Water Act. The discharge must also comply with the EPA's Section 404(b)(1) guidelines (40 CFR, Part 230).

A COE permit may be required for wetland fill areas associated with the West Access Route alternative and the bridge associated with the East Access Route.

This Act addresses Federal water pollution control and requires permits under the National Pollutant Discharge Elimination System (NPDES). The NPDES imposes precise and detailed discharge requirements including numerical limits on surface water discharges based on technology-based guidelines and water quality standards, compliance schedules for construction of new pollution control equipment, and monitoring and reporting requirements.

The EPA regulates oil pollution prevention activities of non-transportation-related onshore and offshore facilities under its Oil Pollution Prevention regulation (40 CFR, Part 112) promulgated under Section 311(j)(1)(C) of the Clean Water Act, as amended by the Oil Pollution Act of 1990 (OPA). The regulation establishes the requirements for SPCC Plans to prevent spills of oil into waters of the United States.

The EPA is in the process of developing revisions of the Oil Pollution Prevention regulation to incorporate the requirements of OPA. In addition to other changes, OPA amends Clean Water Act Section 311(j) to require the preparation of response plans for worst-case oil and hazardous substances discharges. Guidelines for the preparation of the response plans are being developed by the EPA. A spill response plan would have to be prepared and submitted to EPA prior to the commencement of drilling operations.

1.6.13 Safe Drinking Water Act (SDWA) (42 USC 300 et seq.)

The SDWA was enacted in 1974 and most recently amended in 1986. This Act mandates that the EPA establish regulations to protect human health from contaminants in drinking water or potential drinking water supplies. Part C of Title XIV authorizes establishment of the Underground Injection Control (UIC) permit program, the Sole Source Aquifer Program, and the Wellhead Protection Program.

Owners and operators of underground injection wells must obtain permits or be authorized by rule under the UIC permit program.

An aquifer identified as the sole or principal source of drinking water for an area may be designated as a "sole-source aquifer" under Section 1424 (e) of the Act. No commitment of Federal financial assistance may be made for any project that may contaminate a sole source aquifer so as to create a significant public health hazard.

1.6.14 Florida Department of Transportation (FDOT) - Transport Permits

Transport of oversize, overweight or overlength loads (particularly the drilling rig) would require transport permits from the State (for State and Federal highways). Equipment used to transport rig equipment must comply with FDOT standards and permits for loads over 63,000 pounds.

Access Alternative C would require the use of an existing non-public access point from I-75. New access points, or public use of non-public access points on limited access interstate highways require approval from the FDOT.

1.6.15 South Florida Water Management District Right-of-Way Use Permit

SFWMD asserts an O&M easement for the L-28 component of the Central & South Florida Flood Control Project. Accordingly, portions of the proposed action and Alternative C may require a Right of Way Use Permit from the District in accordance with Florida Administrative Code Rule 40E-6. The District's policy as stated in Permit Information Manual Volume V, is to allow adjacent owners to utilize the waters and lands of the District provided that the use does not adversely impact or interfere with the District's ability to utilize the lands for water management purposes. The manual also specifies Bridge Crossing Criteria for Canals.

1.6.16 Federal Highway Administration (FHWA) Access Approval

Access Alternative C would require the use of an existing non-public access point from I-75. New access points, or public use of non-public access points on limited access interstate highways require approval from the FHWA.

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ALTERNATIVES INCLUDING THE PROPOSED ACTION

CHAPTER 2

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2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Introduction

This chapter provides a description of the proposed action and alternatives to the proposed action, including the access routes, drill site construction, drilling operations, testing, abandonment and reclamation. The proposed action was identified by SWEPI in their APD. The alternatives were identified by BLM, BIA, SWEPI, and Dames & Moore through an interdisciplinary, analytical approach.

The proposed action and alternatives discussed in this section meet specific geologic objectives and provide access to specific geologic targets. The proposed action was developed by SWEPI, as a means to explore specific geologic targets that were identified and located through seismic testing.

2.1.1 Geologic Objectives and Targets

The SWEPI Miccosukee 3-1 well has been designed to penetrate the entire sedimentary column to basement rock at 17,730 feet TVD. In order to successfully evaluate hydrocarbon potential, geologic objectives within this column must be penetrated in particular locations. Consequently, two subsurface targets have been identified by SWEPI.

The uppermost geologic target is the Sunniland Formation at a depth of 11,215 feet. When this subsurface target is projected to the surface, it is approximately 3,000 feet east of the L-28 Canal (see Figure 2-1). The lower target is the Basal Clastics (or basement) at a depth of 17,730 feet. When projected to the surface, this target is approximately 4,100 feet east of the L-28 Canal. Both targets are approximately 750 feet south of the C-60 canal and thus define a subsurface well path between the targets which must move 1,100 feet due east.

2.1.2 Selection of Alternatives

Reasonable alternatives to the proposed action which meet the purpose and geologic objectives of the project are limited by technological and practical constraints and environmental considerations. Alternatives which do not meet the purpose and objectives of the project are limited to the No Action Alternative.

The rationale used in identifying the proposed action and alternatives is best explained by defining geographic limitations to reaching the stated targets. The technologically preferred option of vertical drilling to the targets is unattractive because the proposed well is a wildcat well, and it would require a surface site in WCA-3A. Locating a surface site outside of WCA-3A requires directional drilling which is practicable but has its own technological limitations as described in Appendix A-2. Technological constraints on directional drilling to the targets from a site not within WCA-3A limits the surface site to

a location not greater than 5,400 feet west of the deepest target. Minimizing impacts to sensitive wetlands from construction of a well site and access roads further limits the alternatives. These limiting factors result in only one well site location with several access route alternatives being feasible to reach the geologic targets identified by SWEPI. The proposed well site could be shifted slightly within the geographic area west of the L-28 Canal as shown on Figure 2-1. However, there are no distinct advantages to relocation, and the results of the analysis would not differ significantly.

Selection of the proposed surface site and alternatives is discussed in more detail in Appendix A-2.

2.2 Description of Alternatives

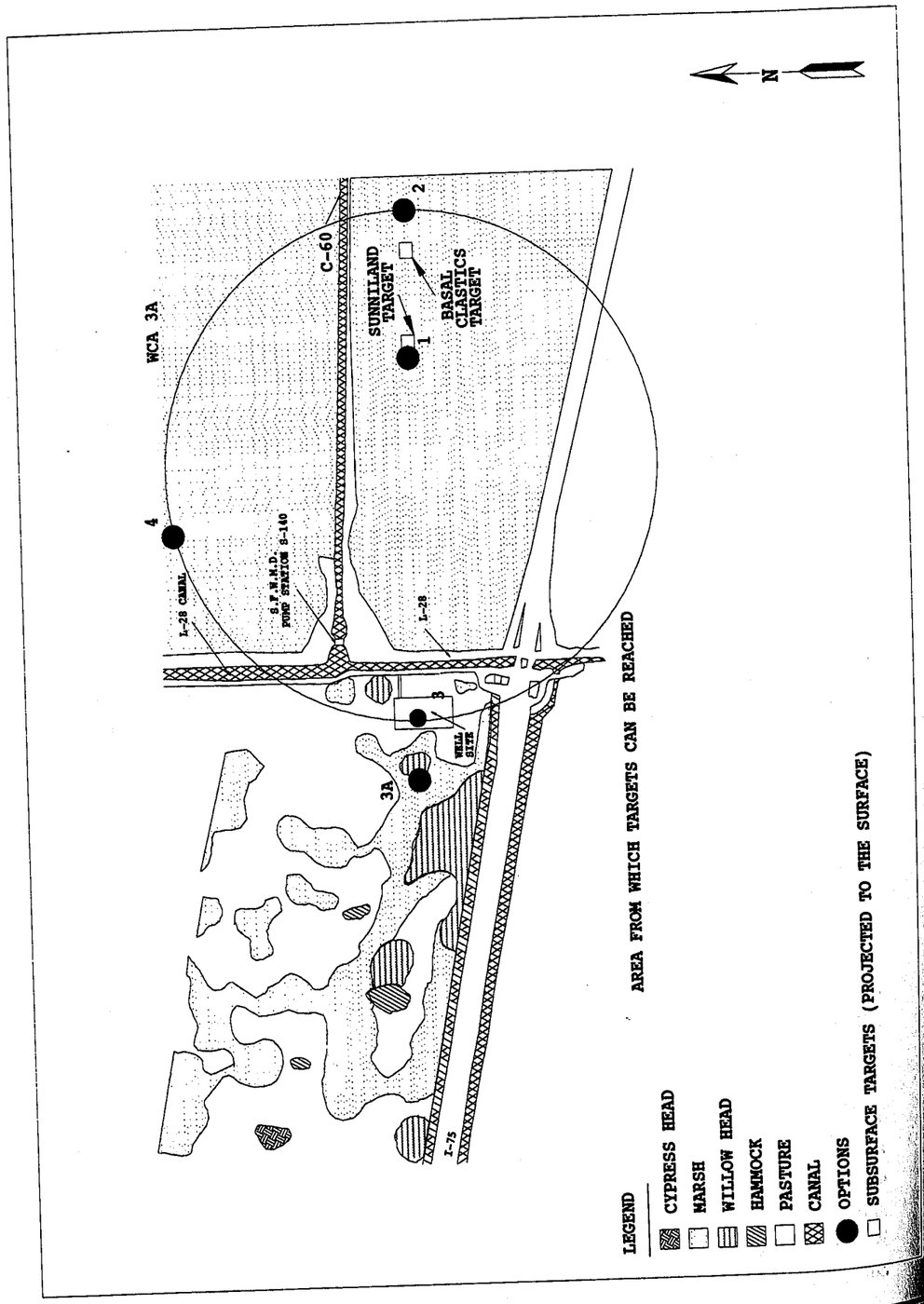
2.2.1 Alternative A - Proposed Action

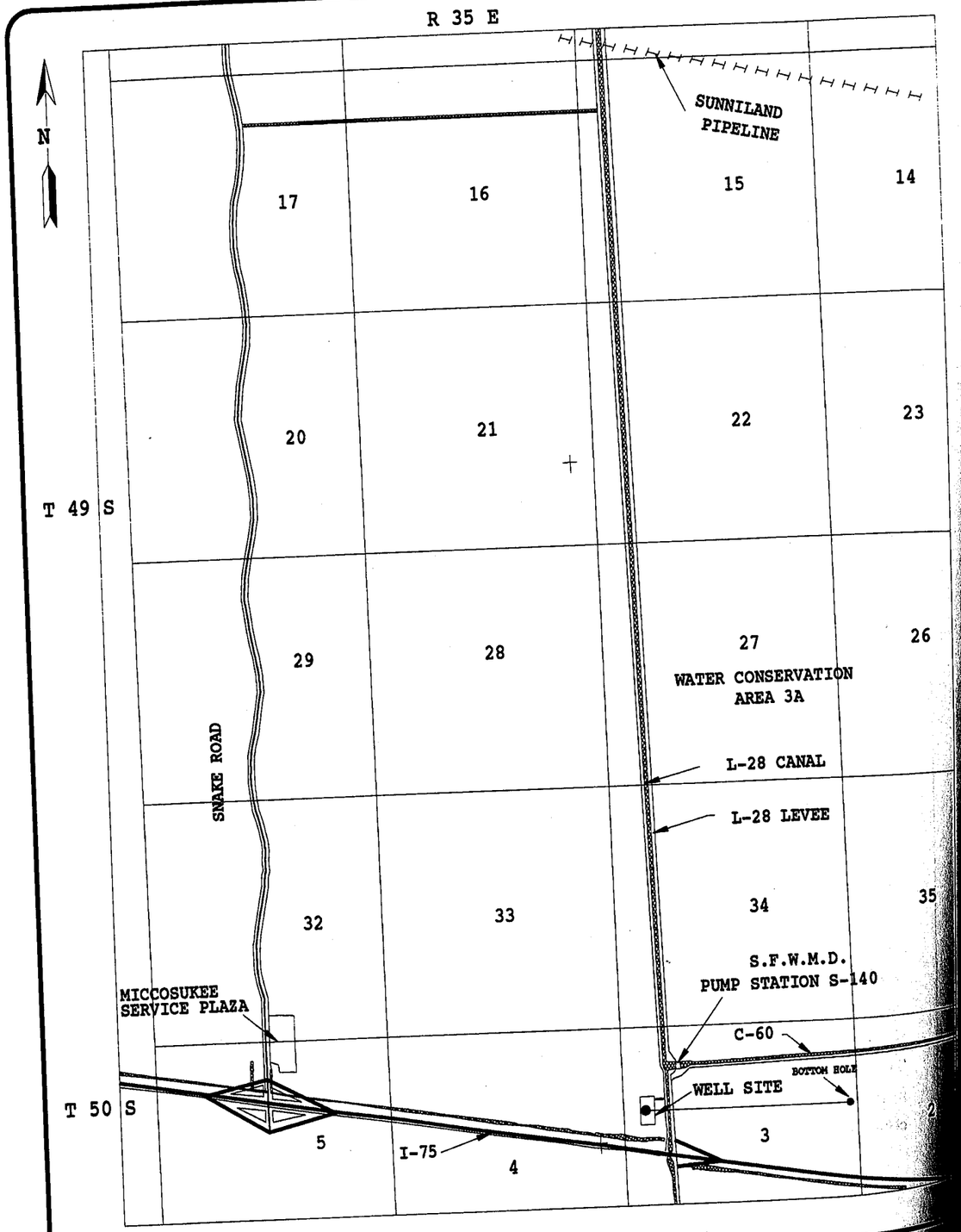
This is the drill site and access route proposed by SWEPI, located on pasture land in Broward County, three miles east of the Collier-Broward County line, north of I-75 and immediately west of the L-28 Canal and WCA-3A (see Figure 2-2). The drill site would occupy approximately five acres.

Major highway access to the drill site would be provided via I-75 from the east and/or west to the Snake Road interchange, located west of the proposed drill site. Local highway access is via Snake Road to a point about four miles north of the I-75 interchange where an existing earth and rock-filled road intersects Snake Road from the east. From this point the route extends approximately 1.5 miles east on an existing road to the L-28 Canal and then south parallel to the canal on an existing farm road adjacent to the L-28 Canal for approximately four miles to the drill site (Figure 2-3).

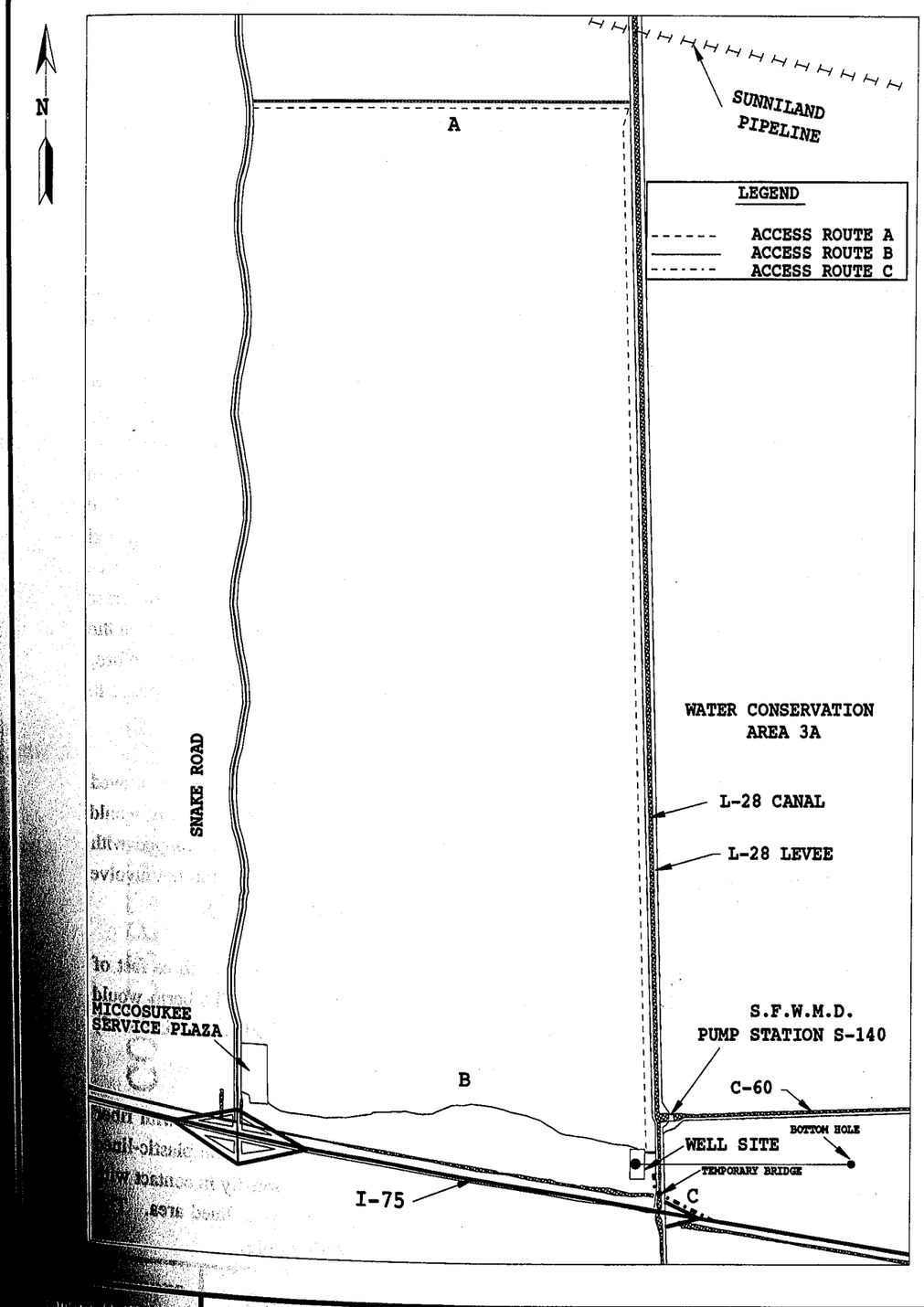
2.2.1.1 Proposed Access Route Construction

The proposed access route from Snake Road is on an existing earthen berm approximately 15 feet in width, and consists of a one lane, rock-filled roadbed approximately 5.5 miles in length. The proposed access route would be topped with crushed limerock to create a smooth road surface capable of handling the traffic of rig equipment. The condition of the crushed limerock roadbed would be evaluated and additional material would be added to the top of the berm as necessary. The proposed access route would continue to be a one lane route, and no widening would occur. Construction of vehicle turnouts to allow the safe passing of opposing traffic would be required at selected locations along the 5.5 mile route. These 100-foot long 15-foot wide vehicle turnouts would be constructed at intervals of between ½ to ¾ mile. Exact locations would be established in the field to avoid impacts to wetland and hammock plant communities.





Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	0 1,500' SCALE	SITE VICINTY MAP	FIGURE 2 D&M JOB No. AUTOCAD FILE:



& Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	0 1,500' SCALE	SITE ACCESS ROUTE MAP	FIGURE 2-3 D&M JOB No. 13501-072-049 AUTOCAD FILE: ACCESS.DWG

A cattle guard and gate would be installed at the entrance to the access route from Snake Road. The gate would be locked and guarded 24 hours per day during the drilling operation. Other cattle guards would be installed to replace five existing cross fences along the access route.

2.2.1.2 Drill Site Construction

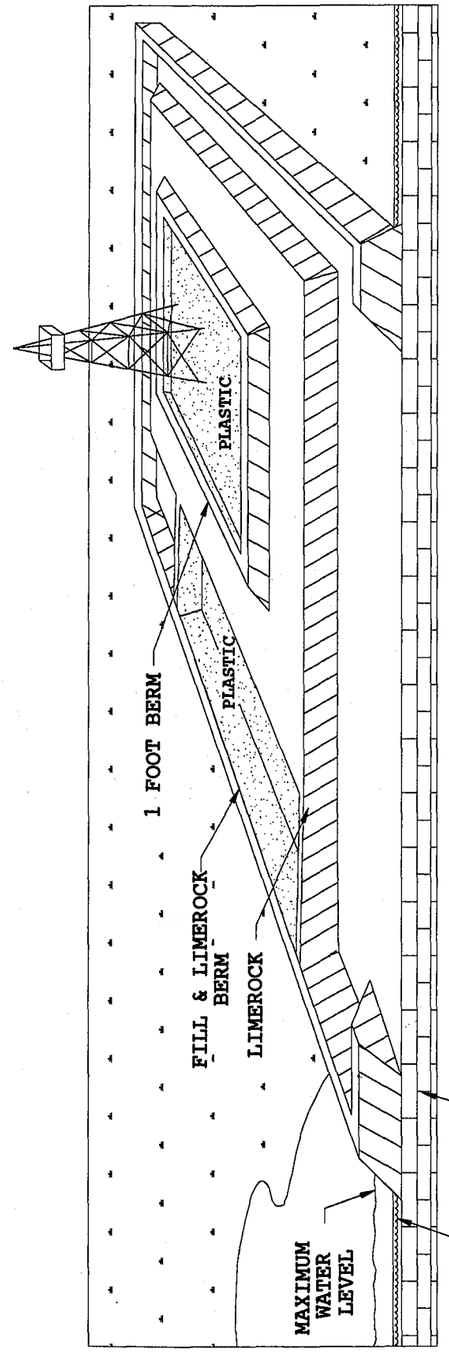
The drill site dimensions would be approximately 320 feet by 615 feet occupying approximately 5 acres of pasture. Although larger than a typical South Florida single well site, the increased area would be necessary to accommodate all required design features, equipment, and work space, as there are no existing SWEPI operations or potential auxiliary sites available in the immediate area of the Proposed Action. The drill site would accommodate design provisions specific to the proposed directionally drilled deep well located adjacent to environmentally sensitive resources. These design provisions include: on-site retention/detention of all stormwater runoff; a large retention capacity capable of oil/brine spill containment; on-site storage for drill cuttings; accommodation of a larger than typical drilling rig required for a deep directional well; accommodation of a closed drilling fluid system; on-site storage of H_2S and health and safety response equipment; accommodation of a larger than normal number of mobile office trailers for site workers as required by remote site and specific operations; and on-site location of water supply wells and water quality monitoring wells. The design of the proposed drill site was based on the assumption that these provisions are desirable for mitigation of environmental impacts, and therefore, justify filling of a larger than typical site, considering that the site will displace pasture as opposed to indigenous biological communities.

The general arrangement of the drill site is shown on Figures 2-4 and 2-5. Top soil would be removed and stockpiled for use in the reclamation of the site. The drilling rig and associated equipment would rest on a specially designed pad. The pad would be constructed of select fill material topped with 18 inches of crushed limerock, compacted to 12 inches. Construction of the drill site would not involve any excavation of the caprock (located approximately four inches below the topsoil layer).

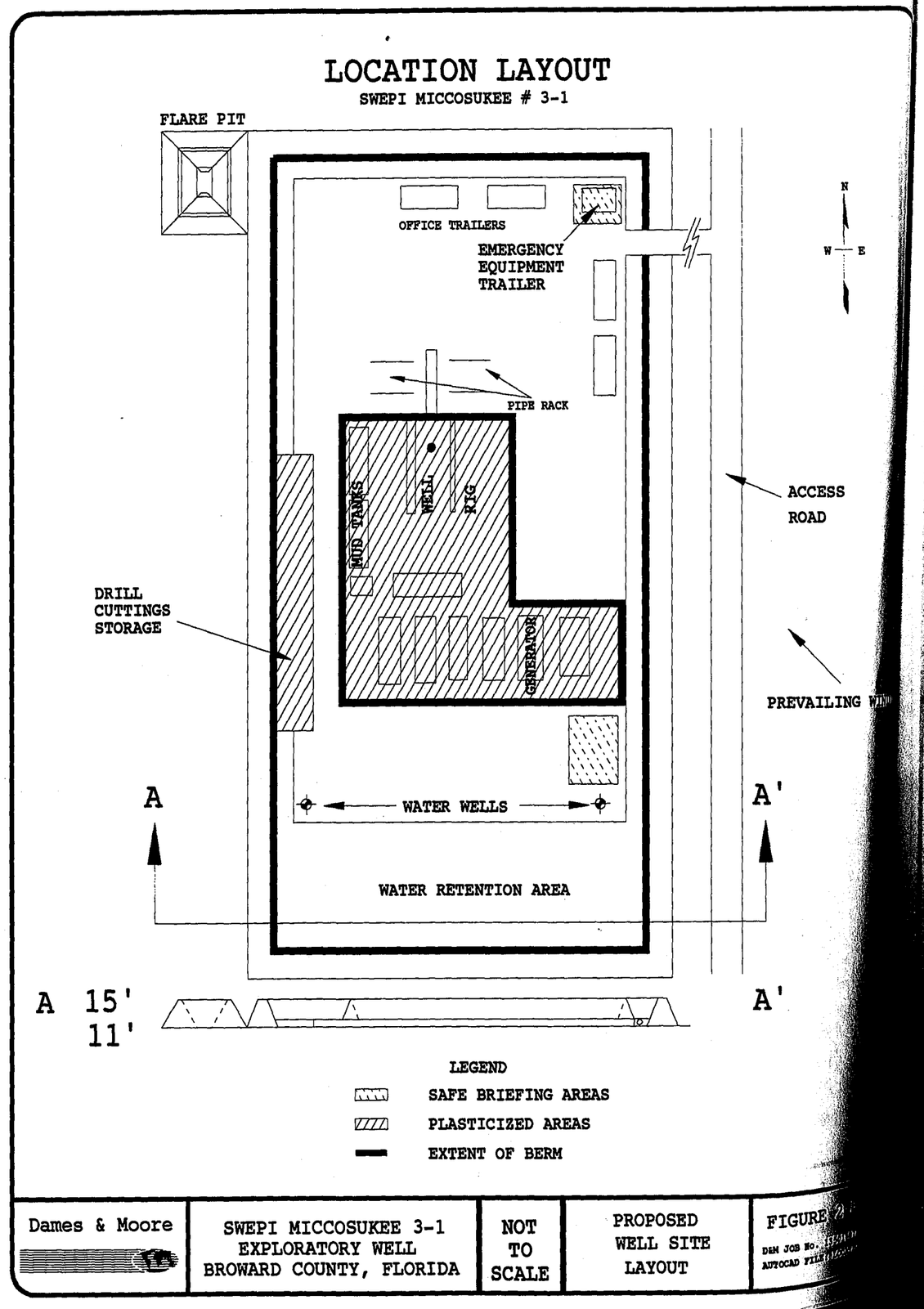
The drill site would include a four-foot perimeter berm which would be constructed with three feet of select fill and one foot of crushed limerock to minimize erosion during rainstorms. The berm would encompass the complete drill site and would serve to 1) contain all stormwater or spilled material and 2) exclude flood waters that could occur during heavy rain storms or hurricane events.

The area under the rig equipment would be trenched and a plastic liner (12 mil. minimum with fiber reinforcement) installed to eliminate the possibility of liquid leaching into the soil. The plastic-lined section would have a one-foot berm around it, such that all rain water and fluids normally in contact with the rig, including drilling mud and rig wash down water, would drain to this plastic lined area. The collected fluids would then be pumped to a storage tank and used in the drilling fluid.

CONCEPTUAL DRILL SITE FEATURES



Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	N.T.S. SCALE	CONCEPTUAL DRILL SITE FEATURES	FIGURE 2-4 D&M JOB No. 13501-072-049 AUTOCAD FILE: SITE.DWG



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The west side of the drill site would have a retention area to contain stormwater that accumulates on the location (other than in the above-mentioned plastic-lined area). The water retention area, specifically designed for routine accommodation of fluids, would store the equivalent of 3.0 inches of rain over the drill site. Under more severe rainfall conditions, the storage volume of the entire bermed pad can be utilized to retain rain water runoff. The pad perimeter berm can contain 220,320 cubic feet of liquid, a volume greater than would be collected from a 3-day, 100-year storm (12 inches).

A plastic-lined depression, completely isolated from the stormwater retention area, would be prepared to contain drill cuttings until they can be removed and disposed of off-site. A flare pit would be provided for emergency flaring and would be located approximately 250 feet from the well bore for safety and to isolate (from the stormwater retention area) any fluid which might be accumulated. Because of potential heat from flaring, this pit would be lined with two inches of bentonite on the bottom (tapering to the top of the berm) to prevent leaching into the soil. Any fluids which are accumulated can be pumped to the appropriate storage area.

Two water supply wells would be drilled on site. These would serve as the primary and standby water supplies for drilling and sanitary uses on site. The estimated supply well depth is 120 feet. The casing would be 9 5/8 inches set at about 60 feet and cemented full length. The total estimated water use from the wells is expected to average about 7,500 gallons per day over the course of the drilling operations. Total water use would be minimized through use of a "closed mud system," solids removal equipment, and rain water collection/utilization.

The planned 18,850 feet MD for the Miccosukee #3-1 well would require a large, well equipped drilling rig. Actual rig specifications are unknown since the drilling contractor has not been selected at this time. It is anticipated that the rig would be of a class capable of drilling to 28,000 feet. Such a rig would have a 30 foot raised floor substructure and a 142 foot mast.

Construction of the drill site would require about 30 days.

2.2.1.3 Exploratory Drilling

Once drill site and access road construction and improvements are completed, and the drilling rig is in place, the drilling of the proposed exploratory well would begin. The proposed well is a wildcat test of the entire geologic section to basement at an anticipated TVD of 17,730 feet. The principal geologic targets occur between the Sunniland and Basal Clastics Formation. The Sunniland Formation is anticipated to lie at a depth of 11,215 feet TVD.

CHAPTER TWO

SWEPI designed a well casing and cementing program to protect the aquifers in the area and to provide the necessary basis for well control. The casing program with the proposed setting depths, hole sizes, geologic formations, and principal aquifers is shown in Figures 2-6 and 2-7. The elements of the casing program are:

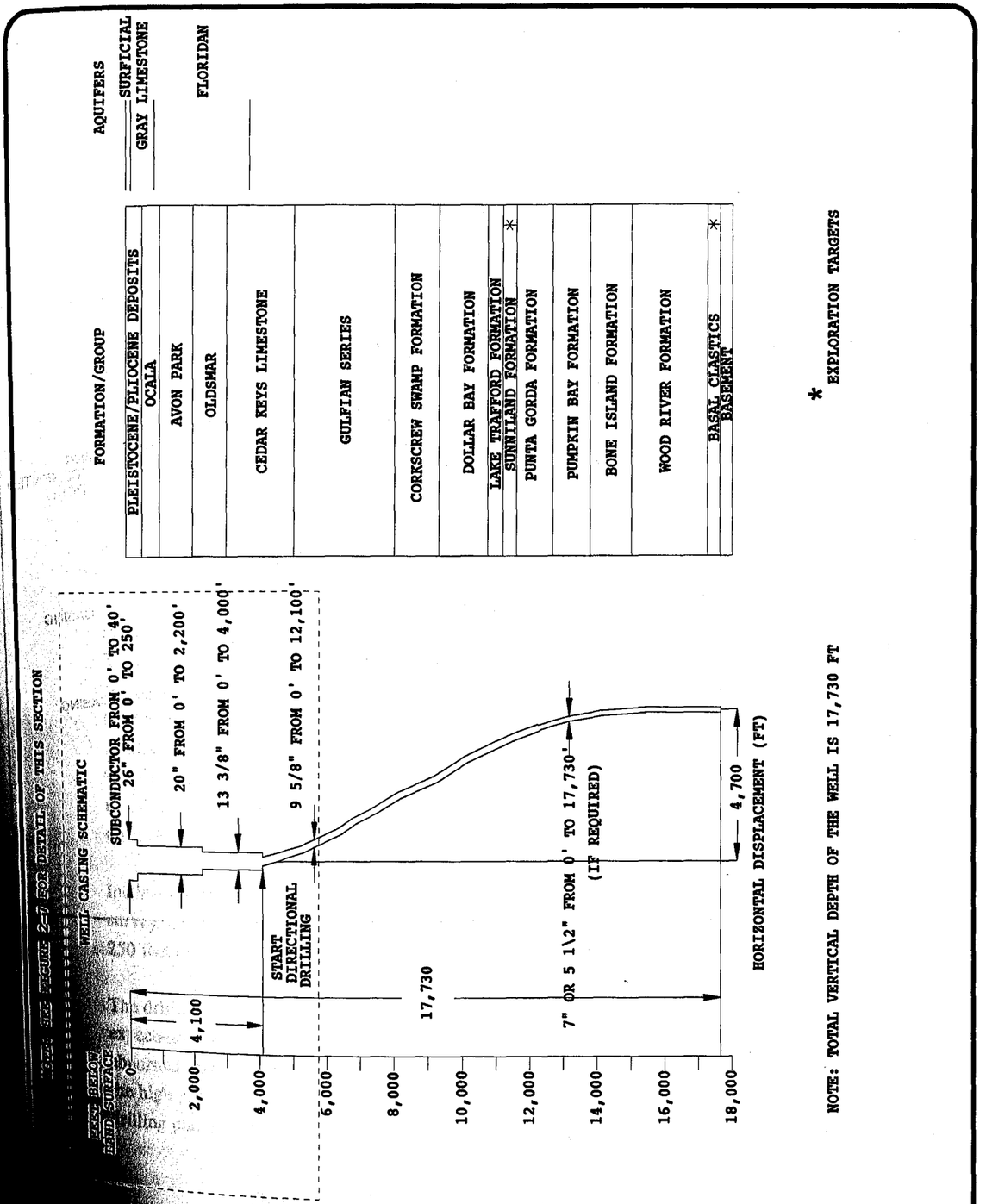
Sub-conductor - conduit pipe which would allow the passage of a 30-inch diameter bit would be set about 40 feet below ground level and would be surrounded with cement or concrete.

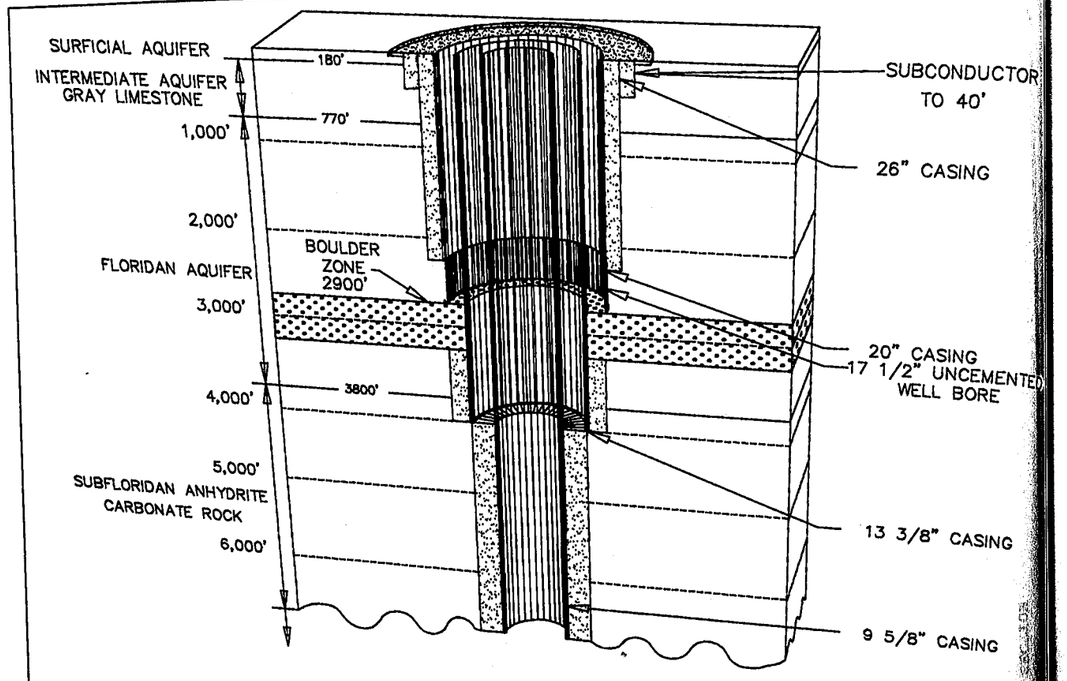
Conductor - casing consists of about 250 feet of 26-inch line pipe placed within a 30-inch diameter hole. The annulus between the conductor and the hole wall would be cemented back to surface. Casing would be pressure tested to 500 pounds per square inch (psi). The conductor pipe and cement seal the fresh water aquifer from the well and provides the initial base for BOP.

Surface - casing consists of about 2,200 feet of 20-inch pipe placed within a 24-inch diameter hole. The annulus between the surface casing and the hole wall would be cemented back to surface. Casing would be pressure tested to 1,500 psi. The surface casing pipe and cementing seal the Intermediate aquifer and brackish waters from the well but stop short of the deeper saline waters of the Floridan aquifer which includes the "boulder zone." This allows the cementing of the casing string to the surface.

Protective I - casing consists of about 4,000 feet of 13 3/8-inch pipe placed within a 17½-inch hole. The annulus between the protective casing and the hole wall would be cemented. Cement would be run from about 4,000 feet to about 3,100 feet. Casing would be pressure tested to 1,500 psi. This protective casing would isolate the "boulder zone" and associated potential for lost circulation at 2,900 feet and the remainder of the Floridan aquifer which extends to 3,800 feet.

Protective II - a second protective casing string consists of about 12,100 feet of 9 5/8-inch pipe placed within a 12 1/4-inch diameter hole. The annulus between the protective casing and the hole wall would be cemented. Cement would be run from about 12,100 feet to about 4,000 feet. Casing would be pressure tested to 2,000 psi. This second protective casing would seal the Lake Trafford Formation and potential salt water flows.





LEGEND

- CEMENT
- BOULDER ZONE
- WELL CASING
- UNCEMENTED WELL BORE

NOTE: SEE FIGURE 2-6 FOR THE LOCATION OF THIS DETAIL

Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	N.T.S SCALE	*CASING AND CEMENTING DETAIL*	FIGURE

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Production - if the well encounters hydrocarbons, a final casing string would be set to allow production testing of the formations. Production casing consists of five and one-half-inch or seven-inch pipe placed within an eight and one-half inch hole. Pipe length and cementing would depend upon the selected depth at which the production testing is selected to take place.

The geologic targets which SWEPI is seeking to test are between 3,600 feet and 4,700 feet east of the drill site beneath WCA-3A. Directional drilling techniques would be used to reach these objectives without the need for a surface site in the WCA. The bottomhole location is approximately 4,700 feet east of the surface site in the NE quarter of Section 3, T50S, R35E. The projection of the bottomhole location to the ground surface is shown in Figure 2-2.

All directional drilling would be done below 13 ⅝ inch casing at 4,000 feet. Thus, all water bearing aquifers and the "boulder zone" of the Floridan aquifer would be drilled and cased in a straight hole section directly under the surface location. The wellbore drilled below 5,700 feet would be under WCA-3A within the Miccosukee Reservation boundaries.

Figure 2-6 shows the estimated plan to directionally drill the well. Kick off point (KOP) is 4,100 feet TVD. The angle would be built to 30 degrees at a rate of 1.6 degrees per 100 feet of vertical depth with downhole motors, appropriate directional drilling equipment and techniques. Maximum angle would be built at 6,141 feet MD and the angle maintained to 9 ⅝ inch casing point at 12,100 feet MD. Horizontal displacement at the top of the Sunniland Formation would be approximately 3,600 feet. Below the 9 ⅝ inch casing, the angle would be dropped until near vertical is reached at 17,000 feet MD. The remainder of the well would be drilled vertically. Horizontal displacement from the surface site is estimated at 4,700 feet when measured total depth of 18,850 feet is reached.

Inclination surveys would be taken every 500 feet or less from surface to 4,000 feet. A directional survey would be taken prior to KOP at 4,100 feet and the well would be directionally surveyed every 250 feet or less from this point to total depth.

The drilling operations are not expected to encounter any unusual conditions or geologic hazards. These expectations are based upon review of conditions encountered in representative wells in Florida. No abnormal formation pressures or temperatures are anticipated. Severe lost circulation is expected due to the high permeability in the "boulder zone" of the Floridan aquifer at about a depth of 2,900 feet. The drilling plan includes provisions to appropriately deal with this condition.

CHAPTER TWO

Although H_2S generally is not found in the Sunniland Formation and only trace amounts have been detected in South Florida wells, the possibility of occurrence does exist. A "Contingency Plan and Public Protection Plan" has been prepared for the possibility of H_2S and is included as Appendix A-3.

The drilling fluids program is designed to achieve the technical drilling objectives of hole cleaning, hole stabilization, bit cooling and well control as well as to minimize potential environmental impacts. A "closed mud system," which does not require a reserve pit, would be used. All liquids would either be reused in the mud system or disposed by injection into the "boulder zone."

Drilling fluid components would be transported to the site by truck in dry form, and stored in/on trailers located within the bermed drill site. Truck transport of drilling fluid components would be conducted in accordance with all applicable state and Federal transportation regulations. The drilling operations would recycle all drilling fluids possible through an extensive separation system to remove drill cuttings.

Only water based drilling fluids would be used. All of the additives used in the drilling fluids program have acceptable toxicity levels as defined by EPA offshore testing protocols. If drilling fluids are lignosulfonate and lignite based, only chrome-free mixtures would be used.

Table 2-1 lists the materials and their estimated total usage during the proposed drilling program. The materials would be mixed with water to produce the drilling fluids used during the drilling program. The actual composition of the drilling mud would consist of percentages of the listed material which vary in response to the specific conditions encountered during the drilling operations. The actual volume of material required would depend on site specific conditions encountered during drilling operations.

Drilling fluid disposal would be minimized. Water and drilling fluid washed from equipment would be collected by a plastic liner under the equipment area and would be routed to the lined cellar area and subsequently to a storage tank.

The drilling operations would reuse all possible drilling fluids through an extensive processing system to remove drilled solids. The primary disposal fluid would be stormwater accumulated during heavy rains. Excess drilling fluids and stormwater would be disposed of into the "boulder zone" of the Floridan aquifer which is a severe lost circulation zone beneath all the fresh water aquifers at about 2,900 feet. This zone is commonly used for waste injection wells in South Florida. Such disposal during the construction of a hydrocarbon well is not subject to UIC permit requirements. SWEPI would analyze the fluids to be pumped into the "boulder zone" and would maintain records of such tests. If any toxic or radioactive fluids are accumulated, they would not be pumped into this zone. After characterization, such fluids would be disposed of at an appropriate licensed facility. The drilling operations would generate a maximum of about 2,000 cubic yards of drill solids or cuttings. The Miccosukee Indians have

TABLE 2-1
ESTIMATED TOTAL DRILLING FLUID COMPONENT REQUIREMENTS

MATERIAL	GENERIC COMPOSITION	UNITS	TOTAL QUANTITY
Barite	Barium Sulfate	Bulk	500 tons
M-I Bar	Barium Sulfate	100 lb sack	400-500 tons
M-I Gel	Bentonite (Sodium Montmorillorite)	100 lb sack	400-450 tons
Caustic	Sodium Hydroxide	50 lb sack	25-50 tons
Lime	Calcium Hydroxide	50 lb sack	12.5-25 tons
Spersene CF	Chrome-free Lignosulfonate	50 lb sack	20-37.5 tons
Tannathin	Processed Lignite	50 lb sack	20-25 tons
Poly Pac	Polyanionic cellulosic polymer	50 lb sack	5-10 tons
Kwik Thik	Sodium Montmorillorite/ Polyacrylamide blend	50 lb sack	25-50 tons
Kwik Seal (Coarse)	Blend of nut shells, cellophane flakes and wood fibers	50 lb sack	20-37.5 tons
Kwik Seal (Medium)	Blend of nut shells, cellophane flakes and wood fibers	50 lb sack	20-37.5 tons
Mica (Coarse)	Mineral Mica	50 lb sack	12.5-20 tons
Mica (Medium)	Mineral Mica	50 lb sack	5-12.5 tons
Lube 106	Proprietary fatty acid blend	55 gal drum	550-825 gal
Gypsum	Calcium Sulfate	50 lb sack	5-10 tons
Sulf-X	Zinc Oxide	50 lb sack	2.5-7.5 tons

agreed, in principle, to use the cuttings as fill in upland areas of the reservation. Representative samples would be tested using Toxicity Characteristic Leaching Procedure (TCLP) to assess availability of heavy metals for leaching, tests for chlorides, tests for oil and grease, and screening for radioactivity. Landfill disposal is an alternative to upland filling.

In the event of hurricane force winds, all of the drill strings would be removed from the derrick, equipment secured and drilling operation suspended to ensure well and personnel safety. A hurricane contingency plan for the project is included as Appendix A-11.

Exploratory drilling and well evaluation operations are expected to take about 145 days.

2.2.1.4 Well Testing

Well or production testing operations would be conducted if the open hole evaluation indicates the need to determine hydrocarbon content and reservoir productivity. Production testing would be performed after the well casing has been installed and cemented across the geologic formation interval(s) of interest.

All testing would be conducted in accordance with SWEPI's "Contingency Plan and Public Protection Plan," until such time that the reservoir is determined to be free of H_2S gas. Should multiple intervals of interest be encountered, each would be evaluated individually. Generally, the deepest interval would be tested first. This interval would then be plugged and the next interval above it tested, until all intervals have been tested.

Production processing and handling at the surface would be performed with temporary surface well test facilities. The oil, gas and water would be separated and metered. The gas would be flared. Storage tanks would be provided for oil and water. The water would be injected into the "boulder zone." The oil would be hauled from the proposed site in tanker trucks.

If, upon completion of testing, it is determined that commercial quantities of oil are present, the well would be left in temporary abandoned status with all perforated intervals plugged back with cement. If the well is non-commercial, it would be permanently plugged and abandoned.

2.2.1.5 Abandonment and Reclamation

In the event of permanent well abandonment, SWEPI's abandonment plan provides for protection for all usable quality water, hydrocarbon resources, and mineral deposits. Approval from the BLM would be obtained prior to any plugging operation. Since the proposed well is a wildcat and the geologic profile is unknown, it is not possible to address all potential plugs needed at this time. Cement plugs would be

placed across any zone which contains fluid or gas which could migrate or any mineral deposit. A minimum of 100 feet above and below such an interval would be covered with the plug. Cement plugs extending a minimum of 150 feet above and 150 feet below any casing shoes would be set. Cement plugs would be set across all casing stubs and extended a minimum of 100 feet above and 100 feet below the cutoff point: A 400-foot minimum cement plug would be set inside the 20-inch casing to protect water quality in the usable aquifers. A minimum of 100 feet of cement plug would be set in the top of the 20-inch casing which extends to surface. All annuli extending to surface would also be cemented. The water supply wells and monitoring wells would also be plugged unless the Miccosukee Tribe specifically requests that the wells be left in a functional status. If left intact, the wells would be capped.

Every effort would be made by SWEPI to restore this well site to its "native state" consistent with the desires of the Miccosukee Tribe. The Miccosukee Tribe may elect to leave the well pad and/or road improvements in place for other purposes. SWEPI's reclamation plans include the following:

- Immediately after removal of the drilling and/or completion rig, all trash, debris, unused material, and other equipment would be removed.

- Plastic liners placed under the drilling rig and the drilled cuttings collection area would be removed and the area graded.

- The auxiliary holes would be filled with earthen material or cement.

- If the well is permanently abandoned, the berm around the site would be removed and the material used to fill in fluid collection areas. Soil removed from the caprock and stockpiled during site construction would be placed over the berm filled areas and seeded with green alta (*Hemarthria altissima*), the grass currently planted in the area. The rocked location can be sodded or the rock can be removed and hauled to a stockpile location for the Miccosukee Tribe's later use. The soil would then be spread back to its original location and seeded. With either alternative, the site would be covered with green alta. If the well is temporarily abandoned, the berm would be left and the stockpiled soil spread around the outside of the berm (wetland areas would be avoided) and seeded with the green alta.

- Assuming weather conditions would permit, reclamation described above would be completed within 120 days after permanent or temporary well abandonment.

2.2.2 Alternative B - West Access Route

Under this alternative the drill site, exploratory drilling, well testing, abandonment and reclamation are the same as described in Alternative A. The access route is the only variable. Therefore, the following discussion of Alternative B is limited to the West Access Route.

This access route would originate from the Snake Road Interchange at I-75 and would travel north a short distance to the Miccosukee Service Plaza. From this point the access route would travel east on a trail, directly north of the I-75 borrow canal for approximately 1.6 miles to the drill site (Figure 2-3).

2.2.2.1 Access Route Construction

Because this alternative access route is unimproved and no road or berm exists, approximately 1.6 miles of new road construction would be required. Road construction would require several vertical feet of fill to create a one-lane access road (15 feet top width) and vehicle turnouts. Vehicle turnouts would be 100-feet long by 15-feet wide, spaced at ½ to ¾ mile intervals. A total of two or three vehicle turnouts would be required. All vehicle turnouts would be field located to avoid wetland and hammock areas. Fill would be hauled to the site from a commercial off-site source. After completion of the project, the road would be reclaimed or left in place if desired by the Miccosukee Tribe.

2.2.3 Alternative C - East Access Route

Under this alternative the drill site, drilling, testing, and abandonment and reclamation are the same as described in Alternative A - proposed action. Therefore, the following discussion of Alternative C is limited to the East Access Route.

The East Access Route would originate from I-75 westbound at the exit ramp to SFWMD S-140 pump station located east of the L-28 Canal. From this point the access route would connect to a private road, maintained by the SFWMD, extending north to a point that is directly across from the drill site and separated by the L-28 Canal (Figure 2-3). Vehicles exiting the drill site would travel south under I-75 on an existing road adjacent to L-28. An eastbound acceleration lane provides access on the south side of I-75.

2.2.3.1 Access Route Construction

The existing I-75 ramps and SFWMD road appear in good condition and able to handle project traffic and rig equipment weight. However, a vehicular bridge must be constructed across the L-28 Canal to access the drill site. SFWMD criteria would require a low beam elevation of 6 feet above the water

The center span clear zone requirement is a width of 25 feet. This bridge would most likely be of pre-cast concrete construction similar to the adjacent I-75 bridges. Only one lane would be required. This alternative would require a right-of-way use permit from SFWMD. After completion of the project, the bridge could either be dismantled or left in place, if desired by the Miccosukee Tribe and authorized by SFWMD.

2.2.4 No Action Alternative

Section 1502.14(d) of the NEPA requires that the alternative analysis in an EIS include an Alternative of "No Action."

In this instance, No Action means denial of the SWEPI APD for an exploratory well at the proposed drill site, or any alternative sites that could meet the geologic objectives of the project. The No Action Alternative is a valid alternative to the decision maker.

The Miccosukee Tribe entered into a lease with SWEPI. The lease grants SWEPI the exclusive right to use the lease premises for exploring, drilling, operating for, producing and owning oil, gas and other enumerated minerals. The lease rights are subject to compliance with Federal regulations including 43 CFR, Part 3160, governing oil and gas operations on Federal and Indian lands. Lease rights are legally protected interests entitled to constitutional protection against taking without just compensation.

The BLM may withhold approval of a specific permit to drill when the proposal cannot be conducted in a manner which complies with the lease terms and regulations, and does not protect natural resources, environmental quality, life and property. However, the authority of BLM to withhold approval of a specific permit to drill does not mean that SWEPI may be denied surface use of the entire leased premises. To deny all use of the lease hold surface would amount to confiscation of a valuable property right acquired by SWEPI. The BLM, acting pursuant to the delegated authority of the Secretary of the Interior, does not possess the authority to "take" SWEPI's property.

Hence, BLM's authority with regard to the No Action Alternative is restricted to denial of a permit when specific conditions warrant such a denial. BLM may not deny the lessee reasonable opportunity to develop the lease.

The Miccosukee Tribe also has property rights that must be recognized. As the beneficial land owner, it has the right to pursue development of its property. It is in pursuit of this right that the Tribe leased its reservation to SWEPI for mineral development.

[illegible] options

2.3 Features Common to All Alternatives

Common features of all alternatives include the drill site, which is the only location considered for analysis based on a process of elimination considering: the nature of the well (a wildcat); project objectives; and environmental, geologic, and technological factors. Therefore, all exploratory operations, including drill site construction, exploratory drilling, well testing and abandonment and reclamation would be identical for all alternatives. Access to the drill site is the only variable.

2.4 Summary Comparison of Alternatives

Table 2-2 provides a data summary of the proposed access route and alternatives. With the exception of a vehicle bridge the proposed access and alternatives differ in location, not in major components.

TABLE 2-2
COMPARISON OF ALTERNATIVES

COMPONENT	ALT. A	ALT. B	ALT. C
Access Roads (miles)			
In current public use	4.0	0.2	0
In current limited use	5.5	0	0.33
New construction	0	1.6	0
New construction across wetlands	0	0.1	0
Canal Environment			
Existing canal crossings	0	0	0
New canal crossings (bridge)	0	0	1
Total crossings	0	0	1
Miles of road within 100 feet of a canal	9.5	0	0.33
Disturbance/Land Clearing (acres)			
Vehicle turnouts	0.4	0.1	0
New road construction	0	2.9	0
Total	0.4	3.0	0

2.5 Alternatives Considered but Eliminated from Detailed Analysis

One of the issues identified through scoping was eliminating the need for the project by utilizing alternative energy sources. This alternative to the proposal is not considered practical or feasible for several reasons as follows: The BLM and BIA do not have any means or authorization to require use of alternate energy sources as an alternative to the proposal. This would not fulfill the purpose or intent of the proposed action to determine if hydrocarbons are present in the area of the proposed action. In addition, this alternative would not be consistent with the intent of the IMDA; to allow any Indian tribe to enter into any Minerals Agreement; providing for the exploration of mineral resources. Hence, this alternative is not considered a reasonable alternative to the proposed action and is not within the scope of the analysis.

Alternatives that meet the stated purpose and geologic objectives of the proposed action are limited by geographical and technological constraints and environmental considerations. Four alternative well sites were identified, but eliminated from detailed analysis for various reasons prior to further detailed analysis. The alternatives are:

Option 1

A surface location directly above the Sunniland Target, eliminated due to the nature of the well (a wildcat) and the location in WCA-3A.

Option 2

A location 2,000 feet east of the Sunniland Target, eliminated due to four angle changes in directional path of the drill hole, nature of the well (a wildcat) and location of the surface site in WCA-3A.

Option 3A

A location 700 feet west, slightly northwest, or slightly southwest of the proposed action alternative. Eliminated due to potential wetland impacts.

Option 4

A location along a 2,600-foot radius from a center located 1,100 feet west of the Sunniland Target, eliminated due to the nature of the well and the location in WCA-3A or other wetlands.

These options are discussed in greater detail in Appendix A-2.

2.6 Agency Preferred Alternative

Alternative B (West Access Route) is the Agency Preferred Alternative.

The BLM authorized officer is authorized and directed to require compliance with lease agreement terms, regulations under 43 CFR and all other applicable regulations; and to require that all lease operations be conducted in a manner which protects natural resources, environmental quality, life and property. It is the opinion of the BLM, in consultation with BIA, that the analysis presented in this FEIS shows that Alternative A, the Proposed Action, as well as Alternatives B and C, with recommended mitigation, comply with the terms of the lease agreement and all applicable regulations, and assures protection of natural resources, environmental quality, life and property. Hence, the No Action Alternative is not warranted.

The DEIS identified Alternative A as the Preferred Alternative. However, Alternative B was identified as a second choice, if jurisdictional conflicts relating to access along the berm road west of the L-28 Canal prohibit selection of Alternative A. Following completion of the DEIS, additional consultation was initiated with the SFWMD and the Miccosukee Tribe concerning this issue. This jurisdictional conflict, documented by letters found in Appendix A-12, can be summarized as follows:

The SFWMD asserts a right-of-way for the L-28 component of the Central and Southern Florida Flood Control Project. On May 13, 1993, the Governing Board of the SFWMD adopted Resolution 93-18 opposing the construction of exploratory wells in, adjacent to, or under any WCA within the Everglades. The Resolution states that the Governing Board is against the use of District's property for the access or transportation facilities that may be required. By letter dated February 18, 1994, SFWMD claims authority to require SWEPI to apply for a permit to utilize any portion of the asserted L-28 right-of-way.

The Miccosukee Tribe disputes the SFWMD position. The Tribe maintains that neither the Tribe nor any of its lessees, including SWEPI, need to obtain a permit from SFWMD for use of the western berm road, as proposed by SWEPI (Alternative A). The Tribe's position is documented in a letter from the law firm Hobbs, Straus, Dean & Wilder dated March 24, 1994.

Based on the conflicting positions of the SFWMD and the Miccosukee Tribe, a jurisdictional conflict exists between two governmental entities concerning the access route under Alternative A. This conflict cannot be resolved through the NEPA process.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

The Tribe recommends that the BLM and BIA consider Alternative B (West Access Route) as the Preferred Alternative since this route provides an acceptable route without any jurisdictional conflict.

Alternative B considers construction of the West Access Road from Snake Road to the well site. Since Alternative B requires construction of a new access road, the DEIS noted that impacts associated with this alternative would be greater than impacts associated with Alternatives A and C. However, the impacts associated with Alternative B were not found to be significant.

Impacts associated with the Alternative B access route include:

- Suspended dust and/or particulate matter.
- Fill placement over three acres of existing soil profile, including 0.25 acres of wetlands.
- Located near several hardwood hammocks and a potentially significant archaeological site.
- Slight increase in traffic volume on existing roads.
- Minor increase in noise.
- Access road, truck traffic and dust visually apparent from I-75.
- Slightly elevated surface water turbidity during construction.
- Minor impacts to wetland-dependent species may occur.
- Additional barrier to southeastward sheetflow.

b/Advantages of the Alternative B access route over Alternatives A and C include:

- No jurisdictional conflict exists concerning this route.
- Recommended as the preferred alternative by the Miccosukee Tribe.
- Access is not off I-75 as is required under Alternative C.

- This route is confined to an area closer to I-75 than Alternative A. Since the ambient noise level increases closer to I-75, the noise associated with the project would be less apparent along the Alternative B route than Alternative A.

- Bridge construction across the L-28 Canal would not be necessary as required under Alternative C.

- The Alternative B access route (1.6 miles), from the I-75 exit at Snake Road, would be considerably shorter than the Alternative A route from the I-75 exit (9.5 miles). The cumulative miles of vehicular traffic during the life of the project would be considerably less under Alternative B.

- Potential wildlife fatalities resulting from collisions with vehicles along the West Access Road would be less than Alternative A due to the shorter distance.

- Under Alternative B, an oil spill into the L-28 Canal, due to a vehicle turnover into the canal, would not be possible. The Alternative B route would be confined to the pasture west of the L-28 Canal berm and north of I-75.

- This route would not be located near the State listed fern species found along the toe of the slope of the L-28 berm.

- This route would not be located near the alligator nest found along the proposed access route.

The Agencies' selection of this alternative would be subject to the following conditions:

(a) If a discovery of commercial quantities of hydrocarbons is made, further exploration, production and development in the area of the well would not be considered until an EIS of field development has been completed. In this event, the applicant would be required to submit a conceptual field development plan to the BLM. The conceptual field development plan must describe the extent, location, duration and timing of additional wells and other facilities.

(b) All mitigation measures and monitoring requirements identified in Chapter 4 would be required.

(c) SWEPI would provide a road design plan to BLM prior to construction.

AFFECTED ENVIRONMENT

CHAPTER 3

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3.0 AFFECTED ENVIRONMENT

3.1 Introduction

This chapter discusses environmental, social and economic factors as they currently exist within the subjects of analysis. The information presented here is based upon public issues identified through the scoping process and interdisciplinary field analysis.

3.2 Critical Elements Not Present and/or Not Affected

Critical elements which are required to be addressed by this FEIS but which are either not present and/or not affected by the proposed action include the following:

Wild and Scenic Rivers

Because there are no Federal designated wild and scenic rivers on the project site or in the immediate vicinity of the project site, this element is determined not present.

Wilderness

Federal designated wilderness areas in the project area that would be affected by the proposed action or alternatives do not exist.

Farmlands (Prime or Unique)

The project site is located on pastureland (grazing). The Broward County Office of the SCS has determined no prime or unique farmlands exist on or adjacent to the project site, therefore, this element is determined not present. Correspondence from the SCS regarding this issue is presented in Appendix A-12.

Areas of Critical Environmental Concern (ACEC)

ACEC is a designation applicable to public lands under BLM jurisdiction. The project site and adjacent area are not public lands, thus, are not Federal designated or eligible for designation as ACEC. Therefore, this element is not affected by the proposed action.

Floodplains

The area west of the L-28 Levee and Canal (the project area) has been severed from the Everglades floodplain, which is recognized as a waterbody by the State of Florida. The site area is not flooded by WCA-3A or any other inland waters and is, therefore, not considered a floodplain (see definition of a

floodplain, Section 1.6.4). The area is floodprone due to ponding of rainwater, primarily in the summer months. Hydrological modeling indicates that the project site is inundated approximately 5.5 days per year (average).

Western Broward County has been rated a Zone D by the Federal Emergency Management Agency (FEMA). Zone D is defined as areas of undetermined but possible flood hazards. The fact that the area is floodprone due to the ponding of rainwater, but not within the floodplain of the Everglades, results in a determination by the BIA that the EO regarding floodplains (EO 11988) is not applicable to the proposed action or alternatives.

Coastal Zone Management

Indian lands are excluded from the jurisdiction of the Florida Coastal Zone Management Plan.

In addition, the definition of "coastal zone" in the Coastal Zone Act states that " ...Excluded from the coastal zone are lands the use of which is by law solely to the discretion of or which is held in trust by the Federal Government..." (16USC,1453). The Miccosukee Federal Indian Reservation is land held in trust by the Federal Government.

3.3 Elements

3.3.1 Air Quality

Air quality could be impacted as a result of project construction and operation in the following ways: 1) suspended particulate matter generated from the road and drill site construction activities; 2) accidental emissions of pollutants such as sulphur dioxide or H_2S during exploratory well drilling; 3) accidental spills of volatile petroleum products; or 4) emissions from construction machinery.

3.3.1.1 Alternative A - Proposed Action

Air quality in the project area, although not monitored, is good to moderate except for the air pollutant Ozone. Based on ten years of monitoring data, the national ambient air quality standard for Ozone is periodically exceeded in the eastern urbanized coastal part of Broward County. The project area is in the rural western part of the county. All of Broward County (as well as Palm Beach County to the north and Dade County to the south) is classified by the EPA as an Ozone Non-attainment Area.

Short-term occurrences of elevated levels of airborne particulate matter could occur periodically in the project area due to natural fires and fires from controlled burns. Air pollution from the urbanized coastal

area is also expected to affect the air quality of the project area. Existing major stationary sources in the South Florida area include an oil-fired power plant at Fort Myers (West Coast), oil-fired power plants and municipal waste incinerators in the eastern coastal areas of Palm Beach, Broward, and Dade Counties, sugar cane processing mills near Clewiston and Belle Glades (north of the project area) and a portland cement plant in Western Dade County, (southeast of the project area). Alligator Alley (I-75), which connects Fort Lauderdale (East Coast) with Naples (West Coast), runs east-west approximately 1,000 feet south of the center of the proposed well site. Approximately 3,000 vehicles cross Alligator Alley each day in each direction. Approximately 300 VPD utilize Snake Road which is 1.5 miles to the west of the proposed well site. The proposed access route to the well site from Snake Road would have approximately 25 VPD during the initial construction, exploratory drilling, and the reclamation phase of the project (approximately six months).

The East Coast urbanized area of Dade, Broward and Palm Beach Counties has a population of approximately three million people. The prevailing southeast winds carry emissions from the metropolitan areas and regional oil-fired power plants and waste incinerators into the project area. Regional haze and smoke plumes attributed to the power plants have been observed in the adjoining BCNP area. Observations from Miami and Fort Lauderdale International Airports indicate a typical visual range of 10 to 15 miles.

The flat coastal and inland terrain, in combination with diurnal changes in temperature, land - sea breeze recirculation, and frequent South Florida afternoon thunderstorms, constantly alters the surface air flow over the project area and provides for continuous air movement and circulation. These factors provide good dispersion rates. No areas or periods of prolonged or poor dispersion are expected in the project area.

The project area has been designated in the Clean Air Act, (42USC,7472) as a Prevention of Significant Deterioration (PSD) Class II area for all EPA regulated air pollutants except ground level Ozone. Industrial development is allowed within such areas provided the release of air pollutants associated with such development complies with the requirements of Ambient Air Quality, PSD, and Nonattainment New Source Review standards.

PSD Class I areas, including wilderness areas established prior to the enactment of the Clean Air Act in 1977, and national parks, have more stringent standards than the PSD Class II areas. The nearest Class I area to the proposed drill site is ENP, located approximately 30 miles to the south of the proposed test drill site.

3.3.1.2 Alternative B - West Access Route

The affected environment of the West Access Route is similar to the proposed access route with the exception that emissions from vehicle traffic would be limited to the area along the 1.6 mile access route.

3.3.1.3 Alternative C - East Access Route

The affected environment of the East Access Route is similar to the proposed access route with the exception that this route is very direct, resulting in a very limited area influenced by vehicle emissions.

3.3.2 Cultural Resources

Background information on cultural resources in South Florida was obtained from the Environmental Assessment, Oil and Gas Leasing Program, December 1981.

The Miccosukee Indians settled primarily in Northern Florida starting in the early 1700's. The Miccosukee gradually migrated southward when a great influx of non-Indian explorers and settlers moved into Florida. This migration continued into the 1800's. Removal and relocation of many Indians to reservations west of the Mississippi River occurred as a result of the Seminole Wars of the 1800's and the Indian Removal Act of 1830. The remaining Miccosukees moved farther south and established themselves in the Everglades, Big Cypress Swamp, and the Ten Thousand Islands. Most of the people lived on upland tree islands (hammocks), and used dugout canoes for transportation, hunting, and trading. Dwellings, called chickees, were constructed of cypress logs and palm fronds. The Miccosukee lifestyle endured for the remainder of the century and still endures to a certain extent.

Urbanization presented problems in the early 1900's for the Miccosukees. In 1928, the Tamiami Trail (U.S. 41) opened, providing access for more settlement. This transportation route and additional settlements resulted in significant lifestyle changes for the Miccosukees.

Formal organization of the Miccosukee Tribe of Indians of Florida occurred in 1961. The Tribe achieved Federal recognition in 1962. The Tribe adopted a constitution and bylaws in addition to obtaining assistance from the BIA for development of education, housing, economic development, and social welfare programs. The Miccosukee Tribe negotiated a contract with the BIA on May 12, 1971, resulting in the Tribe assuming the administration of all programs previously administered by the Bureau. The Tribe also assumed responsibility for hiring of personnel and managing its own funds.

The Miccosukees have two main reservation areas in South Florida: the 333-acre Tamiami Trail Reservation which is a permit area from the NPS; and the 76,800-acre Miccosukee Federal Indian

Reservation in Broward County. The Tribe also has two smaller reservation parcels known as the Krome Avenue Reservation and the Dade Corner Reservation. All Tribal operations, as well as the center of Miccosukee population, are at the area along U.S. 41. The proposed well site is located on the Miccosukee Federal Indian Reservation in Broward County. Currently, none of the Tribal members reside at the 76,800-acre Reservation in Broward County.

Archaeology

The initial appearance of the first Native Americans in Southern Florida is uncertain, but it is believed that the Calusas inhabited Florida for over 1,000 years. The Calusas were hunters and gatherers concentrated primarily in coastal areas, subsisting by fishing, collecting shellfish, and gathering wild plants for food. It is estimated that approximately 10,000 Calusas inhabited Southern Florida prior to contact with Europeans.

Interaction between Spanish and French explorers and the Calusas occurred during the 16th century. The European settlers attempted to convert to Christianity and alter their social structure. The Spanish retreated from Florida in the 1570's leaving the Calusas undisturbed during the 1600's. Approximately 6,000 Calusas remained, but disease and occasional European invaders probably continued to reduce the population.

Other Indian tribes and the English arrived in Southern Florida during the late 1600's and early 1700's. As a result of conflicts, the Calusas eventually disappeared. The possibility exists that a few remained and were assimilated into the Miccosukee and Seminole Tribes.

Limited archaeological information is available for the Reservation. No sites are recorded in the NRHP from the Miccosukee Indian Reservation. Eight sites were identified in the 1981 EA which at the time required further investigation to make a determination of eligibility. Of these eight sites (8Bd31, 8Bd32, 8Bd43, 8Bd46, 8Bd61, and 8Bd184-186), only three (8Bd184-186) currently exist, according to the DHR personnel. These three sites are located west of Snake Road which is approximately 2 1/2 miles west of the proposed drill site. The other five sites were either excavated or destroyed by vandals since the original review was conducted in 1981.

In 1991, the DHR reviewed the proposed drill site. No sites were identified, and the DHR determined that the proposed project would have no effect on cultural resources (Appendix A-12).

The DHR was contacted for this FEIS analysis to update both the 1981 and 1991 review. According to the DHR personnel, there are currently 12 sites identified in the vicinity of the project. Only one (8Bd1439) of these sites is located north of I-75, west of L-28, and east of Snake Road. All 12 sites

identified in the project vicinity are considered potentially eligible for listing in the National Register of Historic Places. Further surveys and testing would be required if the project were to affect any of these sites. Actual listing in the Register would be done if test excavation revealed that the site is virtually undisturbed and of high quality.

Given the extensive aboriginal activity in Southern Florida, it is likely that additional significant archaeological sites may be located on the Reservation property. The Miccosukee Tribe has specified that archaeological surveys be conducted prior to construction activities or land disturbance of any kind.

Site Archaeological Survey

In February 1990, Robert S. Carr performed an archaeological assessment of the proposed drill site (Appendix A-4). Previous research was reviewed by Mr. Carr to determine a site locational model for the general area of the BCNP and the ENP. This review identified "hardwood tree islands in relation to deep ponds and sloughs" as primary high probability areas for archaeological sites. Typically, sites were found "on that portion of the hammock island opposite the deepest slough or pond that is adjacent to the island."

A predictive site model was developed based on previous surveyed traverses through the Big Cypress and Western Everglades. The proposed site model includes sites located on upland areas "adjacent to or immediately adjacent to areas that maintain an adequate water level during cycles of low water." Specific site locations can be predicted from mean low water levels. Sites would typically be found in the nearest adjacent upland in areas that maintained flowing water during mean low water levels.

The same settlement model was applied to the Everglades. Since flowways are less localized in the Everglades, the pattern is less apparent and tree islands located near or on sloughs appear to be selected for sites. Also, most sites in the Everglades occur in areas where a clay-like substance was near the surface and non-persistent emergent vegetation (pickerelweed and arrowhead) was present. Mr. Carr hypothesized that the clay-like substrate provided an impermeable layer that allowed for water retention.

Based on the archaeological surveys conducted in the area, two factors were found to influence site selection: drainage flow and cypress sloughs/sawgrass ecotones. Hardwood hammocks were frequently located in these mixed marshes and sloughs.

3.3.2.1 Alternative A - Proposed Action

Mr. Carr reported archaeological sites on three tree islands (Hammocks) located within one mile of the proposed drill site. He suggested avoidance of tree islands when constructing roads, or the proposed drill site.

3.3.2.2 Alternative B - West Access Route

The concerns for potential archeological sites would be the same as listed in Alternative A.

3.3.2.3 Alternative C - East Access Route

The concern for potential archeological sites would be the same as listed in Alternative A.

3.3.3 Geology/Soils

Geologic Formations

Regional Geology

The regional geology of Southern Florida consists of sedimentary rocks ranging in age from Early Pleistocene to Jurassic - Early Cretaceous. The surficial sediments are composed primarily of sand, marine and fresh water shell marls and limestone. The Pleistocene-age Fort Thompson Formation comprise these surficial sediments and collectively are approximately 10- to 40-feet thick. The Pliocene-age Tamiami Formation underlies the surficial sediments. This formation consists mainly of sand, limestone, and sandy marl. The thickness of this unit is generally less than 140 feet. The Miocene-age Hawthorn Formation is comprised of sandy marl, clay, and silty sands and can be 300- to 500-feet thick. The Miocene-age Tampa Formation is comprised of permeable limestone and calcareous sandstone and can reach 200-feet thick. The Oligocene-age Suwannee Limestone and the Eocene-age Ocala Group, Avon Park Formation, and Oldsmar Formation are all composed of carbonates (limestone, dolostone) and evaporates (anhydrites and gypsum). Collectively, the thickness for all of the units is approximately 2,350 feet.

Local Geology

The Miccosukee Reservation is underlain by a sequence of sediments ranging in age from Recent through Jurassic-Early Cretaceous in age, which include sections capable of yielding large quantities of

groundwater. Figure 3-1 is a cross-section showing the major geologic formations and units underlying the site.

Geology of the Surficial Aquifer

Surficial sands and peats overlie the Pleistocene age Fort Thompson Formation. The undifferentiated sands and peats extend only a few feet below ground level. The Fort Thompson Formation is approximately 10 to 40-feet thick and is composed of sand, shells, lime mud, and limestone. The limestone has poorly to moderately developed solution-cavity zones. Thin zones with cavities may however be highly permeable (Fish, 1988).

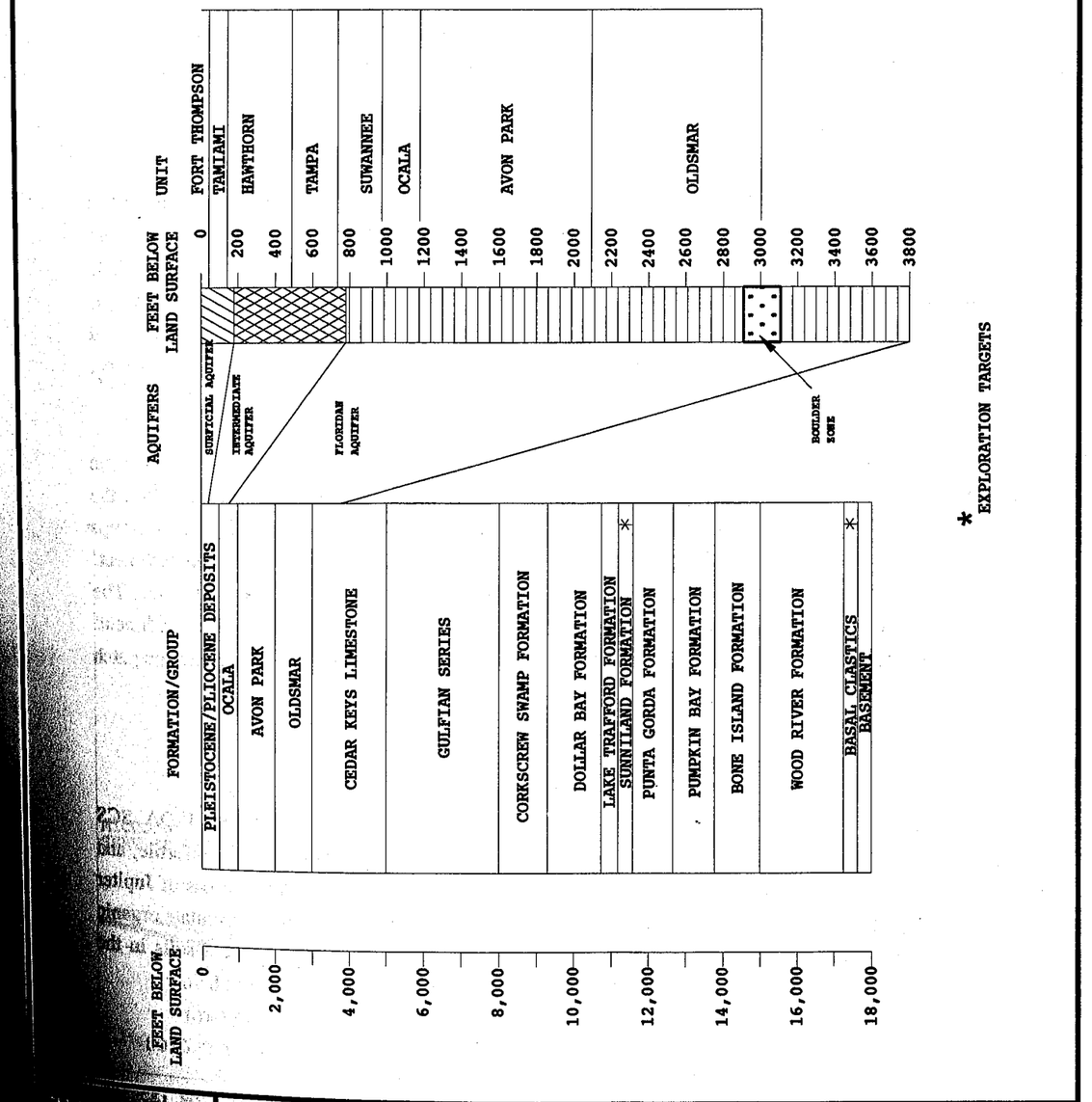
The Pliocene age Tamiami Formation underlies the Fort Thompson Formation. This unit consists of sandy clay and lime mud in the upper unit and a more permeable aquifer-bearing gray limestone in the middle, followed by fine sands and phosphatic clayey sand at the base of the unit. From 20 to 60 feet of green, clayey sand, shell, and limestone of the upper part of the Tamiami Formation, mostly of low to moderate permeability, occur below the Fort Thompson Formation at the site (Fish, 1988). Gray, shelly, relatively soft limestone of the Tamiami Formation forms a water-bearing unit referred to as the gray limestone aquifer. The top of this unit is approximately 70 feet below grade. Minor quartz sand occurs near the base of the unit. The upper part of the limestone unit consists of a poorly consolidated and cemented facies of a lime mud-shell-sand mixture (Fish, 1988). The thickness of the unit is approximately 100 feet.

Geology of the Intermediate Aquifer

The Miocene age Hawthorn Group underlies the Tamiami Formation at the site. This unit is composed of sand, clays, and carbonates. Intertwining of permeable and non-permeable layers is characteristic of this unit. Three shelly limestone layers comprise the intermediate aquifer system in the Hawthorne Group (Meyer, 1988). The lowest intermediate aquifer from 540 to 600 feet below grade and is comprised of the Tampa Limestone. Silty, green, clay separates the intermediate and Floridan limestone aquifers. The lower bed of clay is the principal confining unit above the Floridan aquifer system (Meyer, 1988). The entire Hawthorn and Tampa unit is approximately 700-feet thick at the site.

Geology of the Floridan Aquifer

Underlying the Hawthorn Group are the limestone, dolomite, and anhydrites units comprising the Floridan aquifer. These units and their corresponding thicknesses include the Oligocene age Suwannee Limestone (200-feet thick), and the Eocene age Ocala Group (150-feet thick), Avon Park Formation (1,000-feet thick), the Oldsmar Formation (1,000-feet thick) (Meyer, 1989).



Dames & Moore

SWEPI MICCOSUKEE 3-1
EXPLORATORY WELL
BROWARD COUNTY, FLORIDA

GEOLOGICAL
FORMATIONS
AND UNITS

FIGURE 3-1

D&M JOB No. 13501-072-049
AUTOCAD FILE: WELL_SCH.DWG

CHAPTER THREE

The Suwannee Limestone is white, cream, or tan, fossiliferous, poorly to well indurated, and variably recrystallized. Benthic foraminifera, bryozoans, mollusks, and echnoids are common fossils. The Ocala Group is white to cream to dark brown, granular, fossiliferous, poorly to well indurated limestone. The Avon Park Formation consists of finely crystalline dolomite with fossiliferous limestone. It is highly fractured and very permeable in some zones. The base of the formation forms a confining unit, separating the upper and lower Floridan aquifers. The Oldsmar Formation consists mostly of tan to dark dolostone. The lower unit is the highly permeable confined "boulder zone" of the lower Floridan aquifer.

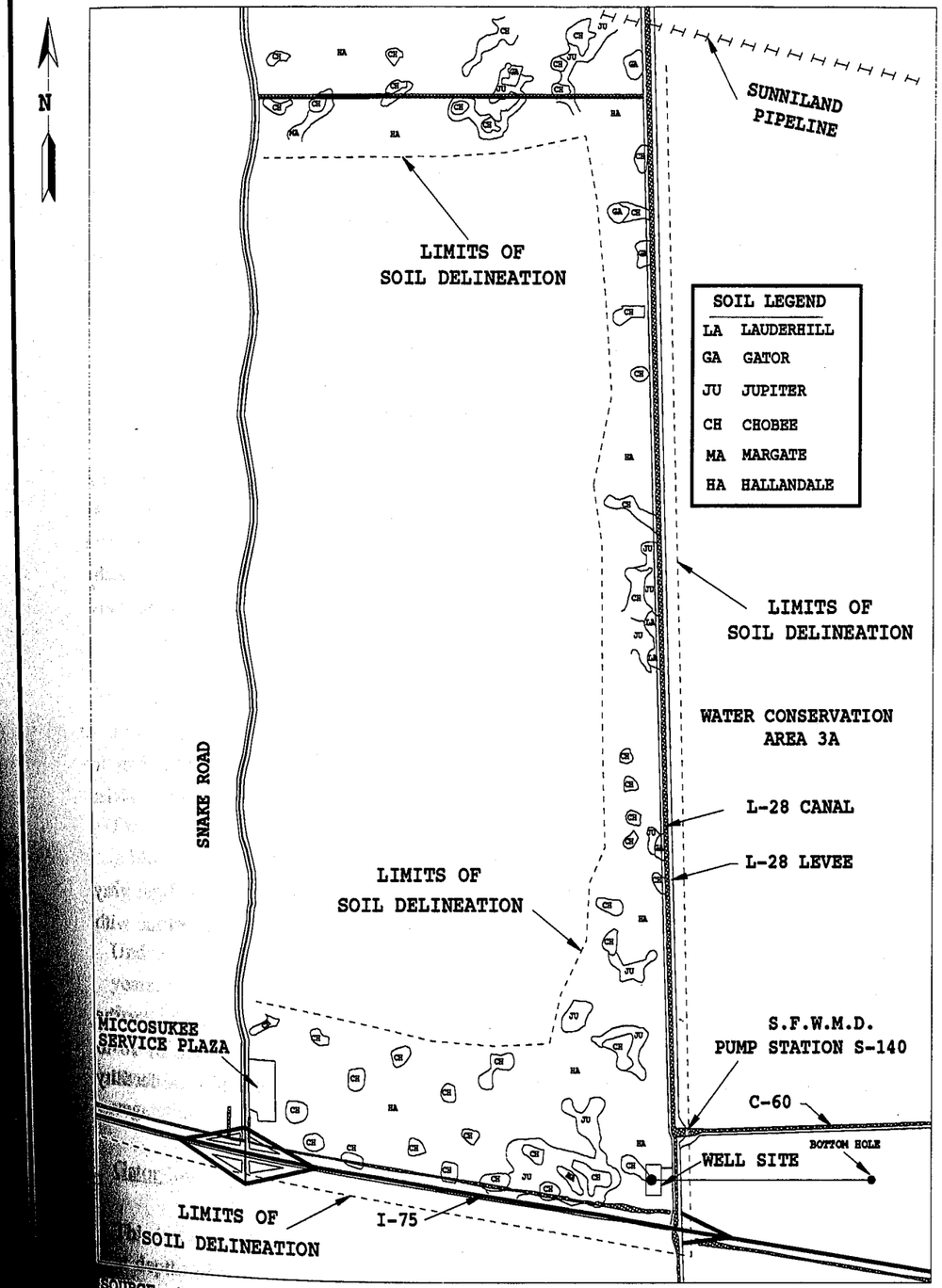
Geology Below the Floridan Aquifer

Below the Floridan aquifer, sediments at depths of 3,800 to 5,000 feet consist mainly of clastic materials such as sands, silts, clays, marls, and shellbeds, as well as carbonates composed of limestones and dolomites. Sediments in the deeper parts of the sedimentary sequence, at depths of 10,000 to 12,000 feet, consist of an organic-rich sequence of carbonate beds. This layer is known as the Sunniland Formation, and it is the current focus for hydrocarbon exploration in South Florida. Ancient reef areas on the trend have especially high potential for oil and gas deposits because the reef areas trapped organic matter, which subsequently decomposed and turned into hydrocarbons.

The proposed Miccosukee 3-1 well would explore in this area of small carbonate reefs and bioclastic banks and mounds which are commonly termed patch reefs. These structures are found within the Sunniland Limestone. They were formed in shallow seas on continental shelf margins by small groups of organisms which create reefs. These reefs are composed primarily of broken shells and sediment. They have excellent porosity and permeability and form generally small, high quality reservoirs. The hydrocarbons in these fields are believed to be derived from the reef itself and surrounding sediment. The hydrocarbons are usually trapped by a decrease in permeability in the rocks surrounding the patch reef.

Soils

The SCS has completed a soil survey report for the Miccosukee Federal Indian Reservation [USDA, SCS (n.d.)]. According to the report, soils in the vicinity of the project are typically shallow, infertile, and poorly drained. The dominant soil in the project area is Hallandale Fine Sand. Small areas of Jupiter Fine Sand and Margate Fine Sand are also present. Depressional wetlands in the area accumulate organic materials forming Gator Muck, Chobee Muck, or Lauderhill Muck. Occurrences of the soils in the project vicinity are indicated on Figure 3-2. A description of each soil type is presented below.



& Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	0 1,500' SCALE	SITE SOIL MAP	FIGURE 3-2 D&M JOB No. 13501-072-049 AUTOCAD FILE: SOIL.DWG

Hallandale Fine Sand

This is a nearly level, poorly drained, sandy soil underlain by limestone at a depth of 4 inches to 20 inches. It is on broad, low flats or prairies interspersed with numerous depressions and shallow drainageways. Though all of the Miccosukee Reservation Land is made up of lowlands associated with the Everglades, this soil is slightly elevated above the rest and makes up about 75 percent of the Reservation. Slopes are mostly smooth to convex and range from zero percent to two percent.

Typically the surface layer is black fine sand about four-inches thick. The subsurface layer is light brownish gray fine sand about three-inches thick. The subsoil is yellowish brown fine sand about seven-inches thick. Limestone with numerous solution holes is at a depth of about 14 inches.

Under natural conditions the water table is within a depth of 10 inches for 2 to 4 months, and within a depth of 10 inches to 30 inches most of the rest of the year. During periods of high rainfall most areas are covered by shallow water for seven days to a month. With the existing drainage in the area, the water table usually fluctuates with the water level in the canals and much of the time is below 20 inch. Permeability is moderately rapid to rapid throughout. Natural fertility and organic matter content are low, as is erosion potential.

Margate Fine Sand

This is a nearly level, poorly drained, sandy soil underlain by limestone at a depth of 20 inches to 40 inches. It occurs on the broad, slightly elevated prairies and in transitional areas between the prairies and depressional areas. Slopes are less than two percent.

Typically, the surface layer is black fine sand about six-inches thick. The subsurface layer is light gray fine sand about 13-inches thick. The subsoil is brown fine sand about 11-inches thick. Limestone with numerous solution holes is at a depth of 30 inches.

Under natural conditions the water table is within a depth of ten inches for about four months, or the surface is covered by shallow water for one to three months. The water table is at depths of 10 to 30 inches most of the rest of the year. Permeability is rapid in all layers of this soil. Natural fertility and content of organic matter are low, as is erosion potential.

Jupiter Fine Sand

This is a nearly level, poorly drained, black sandy soil resting on limestone at a depth of 7 to 20 inches occurring in low flats, poorly defined drainageways, and in shallow depressions. Slopes are mostly smooth to concave and range from zero percent to two percent.

Typically, the surface layer is black mucky fine sand about four-inches thick. Below this is very dark gray fine sand about eight-inches thick. Limestone with numerous solution holes is at a depth of 12 inches.

Under natural conditions the water table is within a depth of less than 10 inches for about 4 months, and within depths of 10 inches to 20 inches most of the rest of the year. Lowest areas are covered by shallow water for periods of three months or more. The existing drainage in the area has to some extent reduced the periods of high water tables, but the lowest areas of this soil are little affected. Permeability is rapid throughout. Content of organic matter is medium to high in the surface layer and natural fertility is medium. Erosion potential is low.

Chobee Muck, Limestone Substratum, Depressional

This is a nearly level, very poorly drained soil with a thick muck surface over loamy materials resting on limestone at depths of more than 40 inches. It occurs in depressions and drainageways throughout the area. Slopes range from zero percent to one percent.

Typically, the surface layer is black muck about six-inches thick. Below this, the mineral soil surface is black sandy clay loam about 20-inches thick. The subsoil is gray sandy clay loam about 16-inches thick. Limestone underlies the soil at a depth of about 42 inches.

Under natural conditions this soil is covered by about one foot of water for six months or more in most years. The water table is within ten inches of the surface most of the rest of each year except during droughts. Existing drainage in the areas has slightly reduced the period of standing water. Permeability is rapid in the organic surface layer but is slow in the underlying loamy mineral layers. Organic matter content and natural fertility are high. All areas of this soil on the Reservation remain in native wetland vegetation.

Gator Muck, Limestone Substratum, Depressional

This is a nearly level, very poorly drained organic soil over loamy mineral material resting on limestone at depths of more than 40 inches. It occurs in the centers of a few of the larger or deeper depressions

in the area where conditions are favorable for the accumulation of organic materials. Slopes range from zero percent to one percent.

Typically, this soil has a surface layer of black muck about 30-inches thick over a layer of black sandy clay loam about 14-inches thick. This is underlain by limestone at a depth of about 44 inches. Under natural conditions the soil is covered by about one foot of water for six months or more in most years. The water table is at or near the surface the rest of each year, except during the extended droughts. Existing drainage has only slightly reduced the period of standing water. Permeability is rapid in the organic surface layer and slow in the loamy mineral layer. Organic matter content is very high and natural fertility is high. All areas of this soil on the Reservation remain in native wetland vegetation.

Lauderhill Muck

This is a nearly level, very poorly drained organic soil underlain by limestone at a depth of 30 to 40 inches. It occurs in a few of the deeper depressions in the area where conditions are favorable for the accumulation of organic materials. Slopes range from zero percent to one percent.

Typically, this soil has a surface layer of black muck about 22-inches thick. Below this is a thin layer of gray loamy marl with numerous limestone fragments. This layer rests on limestone at a depth of about 25 inches and fills solution holes in the rock.

Under natural conditions the soil is covered by water most of the year, even with the existing drainage in the area. The water table is at or near the surface most of the time. Permeability is rapid in the surface organic materials and moderate in the thin marl layer, though this layer is normally covered by water or is absent in some places. Organic matter content and natural fertility are also high.

All areas of this soil on the Reservation remain in native wetland vegetation. This soil occupies the lowest position in the landscape.

Hydric Soil Types

Hydric soil types, which can indicate the presence of wetland communities include Jupiter Fine Sand, and the Lauderhill, Chobee, and Gator Mucks. The SCS classifies Margate and Hallandale Fine Sands as non-hydric soils.

Prime or Unique Farmland Soils

In accordance with the CEQ Memorandum on Prime or Unique Farmland Soils, the BLM is required to assess the effects of their actions on soils classified by the SCS as prime and unique farmlands. The Broward County offices of the USDA - SCS was contacted to determine if prime or unique soils are present in the vicinity of the project. According to SCS, Broward County does not contain any prime soil. Unique soil designations are limited to those areas currently supporting or highly suitable for supporting vegetables or fruit crops. Since the only agricultural land use on the Miccosukee Reservation is improved pasture and the soils are marginal for crop production, unique soils are not present.

3.3.3.1 Alternative A - Proposed Action

Soils within the alignment of the well site and the proposed access road vehicle turnouts are limited to Hallandale Fine Sand. The proposed access route was previously filled.

3.3.3.2 Alternative B - West Access Route

Soils within the alignment of the West Access Route include Hallandale Fine Sand and Jupiter Fine Sand.

3.3.3.3 Alternative C - East Access Route

Soils within the alignment of the East Access Route have been previously altered by filling activity.

3.3.4 Health and Safety

The cattle grazing operation conducted by the agricultural lessee of the Miccosukee Tribe is the only existing activity in the area of the well site and access routes. This activity does not present any health and safety concerns in the area.

3.3.5 Noise

The vicinity of the proposed well site is rural in character consisting of pasturelands and undeveloped lands. No residences exist within 10 miles of the well site.

Existing sources of noise are limited to traffic along I-75 located 1000 feet south of the center of the proposed well site and the S-140 pump station approximately 1000 feet northeast of the center of the proposed well site. Snake Road is approximately 1.5 miles west of the site. The Miccosukee Service

Plaza at the intersection of Snake Road and I-75 is a source of noise produced by vehicles and activities of patrons.

Noise measurements are not available for the project site or the S-140 pump station. Rural, undeveloped sites have typical noise levels of 35-55 Db. Sound levels along transportation arteries are typically in the range of 70 Db.

3.3.5.1 Alternative A - Proposed Action

The proposed access route would utilize existing roads (I-75 and Snake Road), then follow an upgraded one-lane private road for a distance of 5.5 miles. Snake Road and I-75 currently produce the noise associated with vehicle traffic. The existing private roads are used only occasionally by Tribal personnel or lessees. The well site is within close proximity (1000 feet) to the noise of the S-140 pump station and I-75.

3.3.5.2 Alternative B - West Access Route

The West Access Route would cross a cattle pasture currently unaffected by vehicular noises except for that created by occasional maintenance access to the billboards along I-75. Currently, noise along the route is confined to that produced by the Miccosukee Service Plaza to the west and the noise audible from I-75, 400-1,200 feet south of the alignment.

3.3.5.3 Alternative C - East Access Route

The East Access Route would utilize an existing ramp from I-75 and require a new bridge across the L-28 Canal and just north of the I-75 bridges. This area is affected by the noise of I-75, the S-140 pump station, and vehicles traveling to the S-140 pump station.

3.3.6 Socioeconomics

The Miccosukee Tribe's decision to execute the agreement and allow for exploration of hydrocarbons was done as part of the Reservation's economic development plans. Revenues from activities and development on the Reservation are an integral component of the Tribe's plans for self sufficiency and self determination.

3.3.6.1 Alternative A - Proposed Action

The proposed action would be in the north central section of the Miccosukee Reservation within a 20,571 acre rectangular tract of trust land designated by the Miccosukee Tribe as an Area of Future Development.

The Miccosukee Federal Indian Reservation is presently uninhabited. Other Miccosukee Reservation areas include the 333-acre Forty Mile Bend area and other lands consisting of approximately 54,271 acres.

The total Indian Service Population of the Miccosukee Reservation and surrounding area is 550 persons (USDI, BIA Report on Service Population and labor force, September 1991). About 413 Indian people live at the Forty Mile Bend area along U.S. 41.

The nearest activities to the proposed action are the SFWMD's S-140 pump station located approximately 1,000 feet northeast of the center of the proposed drill site, vehicles on I-75 1,000 feet south of the center of the proposed drill site, and the Miccosukee Service Plaza located 1.5 miles west of the well site. The well site is within air area currently under lease for cattle grazing.

The total potential labor force of the Tribe is 295 persons (16 years old and over). Currently 190 of these persons or 64 percent are employed, while 105 or 36 percent are unemployed.

3.3.6.2 Alternative B - West Access Route

Socioeconomic conditions for the West Access Route are the same as the proposed action.

3.3.6.3 Alternative C - East Access Route

Socioeconomic conditions for the East Access Route are the same as the proposed action.

3.3.7 Transportation

The existing transportation network in the vicinity of the project site consists of I-75, Snake Road and private limerock roads. I-75 is a recently improved asphalt-paved, 4-lane divided highway which runs east to west and is approximately 1,000 feet south of the center of the drill site, as shown on Figure 2-2. According to the FDOT, current average daily traffic (ADT) volumes for the section of I-75 between State Road (S.R.) 27 and the Naples toll booth are 3,172 eastbound and 3,349 westbound. The current Level of Service (LOS) for this section of I-75 is A; primarily free traffic flow operations. I-75 is a

limited access road, with an interchange at Snake Road being the only public access and exit for many miles.

Snake Road is a 16-mile, two-lane, paved roadway that extends north from the I-75 Interchange eventually terminating at S.R. 846 in Hendry County. Snake Road is a Federal road managed by the BIA as a part of the National Transportation System. Snake Road is approximately 1.5 miles west of the drill site. A transportation plan prepared for the Miccosukee Tribe indicates that the ADT volume for Snake Road north of the existing Miccosukee Service Plaza is approximately 300 VPD. Snake Road does not have a LOS standard.

Access from I-75 for mineral development is addressed in the 1985 Environmental Re-evaluation of I-75. The FDOT and FHWA policy is to limit additional access directly off I-75, as long as reasonable access alternatives exist. Snake Road and a limited access to the SFWMD S-140 pump station are the only existing access points from I-75 to the vicinity of the proposed drill site. After exiting I-75, three access alternatives to the proposed well site are available as described below.

3.3.7.1 Alternative A - Proposed Action

The proposed access route originates from I-75 at the Snake Road interchange, west of the proposed drill site. From the interchange the access route travels north along Snake Road for approximately four miles to an existing limerock road, extending east approximately one and one-half miles to the L-28 Canal and then south approximately four miles parallel to the canal, to the proposed drill site. The limerock road must be improved to handle the weight and traffic of hydrocarbon exploration equipment. The drill site could be accessed or evacuated in an emergency situation by utilization of an existing gate at the L-28/I-75 intersection.

3.3.7.2 Alternative B - West Access Route

The West Access Route originates from the Snake Road interchange off I-75. From this point the route travels north a short distance to a point adjacent to the Miccosukee Service Plaza. From this point the route travels east parallel to the I-75 borrow canal for approximately 1.6 miles to the drill site. This alternative access route is unimproved.

3.3.7.3 Alternative C - East Access Route

The East Access Route originates off of westbound I-75 to the S-140 pump station via a non-public deceleration lane east of the L-28 Canal. The deceleration lane connects to a private road that is currently maintained by the SFWMD. This road is gated and is used for maintaining the S-140 pump station

located to the north, approximately 2,000 feet. Vehicles leaving the pump station travel south under I-75 on an existing road adjacent to L-28. An eastbound acceleration lane provides access on the south side of I-75.

3.3.8 Vegetation

The Miccosukee Reservation lies in an area that once formed a transitional zone between the western edge of the Everglades and the Big Cypress Swamp. The 76,800-acre Reservation is largely comprised of freshwater marshes, prairie, cypress forests, willow heads, ponds, and hammocks. Because of the extremely flat topography in South Florida, the character of these vegetative communities depends on minor changes in elevation, hydroperiod, soil composition, and the frequency and intensity of fires.

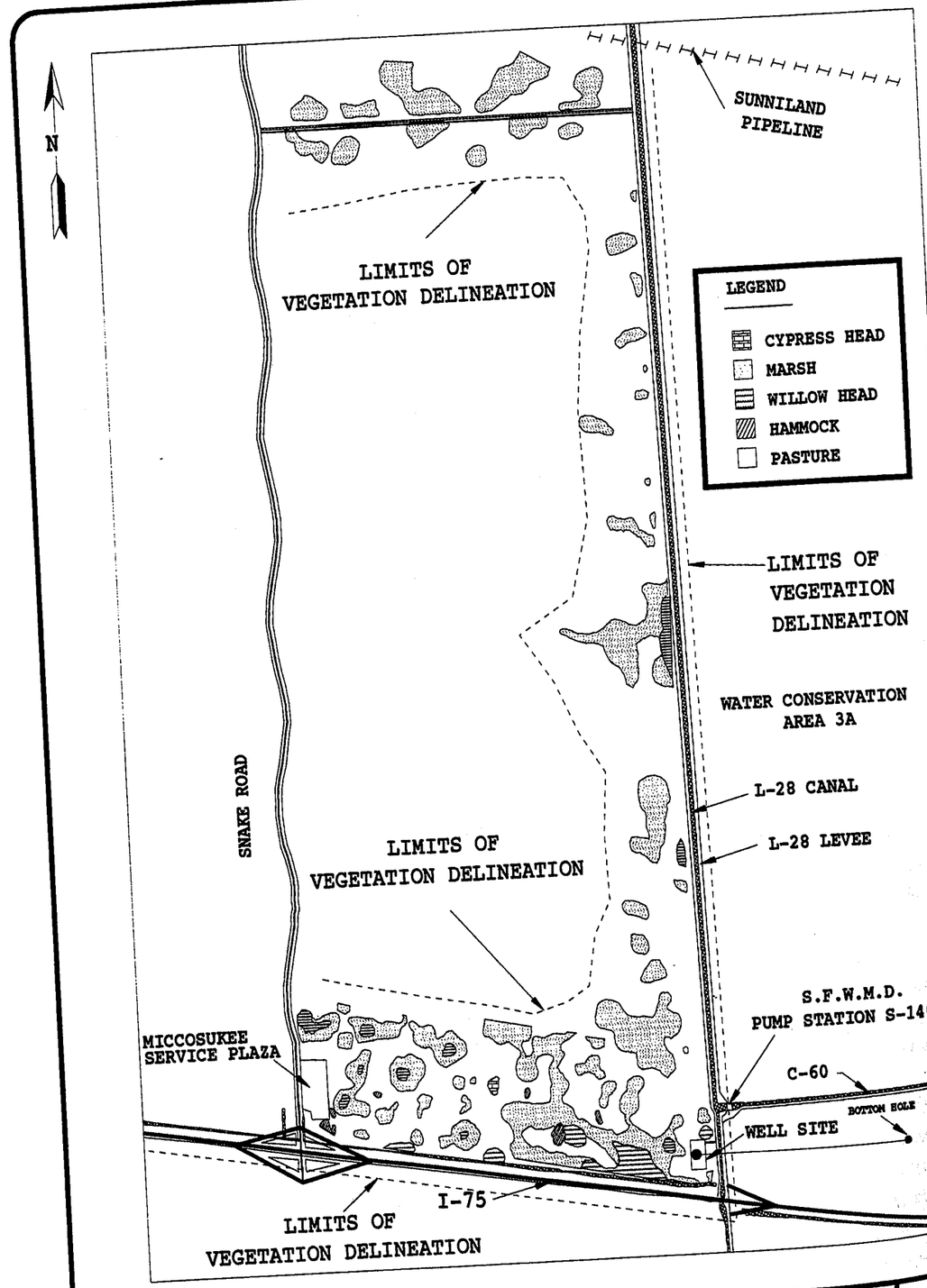
Highways crossing the southern tip of Florida have also impacted the hydrology of the area. Common agricultural and land management practices have altered the vegetation on the Reservation. In the 1970's, much of the prairie areas in the Reservation were converted to pasture by discing and replacing the native grasses with green alta *(Hemarthria altissima)* which provided better cattle forage than the native vegetation.

Currently the majority of the Reservation land in the vicinity of the proposed site is comprised of pasture/prairie, with small areas characterized as marshes, willow heads, cypress forests and hammocks (Figure 3-3).

Pasture/prairie communities are vegetated by a variety of planted and volunteer species. Predominant species include green alta, dropseed (*Sporobolus jacquemontii*), bushy bluestem (*Andropogon glomeratus*), Elliotts lovegrass (*Eragostis elliottii*), and spikerush (*Eleocharis cellulosa*). The pasture/prairie has little topographic relief and during periods of heavy rainfall, standing water may be present over large areas for several days.

Freshwater marshes in the vicinity of the proposed site are dominated by pickerelweed (*Pontederia cordata*), sawgrass (*Cladium jamaicense*), cattail (*Typha spp.*), arrowroot (*Thalia geniculata*), spikerush, primrose willow (*Ludwigia octovalis*) and maidencane (*Panicum hemitomon*). These areas are located in depressions over thick organic muck and are inundated for most of the year.

Willow heads are vegetated predominately by Carolina willow (*Salix caroliniana*) with other shrubs such as wax myrtle (*Myrica cerifera*), Brazilian pepper (*Schinus terebinthifolius*), cabbage palm (*Sabal palmetto*), and elderberry (*Sambucus canadensis*). Willow heads are also found on depressional areas where water has been impounded or where some other disturbance has occurred.



AFFECTED ENVIRONMENT

Cypress forests are generally small isolated areas in the vicinity of the proposed drill site. Bald cypress (*Taxodium distichum*) comprises the open canopy with a sparse understory of sawgrass and various other grasses and sedges. The cypress forests are typically found in poor, shallow soil in depressions in the limestone bedrock. The cypress forests are usually inundated for most of the year.

Hammock areas in the vicinity of the proposed site are also small isolated forested areas. The canopy is generally dominated by red bay (*Persea borbonia*) and cabbage palm, with wax myrtle and Brazilian pepper forming a dense perimeter. Various grasses, sedges and ferns form a sparse understory.

Endangered and Threatened Plant Species

No plants listed by the USFWS as endangered, threatened or species of special concern were noted on the site or in the vicinity of the access route alternatives. No Federal-listed plants are expected to occur in this area due to the highly altered nature of the available habitat. State-listed ferns observed in the vicinity of the proposed access route would be avoided when the turnout areas are located and constructed.

3.3.8.1 Alternative A - Proposed Action

Vegetation on the drill site was surveyed during November and December of 1989 and July of 1992. The surveys were conducted during different years and different times of the year to accommodate the temporal and seasonal changes known to occur in the vegetative composition of natural herbaceous systems with fluctuating hydroperiods. The initial surveys (1989) are included in this document as Appendix A-5. The subsequent survey was undertaken for the purposes of this document.

The initial surveys determined the existence of six vegetative communities based on the cover values of the present dominant and co-dominant species. The communities distinguished were the green alta-dropseed-bushy bluestem dominated community, the green alta-spikerush community, the green alta "grazed" community, the primrose willow-sawgrass community, the willow-wax myrtle "head," and the community.

The green alta-dropseed-bushy bluestem community comprised the majority of the vegetative cover. The green alta dominated the community, providing 40 percent to 75 percent of the cover. The cover provided by the dropseed varied from 25 percent to 50 percent and occasionally 70 percent. Third and fourth co-dominants were bushy bluestem and Elliott's lovegrass which comprised approximately 30 percent and 15 percent cover respectively. Minor constituents in the vegetative cover of this area were wax myrtle, marsh pennywort (*Hydrocotyle umbellata*), dayflower (*Commelina diffusa*), umbrella sedges (*Cyperus spp.*), joint-vetches (*Aeschynomene americana*), and string-lily (*Crinum americanum*).

CHAPTER THREE

The green alta "grazed" community was located within the above vegetative association and was distinguished by the high degree of cattle grazing activity, frequent patches of bare ground and an abundant cover of unidentifiable seedlings. The species mentioned previously in the green alta-dropseed-bushy bluestem community were present in this grazed area, but were reduced in stature.

The green alta-spikerush community was the second most widespread community and was located along the western edge of the drill site. The two grass species, green alta and spikerush, varied in cover from approximately 45 percent to 60 percent. Minor constituents in this community included pickerelweed, smartweed (*Polygonum spp.*), dayflower, marsh pennywort, primrose willow, and cattail.

A combination of primrose willow and sawgrass comprised the third largest community in areal cover. This vegetative association was restricted to two locations on the drill site, forming the outer edge of two depressional areas. The depressions are located in the northeast corner and on the western boundary of the drill site. The first survey did not attempt to estimate the vegetative cover provided by these two species stating that the cover was highly variable. Other species noted in this community included smartweed, pickerelweed, umbrella sedges, string-lily, arrowroot, maidencane, and a variety of aster species.

The interior of these two depressions was dominated by a mixture of Carolina willow and wax myrtle. These two species formed a dense stand up to approximately 20-feet tall. The exotic nuisance species Brazilian Pepper occurred infrequently within the fringes of the depressional areas.

Cordgrass (*Spartina bakeri*) dominated the vegetative cover in two areas adjacent to the northwestern corner of the drill site. The cordgrass comprised 60 percent to 90 percent of the cover in this community. Minor associated species included bushy bluestem, ceasar weed (*Urena lobata*), marsh pennywort, broomweed (*Sida acuta*), pepper vine (*Ampelopsis arborea*), *Desmodium scorpiurus*, and *Aster dumosus*. No standing water was present during the 1989 site investigation, but sediments were damp in the two depressional willow heads and in several smaller depressions located adjacent to the drill site. The canal along the southern site boundary was choked with water hyacinth (*Eichhornia crassipes*) and no determination of the water elevation was made.

During the site investigation conducted in July, 1992, the entire proposed drill site was inundated by a minimum of 6 inches of water. Several small unvegetated depressional areas had periphyton mats under water, indicating that the present water level had not maintained that elevation for a long period of time and was probably a result of recent heavy rains. The water levels in the canals adjacent to the southern and eastern boundary of the site were high, the S-140 pump station was in operation, and a high rate of flow was evident. None of the heavy infestation of water hyacinths that choked the canals during the earlier site investigation was noted, probably due to the high rate of flow.

AFFECTED ENVIRONMENT

During the July, 1992 site investigation, it was noted that the patterns of vegetation had not substantially changed and that the community boundaries mapped by the previous survey were still accurate after two and one half years. The high water levels had, however, significantly altered the vegetative composition within several of the communities. It was also noted that no grazing activity had recently occurred, which facilitated the site inspection.

The vegetative community previously described as green alta-dropseed-bushy bluestem was now dominated by dropseed which comprised approximately 60 percent to 80 percent of the cover. The bushy bluestem and green alta comprised no more than 20 percent cover each. Also present in fewer numbers were the species mentioned in the previous survey, as well as white-topped sedge (*Rhynchospora colorata*), water hyssop (*Bacopa caroliniana*), green arum (*Peltandra virginica*), camphorweed (*Pluchea odorata*), and Tracy's beakrush (*Rhynchospora tracyi*). These species collectively comprised less than five percent of the vegetative cover in this community.

The spikerush-green alta community had also experienced a shift in species dominance. This community in the western portion of the site was now dominated by the spikerush previously mentioned as a subdominant. Also present in this community were the species noted earlier, as well as smartweed, coinwort (*Centilla asiatica*), and buttonbush (*Cephalanthus occidentalis*).

The green alta "grazed" community was not distinguishable during the recent site inspection due to the lack of grazing activity on the site. The area delineated by the earlier survey for this community has been incorporated into the green alta-dropseed-bushy bluestem community.

The remaining three vegetative associations had not changed appreciably over the two and one half years between the site inspections. As these communities were already dominated by hydrophytic plants, the temporary change in water elevations were not as likely to result in changes in species composition as were the upland and transitional communities.

No floral species listed as endangered, threatened, or a species of special concern by State or Federal agencies were encountered on the proposed drill site during either inspection. No listed species are expected to occur due to the highly altered condition of the available habitat. A list of protected floral species potentially present is provided in Table 3-1. These species are listed because of the available habitat on the site.

The proposed access route would utilize a road along an east-west canal for the northern portion and a road on the berm along the west side of the L-28 Canal for the remainder of the drill site access route. This route would minimize impacts to wetland vegetation for roadway improvements. Vegetation on the road across the northern portion of the route was dominated by common ruderal species such as ragweed

Table 3-1
Protected Plant Species Present and Potentially Present Within the Project Area

Scientific Name	Common Name	FDA[1]	USFWS[2]	HABITAT[3]
Acoelorrhaphe wrightii	Paurotis palm	T		A, D
*Acrostichum danaeifolium**	Giant leather fern	T		C
Adiantum tenerum	Maidenhair fern (unnamed)	T		A, D
Calopogon pulchellus	Grass pink (unnamed)	T		A, C
Calopogon tuberosus	Grass pink (unnamed)	T		A, C
Catopsis berteroniana	Powdery catopsis	E		B, D
Catopsis floribunda	Air plant (unnamed)	E		B, D
Chamaesyce porteriana var. porteriana	Porter's hairy-podded spurge	E	C2	B
Chrysophyllum olivae forme	Satinleaf	E		B
Ctenitis sloanei	Comb fern (unnamed)	T		B
Cyrtopodium punctatum	Cowhorn orchid; cigar orchid	E		B, C, D
Digitaria pauciflora	Two-spike finger grass		C2	B
Elytraria carolinensis var. angustifolia	Narrow-leaved Carolina scalystem		C2	A
Encyclia boothiana var. erythronioides	Dollar orchid;	E		B, D
Encyclia cochleata	Shell orchid;	T		B, D
Encyclia tampensis	Butterfly orchid	T		B, D
Epidendrum anceps	Dingy-flowered epidendrum	T		B, D
Epidendrum difforme	Unbelled epidendrum	T		B, D
Epidendrum nocturnum	Night-scent orchid	T		B, D
Epidendrum rigidum	Rigid epidendrum	T		B, D
Eriochloa michauxii var. simpsonii	Longleaf cup grass; Simpson's cup grass		C2	A
Erythrodes querceticola	Low erythrodes	T		B, D
Eulophia alta	Wild coco; ground coco	T		A, B, C, D
Galeandra beyrichii	Orchid	T		B
Guzmania monostachia	Fuch's bromeliad	E		B, D

Table 3-1
Protected Plant Species Present and Potentially Present Within the Project Area

Scientific Name	Common Name	FDA[1]	USFWS[2]	HABITAT[3]
Habenaria quinqueseta	Michaux's orchid; long-horned orchid	T		B, D
Habenaria repens	Water spider orchid;	T		C
Ionopsis utricularioides	Delicate ionopsis	E		B, D
Linum carteri var. carteri	Carter's small-flowered flax	E	C2	A
Linum carteri var. smallii	Carter's large-flowered flax; South Florida flax	E	C2	A
Myrcianthes fragrans var. simpsonii	Simpson's stopper; twinberry		C2	B
Nephrolepis biserrata	Boston fern (unnamed)	T		B, D
Oncidium floridanum	Florida oncidium	T		B, D
Ophioglossum palmatum	Hand adder's tongue fern	E		B, D
Ophioglossum petiolatum	Adder's tongue fern	T		B, C, D
Osmunda regalis	Royal fern	CE		B, D
Peperomia floridana	Everglades peperomia	E		B, D
Peperomia glabella	Cypress peperomia	E		B, D
Phlebodium aureum	Golden polypody	T		B, D
Platanthera nivea	Snowy orchid	T		A, C
Polypodium plumula	Polypody fern	T		B, D
Polystachya flavescens	Pale-flowered polystachya	T		B
Ponthieva racemosa	Shadow witch	T		
Psilotum nudum	Whisk fern; fork fern	T		B, D
Pteris longifolia	Ladder brake fern	T		B, D
*Pteris vittata**	Brake fern	T		B, D
Roystonea elata	Florida royal palm	E	C1	B
Spiranthes cernua var. odorata	Fragrant ladies' tresses	T		C
Spiranthes costaricensis	Ladies' tresses	T		B
Spiranthes vernalis	Spring ladies' tresses	T		A, C
Stillingia sylvatica ssp. tenuis	Slender queen's delight		C2	A

Table 3-1
Protected Plant Species Present and Potentially Present Within the Project Area

Scientific Name	Common Name	FDA[1]	USFWS[2]	HABITAT[3]
*Thelypteris interrupta**	Aspidium fern	T		B, D
*Thelypteris kunthii**	Aspidium fern	T		B, D
Thelypteris ovata	Aspidium fern	T		B, D
*Thelypteris palustris**	Marsh fern	T		B, D
Thelypteris quadrangularis	Aspidium fern	T		B, D
Thrinax microcarpa	Brittle thatch palm	CE		B
Tillandsia balbisiana	Wild pine	T		B, D
Tillandsia fasciculata	Common wild pine	CE		B, D
Tillandsia flexuosa	Twisted air plant	T		B, D
Tillandsia paucifolia	Wild pine	T		B, D
Tillandsia polystachia	Wild pine	T		B, D
Tillandsia pruinosa	Fuzzy-wuzzy air plant	E		B, D
Tillandsia setacea	Wild pine	T		B, D
Tillandsia utriculata	Giant wild pine	CE		B, D
Tillandsia valenzuelana	Wild pine	T		B, D
Vanilla phaeantha	Leafy vanilla	T		B
Vittaria lineata	Shoestring fern	T		B, D

Notes

1. Florida Department of Agriculture
   - T Threatened
   - E Endangered
   - CE Commercially Exploited

2. U.S. Fish and Wildlife Service
   - C_1 A candidate for Federal listing, with enough substantial information on biological vulnerability and threats to support proposals for listing.
   - C_2 A candidate for listing, with some evidence of vulnerability, but for which not enough data exist to support listing.

3. Habitat Types:
   - A. Prairie
   - B. Hammock
   - C. Marsh
   - D. Cypress Forests

* Observed along the proposed access route.

(*Ambrosia artemisiifolia*), beggar-ticks (*Bidens alba*), umbrella sedge (*Cyperus haspan*), ceasar weed, goldenrod (*Solidago stricta*), and lantana (*Lantana camara*). In depressions and in swales along this portion of the road, the vegetation consisted of common herbaceous aquatic species such as cordgrass, pickerelweed and primrose willow.

The vegetation along the L-28 Berm was more diverse in character than that along the northern portion of the route. The east side of the berm was bordered by pasture and willow heads similar in vegetative character to the drill site. Brazilian pepper, salt bush (*Baccharis halimifolia*), cabbage palm, elderberry, and pond apple (*Annona glabra*) were present as minor constituents in the shrub communities. The western side of the berm was vegetated by similar species as well as several species of ferns, buttonbush, peppervine, and morning glory (*Ipomea sagittata*). The berm was vegetated by common grasses including the dropseed which dominated the drill site.

Five fern species listed as threatened by the Florida Department of Agriculture (FDA) were located along the toe of the slope of the L-28 Berm. The FDA designation as a threatened species protects these plants from collection by non-landowners but does not prohibit activities by landowners that would impact listed plant species. These plants are listed in Table 3-1.

3.3.8.2 Alternative B - West Access Route

The West Access Route would begin at the Miccosukee Service Plaza on Snake Road and extend east through pasture lands to the drill site. The majority of the wetlands and all hammock areas would be avoided. The pasture area in the alignment of the West Access Route is dominated by the same grass species found on the drill site; i.e., green alta and dropseed. Marsh areas within the alignment of the route are vegetated by pickerelweed, cordgrass and spikerush.

No floral species listed as endangered, threatened or species of special concern by State or Federal agencies were encountered along the route alignment. Several listed species are potentially present within adjacent hammock areas which would be avoided. These species are listed in Table 3-1.

3.3.8.3 Alternative C - East Access Route

The East Access Route would utilize an existing exit ramp from the westbound I-75 lane east of the L-28 Canal. The L-28 Canal would be crossed by a new vehicular bridge. The canal banks in the vicinity of the proposed bridge are stabilized by rock which limits much of the vegetative cover. However, some vegetation exists and includes cattail, cogon grass (*Imperata brasiliensis*), ragweed, and beggar tick. No listed species are present in this area and none are expected to occur. The banks of the canal are routinely maintained.

3.3.9 Visual Resources

Introduction

Visual resources is the term used to describe the physical characteristics of a landscape that determine its scenic quality in relevant value to the viewing public. These characteristics are frequently described by using basic design terms such as: form, texture, and pattern; and by actual reference to natural features in the environment (vegetation, water, ecological, formations, soil, etc.) that make up a specific landscape scene as viewed from various perspectives.

Visual Resources - Existing Conditions

The landscape of the project area has been altered by past land drainage, conversion of land to pasture, grazing activity, construction of roads, and the construction of miscellaneous structures. The four-lane divided interstate highway (I-75) and a parallel "borrow canal" constitute the southern boundary of the project area. The eastern boundary is delineated by the L-28 Canal and Levee with a gravel maintenance road and single pole power line leading to a microwave tower approximately one mile north of the proposed drill site. Northwest of the proposed drill site is SFWMD's S-140 pump station facility. Snake Road located 1.5 miles west of the proposed drill site creates the western boundary with a single pole power line accented by a microwave tower and the remains of the Sabine drill site. Proceeding northward, an east-west access road connects Snake Road to the L-28 Canal berm road. The southwest corner of the project area features a shallow diamond interchange that provides access to the unbuffered Miccosukee Service Plaza. The southeast corner of the project area features two-lane concrete bridges crossing the L-28 Canal. In the 1.5 mile stretch from L-28 to Snake Road along I-75, four large billboards and a tall sign for the Miccosukee Service Plaza front the highway.

In spite of the altered condition of the site, the landscape character of the balance of the project area could be judged as generally "natural" by the average viewer. As a similar area was described in an EA prepared for the Seminole Tribe of Florida, Big Cypress Reservation, Petroleum Development Project (Simpleton, 1981):

> "The overall impression is one of vast openness. If the scattered 'islands' or hammocks were removed, the entire Reservation area would present to the viewer an impression of one great, very flat prairie."

Variety Class

The project area may be characterized as a landscape unit or scenic quality rating unit (U.S. Forest Service and BLM terminology) of wet prairie. The overall visual variety within this landscape unit at the project area is minimal with little or no diversity. This perception of minimal diversity results not only from the subtle differences in landscape form, color, and texture, but is also a result of the dynamic mode of the average observer. Traveling at the posted interstate highway speed limit not only tends to narrow and focus the observer's cone of vision, but details of color, form and texture are more difficult to discern. The observed existing visual condition (EVC) class varies from an:

EVC3 - Minor disturbance changes in the landscape are noticed by the average person but they do not attract attention; to

EVC4 - Disturbed changes in the landscape area easily noticed by the average person and may attract attention.

Distance Zones

Distance zones refer to divisions of the particular landscape being viewed. Foreground is typically limited to areas within 0.25 to 0.5 miles from the observer. Middle ground extends from the foreground zone to about three to five miles from the observer. Background views extend from the middle ground to the horizon. The predominant public view access to the proposed action is afforded by I-75 which passes as close as 600 feet to the edge of the proposed drill site. Consequently, the relevant distance zone is the foreground zone.

Sensitivity Levels

Sensitivity levels are used to describe the observer's concern for the scenic qualities of an area. High, moderate, and low levels of concern are identified based on professional judgment and expressed attitudes. Use-volumes are considered, but user attitude is usually weighted more heavily.

Visual Quality

The typical combination of variety class, distance zone, and sensitivity level could be extrapolated to a visual quality objective (VQO) of either:

PR Partial Retention - Management activities which remain visually subordinate. The natural appearing landscape remains dominant. Changes in the landscape are evident but not dominant; or

M Modification - Management activities to dominate the natural-appearing landscape, although the change must be in harmony and balance with the elements of the landscape.

3.3.9.1 Alternative A - Proposed Action

The proposed drill site is in the immediate vicinity of I-75, the L-28 Canal and bridges, the S-140 pump station, microwave towers, billboards, and a cattle pasture (Figure 3-4). The proposed access route would not be readily visible from I-75 or Snake Road as it extends north and west of the drill site.

The existing visual quality level is one of partial retention at the macro level and of modification at the site specific level. In the larger context of the project area, the apparent natural visual attributes are dominant over existing structures. At the actual location of man-made structures, the modifications dominate the proximate apparent natural setting.

3.3.9.2 Alternative B - West Access Route

This access route is currently a pasture area that is visible from I-75. The route originates near the Miccosukee Service Plaza and extends eastward to the vicinity of the S-140 pump station. The visual quality level is similar to that of Alternative A.

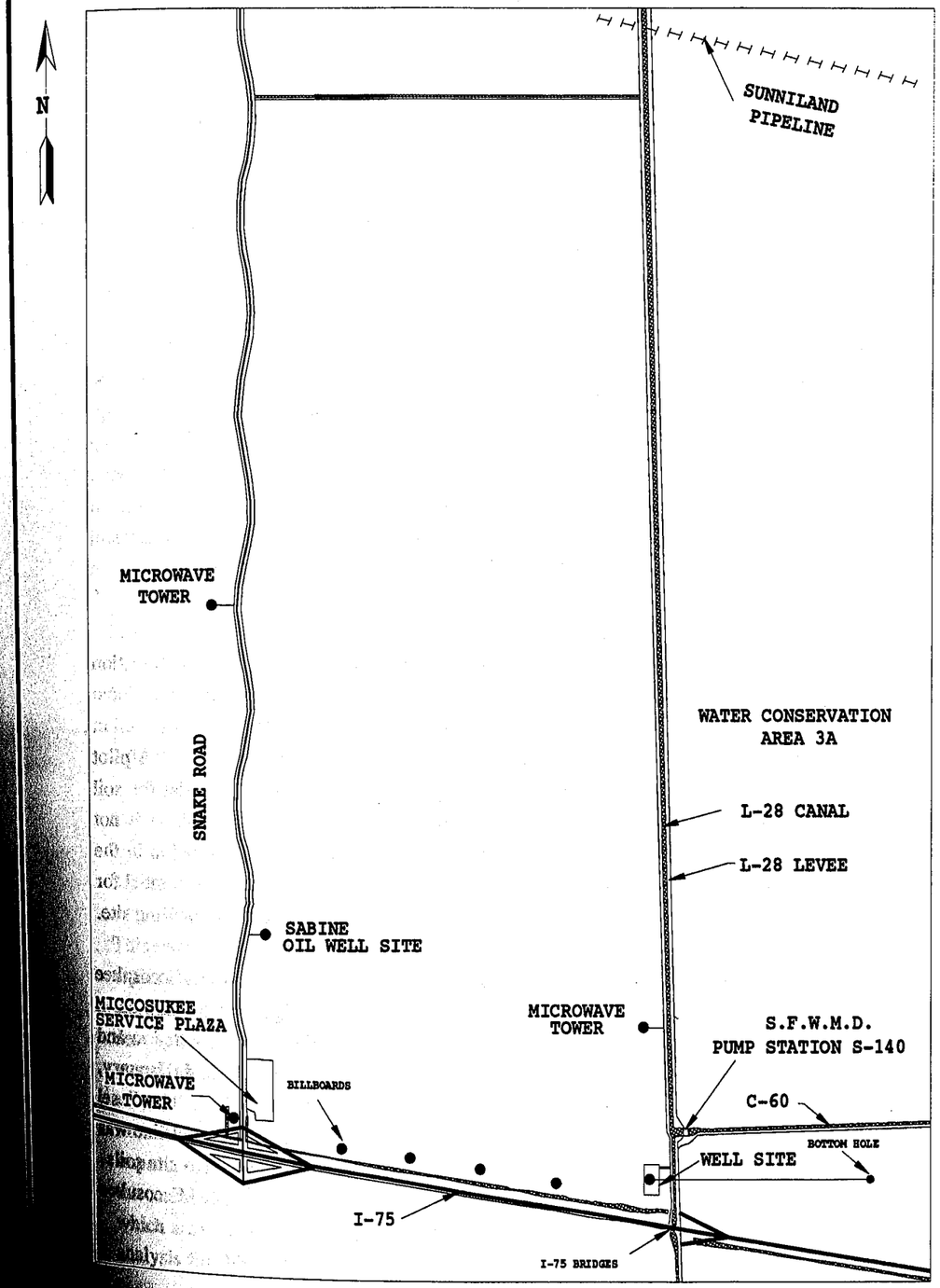
3.3.9.3 Alternative C - East Access Route

This route is in the vicinity of the well site as described in 3.3.9.1. The visual quality level is similar to that of Alternative A.

3.3.10 Waste Management

Within a five-mile radius of the proposed drill site, there are three potential contamination sources. The location of these potential contamination sources include the following:

- SFWMD S-140 pump station with two aboveground diesel fuel storage tanks is located North and East of the proposed drill site.



Dames & Moore | SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA | 0 1,500' SCALE | VISUAL OBSTRUCTION MAP | FIGURE 3-4 D&M JOB No. 13501-072-049 AUTOCAD FILE: VISUAL.DWG

- Sunniland Oil Pipeline pump station with aboveground petroleum storage tanks is located at Section 15, Township 49 South, Range 35 East.

- The Miccosukee Service Plaza with underground gasoline and diesel fuel storage tanks is located at the I-75 Snake Road interchange.

The 1992 EPA database was reviewed to determine if known contamination areas exist in the project vicinity. According to the database, none of these above-mentioned sites are included in the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) or RCRA lists. However, the Florida Department of Environmental Regulation (now FDEP)) Bureau of Waste Cleanup, Petroleum Contamination Detail Report, dated September 30, 1991, indicates the SFWMD S-140 pump station did have a diesel fuel spill on June 18, 1991. According to Raul Pellegrino of SFWMD, approximately 40-50 cubic yards of diesel fuel-contaminated soil was excavated from the two 15,000-gallon aboveground storage tank compound under an initial remedial action. The excavated soil was then transported to a permitted thermal treatment facility for decontamination. The excavated area was replaced with clean fill material.

According to a conversation with Raul Pellegrino of SFWMD on December 17, 1993, a contamination assessment report (CAR) of the reported diesel fuel spill at S-140 pump station has been completed and a "No Further Action" status was recommended. The Florida Department of Environmental Protection (FDEP) (successor agency to the FDER) and EPA have been advised of the recommendation. A pilot Vapor Extraction Test was performed on the soils at station S-140. There exists a potential for soil contamination under the superstructure. Per the SFWMD, groundwater at S-140 pump station is not contaminated. The submitted CAR did not indicate the presence of groundwater contamination in the vicinity of the S-140 pump station. Based upon the above-stated information, there is a low potential for contaminants from the S-140 site to be pulled south by water wells at the proposed SWEPI drilling site.

In July, 1993, free product (diesel fuel) was detected in a fuel tank monitoring well at the Miccosukee Service Plaza. The EPA directed the Miccosukee Tribe to submit a contamination assessment plan in accordance with 40 CFR, Section Subpart E. The contamination assessment plan was submitted to and approved by the EPA in November, 1993. The contamination assessment was completed in January, 1994. EPA directed that a corrective action plan be submitted to the agency by May 2, 1994. The diesel fuel spill is thought to have occurred during monitoring well installation in 1988, when a fuel line was ruptured. The ruptured line was immediately replaced. Contamination is currently limited to site soils. Contaminated soils will be removed during implementation of the corrective action plan. The Miccosukee Service Plaza is located approximately 1.5 miles west of the proposed drill site.

The S-140 pump station and Miccosukee Service Plaza dispose of domestic wastes through septic tanks and field systems. Solid waste generated at the Miccosukee Service Plaza and S-140 are hauled off-site to approved disposal facilities.

Sabine Oil and Gas, Inc. drilled an exploratory well, Miccosukee 32-1, approximately two miles northwest of the drill site in 1985 (Figure 3-4). This well tested the Sunniland Formation to a depth of 11,604 feet. The well was permitted and monitored by the Florida Department of Natural Resources (FDNR), Bureau of Geology (Permit No. 1169) and the BLM and BIA. According to the FDNR permit files, Miccosukee 32-1 was completed without encountering H_2S gas. No contamination events resulted from drilling operations. Miccosukee 32-1 was plugged and abandoned as a dry hole in 1985. The site was restored per the requirements of the Miccosukee Tribe with the pad left intact.

3.3.10.1 Alternative A - Proposed Action

The proposed drill site and access route do not contain any known contaminants.

3.3.10.2 Alternative B - West Access Route

The West Access Route does not contain any known contaminants.

3.3.10.3 Alternative C - East Access Route

The East Access Route does not contain any known contaminants.

3.3.11 Water Resources

This section describes the water resources of the proposed drill site and surrounding areas. Surface water topics include precipitation patterns, drainage area extent and characteristics, surface water overland flow and channel conveyance, flooding, and existing water quality. Groundwater discussion focuses on a description of major aquifer systems, subsurface flow direction and velocity, the location of potable groundwater sources and ambient groundwater quality.

Most of the surface water and groundwater hydrologic features are common to the consideration of the impacts of each alternative. The following discussion of Alternative A, the proposed action, describes the common hydrologic features. The discussions of Alternatives B and C briefly review any differences which are unique to the respective access route. Appendix A-6 provides much of the supporting data and analysis for this section.

3.3.11.1 Alternative A - Proposed Action

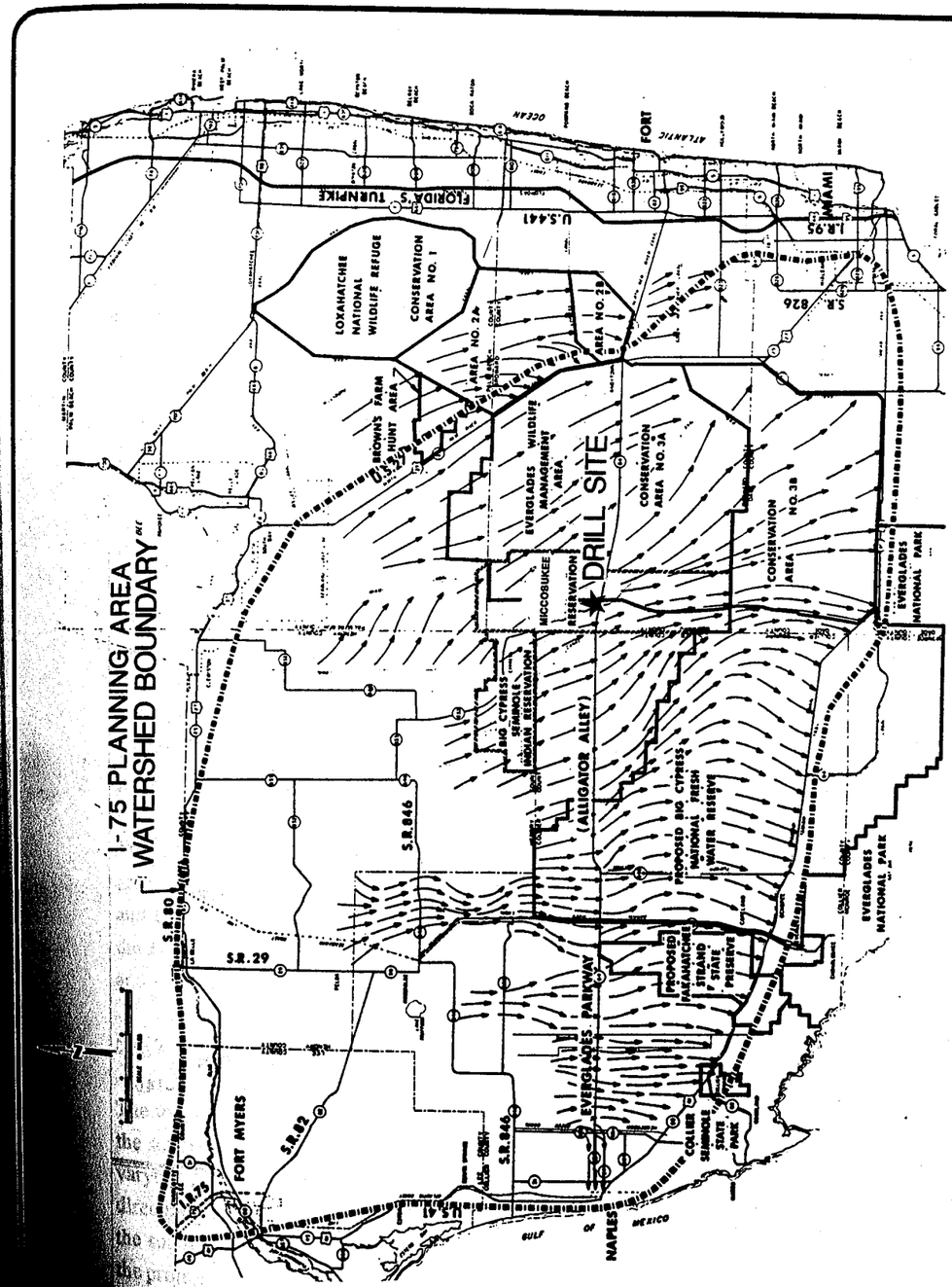
Surface Water Hydrology

The proposed drill site is located in the transitional region between the Everglades and the Big Cypress Swamp physiographic provinces as indicated on Figure 3-5. The Everglades physiographic province is an extremely flat area which slopes to the south and southeast. Natural drainage of this area has been altered by an extensive system of canals, levees and control structures which regulate water movement through this area. The Big Cypress Swamp is a loosely defined physiographic province of approximately 2,450 square miles consisting of flat, swampy areas that merge into a coastal marsh and estuarine environment. The northeastern portion of the area drains southeast into WCA-3A. The central portion constitutes about three-fifths of the Big Cypress and drains naturally to the south except for two canals in the west, the Barron River and Turner River Canals. The western portion of the area contains an extensive system of canals which drain south and westward. Developmental impacts, especially the construction of the canals and water control structures of the Central and Southern Florida Flood Control System and roadways (I-75), have significantly altered overland flow characteristics. These features have a significant influence on the flow of water into and out of the area in which the drilling site is located.

Figure 3-6 indicates the principal hydrologic features which control surface flow in the vicinity of the project site. These features include an east-west farm canal and elevated access route to the north, the I-75 roadway and borrow canal to the south, the L-28 Canal and Levee to the east and Snake Road to the west. These features essentially isolate the project site by limiting the flow of surface water from the site to surrounding areas.

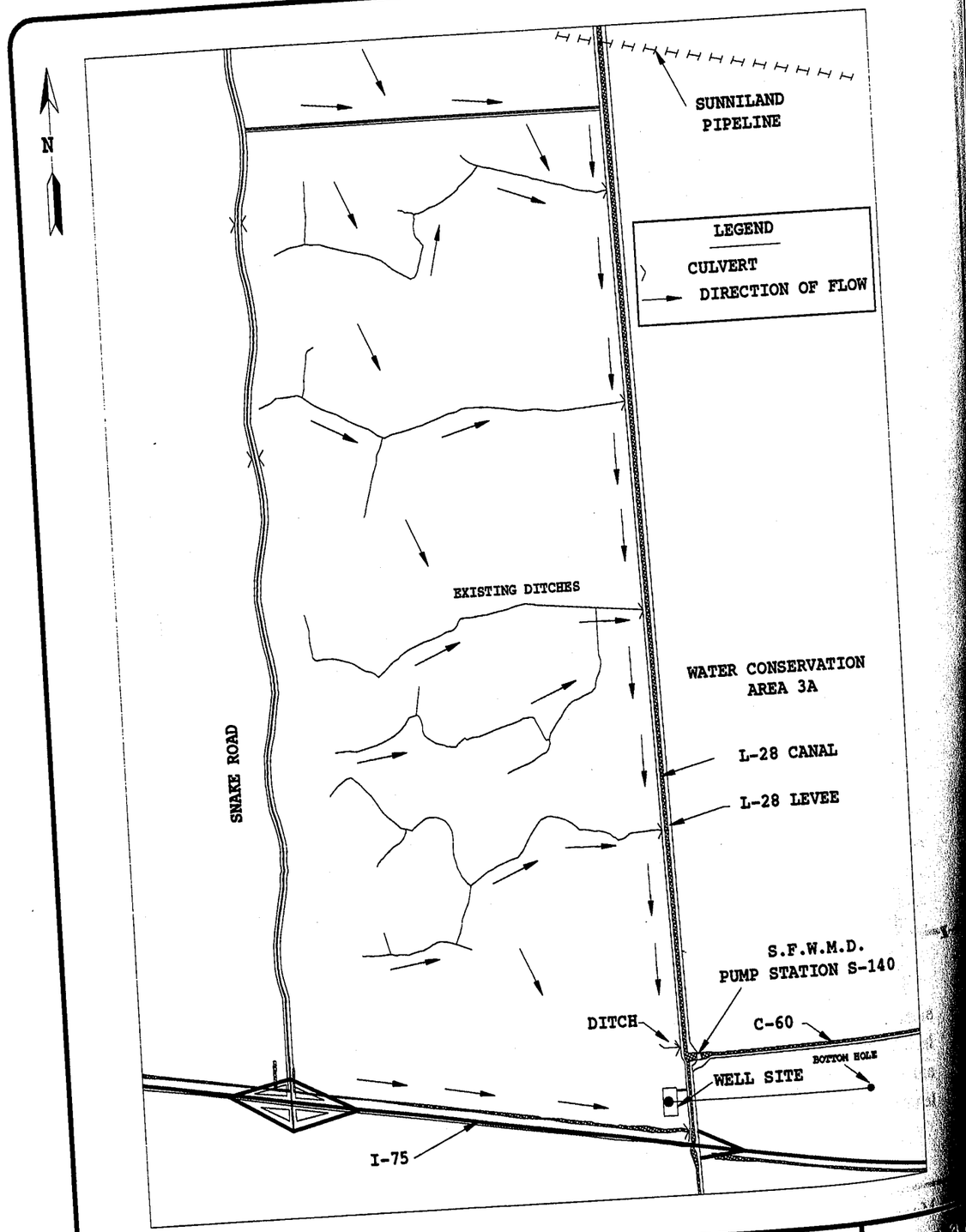
A surface water management canal and access road located approximately four miles north of the site limits surface water flow to the north of the project site. The surface water management canal is aligned in an east-west direction and is situated between Snake Road to the west and the L-28 Canal and Levee to the east. The access route is located immediately south of the canal and is elevated approximately one to two feet above surrounding ground elevations. One culvert is located through the western extremity of the access route at its junction with Snake Road.

I-75 and the roadway borrow canal limit surface flow to the south of the project site. The interstate highway is substantially elevated above prevailing grade particularly in the vicinity of the L-28 Canal bridge approach. The borrow canal is located immediately north of the roadway, and follows the east-west alignment of I-75. East of Snake Road, the roadway borrow canal empties into the L-28 Canal through a culvert. Discharge at the culvert is controlled with a flashboard riser.



SOURCE: FROM F.D.O.T., 1972)

Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA		BIG CYPRESS AND EVERGLADES WATERSHEDS BOUNDARIES	FIGURE 3-5 D&M JOB No. 13501-072-049 AUTOCAD FILE: ARCHBOLO.DWG



AFFECTED ENVIRONMENT

The L-28 Canal and Levee prevent movement of surface flow east of the project area. The 15-foot tall levee is located east of the canal, separating the canal and project area further west, from WCA-3A. A berm, approximately three feet above prevailing grade, borders the western side of the canal and serves as an access road to the project site. Five shallow drainage ditches aligned in a general east-west direction drain the pasture bounded by the access route to the north, the I-75 borrow canal to the south, Snake Road to the west and the L-28 Canal to the east. These shallow ditches drain directly to the L-28 through culverts controlled with flashboard risers. The L-28 Canal terminates to the south and provides no direct conveyance to WCA-3A.

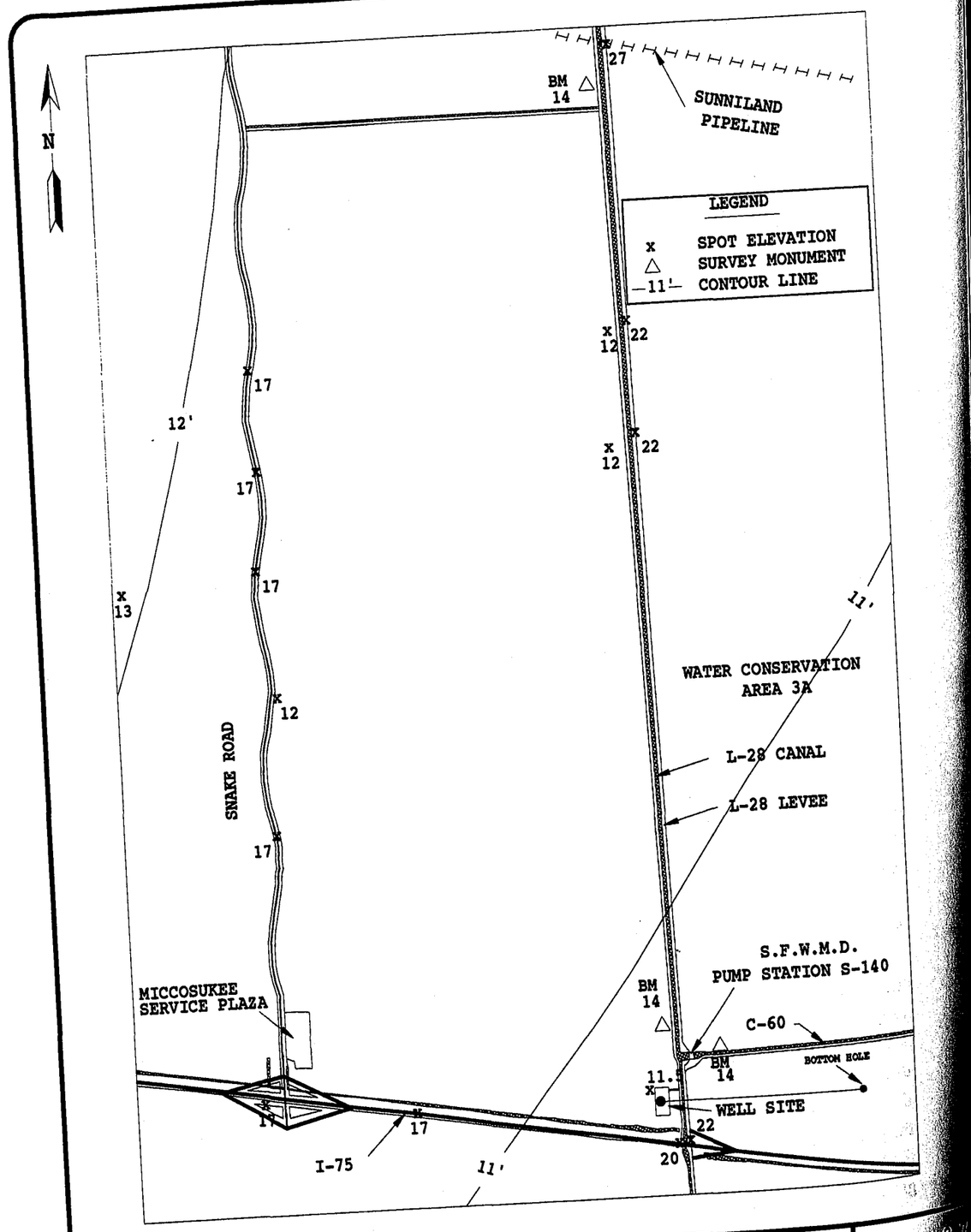
Snake Road is located within the Reservation, approximately two miles west of the project site. The road is elevated approximately four feet above surrounding ground elevations. In the area north of I-75 and south of the farm canal, overland flow is generally east and southeast, and utilizes two culverts of 24-inch and a 36-inch diameter beneath the road. Except for surface drainage through these culverts, Snake Road limits any surface flow west of the project site.

The Levee-28 Interceptor Canal is located further west of the project site, beyond Snake Road. The interceptor canal drains the western portion of the Seminole and Miccosukee Indian Reservations. Between the West Feeder Canal in Hendry County and the southern terminus in Broward County, the L-28 Interceptor Canal is generally aligned in a southeasterly direction. South of I-75, at the junction with the L-28 Canal, the alignment of interceptor canal turns easterly, draining into WCA-3A. The L-28 Interceptor Canal and L-28 Canal are not hydraulically connected.

The major controlled surface water feature near the study area is WCA-3A, located east of the project area. WCA-3A covers an area of 915 square miles. Its boundaries are the L-5 Levee, the Rotenberger and Holey Land wildlife management areas, and the Everglades Agricultural Area (EAA) to the north; the L-29 Levee, U.S. 41 and ENP to the south; the boundaries to the east are levees L-30, L-33, L-37 and L-38; boundary to the west is the levee L-28.

Site Topography

The topography in the vicinity of the project site is shown on Figure 3-7. The area is flatly sloped to the southeast. The transition from higher to lower areas occurs by relatively uniform surface gradients varying from 0.2 to 0.5 feet/mile in the north to south direction and 0.3 feet/mile in the west-east direction. Snake Road to the west, access roads to the north and east along the L-28 Canal and I-75 to the south, as well as the L-28 Levee east of L-28 Canal are the predominant elevated features isolating the project site from the surrounding areas. Five shallow drainage ditches generally aligned west to east, the L-28 Canal, and the borrow canal paralleling I-75 are the only depressional features in the area. The ground elevation at the drill site is approximately 11.3 feet above sea level.



AFFECTED ENVIRONMENT

Rainfall

South Florida receives approximately 53 inches of rain annually, 75 percent of which falls during the wet season, extending from May to October. The wet season is characterized by frequent local thunderstorms, often accompanied by intense rainfall of short duration. Severe tropical storms can also occur during the wet season.

The dry season is characterized by mild, dry weather. Frontal storms dominate the weather during the dry season. Rainfall from these fronts exhibits a more uniform distribution across the region as compared to rainfall derived from the highly variable thundershowers that occur during the wet season.

Within the Everglades Planning Area the greatest average annual rainfalls occurs in the EAA and in ENP. The lowest average annual rainfall occurs in WCA-3A near the Miccosukee Reservation (MacVicar, 1983; Sculley, 1986). SFWMD maintains a rainfall gauge located at S-140 pump station. Records for this station indicate average annual rainfall of 33.4 inches. The minimum and maximum annual recorded rainfall was 25.4 inches (1988) and 41.5 inches (1989), respectively.

The SFWMD has developed rainfall data for return interval storms in South Florida. This information is provided in Table 3-2 below.

TABLE 3-2
RAINFALL, STORM FREQUENCY AND DURATION

STORM RETURN PERIOD	RAINFALL (INCHES)	
	24-HOUR DURATION	72-HOUR DURATION
Mean Annual Max.	3.6	5.0
5-Year	4.5	6.7
10-Year	5.7	7.3
25-Year	6.7	9.8
50-Year	7.5	10.8
100-Year	8.5	11.6

CHAPTER THREE

Local Surface Water Flow

Surface flow in the project area is generally to the east and southeast. Developmental impacts, especially the canal and structure system previously described and construction of I-75 have significantly altered overland flow characteristics. Much of the surface runoff travels to the south and east via channelized conveyances. Impediments to surface flow include Snake Road, which does afford some culvert flow to the east, and the roadbed of I-75 which prevents north to south overland flow. Additional impediments to surface flow moving eastward are the nearly continuous berm along the L-28 Canal, and the berm located along the farm canal, north of the project site.

The primary control on water levels near the project site is pumping at SFWMD S-140 pump station. This station has a capacity of approximately 1,300 cubic feet per second under design conditions and functions primarily for flood control in the 110 square mile basin served by the L-28 Interceptor Canal and Levee to the west and the L-28 Canal and Levee to the east. Pumping occurs for flood control purposes when the headwater stage in L-28 Canal rises to 10.5 feet above sea level to prevent flooding. Since becoming operable in 1970, pumping has occurred approximately 55 percent of the time, mostly during the wet summer months.

SFWMD water level data for the S-140 pump station provide water levels of the L-28 Canal immediately adjacent to the proposed drilling site. The partial water level record represents nearly 8,000 water level measurements collected since 1970. Flooding analysis of the proposed drill site was based on a site elevation of about 11.3 feet above sea level. Water elevation and duration data indicate that the area surrounding the site would be inundated an average of only 5.5 days per year. This is a statistical average, and further indicates that the days of consecutive flooding would be less than the 5.5 days. The data indicate that the maximum height of water at the site under flooding conditions would be one foot above the site grade, and would occur for about 0.2 days per year.

Water Quality

Long-term surface water quality data is available from the S-140 station adjacent to the project site (SFWMD, 1992). The SFWMD has been collecting water quality data from this station since December 21, 1977 to the present on a weekly, bi-weekly, quarterly and bi-annual basis for chemical and physical parameters. Table 3-3 presents a summary of these water quality parameters.

Historical data on the quality of the L-28 water are available from the west side of the S-140 station adjacent to the project site. The water quality data has been compiled by the SFWMD since December 21, 1977 to present as part of the WCA Inflows and Outflows water quality monitoring program. Physical parameters and nutrients are collected and analyzed on a bi-weekly basis. Major ions

TABLE 3-3
SUMMARY OF WATER QUALITY PARAMETERS FOR STATION S140

PARAMETER NAME	PARAMETER NUMBER	UNITS	MEDIAN VALUE	AVERAGE VALUE	VARIANCE	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF SAMPLES
PHYSICAL PARAMETERS								
FIELD COND.	9	MMHO/CM	470.0000	470.0299	9082.3413	205.0000	864.0000	301
PH	10	UNIT	7.2000	7.2397	0.1555	5.9000	8.2300	296
TURBIDITY	12	NTU	1.9000	2.4564	6.6387	0.3000	34.0000	280
TOTAL SUS. SOLIDS	16	MG/L	2.0000	3.6379	9.3603	1.0000	12.0000	29
MAJOR CONSTITUENTS								
DIS. SILICA	27	MG/L	5.7500	6.2656	7.2841	1.8000	17.5000	122
DIS. SODIUM	28	MG/L	25.5500	27.3310	97.6561	9.2000	70.3300	78
DIS. POTASSIUM	29	MG/L	2.2950	2.5265	0.5551	0.5100	4.6000	78
DIS. CALCIUM	30	MG/L	66.3700	65.2405	119.6413	32.6000	96.5000	126
DIS. MAGNESIUM	31	MG/L	5.6000	5.7726	8.1221	2.4700	33.8600	125
TOT. CHLORIDE	32	MG/L	34.6500	36.6859	221.1561	10.8000	141.5000	304
TOT. SULFATE	33	MG/L	9.4000	12.8162	225.3408	3.2000	121.7000	68
ALKALINITY	34	MEQ/L	3.5350	3.5050	0.5240	1.6000	6.1000	260
ALKALINITY	91	MG/L	178.5000	176.8954	1251.8341	80.5000	306.5000	282
HEAVY METALS								
TOT. IRON	36	MG/L	0.2700	0.2973	0.0256	0.0800	0.6600	37
TOT. DIS. IRON	37	MG/L	0.1900	0.1900	0.0064	0.1100	0.2700	2
TOT. DIS. CADMIUM	42	MICROG/L	0.6670	3.7097	46.7914	0.4440	19.0000	6
TOT. DIS. CHROMIUM	43	MICROG/L	0.6650	1.1600	0.8539	0.6070	3.0000	5

TABLE 3-3 (CONTINUED)
SUMMARY OF WATER QUALITY PARAMETERS FOR STATION S140

PARAMETER NAME	PARAMETER NUMBER	UNITS	MEDIAN VALUE	AVERAGE VALUE	VARIANCE	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF SAMPLES
TOT. DIS. COPPER	45	MICROG/L	6.0000	6.8937	15.7089	3.0000	15.0000	7
TOT. DIS. LEAD	46	MICROG/L	1.0190	1.8584	1.6711	0.4840	4.0000	7
TOT. DIS MANGANESE	48	MICROG/L	11.0000	13.1620	122.8664	3.0000	37.0000	9
TOT. DIS. NICKEL	50	MICROG/L	3.3055	3.3055	1.7043	2.0000	4.6110	2
TOT. DIS. STRONTIUM	53	MG/L	0.2850	0.3369	0.0245	0.1000	0.7700	14
TOT. DIS ZINC	54	MICROG/L	15.0000	18.1111	87.6543	5.0000	33.0000	9
TOT. MERCURY	102	MICROG/L	0.2000	0.2670	0.0152	0.1610	0.4400	3
TOT. CADMIUM	103	MICROG/L	0.3785	0.3713	0.0218	0.0850	0.5700	6
TOT. COPPER	104	MICROG/L	1.4450	2.0367	3.3193	0.4500	6.8700	18
TOT. ZINC	105	MICROG/L	27.5000	35.2333	620.9222	14.1000	102.2000	9
TOT. ARSENIC	106	MICROG/L	1.9100	2.1115	1.2439	0.5100	5.6300	15
TOT. LEAD	107	MICROG/L	0.7150	1.0927	1.7701	0.3400	5.0370	10
TOT. COBALT	109	MICROG/L	2.2580	2.2580	0.0000	2.2580	2.2580	1
TOT. MANGANESE	110	MICROG/L	26.9110	26.9110	272.4150	10.4060	43.4160	2
NUTRIENTS								
NO2+NO3	18	MG N/L	0.0495	0.0901	0.1166	0.0040	5.4630	270
NITRITE	19	MG N/L	0.0080	0.0122	0.003	0.0040	0.1740	222
AMMONIA DISSOLVED	20	MG N/L	0.0500	0.0679	0.0023	0.0100	0.3000	221
TOT. KJELDAHL NITRO	21	MG N/L	1.4700	1.6182	0.4261	0.5500	7.1200	303
DISS. KJEEDAHL NITR	22	MG N/L	1.3600	1.5061	0.4784	0.7200	4.5300	36

TABLE 3-3 (CONTINUED)
SUMMARY OF WATER QUALITY PARAMETERS FOR STATION S140

PARAMETER NAME	PARAMETER NUMBER	UNITS	MEDIAN VALUE	AVERAGE VALUE	VARIANCE	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF SAMPLES
ORTHO PHOSPHORUS	23	MG P/L	0.0230	0.0404	0.0028	0.0030	0.05010	243
TOTAL PHOSPHORUS	25	MG P/L	0.0510	0.0725	0.0058	0.0080	0.6880	304
TOT. DIS. PHOSPHORUS	26	MG P/L	0.0290	0.0459	0.0024	0.0070	0.2280	37
PERCENT SAT. D.O.	76	PERCENT	51.5000	53.6633	680.2100	5.0000	141.0000	300
NITRATE NITROGEN	78	MG N/L	0.0450	0.0898	0.1235	0.0040	5.3210	241
TKN - NH4	79	MG N/L	1.4200	1.5621	0.4286	0.5000	7.0800	301
TOTAL NITROGEN	80	MG N/L	1.5400	1.6948	0.5268	0.5200	7.3000	304
PARTICULATE NITROGEN	81	MG N/L	0.3800	0.8343	1.0938	0.1700	5.0500	23
DIS. ORGANIC PHOS.	82	MG P/L	0.0165	0.0208	0.002	0.1007	0.0740	20
SUS. PHOSPHORUS	83	MG P/L	0.0195	0.0273	0.0005	0.0110	0.0950	28
DIS. ORGANIC CARBON	89	MG/L	15.5000	13.6769	36.1849	3.5000	23.1000	13
DIS ORGANIC NITROGEN	90	MG N/L	1.2950	1.4539	0.4752	0.7100	4.5200	36
NOX+NH4	92	MG N/L	0.1100	0.1416	0.1203	0.0100	5.6900	283
TOT. ORGANIC CARBON	100	MG/L	19.7000	20.2728	46.7178	8.0000	69.7000	81

TABLE 3-3 (CONTINUED)
SUMMARY OF WATER QUALITY PARAMETERS FOR STATION S140

PARAMETER NAME	PARAMETER NUMBER	UNITS	MEDIAN VALUE	AVERAGE VALUE	VARIANCE	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF SAMPLES
TOT. DIS. COPPER	45	MICROG/L	6.0000	6.8937	15.7089	3.0000	15.0000	7
TOT. DIS. LEAD	46	MICROG/L	1.0190	1.8584	1.6711	0.4840	4.0000	7
TOT. DIS MANGANESE	48	MICROG/L	11.0000	13.1620	122.8664	3.0000	37.0000	9
TOT. DIS. NICKEL	50	MICROG/L	3.3055	3.3055	1.7043	2.0000	4.6110	2
TOT. DIS. STRONTIUM	53	MG/L	0.2850	0.3369	0.0245	0.1000	0.7700	14
TOT. DIS ZINC	54	MICROG/L	15.0000	18.1111	87.6543	5.0000	33.0000	9
TOT. MERCURY	102	MICROG/L	0.2000	0.2670	0.0152	0.1610	0.4400	3
TOT. CADMIUM	103	MICROG/L	0.3785	0.3713	0.0218	0.0850	0.5700	6
TOT. COPPER	104	MICROG/L	1.4450	2.0367	3.3193	0.4500	6.8700	18
TOT. ZINC	105	MICROG/L	27.5000	35.2333	620.9222	14.1000	102.2000	9
TOT. ARSENIC	106	MICROG/L	1.9100	2.1115	1.2439	0.5100	5.6300	15
TOT. LEAD	107	MICROG/L	0.7150	1.0927	1.7701	0.3400	5.0370	10
TOT. COBALT	109	MICROG/L	2.2580	2.2580	0.0000	2.2580	2.2580	1
TOT. MANGANESE	110	MICROG/L	26.9110	26.9110	272.4150	10.4060	43.4160	2
NUTRIENTS								
NO2+NO3	18	MG N/L	0.0495	0.0901	0.1166	0.0040	5.4630	270
NITRITE	19	MG N/L	0.0080	0.0122	0.003	0.0040	0.1740	222
AMMONIA DISSOLVED	20	MG N/L	0.0500	0.0679	0.0023	0.0100	0.3000	221
TOT. KJELDAHL NITRO	21	MG N/L	1.4700	1.6182	0.4261	0.5500	7.1200	303
DISS. KJELDAHL NITR	22	MG N/L	1.3600	1.5061	0.4784	0.7200	4.5300	36

TABLE 3-3 (CONTINUED)
SUMMARY OF WATER QUALITY PARAMETERS FOR STATION S140

PARAMETER NAME	PARAMETER NUMBER	UNITS	MEDIAN VALUE	AVERAGE VALUE	VARIANCE	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF SAMPLES
ORTHO PHOSPHORUS	23	MG P/L	0.0230	0.0404	0.0028	0.0030	0.05010	243
TOTAL PHOSPHORUS	25	MG P/L	0.0510	0.0725	0.0058	0.0080	0.6880	304
TOT. DIS. PHOSPHORUS	26	MG P/L	0.0290	0.0459	0.0024	0.0070	0.2280	37
PERCENT SAT. D.O.	76	PERCENT	51.5000	53.6633	680.2100	5.0000	141.0000	300
NITRATE NITROGEN	78	MG N/L	0.0450	0.0898	0.1235	0.0040	5.3210	241
TKN - NH4	79	MG N/L	1.4200	1.5621	0.4286	0.5000	7.0800	301
TOTAL NITROGEN	80	MG N/L	1.5400	1.6948	0.5268	0.5200	7.3000	304
PARTICULATE NITROGEN	81	MG N/L	0.3800	0.8343	1.0938	0.1700	5.0500	23
DIS. ORGANIC PHOS.	82	MG P/L	0.0165	0.0208	0.002	0.1007	0.0740	20
SUS. PHOSPHORUS	83	MG P/L	0.0195	0.0273	0.0005	0.0110	0.0950	28
DIS. ORGANIC CARBON	89	MG/L	15.5000	13.6769	36.1849	3.5000	23.1000	13
DIS ORGANIC NITROGEN	90	MG N/L	1.2950	1.4539	0.4752	0.7100	4.5200	36
NOX+NH4	92	MG N/L	0.1100	0.1416	0.1203	0.0100	5.6900	283
TOT. ORGANIC CARBON	100	MG/L	19.7000	20.2728	46.7178	8.0000	69.7000	81

and trace metals are collected and analyzed on a quarterly and bi-annual basis, respectively. Descriptive statistics have been performed on over 6,900 data points obtained from the SFWMD data base. The results of the statistical analyses performed for station S-140 are discussed below and are summarized on Table 3-3.

Physical parameters: The specific conductance of water provides an indication of its ionic concentration. Measured field values of specific conductance value range from a low of 205 micro-Siemens (μS) to a high of 864 μS. The median value, as well as the average value, of specific conductance is 470 μS. The activity of hydrogen ions in water is expressed in terms of pH. Values of pH range from 5.9 to 8.23 units. The median value of pH is 7.2 units.

Nutrients: Levels of total nitrogen have a wide range of variability, the minimum value (0.52 mg/l) is 14 times lower than the maximum value recorded (7.30 mg/l). The median concentration of nitrate plus nitrite (NO_x) is 0.0495 mg/l. The median concentration of dissolved ammonia of 0.05 mg/l is low and near the detection limit (0.02 mg/l). The median value of nitrate is 0.045 mg/l and it is well below Florida's primary drinking water quality standards (10 mg/l). The mean concentration for Total Kjeldahl Nitrogen (TKN) is 1.47 mg/l. Total phosphorous concentration has a wide variability, the lowest value is 0.008 mg/l, near the detection limit (0.002 mg/l) and the highest value is 0.688. The median value of total phosphorous is 0.051 mg/l.

Major Ions: Chloride concentrations are moderately low at S-140 ranging from 10.8 mg/l to 141.5 mg/l. This range is well below Florida's secondary drinking water quality standards of 250 mg/l. The median chloride concentration is 34.65 mg/l. Sodium concentrations range between 9.2 mg/l and 70.3 mg/l with a median value of 25.5 mg/l. These values are well below primary drinking water standards for sodium of 160 mg/l.

Water Quality Standards and Criteria

Most surface waters in the general study area, including WCA-2 and WCA-3A, are classified by the State as Class III waters, but unlike WCA-1 do not have Outstanding Florida Water (OFW) status. Class III waters are designated for recreational use and propagation and maintenance of a healthy, well-balanced population of fish and wildlife [Florida Administrative Code 17-3.081(1)]. Maintenance of State water quality standards for Class III waters for dissolved oxygen (DO), nutrient concentrations, biochemical oxygen demand (BOD), pH, bacteria, pesticides and macroinvertebrate diversity indices and other water quality parameters (chloride, specific conductance, iron, total dissolved solids) is recognized as a concern within the canals and perimeter marshes of the WCA's.

Regional Hydrogeology

Regionally, there are several aquifer systems in the underlying limestones and sands in south Florida. However, only the unconfined Biscayne aquifer is suitable for potable use. The productive zones of this aquifer are located in Palm Beach, Broward, Dade, and eastern Monroe County. Figure 3-8A shows the approximate locations of the major south Florida aquifers including the Biscayne aquifer. The Biscayne aquifer is absent at the project site. Fish (1988) completed a series of borings to delineate the extent and thickness of the surficial aquifer system and its principal units. Figure 3-8B shows the extent and thickness of the Biscayne aquifer in the vicinity of the drill site. Several wells located along the L-28 Levee and one well west of the site along I-75 did not encounter the Biscayne aquifer (see Figure 3-8B). In a separate study (Meyer, 1988), the USGS test well G-2296 located approximately 0.5 miles ENE of the drill site, also did not encounter the Biscayne aquifer. Fish (1988) places the approximate western limit of the Biscayne aquifer at a location about three miles east of the drill site.

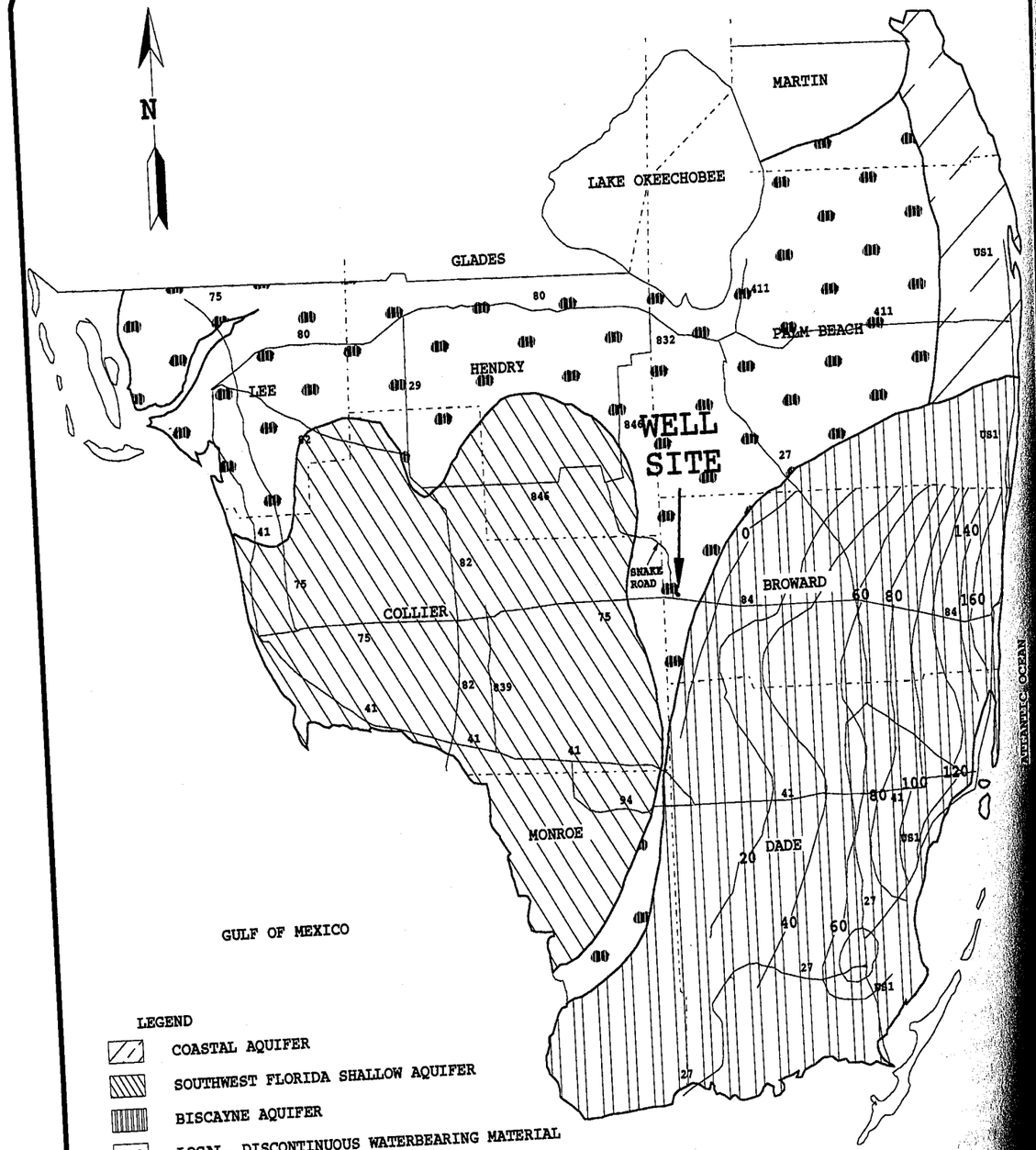
The intermediate and Floridan aquifers underlie the Biscayne aquifer, but these aquifers contain brackish to saline waters. At depth, in the lower Floridan aquifer, there is a highly transmissive zone in the Oldsmar Formation known as the "boulder zone." This zone has a chemistry composition similar to sea water and is generally used for injecting waste, brine, and other contaminants.

Local Hydrogeology

Three aquifer systems are present at the drill site: the surficial, the intermediate, and the Floridan aquifer systems. Potable water is found in the surficial aquifer system, with brackish water in the intermediate aquifer system, and brackish to saline water in the Floridan aquifer system. The Biscayne aquifer is absent at the project site.

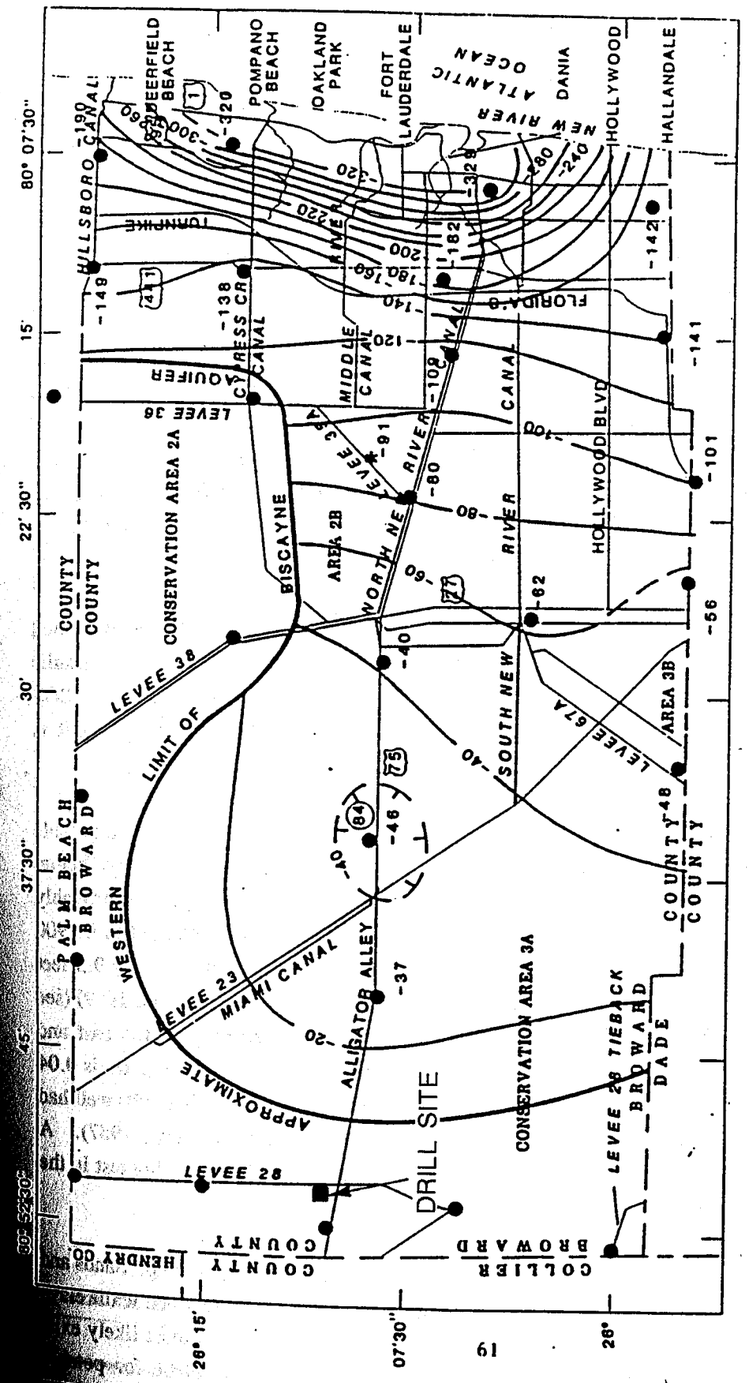
No SFWMD or FDER permitted water use wells exist within a 10-mile radius of the drill site (SFWMD, 1992; FDER, 1992). However, several wells have been completed on the Miccosukee Reservation which are not under the jurisdiction of the SFWMD. These wells are finished in the gray limestone aquifer. Three wells are located in the vicinity of the service plaza north of I-75, approximately two miles to the west of the site. Three wells are located in the vicinity of the S-140 pump station approximately 1,000 feet to the northeast of the drill site. Other well(s) are located to the south in excess of two miles from the drill site.

The USGS drilled a 2,811-foot test well, designated G-2296, as a part of the Floridan Regional Aquifer System Analysis project in 1980 (Meyer, 1987). This test well is located approximately one-half mile east-northeast of the drill site. This test well penetrated and tested the surficial, intermediate and Floridan aquifer systems.



SOURCE: U.S.G.S., 1978 BISCAYNE AQUIFER, SOUTHEAST FLORIDA WATER RESOURCE INVESTIGATION 78-107.

Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	0 10 MILES SCALE	REGIONAL AQUIFER MAP	FIGURE 3-8A D&M JOB No. 13501-072-049 AUTOCAD FILE



Source: Fish, 1988

Thickness to the base and aerial extent of the Biscayne aquifer

Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	SCALE	BISCAYNE AQUIFER LOCATION IN BROWARD COUNTY	FIGURE 3-8B D&M JOB No. 13501-072-049

CHAPTER THREE

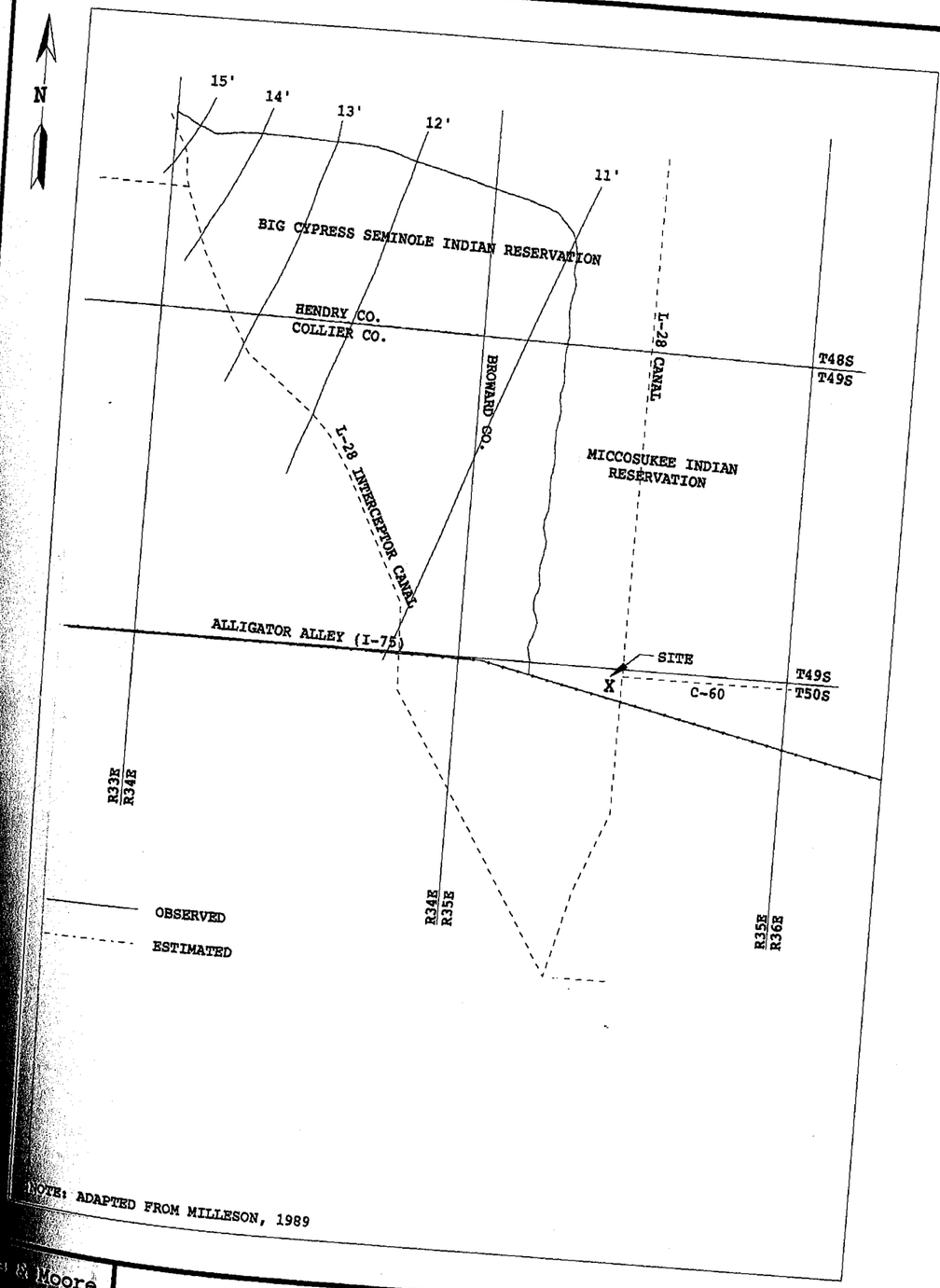
Aquifers located in the Fort Thompson and the Tamiami Formations comprise the surficial aquifer system (Meyer, 1988). A shallow aquifer is located in the Fort Thompson Formation, however, the yield is low and the water quality is not suitable for potable uses. This aquifer is located in the sands and shells of the Fort Thompson Formation and has a thickness of approximately 30 feet. A slug test conducted in this aquifer at the USGS well G-2329B from an interval of 17-20 feet below grade yields a hydraulic conductivity of 16 feet/day (Fish, 1988).

The water table generally is a subdued expression of the surface topography and is located at the surface or one to three feet below grade under normal conditions. The water table at the site during October, 1987 was approximately 11.5 feet National Geodetic Vertical Datum of 1929 (NGVD) and in May, 1988 the water table was approximately 10.5 feet NGVD (Milleson, 1989) (see Figures 3-9 and 3-10). The flow direction is generally to the east and southeast and a hydraulic gradient of 0.000022 ft/ft was estimated from the configuration of the water table. The average groundwater velocity calculated by multiplying the gradient by the hydraulic conductivity is 0.00035 feet/day.

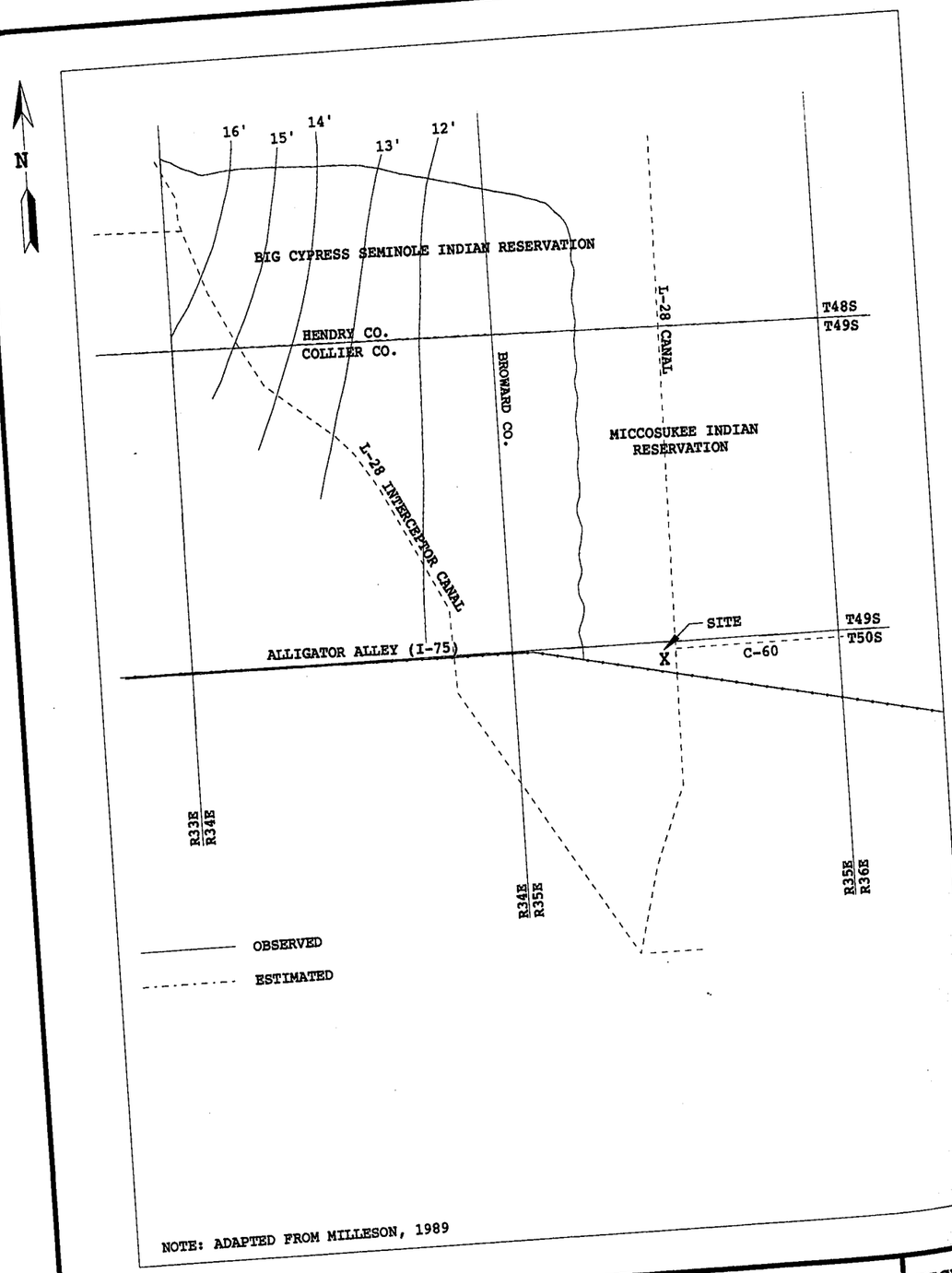
A confining unit in the Upper Tamiami Formation composed of mixed lime mud, shell fragments, and quartz sand separates the upper surficial aquifer from the gray limestone aquifer. A hydraulic conductivity of 0.16 feet/day for the confining unit was calculated from a slug test conducted at the USGS well G-2329B from a screened interval of 36-40 feet (Fish, 1988). The thickness of this unit is approximately 30 feet (Causaras, 1985).

The middle unit of the Tamiami Formation referred to as the gray limestone unit is used as a potable water source by the Miccosukee Reservation. The top of this aquifer is approximately 70 feet below grade and is 100-feet thick (Causaras, 1985). Minor quartz sand near the base of the aquifer is probably less permeable than the gray limestone (Fish, 1988). The hydraulic conductivity is reported to be 900 feet/day (Fish, 1988). The water level in the gray limestone in May, 1988 was approximately 9.5 feet NGVD and in October, 1987 the water level was approximately 11.75 feet NGVD (Milleson, 1989) (see Figures 3-11 and 3-12). The flow direction in the gray limestone unit is generally to the east and southeast and has a gradient of 0.000045 ft/ft. The average groundwater velocity in this aquifer is 0.04 feet/day. In 1982, a water sample taken from the gray limestone aquifer in the USGS G-2329B well had a chloride concentration of 120 mg/l and specific conductance of 1,000 μS/cm (Howie, 1987). A hydraulic conductivity of 0.061 feet/day at the USGS G-2338H well was derived from a slug test in the confining zone that underlies the gray limestone aquifer (Fish, 1988).

The intermediate aquifer system is found in the more permeable units in the Hawthorn Group. Sands and carbonates are the most permeable units in the group. The aquifers are located in these units, while clays and lower permeable carbonates comprise the confining units. Two to three aquifers most likely exist within the Hawthorn Group. The groundwater in this zone is brackish, making it unsuitable for potable

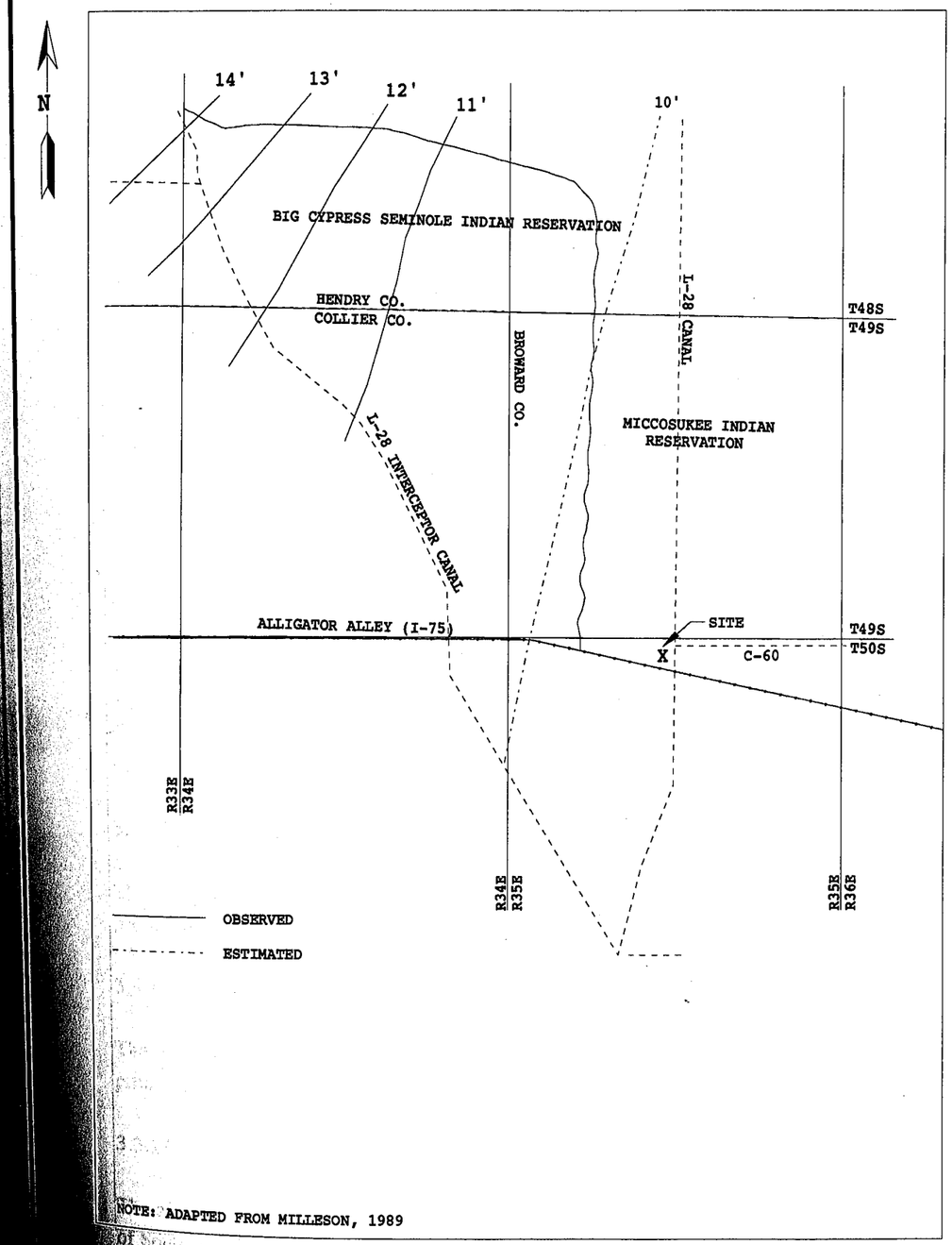


Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	WATER TABLE CONTOURS LOW WATER CONDITIONS (MAY 1988)	FIGURE 3-9 D&M JOB No. 13501-072-049 AUTOCAD FILE: SHELL.DWG



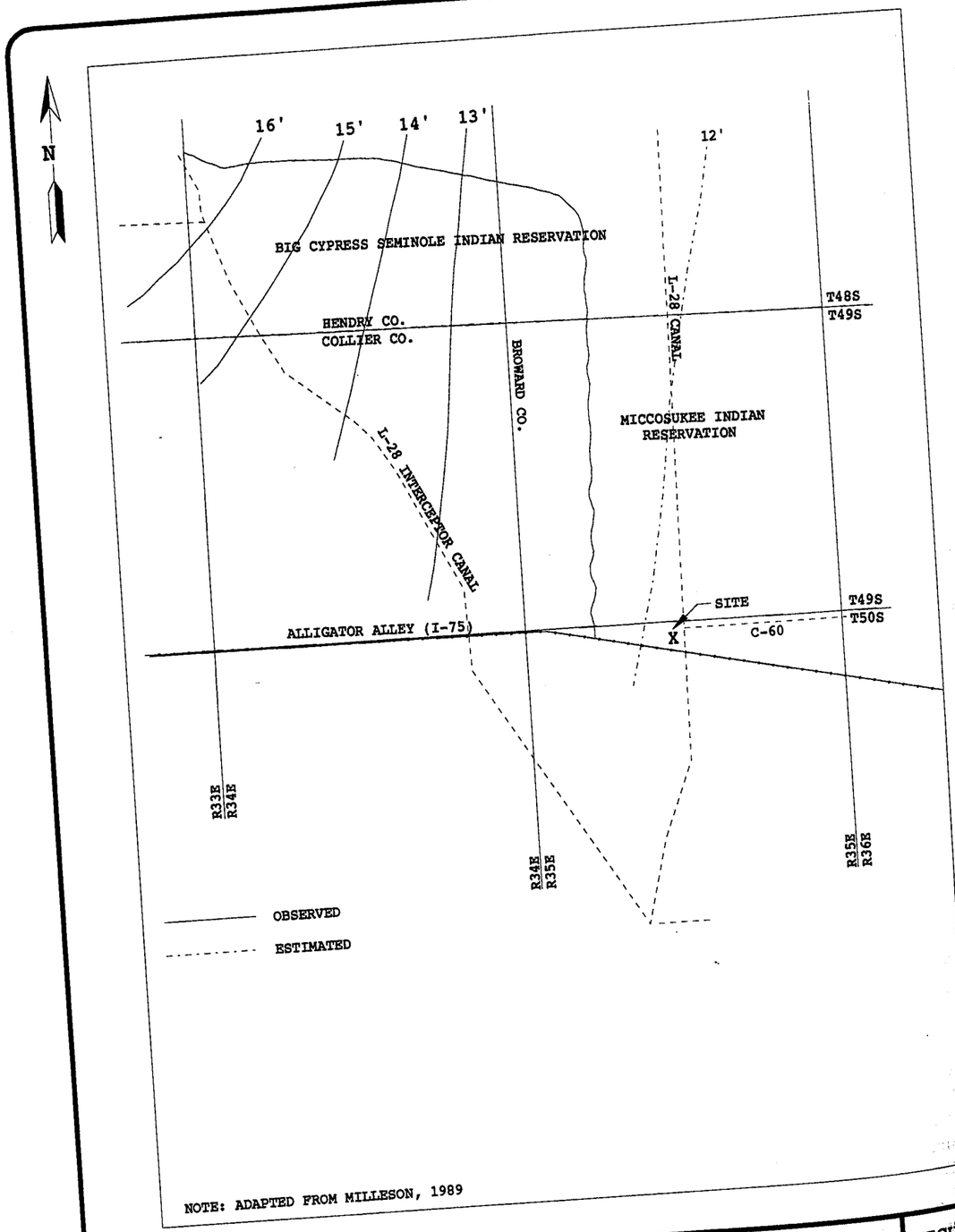
NOTE: ADAPTED FROM MILLESON, 1989

Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	WATER TABLE CONTOURS HIGH WATER CONDITIONS (OCT 1987)	FIGURE 3 D&M JOB NO. AUTOCAD FILE:



NOTE: ADAPTED FROM MILLESON, 1989

Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	WATER LEVELS IN THE GRAY LIMESTONE AQUIFER LOW WATER CONDITIONS (MAY 1988)	FIGURE 3-11 D&M JOB No. 13501-072-049 AUTOCAD FILE: SHELL.DWG



Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	WATER LEVELS IN THE GRAY LIMESTONE AQUIFER HIGH WATER CONDITIONS (OCT 1987)	FIGURE 3-4

water needs (Fish, 1988). Recorded use of water from these aquifers in Broward County does not exist. No recent water level records for this aquifer system are available. Overall, the Hawthorn Group actsas a confining unit for the Floridan aquifer. This assumption is further used for modeling purposes (Meyer, 1989).

The Floridan aquifer system extends from the Suwannee Limestone through the Cedar Keys Formation. The formations that comprise the Floridan aquifer system are composed of many alternating zones of low and high permeability. Vertical flow between permeable zones probably occurs through sinkholes and fractures. The amount of vertical flow is, however, small compared to the amount of horizontal flow. The zones of highest permeability generally are at or near unconformities and parallel to bedding planes (Meyer, 1989). The Upper Floridan aquifer zone is located in the permeable zones of the Suwannee Limestone, Ocala Group, and the Upper Avon Park Formation. The groundwater in the upper zone is brackish and the salinity increases with depth. The Floridan aquifer system at the site is not used for potable water. It is used as a sink for injection of waste fluids, with injection wells introducing fluids into the "boulder zone" of the lower Floridan aquifer. The potentiometric surface near the study site measured in April 1981 ranged from 51 to 58 feet above sea level (Meyer, 1988). The transmissivity was estimated to vary between 10,000 and 50,000 feet^2/day (Bush and Johnston, 1988). An average transmissivity of 30,000 feet^2/day is assumed for the Floridan aquifer underlying the site. Using an average thickness of 600 feet for the Upper Floridan aquifer, the hydraulic conductivity is 50 feet/day. The flow direction is generally to the east and southeast with a hydraulic gradient of 0.00000085 ft/ft (Meyer, 1989). The average groundwater velocity is 0.0000425 feet/day. The water quality analysis in the aquifer in 1980 and 1981 are shown in Table 3-4.

3.3.11.2 Alternative B - West Access Route

The affected environments within the vicinity of Alternative B are essentially the same as those of the proposed action.

3.3.11.3 Alternative C - East Access Route

The affected environments within the vicinity of Alternative C are essentially the same as those of the proposed action.

3.3.12 Wetlands

The area in the vicinity of the project site is a transition between two distinct physiographic provinces of Southern Florida: the Everglades and the Big Cypress Swamp physiographic provinces.

TABLE 3-4 - SELECTED WATER QUALITY DATA
(µS/cm, micro-Siemens per centimeter; mg/L, milligrams per liter; °C, degrees, Celsius; gal/min, gallons per minute; min., minutes)

DATE	TIME	DEPTH (FEET)	SPECIFIC CONDUC-TANCE (US/CM)	CHLOR-IDE (MG/L)	TEMPER-ATURE (°C)
10/16/80	19:30	895-915	1,750	--	--
10/17/80	07:10	895-915	2,180	--	--
	13:10	895-925	2,520	--	27.0
	15:30	895-934	4,180	--	27.5
	16.30	895-934	4,200	--	27.0
10/18/80	03:00	895-934	4,600	1,200	26.5
11/18/80	07:30	0-895	5,750	--	--
	08:30	895-2,776	23,100	--	--
	09:00	895-2,776	25,800	--	--
	09:30	895-2,776	25,800	--	--
	10:15	895-2,776	23,500	--	26.0
	12:00	895-2,776	25,800	--	26.5
	12:45	895-2,776	24,900	--	26.5
	13:55	1,027	14,600	4,800	--
	14:10	1,130	37,500	14,100	--
	14:40	1,220	41,000	15,800	--
	14:45	895-2,776	22,300	--	26.0
	14:50	1,870	47,500	18,500	--
	15:10	2,690	48,500	19,200	--
03/02/81	14:20	895-2,811	29,500	--	26.0
03/03/81	18:30	895-2,457	13,500	4,800	25.1
03/04/81	02:00	2,453-2,811	50,000	19,500	24.7
03/05/81	13:30	895-2,811	29,000	--	26.0
03/06/81	07:00	895-2,811	24,700	--	26.0
	23:55	895-1,428	3,120	800	26.0

TABLE 3-4 - SELECTED WATER QUALITY DATA
(µS/cm, micro-Siemens per centimeter; mg/L, milligrams per liter; °C, degrees, Celsius; gal/min, gallons per minute; min., minutes)

DATE	TIME	DEPTH (FEET)	SPECIFIC CONDUC-TANCE (US/CM)	CHLOR-IDE (MG/L)	TEMPER-ATURE (°C)
03/07/81	02:00	1,433-1,618	6,050	1,800	25.9
	07:15	895-1,428	3,400	--	26.0
	07:16	1,433-1,618	5,000	--	26.0
03/08/81	06:30	695-1,249	3,150	800	26.2
	11:45	1,254-2,811	10,450	3,000	26.0
03/09/81	07:30	895-1,124	3,325	850	26.2
	10:00	1,129-2,811	8,900	2,800	26.1
03/26/81	12:15	895-2,811	3,700	--	--
	12:25	895-2,811	31,000	--	--
	13:26	895-2,811	25,500	--	--
04/01/81	09:55	895-2,811	29,000	11,000	26.0
04/08/81	12:39	1,020	26,000	9,350	--
	12:53	1,040	38,000	14,050	--
	13:08	1,280	42,700	16,050	--
	13:26	1,600	44,000	17,700	--
	13:49	2,250	50,000	19,350	--
	14:17	2,520	50,000	19,350	--
	14:45	895-2,811	26,200	9,400	--
	14:47	2,600	50,000	19,350	--
04/24/81	10:15	811-816	5,400	--	26.0
	11:00	811-816	6,400	--	--
10/19/81	10:30	895-2,811	3,700	1,100	--
	12:30	811-818	6,200	1,600	--
	15:00	2,500	54,000	22,700	--

The Everglades physiographic province is an extremely flat area which slopes to the south and southeast. Natural drainage of this area has been greatly altered by components of the Central and Southern Florida Flood Control Project which affects 1.1 million acres of the land. An extensive system of canals, levees and control structures regulates water movement through this area. Wetlands in the Everglades are characteristically large expanses of marsh dominated by sawgrass. Willow heads dominated by coastal plain willow also occur.

The Big Cypress Swamp is a loosely defined physiographic province of approximately 2,450 square miles located southwest of Lake Okeechobee and consisting of flat, swampy area that merges into a coastal marsh and estuarine environment. The northeastern portion of the area drains southeast into WCA-3A.

Wetlands in the northeast portion of the Big Cypress Swamp typically consist of cypress heads and strands dominated by bald cypress, and pond cypress, mixed hardwood swamps dominated by red maple (*Acer rubrum*), white bay (*Magnolia virginiana*), and swamp bay (*Pursea palustris*), willow heads, and depressional marshes dominated by pickerelweed, and sawgrass.

The project area is hydrologically severed from the Everglades physiographic province by the L-28 Levee and Canal. A network of drainage ditches constructed west of the canal during the 1960's along with the operation of S-140 pump station have resulted in a modified hydroperiod west of the L-28 Levee. While depressional cypress heads, willow heads, and marshes still exist between Snake Road and the L-28 Levee and Canal, the drainage provided by ditches and the S-140 pump station allowed the remaining area to be converted to pasture in the early 1970's.

The Federal definition of wetlands is based upon the presence of hydric soils, hydroperiod, and hydrophytic vegetation. Based upon these criteria, the pasture area (described in Section 3.3.8.2) in the project vicinity is not classified as a wetland. The areas identified as cypress head, willow head, or marshes on Figure 3-3 depict wetlands in the vicinity of the project site and are subject to regulation by the COE (Section 404 of the Clean Water Act). The COE determined that the well site is not a wetland subject to regulation under Section 404 of the Clean Water Act. The June 20, 1991 determination was made on the basis of The Federal Manual for Identifying and Delineating Jurisdictional Wetlands, January, 1989. On September 3, 1991, the COE issued a notice directing use of the 1987 COE Wetland Delineation Manual until further notice. A subsequent COE wetland jurisdictional determination was completed in March, 1994 under the criteria of the 1987 manual. Correspondence related to this determination is included in Appendix A-12. A significant difference between the two determinations does not exist.

3.3.12.1 Alternative A - Proposed Action

The proposed access route to the project site utilizes: Snake Road; an existing 1.5-mile fill road adjacent to a Miccosukee surface water management canal running in a general east to west direction, located north of I-75 between Snake Road and the L-28 Levee and Canal; and a fill road running four miles south from the surface water management canal and fill road along L-28 to the proposed drill site. The fill roads are constructed approximately three feet to four feet above prevailing ground elevation. Five drainage ditches convey water across the pasture area to and beneath the road into the L-28 Canal via culverts. Depressional marshes and willow heads are located adjacent to the 5.5 mile access route from Snake Road to the well site (Figure 3-3).

The proposed well site is currently an upland pasture area west of and adjacent to the L-28 Canal. Depressional willow heads are located north and west of the proposed well site and a small marsh area is located south of the well site.

3.3.12.2 Alternative B - West Access Route

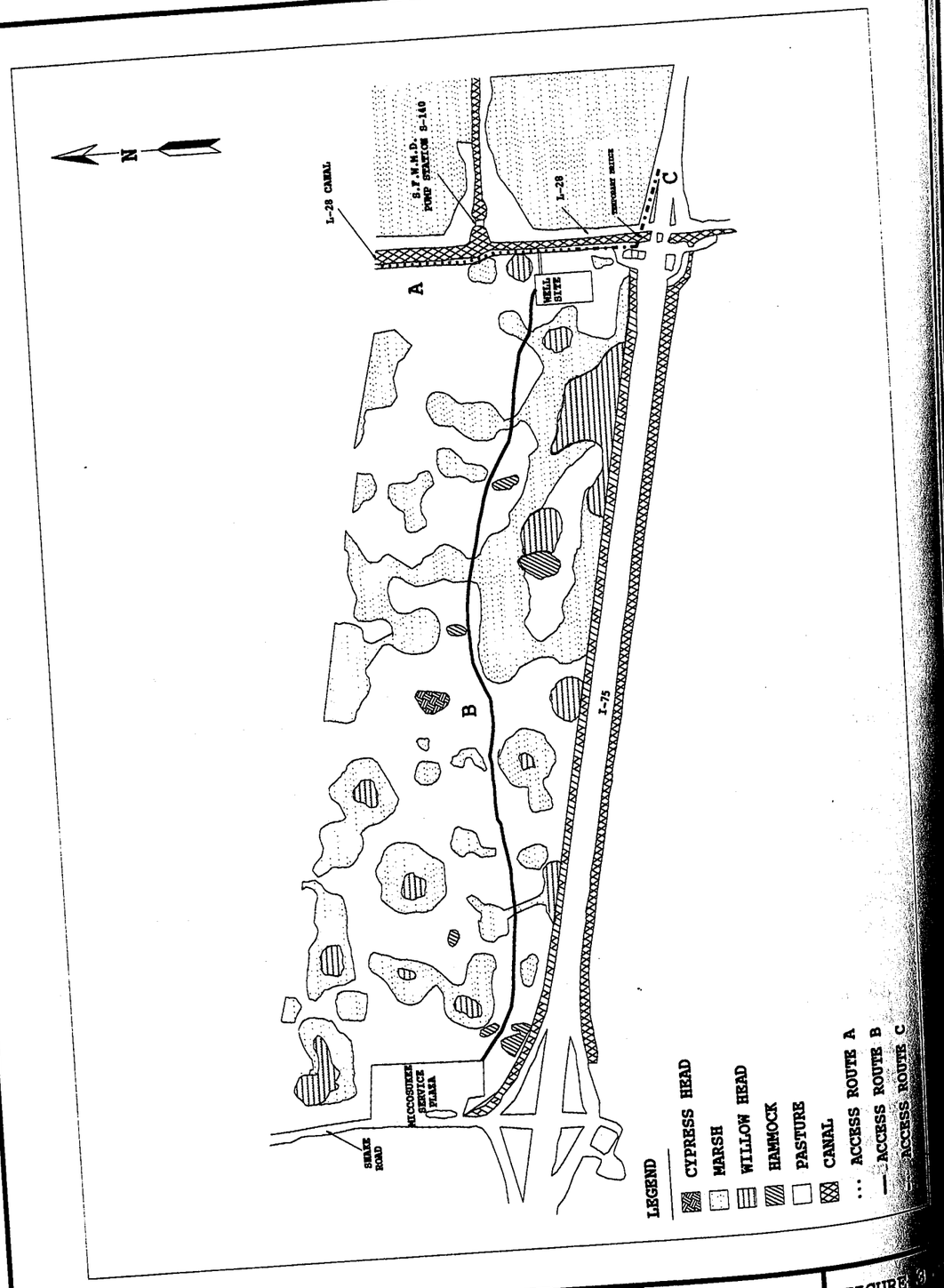
This access route would require construction of a new one-lane fill road approximately 15-feet wide by 1.6-miles long with vehicle pull outs between Snake Road and the well site. This area is predominantly pasture, with a number of depressional marshes and willow heads. One cypress head exists in the vicinity as indicated on Figure 3-13.

3.3.12.3 Alternative C - East Access Route

The access route would require placement of a vehicular bridge across the L-28 Canal. The L-28 Canal is approximately 100-feet wide. Narrow bands of littoral wetland vegetation cling to the canal banks at the water line. The growth of aquatic vegetation is controlled through herbicide application by the SFWMD. This alternative would not involve wetlands other than the L-28 Canal.

3.3.13 Wildlife

The Everglades region is recognized as an important area for many species of wildlife. Numerous surveys and studies of the regional fauna have been completed. Many of the State and Federal-listed species of the region have been studied extensively by wildlife biologists. A few of the regional studies and impact statements germane to this FEIS are listed and summarized below, along with studies and correspondence directly related to the proposed action addressed in this FEIS.



Dames & Moore

SWEPI MICCOSUKEE 3-1
EXPLORATORY WELL
BROWARD COUNTY, FLORIDA

0 750'
SCALE

ACCESS
ROUTE
DETAILS

FIGURE 3

D&M JOB NO.
AUTOCAD FILE NO.

AFFECTED ENVIRONMENT

Final Environmental Assessment, Miccosukee Indian Reservation Oil & Gas Leasing Program, 1981

This document was prepared by the NPS for the BIA. The EA addressed the impacts associated with hydrocarbon development on the entire Miccosukee Reservation. The report included a Biological Assessment and a subsequent Biological Opinion for Threatened and Endangered Species from the USFWS. A determination of "no effect" was made for the American alligator, bald eagle and red-cockaded woodpecker. A determination of "may affect" was made for the Florida panther, Everglades kite and Eastern indigo snake. This determination was made for the entire Reservation, encompassing approximately 76,800 acres of land. The proposed action addressed in this FEIS encompasses only a portion of land within the Reservation covered by that biological opinion.

Big Cypress Seminole Indian Reservation, Environmental Assessment

The BIA prepared a Final EA, dated September 1981, addressing the current Petroleum Development Project on the BCSIR in Hendry County, Florida. With regards to Federal-listed species, the report addresses the Eastern indigo snake and American alligator.

Miccosukee Wildlife Management Handbook

The Miccosukee Tribe has an active wildlife management program. The program includes game species, non-game species, habitat management, water management and exotic plant control. Endangered and threatened wildlife and plants are also addressed in the document.

Miccosukee Tribe - American Alligator Surveys

Alligator basking and nest surveys have been conducted by representatives of the Miccosukee Tribe since the early 1980's (Jennings, 1985; Patterson 1990, 1991, 1992). The surveys show alligators present in the canal systems of the Reservation.

Systematic Reconnaissance Flights

The National Audubon Society (NAS) performs Systematic Reconnaissance Flights (SRF) for the SFWMD. The SRF Program surveys the EAA and the three WCA's. Data from the SRF Program does not cover the proposed site or study area addressed in this FEIS, but does provide valuable information about wading bird utilization of adjacent areas.

I-75 Environmental Re-Evaluation

In 1987, the FHWA performed an environmental re-evaluation of the 1972 I-75 EIS. A Biological Assessment was performed in 1984, in which "no adverse impact" was anticipated for any listed species. A Section 7 Consultation addressed the Florida panther, red-cockaded woodpecker, Eastern indigo snake, American alligator, arctic peregrine falcon and bald eagle. The USFWS responded with a finding of jeopardy for the Florida panther. The concerns were addressed by providing 23 new animal crossings, 13 bridge expansions and animal fencing. This resulted in a finding of no further impacts to these species as a result of the construction of I-75.

Law Environmental, Inc. Wildlife Report

A specific wildlife evaluation was performed in March 1990 for the site of the proposed action addressed in this FEIS by Law Environmental, Inc. (Appendix A-9). The study incorporates literature, personal communications with appropriate wildlife experts and a site inspection. The list of endangered and threatened species potentially occurring on the site is similar to the list compiled in this FEIS. The conclusions in the report are general, but similar to the conclusions of this FEIS.

Florida Natural Areas Inventory (FNAI)

The records of the FNAI were checked for occurrences of listed wildlife and vegetation. Two panthers were reported; one was four miles southwest and one was three and one-half miles to the southeast of the proposed action. A rookery of little blue herons and great egrets was reported six miles west of the proposed action. This information was obtained on June 8, 1992.

Florida Panther Habitat Preservation Plan, South Florida Population

The January, 1994 report presents telemetry data for 43 radio-collared panthers collected from 1981 to 1991. The plan identifies occupied and potential panther habitats, threats to these habitats, and options available to maintain sufficient habitat for a self-sustaining population of panthers in South Florida. The report was prepared by the Florida Panther Interagency Committee.

Section 7 Consultation for DEIS, SWEPI - APD

On February 15, 1991, the BLM initiated informal consultation with the USFWS regarding the APD. The BLM requested information regarding the Florida panther, snail kite and wood stork, and solicited suggestions for mitigative measures to minimize negative impacts to the biological resources of the site.

The response from USFWS states that effects would occur on a "negligible portion of the panther's range," and that the character of the site renders it "of little use to either the wood stork or snail kite." Upon determining that an EIS would be completed for this Action, the BLM contacted the USFWS on July 16, 1992 requesting concurrence on a revised list of Federal-listed species. The USFWS determined on September 18, 1992 that the revised list was acceptable for analysis in a biological assessment. A biological assessment regarding the potential impacts of the proposed action and alternatives on the protected wildlife species listed in Table 3-5 was transmitted to the USFWS and Florida Game and Fresh Water Fish Commission (FGFWFC) on October 16, 1992. The biological assessment was a compilation of the information presented in Sections 3.3.13 and 4.3.13 of this FEIS. On October 30, 1992, the USFWS determined that the project is not likely to affect Federal-listed species. The correspondence related to this consultation is included in Appendix A-12.

Consultation With FGFWFC

BLM policy is to consult with the appropriate State wildlife agency when considering an APD. A biological assessment regarding the potential impacts of the Proposed Action and alternatives on the protected wildlife species listed in Table 3-5 was transmitted to the FGFWFC on October 16, 1992. The biological assessment was a compilation of the information presented in Sections 3.3.13 and 4.3.13 of the EIS. By letter of October 20, 1992, the FGFWFC provided comments on the biological assessment. Their comments did not raise any substantive issues or disagreement with the biological assessment's conclusion that the project is not likely to affect listed species. The correspondence related to this consultation is included in Appendix A-12.

3.3.13.1 Alternative A - Proposed Action

The Study Area

The term "Study Area" in this FEIS refers to the area in the Miccosukee Reservation bounded by I-75, an east-west fill road, Snake Road and the L-28 Canal (Figure 2-2). The adjacent habitats and wildlife species found within WCA-3A, BCNP and ENP are discussed but are somewhat separated from the proposed action by a number of physical barriers.

Though it is recognized that animals do not adhere to political boundaries, some of these boundaries do represent significant physical barriers to many species. The habitats of the adjacent areas may be important to a number of wide-ranging, highly mobile wildlife species. In contrast, habitats within the study area are generally affected by the agricultural practices currently in place.

TABLE 3-5
CONCURRENCE LIST OF
PROTECTED WILDLIFE SPECIES

Scientific Name	Common Name	FGFWFC[1]	USFWS[2]
Alligator mississippiensis	American alligator	SSC	T-S/A
Drymarchon corais couperi	Eastern indigo snake	T	T
Falco sparverius paulus	Southeastern American kestrel	T	C2
Felis concolor coryi	Florida panther	E	E
Grus canadensis pratensis	Florida sandhill crane	T	
Haliaeetus leucocephalus	Bald eagle	T	E
Mustela vison mink (evergladensis)	Florida everglades mink	T	C2
Mycteria americana	Wood stork	E	E
Polyborus plancus audubonii	Audubon's crested caracara	T	T
Rostrhamus sociabilis plumbeus	Everglades snail kite	E	E
Ursus americanus floridanus	Florida black bear	T	C2

Notes

[1] Florida Game and Fresh Water Fish Commission
- E Endangered
- T Threatened
- SSC Species of Special Concern

[2] U.S. Fish and Wildlife Service
- E Endangered
- T Threatened
- C1 A candidate for Federal listing, with enough substantial information on biological vulnerability and threats to support proposals for listing.
- C2 A candidate for listing, with some evidence of vulnerability, but for which not enough data exist to support listing.
- T-S/A Threatened due to Similarity of Appearance

Wildlife habitats within the study area consist mainly of isolated marsh systems, willow heads, cypress swamps and hardwood hammocks within a matrix of improved pasture. No significant natural upland forest habitats exist within the study area. The site is physically separated from WCA-3A by the L-28 Canal and Levee to the east, and by I-75 to the south.

Wildlife of the Site and Study Area

The Miccosukee Wildlife Management Handbook (1984) indicates that little overall changes have occurred to populations of resident species since the conception of the WCA's, with the exception of those in the northwestern portion of the Reservation. All wildlife was adversely affected in the northwest portion upon the conversion to grazing and agricultural land.

Improved pasture is the predominant habitat found within the proposed five-acre well site and is the most abundant type within the study area. The pasture is largely introduced grass species which support ubiquitous and resilient species such as meadowlarks, armadillos, and cattle egrets. Pastures typically are utilized by raptors for hunting. Arthropods are abundant for such a spatially homogeneous habitat and provide prey for many species. Grazing mammals including deer obviously find vast resources in improved pastures, which are managed as genetically homogeneous stands of grasses adapted to constant pressures of cropping, trampling and fire.

The cattle egret is likely the most common vertebrate species in this area. Red-winged blackbirds are abundant in the cattails which fringe nearly every forested low area within the pastures. Ground-dwelling birds such as killdeer and meadowlarks are expected to inhabit the site. Wildlife species that utilize wetlands such as black-necked stilts, Florida ducks and snail kites are not expected to frequent the site due to its status as pasture. Wetland species which regularly utilize improved pasture, such as sandhill cranes and wading birds, are expected to periodically utilize the site.

Freshwater marsh habitat does not occur within the proposed well site, but is found immediately adjacent and within the study area in small isolated, and large contiguous systems. The most important marsh habitats are found in the WCA's, BCNP and ENP. In South Florida, the freshwater marshes of the Everglades and Big Cypress Swamp physiographic regions are highly productive systems. These ecosystems support a highly abundant and diverse fauna in spite of modifications by humans.

Small, dense stands of willow (willow heads) add spatial diversity to a homogeneous system of marshes and pastures of the study area. Willow heads are found near the proposed site, throughout the study area, and in surrounding habitats, but are not present within the proposed well site. Willow heads may be of significance to avian species which nest above water, such as egrets, herons, ibis and other wading birds. Aquatic and wetland species find cover among willow heads.

Hardwood hammocks are not found on the proposed drill site, but are found in the immediate vicinity. Hardwood hammocks provide increased habitat diversity in the otherwise homogeneous landscape of the region. The significance of hardwood hammocks is mostly evident in times of high water, during which animals may seek refuge in these wooded areas. Also, seeds and fruits from hammock species provide forage for wildlife. Many species require these habitats for nesting or reproduction in general.

Cypress swamps are numerous and extensive in the BCNP, but less so as one moves eastward toward ENP. One cypress dome is located approximately 0.85 miles west of the proposed drill site. It is the sole representative of this habitat type in the south portion of the study area. Additional cypress swamps are located between Snake Road and the boundary of BCNP, one and one-half miles west of Snake Road. Cypress swamps of South Florida are relatively low in vegetational diversity and density. However, they provide large wildlife corridors in the BCNP, where cypress is distributed in large strands as well as small domes. This habitat is important to wood storks, bald eagles and other wading birds for nest sites. Many avian species such as flycatchers, shrikes and even snail kites roost in cypress trees, or forage from perches. White-tail deer, panthers, black bears, bobcats and other large, mobile species utilize swamps as corridors and hunting grounds.

Wildlife of Adjacent Areas

WCA-3A lies directly east of the L-28 Canal and associated levee. It contains a number of distinct habitat units. North of I-75, WCA-3A is mostly a short-hydroperiod High Marsh of sawgrass with a heavy colonization of wax myrtle. This area has few tree islands and is being invaded by melaleuca and cattail (NAS, 1990). The WCA-3A High Marsh supports relatively few wading birds, which include great egrets, white ibis and great blue herons. Avian usage is usually concentrated near the Miami Canal Strip, ten miles east of the proposed site (NAS, 1990).

South of I-75, the two main habitat areas near the study area are the Alligator Alley High Marsh and the marsh in the vicinity of the L-28 Gap. The Alligator Alley High Marsh lies directly south of I-75 and from the L-28 Canal east to the center of WCA-3A. It is a short-hydroperiod sawgrass marsh with a significant shrubby component. Wading birds (mostly great egrets) utilize this area extensively during periods of high water (NAS, 1990). The marsh in the vicinity of the L-28 Gap lies over six miles south of the proposed drill site. The unit supports diverse habitats, has more topographical relief and has a complex hydrological cycle influenced by the canals. It stays wetter than the surrounding high marshes and hosts numerous birds, particularly when other WCA-3A areas are dry. Great egrets and white ibis dominate, but the area provides excellent wood stork habitat as well (NAS, 1990). Although not mentioned in the NAS (1990) report, personal communications with R. Bennetts (1992) indicate that this area supports the Miccosukee Roost: the largest population of snail kites in WCA-3A and the State of Florida.

Contrary to popular belief, the Everglades are considered poor habitat for some wildlife species due to the extremely wet conditions and relatively low, sparse cover. Panthers are known to tolerate these conditions for relatively short periods of time. Black bears prefer extremely dense, forested habitats of the BCNP. The relative productivity of Everglades habitat is low compared to many other herbaceous wetland habitats in Florida. This is largely due to the presence of shallow marl soils and the nutrient inputs being provided by rainfall rather than upland runoff.

West of Snake Road, the habitats are more characteristic of the Big Cypress ecosystem. This includes marshes, hammocks, rockland, cypress heads, strands, or savannas. However, between Snake Road and the western Reservation boundary, drainage and agricultural activities have affected the habitats present. Most marsh systems in this area are colonized by a shrubby layer of wax myrtle and also heavily infested with exotic vegetation, including Brazilian pepper and Melaleuca. Approximately six miles north of I-75 on the BCSIR, an area of dense shrubby vegetation crosses Snake Road. This is representative of the habitat traversed by the single radio-collared male panther presented in various literature and mentioned in personal communications (Maehr, 1992). Black bears are numerous in the BCNP, and their range is shown to enter Broward County. However, they do not likely traverse the open pastures found in the study area.

Mature pine forest does not occur within the Reservation. The nearest pine forest lies approximately 1.5 miles southwest of the Reservation in the BCNP, which would be over 15 miles from the proposed action. This area is utilized by the red-cockaded woodpecker as a colony area (Paterson and Robinson, 1981).

Endangered and Threatened Species

Table 3-6 includes protected wildlife species present and potentially present in the vicinity of the proposed action and alternatives. The following discussion identifies 11 Federal and/or State-listed animal species observed or potentially occurring in the vicinity of the proposed action, as identified for detailed review.

American alligator *Alligator mississippiensis*

The American alligator was hunted relentlessly until 1961, when alligator hunting was declared illegal in Florida. The Lacey Act halted interstate commerce on many animal hides, including reptiles, and the ESA of 1973 protected them further. These and other laws enabled the population of alligators in Florida to rebound sufficiently for de-listing by 1985. This crocodilian is currently Federal-listed as threatened due to the similarity of appearance to the American crocodile (*Crocodylus acutus*), which is an endangered species (Federal Register, 1985). This confers an added measure of protection for the crocodile, especially in waters where the two species co-exist. Crocodiles nest only in coastal estuarine

TABLE 3-6
PROTECTED WILDLIFE SPECIES PRESENT AND POTENTIALLY PRESENT WITHIN THE PROJECT AREA

Scientific Name	Common Name	FGFWFC[1]	USFWS[2]	Habitat[3]
Ajaia ajaja	Roseate spoonbill	SSC		D, E
*Alligator mississippiensis**	American alligator	SSC	T-S/A	C, D, E
Aramus guarauna	Limpkin	SSC		C, D, E
Athene cunicularia	Burrowing owl	SSC		C
Blarina carolinensis	Sherman's short-tailed shrew	SSC	C2	A
Cryptotis parva	Least shrew	SSC	C2	B, D
Dendroica kirtlandii	Kirtland's warbler	E	E	B
Dichromanassa rufescens	Reddish egret	SSC	C2	C, E
*Drymarchon corais couperi**	Eastern indigo snake	T	T	A, B, E
Egretta caerula	Little blue heron	SSC		C, E
Egretta thula	Snowy egret	SSC		C, E
Egretta tricolor	Tricolored heron	SSC		C, E
Falco peregrinus tundrius	Arctic peregrine falcon	E	T	A, B, C, D, E
*Falco sparverius paulus**	Southeastern American kestrel	T	C2	A
*Felis concolor coryi**	Florida panther	E	E	A, B, C, D, E
Gopherus polyphemus	Gopher tortoise	SSC	C2	A, B, E
*Grus canadensis pratensis**	Florida sandhill crane	T		A, B, C
*Haliaeetus leucocephalus**	Bald eagle	T	E	A, B, C, D, E
Lanius ludovicianus migrans	Migrant loggerhead shrike		C2	A, B
Mustela frenata	Longtail weasel		C2	A, B, D, E
*Mustela vison mink (evergladensis)**	Florida everglades mink	T	C2	A, B
*Mycteria americana**	Wood stork	E	E	A, C, E
Neofiber alleni	Round-tailed muskrat		C2	C, D
Pandion halaetus	Osprey	SSC		A, C, E
Percmyscus floridanus	Florida mouse	SSC	C2	A, B, E
Pituophis melanoleucus mugitus	Florida pine snake	SSC	C2	A, B, E
*Polyborus plancus audubonii**	Audubon's crested caracara	T	T	A, B
Rana areolata aesophus	Gopher frog	SSC	C2	C, E
*Rostrhamus sociabilis plumbeus**	Everglades snail kite	E	E	C
Sceloporus woodi	Florida scrub lizard		C2	A, B
Sciurus niger avicennia	Big Cypress fox squirrel	T	C2	B, D
Sterna antillarum	Least tern	T		A
Tantilla oolitica	Miami black-headed snake	T	C2	A, B, E
*Ursus americanus floridanus**	Florida black bear	T	C2	B, D
Vermivera bachmanii	Bachman's warbler	E	E	B, D

Notes

[1] Florida Game and Fresh Water Fish Commission
E Endangered
T Threatened
SSC Species of Special Concern

[2] U.S. Fish and Wildlife Service
E Endangered
T Threatened
C1 A candidate for Federal listing, with enough substantial information on biological vulnerability and threats to support proposals for listing.
C2 A candidate for listing, with some evidence of vulnerability, but for which not enough data exist to support listing.
T-S/A Threatened due to Similarity of Appearance

[3] Most Common Habitat Types Utilized:
A Pasture
B Hammock
C Marsh
D Cypress Forests
E Canal/Levee

*Species subject to concurrency review by USFWS.

and mangrove systems and are not present in the central, inland regions of Florida (Kushlan and Mazzotti, 1989).

Alligators remain a species of special concern under Florida regulations. Alligators are quite common in the Everglades/Big Cypress region of South Florida.

The alligator population on the Miccosukee Reservation has been monitored for at least ten years. Basking surveys and nest surveys are performed annually. The basking and nest survey reports indicate regular use of the L-28 Canal by this species (Jennings, 1985; Patterson 1990, 1991, 1992). One confirmed nest site, utilized in 1989 and 1990, lies along the west side of the L-28 Canal approximatelyone mile north of the proposed drill site. The site was not used for nesting in 1991, 1992 or 1993 (S. Terry, personal communication).

Eastern indigo snake *Drymarchon corais couperi*

Historical pet trade practices were instrumental in the initial demise of this large, attractive snake (Blaney and Blaney, 1974). However, habitat destruction is currently the major threat to this snake species (USFWS, 1982), which is currently considered threatened by the USFWS and the FGFWFC. A Recovery Plan (USFWS, 1982) addresses the loss of habitat, the pet trade and reintroduction of captive-bred individuals to suitable habitats. In South Florida, pine flatwoods or scrub associations are very suitable habitat for this species. Indigos are also regularly found utilizing ecotones between forested habitats and disturbed, agricultural areas. However, forested systems are not a specific habitat requirement of this snake (P. Moler, personal communication). Indigo snakes are likely present along canal levee systems in South Florida (Lawler, 1977), and may also be found associated with hardwood hammock systems. They prey mainly on other snakes, but would also take mammals.

Southeastern American kestrel *Falco sparverius paulus*

The southeastern subspecies of the American kestrel is under consideration for Federal listing (C2) and is considered threatened by the FGFWFC. An open, park-like stand of pines with an established herbaceous component and available snags is the preferred habitat for this subspecies. Forested habitat is required for at least part of its life history. The non-migrant subspecies uses small cavities of other animals (usually woodpeckers) for nesting. This small raptor prefers open areas and pastures for foraging (Wood and Collopy, 1986), in which it hunts for mostly grasshoppers, though it would take lizards and other small vertebrate species.

Nest sites are more important in limiting the population range of this subspecies than are foraging sites (Hoffman, 1983; Bohall, 1984).

No southeastern kestrels were observed during field investigations for this FEIS, which, though performed during the appropriate time of year, was performed only for one day. The southeastern subspecies was not reported in previous wildlife surveys in the area. No acceptable kestrel nesting habitat exists within miles of the proposed drill site. The southeastern American kestrel is not likely to utilize this site for foraging for the above reasons, however, individuals could stray into the area during lengthy feeding forays.

Florida sandhill crane *Grus canadensis pratensis*

This crane does not appear on the Federal species list, but is listed as threatened by the FGFWFC. This non-migratory subspecies, or subspecies, is found only in Florida and the Okefenokee Swamp in Southern Georgia. It ranges into extreme South Florida, but is scarce in Monroe and Dade Counties. The migratory subspecies of this species, *G. c. tabida*, is also found in Florida during winter months, where it is usually observed in loose flocks.

The preferred habitats for this bird include mainly freshwater marsh, wet prairies and flooded areas in general. They regularly forage in improved pasture lands as well. The resident subspecies breeds in large permanent herbaceous marsh systems usually containing pickerelweed, maidencane and duck potato (Pritchard, 1978). The large nest is constructed of pulled-up wetland vegetation in about a foot of water. In Southern Florida, nesting begins in January if water levels are suitable.

Florida sandhill cranes are known to nest within the BCNP (NPS, personal communication), and may periodically forage in improved pastures within the Reservation (FGFWFC, personal communication). The marsh habitats within the study area, although suitable, are not likely to be chosen by cranes for nesting sites. These marshes have been drained by agricultural activities and are regularly trampled by cattle.

Bald eagle *Haliaeetus leucocephalus*

The bald eagle is Federal-listed as endangered and is listed as threatened by the FGFWFC. This well known raptor usually nests in tall pine or cypress trees which provide a sufficient view of the surrounding area. Nests are constructed within reach of water bodies and large expanses of swamp. This bird usually returns to the nest tree or the immediate vicinity each season and young eagles usually acquire territories near that of the parent birds. In the southeast, nest building is initiated in late fall and breeding occurs in the winter; the actual date depending on latitude.

The main factor causing the past decline of this species was the lowered reproductive success attributed to the pesticide DDT. Since 1972, when the use of DDT was banned (in the U.S.), continued habitat

destruction has retarded the recovery of eagle populations. The Bald Eagle Recovery Plan (USFWS, 1989) addresses the number of breeding areas and nesting success, rather than raw numbers of birds. The recovery goal for Florida is 400 occupied territories.

In Florida, the number of occupied territories has increased from 340 in 1981 to 660 in 1992. The nearest such territory is located in Western Broward County, approximately seven miles south of the proposed drill site.

Wood stork *Mycteria americana*

The wood stork is considered an endangered species by the USFWS and the FGFWFC. This designation includes only the United States breeding population.

This bird is known to exploit seasonal low water events within wetlands, in which aquatic organisms (especially fish) become highly concentrated. Usually these areas are small backwaters, sloughs, potholes within lake littoral zones or sections of ditch connected to permanent waterbodies. These flooded areas become isolated during receding water, trapping fish. Success of the subsequent breeding season is known to depend on the availability of such foraging sites in spring, which is intricately tied to wetland hydroperiod.

The wood stork does not currently nest in the vicinity of the project site. A number of small marsh systems are located near the proposed site which could provide foraging opportunities for the wood stork. These occur among the improved pasture in the project area. Ditches in the area are likely foraging sites for these birds.

The Wood Stork Recovery Plan (USFWS, 1986) calls for downlisting the U.S. population when levels reach and are maintained at 6,000 breeding pairs.

Everglades snail kite *Rostrhamus sociabilis plumbeus*

This raptor is listed as endangered by the USFWS and FGFWFC. The snail kite historically ranged over most of peninsular Florida in large freshwater marsh habitats. Its present range includes the St. John's River Marsh, southwest side of Lake Okeechobee, parts of WCA's 1, 2 and 3 and the north portion of ENP (USFWS, 1991).

This bird is well known as a foraging specialist. It feeds specifically on apple snails (*Pomacea paludosa*), using its curved beak to extract the meat from the shell. In fact, freshwater marsh habitats generally must include the presence of these snails to be considered suitable snail kite habitat. Because the snail kite is

dependent on the apple snail, it is in turn dependent on a wetland water regime which would support snail populations (Sykes, 1983).

The largest concentration of breeding individuals in the State, the Miccosukee Roost, lies south of the intersection of the L-28 Canal and the L-28 Interceptor Canal (R. Bennetts, personal communication), approximately six miles south of the proposed site. The annual snail kite survey discovered 437 birds in 1983, 668 birds in 1984 and 464 birds in 1989 (USFWS, 1990). A total of 403 and 462 birds were present in Conservation Area 3A in 1983 and 1984, respectively. This represents over half of the statewide population for those years. Conservation Area 3A routinely supports the highest number of snail kites in the State (R. Bennetts, personal communication; FGFWFC, 1985).

Objectives for the preservation of snail kites are defined in the Snail Kite Recovery Plan (USFWS, 1986). Critical habitat was established for the snail kite in nine separate areas, one of which includes Conservation Area 3A. The Critical Habitat area is located southeast of the proposed well site, east of the L-28 Canal and south of I-75 (USFWS, 1991).

Florida everglades mink *Mustela vison mink*

This species is under consideration for listing (C2) by the USFWS and is listed threatened by the FGFWFC. Relatively little is known about the actual distribution or habits of this small weasel. They are highly water-dependent animals which feed on a wide variety of mostly aquatic animals. In BCNP, mink are widely dispersed in all types of shallow wetlands. Even high marshes are occupied during the wet season. During the dry season, they leave high marsh areas in favor of long-hydroperiod marshes and forested swamps (Humphrey, 1992).

The South Florida population of the mink occurs in Monroe, Collier and Dade Counties well to the south of the proposed construction site. This population of the mink is relatively common in the Everglades and Big Cypress Swamp, south of I-75 (Humphrey and Zinn, 1982). Historically, the mink may have occurred as far north as Lake Okeechobee (Allen and Neill, 1952). Mink are known to inhabit the canal systems of the Everglades (Smith, 1980). They could occur in the vicinity of the proposed action, but are unlikely to occur within the agricultural lands of the study area.

Florida panther *Felis concolor coryi*

This subspecies of the wide ranging cougar is listed as endangered throughout its range (Federal Register) by the USFWS and FGFWFC. Current population estimates for this subspecies vary, but likely between 30 to 50 individuals remain (USFWS, 1991). The only known, viable population of Florida panthers

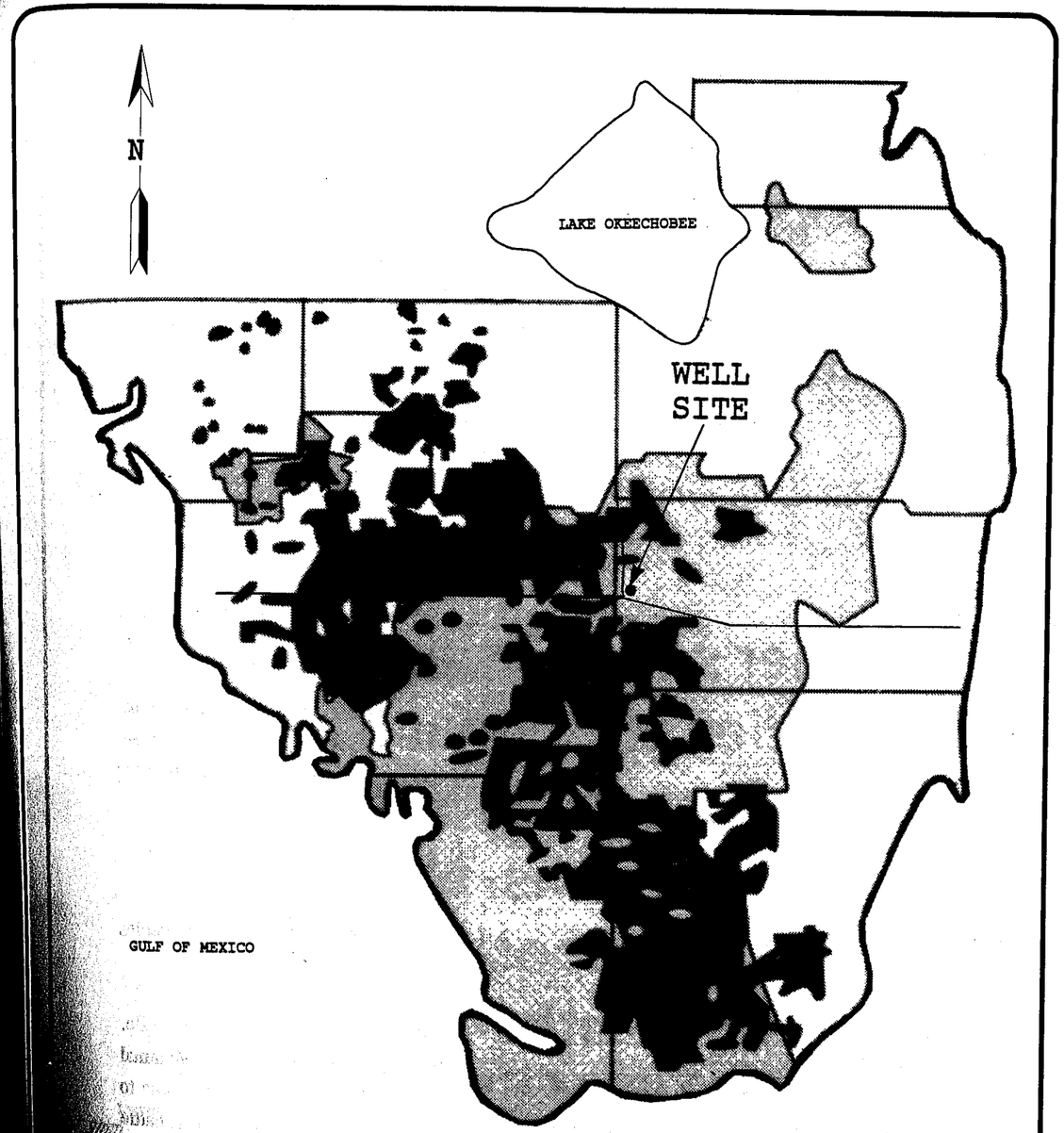
occurs in South Florida in the Big Cypress and Everglades physiographic regions in Broward, Collier, Dade, Glades, Hendry, Lee, Monroe and Palm Beach Counties (Figure 3-14).

The generalized nature of habitats utilized by this cat are reflective of the extremely large home ranges occupied by single individuals. Home range sizes of 13 radio collared panthers in Southwest Florida averaged 255 and 135 square miles for adult males and adult females, respectively (Maehr, 1988). As of 1989, data had been gathered from 33 radio-collared panthers (USFWS, 1991). Currently, the FGFWFC has 20 working radio collars on panthers and the NPS has 4 (D. Maehr, personal communication). The best panther habitat in South Florida is Fakahachee Strand and the Federal Panther Reserve west of BCNP. Panthers are not known in area of the proposed action, according to available literature and conversations with D. Maehr (1992). Panther reproduction has not been documented within any of the WCA's. The area is sparsely vegetated and the prey base is minimal, as it is in the ENP and BCNP. Apparently, young male cats sometimes disperse into the WCA's (from BCNP) for a short period of time. They later attempt to return to the area and many times are killed by vehicles or by adult male cats with established territories (D. Maehr, unpublished).

One collared adult male panther has crossed the Reservation into WCA-3A (NPS, personal communication) approximately six to eight miles north of the proposed well site. Vegetation in this area is shrubby and dense, providing a continuous corridor into WCA-3A. Another area of panther concentration lies to the south of the L-28/L-28 Interceptor Canal intersection. These cats tended to range between the Reservation, ENP, WCA-3A and the BCNP. Four radio collared cats recently moved west and currently utilize the BCNP exclusively (D. Maehr, personal communication). The Florida Panther Recovery Plan (USFWS, 1987) is currently being implemented, by Federal and State agencies.

Florida black bear *Ursus americanus floridanus*

The black bear is under consideration for Federal listing (C2), and is considered threatened by the FGFWFC. The Southwest Florida population of the Florida black bear is distributed mainly in Collier, Monroe, Hendry, Lee, Glades and Highlands Counties. The distribution reaches the Western Broward County line near the site. The distribution of black bears is truncated at the boundaries of the WCA's due to the abrupt change in habitat type (D. Maehr, personal communication). Bears generally do not utilize the sparsely vegetated WCA's or the Reservation, but may wander into these areas periodically.



CHAPTER THREE

Audubon's crested caracara *Polyborus plancus audubonii*

The caracara is Federal and State-listed as threatened. The project area is at the southeastern corner of the breeding range for this bird, but there were three sightings of caracara in 1988 an 1989 (totalling four birds) in northwest Broward County (Jim Layne, personal communication). While the project area provides acceptable habitat for foraging, it does not contain the preferred nesting habitat of dry prairie with cabbage palm or oak.

The caracara is an opportunistic feeder. Carrion constitutes a substantial portion of the diet. Caracara also hunt small mammals, reptiles, amphibians and invertebrates (Layne 1978 and Bent 1961). Once paired, caracara tend to stay within a more or less exclusive home range.

Critical Habitats

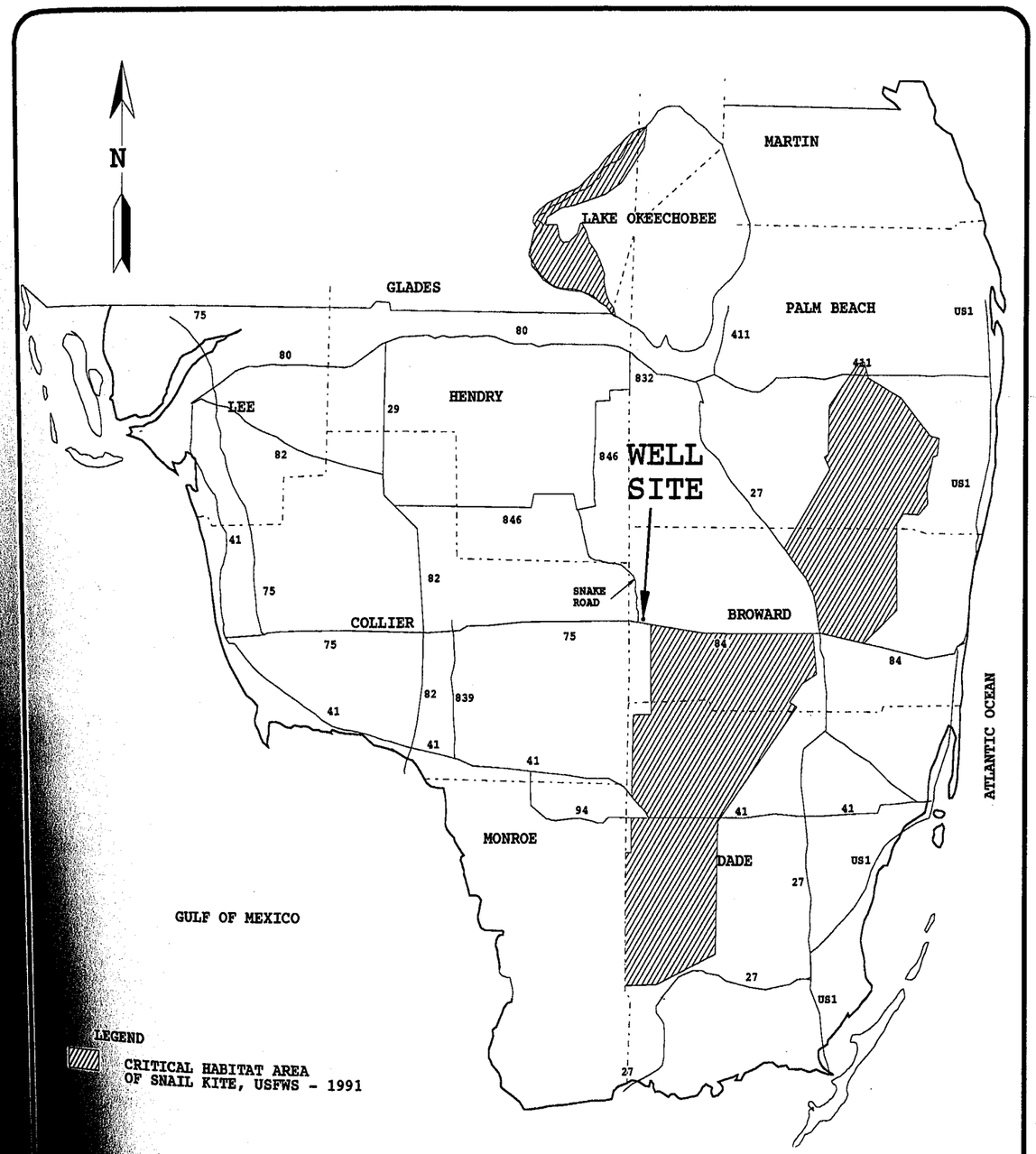
Critical Habitat is a Federal term used to formally designate a specific area as critical to the survival of that species.

Of the listed species in this FEIS, Critical Habitat has been officially designated only for the snail kite. The area considered Critical Habitat lies to the southeast of the proposed action within WCA-3A, entirely east of the L-28 Canal and south of I-75 (USFWS, 1991). Figure 3-15 shows the proposed exploratory well site in relation to snail kite critical habitat.

Exotic Species

The study area and surrounding habitats are known to be inhabited by a number of exotic animal species which, in many cases, have established a breeding population in the area.

Exotic mammals present include, but are not limited to, the feral hog, armadillo and domestic cattle. Cattle have the most far-reaching effects of all on the quality of habitats in the study area. Mammal species related to human dwellings, such as the Norway rat or house mouse, may not be present due to the lack of human inhabitants in the area. Non-native avian species include the European starling, cattle egret, house sparrow and rock dove. Exotic reptiles in the study area may include the spectacled caiman, Mediterranean gecko and brown anole, though none of these have been documented. The Cuban tree frog and greenhouse frog are two amphibians very likely to occur in the study area. The walking catfish, oscar, talapia and black acara have all been documented in the canals of South Florida. These may occur in the L-28 Canal and I-75 borrow canal, but the site itself does not contain aquatic habitats. The fire ant and love bug are familiar invertebrates in the study area.



Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	1" = 20 MILES SCALE	SNAIL KITE CRITICAL HABITAT MAP	FIGURE 3-15 D&M JOB No. 13501-072-049 AUTOCAD FILE: FL_CRIT.DWG

3.3.13.2 Alternative B - West Access Route

The affected environments within the vicinity of Alternative B are essentially the same as those of the proposed action.

3.3.13.3 Alternative C - East Access Route

The affected environments for this alternative are essentially the same as those mentioned for Alternative A. The affected environments for the access route consist of the L-28 Canal itself and the associated levee and berms. The only listed species known to occur in the canal is the American alligator. The Florida mink may also inhabit the L-28 Canal.

ENVIRONMENTAL CONSEQUENCES

CHAPTER 4

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4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This chapter provides an analysis of potentially significant environmental impacts that could result from implementation of the proposed action or reasonable alternatives considered in this FEIS. These impacts are based on detailed analysis of the elements considered in the DEIS, which are derived from significant issues and concerns. The impacts are discussed in terms of the project components and associated actions such as access routes, drill site, exploratory drilling, well evaluation, well testing and abandonment and reclamation. Certain measures that could avoid or reduce impacts have been included by SWEPI in the proposal. Such measures are considered design features of the proposal as discussed in Chapter 2. The following analysis takes these measures into consideration.

Initially, impacts to each element are identified based on the proposal, including all design features but with no additional mitigation measures. This is followed by a listing of mitigation and monitoring measures that could be used to avoid and/or reduce potential impacts and the impacts that remain (residual impacts) after implementation of such measures.

Since implementation of the No Action Alternative could leave the existing environment unchanged, except for the impacts of those actions already occurring, this alternative is not discussed specifically under each element. The No Action Alternative is discussed in Section 4.3.14 of this chapter.

This chapter also includes a comparative analysis of the proposed action and alternatives and analysis pertaining to the following topics: Cumulative Impacts; Unavoidable Adverse Impacts; Potential Conflicts Between the Proposed Action/Alternatives and Plans, Policies and/or Controls; Irreversible and Irretrievable Commitment of Resources; Long-Term Productivity Versus Short-Term Use of Resources; and Energy and Natural Resource Requirements and Conservation Potential.

4.2 Assumptions and Assessment Guidelines (Methodologies and Significance Criteria)

Some portions of the analysis have required development of predictive models to simulate potential impacts. The assumptions, guidelines and methods used to conduct such analysis are stated to provide the reader with a basis for understanding and judging the reliability of the analysis.

Impact Significance Criteria

Impact significance criteria is defined as the criteria used to establish the threshold or magnitude at which an impact could be considered significant, thus warranting special attention such as mitigation. These criteria are derived from government regulatory standards, available scientific documentation, previously prepared environmental documents, and the professional judgment of resource specialists.

CHAPTER FOUR

4.3 Impacts of the Proposed Action and the Alternatives

4.3.1 Air Quality

Air quality could be impacted as a result of proposed construction, drilling, and testing operations in the following ways: 1) suspended particulate matter generated from access road, and drill site construction and site reclamation activities; 2) accidental emissions of pollutants such as sulphur dioxide or H_2S during exploratory well drilling; 3) accidental spills of volatile petroleum products; 4) emissions from construction machinery and vehicles transporting equipment; and 5) flaring of gas during well testing.

4.3.1.1 Impact Significance Criteria

The following criteria were used to determine the significance of impacts to air quality that could result from project implementation. Impacts to air quality could be considered significant if:

- The accidental emission of H_2S, sulfur dioxide, or other harmful compounds occurred in sufficient concentrations and duration to affect the health and safety of workers at the site, area residents, or visitors in the vicinity.

- The emission of pollutants from any activities associated with the construction and operation of the proposed project exceeded any applicable significance emissions or ambient concentration threshold values set by the EPA PSD permitting rules, the FDER Nonattainment NSR rules (for volatile organic compound [VOC] emissions) or any Ambient Air Quality Standard established by the FDER or the Broward County Office of Natural Resources Protection Air Quality Rules and Regulations.

4.3.1.2 Impacts of Alternative A - Proposed Action

The proposed action is not expected to cause significant impact to the air quality of the project area or the region as indicated by the operating experience of the Raccoon Point field that has been operating for several years at a site 13 miles to the south-southwest of the proposed test drill site.

The primary source of air emissions for the proposed action could be the three drilling rig diesel engines (Nitrogen Oxide emissions) and increased vehicular traffic on the proposed access route (Particulates). The air emissions estimated to result from the site construction, exploratory drilling, well testing, and site reclamation (Table 4-1) are significantly less than the emissions thresholds which trigger PSD or Nonattainment Area new source review.

TABLE 4-1 EMISSION ESTIMATES FOR SHELL WESTERN E&P, INC. MICCOSUKEE 3-1 EXPLORATORY WELL, BROWARD COUNTY, FLORIDA

ACTIVITY/AIR POLLUTANT	REFERENCE[a]	AIR EMISSIONS PPD[a]	AIR EMISSIONS TPY[b]
TOTAL PROJECT:			
Particulate Matter			54
Nitrogen Oxides			50
Carbon Monoxide			6
Volatile Organic Compounds			1
Sulfur Dioxide			6
Hydrogen Sulfide[f]			<1
CONSTRUCTION (30 DAYS)			
Particulate Matter		512	8
(1) Wind Erosion	1	(3)	(<<1)
(2) Earthmoving	1	(53)	(<1)
(3) Vehicle Traffic[c]	1	(456)	(7)
Nitrogen Oxides[d]	42	26	<1
Carbon Monoxide[d]	42	5	<<1
Volatile Organic Compounds[d]	42	3	<<1
WELL DRILLING, EVALUATION AND TESTING (175 DAYS)			
Particulate Matter		525	38
(1) Wind Erosion	1	(3)	(<1)
(2) Diesel Engines[e]	2	(66)	(5)
(3) Vehicle Traffic[c]	42	(456)	(32)
Nitrogen Oxide		686	50
(1) Diesel Engines[e]	2	(660)	(48)
(2) Vehicle Traffic[d]	42	(22)	(2)

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TABLE 4-1 EMISSION ESTIMATES FOR SHELL WESTERN E&P, INC. MICCOSUKEE 3-1 EXPLORATORY WELL, BROWARD COUNTY, FLORIDA			
ACTIVITY/AIR POLLUTANT	REFERENCE*	AIR EMISSIONS PPD[a]	TPY[b]
WELL DRILLING, EVALUATION AND TESTING (175 DAYS) (continued)			
Carbon Monoxide		**77**	**6**
(1) Diesel Engine[c]	2	(72)	(6)
(2) Vehicle Traffic[d]	42	(5)	(< < 1)
Volatile Organic Compounds		**20**	**1**
(1) Diesel Engine[c]	2	(17)	(1)
(2) Vehicle Traffic[d]	42	(3)	(< < 1)
Sulfur Dioxide[e]	2	**80**	**6**
Hydrogen Sulfide[f]	2	**150**	**<1**
RECLAMATION (120 DAYS)[g]			
Particulate Matter		**519**	**8**
(1) Wind Erosion	1	(3)	(< < 1)
(2) Earthmoving	1	(12)	(< 1)
(3) Vehicle Traffic[c]	1	(456)	(7)
Nitrogen Oxide[d]	42	**26**	**<1**
Carbon Monoxide[d]	42	**5**	**< <1**
Volatile Organic Compounds[d]	42	**3**	**< <1**

FOOTNOTES

[a]Pounds per day
[b]Tons per year (Total Emission for Project Duration)
[c]Vehicle traffic 125 vehicle miles per day; 30 day construction; 175 operation, 120 day reclamation
[d]NO_x, CO, VOC resulting from the increase in vehicle traffic to the site during the project period -- diesel trucks and construction equipment
[e]3-1215 HP Drill Rig Diesel Engines @ 1300 gallon fuel/day
[f] Contingency: Accidental emission for hydrogen sulfide gas (due to drilling into an H_2S gas pocket and the failure of the flare flame to ignite, or a sudden casing failure -- both possible but unlikely). See the SWEPI H_2S Contingency & Public Protection Plan
[g]The estimated air emissions assume daily equipment operations during the reclamation period.

*References: U.S. EPA Computation of Air Pollution Emission Factors, Volumes 1, 2, and 42.

Any increase in vehicular generated suspended particulate and drilling equipment generated pollutants could be temporary, occurring during construction, drilling, and reclamation. Natural air dispersion of the pollutants generated by the project, air circulation patterns characteristic of the area, and the low frequency of occurrence of air stagnation or inversions in the project area minimizes the potential for developing concentrations in excess of any applicable standards (Ambient and PSD standards and increments). Due to the temporary nature of the project and the comparative low annual emissions, the ENP PSD Class I area, which has also been designated as a United Nations Biosphere Reserve and World Heritage Site, could not be significantly affected.

Potentially significant impact of the proposed action could occur in the immediate area surrounding the proposed drill site only in the event of an unexpected short-term high emission of sulfur dioxide or H_2S during exploratory drilling or well testing. The quantities of these gases released during well testing could normally be small due to the highly controlled nature of such tests and, therefore, could have minor impact on air quality. Released H_2S gas could be flared to sulfur dioxide to reduce potential impacts to air quality and associated public and worker health and safety. Health and safety concerns regarding hydrogen sulfide gas and/or a blowout are addressed in Section 4.3.4.2.

4.3.1.3 Impacts of Alternative B - West Access Route

Air quality impacts of utilizing the West Access Route could not differ greatly from the proposed access route. Unpaved access road construction and use (and associated air emissions) could occur along the 1.6 mile route.

4.3.1.4 Impacts of Alternative C - East Access Route

Air quality impacts of utilizing the East Access Route could occur along the 0.33 mile route. This access route is paved, therefore, minimal dust and/or suspended particulate matter could be generated by road use. Construction of a vehicular bridge could result in generation of construction related dust and suspended particulate matter.

4.3.1.5 Mitigation Measures

To assure that air emissions related to the proposed action are kept to a minimum, the following measures could be implemented:

- Burning of vegetation, construction debris or site-produced wastes could not be allowed.

- Roads would be watered as needed to minimize release of dust and suspended particles from road traffic and construction activities.

- Necessary precautions would be taken to prevent and suppress wildfires. Fire prevention and suppression equipment would be provided on site.

4.3.1.6 Residual Impacts

No significant impacts to air quality are expected as a result of project implementation with mitigation measures. The implementation of any of the alternatives is not expected to add significantly to impacts that have occurred or that may occur to air quality due to other on-going activities in the Southeastern Florida area. Road watering, or use of water additives on roads, could prevent or minimize release of dust and suspended particulate problems. Implementation of SWEPI's H_2S Contingency and Evacuation Plan, the requirements of Onshore Oil and Gas Operations Regulations (43 CFR, Part 3160) and related guidelines, and drilling precautions described in the APD, such as BOP, should preclude the occurrence of significant impacts resulting from project implementation.

4.3.2 Cultural Resources

Cultural resources on Federal and Indian lands, including archaeological sites, historic properties and Native American religions concerns, are protected by various Federal laws and regulations including the Antiquities Act of 1906 (36 CFR, Part 800) and the National Preservation Act of 1966 (Public Law 89-665). In Florida, the DHR is responsible for administering historical site regulations. In addition, the American Indian Religious Freedom Act of 1978 affords protection for ceremonial and habitation sites.

Potential adverse effects from the proposed action could consist of direct, indirect, or cumulative impacts. Direct impacts are physical, and adversely impact the site or its setting. The primary direct impact which typically affects sites or structures results from construction activities. Indirect impacts are those which do not immediately result in physical changes of the site or its setting. For example, a new public road into an area containing significant sites could provide public access and new exposure to the area. Introduction of additional people in an area could result in artifact collection or similar activities that could physically alter the site. If such activities occur sporadically over a period of time, the impact could be considered cumulative.

4.3.2.1 Impact Significance Criteria

The following are considered significant impacts to cultural resources:

- Destruction or alteration of all or part of a archeological or historical property.

- Isolation of a cultural resource from or alteration of its surrounding environment.

- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.

4.3.2.2 Impacts of Alternative A - Proposed Action

The DHR was contacted for review of the site of the proposed action and alternative access routes. The DHR staff recommended cultural resource assessment surveys of any hardwood hammocks that may be encountered along the access routes. The survey(s) must be completed prior to any land clearing or ground disturbing activities. The report must be forwarded to the DHR for review and determination of impacts on significant archaeological and historic resources. A copy of the DHR response letter is included in Appendix A-12.

The archeological site survey conducted in February 1990, found no archeological sites in the area affected by the proposed action. According to the DHR, there are no recorded archaeological sites in the area of the well site or along the proposed access route. Potential archeological site locations are not encountered along the proposed access route.

4.3.2.3 Impacts of Alternative B - West Access Route

Review of the Florida Site File by the DHR staff indicated that a potentially significant archaeological site (8BD1439) exists in the vicinity of Access Route B. If Access Route B is selected, the DHR recommends avoidance of this site.

4.3.2.4 Impacts of Alternative C - East Access Route

No recorded sites were reported by the DHR along the East Access Route. Probable sites are not encountered along this route.

4.3.2.5 Mitigation Measures

The proposed drill site was subject to an archeological survey in February, 1990. The proposed access route and Alternative C, the East Access Route, would utilize existing filled roads. Alternative B, the West Access Route, would require a new road in an area unimpacted by construction. Accordingly, an archeological site survey could be conducted on the West Access Route prior to construction. If SWEPI

were to encounter any evidence of archeological artifacts or activity during drill site and access road construction, all work could cease and the Miccosukee Tribe, BLM, BIA and the DHR could be notified.

4.3.2.6 Residual Impacts

The proposed action and alternatives with mitigation measures could not have a significant impact on cultural resources.

4.3.3 Geology/Soils

Geology and soils impacts resulting from the proposed action and alternatives could be limited to excavation and filling activities from construction of the well site and access routes.

4.3.3.1 Impact Significance Criteria

The following criteria were used to determine significant impacts to geology/soils:

- Impacts to soils were considered significant if increased erosion potential or reduction of soil productivity could prevent successful reclamation (the process of applying mechanical and revegetation techniques to limit soil loss to near preconstruction levels on disturbed sites) and eventual vegetation regeneration (reestablishment of at least 80 percent of pre-existing vegetative cover within 5 years).

- Impact to one acre or more of hydric soils.

- Evaluations of successful reclamation were based on whether soils could stabilize to near preconstruction conditions within five years following application of appropriate reclamation measures.

- Large scale topographic alteration occurred causing other related impacts such as on the visual resource.

4.3.3.2 Impacts of Alternative A - Proposed Action

Construction of the well site and proposed access road could not have significant impacts on soils or geology in the project area. Well site construction could disturb approximately five acres of the soil profile by scraping and filling activity. Filling of vehicle turnouts for the access route could disturb an additional 0.4 acre. Upon completion of the proposed action, fill areas could be removed, and the site

reclaimed to the original topography unless the Miccosukee Tribe specifies that the fill areas be left in place for other purposes.

4.3.3.3 Impacts of Alternative B - West Access Route

Construction of a new 1.6 mile access route and vehicle turnouts could result in fill placement over three acres of the existing soil profile, including 0.25 acres of hydric soils.

4.3.3.4 Impacts of Alternative C - East Access Route

This alternative could not require any additional fill areas. Construction of a new vehicular bridge could require pile placement in the L-28 Canal resulting in very minimal impacts to the subsurface limestone.

4.3.3.5 Mitigation Measures

Filled shoulders of the access road and topsoil stockpile areas could be seeded with an appropriate grass seed mixture. Straw mulching using only certified weed-free straw could be completed to protect the seed bed.

Site reclamation could be monitored to assure that the soil profile and site topography is properly reestablished. If the fill areas were left in place at the request of the Miccosukee Tribe, proper stabilization of fill by vegetation could be accomplished and documented. Soil stockpiled during drill site construction could be stabilized to prevent erosion.

4.3.3.6 Residual Impacts

The proposed action and alternatives could have only minor impacts to soils or geology. Reclamation of the well site and access routes could result in these minor impacts being temporary in nature. If reclamation is not undertaken (at the request of the Miccosukee Tribe), minor permanent impacts would result from the creation of additional fill areas as quantified for each alternative.

4.3.4 Health and Safety

Potential risks associated with implementation of the proposed action include the following:

- A very low risk of exposure to a H_2S concentration due to an equipment failure or accident during drilling operations.

- The normal occupational hazards associated with increased traffic, heavy construction, and drilling operations. Heat stroke and lightning strikes are also of concern when working in South Florida environments.

- The risk of fire on the drill site.

- The possibility of a hurricane damaging the drill and site and spreading materials and substances that could cause environmental contamination.

4.3.4.1 Impact Significance Criteria

Significant health and safety impacts could occur from the following:

- Exposure to H_2S concentration could cause discomfort and that might be lethal to certain sensitive individuals, e.g., to the very old, very young, or infirmed. Concentrations at levels that could cause eye irritation, loss of smell, and possible coughing (≥100 ppm). Exposure to an instantaneous concentration of 1,000 ppm (almost always lethal to humans).

- Substantially increased risk to the general public the normal operation hazards associated with increased traffic, and construction, and drilling operations.

4.3.4.2 Impacts of Alternative A - Proposed Action

Drill Site & Drilling Activity

Drill site hazards could be those that are normally associated with heavy construction and drilling operations. SWEPI employees, contractors, and authorized persons could be exposed to these hazards. The general public could have no exposure to these drill site hazards. Construction and drilling activities are required to comply with OSHA and BLM requirements, reducing the risk of injuries.

Although geologic conditions make it unlikely, a remote possibility exists of an accidental release of H_2S due to equipment failure or natural disaster. Based on other exploratory wells drilled within South Florida, the probability of encountering H_2S is minimal. H_2S may be released if a "blowout" occurred.

Preventing well blowouts is an important concern during drilling and is accomplished by use of experienced drilling personnel; proper casing and cementing; proper design and use of drilling muds; constant monitoring of the characteristics and volume of drilling mud to determine conditions in the wellbore; and equipping the well with BOP which can be used to shut-in the well if needed.

Although unlikely, a well blowout could cause unpredictable, and possibly severe damage near the proposed well site. The extent of damage could depend on the volume and characteristics of the materials released; environmental conditions at the time of the blowout; and on the length of time required to bring the well back under control. A blowout could release liquid materials (drilling fluids, formation waters, oil, or natural gas condensate) under pressure. These liquids could be spread some distance from the well site.

A well blowout could also release methane, carbon dioxide, H_2S and other gases to the atmosphere. If fires accidently occurred, or if the well was intentionally set on fire for safety reasons, sulfur dioxide could be produced. If present in high concentrations, H_2S gas could be hazardous or even lethal to humans and wildlife in the vicinity of the well. A blowout could be treated as an emergency situation and could require road closure, and evacuation nearby hazardous areas.

Although H_2S is one of the potential emissions from a well blowout, the likelihood of occurrence of H_2S is low and could most likely not be encountered in the proposed well. The low potential for encountering H_2S is supported by the fact that the Sabine well, located two miles northwest of the proposed well site was completed without encountering H_2S. (See Section 3.3.10 for further discussion of the Sabine well.)

The public health risks of operations involving H_2S gas depend primarily on the characteristics of any atmospheric gas release that may occur (i.e., the emission rate, duration, and effective height of the release) and characteristics of the resulting population exposures (i.e., ambient H_2S concentrations, durations of inhalation, the size of the affected population, and individual susceptibilities). H_2S gas is a highly toxic gas. The gas could be readily carried and diluted by winds.

H_2S, being heavier than air, would settle in low areas when released. It could pose an immediate health hazard to humans in the vicinity of the project. Calculations indicate that the radius of exposure for 500 ppm, 100 ppm, and 15 ppm H_2S in a gas stream would be, respectively, 70 feet, 150 feet and 510 feet. The nearest public contact area, I-75, is approximately 875 feet from the proposed well location.

H_2S encounters in South Florida are rare. In July 1987, two production wells in the Raccoon Point field developed casing leaks that resulted in the release of H_2S at concentrations of 100 to 200 ppm. The operator took the necessary actions and precautions to prevent additional release of the gas. It is important to note that this H_2S occurrence most likely resulted from bacterial production occurring while the wells were temporarily abandoned and not from in situ deposit of H_2S. However, this event demonstrates that a release of H_2S can occur from the South Florida hydrocarbon reserves and has the potential to pose a threat to humans and wildlife near well sites if adequate measures are not taken to

prevent and control accidental releases. As of the summer of 1992, no additional H_2S releases have been reported for any of the South Florida wells.

SWEPI has prepared and submitted an H_2S Contingency Plan in the event H_2S is encountered. A copy of this plan has been included in Appendix A-3.

Drilling operations in the hot, humid climate of subtropical South Florida could result in heat related emergencies to site workers. These heat emergencies include possible heat cramps or heat exhaustion from heavy work in a hot, humid environment. In extreme cases, heat exhaustion could lead to the more serious heat stroke, which is a life threatening situation if left untreated.

In the wet season, South Florida is prone to numerous thunderstorms that frequently include lightning strikes. Lightning could hit the drill rig resulting in possible fire or injuries to site workers. Fire control equipment would be present on-site to contain an equipment, liquid, or grass fire.

In the event of hurricane force winds, time permitting, all of the drill pipe would be removed from the derrick, equipment secured and drilling operation suspended to ensure well and personnel safety.

Significant long-term health and safety impacts would not be expected in association with the proposed drilling action. The risk of accident is low and proper safety, control, and contingency measures are incorporated by SWEPI into the Plan of Operations, H_2S Contingency Plan (Appendix A-3), SPCC Plan (Appendix A-10) and Hurricane Contingency Plan (Appendix A-11).

Access Route

Short-term health and safety risks could increase during the construction of the proposed access route. Utilization of the proposed access route by vehicles could have some effect on existing public traffic along I-75 and Snake Road for a distance of four miles north of the I-75 interchange. An increase in traffic volume would have a tendency to increase the risk of accidents. However, since the transportation corridors are well within operational capacity, the addition of 10-25 VPD is not considered substantial and should have minimal impact.

4.3.4.3 Impacts of Alternative B - West Access Route

The use of this access route would have similar effects as the proposed access route. Increased traffic would be confined to I-75 and the Snake Road interchange.

4.3.4.4 Impacts of Alternative C - East Access Route

The use of this access route would have similar effects as the proposed access route. Increased traffic would occur on I-75 and at the exit ramp to the S-140 pump station.

4.3.4.5 Mitigation Measures

In order to decrease the risk of accident resulting from vehicle traffic associated with the proposed action, warning signs could be placed at strategic locations along Snake Road (for the proposed action and Alternative B) or along I-75 (for Alternative C) to alert road users of the project traffic activities. Access routes could be properly signed to indicate maximum speed, turnouts, curves, etc. (as approved by FDOT or the Miccosukee Tribe as appropriate).

Health and safety training of SWEPI employees and contractors on-site could include learning the signs of heat emergencies and first aid measures.

4.3.4.6 Residual Impacts

The risk of health and safety hazards associated with the daily operations under the proposed action would be minimized by proper implementation of the plan of operations, emergency response equipment, and contingency plans. A well blowout or H_2S gas release would not affect populated areas due to the remoteness of the site. Use of the East Access Route would not increase traffic on Snake Road or at the I-75 interchange. Use of the proposed or West Access Routes would increase traffic by only 10 to 25 VPD, resulting in an increase in vehicle accident risk that would be considered insignificant.

4.3.5 Noise

Noise impacts associated with the proposed action would occur from operation of machinery and equipment, construction, drilling, and human activities.

Federal environmental-related noise regulations that apply to activities associated with the proposed action or alternatives do not exist. EPA guidelines recommend 50-55 dBA as a general threshold of acceptable sound levels for all environments.

In general, average levels of 65 dBA or less are judged to be acceptable for residential areas. Another consideration in evaluating noise levels is with regard to health and safety. OSHA standards for environmental sound levels generally relate exposure times to sound levels with the 8-hour duration of 85 dBA. Higher levels require successively shorter exposure limits with an exposure limit of 15 minutes

being prescribed for sound levels of 115 dBA. In addition, single event sound level peak values are limited to 140 dBA.

The impacts of noise depend upon several factors. The relationship between the noise source and the nature of the community is one important factor. Secondly, frequency and duration of a noise source factors are important, with annoyance resulting with more frequent and longer occurrences. Finally, the nature of the area where the noise is heard is of significant importance.

Since there are no residences within a 10-mile radius of the proposed action, noise impacts to humans, other than project workers, are not a concern.

Information on the nature and effects of noise exposure to wildlife is sparse. In general, constant low level background noise seems to be less disrupting than loud and variable noises. The major concern with noise impacts is the relative level of noise present, not the absolute value of the noise.

The NPS has been monitoring the impacts of the noise associated with hydrocarbon exploration activity in the BCNP since 1974. The BCNP Management Plan includes the following discussion of the influences of noise on wildlife:

> "The influences on wildlife from noise are generally associated with human presence and other stimuli, such as sight and smell. Wildlife studies indicate that factors affecting animal response to human disturbance include the intensity of the stimulus, the frequency of the stimulus, the experience of the animals in association with the stimulus, the condition of the animal at the time of the disturbance, and environmental conditions. Wildlife responses to disturbance are behavioral and metabolic. Behavioral responses relate primarily to movement, including remaining motionless to avoid detection, seeking cover, aggressiveness, or abandonment of home range. Metabolic responses, occurring simultaneously include increased heart rates and stress. An unusual noise in combination with a visual stimulus, such as an aircraft or off-road vehicle, may be particularly disturbing (Busnel, 1978).
>
> In some field studies that have investigated the effects of noise on wildlife populations, very little or no behavioral response to noise has been observed, but animals that appear to be habituated to noise may be adversely affected by interference with auditory signals important to survival (Memphis State University, 1971). Such masking of information may be more harmful to animals that the direct physical effects of sound (Manci, et. al, 1988). Animals may be most disturbed by noises that interfere with intraspecies communication (Luz and Smith, 1976)."

4.3.5.1 Impact Significance Criteria

A significant impact for noise would occur if any long-term (one year) exceedance of Federal noise standards [55 dBA] occurred within a noise-sensitive area.

4.3.5.2 Alternative A - Proposed Action

Proposed Access Route

The proposed access route would require improvement of approximately five and one-half miles of existing limestone roads. Improvements would consist of topping the existing road with limestone, and grading and compacting it to create a stable road surface capable of handling the project traffic. Noise sources during access road construction include heavy equipment such as bulldozers, graders, front end loaders, and large gravel hauling trucks. This type of equipment usually creates sound levels in the 70 to 90 dBA range at a distance of 50 feet. Such levels are generally audible within one mile. The ambient noise levels from existing local noise sources decrease as one moves away from I-75, the S-140 pump station and Snake Road. The noise impact associated with construction of the proposed access route and well site would not exceed 30 days.

The Big Cypress Preserve Management Plan includes the following discussion of noise impacts to wildlife related to road construction activity.

> "Wildlife impacts attributable to noise generated during road construction activity appears to be highly variable, as reported in the literature. Pedersen (1979) determined that during road construction, elk use declined adjacent to the disturbed area for nearly 1 mile. He further documented that some elk moved up to 2.5 miles from road construction operations. Lyon (1975) reported that elk distribution is disrupted up to 4.0 miles from logging and road construction activity, and new road construction appeared to be extremely disruptive. Other studies, such as Michael (1978), show that the effects of road construction on game animals is significantly less than reported in the previously mentioned literature. Populations of white-tailed deer, rabbits, ruffed grouse, gray squirrels, and turkeys were apparently not affected by road construction, as determined by comparing the number of animal signs near the construction site with the number seen 1 mile away (Michael, 1978). However, documentation of physical response was not addressed in this particular study."

CHAPTER FOUR

Drill Site

Preparation of the proposed drill site would require construction of a five-acre fill pad, earth berms, and containment cells. The same types of construction equipment required for access road construction would be utilized, and the noise impacts would be similar. The ambient noise levels at the well site is affected by the S-140 pump station and I-75.

Exploratory Drilling, Evaluation and Testing

Noise generation during drilling, evaluation and production testing operations would be associated with vehicle movements and the operation of drilling equipment. During rigging-up operations, noise would be generated by equipment operation and the movement of large trucks used to transport the rig components.

While the drilling rig itself may be considered as a noise source, it is in reality a component of several individual sources including the diesel engines, the rotary drive, circulating water pumps and mud pumps, the shale shaker and assorted equipment. Noise from each such source is transmitted by both structural and airborne means to form the combined noise from the rig.

Tests which SWEPI has run on noise levels associated with drilling rig activity in other areas indicates that the following might be expected:

Noise Level (dBA)

Near Source	At 200 feet	At 800 feet	At 1,500 feet
80+	< 70	< 50	< 40

These data indicate that noise disturbance would be limited to an area in close proximity to the rig site. A noise level comparison chart is presented as Figure 4-1.

Trucks used to bring material to the site and vehicles used by site workers are additional sources of noise. During the drilling, evaluation and testing phase, an average of 10 VPD would travel to and from the drill site, a round trip of 11 miles from Snake Road. These vehicles would include dump trucks, automobile and various utility vehicles. Up to 25 VPD may access the project area for short-term operations. The duration of drilling, evaluation and testing activity is not expected to exceed 175 days.

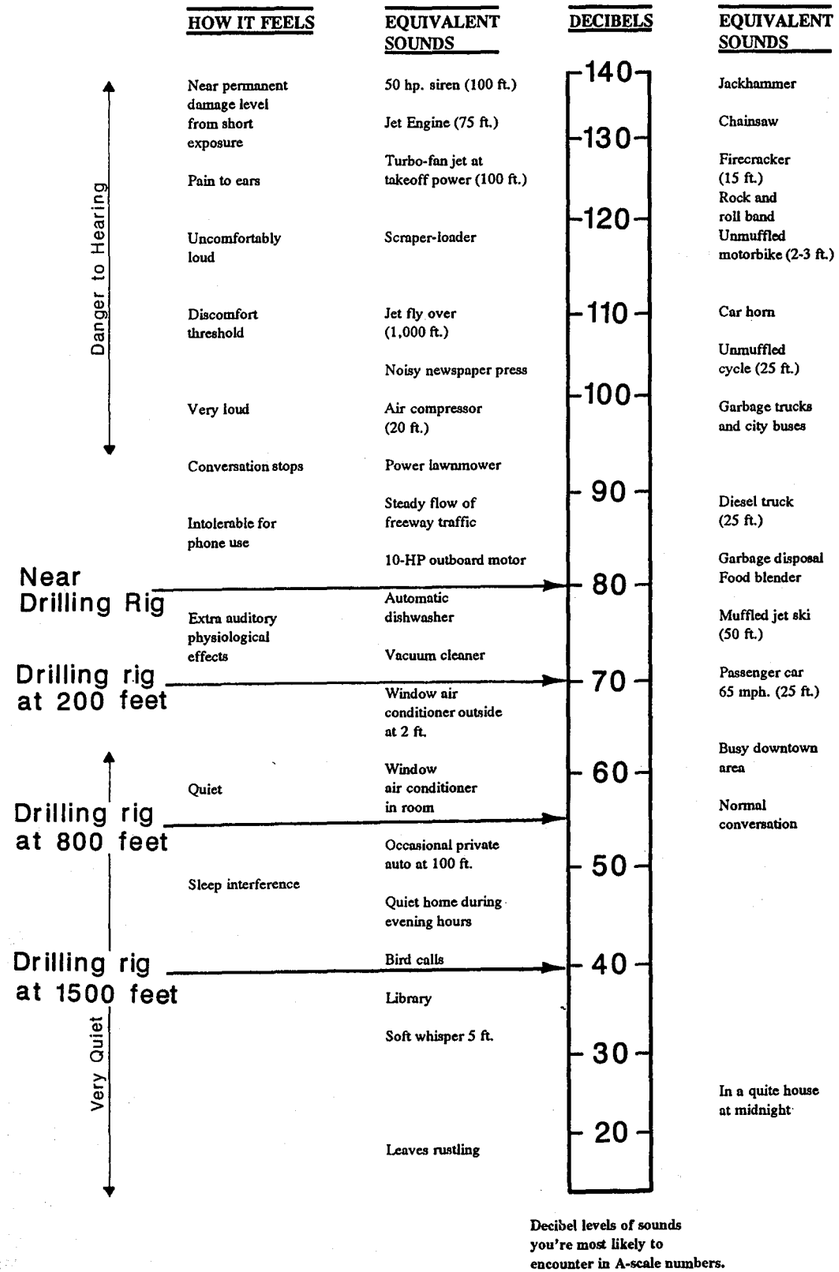


Figure 4-1 Noise Level Comparison Chart
Note: Modified From Amoco Beartooth Well EA, Dames & Moore, 1985

The Big Cypress Preserve Management Plan included the following discussion of the noise impacts to wildlife associated with vehicular traffic and hydrocarbon drilling operations:

> "Noise generated by vehicular traffic on roads appears to affect wildlife species in varying degrees, depending on the biological state of the animals, the season, population, density, physical parameters of the noise, and use intensity (Busnel, 1978, Hersey and Leege, 1976). Several studies have documented the effects of road use on wildlife. Elk on summer range in north-central Idaho showed preference for areas more than 0.25 mile from primary and secondary logging roads (Hershey and Leege, 1976). In a similar study, Pedersen (1979) determined that elk use was reduced within 0.5 mile of main logging roads. Perry and Overly (1976) report that deer in the Blue Mountains of Washington significantly decreased their use of meadows within 0.12 to 0.5 mile from roads. Therefore, it appears that road construction followed by high traffic volume generally disturbs wildlife within a 0.5-mile radius.
>
> Oil and gas drilling rigs generate continuous low-frequency noise from several sources, including large main and auxiliary engines, pumps, and supply handling. Handling of materials such as drill pipe or well casing can be a source of sharp, high-frequency noises, with metal banging against metal.
>
> Noise levels associated with drilling operations in BCNP were documented by Vibra-Tech South Corporation (1986). The study was conducted for Exxon Company in December 1985 during typical rotary drilling operations and conductor casing drive hammer operations at the Collier 2-4 well. Noise levels were recorded at varying distances from the operation, ranging from 10 feet to 1,200 feet. During conductor casing drive hammer operations, decibel levels were highest within 10 feet of the drilling rig (93 dBA) and lowest (40 dBA or less) at distances of 10,000 feet or greater from the rig. During rotary drilling operations, 85 dBA was recorded 10 feet from the rig and 40 dBA or less was recorded 9,200 feet from the drilling operation. It is important to note that the noise level recording equipment used in this study had a minimum detection limit of 40 dBA.
>
> Ambient noise levels in the preserve generally range between 24 and 40 dB, depending upon the contribution of insects (Law Environmental, 1990). Using 40 dB as a maximum ambient level, noise from rotary drilling operations can be detected up to 8,500 feet (1.6 miles) from a rig, and noise generated from a conductor casing drive hammer operation can be detected up to 9,200 feet (1.74 miles) from a rig in the preserve. By applying the Forest Service's acceptable level of 10 dB above ambient noise, which if exceeded would likely result in public complaints, the threshold distance for rotary drilling operations is at least 2,400 feet (0.45 mile) and nearly 8,500 feet (1.61 miles) for conductor casing drive hammer operations.
>
> The effects of oil drilling operation noise on wildlife populations is not well documented in the literature. However, Barry and Specer (1976) reported the effects of drilling operation noise and activity on bird species in Alaska. Of 40 bird species studied, 43 percent were significantly less numerous than normal within 1.5 miles of the drilling operation, no change was observed in 52 percent, and 5 percent (two species) were more abundant than normal. Geese and swans were more sensitive to the disturbance than were other birds, especially when molting or when accompanied by young, and stayed at least 1.5 miles from the rig. Other species showed signs of habituation. It is suspected that drilling operation noise effects on some wildlife species may be lessened in areas where vegetative cover is dense enough to reduce visibility of the activity."

Abandonment and Reclamation

Abandonment and reclamation operations contribute noise from several sources, including well plugging, earth moving, and transportation. The various types of pumps used in well plugging can affect the noise environment. Pumps are usually powered by internal combustion engines. Heavy equipment would be required to remove the well site fill. The main impacts would be similar to those described under Proposed Access Route in this section.

Car and truck traffic associated with abandonment and reclamation activities is also a source of noise. Cars carry the work crews, and large trucks carry well-plugging equipment and supplies, as well as earth-moving equipment and reclamation materials.

4.3.5.3 Impacts of Alternative B - West Access Route

The West Access Route would be a new road following a trail extending east from the Miccosukee Service Plaza, a distance of 1.6 miles to the well site. The noise impacts associated with the West Access Route would be similar to those associated with the proposed access route. The noise impacts would be confined to an area closer to I-75, but would also be closer to several hardwood hammocks, and wetland habitats which may provide wildlife refuge.

4.3.5.4 Impacts of Alternative C - East Access Route

The East Access Route would utilize existing roads associated with the S-140 pump station access from I-75, and the limited access provided for the Miccosukee Tribe west of L-28. The only construction

required would be placement of a vehicular bridge across the L-28 Canal. The noise impacts associated with this alternative would be similar to the proposed access except that the construction of the vehicular access and bridge would be restricted to the area immediately adjacent to I-75. If bridge construction were to require pile driving, noise levels of 90 dBA near the pile driver would occur and would be audible for a distance of 1 - 1.5 miles. In addition, vehicles would not have to utilize the proposed or West Access Routes offered by other alternatives; therefore, noise impacts would be minimized because of more direct access to the drill site.

4.3.5.5 Mitigation Measures

Mitigation measures for noise abatement would not be required due to the nature and location of the proposed action in relationship to existing sources of noise.

4.3.5.6 Residual Impacts

The project area is not considered a noise sensitive area by Federal definitions. The noise associated with the proposed action and alternatives would be short-term in nature (325 days) and would not contribute significantly to the ambient noise conditions in the area resulting from I-75 and the S-140 pump station.

4.3.6 Socioeconomics

The impacts of the proposed action are anticipated to be primarily economic with their influence generally limited to the Miccosukee Reservation. These impacts would be temporary as a result of the 325 day duration of the proposed action.

4.3.6.1 Impact Significance Criteria

Economic and social impacts to the Miccosukee Tribe would be significant if they involved:

- Temporary or permanent displacement of residents or users of the project area;
- Identifiable changes in, or conflicts with existing tribal ways of life, including occupational, leisure, religious, or social;
- Any change in revenue flows within the Miccosukee economy; and
- Any change in the unemployment rate on the Miccosukee Reservation.

4.3.6.2 Impacts of Alternative A - Proposed Action

The proposed action would not displace any residents because there are none living within at least 10 miles of the project area. The site is currently leased to interests outside of the Tribe for cattle grazing. The temporary removal of five acres of land from grazing would neither significantly impact this grazing operation nor would it significantly reduce the land lease income to the Tribe.

Workers temporarily relocated to work on the proposed action would live in surrounding communities. The drill site development would not include temporary housing facilities.

The proposed action is not anticipated to result in any significant changes in, or conflicts with existing tribal ways of life. Tribal Council members and other members of the Miccosukee Tribe expressed no dissatisfaction during meetings in which their comments were solicited.

The Miccosukee Tribe receives direct economic benefits as a result of the leasing. The Miccosukee Tribe received a lump sum bonus payment upon executing the oil and gas lease with SWEPI. This payment is independent of any proposed or actual drilling by SWEPI. The Tribe also receives rental payments from SWEPI for the lands under lease. Although the Tribal property is held in trust by the Federal Government, all revenue resulting from the agreement including the agreement bonus, rent and royalty are paid in total to the Tribe. If the proposed action is not approved, SWEPI may consider relinquishing its rights on all or part of the leased lands, thereby ending or reducing its rental payments to the Miccosukee Tribe.

If commercial quantities of hydrocarbons are produced, the Miccosukee Tribe would be entitled to a production royalty. Field development and production are not part of the proposed action. Therefore, royalty payments are not a direct economic impact of the proposed action. The exploratory program would determine if hydrocarbons are present. This knowledge would enable the Miccosukee Tribe to realistically evaluate the potential for future royalty income.

Construction of the drill site and the exploratory drilling operations requires that a substantial percentage of the work force be skilled labor. The oil and gas lease contains a Tribal Employment Clause which commits SWEPI and its contractors to employ Miccosukee Tribal Members to the fullest extent to which their qualifications permit. Given the very high rate of unemployment within the Tribe, even a few temporary jobs during site construction and drilling become beneficial in boosting tribal household incomes.

The implementation of the proposed action may also provide some economic benefits to the surrounding communities from utilization of local goods and services.

4.3.6.3 Impacts of Alternative B - West Access Route

The socioeconomic impacts of utilizing the West Access Route would not differ from the proposed action.

4.3.6.4 Impacts of Alternative C - East Access Route

The socioeconomic impacts of utilizing the East Access Route would not differ from the proposed action.

4.3.6.5 Mitigation Measures

The proposed action would not have any adverse social impacts. The SWEPI lease provides for positive economic benefits to the Miccosukee Tribe. Mitigation measures would not be required.

4.3.6.6 Residual Impacts

The proposed action would create positive economic benefits and minimal social impacts. To the Miccosukee Tribe, the lease provides revenue and an opportunity to determine the potential for an economically recoverable resource which, in turn, would provide the potential for additional revenue. Furthermore, because no people inhabit, work or recreate in the vicinity of the drill site, no displacement or disruption of existing ways of life would occur. Limited temporary employment opportunities may also develop for tribal members.

4.3.7 Transportation

Impacts to the existing transportation network in the vicinity of the proposed action and alternatives would be limited to a temporary increase in truck traffic and traffic weight. Because project traffic is anticipated to be only 10 to 25 VPD, significant increases in traffic volumes would not occur.

4.3.7.1 Impact Significance Criteria

Significant impacts to transportation would result from:

- An increase in traffic that would reduce the existing Level of Service (LOS).
- A measurable increase in the vehicle accident probability based on an increase in ADT volumes from the proposed project traffic.

- Degradation of road surfaces due to heavy truck loads during construction, drilling and reclamation.

4.3.7.2 Impacts of Alternative A - Proposed Action

Several impacts would result from the utilization of the proposed access route, including an increase in the traffic mix (i.e., more heavy truck utilization) and traffic weight due to vehicles transporting equipment and materials. During road reconstruction and project drill site construction, project traffic would be 10 to 25 VPD, with most loads between 40,000-45,000 pounds or below. Typically, there would also be a total of 3 to 4 permit loads of 80,000-90,000 pounds. Other permit loads would be for width, not weight. The type of vehicles used during the proposed action include dump trucks, tractor trailer rigs and other support and utility vehicles.

Currently 16 percent of the traffic on I-75 is truck traffic. The traffic from the proposed action would be only 2.4 percent of existing I-75 truck traffic and is, therefore, determined not to have any significant impacts. Truck loads from the proposed action would be within the legal limits for truck weight on I-75, therefore, no adverse impacts are anticipated. Furthermore, permits for heavier loads include an impact fee for road damages. The three to four weight permit loads are likewise not anticipated to cause any adverse impacts due to the limited number of trips. As previously mentioned, the current LOS for I-75 between S.R. 27 and Naples is LOS A.

Current daily traffic volumes (1991 annual average) for this section of I-75, according to the FDOT are 3,172 vehicles eastbound and 3,349 vehicles westbound. Cumulatively, these traffic volumes make up 31.2 percent of the LOS A capacity volume for this section of I-75. To reduce the LOS to B, approximately 14,379 additional vehicles, or a 68.8 percent increase, would have to travel this section of I-75.

The 10 to 25 VPD generated by the proposed action only accounts for a maximum of .0011 percent of the LOS A capacity volume. Therefore, project traffic would not adversely impact current roadway capacity.

Additionally, because 16 percent of the existing traffic volume on I-75 and Snake Road are trucks, existing road users would not encounter any significant adverse impacts from additional heavy truck traffic associated with the proposed action.

I-75 offers adequate sight distance from the east and west; therefore, it can be reasonably assumed that, given the minor traffic generated by the proposed action and existing truck traffic, no significant impact would occur to existing road users or increase accident probability.

Snake Road, a two-lane paved facility that runs north and south, would also not be adversely impacted. Recent statistics from the Transportation Plan for the Miccosukee Tribe prepared by A/E Group, Inc. and dated May 17, 1992, indicate that the roadway is in good condition and is used by less than 300 VPD north of the Miccosukee Service Plaza. About 16 percent of the traffic on this section of Snake Road is made up of trucks and heavy vehicles. The 10 to 25 VPD generated by the proposed action would only be .083 percent of the existing traffic volume.

While no LOS standards exist for Snake Road, it can be reasonably assumed that the 10-25 VPD generated by the project would not reduce the LOS on Snake Road or have any significant adverse impacts to existing road users.

However, because Snake Road is a two-lane facility, existing traffic flows may be interrupted due to "slow moving vehicles and wide truck loads." Given the temporary nature of the proposed action, these impacts should not be significant.

4.3.7.3 Impacts of Alternative B - West Access Route

This access route would require the addition of a new access point located adjacent to the Miccosukee Service Plaza (See Figure 3-13). As with the proposed access route, traffic associated with the proposed action, such as trucks entering and exiting the access route from Snake Road and slow moving trucks transporting rig equipment, would interrupt traffic flow. Again, the temporary nature of the proposed action would decrease the significance of the impacts.

4.3.7.4 Impacts of Alternative C - East Access Route

The utilization of this access route would not have significant impacts on the public transportation network. Adverse impacts to SFWMD maintenance vehicle traffic could occur from traffic associated with the proposed action utilizing the entrance to the S-140 pump station and turning west onto a proposed vehicular bridge to access the drill site. However, given the infrequency of the use of this road by district maintenance vehicles, these potential impacts are not anticipated to be significant. The FHWA objects to the implementation of this alternative. Their objection is that new public access points to interstate highways should not be established when existing access is available. Their preliminary assessment is that the Snake Road interchange provides access to Alternatives A and B, therefore use of Alternative C is not warranted. (See letter from FHWA in Appendix A-12).

4.3.7.5 Mitigation Measures

Several mitigation measures could be undertaken to minimize the short-term impacts of traffic from the proposed action including: the posting of warning signs to alert other drivers of increased vehicle activity (i.e., trucks entering and exiting highway, trucks turning, etc.); temporarily reducing vehicle speed limits within one mile in each direction along Snake Road; use of escort vehicles for permit loads during construction and dismantling activities; utilization of a single lane for truck traffic associated with the proposed action on a specified portion of I-75 to minimize driver discomfort and accident probability; and installation of a cattle guard and gate at the entrance of the proposed access route from Snake Road to assist the flow of vehicles entering and leaving that access route.

4.3.7.6 Residual Impacts

The proposed action and alternative access routes with mitigation measures would have minimal impacts to the surrounding transportation network in terms of increased project traffic and loads, driver discomfort, accident probability and road safety. Alternative C - East Access Route would have the least impacts on traffic and the surrounding transportation network given the use of the existing non-public exit from I-75 at the S-140 pump station.

4.3.8 Vegetation

The clearing of vegetation, the disturbance of soils, and the deposition of fill during the construction of the drill site and an access route would directly impact the vegetation in the project area. The reduction in areal cover of the affected vegetative community types would be a negligible impact since the communities have a widespread distribution, occur with high frequency within the project area, and for the most part have resulted in response to man's influence. Disturbances to the wetlands in the vicinity of West Access Route alternative would require coordination with the COE as discussed in Section 1.6.11. The duration of the impacts depends upon the success of the exploratory well. The access route and drill site construction would require approximately 30 days. The drilling operation would require approximately 145 days. If the well is nonproductive, it would be plugged and the site would be returned to original grade. If the well shows signs of being economic, further field analysis would be required and restoration would occur when such studies or production ceases. Reclamation activities would be completed within the 120 days, weather permitting. The vegetation would be expected to return to preconstruction conditions within one year of abandonment and grade restoration. If the site fill were left in place in response to the desires of the Miccosukee Tribe, pasture grasses would be reestablished on the fill areas.

4.3.8.1 Impact Significance Criteria

Impacts to vegetation resources associated with implementation of the proposed action or alternatives would be considered significant if:

- Reclamation of disturbed areas would not attain an adequate cover of vegetation to stabilize the disturbed site to predisturbance conditions; or attain a species composition to support pre-existing land uses including grazing and wildlife habitat within five years following revegetation.

- Removal or disturbance of greater than one acre of riparian and wetland vegetation (as regulated by Section 404) occurred during road, drill site, or other project component construction.

- Any Federal-listed threatened or endangered, candidate plant species, or other rare species were affected through direct mortality of individual plants or reduction of required habitat. These impacts could contribute to the decline of any sensitive plant species that may occur in the project area.

4.3.8.2 Impacts of Alternative A - Proposed Action

The Drill Site

As stated in Section 3.3.8, no protected plant species are present on the drill site. The temporary displacement of the vegetation on the drill site would result in the loss of a maximum of five acres of cattle forage. Given the vast expanse of rangeland owned by the Miccosukee Tribe, the loss would be negligible. The herbaceous species to be displaced are present due to common land management practices and could be reestablished when the well is abandoned.

Access Route

The berm along the western edge of the L-28 Canal would require widening in several areas to accommodate vehicular turnouts. These turnouts would be located to avoid areas of significant impact such as wetlands, native vegetation and the State-listed plant species noted in Section 3.3.8.

The existing road along the northern portion of this proposed access route would require top grading and top fill to accommodate heavy equipment. Roadway widening would not impact wetlands. Impacts to the adjacent pasture areas would be minimal. Vehicle turnouts (100 ft. x 15 ft.) constructed at 1/2 to 3/4 mile increments would require filling a total of approximately 0.4 acres of pasture.

4.3.8.3 Impacts of Alternative B - West Access Route

The proposed West Access Route would follow a trail for the majority of the route. The majority of the wetlands and all upland hammocks would be avoided, with impacts limited whenever possible to the pasture areas. The impacts would be temporary and would be limited to approximately three acres of pasture including 0.25 acres of marsh. A detailed assessment of wetland impacts is provided in Section 4.3.12.3. The impacts to vegetation would occur as a result of creating a 15-foot wide fill road approximately 1.6 miles in length.

4.3.8.4 Impacts of Alternative C - East Access Route

The proposed East Access Route would result in the least amount of impact to vegetation. The impacts to the marginal vegetation on the banks of the canal would be temporary and minor, affecting less than 0.12 acre in area. No listed plant species are present in this area.

4.3.8.5 Mitigation Measures

Mitigation measures that would minimize impacts to vegetation include the following actions: SWEPI could provide a qualified inspector on site during all construction activities to ensure construction compliance with approved road and drill site design plans; any new access roads could be designed to conform in general with BLM Road Standards (BLM Manual Section 9113); all vehicles could be restricted to existing roads, and roads constructed as part of the proposed action or alternatives; reclaimed areas could be monitored for success in terms of reduced erosion and revegetation in accordance with BLM and BIA requirements and the project reclamation plan; the location of vehicle turnouts required for the proposed access route could be inspected by a qualified biologist to assure that State-listed plant species are avoided; wetland impacts that would occur as a result of construction of the West Access Route could be mitigated in accordance with criteria established by the COE.

4.3.8.6 Residual Impacts

The impacts that the construction of the drill site and any of the three access route alternatives with mitigation measures would have on the vegetation in the project area would be negligible. The clearing required would impact rangeland vegetation which was planted by the Miccosukee Indians as agricultural improvements. The East Access Route (Alternative C) would result in the least amount of impact to vegetation. The drill site would be replanted with rangeland vegetation, resulting in no cumulative impacts. Access Road B, if not reclaimed, would result in elimination of three acres of pasture including 0.25 acres of wetland vegetation.

4.3.9 Visual Resources

Visual impacts associated with drilling typically include visual contrasts between the industrial character of the drilling rig and the characteristic landscape. In addition, the access route, truck traffic, and associated dust may also become adverse visual impacts.

4.3.9.1 Impact Significance Criteria

A visual impact is considered significant if it:

- Would exceed the level of visual change allowed to maintain a given visual quality level or objective.
- Would result in contrast visible to potentially large numbers of viewers.
- Would appreciably diminish the aesthetic experience of these viewers.

4.3.9.2 Impacts of Alternative A - Proposed Action

The proposed action's main visual components are a four-foot high berm around an area approximately 320 feet by 615 feet with a 30 foot elevated work area and drilling rig with an overall height of approximately 170 feet. Approximately, six trailers would accommodate offices and emergency equipment. The vertical form and manufactured character of the rig would be in contrast to the overall character of the apparent "natural," flat wet-prairie nature of the project area. However, the existing vertical elements of power poles, microwave towers, and billboards together with the other man-made structures, tend to mitigate this contrast. The use of the proposed access route from the north would minimize visual impact of vehicles to I-75 observers.

It can be expected that the sensitivity level of the public during drilling would probably vary with viewer type. Some viewers may feel that visual qualities are impaired, regardless of the limited duration and scale of the project and existing visual conditions. They may feel that any additional element of an industrial character has an adverse visual impact. At the other extreme, other observers may not perceive any reduction in visual quality and may even consider the rig a novel sight adding variety to a flat uniform landscape. Consequently, a sensitivity level of two, or moderate level of concern, may be considered relative to the proposed action and alternatives.

4.3.9.3 Impacts of Alternative B - West Access Route

The use of the West Access Route from Snake Road, parallel and adjacent to I-75, would create short-term visual impacts during construction. The use of this access would make the projected 10 to 25 VPD, and possible dust impacts, visually apparent from I-75.

4.3.9.4 Impacts of Alternative C - East Access Route

The use of an alternative access from the east, parallel and adjacent to I-75 may have more short-term impacts. This is due to the need to construct a single lane bridge over the L-28 Canal. While this bridge would be low and close to I-75 making it difficult to be seen, the construction activity may create some short-term visual impacts. Again, the use of this accessway could result in truck and dust impacts very visible from the adjacent I-75.

4.3.9.5 Mitigation Measures

Several measures could be undertaken to mitigate visual impacts. Watering of unpaved access roads during dry periods could minimize the visual impact of truck-created dust plumes. The visual appearance of the rig and drill site could be maintained in a clean and orderly manner.

4.3.9.6 Residual Impacts

The proposed action and alternatives with mitigation would not be considered visually significant, particularly in light of the temporary nature of the project, and existing visual obstructions.

Upon completion of the exploratory drilling activity, the removal of the rig and trailers together with site restoration to reestablish the pasture grass should eliminate any long-term adverse or cumulative visual impacts.

4.3.10 Waste Management

Proper management of wastes generated by the proposed action is an important component in minimizing the risk of potential environmental hazard. The produced wastes include the following: contaminated stormwater runoff, drilling muds, drill cuttings, brine water, oil and solvents, solid waste, and domestic waste. If oil were discovered, production testing could include handling of oil and oil/brine water.

Oil and Oil/Brine Spills

The Florida Geological Survey (FGS) has monitored oil spills in Florida since January, 1972; the data were summarized in February, 1990. Since 1972, there have been 97 oil spills or oil-brine spills in Florida. An oil-brine spill consists of the formation water that is pumped to the surface during oil production. The brine has a chloride content of 100,000 to 150,000 ppm.

Of the 97 spills, 89 were actual fluid releases, and 8 were cleanups of old or unknown spills that were discovered by Florida Geological Survey personnel during site inspections.

Of the 89 releases, 34 percent consisted of quantities of $\leq$ 5 barrels of oil or oil-brine fluid, 49 percent were between 5 and 15 barrels, and 17 percent were $>$ 100 barrels. Thirty-eight percent of the fluid releases occurred at the production pad or tank battery and were contained within the diked area. Fluid releases occurred in upland areas 29 percent of the time, in wetland areas 21 percent of the time, and directly into ditches or canals 11 percent of the time.

The principal causes of the 89 fluid releases were corrosion (32 occurrences), human error (27 occurrences), vandalism (2 occurrences), and tornado damage (1 occurrence). The majority of fluid releases occurred during transport activities. The cause(s) of the remainder of the spills was unknown (FGS, 1992, personal communication).

Regulations Concerning Drilling Waste Disposal

RCRA hazardous waste regulations exempt certain wastes associated with the exploration and production of oil and gas from the definition of hazardous waste.

Rules of the FDNR, Conservation of Oil and Gas, [16C-28.003(7)(8)(9), FAC] specifically cover oil and gas associated drilling waste disposal in the State. The regulation states that no waste material or drilling mud shall be disposed of into any wetland, lake or any other body of water or into any ditch or surface drainage depression leading into any wetland, stream, lake or other body of water. Such waste shall be contained for proper disposal in an approved waste disposal site. The regulation further states that solid waste and sewage must be disposed of at an approved waste disposal site.

In order to comply with Federal regulations and terms of the lease in regard to drilling waste disposal, SWEPI has an extensive waste management plan, which complies with Rule 16-28 FAC.

4.3.10.1 Impact Significance Criteria

The impact significance criteria relative to waste management are as follows:

- Contamination of the soil, surface or groundwater from wastes generated during the drilling and testing of the exploratory well. These generated wastes include contaminated stormwater, drilling fluids, drill cuttings, solid wastes, and sewage.

4.3.10.2 Impacts of Alternative A - Proposed Action

SWEPI has an extensive plan to contain and manage generated wastes. The drill site itself would act as a containment for generated wastes during the actual drilling of the exploratory well. The generated wastes would include the following: contaminated stormwater, drilling fluids, drill cuttings, solid waste.

Drill Site Containment

The drill site location would be a contained compound which would utilize approximately five acres of surface area. The topsoil on the site area is about four-inches thick and would be removed and stockpiled for use during reclamation of the site. The drill site would be constructed of select fill material and topped with 18 inches of crushed limerock, compacted to 12 inches. The location would also include a four-foot high berm constructed with three feet of select fill and one foot of crushed limerock to minimize erosion during rain storms. The berm would encompass the complete location and would serve dual purposes: 1) to contain all stormwater or spilled material, and 2) to exclude flood waters that could occur during heavy rain storms or hurricanes.

Drill Rig Containment

In order to minimize the potential for soil and groundwater contamination from drilling waste leaching, the area under the drill rig equipment would be trenched and a plastic liner (12 mil minimum with fiber reinforcement) would be installed over the compacted limerock base. The plastic lined section would include a one-foot berm such that all fluids and/or rain water which have been in contact with rig equipment would drain to the cellar. This fluid would then be pumped to a storage tank and used in the drilling fluid. The compacted limerock base is estimated to have a permeability of about 3×10^{-5} cm/s. This is comparable to silt which has a very low permeability. This limerock pad provides an additional level of protection in the event of the failure and oil leakage through the plastic liner.

The west side of the drill site would have a retention area to contain all stormwater that accumulates on the location (other than the previously mentioned plastic lined area under the rig). The entire bermed

drill site is designed to contain 220,320 ft³ of liquid, a volume greater than would be collected from a 3-day 100-year storm.

Drill Cuttings Containment

A plastic-lined depression, completely isolated from the stormwater retention area, would be prepared to contain drill cuttings until they can be analyzed to determine proper disposal.

Storage Tank Containment

Storage tanks used on the drill site including the diesel, lube oil, and hydraulic fluid tanks would be placed within the drilling rig containment. The plastic lined drilling rig containment area would act as secondary containment for these tanks.

Management of Drilling Fluids

The drilling fluids used in drilling the proposed exploratory well would be water-based. The estimated total drilling fluid component requirements are listed in Table 2-1. All material additives selected for use meet EPA toxicity standards of 30,000 parts per million for offshore surface water discharges. (Offshore standards are used as a reference guideline only.)

However, for the proposed well a "closed mud system" (no reserve pit) would be used and all drilling liquids would be either reused in the mud system or disposed of into the "boulder zone" as detailed under Fluids Disposal.

The toxicity measure is based on the concentration (parts per million) it takes to kill 50% of a quantity of mysid shrimp in 96 hours (LC50 toxicity standard). Therefore, a smaller concentration corresponds to a more toxic substance.

The following is a general representation of toxicity levels of common components of drilling fluids:

COMPONENT	LC50 TOXICITY RANGE 96Hr Mysid - ppm
Water	
Barite	1,000,000 ppm
Bentonite (clay)	1,000,000 ppm
Chrome-free lignosulfonates	310,000-1,000,000 ppm
Chrome-free lignite	1,000,000 ppm
Caustic soda	160,000-1,000,000 ppm
Polymers	305,000-1,000,000 ppm
Zinc Oxide	31,000-78,000 ppm
Drilling Fluid Mixture	**518,000 - 762,000 ppm** (overall mud system - predicted)

Drill Cuttings

A "closed mud system" (no reserve pit) would be utilized for this well to minimize potential environmental impacts to the drill site. In order to control drill solids, a "fluid processing system" or similar equipment would be used. This system would reduce liquid disposal volumes as well as drill solids in the mud system.

The fluid processing system equipment would include shale shakers, degasser, desander, desilter, and centrifuges. Solids removed by this equipment would be caught in a cuttings catch tank. Any liquids which separate from the drilled solids would be pumped to a storage tank for eventual reuse or disposal. Solids remaining in the catch tank would be stacked in a bermed and plastic-lined area. Any further drainage from the cuttings would flow to a cellar through ditches and would also be pumped to a storage tank.

Drill Solids Disposal

Upon approval of an agreement with the Miccosukee Tribe, drill cuttings would be spread on a non-wetland area of the Miccosukee Reservation. These drill cuttings would be stored on the drill site prior to hauling to allow complete drying. Prior to disposal, representative samples of the cuttings would be tested. Tests would include as a minimum: Toxicity tests to assess availability of heavy metals for

leaching, tests for chlorides, tests for oil and greases, and screening for radioactivity. An alternative disposal site for drill cuttings would be a local landfill. If cuttings are not acceptable for spreading on the Reservation due to oil or other contaminants, they would be transported to a Class I landfill.

Fluids Disposal

SWEPI plans to reuse as much drilling fluid as possible through an extensive processing system to remove drilled solids. Thus, drilling fluid disposal would be minimized. The primary fluid requiring disposal would be stormwater accumulated on the drill site from heavy rains. SWEPI plans to dispose of the stormwater and excess drilling fluid into the "boulder zone," a confined porous geologic interval of the Floridan aquifer that occurs at a depth of approximately 2,900 feet. Oil and gas operations in Florida have frequently used this zone to dispose of drilling fluids. Over 100 wells in South Florida have used this fluids disposal procedure. The "boulder zone" is also used for deep injection of treated industrial and municipal wastewater. As of September, 1992, there were 74 Class I injection well sites which included 93 operating wells, 20 proposed wells, 25 wells which are under construction, abandoned or in standby/inactive status. The injected wastewater volume in Class I wells amounted to 295 million gallons per day in 1990 (Deuerling, 1992).

Federal and State underground injection control regulations do not apply to the subsurface emplacement of fluids during the construction of oil or gas wells. The Federal exclusion for this activity is found in the preamble discussion in 41 FR 36730-36732 (August 31, 1976).

While Federal underground injection control regulations do not apply to this activity, the SWEPI plan of operation incorporates many of the regulatory provisions for Class II Injection Wells (wells which inject fluids which are brought to the surface in connection with conventional oil or natural gas production). Federal criteria and standards applicable to Class II wells that would be incorporated in the Proposed Action include: injection to a formation which is separated from underground sources of drinking water by confining zones free of known open faults or fractures within the area of review; casing and cementing of the well bore to prevent movement of fluids into or between underground sources of drinking water; appropriate logs and other tests to determine and verify the lithology; cement bond, caliper, and pressure testing to ensure the integrity of the casing strings; monitoring of the nature of fluids prior to injection to assure they do not contain oil, grease, or toxic materials; and plugging of the well prior to abandonment. In addition, fluids would be injected at low pressures (gravity flow) and for a short duration. Most drilling fluids would be injected during a single event of short duration upon completion of drilling activities.

Naturally Occurring Radioactive Material (NORM)

All soils and rocks are known to contain some amount of NORM. Uranium and thorium and their radioactive decay products are known to be present in varying concentrations in underground geologic formations from which oil and gas are produced. The formation water contains dissolved mineral salts, a small portion of which may be radioactive because of the presence of uranium and thorium and their decay products in the underground formation. Thus, the amount of NORM material from a producing field generally increases with the amount of water pumped from the formation. The uranium and thorium are relatively insoluble and remain in place. However, radium is slightly more soluble and may, under certain conditions, become mobilized by the liquid phases in the formation.

As it is brought to the surface, the natural formation water undergoes changes in temperature and pressure and may, again under certain conditions, deposit scale within the oil production system. This accumulation of scale and sludge within the oil production equipment occurs over time.

The usual problem with oil field NORM is not the initial concentrations in the production water. The NORM problem is the scale deposits which form on the interior of piping as precipitates of carbonates and sulfates of calcium, barium and strontium. The scale could contain elevated levels of radioactive compounds.

The SWEPI exploratory well would undergo limited production testing if hydrocarbons are found. This testing would last for up to 30 days. Scale formation over this short testing period would be insignificant.

The FDEP, Bureau of Geology tested for the radium-226 and radium-228 (the primary radionuclides of concern when discussing NORM) content in production water samples of three South Florida oil fields. The results of this sampling are presented below.

Production Water Sample Results from South Florida Oil Fields (pCi/l)*

Radionuclide	Lehigh Park	Bear Island	Raccoon Point
Radium-226	0.2 ± 0.0	0.4 ± 0.1	0.3 ± 0.1
Radium-228	1.4 ± 1.4	1.7 ± 1.4	3.7 ± 1.3
Total Radium	1.6 ± 1.4	2.1 ± 1.4	4.0 ± 1.3

*Picocuries per liter
Reference: W. R. Byrd, December 14, 1989

Federal and State drinking water standards (40 CFR, Part 141.15 and FAC 17-550.310) set the maximum contaminant levels for radium-226 and radium-228 at 5 Pci/l each. The analysis results tabulated above indicate that the NORM in production water from South Florida production wells are less than the standards for drinking water. These results led the Bureau of Geology to conclude that NORM is an insignificant problem in production water of South Florida production wells.

The low radium-226 and radium-228 NORM contaminant levels measured in South Florida production water samples, the FDEP's evaluation that NORM is an insignificant problem in production water of South Florida production wells, and the exemption of production waters from the various states NORM regulations, all suggest that NORM testing of the production waters, if any occur, is not warranted. Production waters would be subject to toxicity testing.

The drill cuttings and drilling fluids would also be tested for NORM.

Domestic and Solid Waste Disposal

Solid waste which does not require special handling would be collected in dumpster containers and hauled to the Broward County Landfill via a local commercial service.

Portable toilets and holding tanks would be used to collect domestic waste and gray water. These wastes would be transported by commercial haulers to an approved site for treatment.

Used oil from internal combustion engines or other sources would be collected for transportation to the Miccosukee Oil Recycling Center on Tamiami Trail.

Access Route Containment

The proposed access route runs parallel to a surface water management canal and the L-28 Canal. These canals could potentially disperse pollution within a limited area resulting from a vehicle turnover or spill. Strict adherence to low speed limits by site personnel would minimize the risk.

4.3.10.3 Impacts of Alternative B - West Access Route

A vehicle turnover on this route could result in a spill that would be contained in the adjacent pasture area. Strict adherence to slow speed limits would minimize the risk.

4.3.10.4 Impacts of Alternative C - East Access Route

A vehicle turnover or spill on this route could potentially enter the L-28 Canal. Strict adherence to slow speeds would minimize the risk.

4.3.10.5 Mitigation Measures

Analysis of the proposed liner system (12 mils thickness) indicated that increasing the thickness to a minimum of 20 mils would provide a significant increase in protection of the groundwater. Additional specifications are also prescribed to assure that the proposed drill rig containment area and cuttings storage area liners perform their intended function of fluid containment. Therefore, the following measures could be required.

General Requirements for Liner Materials:

- Polymer type: not specified, subject to conformance with the other requirements;
- Oil-resistant (hydrocarbon-resistant) properties;
- Minimum thickness 20 mils;
- Ultraviolet-resistant properties;
- One piece with manufacturer's seams certified; documentation showing licensing or other endorsement of installer/fabricator, including qualifications of personnel, and specific experience of on-site superintendent or fabrication superintendent;
- Any field seams would be nondestructively tested and certified by third party; quality assurance (QA) test procedures shall be directly observable and/or quantifiable (e.g., vacuum testing or air pressure [high density polythecyene (HDPE), double wedge] testing); QA consistent with the requirements of FDER Rule 17-701 FAC, Section 17-701.400(7).

Configuration and Cover Requirements

- Liners could be provided continuously throughout the drill rig and cutting storage containment areas (including the 10 ft x 200 ft connecting area), extending at least to the top of the perimeter containment berms, and anchored in accordance with industry standards in a continuous anchor trench, either at the top of the berm, or at the base of the outside of the berm;

- A protective cover layer, at least three-inches in thickness, could be required above all liner materials, consisting of soils that would provide suitable trafficability under all expected weather conditions for vehicular and pedestrian traffic; and

- A cushion layer, above the liner and below the protective cover layer, could consist of a non-woven, needlepunched geotextile, with minimum mass per unit area of 10 ounces per square yard.

SPCC Plan

A site specific SPCC Plan could be submitted to BLM prior to commencement of site operations.

Waste Injection

In order to ensure that the waste disposal activities do not endanger any underground source of drinking water, plans for the injection of waste drilling fluids and excess stormwater into the "boulder zone" could be developed and submitted to BLM prior to the initiation of any disposal operations. BLM could provide the information to EPA.

During disposal activities, SWEPI could provide an activity summary of the disposal operations together with supporting documentation which should include well logs for the shallow portion of the hole, geologic formation tops for the well, if available, well log calculations of the shallow hole to the lowermost source of drinking water, chart recorder of pressures tests documenting cement shoe casing protection of the lowermost underground source of drinking water, pump pressure logs of disposal activities to document that test pressures do not exceed the fracture gradient at the 20-inch casing cement shoe, copies of daily reports for disposal activity, chart recorder of pump pressures for disposal activity, copy of well log and completion report affidavit, and a copy of the plugging affidavit, if appropriate.

The following measures could be implemented to assure that drilling fluids, produced water and drill cuttings are properly analyzed and disposed of in an appropriate manner:

Testing of Drilling Wastes

Prior to disposal, representative samples of the cuttings, drilling fluids, and produced waters would be collected for laboratory analysis. The composite samples collected would be analyzed in accordance with EPA test methods established in the EPA SW 846 Manual (EPA, September, 1986). Samples would be tested for the following metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Drill cuttings would be tested for total metals. If the totals analysis for drill cuttings exceeds maximum allowable concentrations, the TCLP would also be completed. Drilling fluids and produced

waters would be tested using the TCLP. In addition, EPA method 8015 (modified) would be used to test for total recoverable petroleum hydrocarbons (TRPH). The maximum allowable concentrations for the metals would be consistent with the RCRA Hazardous Waste/Criteria, and for State of Florida Clean Soil Criteria, identified in the table below. FAC Rule 17-775.400 does not apply to the proposed action. It is used as a guideline to establish a reasonable threshold since Federal clean soil criteria regulations do not exist at this time.

MAXIMUM ALLOWABLE CONCENTRATIONS

COMPOUNDS	TCLP[1] (mg/l)	Total[2] (mg/kg)
Arsenic	5.0	10
Barium	100.0	4940
Cadmium	1.0	37
Chromium	5.0	50
Lead	5.0	108
Mercury	0.2	23
Selenium	1.0	389
Silver	5.0	353

[1] 40 CFR, Part 261.24, Table 1 and FAC Rule 17-775.400
[2] FAC Rule 17-775.400

The maximum TRPH concentration for drill cuttings would be ten mg/kg. This threshold is consistent with the criteria of FAC Rule 17-775.400, Criteria for Clean Soil.

The maximum TRPH concentration for drilling fluids and produced waters would be five mg/l. This threshold is consistent with the criteria of FAC Rule 17-770, Petroleum Contamination Site Cleanup Criteria. This regulation does not apply to the proposed action and is used only as a guideline to establish a reasonable threshold.

In addition, drill cutting samples would be tested for soluble salts and cationic distributions. Limits for soluble salts and cationic distributions in drill cuttings would be as follows:

(a) Electrical conductivity (EC-solution phase); < 4 mmhos/cm
(b) Sodium adsorption ratio (SAR-solution phase): < 12
(c) Exchangeable sodium percentage (ESP-solid phase): < 15%

The soluble salts and cationic distributions thresholds are consistent with Louisiana regulations for nonhazardous oil field wastes (LAC Title 43: Part XIX). The Louisiana standards are used to establish acceptable maximum concentrations since no Federal or state (Florida) criteria exists. Drilling fluids and produced water would be tested for total chlorides. Limits for chlorides in drilling fluid and produced water would be 20,000 ppm.

Radioactivity Testing

The drill cuttings and drilling fluids would also be tested for NORM. Drill cuttings and drilling fluids would be tested for radium-226 and 228 by gamma spectroscopy. If levels do not exceed five pCi/gram for each, above background, the drill cuttings could be disposed of on the Reservation or at a landfill. This threshold is consistent with Louisiana regulations (LAC Title 33: Part XV.1404) which are currently the most comprehensive NORM regulations in existence. This regulation has been used as a guideline since the Federal government and the State of Florida do not have regulations or guidance documents regarding NORM. If levels in drilling fluids do not exceed 60 pCi/l, the drilling fluids could be disposed of by injection into the "boulder zone." This threshold is consistent with FAC Rule 17-28.120, the State of Florida's Underground Inspection Control regulation for industrial and sanitary wastes. This regulation has been used as a guideline since neither the Federal government or the State of Florida has regulations for disposal of drilling fluids from exploratory oil wells.

Disposal of Drilling Wastes

The laboratory results would determine the acceptability of on-site disposal. Drill cuttings that meet the State of Florida clean soil criteria for Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, and TRPH, as outlined in FAC Rule 17-775 (used as a guideline) and meet the soluble salts and cationic distributions and the NORM criteria set forth in the previous section (less than five pCi/gram, above background of radium-226 or radium-228), may be used as fill material on non-wetland areas of the Reservation. The Miccosukee Tribe would designate an on-reservation non-wetland location for disposal of the drill cuttings.

Drill cuttings that exceed the State of Florida clean soil criteria, but do not exceed the hazardous waste thresholds found in 40 CFR, Part 261 and the NORM criteria set forth in the previous section, would be transported to a Class I landfill for proper disposal. Should the hazardous waste thresholds and/or TRPH analysis exceed the established maximum concentrations, the BLM would determine a proper disposal or treatment procedure.

Drilling fluids which do not exceed the hazardous waste thresholds found in 40 CFR, Part 261 and the total chlorides and UIC radioactive material criteria set forth in the previous section would be disposed

of in the "boulder zone." Should the TCLP and/or TRPH analysis exceed established thresholds, the BLM would determine a proper disposal or treatment procedure.

Should drill cuttings exceed 5 pCi/g of radium-226 or radium-228, above background, or drilling fluids exceed 60 pCi/l, these wastes could be disposed of at NORM facilities in Louisiana, or at a low-level radioactive waste disposal facility in South Carolina.

Production waters would be disposed of in the "boulder zone," if the referenced hazardous waste, TRPH, and total chlorides thresholds are not exceeded. If the established thresholds are exceeded, the BLM would determine a proper disposal procedure.

4.3.10.6 Residual Impacts

Waste-induced impacts associated with the drill site could result from the mismanagement of generated wastes. Lack of containment and improper handling of generated wastes could possibly result in contamination of the soil, surface and groundwater in the immediate vicinity of the proposed drill site. Proper construction of the drill site and implementation of the SWEPI waste management plan and recommended mitigation measures would minimize the risk of potential environmental contamination by wastes associated with the proposed action. Proper adherence to speed limits would minimize the risks associated with spills from vehicles utilizing the proposed site access or alternatives. Proper waste management would assure no significant impacts resulting from the proposed action.

4.3.11 Water Resources

Potential impacts to water resources may occur during either the construction phase of the proposed action or during the testing of the well. Potential construction-related impacts are limited to minor disruption of surface flow caused by the construction of an impervious liner and containment berm around the drill site and the improvement of an access route to the drill site. The five-acre drill site would not induce a significant impedance to surface flow. The drill site represents about 0.1 percent of the broad land areas bounded by a Miccosukee canal to the north, the I-75 borrow canal and roadway to the south, the L-28 Canal and Levee system to the east and Snake Road to the west, minimizing recharge area impacts.

Water used for construction activities would either be trucked in from an off-site source or supplied directly from nearby groundwater sources. No significant volume of water would be required for construction of the drill site. Drilling fluids and stormwater would be reused in the drilling operations to the maximum practical extent. Water usage during drilling of the exploratory well would be supplied from 2 on-site wells completed to depths of approximately 100 feet below ground surface. Impacts

associated with the anticipated low rates of withdrawal from these wells are transient and expected to have minor influence on the overall capacity of the gray limestone unit of the Tamiami Formation.

Potential water quality impacts to surface water are associated with increases of sediment in runoff from access roadway improvement activities and topsoil stockpiles. The impacts would consist of localized increases in turbidity in waters adjacent to these construction sites.

Possible contamination of water resources may occur during the drilling and testing of the exploratory well. Possible contamination scenarios include a surface spill of brine formation water or oil, leakage of brine formation waters from the lower Floridan into upper fresh water aquifers, and leakage of oil from the well into aquifers. Much of the risk of occurrence of these potential impacts would be eliminated by features of the proposed action. These features include the construction of a bermed pad at the drill site, use of impervious liners at possible spill locations within the drill site, and a drilling plan which uses multiple well casings and cementing to protect surrounding formations.

Stormwater accumulating within the bermed drill site would be recycled to the maximum practical extent in the preparation of drilling fluids. Excess drilling fluids and excess stormwater would be disposed of by injection into the "boulder zone" of the Floridan aquifer.

4.3.11.1 Impact Significance Criteria

Several performance criteria were used to evaluate the significance of potential impacts to surface water or groundwater resources due to the proposed action and alternatives. These criteria are summarized below:

General

- Violation of COE management criteria for WCA-3A and other nearby environmentally sensitive areas.

Surface Water

- Degradation of water quality such that applicable State (FAC Rule 17-302) or Federal standards (Clean Water Act) are not met.
- Impacting existing water quality characteristics that would affect established water users such as humans, livestock, fish, and wildlife.

- Inducing unacceptable impacts to downstream areas in terms of water quality and flow patterns.

Groundwater

- Degradation of groundwater quality of aquifers used for potable supply, irrigation, livestock, or other uses that require minimum standards (FAC Rule 17-550).
- Increase or decrease of shallow or deep aquifer levels resulting from construction, drilling or testing activities.

4.3.11.2 Impacts of Alternative A - Proposed Action

The proposed action includes only one location for the drilling site. However, two alternate access roadway alignments have been identified. Impacts associated with the drilling site construction and operation are identical for all of the alternatives. These impacts are only discussed under the proposed action. The discussion of impacts associated with Alternatives B and C deal solely with the differences in the impacts from those associated with the proposed action.

Proposed Drill Site

The proposed drill site, previously discussed in Chapter 3, is located north of I-75, west of Canal L-28, and east of Snake Road, on the Miccosukee Reservation in west Broward County, Florida.

The drill site would not likely cause significant impacts to surface water resources because of measures which would be implemented during its construction. These include the construction of a bermed containment system around the drill site, installation of impervious membrane liners at possible spill locations at the drill site, use of site design features to limit and contain potential fluid spills, elimination of stormwater discharge from the site, and by minimizing the extent and duration of disturbance to affected areas.

Cattle watering constitutes the primary surface water use in the vicinity of the drill site. This surface water use would not be adversely impacted by the drill site and access road construction and their associated sediment-related effects. No significant surface flow paths, including stream channels, canals or overland flow routes would be blocked by this construction.

The construction and short-term use of the five-acre drill site would result in a temporary and insignificant loss of recharge to the surficial aquifer. The potential recharge loss is very small due to the

very small increase in impervious cover, and the low permeability of the limestone layer which lies within a few inches of the ground surface.

The drill site occupies about 0.1 percent of the area enclosed by I-75 to the south, Snake Road to the west, an existing Miccosukee canal and bermed access road to the north, and the L-28 Levees and Canal to the east. The surficial aquifer is a regional feature extending well beyond the limits of the enclosed area. Therefore, the drill site's construction represents a very small increase in impermeable cover over the surficial aquifer.

The Fort Thompson Formation underlies a thin veneer of surficial soils at the drill site. The upper part of the Fort Thompson Formation consists of hard, dense limestone with sand and shell in a lime mud matrix. This upper bed generally retards the vertical movement of water. Therefore, the aquifer recharge from the drill site would be very small.

The BIA has determined that the drilling site is not situated within a 100-year floodplain. However, local area flooding can occur. The site elevation is about 11.3 feet NGVD. Pumping at the S-140 pump station begins when the L-28 Canal water level reaches 10.5 feet NGVD. Analysis of the partial water level data record at the S-140 pump station indicates that water levels equal or exceed 11.3 feet NGVD, the ground level at the site, on an average of 5.5 days per year. Water levels equal or exceed 12.3 feet NGVD, the recorded high water level, about 0.2 days per year. The site berm provides about three feet of freeboard over these measured high water levels. Therefore, there is virtually no risk of flood waters encroaching on the drill site.

Stormwater would not discharge from the drill site. The water retention area would store the equivalent of three inches of rainfall over the drill site. Under more severe rainfall conditions, the storage volume of the entire bermed site can be utilized to retain stormwater runoff. The site perimeter berm can contain 1,648,000 gallons of liquid, a volume greater than would be collected from a 3-day 100-year storm event (12 inches). All stormwater would either be reused in the drilling mud system or disposed of by injection into the "boulder zone" of the Floridan aquifer as described in Section 4.3.10.2, Fluids Disposal.

Drilling operations involve the use of engines and pumps, and the storage and handling of diesel fuel, lube oils, and hydraulic fluids. Minor spills, leaks or ruptures of storage tanks are possible. The drill site design includes a compacted limerock pad with plastic-lined, bermed areas at potential leak locations. The compacted limerock base is estimated to have a permeability of about 3 X 10^{-5} cm/s. This is comparable to silt which has a very low permeability. This limerock pad provides an additional level of protection in the event of the failure and fluid leakage through the plastic liner. In addition, a four-foot high berm encloses the drill site to provide containment of larger spills. Drill site design features, on-site availability of oil spill control equipment, and the existence of "Spill Prevention Control and

Countermeasure Plan" and "Oil Spill Contingency Plan" documents provide the means to monitor, control and contain any spill before areas outside of the containment are affected.

Large surface spills of oil or brine formation fluids are unlikely. Such spills result from a loss of well control during the drilling operations. The geologic structure in the South Florida area is not conducive to loss of well control. No abnormal formation pressures or temperatures have been found in existing wells, and these conditions are not anticipated to occur in the proposed well. Over 400 wells have been drilled in the South Florida without the occurrence of a blowout. SWEPI expects well pressures at the drill site to be normal, based upon a review of records for wells drilled in the area. Most producing wells actually require pumping to assist bringing oil to the surface. Additional well safety features incorporated in the drilling program include use of weighted drilling muds to control formation pressures while drilling and the installation of a series of BOP. These pressure control valves can close off the well if unexpected pressures are encountered.

The effects of large surface releases of oil or brine formation waters were evaluated in spite of the unlikely probability of occurrence. A catastrophic accident scenario postulated the occurrence of a well control spill large enough to fill the entire 1,650,000 gallon capacity of the drill site berm with either oil or brine formation waters. A coincident 100-year, 24-hour rainfall event establishes the wet conditions of the site. The scenario further assumes a breach in the berm and subsequent release of all the contained fluids to the surrounding area.

A levee and berm borders the L-28 Canal on both sides. The berm nearest the site is approximately three feet higher than the prevailing drill site grade. Except where there are control structures breaching the berm for drainage purposes, the berm generally has a damming effect, preventing the surface flow of liquids into the L-28 Canal. A flash board riser, about 1,000 feet from the center of the site, is the nearest control structure. If maintained at an elevation of 11 feet NGVD, over 13,400,000 gallons of liquid can be contained. Therefore, the berm and maintenance of control structures operations provide a significant level of spill containment protection.

If spill fluids bypass the berm and control structure containment, they would flow directly into the L-28 Canal. The L-28 Canal terminates to the south and provides no direct conveyance into WCA-3A. S-140 pump station provides the only potential flow path from the L-28 Canal into WCA-3A. In order for fluids within the L-28 Canal to become part of the sheet flow in WCA-3A, they must be actively pumped into the C-60 channel, flow down the channel for about four miles. At that point, I-75 crosses the C-60 canal at a bridge. The canal flows as well as sheetflow in areas adjacent to the canal can only move south at this bridge location. The I-75 roadbed restricts flows at other locations.

Should a major spill overflow the western levee of L-28, FDER regulations would not allow pumping, even during wet season conditions. The L-28 Canal would, therefore, contain any surface spill. The roadbed of I-75 provides an additional impediment to north-south sheetflow.

Four scenarios were simulated to assess the possible impacts to the groundwater at depth during drilling or during the operation of the well. Details of the analysis are provided in Appendices A-7 and A-8. These scenarios are the "worst case" possibilities; therefore, any smaller spills would have less of an impact than the model simulations. The first scenario simulates a surface spill involving a release of brine from a breached containment berm into the surficial groundwater. The second scenario simulates a constant leak of brine into the gray limestone aquifer and the upper Floridan aquifer, due to faulty well installation. The third scenario simulates a surface spill involving the release of oil from a breached containment berm. The fourth scenario simulates a leak of oil into the gray limestone and Upper Floridan aquifers due to faulty well installation.

In scenario one, a simulated two million gallon brine spill leaks from the bermed containment area over a period of 14 days and enters the surficial aquifer. Appendix A-7 describes the setup of the USGS Saturated-Unsaturated TRAnsport (SUTRA) program, the estimated input parameters, and illustrates the brine plume's movement and growth after periods of 14 days, 5 years, 25 years, and 100 years. Several of the input parameters to the SUTRA program had to be estimated due to the lack of site-specific data. Nevertheless, the model results represent reasonable estimates on the bounds of the movement of the contaminate plumes.

The maximum level of chlorides in drinking water is 250 mg/l. After 14 days, the brine plume has a radius of 420 feet to the 250 mg/l isochlor contour. Over a period of 100 years, the plume grows slowly to a radius of 1,150 feet (250 mg/l isochlor contour). No potable water wells are finished in this aquifer. Therefore, the hypothetical spill would not adversely affect any existing potable groundwater uses. Leakage of the brine plume into the L-28 Canal is possible. However, remedial action would be very effective for any type of spill in this aquifer because of the slow groundwater velocities involved.

Typical remediation may involve the installation and operation of a well or system of wells in the areas of highest known contamination. Field screening methods such as temporary wells may be used to aid in location of additional wells and to evaluate the horizontal extent of the contamination. The number of wells, their location and pumping rates would be designed so that the plume would be fully within the capture zone of the recovery system. Effluent disposal in the case of the brine spill could be by injection into the "boulder zone" of the Floridan aquifer through the exploratory well.

Typically, aquifers are confined or segregated from adjacent aquifers by layers of geologic materials with low permeability. Some variability in the confining layer between the surficial and gray limestone

aquifers exists at the drill site. In the event of an unlikely brine spill as described in scenario one, it may be possible for some of the brine plume to leak into the underlying gray limestone aquifer. However, since the surface spill in this scenario would be immediately apparent, contingency plans could be activated immediately before there is any significant movement of the brine plume in the surficial aquifer.

Any leak of brine into the gray limestone aquifer, even after several years, could be cleaned up with standard remedial methods, due to the slow movement of the contamination plume and the distance to the nearest potable well (about two miles to the west). Other wells nearby are for non-potable use and would not be impacted by brine water intrusion.

In scenario two, a postulated well casing leak allows about seven million gallons of brine solute into an aquifer over a period of 30 days. Separate brine leaks into the gray limestone and the Upper Floridan aquifers were simulated using this scenario. In the gray limestone aquifer, the 250 mg/l isochlor contour has a radius of about 650 feet after 30 days. After a period of 100 years, the plume enlarges and moves about 4,900 feet to the southeast. The 250 mg/l isochlor contour has a radius of about 2,000 feet at that point.

Although the gray limestone aquifer has the highest groundwater velocity of the three principal aquifers at the site, the groundwater velocity is still very small compared to most aquifers in Florida. Any brine leak into the gray limestone aquifer, even after a period of several years, could be cleaned up with standard remedial methods, due to the slow movement of the plume and the long distance to the nearest potable well (about two miles to the west).

The Upper Floridan aquifer is not used as a potable water source because the groundwater in this aquifer is brackish. The scenario for this aquifer is the same used for the gray limestone aquifer, with the injection of over seven million gallons of brine into the aquifer over a 30-day period. No appreciable rise in the water level or testing pressure occurred. The simulated brine plume moves little during the 100-year simulation time period and has a radius (250 mg/l isochlor contour) of about 650 feet.

For all of the aquifers analyzed, movement of the oil plume was minimal throughout the 100-year simulation. Upward movement of the oil plume is possible due to the lighter density of oil compared to water. However, no movement through the confining layers occurred and the oil remained as an immiscible fluid. Therefore, remedial clean-up efforts would be very effective due to the slow rate of flow and the effectiveness of the confining layers inhibiting upward migration.

In addition to leaks into the aquifers, it may be possible for a leak to occur in the casing at levels below the water bearing formations. The subfloridan anhydrites/carbonate rock formations lie beneath the "boulder zone" and the three aquifer systems. These formations consist of low permeability rock and are

not water bearing formations. Any oil leaking at these depths would remain in the immediate vicinity of the well bore. The low permeability of the rock would prohibit any significant vertical or horizontal movement away from the leak site. Confining layers of the aquifers would also prevent any oil from a well leak in the subfloridan carbonate rock layers from moving up into the aquifers. Therefore, an oil leak in the casing at depths below 3,800 feet would have no impact on any ground or surface water resources.

Two water supply wells would be drilled on site. These wells would serve as the primary and standby water supplies for drilling and sanitary uses on site. The total estimated water use from the wells would average about 7,500 gallons per day over the course of the drilling operations. The low withdrawal rate, the limited duration of the exploratory program and the distance to nearby active wells significantly limit any possible effects on the gray limestone aquifer system or its existing users. The total water use would be minimized through use of a "closed mud system," solids removal equipment, and stormwater collection/ utilization.

Proposed Access Route

The improvement of the proposed access route would result in slight impacts to the water resources of the area. The proposed access route would involve improving an existing roadbed from Snake Road east to the L-28 berm, a distance of approximately one and one-half miles. The existing access road is on an earthen berm approximately 15 feet in width, consisting of a one-lane, rock-filled roadbed. The access road would be improved to handle the weight and traffic of drilling equipment. The condition of the crushed limerock roadbed would be evaluated and additional fill material would be added as necessary. The access route would be maintained as a one-lane route. No new culvert construction would be required. Surface water flow patterns or discharge volumes would not be affected by the roadway improvement.

Limited widening at selected locations would be required to allow the safe passing of opposing traffic. These vehicle turnouts would be constructed at intervals of between 1/2 to 3/4 mile. These turnouts represent the only filling beyond the limits of the existing roadway berm.

Increases in sediment load to adjacent waterbodies could occur in locations where fill placement would be required to raise the access road elevation or widen the road to create the vehicle turnouts. The sediment would not be transported very far away from its source since the area is so flat. The impacts would generally be limited to localized increases in turbidity in the waterbodies.

The proposed access route would continue south along the west Levee of L-28. The existing west berm access road would be used. The improvement of this portion of the roadway would be similar to the

work on a surface water management canal segment. The purpose of the west berm is to contain surface waters, so no additional impacts to surface flow would occur. No additional culverts would be required. No changes in surface water flow patterns would result.

The proposed action includes a limited program of testing to determine hydrocarbon content and reservoir productivity if open hole evaluations provide indications of hydrocarbons. This production program would extend for a period of up to a month if multiple intervals of interest are encountered. Temporary test facilities would serve to separate, and meter the hydrocarbons and water produced. The hydrocarbons and water would be pumped into storage tanks during the tests. Water would be discharged into the "boulder zone." The oil would be trucked off-site to the Sunniland Pipeline pump station (about five miles from the site) for transportation to Port Everglades.

The chance for an oil spill exists if a tank truck was carrying the produced oil were to overturn along the access route. The potential impacts would be limited because of the 5,880 gallons maximum volume capacity of each truck. In the event of a spill resulting from oil transportation on the proposed access route, damage would be limited to the immediate surrounding ground surface, unless the spill occurred on the L-28 Levee segment of the route and oil entered the canal. In the unlikely event of this occurrence, a temporary shutdown of S-140 pumping operations would prevent oil from traveling outside the limited length of the L-28 Canal. This would allow time for a prompt cleanup of the contained spill. The small volume of material would produce minimal impacts to the surface and groundwater environment.

4.3.11.3 Impacts of Alternative B - West Access Route

The roadway construction would have slight impacts to the area in terms of filling new roadbed alignments to elevate the road surface above flood levels. The West Access Route option would extend from the south end of Snake Road east to the drill site just north of I-75. This would require fill placement along the entire route length, and culvert installation to maintain surface flows toward the I-75 borrow canal to the south. Surface water turbidity concentrations may become slightly elevated during construction.

A spill on the West Access Route would be similar to the spill magnitude as discussed for the proposed access route. A West Access Route spill could enter the I-75 borrow canal. This canal is discontinuous, and therefore, limited in the distance flow would travel. Accordingly, a cleanup effort of the contained spill would be effective if the initial response time is short.

4.3.11.4 Impacts of Alternative C - East Access Route

The roadway construction would have slight impacts to the area in terms of filling new roadbed alignments to elevate the road surface above flood levels. Additionally, some water would be needed for construction, but not a sufficient quantity to impact groundwater resources.

The East Access Route would include the use of an existing deceleration lane off of I-75, and the use of an existing SFWMD access road that leads to S-140 pump station. The access route would also require a new bridge to span the L-28 Canal. The L-28 Canal is not a water conveyance canal, therefore, a new bridge cannot have any channel flow capacity impacts. The bridge would be constructed to provide boat clearances and channel characteristics as required by SFWMD. These would involve a six-foot, low member, vertical clearance and a 25-foot horizontal clear span between bridge piles.

A spill on the East Access Route would be similar to the spill magnitude and impacts as discussed for the proposed access route. An East Access Route spill could enter the L-28 Canal. This canal is limited in the distance flow would travel. Therefore, a cleanup effort of the contained spill would be effective if the initial response time is short. Additionally, if a truck spill were to occur on the acceleration ramp, oil could possibly enter WCA-3A to the south of I-75. The construction of a berm along the south side of the ramp to contain such spills could reduce the likelihood of spilled oil flowing into the Conservation Area. The acceleration and deceleration ramps to I-75 were designed to provide access including large volume diesel fuel deliveries to SFWMD's S-140 pump station. Therefore, the East Access Route usage is consistent with the original design intent of the I-75 ramps.

4.3.11.5 Mitigation Measures

The proposed action allows for potential sediment discharge from access road construction areas into adjacent waters. The use of best management practices for erosion and sediment control (USDA, SCS, 1977, and U.S. Dept. of Transportation, FWHA, 1978) would greatly reduce such sediment impacts.

Control measures and structures, such as silt fences, could be used to control runoff, erosion, and off-site sedimentation. Silt fences could be used at the base of all fill and disturbed areas within 100 feet of waterbodies such as the Miccosukee surface water management canal and L-28 Canal. Silt fences could be constructed following the manufacturer's recommended specifications. All runoff and erosion control measures could be inspected periodically, cleaned out, and maintained in functional condition throughout the construction, drilling and reclamation periods.

Filled shoulders of the access road and topsoil stockpile areas could be seeded with an appropriate grass seed mixture. Straw mulching using only certified weed-free straw could be completed to protect the seed bed.

Access road fills other than those on existing embankments could be designed to minimize the disruption of surface water sheet flow. The roadway design could include culverts of appropriate size and spacing to adequately maintain sheet flow patterns.

Existing site-specific groundwater quality data is inadequate. Without an adequate baseline condition, it would be very difficult to verify that the proposed action would not have any significant impacts on water resources. A requirement for the establishment of a pre-drilling water quality baseline and a monitoring program could correct this deficiency and provide the means to quickly detect any drilling-related water quality impacts. The monitoring program could include the following elements:

- SWEPI would design and implement a water quality monitoring program for the projects which would be approved by the BLM and USGS prior to project construction. This program would include the developing of a QA/QC plan for the program, establishing baseline surface and groundwater quality, as well as existing aquatic conditions.

- Care would be taken to protect surface and subsurface water from contamination especially during the drilling phase when large amounts of produced water, drilling fluids, drilling muds, and oil may be in contact with the surface and subsurface waters. Surface and subsurface monitoring stations would be located upgradient and downgradient of the well site to document water quality.

- Each groundwater monitoring station should consist of nested or individual wells, located on the edge of the drill pad, with wells penetrating the two surficial aquifers (in the Fort Thompson and Tamiami Formations) and the intermediate (gray limestone aquifer). One upgradient station and two downgradient stations would be installed and monitored.

- Surface water sampling stations would be established in the L-28 Canal adjacent to the site and in the highway borrow canal adjacent and parallel to I-75.

- Water samples would be collected at surface monitoring stations and from subsurface water monitoring wells at the specified frequency. Insitu measurements of Ph, temperature, and specific conductivity would be made with appropriate instruments. Water samples for all other parameters would be prepared for storage/shipping following standard operation procedures and would be analyzed by an EPA certified lab for concentrations of selected water quality indicator

parameters. Indicator parameters are subject to revision by the BLM, depending on the type of proposed operation. Water quality indicator parameters consist of:

alkalinity
barium
benzene
chlorides
mercury
oil and grease
total petroleum hydrocarbons
Ph
sodium
specific conductivity
temperature
toluene
turbidity
xylene

- Water samples from surface monitoring stations and subsurface monitoring wells would be obtained and analyzed by an EPA certified lab at the following frequency unless otherwise specified by BLM.

  Upgradient - monthly before drilling and after APD approval and continuing monthly throughout the drilling operation; and continuing until site reclamation has been completed.

  Downgradient - monthly before drilling and after APD approval, continuing twice a month beginning when drilling operations start and continuing through well testing and until site reclamation has been completed.

- If surface or subsurface water contamination is documented that is reasonably attributable to oil and gas operations underway in the vicinity, operations must cease immediately and would be immediately modified to rectify procedures causing contamination. Cleanup and restoration must be started immediately, and monitoring would continue until complete reclamation has been accomplished. Under such circumstances, additional testing for one or more of the following water quality parameters may be required by BLM at a frequency determined by BLM:

BOD
calcium
DO (surface water only)
magnesium
metals
sulfates
total dissolved solids (TDS)

- A standardized format would be used to record, list, and display all data.

A report representing the results of the water quality monitoring for each station must be submitted to the BLM upon completion of each analysis (monthly for upgradient stations; bi-monthly for downgradient stations). This report would consist of the following components:

  - A summary table that defines sample station, date of collection, and value for each parameter.

  - A graphic comparison of the differences between sites for each parameter (each graph should represent one parameter for each site; all data should be plotted as bar graphs, and each graph should give the date, site, and specific parameter).

- An annual report presenting the results of the water quality monitoring for each station would be submitted to the BLM. This report would consist of a summary table that defines the sample station, dates of collection, and unit value for each parameter.

- All data and results of monitoring efforts must be reported to the BLM.

- All produced salt water (brine) must be disposed of in accordance with applicable State and Federal laws and regulations. Brine would not be released on surface lands or waters under any circumstances.

Additional general mitigation recommendations that could be implemented to reduce water resource impacts to non-significant levels include:

- Guide all phases of the project, including road and well site construction, reclamation and abandonment, by applicable regulations of the Clean Water Act.

- Minimize the area of disturbance to that absolutely necessary for construction, operation and reclamation to reduce impacts to water resources.

- All water withdrawal and use would comply with applicable Federal and State laws.

- Site wells (i.e., nonproductive, water) would be plugged and capped. The water supply wells would be capped, but not plugged if desired by the Miccosukee Tribe. Well caps would be welded in place, or secured with locks to prevent tampering.

4.3.11.6 Residual Impacts

The proposed action and mitigation is not likely to result in any significant water resources impacts. This includes potential impacts relative to the degradation of surface or groundwater, modification of surface water flow or groundwater elevations and flow, and sediment input to surface waterbodies. Several factors influence this assessment. These include:

- Incorporation of multiple, redundant spill containment elements in the design of the well which includes five separate casing and cementing elements to protect aquifers and provides the necessary basis for well control, interior berming and lining of likely spill areas, complete perimeter berming of the site to contain larger spills and exclude flood waters.

- Reuse of site drainage and stormwaters to the maximum practical extent and disposal of excess stormwater and drilling fluids into the "boulder zone" such that there would be no discharge from the site.

- The existence of a surface and groundwater hydrologic environment which consistently retards flows from the site and contributes to the local containment of potential contaminant spills.

- The separation of the site by distance and/or physical barriers to flow from WCA-3A and important potable water aquifers such as the Biscayne aquifer.

The cumulative impacts of the proposed action would be very minor. Existing land and resource management activities within the project area include the use of grazing land, and the operation and maintenance of I-75 and the canal and levee system. These activities have resulted in some alterations to the natural system, but do not severely impact water resources. Cumulative impacts to the system from the proposed action include a slight and temporary reduction in surface runoff resulting from the containment of surface water on the drill site, and minor increase in sediment input to surface water from roadway construction and use.

4.3.12 Wetlands

Wetland impacts that would result from the proposed action and alternatives are discussed in the following sections.

4.3.12.1 Impact Significance Criteria

Significance Criteria

Impacts produced by the proposed action or alternatives would be considered significant if:

- Wetland vegetation is disturbed or removed in violation of Section 404 of the Clean Water Act; or

- Loss of wetland habitat at any individual location or the combination of which exceeds one acre.

4.3.12.2 Impacts of Alternative A - Proposed Action

The proposed action includes improving the access route which presently consists of existing fill roads, by adding road fill on top of the existing grade. Widening of the existing access route is not required. Vehicle turnouts (100 feet x 15 feet each) located approximately every 1/2 to 3/4 mile would be field located to assure that wetlands are not impacted by construction and fill placement. Therefore, the access route would not have any effect on wetlands. The drill site would be located on an upland pasture area and would not affect wetlands.

4.3.12.3 Impacts of Alternative B - West Access Route

A new road following a trail and associated vehicle turnouts extending from Snake Road eastward to the well site would be routed to the extent practical to minimize impacts to wetlands. The route as depicted on Figure 3-13 would require placement of fill for road crossings in four separate marsh areas. The crossings would be 125, 250, 110 and 125 feet in length by 15 feet in width. Vehicle turnouts would be field located to avoid any wetland impacts. Authorization by the COE would be required for this alternative. Restoration or mitigation features may be required as a condition of a COE permit. A total of approximately 0.25 acres of wetlands would be filled.

4.3.12.4 Impacts of Alternative C - East Access Route

The East Access Route requires construction of a pile-supported one-lane bridge across the L-28 Canal. The bridge could require placement of concrete piles in the canal. No other wetland impacts would occur. Placement of bridge piles in the L-28 Canal immediately north of the existing I-75 would constitute a minor impact.

4.3.12.5 Mitigation Measures

The exact boundaries of the drill site and the west access route could be field staked and inspected by a representative of the COE to prevent and minimize wetland impacts to the extent possible. Wetland mitigation could be completed as required by the COE. Soil removed from the drill site prior to construction could be stockpiled in non-wetland (pasture) area adjacent to the well pad.

4.3.12.6 Residual Impacts

The proposed action and alternatives would not significantly impact wetlands. The West Access Route would require placement of fill in approximately 0.25 acres of marsh. This impact would be temporary, ceasing upon road reclamation at the completion of the project, unless the Miccosukee Tribe were to request that the road remain in place.

4.3.13 Wildlife

4.3.13.1 Impact Significance Criteria

In order to define significant impacts to Federal-listed wildlife species, criteria derived from government regulatory standards, existing scientific documentation, previous environmental documents and/or professional judgement of resource specialists is utilized. The criteria for specific endangered and threatened species were based largely on existing endangered species recovery programs.

The criteria for general wildlife and game species in this document are based on basic ecological principals and incorporate regulatory standards.

General Wildlife

An action would be significant if it disrupts nests or breeding grounds of native wildlife species to the extent that it causes a measurable negative effect to a population of that species. The action should not

permanently interfere with the routine movements of wildlife species within the Reservation or between the Reservation and WCA-3A.

Florida panther

The Florida Panther Recovery Plan, as revised in 1987, includes a recovery objective to achieve three viable, self-sustaining populations within the panther's historic geographical range. An action would be considered significant, if it interferes with this Recovery Plan goal. More specifically, the permanent elimination or decrease in size of any individual panther's known home range would be considered a significant impact.

The panther's range is based on data from radio-collared individuals. It is extremely difficult to determine home range measurement without this type of information.

Everglades snail kite

The Florida Snail Kite Recovery Plan (1986) includes an interim population goal for the species. The goal calls for an annual average of 650 birds for a 10-year period with annual population declines of less than 10 percent of the average population size. Currently, the statewide population of snail kites does not meet the goals of this plan.

An action would be considered significant if it would interfere with the goals of the Snail Kite Recovery Plan.

Bald eagle

The USFWS Bald Eagle Habitat Management Guidelines are utilized in making decisions regarding proposed development near bald eagle nests. In short, the guidelines suggest two management zones be established around a nest; the Primary and Secondary Zones. The Primary Zone extends from the actual nest tree to a radial distance of 750 - 1,000 feet, depending on site conditions. This is the zone which must be maintained to promote acceptable conditions for eagles. Expansive forest habitats or optimal site conditions usually dictate smaller required Primary Zone size. The Secondary Zone is needed to minimize disturbances that may compromise the integrity of the Primary Zone, and ranges from 750 feet to one mile from the nest.

An impact would be significant if it involved construction within the primary zone. Construction or disruptive activities, if allowed, should not be permitted during the nesting season within the primary and secondary zones.

Wood stork

The recovery objectives in the Wood Stork Recovery Plan are centered around maintained numbers of breeding pairs in the U.S. population. Current goals include downlisting the U.S. population when levels reach and are maintained at 6,000 breeding pairs, and de-listing if the U.S. population reaches and maintains 10,000 breeding pairs (USFWS, 1986).

Presently, the total population estimate is 10,000 adult birds (USFWS, 1991). Fewer than 5,000 pairs have bred each year since 1978. An action would be considered significant if it interfered with Recovery Plan goals through loss of any nesting individuals or nesting habitats.

Eastern indigo snake

The recovery plan for this species is over 10 years old and is generalized in its objectives. It calls for the protection of existing reproductive colonies of indigos and re-establishment of historical populations, where suitable habitat exists within the historical range of the species. The Recovery Plan (1982) states that in "South Florida the snake prefers pinewoods and terrestrial habitats, and avoids Everglades marsh." This species may be found within the study area and in hammocks, canal berms, and levees. Impacts to this species would be considered significant if they contribute to a decline of the regional population of Eastern indigo snakes.

4.3.13.2 Impacts of Alternative A - Proposed Action

Significant impacts to general wildlife values are not anticipated as a result of the proposed project and access alternatives. The proposed well site construction would result in the removal of five acres of improved pasture, planted in primarily non-native grasses. The well site does not support significant or sensitive populations or wildlife. A discussion of impacts to Federal-listed wildlife species follows.

American alligator

A confirmed alligator nest site is approximately 20 feet east of the existing road proposed for access to the site. The site was not active during the 1991, 1992 or 1993 breeding seasons. A nest at this site would not be directly affected by the access road but may be subject to disturbance by road improvement activities and passing traffic, if these activities occurred during the nesting season from early June through September. Depending on the availability of alternative nesting sites, a female could be displaced or forego nesting for the season. No significant effect to this species is anticipated.

Florida panther

The proposed action and alternatives are not likely to negatively affect the Florida panther. Direct effects are highly unlikely as a result of the proposed action, since panthers are not known to utilize the proposed site for any stage of their life cycle. Indirect effects to panthers through decline in habitat, decreases of individual home ranges or panther geographic range or decreases in prey item availability is unlikely as well.

The proposed access route is unlikely to disrupt the movements of panthers or result in road kills. The increase in activity may discourage use of the area by young males, but this area is not routinely utilized by panthers. No indirect impacts from increases in public use of the road would be expected. The proposed access road off Snake Road would be gated, locked and guarded for the duration of the drilling operation, public access would not be permitted. The Miccosukee Tribe does not generally permit public use of the access route at any time. The potential for collision related mortality resulting from increased traffic along the access routes would increase slightly during construction and drilling operations. This temporary increase would be expected to be negligible, as panthers rarely utilize this area. It is anticipated that drilling operations would continue 24 hours a day. Panthers are less likely to be active during daylight hours than at night.

Florida black bear

The black bear is not likely to utilize the area of the proposed action, due to poor habitat.

Florida Everglades mink

It is not known whether this species utilizes habitats within the proposed project limits. If mink occur in the area, they are likely near the L-28 Canal. The canal and, therefore, the mink would not be affected by the proposed action. In addition, the literature indicates that mink tolerate human activities (Smith, 1980).

Everglades snail kite

The proposed action would not likely affect the snail kite, directly or indirectly, for a number of reasons. First and most important is that no suitable nesting or habitat is found within the five-acre site, or within the entire study area. Foraging habitat, defined as extensive freshwater marsh containing apple snails, is also lacking on the site, but is very available in the Conservation Areas. Though snail kites have been observed within the study area, they do not likely utilize the project area habitat.

The known concentration of snail kites lies far enough to the south that nesting would not be disturbed by the proposed action. The project would not be expected to affect snail kites.

Bald eagle

The nearest known eagle territory lies seven miles south of the proposed action. Suitable feeding and nesting areas do not occur in the project area, so negative effects to this species would not be anticipated.

Wood stork

This species likely utilizes the immediate area for feeding, but nesting activities have not been documented. The proposed action would temporarily result in human activity in the vicinity of the canals and ditches which may be utilized by storks. However, this species is known to utilize roadside ditches all over Florida, and is not commonly disrupted by vehicles and human activity.

Eastern indigo snake

The negative effects realized by the Eastern indigo snake due to the proposed action would not likely be regionally significant. This snake is a highly mobile species, and the project is temporary in duration. If the indigo snake does in fact utilize the canal bank/berm habitat on the site, they could re-colonize the site subsequent to the reclamation process. Mortality of individuals along the access routes could occur. The negative effects to this species are not likely to be regionally significant or contrary to the Eastern Indigo Snake Recovery Plan.

Southeastern American kestrel

The Southeastern American kestrel is not likely to utilize this site for foraging since suitable nesting habitat does not exist in the project area. However, individuals could stray into the area during lengthy feeding forays. No effect to this species is anticipated.

Audubon's crested caracara

It is unlikely that the project is utilized regularly by caracara. However, according to Jim Layne, FGFWFC, even if the project site was within the home range of a caracara, the proposed drilling activity would not significantly affect the species. Construction related activities on five acres of improved pasture and the temporary increase in vehicular use in the area is not expected to prevent use of the area by caracaras. No appropriate nesting habitat would be disturbed by the proposed project.

Florida sandhill crane

Marsh habitat suitable for sandhill crane nesting would not be impacted by the project. The well site would displace five acres of pasture, which could potentially be utilized for foraging. However, this is a small percentage of the more than 4,000 acres of pasture area in the vicinity of the project.

4.3.13.3 Impacts of Alternative B - West Access Route

As previously discussed in Section 2.2, this alternative includes a 1.6 mile access route north of I-75 between the Snake Road interchange and the proposed drill site. Additional construction would consist of providing a functional roadway for vehicular access. The proposed route is currently an unimproved trail. The construction of this road and the use of the area by vehicles would increase the current level of disturbance resulting from agriculture and maintenance vehicles.

Minor impacts to wetland-dependent species may occur due to the loss of 0.25 acres of wetland habitat (marsh). However, though some mortality would result, the negative effects would generally be temporary in nature. No avian rookeries or roosts are known to occur along the proposed roadway. Willow and cypress head habitat, which is potential roosting or rookery habitat, would be subjected to the effects of road traffic. Increased usage of the area would displace the less tolerant species, but would not affect resilient species or animals adapted to the noise of I-75. Listed species are not likely to be affected by this alternative.

4.3.13.4 Impacts of Alternative C - East Access Route

The effects on wildlife associated with this alternative would not be significant. The bridge is the only new construction proposed. Negative effects may include increased turbidity within the L-28 Canal during bridge construction. If present, turbidity should be low-level and of short duration. Aquatic fauna would leave the area of turbidity during the construction process.

4.3.13.5 Mitigation Measures

Mitigation measures could include limiting vehicle speeds on the access routes, particularly at night to reduce the potential for collisions with wildlife. In addition, site worker shift changes could occur during daylight hours to the maximum extent possible to reduce traffic during night hours.

4.3.13.6 Residual Impacts

The proposed action or alternatives would not significantly impact wildlife in the area due to several factors:

- The project site has been substantially altered and does not provide preferred habitat for any of the Federal or State-listed species known to occur in the area.
- Areas of quality wildlife habitat (willow heads, marsh, cypress heads and hammocks) are avoided by the drill site and access routes. The exception is 0.25 acres of marsh that would be impacted by the west alternative access road.
- The project is temporary in nature, lasting a maximum 325 days and would be returned to pre-project conditions, at the discretion of the Miccosukee Tribe. The only access road would be gated for the duration of the project and would not be available for by the general public even after the project is abandoned. Therefore, the project would not result in long-term or cumulative impacts.
- The project design and operation plan has incorporated contingencies to minimize impacts to wildlife including cumulative impacts, and irreversible activities.

No significant negative impacts to Federal-listed wildlife are anticipated for the proposed project. An alligator nest has been known to occur along the west side of the L-28 Canal approximately one mile north of the well site and approximately 20 feet east of the existing road. Improvement of this road for the proposed access road does not include widening. Depending on the time of year, road improvement and drilling activities could displace an alligator or, depending on alternative nest site availability, could prevent nesting for the season. This impact is expected to be short-term.

Construction and drilling activities may result in avoidance of the area by wood stork, Eastern indigo snake, and Florida panther but this is not considered significant, as the project site does not provide nesting habitat or important foraging areas for any of these species.

Suitable habitat for the Southeastern American kestrel, bald eagle, snail kite, Audubon's crested caracara, and Florida black bear does not occur on the site. These species would not be impacted.

4.3.14 No Action Alternative

No Action would mean the proposed action and alternatives would be denied, resulting in a denial of the APD.

Under this alternative the project area would not be impacted by the proposed action or alternatives considered in this FEIS and would continue to exist as described in Chapter 3. However, should this alternative be selected, several economic impacts could result.

A negative economic impact could be felt on the Miccosukee Reservation as the site would not be explored to determine the potential for hydrocarbons. In this regard the Tribe would not realize revenue from development of the oil and gas lease, or be able to evaluate the potential for future revenue from available hydrocarbons, which could provide economic assistance to existing and future programs and services throughout the Reservation. Furthermore, jobs for some Miccosukees would also not be realized. Given the Miccosukee Tribe unemployment rate of 35 percent, any jobs created by the project would be beneficial in terms of improving employment.

4.3.15 Unavoidable Adverse Impacts

Unavoidable adverse impacts are significant impacts that are unavoidable and cannot be mitigated and, therefore, would remain throughout the duration of the project to some point beyond.

No unavoidable significant adverse impacts would be expected to occur as a result of implementation of the proposed action or alternatives. Impacts that would occur would be insignificant because of their short-term nature and/or their low magnitude of disturbance to the human or natural environment.

Disturbance of the drill site and access route soils and vegetation by fill placement would be temporary, culminating with reclamation upon completion of the proposed action. However, if the Miccosukee Tribe determined that the fill would remain in place, the impact, although minor, would extend beyond the completion of the proposed drill action. The impacts would include five acres of fill within a pasture for the proposed action; three acres of fill within a pasture including 0.25 acres of fill within wetland areas for Access Route B; and a piling supported concrete bridge across the L-28 Canal for Access Route C.

4.3.16 Cumulative Impacts

Cumulative impacts are impacts likely to occur due to the proposed action or alternatives in combination with other past, present and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. For example,

cutting one acre of a 5,000-acre forest to create a homesite may be an insignificant impact. If the remaining forest has been divided into similar one acre homesites, the cumulative impact of clearing all lots would be great. Four factors are considered in the assessment of cumulative impacts:

- Impacts Which Would Occur as a Result of the Proposed Action,
- Geographic Boundaries of the Impacts,
- Impacts That Have Occurred as a Result of Past Actions, and
- Potential Impacts of Reasonably Foreseeable Future Actions.

Impacts Which Would Occur as a Result of the Proposed Action.

The analysis conducted for the FEIS has resulted in a determination that no significant impacts would occur to the environment as a result of the proposed action or alternatives. Construction and operation of the proposed project or alternatives is not expected to cause significant cumulative impacts to air, cultural, geologic, aesthetic, socioeconomic, transportation, vegetation, water, wetlands, or wildlife resources within the project area. More importantly, in terms of cumulative impact assessment, the minor impacts associated with the proposed action are mostly short-term in nature, lasting 325 days or less. The drill site and access road may not be restored if the Miccosukee Tribe requests that these features remain in place, resulting in the permanent impact of five acres of fill area within the pasture for the drill site; three acres of fill within the pasture including 0.25 acres of fill within wetland areas for Access Route B; and a piling supported concrete bridge across the L-28 Canal for Access Route C.

Geographic Boundaries of the Impacts

In order to evaluate the cumulative impacts of an action, geographic boundaries must be established. Physical boundaries such as watersheds, biological boundaries such as habitats, socioeconomic boundaries such as market areas or regions, and political boundaries such as counties may be appropriate for setting analytical parameters, depending on the specific values affected. For each resource an outer boundary can be determined beyond which the impacts of the proposed action are not extended. In considering the proposed action and alternatives, the geographic boundary of the area of impact ranges from the five-acre drill site to several miles as in the case of visual impacts. The area of impact to soils, vegetation, and wetlands is expected to be limited to the five-acre drill site and access road and areas immediately adjacent to these facilities. The area of impact to air quality, water resources and wildlife may extend several hundred feet from the drill site and access road. The boundary of impacts to transportation,

noise, and visual resources ranges from several thousand feet to several miles. The area of impact for most resources is the site vicinity discussed and depicted on maps in the FEIS.

Impacts That Have Occurred as a Result of Past Actions

Past actions within the established geographic boundaries for resource evaluation have resulted in impacts to the environment. It is not possible or necessary to quantify and qualify the conditions of the entire Everglades Ecosystem prior to the first impacts of man and identify each subsequent action and its impacts. The region of the proposed action (the Everglades ecosystem) has been significantly altered by water management and land development activities over the past 100 years. These activities have resulted in a well documented general decline in water quality and wildlife resources. Within the geographic boundaries of the area that could be impacted by the proposed action and alternatives, construction of WCA-3A, L-28, and the S-140 pump station have resulted in a hydrological regime in the project area conducive to maintaining a large area of pasture between WCA-3A and the Big Cypress Swamp. The area has been further altered by construction of I-75 and Snake Road. Presently, the main activities on the Miccosukee Reservation are limited to hunting, fishing, and cattle grazing. Facilities in the area that could be impacted by the proposed action and alternatives are limited to three microwave towers, the Miccosukee Service Plaza, billboards, ditches, pasture areas, fencing, primitive roads, the S-140 pump station, public roads, electrical transmission poles and lines.

Potential Impacts of Reasonably Foreseeable Future Actions

Impacts that may accumulate from other reasonably foreseeable actions in the geographic boundaries of consideration must also be considered in the evaluation of cumulative impacts. The FEIS establishes that the proposed action is not likely to lead to future actions (reasonably foreseeable actions) that result as part of the proposed action. The Miccosukee Tribe's future land use plan is general and does not detail reasonably foreseeable development plans for the Reservation. Specific Everglades restoration plans which could potentially impact the Reservation are not in existence at this time.

Conclusion

In considering the four factors, the proposed action and alternatives would be expected to result in short-term and/or insignificant impacts, confined primarily to the immediate project area. The impacts associated with the project will not contribute significantly to past or present impacts within the affected area, and the proposed action and alternatives would not be likely to lead to future actions (reasonably foreseeable actions). Therefore, the project would not be expected to result in significant cumulative impacts.

CHAPTER FOUR

4.3.17 Comparative Analysis of Proposed Action and Alternatives

The access routes are the only variable in the proposed action and alternatives.

The proposed access route (Alternative A) requires vehicles to travel approximately 11 miles from the intersection of L-28 and I-75 to reach the well site located only 1,000 feet away. This route requires placement of fill on 0.4 acres of pasture in order to construct vehicle turnouts. The public interchange at I-75 and Snake Road would be utilized. Project traffic would travel over five and one-half miles of remote area on existing berm roads adjacent to canals.

The West Access Route (Alternative B) requires vehicles to travel approximately 3.2 miles from the L-28/I-75 intersection to reach the drill site. This route would require fill placement on three acres including 0.25 acre of wetlands in order to create a new access route. The new route would extend from the Miccosukee Service Plaza east to the drill site, passing closely to hammocks, a cypress head, and marshes. Construction of this route may interrupt the natural sheetflow of runoff even if culverts are placed through the road section at close intervals.

The East Access Route (Alternative C) provides direct access to the site from the intersection of I-75 and L-28. Construction of a new bridge over the manmade L-28 Canal would have minimal impacts. This Alternative would not require the use of the Snake Road/I-75 interchange or Snake Road. The existing access from I-75 to the S-140 pump station appears adequate to support project traffic without disrupting I-75 traffic or access to the pump station by SFWMD personnel.

None of the alternatives would result in significant environmental impacts. The West Access Route is the least desirable in terms of impacts to habitats and surface water flow because it requires a new road. The East Access Route (Alternative C) is the most direct to the well sites limiting the effects of the proposed activity to the immediate well site area. Potential prohibitions to the use of Alternative C and the proposed access route are more related to agency policies than environmental impacts. FDOT and FHWA limits use of nonpublic access points from I-75. FHWA is opposed to the east access alternative if other alternatives are practicable, and SFWMD may have authority over activities in the vicinity of the L-28 Canal, the site of the proposed access route and the bridge required in Access Route C. A binding position from these agencies cannot be obtained without a formal proposal.

A summary of the impacts of the proposed action and each access alternative is presented in Table 4-2.

TABLE 4-2
IMPACT SUMMARY OF PROPOSED ACTION & ALTERNATIVES

	ALTERNATIVE A				ALTERNATIVE B	ALTERNATIVE C
	DRILL SITE CONSTRUCTION	EXPLORATORY DRILLING	WELL TESTING	ABANDONMENT & RECLAMATION	PROPOSED ACCESS ROUTE	WEST ACCESS ROUTE	EAST ACCESS ROUTE
AIR RESOURCES	Minor impacts from fugitive dust and vehicle emissions	Minor impact from drill rig engine emissions	Minor impacts from pump engine emissions and process emissions	Minor impacts from fugitive dust and vehicle emissions	Minor impacts from fugitive dust and vehicle emissions along 5.5 miles	Minor impacts from fugitive dust and vehicle emissions along 1.6 miles	Minor impacts from fugitive dust and vehicle emissions at site
CULTURAL RESOURCES	No impact	No impact	No impact	No impact	No impact	Known site close to access route would be avoided	No impact
GEOLOGY/SOILS	Disturbance of soil profile by 5 acres of fill area	No impact	No impact	No impact	Disturbance of soil profile by 0.4 acre of fill area for vehicle pullouts	Disturbance of soil profile for 3 acres of fill area	No additional fill area, bridge piles
HEALTH & SAFETY	Minor risk of contaminant release or equipment accident	Minor risk of contaminant release or equipment accident	Minor risk of contaminant release or equipment accident	Minor risk of contaminant release or equipment accident	Minor risk of contaminant release or equipment accident	Minor risk of contaminant release or equipment accident	Minor risk of contaminant release or equipment accident
NOISE	Minor impact by vehicles and equipment	Minor impact by drill rig motors	Minor impact by equipment	Minor impact by vehicles and equipment	Minor impact by vehicles along 5.5 mile route	Minor impact by vehicles along 1.6 mile route	Direct to site, impacts limited to well site area
SOCIOECONOMIC	Economic benefits to Miccosukee Tribe through lease fees for exploration	Economic benefits to Miccosukee Tribe through lease fees for exploration	Economic benefits to Miccosukee Tribe through lease fees for exploration	Economic benefits to Miccosukee Tribe through lease fees for exploration	Economic benefits to Miccosukee Tribe through lease fees for exploration	Economic benefits to Miccosukee Tribe through lease fees for exploration	Economic benefits to Miccosukee Tribe through lease fees for exploration
TRANSPORTATION	Increase of traffic by 10 to 25 VPD by vehicles accessing drill site	Increase of traffic by 10 to 25 VPD by vehicles accessing drill site	Increase of traffic by 10 to 25 VPD by vehicles accessing drill site	Increase of traffic by 10 to 25 VPD by vehicles accessing drill site	Minor traffic increases along I-75 and Snake Road	Minor traffic impacts on I-75 and Snake Road interchange	Minor traffic increase on I-75, no effect on Snake Rd, requires bridge
VEGETATION	Filling of 5 acres pasture	No impact	No impact	No impact	Filling of 0.4 acre of pasture for turnouts	Filling of .25 acre -marsh; 2.8 acres - pasture	No impact

TABLE 4-2
IMPACT SUMMARY OF PROPOSED ACTION & ALTERNATIVES

	ALTERNATIVE A				B	C
	DRILL SITE CONSTRUCTION	EXPLORATORY DRILLING	WELL TESTING	ABANDONMENT & RECLAMATION	PROPOSED ACCESS ROUTE	WEST ACCESS ROUTE	EAST ACCESS ROUTE
VISUAL RESOURCES	Visible from I-75	Visible From I-75	Visible from I-75	Visible from I-75	Visible from I-75 only near well site	Visible from I-75 for 1.6 miles	Visible from I-75 only at well site
WASTE MANAGEMENT	No impact, minor risk of waste spill	No Impact, minor risk of waste spill	No impact, minor risk of waste spill	No impact, minor risk of waste spill	No impact, minor risk of waste spill	No impact, minor risk of waste spill	No impact, minor risk of waste spill
WATER RESOURCES	Accidental contaminant release could effect water quality	Accidental contaminant release could effect water quality	Accidental contaminant release could effect water quality	Accidental contaminant release could effect water quality	Accidental contaminant release could effect water quality, runs adjacent to canals for 5.5 miles	Accidental contaminant release could effect water quality, new barrier to NE-SW sheetflow	Accidental contaminant release could effect water quality, crosses L-28 Canal directly to site
WETLANDS	No impact	No impact	No impact	No impact	No impact	.25 acre wetland fill	No impact
WILDLIFE	Minor disturbances from humans and noise	Minor disturbances from humans and noise	Minor disturbances from humans and noise	Minor disturbances from humans and noise	Crosses through 5.5 miles of remote area, passes a known alligator nest	Crosses 1.6 miles of pasture adjacent to hammocks, wetlands	Disturbance limited to vicinity of well site
CUMULATIVE IMPACTS	5 acres of additional fill area if not reclaimed	No impact	No impact	No impact	0.4 acre of additional fill area if not reclaimed	3 acres of fill area including .25 acre of wetland fill if not reclaimed	New bridge over L-28 near I-75

4.3.18 Potential Conflicts Between Proposed Action/Alternatives and Plans, Policies and/or Controls

The proposed access route may be within an O&M easement held by SFWMD. The SFWMD asserts that it has the authority to require SWEPI to obtain a permit to use the proposed access route. The Miccosukee Tribe disputes this assertion. There are no potential conflicts between the proposed drill site or Alternative B access route and plans, policies, and/or controls applicable to the site activity. Alternative C would require use of a nonpublic access from I-75. The policies of FDOT and FHWA regarding the particular access proposal appear to be dependent upon the practicability of access alternatives which utilize existing public access from I-75 (see correspondence with FDOT and FHWA, Appendix A-12).

4.3.19 Irreversible and Irretrievable Commitment of Resources

The term "irreversible commitment of resources" describes the loss of future options. This primarily applies to the effects of using non-renewable resources (e.g., minerals or cultural resources) or to processes or factors (e.g., soil productivity) that are renewable only over long periods of time. The term "irretrievable commitment of resources" refers to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is irretrievably lost while an area serves as a agricultural field. The production lost is irretrievable, but the action is not irreversible; if use changes, timber production could resume.The proposed action or alternatives would result in the irretrievable loss of five to eight acres of pasture and 0.25 acres of wetlands that would be converted to well pad and access road. The loss may be temporary, as pasture could be reestablished on the sites upon the completion of the drilling, testing and evaluation. The proposed action or alternatives would not result in any irreversible commitment of resources.

4.3.20 Long-Term Productivity Versus Short-Term Use of Resources

This discussion applies to the proposed action and alternatives and not to field development. Field development is discussed in Appendix A-1. As discussed under each resource element in this chapter, the impacts associated with implementing the proposed action or access alternatives would be short-term impacts. No important irreversible commitment of resources would occur. Any irretrievable commitment would be short-term and reversible. Therefore, the short-term use of resources (i.e., impacts) would not compromise the long-term productivity of the project area.

4.3.21 Energy and Natural Resource Requirements and Conservation Potential

Energy required for this project is limited to fuels required to power equipment and vehicles. Due to the limited duration of the project (325 days total including site preparation and reclamation), the

requirements for energy are short-term. Natural resource requirements are limited to water use of approximately 7,500 gallons per day for the duration of the project. Site runoff is being circulated into the drilling system as a disposal method which would have the added benefit of water conservation.

4.4 Mitigation Summary and Monitoring

The mitigation and monitoring measures presented in Sections 4.4.1 through 4.4.13 are derived from the analysis of each element in this FEIS and could be included as Conditions of Approval for the SWEPI APD to ensure SWEPI's commitment to prevention of and in response to potential impacts of the proposed action and alternatives.

Specifically, these measures describe how the drilling operations could be managed consistent with the APD, applicable lease conditions, and with applicable Federal and/or State regulations. These measures meet or exceed the applicable monitoring stipulations of the Minerals Management Plan for the Big Cypress Preserve (U.S. Department of the Interior [USDI], 1991).

The BLM Standard Conditions of Approval for Permit to Drill would apply. These conditions are presented in Appendix A-13.

In addition to monitoring and reporting by SWEPI, the BLM compliance staff would inspect the activity for compliance with the drilling permit. The operation would be monitored by BLM through required daily drilling reports and would be subject to inspection at any time during the operation. BLM compliance staff are available 24 hours a day for inspections and emergencies. At a minimum, the following inspections would be conducted:

- The BLM inspectors would meet with Miccosukee Tribal, BIA and SWEPI personnel after site construction and prior to drilling operations to review the location construction for compliance with the approved plan.
- An initial detailed drilling inspection. Witnessing of the cementing of the surface casing and witnessing test of blowout preventer and associated equipment.
- Detailed drilling inspection.
- Detailed drilling inspection and inspection of H_2S equipment.
- Plugging inspection (if dry hole).

- Monitor reclamation work.

4.4.1 Air Quality

To assure that air emissions related to the proposed action are kept to a minimum, the following measures could be implemented:

- Burning of vegetation, construction debris or site-produced wastes would not be allowed.
- Roads would be watered as needed to minimize release of dust and suspended particles from road traffic and construction activities.
- Necessary precautions would be taken to prevent and suppress wildfires. Fire prevention and suppression equipment would be provided on site.

4.4.2 Cultural Resources

The proposed drill site was subject to an archeological survey in February, 1990. The proposed access route and Alternative C, the East Access Route, would utilize existing filled roads. Alternative B, the West Access Route, would require a new road in an area unimpacted by construction. Accordingly, an archeological site survey could be conducted on the West Access Route prior to construction. If SWEPI were to encounter any evidence of archeological artifacts or activity during drill site and access road construction, all work could cease and the Miccosukee Tribe, BLM, BIA and the DHR could be notified.

4.4.3 Geology/Soils

Filled shoulders of the access road and topsoil stockpile areas could be seeded with an appropriate grass seed mixture. Straw mulching using only certified weed-free straw could be completed to protect the seed bed.

Site reclamation could be monitored to assure that the soil profile and site topography is properly reestablished. If the fill areas were left in place at the request of the Miccosukee Tribe, proper stabilization of fill by vegetation could be accomplished and documented. Soil stockpiled during drill site construction could be stabilized to prevent erosion.

4.4.4 Health and Safety

In order to decrease the risk of accident resulting from vehicle traffic associated with the proposed action, warning signs could be placed at strategic locations along Snake Road (for the proposed action and Alternative B) or along I-75 (for Alternative C) to alert road users of the project traffic activities. Access routes could be properly signed to indicate maximum speed, turnouts, curves, etc. (as approved by FDOT or the Miccosukee Tribe as appropriate).

Health and safety training of SWEPI employees and contractors on-site could include learning the signs of heat emergencies and first aid measures.

4.4.5 Noise

Mitigation measures for noise abatement would not be required due to the nature and location of the proposed action in relationship to existing sources of noise.

4.4.6 Socioeconomic

The proposed action would not have any adverse social impacts. The SWEPI lease provides for positive economic benefits to the Miccosukee Tribe. Mitigation measures would not be required.

4.4.7 Transportation

Several mitigation measures could be undertaken to minimize the short-term impacts of traffic from the proposed action including: the posting of warning signs to alert other drivers of increased vehicle activity (i.e., trucks entering and exiting highway, trucks turning, etc.); temporarily reducing vehicle speed limits within one mile in each direction along Snake Road; use of escort vehicles for permit loads during construction and dismantling activities; utilization of a single lane for truck traffic associated with the proposed action on a specified portion of I-75 to minimize driver discomfort and accident probability; and installation of a cattle guard and gate at the entrance of the proposed access route from Snake Road to assist the flow of vehicles entering and leaving that access route.

4.4.8 Vegetation

Mitigation measures that would minimize impacts to vegetation include the following actions: SWEPI could provide a qualified inspector on site during all construction activities to ensure construction compliance with approved road and drill site design plans; any new access roads could be designed to conform in general with BLM Road Standards (BLM Manual Section 9113); all vehicles could be

restricted to existing roads, and roads constructed as part of the proposed action or alternatives; reclaimed areas could be monitored for success in terms of reduced erosion and revegetation in accordance with BLM and BIA requirements and the project reclamation plan; the location of vehicle turnouts required for the proposed access route could be inspected by a qualified biologist to assure that State-listed plant species are avoided; wetland impacts that would occur as a result of construction of the West Access Route could be mitigated in accordance with criteria established by the COE.

4.4.9 Visual Resources

Several measures could be undertaken to mitigate visual impacts. Watering of unpaved access roads during dry periods could minimize the visual impact of truck-created dust plumes. The visual appearance of the rig and drill site could be maintained in a clean and orderly manner.

4.4.10 Waste Management

Analysis of the proposed liner system (12 mils thickness) indicated that increasing the thickness to a minimum of 20 mils would provide a significant increase in protection of the groundwater. Additional specifications are also prescribed to assure that the proposed drill rig containment area and cuttings storage area liners perform their intended function of fluid containment. Therefore, the following measures could be required.

General Requirements for Liner Materials:

- Polymer type: not specified, subject to conformance with the other requirements;
- Oil-resistant (hydrocarbon-resistant) properties;
- Minimum thickness 20 mils;
- Ultraviolet-resistant properties;
- One piece with manufacturer's seams certified; documentation showing licensing or other endorsement of installer/fabricator, including qualifications of personnel, and specific experience of on-site superintendent or fabrication superintendent;
- Any field seams would be nondestructively tested and certified by third party; QA test procedures shall be directly observable and/or quantifiable (e.g., vacuum testing or air pressure [HDPE,

double wedge] testing); QA consistent with the requirements of FDER Rule 17-701 FAC, Section 17-701.400(7).

Configuration and Cover Requirements

- Liners could be provided continuously throughout the drill rig and cutting storage containment areas (including the 10 ft x 200 ft connecting area), extending at least to the top of the perimeter containment berms, and anchored in accordance with industry standards in a continuous anchor trench, either at the top of the berm, or at the base of the outside of the berm;

- A protective cover layer, at least three-inches in thickness, could be required above all liner materials, consisting of soils that would provide suitable trafficability under all expected weather conditions for vehicular and pedestrian traffic; and

- A cushion layer, above the liner and below the protective cover layer, could consist of a non-woven, needlepunched geotextile, with minimum mass per unit area of 10 ounces per square yard.

SPCC Plan

A site specific SPCC Plan could be submitted to BLM prior to commencement of site operations.

Waste Injection

In order to ensure that the waste disposal activities do not endanger any underground source of drinking water, plans for the injection of waste drilling fluids and excess stormwater into the "boulder zone" could be developed and submitted to BLM prior to the initiation of any disposal operations. BLM could provide the information to EPA.

During disposal activities, SWEPI could provide an activity summary of the disposal operations together with supporting documentation which should include well logs for the shallow portion of the hole, geologic formation tops for the well, if available, well log calculations of the shallow hole to the lowermost source of drinking water, chart recorder of pressures tests documenting cement shoe casing protection of the lowermost underground source of drinking water, pump pressure logs of disposal activities to document that test pressures do not exceed the fracture gradient at the 20-inch casing cement shoe, copies of daily reports for disposal activity, chart recorder of pump pressures for disposal activity, copy of well log and completion report affidavit, and a copy of the plugging affidavit, if appropriate.

The following measures could be implemented to assure that drilling fluids, produced water and drill cuttings are properly analyzed and disposed of in an appropriate manner:

Testing of Drilling Wastes

Prior to disposal, representative samples of the cuttings, drilling fluids, and produced waters would be collected for laboratory analysis. The composite samples collected would be analyzed in accordance with EPA test methods established in the EPA SW 846 Manual (EPA, September, 1986). Samples would be tested for the following metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Drill cuttings would be tested for total metals. If the totals analysis for drill cuttings exceeds maximum allowable concentrations, the TCLP would also be completed. Drilling fluids and produced waters would be tested using the TCLP. In addition, EPA method 8015 (modified) would be used to test for TRPH. The maximum allowable concentrations for the metals would be consistent with the RCRA Hazardous Waste/Criteria, and for State of Florida Clean Soil Criteria, identified in the table below. FAC Rule 17-775.400 does not apply to the proposed action. It is used as a guideline to establish a reasonable threshold since Federal clean soil criteria regulations do not exist at this time.

MAXIMUM ALLOWABLE CONCENTRATIONS

COMPOUNDS	TCLP[1] (mg/l)	Total[2] (mg/kg)
Arsenic	5.0	10
Barium	100.0	4940
Cadmium	1.0	37
Chromium	5.0	50
Lead	5.0	108
Mercury	0.2	23
Selenium	1.0	389
Silver	5.0	353

[1] 40 CFR, Part 261.24, Table 1 and FAC Rule 17-775.400
[2] FAC Rule 17-775.400

The maximum TRPH concentration for drill cuttings would be ten mg/kg. This threshold is consistent with the criteria of FAC Rule 17-775.400, Criteria for Clean Soil.

The maximum TRPH concentration for drilling fluids and produced waters would be five mg/l. This threshold is consistent with the criteria of FAC Rule 17-770, Petroleum Contamination Site Cleanup Criteria. This regulation does not apply to the proposed action and is used only as a guideline to establish a reasonable threshold.

In addition, drill cutting samples would be tested for soluble salts and cationic distributions. Limits for soluble salts and cationic distributions in drill cuttings would be as follows:

(a) Electrical conductivity (EC-solution phase); < 4 mmhos/cm
(b) Sodium adsorption ratio (SAR-solution phase): < 12
(c) Exchangeable sodium percentage (ESP-solid phase): < 15%

The soluble salts and cationic distributions thresholds are consistent with Louisiana regulations for nonhazardous oil field wastes (LAC Title 43: Part XIX). The Louisiana standards are used to establish acceptable maximum concentrations since no Federal or state (Florida) criteria exists. Drilling fluids and produced water would be tested for total chlorides. Limits for chlorides in drilling fluid and produced water would be 20,000 ppm.

Radioactivity Testing

The drill cuttings and drilling fluids would also be tested for NORM. Drill cuttings and drilling fluids would be tested for radium-226 and 228 by gamma spectroscopy. If levels do not exceed five pCi/gram for each, above background, the drill cuttings could be disposed of on the Reservation or at a landfill. This threshold is consistent with Louisiana regulations (LAC Title 33: Part XV.1404) which are currently the most comprehensive NORM regulations in existence. This regulation has been used as a guideline since the Federal government and the State of Florida do not have regulations or guidance documents regarding NORM. If levels in drilling fluids do not exceed 60 pCi/l, the drilling fluids could be disposed of by injection into the "boulder zone." This threshold is consistent with FAC Rule 17-28.120, the State of Florida's Underground Inspection Control regulation for industrial and sanitary wastes. This regulation has been used as a guideline since neither the Federal government or the State of Florida has regulations for disposal of drilling fluids from exploratory oil wells.

Disposal of Drilling Wastes

The laboratory results would determine the acceptability of on-site disposal. Drill cuttings that meet the State of Florida clean soil criteria for Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, and TRPH, as outlined in FAC Rule 17-775 (used as a guideline) and meet the soluble salts and cationic distributions and the NORM criteria set forth in the previous section (less than five pCi/gram,

above background of radium-226 or radium-228), may be used as fill material on non-wetland areas of the Reservation. The Miccosukee Tribe would designate an on-reservation non-wetland location for disposal of the drill cuttings.

Drill cuttings that exceed the State of Florida clean soil criteria, but do not exceed the hazardous waste thresholds found in 40 CFR, Part 261 and the NORM criteria set forth in the previous section, would be transported to a Class I landfill for proper disposal. Should the hazardous waste thresholds and/or TRPH analysis exceed the established maximum concentrations, the BLM would determine a proper disposal or treatment procedure.

Drilling fluids which do not exceed the hazardous waste thresholds found in 40 CFR, Part 261 and the total chlorides and UIC radioactive material criteria set forth in the previous section would be disposed of in the "boulder zone." Should the TCLP and/or TRPH analysis exceed established thresholds, the BLM would determine a proper disposal or treatment procedure.

Should drill cuttings exceed 5 pCi/g of radium-226 or radium-228, above background, or drilling fluids exceed 60 pCi/l, these wastes could be disposed of at NORM facilities in Louisiana, or at a low-level radioactive waste disposal facility in South Carolina.

Production waters would be disposed of in the "boulder zone," if the referenced hazardous waste, TRPH, and total chlorides thresholds are not exceeded. If the established thresholds are exceeded, the BLM would determine a proper disposal procedure.

4.4.11 Water Resources

The proposed action allows for potential sediment discharge from access road construction areas into adjacent waters. The use of best management practices for erosion and sediment control (USDA, SCS, 1977, and U.S. Dept. of Transportation, FWHA, 1978) would greatly reduce such sediment impacts.

Control measures and structures, such as silt fences, could be used to control runoff, erosion, and off-site sedimentation. Silt fences could be used at the base of all fill and disturbed areas within 100 feet of waterbodies such as the Miccosukee surface water management canal and L-28 Canal. Silt fences could be constructed following the manufacturer's recommended specifications. All runoff and erosion control measures could be inspected periodically, cleaned out, and maintained in functional condition throughout the construction, drilling and reclamation periods.

Filled shoulders of the access road and topsoil stockpile areas could be seeded with an appropriate grass seed mixture. Straw mulching using only certified weed-free straw could be completed to protect the seed bed.

Access road fills other than those on existing embankments could be designed to minimize the disruption of surface water sheet flow. The roadway design could include culverts of appropriate size and spacing to adequately maintain sheet flow patterns.

Existing site-specific groundwater quality data is inadequate. Without an adequate baseline condition, it would be very difficult to verify that the proposed action would not have any significant impacts on water resources. A requirement for the establishment of a pre-drilling water quality baseline and a monitoring program could correct this deficiency and provide the means to quickly detect any drilling-related water quality impacts. The monitoring program could include the following elements:

- SWEPI would design and implement a water quality monitoring program for the projects which would be approved by the BLM and USGS prior to project construction. This program would include the developing of a QA/QC plan for the program, establishing baseline surface and groundwater quality, as well as existing aquatic conditions.

- Care would be taken to protect surface and subsurface water from contamination especially during the drilling phase when large amounts of produced water, drilling fluids, drilling muds, and oil may be in contact with the surface and subsurface waters. Surface and subsurface monitoring stations would be located upgradient and downgradient of the well site to document water quality.

- Each groundwater monitoring station should consist of nested or individual wells, located on the edge of the drill pad, with wells penetrating the two surficial aquifers (in the Fort Thompson and Tamiami Formations) and the intermediate (gray limestone aquifer). One upgradient station and two downgradient stations would be installed and monitored.

- Surface water sampling stations would be established in the L-28 Canal adjacent to the site and in the highway borrow canal adjacent and parallel to I-75.

- Water samples would be collected at surface monitoring stations and from subsurface water monitoring wells at the specified frequency. Insitu measurements of pH, temperature, and specific conductivity would be made with appropriate instruments. Water samples for all other parameters would be prepared for storage/shipping following standard operation procedures and would be analyzed by an EPA certified lab for concentrations of selected water quality indicator

parameters. Indicator parameters are subject to revision by the BLM, depending on the type of proposed operation. Water quality indicator parameters consist of:

alkalinity
barium
benzene
chlorides
mercury
oil and grease
total petroleum hydrocarbons
pH
sodium
specific conductivity
temperature
toluene
turbidity
xylene

- Water samples from surface monitoring stations and subsurface monitoring wells would be obtained and analyzed by an EPA certified lab at the following frequency unless otherwise specified by BLM.

  Upgradient - monthly before drilling and after APD approval and continuing monthly throughout the drilling operation; and continuing until site reclamation has been completed.

  Downgradient - monthly before drilling and after APD approval, continuing twice a month beginning when drilling operations start and continuing through well testing and until site reclamation has been completed.

- If surface or subsurface water contamination is documented that is reasonably attributable to oil and gas operations underway in the vicinity, operations must cease immediately and would be immediately modified to rectify procedures causing contamination. Cleanup and restoration must be started immediately, and monitoring would continue until complete reclamation has been accomplished. Under such circumstances, additional testing for one or more of the following water quality parameters may be required by BLM at a frequency determined by BLM:

BOD
calcium
DO (surface water only)
magnesium
metals
sulfates
total dissolved solids (TDS)

- A standardized format would be used to record, list, and display all data.

A report representing the results of the water quality monitoring for each station must be submitted to the BLM upon completion of each analysis (monthly for upgradient stations; bi-monthly for downgradient stations). This report would consist of the following components:

  - o A summary table that defines sample station, date of collection, and value for each parameter.

  - o A graphic comparison of the differences between sites for each parameter (each graph should represent one parameter for each site; all data should be plotted as bar graphs, and each graph should give the date, site, and specific parameter).

- An annual report presenting the results of the water quality monitoring for each station would be submitted to the BLM. This report would consist of a summary table that defines the sample station, dates of collection, and unit value for each parameter.

- All data and results of monitoring efforts must be reported to the BLM.

- All produced salt water (brine) must be disposed of in accordance with applicable State and Federal laws and regulations. Brine would not be released on surface lands or waters under any circumstances.

Additional general mitigation recommendations that could be implemented to reduce water resource impacts to non-significant levels include:

- Guide all phases of the project, including road and well site construction, reclamation and abandonment, by applicable regulations of the Clean Water Act.

- Minimize the area of disturbance to that absolutely necessary for construction, operation and reclamation to reduce impacts to water resources.

- All water withdrawal and use would comply with applicable Federal and State laws.

- Site wells (i.e., nonproductive, water) would be plugged and capped. The water supply wells would be capped, but not plugged if desired by the Miccosukee Tribe. Well caps would be welded in place, or secured with locks to prevent tampering.

4.4.12 Wetlands

The exact boundaries of the drill site and the west access route could be field staked and inspected by a representative of the COE to prevent and minimize wetland impacts to the extent possible. Wetland mitigation could be completed as required by the COE. Soil removed from the drill site prior to construction could be stockpiled in non-wetland (pasture) area adjacent to the well pad.

4.4.13 Wildlife

Mitigation measures could include limiting vehicle speeds on the access routes, particularly at night to reduce the potential for collisions with wildlife. In addition, site worker shift changes could occur during daylight hours to the maximum extent possible to reduce traffic during night hours.

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CONSULTATION AND COORDINATION

CHAPTER 5

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5.0 CONSULTATION AND COORDINATION

5.1 Scoping

Federal laws and regulations require that either an EA or EIS be prepared when a Federal government agency considers taking an action that may impact the environment. In the consideration of the proposed SWEPI Miccosukee 3-1 Exploratory Oil Well, the Federal agencies of jurisdiction (BLM and BIA) elected to prepare the more detailed EIS to assure that potential environmental concerns regarding the proposed project were thoroughly evaluated.

The CEQ has established regulations for the proper implementation of the NEPA in 40 CFR, Parts 1500-1508. An early scoping process is required to identify significant environmental issues related to the proposed action and alternatives that the EIS should address. The issues and alternatives identified through the scoping process which are relevant to the proposed action are subject to detailed evaluation in the EIS.

The SWEPI Miccosukee 3-1 EIS was prepared by Dames & Moore, Inc., a third party consultant, with the BLM, Jackson District, acting as the lead agency, and the BIA, Eastern Area Office, the joint lead agency.

5.1.1 Public Participation

SWEPI filed an APD with the BLM on January 17, 1991, for an exploratory oil well described in this FEIS as the proposed action. Concurrent with the submittal, SWEPI and the Miccosukee Tribe issued press releases announcing the proposal, and conducted congressional, state government, and media briefings. On February 14, 1991, a field review of the proposed drill site and alternatives was conducted by BLM, BIA, SWEPI, and the Tribe. Accompanying them were representatives of congressional offices, state agencies, and other Federal agencies. On February 15, 1991, briefings were provided by SWEPI to Broward County Commissioner John Hart and representatives of several environmental groups, the Broward County Attorney's Office, Broward County Water Resources Management Division, Broward County Office of Planning and the SFWMD.

On March 13, 1991, Broward County Commissioner John Hart, Assistant County Attorney John Milledge and Broward County Environmental Planner Don Stone toured the proposed well site with SWEPI representatives.

From March 22-28, 1991, a Notice of Request for Comments was published in seven South Florida newspapers. This notice described the proposed action, announced that an EA would be prepared and requested public comments by May 3, 1991. Approximately 350 letters or petitions were received by the BLM in response to the notice.

On November 18, 1991, Congressmen Larry Smith and Harry Johnston and their staffs were presented a briefing on the project by BLM, BIA, the Miccosukee Tribe and SWEPI.

In response to public comments, the BLM issued a Notice of Intent to Prepare an EA and Notice of Public Meeting. The notice was published in the Federal Register on December 24, 1991, and in The Tallahassee Democrat, Fort Lauderdale News/Sun Sentinel, and Palm Beach Post newspapers on January 6, 1992. In addition, news releases were sent to the Fort Lauderdale News/Sun Sentinel, Palm Beach Post, and Miami Herald newspapers. The notice and news release announced a public meeting and requested written comments until February 14, 1992.

A public scoping meeting was held on January 23, 1992, at the Fort Lauderdale Airport Hilton in Dania, Florida. Approximately 300 people attended the meeting and were invited to comment orally and/or in writing until February 14, 1992. Information packets were available to participants. In response to this notice and public meeting, approximately 288 additional letters were received.

On January 25, 1992, SWEPI provided an on-site tour of the proposed well site to representatives of the Sierra Club.

On April 16, 1992, the BLM issued a Notice of Intent to Prepare an EIS in the Federal Register, Tallahassee Democrat, Fort Lauderdale News/Sun Sentinel, and Palm Beach Post newspapers. In addition, news releases were sent to 25 newspapers and 4 television stations. The notice explained that BLM and BIA's decision to expand the analysis from an EA to an EIS was not based on any changes in the proposal's anticipated impacts but was made to recognize public concerns and assure that the potential environmental impacts of the proposal are thoroughly addressed. The notice further stated that any proposal for additional wells and production would require additional NEPA review and decision documents and that all comments previously provided had been and would be considered in the scoping of the EIS. Additional comments were requested by May 18, 1992. An additional eight letters were received in response to this notice.

In addition to the public notices and press releases issued by BLM, an interested parties list containing approximately 380 individuals and organizations was maintained by BLM, and those individuals or organizations on the list were informed of the decision to prepare an EIS, invited to submit additional comments and received a scoping document containing information on the scoping process, description of the project and a map of the project area. In addition, briefing activities conducted by SWEPI, press releases issued by the Miccosukee Tribe, and media coverage of the proposal and public meeting further informed the public of the scoping process. Between December 1990 and November 1991, SWEPI mailed briefing packages to:

- Broward County State representatives and senators;
- St. Petersburg Times, Tampa Tribune and Orlando Sentinel newspapers;
- EPA, Region IV, Atlanta; NPS, BCNP;
- SFWMD Board Members and Executive Director;
- South Florida environmental organizations including Sierra Club, Wilderness Society, Friends of the Everglades, Florida Audubon Society, Florida Wildlife Federation, and Sierra Club Legal Defense Fund;
- State Cabinet aides; FDNR, State Historic Preservation Officer; FGFWFC, FDER;
- Broward County Administrator; and Broward County Attorney.

Individual briefings and briefing packages were provided to:

- South Florida representatives;
- Governor's Office (environmental advisor/staff);
- Miami Herald, Ft. Lauderdale Sun-Sentinel, Palm Beach Post newspapers;
- State Senate and House Natural Resources Committee chairmen/staff; and
- State Garden Club representatives.

Based upon the three public notices inviting comments, the public meeting, briefings to public officials, and media coverage of the proposal and public meetings, BLM determined that the scoping process was adequate and preparation of the DEIS commenced on May 22, 1992.

On September 24, 1992, Congressman Larry Smith and Congressman Harry Johnston and their staffs were presented a briefing on the preparation of the DEIS by BLM, BIA, the Tribe, and Dames & Moore, Inc.

5.1.2 Public and Agency Involvement - DEIS Preparation

During preparation of the DEIS, the joint lead agencies communicated with and received input from: Federal, State, regional, and local government agencies; environmental organizations; and individuals potentially interested in the proposed project. The following agencies, groups, and individuals were contacted and have provided input and/or received a copy of the DEIS. It should be noted that the names of several individuals who submitted comment letters were illegible and, therefore, not included in the list located in Section 5.1.2.5. However, the contents of all letters received were reviewed and recorded.

5.1.2.1 Federal Government Agencies

Advisory Council for Historic Preservation
Council on Environmental Quality
Department of Agriculture:
    Soil Conservation Service
Department of the Air Force
Department of the Army:
    Army Corp of Engineers
Department of Energy
Department of the Interior:
    Office of Environmental Affairs
    Office of Public Affairs
    Natural Resources Library
    Bureau of Land Management
    Bureau of Mines
    Bureau of Reclamation
    U.S. Fish and Wildlife Service
    Office of Surface Mining
    Minerals Management Service
    Bureau of Indian Affairs
    National Park Service
    U.S. Geological Survey
Department of Transportation:
    Federal Highway Administration
    Office of Transportation and Regulatory Affairs
Environmental Protection Agency

5.1.2.2 State Government Agencies

Florida Department of Agriculture
Florida Department of Community Affairs
Florida Department of Environmental Regulation
Florida Department of Natural Resources - Florida Geological Survey
Florida Department of State, Division of Historical Resources
Florida Department of Transportation

Florida Game & Fresh Water Fish Commission
Florida Marine Fisheries Commission
Office of the Governor

5.1.2.3 Regional and Local Government Agencies

Broward County Attorneys Office
Broward County Commission
Broward County Planning Office
Broward County Public Works Department
Cooper City, City Council
Miccosukee Tribe of Indians of Florida
South Florida Water Management District

5.1.2.4 Environmental Organizations

Environmental Coalition
Broward County Audubon Society
Sierra Club - Broward County Group
Environmental Leaders Council
Clean Water Action
Big Cypress Earth First
Manatee Survival Foundation
Audubon Society of the Everglades
Florida Federation of Garden Clubs, Inc.
Friends of the Everglades
Friends of the Oleta River
Greenpeace

5.1.2.5 Individuals and Other Groups

Don Agony
Monigue Aiken
Jason Aldrich
Grace Alleman
George Amreihn
Melissa Anderson
Julie Apilian
Mary Leigh Arnold
Frances Avergy Arnold
Karl A. Baden
Jocelyn Baker
Robert M. Baker
Louis B. Banasky
Brad Bantz
Linda Barron
Anne Bartlett
Virginia Bartz
Wayne Bartz
T. Bearder
Leah Becker
Mr. and Mrs. Brad Becker
Ellen Beers
Warren Beglez
Elizabeth Beletti
Judith L. Berard
John Bilknap
Mike Billington
Bob Binnix
Leslie J. Bird
Lucianne Blair
Jason Blake
Matthew J. Boina
Colonel Robert M. Brantley
L. B. Brashier, Jr.

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James R. Brewer
Randall T. Briggs
Bob Brister
Vernon R. Brons
Scott Brown
Carol Browner
Bob Brownley
Lisa Brownstein
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Richard L. Bryant
Robert H. Butterworth
Jeff Byron
Charles Calendrillo
Earl Campbell
Shana Campbell
Cathy A. Cancellare
Katrina Carnes
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Marjorie K. Case
William Castognetta
Bob Caughey
Wendy Causey
Erin Cavanaugh
Sheryl Chapman
James B. Charles, Jr.
Janet Chase
Shirley Chatham
Chris Christopher
Richard T. Clark
Ruth H. Clark
N. Montgomery Clarke
Ginger Clements
Susan Colburn
Randolph L. Compton
Robert Connelly
Incresha Cooper
Allan Copeland
John J. Copeland
Boris P. Coppinger, Jr.
Ron Costantini
G. Counts
Robert K. Cowhig
Joan Craig
Amy Creekmur
Tilford Creel
Nancy Cross
Sharon Cruz
Lynette S. Culp
Henriette M. Daoulton
Henriette Daveton
Sue Davis
Wesley H. Day
Catherine Dees
Jennifer DeHart
Michael Dent
Charles DeVeney
Gertrude Dewaz
Petty S. DeWitt
Kristen DiBianca
J. P. Dinkel
Pauline Dinkins
Charles B. Dixon
James Dixon
R. Douglas Burleson
Francis J. Dowd
Edmond H. Dressler
Michele Droll
Robert D. Duncan, Jr.
Verner Earls
Philip R. Edwards
Mr.& Mrs. Peter Elmore
Brian Emerick
A. T. Engler, Jr.
Mrs. E. (Sarah) Entstasser
Jeffrey W. Ewing
A. T. Eyer, Jr.
Honorable Dante Fascell
Anita Fassman
Al Feuer
June Ficker
Elizabeth Finney
Bob Fisher
A. A. Fisikelli
Peter Foreman
Steve Fox
Catherine Fradenberg
Natalie Franover
Steve Friedland
Elizabeth Fritz
Blanche Froomlin
Ronald N. Fyall
Edward J. Gallagher, P.E.
Tom Gardner
A. P. Garner
William W. Gauntt

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Ken Gellert
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Sonya Gill
Marc Gimbel
Mark & Debbie Ginsberg
Glenda Goelz
Jim Goldasich
Larry Goldberg
Sidney Goldin
Luke A. Gonzalez
C. B. Goodman
Elizabeth Gover
Joan Graff
Honorable Bob Graham
Rosco Grasso
Mary Ann Gray
William W. Grontt
Cathi Grust
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Leticia I. Hale
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Susan Hurwiz
Michael Hutchinson
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G. H. Illersen
Mr. Irani
William L. Jacobs
Brenda Jacobson
John J. Jatho
Lynn Jenkins
Frank E. Jeter
Richard Johnson
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Steve Koetzmann
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Steve Kretzmann
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Linda Lacy
Molly Leban
Kirk Ledbetter
Lauren C. Leitkowski
Perl S. Lepin
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Vicki Margetich
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Danette Marks
Michelle Marson
Ken Martin
Mr. & Mrs. Greg Martin
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Michelle Masser
Crawford P. Maxson
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Lee Ann May
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Mr. & Mrs. E. O'Toole
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Elaine Paster
Bob Pendleton
J. Carter Perkins
Catherine Anne Perry
Harriet Pettit
Alice B. Philson
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Liliana Pomareda
Burnette Pope
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Mike Powell
Marlo Predo
Clarence Prescott
Diane Provencal
Brian Puderman
George Purish
Lesley Purkey
Michael Putragall
Danielle Rasting

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Luiz Santos
Lisa Saylor
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Gerald W. Schaaf
Cheryl Schaffer
Tom Scheff
Brian Scherf
Rosalyn Scherf
Lesley Schers
Jody Schiavoni
Chris Schlamp
Ellen Schmidt
W. Schmidt
Eleanor Sciacca
Mike Scott
Modren M. Seiler
Patti Seki
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Roberta Shaw
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Laurie Shiver
Henry Shones
Henry L. Shores
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Honorable Larry Smith
Kari Smith
Janice C. Solomon
Mario Sorrentino
Bertram I. Span
Bertram I. Sparr
Charles E. Staines
Charles M. Steiner, DDS, PA
Susanna Stenloma
George L. Stetson
V. W. Stewart
Scott J. Stone
Andrea Strachan
James S. Strouss, III
K. Michael Stumpe
Judith Summers
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Cinada Topes
Sabrina Torelli
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Josephine Traino
Ms. S. E. Trazehagen
Kim Tripp
Maria Uriarte
Kathy Valentine
Barclay Van Dyke
Woodie Van Voorhees
Cathy Verschneider
Nan Vollbracht
Michele Wadlez
Michael Wagner
Troy R. Wales
William C. Walker
Kurt Walters
Christopher J. Ward
Jim Webb
Mary Weedhouse
Arnold J. Welker

Lawrence B. Welky
A. Jeff Wells
Don Wheeler
Bobbi White
Dita White
Stephen Whitney
Ann W. Wiley
Kathi Wilson
Mrs. Robert D. Wilson
Amy M. Windhorst
Brenda Wolk
Theresa Woody
Ivy P. Wright
Margeret Yawn
Bernie Yokel
Lila Yorra
Jennifer Young
Jeff Zambruski
Lillian Zane
Cy Zaneski
Peter W. Zaremba
Ingrida Zebelins, Ph.D.
F. E. Zeter
Barbara Zias

5.1.3 Public and Agency Involvement - FEIS Preparation

The DEIS was completed on March 8, 1993. The DEIS was distributed to the government agencies listed in Sections 5.1.2.1 through 5.1.2.3. All environmental organizations listed in Section 5.1.4 and individuals and other groups listed in Section 5.1.2.5 were advised of publication of the DEIS by a mailed announcement. Recipients of the announcement were given the opportunity to request the DEIS and/or DEIS Summary documents.

The DEIS was filed with the EPA during the week of March 8, 1993. A "Notice of Availability" was published in the Federal Register on March 17, 1993. Based on this notice, the public was invited to comment on the DEIS until May 18, 1993. Subsequently, at the request of Congressman Peter Deutsch, the public comment period was extended to August 18, 1993. Notice of the extension to the comment period was published in the Federal Register on June 17, 1993.

In addition to the Notice of Availability, a variety of methods were used to inform interested parties of the DEIS. These methods included: press releases and newspaper legal notices, a BLM/BIA press meeting held in Fort Lauderdale, Florida, on April 13, 1993; a public hearing and open house held in Fort Lauderdale, Florida, on April 14, 1993; distribution of the DEIS to Federal agencies and the State of Florida Clearinghouse administered by the Governor's Office; distribution of reading copies of the DEIS to the Broward County, Leon County and Palm Beach County public libraries, and the State Library in Tallahassee, Florida; and distribution of reading copies to the BLM Office of Public Affairs, Washington, D.C., BLM, Jackson District office and BIA, Arlington, Virginia office. Approximately 275 copies of the DEIS and 450 copies of a DEIS Summary Document were distributed to organizations, government agencies and individuals.

Briefings on the DEIS were presented to staff of Congressman Harry Johnston and staff of Senator Bob Graham on March 16, 1993. On March 18, 1993, staff of Governor Lawton Chiles was presented a briefing on the DEIS. Congressman Peter Deutsch and staff were presented a briefing on the DEIS on

April 21, 1993. Staff of the Governor's Office, state agency and SFWMD representatives met with the BLM, BIA, and Miccosukee Tribe on May 27, 1993 to discuss the DEIS.

On April 14, 1993, a public hearing was held at the Greater Fort Lauderdale - Broward County Convention Center, 1950 Eisenhower Boulevard, Fort Lauderdale, Florida. The hearing was attended by approximately 350 people. Oral comments were presented by 51 people. A complete transcript of the hearing is presented in a separate document, entitled "Public and Agency Comments." During the DEIS public comment period, 425 letters and petitions were received by the BLM. The comment letters are presented in the document, entitled "Public and Agency Comments."

An alphanumeric code was developed to identify the individuals and organizations who submitted written comments or provided oral comments at the public hearing. The assigned code identifies the pages of the "Public and Agency Comments" document where each substantive comment can be found. This code further identifies the individual(s) or organization(s) offering the specific comments on the issues discussed in Section 5.1.4. A listing of the alphanumeric code and corresponding individual(s), businesses, organization(s), and agencies that provided comments are provided below:

INDIVIDUAL

Individual alphanumeric codes are listed in alphabetical sequence, ordered by surname. In the case of double last names, the alphanumeric codes are listed in sequence by the second surname. Individual surnames which include a prefix are listed at the beginning of each alphabetic category. McCluskey, for example, would precede all surnames which do not include a prefix. The listing of alphanumeric codes for individuals is as follows:

I-1	Ms. Rose Adams	I-16	Ms. Florence R. Beardsley
I-2	Ms. Maisy Alpert	I-17	Mr. Chris Beck
I-3 to I-4	Ms. Wendy M. Altman	I-18	Ms. Gertrude M. Bishop
I-5 to I-6	Mr. George Amreihn	I-19	Ms. Judy Bissell
I-7	Mr. Mauro Aronovski	I-20	Mr. Darrell L. Black
I-8	Ms. Stella Ashen	I-21	Ms. Mary D. Blackman
I-9	Mr. Mark Asmus	I-22	Ms. Esther E. Blanton
I-10	Ms. Miriam Assef	I-23	Mrs. A. Bonk
I-11	Ms. Jessica Azola	I-24	Mr. Brett D. Boulmay
I-12	Mr. Karl A. Baden	I-25	Ms. Jocelyn Boyce
I-13	Mr. Sheezan Bakali	I-26	Mr. Paul Brandofino
I-14	Mr. Louis B. Banasky	I-27	Ms. Myra C. Becher
I-15	Mr. F. C. Barhoover	I-28	Ms. Joy Bright

I-29 to I-30	Mr. Chad Brocato
I-31	Ms. Kathleen T. Brock
I-32	Mr. Thomas J. Brosnan
I-33	Mr. & Mrs. Edgar H. Brown
I-34	Ms. Elaine Brown
I-35 to I-36	Ms. Marian D. Browne
I-37	Ms. Barbara J. Brush
I-38	Mr. Douglas Burleson
I-39	Mr. Christopher Burroughs
I-40	Ms. Rachel Bussel
I-41	The Cannon Family
I-42	Ms. Bernice C. Carlson
I-43	Ms. Tracey Carlson
I-44	Ms. D. H. Carmody
I-45	Ms. Martha E. Carnes
I-46 to I-47	Ms. Joan W. Carroll
I-48	Mr. L. B. Case, Jr.
I-49	S. Chisen
I-50	Ms. Julia Chretien
I-51	Mr. Richard Chung
I-52	Ms. Ruth H. Clark
I-53	Mr. N. Montgomery Clarke
I-54	Mr. Santo J. Coco
I-55	Mr. Randolph L. Compton
I-56	Ms. Suzanne Conner
I-57	Mr. Dennis Connolly
I-58	Ms. Jane Copenhaver
I-59	Mr. Boies Coppinger
I-60	Mr. Donald L. Cosby
I-61	Ms. Jan Cosby
I-62	Richard & Muriel Covington
I-63	Ms. Dorothy A. Cowdrey
I-64	Mr. Timothy A. Crain
I-65	Mr. John G. Croes
I-66	Mr. Paul W. Croy
I-67	The Cullis Family
I-68 to I-69	Mr. Angelo V. D'Alessandro
I-70	Mr. & Mrs. Scott Dash
I-71	Mr. Fred J. Davies
I-72	Ms. Kelley Ann Davis/ Mr. Don R. Elderkin
I-73 to I-74	Mr. Timothy Day
I-75	Mr. Wesley H. Day
I-76	Mrs. Nada DeGaetano
I-77	Ms. Sherie DeGroff
I-78	Ms. Susan Deifallah
I-79	Mr. Jeff Delgado
I-80	Mr. Luiz A DePaula Santos
I-81	Ms. Audrey E. De Rosa
I-82	Mr. Fred A. Dickmeyer
I-83	Mr. A. L. Diehl
I-84	Mr. J. P. Dinkel
I-85	Mrs. Emily N. Dipple
I-86	Dr. Guy A. Distasio
I-87	Ms. Suzanne Donovan
I-88	Charles & Gloria Dunsford
I-89	Ms. Ellie Durr
I-90	Ms. Teresa A. Dwyer
I-91	Armand & Martha Dyner
I-92	Mr. Arthur Eichner
I-93	Mr. Manuel Elaraj
I-94	Mr. Don R. Elderkin
I-95	Ms. Barbara J. Elliott
I-96	Mr. Wayne Engroff
I-97	Mr. Lennard C. Ericsson
I-98	Ms. Marlene Escoto
I-99	Ms. Ethel E. Fallon
I-100	M. & J. Fasano
I-101	Mr. Greg Fernandez
I-102	Mrs. Ann Fetters
I-103	Mr. Allen Filekoff
I-104	Charles & Lillian Finger
I-105	Ms. V. Virg Foland
I-106	Ms. Winnie Foster
I-107	Ms. Linda M. Francis
I-108	Mr. Clarence Freeman

I-109	Mr. Arthur M. Friedrichs
I-110	Mrs. Adele V. Frisch
I-111	Mr. Gerald Fritz
I-112	Mr. Kenneth L. Frost
I-113	Mr. Robert Gallagher
I-114	Mr. John Gallo
I-115	Mr. & Mrs. Robert J. Gardner
I-116 to I-117	Mr. A. P. Garner
I-118	Mr. James L. Garrett
I-119	R. Gehlert & Family
I-120	Sister Teresa Gerlits
I-121	Mr. Theodore H. Gilbert
I-122	Mr. Darren Giuffre
I-123	Mr. Gary Gold
I-124	Ms. Helen L. Goldin
I-125	Mr. Sidney Goldin
I-126	Mr. C. B. Goodman
I-127	Mr. P. Graef
I-128 to I-129	Ms. Heather Grand
I-130	Mr. David Green
I-131	Mr. Edward B. Green
I-132	Mr. Thomas Gunderman
I-133	Mr. J. J. Guyett
I-134	Ms. Eleanor Haarmeyer
I-135	Ms. Shari L. Haas
I-136	Mr. Albert Haeberle
I-137 to I-138	Mr. Gordon W. Hagey
I-139	Peggy & Robert James Hall
I-140	Mr. John E. Harman
I-141	Ms. Denise Harris
I-142	Mr. H. L. Hassell
I-143	Ms. Janet Hassoun
I-144	Mr. William Heim
I-145	Ms. Joan Heiman
I-146	Mr. J. Heisner
I-147	Ms. Dorothy M. Henfield
I-148	Mr. Andrew G. Henning
I-149	Ms. Monique Henry
I-150 to I-151	Ms. Sheri Hensley
I-152	Morton & Rita Hepner
I-153	Mr. M. M. Hess
I-154	Mr. Richard J. Hess
I-155	Mr. Daniel Higgins
I-156 to I-157	Ms. Linda A. Hill
I-158	Ms. Edith Hilton
I-159	Ms. Helen Hirschfeld
I-160	William & Mary Holsworth
I-161 to I-162	William & Jeanne Homer
I-163	Mr. John J. Hopkins
I-164	Mr. Scott Horowitz
I-165	Mr. W. W. Horstman
I-166	Ms. Lguana Howard
I-167	Mrs. J. A. Hugh
I-168	Mr. George G. Hughes
I-169	Mr. Leonardo Iannone
I-170	Mr. Carlton Inman
I-171	Ms. Rae Irland
I-172	Mr. Bill Irwin
I-173	Violet & Leo Isacson
I-174	Mr. M. Carpenter-Jaquinta
I-175 to I-176	Mr. Paul G. Jameson
I-177	Ms. Joan W. Jenrich
I-178	Ms. Lauren A. Jewell
I-179	Mr. W. H. Jobe
I-180	Mr. Bevin John
I-181 to I-182	Ms. Dorothy Johnson
I-183	Mr. Perry W. Johnson
I-184	Ms. Joan Johnston
I-185	Mr. G. Jones
I-186	Mr. Frank H. Jones, Jr.
I-187	Ms. Jan Jones
I-188	Ms. Peggy M. Juntilla
I-189 to I-190	Richard & Edith Kappler
I-191	Milton & Bonnie Katz
I-192	Mr. Howard Katzman
I-193 to I-194	Ms. Sherra Keeley and Mom

I-195	Mr. Edward Kempa
I-196	Mr. Samuel Kendall
I-197	Mr. William F. Kenney
I-198	Mr. Steven P. Kent
I-199	Ms. Rose Kenach
I-200	Ms. Dawn A. Keon
I-201	Ms. Hope C. Kimbrell
I-202	Mr. Donald H. King
I-203	Mr. Brian F. Kingston
I-204	Mr. George A. Kitchen
I-205	Ms. Karen Klein
I-206	Mr. Michael Klein
I-207	Mr. Florence R. Knice
I-208	Mr. & Mrs. Milton Knopoff
I-209	Ms. Heidi Knost
I-210	Ms. Elizabeth A. Knowles
I-211	Mr. Ray A. Kralis
I-212	Mr. Richard F. Kulow
I-213	Mrs. Lois M. Lacoste
I-214	Ms. Melissa A. Lakey
I-215	Ms. Nancy Lanzi
I-216	Ms. Gail Larkin
I-217	Ms. Iris Larson
I-218	Ms. Maggie Lee
I-219	Ms. Michele LeFeore
I-220	Mr. Howard E. Lemaster
I-221	Ms. Geri Levites
I-222	Ms. Susan R. Libera
I-223	Ms. Elsa Lindenfeld
I-224	Mr. George H. Link
I-225	Ms. Debbie Lord
I-226	Mr. Rick Loss
I-227	Mr. Ronald N. Lyall
I-228	Dottie Lyons
I-229	Ms. Josephine McArthur
I-230	Mrs. Gloria R. McCluskey
I-231	Ms. Joann McDaniel
I-232	Mr. Robert E. McDonnell
I-233 to I-235	Mr. Stephen G. McKenzie
I-236	Ms. Gloria Mack
I-237	Mr. John Malloy
I-238	Chet & Marilyn Markot
I-239	Ms. Mary Ann Massey
I-240	Mr. Jack Mathews
I-241	Mr. Aston Mattis
I-242	Ms. Anne Maurer
I-243	Ms. Cherie K. Mazzenga
I-244 to I-246	Ms. Lynn A. Meder
I-247	Ms. Velda M. Meloy
I-248 to I-250	Ms. Cathy Menendez
I-251	Jules V. & Barbara L. Meyers
I-252	Charles & Nancy Miller
I-253	Ms. Margie Miller
I-254	The Mills Family
I-255	Mrs. Esther B. Mintz
I-256 to I-257	Ms. Jacqueline Monckton
I-258	Ms. Allen Morgan
I-259	Ms. Dana Morgan
I-260	Ms. Pam Morgan
I-261	Ms. Martha Munzee
I-262	Ms. Margaret Murphy
I-263	Mr. Fred Myers
I-264	Mr. Cary Nagy
I-265	Mr. Paul Nanes
I-266	Ms. Linda Neale
I-267	Mr. Steve Nelson
I-268	Keith & Elizabeth Newman
I-269 to I-270	Ms. Kathleen M. Nicula
I-271	Mrs. Helen K. Nielsen
I-272	Mr. Matthew Noonan
I-273 to I-274	Ms. Susan Noonan
I-275	Mr. Richard Obregon
I-276	Ms. Patricia O'Connor
I-277	Ms. Jan Craig-Olinger
I-278	Mr. James R. O'Neal
I-279	Mrs. Rosemarie O'Neidas

I-280	Mr. James Ongley
I-281	Mr. Tom Paddock
I-282	Ms. Kathy Pawlak
I-283	Ms. Browne Pearson
I-284	Ms. Natisha L. Peavy
I-285	Ms. Burnette Pope
I-286	Israel & Edith Port
I-287 to I-288	Ms. Louise C. Porter
I-289	Mr. & Mrs. John Prenovitz
I-290 to I-291	Ms. Sharon A. Proue
I-292	Mr. Earl J. Purcell
I-293	Mr. Charles L. Raymond
I-294	Ms. Deborah A. Reeder
I-295	Otto & Winifred Reuter
I-296	Ms. M. Tamara Rimes, Esq.
I-297 to I-298	Ms. Derry L. Riquelme
I-299	Mr. Jock Ritchie
I-300	Ms. Tina M. Rizzo
I-301	Ms. Grace A. Roberts
I-302	Dr. E. B. Robinson, Jr.
I-303	Mr. Jose L. Rodriguez
I-304	Mr. Raul Rodriguez
I-305	Ms. Bernice Rubin
I-306 to I-307	Mr. & Mrs. Dennis Russell
I-308	Mr. James J. Ryan
I-309	Ms. Karen L. Ryan
I-310	Mr. Terry Sader
I-311	Mr. Robert Sadowski
I-312	Mr. Charles Salter, Jr.
I-313	Mr. Harlee Samuels
I-314	Ms. Ruth Samuels
I-315	Mrs. Gertrude Sanders
I-316	Ms. Lisa M. Sannasardo
I-317	Mr. Peter R. Sannasardo
I-318	Dr. R. C. Sansing
I-319	Ms. Patricia Scarborough
I-320	Ms. Elizabeth Schane
I-321 to I-329	Brian and Rosalyn Scherf
I-330	Ms. Carrie A. Schick
I-331 to I-332	Mr. E. K. Schluntz
I-333	Mr. Stephen G. Schorr
I-334	Mrs. R. L. Schreiber
I-335	Herbert & Ruth F. Schwartz
I-336	Gerard & Joanne Shrewsbury
I-337	Mrs. Gladys Schroeder
I-338	Captain Jennifer Schubert
I-339	Mr. M. Valenteyn Schut
I-340	Ms. Patrice Shawe
I-341	Ms. Kay Shoemaker
I-342	S. Paul & Marie Shuler
I-343	Ms. Millicent J. Singer
I-344	Ms. Carolyn Slaton
I-345	Mr. Jason Slaughter
I-346	Ms. Carol Smith
I-347	Mr. James Smith
I-348	Ms. Dianne Parrott Spook
I-349	Ms. Sheila Stark
I-350	Mr. Frank H. Staub
I-351	Ms. Sheila Steinberg
I-352	P. Stentz and family
I-353	Ms. Carol Stern
I-354	Ms. Sara Stern
I-355	Mr. George L. Stetson
I-356	Ms. Joanne Stevenson
I-357	Mr. Al Stewart
I-358	Ms. Diana H. Storch
I-359	Ms. Karen Stow
I-360	Mr. Scott J. Stow
I-361	Ms. Andrea Sturzen
I-362	Mrs. Grace E. Sutton
I-363	Mr. John Sziber
I-364	Jack & Mary Tagge
I-365	Ms. Pauline Taisian
I-366	Ms. Elizabeth Leeds Tait
I-367	Ms. Kristen Talton
I-368	The Taylor Family

I-369 to I-370	Ms. Carol Taylor
I-371	Mr. William Terry
I-372 to I-374	Mr. Roderick Tirrell
I-375	Mr. Joseph L. Titus
I-376	Ms. Yvette Toepfer
I-377	Mr. Peter Tolk
I-378	Mr. Sten J. Tonessen
I-379	The Torrent Family
I-380 to I-383	Ms. Lisa Turtle
I-384	Mr. Fred Tutt
I-385	Ms. Annette Ungerman
I-386	Ms. Maggie Vail
I-387	Ms. Kathleen Valentine
I-388	Ms. Jan Valliere
I-389	Mr. C. Van Den Heuvel Jr
I-390	Mr. Raoul F. Van Ligten
I-391	The Varga Family
I-392	Mr. Ralph Ventinigig
I-393	Ms. Cecile R. Vogel
I-394	Mrs. Ann C. Vordenberg
I-395	Mr. Michael Blaine Walder
I-396	Donald E. & Emily B. Walls
I-397	Ms. Diana D. Ward
I-398	Mr. & Mrs. Brian Waterman
I-399	Mr. Troy Webster
I-400	Mr. Walter Weeks
I-401	Ms. Sylvia Weess
I-402	Ms. Gladys Weinberg
I-403	Ms. Marlene Weiss
I-404	Mr. Arnie Welber
I-405	Mrs. Ginia Davis Wexler
I-406	Mr. Stephen Whitney
I-407	Ms. Michelle Whitt
I-408	Mr. Daryl E. Wilcox, Esq.
I-409	Paul A. & Marie S. Willey
I-410	Ms. Wylene Williams
I-411	Mr. Mark G. Winder
I-412	Mrs. Amy M. Windhorst
I-413 to I-414	Ms. Jean Winter
I-415	Ms. Alicia Witt
I-416	John P. & Dametia Yianilos
I-417	Mr. Lee Zausner
I-418 to I-419	Mr. Evan Zekofsky
I-420	Dr. Ingrida Zebelins and Mr. James Kolze

NO NAME/ADDRESS/ILLEGIBLE

Alphanumeric codes for correspondence received without a signature or other identification or where such identification was illegible are listed as follows. Alphanumeric codes are listed by presumed alphabetical order of surname or after identifying factors such as a picture post card.

I-421	"Mental Floss"
I-422	Post Card (no picture)
I-423	James L. S?????
I-424	Post Card (moose picture)
I-425	Adam ta Daniel SIMJ?
I-426	Soni?? Caragon?
I-427	Dan Vegala?
I-428	Stacy Ul?
I-429	Joan Doxay?

CONSULTATION AND COORDINATION

BUSINESS

Alphanumeric codes for correspondence received from businesses are listed in alphabetical order by name of the business. The signatory, where identified, precedes the business name.

B-1	Mr. Douglas A. Opell, Heritage Remediation/Engineering, Inc.
B-2	Parkins Marine, Inc.
B-3	Mr. Hugh Hoffman, President, Religious Vacations, Inc.
B-4 to B-5	Mr. R. F. Gardner, Shell Oil Company
B-6	Spellacy, Lescano and Duckett, PA

ORGANIZATION

Alphanumeric codes for organizations are listed in alphabetical sequence by name of organization. When correspondence was signed by an individual, that person's name is shown before the organization's name.

O-1	Ms. Patricia Meacham, Broward Audubon
O-2 to O-3	Mr. Tom Weise, Clean Water Action
O-4 to O-35	David Posnack Hebrew Day School, Fifth and Seventh Grades
O-36 to O-37	Ms. Dianne Petitjean, Environmental Coalition
O-38	Mr. R. P. Haviland, P.E., Environmental Council
O-39 to O-41	Environmental Leaders Council of South Florida
O-42 to O-51	Ms. Ann Whitfield and William A. Wood, Florida PIRG
O-52 to O-55	Mr. Joseph E. Podgor, Jr., Friends of the Everglades
O-56 to O-73	Ms. Joette Lorion, Greenpeace Advisor
O-74	Mrs. Winifred Reuter, Humanitarians of Florida, Inc.
O-75 to O-76	Ms. Kay Allen/Ms. Stephanie Pearson, League of Women Voters of Florida
O-77	Ms. Elizabeth C. Lemon, League of Women Voters of Monroe County
O-78 to O-80	Ms. B. Suzi Ruhl, J.D., M.P.H., Legal Environmental Assistance Foundation
O-81	Mrs. Hana Rosenberg, National Council of Jewish Women
O-82 to O-94	Northeast High School Ecology Club
O-95 to O-98	Ms. Catherine Dees, Save the Florida Panther
O-99 to O-101	Mr. Larry Marvet, Sierra Club

CHAPTER FIVE

LOCAL GOVERNMENT

Alphanumeric codes for local governments are listed alphabetically. The signatory precedes local government identification.

LG-1 to LG-7 Mr. John P. Hart, Broward County Commissioner
LG-8 to LG-15 Ms. Mira Barer, Broward County, Dept. of Natural Resource Protection
LG-16 to LG-18 Mr. John J. Copelan, Jr., Broward County, Office of the County Attorney

STATE & REGIONAL GOVERNMENT

Alphanumeric codes for state and regional governments signatories are identified below.

SG-1 to SG-19 Governor Lawton Chiles, State of Florida
SG-20 to SG-21 Mr. John P. Hart, Chairman, South Florida Regional Planning Council
SG-22 to SG-23 Dr. John G. Dempsey, South Florida Water Management District

TRIBE

The alphanumeric code for correspondence received from a tribe is identified below.

T-1 Miccosukee Tribe of Indians of Florida

FEDERAL GOVERNMENT

Alphanumeric codes for correspondence received from Federal governmental agencies and signatories are identified below. Federal agencies are listed by alphabetical sequences.

FG-1 to FG-2 Mr. Mark H. Hibpshman, Bureau of Mines
FG-3 to FG-7 Mr. Heinz Mueller, Environmental Protection Agency (2 letters)
FG-8 Mr. Edward J. Koszalka, Geological Survey, Water Resources Division
FG-9 to FG-11 Mr. James W. Coleman, Jr., National Park Service

CONSULTATION AND COORDINATION

PETITIONS

Alphanumeric sequence for petitions, alphabetized by name, are listed below.

P-1	Broward Audubon, et al	P-6	Greenpeace
P-2	Linda Coxon, et al	P-7	Julia Pickett, et al
P-3	Earth First!	P-8	Jill Forsberg, et al
P-4	Friends of the Everglades	P-9	Helen M. Roeder, et al
P-5	Greenpeace	P-10	Charlotte R. Seely, et al

5.1.4 Response to Comments

Comment letters and transcripts of oral comments received during the DEIS comment period are presented in their entirety in a separate document, entitled "Public and Agency Comments." Limited copies of this document are available upon request from the Bureau of Land Management, 411 Briarwood Drive, Suite 104, Jackson, Mississippi 39206. Reading copies of the document are available at: the Broward County, Leon County and Palm Beach County public libraries, and the State Library in Tallahassee, Florida; the BLM Office of Public Affairs, Washington, D.C.; the BLM, Jackson District office; and BIA, Arlington, Virginia office.

Numerous public comments were essentially opinions in opposition to, or in support of, the proposed SWEPI Miccosukee 3-1 Exploratory Well. The number of comments and the range of their opinion reinforce the observations contained in the DEIS that there are diverse and, at times, conflicting values and preferences regarding natural resource development projects among various segments of the public. Although statements of opinion have not been responded to individually in this document, it is recognized that such comments provide useful insights into public perceptions of the proposed project.

All oral statements made during the public hearing and all written comments submitted during the comment period for the DEIS were reviewed jointly by the agencies (BLM and BIA) and Dames & Moore, Inc. to identify substantive comments.

The substantive comments can be categorized as: 1) inaccuracies and discrepancies; 2) adequacy of the analysis; 3) identification of new impacts, alternatives, or mitigation measures; or 4) disagreements with significance determinations.

Analysis of the substantive comments indicated that similar comments could be grouped into issues. Ninety-five issues were identified. These 95 issues were assigned a number from 1 through 95 and were divided into 21 major topics.

CHAPTER FIVE

In the following pages, first an index of all issues is presented, in alphabetical sequence by major topic name, along with a brief statement of the nature of the comment(s) and the issue number. This "index" also provides the page number where the issues are presented. This index is provided as an aid for the reader to summarize substantive comments and to tie substantive comments.

Following the index, the major topics and related issues are repeated along with the actual text of the comment. For those cases where more than one comment was made on the same issue, one comment is quoted that was determined to best represent the issue. The alphanumeric code of the quoted letter or statement is noted, as well as the alphanumeric code for any other letters or statements presenting similar issues.

The agencies' response to each issue is presented immediately after the comment. These responses may be found in Sections 5.1.4.1 through 5.1.4.21. An index of the major topics follows:

Section		Index of Major Topics	Page
5.1.4.1	**Access**		
	Issue 1	DEIS does not contain details concerning road construction on berm	5-25
	Issue 2	Disagree with acreage of road turnouts.	5-25
	Issue 3	Recommends more details of Alternative B access road, impacts to wetlands	5-26
	Issue 4	Highway Department agrees with access from I-75 via Snake Road Interchange	5-26
	Issue 5	Questions reasons for FHWA opposition to Alternative C.	5-27
5.1.4.2	**Affected Environment**		
	Issue 6	DEIS needs to be expanded to include historical Everglades.	5-27
5.1.4.3	**Air Quality**		
	Issue 7	DEIS fails to properly evaluate gas flaring procedures, other contaminants and air pollution monitoring.	5-28
5.1.4.4	**Alternatives**		
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	Issue 9	DEIS fails to adequately consider alternatives.	5-37
5.1.4.5	**Archaeological Resources**		
	Issue 10	Concerns the cultural resource potential of the tree islands.	5-38
	Issue 11	DEIS adequately addresses state's concerns for archaeological preservation	5-39
	Issue 12	Nearby archaeological site should be avoided.	5-39
5.1.4.6	**Cumulative Impacts**		
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	Issue 14	Concerns cumulative impacts, impacts on state land use programs and Everglades restoration plans	5-42
5.1.4.7	**Full Field Development**		
	Issue 15	DEIS fails to consider effects of oil development in area. Contrary to Conner v. Burford.	5-43
	Issue 16	DEIS does not analyze worst case oil spill.	5-48
	Issue 17	Requests that agency retain authority to restrict further development based on Sierra Club v. Peterson.	5-50
	Issue 18	Concerns further drilling and production in WCA.	5-52
	Issue 19	Questions what basis production and field development are not reasonably foreseeable.	5-53
	Issue 20	DEIS should specify level of analysis for production and/or field development	5-55
	Issue 21	DEIS fails to include analysis of oil transport.	5-55
	Issue 22	DEIS does not consider gain against risk of oil and gas development	5-56
	Issue 23	Concerns that drilling would set a legal precedent.	5-56
5.1.4.8	**Hurricane Contingency Plan**		
	Issue 24	Questions adequacy of hurricane contingency plan.	5-57
5.1.4.9	**Hydrology**		
	Issue 25	DEIS fail to include analysis of Everglades Restoration Plan.	5-58
	Issue 26	Data concerning location of Biscayne aquifer is not accurate.	5-59
	Issue 27	Requests "Sole Source Review".	5-61
	Issue 28	DEIS does not adequately address wetlands and floodplains under EO's 11990 and 11988.	5-62
	Issue 29	Concern that the gray limestone aquifer is hydraulically connected to the Biscayne aquifer.	5-63
	Issue 30	Concerns pertaining to direction of drainage from proposed well site.	5-64
	Issue 31	Concerns relative to proximity and effects on Biscayne aquifer and Water Conservation Area. DEIS is not based on scientific field studies	5-65
	Issue 32	DEIS fails to consider applicability of UIC rules to disposal of drilling fluids.	5-67
	Issue 33	DEIS does not analyze long term migration of contaminants or monitoring of potential contaminants.	5-68
	Issue 34	Inadequate evaluation of effects on Floridan and gray limestone aquifer.	5-68

Section	Index of Major Topics	Page
Issue 35	Questions adequacy of four-foot high containment berm.	5-69
Issue 36	DEIS fails to analyze spills into canals.	5-72
Issue 37	Concerns the lateral migration of contaminated groundwater.	5-72
Issue 38	DEIS fails to consider contamination of groundwater due to drilling pressure.	5-73
Issue 39	Questions how injected produced water would be prevented from spreading in substrates.	5-74
Issue 40	Questions how public would be provided fresh water in case of disaster.	5-74
Issue 41	Questions whether Appendix A-6 was included as scientific support for the BLM position.	5-75
Issue 42	Concerns that short term use could threaten the Biscayne aquifer.	5-75
5.1.4.10	**Jurisdiction**	
Issue 43	Concerns about the public interest in the proposal.	5-77
Issue 44	DEIS does not contain a Coastal Zone Management Act consistency determination.	5-77
Issue 45	Claims that the DEIS conflicts with state plans. DEIS should address impact to drinking water and social and economic impacts	5-78
Issue 46	States that the South Florida Water Management District Governing Board passed resolution opposing proposal.	5-79
Issue 47	Claims that the state has civil regulatory jurisdiction over the on-reservation drilling activity.	5-81
Issue 48	Concern about right-of-way on levee, berms and canal.	5-82
Issue 49	Proposal has no significant impact on state transportation system and partially satisfies Coastal Zone Management consistency requirements.	5-83
Issue 50	Proposal generally agrees with state's oil and gas development requirements.	5-84
Issue 51	Claims that the water conservation area is state land and not Miccosukee's.	5-84
5.1.4.11	**Land Use**	
Issue 52	DEIS fails to include discussion of the Florida EO banning development in WCA's.	5-85
5.1.4.12	**Monitoring and Enforcement**	
Issue 53	Recommends adding laboratory analysis of petroleum hydrocarbon to monitoring wells.	5-85
Issue 54	Requests that EPA review plans and monitor disposal of waste by injection	5-86 5-87
Issue 55	Questions adequacy of SPCC plan.	5-87
Issue 56	DEIS does not evaluate financial commitments in case of spill.	
Issue 57	Suggests resistivity and porosity logs be run on open hole conditions before setting casing.	5-88

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Issue 58	Questions monitoring of truck speeds, emissions and noise.	5-89
5.1.4.13	**NEPA Process**	
Issue 59	Requests that decision on proposal be made by the Secretary of the Interior	5-89
Issue 60	Questions if DEIS provides Federal accountability.	5-90
Issue 61	Questions why EPA was not a Cooperating Agency.	5-91
Issue 62	DEIS does not include a disclosure statement.	5-91
Issue 63	DEIS does not meet NEPA goals of enhancing "quality of the human environment."	5-91
5.1.4.14	**Noise**	
Issue 64	DEIS does not adequately analyze effect of noise on wildlife.	5-94
Issue 65	DEIS fails to address effect of noise during wading bird breeding periods.	5-95
5.1.4.15	**Socioeconomics**	
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Issue 67	DEIS fails to address impacts to communities.	5-97
Issue 68	Project is consistent with Department policies to promote economic development in economically distressed areas.	5-98
5.1.4.16	**Spills**	
Issue 69	Concerns relative to on-site impacts due to leaks before and after exploratory well abandonment.	5-98
Issue 70	Concern that groundwater would be contaminated from previous diesel fuel spill and that water wells would pull fuel into exploratory wells.	5-100
Issue 71	Recommends expansion of lined area.	5-100
Issue 72	DEIS fails to show probability of spills and spill record.	5-101
5.1.4.17	**Vegetation**	
Issue 73	Vegetation report not accurate of true character of area.	5-101
Issue 74	DEIS does not consider vegetation adjacent to Snake Road.	5-102
5.1.4.18	**Visual Resources**	
Issue 75	DEIS fails to recognize impacts on visual quality and effects on people and wildlife.	5-103

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Issue 76	DEIS does not adequately analyze containment, testing, and disposal of wastes.	5-104
Issue 77	Concerns radioactive levels in water and effects on humans and wildlife	5-110
Issue 78	Questions applicability of offshore surface water discharge standards.	5-112
Issue 79	Inconsistent specifications for plastic liner.	5-114
Issue 80	Concerns movement of drill cuttings.	5-114
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5.1.4.21	**Wildlife Resources**	
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Issue 85	Inadequate data on Florida panther telemetry.	5-120
Issue 86	DEIS does not evaluate effects of spills on wildlife and habitat.	5-121
Issue 87	Inadequate analysis of effects on Florida panther.	5-123
Issue 88	Recommends formal Section 7 Consultation and range of Florida Panther.	
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Issue 90	DEIS fails to consider ecological significance of ecotone.	5-125
Issue 91	Appendix A-9 fails to address adverse effects on wildlife.	
Issue 92	DEIS fails to address impacts of man-made or natural catastrophes on wildlife.	5-126
Issue 93	Concerns critical habitat designation for Florida panther. DEIS fails to consider cumulative impacts on panther.	5-127
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Issue 94	DEIS fails to disclose actual panther activity.	
Issue 95	DEIS fails to show importance of area for dispersal of sub-adult panthers.	5-130

A general response to each of the 95 issues was developed. The response was individualized to address specific points raised in each letter, within the context of the overall issue. This approach provided a more comprehensive discussion of the issues rather than providing specific responses on a point by point basis. Upon completion of the responses, the DEIS text was appropriately modified to produce the FEIS.

The following sections provide specific responses to issues organized in 21 topics.

5.1.4.1 Access

ISSUE 1 ***DEIS does not contain details concerning road construction on berm.***

COMMENT FG-4: "The preferred alternative (Alternative A) requires modifying an existing berm system such that the load bearing capacity of the berm is strengthened to support the weight and traffic of drill rig equipment. Because this berm road will only be 15 feet wide, additional areas (turnouts) need be built to allow passage of two oncoming vehicles/equipment. The Draft EIS should contain more specific details of the required road construction such as estimates of volume of crushed rock aggregate needed to strengthen the berm, and whether the widening of the berm is expected to encroach into any wetland or upland hammock areas."

RESPONSE: The existing berm would be topped with crushed rock aggregate to create a smooth road surface. The berm, as presently constructed, has been sufficiently compacted to support traffic weights. The crushed rock aggregate would serve to control rutting and erosion. The road would not be filled to any specific minimum elevation and the amount of fill required would depend upon the conditions that exist at the time of road improvement. Therefore, the actual fill requirements are unknown. The berm would not be widened, but would require construction of vehicle turnouts. Sections 4.3.8.2 and 4.3.12.2 state that the turnouts would be located in pasture areas to avoid any impact to wetlands or hammocks.

In response to this comment, Section 2.2.1.1 of the FEIS has been modified to include a more comprehensive discussion of the proposed access route construction.

Please note that Alternative A is not the agency preferred alternative of the FEIS.

ISSUE 2 ***Disagree with acreage of road turnouts.***

COMMENT FG-4: "We estimate that 2.9 - 4.4 acres will be filled to construct 7 - 11 turnouts (each turnout has a footprint of about 0.4 acres). We propose that Table 2-1 be modified to reflect this acreage. Turnouts should be located so as to avoid hammocks, tree islands, willow heads and marsh areas."

RESPONSE: As stated in Section 2.2.1.1 of the DEIS, 100-foot long vehicle turnouts would be constructed at intervals of 1/2 to 3/4 mile along the 5.5 mile access route. Each turnout would be approximately 100-feet long by 15-feet wide, an area of 1,500 square feet or 0.035 acres. Assuming that the maximum number of 11 turnouts would be required, the total area would be 11 times 0.035 acres, or 0.385 acres. The total was rounded to 0.4 acres for Table 2-1 (presented as Table 2-2 in the FEIS).

The table is correct as is. Turnouts would be located to avoid hammocks and wetland areas as stated in Sections 4.3.8.2 and 4.3.12.2 of the DEIS. Sections 2.2.1.1, 4.3.8.2 and 4.3.12.2 of the DEIS were modified to clarify the information given in response to this comment.

ISSUE 3 ***Recommends more details of Alternative B access road, impact to wetlands.***

COMMENT FG-4: "The preferred Alternative would require an easement for access to the L-28 Canal and Levee system from South Florida Water Management District (SFWMD). In the event that SFWMD is unable to provide the applicant an easement to their levee system, or if using the Levee as a roadbed is determined to be technically unfeasible, an alternative access route would be needed. Because Alternative B - a route from Snake Road Amoco Station east to the well site - would avoid the levee system, we encourage the applicant to provide more specific details of the road construction, impacts on 404 jurisdictional wetlands, and proposed mitigation for wetland impacts for Alternative B."

RESPONSE: Section 2.2.2.1 of the FEIS has been modified to provide additional details of Alternative B. Section 4.3.12.3 was modified to provide further details of the wetland impacts of Alternative B.

Construction of a one-lane (15-foot top width) road approximately 1.6 miles in length would be required. Vehicle turnouts (100 feet by 15 feet) would be placed at 1/2 to 3/4 mile intervals. All turnouts would be field located to avoid impacts to wetlands and hammocks. The access road would cross four herbaceous marsh areas as depicted on Figure 3-13. The crossings would be approximately 250, 110, 125, and 125 feet in length by 15 feet in width. The total marsh area impacted would be approximately 0.25 acres. This impact would be subject to COE permitting as authorized by Section 404 of the Clean Water Act (see Section 1.6.12 of the FEIS). Section 4.3.12.5 of the FEIS acknowledges that the COE may require mitigation for these impacts. The details of COE required mitigation are unknown at this time. Construction of the west access road could occur only after all COE permit requirements were met.

ISSUE 4 ***Highway Department agrees with access from I-75 via Snake Road Interchange.***

COMMENT SG-16: "I-75 is a limited access Interstate. Reasonable access to this project appears to be provided by the I-75 interchange at Snake Road. Both transportation access alternatives A and B make use of this interchange and would be the desirable route of entry."

RESPONSE: Alternative B is the alternative preferred by the BIA and BLM. Alternative A (the proposed action) is considered an acceptable alternative as a second choice but is not the preferred alternative because of unresolved jurisdictional conflicts between the Miccosukee Tribe and SFWMD.

Authorization of Alternative B would be subject to SWEPI's providing specific road construction plans that conform with BLM road standards, conducting an archaeological survey of the affected area and obtaining any required wetlands permits from the COE.

ISSUE 5 ***Questions reasons for FHWA opposition to Alternative C.***

COMMENT I-198: "In the discussion of alternative C, the comment is made that FHWA is opposed to the use of this access route. Can you tell me what is the reason for their opposition?"

RESPONSE: Alternative C would require the use of an existing limited access point from I-75. The limited access point was constructed to provide access to the SFWMD S-140 pump station and L-28 Levee. The access is not public, and is restricted to use by authorized personnel.

Interstate highways are limited access roads. FHWA policy is to grant access to an interstate highway only when no access exists to a parcel of land. Since the site of the proposed action is accessible via the I-75 and Snake Road Interchange, FHWA is opposed to granting access to SWEPI at the non-public pump station exchange. A FHWA letter is included in Appendix A-12. This letter provides a full explanation of FHWA's position regarding this matter.

Section 1.6.16 has been added to the EIS to provide a discussion of the required authorization. A discussion of the FHWA coordination and position has been added to Section 4.3.7.4.

5.1.4.2 Affected Environment

ISSUE 6 ***DEIS needs to be expanded to include historical Everglades.***

COMMENT I-321: "Consistently throughout the DEIS the study area is limited to 5 acre pasture site while the area of the proposed action is the Everglades ecosystem (p. 4-60). The affected environment is the Everglades ecosystem but Section 3.0 does not describe the (sic) how the ecosystem functions nor its natural boundaries. The analysis needs to be greatly expanded to include the historical Everglades watershed."

RESPONSE: The five-acre pasture site is within the Everglades ecosystem. The area affected by the proposed action varies geographically by the element of the environment being considered. For example, vegetation impacts would be limited to the area filled for the five-acre drill site and access road. Impacts to water quality could occur outside the immediate area of the drill site if a large spill occurred, but

would be contained within a known and limited geographic area as explained in Section 4.3.11 of the FEIS. Transportation impacts would occur on 1-75, Snake Road, and the site access roads. Visual impacts would occur within a radius up to several miles from the drill site. The FEIS concludes that impacts would occur to various elements of the environment, but that the impacts are not significant. The impacts of the proposed action and alternatives would not significantly affect the Everglades ecosystem. The impacts of the proposed action in combination with past, present and reasonably foreseeable actions are discussed under cumulative impacts, Section 4.3.16 of the FEIS.

5.1.4.3 Air Quality

ISSUE 7 ***DEIS fails to properly evaluate gas flaring procedures, other contaminants and air pollution monitoring.***

COMMENT LG-3: "There is little evaluation of the gas flaring procedure. Poor combustion could result in dispersion of metals such as mercury and cadmium, oily particulates, and other combustion products over a wide area around the burn pit. This is a demonstrated phenomenon.

There is no explanation on how the design of the burn pit will mitigate air impacts. Data should be collected which will measure actual air quality effects. These should include particulate monitors, metals analysis of flare fallout, volatile organic compounds, etc. The document did not contain predictive air pollution modelling, and indeed dismisses the possibility of measurable air pollution altogether, citing the proximity of the highway. The presence of a highway nearby does not relieve SWEPI of the responsibility under NEPA to examine the potential for the discharge of toxic air pollutants from the project."

Also considered in the response to this issue were the following similar substantive comments: I-373, LG-10, O-100, SG-14.

RESPONSE: These comments raise several issues which include:

- Compliance with applicable air regulations;
- Accidental emissions of airborne contaminants;
- Potential for cumulative impacts;
- Potential emission of metals and other pollutants from gas flaring; and

- Absence of air dispersion modeling.

Each of these issues is individually discussed below.

Air Regulations

The proposed exploratory well is not subject to review under the EPA nonattainment area or attainment area (PSD) new source review air rules because the emissions would be temporary. Temporary emissions do not consume PSD increments. All emissions originating within the U.S. are subject to the EPA's national attainment air quality standards. There are no specific Federal air emission limiting standards that apply to drilling an exploratory well. Florida has six general air rules that could be applied to an exploratory well:

1) The unconfined particulate emissions rule (requires the use of reasonable measures to control road dust, stockpiles, etc.).

2) The general opacity rule (requires point source emissions, such as a flare to have a visual opacity of less than 20 percent, with some exception).

3) The general VOC rule (requires VOC's to be controlled using reasonable means as found necessary and ordered by the FDEP).

4) The no objectional odor rule (requires emissions not to cause an objectionable odor in a place to which the general public has access).

5) The general excess emissions rule (allows emissions in excess of that allowed by general or source specific emission limits for up to two hours -- with some exceptions -- for start-up, shut down, and malfunctions. The rule specifies when the operator is required to notify the FDEP or its agent of such circumstances).

6) The Federal and state ambient air quality standards (requires that the combined emissions of a given pollutant from all sources that affect any location not exceed specified ambient air concentrations for various averaging times more than a prescribed number of times per quarter, year, or three-year period.

Section 1.5 of the FEIS establishes that state regulations do not apply to the proposed exploratory well. The proposed action, however, would meet the six Florida air rules previously discussed.

Exploration vs. Production Emission

Although an exploratory well is not subject to PSD or nonattainment new source review, a permanent production well would be subject to the general prohibitions of those two rules (which require that particulate matter, sulfur dioxide, or nitrogen oxides emissions not cause or contribute to a PSD increment violation, and that any emissions not interfere with maintaining "reasonable further progress" in attaining the violated ambient standard in a nonattainment area.

A production well could be subject to other provisions of those rules depending on the magnitude of the proposed allowable emissions for the facility. A separate NEPA analysis (that considers these other factors) would be required before a production well could be established and operated on the Miccosukee Federal Indian Reservation.

Accidental Air Emissions

Accidental air emissions could occur as a result of flaring natural gas containing H_2S or the release of H_2S resulting from a casing blowout during the test drilling. Based on data contained in the Air Pollution Engineering Manual (Air & Waste Management Association, 1992), concerning national blowout data over a 10-year period, the probability of a blowout in a modern well is less than 1 for every 2,575 wells drilled.

The proposed exploratory well is to be equipped with BOP. In the event that this equipment and the other proposed precautions fail to prevent a blowout, the proposed H_2S Contingency and Public Protection Plan provides for evacuating the area potentially affected by the release of H_2S gas, and the potential ignition of the gas until the well can be capped. Atmospheric dispersion analysis was used to estimate the area potentially affected by dangerous levels of H_2S due to a blowout. Calculations indicated that beyond 510 feet from the well, the H_2S concentration would be less than 15 ppm. Ten ppm is the American Conference of Governmental Industrial Hygienists (ACGIH) recommended Threshold Limit Value (TLV) (eight-hour average). At 20 ppm, which is the Federal OHSA acceptable ceiling level for industrial exposure, some eye, nose and respiratory irritation usually occurs after one hour of exposure.

Potential Air Pollutant Emission

The potential for air pollutant emissions during the project was estimated and presented in Section 4.3.12 of the DEIS. Mitigation measures were recommended in Section 4.3.15 of the DEIS.

The potential emission of H_2S gas as a result of a well blowout was discussed in the previous section. A blowout is unlikely (less than 1 chance in 2575). Dangerous levels of H_2S gas at ground level would

most likely occur within 600 feet of the well, and the H_2S, SO_2, particulate, NO_2 and CO emissions at the levels predicted would not have any long term adverse environmental effects. These expectations are consistent with actual experience with other test and production oil wells in the U.S.

Cumulative Effects

Extensive air quality monitoring was conducted at the Riley Ridge field development project in Wyoming, a large field involving 220 wells (USDI, 1983). The findings of the study were that sufficient dispersion existed to preclude development of concentrations in excess of the ambient air standards or PSD increments. Air dispersion in Florida is generally better than in Wyoming, particularly in South Florida.

The PSD rules require cumulative air quality impacts to be considered in the permitting of any new or modified source. No air permit is to be issued unless the applicant provides "reasonable assurance" that the source emissions would not cause or contribute to a violation of an ambient air quality standard or PSD increment or interfere with "reasonable further progress" in attaining the violated ambient standard in a nonattainment area.

Gas Flaring Procedure

Gas flares are standard equipment in the petroleum industry. They are generally 95-99 percent efficient in converting combustible gas to non-combustible gas and water vapor. When properly operated there is very little visible emissions or oil soot emitted. The amount of heavy metals (mercury, cadmium, etc.) is not a function of the flare combustion efficiency. They are not readily combustible. Whatever is in the gas stream going to the flare would be emitted. Mercury emissions are discussed later in this response.

Flare Pit - Air Impacts

The flare pit is intended as a safety feature and is not intended to mitigate air impacts. Its purpose is to minimize water contamination and accumulate flammable gasses and liquids (oil, brine, etc.) that might be emitted from the flare. Most of such materials would fall out of the flare plume close to the flare.

Air Dispersion Analysis

Air dispersion analysis was used in developing the H_2S Contingency Plan (Appendix A-3). Temporary emissions are not subject to PSD increments. Sources that do not emit criteria air pollutants at a rate greater than the PSD threshold amounts generally do not cause violations of ambient standards. The Wyoming air monitoring study and other assessments of oil well drilling indicate that absent a major well

blowout that results in an oil well fire, the emissions from oil well drilling do not cause violations of ambient standards.

The reference to the nearby highway was to provide a comparison of the criteria pollutants estimated to be emitted by the proposed test well drilling to vehicle traffic on the nearby highway. On a daily basis, the project emissions of criteria air pollutants (those for which a national ambient air quality standard has been set) are approximately the same as emitted by vehicular traffic on a five mile length of that roadway.

Toxic Air Pollutants

There would be small amounts of various metals and polyorganic materials emitted from the stationary diesel engines used to power the drilling rig. The types and amounts would be similar to that emitted by motor vehicles on the adjacent highway. Hydrogen sulfide and some heavy metals could be emitted from a well blowout or as a result of venting a gas pocket through the flare. Hydrogen sulfide emissions have already been addressed. The heavy metal of most concern in South Florida is mercury.

In 1992, FDEP (then FDER) completed an initial study of mercury emissions in Florida. Recently, the FDEP's Environmental Regulation Commission adopted new rules to significantly reduce mercury emissions from municipal waste incinerators such as the Broward County Waste-to-Energy facilities. Additional rule making is planned for other types of mercury emitting sources. The following tables summarizes the current best estimate of mercury emissions in Broward County and statewide by various source categories and fuel types during 1990.

The total county-wide mercury emissions (not including the two new county waste-to-energy incinerators) have been estimated to be approximately 2,000 pounds per year. Half of that is from man-made sources, the other half from natural sources, primarily soil degassing. Major man-made sources are electric apparatus, paint, and medical waste -- 75 percent of the man-made total. About ten percent of the remaining man-made emissions are from fuel combustion. Seventy percent of that is from burning gasoline and diesel fuel. Twenty percent of the fuel combustion total (or less than two percent of the man-made total) is from burning residual fuel oil, primarily in utility boilers. The burning of all natural gas in the county accounts for less than two-tenths of a pound per year.

Mercury is primarily an environmental concern not because of the potential for breathing high concentrations of mercury in the ambient air, but because mercury that gets into waterbodies is accumulated and concentrated through the food chain. Unacceptable levels of mercury have been found in fish in South Florida and other parts of the state.

Broward County Mercury Emissions (lbs/year) 1990 Estimates[1]		
Source Title	Florida Total	Broward County Total
MSW[2]	11,444	(0)[2]
Utilities	6,758	104
Medical Waste	1,780	154
Sugar	281	0
Cement	102	0
Other Fuels	1,023	31
Paint	1,704	165
Electrical Apparatus	3,703	359
Dental	50	5
Lab Use	147	14
Diesel Fuel	403	22
Gasoline/Jet Fuel	437	38
Open Burning	215	0
Sewage	123	12
Anthropogenic Total	**28,155**	**904**
Natural (Soil Degassing)	**97,729**	**1,093**
GRAND TOTAL	**125,884**	**1,996**

1 Mercury Emissions to the Atmosphere in Florida, May 1992 (prepared for the Florida Department of Environmental Regulation by KBN Engineering and Applied Sciences, Inc.).

2 Does not include the current emissions from the Broward County WTE facilities. Large MSW facilities can emit several thousand pounds of mercury each year. If they are equipped with the type of air pollution control equipment required by the recently adopted FDEP mercury air emissions rule, the mercury emissions can be reduced to several hundred pounds per year.

Broward County Mercury Emissions (lbs/year) 1990 Estimates		
Fuel Type	Florida Total	Broward County Total
Residual Oil	326.6	16.7
Distillate Oil	236.8	9.1
Natural Gas	2.0	0.12
Diesel Fuel	403	22[1]
Gasoline	430	37[2]

1 46.97 million gallons burned

2 529.1 million gallons burned

If a well blowout was to occur, crude oil and natural gas would be emitted and burned for several hours. The mercury content of the crude oil would most likely be similar to that found in residual oil. The amount burned per hour would be much less than the hourly total residual oil burned in the county and would be burned for a few hours instead of 8,760 hours per year. If the hourly amount of oil burned during the blowout was equal to the existing rate from all other sources in the county and the well burned for one day, the likely mercury emissions would be approximately 1/500th of a pound, an insignificant amount.

Conclusion

Extensive air monitoring has been conducted at the Riley Ridge well field in Wyoming, a large production oil well field (220 wells). No cumulative effects or violation of air standards were found. Several previous assessments of test oil well projects have been done which concluded no significant impacts from this type of operation. The likely air emissions for this project have been estimated. The normal emissions from the test site would be comparable to vehicular emissions on a five-mile length of the nearby major roadway.

Absent a major well blowout, all of this information indicates that there is a very high probability that the air emissions associated with the proposed test well drilling operation would not have any significant short or long term adverse impact on the environment or people in the area. Dispersion analysis was used to calculate the maximum distance from the well within which dangerous levels of H_2S might occur

in the event of a well blowout. The chances of that happening are approximately one in 2575. In the event a blowout would occur, SWEPI would promptly implement the H_2S Contingency and Public Protection Plan which includes communications, public notification and evacuation procedures for the local area. The available information on mercury and other toxic pollutant emissions indicates that there would be very little mercury or other toxic air pollutants emitted from the test site. Significant sources of mercury emissions in Broward County include natural soil degassing, electrical apparatus, paint, medical waste, utilities, and the new county waste-to-energy facilities.

5.1.4.4 Alternatives

ISSUE 8 ***Improper restriction of No Action Alternative.***

COMMENT O-101: *"The decision to reject the No Action Alternative because it does not meet the objectives of the project is an improper restriction of the alternatives. This restriction can only lead to one choice, drilling, though the true objective is to obtain energy for consumers. Thus, alternative energy sources, conservation, etc. must be considered."*

Also considered in the response to this issue were the following similar substantive comments: I-56, I-321, I-322, I-327, I-373, I-374, LG-2, LG-9, LG-10, O-2, O-3, O-36, O-39, O-45, O-46, PH-8, PH-15, PH-19, SG-20.

RESPONSE: These comments contain three separate issues which are:

- Consideration of the No Action Alternative;
- Alternatives to the proposed action; and
- Objectives of the project.

The No Action Alternative was not rejected because it does not meet the objectives of the project, as suggested in this comment. The DEIS stated that implementation of the No Action Alternative would result in no impacts over and above those already occurring. For this reason the No Action Alternative was not discussed specifically under each resource element in Chapter 4 of the DEIS. A resource by resource discussion was not added to the FEIS for the same reason.

The Miccosukee Tribe entered into a lease with SWEPI. The lease grants SWEPI the exclusive right to use the lease premises for exploring, drilling, operating for, producing and owning oil, gas, and other enumerated minerals. The lease rights are subject to compliance with Federal regulations including 43 CFR, Part 3160, governing oil and gas operations on Federal and Indian lands. The BLM may withhold approval of a specific permit to drill when the proposal cannot be conducted in a manner which complies with the lease terms and regulations, and does not protect natural resources, environmental quality, life and property. However, the authority of BLM to withhold approval of a specific permit to drill does not mean that SWEPI may be denied surface use of the entire leased premises. To deny all use of the leasehold surface would amount to confiscation of a valuable property right acquired by SWEPI. Lease rights are legally protected interests entitled to constitutional protection against taking without just compensation. The BLM, acting pursuant to the delegated authority of the Secretary of the Interior, does not possess the authority to "take" SWEPI's property. Hence, BLM's authority with regard to the No Action Alternative is restricted to denial of a permit when specific conditions warrant such a denial. BLM may not deny the lessee reasonable opportunity to develop the lease.

The Miccosukee Tribe also has property rights that must be recognized. As the beneficial land owner, it has the right to pursue development of its property. It is in pursuit of this right that the Tribe leased its reservation to SWEPI for mineral development.

In this instance, No Action means denial of the SWEPI APD for an exploratory well at the proposed drill site, or any alternative sites that could meet the geologic objectives of the project. The No Action Alternative is a valid alternative to the decision maker.

As stated in Section 2.6 of the FEIS, "It is the opinion of the BLM, in consultation with BIA, that the analysis presented in the DEIS shows that Alternative A, the proposed action, as well as Alternative B and C, with recommended mitigation, comply with the terms of the lease agreement and all applicable regulations, and assure protection of natural resources, environmental quality, life and property. Hence, the No Action Alternative is not warranted." The agencies clearly recognize that the No Action Alternative is a valid alternative available to the decision maker, and that this alternative has been fully considered, but it has not been found to be justified in this instance.

Section 2.2.4 has been expanded to provide a better understanding of the BLM's authority and limitations relative to the No Action Alternative.

The broad goal of gas and oil exploration is to locate energy deposits that can be developed to meet consumer energy demand. However, the specific objective of the proposed action is to determine if hydrocarbons are present on a specific area of the Miccosukee Reservation. Alternative energy sources and conservation are not alternatives that would determine the presence of hydrocarbons on the

Miccosukee Reservation. Therefore, these alternatives would not be implemented by the applicant. Additional discussion of alternatives is included under issue 9.

Issue 9 ***DEIS fails to adequately consider alternatives.***

COMMENT O-39: *"The treatment of alternatives in the Draft EIS was completely unsatisfactory to us and to the requirements and spirit of the National Environmental Policy Act. The alternatives listed were in fact the same option in three configurations. We expect a new DEIS to include real alternatives, fully discussed, including a serious discussion of the no-action alternative, alternative energy sources, and alternatives offsite. The discussion of alternatives should identify what is, in fact, the public interest in the proposal and how that interest can be served or harmed by the project."*

Also considered in the response to the issue were the following similar substantive comments: I-34, I-226, I-266, I-373, LG-2, LG-10, O-2, O-45, O-46, O-61, O-62, O-75, PH-5, PH-8, PH-9, PH-10, PH-11, PH-12, PH-17.

RESPONSE: The phrase "range of alternatives" refers to all reasonable alternatives, which must be rigorously explored and objectively evaluated, as well as those other alternatives, which are eliminated from detailed study with a brief discussion of the reasons for eliminating them. Reasonable alternatives include those that are *practical* or *feasible* from a technical and economic standpoint (46 FR 18026-18038) (March 23, 1981).

The DEIS considers a full spectrum of surface locations and access routes that meet the purpose and geologic objectives of the project. As stated in Section 2.1.2 of the DEIS, these alternatives are limited by technological and practical constraints and environmental considerations. Specific geologic targets were identified by the applicant through seismic testing. The proposed well is designed to penetrate the entire sedimentary column to basement rock at 17,730 TVD and to penetrate specific subsurface targets which have been identified as having potential for containing hydrocarbons. The locations of the targets are identified on Figure 2-1 of the DEIS. The proposed drilling is designed to test the targets by means of directional drilling. Directional drilling has technological limitations in terms of the distance the surface location can be from the target. These limitations are discussed in the DEIS, Appendix A-2. Off-site alternatives outside the area that is technologically feasible are not considered reasonable alternatives and were eliminated from detailed analysis as discussed in DEIS Section 2.5.

The DEIS also considered alternate energy sources within the range of alternatives. However, as discussed in DEIS Section 2.5, these alternatives were not considered practical or feasible (reasonable) alternative(s) to the proposed action. Ultimately, the agency's preferred alternative should be the

alternative which they believe would fulfill their statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors. Each alternative, except for the No Action Alternative, should represent an alternate means of satisfying the intended purpose and need of the proposal. As stated in the DEIS, this alternative would not fulfill the purpose or intent of the proposed action; to determine if hydrocarbons are present in the area of the action within the Miccosukee Reservation, nor is it consistent with the intent of the IMDA; to allow any Indian tribe to enter into Minerals Agreements providing for the exploration of mineral resources.

The No Action Alternative is a legitimate alternative which receives full consideration in the analysis and decision making process. The No Action Alternative could be the agencies' preferred alternative if the proposed action could not comply with the terms of the lease agreement, applicable regulations, or assure protection of natural resources, environmental quality, life and property. The No Action Alternative in this case is not warranted as the agencies' preferred alternative. Please refer to Section 2.2.4 of the FEIS which discusses treatment of the No Action Alternative.

The proposed action is intended to fulfill a lease agreement between the Miccosukee Tribe and SWEPI. The proposed action is not a publicly funded project, is not to be conducted on public lands, and does not require a determination of public interest to be approved. The proposed action must, however, be in full compliance with all applicable laws, regulations and standards in order to be approved. Compliance assures that the proposed action and alternatives are not contrary to the public interest.

5.1.4.5 Archaeological Resources

Issue 10 ***Concerns the cultural resource potential of the tree islands.***

COMMENT FG-4 and FG-5: *"The Archaeological Review Assessment (Appendix 4-A) reported no cultural resources at the drill site but did not specifically address the hammock/tree island areas located west of L-28 which may be impacted by the berm widening for roadway use. Hammock/tree islands are the most likely location for cultural resources to be found. The number of cultural resources known to be within a mile of the site suggests the region was at one time actively used by native Americans. While we agree with the archaeological consultant's general recommendation that tree islands should be avoided, we were unable to find concrete statements that anyone has actually examined those tree islands to determine their cultural resource potential."*

RESPONSE: The berm along the west side of the L-28 Canal would not be widened. The surface of the berm would be topped with crushed rock aggregate to create a smooth road surface. Vehicle turnouts of 100-feet in length would be constructed at intervals of 1/2 to 3/4 miles. Hammocks would not be

impacted by the turnouts, as there are no hammocks along the proposed access route. The west access route (Alternative B) is also cited to avoid hammocks. Since hammocks would not be impacted by the proposed action or alternatives, archaeological surveys of the hammocks in the vicinity of the project were not conducted.

An archaeological survey of the drill site was completed. Section 4.3.2.5 of the FEIS states that if the west access route is selected, an archeological survey of the affected area would be required prior to construction.

ISSUE 11 ***DEIS adequately addresses state's concerns for archaeological preservation.***

COMMENT SG-18: *"We have reviewed the DEIS and note that Sections 3.3.2, 4.3.2 and 4.4.2 adequately address this agency's historic preservation concerns. In addition, a review of our files indicates that no significant archaeological sites are likely to occur within the proposed drill site or as a result of Alternative A or Alternative C. Project activities associated with the above will have no effect on properties potentially eligible for listing in the National Register, or otherwise of historical or architectural value. These portions of the project are also consistent with the historic preservation laws of Florida's Coastal Management Program and may proceed."*

RESPONSE: This determination is consistent with the findings of the DEIS and a previous consultation with DHR which was conducted in July, 1992. (See Correspondence in Appendix A-12).

ISSUE 12 ***Nearby archaeological site should be avoided.***

COMMENT SG-18 and SG-19: *"Concerning Alternative B, a potentially significant archaeological site, 8BD1439, is recorded in the vicinity of Access Route B. This site should be avoided and preserved. If this is not feasible, professional Phase II testing will need to be performed at the location of this site prior to any project related ground disturbing activities. The resultant final report would then need to be forwarded to this office in order to complete the project review process."*

RESPONSE: The exact location of archaeological site 8BD1439 is known, and this site is avoided by all components of the proposed action and alternatives. In addition, all hammock areas are avoided to assure that potential archaeological sites would not be impacted. Finally, Section 4.3.2.5 of the FEIS includes a mitigation measure which requires an archaeological survey to be conducted on Access Route B prior to construction.

5.1.4.6 Cumulative Impacts

ISSUE 13 ***DEIS fails to evaluate cumulative impacts upon the Everglades ecosystem.***

COMMENT I-322: "The DEIS fails to adequately evaluate cumulative impacts upon the Everglades ecosystem. Cumulative impacts are impacts likely to occur due to the proposed action or alternatives in combination with other past, present, and reasonably foreseeable future actions (p. 4-60). The DEIS evades this requirement completely. The Everglades has been degraded by the cumulative impacts of thousands of individual projects since the late 1800's. The fundamental issue debated here is not technology but the integrity of critically endangered ecosystem. The proposed action is analyzed in isolation from the rest of the ecosystem, treating it as if it was the only development in a pristine environment. When an agency proposes a single action it must be evaluated in context with all the cumulative effects of all past, present, and proposed actions in the same ecosystem."

Also considered in the response to this issue were the following similar substantive comments: I-325, I-326, I-327, I-372, I-374, LG-2, O-2, O-37, 0-55, O-100, PH-3, PH-8, PH-10, PH-17, PH-18, PH-20, PH-24, PH-25, PH-29, PH-30.

RESPONSE: Section 4.3.16 of the DEIS addresses cumulative impacts. Cumulative impacts are impacts likely to occur due to the proposed action or alternatives in combination with other past, present and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. For example, cutting one acre of a 5,000-acre forest to create a homesite may be an insignificant impact. If the remaining forest has been divided into similar one acre homesites, the cumulative impact of clearing all lots would be great. Four factors are considered in the assessment of cumulative impacts:

- Impacts Which Would Occur as a Result of the Proposed Action,
- Geographic Boundaries of the Impacts,
- Impacts That Have Occurred as a Result of Past Actions, and
- Potential Impacts of Reasonably Foreseeable Future Actions.

Impacts Which Would Occur as a Result of the Proposed Action.

The analysis conducted for the FEIS has resulted in a determination that no significant impacts would occur to the environment as a result of the proposed action or alternatives. Construction and operation

of the proposed project or alternatives is not expected to cause significant cumulative impacts to air, cultural, geologic, aesthetic, socioeconomic, transportation, vegetation, water, wetlands, or wildlife resources within the project area. More importantly, in terms of cumulative impact assessment, the minor impacts associated with the proposed action are mostly short-term in nature, lasting 325 days or less. The drill site and access road may not be restored if the Miccosukee Tribe requests that these features remain in place, resulting in the permanent impact of five acres of fill area within the pasture for the drill site; three acres of fill within the pasture including 0.25 acres of fill within wetland areas for Access Route B; and a piling supported concrete bridge across the L-28 Canal for Access Route C.

Geographic Boundaries of the Impacts

In order to evaluate the cumulative impacts of an action, geographic boundaries must be established. Physical boundaries such as watersheds, biological boundaries such as habitats, socioeconomic boundaries such as market areas or regions, and political boundaries such as counties may be appropriate for setting analytical parameters, depending on the specific values affected. For each resource an outer boundary can be determined beyond which the impacts of the proposed action are not extended. In considering the proposed action and alternatives, the geographic boundary of the area of impact ranges from the five-acre drill site to several miles as in the case of visual impacts. The area of impact to soils, vegetation, and wetlands is expected to be limited to the five-acre drill site and access road and areas immediately adjacent to these facilities. The area of impact to air quality, water resources and wildlife may extend several hundred feet from the drill site and access road. The boundary of impacts to transportation, noise, and visual resources ranges from several thousand feet to several miles. The area of impact for most resources is the site vicinity discussed and depicted on maps in the FEIS.

Impacts That Have Occurred as a Result of Past Actions

Past actions within the established geographic boundaries for resource evaluation have resulted in impacts to the environment. It is not possible or necessary to quantify and qualify the conditions of the entire Everglades Ecosystem prior to the first impacts of man and identify each subsequent action and its impacts. The region of the proposed action (the Everglades ecosystem) has been significantly altered by water management and land development activities over the past 100 years. These activities have resulted in a well documented general decline in water quality and wildlife resources. Within the geographic boundaries of the area that could be impacted by the proposed action and alternatives, construction of WCA-3A, L-28, and the S-140 pump station have resulted in a hydrological regime in the project area conducive to maintaining a large area of pasture between WCA-3A and the Big Cypress Swamp. The area has been further altered by construction of I-75 and Snake Road. Presently, the main activities on the Miccosukee Reservation are limited to hunting, fishing, and cattle grazing. Facilities in the area that could be impacted by the proposed action and alternatives are limited to three microwave towers, the

Miccosukee Service Plaza, billboards, ditches, pasture areas, fencing, primitive roads, the S-140 pump station, public roads, electrical transmission poles and lines.

Potential Impacts of Reasonably Foreseeable Future Actions

Impacts that may accumulate from other reasonably foreseeable actions in the geographic boundaries of consideration must also be considered in the evaluation of cumulative impacts. The FEIS establishes that the proposed action is not likely to lead to future actions (reasonably foreseeable actions) that result as part of the proposed action. The Miccosukee Tribe's future land use plan is general and does not detail reasonably foreseeable development plans for the Reservation. Specific Everglades restoration plans which could potentially impact the Reservation are not in existence at this time.

Conclusion

In considering the four factors, the proposed action and alternatives would be expected to result in short-term and/or insignificant impacts, confined primarily to the immediate project area. The impacts associated with the project will not contribute significantly to past or present impacts within the affected area, and the proposed action and alternatives would not be likely to lead to future actions (reasonably foreseeable actions). Therefore, the project would not be expected to result in significant cumulative impacts.

Section 4.3.16 of the FEIS has been expanded to address the consideration of cumulative impacts in greater detail.

ISSUE 14 ***Concerns cumulative impacts, impacts on state land use programs and Everglades restoration plans.***

COMMENT O-2: "Cumulative impacts on the ecosystem, potential impacts on public water supplies, the impact on State land use programs and, most importantly, complications regarding as-yet-to-be-drafted Everglades Restoration Plans, need to be considered in their entirety in the revised DEIS."

RESPONSE: Three separate issues are raised in this comment:

- Assessment of cumulative impacts;
- Impact on state land use programs; and
- Impact on Everglades restoration plans.

The assessment of cumulative impacts is discussed in Section 4.3.16 of the FEIS which has been expanded to address the consideration of cumulative impacts in greater detail.

The proposed action and alternatives would not conflict with any state land use programs. State land use programs are not applicable to the lands within the Miccosukee Reservation, primarily because these are lands held in trust by the Federal government for the Miccosukee Tribe. As stated in Sections 1.5 and 1.6 of the FEIS, state land use regulations do not apply to the Miccosukee Reservation.

The COE is conducting a multi-year comprehensive review study of how to modify the Central and South Florida Flood Control Project to restore the ecosystem of South Florida consistent with other demands. On September 23, 1993, the U.S. Departments of the Interior, Commerce, Army, Justice and Agriculture and the EPA entered into an interagency agreement in an effort to develop the Federal objectives of the study. In December, 1993, public workshops were held to solicit public input. The study has several phases. The reconnaissance phase began in June, 1993 and would be completed in November, 1994. The reconnaissance phase would consist of identifying problems and potential solutions. The second phase, the feasibility study would begin in early 1995 and would require three years for completion. The feasibility study would result in recommendations for modifications to the Federal project. After the feasibility study is completed individual projects must be designed and plans and specifications must be developed. According to the COE, six to ten years would pass before any projects are undertaken as a result of the comprehensive review study.

The proposed action of the FEIS would be completed before Everglades restoration plans are implemented. Furthermore, as stated in Section 4.3.19, the proposed action and alternatives would not result in an irreversible commitment of resources.

5.1.4.7 Full Field Development

ISSUE 15 ***DEIS fails to consider effects of oil development in area. Contrary to Conner v. Burford.***

COMMENT LG-16: "Shell's failure to consider the effect of oil development in the area is contrary to the holding of the court in Conner v. Burford, 848 F.2d 1441, 1450-1451 [9th Cir. 1988 (sic)]. While recognizing the speculative nature of oil exploration, the court in Conner, held that an EIS assessing the full environmental consequences of development must be prepared prior to exploration. The decision to approve now and ask questions later is precisely the type of environmentally blind decision-making that the National Environmental Policy Act (NEPA) was designed to avoid. Pursuant to the holding on Conner, Shell is required to consider the effects of oil production at the exploratory stage."

Also considered in the response to this issue were the following similar substantive comments: FG-3, FG-4, FG-10, I-372, LG-2, LG-9, O-44, O-60, O-61, O-101, PH-3, PH-4, PH-8, PH-9, PH-10, PH-12, PH-16, PH-17, PH-32, SG-15, SG-20.

RESPONSE: Several substantive issues are raised by these comments:

- Applicability of Conner v. Burford;
- Scope of analysis of post-lease actions; and
- Classification of the proposed well as a wildcat well.

Each of these issues is addressed below.

Applicability of Conner v. Burford

Conner v. Burford, 848 F.2d 1441, (9th Cir. 1988) is not applicable to the proposed action or alternatives. This case pertains specifically to a leasing action, and not to post-lease actions such as applications for permit to drill. A significant and fundamental distinction needs to be understood concerning the agencies' authority in the pre-lease phase versus the post-lease phases.

Conner v. Burford, 848 F.2d 1441, considers the issuance of oil and gas leases on lands within the Flathead and Gallatin National Forests of Montana. This case presents the question whether Federal agencies violated NEPA or the ESA by selling oil and gas leases on 1,300,000 acres of national forest land without preparing either an EIS or a comprehensive biological opinion encompassing the impact of post-leasing activities on threatened or endangered species. The court made a distinction between leases that allow for surface occupancy and leases that prohibit surface occupancy. Leases that prohibit surface occupancy are referred to as "no surface occupancy" (NSO) leases. Leases that provide for surface occupancy are non-NSO leases. The court concluded that Federal agencies violated NEPA by issuing non-NSO leases without an EIS and violated the ESA by making lease sales without preparing a biological opinion which considers the effects of post-leasing oil and gas activities.

The court concluded that the sale of an oil or gas lease without the no surface occupancy stipulation constitutes the "point of commitment," and that after that point the government no longer has the ability to prohibit potentially significant inroads on the environment. This opinion serves as the basis for the courts opinion that the effects of exploration must be evaluated before selling non-NSO leases.

The environmental effects of oil and gas activity, including exploration through field development and eventual site abandonment activities were considered in general terms and assessed prior to the commitment to lease the oil and gas minerals on the Miccosukee Reservation. This was done via an EA (NPS, December, 1981) prepared by the NPS, Denver Service Center, for the BIA and the Miccosukee Tribe of Indians of Florida. The purpose of the assessment was to provide sufficient information to determine if the leasing of the Reservation lands would be a major Federal action that could significantly affect the environment. This EA served as the basis for issuance of a FONSI by the BIA dated March 29, 1982. Hence, the BIA and the Miccosukee Tribe made the decision to issue leases on the Miccosukee Reservation, based on evaluation of the environmental consequences prior to the lease sale; the "point of commitment."

The EA of the oil and gas leasing program for the Miccosukee Reservation is discussed in Sections 1.4.4 and 1.4.5 of the FEIS.

Scope of Analysis of Post-Lease Actions

The issue relative to post-lease actions is whether or not a conceptual field development plan should be required for evaluation at the post-lease phase for an exploratory well proposal. A conceptual field development plan would describe the extent, location, duration and timing of wells and facilities required to explore and develop a field based on data concerning the characteristics of a reservoir. The BLM and BIA maintain that, in this case, it is not reasonable to require such a plan prior to completion of the proposed exploratory well. This issue pertains to defining the scope of analysis for post-lease actions. This issue has been considered on several occasions by the USDI, Office of Hearing and Appeals, Interior Board of Land Appeals (IBLA), where the BLM's decision has been appealed, in part, for not considering field development at the exploration stage for oil and gas or geothermal drilling proposals. The Sierra Club et al, 104 IBLA 76 (1988), Utah Chapter Sierra Club et al, 120 IBLA 229 (1991), Sierra Club, Inc., et al, 126 IBLA 142 (1993). In each case, the IBLA has issued a decision that the BLM properly defined the scope and that the analysis was not in error for not including field development at the exploration phase.

When determining the scope of analysis, the agency must consider three types of actions, three types of alternatives, and three types of impacts. The three types of actions are connected action, cumulative actions and similar actions.

In accordance with NEPA regulations (40 CFR, 1508.25), actions are considered connected if they: 1) automatically trigger other actions, 2) cannot or will not proceed unless other actions are taken previously or simultaneously, or 3) are interdependent parts of a larger action and depend on the larger action for their justification. The proposed exploratory well would not automatically trigger production or field

development, can proceed without other actions occurring previous or simultaneous, and does not depend on a decision on production or field development for its justification. The action is proposed for the purpose of testing for the potential occurrence of hydrocarbons and is fully justified for that purpose and objective. Hence, exploratory drilling and production/field development are not connected actions as defined by the NEPA regulations. In addition, approval of the proposed well would not commit BLM or BIA to any future decisions regarding production or field development.

Cumulative actions include actions, which when viewed with other proposed actions, have cumulatively significant impacts. Similar actions include actions, which when viewed with other proposed or reasonably foreseeable actions, have similarities that provide a basis for evaluation together. Production and field development are not proposed or reasonably foreseeable as discussed in Section 1.1.4.2 of the FEIS.

Alternatives considered in the scope of analysis include: 1) the No Action Alternative; 2) other reasonable courses of action; and 3) mitigation measures. These have all been considered and discussed in the FEIS.

Impacts considered in the scope of analysis include impacts which may be: 1) direct, 2) indirect, or 3) cumulative. These have all been considered and discussed in the FEIS.

The BLM and BIA maintain that the appropriate time to require submittal of a conceptual field development plan, relative to this proposed action, is when a reasonable basis exists to view field development as reasonably foreseeable. The agencies further believe that such a point exists upon completion of a discovery well. Prior to the drilling of an exploratory well, there is no basis to establish that hydrocarbons even exist, much less that hydrocarbons exist in quantities capable of commercial production and field development. Prior to the point of discovery, the probability of production and field development must be viewed as a highly speculative possibility as opposed to a reasonably foreseeable consequence. The analysis of field development must be based on the conceptual plan of development. The conceptual plan must be based on data relative to the existence and characteristics of a reservoir. Such a plan must not be based on conjecture, but supported by credible scientific evidence, and must be within the rule of reason. These basic criteria are reflected in the NEPA implementing regulations. Exploratory drilling is typically based on geophysical seismic data. While such data provides some indications of geologic structures, it is indirect, incomplete and inconclusive as to the presence of hydrocarbons. Hence, assumptions relative to the existence of hydrocarbons, well production and/or field development, prior to the drilling of the proposed exploratory well are highly speculative and not supported by credible scientific evidence. In fact, the purpose of drilling the proposed exploratory well is to obtain tangible evidence as to the presence or absence of hydrocarbons. To require an analysis of production and field development on the basis of highly speculative assumptions and conjecture is not,

in the opinion of the BLM and BIA, within the rule of reason. A discovery would provide the necessary basis to consider a conceptual plan of development.

This issue is discussed in Park County Resource. v. United States Department of Agriculture. 817 F.2d 609, 623 (10th Cir. 1987).

> "As an overall regional pattern or plan evolves, the region-wide ramifications of development will need to be considered at some point. A singular, site-specific APD, one in a line that prior to that time did not prompt such a broad-based evaluation, will trigger that necessary inquiry as plans solidify."

The BLM and BIA have stated in the FEIS that if a discovery of commercial quantities of hydrocarbons is made, further exploration and development in the area of the proposed action will not be authorized until an EIS of field development has been completed and appropriate permits issued. Such analysis would be based on a conceptual field development plan.

Classification of the Proposed Well as a Wildcat Well

Some reviewers question the proposed well status as a wildcat exploratory well. Appendix A-1 of the FEIS includes a definition of a wildcat well as a well drilled in search of an as-yet undiscovered pool of oil or gas.

The proven production in South Florida comes from the Sunniland Formation. The active oil fields are located along the Sunniland Trend; a geologic trend that is oriented northwest to southeast from Lee and Hendry counties through Collier County and into Dade County. The fields in this trend consist of relatively small reservoirs derived from small carbonate reefs. These structures have limited areal extent. A typical field, such as Raccoon Point field, extends less than two miles from the center of the reservoir. The closest production to the proposed well site is Raccoon Point field, located approximately 13 miles south-southwest. Hence, the proposed well site is not a potential extension of Raccoon Point or any known field. In addition, the proposed site is several miles northeast of the northern edge of the Sunniland Trend; a direction opposite the orientation of the trend, and exploration in the Sunniland Formation near the proposed well (approximately two miles west-northwest) has proven dry. The existing nearby well control provides some geologic information about the Sunniland Formation, but not about the existence of an oil accumulation or its areal extent. The deeper portion of the geologic section has not been penetrated sufficiently to provide an understanding of possible reservoirs. The lack of well control of the deeper geologic section in combination with limited Sunniland information make this a wildcat.

The drilling of exploratory wells with highly speculative potential is not unique or unusual. Statistics included in the FEIS show that nearly 700 wildcat wells have been drilled in Florida, including the dry hole drilled approximately two miles from the proposed site in 1985. These wells have resulted in 22 discoveries. Nationally, about 15% of wildcat wells result in potential oil and/or gas production. In South Florida, the figure is about 7%. However, this relatively low rate of success has been an acceptable risk to industry for the potential of finding new sources of hydrocarbons.

ISSUE 16 ***DEIS does not analyze worst case oil spill.***

COMMENT LG-17: "In addition to failing to consider the effect of oil production on the region, the DEIS does not set forth a worst case analysis in the event that an oil spill occurs. In Village of False Pass v. Clark, 733 F.2d 605, 614 (9th Cir. 1984), the court recognized the importance of a worst case analysis where the federal agency would only have one opportunity to consider the potential environmental impacts of leases and their possible exploration, development and production. In cases such as this, where further EIS's will not be required, the effect of a possible oil spill must be considered at the exploratory stage."

Also considered in the below response are the following similar substantive comments: LG-10, PH-18.

RESPONSE: These comments raise three issues which are:

- Applicability of the case to this EIS; and
- Reasonableness of the spill analysis.
- Requirements for further NEPA analysis.

These issues are discussed in the following paragraphs.

Case Applicability

The case of Village of False Pass v. Clark involved the proposed sale of oil leases under the Outer Continental Shelf Leasing Act. The case is not applicable to the proposed action and alternatives. It involved agency actions at the leasing stage of mineral developments where the decision on whether to commit a resource to development is made. The present EIS involves a operational decision made after the leasing commitment has been made.

Reasonableness of the Spill Analysis

A "worst case analysis" requirement originally appeared in Section 1502.22 of the CEQ's NEPA regulations (40 CFR, Part 1502). The entire section deals with the evaluation of significant adverse effects on the human environment in an EIS when there are gaps in relevant information or scientific uncertainty. The original wording of Section 1502.22 in part was:

> "(b) If (1) the information relevant to adverse impacts is essential to a reasoned choice among alternatives and is not known and the overall costs of obtaining it are exorbitant or (2) the information relevant to adverse impacts is important to the decision and the means to obtain it are not known (e.g., the means for obtaining it are beyond the state of the art) the agency shall weigh the need for the action against the risk and severity of possible adverse impacts were the action to proceed in the face of uncertainty. If the agency proceeds, it shall include a worst case analysis and an indication of the probability or improbability of its occurrence."

The CEQ issued an amendment to Section 1502.22 which became effective on May 27, 1986 (postdating the 1984 Village of False Pass v. Clark decision). The regulation eliminates the "worst case analysis" requirement. Instead, agencies are required to evaluate reasonably foreseeable potential impacts which include those which have a low probability of occurrence but which would be expected to result in catastrophic consequences if they do occur.

However, the regulation specifies that the analysis must be supported by credible scientific evidence, not based on pure conjecture, and be within the rule of reason.

Section 4.3.11 of the FEIS evaluates the environmental consequences of postulated surface and subsurface releases of oil and brine formation waters. The evaluation is supported by Appendices A-7 and A-8 which detail computer modeling of the postulated releases. The modeling analysis has undergone review by the USGS as well as by all other agencies, organizations and individuals who have reviewed and commented on the DEIS. No significant challenge to the modeling approach has been raised. Therefore, it is only necessary to justify the magnitude of the postulated spills to show compliance with 40 CFR 1502.22.

EPA regulations (40 CFR, Part 112) govern oil spill prevention at the proposed facility. These regulations establish applicable volumes for spill planning purposes at the facility. These volumes are listed below:

Average Most Probable Discharge = 50 bbls/day

Maximum Most Probable Discharge = 857 bbls/day

Worst Case Planning Volume = all associated lines and well with the highest output at the facility

South Florida wells do not flow under their own pressure and must typically be pumped. Raccoon Point wells averaged 173 bbls/day during the 1988 to 1989 period (Lloyd and Tootle, 1991). Other South Florida wells have similar daily production. Therefore, the controlling spill volume for regulatory planning purposes is 857 bbls/day (35,994 gallons/day).

The spill analysis of the DEIS postulated separate surface discharges of oil and brine formation water. In the surface discharges, 2,000,000 gallons of oil or brine flow from the bermed area over a period of 14 days. For the subsurface discharges, 7,000,000 gallons of oil or brine flow from well casing leaks. These postulated spill scenarios range from about four to six and one-half times the regulatory planning rates. In spite of the huge postulated spill volumes, the analysis shows only localized impacts. In the case of oil spills, the DEIS has gone beyond the regulatory requirements and evaluated low probability events which have only localized impacts.

The requirements for further NEPA analysis are discussed in Section 1.1.4.2 of the FEIS.

ISSUE 17 ***Requests that agency retain authority to restrict further development based on Sierra Club v. Peterson.***

COMMENT LG-17: "If, however, it is determined that the environmental consequences of oil production are not foreseeable or capable of evaluation at the exploratory stage, Sierra Club v. Peterson, 717 F.2d 1409, 1415 (9th Cir. 1983) the federal agency involved is required to retain authority to preclude all activities pending the submission of further information and the authority to prevent proposed activities if the environmental consequences are unacceptable. Pursuant to the holding in Sierra Club, Broward County requests that this agency retain the power to determine the environmental effects if oil is discovered and, if it is determined that the environmental consequences would be substantial, restrict further oil development in the region."

RESPONSE: This comment raises two issues which are:

- Applicability of this case to this EIS; and

- The authority of the agencies to preclude activities pending the submission of further information and to prevent proposed activities if the environmental consequences are unacceptable.

Both of these issues are discussed below.

Sierra Club v. Peterson, 717 F.2d 1409, 1415 (D.C. Cir. 1983) pertains specifically to the issuance of oil and gas leases on lands within the Targhee and Bridger-Teton National Forests of Idaho and Wyoming, and not to post-lease actions such as applications for permit to drill. Hence, Sierra Club v. Peterson is not applicable to this FEIS. A significant and fundamental distinction needs to be understood concerning the agencies authority in the pre-lease phase versus the post-lease phases. The court supported the position that assessing the full environmental consequences of oil and gas activities must be prepared at the point of commitment - when the leases are issued. The environmental impact of oil and gas activity, including exploration through field development and abandonment activities were considered in general terms and assessed prior to the commitment to lease the oil and gas minerals on the Miccosukee Reservation. This was done via an EA prepared by the NPS for the BIA and the Miccosukee Tribe of Indians of Florida. This EA served as the basis for issuance of a FONSI by the BIA. Hence, the BIA and the Miccosukee Tribe made the commitment to issue leases on the Miccosukee Reservation, based on evaluation of the environmental consequences at the commitment - lease stage. This and other case law supports the position that when lands are leased without prohibiting surface occupancy, the Department cannot preclude surface disturbing activities; it can only impose reasonable conditions which are designed to mitigate the environmental impacts of the exploration and/or drilling activities. Section 4.4 of the FEIS recommends mitigation measures that meet or exceed the State standards, as well as, stipulations of the Minerals Management Plan for the Big Cypress Preserve.

In the post-lease phase, the BLM maintains the authority to disapprove specific proposals (APD, production facilities) if the environmental consequences of the proposal are unacceptable. Section 1.1.2 of the FEIS reviews the environmental analysis process for oil and gas operations on Indian lands. The APD is a proposed action requiring Federal approval. The APD requirements and the environmental review process are governed by Onshore Oil and Gas Order No. 1, Approval of Operations on Onshore Federal and Indian Oil and Gas Leases (43 CFR, Part 3164). Section III G of this order requires a complete APD to include the identification of existing and/or proposed production facilities and lines to be installed if the well is successfully completed for production.

Section III G also provides for a deferral of the identification of the proposed production facilities if the information is not known or cannot be accurately presented at the time the APD is submitted.

SWEPI has opted to limit its APD operations plan to include drilling of a single exploratory well; production testing of hydrocarbon bearing formations (if encountered); and temporary abandonment (if

hydrocarbons are found), or permanent abandonment and reclamation (if the well is a dry hole). If SWEPI later modifies its operations plan to include possible production from this well or additional new wells, Oil and Gas Order No.1 requires that SWEPI must submit full details of the new operations plan to BLM. Section IV.D of the Order requires an environmental review for any surface disturbing operations which would include addition of production facilities. BLM has committed that such production proposals would be subject to a separate EIS before consideration would be given to approval of such activities. Therefore, there would be no commercial production from this well or additional production wells without a subsequent EIS and its associated opportunities for public review and comment on any proposed production operation.

ISSUE 18 ***Concerns further drilling and production in Water Conservation Area.***

COMMENT SG-2: "The proposed well would be located immediately outside of the State Water Conservation Area 3 (WCA3), and through slant drilling, would terminate under them (sic). We can only conclude that Shell Western intends to explore for oil in the WCA's. A find with this exploratory well would lead to further drilling pursuits and likely application for production in the WCA's. Since oil drilling cannot be allowed in the WCA's, we see no useful purpose."

Also considered in the response to this issue is the following similar substantive comment: SG-22.

RESPONSE: The SWEPI Oil and Gas lease includes the portions of the Miccosukee Reservation beneath WCA-3A. The subject lands and the underlying minerals are held in trust for the Miccosukee Tribe by the Federal government, and are not owned by the State of Florida. Florida's prohibition on development of minerals under WCA's applies only to state-owned minerals. The state's prohibition does not apply to Miccosukee lands or minerals within WCA-3A.

The SFWMD has a flowage easement for flood control purposes over the Miccosukee lands within WCA-3A. Any surface impacts on the Miccosukee lands within WCA-3A would have to be consistent with the provisions of the flowage easement.

SWEPI has not developed any plans for surface facilities within the WCA. If the proposed action results in a discovery of hydrocarbons, future plans could, but would not necessarily include facilities in WCA-3A. The BLM and BIA will assure that any future oil and gas drilling, production or development actions in the area of the proposed well are subject to an EIS.

ISSUE 19 ***Questions what basis production and field development are not reasonably foreseeable.***

COMMENT SG-22: "Please clarify on what basis production from a single well and well field development were determined not to be reasonably foreseeable actions (which would require that they be addressed in this EIS). This appears to contradict the purpose of a wildcat exploratory well which is to look for exploitable resources of oil."

RESPONSE: This comment raises two questions:

- What basis was single well development determined not to be reasonably foreseeable? and
- What basis was field development determined not to be reasonably foreseeable?

These questions pertain to defining the scope of analysis. This issue is discussed in DEIS Section 1.1.4.2 and discussed below.

The term "reasonably foreseeable" refers to the chain of operations or procedures that are likely to take place when a given proposed action is implemented. In order to foresee future operations or procedures, the agencies must have a reasonable basis to consider such future actions probable or likely. The proposed well is a wildcat test of the entire geologic section to basement. The purpose of such a test is to examine and test portions of the geologic section for the possible presence of hydrocarbons. Appendix A-1 of the DEIS, provides historical data concerning the probability of wildcat drilling resulting in a discovery well. It is clear from this data that the probability of a discovery is very low, reaffirming the fact that exploratory drilling is a highly speculative activity.

In response to the first question concerning the feasibility of single well development, SWEPI has not proposed any activity beyond the drilling and testing of a single exploratory well. The Plan of Operations and APD state that upon completion of testing, and if the well is commercial, the well "will be left in temporarily abandoned status. If the well is non-commercial, it will be plugged and abandoned." These are the only two options proposed or contemplated. In addition, production of a reservoir by a single well is unlikely to be economically feasible in South Florida. Thus, regardless of the outcome of the proposed Miccosukee 3-1 Well, production under a single well scenario is highly unlikely and not considered a reasonably foreseeable consequence of implementing the proposed action.

In response to the second question concerning the feasibility of field development, the areal extent of a possible reservoir is unknown at this time. Production data in South Florida comes from the Sunniland Formation. The closest production to the proposed well site is Raccoon Point field located approximately 13 miles south-southwest from the proposed well. Previous exploration in the Sunniland Formation near

the proposed well did not result in a discovery. The existing nearby well control provides some geologic information about the Sunniland Formation, but not about the existence of an oil accumulation or its areal extent. The deeper portion of the geologic section has not been penetrated sufficiently to provide an understanding of possible reservoirs. The lack of knowledge of the deeper geologic section in combination with limited Sunniland information make this a wildcat well.

When an exploratory well is drilled, the party undertaking the project hopes to find sufficient oil and /or gas reserves to make full scale development and production economically feasible. However, the mere fact that the party is proposing a project and is hopeful for success does not mean that such success is likely or reasonably foreseeable. Unless and until oil and/or gas is discovered, such development is considered a highly speculative undertaking. SWEPI states that even if this well indicates the presence of oil and/or gas, additional drilling would have to be conducted to determine the extent and feasibility of field development.

As discussed in the DEIS page 1-6, the proposed exploratory well is not considered a "connected action" to production/field development as defined in 40 CFR, 1508.25(a)(1), for the following reasons: 1) implementation of the proposed action would not automatically trigger production and field development; 2) the proposal is not dependent upon other actions, occurring previous, or simultaneous, before it can proceed; and 3) the proposed action is not an interdependent part of a larger action and does not depend on any larger actions for its justification. The proposed action has independent utility because it would increase knowledge of the existence or lack of oil and gas reserves in the area.

For these reasons, the BLM and BIA do not believe that a basis exists, at this stage, to consider field development an event that is reasonably seen or known beforehand. However, in response to this issue, the agencies included in the DEIS a discussion of well and field development, Appendix A-1. This appendix includes a discussion of the probability of discovery, typical field development components, impacts associated with typical well and field development activities, Raccoon Point Field Operation and Facilities, and Environmental Review. It is explained in this appendix that, if a discovery of commercial quantities of hydrocarbons is made, further exploration and development in the area of the proposed action would not be authorized until an EIS of field development has been completed. Such analysis would be based on a conceptual field development plan.

ISSUE 20 ***DEIS should specify level of analysis for production and/or field development.***

COMMENT SG-22: "The draft EIS needs to specify what level of environmental analysis would be required to allow single well production and/or well field development. The time frames and opportunities for comment will differ if these actions can be addressed in a supplement to the existing EIS versus conducting a new EIS."

RESPONSE: Please refer to Appendix A-1, Section A.1.6. This section describes the process for environmental review that would occur in the event of a discovery of commercial quantities of hydrocarbons. It states that the BLM would require SWEPI to prepare a conceptual field development plan and that BLM and BIA would complete an EIS of all aspects of the development plan and reasonably foreseeable field development activities. It also states that environmental review would include a formal process for identifying public and agency concerns regarding field development and that distribution would be made for public, State and Federal agency review and comment.

ISSUE 21 ***DEIS fails to include analysis of oil transport.***

COMMENT I-323: "If the exploratory well struck oil, this oil would have to be transported most likely to Port Everglades. No analysis is presented in the DEIS of oil delivery systems. The most likely delivery system would be the Suniland (sic) pipeline. The pipeline is a connected action and must be analyzed. The pipeline runs from the Suniland (sic) area across Water Conservation Area 3 and presents a high probability of an oil spill. In fact, this pipeline is over 20 years old and has had 33 leaks. The FEIS should depict the location of the pipeline, locations of all leaks, the extent of the leak, dates and description of environmental damage."

Also considered in the response to this issue are the following similar substantive comments: I-3, I-11, I-34, I-46, I-79, I-122, I-330, I-345, I-353, I-354, I-407, I-410, PH-12.

RESPONSE: The proposed action covered in SWEPI's APD is limited to the drilling of a single exploratory well; production testing of hydrocarbon bearing formations (if encountered); and temporary abandonment (if hydrocarbons are found), or permanent abandonment and reclamation (if the well is a dry hole). The proposed action does not include establishment of connections to the Sunniland Pipeline or movement of commercial quantities of oil from the site. Any production proposals would be subject to a separate environmental review under NEPA. Therefore, there would be no commercial production from this well or additional wells without a subsequent EIS and its associated opportunities for public review and comment on any proposed production operation.

The proposed action does include a limited testing program to evaluate the production potential of any oil-bearing formations encountered. This testing program is described in Section 2.2.1.4 of the FEIS and would require up to 30 days. Any produced oil would be hauled from the site in tanker trucks.

ISSUE 22 ***DEIS does not consider gain against risk of oil and gas development.***

COMMENT O-47: "The DEIS does not place the expected potential finds of oil and/or gas -- which are minimal -- within the context of the nation's energy needs, nor weigh this minimal gain against the risk posed to one of the nation's premiere environmental resources."

Also considered in the response to this issue were the following similar substantive comments: I-346, LG-2, LG-9, PH-7, PH-14, PH-26.

RESPONSE: The purpose of the proposed action is to determine if hydrocarbons are present beneath the surface of the Miccosukee Reservation in the area of the proposed action. The Miccosukee Tribe entered into a minerals agreement with SWEPI in accordance with the IMDA. The agreement is based on the right and desire of the Tribe to allow for the exploration and development of a potentially valuable natural resource that may occur on Tribal property. Exploratory drilling is needed in order to test and evaluate the geologic targets. The gain from the proposed activity is greater knowledge as to the presence or absence of hydrocarbons at the geologic targets. Section 1.2 of the FEIS has been expanded to clarify the purpose and need of the proposed action.

The environmental impacts and risks associated with the proposed exploratory well are the subject of analysis in the FEIS. Any assumptions regarding the presence and significance of hydrocarbons beneath the Miccosukee Reservation would be purely speculative at this time. The conclusion of the FEIS is that the impacts and risks associated with the proposed action are not significant.

ISSUE 23 ***Concerns that drilling would set a legal precedent.***

COMMENT PH-18: "...to be complete the environmental impact statement must address the impact of all the environmental consequences of allowing exploratory drilling at this site. And one consequence that you cannot ignore is the virtually automatic permitting of other exploratory drilling sites and productive drilling at this site and other similar sites if significant reserves of oil are found.

Drilling at this site would set a legal precedent and denial of permits for future drilling sites could reasonably be considered arbitrary and capricious on the part of the regulatory agencies unless you are able to prove that the facts of the situation have changed."

The following similar substantive comments are considered in the development of the response to this issue: I-127, I-159, I-343, O-45, PH-36.

RESPONSE: The Miccosukee Tribe has the right to pursue development on its reservation. SWEPI currently has the legal right to explore for hydrocarbons based on a lease agreement with the Miccosukee Tribe. Section 1.1.4.2 of the DEIS addresses both well and field development considerations. Approval of the proposed action or alternatives considered in the DEIS would not commit BLM or BIA to approve any future actions including additional drilling, well production or field development. If the SWEPI Miccosukee 3-1 Well is drilled and hydrocarbons are discovered, an EIS would have to be completed on all aspects of field development and production activities before any further action could be taken on additional APDs related to the development of the field.

5.1.4.8 Hurricane Contingency Plan

ISSUE 24 ***Questions adequacy of hurricane contingency plan.***

COMMENT PH-23: "What will they do in case of a hurricane? What they have written in the EIS is insufficient when you compare it to what happened when Andrew came."

Also considered in the response are the following similar substantive comments: I-156, O-68.

RESPONSE: A Hurricane Preparation and Evacuation Plan is included as Appendix A-11 of the FEIS. A release of contaminants from the drill site is the primary environmental impact that could result from the effects of a hurricane. The Hurricane Preparation and Evacuation Plan is structured to require securing and evacuation of the drill site upon advanced warning of potential hurricane conditions. Proper precautionary preparation of the site would provide reasonable assurance that a release of contaminants would not occur as a result of a hurricane.

5.1.4.9 Hydrology

ISSUE 25 ***DEIS fails to include analysis of Everglades restoration plan.***

COMMENT I-323: "Recently, the Army Corps of Engineers (ACOE) announced plans for a 2 year study that would result in radical changes to restore a more natural water flow to the Everglades. The Secretary of the Interior has also stated the government's high priority to Everglades restoration. The drill site lies in a transition area between the Everglades proper and the Big Cypress Swamp. Water would naturally flow from one area to the other in times of flood and drought. Everglades restoration plans may call for reestablishment of this hydrologic link. An exploratory well or potential production field may significantly impede restoration plans. No analysis or consultation with the ACOE about restoration plans was conducted in the DEIS. Immediate consultation with the ACOE is warranted and its results presented in the FEIS."

Also considered in the response to this issue were the following similar substantive comments: I-52, I-56, I-107, I-325, I-326, I-372, LG-2, LG-9, O-2, O-36, O-39, O-55, PH-6, PH-8, PH-11, PH-17, PH-19, PH-20.

RESPONSE: The COE is involved in several studies and projects which may contribute to the restoration of the Everglades. The project apparently referred to in the comment is a surface and groundwater modeling study which has the objectives of restoring of more natural flows on the ENP and Taylor Slough, as well as the continuation of flood control in residential and agricultural areas. The area of primary interest is in the L-31N and C-111 canal systems which supply much of the water to the ENP. This project addresses hydrologic conditions in southern Dade County. The SWEPI project is sufficiently removed from this area that it would not influence the COE study area.

The COE also began work on the Central and Southern Florida Project Comprehensive Review Study. This study seeks to determine how to modify the very large system of canals, dikes and control structures composing the Central and Southern Florida Project to restore the ecosystem of South Florida consistent with other demands. Because the region has many important resources and complex problems, the COE has been making efforts to accomplish the study with the help of other Federal resource agencies. On September 23, 1993, representatives of the U.S. Departments of the Interior, Commerce, Army, Justice, and Agriculture and the EPA signed an interagency agreement regarding this study. The Department of the Interior has taken the lead in a multi-agency effort to develop the Federal objectives for the study.

In December, 1993 public workshops were held to solicit public input. The study has several phases. The reconnaissance phase began in June, 1993 and would be completed in November, 1994. The reconnaissance phase would consist of identifying problems and potential solutions. The second phase,

the feasibility study would begin in early 1995 and would require three years for completion. The feasibility study would result in recommendations for modifications to the Federal project. After the feasibility study is completed individual projects must be designed and plans and specifications must be developed. According to the COE it would be six to ten years before any projects are undertaken as a result of the comprehensive review study.

Realistically, the proposed action of the EIS would be completed years before Everglades restoration plans are implemented. Furthermore, as stated in Section 4.3.19, the proposed action and alternatives would not result in an irreversible commitment of resources.

ISSUE 26 ***Data concerning location of Biscayne aquifer is not accurate.***

COMMENT I-325: "The most serious deficiency of the DEIS is its discussion of the Biscayne Aquifer. The Biscayne Aquifer has been designated by the U.S. Environmental Protection Agency as a 'sole source Aquifer' — south Florida's only drinking water supply. The aquifer is unconfined, highly permeable, and is vulnerable to surface water contamination according to the South Florida Water Management District SWIM Plan (p. 38-39). The DEIS states that 'local freshwater aquifers may be contaminated by leakage of drilling fluids or produced oil and by mixing groundwater between aquifers' (p. S-11). Yet the DEIS only devotes a few paragraphs in discussing the Biscayne Aquifer.

Under NEPA the DEIS is mandated to use the best available data. Data presented about the location of the Biscayne Aquifer is (sic) not accurate. The aquifer map presented was produced in 1978 by the U.S. Geological Survey (USGS). A more accurate aquifer map was prepared by the EPA and USGS in 1992 showing the western boundary of the aquifer extending to the Broward-Collier county line. Further research by analyst Jim Goldsich of the Broward County Office of Natural Resource Protection reveals that the aquifer currently extends within two miles of the drill site and not the five to ten miles alleged by the DEIS.

Since the Biscayne Aquifer is highly permeable and variable in size depending on rainfall, surface water flow, and withdrawal rates it is reasonable to assume that the aquifer may expand in the future. Several years of above normal rainfall would likely enlarge the size of the aquifer shifting it closer to the drill site."

Also considered in the response to this issue were the following similar substantive comments: I-27, I-52, I-54, I-56, I-62, I-72, I-106, I-234, I-305, I-322, I-323, I-326, I-344, I-346, I-351, I-372, I-401, LG-5, LG-13, O-2, O-36, O-39, O-55, O-75, O-77, PH-3, PH-6, PH-11, PH-14, PH-17, PH-19, PH-20, PH-34, PH-35, PH-36, SG-20.

RESPONSE: The comments raise several issues which are:

- Inadequacy of the discussion of the Biscayne aquifer;
- Use of outdated data relating to the location of the limits of the Biscayne aquifer; and
- Variability of Biscayne aquifer characteristics.

These issues are discussed in the following paragraphs.

Biscayne Aquifer Discussion

The CEQ published guidelines (40 CFR, Parts 1500-1508) governing the preparation of EISs. Section 1502.1 of the regulations state in part that:

> "Agencies shall focus on significant environmental issues and alternatives and shall reduce paperwork and the accumulation of extraneous background data. Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analysis."

The Biscayne aquifer and its importance as a water supply source to the region were noted in Section 3.3.11 of the DEIS. This section also notes that the Biscayne aquifer is not present at the site.

Section 1.6 of the DEIS highlighted the various regulatory agencies and discusses their jurisdiction over various aspects of the proposed action and alternatives. The EPA's Sole Source Aquifer Program was referenced in Section 1.6.13 of the DEIS.

The Biscayne aquifer is not in the zone of influence of the proposed project. Section 4.3.11 and supporting groundwater modeling reports cited in Appendices A-7 and A-8 clearly determined that there would be no significant impacts to groundwater systems. Therefore, in keeping with the CEQ guidelines, extensive discussion of the Biscayne aquifer were not included in the DEIS proper. However, details of the regional aquifer systems including the Biscayne aquifer were provided in Appendix A-6.

Biscayne Aquifer Location

The aquifer discussion in Section 3.3.11 of the DEIS included Figure 3-8 which depicts the regional aquifer systems. The figure was selected because it conveniently indicates the general relationship of four major aquifer systems in South Florida. Unfortunately, as the letters accurately point out, the figure

neither represents the most recent data nor the most accurate location of the Biscayne aquifer relative to the drill site. Figure 3-8 was referenced in a 1978 USGS report (US Geological Survey, 1978). The most recent aquifer delineation data for the Biscayne aquifer are presented in a 1988 study by Fish. The areal extent of the Biscayne aquifer was shown on Figure 9 of Appendix A-6 of the DEIS. This figure shows the approximate western edge of the Biscayne aquifer about 2.8 miles east of the drill site.

The EPA published a 1992 study of the Biscayne aquifer. While this study presents a new map of the Biscayne aquifer, it is based upon Fish's 1988 study and does not include any new data delineating the areal extent of the Biscayne aquifer.

Section 3.3.11 was revised for the FEIS to clarify the location of the Biscayne aquifer relative to the site.

Variability of aquifer characteristics

An aquifer is a geologic formation which contains water and transmits it from one point to another in quantities sufficient to permit economic development (Linsley, et al, 1975). The key words of the definition are "geologic formation." As a geologic formation, an aquifer's physical location remains relatively fixed. Various hydrologic events such as precipitation variations, water withdrawals, and activities affecting the aquifer's recharge areas would affect water levels and volume of water within the aquifer and water movement. However, above average rainfall occurrences would neither enlarge the thickness of the Biscayne aquifer, nor move its edge closer to the drill site.

ISSUE 27 ***Requests "Sole Source Review."***

COMMENT O-52: *"Friends of the Everglades requests the Bureau of Land Management to provide to the U.S. Environmental Protection Agency all available data concerning this issue for the purpose of a 'Sole Source' Review of the effects this project might have on the water supplies of the four million people dependent on the Biscayne Aquifer for their sole source of drinking water.*

We ask, through you, that this review be conducted by EPA as provided for under Section 1424(e) of the Federal Safe Drinking Water Act, under which Act the Biscayne Aquifer was designated as a 'Sole Source Aquifer' by EPA in 1978. This proposed project does lie within the area covered by that designation, a designation obtained as a result of a petition filed in 1976 by Board Members of Friends of the Everglades, and by its President, Marjory Stoneman Douglas."

Also considered in the development of the response to this issue were the following similar substantive comments: I-52, I-372, LG-17, O-37, O-40, O-66, O-101, PH-6, PH-15.

RESPONSE: Section 1.6.13 of the DEIS outlined the SDWA. The "sole source aquifer" provision under Section 1424(e) of the Act deals specifically with the commitment of Federal financial assistance for projects which may impact such aquifers. Since there is no Federal financial assistance involved in the proposed action, Section 1424(e) was not applicable.

Because of the comments raised on this issue, BLM asked EPA to formally address the "sole source" question in its comments on the DEIS. The EPA did so in its letter of August 18, 1993 (see comment letter FG-7) confirming that the proposed action is not subject to the provisions of the Sole Source Aquifer Program.

ISSUE 28 ***DEIS does not adequately address wetlands and floodplains under Executive Orders 11990 and 11988.***

COMMENT O-70: *"The DEIS glossed over how this proposal was affected by the Federal Executive Orders 11990 and 11988 that govern wetlands and floodplains. We believe that a serious analysis of this issue must be conducted and included in the DEIS if the public welfare and wetlands are to be protected. This should include an analysis of the effect that discovering oil at this site might have on encouraging more building and drilling in the Everglades ecosystem."*

Also considered in the development of the response to this issue were the following similar substantive comments: I-374, O-40.

RESPONSE: The requirements of Executive Orders 11988 (Floodplains) and 11990 (Wetlands) were discussed in Sections 1.6.4. and 1.6.5 of the DEIS.

The evaluation of impacts to floodplains was conducted by first determining the presence of floodplains in the area of the proposed action. Section 3.2 of the FEIS establishes that the BIA made a determination that the area affected by the proposed action and alternatives is not a floodplain therefore, EO 11988 is not applicable.

The evaluation of impacts on wetlands was conducted by determining the extent of wetlands in the project area (Section 3.3.12 of the FEIS) and the effect of the proposed action and alternatives on wetlands (Section 4.3.12 of the FEIS). Coordination with the COE, the Federal agency which regulates wetlands was also conducted. The findings were that the proposed action would not affect wetlands. Alternative B would result in the filling of 0.25 acres of marsh. The DEIS acknowledged that a COE permit would be required for Alternative B, and that mitigation may be required by the COE. In summary, the proposed action would not affect wetlands. Alternative B could only be constructed and used for access

if the COE permit criteria were met. Therefore, the proposed action and alternatives are or would be in full compliance with EO 11990 at the time of implementation.

No field development actions are proposed at this time. Future field development actions were not included in the analysis of impacts. The reasons for exclusion of field development were discussed in Section 1.1.4. of the DEIS. Field development would depend upon SWEPI's ability to obtain further authorization from BLM and any development plans would be subject to an environmental review under NEPA. This review would include consideration of Executive Orders 11988 and 11990.

ISSUE 29 ***Concern that the gray limestone aquifer is hydraulically connected to the Biscayne aquifer.***

COMMENT O-54: *"The Grey (sic) Limestone Aquifer underlies the site and is hydraulically connected to, in part (and indistinguishable from, in other parts), the Biscayne Aquifer, an aquifer designated as a Sole Source by EPA. Leaks in the well, the site, and the accessory activities risk contamination in a way that may create a significant hazard to public health."*

Also considered in the response to this issue was the following similar substantive comment: PH-6.

RESPONSE: The Biscayne aquifer is the primary aquifer of the surficial aquifer system in southeast Florida. It is the groundwater source for virtually all potable water systems along the eastern coast. It underlies nearly all of Dade County and most of Broward County.

The surficial aquifer at the drill site is in local, discontinuous waterbearing material which is not connected to the Biscayne aquifer. In Broward County, the Biscayne aquifer extends from the coast inland to within about three miles of the drill site. Figure 9 of Appendix A-6 of the DEIS indicated the areal extent of the Biscayne aquifer. The Biscayne aquifer is not present at the drill site.

The gray limestone aquifer is the intermediate aquifer at the drill site. It extends eastward to about the eastern boundary of WCAs 2 and 3. Figure 10 of Appendix A-6 of the DEIS indicated the extent of the gray limestone aquifer. Beneath the west-central part of Broward County, the Biscayne aquifer is underlain by the gray limestone aquifer, and is separated from it by a 40- to 50-foot confining unit.

Analysis summarized in the DEIS and presented in detail in Appendices A-7 and A-8 of the DEIS modeled hypothetical extreme spills of brine formation waters and oil within the three aquifer systems at the drill site. The modeled growth and migration of the resulting contaminated groundwater plumes

were limited. Even under extreme scenarios, it was not possible to contaminate any portion of the Biscayne aquifer.

ISSUE 30 ***Concerns pertaining to direction of drainage from proposed well site.***

COMMENT O-55: "The DEIS claims that water does not drain south and east of the proposed site, yet the photos and maps of the site show clearly that those are the precise destinations of the site's drainage water. Water Conservation Area #3 will receive both routine drainage and emergency overflows from the oil well site under this proposal. Emergencies such as hurricanes, blowouts, spills, floods, and fires can have serious impacts on the WCA #3 and downstream systems (such as Everglades National Park), including the primary recharge areas of the Biscayne Aquifer which are affected by direct recharge and seepage from WCA #3."

Also considered in the response to this issue were the following similar substantive comments: PH-6, PH-11.

RESPONSE: These comments raise three issues which are:

- Accuracy of the surface water flow discussions of the DEIS;
- Possibility of routine and emergency discharges from the site flowing into WCA-3A; and
- Impacts to WCA-3A and downstream systems.

These issues are discussed in the following paragraphs.

Surface Water Flow

Section 3.3.11.1 of the DEIS discussed the surface water hydrology of the proposed drill site. It described the natural southeast flow pattern, as indicated in the comment. This natural flow pattern existed before transportation improvements and water management features were introduced into the area. The construction of I-75 and WCA-3A have significantly altered the area's surface drainage. The levees of I-75 and WCA-3A essentially isolate the project site by limiting the flow of surface water from the site to the surrounding areas.

Routine and Emergency Discharges from the Site

The drill site was described in detail in Section 2.2 of the DEIS. The five-acre drill site is larger than the typical South Florida single well site so that it may include several design provisions appropriate to a directionally-drilled deep well located adjacent to environmentally sensitive resources. These provisions include: on-site retention/detention of all stormwater runoff; a large retention capacity capable of oil/brine spill containment; on-site storage of drill cuttings; accommodation of a closed drilling fluids system; a capability to dispose of excess stormwater and drilling fluids down the well casing annulus and into a highly permeable geologic interval; and on-site location of water supply wells and water quality monitoring wells. As a result of these design provisions, there would not be any routine discharges of any kind from the site.

The large retention capacity and the capability to dispose of stormwater through the well prevent even large accidental spills or major storm event runoff from being discharged from the site.

Impacts to WCA-3A and Downstream Systems

Section 4.3.11.2 discussed postulated spills of oil and brine formation waters. Even under a highly improbable catastrophic spill scenario, it is unlikely that the spill would move past the L-28 Canal Levee and into the L-28 Canal. If the spill reaches the L-28 Canal, the only manner in which contaminants could reach WCA-3A is through physical pumping over the 15-foot high WCA-3A levee. The possibility of spill contaminants reaching WCA-3A is, therefore, extremely remote. It is not realistic to postulate any spill impacts to WCA-3A or downstream areas.

ISSUE 31 ***Concerns relative to proximity and effects on Biscayne aquifer and Water Conservation Area. DEIS is not based on scientific field studies.***

COMMENT O-65: "Why have no scientific field studies been performed to determine exactly how close the Biscayne Aquifer is to the site? Why wasn't site specific information gathered and plugged into computer models before the DEIS was completed? Why have no probabilistic risk assessments been performed of the worst case potential risk to the water supply that may be posed by this proposed project performed and contained in the DEIS?"

Also considered in the development of the response to this issue were the following similar substantive comments: I-79, I-410, LG-5, LG-13, O-101, PH-3, PH-14, PH-15, SG-20.

RESPONSE: SWEPI commissioned several preliminary environmental studies of the proposed drill site prior to the submission of the APD in January, 1991. The Hydrology Report included as DEIS Appendix A-6 was one of the preliminary studies. This study reviewed existing studies on the hydrogeology of the Miccosukee Reservation. The USGS studies by Fish (1988) and Meyer (1988) were included in the review. The USGS studies reported on existing wells located in the vicinity of the drill site including some located east of the site. The wells did not encounter the Biscayne aquifer in the drill site vicinity. Fish (1988) also delineated the extent and thickness of the surficial aquifer units including the Biscayne aquifer. Fish placed the approximate western edge of the Biscayne aquifer at about three miles east of the drill site. The available data, together with computer modeling of contaminated groundwater plumes based on postulated catastrophic surface and subsurface releases of oil and brine formation waters, provided sufficient basis to determine that the proposed well cannot threaten the Biscayne aquifer.

A "worst case analysis" requirement originally appeared in Section 1502.22 of the CEQ's NEPA regulations (40 CFR, Part 1502). The entire section dealt with the evaluation of significant adverse effects on the human environment in an EIS, when there are gaps in relevant information or scientific uncertainty.

The CEQ issued an amendment to Section 1502.22 which eliminated the "worst case analysis" requirement. Instead, agencies are required to evaluate reasonably foreseeable potential impacts which include those which have a low probability of occurrence but which would be expected to result in catastrophic consequences if they do occur. However, the regulation specifies that the analysis must be supported by credible scientific evidence, not based on pure conjecture, and be within reason.

Section 4.3.11 of the DEIS evaluated the environmental consequences of postulated surface and subsurface releases of oil and brine formation waters. The evaluation was supported by Appendices A-7 and A-8 which detailed computer modeling of the postulated releases. The modeling analysis was reviewed by the USGS as well as by all other agencies, organizations and individuals. No significant challenge to the modeling approach was raised. Therefore, it was only necessary to justify the magnitude of the postulated spills to show compliance with 40 CFR, 1502.22.

EPA regulations (40 CFR, Part 112) govern oil spill prevention at the proposed facility. These regulations establish applicable volumes for spill planning purposes at the facility. These volumes are listed below:

Average Most Probable Discharge = 2,100 gal/day

Maximum Most Probable Discharge = 36,000 gal/day

Worst Case Planning Volume = all associated lines and well with the highest output at the facility

South Florida wells do not flow under their own pressure and must typically be pumped. Raccoon Point wells averaged 173 bbls/day during the 1988 to 1989 period (Lloyd and Tootle, 1991). Other South Florida wells have similar daily production. The controlling spill volume for regulatory planning purposes was 36,000 gallons/day.

The spill analysis of the DEIS postulated separate surface discharges of oil and brine formation water. The analysis considered surface discharges of 2,000,000 gallons of oil or brine flow from the bermed area over a period of 14 days. For the subsurface discharges, the analysis considered 7,000,000 gallons of oil or brine flow from well casing leaks. These postulated spill scenarios ranged from about four to six and one-half times the regulatory planning rates. In spite of the huge postulated spill volumes, the analysis indicated only localized impacts.

ISSUE 32 ***DEIS fails to consider applicability of UIC rules to disposal of drilling fluids.***

COMMENT O-78: "LEAF believes that the DEIS is fundamentally flawed because it fails to properly consider the applicability of the Safe Drinking Water Act to this activity and erroneously concludes that the disposal of drilling fluids and stormwater is not governed by federal Underground Injection Control (UIC) rules."

Also considered in the development of the response to this issue were the following similar substantive comments: LG-4, LG-11, O-79.

RESPONSE: Section 4.3.10 of the DEIS outlined the regulatory controls on fluids disposal in exploratory wells and stated that Federal UIC rules were not applicable. EPA in its comment letter of June 7, 1993 confirmed this interpretation. The letter stated that the EPA is aware that it is common industry practice to inject drilling waste fluids into exploration and production wells after completion of drilling operations on these wells. Although EPA does not issue UIC permits for these wells, it has been the position of EPA Region 4 to allow the option of reinjecting wastes provided that underground injection does not endanger any underground source of drinking water. In its letter, the EPA requested that the applicant's underground waste injection plans be submitted to them to ensure that this activity would not endanger any underground source of drinking water. Section 4.4.10 of the DEIS has been amended to include submission of the requested fluids disposal program information to BLM. BLM will provide the plans to EPA for its information.

ISSUE 33 ***DEIS does not analyze long-term migration of contaminants or monitoring of potential contaminants.***

COMMENT O-100: "Long term evaluation of future migration of chemical, brine, petroleum and other contaminants is not fully evaluated nor are long term monitoring programs proposed."

Also considered in the development of the response to this issue was the following similar substantive comment: PH-35.

RESPONSE: Section 4.3.11.2 of the DEIS discussed multiple scenarios for large surface and subsurface spills of oil and brine formation waters. The migration of the spills over a 100-year long period was numerically modeled. Complete discussions of the modeling were provided in DEIS Appendices A-7 and A-8.

Surface and groundwater monitoring would begin prior to the construction of the well, and would continue until site reclamation is complete. At the completion of operations, SWEPI would implement its abandonment plan which provides for protection to all usable quality water, hydrocarbon resources, and mineral deposits as described in Section 2.2.1.5 of the DEIS. Cement plugs would be placed across any zone which contains fluid, gas or any mineral deposit. Location of cement plugs can be verified and space between plugs is filled with drilling fluids. This plugging is subject to BLM approval and oversight. This plugging plan would prevent the release of oil or fluids from the well once it is abandoned.

ISSUE 34 ***Inadequate evaluation of effects on Floridan and gray limestone aquifer.***

COMMENT LG-6: "The Floridan and Gray Limestone aquifers, possible future sources of potable water for South Florida, are treated as expendable repositories for unspecified wastes. This cavalier treatment of our most important resources is inexcusable in a document of this magnitude."

Also considered in the response to this issue were the following similar substantive comments: LG-13, O-101.

RESPONSE: Appendices A-7 and A-8 detailed postulated catastrophic spills of oil and brine formation waters into each of the major aquifer systems at the site; the surficial; the gray limestone; and the Floridan aquifers. The movement and growth of the contaminated groundwater plumes were modeled numerically for a 100-year period of time.

The analysis and the results of the numerical modeling were summarized in DEIS Section 4.11. In all three aquifers, the growth and migration of the contaminated groundwater plumes were limited, even after a 100-year period and without the benefit of any spill remediation. A major groundwater monitoring program was developed and included in the mitigation requirements to further limit potential impacts.

Excess drilling fluids and stormwater would be disposed of in the "boulder zone," a confined, highly permeable zone located below the major aquifer systems. A UIC permit is not required for this activity. As requested by EPA Region 4, submission of the injection plan has been added to the mitigation section (Section 4.3.10.5). Review of the mitigation plan would be advisory to the BLM and BIA.

ISSUE 35 ***Questions adequacy of four-foot high containment berm.***

COMMENT LG-3 and LG-4: "The bermed 'water retention area' was designed for a three-day, 100-year precipitation event, which would total 12 inches of rainfall in the three days. In fact, rainfall amounts in some Broward County locations have exceeded this amount several times in recent years.

When (not if) rainfall exceeds the document's 'worst-case' estimates, the site will be flooded and contaminated stormwater will be discharged."

Also considered in the response to this issue were the following similar substantive comments: LG-11, PH-5.

RESPONSE: These comments raise three sub-issues which are:

- The appropriateness of a 100-year design rainfall criterion;
- The apparent frequent occurrence of the 100-year precipitation events in Broward County;
- The effect of exceedance on the performance of the containment facility.

Each of these sub-issues is addressed in the following paragraphs of the response.

Design Rainfall Criterion

It is important to understand probability terminology to appreciate the level of safety incorporated into the design of the berm. Design of most facilities in the U.S. is based upon the concept of probability. A facility is designed to provide a specific degree of safety against a design value of an environmental

ISSUE 33 ***DEIS does not analyze long-term migration of contaminants or monitoring of potential contaminants.***

COMMENT O-100: "Long term evaluation of future migration of chemical, brine, petroleum and other contaminants is not fully evaluated nor are long term monitoring programs proposed."

Also considered in the development of the response to this issue was the following similar substantive comment: PH-35.

RESPONSE: Section 4.3.11.2 of the DEIS discussed multiple scenarios for large surface and subsurface spills of oil and brine formation waters. The migration of the spills over a 100-year long period was numerically modeled. Complete discussions of the modeling were provided in DEIS Appendices A-7 and A-8.

Surface and groundwater monitoring would begin prior to the construction of the well, and would continue until site reclamation is complete. At the completion of operations, SWEPI would implement its abandonment plan which provides for protection to all usable quality water, hydrocarbon resources, and mineral deposits as described in Section 2.2.1.5 of the DEIS. Cement plugs would be placed across any zone which contains fluid, gas or any mineral deposit. Location of cement plugs can be verified and space between plugs is filled with drilling fluids. This plugging is subject to BLM approval and oversight. This plugging plan would prevent the release of oil or fluids from the well once it is abandoned.

ISSUE 34 ***Inadequate evaluation of effects on Floridan and gray limestone aquifer.***

COMMENT LG-6: "The Floridan and Gray Limestone aquifers, possible future sources of potable water for South Florida, are treated as expendable repositories for unspecified wastes. This cavalier treatment of our most important resources is inexcusable in a document of this magnitude."

Also considered in the response to this issue were the following similar substantive comments: LG-13, O-101.

RESPONSE: Appendices A-7 and A-8 detailed postulated catastrophic spills of oil and brine formation waters into each of the major aquifer systems at the site; the surficial; the gray limestone; and the Floridan aquifers. The movement and growth of the contaminated groundwater plumes were modeled numerically for a 100-year period of time.

The analysis and the results of the numerical modeling were summarized in DEIS Section 4.11. In all three aquifers, the growth and migration of the contaminated groundwater plumes were limited, even after a 100-year period and without the benefit of any spill remediation. A major groundwater monitoring program was developed and included in the mitigation requirements to further limit potential impacts.

Excess drilling fluids and stormwater would be disposed of in the "boulder zone," a confined, highly permeable zone located below the major aquifer systems. A UIC permit is not required for this activity. As requested by EPA Region 4, submission of the injection plan has been added to the mitigation section (Section 4.3.10.5). Review of the mitigation plan would be advisory to the BLM and BIA.

ISSUE 35 ***Questions adequacy of four-foot high containment berm.***

COMMENT LG-3 and LG-4: "The bermed 'water retention area' was designed for a three-day, 100-year precipitation event, which would total 12 inches of rainfall in the three days. In fact, rainfall amounts in some Broward County locations have exceeded this amount several times in recent years.

When (not if) rainfall exceeds the document's 'worst-case' estimates, the site will be flooded and contaminated stormwater will be discharged."

Also considered in the response to this issue were the following similar substantive comments: LG-11, PH-5.

RESPONSE: These comments raise three sub-issues which are:

- The appropriateness of a 100-year design rainfall criterion;
- The apparent frequent occurrence of the 100-year precipitation events in Broward County;
- The effect of exceedance on the performance of the containment facility.

Each of these sub-issues is addressed in the following paragraphs of the response.

Design Rainfall Criterion

It is important to understand probability terminology to appreciate the level of safety incorporated into the design of the berm. Design of most facilities in the U.S. is based upon the concept of probability. A facility is designed to provide a specific degree of safety against a design value of an environmental

loading such as wind speed or rainfall. The probability that an actual loading exceeds the design value is an expression of the risk involved. For instance, the U.S. national standards on structural loads [ASCE 7-88 (ASCE 7/ANSI, 1988), formerly ANSI A58.1] require that ordinary structures be designed for an annual exceedance probability of 2 percent (equivalent to a 50-year return period). Crucial facilities such as hospitals must be designed for an annual exceedance probability of 1 percent (equivalent to a 100-year return period). The 100-year standard is also used in the design of hydraulic structures whose failure may threaten human life. Thus, the selection of the 100-year precipitation event represents a high degree of concern for the functional performance of the berm.

Inherent in applying a design standard to a structure, is the understanding that the structure would continue to be exposed to the risk of design value exceedance throughout its functional life. For example, the chance that the design value of a structure (100-year design standard and 30-year life) is exceeded at least once during its service life is about 26 percent. The risk of design value exceedance for a 50-year design standard, 30-year life structure rises to about 45 percent. Safety factors incorporated into the design of facilities usually allow them to resist actual conditions in excess of the design value. Therefore, the probability that the facilities would be destroyed or seriously damaged during their service life is much less than the design value exceedance probabilities (26 percent and 45 percent for the 100-year and 50-year designs respectively). Nevertheless, some significant chance of damage or destruction during a crucial facility's service life still remains.

The actual risk of failure of the berm is very low due to its very short service life. The exploratory well program should require 30 days for site preparation and construction, 145 days for well drilling and evaluation, 30 days for production testing, and 120 days for well abandonment and site reclamation for a total of 325 days. Actual oil well operations which involve handling drill cuttings, drilling fluids and possibly oil from production tests require 175 days of the 325 day program. The remaining time is consumed in site preparation or reclamation tasks. The probability of rainfall exceeding the 100-year design criterion of the berm during the 175 days of well operations is about 0.5 percent. Stated another way, there is only 1 chance in 200 that the actual precipitation would exceed the 12 inch design value.

Apparent Frequent Occurrences of 100-Year Precipitation in Broward County

Extreme precipitation totals vary across South Florida. The lowest 100-year daily rainfall amount is 8.7 inches for Moore Haven located on the western shore of Lake Okeechobee. The rainfall totals generally increase toward the southeast with the highest value of 17.2 inches predicted for Miami (Fernald and Patton, 1984). Similar trends occur for longer duration storm events. Therefore, the 12-inch 100-year, 3-day design precipitation at the drill site is not directly comparable to the precipitation for the same statistical storm event in other portions of Broward County. In fact, most areas of Broward County have

100-year precipitation values higher than the drill site. A precipitation total of 12 inches at these other Broward County locations may actually translate to a significantly more frequent event.

It is also important to understand the meaning of a 100-year storm event. It is commonly referred to as a once-in-100 year event. This erroneously leads to the impression that such events have very long time intervals between them. The accurate definition of a 100-year storm is one which has a 0.01 chance of occurring in a given year. Given this understanding of the storm probability, it is clearly possible but very rare to have back-to-back 100-year storm events. Two storms, each having an intensity approximately that of a 100-year storm, occurred within 3 months of each other in Northern Palm Beach County in the early 1980's (SFWMD, 1989). Even if such back-to-back events have occurred in Broward County as suggested by the Commenter, the risk of occurrence of a single 100-year storm remains at 0.01 unless a fundamental change in climate has occurred.

Some studies have suggested possible climatic changes in South Florida. Gannon (1978) has suggested that extensive urbanization and wetlands drainage in South Florida has decreased wet season rainfall. Shih (1983) demonstrated that, averaged over all of South Florida, mean annual rainfall has decreased and the seasonal distribution of rainfall has changed in recent years. Such climatic changes, if they have occurred, only serve to make the design precipitation for the berm more conservative.

Consequences of Precipitation in Excess of 12 Inches

As with most properly designed structures, the berm would not fail as soon as the design precipitation was exceeded. A safety factor in the drill site's stormwater system includes the capability to dispose of stormwater into the "boulder zone." Excess stormwater would be directed to the "boulder zone," a geologic interval of high permeability at about 2,900 ft below the ground surface. The stormwater would be pumped into the annulus between the 20" and the 13 3/8" casing strings and allowed to gravity flow into the "boulder zone." This stormwater disposal method has a very high capacity to drain the complete bermed area quickly.

In summary, the bermed area has been designed with an appropriately high degree of protection against flooding and is backed up with a stormwater disposal system which eliminates surface water releases from the site. The risk of contaminant release from the drill pad due to site flooding is, in fact, very small.

ISSUE 36 ***DEIS fails to analyze spills into canals.***

COMMENT LG-6: "The hydrology analysis fails to appreciate that the canals in the area are indeed water conveyance systems and do not 'limit water flow' as claimed in the document. A spill or discharge into one or more of these canals is relatively likely. The document does not detail cleanup methods or procedures, or offer mitigation with respect to spills."

Also considered in the response to this issue was the following similar substantive comment: LG-13.

RESPONSE: Section 3.3.11.1 of the DEIS discussed surface water hydrology at the proposed drill site. Several surface features isolate the project site by limiting the flow of surface water from the site to the surrounding areas. For example, the L-28 Canal and Levee system actually consist of a canal flanked by levees on both sides. The WCA-3A enclosure levee is located on the east side of the canal and is about 15-feet high. A smaller berm of about three feet in height is on the west side of the canal. Drainage flow does not move directly off of the pasture area containing the drill site into the L-28 Canal. It must flow through the berm in culverts controlled with flashboard risers. Other features similarly limit surface water flow and were described in the DEIS.

ISSUE 37 ***Concerns the lateral migration of contaminated groundwater.***

COMMENT PH-32: "The study fails to delineate the hydrologic conditions that would serve as a barrier in this lateral migration of contaminated groundwater into the Biscayne Aquifer."

RESPONSE: DEIS Appendices A-7 and A-8 detailed postulated catastrophic spills of oil and brine formation waters into each of the major aquifer systems at the site: the surficial; the gray limestone; and the Floridan aquifers. The movement and growth of the contaminated groundwater plumes were modeled numerically for a 100-year period of time.

The analysis and the results were summarized in DEIS Section 4.11. In all 3 aquifers, the growth and migration of the contaminated groundwater plumes are areally limited even after a 100-year period. The analysis is conservative since it did not consider the benefits of any spill remediation. This very slow groundwater movement effectively contains contaminated groundwater close to the initial point of contamination.

A groundwater monitoring program was developed and included in the mitigation requirements to further limit potential impacts. This monitoring program would allow early detection and cleanup of any groundwater contamination while it is within the immediate vicinity of the exploratory well.

ISSUE 38 ***DEIS fails to consider contamination of groundwater due to drilling pressure.***

COMMENT PH-32: "This analysis also fails to consider lateral displacement and the effect of pressure caused by drilling, which could cause further contamination of underground sources of drinking water."

RESPONSE: The comment suggests impacts which do not exist. An explanation of the drilling process is offered in an attempt to clear up any misunderstandings.

A rotary drilling rig is a large and complex mechanism whose basic function is relatively simple. Its function is to drill a hole in the ground by supporting and rotating a string of drill pipe. It must occasionally pull the drill pipe out of the hole to allow pipe to be added and for drill bit changes. The rig is really a large crane for lifting and lowering drill pipe, with a rotary table to rotate the drill pipe.

The drilling rig also performs secondary functions such as circulating drilling fluid to clean the well bore and supporting the weight of the drill string so that the weight on the drill bit can be controlled. For example, if the drill string weighs 250,000 lbs. and only 30,000 lbs. of weight is needed on the bit, the rig must support 220,000 lbs. of the string while the well is being drilled. Due to the depth of the exploratory well, a large rig with a minimum lift capacity of 1,300,000 lbs. would be used.

For several technical and safety reasons, it is important to maintain a clean and smooth well bore. This is accomplished by carefully cutting through the formations and not just punching through. As mentioned before, the rig allows control of the weight on the drill bit to achieve this optimum cutting performance. Typical loading on the drill bits is on the same order of magnitude as on timber piles in common foundation systems. Such loadings are clearly not detrimental to aquifer systems.

Besides removing cuttings from the well bore, drilling fluids serve to keep the well bore from collapsing under the high earth pressures. This is done by carefully adjusting the density of the drilling fluids so that they hydrostatically balance the formation pressures. Drilling fluids are not adjusted to produce excess pressures within the well bore since such pressures could damage weak formations and result in drilling problems.

ISSUE 39 ***Questions how injected produced water would be prevented from spreading in substrates.***

COMMENT PH-33: "How will produced waters be reinjected and prevented from spreading among the lateral substrates and the geologic faults below?"

RESPONSE: Section 2.2.1.3 of the DEIS described the casing program for the proposed well. The well is designed to provide direct access, via the annular space between the 20-inch outer casing and the 13 3/8-inch interior casing, to a geologic interval of high permeability known as the "boulder zone." This interval lies at about 2,900 feet beneath the surface and is beneath all of the freshwater aquifer units. Thick layers of impermeable material confine the "boulder zone" isolating it from other permeable layers.

The EPA does not issue permits for underground injection of fluids from exploratory wells. EPA's request for disposal program data has been incorporated into the mitigation and monitoring requirements of Section 4.4.10 of the FEIS. EPA's review of the disposal program would be advisory to the BLM and BIA.

Once produced water has been tested and found to be acceptable for disposal in the "boulder zone," it would be pumped from the storage tank into the casing annulus where it would flow by force of gravity into the "boulder zone."

ISSUE 40 ***Questions how public would be provided fresh water in case of disaster.***

COMMENT I-307: "Has the 'environmental impact statement' stated how it will provide all of us fresh drinking water in the event of a major disaster?"

RESPONSE: The DEIS presented an analysis of huge brine water and oil spills. These spills were between four and six and one-half times larger than worst case spill planning volumes established in EPA regulations for an oil production facility. In none of these postulated scenarios does the contaminant plume even threaten the western edge of the Biscayne aquifer. Under no circumstances would the fresh drinking water sources of the southeast Florida coast be threatened by the proposed exploratory well.

ISSUE 41 ***Questions whether Appendix A-6 was included as scientific support for the BLM position.***

COMMENT O-65: "It is unclear whether the documents attached in Appendix A-6 are included as scientific support for the BLM position. The Preliminary Analysis of the Hydrologic and Geologic Characteristic (sic) of the Miccosukee Indian Reservation dated January 1991 attached therein contains a statement on page 16 that, 'Under no circumstances would an oil spill within the North part of the Miccosukee Indian Reservation affect any of the major drinking water supplies along the southeast coast.'

The report does not appear to contain any independent scientific analysis to support this statement. In fact, the author states on page 22 of the report that the scope of his work 'included researching literature and files of government agencies to gather information on the geology and hydrology of the reservation and adjacent areas.' Indeed, attached to his report is an impressive bibliography of documents from 1944 to 1990 but there does not appear to have been any independent scientific field data gathering or computer models performed for the area."

RESPONSE: SWEPI contracted with Hydrologic Associates U.S.A. of Miami to develop a preliminary analysis of the hydrology and geology of the Miccosukee Reservation prior to its submission of its APD to the BLM. The document provided background data supporting the analyses in the DEIS and is included as an appendix, consistent with NEPA regulations (40 CFR, Part 1502). The Hydrologic Associates study references a wide range of studies and reports which characterize the hydrologic environment of the project site. Independent verification of all of the previously published regional data was neither practical nor required by NEPA regulations.

Additional studies were completed as a part of the DEIS analysis. These include modeling of dense brine plumes resulting from postulated surface and subsurface discharges of formation waters, and the modeling of oil plumes resulting from postulated surface and subsurface discharges of oil. These groundwater modeling studies are presented in Appendices A-7 and A-8 respectively.

ISSUE 42 ***Concerns that short-term use could threaten the Biscayne aquifer.***

COMMENT O-66: "NEPA also requires that the relationship between local short term uses of man's environment and the maintenance and enhancement of long term productivity be address (sic) and analyzed. It is clear that a scientific analysis based on current data should be performed to assess the possibility and probability that the drilling and production of oil at this site could be a short term use that could threaten the Biscayne Aquifer, a potable drinking water source for four million people, and the gray limestone aquifer, the only major fresh groundwater source for the Miccosukee Reservation."

RESPONSE: A "worst case analysis" requirement originally appeared in Section 1502.22 of the CEQ's NEPA regulations (40 CFR, Part 1502). The entire section deals with the evaluation of significant adverse effects on the human environment in an EIS when there are gaps in relevant information or scientific uncertainty.

The CEQ issued an amendment to Section 1502.22 which eliminated the "worst case analysis" requirement. Instead, agencies are required to evaluate reasonably foreseeable potential impacts which include those which have a low probability of occurrence but which would be expected to result in catastrophic consequences if they do occur. However, the regulation specifies that the analysis must be supported by credible scientific evidence, not based on pure conjecture, and be within reason.

Section 4.3.11 of the DEIS evaluated the environmental consequences of postulated surface and subsurface releases of oil and brine formation waters. The evaluation was supported by Appendices A-7 and A-8 which detailed computer modeling of the postulated releases. The modeling analysis was reviewed by the USGS as well as by all other agencies, organizations and individual. No significant challenge to the modeling approach was raised. Therefore, it is only necessary to justify the magnitude of the postulated spills to show compliance with 40 CFR, 1502.22.

EPA regulations (40 CFR, Part 112) govern oil spill prevention at the proposed facility. These regulations establish applicable volumes for spill planning purposes at the facility. These volumes are listed below:

Average Most Probable Discharge = 2,100 gal/day

Maximum Most Probable Discharge = 36,000 gal/day

Worst Case Planning Volume = all associated lines and well with the highest output at the facility

South Florida wells do not flow under their own pressure and must typically be pumped. Raccoon Point wells averaged 173 bbls/day during the 1988 to 1989 period (Lloyd and Tootle, 1991). Other South Florida wells have similar daily production. The controlling spill volume for regulatory planning purposes was 36,00 gallons/day.

The spill analysis of the DEIS postulated separate surface discharges of oil and brine formation water. The analysis considered surface discharges of 2,000,000 gallons of oil or brine flow from the bermed area over a period of 14 days. For the subsurface discharges, the analysis considered 7,000,000 gallons of oil or brine flow from well casing leaks. These postulated spill scenarios ranged from about four to six

and one-half times the regulatory planning rates. In spite of the huge postulated spill volumes, the analysis indicated only localized impacts.

5.1.4.10 Jurisdiction

ISSUE 43 ***Concerns about the public interest in the proposal.***

COMMENT O-3: *"The analysis of alternatives should identify what, specifically, the public interest is in the proposal and how that interest may be harmed or served by the project."*

Also considered in the response to this issue was the following similar substantive comment: PH-7.

RESPONSE: The proposed project affects property held for the benefit of the Miccosukee Tribe. The Miccosukee Reservation is not public property. The United States has a fiduciary obligation toward Indian Tribes with respect to management of Indian oil and gas leases. This trust obligation is carried into the IMDA, under which the lease was issued, the intent of which is to ensure that Indian mineral owners wishing to develop their mineral resources are able to achieve development in a manner that maximizes their best economic interests and minimizes any adverse environmental and cultural impact.

Section 1.2 of the DEIS explained that the proposed action is intended to fulfill a lease agreement between the Miccosukee Tribe and SWEPI. The proposed action is not a public project, does not involve public funding, is not to be conducted on public lands and, therefore, does not require a determination of being in the public interest to be approved. The proposed action must, however, be in full compliance with all applicable laws, regulations and standards in order to be approved. This compliance review assures that the proposed action and alternatives are not contrary to the public interest.

ISSUE 44 ***DEIS does not contain a Coastal Zone Management Act consistency determination.***

COMMENT SG-15: *"The direct and cumulative impacts of this project may result in significant adverse effects on land and water uses in the state's coastal zone. Any such activities should be evaluated for consistency with the Florida Coastal Management Program. Shell Western should provide a consistency certification to the state and the Bureau of Land Management in accordance with the procedures laid out in 15 CFR 930 Subpart D."*

Also considered in the response to this issue was the following similar substantive comment: SG-1.

RESPONSE: Section 1.5 of the DEIS discussed the relationship of this project with state and local plans, policies, programs, and regulations. State and local regulation do not apply on Indian lands. The sovereignty of Indian lands is discussed in Section 1.5 of the FEIS.

In addition, the definition of "coastal zone" in the Coastal Zone Act states that " ...Excluded from the coastal zone are lands the use of which is by law solely to the discretion of or which is held in trust by the Federal Government..." (16USC,1453). The Miccosukee Federal Indian Reservation is land held in trust by the Federal Government.

Nevertheless, several state agencies stated in their comments on the DEIS, that the proposal meets consistency requirements within their agency's areas of responsibility. These comment letters may be found in the "Public and Agency Comments" document on pages SG-4 through SG-19.

ISSUE 45 ***Claims that the DEIS conflicts with State plans. DEIS should address impact to drinking water and social and economic impacts.***

COMMENT SG-1: "We find the proposal described in the Draft Environmental Impact Statement (DEIS) in conflict with State plans, programs, policies and objectives. The Florida Everglades is not only a fragile and unique ecological system, it is also an integral component of the water supply to more than 4 million people of southeast Florida and essential to a healthy economic and social structure in South Florida and the Florida Keys. Any threat to the Everglades, and certainly that of oil drilling, is unacceptable because the release of hydrocarbons that might result from human error or natural disaster could be devastating to the environmental, social and economic well-being of Florida."

Also considered in the response to this issue were the following similar substantive comments: I-3, I-11, I-19, I-21, I-27, I-41, I-67, I-99, I-107, I-122, I-128, I-170, I-234, I-254, I-324, PH-33, PH-34, SG-21.

RESPONSE: The objection of the Governor's Office is respectfully acknowledged and becomes a part of the record.

Section 1.5 of the DEIS established that the Miccosukee Reservation is not subject to the requirements established in environmental regulations and land use plans adopted by the State of Florida. In order to assure that activities conducted under the oil and gas lease with SWEPI are conducted in an environmentally responsible manner, the Miccosukee Tribe imposed a lease stipulation which provides that "if there is a conflict between the various State, Federal, or tribal regulations, rules, laws or orders, SWEPI shall comply with the more stringent regulation, rule, law, or order..." The state review which

was coordinated by the Governor's Office resulted in review of the DEIS by appropriate state agencies to determine compliance with state regulations. The state agency that regulates drilling activities found the SWEPI proposal to generally conform with their regulations (see comment SG-5). Review of the comments from state agencies did not identify any conflicts with state regulations, rules, laws, or orders.

An extensive analysis of the impacts of the proposed action and alternatives on the environment was conducted. This analysis included consideration of water resources and potential hydrocarbon releases from hurricane effects and human error. The conclusion of the DEIS was that the proposed action and alternatives would not have significant environmental impacts and complies with all applicable regulations and the lease terms.

ISSUE 46 ***States that the South Florida Water Management District Governing Board passed resolution opposing proposal.***

COMMENT SG-10: "On May 13 (1993) the Governing Board of the South Florida Water Management District adopted Resolution 93-18 opposing the construction of exploratory oil wells in, adjacent to, or under any Water Conservation Area within the Everglades. This was prompted by the pending application of Shell Western E & P Inc. to drill in the Everglades.

Attached is a copy of the resolution. The Board's concerns include possible contamination of the aquifers which are the source of water for millions of residents; the potential threat to fish, wildlife and the environment; and conceivably the interruption of sheetflow to Everglades National Park."

Also considered in the response to this issue was the following similar substantive comment: SG-2.

RESPONSE: The comments include two issues which are:

- Concern over potential environmental impact to the Everglades ecosystem; and
- Jurisdiction of the SFWMD on Indian lands.

These issues are discussed in the following paragraphs.

Environmental Impacts

The scope of the FEIS includes full analysis of the potential impacts to the environment as a result of the exploratory drilling program. The FEIS concludes that no significant environmental impacts would occur as a result of the proposed action or alternatives.

SFWMD Jurisdiction

The civil regulatory laws of states or their political subdivisions are not applicable on Indian reservations. California v. Cabazon Band of Mission Indians 480 U.S. 202 (1987); Bryan v. Itasca County, 426 U.S. 373 (1976); Seminole Tribe of Florida v. Butterworth, 658 F 2d 310 (5th Cir. 1981), Cert. denied, 455 U.S. 1020(1982). The Federal government has totally pre-empted the field of regulation of oil and gas leasing and development on Indian land. See IMDA, 25 USC § 2101, et seq; 25 CFR Part 225.

The United States holds the Reservation lands in trust for the Miccosukee Tribe. This includes the large portion of Reservation land which is occupied by WCA-3A. Neither Broward County, SFWMD, nor the State of Florida hold title to any Alligator Alley Reservation lands or its minerals. The history of the Reservation ownership is provided in the following paragraphs.

There are several different types of Miccosukee lands in Florida. The 78,000-acre "Alligator Alley" parcel in which the proposed drilling is to occur is in Reservation status. In 1950, the predecessor of SFWMD obtained a surface flowage easement without Federal or tribal approval. WCA-3A was established in 1962 on lands covered by this easement. WCA-3A occupies the eastern two-thirds of this Miccosukee Reservation parcel, covering approximately 50,000 acres.

The Miccosukee Tribe brought legal action against the state in an attempt to regain its possessory and proprietary interests in the 50,000-acre tract. The Miccosukee Tribe and the State of Florida settled the Tribe's land claim lawsuit in 1982. SFWMD was also a party to the settlement and signed the settlement agreement. This settlement was approved by Congress in the Florida Indian Land Claims Settlement Act, 25 U.S.C. §1741, et seq. Pursuant to this settlement, Florida deeded all "right, title and interest" in the Alligator Alley Reservation to the United States, in trust for the Miccosukee Tribe.

SFWMD retains the surface flowage easement on the portion of the Reservation occupied by WCA-3A. SFWMD also asserts an O&M easement for the L-28 component of the Central and South Florida Flood Control Project.

ISSUE 47 ***Claims that the State has civil regulatory jurisdiction over the on-reservation drilling activity.***

COMMENT SG-2: "The Department of Natural Resources holds that the State has civil regulatory jurisdiction over the on-reservation drilling activity of Shell Western E&P, Incorporated. This determination is based on Section 377.22, Florida Statutes, which provides for the regulation of the exploration, drilling and production of oil and gas and to ensure all precautions are taken to prevent damage including spillage, fires, 'blowouts,' 'caving,' 'seepage,' the intrusion of oil into the aquifer, injury to neighboring properties, etc."

Also considered in the development of the response to this issue was the following similar substantive comment: SG-6.

RESPONSE: The comments raise two separate issues. These are:

- A state claim of civil regulatory jurisdiction of oil and gas developments on Indian lands; and
- An implied requirement for state regulation to avoid environmental damage.

These issues are discussed separately in the following paragraphs.

State Regulatory Jurisdiction

The proposed drilling program involves Miccosukee land which is in Reservation status. Title to Miccosukee Reservation land is held in trust by the United States for the Tribe. The civil regulatory laws of states or their political subdivisions are not applicable on Indian reservations. California v. Cabazon Band of Mission Indians 480 U.S. 202 (1987); Bryan v. Itasca County, 426 U.S. 373 (1976); Seminole Tribe of Florida v. Butterworth, 658 F 2d 310 (5th Cir. 1981), Cert. denied, 455 U.S. 1020(1982). The Federal government has totally pre-empted the field of regulation of oil and gas leasing and development on Indian land. See IMDA, 25 USC § 2101, et seq; 25 CFR Part 225.

Additionally, Federal law preempts the field of mineral development on Indian reservations. Applicable legislation includes the IMDA (25 U.S.C. §2101, et seq.) and the Indian Mineral Leasing Act of 1938 (25 U.S.C. §396a, et seq.). Applicable BLM regulations are found at 43 CFR, Part 3160. Applicable BIA regulations are found at 25 CFR, Part 225. The state has no regulatory authority over the Tribes on reservation activities.

No mineral lease to Indian land is valid unless approved by both the Tribe and the United States, as trustee. This approval function is discharged by the Secretary of the Interior. Furthermore, the Department of the Interior, acting primarily through the BLM and the BIA, supervises lease performance, reviews required permit applications, and assures timely and proper payment of rental and royalties.

Environmental Safety Without State Regulation

The fact that Florida does not have jurisdiction over oil and gas development on Indian lands does not automatically imply that the principles of the state's regulatory program are violated. SWEPI has carefully designed the exploratory drilling program to minimize environmental impact.

The state agency that regulates drilling activities found the SWEPI proposal to generally conform with their regulations (see comment SG-5).

ISSUE 48 ***Concern about right-of-way on levee, berms and canal.***

COMMENT SG-22: "...the District is extremely concerned about any use of the right-of-way that may have adverse impacts on our levees, berms and the adjacent canal. It is requested that the applicant consult with the District to determine the extent of the right-of-way encroachment, whether other alternatives are available, and, if appropriate, submit an application for a permit."

Also considered in the response to this issue was the following similar substantive comment: PH-3.

RESPONSE: The DEIS identified Alternative A as the Preferred Alternative. However, Alternative B was identified as a second choice, if jurisdictional conflicts relating to access along the berm road west of the L-28 Canal prohibit selection of Alternative A. Following completion of the DEIS, additional consultation was initiated with the SFWMD and the Miccosukee Tribe concerning this issue. This jurisdictional conflict, documented by letters found in Appendix A-12, can be summarized as follows:

> The SFWMD asserts a right-of-way for the L-28 component of the Central and Southern Florida Flood Control Project. On May 13, 1993, the Governing Board of the SFWMD adopted Resolution 93-18 opposing the construction of exploratory wells in, adjacent to, or under any Water Conservation Area within the Everglades. The Resolution states that the Governing Board is against the use of District's property for the access or transportation facilities that may be required. By letter dated February 18, 1994, SFWMD claims authority to require SWEPI to apply for a permit to utilize any portion of the asserted L-28 right-of-way.

> The Miccosukee Tribe disputes the SFWMD position. The Tribe maintains that neither the Tribe nor any of its lessees, including SWEPI, need to obtain a permit from SFWMD for use of the western berm road, as proposed by SWEPI (Alternative A). The Tribe's position is documented in a letter from the law firm Hobbs, Straus, Dean & Wilder dated March 24, 1994.

Based on the conflicting positions of the SFWMD and the Miccosukee Tribe, a jurisdictional conflict exists between two governmental entities concerning the access route under Alternative A. This conflict cannot be resolved through the NEPA process.

The Tribe recommends that the BLM and BIA consider Alternative B (West Access Route) as the Preferred Alternative since this route provides an acceptable route without any jurisdictional conflict.

Alternative B considers construction of the West Access Road from Snake Road to the well site. Since Alternative B requires construction of a new access road, the DEIS noted that impacts associated with this alternative would be greater than impacts associated with Alternatives A and C. However, the impacts associated with Alternative B were not found to be significant. In consideration of these facts, Alternative B (West Access Road) is the Preferred Alternative of the FEIS.

ISSUE 49 ***Proposal has no significant impact on state transportation system and partially satisfies Coastal Zone Management consistency requirements.***

COMMENT SG-16: "Based upon the information provided, we find the subject project to have no impact on the State Transportation System. The project has been reviewed under Presidential Executive Order 12372 and the Florida Coastal Zone Management Program for consistency with only the following plans and policies:

- *Intergovernmental Coordination"*

RESPONSE: While Federal regulations preclude state and local regulation of the Miccosukee Federal Indian Reservation property, verification that the project nevertheless is consistent with the state plans and policies within your agency's areas of responsibility is noted.

ISSUE 50 ***Proposal generally agrees with State's oil and gas development regulations.***

COMMENT SG-5: "Shell's proposal generally conforms to the Department's Rules regulating drilling and production of oil and gas in Florida."

RESPONSE: This comment is noted, and supports the conclusion that the lease stipulation regarding state regulations for oil and gas development has been fulfilled.

ISSUE 51 ***Claims that the water conservation area is State land and not Miccosukee's.***

COMMENT PH-15: "I also object to any proposal to drill at a slant underneath or near the conservation area. This conservation area is owned by the people of Broward County and State of Florida, not by the Miccosukee Indian Tribe."

RESPONSE: The U.S. holds the Reservation lands (including mineral rights) in trust for the Miccosukee Tribe. This includes the large portion of Reservation land which is occupied by WCA-3A. Neither Broward County nor the State of Florida hold title to any reservation lands or minerals. The history of the Reservation ownership is provided in the following paragraphs.

There are several different types of Miccosukee lands in Florida. The 78,000-acre "Alligator Alley" parcel in which the drilling is proposed to occur is in Reservation status. In 1950, the predecessor of the SFWMD obtained a surface flowage easement without Federal or tribal approval. WCA-3A was established in 1962 on lands covered by this easement. WCA-3A occupies the eastern two-thirds of this Miccosukee Reservation parcel, covering approximately 50,000 acres.

The Miccosukee Tribe brought legal action against the state in an attempt to regain its possessory and proprietary interests in the 50,000-acre tract. The Miccosukee Tribe and the State of Florida settled the Tribe's land claim lawsuit in 1982. SFWMD was also a party to the settlement and signed the settlement agreement. This settlement was approved by Congress in the Florida Indian Land Claims Settlement Act, 25 U.S.C. §1741, et seq. Pursuant to this settlement, Florida deeded all "right, title and interest" in the Alligator Alley Reservation to the United States, in trust for the Miccosukee Tribe. At the time of the settlement, the possible development of minerals was discussed. SFWMD retains the surface flowage easement on the portion of the Reservation occupied by WCA-3A.

The SWEPI exploratory well would be entirely within Miccosukee-owned lands. The proposed bottomhole location is about 4,700 feet east of the surface entry point, and lies beneath WCA-3A. However, the bottomhole location is still about 2 miles inside of the Miccosukee Reservation's eastern boundary.

5.1.4.11 Land Use

ISSUE 52 ***DEIS fails to include discussion of the Florida Executive Order banning development in Water Conservation Areas.***

COMMENT O-39: "Discussion of the Florida Executive Order banning commercial development in the Everglades Water Conservation Areas and the effects of this project must be included."

Also considered is the response to this issue was the following similar substantive comment: I-372.

RESPONSE: A 1988 EO by then Governor Martinez allows development on state-owned lands in the WCA's only if it is for the better management of the lands. In 1990, a Policy Statement by the Governor and Cabinet was issued prohibiting oil and gas activities on state-owned lands in the WCA's. Both of these orders apply only to state-owned lands within the WCA's.

The Miccosukee Reservation is land held in trust for the Tribe by the Government of the United States. A portion of the Reservation is within WCA-3A but is not state-owned lands. Furthermore, as stated in Sections 1.5 and 1.6 of the FEIS, the Miccosukee Reservation is not subject to state and local laws, ordinances, codes, resolutions or rules limiting or otherwise controlling the use or development of real property. Therefore, neither the executive order nor the policy statement is applicable to the proposed action or alternatives.

The SFWMD holds a flowage easement over the surface portion of Miccosukee Reservation lands within the boundary of WCA-3A. The proposed action and alternatives do not include any surface facilities within WCA-3A.

5.1.4.12 Monitoring and Enforcement

ISSUE 53 ***Recommends adding laboratory analysis of petroleum hydrocarbon to monitoring wells.***

COMMENT FG-5: "Because of the uncertainty of diesel fuel migration into the aquifer, the applicant

should add to the laboratory analyses the total petroleum hydrocarbon parameters in the downgradient and upgradient monitoring wells."

RESPONSE: The comment refers to the diesel fuel spill and the cleanup efforts by SFWMD at its S-140 pump station which were described in Section 3.3.9.3 of the DEIS. EPA's comment is noted and Section 4.4.11 has been amended to include the requested laboratory analyses.

ISSUE 54 ***Requests that EPA review plans and monitor disposal of waste by injection.***

COMMENT FG-5 and FG-6: *"The applicant plans to dispose of excess drilling fluid and stormwater into the 'boulder zone' at a depth of about 2900 feet (page 4-34, Fluids Disposal). EPA is aware that it is common industry practice to inject drilling waste fluids into exploration and production wells after completion of drilling operations on these wells. Although EPA does not issue Underground Injection Control (IUC) (sic) permits for these wells, it has been the position of EPA Region 4 to allow the option of reinjecting wastes provided that underground injection does not endanger any underground source of drinking water. EPA therefore requests that the applicant's underground waste injection plans be submitted to this Agency to ensure that this activity will not endanger any underground source of drinking water.*

Our Ground-water Protection Control Section would like to monitor disposal activities after the Final EIS is prepared and the project commences. During disposal activities, we request that the applicant provides an activity summary of the disposal operations together with supporting documentation which should include well logs for the shallow portion of the hole, geologic formation tops for the well, if available, well log calculations of the shallow hole to the lowermost source of drinking water, chart recorder of pressures tests documenting cement shoe casing protection of the lowermost underground source of drinking water, pump pressure logs of disposal activities to document that test pressures do not exceed the 20-inch casing cement shoe, copies of daily reports for disposal activity, chart recorder of pump pressures for disposal activity, copy of well log and completion report affidavit, and a copy of the plugging affidavit, if appropriate."

Also considered in the response to this issue were the following similar substantive comments: I-373, PH-10, PH-19, PH-37.

RESPONSE: EPA's comment is noted and Section 4.4.10 has been amended to include the provisions to provide EPA with the requested underground waste injection plans and monitoring reports through the BLM.

ISSUE 55 ***Questions adequacy of SPCC plan.***

COMMENT FG-6: *"The drilling operation offers the potential for spills to the adjacent surface water system. The Spill Prevention Control, and Countermeasure (SPCC) Plan is somewhat general in nature because it does not address site specific remedial or containment activities. We would expect to see a plan specific to this site in the Final EIS. Also, we would expect to see notification of all spill events extended to include SFWMD."*

Also considered in the development of the response to this issue were the following similar substantive comments: I-324, I-373, PH-10.

RESPONSE: The need for a site-specific SPCC Plan prior to commencement of on-site operations is recognized. Section 4.3.10.5 has been amended to include the recommendation for establishment of a site specific SPCC plan prior to commencement of site operations. The current SPCC plan (Appendix A-10), includes a provision for notification of SFWMD in the event of a spill.

ISSUE 56 ***DEIS does not evaluate financial commitments in case of spill.***

COMMENT I-324: *"In the event of a catastrophic spill, financial resources will be critical. Shell makes no guaranteed commitment of money or personnel. Shell should be required to post a one billion dollar bond at the time of application. Financial commitments by bonds or other means needs to be evaluated in the DEIS."*

Also considered in the development of the response to this issue were the following similar substantive comments: I-136, I-373, I-374, PH-10.

RESPONSE: Specific Federal laws exist that address oil spill liability. Oil spills in the U.S. on land and navigable inland waters are covered by OPA or Public Law 101-380 of August 18, 1990. This comprehensive legislation focuses on oil spill liability and compensation, and oil spill prevention and response. OPA amends the Clean Water Act. Section 1.6.12 of the DEIS explained the relationships of the legislation and implementing regulations.

Liability under OPA is strict, joint and several. Indemnification agreements do not remove liability because it cannot be transferred. A responsible party may be liable for removal costs and damages resulting from discharges of oil only. Damages may be recovered by both public and private parties and may include:

- Damages to natural resources;
- Damages to property;
- Loss of subsistence use of natural resources;
- Loss of revenues;
- Loss of profit and earning capacity; and
- Costs of increased or additional public service.

Liability for spills from onshore facilities is limited to $350,000,000. Liability is unlimited if the spill was caused by gross negligence, willful misconduct, or violation of a Federal regulation on the part of the responsible party. Liability is also unlimited if the responsible party fails or refuses to report the incident; cooperate with responsible officials; or comply with an order issued under the Federal Water Pollution Control Act.

OPA includes financial responsibility provisions which are intended to ensure adequate funds would be immediately available to compensate injured parties. Potential responsible parties must demonstrate capability to meet liability up to the limits specified in the Act. SWEPI has complied with OPA.

EO 12777 assigned regulatory authority over five types of facilities to various Federal agencies. The exploratory well is a non-transportation related onshore facility and comes under the jurisdiction of the EPA. Tank trucks which would be used to transport any oil recovered during the production tests are non-marine transportation related facilities and come under the jurisdiction of the Research and Special Programs Administration within the Department of Transportation.

ISSUE 57 ***Suggests resistivity and porosity logs be run on open hole conditions before setting casing.***

COMMENT SG-5: "Shell did not outline their logging program. In order to better estimate water quality and ensure adequate ground water protection, we recommend that resistivity and porosity logs be run in open hole prior to setting conductor and surface casings."

RESPONSE: SWEPI's well logging program includes resistivity and porosity logs as suggested. The well logs would be submitted to BLM for review.

ISSUE 58 ***Questions monitoring of truck speeds, emissions and noise.***

COMMENT PH-37: "They say there is going to be speed limits on the trucks. You know, well, who's going to be there to enforce it? Are the trucks going to be checked for emissions? Are the trucks going to be checked for noise? These things are not mentioned at all."

RESPONSE: SWEPI would be responsible for compliance with the permit to drill and all conditions of the permit. A site supervisor would be in charge of the exploratory drilling plan of operation. An appropriate speed limit would be posted. In addition, BLM would conduct inspections to assure permit compliance. All trucks would be licensed vehicles and would comply with established standards for vehicle performance and safety.

5.1.4.13 NEPA Process

ISSUE 59 ***Requests that decision on proposal be made by the Secretary of the Interior.***

COMMENT O-3: "Finally, we respectfully request that the final decision to approve or deny this project be made at the highest levels of government -- by the Secretary of the Interior, Bruce Babbitt. We feel that in light of Mr. Babbitt's public pronouncements signaling his commitment to protecting the Everglades, he himself must make the final decision on this project, as it has the potential to severely undermine his Everglades protection initiatives."

Also considered in the development of the response to this issue was the following similar substantive comment: PH-18.

RESPONSE: The District Manager of the Jackson District of the BLM has the authority, delegated from the Secretary of the Interior, to approve or deny all APD for oil and gas development projects within the District boundaries. Any adversely affected party may request an administrative review, before the State Director of the BLM. Any party who is adversely affected by the State Director's decision may appeal that decision to the IBLA.

Under certain circumstances, the decision on a particular proposal may be elevated to the Office of the Secretary of the Interior. The opportunity for appeal by to IBLA is not available if the APD decision is made at the Secretary's level.

ISSUE 60 ***Questions if DEIS provides Federal accountability.***

COMMENT O-71 and O-72: "Because it is unclear as to the degree of delegation that was given on the DEIS to third party consultants by the federal government, it raises questions as to whether the DEIS meets NEPA's most basic purpose of providing federal accountability for the environment. We request that BLM and BIA more fully explain the extent and manner of their involvement in both the gathering and analysis of data, and the preparation of the DEIS itself. This should include as explanation of how the responsible federal agency conducted its own independent evaluation of the information supplied by the consultants, and in what manner and to what extent they performed an independent and critical evaluation of the environmental considerations."

RESPONSE: The environmental analysis process is outlined in Section 1.1.2 of the DEIS. The responsibilities of the BLM as Lead Agency and the BIA as Joint Lead Agency are described together with appropriate references to Federal regulations which prescribe these responsibilities.

The evaluation of the SWEPI proposal and alternatives was accomplished by a interdisciplinary review with representatives from the BLM, BIA, and USGS. Interdisciplinary participation has been provided by the environmental consulting firm of Dames & Moore, Inc. under a third party contract. Federal agencies commonly utilize such arrangements. Provisions of 40 CFR, 1506.5 specify the requirements for selecting contractors and preparing EIS's under such arrangements. The regulations also state that:

> "If the document is prepared by contract, the responsible Federal official shall furnish guidance and participate in the preparation and shall independently evaluate the statement prior to its approval and take responsibility for its scope and contents."

The BLM and BIA have furnished guidance on a continuous basis throughout every phase of the analysis and actively participated in the preparation of this EIS. A review team with the agencies has independently evaluated every aspect of the statement and the responsible Federal officials take full responsibility for its scope and contents.

The List of Preparers and Reviewers (see Section 5.2, Table 5-1) of the FEIS has been revised to include all BLM and BIA reviewers.

ISSUE 61 ***Questions why EPA was not a Cooperating Agency.***

COMMENT LG-2: "No effort was made to enlist EPA as a Cooperating Agency, which would utilize EPA's expertise in many of the considered criteria."

Also considered in the response to this issue was the following similar substantive comment: LG-9.

RESPONSE: The EPA has and would have full opportunity to review and comment on the document as it proceeds through the process as outlined in DEIS Section 1.1.2. Region 4 EPA provided two letters which contain valuable comments on the DEIS. These letters and responses to the EPA comments are available in other sections of this response document. One of the most important issues which the DEIS dealt with was evaluation of possible impacts on the surface and groundwater systems. Section 1.1.2 of the DEIS explained the applicable Federal agency relationships. The USGS in Miami participated in the analysis as a Cooperating Agency as provided in 40 CFR, 1501.6. The USGS has special expertise concerning surface and groundwater resource considerations and is officially designated as the Federal authority concerning these resources.

ISSUE 62 ***DEIS does not include a disclosure statement.***

COMMENT LG-2: "The Consultant's Disclosure Statement, required by NEPA Section 1506.5(c), is omitted from the document."

Also considered in the development of the response to this issue was the following similar substantive comment: LG-9.

RESPONSE: 40 CFR, 1506.5(c) requires consultants to file a statement specifying that they have no financial or other interest in the outcome of the project. Dames & Moore, Inc. submitted the requisite Consultant's Disclosure Statement to the BLM where, as any public document, it is available for inspection. The CEQ regulations do not require that the Disclosure Statement be a part of the EIS document.

ISSUE 63 ***DEIS does not meet NEPA goals of enhancing "quality of the human environment."***

COMMENT SG-2: "The drilling for oil in this ecosystem is not in accord with goals of restoring and protecting the South Florida ecological system. This DEIS is not in consonance with NEPA goals of enhancing the 'quality of the human environment'."

RESPONSE: The CEQ regulations (40 CFR, Parts 1500-1508) implement the NEPA. Section 1502.1 of the regulations state that:

> "The primary purpose of an EIS is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal Government."

The policy referred to in the regulations is found in Title 1 Section 101.(a) of NEPA and it states:

> "The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practical means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social and economic, and other requirements of present and future generations of Americans."

NEPA Title 1 Section 101.(b) goes on to enumerate the goals of the Act. It states:

> "In order to carry out the policy set forth in this Act, it is the continuing responsibility of the Federal Government to use all practical means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may --
>
> (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
>
> (2) assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
>
> (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintentional consequences;

> (4) preserve important historic, cultural and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
>
> (5) achieve a balance between population and the resource use which would permit high standards of living and a wide sharing of life's amenities; and
>
> (6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

While the NEPA policy and goals establish wide-ranging environmental protection responsibilities upon Federal agency decision makers, they do not require that Federal actions "enhance the quality of the human environment." CEQ regulations (Section 1502.1) continue to outline the requirements of an EIS which satisfies the NEPA policy and goals stating that:

> "It shall provide full and fair discussion of significant environmental impacts and shall inform decision-makers and the public of reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. Agencies shall focus on significant environmental issues and alternatives and shall reduce paperwork and the accumulation of extraneous background data. Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analysis. An environmental impact statement is more than a disclosure document, It shall be used by Federal officials in conjunction with other relevant material to plan actions and make decisions."

In order to ensure that Federal agencies evaluate the environmental effects of any major Federal action, the Act requires that all Federal agencies follow specific procedures prior to making a decision on actions that significantly affect the quality of the human environment. Such procedures include providing a detailed statement by the responsible official on:

- The environmental impact of the proposed action;
- Any adverse environmental effects which cannot be avoided should the proposal be implemented;
- Alternatives to the proposed action;
- The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and

- Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

All of these items have been fully considered and addressed in the FEIS (see Chapters 2 and 4).

The Act further requires that:

- The responsible Federal official consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved; and

- Make available copies of the statement and comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards to the President, the CEQ and to the public.

These procedures have been diligently followed. See Chapter 5 of the FEIS.

The FEIS, together with the review and comments by Federal agencies with specialized knowledge and statutory authority in the relevant areas, state, and local governments, concerned public and private organizations and individuals, satisfies the intent, form and function requirements of NEPA and its implementing regulations.

5.1.4.14 Noise

ISSUE 64 ***DEIS does not adequately analyze effect of noise on wildlife.***

COMMENT O-101: "The effects of noise on wildlife are inadequately evaluated. Only low constant engine noise is even superficially covered. Sharp, high pitched noises - typically disruptive to wildlife - will be generated yet are not evaluated."

Also considered in the response to this issue were the following similar substantive comments: I-373, LG-6, LG-13, O-68.

RESPONSE: Contrary to the above comment, pages 4-14 through 4-20 of the DEIS discussed noise levels expected to be emitted from the drill rig, based on known noise levels of similar rigs in the BCNP. Numerous literature citations were given in support of the information, including levels of expected noise frequencies associated with the proposed rig, and the expected and known effects on wildlife. The DEIS

discussed "sharp, high pitched noises," especially those generated during conductor casing drive hammer operations. Apparently, an area within approximately a one and one-half mile radius from a drill rig site in Alaska was avoided by approximately half of the species studied, including geese and swans. Conductor casing drive hammer operations could reach 10 dB above ambient (the USFS acceptable level) at approximately 1.6 miles from the drill rig. The duration of hammer operations would be limited to several days. No significant wading bird rookeries are known in the area between the L-28 Canal and Snake Road. While rookeries may occur to the east in WCA-3A, none were indicated within 1.5 miles of the proposed well site by the NAS's SRFs for the SFWMD. Snail kite critical habitat is found within 1.5 miles from the proposed well site, but the large breeding colony (the Miccosukee Roost) lies over five miles south of the proposed well site.

Definitive studies that identify the level of human activity that would disrupt the Florida panther's behavior or alter its range are not available (NPS, 1991). Hunting and off-road vehicle (ORV) use are considered the principal activities that may affect the Florida panther (NPS, 1991). Telemetry data indicated that panthers alter their habitat use patterns in response to human activities during hunting season (Schortimeyer, et al, 1991). Oil and gas exploration activities appear to be less disruptive to panthers than hunting and ORV use (NPS, 1991). It is apparent from panther telemetry data that panthers already avoid the project vicinity, the Miccosukee Service Plaza, and S-140 pump station. Panthers likely cross I-75 at the easternmost wildlife underpass, which is located a few miles west of the proposed Miccosukee 3-1 well site.

ISSUE 65 ***DEIS fails to address effect of noise during wading bird breeding periods.***

COMMENT SG-22: "Under the assessment of noise impacts on wildlife, the study fails to address the timing of noise disturbances during wading bird breeding periods."

RESPONSE: The DEIS discussed noise levels, including those generated during conductor casing drive hammer operations, and the potential for effects on wildlife. Apparently an area of approximately one and one-half mile radius from a drill rig site in Alaska was avoided by approximately half of the species studied, including geese and swans. Conductor casing drive hammer operations could reach 10 dB above ambient (the USFS acceptable level) at approximately 1.6 miles from the drill rig for a duration of several days. No significant wading bird rookeries are known in the area between L-28 Canal and Snake Road. While rookeries may occur to the east in WCA-3A, none were indicated within one and one-half miles of the proposed well site by the NAS's SRFs for the SFWMD. Snail kite critical habitat is found within one and one-half miles from the proposed well site, but the large breeding colony (the Miccosukee Roost) lies over five miles south of the proposed well, outside of the area that could be affected by increased noise levels.

The timing of drilling operations would depend on when the project is approved, but it is known that the construction of the drill site would take about 30 days, and the entire drilling operation would encompass about 145 days.

5.1.4.15 Socioeconomics

ISSUE 66 ***DEIS fails to address impacts to tourism.***

COMMENT O-70 and O-71: "The DEIS states that 'no significant negative socioeconomic impact would result from the proposed action and alternative.' The DEIS does not attempt to address or analyze any negative socioeconomic impacts to tourism that might occur as a result of an oil spill or other hazardous wastes contaminating a portion of the Everglades and its wildlife or the water supply. Nor, does the DEIS perform a probabilistic risk assessment to prove that such a catastrophic event could not happen. Since tourism is an important industry for both Dade and Broward County, the DEIS should attempt to analyze what effect in terms of dollars and jobs lost that a catastrophic spill, one that might contaminate the Biscayne Aquifer, could have on Dade and Broward counties."

Also considered in the response to this issue were the following similar substantive comments: O-101, PH-13, PH-14, PH-15, PH-33, PH-34, PH-37.

RESPONSE: Section 4.3.11 of the DEIS included analysis of effects on groundwater and surface water that could occur from a release of oil at the drill site under catastrophic conditions. The analysis established that existing and proposed physical and hydrological barriers at the drill site would prevent the widespread migration of contaminants.

Section 4.3.13.2 of the DEIS established that the pasture area in the vicinity of the well site does not provide high quality wildlife habitat, hence wildlife utilization in the immediate area is low. A release of contaminants could affect water and wildlife resources in the vicinity of the drill site but the effects would not be widespread due to existing and proposed containment features.

A spill could occur at the site, but the probability of a major spill is very low. Appendix A-1 of the DEIS established that the probability of oil discovery at the site is less than seven percent. Oil wells in South Florida generally require pumping to bring the oil to the surface, therefore, a free flowing blowout is unlikely. The integrity of the well would be protected by blowout preventers capable of controlling pressures greater than those expected to be encountered.

If a spill did occur, even a large spill as contemplated in Section 4.3.11 of the DEIS, the contaminants would be contained to the immediate pasture area. Consequently, wide spread environmental effects and resulting effects on the tourist economy of South Florida would not occur.

A detailed assessment of all conceivable impacts that could result from a catastrophic event would be totally speculative and is, therefore, not realistic. This issue was addressed in 1986 changes to NEPA regulations. The revised regulations stated that impacts of low probability of occurrence, but with catastrophic consequences if they do occur, should be evaluated if the analysis is supported by credible scientific evidence and is not based on pure conjecture, and is within the rule of reason. The level of impact analysis contained in the EIS meets the requirements of NEPA.

ISSUE 67 ***DEIS fails to address impacts to communities.***

COMMENT LG-6: "The socioeconomic analysis is superficial and totally inadequate. There is no discussion of where the skilled workers will come from, where they will live, where they will buy food and supplies, and how their activities will impact neighboring communities. Without an examination of the services necessary to support the drilling operations, it is impossible to effectively assess the potential socioeconomic impacts from the proposed action."

Also considered in the response to this issue were the following similar substantive comments: LG-14, O-101, PH-15.

RESPONSE: The socioeconomic impacts associated with accommodating the living requirements of construction workers would be limited to the 325 day duration of the proposed action. Section 4.3.6.2 of the DEIS acknowledged that the required skilled labor would largely come from workers who would temporarily relocate to the area, and would live in surrounding communities of the Fort Lauderdale or Naples urban areas. No temporary living quarters are proposed on-site.

Section 4.3.7 addressed the transportation impacts of traffic related to the commute of the site workers. The Fort Lauderdale and Naples urban areas have more than adequate facilities to accommodate the estimated 25 individuals who would comprise the work force for the proposed action. Both urban areas depend upon short-term visitors and seasonal residents as significant contributors to the local economy. Given the size of the urban areas where site workers would temporarily reside, impact of the small SWEPI work force for the proposed action does not require a detailed investigation to determine its insignificance to the socioeconomic conditions of the region.

ISSUE 68 ***Project is consistent with Department policies to promote economic development in economically distressed areas.***

COMMENT SG-17: "This project is consistent with the Department's long-term goals and policies to promote economic development in economically distressed areas in Florida without lessening our environmental permitting standards."

RESPONSE: This comment is noted, and supports the findings of the EIS.

5.1.4.16 Spills

ISSUE 69 ***Concerns relative to on-site impacts due to leaks before and after exploratory well abandonment.***

COMMENT LG-4: "In other areas, abandoned oil and gas wells are leaking brine, petroleum product, and other chemicals. In fact, the DEIS mentions that two wells in the nearby Raccoon Field developed casing leaks. What assurances do we have that this well will not develop leaks, either during the project or long after abandonment? How will SWEPI address future leaks and contamination? Will SWEPI commit to future monitoring and cleanup? Have contamination assessments been performed on abandoned well sites in Florida? What were the results? These issues must be addressed in the document."

Also considered in the response to this issue were the following similar substantive comments: I-374, LG-11, PH-3.

RESPONSE: Section 4.3.4.2 of the DEIS referred to the two wells at Raccoon Point which developed casing leaks and released H_2S. The wells were in a temporarily abandoned status. Permanent abandonment requires extensive plugging with cement to seal off all intervals where hydrocarbons or water are detected.

Surface and groundwater monitoring are included in the required mitigation program. The monitoring program is patterned after the NPS's recently added requirements for oil and gas development in the Big Cypress Preserve. These requirements were developed from the NPS's experience in managing the Raccoon Point operations.

Oil spills in the US on land, navigable inland waters and waters throughout the US Exclusive Economic Zone (200 mile limit) are covered by the OPA or Public Law 101-380 of August 18, 1990. This

comprehensive legislation focuses on oil spill liability and compensation, and oil spill prevention and response. OPA amends the Clean Water Act. Section 1.6.12 of the DEIS explains the relationships of the legislation and implementing regulations.

Liability under OPA is strict, joint and several. Indemnification agreements do not remove liability because it cannot be transferred. A responsible party may be liable for removal costs and damages resulting from discharges of oil only. Damages may be recovered by both public and private parties and may include:

- Damages to natural resources;
- Damages to property;
- Loss of subsistence use of natural resources;
- Loss of revenues;
- Loss of profit and earning capacity; and
- Costs of increased or additional public service.

Liability for spills from onshore facilities is limited to $350,000,000. Liability is unlimited if the spill was caused by gross negligence, willful misconduct, or violation of a Federal regulation on the part of the responsible party. Liability is also unlimited if the responsible party fails or refuses to report the incident; cooperate with responsible officials; or comply with an order issued under the Federal Water Pollution Control Act.

OPA includes financial responsibility provisions which are intended to ensure adequate funds would be immediately available to compensate injured parties. Potential responsible parties must demonstrate capability to meet liability up to the limits specified in the Act. SWEPI has complied with OPA.

EO 12777 assigned regulatory authority over five types of facilities to various Federal agencies. The exploratory well is a non-transportation related onshore facility and comes under the jurisdiction of the EPA and is regulated under 40 CFR, Part 112.

The proposed action includes monitoring of the groundwater, and testing of drill cuttings, drilling fluids, and drill site fill material to assure that the drill site is properly abandoned. Best available technology would be used in drilling and plugging the well.

ISSUE 70 ***Concern that groundwater would be contaminated from previous diesel fuel spill and that water wells would pull fuel into exploratory well.***

COMMENT FG-5: "We are concerned that potential ground-water contamination from the diesel fuel tank spill (page 3-31) will be pulled south by the water wells to the drill site. The cones of depression created by water well pumping could draw hydrocarbon contamination into the exploratory well. Two water supply wells are to be drilled south and on the either side of the surface hole location. These wells will be cased to approximately 60 feet, and open hole (uncased) to about 120 feet. The Draft EIS notes the existence of a diesel fuel spill from two 15,000-gallon aboveground storage tanks situated at SFWMD S-140 pump station which is located about 1225 feet northeast of the surface hole location. While the contaminated soil had been removed, the Draft EIS indicated that the horizontal and vertical delineation of the soil and groundwater contamination has not been determined. If the exploratory well is not cased during the initial drilling, the exploratory well might act as a conduit for contaminant migration into these water wells."

RESPONSE: According to a conversation with Raul Pellegrino of SFWMD on December 17, 1993, a CAR of the reported diesel fuel spill at S-140 pump station has been completed and a "No Further Action" status has been requested. To date, the FDEP has failed to respond to said recommendation. A pilot Vapor Extraction Test was performed on the soils at station S-140. There exists a potential for soil contamination under the superstructure. Per the SFWMD, groundwater at S-140 pump station is not contaminated. The submitted CAR did not indicate the presence of groundwater contamination in the vicinity of the S-140 pump station. Based upon the above-stated information, there is a low potential for contaminants from the S-140 site to be pulled south by water wells at the proposed SWEPI drilling site. In order to assure that off-site contamination is not pulled to the drill site, the monitoring wells would also be sampled for hydrocarbons.

Section 3.3.10 of the FEIS has been updated regarding the current status of the diesel fuel spill at S-140 pump station. Section 4.3.11.5 has been modified to include hydrocarbon testing in the well site water quality monitoring plan.

ISSUE 71 ***Recommends expansion of lined area.***

COMMENT FG-11: "Figure 2-5 defines areas on the drilling pad that will be lined and bermed to prevent surface and subsurface contamination. This includes the area for the drill rig and temporary storage for drill cuttings. We suggest expanding the lined and bermed area on the pad for well testing,

fracing, or acidizing operations because more equipment having leak potential will be on the location. Additional lined and bermed area on the drilling pad will afford more secure space for well testing or treating equipment and associated storage tanks."

RESPONSE: Although the proposed lined pad area is believed to be adequate to accommodate the proposed drilling program, SWEPI has agreed to provide a 10' x 200' increase in the lined area. This addition will be installed between the cuttings catch tank and the drill cuttings storage area. The additional lined area will serve to contain any spillage of drill cuttings as they are mechanically transferred to the cuttings storage area. The additional liner has been added to the mitigation recommendations listed in Section 4.3.10.5 of the FEIS.

ISSUE 72 ***DEIS fails to show probability of spills and spill record.***

COMMENT I-328: "Contrary to the impression given in the DEIS, oil spills are a common occurrence in oil exploration and production operations. Production activity may last 20 years or more. The DEIS distorts the risks of oil, brine, and drilling fluid spills. It fails to disclose the oil spill record in south Florida. Over the last 20 years, 81 spills have been recorded resulting in 163,000 gallons of oil and 120,00 (sic) gallons of brine contaminating soil and water. According to the South Florida Water Management District, a large number of leaks were discovered in the Suniland (sic) pipeline that crosses the conservation area causing alarm over water quality and habitat protection."

Also considered in the response to this issue were the following similar substantive comments: I-322, I-407, PH-25.

RESPONSE: The FGS has monitored oil spills in Florida since January 1972. Section 4.3.9.6 of the DEIS provided a discussion of these monitoring data. Production, other than testing, is not addressed in this EIS due to production being outside the scope of the proposed action.

5.1.4.17 Vegetation

ISSUE 73 ***Vegetation report not accurate of true character of area.***

COMMENT LG-4: "The fieldwork for Appendix A-5, Vegetation Report, was conducted during November and December, 1989, which was the dry season, and at the peak of a three-year drought. Vegetation and hydrology likely were very different then than now. Since the Corps of Engineers'

jurisdictional determination is due to expire in June 1993, a revised jurisdictional determination must be performed, which may result in a reclassification by the Corps of the vegetation in the vicinity."

Also considered in the response to this issue were the following similar substantive comments: I-374, LG-12, O-101.

RESPONSE: As stated in Section 3.3.8.1 of the DEIS, analysis of site vegetation was conducted during November and December of 1989 and July of 1992. The surveys were conducted at different times of year to accommodate the temporal and seasonal changes known to occur in the vegetative composition of natural herbaceous systems with fluctuating hydroperiods. During the July, 1992 site investigation, the proposed drill site was inundated by a minimum of six inches of water. The plant community boundaries mapped in July, 1989 were still accurate, however, vegetation composition within several plant communities had been significantly altered by the high water levels.

The COE's jurisdictional determination that was included in the DEIS had an expiration date of June, 1993. Subsequent to publication of the DEIS, the COE extended the expiration date to June, 1994.

To address concerns that jurisdictional wetland boundaries may have changed at the site since the COE inspection of March, 1991, the jurisdiction determination process was repeated in 1994. The COE inspected the site of the proposed action and alternatives on February 14, 1994. A jurisdictional determination letter from the Miami Regulatory Field Office of the COE was issued on March 4, 1994 and is included in Appendix 12.

The status of COE wetland jurisdiction is essentially the same in 1994 as it was in 1991. One small area (0.05 acres) of additional jurisdiction area was noted within the Alternative B access road corridor. This change has been reflected in appropriate sections of the FEIS. The wetland impacts that would result from implementation of Alternative B increase slightly from 0.02 acres as reported in the DEIS to 0.25 acres.

ISSUE 74 ***DEIS does not consider vegetation adjacent to Snake Road.***

COMMENT LG-5: "The vegetation maps in the DEIS are not based on Appendix A-5, Vegetation Report, but rather on a separate study done by the consultant. This study, based on aerial photography and ground-truthing, did not even consider vegetation adjacent to Snake Road, upon which every truckload and drumfull (sic) of fuel, lubricant, hydraulic fluid, mud chemical, and waste product will be transported."

Also considered in the response to this issue were the following similar substantive comments: LG-12, O-101.

RESPONSE: The vegetation map in the DEIS was based upon aerial photo interpretation and site investigations conducted by Dames & Moore, Inc., in July, 1992. Vegetation communities in the vicinity of the proposed project components (i.e., drill site, access road alternatives and, turnouts) were mapped in order to determine the potential impacts which could occur from project implementation. There are no project components being considered which would impact Snake Road and adjacent vegetation. Snake Road, a Federal road which is part of the public transportation system, would be utilized as access to the project area as would I-75 and many other roads, depending upon the origination of materials and equipment being transported to the site. Transport of all materials via the roadways must be conducted within Federal and State Transportation Standards. The probability of a release of contaminants resulting from project-related transport on Snake Road is low. Any spill that did occur would be reported and remediated in accordance with state and Federal regulations.

A detailed assessment of all conceivable impacts that could result from a spill event at various locations along roadways is not realistic. This issue was addressed in 1986 changes to the CEQ's NEPA regulations. The revised regulations stated that impacts of low probability of occurrence, but with catastrophic consequences if they do occur, should be evaluated if the analysis is supported by credible scientific evidence and is not based on pure conjecture, and is within the rule of reason. The level of impact analysis contained in the EIS meets the requirements of the NEPA regulations.

5.1.4.18 Visual Resources

ISSUE 75 ***DEIS fails to recognize impacts on visual quality and effects on people and wildlife.***

COMMENT LG-6: "The analysis of visual resources fails to note the intuitively obvious fact that, even in the presence of some buildings and billboards, a 170 foot tall, well-lit tower with a 30 foot high working platform will be a visual spectacle for miles, especially at night. Interestingly, there is very little analysis on the visual impact of the project on wildlife."

Also considered in the response to this issue were the following similar substantive comments: LG-13, PH-3, PH-5, SG-1.

RESPONSE: Visual resources are discussed in detail in Sections 3.3.9 and 4.3.9 of the FEIS. The "visual impacts" of the proposed project on wildlife are not covered because of an almost complete lack of information regarding visual impacts of oil well drilling on wildlife. Powerlines are known to affect

many migratory bird species, causing mortalities due to collisions with the tower structures and wires. In Florida, sandhill cranes appear to be susceptible to this type of mortality. Though it is possible that collisions between cranes and the drill rig towers could occur, it is more likely that the human activities at the drill site would keep birds at a distance, significantly reducing the potential for this type of mortality.

As a "visual spectacle," at night, nocturnal wildlife would either completely avoid the site, or would be drawn to the site by the increase in insect prey abundance that is known to accompany heavily lit areas. For instance, anurans, especially toads, and their predators, are drawn to lit areas because of the prey base present on a regular basis. Bats may exhibit the same behaviors. The benefits of a regular insect prey base may be partially or entirely offset by the increase in mortality from the operation and traffic. Nocturnal mammals, panthers and their prey would be likely to avoid the area entirely due to the lights and no significant impacts are expected.

5.1.4.19 Waste Management

ISSUE 76 ***DEIS does not adequately analyze containment, testing and disposal of drilling wastes.***

COMMENT O-66: "Finally, the DEIS has not adequately addressed or analyzed how produced waters, drilling muds, cuttings and other wastes carrying contaminants including heavy metals, such as mercury, and radium, a radioactive isotope, might impact our ground and surface water systems and further contaminate the Everglades and Everglades National Park. Florida is currently performing studies on the mercury contamination problem in the Everglades and the threat it poses to public health. In light of this public health threat, it is imperative that the BLM to (sic) analyze how the project might increase the extent of Florida's mercury problem."

Also considered in the development of the response to this issue were the following similar substantive comments: FG-5, LG-3, LG-10, O-68, PH-10, PH-19, PH-32, PH-33.

RESPONSE: These comments raise several issues which are:

- Containment and disposal of drill cuttings, drilling fluids and produced waters;
- Testing drill cuttings, drilling fluids, and produced waters for toxicity and radioactivity;
- Mercury contamination; and

- Spread of contaminants by a hurricane.

Each of these comments is discussed below.

Containment of Wastes

Section 2.2.1.2 of the DEIS described drill site construction and the containment area construction detail including figures of the drill cuttings containment area. A description of the drill cuttings containment area was included. The drill cutting containment area within the bermed area of the drill site consists of a plastic lined depression completely isolated from the stormwater retention area of the drill site. The drill cutting containment area would be prepared to contain drill cuttings until they can be analyzed, removed and disposed of off-site.

Detail on the plastic liner and construction of the bermed area was included in Section 2.2.1.2 of the DEIS. The liner is a precautionary measure to assure that drill cuttings are contained until properly analyzed. Section 2.2.1.3 of the FEIS describes the management of drilling fluids. A "closed mud system" (tanks) which does not require a reserve pit would be used. Section 2.2.1.4 describes that any produced water would also be stored in tanks prior to disposal.

Toxicity Testing

Section 4.3.10.2 of the DEIS indicated that prior to disposal, representative samples of the cuttings, drilling fluids, and produced waters would be collected for laboratory analysis. The composite samples collected would be analyzed in accordance with the EPA test methods established in the EPA SW 846 Manual (EPA, September, 1986). Upon completion of the drilling operation and prior to disposal, the drill cuttings, drilling fluids, and produced waters would be tested accordingly.

Section 2.2.1.3 of the DEIS discussed the details of toxicity testing of the drill cuttings, drilling fluids, and produced waters. This section indicated that representative samples of the drill cuttings, drilling fluids, and produced waters would be tested using the TCLP established in 40 CFR, Part 261. The TCLP is used to determine the toxicity of waste material. The TCLP entails testing the leachate from the cuttings, drilling fluid, and produced waters for the following metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Drill cuttings would first be tested for total metals. If the totals analysis for drill cuttings exceeds the maximum allowable concentrations, the TCLP would also be completed. In addition, EPA method 8015 (modified) would be used to test for TRPH. The maximum allowable TCLP concentrations for the metals would be consistent with the RCRA Hazardous Waste/Criteria, identified in the table below, even though the RCRA regulations do not apply to wastes associated with the exploration and production of oil and gas. The maximum allowable totals

concentrations in drill cuttings would be consistent with Florida Clean Soil Criteria (FAC Rule 17-1775.400). This regulation does not apply to the proposed action and is used only as a guideline to establish a reasonable threshold, since Federal regulations regarding clean soil criteria do not exist at this time.

MAXIMUM ALLOWABLE CONCENTRATIONS

COMPOUNDS	TCLP[1] (mg/l)	Total[2] (mg/kg)
Arsenic	5.0	10
Barium	100.0	4940
Cadmium	1.0	37
Chromium	5.0	50
Lead	5.0	108
Mercury	0.2	23
Selenium	1.0	389
Silver	5.0	353

[1] 40 CFR, Part 261.24, Table 1 and FAC Rule 17-775.400
[2] FAC Rule 17-775.400

The maximum TRPH concentration for drill cuttings would be ten ppm. This threshold is consistent with the criteria of FAC Rule 17-775.400, Criteria for Clean Soil.

The maximum TRPH concentration for drilling fluids and produced waters would be five mg/l. This threshold is consistent with the criteria of FAC Rule 17-770, Petroleum Contamination Site Cleanup Criteria. This regulation does not apply to the proposed action and is used only as a guideline to establish a reasonable threshold.

In addition, drill cutting samples would be tested for soluble salts and cationic distributions and radioactivity. Limits for soluble salts and cationic distributions in drill cuttings would be as follows:

(a) Electrical conductivity (EC-solution phase); < 4 mmhos/cm
(b) Sodium adsorption ratio (SAR-solution phase): < 12
(c) Exchangeable sodium percentage (ESP-solid phase): < 15 percent

Drilling fluids and produced water would be tested for chlorides. Limits for total chlorides in drilling fluid and produced water would be 20,000 ppm, the approximate concentration in the "boulder zone" where the drilling fluids would be disposed. The soluble salts and cationic distributions thresholds are consistent with Louisiana regulations for nonhazardous oil field wastes (LAC Title 43: Part XIX). The Louisiana standards are used to establish acceptable maximum concentrations since no Federal or state (Florida) criteria exists.

Radioactivity Testing

The drill cuttings and drilling fluids would also be tested for NORM. The Federal government and the State of Florida do not have regulations or guidance documents regarding NORM. To date, four oil producing states (Louisiana, Texas, Mississippi and Arkansas) have promulgated regulations for the handling of NORM. Other states are in the process of developing NORM regulations. The Louisiana standards for NORM are currently the most comprehensive. The Louisiana regulations, basically, state that NORM containing radium-226 and radium-228 at levels greater than 5 pCi/gram, (each) above background, are subject to regulations (LAC Title 33: Part XV.1404) which require licensing of the material and a regulatory-approved method of disposal.

In the SWEPI well, drill cuttings would be tested for radium-226 and 228 by gamma spectroscopy. If levels exceed five pCi/gram, above background for each, the drill cuttings would be disposed of at a facility licensed to receive NORM wastes. NORM is most commonly found accumulated in oil and gas production and processing equipment. The trend is for the relative quantity of NORM to increase as the well ages and as oil and gas resources are depleted. Past studies have provided data on radiation concentration levels in oil and gas scale in production facilities (not exploratory wells). These studies have been performed on equipment with suspected elevated levels of radium and may represent a biased estimate (USEPA, 1991). A discussion of NORM can be found in Section 4.3.10.2 of the FEIS.

The drilling fluids would be disposed of by injection into the "boulder zone." This method of disposal of exploratory well drilling fluids is not regulated by either the state or Federal government. Florida does establish limits of radioactive material in its UIC program (FAC Rule 17-28.120) for industrial and sanitary wastes other than oil field wastes. The UIC regulations state that radioactive waste means any waste which contains radioactive material in concentrations which exceed those listed in 10 CFR, Part 20, Appendix B, Table 2, Column 2. The specific liquid effluent concentration for both radium-226 and radium-228 is 60 pCi/l. Although this concentration limit is not a regulatory standard for drilling fluids, it does provide a guide for evaluating the suitability of surface disposal of the drilling fluids.

Production waters would occur during the testing phase of the exploratory well. During drilling of the well, production waters would be avoided since water mixed with the drilling fluids will create poor,

unreliable drilling conditions. In the Louisiana regulations (and similarly in other state regulations), production waters are exempt from Louisiana NORM regulations and are regulated under LAC 33:IX Chapter 7 by the Bureau of Natural Resources. The acceptable method of disposal for production waters in Louisiana is reinjection into an approved injection well. Since production waters typically are not a NORM problem, the Louisiana regulations do not require testing of the radionuclide content of production waters for injection to an approved well.

The FDEP, Bureau of Geology tested for the radium-226 and radium-228 (the primary radionuclides of concern when discussing NORM) content in production water samples of three South Florida oil fields. The results of this sampling are presented below.

PRODUCTION WATER SAMPLE RESULTS FROM SOUTH FLORIDA OIL FIELDS pCi/l)

Radionuclide	Lehigh Park	Bear Island	Raccoon Point
Radium-226	0.2 ± 0.0	0.4 ± 0.1	0.3 ± 0.1
Radium-228	1.4 ± 1.4	1.7 ± 1.4	3.7 ± 1.3
Total Radium	1.6 ± 1.4	2.1 ± 1.4	4.0 ± 1.3

Reference: W. R. Byrd, December 14, 1989

Federal and state drinking water standards (40 CFR, Part 141.15 and FAC Rule 17-550.310) set the maximum contaminant levels for radium-226 and radium-228 at 5 pCi/l each. The analysis results tabulated above indicate that the NORM in production water from South Florida production wells are less than the standards for drinking water. These results led the Bureau of Geology to conclude that NORM is an insignificant problem in production water of South Florida production wells.

The low radium-226 or radium-228 NORM contaminant levels measured in South Florida production water samples, the DEP's evaluation that NORM is an insignificant problem in production water of South Florida production wells, and the exemption of production waters from the various states' NORM regulations, all suggest that NORM testing of the production waters, if any, is not warranted. Production waters would be subject to toxicity testing.

Disposal Methods

The laboratory results would determine the acceptability of on-site disposal. Drill cuttings that meet the State of Florida clean soil criteria for Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, and TRPH, as outlined in FAC Rule 17-775 and meet the soluble salts and cationic distributions and the NORM criteria set forth in the previous section (less than five pCi/gram, above background of radium-226 or radium-228), may be used as fill material on upland areas of the Reservation. The Miccosukee Indians would designate an on-reservation non-wetland location for disposal of the drill cuttings.

Drill cuttings that exceed the State of Florida clean soil criteria, but do not exceed the hazardous waste thresholds found in 40 CFR, Part 261 and the NORM criteria set forth in the previous section, would be transported to a Class I landfill for proper disposal. Should the TCLP and/or TRPH analysis exceed the established thresholds, the BLM would determine a proper disposal or treatment procedure.

Drilling fluids which do not exceed the hazardous waste thresholds found in 40 CFR, Part 261 and the total chlorides UIC radioactive material criteria set forth in the previous section would be disposed of in the "boulder zone." Should the metals and/or TRPH exceed established maximum concentrations, the BLM would determine a proper disposal or treatment procedure.

Should drill cuttings exceed 5 pCi/g of radium-226 or radium-228, above background, or drilling fluids exceed 60 pCi/l, these wastes could be disposed of at NORM facilities in Louisiana, or at a low-level radioactive waste disposal facility in South Carolina.

Production waters would be disposed of in the "boulder zone," a confined geologic unit, if the referenced toxicity, TRPH, and total chlorides are not exceeded. If the established thresholds are exceeded, the BLM would determine a proper disposal procedure.

Mercury Contamination

The TCLP test includes testing for the presence of mercury. If the leachate from the drill cuttings exceed the TCLP regulatory limit for mercury, the drill cuttings would be transported to a hazardous waste landfill. If the TCLP limit for mercury is exceeded in the drilling fluids, or produced waters, the BLM would determine the proper disposal method.

Hurricane - Spread of Contaminants

Appendix A-11 is a contingency plan for hurricanes. Section 2.2.1.2 of the DEIS described drill site construction and the containment area construction detail including figures of the drill cuttings containment area. A section describing the drill cuttings containment area is included. The drill site containment has been designed to contain a volume greater than would be collected from a 3-day, 100-year storm. Drilling fluids and produced waters would be stored in a closed tank system. The most important aspect of the contingency plan for hurricanes is advanced warning and appropriate preparation of the site to prevent broadcast of contaminants.

Section 4.3.10.5 of the FEIS has been modified to include this specific information regarding testing and disposal of drill cuttings, drilling fluids, and produced waters as a mitigation measure.

ISSUE 77 ***Concerns radioactive levels in water and effects on humans and wildlife.***

COMMENT O-69: *"As for the radioactive material, page 4-35 of the DEIS states that Naturally Occurring Radioactive Material (NORM) in the form of radium and thorium may be contained in the produced waters from drilling. In the discussion of NORM, it states that the Bureau of Geology analyzed produced water from three other South Florida oil fields and determined that NORM is an insignificant problem from South Florida oil fields. We contend that the analysis of the water for levels of radioactive material is not sufficient to protect the wildlife or human health since it does not accurately assess the manner and level in which the radioactive material can bioaccumulate in living things."*

Also considered in the development of the response to this issue was the following similar substantive comment: O-70

RESPONSE: The comment raises two issues relative to possible NORM. These are:

- NORM contamination in produced waters; and
- Bioaccumulation of NORM.

These issues are addressed in the following paragraphs.

NORM Contamination of Produced Waters

All soils and rocks are known to contain some amount of NORM. Uranium and thorium and their radioactive decay products are known to be present in varying concentrations in underground geologic formations from which oil and gas are produced. The formation water contains dissolved mineral salts, a small portion of which may be radioactive because of the presence of uranium and thorium and their decay products in the underground formation. Thus, the amount of NORM material from a producing field generally increases with the amount of water pumped from the formation. The uranium and thorium are relatively insoluble and remain in place. However, radium is slightly more soluble and may, under certain conditions, become mobilized by the liquid phases in the formation.

As it is brought to the surface, the natural formation water undergoes changes in temperature and pressure and may, again under certain conditions, deposit scale and sludge within the oil production system. This accumulation of scale and sludge within the oil production equipment occurs over time.

The usual problem with oil field NORM is not the initial concentrations in the production water. The NORM problem is the scale deposits which form on the interior of piping as precipitates of carbonates and sulfates of calcium, barium and strontium. The scale could contain elevated levels of radioactive compounds.

The SWEPI exploratory well would undergo limited production testing if hydrocarbons are found. This testing would last for up to 30 days. Section 4.3.10 of the DEIS reviewed the NORM contamination risks for the exploratory well.

The FDEP, Bureau of Geology tested for the radium-226 and radium-228 (the primary radionuclides of concern when discussing NORM) content in production water samples of three South Florida oil fields. The results of this sampling are presented below.

Production Water Sample Results from South Florida Oil Fields
(pCi/l)

Radionuclide	Lehigh Park	Bear Island	Raccoon Point
Radium-226	0.2 ± 0.0	0.4 ± 0.1	0.3 ± 0.1
Radium-228	1.4 ± 1.4	1.7 ± 1.4	3.7 ± 1.3
Total Radium	1.6 ± 1.4	2.1 ± 1.4	4.0 ± 1.3

Reference: W. R. Byrd, December 14, 1989

Federal and State drinking water standards (40 CFR, 141.15 and FAC Rule 17-550.310) set the maximum contaminant levels for radium-226 or radium-228 at 5 pCi/l. The analysis results tabulated above indicate that the NORM in production water from South Florida production wells are less than the standards for drinking water. These results led the Bureau of Geology to conclude that NORM is an insignificant problem in production water of South Florida production wells.

Bioaccumulation of NORM

The fundamental concern about the radioactive contaminants that are dispersed into the environment is that these materials will reach the regional biota and the human population at concentrations that result in an elevated radiation dose to the receptor. Bioaccumulation is the process wherein contaminants concentrate in the flesh of organisms living in the affected environment.

The potential for bioaccumulation of NORM is minimized through the procedures proposed for containment. Drill cuttings will be collected and stored in the cutting containment area (FEIS, Section 2.2.1.2). Drilling operations will use a "closed mud system" and drilling fluids will be collected and stored in tanks (FEIS, Section 2.2.1.3). Production water will be collected and also stored in tanks (FEIS, Section 2.2.1.4). The drill cuttings, drill fluids, and production water would be analyzed for contaminants and the appropriate disposal method would be chosen as described in Section 4.3.10.5.

These procedures have been developed to prevent contaminant dispersion. These mitigative procedures are appropriate to prevent dispersion of NORM wastes generated from drill cuttings, drilling fluids, and production waters.

ISSUE 78 ***Questions applicability of offshore surface water discharge standards.***

COMMENT O-80: *"LEAF questions the applicability of offshore surface water discharges to the management of drilling fluids (see p. 4-32). LEAF submits that EPA rules governing on shore surface water discharges, found at 40 C.F.R. 435.31 Subpart C (1992) should apply."*

RESPONSE: There are two sub-issues raised by this comment. These are:

- The applicability of EPA regulations to the discharge of the drilling fluids; and
- The character of the contaminants expected in the drilling fluids proposed for use in this well.

These sub-issues are addressed separately in the following paragraphs.

Applicability of Regulations

The proposed action calls for disposal of excess drilling fluids into the "boulder zone," a confined porous geologic interval of the Floridan aquifer that occurs at a depth of approximately 2,900 feet. Oil and gas operations in Florida have frequently used this zone to dispose of drilling fluids. EPA rules governing onshore surface water discharges, found at 40 CFR, Part 435, Subpart C (1992) do not apply since the proposed action does not include surface discharge of drilling fluids.

Likewise, the EPA rules covering offshore discharge (40 CFR, Part 435, Subpart A -1993) also do not apply. The reference to these rules in DEIS Section 4.3.10.2 was misleading. The intent of the discussion in that section was to provide information on the relative toxicity of the drilling fluid components and not to suggest the applicability of specific regulations. The language of Section 4.3.10.2 has been revised to avoid this ambiguity. The specific discussion of drilling fluid toxicity is provided in the following major section of this response.

Federal and state UIC regulations do not apply to the subsurface emplacement of drilling fluids during the construction of oil or gas wells. While the EPA does not issue UIC permits for subsurface drilling fluid disposal, it is the position of EPA Region 4 to allow the option of reinjecting wastes provided that underground injection does not endanger any underground source of drinking water. In order to assure that waste disposal activities do not endanger any underground source of drinking water, plans for the injection of waste drilling fluids and excess stormwater into the "boulder zone" would be developed and submitted to BLM prior to initiation of any disposal activities. BLM would provide the information to EPA. These provisions are incorporated as revisions of the mitigation and monitoring program requirements in Section 4.3.10.5.

All material additives selected for use in drilling fluids meet the EPA toxicity standards of 30,000 parts per million for offshore surface water discharges. (Offshore toxicity standards are used as a guideline only).

Section 4.3.10.2 gave a general representation of the toxicity levels of common components of drilling fluids. Bentonite and barite are the two major constituents of drilling fluids. Barite, also known as barium sulfate, is presently the accepted standard weighing agent for water base fluid. Barite increases the density of drilling fluid, however, it does not hydrate or swell on wetting, and when it is added to fluid, it becomes a part of the inert fraction of the fluid. The addition of bentonite (clay) to the drilling fluid enhances the viscosity and filtration properties of the fluid. Bentonite swells upon contact with water.

The LC50 toxicity standard, which is based upon the concentrations (ppm) required to kill 50 percent of a quantity of mysid shrimp in 96 hours, is the same for both barite and bentonite. The LC50 toxicity standard for barite and bentonite is 1,000,000 ppm. Other components of drilling fluid can be found in Section 4.3.10.2 of the FEIS.

ISSUE 79 ***Specifications for plastic liner***

COMMENT LG-3: "Specifications for the plastic liner are contradictory in the document. On some pages, the minimum liner thickness is required to be 12 mils, and in other sections, it is specified as 20 mils. Consistency and standardization of requirements is important to avoid confusion."

Also considered in the response to this issue were the following similar substantive comments: LG-10, PH-32.

RESPONSE: Chapter 2 of the DEIS discussed the details of the proposed action as presented in SWEPI's APD. This section described a liner with a minimum thickness of 12 mils. The environmental impact analysis is conducted upon the proposed action. If potential impacts can be reduced or better controlled by modifications to the proposed action, the modifications are included as mitigation (see Section 4.4).

Analysis of the liner system indicated that increasing the liner thickness to a minimum of 20 mils would provide a significant increase in protection to the groundwater. The details of the thicker liner system were discussed in DEIS Sections 4.3.10.5 and 4.4. The wording of the FEIS sections have been revised to more clearly distinguish between proposed action details and mitigation program requirements.

ISSUE 80 ***Concerns movement of drill cuttings.***

COMMENT LG-3: "There are no explanations or drawings to indicate how drill cuttings get from the drilling rig/mud system to the storage area without contamination of the intervening space with drilling fluids and downhole materials."

Also considered in the response to this issue was the following similar substantive comment: LG-11.

RESPONSE: Figure 2.4 indicates the conceptual drill site features. The site would be constructed to minimize spillage of waste into the surrounding environment.

The cleaned cuttings would be transferred from a collection tank in the mud system by clam shell or backhoe bucket to the drill cutting storage area. This mechanical transfer system would require extension of the liner to provide continuous protection. Section 4.3.10.5 has been modified to include the liner extension as a mitigation measure.

ISSUE 81 ***Insufficient discussion of composition, transport, and storage of drilling fluid components.***

COMMENT LG-4: "There is insufficient discussion of the composition, transport, and storage of drilling fluid components. Many of the possible ingredients of drilling mud are considered toxic in concentrated form. How will the chemicals be transported to the site? How will they be stored? Exactly what chemicals, and in what quantities, will be utilized?"

Also considered in the response to this issue were the following similar substantive comments: LG-11, O-70, O-100, PH-3.

RESPONSE: Section 2.2.1.3 of the DEIS discussed the composition of the proposed drilling fluids. The drilling fluids would be water based. Section 4.3.10.2 of the DEIS outlined the components and toxicity levels of drilling fluids. The actual volume of material required would depend on actual site specific conditions encountered during drilling operation.

The following table lists the materials and their estimated total usage during the proposed drilling program. The materials would be mixed with water to produce the drilling fluids used during the drilling program. The actual composition of the drilling mud consists of percentages of the listed material which vary in response to the specific conditions encountered during the drilling operations.

This material was added to the FEIS as Table 2-1.

All material additives selected for use in drilling fluids meet the EPA toxicity standards of 30,000 parts per million for offshore surface water discharges. (Offshore toxicity standards are used as a guideline only).

ESTIMATED TOTAL DRILLING FLUID COMPONENT REQUIREMENTS			
Material	Generic Composition	Units	Total Quantity
Barite	Barium Sulfate	Bulk	500 tons
M-I Bar	Barium Sulfate	100 lb sack	400-500 tons
M-I Gel	Bentonite (Sodium Montmorillorite)	100 lb sack	400-450 tons
Caustic	Sodium Hydroxide	50 lb sack	25-50 tons
Lime	Calcium Hydroxide	50 lb sack	12.5-25 tons
Spersene CF	Chrome-free Lignosulfonate	50 lb sack	20-37.5 tons
Tannathin	Processed Lignite	50 lb sack	20-25 tons
Poly Pac	Polyanionic cellulosic polymer	50 lb sack	5-10 tons
Kwik Thik	Sodium Montmorillorite/ Polyacrylamide blend	50 lb sack	25-50 tons
Kwik Seal Course	Blend of nut shells, cellophane flakes and wood fibers	50 lb sack	20-37.5 tons
Kwik Seal Medium	Blend of nut shells, cellophane flakes and wood fibers	50 lb sack	20-37.5 tons
Mica Course	Mineral Mica	50 lb sack	12.5-20 tons
Mica Medium	Mineral Mica	50 lb sack	5-12.5 tons
Lube 106	Proprietary fatty acid blend	55 gal drum	550-825 gal
Gypsum	Calcium Sulfate	50 lb sack	5-10 tons
Sulf-X	Zinc Oxide	50 lb sack	2.5-7.5 tons

Section 4.3.10.2 gave a general representation of the toxicity levels of common components of drilling fluids. Bentonite and barite are the two major constituents of drilling fluids. Barite, also known as barium sulfate, is presently the accepted standard weighing agent for water base fluid. Barite increases the density of drilling fluid, however, it does not hydrate or swell on wetting, and when it is added to fluid, it becomes a part of the inert fraction of the fluid. The addition of bentonite (clay) to the drilling fluid enhances the viscosity and filtration properties of the fluid. Bentonite swells upon contact with water.

The LC50 toxicity standard, which is based upon the concentrations (ppm) required to kill 50 percent of a quantity of mysid shrimp in 96 hours, is the same for both barite and bentonite. The LC50 toxicity standard for barite and bentonite is 1,000,000 ppm. Other components of drilling fluid can be found in Section 4.3.10.2 of the DEIS.

Drilling fluid components would be transported to the site by truck in dry form, and stored in/on trailers located within the bermed drill site. Truck transport of drilling fluid components would be conducted in accordance with all state and Federal transportation regulations. The drilling operations would recycle all possible drilling fluids through an extensive separation process system to remove drill cuttings and solids. Upon completion of drilling, the fluids would be disposed of by injection to the "boulder zone" or transported off-site to an appropriate disposal facility via tank trucks. The disposal method would depend upon the results of toxicity and radioactivity testing as discussed in Section 4.3.10.5 of the FEIS.

Section 2.2.1.3 has been modified to include information regarding transportation and storage of drilling fluid components, and the drilling fluid components required for the proposed action.

5.1.4.20 Well Abandonment

ISSUE 82 ***Abandonment of water wells.***

COMMENT FG-10 and FG-11: *"The proposed action addresses the drilling of water wells on the oil well drilling pad. However, the DEIS does not discuss plugging and abandonment methods for the water wells. Section 2.2.1.5, Abandonment and Reclamation, should describe proposed methods to accomplish water well plugging and abandonment."*

RESPONSE: Two 9 5/8-inch diameter water supply wells would be drilled on-site to a depth of approximately 120 feet. Three additional monitoring wells would also be drilled. Upon completion of the proposed action, the status of the wells would be determined by the Miccosukee Tribe. SWEPI plans to completely plug the wells with concrete unless the Tribe elects to leave the wells in place. If left in place, the wells would be fitted with locking caps to assure that they would not be tampered with. Section 2.2.1.5 of the DEIS has been modified to include details of water supply and monitoring well abandonment. Section 4.3.11.5 has been modified to include the provision of locking caps if the wells are left unplugged.

ISSUE 83 ***Impacts of well and haul road abandonment.***

COMMENT PH-3: "In the area of well construction and abandonment, we find that not adequate consideration was given to the potential impacts in the site of the well and off-site on the haul roads and along existing roads and travel corridors."

Also considered in the response to this issue was the following similar substantive comments: I-373, I-374, and PH-3.

RESPONSE: Each component and phase of the proposed action and alternatives is considered in detail throughout the EIS. The well site and access routes were evaluated to determine the potential impacts to the natural and human environment. The transportation analysis considered the impacts of project related traffic on the travel corridor which included 1-75 and Snake Road.

ISSUE 84 ***Time limit on exploratory well abandonment.***

COMMENT P-7: "Where and If Temporary abandment (sic) is warranted there should be a definite length of time set for Shell Oil Co. to abandon the area."

RESPONSE: If well testing determines that commercial quantities of oil are not present, the well would be permanently plugged and abandoned according to the procedures described in Section 2.2.1.5 of the DEIS. The well would only be left in a temporary abandoned status, with all perforated intervals of casing plugged back with cement, if commercial quantities of oil were discovered.

Temporary abandonment would allow time for the development of plans for additional wells and production facilities, as appropriate, and for the completion of environmental reviews. Since proposals for additional wells and production facilities at this site would require a new NEPA analysis, the well could be in temporary abandonment for a period of about three to five years. If additional field development is dropped from consideration, SWEPI must then permanently plug and abandon the well and complete all of the site reclamation work. The BLM and BIA, as well as the Miccosukee Tribe, would ensure that final abandonment and surface reclamation are not unduly delayed.

5.1.4.21 Wildlife Resources

ISSUE 85 ***Inadequate data on Florida panther telemetry.***

COMMENT I-323 and I-324: "The best available data on panther telemetry is (sic) not presented in the

DEIS. The panther telemetry map used in the Florida Panther Draft Habitat Protection Plan (DHPP) (Fig. D-2) should be used minus the gum swamp label that covers the drill site area. This map clearly shows the drill site within the range of the panther. Both the DEIS and DHPP maps show a gap between two panther activity areas where more intense human activity and degraded habitat in the middle, has driven panthers away. Although, the area would be considered marginal panther habitat, these areas are important for dispersal of sub-adult male panthers and aid in the establishing new home territories and avoiding mortality from dominant males. Yet, the DEIS states that the increase in activity may discourage use of the area by young males (p. 4-55)."

Also considered in the response to this issue were the following similar substantive comments: I-62, I-72, I-106, I-305, I-344, I-346, I-351, I-401, O-2, O-36, O-39, O-55, O-75, O-77, O-95, O-98, PH-23.

RESPONSE: The Draft Florida Panther Habitat Protection Plan (DHPP) (USFWS, 1993) was not available during the preparation of the DEIS. However, the telemetry data utilized in the DHPP was also utilized to generate the maps for the DEIS. The telemetry locations presented in the DHPP are from panther numbers 1-43, between 1981 and 1991. The telemetry data utilized for the maps which were reproduced and cited in the DEIS were taken from the same animals between 1981 through 1989.

Unfortunately, in the DHPP, a map label for Gum Swamp was inadvertently placed directly over the SWEPI Miccosukee 3-1 Well study area. The label was placed in a disturbed area which is rarely used by panthers, based on ten years of telemetry data, and personal communications with FGFWFC wildlife officials. Comment I-323 and I-324 states that DHPP Figure D-2 "clearly shows the drill site within the range of the panther." The same comment states, in the next sentence, that "both the DEIS and DHPP maps show a gap between two panther activity areas where more intense human activity and degraded habitat in the middle, has driven panthers away." The second statement is more correct, as telemetry data shows an avoidance of the area around the proposed SWEPI site.

The DHPP was finalized in January, 1994. The final document is entitled Florida Panther Habitat Preservation Plan, South Florida Population. The final document includes a higher quality map of the panther telemetry data than the draft. This is the most recent and comprehensive map of the ten years of panther telemetry data. Figure 3-14 of the DEIS has been replaced with the map from the 1994 panther report. The well site has been depicted on the map.

While it is possible for panthers to reach the proposed SWEPI site, it is highly unlikely that panthers would cross the site for a number of reasons. Panther telemetry data has shown that cats are only rarely found in this area. The few cats which occupy home ranges to the north of the SWEPI site apparently cross Snake Road and the L-28 Canal approximately six miles to the north, and may only rarely venture south onto the project site. The Miami Canal appears to delimit their range to the northeast. The few cats that are known to have home ranges to the south and southwest of the site likely cross I-75 at the

eastern-most wildlife crossing, which is a few miles west of the proposed Miccosukee 3-1 Well site. In fact, all of the 36 wildlife underpasses are located west of the proposed site, in Collier County (Humphrey and Foster, 1991). Panthers are likely to avoid the S-140 pump station, the Miccosukee Service Plaza at the Snake Road exit, Snake Road itself, and the open agricultural lands present in the project area. Panthers are able to cross waterways, but likely avoid the numerous intersecting canals and levees found within a few miles of the proposed site (including L-28, C-60, the Miami Canal, and the Interceptor Canal).

As the DEIS stated (page 3-69), young males sometimes disperse into the WCA's from BCNP for a short period of time. It has not been shown that the disturbed agricultural areas between the two population centers which encompasses the proposed SWEPI site are "important for dispersal of sub-adult male panthers and aid in the establishment of new home territories," as stated in Comment I-323. It is possible that the study area is crossed by panthers, however, the site does not lie in a frequently utilized panther corridor. The site is bounded on the east by a large, deep canal (L-28), and a large SFWMD pumping station, which is a source of noise and frequent human presence. The pumping station is also flooded with lights at night. Panthers crossing the L-28 would be highly unlikely to utilize the proposed well site for crossing the canal.

The DEIS stated that an increase in activity may discourage use of the area by young males, but further stated that the area is not routinely utilized by panthers. The habitats on the Miccosukee Reservation are of low quality and the prey base is depressed, due to past agricultural practices. Young male panthers may wander through this area periodically, but do not maintain home ranges or regularly utilize the site as a dispersal route. This fact is clearly shown by telemetry data. Precluding the use of this five-acre area by young male panthers should, therefore, not be viewed as a significant negative effect to the panther population.

ISSUE 86 ***DEIS does not evaluate effects of spills on wildlife and habitat.***

*COMMENT LG-5: "In addition to the panther, the Everglades Snail Kite, the Wood Stork, the Eastern Indigo Snake, and several other listed species utilize nearby areas as habitat and/or feeding areas. The document does not adequately address the potential impacts on these animals of worst case spill/discharge scenarios. Broward County feels that **any** impact on endangered species is sufficient to preclude this project, the benefits of which have not been established."*

Also considered in the response to this issue were the following similar substantive comments: LG-12, O-36, O-68, O-101, PH-19.

RESPONSE: These comments raise two issues which are:

- Effects of spills on wildlife, and
- Bioaccumulation of mercury and hydrocarbons.

These comments are discussed below.

Measures which would be utilized to protect surrounding areas from man-made or natural catastrophes are addressed in the SWEPI SPCC and Oil Spill Contingency Plan, (Appendix A-10 of the DEIS), and the Hurricane Preparation and Evacuation Plan (See DEIS, Appendix A-11). Negative effects to wildlife in surrounding areas resulting from events such as hydrocarbon spills are possible, but are not likely to be significant, for reasons discussed below.

Events resulting in dispersal of oil and other contaminants into adjacent areas would certainly result in negative effects to some species of wildlife. However, the potential for far-reaching negative effects is low, due to the habitat quality in the immediate area (the study area). The adjacent WCA-3A and Miccosukee Indian Reservation contain significant wildlife populations to the south, including snail kite critical habitat and wading bird rookeries. However, there are a number of effective barriers between the proposed SWEPI site and these areas. The I-75 berm and Levee 28 are large, effective barriers immediately to the south and east, respectively. Habitats to the west and north, between the proposed drill site and Snake Road, are predominantly improved pastures, therefore, significant losses to wildlife would not occur as a result of any spill events at the drill site.

Bioaccumulation of hydrocarbons and mercury is not a realistic concern for the following reasons. Bioaccumulation is the process wherein containments concentrate in the flesh of organisms living in the effected environment. All wastes generated by the proposed action will be tested for hydrocarbons and mercury, and will be disposed of properly. Section 4.3.10.5 of the FEIS outlines the waste monitoring and disposal plan. In the unlikely event that a hydrocarbon spill did occur at the drill site, dikes and other physical barriers would contain the spill at the drill site. Therefore, the potential for mercury or hydrocarbons to be introduced to the ecosystem is very low.

ISSUE 87 ***Inadequate analysis of effects on Florida panther.***

COMMENT O-67: "Although the Biological Assessment was not attached to the DEIS, a Wildlife Evaluation prepared by a private consultant for Shell in 1990 was attached as Appendix A-9. This wildlife evaluation of the site indicates that there is panther activity in the vicinity of the site and states

that a male panther currently utilizes the Snake Road area, and a female panther visits that area occasionally. In fact, page 9 of the report states that 'the project vicinity is within the range of panther activity.' Additionally, the statements in the Dames & Moore memo attached to Appendix A-12 from Jackie Moore (sic) to Mike Nagy dated June 8, 1992 indicate that a record check indicated that, 'Two Florida panthers were reported in the vicinity.'

Curiously, these reports do not appear to support the statement on page 3-69 of the DEIS that 'Panthers are not known in the area of the proposed action, according to available literature and conversations with D. Maehr (1992).' In light of the above, it is imperative that the DEIS address and analyze the effects that the project may have on the Florida panther, including the issue of whether disturbing this habitat may interfere with any potential reproduction activity of the male and female panther, and any other threat that the project may pose to the likelihood of survival and recovery of these few remaining endangered panther that exist only in South Florida."

Also considered in the response to this issue were the following similar substantive comments: I-407, I-410, LG-5, LG-12, O-96, PH-11, PH-23, PH-37.

RESPONSE: The discussion of Section 7 Consultation found in Section 3.3.13 of the FEIS establishes that the biological assessment was a compilation of the information presented in Sections 3.3.13 and 4.3.13 of the FEIS.

The proposed project lies within the historical range of the Florida panther, and there are a few cats which maintain home ranges within five miles of the proposed well site. In the DEIS, the use of non-specific descriptive words such as "area" and "vicinity" could have resulted in a misunderstanding of the facts regarding panther movements and habitat uses. Two panthers have been reported in the vicinity by the FNAI. Both panthers reported in the memo were located within the range of the individual panther known to occupy the area south of I-75. This was likely a multiple sighting of the same animal. This animal could wander onto the proposed project site, but this is highly unlikely for a number of reasons. The few cats that are known to have home ranges to the south and southwest of the site likely cross I-75 at the eastern-most wildlife crossing, which is a few miles west of the proposed SWEPI site. In fact, all of the 36 wildlife underpasses are located west of the proposed site, in Collier County (Humphrey and Foster, 1991).

While it is possible for panthers to reach the proposed SWEPI site, it is highly unlikely that panthers would actually cross the site. Panther telemetry data has shown that cats are only rarely found in the study area, which is referred to in the DEIS as "the area of the proposed action." The study area is defined by the proposed access road which would traverse the area between Snake Road and the L-28

Canal, four miles north of the well site. The DEIS clearly stated on page 3-71 that a panther is known to cross the Reservation approximately six miles north of the proposed well site.

The few cats which occupy home ranges to the north of the SWEPI site apparently cross Snake Road and L-28 approximately 6 miles to the north, and apparently do not venture south onto the project site. The Miami Canal appears to delimit their range to the northeast. Panthers are likely to avoid the S-140 pump station, the Miccosukee Service Plaza at the Snake Road exit, Snake Road itself, and the open agricultural lands present in the project area because of human activity and suboptimal habitat. Panthers are able to cross waterways, but likely avoid the numerous intersecting canals and levees found within a few miles of the proposed site (including L-28, C-60, the Miami Canal, and the Interceptor Canal) for the same reasons.

ISSUE 88 ***Recommends formal Section 7 Consultation and range of Florida panther.***

COMMENT O-97: "Based on comprehensive telemetry data maps from a ten year study conducted by the GFC (Florida Game and Fresh Water Fish Commission), we recommend that the BLM acknowledge that a formal consultation under Section 7 is in order to review the proposed project's impact on the endangered Florida panther."

Also considered in the response to this issue were the following similar substantive comments: O-101, PH-23, PH-33.

RESPONSE: The BLM solicited informal Section 7 Consultation from the USFWS on October 16, 1992 by submitting a Biological Assessment for the Miccosukee 3-1 Exploratory Well. Appendix A-12 of the DEIS contained the response from the USFWS, dated October 30, 1992. The Service concurred with the BLM's determination that "the project is not likely to adversely affect Federally listed species," and gave one further suggestion of keeping a locked gate at the entrance to the access road, to eliminate ORV use of the access road. The Service further stated that the October 30, 1992 letter fulfills the requirements of the Endangered Species Act, and that "no further action is required" by the BLM, unless additional information becomes available regarding the potential for impacts to listed species.

To complete the Biological Assessment which the USFWS reviewed, the information from the FGFWFC panther telemetry study was utilized, along with personal communications (in 1992) from panther experts who conducted the study. The BLM feels that the best available information was obtained for the biological assessment and reviewed by the Service, therefore, further consultation with the Service is not warranted.

ISSUE 89 ***Recommends non-consumptive land use on Reservation because of panther Range.***

COMMENT O-97: "Further, the BLM and BIA must commit to over-see benign, non-consumptive land-use on the Reservation because of documented panther range. Matters of endangered species preservation must be given priority when activities are proposed which are inconsistent with recovery, specifically that of the Florida panther."

RESPONSE: The Florida Panther Recovery Plan (USFWS, 1987) has a recovery objective to downlist the animal, and a recovery criteria of a minimum of three viable, self-sustaining populations within the historic range of the animal. The USFWS, Region 4 Office is responsible for implementing the recovery plan. The service issued a letter to the BLM on October 30, 1992 regarding the proposed Miccosukee 3-1 Well stating that the project is not likely to adversely affect Federally listed species. The letter did not state that the proposed project was inconsistent with recovery plans for the panther or any other listed species.

ISSUE 90 ***DEIS fails to consider ecological significance of ecotone.***

COMMENT LG-5: "The ecological significance of this ecotone (transitional area) between the WCA and the Big Cypress is downplayed in the document. Ecotones are highly productive and are vital to indigenous wildlife."

Also considered in the response to this issue was the following similar substantive comment: LG-12.

RESPONSE: An ecotone is defined as the transition zone between two diverse community types (Krebs, 1985). Ecotones contain a suite of the species and resources available from each of the individual adjacent communities. As a result, ecotones are generally areas of greater biotic diversity than is found in the individual adjacent habitats, and usually provide more resources than are available in a single individual community. The proposed SWEPI site is located within an area once considered transitional between the Big Cypress Swamp and the Everglades Marsh physiographic regions. Presently, the boundaries between these two regions are abrupt (a canal), and former ecotonal habitats are highly disturbed.

The Big Cypress Swamp is situated topographically higher than the Everglades, and is a mosaic of cypress swamps and freshwater marshes, as well as upland pineland habitats and hardwood hammocks. Much of the water from the eastern portion of the Big Cypress Swamp historically sheet-flowed into the Everglades, and continued south along Shark Valley Slough and into Florida Bay (Duever, et al, 1986).

The Everglades is best characterized as a large, flowing freshwater marsh system between Lake Okeechobee and Florida Bay. The marsh contains numerous small islands of Tropical Hardwood Hammock habitat dispersed throughout. The Everglades Marsh was historically contained in a large bedrock depression known as the Everglades Trough, which is bounded by the Atlantic Coastal Ridge to the east, and the Immokalee Rise and Big Cypress Swamp to the west (Meyers and Ewel, 1990). The northernmost marshes have been converted to muck farming operations, and the remaining Everglades north of Tamiami Trail are presently contained within 3 WCA's, which lie immediately east of the proposed SWEPI site. The portion south of Tamiami Trail is now within the ENP.

The original characteristics of the Big Cypress Swamp - Everglades ecotone have been almost entirely lost in the project area through water flow alteration and conversion to agricultural lands. This transitional zone does not function as a classical ecotone, which would maintain an unrestricted interchange of flora, fauna, and abiotic factors. The hydrologic functioning of the ecotone has been totally altered by a system of large canals and levees, of which L-28 is a part. Although the water continues to flow generally south to Florida Bay, all flow is controlled mechanically, and water does not sheet flow through these marshes as before. Wildlife movements have been highly disrupted, though not entirely restricted, by the canals and levees. More importantly, the habitats have been altered and compartmentalized to the extent that natural transitional zones are very rare. Most habitat boundaries, or "transitional zones" in South Florida consist of the large canals and levees themselves, with highly disparate habitat types on either side. As a result, the ecological significance of the proposed Miccosukee 3-1 Well site (and the area between Snake Road and L-28 as a whole) as a high quality transitional area is questionable at best.

ISSUE 91 ***Appendix A-9 fails to address adverse effects on wildlife.***

COMMENT PH-14: "Appendix 8 A-9 speaks of wildlife, but fails to address the adverse effects to wildlife in the area as well as Federal and State-owned lands that are parks and natural preserve areas."

RESPONSE: The wildlife report in Appendix A-9 addresses wildlife impacts by illustrating the low potential for negative effects on endangered species or other wildlife, largely due to the lack of natural habitats found on the drill site for any of the species listed. The USFWS concurred with this finding in a letter dated October 30, 1992, in which it found the proposed well site and access road alternatives "would not likely adversely affect" Federally-listed species (see FEIS Appendix A-12).

The entire five-acre proposed Miccosukee 3-1 drill site is composed of non-native pasture grasses planted for cattle consumption. The value of this five-acre portion of pastureland as wildlife habitat is questionable, if not negligible. Pasturelands are mainly considered range lands for domestic livestock

production, which may provide some secondary functions for wild and feral grazing animals such as deer and hogs. Certain species, such as sandhill cranes and some raptors, are known to periodically forage within pastures. Other wide ranging species may wander across these lands on an irregular basis en route to other more suitable areas. Furthermore, pastureland is not a unique cover type in the vicinity of this project. On the contrary, it is by far the most abundant cover type in the area of the Miccosukee Federal Indian Reservation bounded by L-28 Canal, the Interceptor Canal, the northern Reservation boundary and the western Reservation boundary. Of the 19,000 acres of land found within the previously described area, nearly 11,000 acres have been "improved" as grazing land (Patterson, 1984), which generally have diminished wildlife habitat values.

In regards to state and Federal lands, the proposed SWEPI Miccosukee 3-1 Well site lies within the Reservation, but is not within any other state or Federally-owned lands. The SFWMD's WCA-3A is east of the site, across a large canal (L-28). The BCNP Northern Reserve lies approximately three miles to the west of the site. Other state and Federal lands (Everglades National Park, Fakahatchee Strand, the Panther Reserve, etc.) are much farther away (28, 34 and 34 miles respectively), and would clearly not be affected by this project.

Officials from each of the agencies which own, control, or otherwise manage adjacent lands, have been contacted regarding the proposed SWEPI project, and have received a copy of the SWEPI DEIS for comments. The FGFWFC provided only editorial comments on the draft Biological Assessment (Appendix A-12). To date, the SFWMD is the only state agency which has commented about potential wildlife impacts, specifically, the effects of noise on breeding bird populations. A response to their comment is found in response to issue 65.

ISSUE 92 ***DEIS fails to address impacts of man-made or natural catastrophes on wildlife.***

COMMENT PH-18: "However, the Statement fails totally to address the impact of man-made or natural catastrophes on wildlife."

RESPONSE: Measures which would be utilized to protect surrounding areas from man-made or natural catastrophes are addressed in Appendices A-10 and A-11 of the DEIS. Negative effects to wildlife in surrounding areas resulting from catastrophic events such as hydrocarbon spills are possible, but are not likely to be significant, for reasons discussed below.

The potential for significant negative effects in the immediate study area is low. The area north and west of the drill site consists of highly disturbed habitats which exhibit low utilization by wildlife. There are a number of effective barriers between the proposed drill site and WCA-3A. The I-75 berm and Levee 28 are large, effective barriers immediately to the south and east, respectively.

ISSUE 93 ***Concerns critical habitat designation for Florida panther. DEIS fails to consider cumulative impacts on panther.***

COMMENT I-324: "The US Fish and Wildlife Service is currently studying whether Critical Habitat Designation should be applied to the entire documented range of the Panther. If so designated, the proposed action would result in a jeopardy determination by the Service. The cumulative impacts upon the panther need to be analyzed in the DEIS. Panther habitat is being destroyed daily and the proposed action would cumulatively contribute to this trend and doom recovery efforts to save the panther from extinction."

RESPONSE: Critical Habitat under Section 4 of the Endangered Species Act has not been designated for the Florida panther as of this date. Plans to "evaluate the need" for designation of Critical Habitat for the panther are presented in the Florida Panther Habitat Preservation Plan. The northwest portion of Broward County, and the Miccosukee Reservation, are clearly within this area (Logan, 1994). However, even if critical habitat were designated for the entire documented range of the Florida panther, a prohibition of all Federal activities would not necessarily follow. The designation of Critical Habitat does not create wildlife preserves or refuges, but instead, highlights geographical areas that listed species absolutely require for survival and recovery, and provides guidance for meeting the needs of those species. Economic impacts must be considered under the Endangered Species Act, and may preclude areas from protection if the cost of protection clearly outweigh the benefits to the species. Because of this balancing requirement, a jeopardy determination is not automatic for Federal actions conducted within critical habitat. Section 7 of the Endangered Species Act requires consultation with Federal agencies to determine if Federal actions would jeopardize the survival of a listed species or adversely affect critical habitat.

The proposed Miccosukee 3-1 Well site is a small site, entirely within agricultural land, and not necessarily a required habitat for the continued existence of the Florida panther. All of the proposed access routes are within highly disturbed areas as well. Accordingly, the USFWS has found that the proposed action would not result in a finding of jeopardy for any listed species (see Appendix A-12, DEIS).

In terms of cumulative impacts, the proposed project would not be considered a threat to the long term survival of the Florida panther. The lack of panther habitat within the five-acre drill site and the lack of documented regular use of the project site by panthers has resulted in a finding of "not likely to jeopardize" for the project itself. Removal of high quality, native habitats would not occur as a result of the project, as the proposed drill site is entirely pastureland, and the access roads would largely be improvements of existing graded trails.

The northern access road represents the closest approach of the project to known occupied panther home ranges, though it apparently would fall short of these panther home ranges by approximately two miles. Recent studies on hunting and ORV use indicate that these activities are the principal activities that affect the panther (NPS, 1991). The USFWS considered the proposed drill site access road acceptable, if the entrance to the access road is gated to preclude ORV use. The BLM feels that the proposed action would in no way interfere with implementation of the 1978 Florida Panther Recovery Plan, based on input from state and Federal wildlife biologists and the USFWS letter of October 30, 1992 (see Appendix A-12). In addition, the Florida Panther Habitat Preservation Plan does not delineate the Miccosukee Federal Indian Reservation as an area to be preserved or acquired, but suggests that "best management practices" be implemented on public lands (Logan, 1994).

ISSUE 94 ***DEIS fails to disclose actual panther activity.***

COMMENT I-327: "The Florida panther is in extreme danger of extinction. Further industrial activity and human encroachment cannot be tolerated. Panther telemetry maps used in the DEIS and the recently released Florida Panther Habitat Preservation Plan (FPHPP) clearly identifies (sic) the drill site as within occupied panther habitat. The DEIS fails to disclose that actual panther activity is under-represented because the locations represent only radio collared panthers which likely depict less than half of the wild population. Both the DEIS and the FPHPP show a gap between two large panther activity areas where the Miccosukee service plaza and drill site are now located. Increased human activity and destruction of native cover and prey in the general drill site area have created marginal habitat conditions."

RESPONSE: Habitat destruction was clearly the primary cause of the decline in the Florida panther population. Presently, a number of factors combine to further decrease the panther population. The habitat impacts in the area of the proposed SWEPI project occurred many years ago as the Everglades were ditched, diked and subsequently drained, and the remaining lands were cleared and planted in non-native grasses for use as pasturelands. The BLM concurs with the comment that marginal habitat conditions occur in the general drill site area. The area of the proposed action and alternatives provide none of the essential requirements for suitable panther habitat. In fact, panthers have been shown to avoid agricultural lands (Maehr, Land and Roof, 1991) unless bounded by extensive forested areas or

within a mosaic of native habitat (USFWS, 1993). Forested areas greater than 250 acres are thought to be a critical component of panther habitat (Maehr, Land and Roof, 1991). Figure 5 of the Florida Panther Habitat Preservation Plan depicts forested areas of this size superimposed on the various Federal areas, including the Miccosukee Reservation. The proposed Miccosukee 3-1 Well site clearly lies east of these forested areas.

The map presented in the DEIS was generated from the ranges of all radio-collared panthers in and around the BCNP between 1981 and 1989. According to the 1991 NPS Big Cypress EIS Biological Opinion, the radio-tracking data and other searches for sign and tracks by the NPS and FGFWFC "indicate two principal population centers in the present range of the species." Although the Miccosukee 3-1 Well site clearly lies between the two population centers, the inclusive range (total potential range) of the Florida panther would encompass the site. The most recent and accurate map depicting the panther's range as determined by ten years of telemetry data is presented in the January, 1994 report entitled Florida Panther Habitat Preservation Plan. Figure 3-14 of the FEIS is a presentation of the map with the well site added.

The geographic range of the Florida panther is presented inconsistently, but not very differently, in the literature. The composite range represents all of the potential areas that panthers could occur, whereas the range of all radio-collared animals is somewhat smaller. Not all of the existing panthers have been radio-collared and tracked. Studies in the last 10 years have been based on 20-30 animals. This sample size is small, but represents a very large sampling ratio (over 50 percent) compared to most wildlife sampling studies, where sampling 20 percent of a population is many times quite suitable for statistical analysis. If the estimate of 50 panthers is correct, over half of the population has been radio-collared and tracked for many years.

The ranges of radio-tracked panthers do not paint a complete picture of occupied or potentially-occupied panther habitats in South Florida, but provide a very good estimate of the composite range. Female panther ranges overlap extensively, and male panthers generally wander between a number of female home ranges. Radio-tracked female ranges could show the entire female and male panther composite range. However, male panthers rarely overlap in their ranges, and a sample of the male population would not show their entire occupied range, unless all the males on the edge of the geographic range were sampled. Also, young males are known to disperse to the periphery of adult male ranges.

ISSUE 95 ***DEIS fails to show importance of area for dispersal of sub adult panthers.***

COMMENT I-327 and I-328: "The DEIS alleges that panthers are not known to utilize the area for any stage of their life cycle (p. 4-55). Wildlife biologists would disagree. Although the area is considered marginal habitat, these areas are important for dispersal of sub-adult panthers and aid in establishing new territories and avoiding intraspecific aggression. The DEIS explicitly admits that the increase in industrial activity may discourage use of the area by young males. The DEIS alleges that the area is not routinely utilized by panthers but panther telemetry conclusively indicates the opposite."

Also considered in the response to this issue was the following similar substantive comment: P-3.

RESPONSE: The proposed project lies within the historical range of the Florida panther, and there are a few cats which maintain home ranges within five miles of the proposed drill site. In the DEIS, the use of non-specific descriptive words such as "area" and "vicinity" could have resulted in a misunderstanding of the facts regarding panther movements and habitat uses.

Recent literature has been reviewed, and state and Federal wildlife biologists have been contacted regarding the use of the proposed SWEPI site by panthers. The DEIS document is consistent with recent literature and the opinions of various wildlife officials, as it was written based on recent literature and personal communications with agency biologists. The area of the proposed action and alternatives is pastureland. This type of habitat is generally avoided by panthers unless adjacent to large tracts of forest or within a matrix of habitats (USFWS, 1993). These conditions are not present in the study area. To reiterate the point made in Section 3.3.13.1 of the DEIS, panthers are not known to occupy the project study area, based on telemetry data and conversations with agency personnel. The home range maps generated by telemetry data show that panthers (including male #26) occupy ranges over five miles to the north of the proposed SWEPI site, and that one panther occupies a range south of I-75. The center of activity for this cat lies directly south of the intersection of the interceptor canal and L-28.

The few young male panthers that wander into the WCA's are not known to reproduce, and are routinely killed by adult males upon returning to the core population in the BCNP.

As DEIS Section 3.3.13.1 stated, young males sometimes disperse into the WCA's from BCNP for a short period of time. It has not been shown that the disturbed agricultural areas between the two population centers which encompasses the proposed SWEPI site are "important for dispersal of sub-adult male panthers and aid in the establishment of new home territories," as stated in the comment. It is possible that the study area is crossed by panthers, however, the site does not lie in a frequently utilized panther corridor. The site is bounded on the east by a large, deep canal (L-28), and a large SFWMD pump station, which is a source of noise and frequent human presence. The pump station is also well

lit at night. Panthers crossing the L-28 would be highly unlikely to utilize this site for crossing the canal. Furthermore, the nearest panther crossing under I-75 is a few miles to the west of this site.

The DEIS stated that an increase in activity may discourage use of the area by young males, but the habitats on the Miccosukee Reservation are of low quality and the prey base is depressed, due to past agricultural practices. Precluding the use of the well site area by panthers should, therefore, not be viewed as a significant negative effect to the panther population.

5.2 List of Preparers

Table 5-1 lists the principals involved in preparing, directing, writing, reviewing and/or producing this FEIS.

TABLE 5-1
LIST OF PRINCIPAL PREPARERS & REVIEWERS

NAME	RESPONSIBILITY	QUALIFICATIONS
Bureau of Land Management:		
Sid Vogelpohl	BLM Project Coordinator	BS, MS Geology; 16 years experience
Bob Schoolar	BLM Project Coordinator	BS Geophysical Science; 16 years experience
Ken Adams	Geology	BS Geology; 15 years experience
Quazi Islam	Hazardous Materials	BS, MS Geology; 10 years experience
Clay Moore	Soils, Air, Noise Visual, Transportation	BS Forest Management; 22 years experience
Daryl Nations	Petroleum Engineering	BS Geology, MS Petroleum Engineering; 11 years experience
Judith Pace	Cultural Resources	BA/MA Anthropology; 7 years experience
Faye Winters	Wildlife	BS Biology; 15 years experience
Bureau of Indian Affairs:		
Jim Harriman	BIA Project Coordinator	BS Forestry; MS Forest Hydrology; 18 years experience

TABLE 5-1 (CONTINUED)
LIST OF PRINCIPAL PREPARERS

NAME	RESPONSIBILITY	QUALIFICATIONS
Pete C. Aguiler	BIA, Petroleum Geologist	BS, Geology/Engineering; MS Sci. Ed., 30 years experience
U.S. Geological Survey		
Edward Koszalka	USGS Reviewer	BS, MS Geology; 20 years experience
Consultant Interdisciplinary Team:		
Mike Nagy	Interdisciplinary Team Leader Noise, Wetlands	BS Natural Resources; 16 years experience
Dick Czlapinski	Water Resources	BS, MS Civil Engineering; 21 years experience
Mike Nelson	Transportation, Socioeconomics	BA Urban Affairs; 10 years experience
Todd Campbell	Wildlife Resources	BS, MS Zoology; 6 years experience
Kathy Kuhlman	Vegetation	BS Botany; 6 years experience
Robert Taylor	Waste Management, Geology, Health & Safety	BS Engineering; 10 years experience
Chris Macey	Visual Resources	BS, MS Landscape Architecture; 26 years experience
Jackie Fry	Cultural Resources	BS Biology; 12 years experience
Steve Smallwood	Air Resources	BS Mechanical Engineering, 25 years experience (Air Pollution Control Engineer)

GLOSSARY

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GLOSSARY

AQUIFER - A water-bearing bed or layer of permeable rock, sand, or gravel, capable of yielding water.

AQUIFER RECHARGE - The introduction of water into an aquifer by percolation through surface soils, or through wetlands, streams and other waterbodies.

ARCHAEOLOGICAL RESOURCES - All prehistoric and historic physical evidence of past human activity which can be used to reconstruct lifeways and cultural history of past peoples. They include sites, artifacts, environmental data, and all other relevant information and the contexts in which they occur.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN (ACEC) - Areas within the public lands (BLM) where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural system or processes, or to protect life and safety from natural hazards.

ARTIFACT - Any object made, modified, or used by humans, usually movable. Objects which are recorded as prehistoric or historic artifacts have sociocultural or scientific values and meet the general criterion of being more than 50-years old.

AUXILIARY HOLE - A hole in the rig floor used to store the kelly and swivel while making a trip; also refers to the portion of the hole drilled deeper than the pay zone to allow for mistakes; or a hole next to the rotary used for placing drill pipe before it is connected to the kelly as joints are added.

BLOWOUT - An uncontrolled flow of gas, oil, or other well fluids into the atmosphere. A blowout, or gusher, occurs when formation pressure exceeds the pressure applied to it by the column of drilling fluid. A kick warns of an impending blowout.

BLOWOUT PREVENTER - One of several valves installed at the wellhead to prevent the uncontrolled release of fluids or gas from the annular space between the casing and drill pipe or open hole (i.e., hole with no drill pipe) during drilling or completion operations. Blowout preventers on land rigs are located beneath the rig at the land's surface.

BOD - Biochemical Oxygen Demand is the amount of oxygen required by bacteria while stabilizing decomposable organic matter under aerobic conditions.

BOTTOMHOLE - The lowest or deepest part of a well. Pertaining to the bottom of the wellbore.

BOULDER ZONE - An interval within the Floridan aquifer located at a depth of about 2,900 feet beneath the surface at the drill site. The interval is very porous and permeable and will generally not support a hydrostatic head of water. It is chiefly used as a receiving zone for injected wastewater in southeastern Florida.

BRINE - Waters with dissolved solids concentrations of 35,000 mg/l and higher.

CASING - Steel pipe placed in an oil or gas well as drilling progresses to prevent the wall of the hole from caving in during drilling and to isolate aquifers and mineral zones. Casing may be a means of extracting hydrocarbons if the well is productive.

CEMENTING - The application of a liquid slurry of cement and water to various points inside or outside the casing.

CHEMICAL OXYGEN DEMAND - Chemical Oxygen Demand (COD) is a test of the pollutional strength of domestic and industrial wastes which measures the total quantity of oxygen required for oxidation of the waste to carbon dioxide and water.

CONFINING LAYER - A geologic formation consisting of impervious materials which prevents movement of groundwater into or out of an aquifer.

COOPERATING AGENCY - Any Federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment.

CRITICAL WILDLIFE HABITAT - That portion of wildlife habitat that is essential to the survival and perpetuation of threatened and endangered species as designated by the U.S. Fish and Wildlife Service.

CULTURAL RESOURCES - Remains of human activity, occupation, or endeavor, as reflected in sites, buildings, artifacts, ruins, etc.

CUMULATIVE IMPACT - The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal, or non-Federal) or person undertakes such other actions.

DECIBEL - A-weighted sound pressure level measurement. The A-weighted scale is a frequency dependent adjustment of sound pressures corresponding to the sensitivity of the human ear. OSHA expresses its occupational noise exposure limits in terms of dBA.

DIRECT AND INDIRECT IMPACTS - See effects.

DIRECTIONAL DRILLING - Intentional deviation of a wellbore from the vertical. Although wellbores are normally drilled vertically, it is sometimes necessary or advantageous to drill at an angle from the vertical. Controlled directional drilling makes it possible to reach subsurface areas laterally remote from the point where the bit enters the earth. It involves the use of turbo drills, Dyna-Drills, whipstocks, or other deflecting tools.

DRILL BIT - The cutting tool in rotary drilling.

DRILL CUTTINGS - Pieces of rock formations cut by the drill bit; drilling fluids circulate cuttings to the surface where they are removed from the mud system.

DRILL STRING - The column, or string, of drill pipe with attached tool joints that transmits fluid and rotational power from the kelly to the drill collars and bit. Often, the term is loosely applied to include both drill pipe and drill collars.

DRILLING FLUIDS - Drilling fluids or drilling muds are fluids designed to accomplish drilling objectives such as hole cleaning, stabilization, bit cooling and well control. The typical drilling fluid includes water, a weighting agent such as barite, and various additives to promote cuttings removal, lubrication, temperature resistance and other performance characteristics as needed.

DRILLING - The operation of boring a hole in the earth, usually for the purpose of gathering geologic data and/or removing subsurface formation fluids such as oil and gas.

DRILLING RIG - The derrick, draw-works and attendant surface equipment of a drilling or workover unit.

ECOSYSTEM - Collectively, all populations in a community, plus the associated environmental factors.

EFFECTS - (a) Direct effects, which are caused by the action and occur at the same time and place; (b) Indirect effects, which are caused by the action and are later in time or farther time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. Effects and impacts as used in [the CEQ] regulations are synonymous. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.

EFFLUENT - A discharge of pollutants into the environment, partially or completely treated or in its natural state. Generally used to regard to discharges into waters.

ENDANGERED SPECIES - Species of animals or plants in danger of extinction throughout all or a significant portion of their ranges. Existence may be endangered because of the destruction, drastic change, or severe curtailment of habitat, or because of over exploitation, disease, predation, or even unknown reasons.

ENVIRONMENTAL ASSESSMENT - (a) A concise public document for which a Federal agency is responsible that serves to: (1) briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact; (2) aid an agency's compliance with NEPA when no environmental impact statement is necessary; (3) facilitate preparation of a statement when one is necessary. (b) Shall include brief discussions of the need for the proposal, of alternatives as required by NEPA, of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted.

ENVIRONMENTAL IMPACT STATEMENT - A detailed written statement as required by Section 102(2)(C) of the National Environmental Policy Act.

EXISTING VISUAL CONDITION (EVC) - The present state of visual alteration of the natural-appearing landscape by man-made objects. Five classes: (1) Untouched, (2) Unnoticed, (3) Minor Disturbance, (4) Disturbed, (5) Major Disturbance.

FAUNA - The animals of a specified region or time.

FIELD - A geographical area in which a number of oil or gas wells produce from a continuous reservoir. The term generally refers to the surface area, although at times it may refer to both the surface and the underground productive formations. In a single field there may be several separate reservoirs at varying depths.

FINDING OF NO SIGNIFICANT IMPACT - A document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded from NEPA will not have a significant effect on the human environment and for which an environmental impact statement therefore will not be prepared. It shall include the environmental assessment or a summary of it and shall note any other environmental documents related to it.

FLARE - An arrangement of piping and a burner to dispose of surplus combustible vapors, usually situated around a gasoline plant, refinery, or producing well.

FLASHBOARD RISER - A discharge control device located on a downstream end of a culvert. Removable flashboards allow the adjustment of water levels maintained upstream of the device.

FLOODPLAIN - The lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, including at a minimum, that area subject to a 1 percent or grater chance of flooding in any given year.

FLORA - The plants of a specified region or time.

FORAGE - Vegetation of all forms available for animal consumption.

FUGITIVE DUST - Airborne particulate matter composed of soil resulting from industrial activity.

GROUNDWATER - Liquid water occurring below the land surface in soil and rock.

HABITAT - A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

HAMMOCK - Forests with many broad-leaved evergreen trees; in South and Central Florida used mainly to indicate isolated patches of forest.

HUMAN ENVIRONMENT - Interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment.

HYDRIC - Pertaining to typically wet conditions as contrasted with mesic (moist) and xeric (dry) conditions.

HYDROCARBONS - Organic compounds of hydrogen and carbon, whose densities, boiling points, and freezing points increase as their molecular weights increase. Although composed only of carbon and hydrogen, hydrocarbons exist in a great variety of compounds, owing to the strong affinity of the carbon atom for other atoms and for itself. The smallest molecules are gaseous; the largest are solids. Petroleum is a mixture of many different hydrocarbons.

HYDROPERIOD - The hydrologic regime of a wetland.

IMMISCIBLE - Refers to a fluid which will not mix, such as water with oil.

IMPACT SIGNIFICANCE CRITERIA - The threshold or magnitude at which an impact would be considered significant, thus warranting special attention such as special mitigation. These criteria are derived from government regulatory standards, available scientific documentation, previously prepared environmental documents, and the professional judgement of resource specialists.

IMPACT - See effects.

ISOCHLOR - A contour line which marks the location of equal concentrations of chlorides.

LEAD AGENCY - The agency or agencies preparing or having taken primary responsibility for preparing the environmental impact statement.

LEVEE - Earthen dike constructed for flood control purposes.

LIMEROCK - Crushed limestone used as a construction fill material.

LITHOLOGY - A science which deals with the characteristics of rocks.

MAST - A portable derrick capable of being erected as a unit, as distinguished from a standard derrick that cannot be raised to a working position as a unit. For transporting by land, the mast can be divided into two or more sections to avoid excessive length extending from truck beds on the highway.

MITIGATION - (a) Avoiding the impact altogether by not taking a certain action or parts of an action. (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation. (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment. (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action. (e) Compensating for the impact by replacing or providing substitute resources or environments.

MUD - The liquid circulated the wellbore during rotary drilling operations. In addition to its function of bringing cuttings to the surface, drilling mud cools and lubricated the bit and drill stem, protects against blowouts by controlling subsurface pressures, and deposits a mud cake on the wall of the borehole to prevent loss of fluids to the formation. Although it originally was a suspension of earth solids (especially clays) in water, the mud used in modern drilling operations is a more complex, three-phase mixture of liquids, reactive solids, and inert solids. The liquid phase may be fresh water, diesel oil, or crude oil and may contain one or more conditioners. See Drilling Fluids.

MUD PUMPS - Large, reciprocating pumps used to circulate the mud on a drilling rig. A typical mud pump is a double - or triple-acting, two-or three-cylinder, piston pump whose pistons travel in replaceable liners and are driven by a crankshaft actuated by an engine. A mud pump also may be called a *"slush pump."*

MUD TANK - A reservoir or tank, usually made of steel plates, through which the drilling mud is cycled to allow sand and fine sediments to settle. Additives are mixed with mud in the pit, and the fluid is temporarily stored there before being pumped back into the well.

NAPL - Nonaqueous phase liquid such as many organic chemicals and petroleum products which are immiscible in water.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) - The Federal law, going into effect on January 1, 1970, that 1): established a national policy for the environment, 2) requires Federal agencies to become aware of the environmental ramifications of their proposed actions, 3) requires full disclosure to the public of proposed Federal actions and a mechanism for public input into the Federal decision-making process, and 4) requires Federal agencies to prepare an environmental impact statement for every major action that would significantly affect the quality of the human environment.

NATIONAL REGISTER OF HISTORIC PLACES - A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture.

NGVD - National Geodetic Vertical Datum is the determination of mean sea level that has been adopted as a standard datum for elevation.

NOTICE OF INTENT - A notice that an environmental impact statement will be prepared and considered.

ONE HUNDRED YEAR STORM EVENT/FLOODPLAIN - The size storm or greater that occurs on the average once in one hundred years. The floodplain associated with the one hundred year storm event.

PERMEABILITY - Extent that a substance is open to passage or penetration, especially by fluids.

PLUG - Any object or device that serves to block a hole or passageway, as a cement plug in a borehole.

PLUME - Contaminated water or air mass with limits delineated along a contour line or surface of equal contaminant concentration.

PRECIPITATION - As used in hydrology, precipitation is the discharge of water, in liquid or solid state, out of the atmosphere, generally upon a land or water surface.

RIGHT-OF-WAY (ROW) - The legal right for use, occupancy, or access across land or water areas for a specified purpose or purposes.

SCOPING - An early and open process for determining the scope of issues to be addressed in an EIS and identifying the significant issues related to a proposed action. Scoping may involve public meetings, field interviews with representatives of agencies and interest groups, discussions with resource specialists and managers, and written comments in response to news releases, direct mailings, and articles about the proposed action and scoping meetings.

SEDIMENT - Soil or mineral transported by moving water, wind, gravity, or glaciers, and deposited in streams or other bodies of water, or on land.

SIGNIFICANT IMPACT - A meaningful standard to which an action may impact the environment. The impact may be beneficial, adverse, direct, indirect, or cumulative, and may have short-term or long-term effects. (See Impact Significance Criteria.)

SITE (CULTURAL RESOURCES) - The physical location where past human activities or events occurred.

SOIL STOCKPILE - Piles of surface soil and rocks stored for use in site restoration after drilling is completed.

SPECIES - 1) The classification level of biological nomenclature which categorized each group of related organisms potentially capable of interbreeding; 2) the accepted level of classification to differentiate one specific type of organism from another.

SUBFLORIDAN CARBONATE FORMATIONS - Impervious non-water bearing rock formations which occur beneath the Floridan aquifer.

SURFACE CASING - Typically the first string of any consequence that goes into a well is called *"surface casing"* because it is set deep enough to protect the well from cave-in of loose formations that are often encountered near the surface. It is the starting point for the casing head and other fittings that will be left on the completed well.

SUTRA - A groundwater modeling code developed by the USGS whose full title is Saturated-Unsaturated TRAnsport (SUTRA). The model provides flexibility in simulating variable-density solute transport and groundwater flow.

SWANFLOW - A groundwater modeling code developed by Geotrans, Inc. whose full title is Simultaneous Water, Air, and Non-Aqueous Phase Liquid FLOW (SWANFLOW). The model has the ability to simulate the flow movement of water and oil which is an immiscible fluid.

UNAVOIDABLE ADVERSE IMPACTS - Significant impacts that are unavoidable and cannot be mitigated, and therefore would remain throughout the duration of the project and to some point beyond.

VISUAL QUALITY OBJECTIVES (VQO) - Classification of the degree of acceptable alteration of the characteristic landscape based on physical and sociological characteristics of an area. Six classes are recognized in the USFS system: (P) Preservation, (R) Retention, (PR) Partial Retention, (M) Modification, (MM) Maximum Modification, (E) Enhancement.

VISUAL RESOURCES - Visible features of the landscape including land, water, vegetation, and animals.

VISUAL SENSITIVITY - The level of user concern for visual change in a landscape unit. Three levels are recognized: (1) High, (2) Moderate, (3) Low.

VISUAL VARIETY - The diversity of landscape character. Three levels are recognized: (1) Class A - Distinctive, (2) Class B - Common, (3) Class C - Minimal.

WATER TABLE - The upper limit of the portion of ground that is wholly saturated with water.

WELL LOGGING - The recording of information about subsurface geologic formations. Logging methods include records kept by the driller, mud and cutting analyses, core analysis, drill stem tests, and electronic and radioactivity procedures.

WELLBORE - The hole made by the drilling bit.

WELLHEAD - The equipment used to maintain surface control of a well. It is formed of the casing head, tubing head, and valves. Also refers to various parameters as they exist at the wellhead, such as wellhead pressure, wellhead price of oil, etc.

WETLAND - Those areas that are inundated or saturated with surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

WILDCAT - A well drilled in an area where no oil or gas production exists.

WILDLIFE - All species of mammals, birds, fish, amphibians, and reptiles found in a wild state.

WILDLIFE HABITAT - All elements of a wild animal's environment necessary for completion of its life cycle. These elements include food, cover, water, and living space.

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LIST OF ACRONYMS

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LIST OF ACRONYMS

Name	Acronym
American Petroleum Institute	API
Application for Permit to Drill	APD
Areas of Critical Environmental Concern	ACEC
Average Daily Traffic	ADT
Big Cypress National Preserve	BCNP
Big Cypress Seminole Indian Reservation	BCSIR
Biochemical Oxygen Demand	BOD
Blowout Preventer Equipment	BOP
Bureau of Indian Affairs	BIA
Bureau of Land Management	BLM
Code of Federal Regulations	CFR
Comprehensive Environmental Response Compensation and Liability Act	CERCLA
Contamination Assessment Report	CAR
Council On Environmental Quality	CEQ
Decibels (A-weighted sound pressure level measurement)	dBA
Decibels (sound pressure level measurement)	dB
Dissolved Oxygen	DO
Draft Environmental Impact Statement	DEIS
Draft Florida Panther Habitat Protection Plan	DHPP
Endangered Species Act of 1973	ESA
Environmental Assessment	EA
Environmental Impact Statement	EIS
Everglades Agricultural Areas	EAA
Everglades National Park	ENP
Executive Order	EO
Existing Visual Condition	EVC
Extraction Procedure	EP
Federal Emergency Management Agency	FEMA
Federal Highway Administration	FHWA
Final Environmental Impact Statement	FEIS
Finding of No Significant Impact	FONSI
Florida Administrative Code	FAC
Florida Department of Agriculture	FDA
Florida Department of Transportation	FDOT
Florida Department of Environmental Protection	FDEP
Florida Department of Environmental Regulation	FDER
Florida Department of Natural Resources	FDNR
Florida Department of State, Division of Historical Resources	DHR
Florida Game and Fresh Water Fish Commission	FGFWFC
Florida Geological Survey	FGS
Florida Natural Areas Inventory	FNAI
High Density Polythecyene	HDPE
Hydrogen Sulfide	H_2S
Indian Mineral Development Act of 1982	IMDA
Interdisciplinary Team	IDT
Interior Board of Land Appeals	IBLA
Interstate Highway 75	I-75

LIST OF ACRONYMS

Name	Acronym
Kick Off Point	KOP
Level of Service	LOS
Measured Depth	MD
Micro Mhos	μMHO
Micro-Siemens	μS
Milliequivalents/Liter	MEQ
National Audubon Society	NAS
National Environmental Policy Act of 1969	NEPA
National Geodetic Vertical Datum of 1929	NGVD
National Park Service	NPS
National Pollutant Discharge Elimination System	NPDES
National Register of Historic Places	NRHP
Naturally Occurring Radioactive Material	NORM
Nephlometric Turbidity Unit	NTU
New Source Review	NSR
No Surface Occupancy	NSO
Notice to Lessees and Operators of Federal and Indian Oil and Gas Leases	NTL
Occupational Safety and Health Administration	OSHA
Off-road vehicle	ORV
Oil Pollution Act of 1990	OPA
Operations and Maintenance	O&M
Outstanding Florida Water	OFW
Picocuries per liter	pCi/l
Picocuries per gram	pCi/g
Pounds per day	PPD
Pounds per square inch	psi
Prevention of Significant Deterioration	PSD
Quality Assurance	QA
Record of Decision	ROD
Resource Conservation and Recovery Act of 1976	RCRA
Safe Drinking Water Act	SDWA
Saturated-Unsaturated TRAnsport	SUTRA
Shell Western E&P, Inc.	SWEPI
Soil Conservation Service	SCS
South Florida Water Management District	SFWMD
Spill Prevention Control and Countermeasure Plan	SPCC
State Historic Preservation Office	SHPO
State Road	S.R. 27
Surface Management Agency	SMA
Systematic Reconnaissance Flights	SRF
Tamiami Trail	U.S. 41
Threshold Limit Value	TLV
Tons Per Year	TPY
Total Dissolved Solids	TDS
Total Kjeldahl Nitrogen	TKN

LIST OF ACRONYMS

Name	Acronym
Total Recoverable Petroleum Hydrocarbons	TRPH
Toxicity Characteristic Leaching Procedure	TCLP
True Vertical Depth	TVD
U.S. Army Corps of Engineers	COE
U.S. Department of Interior	USDI
U.S. Environmental Protection Agency	EPA
U.S. Fish and Wildlife Service	USFWS
U.S. Geological Survey, Water Resources Division	USGS
Underground Injection Control	UIC
Vehicles Per Day	VPD
Visual Quality Objective	VQO
Volatile organic compound	VOC
Water Conservation Area 3A	WCA-3A
Water Conservation Area	WCA

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APPENDIX A-1

WELL AND FIELD DEVELOPMENT DISCUSSION

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A.1 Well and Field Development Discussion

A.1.1 Introduction

This appendix was prepared in response to concerns over potential well and field development activities. It is intended to provide the public general information concerning well and field development. The appendix describes the potential for discovery, activities and impacts associated with typical oil/gas development in south Florida, and the environmental review process that would be used to analyze well and field development activities should the proposed well be drilled and result in a discovery. It should be noted that the activities and associated impacts are typical of well and field development in South Florida environments and should not be viewed as a prediction of well or field development associated with the SWEPI Miccosukee 3-1 Well. Well and field development activities are not included in the Proposed Action and could not be considered or approved without additional applications and environmental analysis. Submission of subsequent plans for production facilities and the analysis of such plans is provided under BLM Oil and Gas Order No. 1. Furthermore, the existence of oil and/or gas deposits in the area of the proposed action and a prediction of the possible locations and number of wells cannot be projected in the absence of previous tests showing the presence of oil and/or gas deposits. Given the historically low statistical probability of finding commercial quantities of oil and/or gas (seven % or less) for an exploratory well of this type, well and field development are not viewed by the agencies as either likely or reasonably foreseeable. A subsequent EIS would be required to consider well and field development if commercial deposits are discovered by the Proposed Action.

A.1.2 Probability of Discovery

A.1.2.1 Oil Well Production

Oil and gas wells are classified as either exploratory or development wells. An exploratory well is defined by the Petroleum Extension Service, University of Texas, Austin as a well drilled either in search of an as-yet-undiscovered pool of oil or gas (a wildcat well) or to extend greatly the limits of a known pool. Exploratory wells may be classified as (1) wildcat, drilled in an unproven area; (2) field extension or step-out, drilled in an unproven area to extend the proved limits of a field; or (3) deep test, drilled within a field area but to unproven deeper zones. Development wells are wells drilled in a proven territory in a field to complete a pattern of production. The proposed well is classified as a wildcat well. A discovery well is the first well drilled in a new field that reveals the presence of a hydrocarbon-bearing formation. Twenty-two discovery wells have been completed in Florida with fourteen in south Florida and eight in Northwest Florida. The fourteen discoveries in south Florida are in Dade, Hendry, Collier and Lee Counties.

As of July, 1992, a total of 1,296 drilling permits have been issued by the Florida Geological Survey. Of the total, 319 wells became producers, 704 were dry holes, 229 were never drilled, and 44 were service wells such as saltwater disposal wells. Statistically, approximately 25 percent of the wells drilled

were producers, 54 percent were dry holes, 18 percent were never drilled, and 3 percent were service wells. However, these statistics include both exploratory and development wells and cannot be used to predict the probability of a wildcat well resulting in a discovery.

Data provided by the American Petroleum Institute shows that nationally, from 1983 through 1991 the average rate of a wildcat being completed with the potential for oil and/or gas production was 14.79 percent. The lowest rate of success during those years was 13.7 percent and the highest 16.4 percent. Data obtained from Petroleum Information Corporation shows that a total of 697 onshore wildcat wells have been drilled in Florida. These wells have resulted in twenty-two discoveries which represents a rate of success of approximately 3 percent since exploration began in Florida around the turn of the century. From 1972 through 1991, 287 wildcat wells were drilled in the State with fifteen discoveries during that period. This represents success of approximately 5 percent during the last twenty years. From 1982 through 1991, 88 Florida wildcat wells were completed with six discoveries or 7 percent success during the last ten years. This data shows that while the success rate of wildcat drilling has increased with increased knowledge and improved geophysical technologies, such operations remain highly speculative.

In the four south Florida counties with past and/or present production (Dade, Hendry, Collier and Lee Counties), 187 onshore wildcats have been drilled resulting in fourteen discoveries. This represents a success rate of approximately 7 percent in those counties. This rate is consistent with the success rate of recent wildcat drilling activity in south Florida. In addition, the adjoining counties of Broward, Palm Beach and Monroe have had a total of 15 wildcats completed without any discoveries. Of these wells, one was drilled in Broward County, five in Palm Beach County and nine in Monroe County.

The only previous well drilled in Broward County was the Miccosukee No. 32-1 drilled by Sabine Corporation and located on the Miccosukee Reservation approximately two miles west northwest of the proposed well site. This well tested the Sunniland Formation to a depth of 11,604 feet and was abandoned as a dry hole in 1985. The last south Florida discovery well was drilled in Collier County in 1985.

Development wells have a much higher rate of success as shown on Table 1. This table is based on data published by the Florida Geological Survey from 1985 to 1991 and personal communications with the Florida Geological Survey concerning recent unpublished data. The data shows that during the period beginning January 1984 through the end of 1991, 72 percent of the onshore development wells drilled in Florida were completed as potential producers while only 7 percent of the wildcats were potential producers. During that same period nineteen wildcats were drilled in south Florida with one discovery. This represents a 5 percent rate of success.

The first discovery drilling in south Florida occurred in 1943. The majority of the producing fields were discovered in the 1970's. Peak production also occurred in the late 1970's. State-wide Florida oil production declined in the late 1980's, but production in south Florida increased during this period.

TABLE 1
FLORIDA WELL SUCCESS STATISTICS
1984-1991

Year	Florida Onshore Wildcat Wells						Source of Data
	Statewide			South Florida			
	Total	Potential Procedures	Dry	Total	Potential Procedures	Dry	
1984	11	1	10	3	0	3	Informational Circular 101 1985 Florida Bureau of Geology
1985	13	1	12	6	1	5	Informational Circular 104 1987 Florida Bureau of Geology
1986	6	1	5	2	0	2	Informational Circular 106 1989 Florida Geological Survey
1987	4	1	3	1	0	1	Informational Circular 106 1989 Florida Geological Survey
1988	9	1	8	4	0	4	Informational Circular 107 1991 Floridian Geological Survey
1989	8	0	8	1	0	1	Informational Circular 107 1991 Floridian Geological Survey
1990	9	0	9	1	0	1	Communications Florida Geological Survey
1991	7	0	7	1	0	1	Communications Florida Geological Survey
TOTAL	67	5	62	19	1	18	
Percent Completion as Potential Procedures	5/67 7%			1/19 5%			

TABLE 1
FLORIDA WELL SUCCESS STATISTICS
1984-1991

Year	Florida Onshore Development Wells						Source of Data
	Statewide			South Florida			
	Total	Potential Procedures	Dry	Total	Potential Procedures	Dry	
1984	15	10	5	12	7	5	Informational Circular 101 1985 Florida Bureau of Geology
1985	10	9	1	7	7	0	Informational Circular 104 1987 Florida Bureau of Geology
1986	7	5	2	2	2	0	Informational Circular 106 1989 Florida Geological Survey
1987	6	5	1	1	1	0	Informational Circular 106 1989 Florida Geological Survey
1988	1	1	0	0	0		Informational Circular 107 1991 Floridian Geological Survey
1989	3	1	2	1	1	0	Informational Circular 107 1991 Floridian Geological Survey
1990	1	0	1	0	0	0	Communications Florida Geological Survey
1991	0	0	0	0	0	0	Communications Florida Geological Survey
TOTAL	43	31	12	23	18	5	
Percent Completion as Potential Procedures	31/43 72%			18/23 78%			

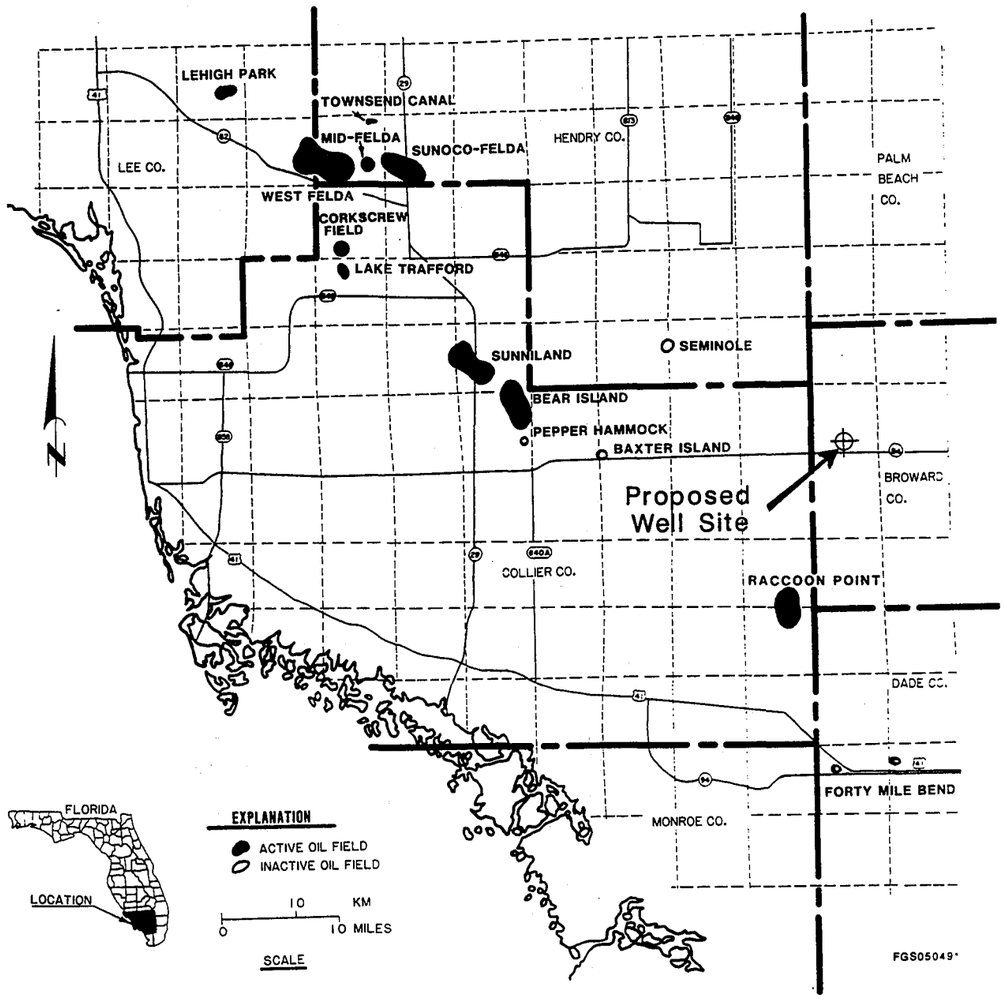
Historically, oil and gas production in south Florida began with the discovery of the Sunniland oil field in 1943, in Collier County. The first well was drilled to a depth of 11,626 feet. The Sunniland Trend had about 37,700,000 barrels of oil originally in place according to FDNR statistics.

The Sunniland formation is the only known oil producing sedimentary zone in south Florida and has produced oil and gas in varying amounts. The producing area extends from the now abandoned Forty Mile Bend field near the Tamiami Trail in Dade County, which has produced 32,888 barrels as of January 1, 1991 northwest to the Lehigh Park field in Lee County, which has produced 5,220,600 barrels. Sunniland Trend oil finds are depicted on Figure 1. There are or have been 14 fields producing crude oil from the Sunniland Trend. The closest field to the proposed well site is at Raccoon Point field located approximately 13 miles south-southwest.

South Florida oil wells generally do not contain significant volumes of natural gas. Approximately 95,377,000 barrels of oil have been produced from south Florida wells through 1990, while about 8,037,000 thousand cubic feet (Mcf) of gas was produced (FDNR, 1991). Recent statistics indicate the remaining recoverable oil and gas reserves in south Florida are about 13,949,000 barrels and 1,376,000 Mcf, respectively (FDNR, 1991). Tables 2 and 3 depict current statistics on oil and gas production in south Florida.

The proposed well would be the first deep well drilling attempt proposed on the Miccosukee Indian Reservation. In 1991 four deep wells (15,000 feet and below) were drilled in Florida with an average well depth of 15,265 feet. None of these wells produced oil and/or gas. In fact, only a few deep tests have been attempted in south Florida and none have been successful. The primary geologic targets of the proposed exploratory oil well include the Sunniland formation and all deeper stratigraphic potentials to the Basal Clastics. The proposed well would be directionally drilled to a true vertical depth of 17,730 feet and measured depth of 18,850 feet, with the bottomhole location approximately 4,700 feet east of the surface site.

Based on the historical well data concerning wildcat drilling activities in Florida; the fact that the proposed well is a deep wildcat test and that no south Florida previous deep wildcat tests have been successful; and considering the results of the Miccosukee No. 32-1; it can be reasonably concluded that the probability of the test resulting in a discovery is significantly less than the national average and less than both the statewide average during the past ten years and the average of the four productive counties in south Florida. Hence, the conclusion of this analysis is that the probability of the proposed well resulting in a discovery is less than seven percent.



Florida Geological Survey, 1991

Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA		SOUTH FLORIDA OIL FIELD LOCATION MAP	FIGURE 1 D&M JOB No. 13501-072-049 AUTOCAD FILE: VISUAL.DWG

TABLE 2

FLORIDA'S OIL RESERVES FOR 1991

Field	Oil gravity °API	Average porosity %	Productive area Acres	Original oil in place bbl	Estimated recovery factor bbl	Oil recoverable oil in place bbl	Oil produced through 1-1-91 bbl	Remaining recoverable oil reserves as of 1-1-91 bbl
SOUTH FLORIDA								
Sunniland	26	15.0	2,080	37,685,118	0.50	18,842,559	18,444,812	387,747
Forty Mile Bend	21	10.0	320	1,112,701	0.07	77,889	32,888	46,001
Sunoco Felda	25	15.0	3,840	28,946,678	0.40	11,578,631	11,556,825	21,806
West Felda	26	15.0	7,500	125,802,366	0.35	44,030,828	41,605,583	2,425,245
Lake Trafford	26	7.9	160	7,690,293	0.04	307,612	277,884	29,728
Bear Island	26	11.9	2,880	42,811,959	0.35	14,984,184	10,762,385	4,221,799
Seminole	25	14.1	480	2,366,665	0.10	236,857	84,755	151,902
Lehigh Park	28	17.7	800	8,211,959	0.65	5,337,609	5,220,600	117,009
Baxter Island	22	19.6	160	1,276,617	0.10	127,662	1,859	125,803
Mid-Felda	26	11.9	480	5,090,419	0.30	1,527,126	1,309,225	217,901
Raccoon Point	23	13.9	2,400	42,437,790	0.25	10,609,448	5,020,835	5,588,613
Pepper Hammock	27	15.3	160	976,713	0.10	97,671	323	97,348
Townsend Canal	28	13.7	640	4,504,699	0.20	900,940	442,018	458,922
Corkscrew	26	6.9	480	1,667,806	0.40	667,122	616,908	50,214
			22,300	310,581,331		109,325,938	95,376,900	13,949,038

TABLE 3

FLORIDA'S GAS RESERVES FOR 1991

	Average gas-oil ratio (SCF/STB)	Original recoverable gas in place (MCF)	Gas produced 1-1-91 (MCF)	Remaining recoverable gas reserves as of 1-1-91 (MCF)
SOUTH FLORIDA				
Sunniland	100	1,884,256	1,824,628	59,628
Forty Mile Bend	50	3,894	1,656	2,238
Sunoco Felda	85	984,184	981,507	2,677
West Felda	80	3,522,466	3,247,882	274,584
Lake Trafford	0	0	0	0
Bear Island	80	1,198,735	850,198	348,537
Seminole	0	0	0	0
Lehigh Park	100	533,761	525,719	8,042
Baxter Island	0	0	0	0
Mid-Felda	10	12,726	10,094	2,632
Raccoon Point	120	1,273,134	595,171	677,963
Pepper Hammock	0	0	0	0
Townsend Canal	0	0	0	0
Corkscrew	0	0	0	
Subtotal		9,413,156	8,036,855	1,376,301

Units: MCF - Thousand Cubic Feet
SCF - Standard Cubic Feet
STB - Stock Tank Barrels

A.1.3 Typical Field Development Components

Upon the completion of a discovery well, if well evaluation and production testing indicate that a well is capable of production, more detailed information regarding the geologic formations of interest is normally required to measure the potential for commercial production in detail. Usually, oil/gas field development requires one or more additional wells to be drilled to accurately assess specific production potential. Should oil and/or gas be found in commercial quantities, and approvals granted, additional production wells are completed and production equipment and facilities installed. However, if the proposed Miccosukee 3-1 well results in a discovery, SWEPI would be required to submit a conceptual field development plan to BLM prior to any consideration of further development activities. The plan would be based on the findings of the discovery and would specify the activities and facilities required to further explore and develop the field. The following is a synopsis of typical south Florida field development components.

A.1.3.1 Confirmation Wells

Should an initial exploratory oil well result in discovery of oil and/or gas, one or more additional well(s) are normally drilled to confirm the initial findings and further test and define the extent of the oil and/or gas reserves. Location of the confirmation wells is dependent upon analysis of discovery well data. Confirmation progresses by drilling one well after another, each being dependant upon results of the previous wells.

A.1.3.2 Production Wells

If the confirmation wells indicate commercial production feasibility, production wells are drilled. Development of production wells may require additional pads from which wells are drilled to begin extracting hydrocarbons from the reservoir. In addition, some confirmation wells may be converted to production wells. The number of production wells required depends upon the findings of the initial exploratory well tests and the confirmation process. Each well pad typically accommodates multiple wells. Each pad includes individual well testing facilities to evaluate their production.

A.1.3.3 Production Facilities

Production facilities typically include short flowlines from each well to a central production manifold located on each pad. The production from the remote pad locations is combined into a common line and transferred to a Central Production Facility (CPF), for primary separation, gas treating, oil dehydration and storage, water treating and storage, and water disposal.

A.1.3.4 Production Transport

The transport of produced oil is determined by production rates and the number of wells. Small quantities are typically handled via tank trucks or existing pipelines, while larger quantities may require a new pipeline.

A.1.3.5 Roads

Roads are constructed to provide access to each of the additional pad locations. Roads are typically elevated above the high water elevation. If necessary, culverts are installed under these roads to reduce impacts to the natural flow of surface water.

A.1.3.6 Safety Systems

All wells, flowlines and facilities are typically protected by safety systems, including automatic safety shutdown valves for wells, and safety shutdown systems for flowlines and gathering system lines should pressure from the wells exceed the maximum pressure rating of the line. The CPF equipment is equipped with instrumentation and shutdown systems to control the process operation and shutdown the equipment if the process exceeds the normal ranges of operations. All major equipment has pressure relief devices, and all pressure relief devices are piped into a closed relief system and flared. All product delivery pipelines are externally coated and further protected by a cathodic protection system. Furthermore, a corrosion monitoring program for all equipment and flowlines is implemented.

A.1.4 Impacts Associated with Typical Well and Field Development Activities

Typical well and field development can result in noise, visual, hydrological, vegetation, air quality, water quality and wildlife impacts. The degree of impact is dependent upon the specific field development plans and site characteristics. Through proper planning and mitigation actions, the degree of impacts can be minimized.

Sources of potential noise associated with field development activities include motorized construction equipment, drilling equipment, pump motors, maintenance activities, and vehicles that transport crews and materials to and from the sites. Visual impacts can occur from surface disturbance for pads and roads, drilling rig masts, and other site equipment, lighting provided to accommodate night operations can also have visual impacts. Hydrological impacts can occur from restricting surface flow by construction of well pads and roads. Water quality impacts occur only in the event of a spill or well casing leak. Vegetation can be impacted by clearing well sites and access roads. Air quality can be affected by emissions from vehicles and equipment as well as fugitive dust resulting from construction activity. The presence of humans, traffic, noise, and the alteration of vegetation by well site and access road construction are the primary disturbances to wildlife.

A.1.5 Raccoon Point Field Operation & Facilities

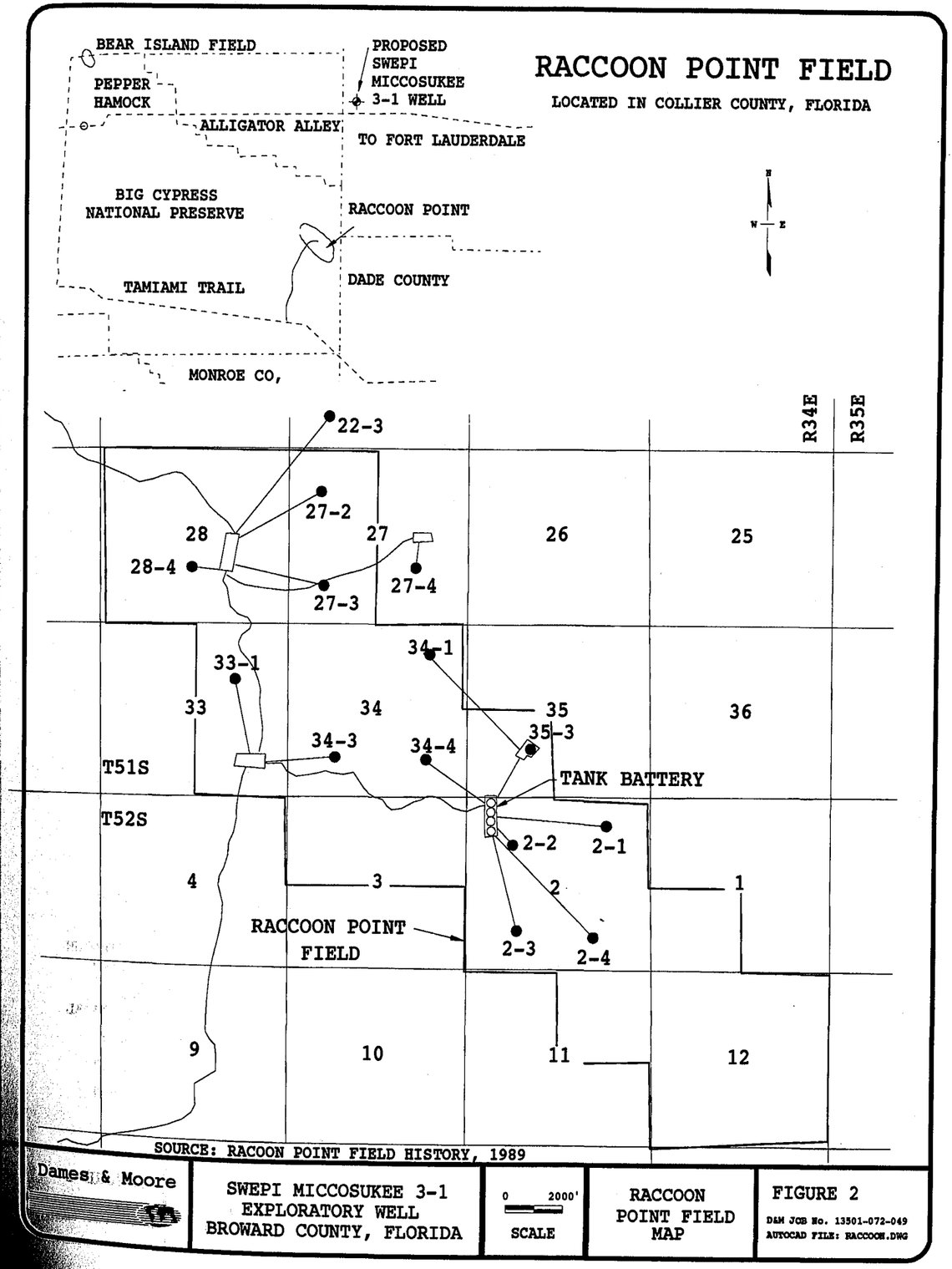
Raccoon Point is a typical actively producing south Florida oil field located in a sensitive environment. It was felt by the BIA and BLM that a discussion of the development at Raccoon Point would provide the reader with a better understanding of well and field development in south Florida. The Raccoon Point oil field is located in the Big Cypress National Preserve, approximately 13 miles south-southwest of the proposed SWEPI Miccosukee 3-1 well site (Figure 2). Land features in the vicinity of the Raccoon Point oil field include pinelands, cypress domes and strands, prairies and marshes. The land surface is flat. During the wet season (summer and fall) heavy rains lead to widespread surface inundation. During the dry season (winter) natural surface water flows are confined to the slightly lower elevation of strands, swamps, and sloughs (USDI, 1991).

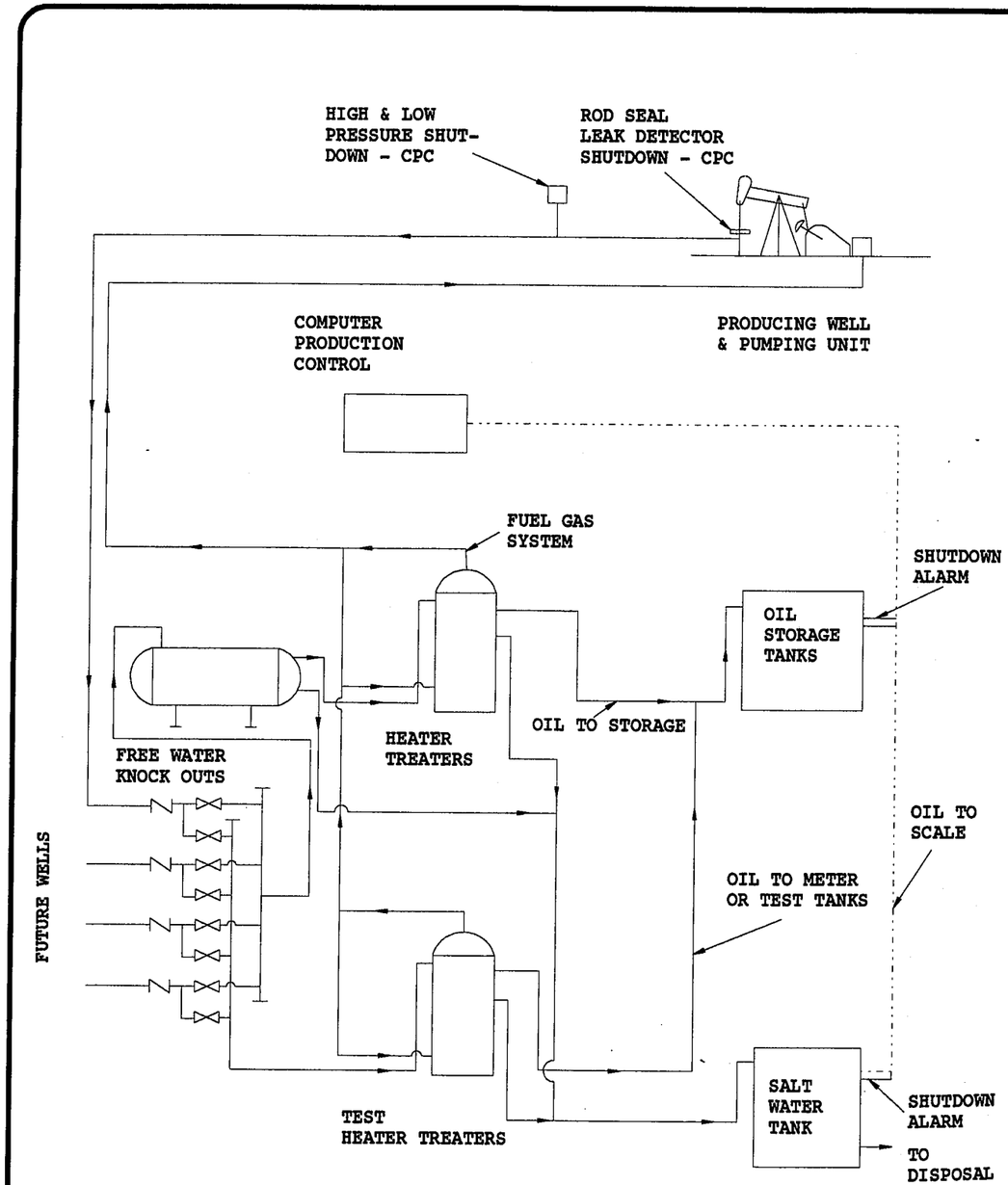
The Raccoon Point field discovery well was completed in June, 1977. Oil reserves were discovered in the Sunniland limestone formation which lies at a depth of approximately 11,300 feet. The production area is now estimated at 2,400 acres and originally contained an estimated 10,609,448 bbls of recoverable oil and 1,273,134 ccf of gas (FDNR, 1991). The development of the field currently includes 17 wells on five pads. Of the 17 wells, 14 are in production, one is uncompleted, one is a saltwater disposal well, and one is shut in. A central tank battery site is used for degassification, oil/water separation, storage and transport (Figure 3). Approximately 15 miles of access roads and 14 miles of pipeline service this field (USDI, 1991). More pads and wells are anticipated in the future under Exxon's 1981 Master Plan of Operation. The total field life of Raccoon Point is estimated at 25 to 30 years (Exxon, 1981).

Raccoon Point was discovered in June, 1977 through the completion of the Oleum 33-4 well. From March, 1978 through May, 1981 four additional wells were drilled to confirm and define the extent of the oil and gas field. Field development progressed by drilling one well after another, each being dependant upon the results of the previous well. A total of ten acres of fill was required for drill pads to accommodate four wells on three sites in the field confirmation process.

Upon completion of the field confirmation process in 1981, Exxon completed a Master Plan of Operations for the Raccoon Point Field. The master plan estimates a maximum of 25 wells on 5 pads and related facilities to process and transport crude oil to market. Construction of roads, drill sites, and production sites was estimated to require a total area of 112 acres. Of the 112 acres, 10 acres had been previously filled for 3 sites on which 4 wells were drilled for field confirmation and 47 acres existed as a 13 mile long low water road which would require improvements (filling) for year round use.

Components of the Master Plan are discussed below.





SOURCE: EXXON MASTER PLAN OF OPERATIONS FOR THE RACCOON POINT FIELD, 1981

Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY WELL BROWARD COUNTY, FLORIDA	N.T.S. SCALE	PRODUCTION FACILITIES SCHEMATIC RACOON POINT FIELD	FIGURE 3 D&M JOB No. 13501-072-04 AUTOCAD FILE: LAYOUT.DWG

A.1.5.1 Roads

Access road routes that follow existing vehicle tracks were selected to the extent possible in order to reduce environmental impacts. Roads require an elevated surface (fill) to assure usability during high water periods. Surface flow is maintained by routing roads parallel to flowways and by placing culverts through the road fill. Roads are limited to one lane, with vehicle turnouts constructed at 1/4 and 1/2 mile intervals to accommodate two way traffic. Access roads are utilized to transport drilling and production equipment to the drill and production sites. Access roads are also used to transport crude oil from the production site. Crude oil is transported in 160 bbl capacity trailers when pipelines are not available.

A.1.5.2 Well Sites

Well sites are designed for multi-well drilling. Environmentally sensitive plant communities are avoided to the extent possible. Drill site construction is accomplished during the dry season. All well sites are contained by perimeter berms. A SPCC plan is developed for each site. Drill equipment is similar to that described in the SWEPI Miccosukee 3-1 Proposed Action. A water well is required at each well site for the drilling process. Production equipment at the well site consists of large beam type pumping units powered by site produced natural gas. Welded steel pipe flowlines from the wells to the tank battery site follow the road alignments and are generally placed above ground beside the road.

A.1.5.3 Tank Battery Sites

Tank battery sites are collocated with drill sites and/or located to accommodate the production of multiple well sites. Remote well sites are connected to the tank battery sites by roads and flowlines. Tank battery sites are contained by a perimeter berm. Tank battery site facilities consist of equipment used to: separate oil, gas and saltwater; store oil; dispose of saltwater; deliver oil to transport systems. A single tank battery site has been constructed at Raccoon Point.

Specific equipment maintained at the tank battery site is described below.

A.1.5.3.1 Oil Treatment Vessel

Well flowlines transport the oil/water/gas mixture from the well head to the oil treatment vessel. The oil treatment vessel is a tank 6 to 10 feet in diameter and 27.5 feet high. Inside the oil treatment vessel the gas collects at the top and is used to heat the oil/water mixture for separation. The water is then siphoned off and stored in a tank for subsequent disposal in an approved saltwater disposal well. The oil is piped to storage tanks. Excess gas is flared at the site. Raccoon Point currently has nine oil treatment vessels.

A.1.5.3.2 Storage Tanks

Oil is temporarily stored in steel storage tanks of varying capacities (1,000-5,000 bbls). These large steel tanks are 21-30 feet in diameter and 16-24 feet high. Raccoon Point has five storage tanks. From the steel tanks, the oil is directed to transport tank trucks or to a pipeline. Initial production from the Raccoon Point Field was transported to Port Everglades via tank trucks. Subsequently, a pipeline was constructed when reserves were proven sufficient to economically justify the costs. The pipeline from the Raccoon Point Field connects to the existing Sunniland Pipeline, which transports crude oil to Port Everglades.

A.1.5.3.3 Other Facilities

Other facilities at the Raccoon Point Production Site include a mobile home for site workers, a potable water well, gas powered electrical generators, a maintenance shed, and a pump house for the pipeline pump.

A.1.5.3.4 Spill Prevention Measures

Exxon has a comprehensive program for preventing oil leaks and spills at the Raccoon Point Field. Monitoring equipment includes: leak detectors at the well pumps and on the pipeline; liquid level and pressure monitors on production facilities; a blowout preventer on wells capable of flowing (during drilling or workover); weekly aerial survey of the pipeline; emergency shutdown systems on all wells and production facilities; field operations that are manned 24 hours each day.

A.1.5.3.5 Reclamation

Upon closing of the Raccoon Point Production Facilities, Exxon will totally reclaim the site. Reclamation includes removal of all facilities and fill areas. Preparation, revegetation, and monitoring of the site will also be completed.

A.1.6 Environmental Review

Discovery of commercial quantities of hydrocarbon reserves would likely lead to additional proposals for field development activities. If the proposed SWEPI Miccosukee 3-1 Well is drilled and commercial quantities of hydrocarbons are found, BLM will require SWEPI to prepare a conceptual field development plan and submit the plan to BLM prior to consideration of any further development in the area of the proposed action. The conceptual field development plan would describe the extent, location, duration, and timing of additional wells and other facilities required to further explore and develop the field based on the data and characteristics of the discovery well.

Once SWEPI submits a field development plan, the BLM and BIA would complete an EIS of all aspects of the development plan and reasonably foreseeable field development activities. The EIS would address the potential direct, indirect and cumulative environmental impacts of the field development plan, reasonably foreseeable field development activities and reasonable alternatives. The document would be prepared in accordance with the National Environmental Policy Act, the implementing regulations of the Council on Environmental Quality and the Department of the Interior and agencies regulations and guidelines.

As required by NEPA, the environmental review would include a formal process for identifying public and agency concerns regarding field development. It would be distributed for public, state and Federal agency review and comment. All comments would be considered in the BLM and BIA decision-making process.

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APPENDIX A-2

DIRECTIONAL DRILLING ANALYSIS OF WELL PATHS FROM ALTERNATIVE SURFACE LOCATIONS - SWEPI MICCOSUKEE 3-1

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APPENDIX A-2

DIRECTIONAL DRILLING ANALYSIS OF WELL PATHS FROM ALTERNATIVE SURFACE LOCATIONS - SWEPI MICCOSUKEE 3-1

Purpose

A directional drilling analysis was performed to evaluate the feasibility of alternative surface locations for the well site. This analysis will provide the reader with an understanding of why SWEPI selected the surface location which has been proposed for the SWEPI Miccosukee 3-1 well.

Introduction

SWEPI is aware of public concern for potential fresh water contamination from petroleum industry activity in the water conservation areas. Since the geologic targets for the proposed well fall within WCA-3A, the options which would minimize potential environmental risk and public concern while achieving the well objectives were investigated.

Summary

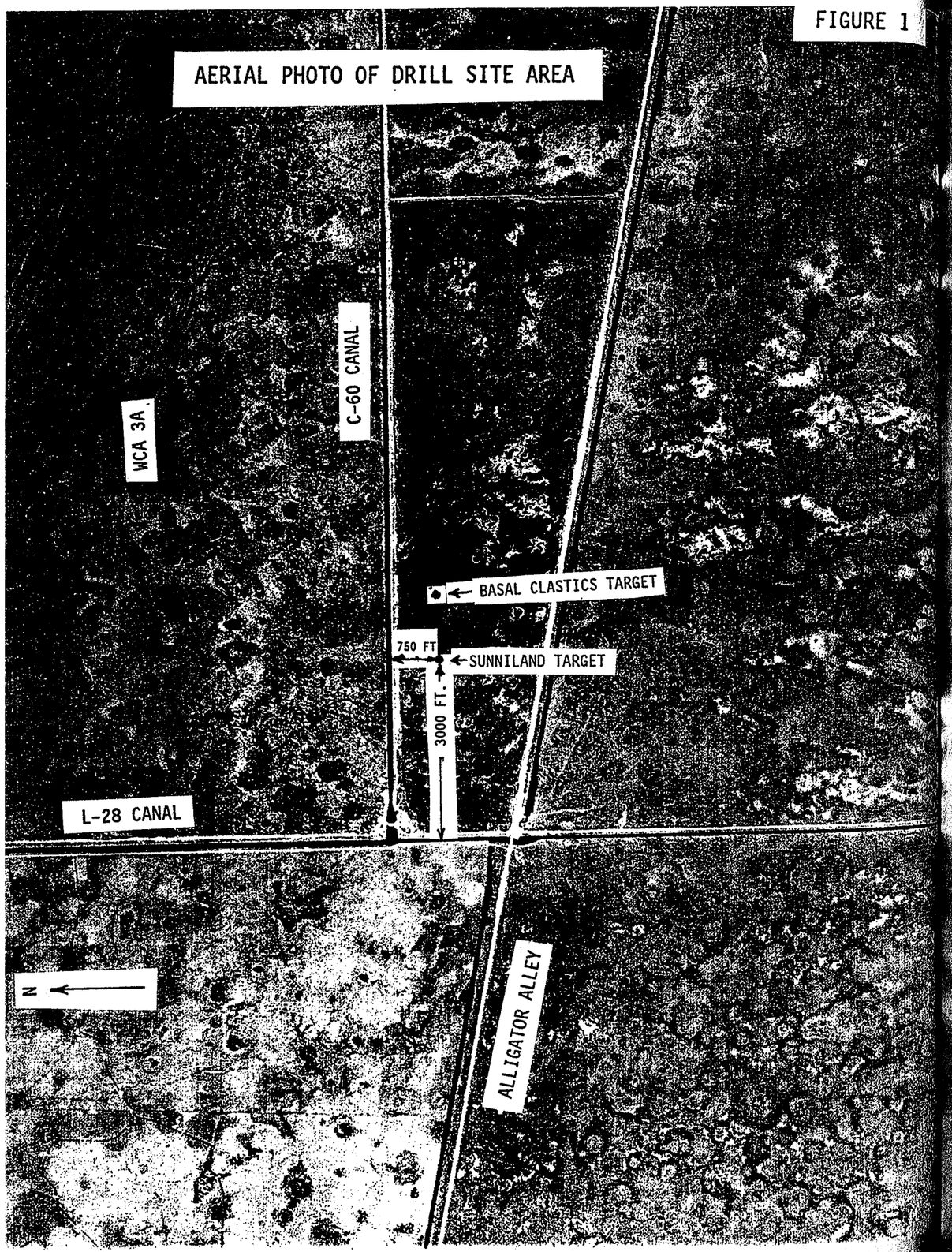
After reviewing alternatives, SWEPI selected a preferred surface location to drill the SWEPI Miccosukee 3-1 well. The site is west of the L-28 canal, north of I-75, located on pasture land outside WCA-3A, and is described as Option 3 in the following analysis. It would result in the least impact and public concern of any alternative investigated. Although this site will result in additional drilling cost, SWEPI believes that it is the best alternative considering the nature of the well (exploratory, wildcat) and aforementioned concerns.

Geologic Objectives and Targets

The SWEPI Miccosukee 3-1 well has been designed to penetrate the entire sedimentary column to basement rock at a vertical depth of 17,530 feet. In order to successfully evaluate hydrocarbon potential, geologic objectives within this column must be penetrated in particular locations. Consequently, two subsurface targets have been identified.

The uppermost geologic target is the Sunniland formation at a depth of 11,215 feet. When this subsurface target is projected to the surface, it is approximately 3,000 feet east of the L-28 Canal (see Figure 1). The lower target is the Basal Clastics (or basement) at a depth of 17,530 feet. When projected, this target is approximately 4,100 feet east of the L-28 Canal. Both targets are approximately 750 feet south of the C-60 canal and thus define a subsurface well path which must move 1,100 feet due east.

FIGURE 1



Directional Drilling Options

The surface alternatives which will allow the successful directional drilling of the well are discussed as follow:

Option 1

A location (see Figure 2) directly above (vertically) the Sunniland target offers the least expensive drilling alternative. The lower target can be reached with minimal directional drilling which would begin below a depth of approximately 11,500 feet. Torque and drag* and operational risk would be the least at this location. As shown on Figure 2, a well drilled from this site would require an "S" shape (an angle building section, followed by an angle holding section, followed by an angle dropping section to near vertical) with a maximum angle of 23 degrees and 1,100 feet of displacement. No changes in direction (azimuth) would be required.

The surface location for this option falls within WCA-3A (Figure 3) in an area that is potentially wetlands. Although the general area (Figure 1) has been impacted by I-75, S-140 pump station, and the L-28 and C-60 canals, public concerns for this option are great. Consequently, SWEPI has investigated alternatives which are more expensive and include increased operational risk.

* Friction loads which result from the drill string contacting the side of the well bore. The contact is caused by angle and directional changes.

Option 2

A surface location east (Figure 2) of the Sunniland target, results in the well path reversing direction from east-west (to the Sunniland) to west-east (from Sunniland to basement). A well drilled from this area would require four angle changes (two "S" shapes). Angle (or direction changes) result in increasing stresses which in turn greatly increase the risk for mechanical difficulties. Option 2 (Figure 3) is located 2,000 feet east of the vertical site, Option 1, and analysis indicates that torque and drag would be so severe that drilling is not practical. The "area from which targets can be reached" on Figure 3 reflects this analysis. A viable location to the east would be no more than 1,500 feet from Option 1. Figures 1 and 3 show that any viable sites east of the Sunniland target would be located in potential wetland areas of WCA-3A.

Option 3

A surface location 3,600 feet west of Option 1 (Figures 2 and 3) and immediately west of the L-28 Canal falls on pasture land (Figure 1), a significant difference in surface topography from Options 1 and 2.

FIGURE 2

Rev. 2/4/93

LOCATION ALTERNATIVES

SWEPI MICCOSUKEE 3-1

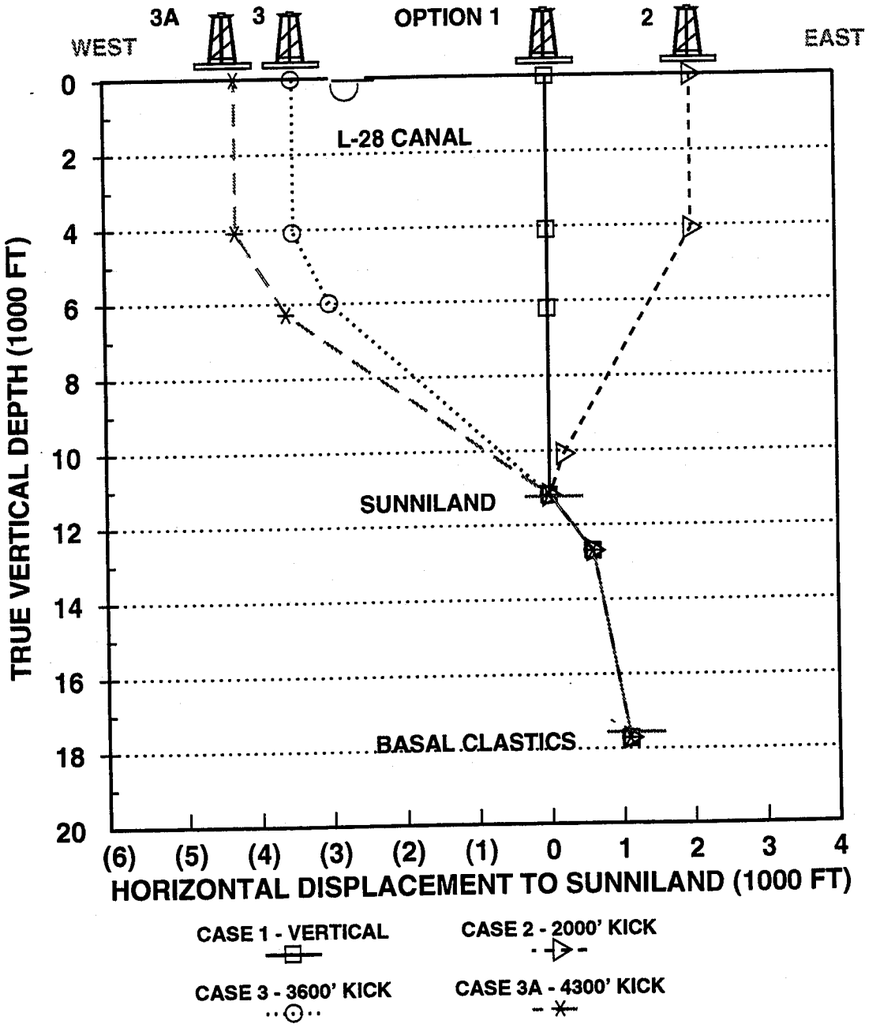
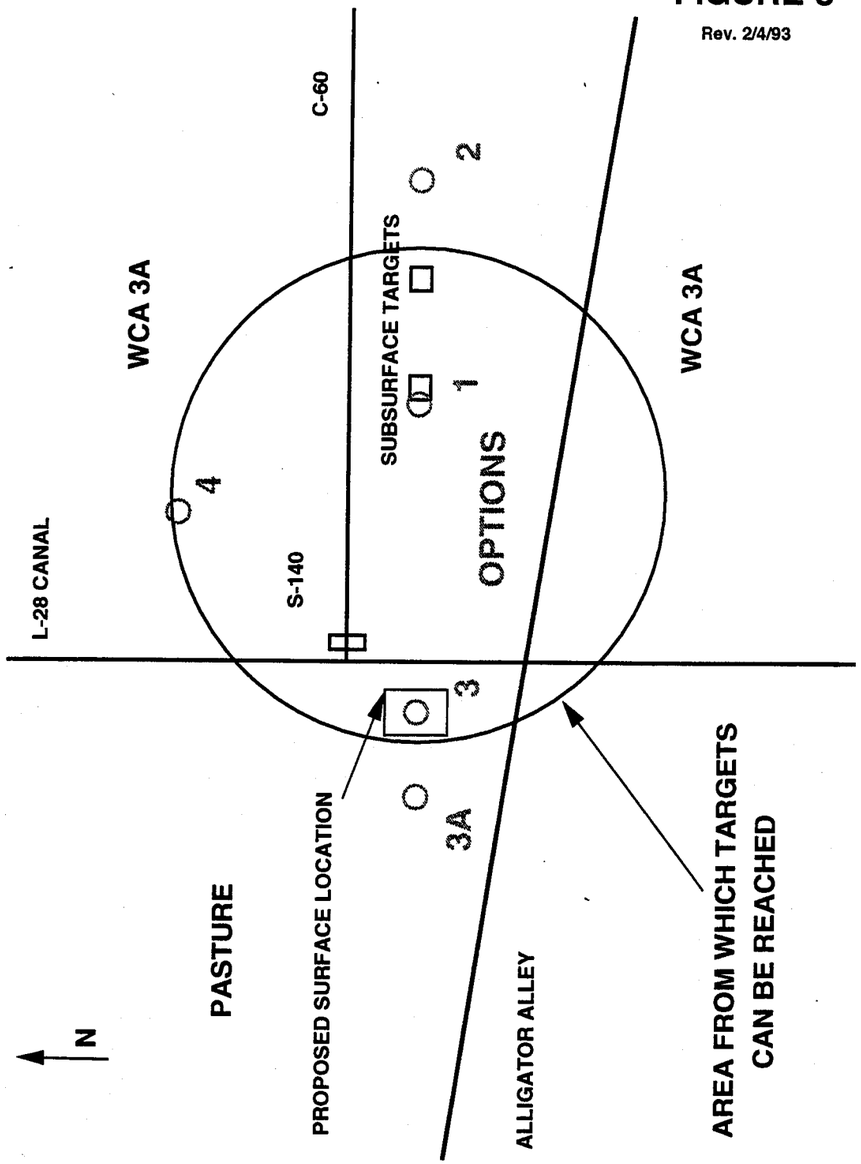


FIGURE 3

Rev. 2/4/93



This proposed surface location was chosen to avoid potential wetlands and willow heads within the pasture. Archaeological, wildlife, and vegetation studies were obtained to minimize any impacts.

Computer based torque and drag models show that the targets can be reached from this location but will result in higher stresses and loads. This option will require precise directional drilling and drill string component design but is achievable at a premium of $450,000 as compared to Option 1.

Option 3A

Theoretically, the surface location could be moved up to 700 feet (west, slightly northwest or slightly southwest) further from the target than Option 3 (see Figures 2 and 3). Although technically feasible, this would substantially increase the risk of encountering mechanical difficulty and well cost ($850,000 over Option 1, $400,000 over Option 3). The additional 700 feet of Option 3A would place the surface location in the potential wetland or willow head areas avoided by Option 3. Access route length would also be increased by Option 3A since Option 3 is immediately west of the proposed access route on the L-28 Levee. Option 3A thus appears to offer no advantage.

Option 4

If the location is moved north or south of Option 3 (along the same 3,600 foot radius), no improvement in surface location is found. A location north of the subsurface targets, within mechanical limitations, falls within WCA-3A, north of the L-28 getaway canal. Similarly, a surface location along a 3,600 foot radius in a southerly direction falls within WCA-3A south of I-75 and offers no advantage.

Viable locations can be described by a circle ("Area from Which Targets Can Be Reached" in Figure 3) with a radius of 2600 feet from a center located 1100 feet west of Option 1. This circle reflects that directional drilling displacement is smallest from a site to the East (Option 2) and greatest to the West (Option 3). This occurs because a change in direction is required in addition to an angle change. The change in direction (or turn) has an effect on torque and drag that is similar to, but generally smaller than, angle changes.

Directional Drilling Problems

In some areas, directional wells reach horizontal displacements greater than 10,000 feet, much greater than proposed for this well. However, the maximum displacement is a function of several factors which include type (shape) of directional well, vertical depth, maximum angle, changes in angle or direction, dogleg severity, type of formation, type of drilling fluid, etc. The "S" shape of the proposed well is recognized as resulting in increased torque and drag and increased risk of mechanical difficulties from key- seating* when compared to other shapes. Further, 6,000 feet of near vertical hole will be drilled below the first target and will result in extreme loads and limitations on displacement.

* A slot the size of the pipe body is worn into the high side of the wellbore from rotation of the drill string. When the drill string is pulled from the well, parts which are larger than the slot (drill pipe tool joints, drill collars, etc.) can be pulled into the slot and stuck. The shape of the wellbore, viewed from above, can be similar to a key hole, hence the name.

Differential sticking is a potential problem for most directional wells. The angle of the wellbore results in the drill string lying on the low side of the hole and when zones of permeability are encountered, an opportunity for sticking exists. This problem has been experienced in the Raccoon Point Field, approximately 12 miles to the southwest. This is one of the reasons that the proposed well plan includes an additional string of casing to cover the first 12,100 feet of hole drilled.

Torque and drag loads on the drill string and related equipment are expected to be large and have imposed limits on drill site selection flexibility. Computer models have been run on many cases to determine these loads and support the aforementioned analysis of options.

Conclusions

Consistent with mechanical limitations, the most acceptable surface location falls west of the L-28 Canal and north of I-75, Option 3. Reasonable alternatives are within a few hundred feet of the proposed site, which was specifically selected by SWEPI to minimize impacts to archaeological sites, wildlife, and sensitive vegetation after studies addressing these issues were conducted. Option 3 increases operational risk and drilling costs as compared to sites in WCA-3A such as Option 1. However, since the probability of a wildcat well finding hydrocarbons in commercial quantities in South Florida is less than seven percent, SWEPI believes that the additional cost and operational risk of Option 3 are warranted for the proposed well in order to minimize public concern.

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APPENDIX A-3

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CONTINGENCY PLAN

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PUBLIC PROTECTION PLAN

DRILLING AND PRODUCTION TESTING WITH HYDROGEN SULFIDE GAS

SWEPI MICCOSUKEE #3-1

BROWARD CO., FLORIDA

JANUARY 11, 1991

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I. STATEMENT OF POLICY

Drilling for hydrocarbons containing hydrogen sulfide presents problems that are greater than those usually encountered in normal oil field operations. These operations can be safely conducted if all concerned are fully aware of the unusual risks involved and are prepared to execute prearranged contingency plans.

Hydrogen sulfide is a toxic gas which in very low concentrations can be deadly. It can also cause sulfide stress cracking failure of many materials including metals, which if part of a critical well component, can result in a disaster. This means that all personnel must be thoroughly familiar with not only the safety regulations and procedures, but also with the type of materials that are safe for sour service.

The CONTINGENCY PLAN and the PUBLIC PROTECTION PLAN set forth the emergency procedures and safety regulations for drilling and testing the SWEPI Miccosukee No. 3-1. All personnel (including appropriate contract personnel) who will be on location more than one day must be thoroughly familiar with this plan and fully comply with these procedures.

P. D. Ching
Division Production Manager
Central Division

II. SCOPE OF PLANS

Shell Western E&P Inc. (SWEPI) proposes to drill the Miccosukee No. 3-1 well for the purpose of evaluating potential hydrocarbon reservoirs. Although hydrogen sulfide (H2S) gas is not found in producing wells (Sunniland Formation) and only trace amounts have been encountered in South Florida wells, it is possible that it may be encountered and adequate safety precautions must be taken.

The Contingency Plan addresses the release of liquid and gaseous hydrocarbons and the special hazards if H2S is present. It includes safety requirements, lists equipment requirements, and determines responsibilities in the event that H2S is encountered. The Plan will be fully implemented at 12,400′ measured depth (MD), the 9 5/8" OD protective casing point.

The Public Protection Plan provides an emergency telephone list, an evacuation map and an evacuation telephone list. Calculations indicate that the radius of exposure for 500 ppm, 100 ppm, and 15 ppm H2S in a gas stream would be respectively 70′, 150′ and 510′ (based on assumptions of 200,000 cfd associated gas and 10,000 ppm H2S). The nearest location of any personnel or structures, other than the proposed SWEPI operation itself, is Interstate Highway 75 (Alligator Alley) which is approximately 875′ from the proposed well location.

There are no residents within a 3 mile radius of the well. Although outside the 100 ppm radius of exposure, potential evacuees would be workers at the South Florida Water Management District pump station (approximately 1000′ from the proposed well), public using I-75, and any personnel on the road connecting the aforementioned (nearest point is 570′ from well location). The Public Protection Plan provides the list of organizations (Exhibit 8) with whom contact is necessary for the protection of the public. These organizations will be contacted prior to commencing any drilling operations.

CONTINGENCY PLAN

III. SPECIAL SAFETY REQUIREMENTS

The personnel training, equipment, and operating procedures included in this plan are expected to meet the most stringent requirements of:

1. Federal Register - Onshore Oil and Gas Operations; Federal and Indian Oil and Gas Leases, Onshore Oil and Gas Order No. 6 - Hydrogen Sulfide Operations.

2. API Recommended Practices for Safe Drilling of Wells Containing Hydrogen Sulfide, RP 49, April 17, 1987.

3. Rules of the Department of Natural Resources, Division of Resource Management, Oil and Gas Rules, State of Florida.

4. National Association of Corrosion Engineers (NACE) MR0175-88,

Standard Material Requirements, Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment.

or 5. SWEPI's appropriate "Safe Practices Manual" for drilling, well servicing, or producing operations and other operating guidelines.

Training

The training of personnel shall include the following:

1. Hazards and characteristics of hydrogen sulfide (H2S), sulfur dioxide (SO2), carbon dioxide (CO2), carbon monoxide (CO), methane gas, and other hazardous substances as may be appropriate. Effects of these substances are discussed in a section that follows.

2. Effect on metal components of the system.

3. Safety precautions.

4. Operation of safety equipment and life support systems.

5. Corrective action and shutdown procedures.

6. Detection and measurement of H2S and combustible gas.

7. Basic first-aid procedures applicable to victims of H2S exposure.

All personnel, whether regularly assigned, contracted, or employed on an unscheduled basis, shall be trained regarding the severity of H2S and other toxic gases, the use of ventilation equipment and breathing apparatus, and the evacuation procedures. Visitors shall also be instructed regarding these matters.

To promote efficient safety procedures, an on-site toxic gas safety program shall be established for all crews. Monthly training sessions will be conducted from spud until "plan" implementation at protective casing point, 12,400'. All rig crew personnel and supervisors will be "H2S trained and certified" prior to reaching this point. Weekly training sessions and drills will be conducted thereafter. Records of attendance shall be maintained at the drill site.

Equipment and Material Specifications

1. Wellhead and blowout prevention equipment (BOP) installed at the 9 5/8" OD protective casing point will conform to those requirements described in "Safe Practices for Drilling and Well Servicing Operations, Volume I". All wellhead equipment, BOP's, pressure containing equipment with potential H2S exposure will use materials meeting NACE MR0175-88 (or latest edition) standards.

2. Ram type blowout preventors, choke manifolds, and accessory equipment will be pressure tested to 100% of working pressure (5000 psi) as described in "PLAN OF OPERATIONS, Drilling Plan, Pressure Control Equipment". Annular preventors will be tested to 70% of working pressure (3500 psi). All equipment will be tested when installed, after any component change, and weekly (maximum one week deferral). Pipe rams will be functionally tested daily and blind rams on trips. All tests will be recorded on the daily tour sheets.

3. The 9 5/8" OD protective casing has been designed to meet SWEPI design requirements for sour gas service. Additional detail on casing and pressure control equipment (meets or exceeds NACE MR0175-88)) is contained in the "PLAN OF OPERATIONS, Drilling Plan."

4. The drill string will use "API Premium" condition or better drill pipe with the lowest yield strength materials practical for design parameters. Grade G-105 may be required and should have been properly quenched and tempered at manufacture for this application.

Drilling Fluid Requirements

1. The pH of the mud system will be maintained above 10 to neutralize any H2S encountered.

2. The drilling fluid will be tested daily for filtrate sulfide following the procedures of API Standard RP13B, Exhibit 1 with a "Garret Gas Train". The Garret Gas Train will also be used to analyze for CO2. Treatment with H2S scavengers, lime, and/or gypsum should be made as necessary. Results of the tests should be reported on the daily drilling report.

3. Storage of mud materials must be adequate and consistent with well conditions. As specified in "PLAN OF OPERATIONS, DRILLING PLAN, Drilling Fluids", materials will be maintained to rebuild 100% of the active mud system and weight material will be available to increase mud weight of the active system by approximately 2.0 ppg.

IV. EQUIPMENT SETUP

To the maximum extent possible equipment will be located as shown in Exhibit 2, Equipment Layout, such that the prevailing South wind will carry any gas from the well head away from ignition sources. The locations of the emergency equipment (EE) trailer, which designates the primary "SAFE BRIEFING AREA", and the alternate safe briefing area are also shown on Exhibit 2. The specific location of other equipment such as airline and self contained breathing apparatus, radios, fire extinguishers, etc., will be specified on the Drilling Foreman's Check List, Exhibit 3. This check list should be reviewed prior to the start

of drilling operations. In setting up the well site, the following criteria must be achieved:

1. The Foreman's vehicle with a mobile radio phone should always be in a safe, accessible area when on location.

2. The primary "SAFE BRIEFING AREA" will always be designated by the location of the Emergency Equipment (EE) Trailer. During an emergency, personnel will assemble at this area (or a secondary upwind briefing area if necessary) for instructions from the SWEPI Foreman.

3. The EE Trailer will contain self-contained breathing units, hose, H2S/SO2 detectors, flare gun, barricade, signs, wind socks, warning flags, first aid kits, litter, fire extinguishers, maps, rope, walkie-talkies, flashlights, and many other emergency equipment items as listed on Emergency Equipment Trailer Checklist, Exhibit 4. It will have a wind sock attached on top to indicate wind direction. The Trailer should be inventoried by the Safety Technician when it is moved on location.

4. If operations are conducted at night, all wind sock poles will be illuminated.

5. A clear plastic container with a list of the current emergency telephone numbers, Exhibit 8 and a map of the local area with all residential areas clearly marked Exhibit 9 will be located on the rig bulletin board in the Foreman's trailer and car, and at the EE trailer.

6. An automatic hydrogen sulfide monitor shall be provided with a minimum of 3 detectors located at the shale shaker, bell nipple, and at the driller's console. Detectors shall be capable of sensing a minimum of 1 ppm H2S in air and shall be able to independently activate visual and audio alarms. A visual alarm will be activated at 10 ppm and a separate visual and an audible alarm at 15 ppm. The audible alarm must be capable of alerting people at any point on the location.

7. A black and yellow sign which reads "Danger -Poisonous Gas May Be Present At This Site" and "Do not approach if yellow flag is flying!" in smaller letters will be posted at the entrance to the location (minimum of 200' from wellsite).

8. Electric fans (24" or larger) with explosion proof motors will be positioned on the rig floor (to blow fumes downward), under the rig floor (to clear gas from substructure), and at the shale shaker.

9. A mud degasser will be installed prior to spud of the well. Location of the degasser is shown on Figure 9 of the "PLAN OF OPERATIONS".

10. Bottled gas shall be located at the flare (or blooie) line as a source of ignition with a continuous burning flame.

V. RESPONSIBILITIES AND DUTIES

All Personnel

1. It is the responsibility of all personnel on a SWEPI location to familiarize themselves with the procedures outlined in this plan. Exhibit 5, a table from API RP49, Recommended Practices for Safe Drilling of Wells Containing Hydrogen Sulfide, shows the physical effects of H2S exposure and is provided for further education of all personnel.

2. In the event of an accident:

   A. All personnel will attend to their personal safety first.

   B. Help anyone who may be injured or overcome by toxic gases. The Foreman will assign someone to administer first aid to the unconscious or injured person(s). Remember to put on respiratory equipment and remove victim at once to fresh air. Attempting to rescue without respiratory equipment can be fatal.

   C. Report to the designated upwind "SAFE BRIEFING AREA" and follow the instructions of the Foreman.

SWEPI Foreman

1. It is the responsibility of the SWEPI Foreman to see that these safety and emergency procedures are observed by all personnel on location.

2. The Foreman will keep the Superintendent advised as to compliance with the procedures as specified herein. A completed Drilling Foreman's Checklist, Exhibit 3 will be forwarded to the Superintendent prior to starting drilling or completion operations.

3. The Foreman shall keep the number of personnel on location to a minimum during hazardous operations.

4. The Foreman is responsible for designating the "SAFE BRIEFING AREA." This area may change depending upon wind direction and must be redesignated as soon as wind change occurs.

5. The SWEPI Foreman shall ensure that classes and drills on emergency procedures presented in this plan are performed. He shall see that the Contract Pusher has adequately trained the drilling crew in handling of emergency procedures. He should satisfy himself that this is the case. He should notify the Superintendent if the Contract Pusher fails to fulfill this

responsibility.

6. If an unexpected emergency occurs, or the H2S alarm is activated, the SWEPI Foreman will assess the situation and will advise all personnel what condition exists.

Contract Pusher

1. In the absence or incapacitation of the SWEPI Foreman, the Contract Pusher or other person previously designated by the SWEPI Foreman will assume all responsibilities designated herein to the SWEPI Foreman. He should be thoroughly familiar with all safety procedures. The SWEPI Superintendent will be immediately notified of the situation.

Rig Operator

1. In the absence or incapacitation of both the Foreman and the Contract Pusher, the Rig Operator will assume their responsibilities as designated herein. He shall direct someone to notify the SWEPI Superintendent immediately of the situation.

2. In the event of a release of gas, the Rig Operator will don his gas mask and secure the rig if time permits.

Safety Technician

1. It is the responsibility of the SWEPI Safety Technician to ensure that the safety equipment called for in this plan is initially supplied and is maintained.

2. The SWEPI Safety Technician will inventory the Emergency Equipment Trailer to assure that the equipment is being properly stored, maintained, and in working order. This should be completed immediately after the trailer is brought on location and an inventory checklist, Exhibit 4 should be sent to the Superintendent.

3. Inventories and safety equipment operational checks will be performed by a safety technician (SWEPI or contract) on a weekly basis and documentation will be maintained in the Foreman's trailer.

4. A safety technician will conduct classes as required in operation and care of the safety equipment.

5. A safety technician will also conduct classes as required in first aid and H2S safety training.

6. A safety technician will ensure that H2S monitors are calibrated on a weekly basis (when in use).

7. The safety technician will also have a digital H2S detector in his possession.

VI. EMERGENCY ACTION

General

In the event an emergency situation occurs (e.g., sudden gas leaks, H2S alarm sounds):

1. **DO NOT PANIC!**
2. Hold your breath.
3. Evacuate quickly to an upwind "SAFE BRIEFING AREA."
   A. Derrick Man - put on gas mask and climb from derrick. **IN CASE OF FIRE** do not attempt to use gas mask. Descend from derrick by emergency slide.
   B. Operator - If time permits, put on gas mask and stop drilling ahead or tripping drill string. It is generally desirable to have all auxiliary services (electricity, air and pumps) in operation).
4. If well control procedures are necessary, follow SWEPI "Safe Practices For Drilling and Well Servicing Operations, Volume I". Stations and duties to be performed will be listed on the doghouse bulletin board.
5. If it can be done safely, help should be given to anyone who might be injured or overcome from toxic gases.
6. The SWEPI Foreman or his designate shall account for the presence of all rig, service, and company personnel.

Foreman's Responsibilities

1. Assess the situation and assign duties to various persons to bring the situation under control.
2. Refer to Exhibits 6 and 7 (H2S Exposure Nomographs) and determine the radius of exposure for 100 ppm and 500 ppm. The formula for determining the 15 ppm radius is as follows:

   15 ppm Radius of Exposure = X

   $X = [10.593(\text{Mole Fraction})(\text{Escape Rate})]^{0.6258}$

   $= [10.593(\text{ppm})(M^2\ \text{cf/d})]^{0.6258}$

3. Determine what condition exists in accordance with one of the **Operating Conditions** listed below and raise appropriate colored warning flag to describe emergency.

4. Advise all persons of the severity of the situation. Post a person wearing a breathing apparatus at the entrance to the well pad to prevent unauthorized entry to the location and apprise essential personnel to the severity of the situation. Also, post the proper color coded flags to indicate severity of the situation in accordance with the following guidelines.

Gas Release Conditions

Condition Green - Normal Operations (Post Green Flag) (H2S levels - 0 ppm, no activated alarms)

1. Conduct operations normally

Condition Yellow - Potential Danger to Life (Post Yellow Flag) (H2S levels - 1 to 15 ppm)

1. The SWEPI Foreman shall order all personnel not working to correct the situation to the "SAFE BRIEFING AREA." When the H2S concentration reaches 10 ppm, all personnel shall wear airline breathing units with egress capability or self-contained breathing equipment while working in the area of detection.
2. The safety technician shall increase gas monitoring using the portable hand-operated H2S detector from the emergency trailer and report findings to the SWEPI Foreman.
3. The SWEPI Foreman shall direct corrective action to control flow of gas.
4. The SWEPI Foreman shall set up road blocks and restrict personnel movements to a minimum.
5. The SWEPI Foreman shall implement SWEPI's Emergency Response Plan by notifying or designating someone to notify the Superintendent. The Foreman shall notify local authorities, regulatory agencies, and other SWEPI personnel as needed as provided in Exhibit 8, Emergency Telephone List.
6. If the situation is expected to be of long duration, the SWEPI Foreman should evacuate as described below and in the PUBLIC PROTECTION PLAN.

Condition Red - Extreme Danger to Life (Post Red Flag) (H2S levels - Greater than 15 ppm, or SO2 - Greater than 2ppm)

1. The SWEPI Foreman shall order all personnel to the upwind "SAFE BRIEFING AREA."
2. All persons not needed to correct the situation should be evacuated. All essential personnel shall wear an airline unit with egress capability or a self-contained breathing apparatus while on location.

3. The SWEPI Foreman shall implement the PUBLIC PROTECTION PLAN and order evacuation of local people within danger zone. Exhibit 9, Evacuation Map and Exhibit 10, Evacuation Telephone Numbers are provided for this emergency. The Foreman shall designate someone to request that the Highway Patrol and/or Sheriff's Department control traffic in the threatened area and assist in evacuation of people, if necessary.

4. The SWEPI Foreman shall implement SWEPI's Emergency Response Plan (ERP), an internal document, by notifying or having someone notify the Superintendent.

5. The Superintendent shall notify the Operations Manager and other appropriate personnel in accordance with the ERP.

6. The Foreman shall have road blocks set up to prevent entry of unauthorized persons. Persons manning the roadblocks should have and be trained in the use of H2S monitoring systems. They should maintain the barriers outside a 5 ppm H2S level.

7. Ignite the well if necessary. (See section VII)

VII. IGNITING THE WELL

Responsibility

The decision to ignite the well is the responsibility of the SWEPI Superintendent. However, the decision should be made only as a last resort and in a situation where it is clear that:

1. Human life or property are endangered.
2. There is no hope of controlling the well under the prevailing conditions.

In all cases an attempt should be made to notify the Division Operations Manager of the plans to ignite the well, if time permits. However, the Superintendent and Foreman must not delay a decision if human life is threatened.

REMEMBER, if the well is ignited, the burning H2S will be converted to sulfur dioxide (SO2) which is also highly toxic. Do not assume that the area is safe after the well is ignited. Follow through with all plans to evacuate endangered persons.

Methods of Ignition

1. In preparation for igniting the well, keep all unnecessary personnel in the upwind "SAFE BRIEFING AREA." Two people are required for the actual ignition. Both men will wear self-contained breathing units and will have 500 ft. retrieval ropes tied around their waists. One man is responsible for checking the atmosphere for explosive gases with explosimeter.

The other man is responsible for igniting the well. Persons remaining in the "SAFE BRIEFING AREA" will closely watch the ignition team; and should either man be overcome by fumes, they will immediately pull him to safety by the retrieval ropes.

2. The primary method for igniting the well will be with a 25MM meteor type flare gun. These guns have a range of approximately 500 feet. If this method fails or well conditions are such that a safer or better method is apparent, then the alternate method should be used.

3. Always ignite the well from upwind and do not approach well any closer than warranted.

4. Select a location to fire the flare gun which provides maximum protection to the ignition team (behind a parked auto, etc.).

5. Choose a location that has good accessibility and from which retreat can easily be made.

6. **Remember,** before firing flare gun or igniting flammable material, check the atmosphere at your location for combustible gases with explosimeter (EE Trailer).

VIII. POST EMERGENCY ACTIONS

Return the Situation to Normal

1. Monitor the evacuated area for H2S and combustible gas concentrations.

2. Evacuees should be allowed to return to their work location and normal use of the highway should be allowed only after the total absence of H2S and combustible gas is confirmed.

3. Remove all barricades and warning signs.

4. Advise all parties previously notified that the emergency has ended.

5. Clean up, recharge, restock, repair and/or replace emergency equipment as necessary and return it to its proper place.

6. Critique all actions. Train or retrain employees in emergency procedures, if the need is indicated.

7. Review the factors that caused or allowed the emergency to happen and, if the need if indicated, modify operating, maintenance and/or surveillance procedures.

IX. APPENDIX A (EXHIBITS)

flowmeter and a Dräger tube. Specifications of Garrett Gas Train:

Body
- Chamber 1
  - Depth ..... 3.54 in (90 mm)
  - Diameter ..... 1.52 in (38 mm)
- Chambers 2 & 3
  - Depth ..... 3.54 in (90 mm)
  - Diameter ..... 1.18 in (30 mm)
- Passages between Chambers:
  - Diameter ..... 0.08 in (2.0 mm)
- Material:
  - Lucite® or equivalent transparent material or glass which is inert to acid, sulfides, and hydrogen sulfide gas.

Dispersion Tube
- Stem:
  - Diameter ..... 0.315 in (8.0 mm)
  - Length ..... approx. 5.9 in (150 mm)
- Dispersion Frit (Bell-shaped ASTM 4-5.5 Fine)
  - Diameter ..... 1.18 in (30 mm)
  - Pyrex® or equivalent glass

Flow Meter: Floating ball type preferred, capable of measuring 300 cm^3 per minute of CO_2 gas.

Flexible Tubing: Type inert to hydrogen sulfide and carrier gas. Latex rubber or Tygon® plastic is preferred.

Fittings and Rigid Tubing: Type inert to hydrogen sulfide and acid.

b. Carrier gas: type inert to hydrogen sulfide, acid, and Dräger tube reagents. Nitrogen is preferred but carbon dioxide is acceptable. (Avoid air or other oxygen-containing gases.)

c. Dräger H_2S Analysis Tubes:

(1) Low range: marked H_2S 100/a (No. CH-291-01)
(2) High range: marked H_2S 0.2%/A (No. CH-2S1-01)

d. Lead-acetate paper disk (see Note Par. A.15o)

e. Sulfuric acid: approximately 5N, reagent grade

f. Octanol defoamer in a dropper bottle

g. Hypodermic syringes: one 10-cm^3 (for acid), and one 2.5-cm^3, one 5-cm^3 and one 10-cm^3 (for sample)

h. Hypodermic needles: two 1.5 in (38 mm) 21-gauge needles

SULFIDE

A.16 Description

a. The concentration of soluble sulfides in a drilling fluid can be determined by this method. Soluble sulfides include H_2S and the sulfide (S^{-2}) and bisulfide (HS^-) ions. Mud filtrate is acidified in a Garrett Gas Train, converting all sulfides to H_2S which is evolved by bubbling an inert carrier gas through the sample. The Gas Train separates the gas from the liquid. The gas stream is passed through a Dräger tube which responds to H_2S by darkening along its length. The darkened length is proportional to the total sulfide in the mud filtrate. The low range Dräger tube turns from white to brownish-black and the high range Dräger tube turns from pale blue to jet-black. No common mud contaminant will cause these color changes.

b. Lead-acetate paper disks can be accommodated in the Garrett Gas Train to determine the presence or absence of sulfide. If the presence of sulfide is indicated by darkening of the lead-acetate paper, a Dräger tube should be used for quantitive analysis.

A.17 Equipment

a. The Garrett Gas Train apparatus, as shown in Fig. A.1, consists of: a transparent plastic gas train, an inert gas supply and pressure regulator, a floating-ball

A.18 Procedure

a. Be sure the gas train is clean, dry and on a level surface, with the top removed.

NOTE: *Moisture in the train can cause the ball in the flowmeter to float erratically and may affect the accuracy of the Dräger tube reading.*

b. Add 20 cm^3 of deionized water to Chamber 1.

c. Add 5 drops octanol defoamer to Chamber 1.

d. See Table A.1 for sample volume and type of Dräger tube required for the expected sulfide range. Select the proper type Dräger tube. Break the tip from each end of the tube.

e. Install the Dräger tube with the arrow pointing downward into the bored receptacle. Likewise, install the flowmeter tube with the word TOP upward. Be sure o-rings seal around the body of each tube.

TABLE A.1
DRÄGER TUBE IDENTIFICATION. SAMPLE VOLUMES AND TUBE FACTORS TO BE USED FOR VARIOUS SULFIDE RANGES

Sulfide Range (mg/L)	Sample Volume (cm^3)	Dräger Tube I.D. (See Tube Body)	Tube Factor (See A.19a)
1.2 - 24	10.0	H_2S 100/a	12
1.5 - 48	5.0		
4.8 - 96	2.5		
60 - 1020	10.0		
120 - 2040	5.0	H_2S 0.2%/A	600*
240 - 4080	2.5		

*"Tube Factor" 600 is based on a "Batch Factor" (stenciled on box) of 0.40. For another "Batch Factor" (as stenciled on box). a corrected "Tube Factor" should be calculated:

$$\text{Correct Tube Factor} = 600\,\frac{\text{(Batch Factor)}}{0.40} \qquad \text{(a)}$$

f. Install the top on the gas train and hand tighten all screws evenly to seal the o-rings.

g. With the regulator backed off, connect the carrier gas to the dispersion tube of Chamber 1 using flexible tubing. If CO_2 cartridge is used, install and puncture cartridge and connect to dispersion tube as shown in Fig. A.1.

h. Attach the flexible tubing from Chamber 3 outlet to the Dräger tube, as shown in Fig. A.1.

NOTE: *Use only latex rubber or inert plastic tubing. Do not clamp flexible tubing: unclamped tubing provides pressure relief in the event of over pressurization.*

i. Adjust the dispersion tube in Chamber 1 to approximately ¼ in (5 mm) above the bottom.

j. Gently flow carrier gas for a 30 second period to purge air from the system. Check for leaks. Shut off the carrier gas.

k. Collect a sufficient volume of solids-free filtrate for analysis. (If a low concentration of soluble sulfides is to be detected, a large volume of filtrate is required. Use Table A.1 as a guide.)

l. Inject a measured volume of the solids-free filtrate sample into Chamber 1 through the rubber septum, using a hypodermic syringe and needle.

m. Slowly inject 10 cm^3 sulfuric acid solution into Chamber 1 through rubber septum using the hypodermic syringe and needle.

n. Immediately restart the carrier gas flow. The flow rate should be maintained between 200-400 cm^3 per minute.

NOTE: *One CO_2 cartridge should provide about 15-20 minutes of flow at this rate.*

o. Observe changes in appearance of the Dräger tube. Note and record the maximum darkened length (in units marked on the tube) before the front starts to smear. Continue flowing for a total of 15 minutes although the front may attain a diffuse and feathery coloration. In the high-range tube an orange color (caused by SO_2) may appear ahead of the black front if sulfites are present in the sample. The orange SO_2 region should be ignored when recording darkened length.

NOTE: *For best Dräger tube accuracy, the "Darkened Length" should fill more than half the tube's length, therefore the filtrate "Sample Volume" must be carefully selected.*

p. A lead-acetate paper disk fitted under the o-ring of Chamber 3 can be substituted for the Dräger tube in the Gas Train. The lead-acetate paper will show qualitatively the presence or absence of sulfides in the sample. A dark discoloration of the paper is a positive indication of sulfides. After the positive indication, the Dräger tube should be used on a separate sample for quantitative analysis.

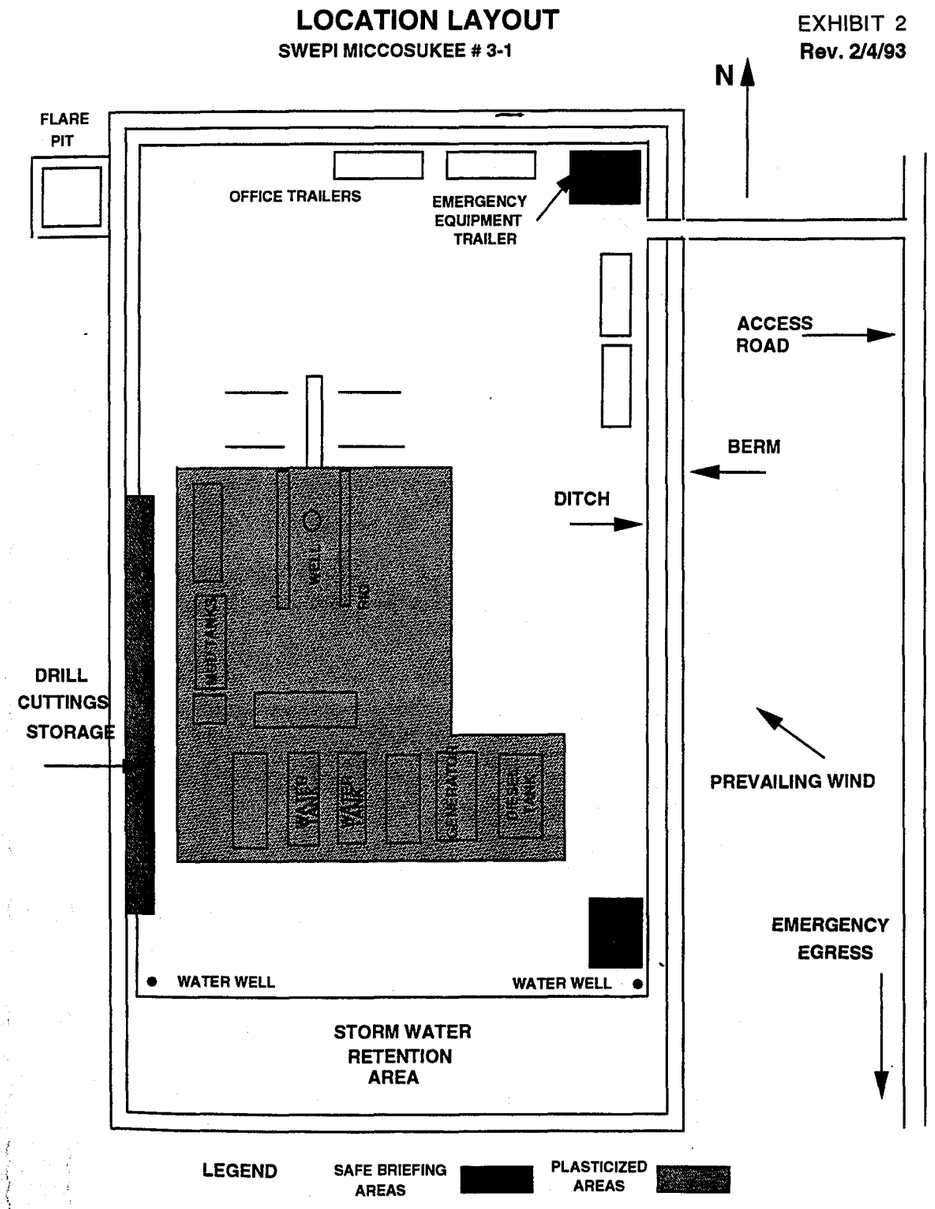
q. To clean the gas train remove the flexible tubing and remove the top. Take Dräger tube and flow-meter out of the receptacles and plug the holes with stoppers to keep them dry. Wash out the chambers with warm water and mild detergent, using a soft brush. Use a pipe cleaner to clean the passages between the chambers. Wash, rinse and blow out the dispersion tube with a dry gas. Rinse the unit with deionized water and allow to drain dry.

A.19 Calculation

a. Using the measured Sample Volume, the Dräger tube's maximum Darkened Length and the Tube Factor from Table A.1, calculate sulfide in the sample:

$$\text{Sulfide, mg/L} = \frac{\text{(Darkened Length*)(Tube Factor)}}{\text{(Sample Volume, cm}^3\text{)}} \qquad \text{(a)}$$

*In units marked on the tube



DRILLING FOREMAN'S CHECKLIST

Equipment to be on Location at Protective Casing Point (12400')

ITEM	QUANTITY	DESCRIPTION	CHECK IF O.K.
1.	3	Cleared land areas (for use as safe briefing).	( )
2.	1	One of above cleared areas designated as current "SAFE BRIEFING AREA."	( )
3.	1	Emergency Equipment (EE) Trailer in the "SAFE BRIEFING AREA."	( )
4.	3	Direction wind socks.	( )
5.	3	"No Smoking" signs on drive post.	( )
6.	3	Electric motor-driven, explosion-proof fan: a. One located on floor. b. One located in substructure. c. Shale shaker.	( ) ( ) ( )
7.	1	Prescribed BOP assembly, choke manifold, gas separator, etc., as shown in Safe Practices Manual for Drilling and Well Servicing Operations, Volume I.	( )
8.	1	Air line breathing unit with emergency egress air supply and airline on monkey board.	( )
9.	6	Air line breathing unit with emergency egress air supply and airlines on rig floor.	( )
10.	3	Air line breathing unit with emergency egress air supply and airlines at mud tanks.	( )
11.	3 (6 bottle)	2,300 psi breathing air systems. One system for the rig floor crew, another for the Driller, Shell foreman and monkey board, and the third for the mud tanks and choke manifold.	( )
12.	3 (6 bottle)	2,300 psi breathing air, cascade-charging system for refilling empty air cylinders.	( )
13.	4	Plastic weatherproof holder containing emergency telephone numbers and map of area showing local residences located at: a. Rig bulletin board. b. Drilling Foreman's office. c. EE trailer. d. Spare copies.	( ) ( ) ( ) ( )

Drilling Foreman's Checklist (Cont.'d)

ITEM	QUANTITY	DESCRIPTION	O.K.
14.	1 or 2	Continuous H2S monitor(s) with detectors at the shale shaker, drilling console, and bell nipple. A yellow strobe light set to be activated at 10 ppm, a red strobe light set to be activated at 15 ppm, and an audible alarm (horn, siren) activated at 15 ppm.*	( )
15.	2	Completed copies of checklists mailed to Superintendent and S.E.C.: a. Foreman's checklist. b. EE equipment checklist (when initially placed on location).	( ) ( )

NOTE: All breathing equipment, not located in the E.E. trailer, must be stored in protective cases, rig floor mud tanks, etc.

*Lights must be visible from all areas on the location. Audible alarm must be able to generate enough sound to be heard at any location on the drilling pad.

Date: _____

Drilling Foreman: _____

EMERGENCY EQUIPMENT TRAILER CHECKLIST

ITEM	QUANTITY	DESCRIPTION	CHECK IF O.K.
1.	8	Self-contained breathing units (30-minute supply).	( )
2.	4	Spare cylinders for self-contained breathing units (30-minute supply).	( )
3.	10	Airline units with egress air supplies.	( )
4.	7	Spare cylinders (8 minutes).	( )
5.	3	Fill hose with tank gauge.	( )
6.		40 tees, 40 whips, 5 regulators and 3 "Y" connectors.	( )
7.	5	Manifold air regulators 2,300-100 psi.	( )
8.	6	100' lengths air hose (100 psi working pressure).	( )
9.	8	30'-50' length of air hose (100 psi work pressure) connected to air connection on rig floor (for driller and other personnel).	( )
10.	2	Resuscitators with positive pressure valves.	( )
11.	2	Spare oxygen cylinders (for resuscitators).	( )
12.	3	Portable hand-operated H2S/SO2 detectors. H2S tubes 0-600 ppm - 4 boxes SO2 tubes 0-200 ppm - 2 boxes	( ) ( ) ( )
13.	1	Explosimeter.	( )
14.	1	25 MM flare gun with 24 meteor-type flare shots.	( )
15.	2	Supported danger "Poisonous Gas," "Authorized Personnel Only" signs with 2 blinker lights each.	( )
16.	1	Road barricade with blinker lights.	( )
17.	3	"No Smoking" signs.	( )
18.	3	Sets of wind socks.	( )
19.	5	Weatherproof plastic envelopes to contain: a. List of emergency phone numbers. b. Map of general area with residences noted.	( ) ( )

EXHIBIT 4

Emergency Equipment Trailer Checklist (Cont.'d)

ITEM	QUANTITY	DESCRIPTION	O.K.
20.	2	Sets (3 each) of condition warning flags with mounts and condition warning explanation sign. CONDITION I - YELLOW CONDITION II - ORANGE CONDITION III - RED	 ( ) ( ) ( )
21.	2	First-aid kits (complete).	( )
22.	1	Pneumatic splint sets.	( )
23.	1	Strokes litter.	( )
24.	4	Fire extinguishers 30#, dry chemical.	( )
25.	10	Copies of each blank form: a. Drilling Foreman's Checklist b. EE Trailer Checklist	( )
26.	15	Copies of map of local area (from Construction Section).	( )
27.	2	500' lengths of retrieval rope (1,000# test).	( )
28.	3	Walkie-Talkie radios.	( )
29.	3	Flashlights with batteries (waterproof and explosion proof).	( )
30.	1	Disinfectant and cleaner for breathing equipment.	( )
31.	1	Breathing equipment and air supply inspection record book.	( )

EXHIBIT 5

TABLE A.1

CONCENTRATION IN AIR

Percent by Volume	Parts per Million By Volume	Grains per 100 Std. Cubic Feet	Milligrams Per Cubic Meter*1	Typical Characteristics Regarding Hydrogen Sulfide Exposure*2
0.000013	0.13*3	0.008	0.18	Obvious and unpleasant odor generally perceptible at 0.13 ppm and quite noticeable at 4.6 ppm. As the concentration increases, the sense of smell fatigues and the gas can no longer be detected by odor.
0.001	10	0.63	14.41	Unpleasant odor. Possible eye irritation. ACGIH recommended Threshold Limit Value (TLV)® (eight-hour TWA).*4
0.002	20	1.26	28.83	Burning sensation in eyes and irritation of the respiratory tract after one hour or more exposure. Acceptable ceiling concentration permitted by Federal OSHA Standard *29 CFR 1910.1000*, Table Z-2 (check latest edition).
0.005	50	3.15	72.07	Loss of sense of smell after about 15 or more minutes exposure. Acceptable peak concentration permitted by Federal OSHA Standard (*29 CFR 1910.1000*, Table Z-2, check latest edition) *once only* for 10 minutes per eight-hour shift, if no other measurable exposure occurs. Exposure over one hour may lead to headache, dizziness, and/or staggering.*5 Pulmonary edema reported following extended exposure to greater than 50 ppm.*6 Exposure at 50 ppm or greater can cause serious eye irritation or damage.
0.01	100	6.30	144.14	Coughing, eye irritation, loss of sense of smell after 3 to 15 minutes. Altered respiration, pain in eyes, and drowsiness after 15 to 20 minutes, followed by throat irritation after one hour. Prolonged exposure results in a gradual increase in the severity of these symptoms.
0.02	200	12.59	288.06	Impairs the sense of smell rapidly. Burns eyes and throat. At concentrations between 250 and 500 ppm, pulmonary edema, which can be life-threatening, almost always occurs.*7
0.05	500	31.49	720.49	Unconsciousness after short exposure, cessation of breathing if not treated quickly.*8 Dizziness, loss of sense of reasoning and balance. Victims need prompt artificial ventilation and/or cardiopulmonary resuscitation techniques.
0.07	700	44.08	1008.55	Unconscious quickly. Breathing will stop and death will result if not rescued promptly. Artificial ventilation and/or cardiopulmonary resuscitation is needed immediately.
0.10+	1000+	62.98+	1440.98+	Unconsciousness at once. Permanent brain damage or death may result. Rescue promptly and apply artificial ventilation and/or cardiopulmonary resuscitation.

(Continued on next page.)

EXHIBIT 6

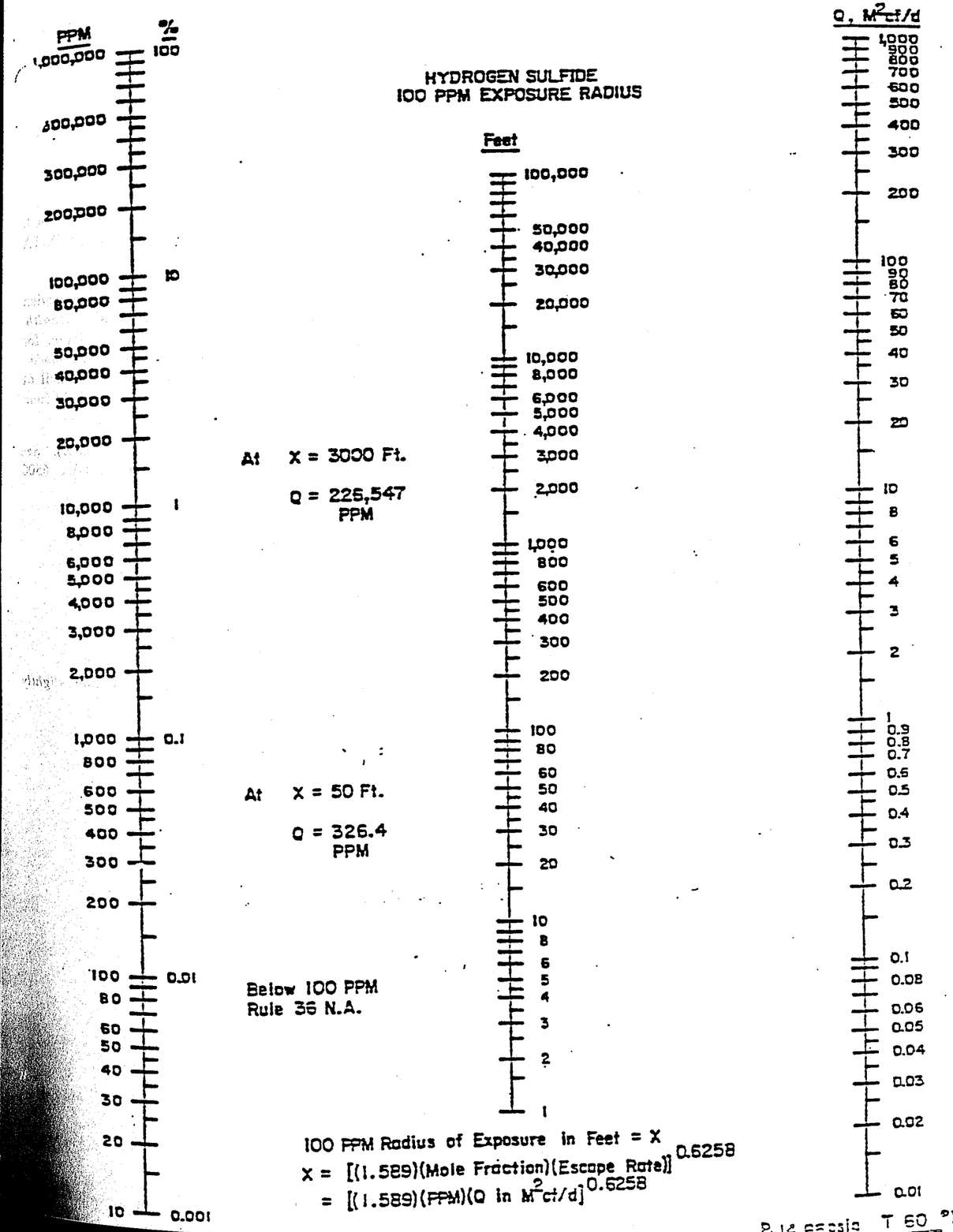


TABLE A.1 CONTINUED

NOTES:

*1 Based on 1% hydrogen sulfide = 629.77 gr/100 SCF @ 14.696 psia and 59 F, or 101.325 kPa and 15 C.

*2 Hydrogen sulfide has physiological effects on humans. These effects vary from person to person. FOR ADDITIONAL INFORMATION, CONSULT WITH THE EMPLOYER AND RESEARCH THE MATERIAL SAFETY DATA SHEETS (MSDS).

*3 There are wide variations in reported odor thresholds for hydrogen sulfide. A U.S. Environmental Protection Agency (EPA) draft report states a range for the odor threshold of 0.1 - 0.2 ppm (refer to Review Draft: *Health Assessment Document for Hydrogen Sulfide, EPA/600/8-86/026A*, August 1986). A Petroleum Association for Conservation of the Canadian Environment (PACE) report, *Review of Ambient Hydrogen Sulphide Standards in Canada, No. 85-5*, December 1985, cites an odor threshold range of 0.005-0.05 ppm from the National Resource Council of Canada (1981) at Table 3.1 (page 3-10). The PACE document also cites reports of wider ranges of odor threshold from 0.0005-1.4 ppm at Table 4.1 (page 4-4).

*4 "TLV" is a trademarked term of the American Conference of Governmental Industrial Hygienists (ACGIH). See *Threshold Limit Values and Biological Indices for 1985-86* and companion documents available from ACGIH, 6500 Glenway Ave., Bldg. D-7, Cincinnati, Ohio 45211. Check latest edition.

*5 PACE Report, supra Note *3, Table 3.1, page 3-10.

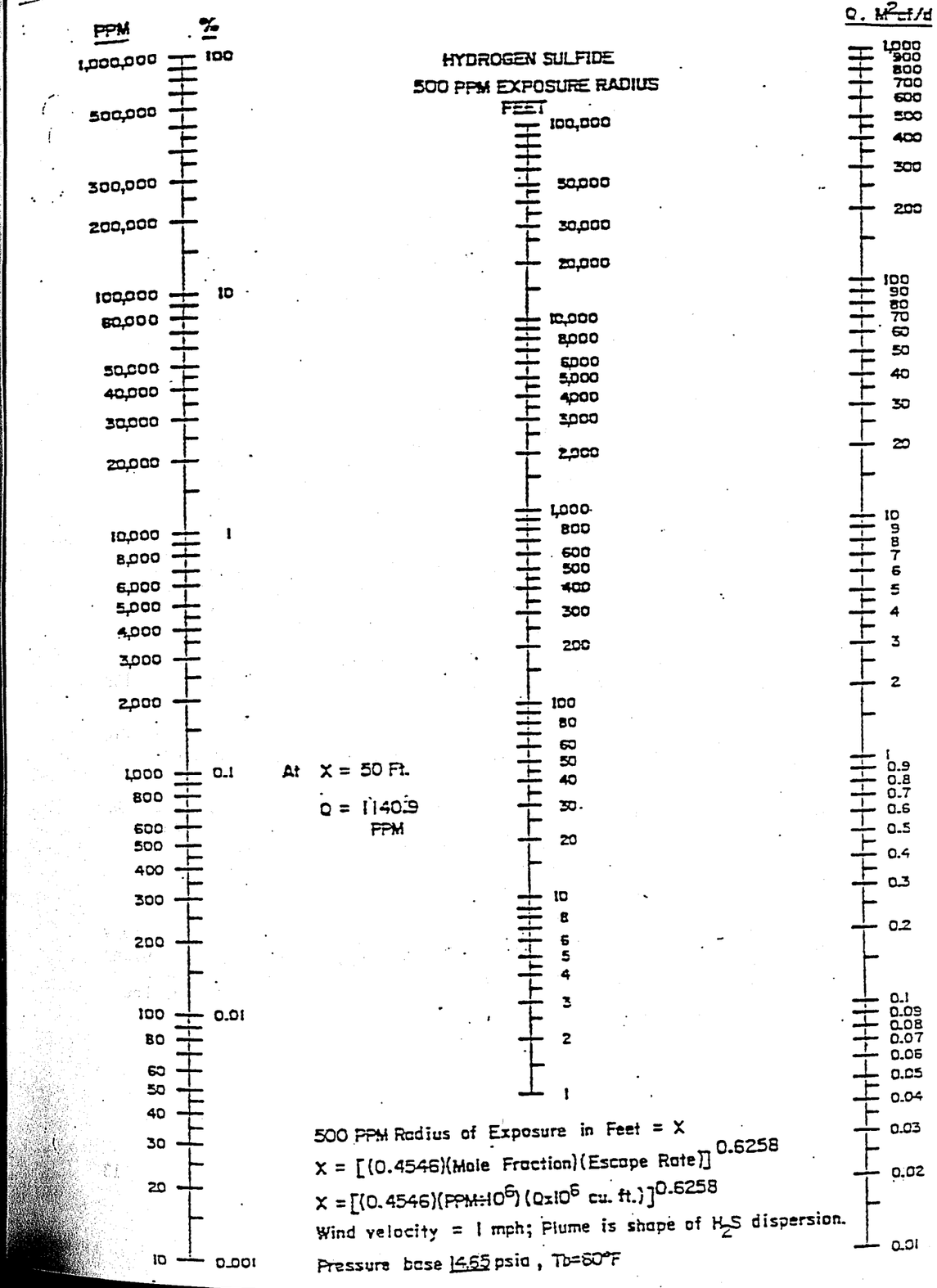
*6 EPA Draft Review Document, supra Note *3, pages 1-2.

*7 Ibid.

*8 PACE Report, supra Note *3, Table 3.1, page 3-10.

NOTE: *Data in Table A.1 are approximate values for guidance. There are published charts which show slightly different values.*

EXHIBIT 7



PUBLIC PROTECTION PLAN

X. DISCUSSION

In the event of an H2S gas release which threatens the public or nearby personnel, evacuation may be required. However, as previously noted, there are no residents within a 3 miles radius of the proposed Miccosukee #2-2 site. Evacuation plans are therefore directed at the two worksites within a 2 mile radius and Interstate Highway 75 (Alligator Alley). Exhibit 9, Evacuation Map is provided to assist should evacuation be necessary.

Calculations show that 500 ppm, 100 ppm, and 15 ppm radius of exposure for H2S in a gas stream are respectively 70', 150', and 510' for the proposed well. However, in the event that gas release greatly exceeds these estimates, procedures outlined in **Gas Release Conditions** should be followed. This includes notification of local authorities and SWEPI personnel provided in Exhibit 8, Emergency Telephone List and in SWEPI's Emergency Response Plan.

XI. EVACUATION

As shown on Exhibit 9, Evacuation Map, dangerous levels of H2S could require evacuating Interstate Highway 75 in the vicinity of the well (1), personnel working at the South Florida Water Management District L-28 Canal Pump Station (2), or the levee road along the side of the L-28 Canal which connects the two, dependent upon wind direction.

The closest "public" location would be on the aforementioned levee road. The road is approximately 490' away from the proposed well at its closest point and any traffic would be clearly visible. It would be necessary to contact the Florida State Highway Patrol and/or the Broward County Sheriff's Department for control or diversion of traffic on the levee road and I-75. Exhibit 8 provides telephone numbers for this possibility.

The remaining potential evacuees within a 3 mile radius would be at the Miccosukee Service Plaza (3), intersection of Snake Road and I-75. This facility is approximately 1.6 miles from the well site. Exhibit 10, Evacuation Telephone Numbers, provides telephone numbers for contacting the evacuation locations.

As previously noted, the SWEPI Foreman is responsible for implementation of the PUBLIC PROTECTION PLAN as well as the CONTINGENCY PLAN. He or his designated representatives shall carry out these plans until assistance is available thru implementation of SWEPI's Emergency Response Plan. A copy of this plan will be available on site for the Foreman's reference.

XII. APPENDIX B (EXHIBITS)

EMERGENCY TELEPHONE LIST

NAME	TELEPHONE NUMBER	
ALL EMERGENCIES	-------- 911 --------	
LOCAL AGENCIES AND CONTACTS		
Broward County Sheriff's Office	305-765-8900	
Broward County (Fire & EMS)	305-357-8201	
Florida Highway Patrol	305-524-6307	
Florida Department of Transportation	305-524-8621	
Miccosukee Tribe of Indians of Florida	305-223-8380	Days
(Automobile Number - S. Terry)	305-342-1224	
(Home Number - S. Terry)	813-455-0785	After Hours
Miccosukee Tribe Police Department	305-223-1600	
Big Cypress Seminole Police Department	813-983-2285	
REGULATORY AGENCIES		
Department of Environmental Regulation	407-689-5800	
Bureau of Land Management	601-977-5400	Days
(Home Number - U.J. Parikah) (Chief Oil & Gas Section)	601-825-7272	After Hours

MEDICAL ASSISTANCE
(Dialing 911 is the correct procedure for assistance. The following are provided for reference)

Ambulance	Broward County EMS (air transportation available)	305-357-8253
	Collier County EMS (air transportation available)	813-775-8900
Hospital	Broward General Medical Center	305-355-4400
	Plantation General Hospital	305-587-5010
	Naples Community Hospital	813-263-5151
Crescent Aviation (private helicopter service)		305-987-1900

EXHIBIT 8

CONTINUED

SWEPI PERSONNEL - HOUSTON
(The Emergency Response Plan contains a complete list of SWEPI contacts. The following are provided specifically for this plan.)

NAME	TITLE	WORK PHONE	HOME PHONE

THESE NAMES WERE PROVIDED TO THE BUREAU OF LAND MANAGEMENT BUT ARE NOT INCLUDED IN THIS PUBLIC DOCUMENT.

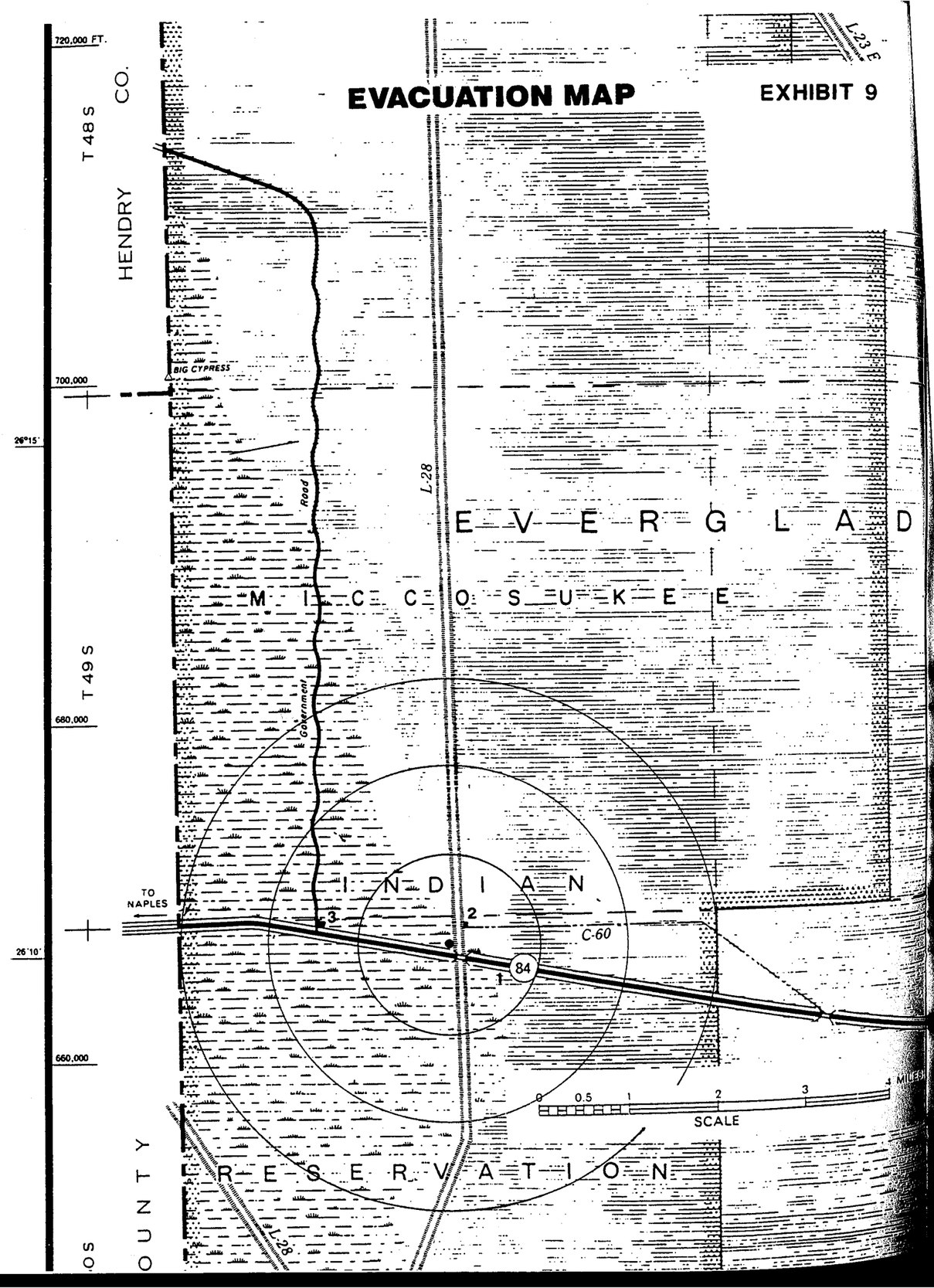


EXHIBIT 10

EVACUATION TELEPHONE NUMBERS
(Reference Exhibit 9)

	EVACUATION POINT	TELEPHONE NUMBER
1.	Interstate Highway 75 (State Highway 84)	524-6307 (Florida Highway Patrol) 765-8900 (Broward Co. Sheriff's Dept.)
2.	South Florida Water Management District Pump Station (L-28 Canal @ I75)	407-346-6695
3.	Miccosukee Service Plaza (Snake Road @ I75) Lomax Wallace - Manager	813-568-8099 813-396-0596

PUBLIC PROTECTION PLAN

X. DISCUSSION

In the event of an H2S gas release which threatens the public or nearby personnel, evacuation may be required. However, as previously noted, there are no residents within a 3 miles radius of the proposed Miccosukee #3-1 site. Evacuation plans are therefore directed at the two worksites within a 2 mile radius and Interstate Highway 75 (Alligator Alley). Exhibit 9, Evacuation Map is provided to assist should evacuation be necessary.

Calculations show that 500 ppm, 100 ppm, and 15 ppm radius of exposure for H2S in a gas stream are respectively 70′, 150′, and 510′ for the proposed well. However, in the event that gas release greatly exceeds these estimates, procedures outlined in **Gas Release Conditions** should be followed. This includes notification of local authorities and SWEPI personnel provided in Exhibit 8, Emergency Telephone List and in SWEPI's Emergency Response Plan.

XI. EVACUATION

As shown on Exhibit 9, Evacuation Map, dangerous levels of H2S could require evacuating Interstate Highway 75 in the vicinity of the well (1), personnel working at the South Florida Water Management District L-28 Canal Pump Station (2), or the levee road along the side of the L-28 Canal which connects the two, dependent upon wind direction.

The closest "public" location would be on the aforementioned levee road. The road is approximately 490′ away from the proposed well at its closest point and any traffic would be clearly visible. It would be necessary to contact the Florida State Highway Patrol and/or the Broward County Sheriff's Department for control or diversion of traffic on the levee road and I-75. Exhibit 8 provides telephone numbers for this possibility.

The remaining potential evacuees within a 3 mile radius would be at the Miccosukee Service Plaza (3), intersection of Snake Road and I-75. This facility is approximately 1.6 miles from the well site. Exhibit 10, Evacuation Telephone Numbers, provides telephone numbers for contacting the evacuation locations.

As previously noted, the SWEPI Foreman is responsible for implementation of the PUBLIC PROTECTION PLAN as well as the CONTINGENCY PLAN. He or his designated representatives shall carry out these plans until assistance is available thru implementation of SWEPI's Emergency Response Plan. A copy of this plan will be available on site for the Foreman's reference.

APPENDIX A-4

ARCHEOLOGY REPORT

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An Assessment of Potential Impact to Archaeological Resources by the Proposed Shell Oil Drilling on the Miccosukee Indian Reservation Drill Site, Broward County, Florida

By
Robert S. Carr
Archaeological Consultant
P.O. Box 450283
Miami, FL 33145

February, 1990

Consultant Summary

This report is in response to T.A. Herbert & Associates' letter of January 31st, 1990, regarding a request for a determination of potential impacts to cultural resources from the proposed location of a 4 acre drilling pad to be located on the Miccosukee Indian Reservation.

It is the consultant's opinion, based on previous surveys of archaeological resources of the project area, specifically within the Everglades and the Big Cypress, and most recently acting as principal investigator for the Shell Big Cypress Seismic Project (Allerton and Carr 1988) that the proposed drilling site can be used with no adverse impact to any archaeological sites including those that might be considered eligible for listing on the National Register of Historic Sites. The basis for this opinion is provided in the subsequent sections.

Previous Research

Although both the Big Cypress National Preserve (Ehrenhard, Carr and Taylor 1978, 1979; Ehrenhard and Taylor 1980; Ehrenhard, Taylor and Komara 1980; Taylor 1980; Taylor and Komara 1983) and the Everglades National Park (Goggin 1950, 1952; Griffin 1976; Ehrenhard, Komara and Taylor 1982; Taylor 1984) have been extensively surveyed by archaeologists, minimal archaeological work had been performed in the area of the Shell Seismic Exploration (Permit G81-86), which is north of the Big Cypress Preserve and along the western portion of Water Conservation Area 3A. The Broward County Archaeological Society visited the area by airboat and recorded at least two sites there (8BD61, 8BD42) in the mid-1960's. In addition, two professional archaeological surveys have been performed in this area: a right-of-way survey of I-75 by Calvin Jones in 1977 resulting in the discovery of several sites (8CR158, 8CR159, 8CR160, 8BD184, 8BD185, 8BD186, 8BD261, 8BD262) and a survey of the L-1, L-2, L-3, L-4, and L-28 Interceptor Canal and levee systems by Deming (1977).

A locational model for sites in South Florida devised by Carr (1974) and later refined by Taylor for the Big Cypress targets "hardwood tree islands in relation to deep ponds and sloughs" (1980:50). Sites are found "on that portion of the hammock island opposite the deepest slough or pond that is adjacent to the island" (Ehrenhard, Carr and Taylor 1978:13-14).

Predictive Site Model

Sites located during the surveyed traverses through the Big Cypress and the Western Everglades suggest a definite settlement pattern in that area. A predictive settlement model is proposed based on the data recovered during the seismic survey. The proposed prehistoric settlement model of the Big Cypress postulates that sites are located on upland areas adjacent to or within a constant drainage flow and are within or immediately adjacent to areas that maintain an adequate water level during cycles of low water. The pre-drainage mean low water level can be used as a criterion for site location. Areas that held flowing water during the mean low levels will contain a site in the nearest adjacent upland. There is reason to believe that this model may be explained by Amerindian exploitation of the Big Cypress and contiguous areas during periods of low water, possibly suggesting seasonal use of the biota and resources of that area. Seasonal exploitation will be discussed fully and documented later in this section.

The same settlement model can be applied to the Everglades, but since sheet flow is less localized in the Everglades, the pattern is less apparent. Observations in the western Everglades by the author suggest that certain tree islands were selected because the islands were located near or on sloughs. Sites were located in areas where a clay-like substrate was near the surface and the vegetation, at present, included a fair number of non-persistent emergents such as pickrelweed and

arrowhead. It is hypothesized that the clay-like substrate provided an impermeable layer that allowed retention of water possibly creating a slough or swale. Since these areas are less dominated by sawgrass, water may have flowed with less resistance creating a stronger local drainage flow.

Ehrenhard, Carr and Taylor have documented that sites in the Big Cypress are located "on that portion of the hammock island opposite the deepest slough or pond that is adjacent to the island" (1978: 13-14). This site model agrees with the data gathered during the Shell Oil survey (Carr and Allerton 1988). Sites were located adjacent to basin marshes (i.e. 8CR682) and sloughs (i.e. 8BD1435, 8BD1436, 8BD1437, 8HN41). In the Everglades, sites are consistently located on tree islands and most often on the north end. The distribution of the archaeological sites in the surveyed area suggests that several physiographic attributes affect site location. Two physiographic factors are strongly correlated to site location based on the archaeological data recovered and the environmental features observed during the Shell seismic survey. These factors are drainage flow and the cypress/sawgrass ecotone. The cypress/sawgrass ecotone is the boundary between the sluggish but constant sheet flow of the Everglades and the slow, irregular overland drainage of the Big Cypress. Thus, this ecotone may be considered as having a specialized drainage pattern. A reconstructed vegetative map of this area, prepared by the Center

for Wetlands at the University of Florida, shows the vegetative pattern of South Florida at the beginning of this century and indicates that the ecotone consisted of marshes and sloughs interspersed with sawgrass marsh. Numerous hardwood hammocks were located in these mixed marshes and sloughs. These marshes, which were located near the border of Broward and Collier counties, were caused by the sheet flow from the northeastern Big Cypress.

Project Archaeological Review Assessment

The proposed drill site on the Miccosukee Indian Reservation in western Broward County is located on a 485' by 465' rectangular plot adjacent to I-75. An aerial photograph of the project area indicates the plot includes no tree islands. The tree island is the principal land form associated with archaeological sites in the Everglades (see previous section).

The wetlands character and absence of tree islands within the 4 acre project area precludes the need for systematic subsurface field testing. The regional predictive site model indicates that no sites should occur or be expected to occur within the project area.

Other tree islands with archaeological sites do occur within one mile of the proposed drill site, and all support facilities, pipelines, roads, and areas of equipment storage should avoid impacting any tree islands. If tree islands are avoided by the support activities of this proposed drill project, then no adverse impact to any archaeological sites, including any significant historic resources considered eligible for listing on the National Register of Historic Sites, is expected to occur.

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APPENDIX A-5

VEGETATION REPORT

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Vegetation at a Western Broward Site

by

Ronald Hofstetter, Ph.D.
8325 SW 116 Terrace
Miami, Florida 33156

5 December, 1989.

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INTRODUCTION

This study was undertaken to provide information on the existing vegetation at a site located in the eastern half of Section 3, T50S, R35E, which lies in the northwest quadrant formed by the intersection of the L28 Canal and the Everglades Parkway ("Alligator Alley", SR 84), in western Broward County. This property is on the Miccosukee Indian Alligator Alley Reservation (Fig. 1).

Historical Perspective

Historically the study area was in the transition zone between the western edge of the Everglades and The Big Cypress. It is located on or near the border of Davis' (1943) "Sloughs, Ponds and Lakes" part of the "Saw-grass Marsh" of Type VI "The Everglades and Other Fresh-Water Marshes" and the "Western Bordering Wet Prairies" of Type VIII "Wet-Prairies"; and on the border between Craighead's (1971) Province VII -"Tree Island Everglades" and Province VIII - "Hammock and Cypress Ridge".

The Everglades today is smaller in size, different in surficial sediments and biological characteristics than the wetland ecosystem that it was in the mid 1800's, before European man's intervention. This site is no longer the graminoid marsh it may once have been. Following is a brief summary of some of the historical factors and events that have effected this change.

In the 1890's they began to construct canals in the upper part of the Everglades for the purpose of draining this vast wetland complex. One of these canals, the Miami Canal, was dug from the upper reaches of the Miami River northwest across the Everglades towards Lake Okeechobee by the late 1920's. This and other initial drainage canals diverted significant amounts of surface water from the upper Everglades basin to the east. The reduction in surface water resulted in increased exposure, subsequent decomposition, mineralization and subsidence of the surficial organic sediments. The thickness of organic soils has been reduced to various degrees, depending on location. Additionally, fibrous sawgrass peats that were common throughout the upper Everglades in the 1940's (Jones, 1948) have been replaced by amorphous mucks through decomposition (McCollum, et al., 1976). Associated in part with the prolonged exposure of organic sediments and the increased occurrence of man-caused dry-season fires, the soil surface was lowered further by ground fires. Later modifications to the shore of Lake Okeechobee, construction of additional canals for flood control, and control of water releases continued to cause changes in hydrologic conditions in the Everglades. By 1963 L28 had been completed, marking the western edge of Conservation Area 3A.

With increasing growth of the human population came the need for an additional road connecting the east and west coasts of southern Florida. The Everglades Parkway, commonly called "Alligator Alley" (SR 84) was constructed in the middle 1960's to supplement the more southerly Tamiami Trail (U.S. Hwy. 41), which was constructed almost four decades earlier. This Parkway has locally altered hydrologic conditions, but to a degree not quantified. Water from the study site can drain into the swale/-canal along its northern side of the highway. Thus, with the completion of the L28 canal and SR 84 by the mid 1960's, the study site probably has a further reduced hydroperiod resulting from drainage more rapid than would occur in the absence of these two features. This road also provides appreciably increased ease of access to the large northern part of the Everglades. Numbers of hunters and, to a lesser extent, fishermen and hikers have undoubtedly increased in numbers and activity in this part of the interior Everglades. The high incidence of fires there may be related to the increase in these activities. Ground fires have been common in the upper, drier part of Conservation Area 3A in the droughtier years of the 1970's and 1980's.

Clearly the hydrologic conditions over much of the historical Everglades basin are no longer natural. Hydroperiod (period of saturation or inundation), water depths, and patterns of water level fluctuations are primary in determining the character of wetlands (Cowardin, et al., 1979). In southern Florida fire (frequency, intensity, and seasonal timing) ranks second in importance in determining wetland conditions (Wade, et al., 1980). When these conditions and forces are altered, eventually the plant communities and animal populations will also be, as will be the sediments. The study area has experienced such changes in habitat conditions and forcing functions, and the vegetation today reflects some of that change.

PRESENT SITE CONDITIONS

General Conditions

The study site is an area about 900-meters (1000 feet) square, bounded on the east by a somewhat elevated roadbed on the immediate west side of the Miami Canal. The south boundary is the swale-canal, which lies along the north edge of the SR 84 embankment. The western and northern boundaries were arbitrarily set by others. The land surface of the study site is relatively flat, with two shallow depressions, one along the north edge, the other along the west edge. A shallower, less distinct depression occurs southeast of the western depression. No surface water was observed within

the site during the study, although surficial sediments were damp in the lower areas, especially the willow-myrtle heads.

Most of the site has a soil classified as "Hallandale fine sand". The depressions contain "Chobee muck" and are partially encircled by "Jupiter fine sand". A copy of the Soil Survey (Soil Conservation Service, 1987) is appended.

In the 1970's much of this site was converted into improved pasture land for cattle through the process of discing the existing vegetation followed by planting of Hemarthria altissima (green alta) (Steve Terry, pers. com.). Cattle have been walking and grazing in the area recently.

Vegetation

For purposes of preparing this report I examined the vegetation at this site on November 7 and December 3, 1989. An attempt was made to determine all macro plant species present and a list was prepared (Table 1). Plants were identified primarily according to Godfrey and Wooten (1979, 1981), and secondarily according to Long and Lakela (1971). These species were also identified as to their status on the "National List of Plant Species That Occur In Wetlands: Southeast (Region 2)" (Reed, 1988) and on the Florida Department of Environmental Regulation Administrative (R. 10/89) "Water Quality Standards, Part II Definitions" 17-3.021 and 17-3.022, and Florida Administrative Code, 1987, Rule 17-4.02 "Definitions" (Table 1). Wetland-identification criteria for Broward are also appended, as are the Florida and Federal criteria.

Plant communities were identified at ground level and their boundaries were drawn on a blue-line copy of an aerial photograph (scale 1 cm. = 18.2 m.; 1 in. = 150 ft.) that was taken in March, 1989 (Fig. 2). Cover estimates were made for the more prevalent species at numerous locations within each of the communities. It is important to appreciate that cover values are influenced by the character (growth form, stage of growth, color and texture) of each species, and by the size of the sampling area. In graminoid-dominated communities, cover is usually determined with quadrats of one-square meter or less. If tussock-forming (i.e. clumped) species (e.g. Spartina bakeri) are present, but distributed in a patchy manner, as in the study area, these species may have cover values from 0 to 100%, depending on the placement of the sampling quadrat. If a larger sampling area (e.g. 5 by 5 meters, ca. 16 by 16 ft.) is used in the determination, the cover values for these species are less varied within that range. In this study, because of the diffuse boundaries and character of the graminoid communities, I estimated cover values for as large an area that would permit replicates analyses for each community. These "sampling

areas" varied from about 4 to 9 square meters (ca. 35 to 100 square feet). The ranges of cover values reported here are therefore more restricted than would result if meter-square areas were assessed.

Community Types:

Identifying kinds of communities is usually easier than delineating the boundaries of these communities. At that scale of the photo some of the communities, particularly the willow-myrtle heads, are readily distinguishable from the adjacent graminoid communities because the image color and texture is different and the boundary is quite sharp. The boundaries between the various graminoid communities on the photo is not possible because these image distinctions are subtle or absent. This is a problem associated more with the character of the communities themselves than with the detail of the photo. Some of these communities are too small and numerous, and their boundaries are diffuse to mark them on the photo, although the cumulative area of each is not small. Because the transition from one community to the other is a broad gradient or a patch mosaic, a line boundary on the photo would be misleading and certainly subject to challenge.

Most of the study area is dominated by mixtures of graminoid species. The various communities in this diverse assemblage vary with location in composition and cover values of the combinations of other species. For convenience, the larger of these sub-divisions are described as separate communities, although the boundaries are commonly not distinct. The communities are named for the dominant species. One species, Hemarthria altissima (green alta), the planted forage species, is present essentially throughout and dominates large patches of the graminoid communities. One community, the Hemarthria-Sporobolus-Andropogon community, is dominated overall by Hemarthria with cover values between 40 and 75%, but within it are areas of much Sporobolus jaquemontii, with cover between 25 and 50%, but with smaller patches having up to 70% cover value. In this unit other common species that locally contribute up to about 30 and 15% respectively are Andropogon glomeratus and Eragrostis elliottii. The Sporobolus-Andropogon component of this community is visibly distinct in the field because of the highly visible inflorescenses of these species during the field work, but no clear distinction shows on the photograph. Throughout this community are scattered, individual plants of Myrica cerifera, which are generally small, up to about 1.2 meters (5 feet) tall. This low-shrub layer is estimated to have a cover value of 5% of the total community, but locally may be up to 20%. Other species found here are listed in Table 1. The vegetation in various locations in this heterogeneous community is relatively dense, with a total vegetative cover of above 90%, and with heights from approximately 0.7 to 1.3 meters (28 to 69 in.) tall. Specimens up to 3 meters (10 feet) tall of

Myrica are common in a belt about 20 meters (65 feet) wide on the north edge of the swale. There Myrica cover values are up to 100%.

Within the above community type, especially in the southeastern quarter, is another community, referred to in Table 1 as "Hemarthria grazed" (for lack of a better descriptor), of vegetation of reduced stature (mostly less than 0.2 meters [8 in.] tall). This community is also dominated by Hemarthria and has considerable species diversity. Some of the reduction in plant stature appears to be due to animal activities, particularly grazing; some due to mechanical disruption by vehicles. Seedlings, which are difficult to identify to species, are abundant. Some of these patches have considerable amounts Hydrocotyle umbellata, Cyperus spp., Commelina, Aeschynomene (chewed off close to the ground), and Crinum americanum (also eaten). Patches of bare sediment are common (locally as high as 25%) where the surface is most disturbed. Soil moisture content appeared somewhat higher here than in the preceding community. These patches are too numerous and small to show on the vegetation map, but on the photo they are somewhat distinguishable by a lighter color than the adjacent area.

Hemarthria is also a co-dominant/subdominant with Eleocharis cellulosa in a more hydric community. The Eleocharis-Hemarthria community is dominated by those two species, with dominance reciprocally varied from about 45 to 65%. The Eleocharis shoots extend above the more procumbent Hemarthria, while the terete stems of the former have a different visual impact than the flatter, laterally extended shoots and leaves of the latter. Consistent cover estimates were difficult to make, with values varying with angle of view and light direction. This community also contains Pontederia lanceolata, with cover locally up to 25%; Polygonum spp., with cover up to 20%; as well as Commelina defusa, and Hydrocotyle umbellata and several other species.

In the southeastern corner of the study area are two small, but distinct depressions dominated by Eleocharis cellulosa and Pontederia lanceolata, as well as having Ludwigia octovalvis and Typha sp.

Of the graminoid-dominated communities only in the Spartina community is Hemarthria not a significant vegetative component. In this community Spartina bakeri dominates, with cover values from 60 to 90%. The remainder of the cover is due to Andropogon, Desmodium spp., Urena, Hydrocotyle, Sida, Aster dumosus, and Ampelopsis in the more open patches between the Spartina clumps. This community occurs in two locations: a larger one northeast and a smaller one southeast of the west-boundary willow-myrtle (Salix-Myrica) head. Individual clumps or small aggregates of Spartina are scattered throughout the Hemarthria-dominated communities.

Dense stands of willow and wax myrtle shrubs dominate the interior parts of the shallow depressions on the southwestern and northern edges. In these "heads" Salix caroliniana, the overall dominant, and Myrica cerifera, the less wide-spread subdominant, are up to about 6 meters (20 feet) tall and have a combined cover estimated of up to 100% when willow is in leaf. The central parts of these heads were not examined in detail because they lie on the edge of the area of primary interest. Individuals of the ubiquitous exotic pest plant Schinus terebinthifolius also occur within these willow-myrtle heads, as well as along an old fence row that extends diagonally along the southwestern side of the head towards the southeastern corner.

Beginning within the outer edge of the shrub-dominated zone and extending outward a distance from 1 to 6 meters (3 to 20 feet) is a community (called the Ludwigia-Cladium community in Table 1) dominated by mixtures of Cladium jamaicense, Ludwigia octovalvis, Polygonum punctatum, Aster spp., Pontederia, Cyperus spp. (especially C. haspan), and locally Crinum, Thalia, and Panicum hemitomon. This community is highly variable in species composition with location.

The canal-swail along the south edge of the study area is completely choked with Eichhornia crassipes.

This study is a preliminary, rather than comprehensive one. The site was visited only twice and within the same season of one (rather atypical) year. A thorough survey of vegetation and community mapping requires that the site be examined several times throughout the year to pick up the seasonal species and to collect the various phenological stages of the plants that are necessary to make definitive identifications. Species composition, plant stature and cover are likely to vary to a degree throughout the year and from one year to another, depending on climate, hydrologic conditions, and, in this situation, on animal activity. Detailed vegetative sampling, which was not requested of this study, is required to delineate these complex community boundaries more clearly.

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Table 1. Vegetation of the Study Site: Species Abundances and Community Status

Species	Communities						Status	
	SM	LC	EH	Sp	HS	Hg	Fed.	FDER
Aeschynomene americana	-	-	-	o	f	f	FAC	
Ampelopsis arborea	-	-	-	f	o	o	FAC+	T
Andropogon glomeratus	-	-	-	a	a	-	FACW+	
Aster carolinianus	-	f	-	o	o	-	OBL	S
Aster dumosus	-	f	-	o	o	-	FAC	
Aster elliottii	-	a	-	-	-	-	OBL	S
Baccharis halimifolia	o	o	-	-	r	-	FAC	
Blechnum serrulatum	-	o	-	-	-	-	FACW+	S
Borreria laevis	-	-	-	o	-	o	FACW	
Centella asiatica	-	o	f	f	r	f	FACW	T
Cephalanthus occidentalis	-	r	r	-	-	-	OBL	T
Circium horridulum	-	-	-	-	r	r	FACW	
Cladium jamaicense	o	d	r	-	-	-	OBL	S
Commelina diffusa	-	-	-	r	-	f	FACW	
Crinum americanum	-	f	f	r	-	o	OBL	S
Cynanchum angustifolium	-	-	-	r	o	-	FACW	
Cyperus flavescens	-	-	-	-	-	f	OBL	
Cyperus globulosus	-	o	r	-	-	r	FAC	
Cyperus haspan	-	f	o	-	r	-	OBL	S
Cyperus rotundus	-	-	-	-	-	o	FAC-	
Desmodium canum	-	-	-	f	o	f		
Desmodium scorpiurus	-	-	-	o	r	r		
Dichromena colorata	-	o	o	-	r	o	FACW	T
Eichhornia crassipes	-	-	-	-	-	-	OBL	S
Eleocharis cellulosa	-	o	d	r	o	o	OBL	S
Eragrostis elliottii	-	-	-	r	a	-	FACW	
Eupatorium coelestinum = Conoclinium coelestinium	-	-	-	-	-	r	FAC	
Fimbristylis sp.	-	-	-	-	-	o	?	?
Fuirena squarrosa	-	-	r	-	o	r	OBL	S
Hedyotis sp.	-	-	-	-	-	-	?	?
Hemarthria altissima	-	r	a	o	d	d		
Hydrocotyle umbellata	-	o	o	o	r	a	OBL	T
Hypericum galioides	-	-	-	r	o	-	OBL	
Hyptis alata	-	-	r	r	r	-	OBL	T
Ipomoea sagittata	-	-	-	r	r	-	FACW	
Ludwigia octovalvis	a	d	o	r	o	r	OBL	S
Ludwigia virgata	-	r	-	r	-	-	OBL	T
Ludwigia sp.	-	-	-	-	-	o	?	?
Melothria pendula	-	-	-	-	-	r	FACW-	

Table 1 (continued)

Species	Communities SM	LC	EH	Sp	HS	Hg	Status Fed.	FDER
Mikania scandens	-	-	-	r	r	r	FACW+	S
yrica cerifera	d	f	-	r	f	r	FAC+	T
Osmunda regalis	r	o	-	-	-	-	OBL	S
Oxypolis filiformis	-	o	r	-	r	-	FACW+	S
Panicum hemitomon	-	o	-	-	-	-	OBL	S
Physalis arenicola	-	-	-	-	-	-		
Phytolacca americana	-	-	-	-	-	-	FACU+	
Pluchea odorata	-	r	r	r	-	o	FACW	S
Polygonum hydropiperoides	-	a	f	-	-	-	OBL	S
Polygonum punctatum	-	f	o	o	r	r	FACW+	S
Pontederia lanceolata	r	a	f	-	-	r	OBL	S
Rhynchospora odorata	-	o	-	-	-	-	OBL	
Sabal palmetto	-	-	-	-	r	-	FAC	0
Sagittaria lancifolia	r	-	-	-	-	-	OBL	S
Salix caroliniana	d	a	-	-	-	-	OBL	S
Schinus terebinthifolius	o	o	-	-	o	-	FAC	0
Setaria geniculata	-	-	r	o	f	r	FAC	
Sida acuta	-	-	-	f	r	o		
Spartina bakeri	-	-	-	d	r	-	FACW+	T
Sporobolus jacquemontii	-	-	-	a	a	-	NI	
Thalia geniculata	-	r	-	-	-	-	OBL	S
Thelypteris palustris = T. thelypteroides	-	o	-	-	-	-	FACW+	T
Typha domingensis	-	r	o	-	-	-	OBL	S
Urena lobata	-	-	-	-	-	-	FACU	

Community Types (abbreviated designation):
- SM: Salix-Myrica head
- LC: Ludwigia-Cladium
- EH: Eleocharis-Hemarthria
- Sp: Spartina
- HS: Hemarthria-Sporobolus-(Andropogon)
- Hg: Hemarthria, grazed

Status:
FED=Ranking in the National Interagency Species List for Southeast (Region 2) (Reed, 1988).
- OBL = Obligate Wetland [species that occur always (estimated probability >99%) under natural conditions in wetlands].
- FACW = Facultative Wetland [species usually occurring in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands].

Table 1 (continued)

- FAC = Facultative [species equally likely to occur in wetlands or non-wetlands (estimated 34%-66%)].
- FACU = Facultative Upland [species usually occurring in non-wetlands (estimated probability 67%-99%0, but occasionally found in wetlands (estimated probability 1%-33%)].
- "+" and "-" specify respectively the higher or lower part of the frequency range for a particular indicator.
- NI = No indicator [species for which an indicator status has not been determined].
- ? = identification not to species, no status determined

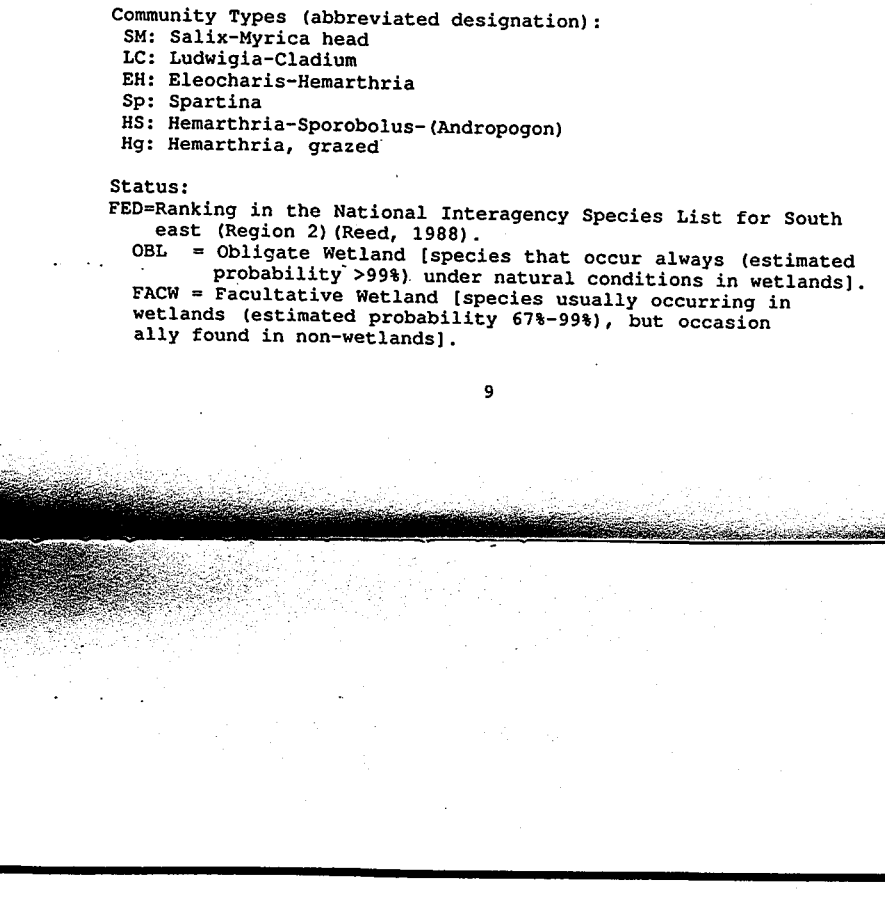
FDER=Ranking in the Florida Department of Environmental Regulation Wetland Species List,
- S = 17-3.022(2) "Submerged Species",
- T = 17-3022(3) "Transitional Species",
- 0 = 17-3022(5) [species that are not to be considered as Submerged, Transitional or Upland Species]

A blank in the "Status" columns indicates the species is not on the Federal list or FDER list respectively.

Abundance categories:
- d: dominant
- a: abundant
- f: frequent
- o: occasional
- r: rare

Species lacking community designation are associated with disturbed sites (levee margin, road bank, canal-swail)

FIGURE 1.—Map of south Florida showing features mentioned in the report.



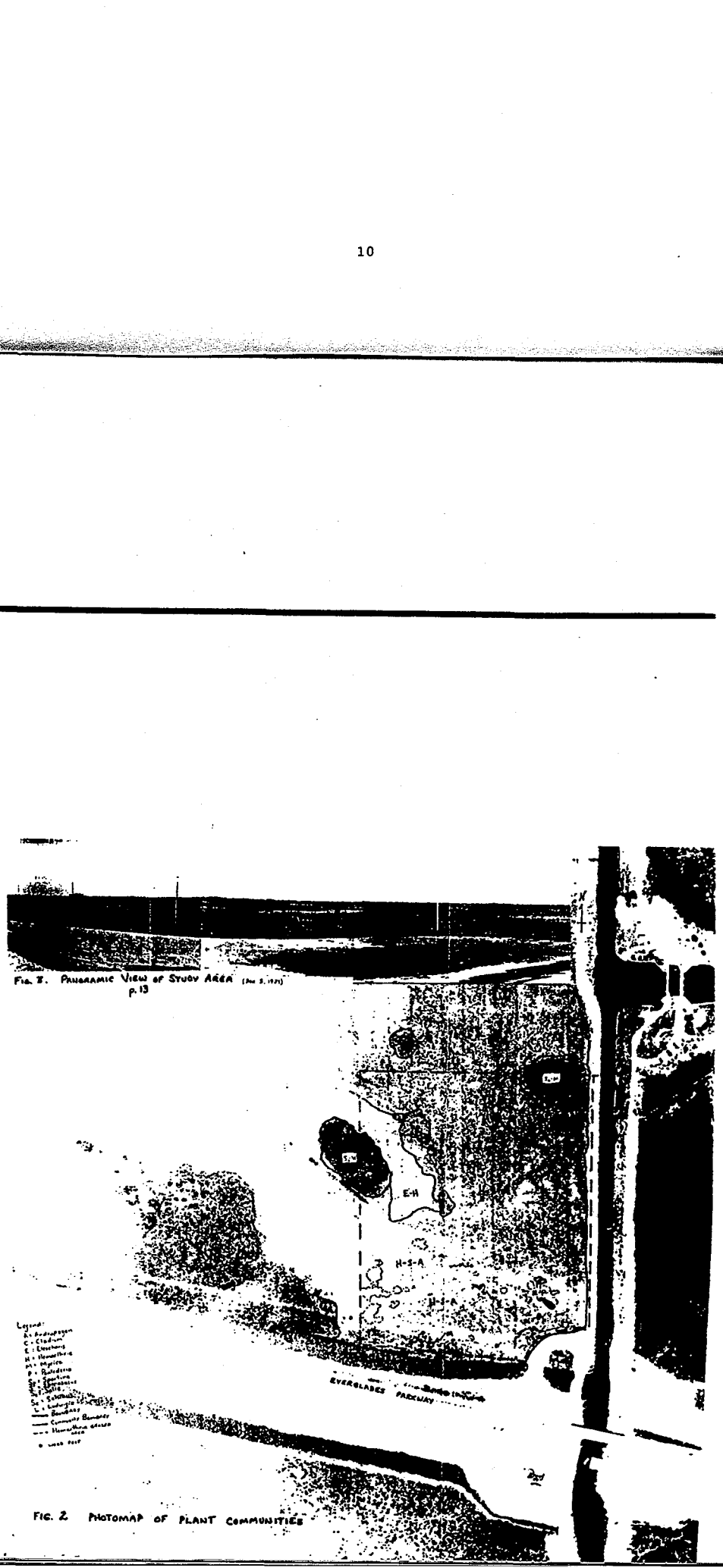
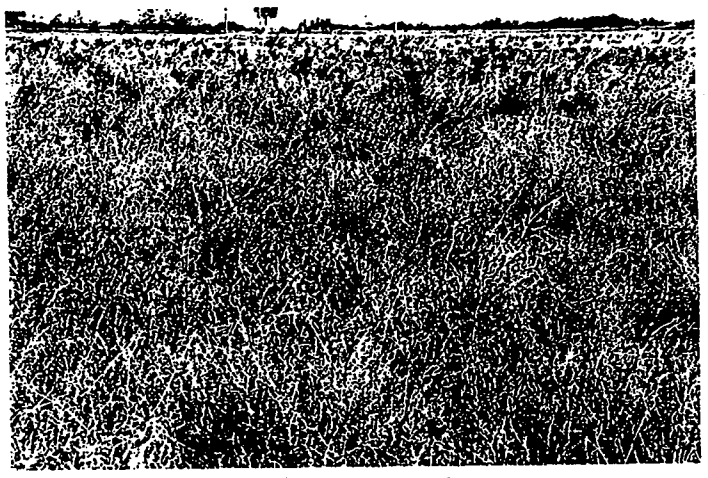


Fig. 4. Variation within the Hemarthria-Sporobolus-Andropogon community



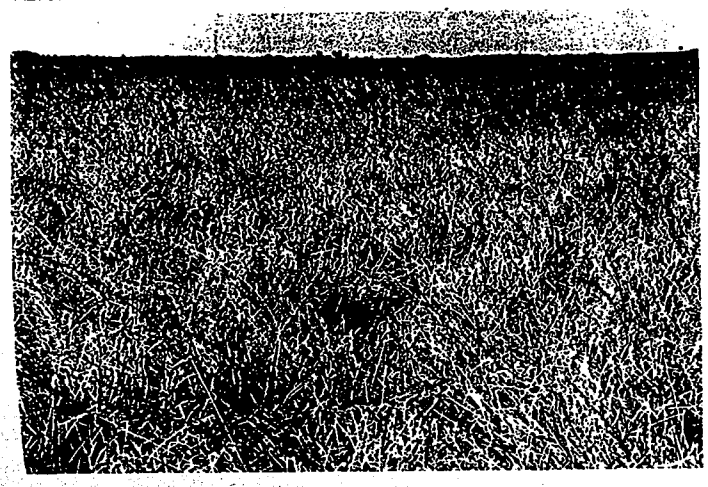


Fig. 5 "Hemarthria grazed" community (in patches among the Hemarthria-Sporobolus-Andropogon community).



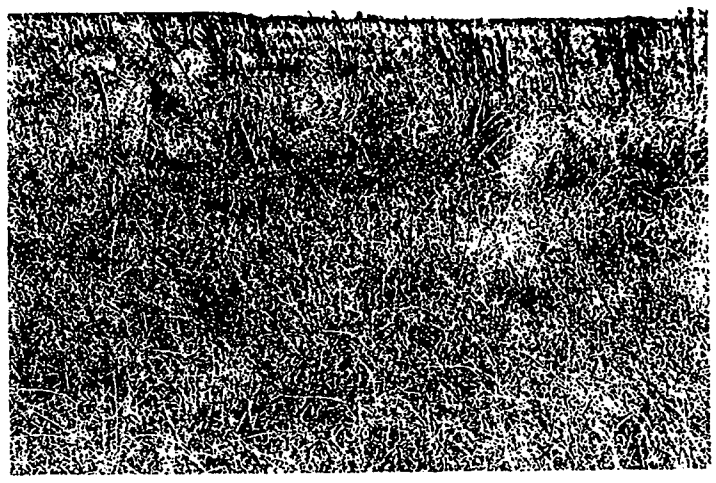
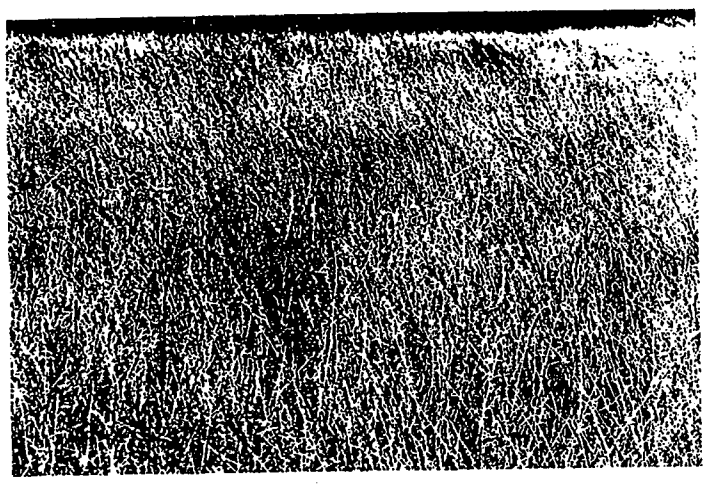


Fig. 6 Variation within the Eleocharis-Hemarthria community



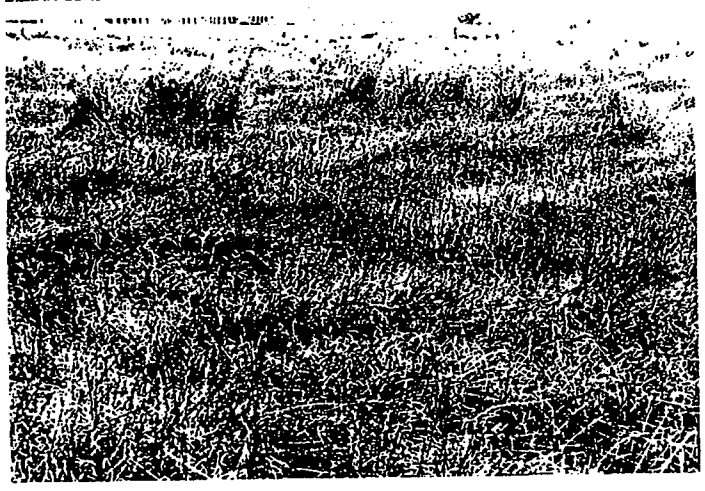
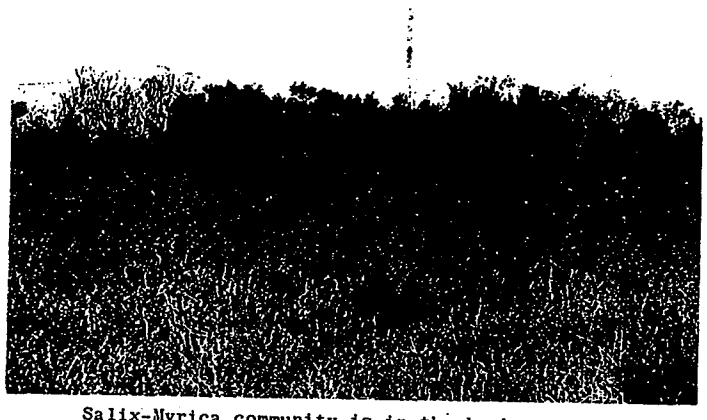


Fig. 7 Spartina community





Fig. 8 Salix-Myrica community ("head")



Salix-Myrica community is in the background,
Ludwigia-Cladium community is in midground,
Eleocharis-Hemarthria is in foreground.

Fig. 9 Ludwigia-Cladium community



Fig. 10. Schinus along the old fence



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APPENDIX A-6

HYDROLOGY REPORT

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HYDROLOGIC ASSOCIATES U.S.A., INC.
14707 South Dixie Highway, Penthouse #403, Miami, Florida 33176
Phone: (305) 252-7118 • Fax: (305) 254-0874

June 17, 1991

PUBLIC AFFAIRS
JUN21 1991

Mr. Dave Smith
Shell Western E & P Inc.
Woodcreek
P.O. Box 576
Houston, TX 77001

Dear Dave,

In the report, Preliminary Analysis of the Hydrologic and Geologic Characteristics of the Miccosukee Indian Reservation, prepared for SWEPI in January 1991, we reported that portions of the northwest quadrant of the reservation would be inundated an average of 55 days per year. This inundation analysis was based on water level data at USGS station C-54, on the western edge of the reservation, which is in an area unaffected by water management practices (drainage).

As requested, we have obtained additional data from the South Florida Water Management District based on the S-140 pump station which provides water levels of the L-28 canal immediately adjacent to the proposed drilling site. The water level duration data and a stage duration curve at the S-140 pump station (upstream) are provided for your use. These data provide information more representative of the water level conditions which may be encountered at the proposed drilling site.

The duration data represents nearly 8000 water level measurements collected since 1970. Although the data are not continuous, it is the best available. An inundation analysis of the proposed drill site was computed based on site specific land elevation averages of about 11.3 feet above sea level based on the surveying report provided by Coastal Engineering Consultants. This elevation and the duration data indicate that the area surrounding the site could flood an average of only 5.5 days per year. This is statistical average and further indicates that the days of consecutive flooding would be less than the 5.5 days per year.

Based on the enclosed data, the maximum height of water at the site under flooding conditions would be 1.0 foot, above land surface or statistically about 0.2 days per year. Because SWEPI will build a 4 foot berm surrounding the proposed site, there is virtually no possibility of flood waters encroaching the drilling site.

Sincerely,

Bradley G. Waller
Principal Hydrologist

cc: Mary Dokianos

HYDROLOGIC ASSOCIATES U.S.A., INC.
14707 South Dixie Highway, Penthouse #403, Miami, Florida 33176
Phone: (305) 252-7118 • Fax: (305) 254-0874

August 8, 1991

PUBLIC AFFAIRS
AUG15 1991

Mr. Dave Smith
Shell Western Oil E & P, Inc.
200 N. Dairy Ashford, Room 6560
P.O. Box 576
Houston, Texas 77079

RE: Volume Calculations on the Miccosukee Indian Reservation

Dear Dave,

Pursuant to our conversations and written responses to letters and newspaper articles, we feel that it is necessary to address another "what if" situation. The question has been brought up regarding "what if the containment berm is breached and liquid escapes." How much liquid can be held on the Reservation until surface overflow occurs into the Levee 28 canal? Water in the Levee 28 canal is the only source of potential surface flow into the Water Conservation Areas.

To address this question, we completed a field reconnaissance of the site to determine how surface water is currently discharged from the Reservation. The primary point of discharge is a stop-log culvert on the extreme southeast corner of the developed, northwest quadrant of the reservation, adjacent to Alligator Alley (I-75). This culvert discharges directly from the canal adjacent to Alligator Alley into the L-28 borrow canal. I suggested that as a further safeguard to spillage, we consider retrofitting the culvert to increase the potential stage (water level) at which overflow can occur from the Reservation to the L-28 canal. Of course, we would need to obtain the permission of the Miccosukee Tribe before we could retrofit any culvert. Currently, the culvert discharges at a stage of approximately 10 feet above sea level, based on field observations, rather than on quantitative measurements.

The question was posed as to what volume of liquid could be maintained on-site if the culverts were retrofitted with additional controls (stop logs) and water was held at higher elevations before discharge occurred into the L-28 canal. A recent topographic map published by Murray / Milleson was used in this analysis. This map shows that most of the developed portion (northwest quadrant) of the reservation is between 11 and 12 feet above sea level. A small portion in the southeast corner of this quadrant is between 10.5 and 11 feet above sea level.

The volume calculations were computed as follows. It was assumed that any liquid would spread uniformly over the area covered and no corrections were made for evaporation or rate of discharge. First, the areas were computed below the 11 foot contour and between the 11 and 12 foot contour. The first computation assumed that the culvert was retrofitted to discharge at a stage of 11.0 feet or greater. Therefore, the entire southeast corner, below the 11 foot contour, would be flooded.

The calculation is as follows:

$$\frac{\text{Area} \times \text{depth} \times 7.48 \text{ gallon/ft}^3}{42 \text{ gallons/barrel}}$$

or $$\frac{7{,}225{,}000 \text{ ft}^2 \times 0.25 \text{ ft} \times 7.48 \text{ gal/ft}^3}{42}$$

= 321,684 barrels of liquid

You can consider this calculation as approximate but probably accurate to within 10 percent.

If the culvert were retrofitted to 12 feet, virtually the entire northwest quadrant of the Reservation would be covered with liquid, given that the berm on the west side of the L-28 borrow canal remains intact. Additional culverts will have to be retrofitted north of the drilling site along the west side berm of the L-28 canal. The calculation is the same as above except tbat the depth below the 11 foot contour increases. The area between the 11 and 12 foot contour is 375,805,000 ft²; therefore, the calculation with a control elevation at 12.0 ft. above sea level is as follows:

$$\frac{375{,}805{,}000 \text{ ft}^2 \times 0.5 \text{ ft} \times 7.48 \text{ gallon/ft}^3}{42}$$

plus $$\frac{7{,}225{,}000 \text{ ft}^2 \times 1.25 \text{ ft} \times 7.48 \text{ gallon/ft}^3}{42}$$

= 35,072,962 barrels of liquid

Again, this calculation is approximate but probably accurate to plus or minus 10 percent.

I hope that these calculations are sufficient for your use. I have also enclosed some vacant photos with captions. If you have any questions or comments, please give me a call.

Sincerely,

Bradley G. Waller
Principal Hydrologist

cc: Mary Dokianos, Public Affairs
cm

HYDROLOGIC ASSOCIATES U.S.A., INC.
14707 South Dixie Highway, Penthouse #403, Miami, Florida 33176
Phone: (305) 252-7118 • Fax: (305) 254-0874

PUBLIC AFFAIRS
JUN1 0 1991
BS
EFS
MBD
WKJ
JGT
JC
Destroy

June 7, 1991

Shell Western E & P Inc.
ATTN: Mary B. Dokianos, Public Affairs
One Shell Square
P.O. Box 61933
New Orleans, LA 70161

RE: Miccosukee Site Water Levels

Dear Mary,

We have computed the stage duration data for the headwaters of the S-140 pump station and have compiled these data in both tabular and graphical format (attached). These data were suppled by the SFWMD data management section. As I mentioned before, the SFWMD only has one year of complete data for this station and therefore a computer generated duration curve could not be done. Therefore we did this work by hand (the old fashioned way).

This curve and statistical table represent 7,090 data points (mean daily water level).

I hope that this information is useful to you in your discussions with the Corps. Call me at your convenience to discuss this.

Sincerely,

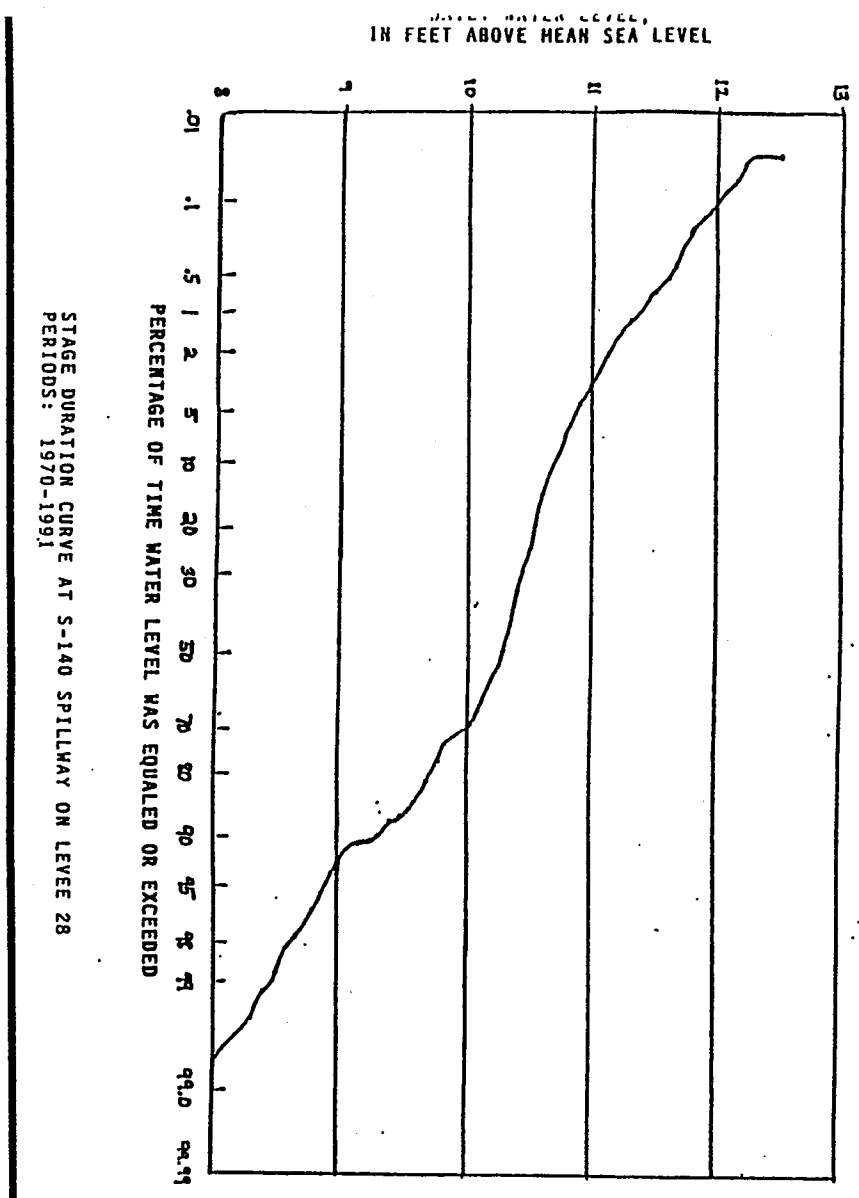
Bradley G. Waller
Principal Hydrologist

cc: Dave Smith
w/ attachments

cm

Water Resources Data
S-140 Spillway on Levee 28

Water Level Category	Percentile Rank
8.00- 8.09	99.77
8.10- 8.19	99.66
8.20- 8.29	99.56
8.30- 8.39	99.40
8.40- 8.49	99.14
8.50- 8.59	98.70
8.60- 8.69	98.04
8.70- 8.79	97.14
8.80- 8.89	96.02
8.90- 8.99	94.77
9.00- 9.09	93.27
9.10- 9.19	92.07
9.20- 9.29	90.85
9.30- 9.39	89.93
9.40- 9.49	88.73
9.50. 9.59	86.94
9.60- 9.69	84.39
9.70- 9.79	81.09
9.80- 9.89	77.60
9.90- 9.99	74.08
10.00-10.09	69.94
10.10-10.19	64.56
10.20-10.29	57.72
10.30-10.39	49.18
10.40-10.49	36.25
10.50-10.59	24.34
10.60-10.69	15.02
10.70-10.79	10.01
10.80-10.89	6.57
10.90-10.99	4.72
11.00-11.09	3.17
11.10-11.19	2.24
11.20-11.29	1.72
11.30-11.39	1.24
11.40-11.49	.92
11.50-11.59	.71
11.60-11.69	.54
11.70-11.79	.37
11.80-11.89	.25
11.90-11.99	.18
12.00-12.09	.13
12.10-12.19	.08
12.20-12.29	.07
12.30-12.39	.06
12.40-12.49	.06
12.50-12.59	.06



STAGE DURATION CURVE AT S-140 SPILLWAY ON LEVEE 28
PERIODS: 1970-1991

Preliminary Analysis

of the

Hydrologic and Geologic Characteristics

of the

Miccosukee Indian Reservation

Broward County, Florida

Prepared for:

Shell Western E and P Inc.
Houston, Texas

Prepared by:

Hydrologic Associates U.S.A., Inc.
14707 South Dixie Highway, Suite 403
Miami, Florida 33176

January 1991

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EXECUTIVE SUMMARY

PRELIMINARY ANALYSIS OF THE HYDROLOGIC AND GEOLOGIC CHARACTERISTICS OF THE MICCOSUKEE INDIAN RESERVATION BROWARD COUNTY, FLORIDA

by

Hydrologic Associates U.S.A., Inc.
Miami, Florida

GENERAL

Location and Physiography

The Miccosukee Indian Reservation, located in extreme western Broward County, Florida, is largely an undeveloped 76,800 acre tract comprised of sawgrass and Cypress forest. The Seminole Indian Reservation lies immediately over its northern border.

Physiographic features of the Miccosukee Reservation with a direct bearing on this investigation would include rainfall, topography, and soil description. Rainfall averages range from between 50-52 inches per year, with 75% of the annual rainfall occurring during the wet season, mid-May through October. Reservation topography is extremely flat; elevations range from about 14 feet above sea level in the northwest corner to around 10 feet above sea level in the southeast corner. The land slopes to the southeast at a gradient of approximately 0.2 feet per mile. Most reservation soils are peat and muck, located on roughly the

eastern two-thirds of the property. The remaining soils are primarily poorly drained sands and marls. It should be emphasized that all of the soils exhibit low permeabilities. A low permeability soil would retard infiltration of oil or drilling fluids into the ground water of the surficial aquifer.

Water Management

The water resources of Southeast Florida are highly controlled for flood control, prevention of overdrainage, water storage, recharge retarding saltwater intrusion, and providing environmental enhancement. A series of levees, canals, water control structures, pumping stations, and water storage areas are operated and managed by the South Florida Water Management District to provide regulation of the water resources. In general, most flood control operations occur in the rainy season and water deliveries occur during the dry season. Storage in the (WCA) Water Conservation Areas is regulated by a fixed schedule established by the Corps of Engineers. Water levels (storage) are usually highest at the end of October and lowest in May. The period of inundation is shortest in the northwestern part of WCA 3A adjacent to the reservation where the land is highest and drainage is greatest.

The primary control on water levels in the reservation is pumping at station S-140. This pump station controls water levels in the northwestern part of the reservation by pumping water from the L-28 Canal into the C-60 getaway canal within WCA 3A. Historically, pumping has occurred 55 percent of the time, mostly during the wet season. Additional water control structures influencing the hydrology in the reservation area include pump station S-8, G-89, S-190, S-339, and S-340.

GENERAL HYDROLOGY

The Reservation can be divided into three general hydrologic areas:

1. The Northwest portion above I-75 (Alligator Alley) and west of L-28 Levee is drained in varying degrees by Pump Station S-140.
2. The Northeast portion, above I-75, is within WCA 3A and is subject to impoundment by the SFWMD under water level regulation schedules established by the Corps of Engineers.

   This northeastern portion has been subject to overdrainage because of water management and higher land elevations, although Control Structures S-339 and S-340 in the Miami Canal were installed to mitigate some of this overdrainage.
3. The Southern portion of the reservation below Alligator Alley is the wettest and least affected by water management practices.

MAJOR AQUIFERS

Two major aquifer systems underlie Broward County. The lower aquifer is the Floridan System which extends from 800 feet to 3500-3800 feet below land surface in the vicinity of

the reservation. Ground water in the Floridan System is brackish in the upper units and nearly seawater in the lower units. The Floridan Aquifer System is confined by over 600 feet of clays and silts.

The upper aquifer is the Surficial Aquifer System which is the only source of fresh ground water in Southeast Florida. This aquifer is approximately 200 feet thick in the reservation area. The principal water bearing unit in the Surficial Aquifer System is the Biscayne aquifer, which is the primary source of municipal water in Dade and Broward Counties. The Biscayne aquifer underlies all but the northwest and west areas of Broward County. The inland edge of the Biscayne aquifer is five to ten miles east and southeast of the Miccosukee Reservation.

In the reservation area, the Surficial Aquifer System is composed of an uppermost water-table aquifer comprised of sand, shells and limestone of low permeability and the semi-confined gray limestone aquifer which is separated from the upper aquifer by 50 to 60 feet of virtually impermeable lime mud, clays, and sand. The top of the gray limestone aquifer occurs 70 to 100 feet below land surface within the reservation and provides the major source of potable water. The quality of ground water in the water-table aquifer and gray limestone aquifer is moderately mineralized, but potable throughout most of the reservation.

Water Levels and Flow Direction

The generalized ground water flow direction in the Surficial Aquifer System is to the east and southeast. However, ground-water levels, particularly in the north part of the reservation are influenced by the proximity to the Miami Canal. Ground water flow in the northeast reservation may take an east-northeast component during prolonged dry periods when the canal picks up ground water to sustain canal flow. In the western part of the reservation, ground water flow is locally influenced by the L-28 Canal, especially during extended dry periods.

Water levels in the reservation have been measured since 1950. Based on water level duration curves, the area surrounding the proposed drilling site to the west of L-28 Canal, is inundated about 55 days per year or approximately 15 percent of the time. In WCA 3A just east of the drill site, inundation occurs about 135 days per year or approximately 37 percent of the time. Surface water flow directions are generally to the south and southeast following the topography of the land with an average slope of about 0.2 foot per mile.

There are a number of surface impediments to surface flow within the reservation. Among these are:

1. Levee 28 which prevents direct surface flow eastward into WCA 3A.

2. The road bed I-75 (Alligator Alley) which prevents north to south overland flow. Only where bridges breach the roadbed is there a direct surface connection.
3. A nearly continuous berm on either side of the Miami Canal.
4. No direct connection between L-28 Canal and L-28 Interceptor Canal. L-28 Canal dead ends to the south.

Surface Water Velocity

The Miccosukee Reservation is partially within the northwest part of Water Conservation Area 3A of the South Florida Water Management District, a vast storage reservoir which furnishes replenishing water (recharge) east to urban coastal aquifers, and south to Everglades National Park to sustain ecologic communities. Conservation Area 3A is inundated during the rainy season (June though October), after which water levels decline throughout the ensuing dry season (November to May). The northwest area of WCA 3A dries out earliest, and drying progresses slowly south and east. Inundation is least and shortest in the north part of the Miccosukee Reservation because of higher land-surface elevations.

Estimates of the velocity of the surface water flowing south near the southern boundary of Conservation Area 3A (Tamiami Trail) ranged from 1550 feet per day at peak discharge in October 1947, before water management , to zero when levels were below the land surface (Leach and others,

1972 Figs. 10, 11). However, the estimated average flow velocity is less than 500 feet per day (Leach and others, 1972, Fig. 10) near the south boundary of Conservation Area 3A. The velocity would be considerably less in the vicinity of the Miccosukee Reservation because of lower gradients and a shorter period of inundation.

Ground Water Velocity

The surface materials within the north part of the Miccosukee Reservation are shallow deposits of sand, muck and peat in varying thicknesses. Under this veneer about 20 feet of hard limestone, sand, and shelly lime mud comprise the water-table aquifer, the upper water bearing unit of the surficial aquifer system. Aquifer tests on the water-table aquifer by Milleson (1989, p.17) coupled with water level gradients indicate an average velocity of 0.4 ft/day or less than 3 miles/100 yr.

The water-table aquifer is underlain by 50-70 feet of lime mud, fine sand, and shelly mud of low permeability which form a semi-confining unit that overlies a gray limestone of high permeability, the lower aquifer of the surficial aquifer system. The top of the gray limestone aquifer occurs about 70 -100 feet below the land surface and is the primary source of drinking water for the reservation and for irrigation in the adjacent areas of Hendry County.

The gray limestone aquifer extends eastward to about the east boundary of Conservation Areas 2 and 3, where it grades into material of low permeability (Fish, 1988, Fig. 45). The average velocity of horizontal flow through the gray limestone is 0.4 ft/day or about 3 miles in 100 years.

Of regional importance to southeast Florida is the protection of the Biscayne aquifer from contamination because it is the ground water source for virtually all potable water systems along the urban coast. The Biscayne is the primary aquifer of the surficial aquifer system. It underlies virtually all of Dade County and most of Broward County.

In Broward County, it extends from the coast inland to 5 to 10 miles east and southeast of the Miccosukee Reservation (Fish, 1988, Fig. 37). Beneath the west-central part of Broward County, the Biscayne aquifer is underlain by the gray limestone aquifer, but is separated from it by a 40 to 50-foot confining unit.

Water-level data furnished by Fish (1988, Figs 40, 41) indicate a hydraulic gradient to the east and to the south of 2 feet in 10 miles -- a very low gradient across Conservation Area 3A. The average velocity of ground-water movement through the Biscayne aquifer beneath Conservation Area 3A is 0.00016 feet per year (1 mile per 5,280 years), or virtual stagnation.

The only areas where appreciable water-table gradients occur are immediately adjacent to the perimeter levees along the east and south sides of the water conservation areas, a result of levee under-seepage.

Parker and others (1955, Fig. 221) and Fish (1988, Fig 45) indicate inferior water quality in the lower part of the surficial aquifer system in much of the western part of Broward County. Parker indicates that the poor quality is due to connate, diluted sea-water residual from Pleistocene sea inundation. Another possibility resulting in poor water quality is slow upward leakage of salty artesian water under high pressure from the Floridan aquifer system for hundreds of years into virtually stagnant water at the base of the surficial aquifer system.

IMPACT OF OIL SPILLS

Because the particular concern is that of an accidental oil spill which could occur during oil exploration, a series of hypothetical cases are presented to indicate: (1) pathways that a spill could take; (2) area affected by the possibility of a spill; (3) the projected effect on major drinking water systems; and (4) potential damage to biological communities. It should be emphasized the remedial or preventive actions can be provided at any time during the migration of a spill.

In south Florida oil occurs under low gas pressure so that no natural flows occur in wells. Most spills are of a minor nature in the vicinity of producing wells. However, a larger spill could occur during the transportation of the product by vehicles or by pipelines. A minor spill can be readily cleaned up, virtually on site. A larger spill has the potential of migrating off site; the area affected would depend upon hydrologic conditions at the time of a spill, and the soil, vegetation and underground strata in the vicinity of a spill.

Case 1 - A spill occurs in the reservation west of Levee 28, north of Alligator Alley during flood time, and drought.

Scenario I: An oil spill during flood season will move with the direction of the surface water flow and at about the same rate (less than 500 ft per day), but, vegetation will cause some retardation in the rate. Because the west area is enclosed by Levee 28 and L-28 Interceptor, the spill will not escape beyond (east or south) the levees unless pump S-140 is operating to direct flood water to Canal C-60. In that event, surface water (and a spill) will migrate east to L-28 Canal. If a spill were to reach the canal, further movement of a spill could be controlled or inhibited by pump station S-140, and clean-up can proceed.

Scenario II: A spill during drought could spread over the surface sediments and finally seep downward to the water table which is normally within 3 feet of the land surface. Some attenuation will occur within the unsaturated zone. Upon reaching the water table, a spill would migrate with the ground-water flow toward the L-28 Canal under a low gradient and at a velocity of about 0.4 foot per day.

Case 2 - A spill occurs at a drill site east of Levee 28, north of Alligator Alley during flood, and drought.

Scenario III: An oil spill during flood season would spread out on the water surface and move generally southeast and then south at an average velocity of less than 500 feet per day. Movement of the oil would be further retarded by vegetation, and vegetation also would tend to retain part of a spill from further downstream movement. The amount of reduction would depend upon the density of the vegetation. At an average velocity of less than 500 feet per day, it would take more than 10 months to reach ENP or areas servicing drinking H_2O supplies. Movement within Conservation Area 3A will continue after the rainy season at a reduced rate until the water level declines to or below the land surface. A spill would then slowly infiltrate the surface to follow the vertical decline of the water table, during which time attenuation within the pore spaces of the unsaturated zone would occur. Once a spill were to become

part of the ground-water system, its horizontal movement would be negligible because of the low water-table gradient.

As the subsequent flood season arrives, part of a spill would rise again above the surface and resume its movement with the surface-water flow for a new cycle.

In the event that remnants of a spill reached areas of the Biscayne aquifer, the extremely low gradient and velocity of movement in the aquifer would preclude any effect on municipal water-supply systems or biological communities in the Everglades National Park.

Scenario IV: An oil spill during drought would spread out over the dry soil and slowly infiltrate vertically through the unsaturated zone of the water table aquifer to the water table. Attenuation within the unsaturated zone would retain part of the spill. A spill would then migrate downgradient (southeast) within the water table aquifer at an average velocity of 0.4 foot per day or less than 150 feet per year. During the following flood season, part of the spill would rise (with the water table) above the land surface and migrate south with the surface-water flow. In the remote possibility that a spill were to enter the upper reach of the Miami Canal, the spill could be controlled by the series of canal structures (S-339, S-340, S-151) which would block movement in the Miami Canal and clean-up measures could then proceed.

IMPACTS OF BRINE SPILLS

A brine spill would be incorporated with natural sheet flow if the spill were to occur during the rainy season. Natural surface flow in the reservation follows the land surface slope, 3 ft in 10 miles, south and southeast. If the drilling site is west of Levee 28 Canal and an uncontrolled flow is of long duration, some of the blended sheet flow could enter Levee 28 Canal, but would not extend beyond structure S-140.

If a spill were to occur during the dry season the salt water would infiltrate the surficial aquifer system to the water table and continue downward, because of its density, and laterally at a slow rate, because of the low permeability of the sediments. The slug of salt water in the surficial aquifer system would take the form of a circle surrounding the source but would have a lobe that extends downgradient, toward the L-28 Canal. Fish (1988, Fig. 19) indicates that the upper 60 ft of sediments ranges in hydraulic conductivity from 0.1 ft to 10 ft/day. After a spill is under control the slug would slowly decrease in size and chemical concentration due to dispersion and mixing with the native ground water.

SUMMARY OF SPILL IMPACTS

The average annual rainfall in Conservation Area 3 is 53 inches (Leach and others, 1972, p.45). Most of the rainfall is lost through evaporation and transpiration; therefore, the

area has nearly gone completely dry several times since it was enclosed. Only during the passage of tropical disturbances or the movement of cold fronts is the rainfall generally distributed over the conservation area. Most rainfall during the rainy season is scattered, unequal and sporadic. The northwest part of Conservation Area 3 and the Indian reservation dry-out earliest because of higher land elevations and the occurrence of less rainfall than the areas to the south and east. Most of the rainfall is of short duration and sporadic, so that sheet flows off the reservation are equally short and sporadic and cease as the water level declines below the land surface. A slug of oil carried by the sheet flow would also cease its movement as the water level falls below the surface. Each time the oil slug contacts the land surface, part would be retained by the vegetation and part would cling to the sand and muck soils, thus reducing the size of the migrating part of the spill with each sequence. The net area that a slug finally covers would depend upon its size, and duration, and the frequency of the storms that occur over the spill area, as well as the density of the vegetation.

A large spill occurring during the dry season, when water levels are below the land surface for weeks or months, would result in a smaller affected area than that which would result during high water levels. Soil and vegetation would retard the movement of a slug, so the overall distance that a

slug moves is further reduced. However, part of a spill would infiltrate vertically, possibly to the water table. Within the ground water system part of the oil residue would move southeast under low hydraulic gradient; a large part of the oil would cling to soil particles to become part of the matrix of the unsaturated zone. Because of the low permeability of the soil and muck the rate of underground movement is extremely slow.

If a salty artesian water spill were to occur (east of Levee 28) during flood time, a spill would become less concentrated by mixing and dispersion with the fresh surface-water flow. The velocity and direction would be that of the hypothetical oil spill described above. Dispersion and mixing would continue through the route of the spill. With additions of rainfall the spill would become further diluted. As sheet flow declined and drying out proceeded, the diluted spill would infiltrate the water table to move horizontally in the ground water system, at the velocity described above. Residual water with high concentrations of chloride (10,000 mg/L or more) would tend to have a downward component in the aquifer because of its higher density. If a salty spill occurred west of Levee 28 during flood time, dispersion and mixing with the surface flow would occur and flow would be toward Levee 28 Canal. Flow in the canal can be controlled at Pump Station S-140.

A salt water spill during drought would infiltrate the water-table aquifer and migrate laterally but also downward because of its density. The spill would take the form of a circle surrounding the source of the spill, but it would be distorted by a lobe that extends in the direction of ground-water flow. In the area west of Levee 28 a spill would move toward the Levee 28 Canal. If a spill were to occur east of Levee 28 its movement would be primarily to the southeast. Dispersion and mixing would continue throughout the spill migration. Velocity of spill movement would be as discussed earlier. No municipal water supplies would be affected.

EFFECT ON MAJOR DRINKING WATER SYSTEM

Under no circumstances would an oil spill within the north part of the Miccosukee Reservation affect any of the major drinking water supplies along the southeast coast. In order for contamination of those water supply systems to take place, a spill must penetrate the Biscayne aquifer 5 to 10 miles east and southeast of the reservation and move east and southeast for distances in excess of 25 miles beneath Conservation Areas 3A and 3B. As indicated above, the hydraulic gradient of the Biscayne aquifer is extremely low, causing virtual stagnation; therefore, the east coast municipal well fields would not be affected by a spill.

Because surface flow averages less than 500 feet per day during periods of high water, it would take approximately 60 days to reach the Miami Canal or 160 days to reach the Tamiami Canal from the most proximate boundary of the reservation. In both cases, water control structures in each canal could block further migration of oil. Clean-up activities could easily commence within this period of time.

PREFACE

Hydrologic Associates U.S.A., Inc. of Miami, Florida was contacted by Ms. Mary Brown Dokianos of public affairs at Shell Offshore Inc., New Orleans, Louisiana, on October 1, 1990, to discuss the hydrologic consequences of oil exploration on the Miccosukee Indian Reservation in western Broward County, Florida. It was agreed upon that Hydrologic Associates would provide Shell with a preliminary analysis of the hydrology and surficial geology of the Miccosukee Reservation. Written permission to proceed was granted on October 4, 1990. This report constitutes the final work product for this initial analysis. All ancillary data and information collected during this study are available to Shell at their request.

INTRODUCTION

The Miccosukee Indian Reservation is a 76,800-acre tract in extreme western Broward County, Florida (Figure 1). The Seminole Reservation lies immediately to the north and west in Hendry, Palm Beach, and extreme northwest Broward County (Figure 2). To the west of the Miccosukee Reservation is Collier County.

The reservation is largely an undeveloped natural tract of land comprised of sawgrass marshes, prairies, and cypress forests; the northwestern corner has been leased for grazing. The western half of the reservation is part of the Big

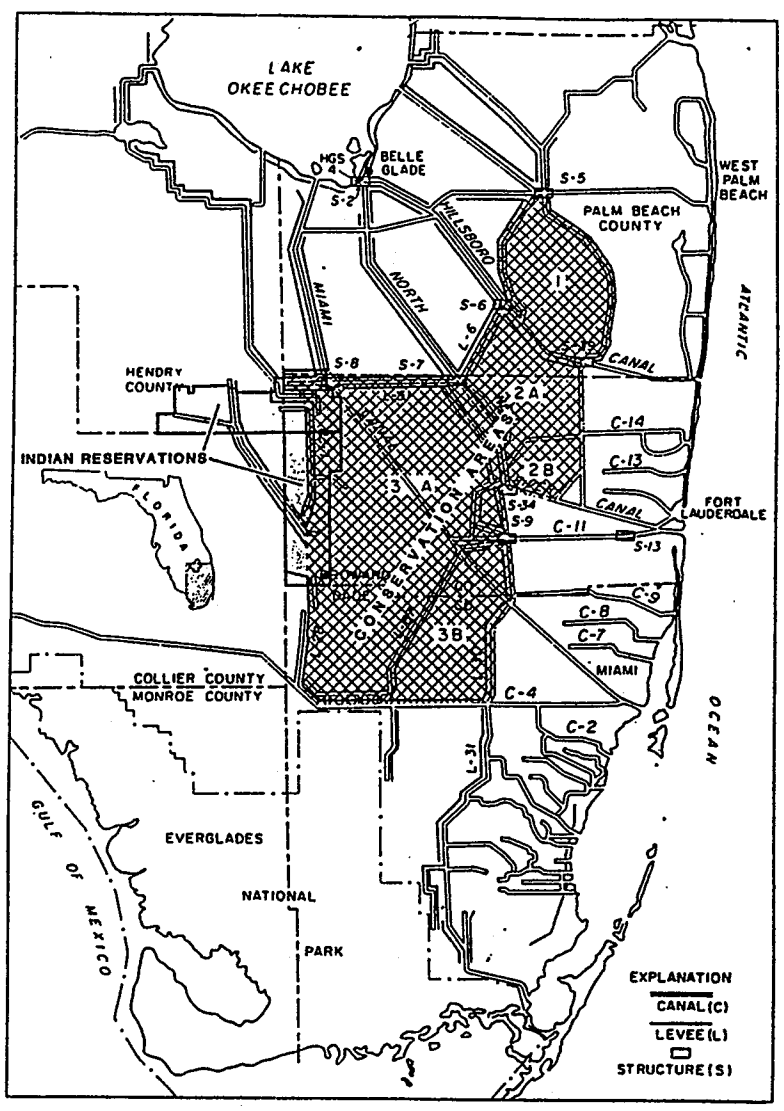


Figure 1.-- Map of South Florida showing location of Miccosukee Indian Reservation in Broward County.

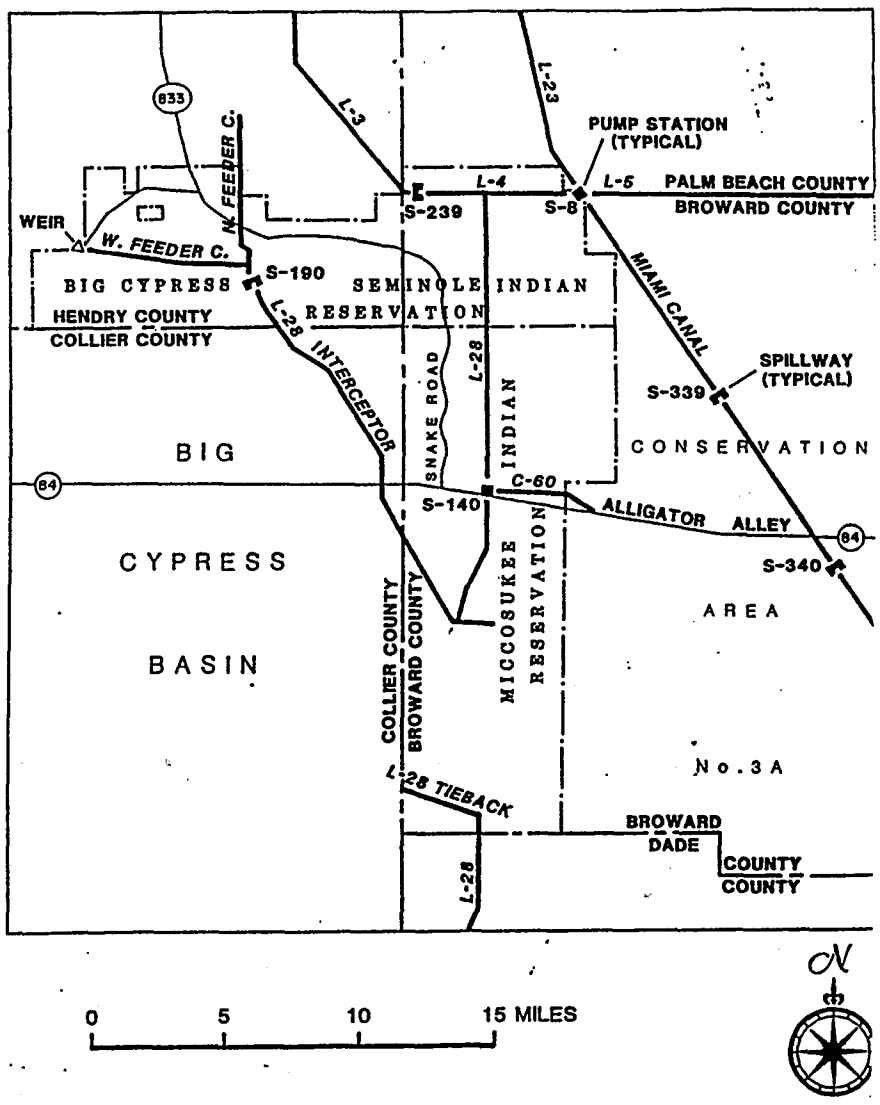


Figure 2.-- Detailed maps showing Miccosukee Indian Reservation and location of primary canals and water control structures.

Cypress Swamp drainage area; the eastern half is part of Water Conservation Area 3A, which is a water storage area maintained by the South Florida Water Management District and part of the Everglades Drainage Basin. Alligator Alley (SR84), built in the mid 1960's, bisects the reservation in an E-W direction and is the primary access route. Prior to the construction of Alligator Alley, access to the Reservation was from the north through Hendry County.

This report describes the hydrologic and geologic conditions on the reservation and relates them to environmental issues involved in oil exploration. Also included are brief discussions on climate, rainfall, topography, physiography, soils and vegetation as they relate to or are affected by the hydrology and geology. Historic conditions are compared to current and projected conditions to determine long-term trends that could affect the hydrology.

Purpose and Scope

The purpose of this report is to present preliminary hydrologic and geologic information on the Miccosukee State Indian Reservation. A compilation of existing data and information is also included as part of the purpose.

The scope of work included researching literature and files of government agencies to gather information on the geology and hydrology of the reservation and adjacent areas.

These data and information were then compiled for presentation in a logical format. Extensive bibliographic references are included and some auxiliary data are presented as appendices. All data and reports are available in the offices of Hydrologic Associates. No additional data were collected as a result of this project.

CLIMATE AND RAINFALL

The climate of south Florida is tropical savannah (sometimes referred to as hyperseasonal savannah) with distinct wet and dry seasons. The hot, humid wet season runs from June through October while the cooler dry season extends from November through April. May is considered a transitional month between wet and dry seasons. Because the southern portion of Florida is a peninsula, climate is affected by water and winds from both west and east, as well as proximity to tropical and temperate zones. Winds from the east and southeast bring warm, moist air from the Atlantic Ocean; the warm currents flow into the Gulf of Mexico as well as along the Atlantic Coast. The Gulf Stream brings warm waters from the south, further tempering the climate of southern Florida. The average annual temperature in Broward County is 73°F, with extremes ranging from 29°F to 96°F (Sherwood and others, 1973). January is generally the coldest month, August the hottest. Temperatures occasionally drop below freezing or climb into the 90's, but such occurrences are infrequent.

Relative humidity is high in southern Florida. At Fort Myers, the mean midday minimum ranges from approximately 50 percent during the spring dry season to 60 percent during the summer wet season. Mean nighttime maximum is approximately 85 to 90 percent all year. Mean midday minimum for Miami is

approximately 55 percent; mean nighttime maximum is 85 percent. During the wet season, humidity is higher inland because of the vast stretches of standing water and high rates of evapotranspiration. During the winter and spring months, ground fog builds up over low wet areas during the night and early morning and generally dissipates by mid-morning (Duever et al. 1979).

There are no long-term rainfall stations in the vicinity of the Miccosukee Indian Reservation, but average, seasonal, and long-term trends in rainfall conditions have been extrapolated from available long-term stations by the SFWMD (South Florida Water Management District). (MacVicar, (1981), MacVicar (1983), and Shih (1983). A summary of these data and analyses are given in Appendix A.

In the area of the reservation, average annual rainfall ranges between 50 and 52 inches per year. About 75 percent of the annual rainfall occurs during the wet season from convective storms and occasional tropical weather systems such as waves, depressions, storms, and hurricanes. Dry season rainfall occurs during the passage of fronts from large continental weather systems. Annual rainfall varies widely, ranging from a low of about 30 inches to a high of greater than 100 inches.

Recurrence intervals and expected volumes for dry season, wet season, and annual rainfall (from MacVicar, 1983) near the Miccosukee Reservation are listed as follows:

(Values in Inches)

INTERVAL	DRY SEASON	WET SEASON	ANNUAL
MEAN	10	40	50
5 YEAR	13	48	58
10 YEAR	16	52	64
25 YEAR	20	58	74
50 YEAR	24	66	80
100 YEAR	26	70	86

These data will be used in later sections covering water levels to determine frequencies of surface water occurring in the reservation. Surface flow would be of most concern because of the potential for transport of oil into downstream areas.

TOPOGRAPHY AND PHYSIOGRAPHY

The topography of the Miccosukee Indian Reservation is extremely flat as is most of south Florida. The landscape within the reservation is almost featureless except for changes in the height of vegetation. These changes in vegetation communities are primarily caused by localized topographic relief, either raised or lowered. Elevations range from about 14 feet in the northwest corner to around 10 feet in the southeast corner. Recent topographic maps by Murray-Milleson (1989 fig. 8) (Figure 3) and Zaffke (1983) (Figure 4) show the generalized land elevation contours in the vicinity of the reservation. The land slopes to the southeast at a gradient of approximately 0.2 ft. per mile. Surface water would move very slowly along these gradients in a southeasterly direction.

The reservation is located in the Coastal Lowlands physiographic region of the Florida Plateau as described by Hoffmeister (1974). This is a very general categorization and other investigators have further divided the physiographic provinces within and adjacent to the reservation. Davis (1943) describes this area as having six distinct vegetative communities in two physiographic regions: the cypress forests and the Everglades. In the cypress forests there are cypress strands and scrub cypress forest, cypress domes or heads and wet prairies. In the Everglades province Davis denotes medium dense to sparse sawgrass

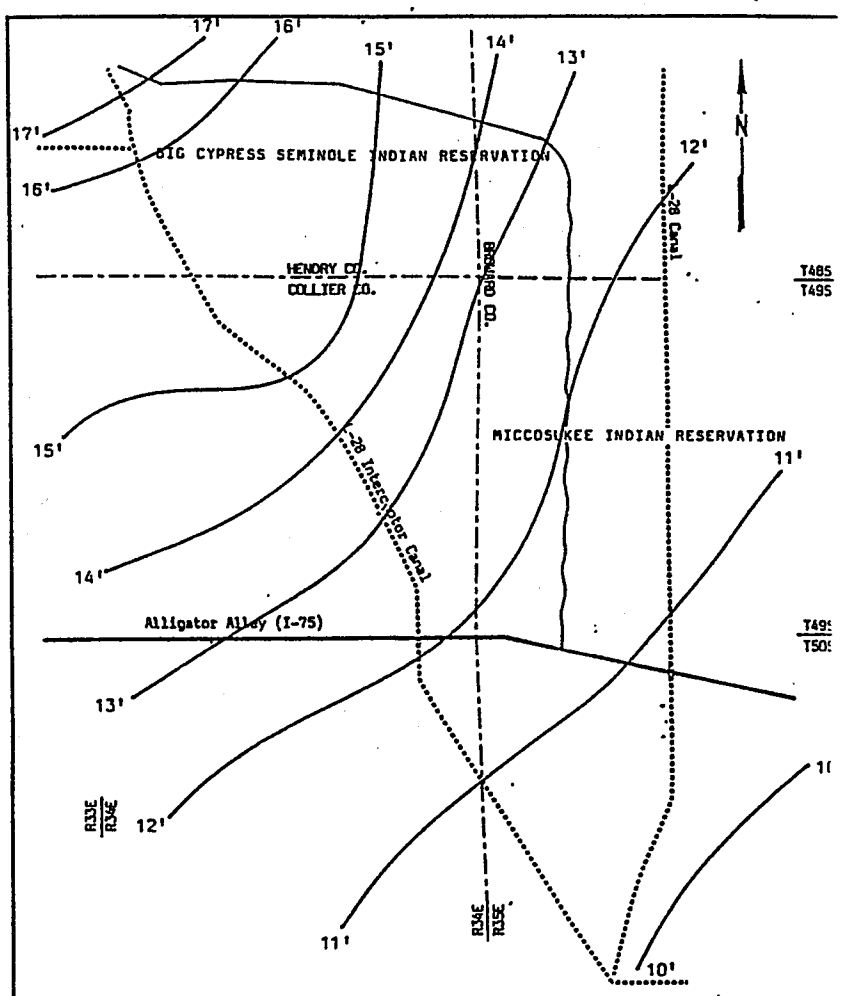


Figure 3.-- Topographic maps in the vicinity of the Miccosukee Indian Reservation (adapted from Murray-Milleson, 1989)

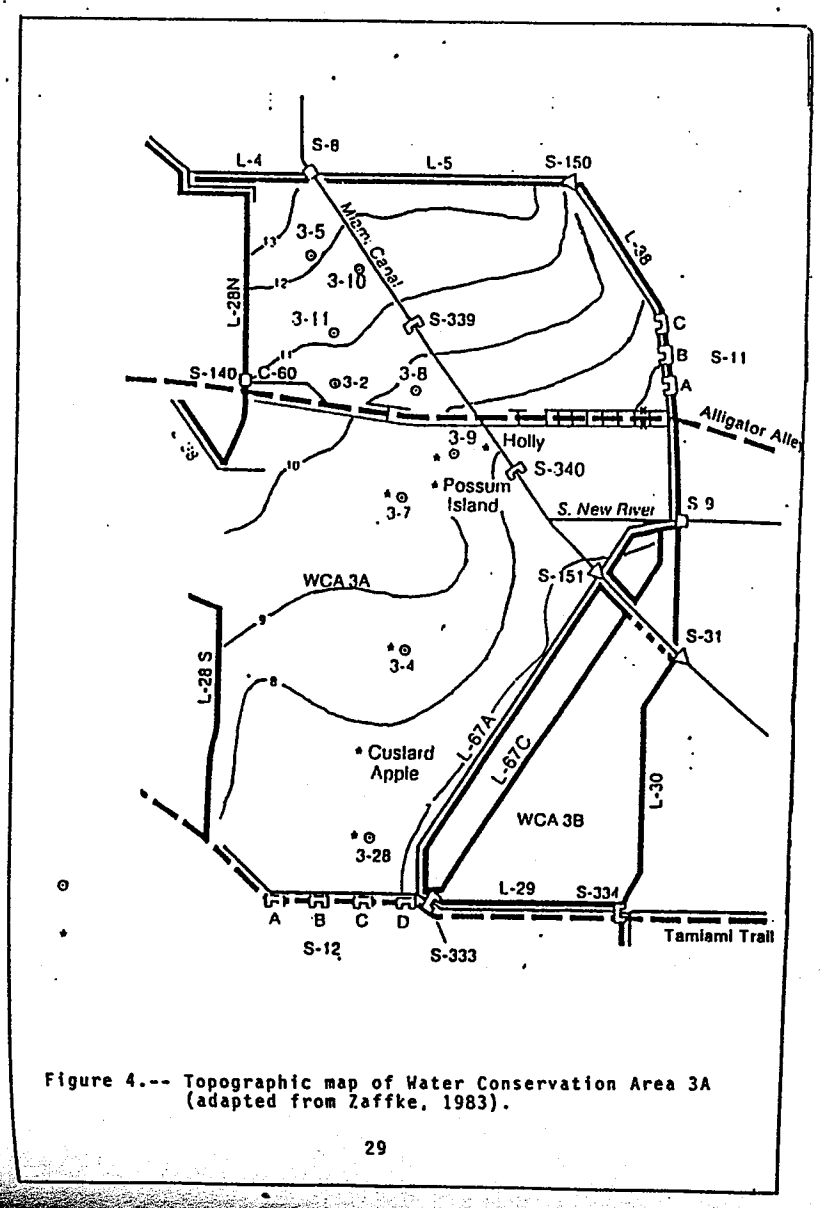


Figure 4.-- Topographic map of Water Conservation Area 3A (adapted from Zaffke, 1983).

marshes, sloughs, ponds and lakes with aquatic plants, and marsh prairies of the southern Everglades. The investigations done by Davis (1943) can be considered as historical conditions in the area of the reservation. Alterations of historical conditions have occurred as the result of water management, fires, overdrainage, development, and conversion of the northwest portion of the reservation to rangeland.

Craighead (1971) gives an overall definition to the physiographic provinces in south Florida and describes their general vegetative communities within those provinces. Two provinces are described in detail and they include the Hammock and Cypress Ridge and the Tree Island Everglades. The descriptions of these provinces are similar to those found in Davis (1943). It is interesting to note that the Hammock and Cypress Ridge province is located on a geologic ridge that runs in a north-south direction and essentially divides the Everglades from the Big Cypress Swamp Drainage. Most of the Reservation is located on this ridge which is mostly karstified limestone of the Tamiami and Fort Thompson Formations. Surface flow from the reservation can enter either the Big Cypress or Everglades drainage basin, but flow is primarily to the south and east towards the Everglades.

SOILS AND VEGETATION

The soils of the reservation are generally shallow and infertile, with poorly developed structure. Soils vary from predominantly organic peats in the eastern half to a thin layer of mineral soils, especially marl and sand overlying the limestone bedrock in the west. Bedrock is generally closer to the surface toward the western boundary of the reservation. The vast majority of soils are subject to seasonal flooding with the organics receiving considerably longer flooded conditions. Four soil associations occur on the reservation. The Lauderhill-Dania association is the most predominant soil series and occurs over roughly the entire eastern half of the reservation. It is a very poorly drained, well-decomposed, organic soil association varying from 16 to 36 inches thick with localized thin sandy layers. The Pompano-Charlotte association occurs mainly west of Levee 28 and north of the Levee 28 Interceptor. These soils are subject to periodic flooding and are poorly drained and sandy throughout. The Ochopee-Broward association occurs mainly south of the Levee 28 Interceptor and in the western third of the reservation. This association is described as nearly level, very poorly to somewhat poorly drained soils, with thin or very thin sandy or loamy layers over limestone. These soils are also subject to flooding. The Broward-Pompano association occupies an estimated 4-square-mile area adjacent to the western boundary of the reservation, just

south of Alligator Alley. These poorly to somewhat poorly drained sandy soils are the only soils on the reservation not subject to flooding.

A generalized soils map (Figure 5), adapted from the 1947 Soil Conservation Service report, gives a general indication of the location of these soil types. Most of the reservation is peat and muck soils located on roughly the eastern 2/3 of the property. The remaining soils are primarily poorly drained sands and marls which are periodically flooded. All these soils exhibit low permeabilities which would tend to retard any infiltration of oil or drilling fluids into the ground water of the surficial aquifer.

The vegetative communities in the reservation are diverse and represent most of the wetland communities in south Florida. As mentioned in the previous section, there are two major physiographic provinces and drainage basins on the reservation: The Big Cypress Swamp and The Everglades. Only a small part of these areas are not subject to seasonal flooding. Historic vegetation patterns (Figure 6) (adapted from Davis, 1943) show the diversity of the vegetative communities on the reservation. Because little development or alternation has occurred, these vegetation patterns remain today. Only in the northwestern part of the reservation where there are sandy soils and historically wet prairies and

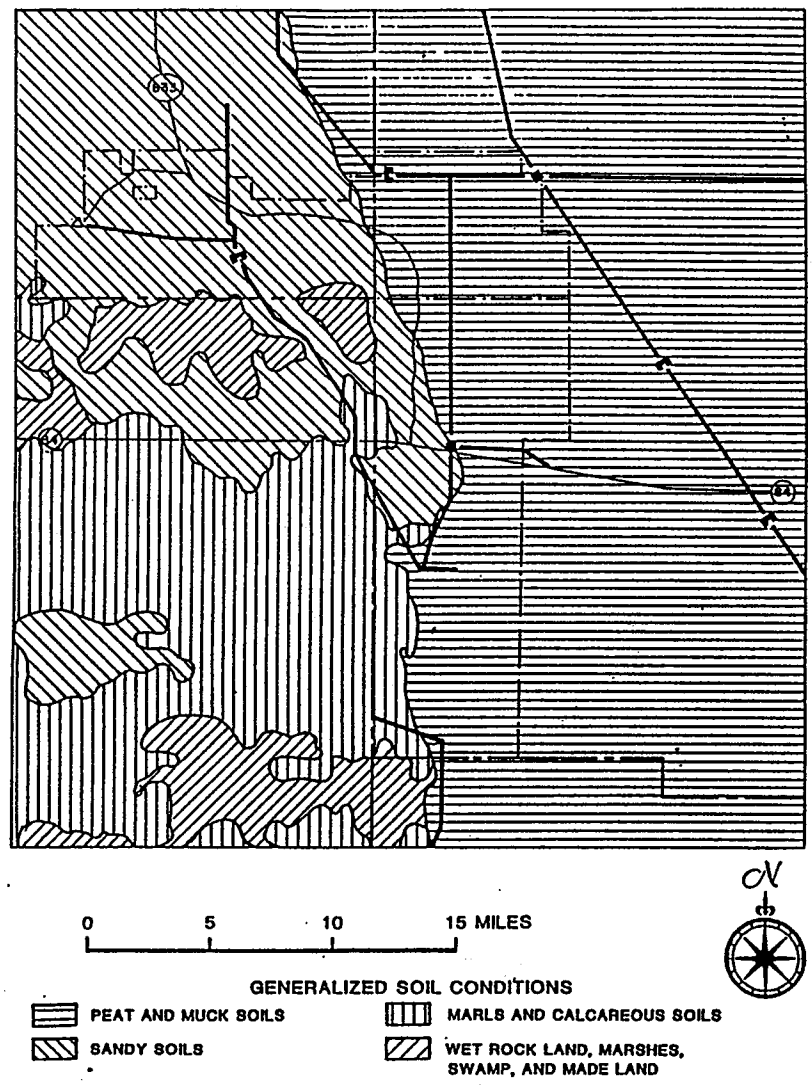


Figure 5.-- Generalized soil map in the vicinity of the Miccosukee Indian Reservation (adapted from Soil Conservation Service, 1949)

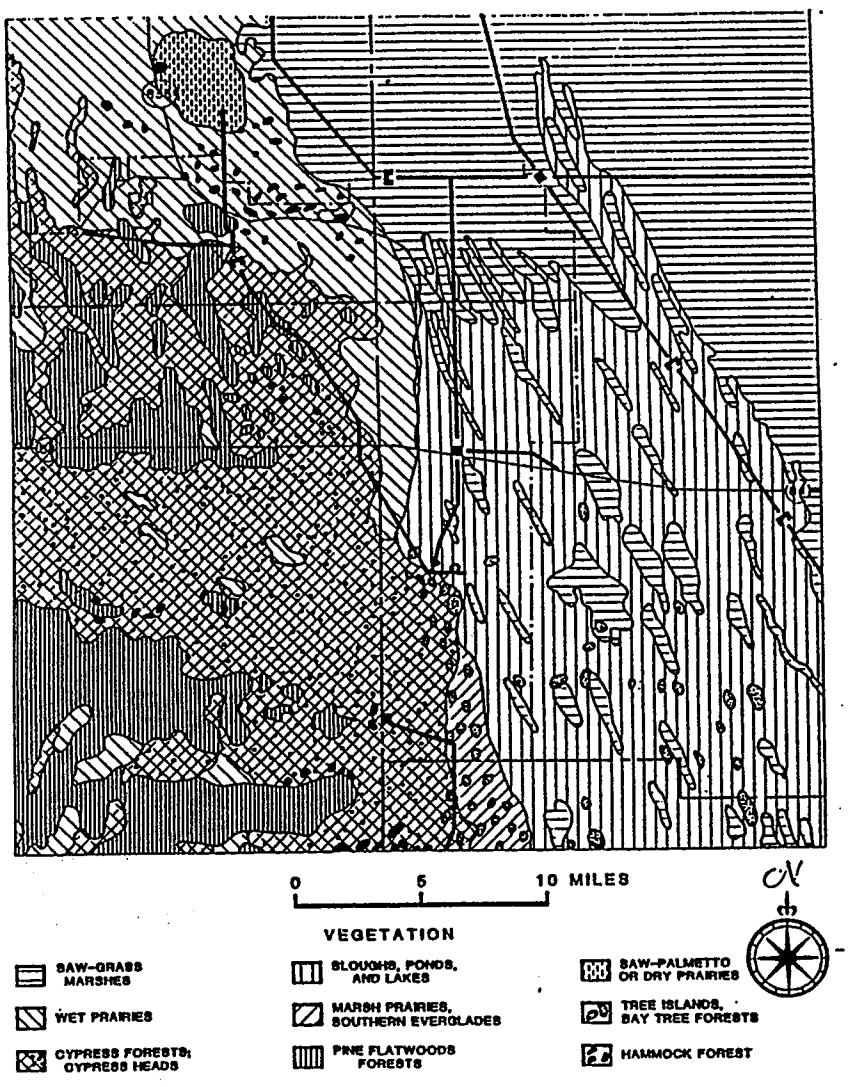


Figure 6.-- Generalized vegetation in the vicinity of the Miccosukee Indian Reservation (adapted from Davis, 1943).

sloughs, has the land been altered for cattle grazing. Lower water levels and extensive fires have altered vegetation in the northeastern part of the reservation north of Alligator Alley within Water Conservation Area 3A. The eastern part of the reservation is dominated by sawgrass marshes and sloughs with a few tree islands to the south. The western edge of the reservation has wet prairies in the north and cypress forest with cypress domes and marsh prairies with tree islands on the south.

MAJOR AQUIFERS

Two major aquifer systems underlie Broward County. The lower is the Floridan aquifer system (Miller, 1986), a regionally extensive system that occurs about 800 feet below sea level in the Miccosukee Reservation area and extends to more than 3500-3800 feet below sea level (Meyer, 1988) (Figure 7). The upper is the surficial aquifer system that extends from the land surface to about 150 ft below sea level in west Broward County, and to about 350 ft in coastal Broward County (Fish, 1988, Fig. 35) (Figure 8). A secondary system, the intermediate aquifer system, which separates the two major systems, is composed primarily of silt, clay, and fine sand of low permeability which forms confining layers above the Floridan aquifer system. The Floridan aquifer system contains water of brackish to seawater quality under hydraulic heads of 30 to 60 ft. above sea level.

The surficial aquifer system is the only source of fresh ground water in Broward County. The most prominent feature of the surficial aquifer system is the Biscayne aquifer, a highly permeable section of limestone, sandstone and sand that is under nonartesian conditions (unconfined). The Biscayne aquifer is the source of all municipal water supplies in Broward and Dade Counties. Fish (1988, Fig. 37) shows that the Biscayne aquifer underlies all but the northwest and west areas of Broward County, (Fig. 9). Its

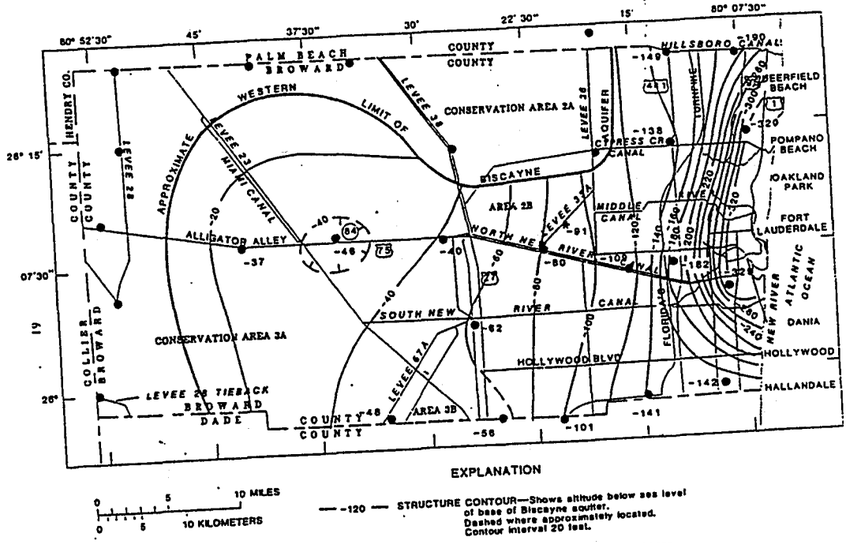


Figure 9.-- Thickness to the base and aerial extent of the Biscayne aquifer (adapted from Fish, 1988).

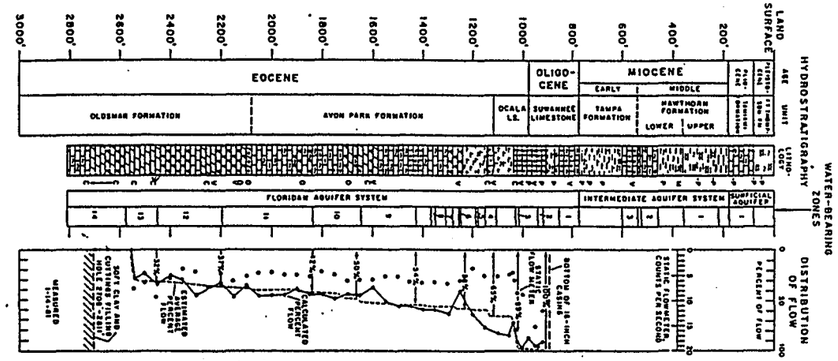


Figure 7.-- Generalized hydrostratigraphy of the major aquifers occurring at the Miccosukee Indian Reservation (adapted from Meyer, 1968).

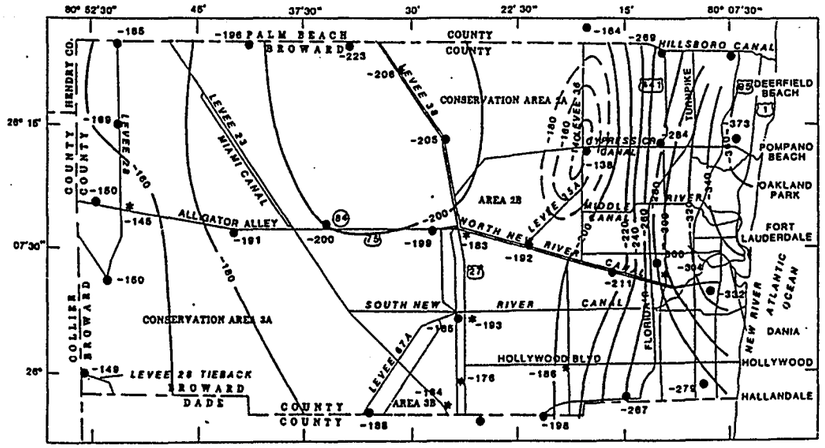


Figure 8.-- Thickness of the surficial aquifer in Broward County, Florida (adapted from Fish, 1988).

inland edge is 5 to 10 miles from the Miccosukee Reservation.

In the Miccosukee area the surficial aquifer system is composed of an uppermost water-table aquifer, which is comprised of moderately permeable sand and shells, and a gray limestone aquifer which is separated from the water table aquifer by lime mud of low permeability. The gray limestone is the primary source of fresh ground water for the Miccosukee Reservation. Fish (1988, Fig. 36) shows the approximate configuration of the top and base of the gray limestone aquifer and the approximate location of its eastern extent in Broward County (figure 10).

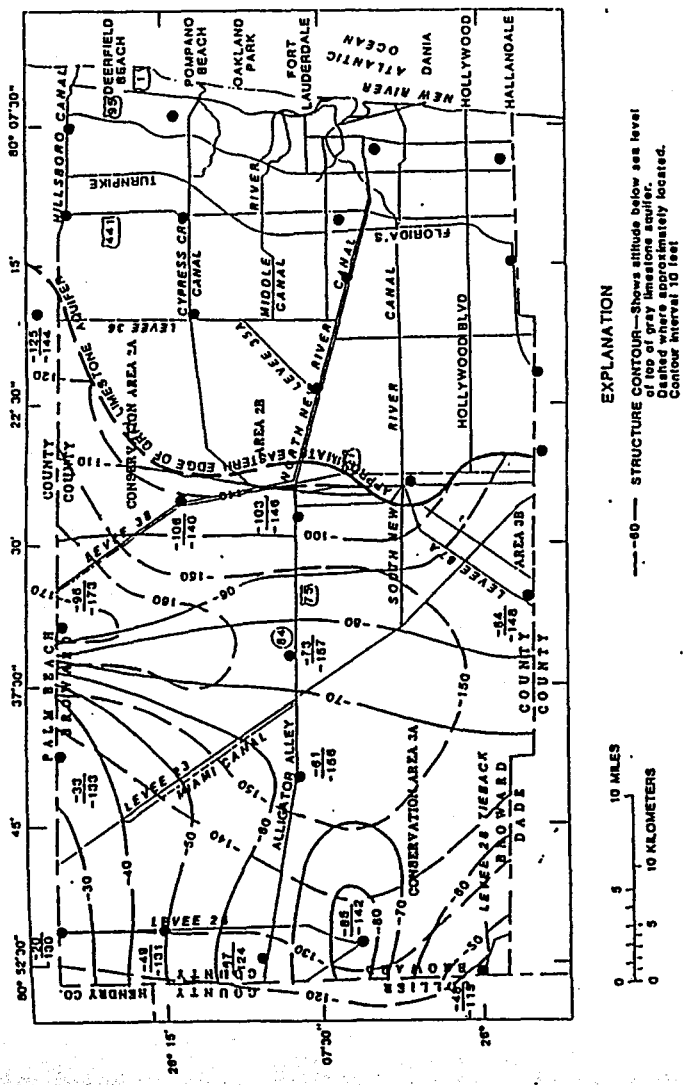


Figure 10.-- Generalized Configuration of the top, base, and extent of the gray limestone aquifer in Broward County, Florida (adapted from Fish, 1988).

GEOLOGY AND GEOHYDROLOGY

The Miccosukee Reservation is underlain by a sequence of sediments ranging in age from Recent downward through Eocene, which includes sections capable of yielding large quantites of ground water (See Appendix B). The surface materials are a veneer of sand, peat, and muck of Recent and Pleistocene age. Under the surface veneer is the Pleistocene Fort Thompson Formation composed of hard, dense limestone, sand, and sandy shelly lime mud to depths of 30 or 40 feet. This section comprises the water-table aquifer, the upper water-bearing unit of the surficial aquifer system. Tests on the water-table aquifer by Milleson (1989, p.17) indicate estimated transmissivities ranging from 32,650 gal/d/ft to 97,950 gal/d/ft (transmissivity = permeability or hydraulic conductivity X thickness of the aquifer).

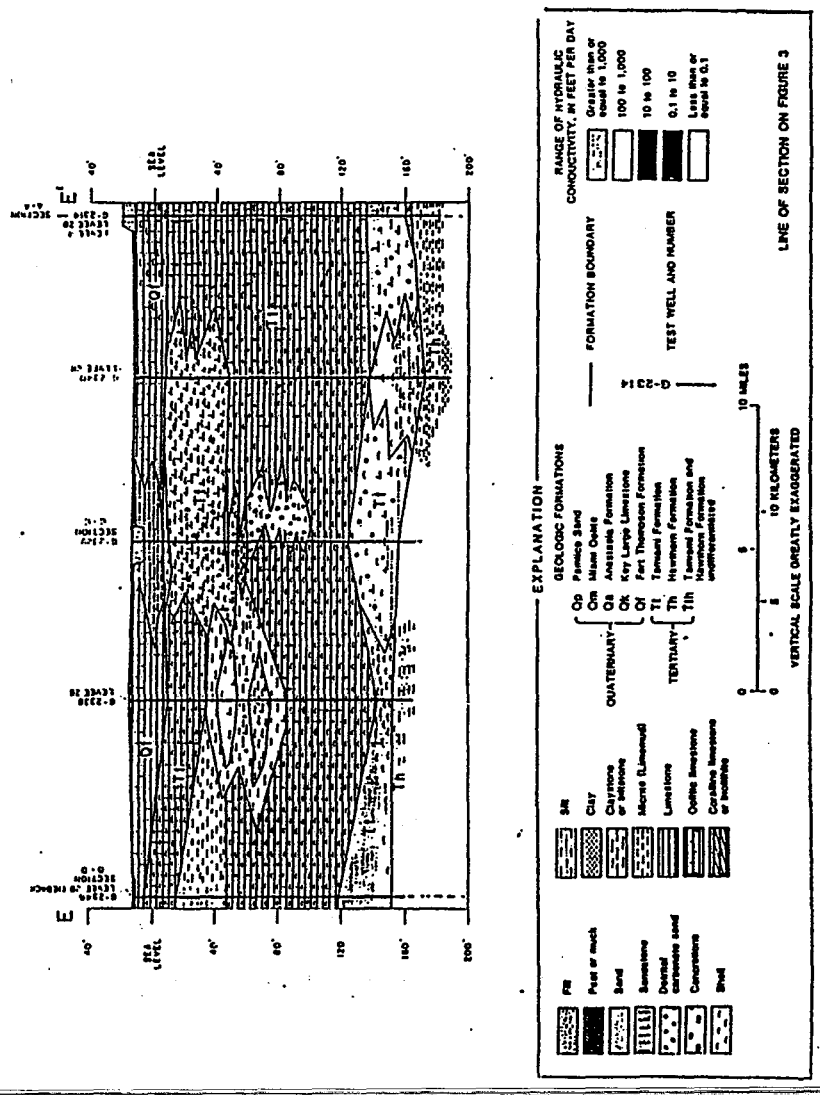
The Fort Thompson Formation is underlain 50 to 70 feet by mixed lime mud, sand and shelly mud of the Tamiami Formation (Pliocene age). The low permeability mud layers form a semiconfining unit that overlies a gray limestone of high permeability in the Tamiami Formation that yields fresh water, and is referred to by Fish (1988, p.42) as the "gray limestone aquifer", the lowermost aquifer in the surficial aquifer system in the county. The top of the gray limestone aquifer normally occurs 70-100 ft below the land surface. Fish (1988, Section E-E') indicates that the gray limestone aquifer along the west side of Broward County extends more

than 130 feet below sea level (Figure 11.) As indicated previously, this aquifer represents the only major source of fresh ground water in the area of the Miccosukee Reservation.

Near the south boundary of the reservation the gray limestone extends from about 50 ft. below sea level to 120 ft. below sea level (Causaras, 1987, section F-F') (Figure 12). Farther south, toward Everglades National Park, the Tamiami Formation contains increasing quantities of clay, marl, and fine sand of low permeability (Causaras, 1987, section F-F').

The base of the Tamiami Formation is marked by 20-40 feet of fine quartz sand which grades to a phosphatic clay at the bottom, at depths ranging from 160 to 200 feet. The base of the Tamiami Formation forms the base of the surficial aquifer system.

Six-inch diameter wells that penetrate the gray limestone aquifer are capable of yielding 600 gal/min or more (Milleson, 1989, p. 13). Calculations of transmissivity by Milleson (1989, p. 13) made from tests of specific capacity in wells (gal/min. divided by ft of drawdown) range from about 172,000 gal/d/ft to 520,000 gal/d/ft. Transmissivity values obtained from aquifer performance tests involving water-level drawdown and recovery in observation wells located specific distances from pumping wells, ranged from 325,000 gal/d/ft to 580,000 gal/d/ft (Milleson, 1989 p. 17).



Geologic section E-E' showing extent of gray limestone aquifer

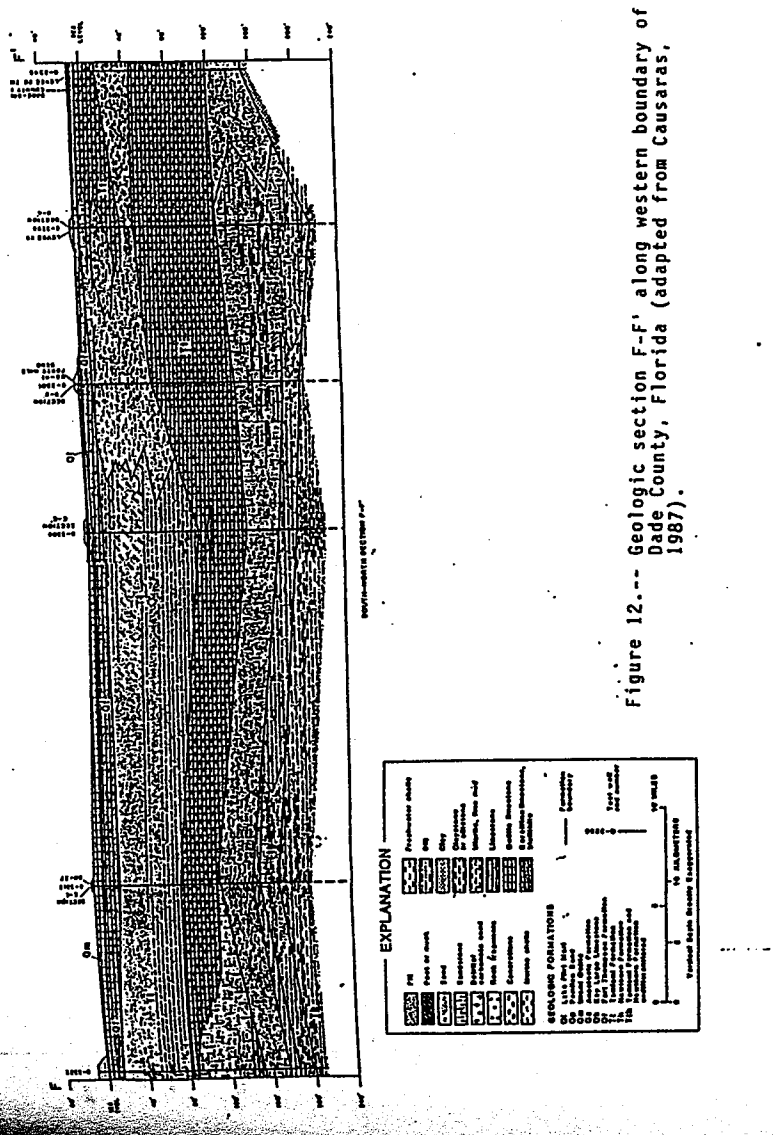


Figure 12.-- Geologic section F-F' along western boundary of Dade County, Florida (adapted from Causaras, 1987).

Meyer (1988, p. 13-16) describes the intermediate aquifer system that occurs between the base of the surficial aquifer system and the top of the Floridan aquifer system. It is represented by nearly 600 feet of confining clay, dense limestone, and interlayers of thin water-bearing units of Miocene age. The confining clays are nearly impermeable and constitute the confining section for the deeper Floridan aquifer system. The water-bearing units in the intermediate aquifer system are mainly within the lower part of the Hawthorn Formation and the upper part of the Tampa Formation of Miocene age (Meyer, 1988, Fig. 6) as shown in Figure 13. Data were obtained by Meyer from a deep test-observation well drilled in the vicinity of Alligator Alley and the Collier-Broward County boundary located on the Miccosukee Indian Reservation.

The top of the Floridan aquifer system coincides with the top of the Suwannee Limestone of Oligocene age at about 770 feet below land surface (Meyer, 1988, Fig. 6). The aquifer system extends to depths exceeding 3500-3800 feet. In addition to the Suwannee Limestone, the Ocala Limestone, the Avon Park Formation and the Oldsmar Formation of Eocene age are included in this aquifer system. Although many permeable zones are recognized throughout the section, most of the water is produced from two major waten-bearing zones: the upper part of the aquifer system, and the "boulder zone" in the lower part of the system. Large water flows occur under a hydraulic head of 50 to 60 feet above sea level; it is brackish in the upper sections and virtual seawater quality,

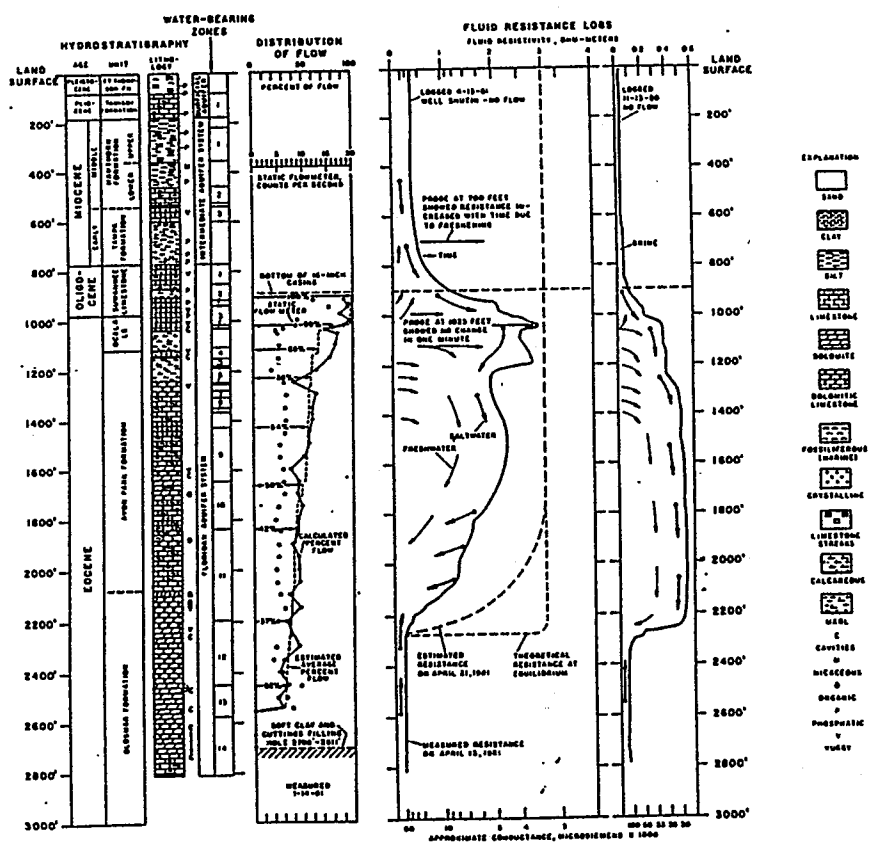


Figure 13.-- Diagram showing water bearing units of the intermediate aquifer system (adapted from Meyer, 1988).

WATER MANAGEMENT

The water resources of southeast Florida are controlled and managed by the South Florida Water Management District (SFWMD) through a system of canals, levees, pumps, control structures, and large water-conservation areas primarily constructed as part of the central and Southern Florida Flood Control project (Klein and Hull, 1978, Fig. 3) (Figure 14.) Canals drain the coastal urban areas to prevent flooding during the rainy season and also function, along with pumping stations, to route water to the conservation areas for flood protection of agricultural lands south and southeast of Lake Okeechobee. A highly important function of the canals is water supply by conveying water east from the conservation areas to the coastal urban areas to replenish the surficial aquifer in the vicinity of the large municipal well fields, and to the south to maintain water levels in the Everglades National Park. Canal flows are regulated by primary (coastal) and secondary (inland) control structures which open and close repeatedly during rainy seasons but are generally closed during dry seasons. Water levels in the water conservation areas are controlled by regulation schedules set by the Corps of Engineers and are usually highest by the end of the rainy season, usually in October, when depth of inundation is greatest. Thereafter, water levels decline through the ensuing dry season to their lowest scheduled level, usually in May. The period of inundation is shortes

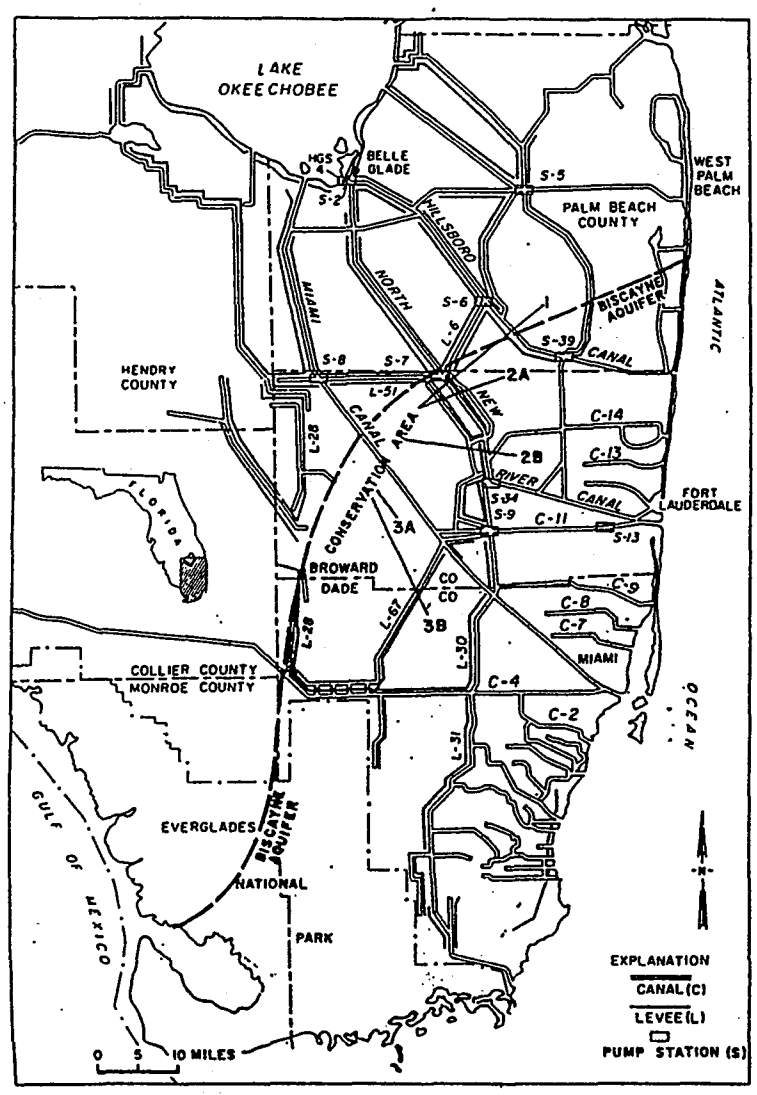


Figure 14.-- Hydrologic features of the South Florida Water Management District in southeast Florida.

in the west and northwest parts of Water Conservation Area 3A in Broward County where the elevation of the land surface is highest, 13-15 ft above sea level, and requested scheduled water levels are lowest. Control structures along the south side of water Conservation Area 3A are operated in accordance with an agreement among the SFWMD the Corps of Engineers, and the Everglades National Park. Water stored in Conservation Areas 3A and 3B is important to ground water supplies along the coast to maintain hydraulic heads in the aquifer needed to sustain eastward and southward ground water flow to the municipalities and the National Park. During prolonged dry seasons supplemental water from Lake Okeechobee is released to primary canals to sustain levels along the coast for control of salt-water intrusion, and for replenishment of municipal well fields.

Structrual Changes

There were virtually no controls on the water resources of the Miccosukee Reservation until the enclosure of Water Conservation Area 3A in 1962. The Miami Canal was constructed by the Everglades Drainage District in the early 1900's, but was ineffective in moving water because the bedrock was not breached and the channel filled in with vegetation (Parker and others, 1955). Levee 4, built in the early 1950's, separated the Everglades Agricultural Area (EAA) from the Everglades to the south. By 1962, Levee L-28

and L-28 Interceptor were completed to enclose the western side of Water Conservation Area 3A. Levee 28 essentially bisects the reservation in a north-south direction. A 7.1 mile gap was left in Levee 28 so that flow from subarea A of the Big Cypress Swamp (McPherson, 1973) could flow freely into WCA 3A. Levee-28 Interceptor Canal drains the western part of the Seminole Indian Reservation in Hendry County and empties into WCA 3A at the junction of Levee 28 via an east-west channel (Figure 15).

Levee 28 Canal has levees on both sides between Alligator Alley and Levee 28 Interceptor. There is no structural connection between the L-28 Canal and L-28 Interceptor, and thus it dead ends to the south. North of Alligator Alley, there is a fifteen foot levee between the canal and WCA 3A.(east side). To the west side of the canal is a low berm that runs for about 4 miles and an access road. Within the reservation, L-28 Interceptor Canal has levees on both sides of the canal.

An additional source of water for L-28 Canal is controlled flow from the L-3 Canal which drains the eastern side of Hendry County. Culverts with stop logs breach the L-28 Levee and allow for release of excess water from the L-3 basin. Borrow ditches located along both sides of Alligator Alley act as a spreader canal while bridges allow for unimpeded flow from north to south. One additional canal

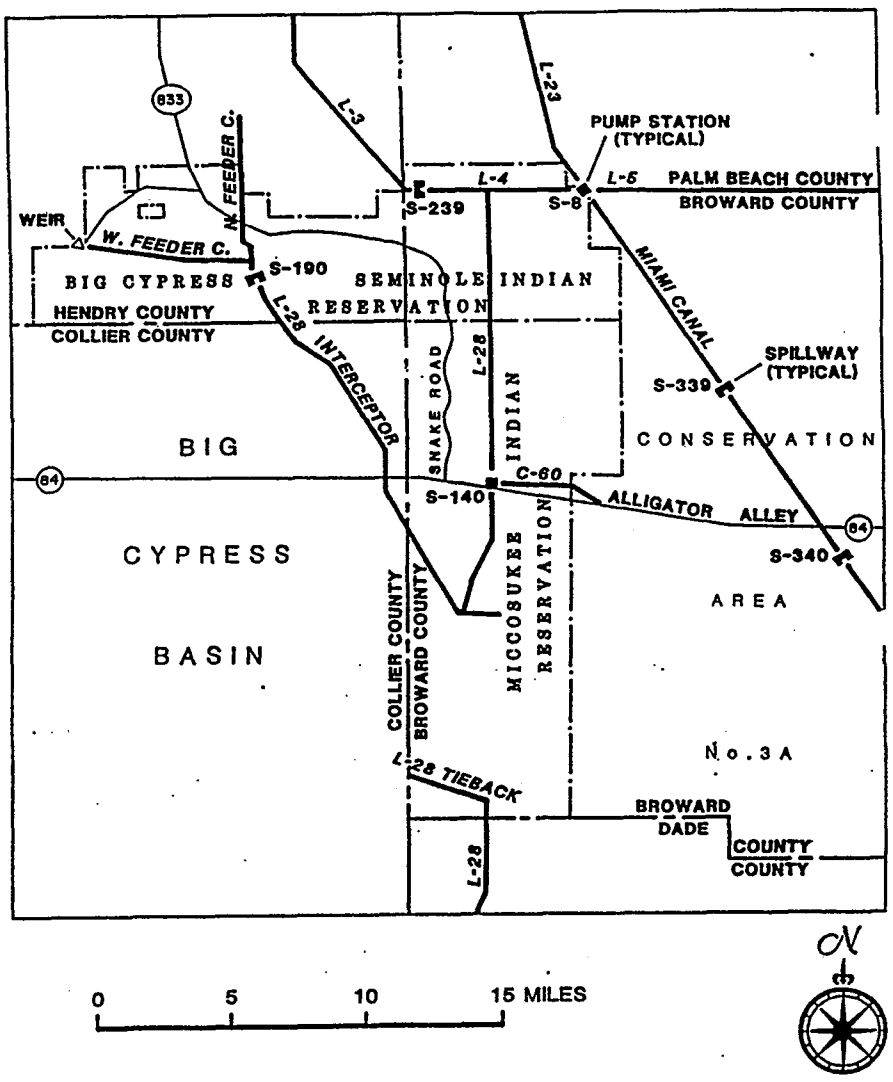


Figure 15.-- SFWMD water control structures and canals near the Miccosukee Indian Reservation.

located in the reservation is C-60 which functions as a getaway channel for pump station S-140; conveying water to the east and south into WCA 3A.

There is only one major water control structure on the Miccosukee Indian Reservation: Pump Station S-140. This station has a capacity of approximately 1300 cubic feet per second under design conditions (Table 1) and functions primarily for flood control in the 110 square mile basin. Most of the flood protection is provided for the northwest portion of the reservation which is also developed for cattle grazing and other commercial business. Additional water control structures affecting water levels and discharge adjacent to the reservation are listed as follows:

Pump Station S-8 (Table 2).

Located on the Miami Canal at the northwestern edge of WCA 3A, this pump station drains a 208 square mile portion of the EAA. S-8 is also equipped with a lift gate that will allow gravity discharge to either WCA 3A or the EAA, depending on hydrologic conditions.

Structure G-89

Located in Levee 28, this structure allows discharge from the L-3 Canal to the L-28 canal. This structure was built in 1976 in response to flooding in Hendry County. Most discharge occurs during the peak of the rainy season June-September.

Structure S-190

Located in the northwestern reach of L-28 Interceptor Canal, this structure controls water levels in the western portion of the Seminole Indian Reservation in Hendry County.

Structures S-339 and S-340

These are environmental structures located in the Miami Canal downstream of S-8 in WCA 3A. They remain closed most of the time and are designed to "back-up" water in the northern portion of WCA 3A and increase the hydroperiod.

TABLE 1.-- General Information Regarding Pumping Station S-140

Date of Initial Operation:	May 15, 1970
Location:	In Levee 28, just north of Alligator Alley, 25 miles west of U.S. Hwy 27, on western edge of Water Conservation Area 3-A, on eastern edge of the Miccosukee Indian Reservation.
Drainage Area Served:	110-square mile area served by Levee 28 Borrow Canal and Levee 28 Intercepter Canal.
Design Purpose:	To remove excess water, 7/16 inch in 24 hours, from designated drainage area and to discharge excess water into Water Conservation Area 3A.
Station Pumping Capacity:	843,436,800 gallons in 24 hours

Pump Specifications:

Number - 3

Type - Vertical propeller (99" diameter), axial flow, 110 inches

Design Speed - 81.6 rpm

Pumping Capacity of Each Pump - 435 cfs (195,240 gpm)

Head Differential - 4.1 feet

TABLE 2.-- General Information Regarding Pumping Station S-8

Date of Initial Operation:	February 9, 1962
Location:	In Miami Canal at NW corner of Water Conservation Area 3A, approximately 15 miles west of U.S. Hwy 27 and Pumping Station No. 7 (S-7).
Drainage Area Served:	208-square mile portion of the Everglades Agricultural Area served by the Miami Canal.
Design Purpose:	To remove excess water, 3/4 inches in 24 hours, from designated drainage area and to discharge excess water into Water Conservation Area 3A.
Station Pumping Capacity:	2,688,768,000 gallons in 24 hours.

Pump Specifications:

Number - 4

Type - Horizontal propeller (139" diameter), axial flow, 152 inches

Design Speed - 67 rpm

Pumping Capacity of Each Pump - 1040 cfs (466,800 gpm)

Head Differential - 4.5 feet

Operational Criteria

The primary control on water levels within the Miccosukee Indian Reservation is pumping at S-140. Water is pumped from the L-28 Canal into the Canal 60 getaway channel within Water Conservation Area 3A. Pumping occurs for flood control purposes when the headwater stage in L-28 Canal rises to 10.5 feet above sea level. Since the pump station became operable in 1970, pumping has occurred approximately 55 percent of the time, mostly during the wet summer months. Water levels in the L-28 Canal are maintained at about 10.5 feet above sea level to prevent flooding.

Water control structure G-89 in Levee 28 is used to alleviate high water conditions in eastern Hendry County when the L-3 Canal cannot discharge enough flood water to the L-4 Canal or through S-155 (a.k.a. S-239) into WCA 3A. This structure has stop logs and CMP culverts and is used infrequently.

Pump Station S-8 has the capability of forward pumping into WCA 3A at the Miami Canal or discharging by gravity through lift gates. Gravity discharge can occur in either direction and is used primarily for water supply purposes. Water levels above (upstream) S-8 are held at or below 12 feet to prevent flooding.

Water control structures S-339 and S-340, located in the Miami Canal within Conservation Area 3A, are used to prevent over drainage of the marshes north of Alligator Alley. These

structures remain closed throughout most of the year except when deliveries are being made for water supply purposes.

GENERAL HYDROLOGY

The Miccosukee Indian Reservation can be divided into three general hydrologic areas. The northwestern portion above Alligator Alley is drained to varying degrees by pump station S-140. The northeastern portion, above Alligator Alley, is within Water Conservation Area 3A and is subject to impoundment by the SFWMD, under regulation (water level) schedules established by the Corps of Engineers. It has been well documented that this northeastern portion of the Reservation has been subject to overdrainage because of water management and higher land elevations. Structures S-339 and S-340 in the Miami Canal were installed by the SFWMD to mitigate some of this overdrainage. The southern portion of the reservation is the wettest and least affected by water management practices. Some local drainage occurs near the L-28 Canal and L-28 Interceptor Canal. The Big Cypress Swamp within the reservation is virtually unaffected by water management practices.

A number of hydrologic monitoring stations are located within and adjacent to the Reservation. These stations measure water levels, discharge and rainfall. Table 3 is a summary of these hydrologic stations giving their period of record, agency affiliation, and selected historical data. The Miccosukee Tribe also maintains some hydrologic stations which are not included in this report. Data from these stations are used in the following sections to describe the

hydrologic regime within the reservation. Both ground and surface water are analyzed, and historic water level conditions and flow are presented. All data are on file, but, because of the volume, not included in this report.

TABLE 3.-- Hydrologic Station Names, Identification Numbers, Responsible Agency, and Period of Record.

WATER LEVEL STATIONS
-SURFACE WATER-

STATION NAME	IDENTIFICATION NUMBER	AGENCY	PERIOD OF RECORD
S-8 (upstream)	261955-804630	SFWMD	8/62 -10/90
S-8 (downstream)	261955-804630	SFWMD	8/62 -10/90
S-8 (upstream)	261955-804630	USGS	10/67 - 3/80
G-88 (upstream)	261952-805252	SFWMD	6/76 - 8/90
G-88 (downstream)	261952-805252	SFWMD	6/76 - 8/90
S-190 (upstream)	261711-805650	SFWMD	'78, 1/84- 9/90
S-190 (downstream)	261711-805650	SFWMD	'78, 1/84- 9/90
3A - NW	261707-804634	SFWMD	6/71 - 9/90
3A - 10	261644-804425	SFWMD	1/81 -11/81
EVERGLADES - 160	261557080464301	USGS	10/76 - 9/90
3A - 11	261304-804439	SFWMD	1/81 - 9/90
S-339 (upstream)	261252-804119	SFWMD	1/81 - 4/90
S-339 (downstream)	261252-804119	SFWMD	1/81 - 4/90
S-140 (upstream)	261017-804942	SFWMD	9/85 - 9/90
S-140 (downstream)	261017-804942	SFWMD	9/85 - 8/90
3A-12	261007-804034	SFWMD	1/78 - 9/90
3A- 9	260721-803853	SFWMD	1/82 - 9/90
S-340 (upstream)	260646-803631	SFWMD	1/81 - 4/90
S-340 (downstream)	260646-803631	SFWMD	1/81 - 4/90
3A-S	260459-804105	SFWMD	1/83 - 9/90
3A-SW	255922-805011	SFWMD	1/82 - 9/90
L-28 TIEBACK	02289037	USGS	6/70 - 9/80
L-3	02289030	USGS	10/69 - 9/90
3-63S	02286998	USGS	10/73 - 9/80
3-64S	02286970	USGS	10/73 - 9/80
3-62S	02286960	USGS	10/73 - 9/80
3-65S	02289043	USGS	10/73 - 9/80

WATER LEVEL STATIONS
-GROUND WATER-

STATION NAME	IDENTIFICATION NUMBER	AGENCY	PERIOD OF RECORD
HE - 3	261859080585401	USGS	'56, 10/73 - 10/83
HE - 862	261735080534002	USGS	12/77 - 10/90
HE - 861	261735080534001	USGS	10/77 - 11/83
C - 54	261000080520001	USGS	2/52 - 8/90

(CONTINUED)

DISCHARGE STATIONS

STATION NAME	IDENTIFICATION NUMBER	AGENCY	PERIOD OF RECORD
S - 8	261955-804630	USGS	4/62-10/90
S - 8	261955-804630	SFWMD	1/83 - 1/86
G - 88	261952-805252	SFWMD	6/78 - 8/90
S - 190	261711-805650	SFWMD	6/69 - 9/90
S - 339	261252-804119	SFWMD	1/84 - 4/90
S - 140	261017-804942	SFWMD	1/70 - 12/84
S - 340	260646-803631	SFWMD	1/84 - 4/90
L - 3	02289030	USGS	10/69 - 9/90

RAINFALL STATIONS

STATION NAME	IDENTIFICATION NUMBER	AGENCY	PERIOD OF RECORD
S - 8	261955-804630	SFWMD	9/62 - 10/90
3A - NW	261707-804634	SFWMD	6/71 - 9/90
S - 140	261017-804942	SFWMD	1/88 - 2/90
3A - L28	260600-805000	SFWMD	1/63 - 1/73
3A - S	260459-804105	SFWMD	6/71 - 9/90
3A - SW	255922-805011	SFWMD	7/75 - 9/90

Shallow Ground-Water Levels and Flow

The general direction of ground-water flow within the surficial aquifer system in the vicinity of the Miccosukee Indian Reservation is to the east and southeast. Water-table contours prepared by Milleson (1989, Fig. 9) (Figure 16), from water-table measurements in wells penetrating the water-table aquifer, indicate an east-southeast water-table gradient of about 4 feet in 4 to 5 miles in late October 1989, a high-water condition. Another water-table contour map (Milleson, Fig. 11) (Figure 17) representing conditions in late May 1988, low water stages, shows a 3 foot in 7 miles water-table gradient to the southeast. Comparative contour maps were prepared by Milleson (1989, Figs. 10, 12) (Figures 18, 19) for the same high-water and low-water conditions from data obtained in observation wells penetrating the gray limestone aquifer. An east-southeast gradient prevails in each of these maps. The gradient for the high condition is 3 feet in 6 miles, and the gradient for the low water condition is 3 feet in 5 miles for the gray limestone aquifer. Comparison of the water levels in both aquifers suggests minimal upward seepage from the gray limestone to the water-table aquifer during high-water conditions, but a reversal to a slight downward component of seepage during low-water conditions.

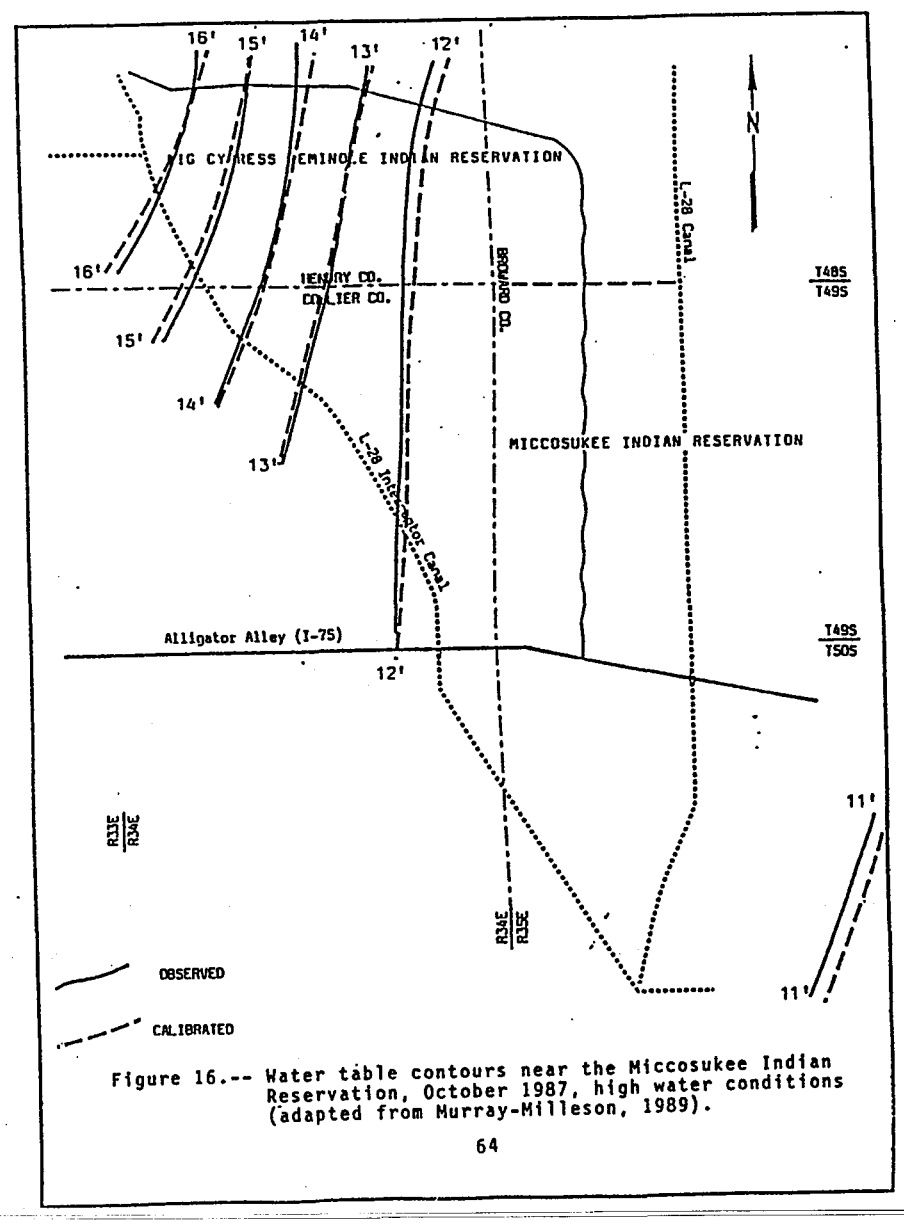


Figure 16.-- Water table contours near the Miccosukee Indian Reservation, October 1987, high water conditions (adapted from Murray-Milleson, 1989).

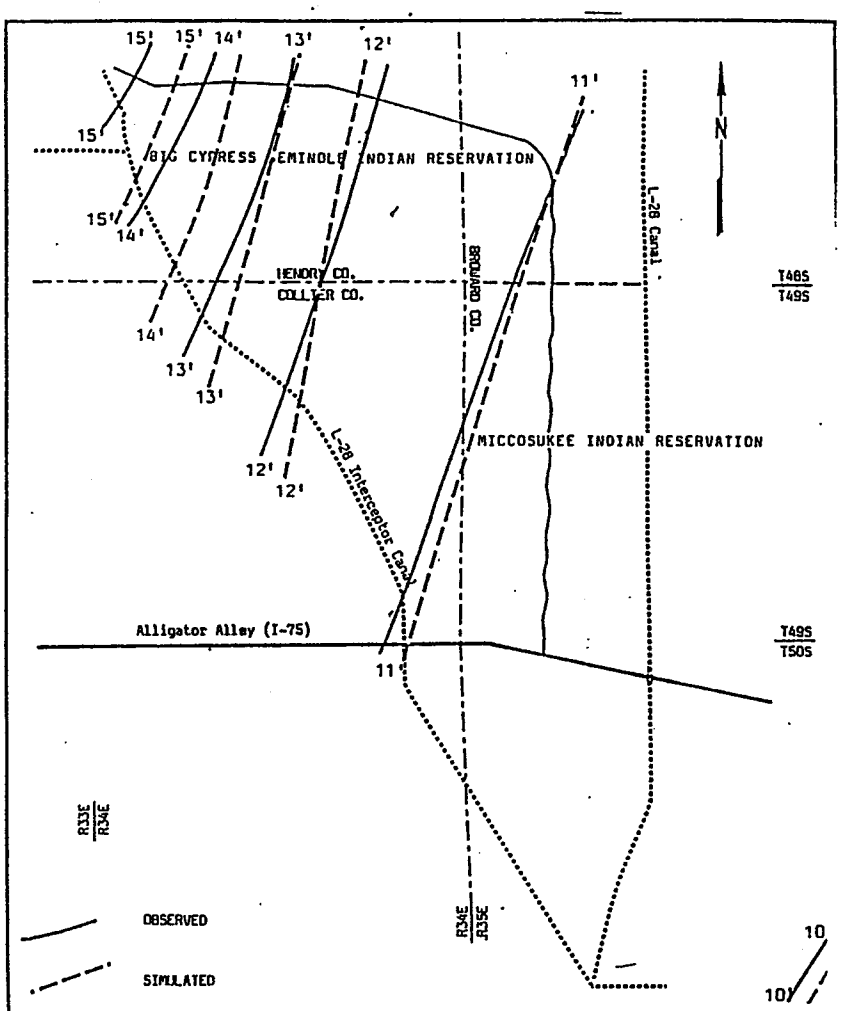


Figure 17.-- Water table contours near the Miccosukee Indian Reservation, May 1988, low water conditions (adapted from Murray-Milleson, 1989).

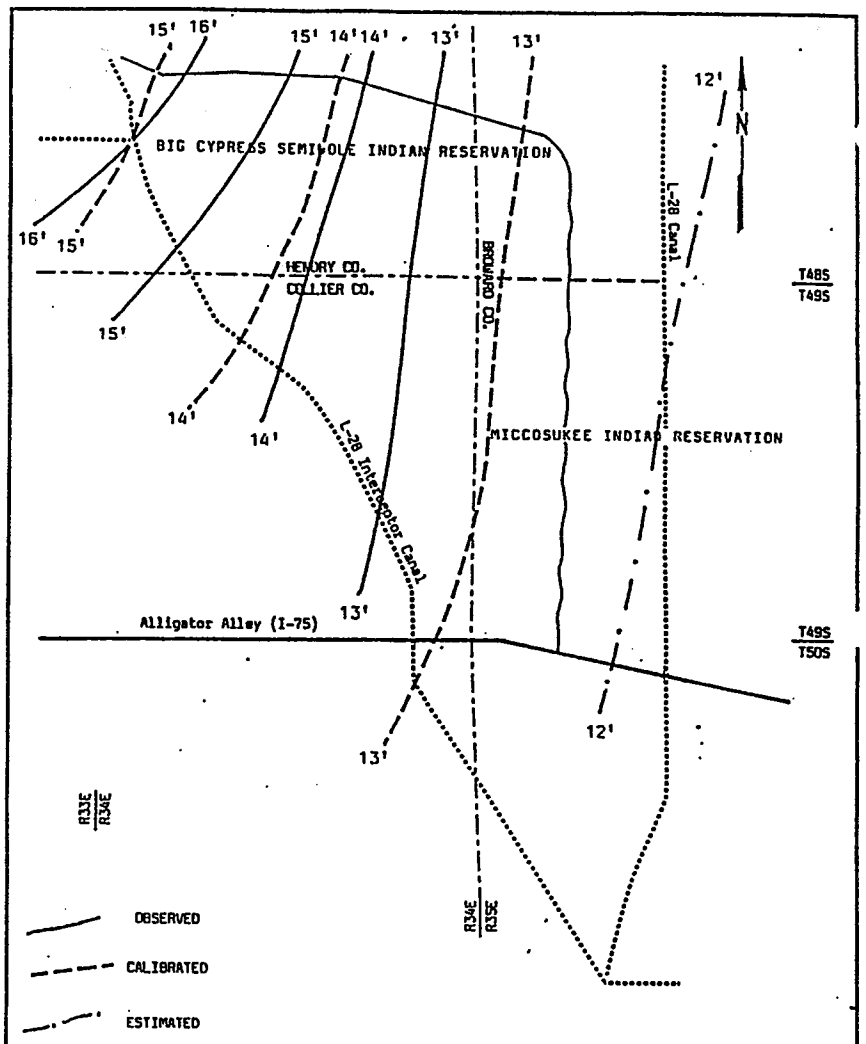


Figure 18.-- Water levels in the gray limestone aquifer near the Miccosukee Indian Reservation, October 1987, high water conditions (adapted from Murray-Milleson, 1989).

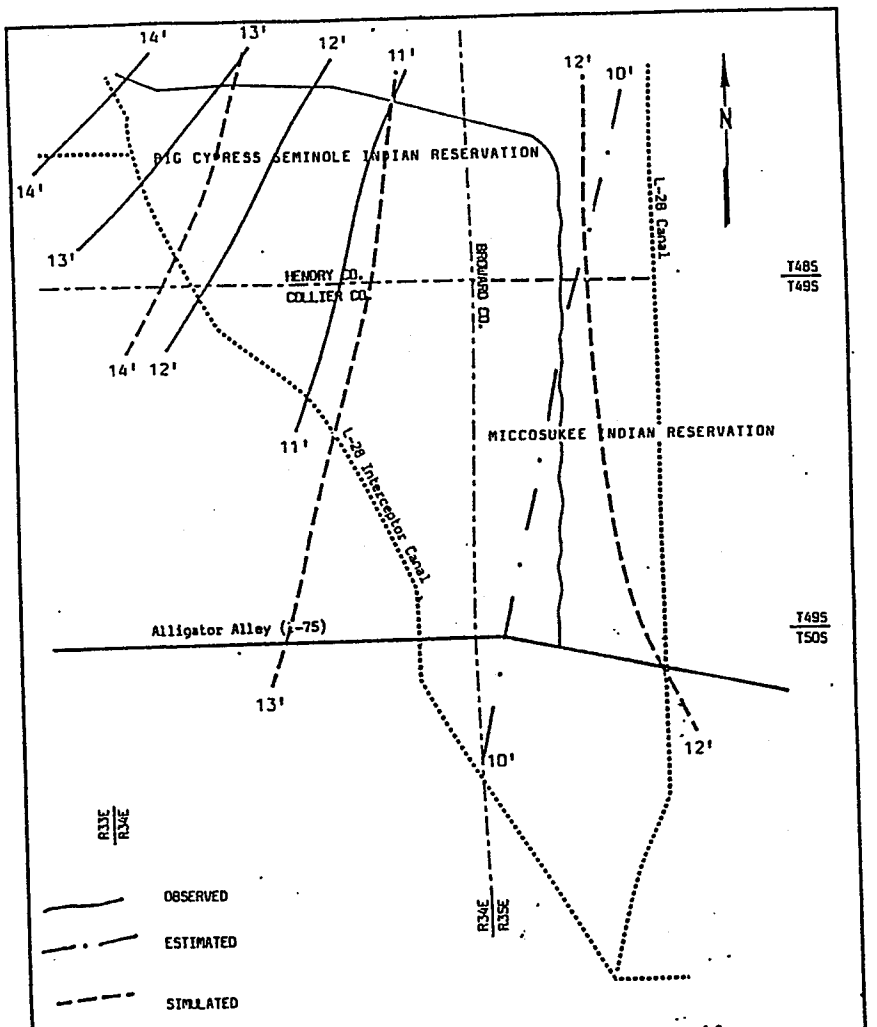


Figure 19.-- Water levels in the gray limstone aquifer near the Miccosukee Indian Reservation, May 1988, low water conditions (adapted from Murray-Milleson, 1989).

Milleson (1989, Fig. 14) (Figure 20) prepared a map showing contours of simulated water levels in the gray limestone aquifer, resulting from continuous pumping of a well at a rate of 4 million gal/d/ after 210 days.

Long-term ground-water levels are available (1951-90) for USGS observation well C-54, located along Alligator Alley at the Collier-Broward County boundary. The well is shallow, penetrating the water-table aquifer. Figure 21 is a hydrograph representing 17 years of record, 1973-90, from that well. The station description in USGS Water-Data Report FL-89-2B (p.85) indicates that the general land-surface elevation in the vicinity of the well is 12.86 ft above sea level; the maximum water level was 13.81 ft above sea level in 1953, and the lowest was 7.81 ft in June 1962. The hydrograph gives an indication of the frequency that water levels occur above or near the land surface. Figure 22 shows a typical 1 year record of water-level fluctuations in the well. The patterns show the rapid and immediate increases in water level in response to rainfall infiltration, an indication of the local high vertical permeability of the surface sediments in that area. A further indication of the permeability of the surface sediments is the rapid decline of levels, but part of that decline is influenced by the proximity of the well to the Levee 28 Interceptor Canal. Ground-water levels are generally within 3 feet of the land surface in that area.

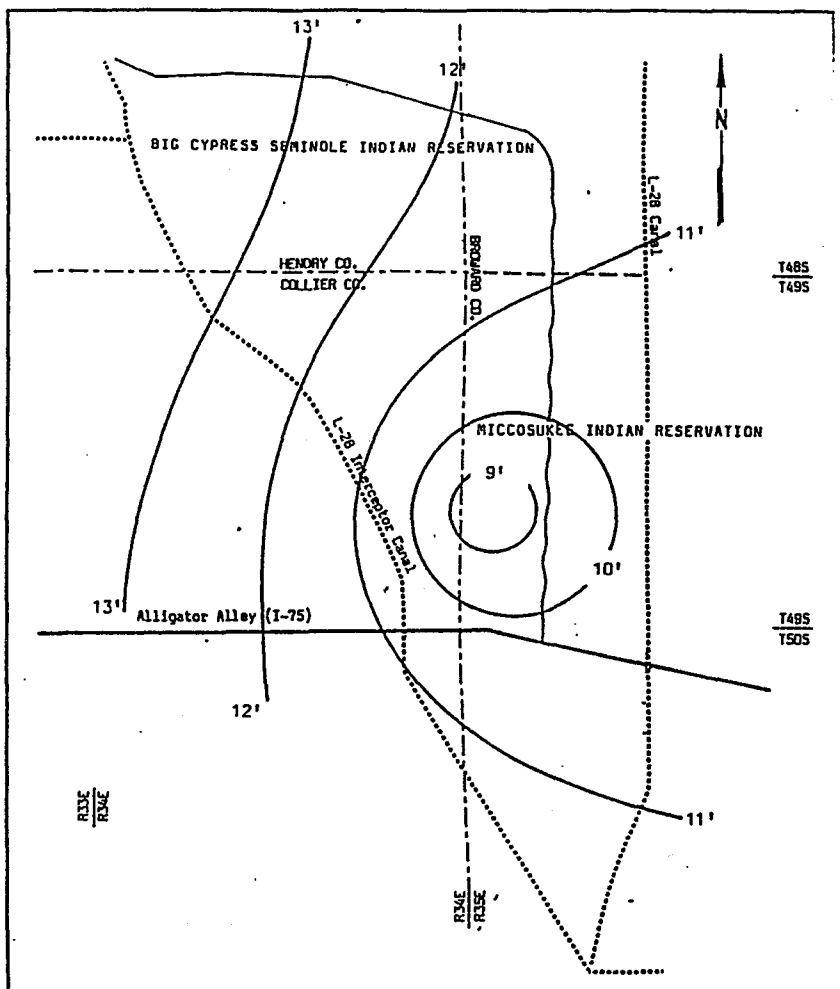


Figure 20.-- Simulated drawdowns in the gray limestone aquifer at the Miccosukee Indian Reservation at a pumping rate of 4 MGD (adapted from Murray-Milleson, 1989)

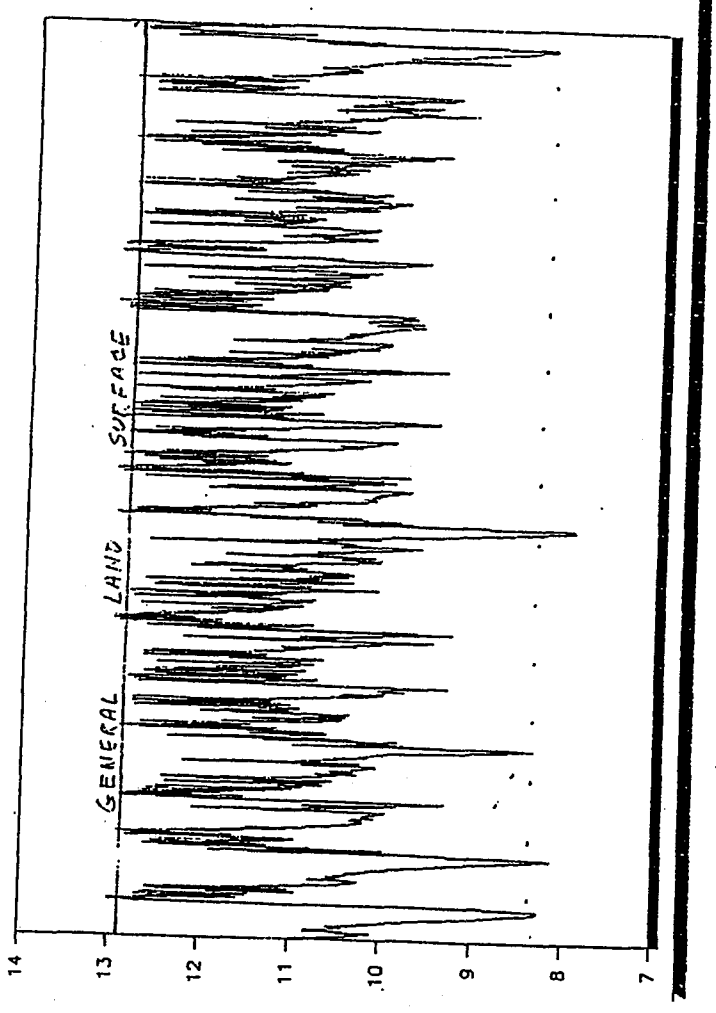


Figure 21.-- Long term hydrograph of U.S.G.S. Observation Well C-54, 1974-1990.

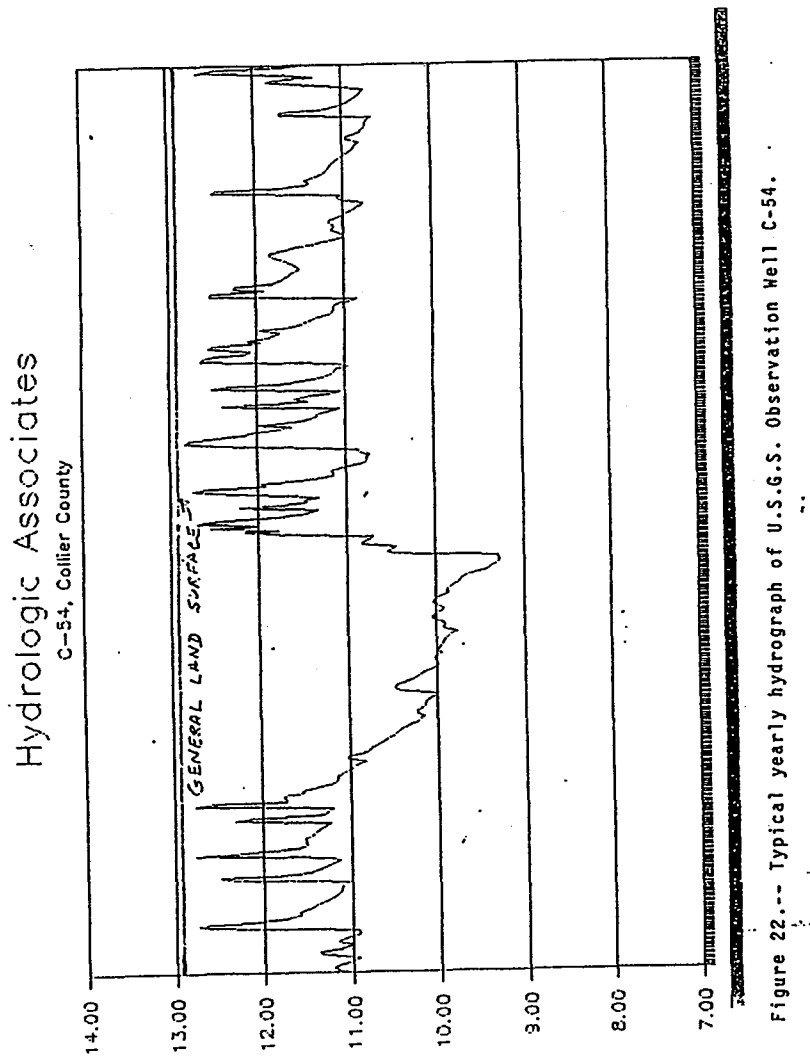


Figure 22.-- Typical yearly hydrograph of U.S.G.S. Observation Well C-54.

Ground-water levels, particularly in the north part of the Indian reservation, will be also influenced by the proximity of the Miami Canal. Ground water flow in the north part of the reservation probably will take an east-northeast component (toward Miami Canal) during prolonged dry seasons when the Miami Canal picks up ground water from aquifer storage to sustain canal flow. Within the west part of the reservation ground water flow may be locally influenced by the L-28 Canal and the L-28 Interceptor Canal. Flow will be toward those canals during dry seasons.

Estimated Ground Water Velocity in the Surficial Aquifer WCA 3A

The rate of downgradient migration can be estimated by considering the hydraulic conductivity (permeability) of the matrix of the surface sediments, the hydraulic gradient of the water table, and the porosity of the matrix materials.

The average velocity of movement of the ground water and thus the movement of the slug can be approximated by the equation (Lohman, 1972, p.10)

$$\text{Velocity} = \frac{K \text{ (permeability)} \times \text{hydraulic gradient}}{\text{porosity (estimate)}}$$

The average transmissivity of the water-table aquifer (upper part of surficial aquifer system), was calculated by Milleson (1989, p.17) to be about 60,000 gal/d/ft or 8,000 ft^2/day. Fish (1988) Figure 8) shows an aquifer thickness of about 20 feet in the north area; thus an average permeability

of 400 ft/day. Applying to the equation:

$$V = \frac{400 \text{ ft/day} \times 4 \text{ ft/4 miles}}{0.2}$$

$$V = \frac{400 \times 4/21{,}000 \text{ ft}}{0.2} = \frac{400 \text{ ft} \times .0002 \text{ft/ft}}{.2}$$

average V = 0.4 ft/day

The water-table aquifer is underlain by 30 or more feet of lime mud of low permeability. In the unlikely occurrence of the slug entering the gray limestone through the layer of mud, a similar approximation of transmissivity for the gray limestone is about 500,000 g/d/ft or 65,000 ft²/day (estimated from Milleson, 1989, p.17) and the average thickness of the gray limestone is about 80 feet. Therefore, the permeability value at the north part of the reservation would be about 800 ft/day. Applying the equation

$V = \frac{K I}{\theta}$ Where:

K = 800 ft/d

I = 3 ft/5 miles

$$V = \frac{800 \text{ ft/d} \times 3 \text{ ft/26,400 ft}}{0.2}$$

$$V = \frac{800 \text{ ft/d} \times .0001}{0.2} = \frac{.08}{.2} = 0.4 \text{ ft/d} \quad \text{or}$$

less than 3 miles in 100 years

Water-level data presented by Fish (1988, Figure 40, 41) indicate that the hydraulic gradients to the east, southeast, and south from the Indian reservation are extremely low compared to the gradients within the reservation. These low

gradients would result in even lower average velocities than those calculated above.

Estimated Ground Water Velocity in the Biscayne Aquifer

An estimate can be made of the movement of an oil spill that occurred within Conservation Area 3A during a dry period where the spill invaded the Biscayne aquifer permeable zones. The average thickness of the Biscayne aquifer in the western half of Broward County is about 40 ft (Fish, 1988, Fig. 37). The average transmissivity of the aquifer system there is 200,000 ft² /d., and the permeability is about 5,000 ft/d. Water-level maps by Fish (1988, Figs. 40, 41) indicate a horizontal gradient across Conservation Area 3A is about 2 ft/10 miles.

A calculation of the average velocity of the ground water beneath the conservation area is as follows:

$$V = \frac{K I}{\theta}$$

$$\text{average velocity} = \frac{5{,}000 \text{ ft/d} \times .000064 \text{ ft/ft}}{0.2}$$

$$= \frac{.000032}{.2}$$

$$= 0.00016 \text{ ft/d}$$

Surface Water

Surface water levels are measured at 19 stations within and adjacent to the Miccosukee Indian Reservation (Figure 23). The periods of record vary widely (See Table 3) because of changing requirements of government agencies responsible for water resource management (See Appendix C for Station Analyses). Discharge in the canals or pump stations is measured at seven stations (See Table 3). The longest term surface water station is at pump S-8 on the Miami Canal. Corps of Engineers Station COE 3-2 (USGS designation 3-62S) is a long term water level monitoring station located just east of the reservation in Water Conservation Area 3A. A number of stations were established in the early 1980's by the SFWMD to determine the hydrologic effects of S-339 and S-340 and to increase the density of coverage for rainfall stations (Figure 24). Two additional stations (HE-862 and C-54) that measured ground water levels on the western edge of the reservation can also be used to determine water table conditions (Figure 25). C-54 has been in operation since 1952 and provides the longest period of water level record for the reservation.

Water-level duration is an important measure of hydrologic conditions. This type of data analysis shows how long water levels were at a given point for a selected period of record. Two stations are used in this analysis: C-54 and

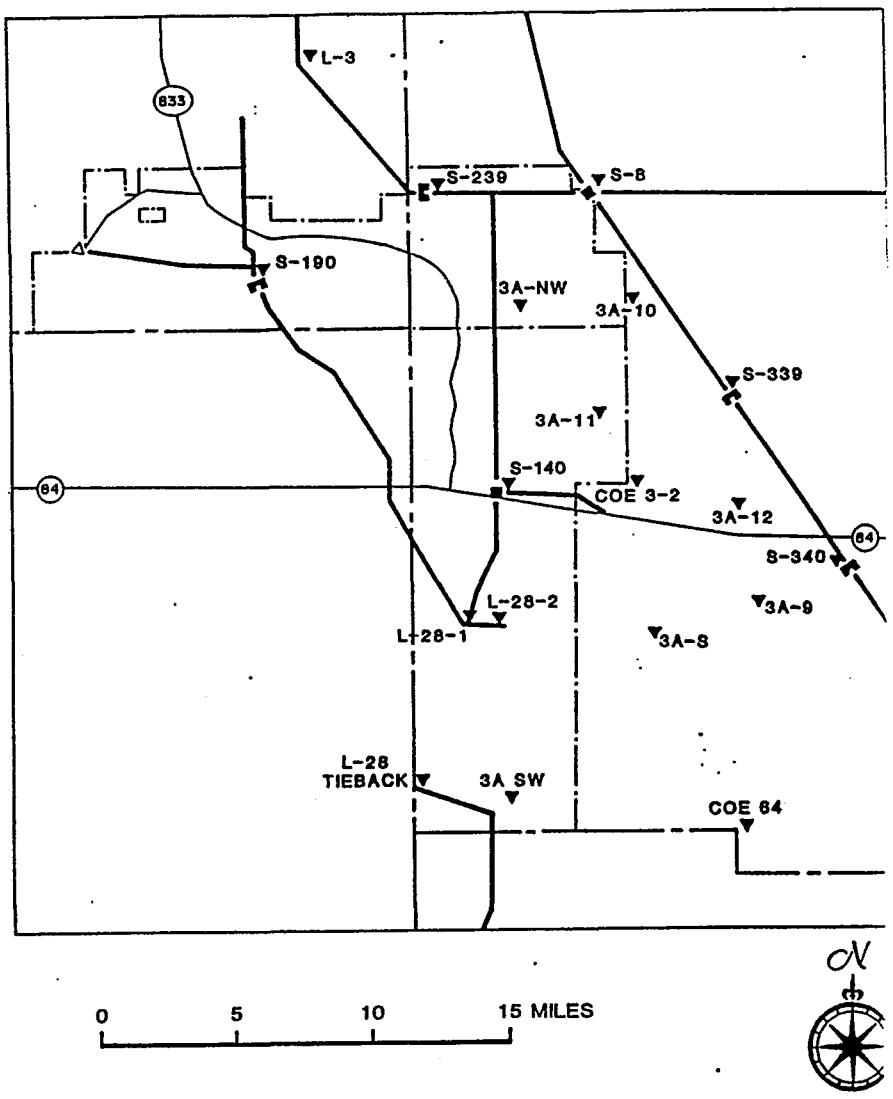


Figure 23.-- Location of surface water hydrologic stations near the Miccosukee Indian Reservation.

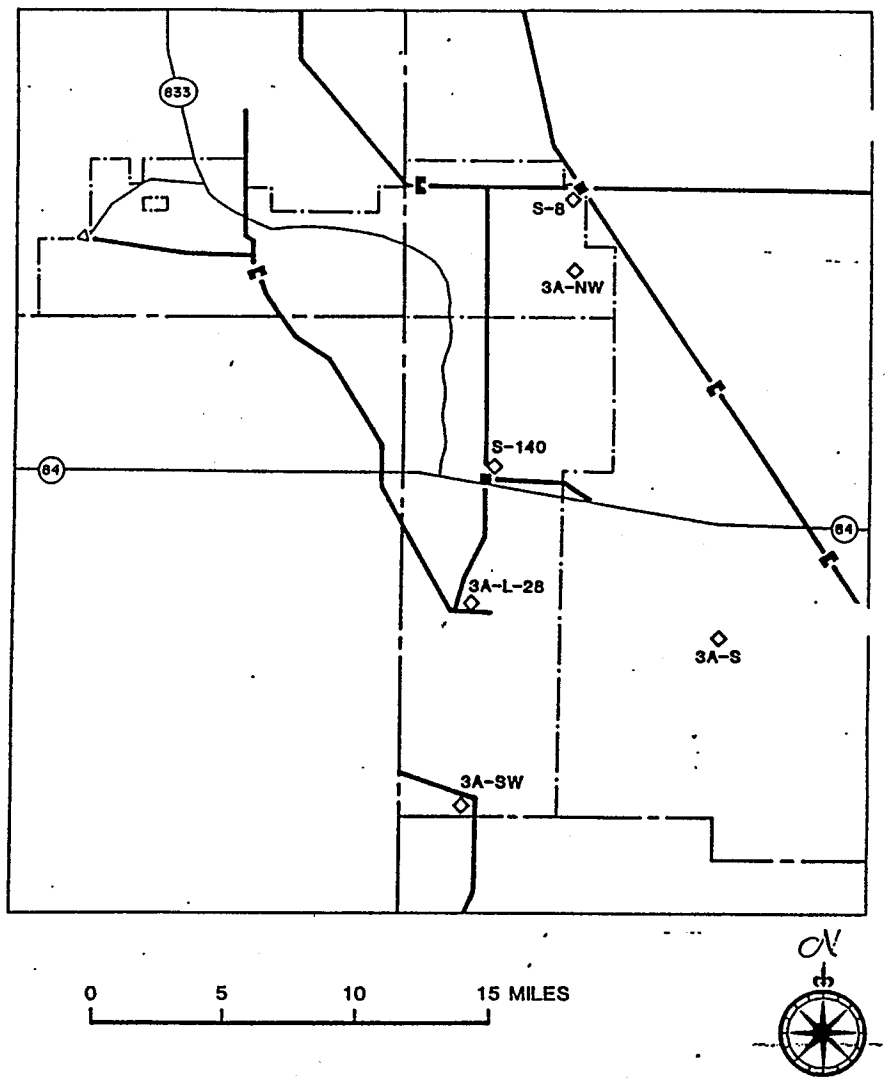


Figure 24.-- Location of rainfall stations near the Miccosukee Indian Reservation.

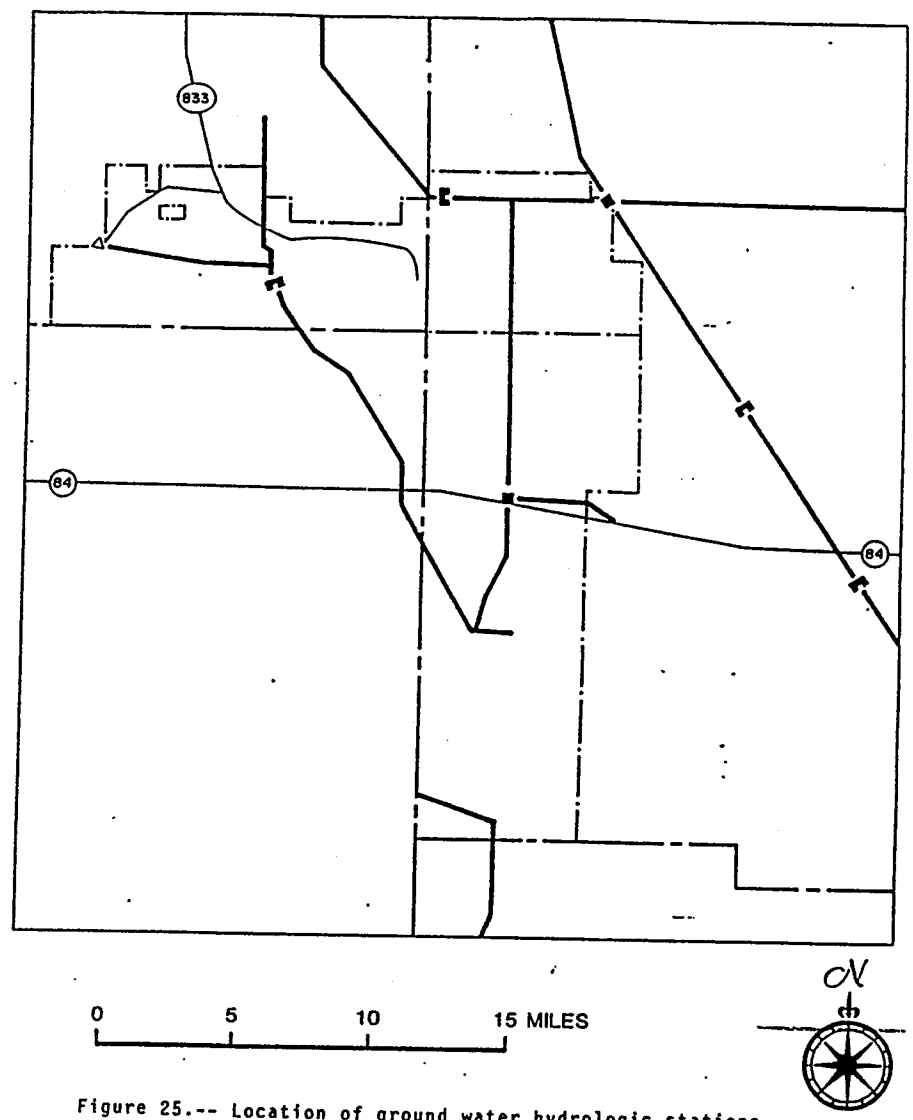


Figure 25.-- Location of ground water hydrologic stations near the Miccosukee Indian Reservation.

COE 3-2 (USGS 3-62S). The period of record for C-54 used in this is water year 1975 through 1990. Land surface elevation at C-54 is about 12.8 feet. Analysis of the duration curve (Figure 26) shows that water levels exceeded 13 feet only 3 days (0.05 percent) in the last 15 years, exceeded 12 feet about 15 percent of the time and exceeded 11 feet about 43 percent of the time. Land elevations in this area of the reservation are around 12-13 feet; therefore, surface inundation will average about 55 days per year.

Water level duration curves for the period 1972-78 were developed for station COE 3-2 in a SFWMD publication (Zaffke, 1983) (Figure 27). These curves show that surface water is present at this station approximately 37 percent of the time or an average of about 135 days per year. Because structure S-339 is designed to increase the hydroperiod in this area, slight increases in periods of inundation can be expected in this part of WCA 3A.

Surface water flow in the reservation is generally to the south and southeast following the topography of the land. Water and land surface elevations have approximately the same slope of 0.2 foot per mile. Sheet flow in the Everglades or Big Cypress Swamp is undetectable unless there are structures, bridges or culverts directing the flow.

There are a number of impediments to surface flow within the reservation. These include Levee 28 which prevents direct surface flow eastward into WCA 3A. Only pumping at

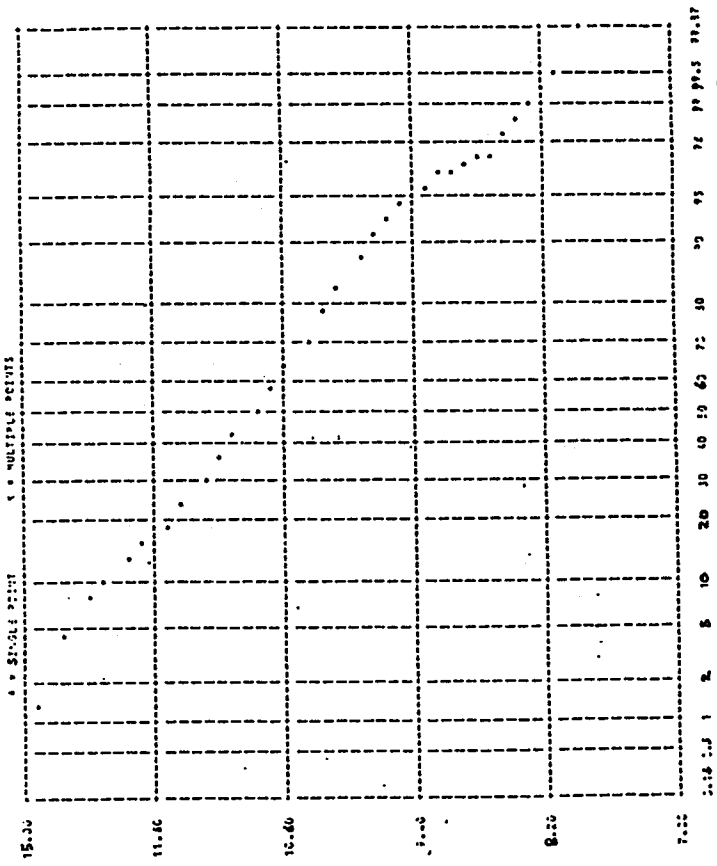


Figure 26.-- Water level duration curve for U.S.G.S. Observation Well C-54, 1975-1990.

section north or Tamiami Canal (adapted from Leach and others, 1972).

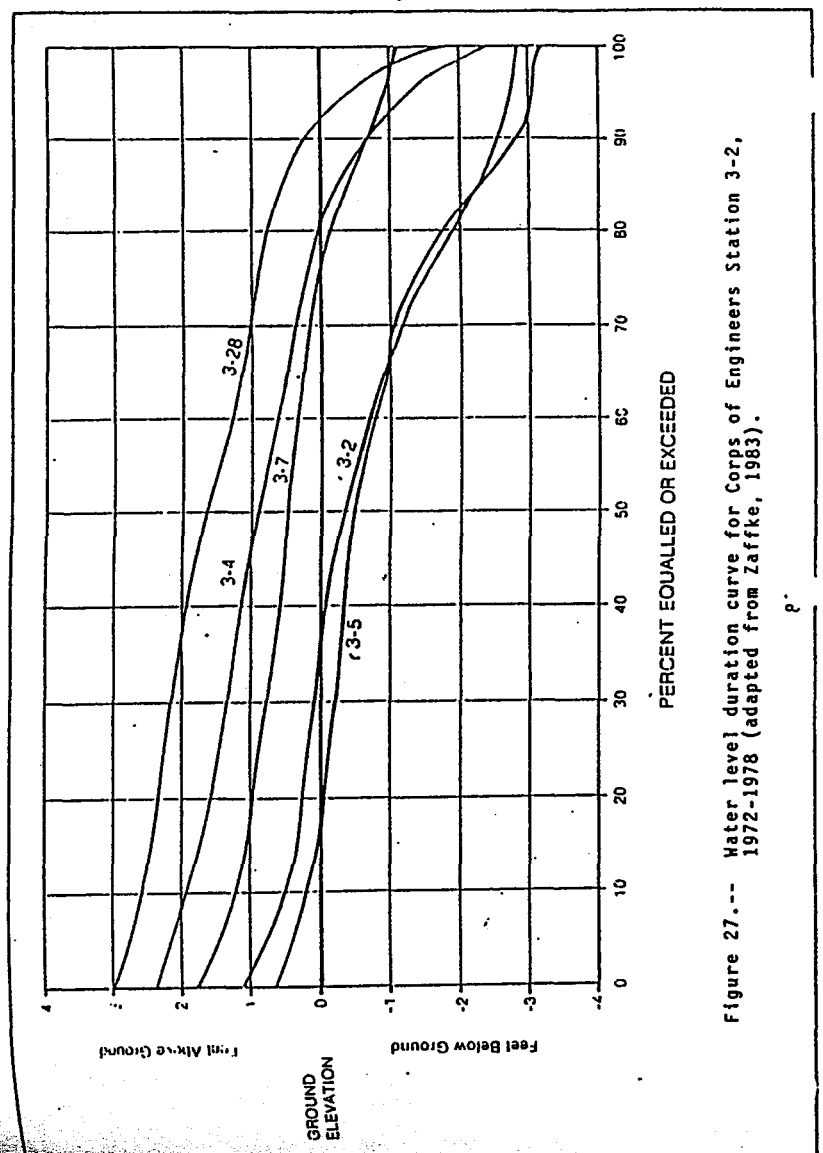


Figure 27.-- Water level duration curve for Corps of Engineers Station 3-2, 1972-1978 (adapted from Zaffke, 1983).

S-140 can move surface waters from the northwestern portion of the reservation into WCA 3A; thus, this station is the ultimate control on surface flow. Other impediments to surface flow include the road bed of Alligator Alley which prevents north to south overland flow. Only where bridges breach the road bed would surface flow move southward. Additional impediments to surface flow moving westward are the nearly continuous berm on either side of the Miami Canal.

Surface water rates of flow in the northern or western parts of WCA 3A have not been determined. Leach and others (1972) estimated flow rates at the Tamiami Trail to be about 500 feet per day under high flow conditions (Figures 28 and 29). Flow rates east and south of the reservation (which is 28 miles north of Tamiami Trail) should be much lower because of lower hydraulic heads, less depth of inundation, and higher land elevations.

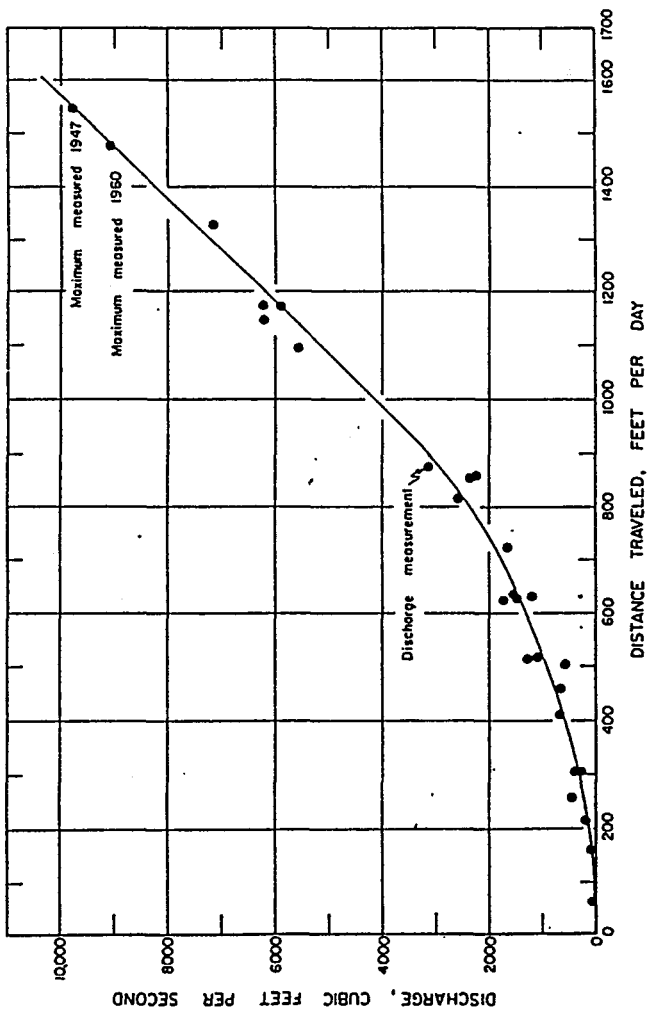


Figure 28.-- Relation between the Tamiami Canal outlets' discharge and the average distance a particle of water would travel in the Everglades in a day (adapt from Leach and others, 1972).

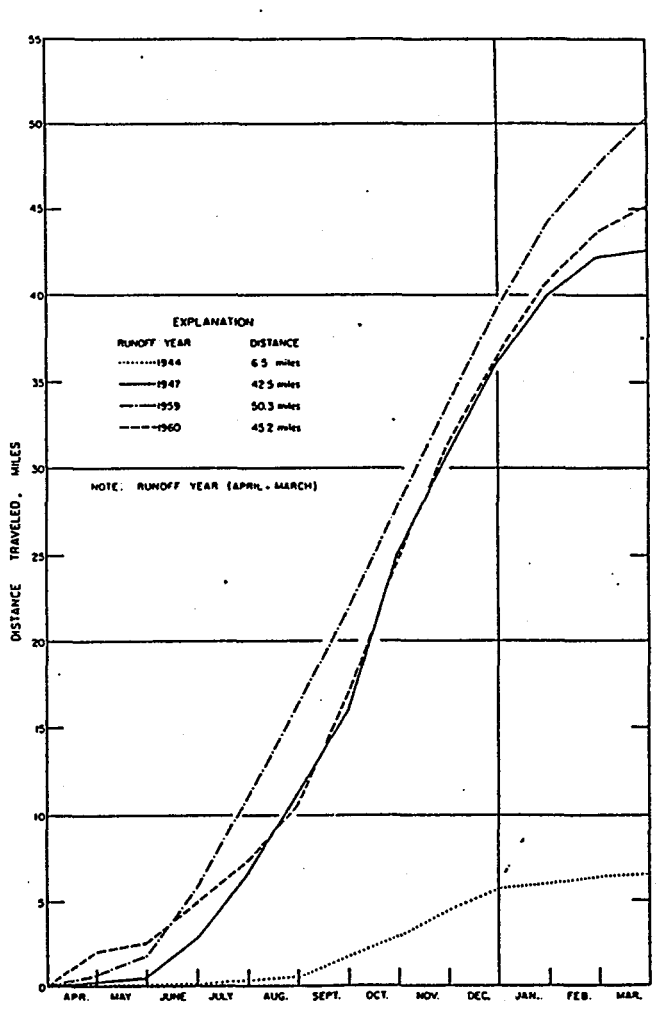


Figure 29.-- Accumulation of the average monthly distance traveled by a particle of water in the Everglades, based on flow in the measuring section north or Tamiami Canal (adapted from Leach and others, 1972).

WATER QUALITY CHARACTERISTICS

Numerous water quality investigations have been undertaken within and adjacent to the Miccosukee Reservation. Some were long-term monitoring programs, some were reconnaissance studies, and others were site specific investigations. In the following text, ground water and surface water quality investigations are separated. Because there are so many investigations, an annotated format is used to make these sections describing selected reports succinct. A summary statement is given at the end of each section.

Ground Water

Parker and others (1955) in their treatise on ground water resources in south Florida presented information on the mineralization of ground waters in the Everglades Basin. This report was first to assess the effects of connate seawater on the aquifer and showed the increasing degree of mineralization with depth (Fig. 221) (Figure 30). Miller (1988) updated this work in the mid 1980's for Palm Beach County; he concluded that this mineralization was increasing from water management practices and flood control operations causing a gradual upwelling of more mineralized ground water.

Howie (1987) completed a very detailed study for the USGS on the groundwater quality of the surficial aquifer system throughout Broward County. Multi-depth samples were

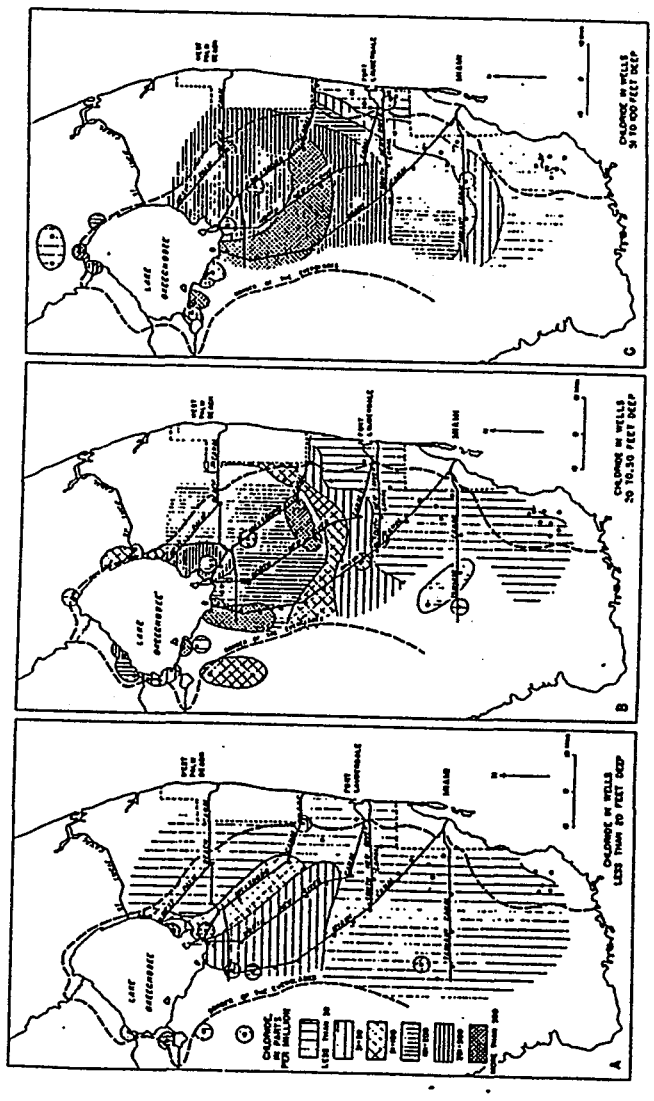


Figure 30.-- Maps showing chloride concentrations in ground water at different depths in the Everglades: A. Wells less than 20-ft deep; B. wells 21-50 feet deep; C. wells 51-100 ft deep (adapted from Parker and others, 1955).

collected in all the geohydrologic units identified by Fish (1988) and Causaras (1985). Four of the wells sampled are located in the Miccosukee Reservation and one well was located to the north on the Broward-Palm Beach County line. Ground water samples were analyzed for major inorganic ions, selected metals, nutrients, and field parameters. In general, the report notes that the ground water from about Alligator Alley and south is potable but does increase in mineralization with depth. Some zones have high iron concentrations which is typical of south Florida groundwater. Ground Water in the northernmost part of the reservation is potable at the water table, but is non-potable at depth because of increased mineralization caused primarily by sodium and chloride ions.

Nealon (1984) of the SFWMD used much of the USGS data in his analysis of ground-water quality in the Water Conservation Areas. The conclusions in this report are much the same as those reported by Howie (1987) for the Reservation area.

Murray-Milleson (1989 p. 15) present the most recent water quality data collected on the reservation. Three wells penetrate the gray limestone aquifer and are designated North Site, South Site, and Northwest Site. Ground water from a water table well at the North Site was also sampled and analyzed. Results of the analyses are listed as follows:

	South Site	North Site	Northwest Site	Water Table North Site
	START	END	END	END	END
Chloride, mg/l	81	141	98	59	47
Iron, mg/l	0.03	0.03	0.03	0.03	1.93
Conductivity*, umhos	810	900	910	810	850
Sulfide*, mg/l	3.5	4.0	5.0	5.0	-
Temperature*, C	24	24	24	26	27
Total Dissolved Solids, mg/l	729	725	660	624	525
Hardness, mg/l	277	269	289	248	453
Sulfate, mg/l	26.6	27.0	18.4	18.4	19.7
pH	7.0	7.0	7.1	6.9	6.7

* Measurements taken in the field using an electric meter and field titrates (CHEMetrics). Remaining analyses by GEOtec, Laboratory, West Palm Beach.

Again these data indicate that the ground water in the gray limestone and water table aquifer are moderately mineralized but are potable within most of the reservation.

The data and information within the above reports can provide a sufficient base to compare any water quality changes that could occur from drilling operations.

Surface Water

The surface water quality investigations listed below were undertaken by various agencies as part of long term monitoring programs. The data and analyses presented can be used primarily as background information for comparison purposes.

McPherson (1970) established a monitoring network in 1969 to assist in the assessment of the environmental impact of the proposed Jetport in the Big Cypress Swamp. Two of the stations were in the Miccosukee Reservation. One (Site 5) was located at the L-28 Tieback Canal (which, in turn, became a long-term USGS monitoring station), and the other was located at a bridge in Alligator Alley (Site 15). Water samples were collected and analyzed on a one-time basis for major ions, nutrients, pesticides, trace metals and plankton. Both material and plants were also analyzed for insecticides at selected stations.

Wimberly (1974) conducted a short-term study to assess the water quality impact at oil exploration sites in the Big Cypress Area. One site was located in the Seminole Indian Reservation about 10 miles north of Alligator Alley adjacent to L-28 Interceptor Canal. Basically what was concluded is that chloride concentrations and mineralization increased slightly downgradient at some sites. Background conditions returned after drilling operations ceased and the wells were properly plugged.

Waller and Earle (1975) conducted a three year intensive water quality investigation in the Everglades Basin. Water samples were collected monthly for nutrients and field parameters; quarterly for trace metals; and semi-annually for major ions, phytoplankton, and metals and pesticides in bottom material. Rainfall chemistry was also analyzed. Three

of the stations were near the Miccosukee Indian Reservation: L-28 Interceptor Canal (Site 9), L-28 Canal above S-140 (Site 11) and Corps of Engineers stations 3-2 (USGS designation 3-625). These data and analyses provide a strong background of information near the proposed drilling site and also indicate the seasonal variability of water quality in the area's canals and marshes.

The SFWMD began long-term water quality monitoring at most structures in the Everglades Basin in the mid-1970's. Initial results are presented by Lutz (1977). Parameters and collection frequencies have changed over the years, but this ongoing monitoring program provides a strong, current data base for comparison studies of water quality (Germain and Shaw, 1988). The Everglades SWIM Plan (SFWMD, 1990) provides loading analyses at major inflows to the Water Conservation Areas. A major study funded by the SFWMD is now underway to determine detailed water-quality characteristics of the L-28 Interceptor Canal Basin for the purpose of reducing phosphorus loading.

IMPACTS OF OIL EXPLORATION/PRODUCTION IN THE MICCOSUKEE RESERVATION ON WATER RESOURCES

A brine spill would be incorporated with natural sheet flow if a spill were to occur during the rainy season. Natural surface flow in the reservation follows the land surface slope, 3 ft in 10 miles, south and southeast. If the drilling site is west of Levee 28 Canal and an uncontrolled flow is of long duration, some of the blended sheet flow could enter Levee 28 canal, but would not extend beyond structure S-140.

If a spill were to occur during the dry season the salt water would infiltrate the surficial aquifer system to the water table and continue downward, because of its density, and laterally at a slow rate, because of the low permeability of the sediments. The slug of salt water in the surficial aquifer system would take the form of a circle surrounding the source but would have a lobe that extends downgradient, toward the L-28 Canal. Fish (1988, Fig. 19) (See Figure 11) indicates that the upper 60 ft of sediments ranges in hydraulic conductivity from 0.1 ft to 10 ft/day. After a spill is under control the slug would slowly decrease in size and chemical concentration due to dispersion and mixing with the native ground water.

The problems of coping with oil spills have been an important factor throughout the history of oil exploration and production. In south Florida oil occurs under low gas

pressure so that no natural flows occur in wells. Most spills are of a minor nature in the vicinity of producing wells.

Minor spills can be readily cleaned up, virtually on site. Larger spills have the potential of migrating off site; the area affected would depend upon hydrologic conditions at the time of a spill, the soil, vegetation, and underground strata in the vicinity of a spill.

The average annual rainfall in Conservation Area 3 is 53 inches (Leach and others, 1972, p.45). Most of the rainfall is lost through evaporation and transpiration, and therefore the area has nearly gone completely dry several times since it was enclosed. Only during the passage of tropical disturbances or the movement of cold fronts is the rainfall generally distributed over the conservation area. Most rainfall during the rainy season is scattered, unequal and sporadic. The northwest part of Conservation Area 3 and the Indian reservation dry-out earliest because of higher land elevations and the occurrence of less rainfall than the areas to the south and east. Because most of the rainfall is of short duration and sporadic, sheet flows off the reservation are equally short and sporadic and cease as the water level declines below the land surface. A slug of oil carried by the sheet flow would also cease its movement as the water level falls below the surface. Each time the oil slug

contacts the land surface, part is retained by the vegetation and part clings to the sand and muck soils, thus reducing the size of the migrating part of the spill with each sequence. The net area that a slug finally covers would depend upon its size, and duration, and the frequency of the storms that occur over the spill area, as well as the density of the vegetation.

A large spill occurring during the dry season, when water levels are below the land surface for weeks or months, would result in a smaller affected area than that which would result during high water levels. Soil and vegetation will retard the movement of a slug, so the overall distance that a slug moves is further reduced. However, part of a spill would infiltrate vertically, possibly to the water table. Within the ground water system part of the oil residue would move southeast under low hydraulic gradient; a large part of the oil would cling to soil particles to become part of the matrix of the unsaturated zone. Because of the low permeability of the soil and muck, the rate of underground movement is extremely slow.

Because the particular concern is that of an accidental oil spill which could occur during oil exploration, a series of hypothetical cases are presented to indicate: (1) pathways that a spill could take; (2) area affected by the possibility of a spill; (3) the projected effect on major drinking water systems; and (4) potential damage to biological communities.

It should be emphasized the remedial or preventive actions can be provided at any time during the migration of a spill.

Case 1 - A spill occurs in the reservation west of Levee 28, north of Alligator Alley during flood time, and drought.

Scenario I: An oil spill during flood season will move with the direction of the surface water flow and at about the same rate (less than 500 ft per day), but, vegetation will cause some retardation in the rate. Because the west area is enclosed by Levee 28 and L-28 Interceptor, the spill will not escape beyond (east or south) the levees unless pump S-140 is operating to direct flood water to Canal C-60. In that event, surface water (and a spill) will migrate east to L-28 Canal. If a spill were to reach the canal, further movement of a spill could be controlled or inhibited by pump station S-140, and clean-up can proceed.

Scenario II: A spill during drought could spread over the surface sediments and finally seep downward to the water table which is normally within 3 feet of the land surface. Some attenuation will occur within the unsaturated zone. Upon reaching the water table, a spill would migrate with the ground-water flow toward the L-28 Canal under a low gradient and at a velocity of about 0.4 foot per day.

Case 2 - A spill occurs at a drill site east of Levee 28, north of Alligator Alley during flood, and drought.

Scenario III: An oil spill during flood season would spread out on the water surface and move generally southeast and then south at an average velocity of less than 500 feet per day. Movement of the oil would be further retarded by vegetation, and vegetation also would tend to retain part of a spill from further downstream movement. The amount of reduction would depend upon the density of the vegetation. At an average velocity of less than 500 feet per day, it would take more than 10 months to reach ENP or areas servicing drinking H_2O supplies. Movement within Conservation Area 3A will continue after the rainy season at a reduced rate until the water level declines to or below the land surface. A spill would then slowly infiltrate the surface to follow the vertical decline of the water table, during which time attenuation within the pore spaces of the unsaturated zone would occur. Once a spill were to become part of the ground-water system, its horizontal movement would be negligible because of the low water-table gradient.

As the subsequent flood season arrives, part of a spill would rise again above the surface and resume its movement with the surface-water flow for a new cycle.

In the event that remnants of a spill reached areas of the Biscayne aquifer, the extremely low gradient and velocity of movement in the aquifer would preclude any effect on

municipal water-supply systems or biological communities in the Everglades National Park.

Scenario IV: An oil spill during drought would spread out over the dry soil and slowly infiltrate vertically through the unsaturated zone of the water table aquifer to the water table. Attenuation within the unsaturated zone would retain part of the spill. A spill would then migrate downgradient (southeast) within the water table aquifer at an average velocity of 0.4 foot per day or less than 150 feet per year. During the following flood season, part of the spill would rise (with the water table) above the land surface and migrate south with the surface-water flow. In the remote possibility that a spill were to enter the upper reach of the Miami Canal, the spill could be controlled by the series of canal structures (S-339, S-340, S-151) which would block movement in the Miami Canal and clean-up measures could then proceed.

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APPENDIX A-7

GROUNDWATER BRINE SPILL SIMULATIONS

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APPENDIX A-7

GROUNDWATER BRINE SPILL SIMULATIONS

1.0 INTRODUCTION

A two-dimensional finite-element transport model was employed to simulate brine leakage into the underlying aquifers at the project site. The USGS SUTRA code was utilized because of its flexibility in simulating variable-density solute transport and groundwater flow. The model employs a two-dimensional hybrid finite-element and integrated-finite-difference method to approximate the governing equations that describe the two interdependent processes that are simulated, namely:

(1) fluid saturated groundwater flow, and
(2) transport of a variable-density solute in the groundwater.

This code was developed by the USGS and is widely used and accepted by the water resources professional community (Voss, 1984).

Two scenarios assess the possible impacts to groundwater at depth during either drilling or operation of the well. The first scenario simulates a surface spill or breach in the drill site containment berm, in which brine flows into the surficial aquifer. The second scenario simulates a constant leak of brine into the gray limestone aquifer and the upper Floridan aquifer through a well casing leak. These scenarios were considered the "worst case" possibilities, therefore smaller spills would have less impact than the model simulations.

2.0 MODEL DEVELOPMENT

In order to evaluate the impacts of a brine spill on the underlying aquifers using the SUTRA model code, each aquifer was modeled separately. The aquifers of concern were the surficial, gray limestone, and the Upper Floridan aquifers. A description of the geology and hydrogeology of each these aquifers are discussed in Section 3.3.11 of the EIS.

The finite-element mesh developed for the modeled aquifers was constructed in a plan view. A single injection point (node) is used to simulate the brine leaking from the well. Multiple nodes were used to simulate a containment berm breach or leakage from the storage pit areas. Since the density difference between the groundwater and the brine will cause the brine to sink, a plan view of the aquifer will not accurately represent the vertical distribution of the brine. The simulated vertically mixed concentrations of the plume are however sufficient to evaluate the areal extent of the contamination.

2.1 Initial Parameters

A finite-element mesh was developed after evaluating existing site hydrogeologic conditions and representative groundwater velocities. The mesh is square-shaped, with rectangle cells of variable spacing (Figure 1). The grid is 13,800 feet by 13,800 feet and divided by 30 rows and 30 columns. Finer grid discretizations are located in the middle of the mesh, centered around the site.

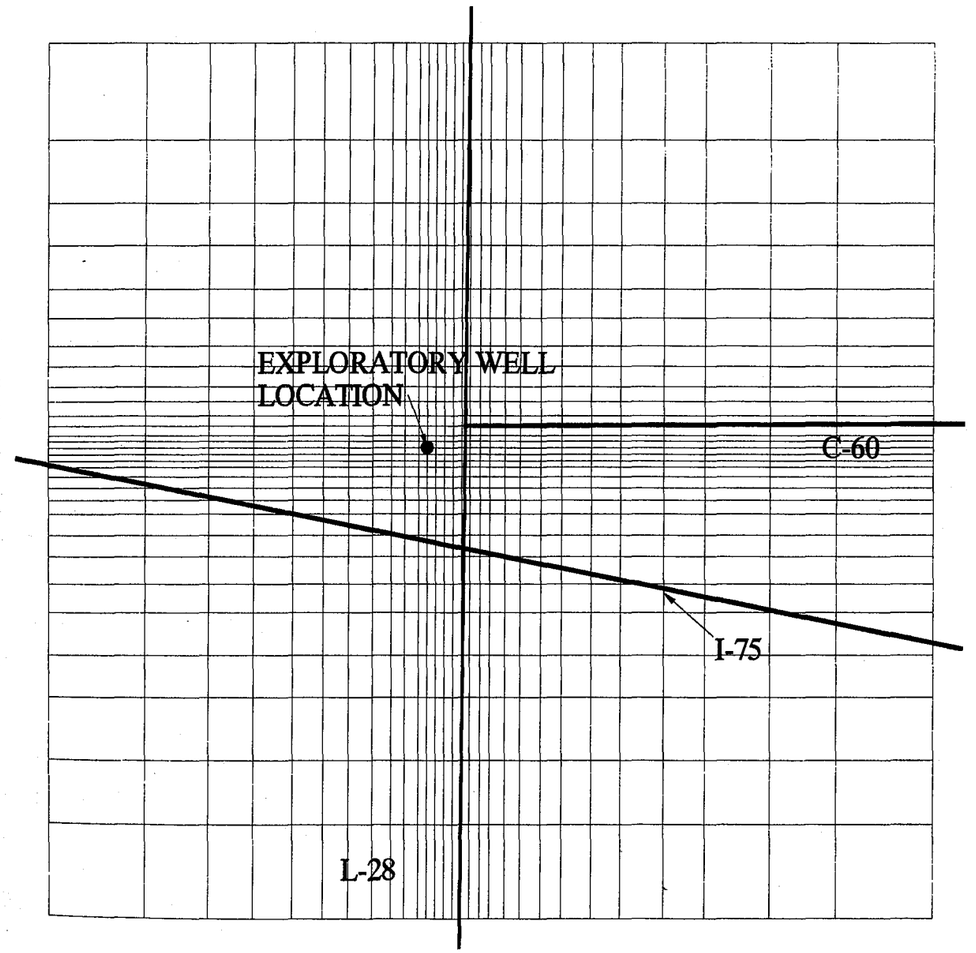
Data input for the model included fluid properties, solid matrix properties, solute concentrations, water pressures (hydraulic heads), and longitudinal and transverse dispersivities. A lack of detailed, site specific data required the estimation of most of the parameters. Required fluid properties input included water compressibility, molecular diffusivity of solute in pure water, density of fluid at base concentration, and water viscosity. The water density, viscosity, and water compressibility were assumed from known standards (Freeze and Cherry, 1979). The molecular diffusivity was estimated from Walton (1984) and Henry (1964). These data are provided in Table 1.

The material matrix data set included porosity, solid matrix compressibility, density of a solid grain, dispersivities, and intrinsic permeabilities. The porosity, aquifer (solid matrix) compressibility, and density of solid grains for the three aquifers were estimated from Todd (1980), Freeze and Cherry (1979), and Battey (1981), respectively, based on the lithology of each aquifer. The intrinsic permeabilities were calculated from the hydraulic conductivities and transmissivities reported in Fish (1988) for the surficial and gray limestone aquifers and Bush and Johnston (1988) for the Upper Floridan aquifer. The longitudinal and transverse dispersivities were estimated from Walton (1984).

The concentration of chloride in the brine was estimated from Meyer (1989) based on an average concentration of chlorides from oil field brines for the south Florida region. The average chloride concentration for oil field brines is approximately 130,000 mg/l.

The thickness of the surficial aquifer was modeled at 50 feet because smaller thicknesses lead to instability of the model. The modeled thickness of the gray limestone and the Upper Floridan aquifers were 100 feet and 600 feet, respectively.

Steady-state simulations were completed to estimate the starting heads for the solute transport simulations in order to achieve the initial starting heads for the brine impact simulations using the above noted parameters. Constant specified boundary heads were estimated from the hydraulic gradient of the aquifers and a known water level for the steady-state runs. Water levels maps for the surficial and the gray limestone aquifers during 1988 were used to calculate the hydraulic gradient and their respective initial boundary heads (Milleson, 1989). The revised potentiometric map of the Upper Floridan aquifer was used to estimate the hydraulic gradient of the aquifer (Meyer, 1989). The model boundary heads of the Floridan aquifer were then estimated using the hydraulic gradient and information from the Alligator Alley test well (Meyer, 1988). Final heads simulated during the steady-state simulations were used for



Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	SUTRA MODEL GRID FOR PROPOSED SWEPI EXPLORATORY WELL	FIGURE 1 D&M JOB No. 13501-072-049 AUTOCAD FILE: SUTRA.DWG

TABLE 1
SUTRA INPUT PARAMETERS FOR BRINE SPILL SIMULATIONS

PARAMETER	UNITS	SURFICIAL SAND AQUIFER	GRAY LIMESTONE AQUIFER	UPPER FLORIDAN AQUIFER
Water Compressibility	Pascals	4.4×10^{-10}	4.4×10^{-10}	4.4×10^{-10}
Molecular Diffusivity	meters^2/ second	6.6×10^{-6}	6.6×10^{-6}	6.6×10^{-6}
Density of water	Kilograms/ meters^3	1000.0	1000.0	1000.0
Density of solid grain	Kilograms/ meters^3	2650.0	2710.0	2710.0
Fluid Viscosity	Kilograms/ meters*seconds	0.001	0.001	0.001
Porosity	Dimensionless	0.25	0.30	0.30
Aquifer Compressibility	Pascals^{-1}	1×10^{-8}	1×10^{-9}	1×10^{-9}
Dispersivities- Longitudinal (Transverse)	Meter	30 (3)	30 (3)	30 (3)
Intrinsic Permeability	Meter^2	5.75×10^{-12}	3.24×10^{-10}	1.80×10^{-11}

the solute transport simulations. The overall gradient and direction of groundwater flow for all three aquifers was to the east and southeast.

Due to the inability of the model to simulate surface water, the hydraulic interaction between the overlying canals (L-28 and C-60) and the surficial aquifer were not simulated. The canals could transport the brine during high water conditions and the brine would slowly infiltrate into the surficial aquifer; however, this effect would probably be negligible during the 100 years of simulation.

3.0 RESULTS OF IMPACT ANALYSES

To evaluate possible impacts to the subsurface environment during operation or due to a brine spill or leak during drilling, two scenarios were selected to simulate "worst case" conditions. The first scenario involved a spill of two million gallons of brine entering the surficial aquifer via multiple node injections over a 14-day period and modeling the migration of the slug over a simulated time of 100 years. Two million gallons is the maximum containment capacity of the drill site. The first scenario simulates 100 percent infiltration of a brine solute into the underlying surficial aquifer.

The second scenario simulates an approximate seven million gallon leak from a single node (well) into the gray limestone or Upper Floridan aquifers for a period of 30 days, and modeling the migration of the ground water plume over a simulated time of 100 years. This scenario presumed a leak resulting from faulty well construction.

The scenarios do not simulate dilution of the brine plume by rainfall. The background chloride concentrations are assumed to be zero.

As noted previously, the mesh is oriented in a plan or map view; therefore, all of the simulated concentrations will be less due to vertical mixing simulated in the model. The results of each simulation are described in detail below.

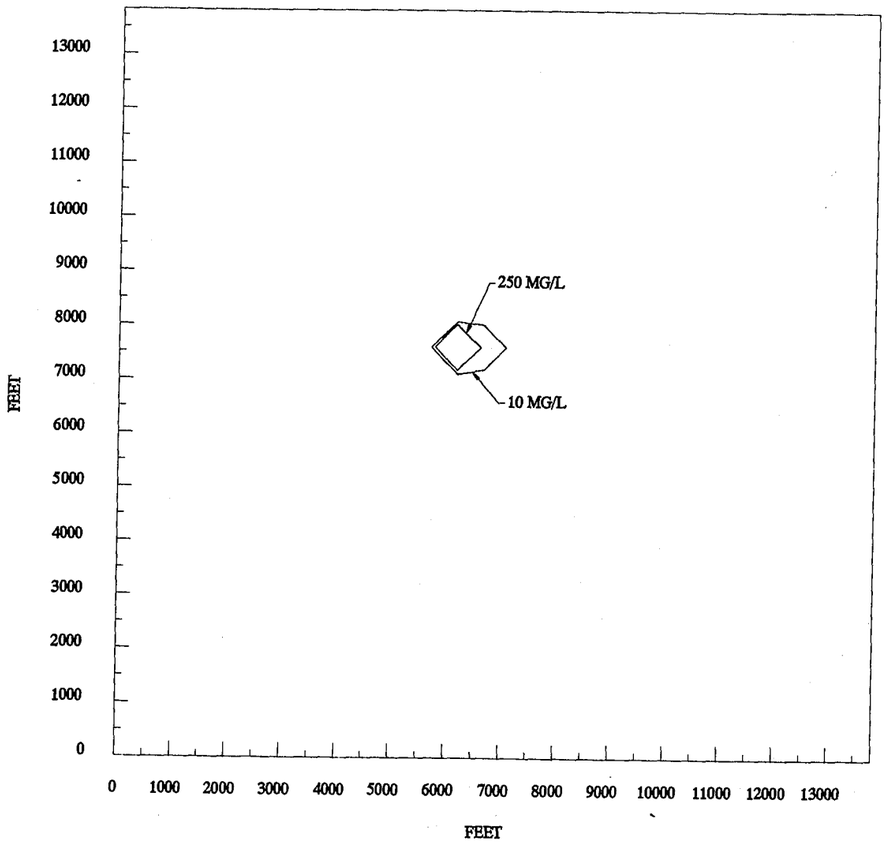
3.1 Surficial Aquifer

The surficial aquifer was subjected to a two million gallon spill over 14 days. After 14 days, the injection sources were turned off and the subsequent plume migration modeled for 100 years. A groundwater mound created by the addition of the simulated brine solute raised the water table by approximately ten feet. The mound was the result of low hydraulic gradients and conductivities. Since the water table is generally one to four feet below land surface, the simulated heads of ten feet above land surface would indicate surface flooding in the vicinity of the drill site. The simulated water table returned to normal levels in a time period of less than two months.

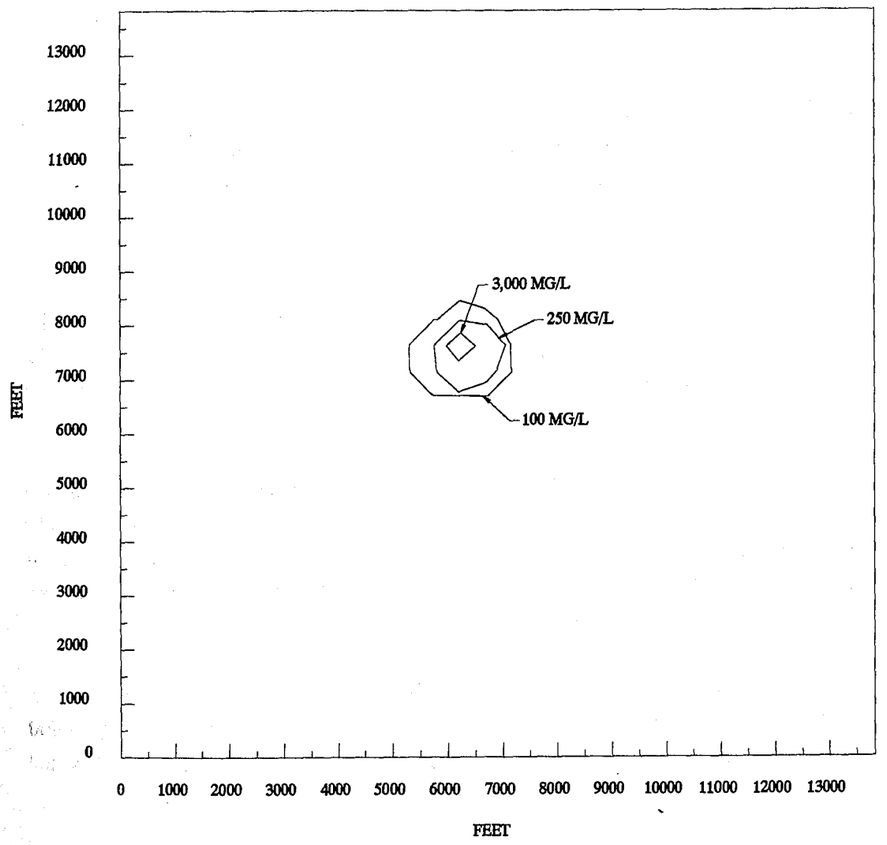
A maximum chloride concentration of 46,000 mg/l was simulated at the site after 14 days at the injection nodes. Decreasing concentrations were observed with increasing distance from the injection nodes. The plume diameter for the 250 mg/l isochlor contour was approximately 820 feet (See Figure 2) (250 mg/l of chloride was the maximum drinking water level). The shape of the plume was square due to the geometry of the mesh. The plume diameter for the 10 mg/l isochlor contour was 1,150 feet. The simulated plume moves to the east.

After a simulated time period of one and one-half years, the plume expanded to the east and southeast, moving with the groundwater flow. Water levels stabilized to the pre-drilling water levels. The maximum chloride concentration was 27,000 mg/l at the injection nodes. The 3,000 mg/l isochlor contour has a diameter of approximately 330 feet. The diameter of the 250 mg/l isochlor and the 10 mg/l isochlor contours are 1,150 feet and 1,640 feet, respectively.

After a simulated time period of five years, the maximum chloride concentration was 15,000 mg/l. The plume has moved easterly as shown in Figure 3. The 3,000 mg/l isochlor contour has a simulated diameter of 650 feet. The 250 mg/l isochlor contour has a diameter of 1,300 feet and the 10 mg/l isochlor contour has a diameter of approximately 2,000 feet.



Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	14 DAY ISOCHLOR CONTOURS OF SURFICIAL SAND AQUIFER	FIGURE 2 D&M JOB No. 13501-072-049 AUTOCAD FILE: 14DAY.DWG



Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	5 YEAR ISOCHLOR CONTOURS OF SURFICIAL SAND AQUIFER	FIGURE 3 D&M JOB No. 13501-072-049 AUTOCAD FILE: 14DY_SSA.DWG

The 25 year time step shows a significant drop of chloride concentration to 4,000 mg/l. The plotted 3,000 isochlor contour was reduced to approximately 1,000 feet (See Figure 4). The 250 mg/l isochlor contour diameter expanded to 1,650 feet. The 10 mg/l isochlor contour diameter was approximately 2,950 feet. The shape of the plume was more concentric, with slight asymmetry to the east and southeast due to groundwater advection and dispersion.

After 50 years of simulation, the maximum chloride concentration was only 2,000 mg/l. The diameter of the 250 mg/l isochlor contour was approximately 2,000 feet. The 10 mg/l isochlor contour was a diameter of 3,300 feet.

The maximum chloride concentration in the final time step of approximately 100 years is 1,000 mg/l. The plume enlarged and became more concentric (See Figure 5). The diameter of the 250 mg/l isochlor contour was 2,300 feet and the 10 mg/l isochlor contour diameter was approximately 4,300 feet.

3.2 Gray Limestone Aquifer

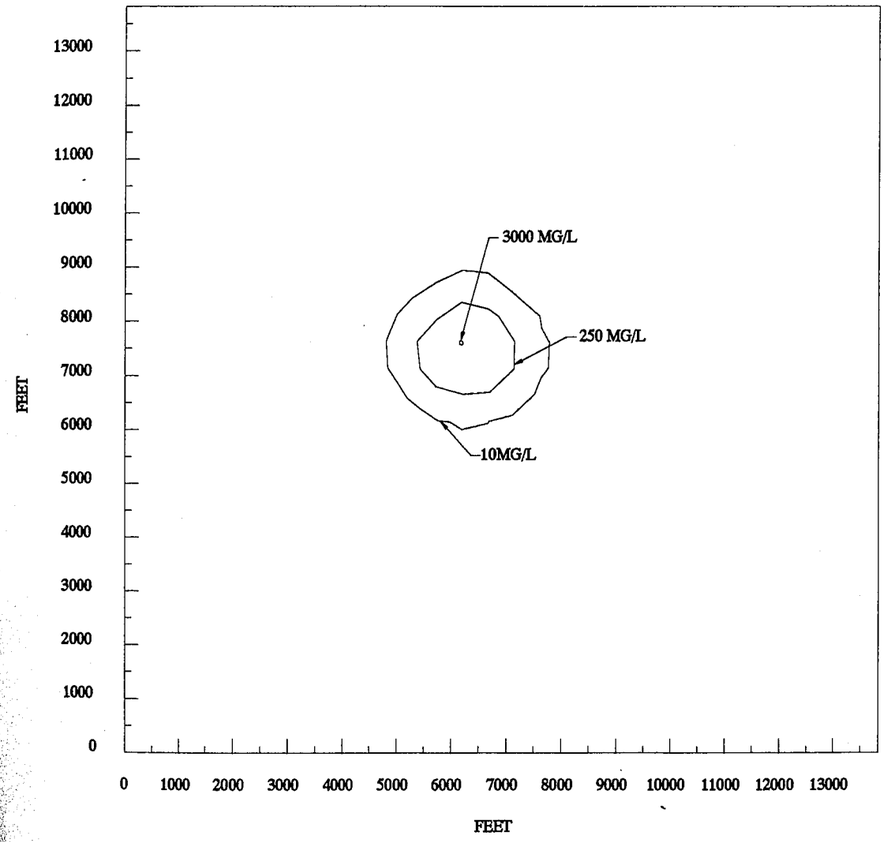
The gray limestone aquifer was simulated for a well leak of approximately seven million gallons of brine solute into the aquifer over a time period of 30 days. The leak was simulated by a single injection node. After 30 days, the injection node was turned off and the model simulated the migration of the plume for a time period of 100 years.

At the end of 30 days, the maximum simulated chloride concentration was 95,000 mg/l. The plume was more asymmetrical to the east and southeast due to groundwater flow and dispersion (See Figure 6). The square shape of the plume was the result of the geometry of the mesh. The 3,000 mg/l isochlor contour diameter was approximately 800 feet. The diameter of 250 mg/l and 10 mg/l isochlor contours were 1,300 and approximately 1,500 feet, respectively.

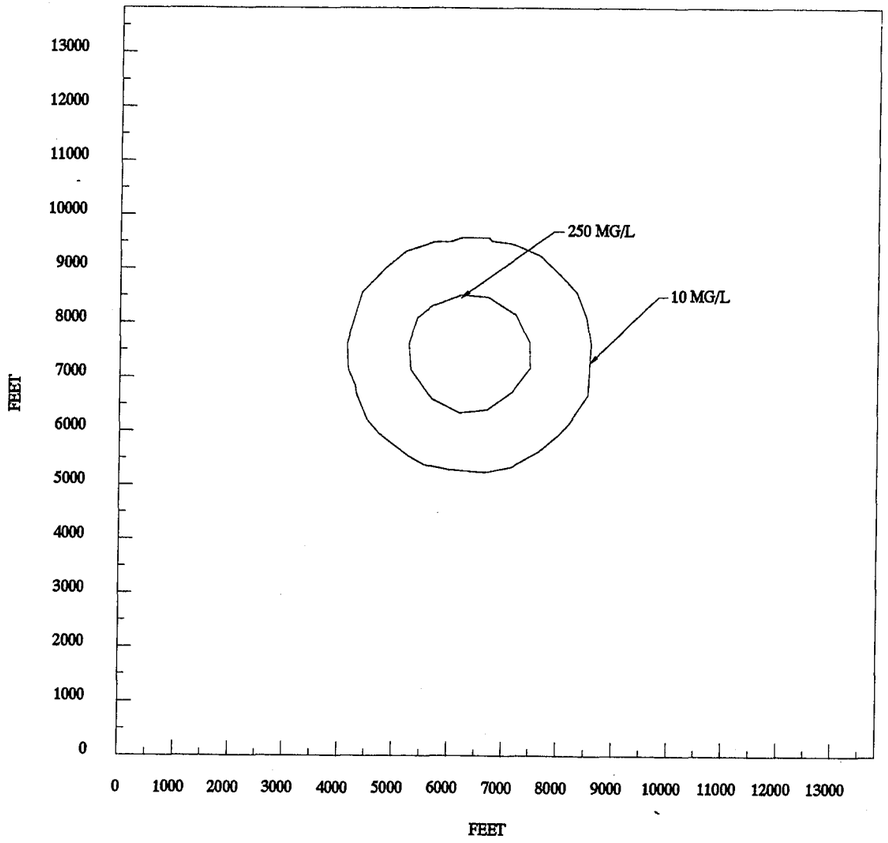
After one and one-half years, the plume expanded slightly. The maximum simulated chloride concentration was 40,000 mg/l. The diameter of the 3,000 mg/l isochlor contour was approximately 800 feet. The diameters of the 250 mg/l and 10 mg/l isochlor contours were approximately 1,500 feet and 2,000 feet, respectively.

At 20 years, the simulated plume shifted to the southeast by approximately 650 feet and the plume was more elongated (See Figure 7). This was the result of higher reported groundwater velocities associated with the gray limestone aquifer. The maximum simulated chloride concentration was 4,000 mg/l. The diameter of the 3,000 mg/l isochlor contour increased to 1,000 feet. The diameters of the 250 mg/l and 10 mg/l isochlor contours were 2,500 feet and approximately 4,900 feet, respectively.

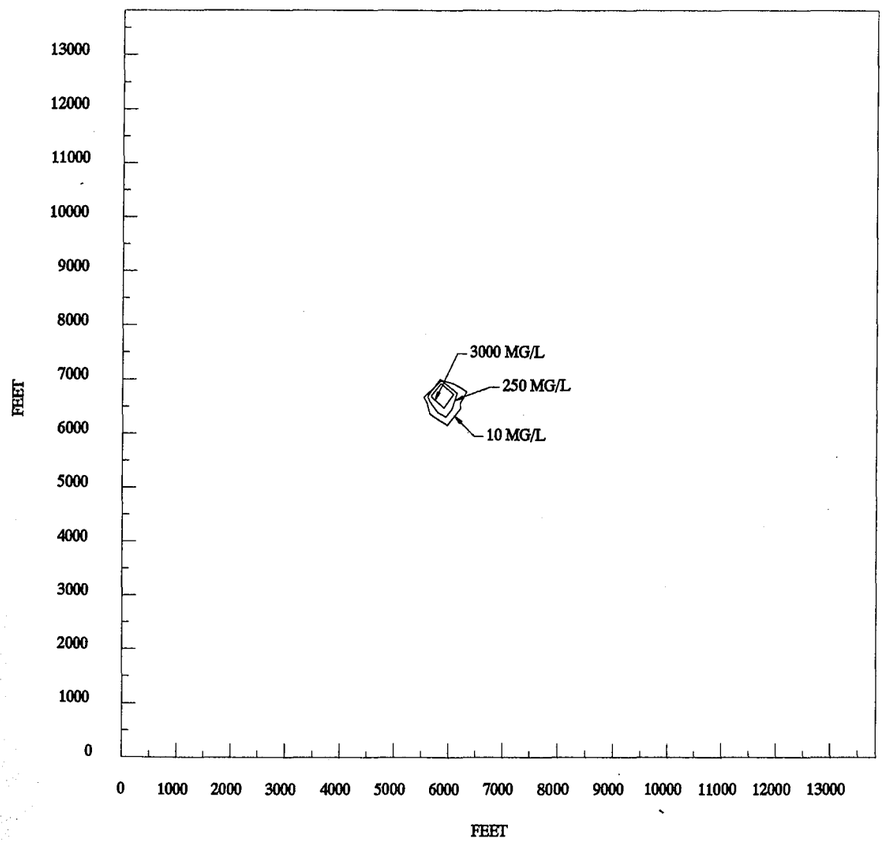
After a simulated time of 50 years, the maximum chloride concentration was reduced to 1,000 mg/l. The diameters of the 250 mg/l and 10 mg/l isochlor contours were 3,500 feet and 6,500 feet, respectively.



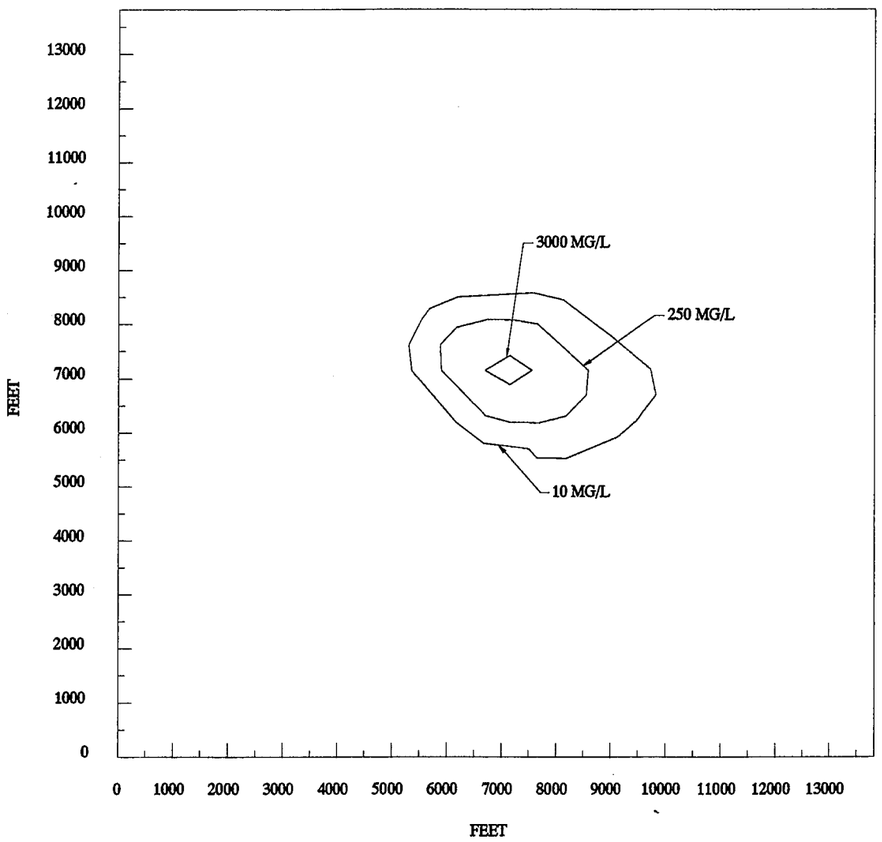
Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	25 YEAR ISOCHLOR CONTOURS OF SURFICIAL SAND AQUIFER	FIGURE 4 D&M JOB No. 13501-072-049 AUTOCAD FILE: 25YR_SSA.DWG



Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	100 YEAR ISOCHLOR CONTOURS OF SURFICIAL SAND AQUIFER	FIGURE 5 D&M JOB No. 13501-072-049 AUTOCAD FILE: 100R_SSAD.DWG



Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	30 DAY ISOCHLOR CONTOURS OF GRAY LIMESTONE AQUIFER	FIGURE 6 D&M JOB No. 13501-072-049 AUTOCAD FILE: 30DY_GLA.DWG



Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	20 YEAR ISOCHLOR CONTOURS OF GRAY LIMESTONE AQUIFER	FIGURE 7 D&M JOB No. 13501-072-049 AUTOCAD FILE: 20YR_GLAD.DG

At the end of the model simulation (100 years), the plume enlarged and moved southeast, by approximately 5,000 feet from the original area (See Figure 8). The maximum simulated chloride concentration dropped to 800 mg/l. The diameter of the 250 mg/l isochlor was approximately 4,000 feet. Part of the ten mg/l isochlor contour moved off of the mesh as shown in Figure 8.

3.3 Upper Floridan Aquifer

The Upper Floridan aquifer was simulated for a well leak of approximately seven million gallons of a brine solution into the aquifer over a time period of 30 days. The leak was simulated by a single injection node. After 30 days, the injection node was turned off and the model simulated the migration of the plume for approximately 100 years. Simulated concentrations were not as high as previous simulations in the surficial and gray limestone aquifers due to the thickness of the aquifer (600 feet). Actual concentrations would most likely be higher.

At the end of 30 days, the simulated brine had a chloride concentration of 50,000 mg/l. The 3,000 mg/l isochlor contour is not shown because the diameter less than 1,000 feet. The diameter of both the 250 mg/l and 10 mg/l isochlors was approximately 800 feet (See Figure 9). The shape of the plume was influenced by the geometry of the mesh.

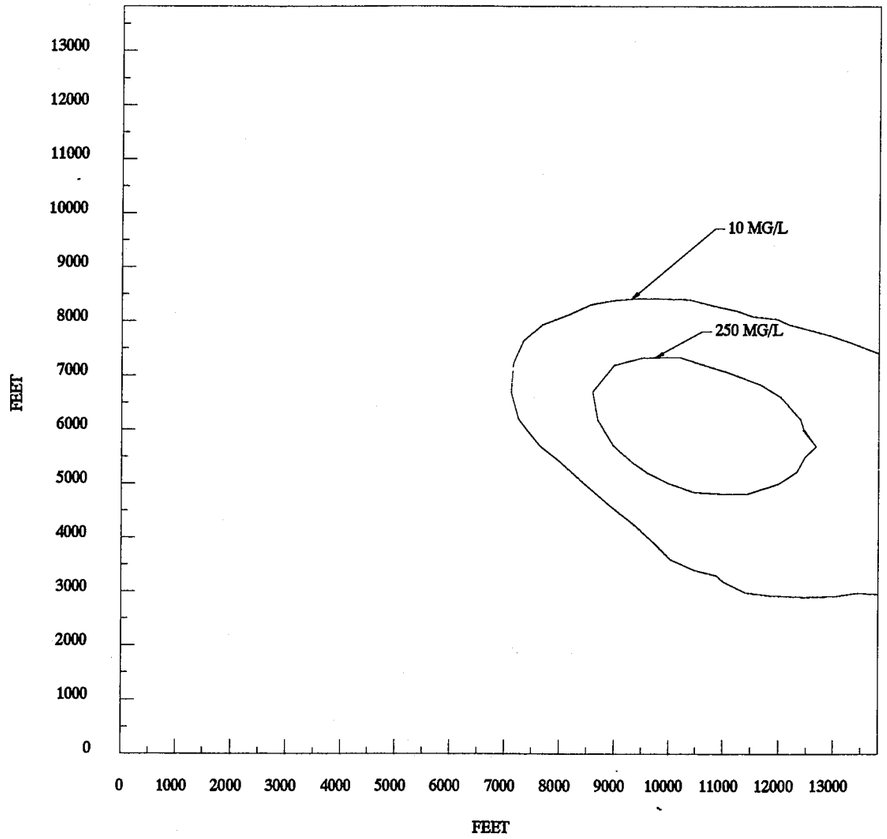
After one year, the maximum chloride concentration was 30,000 mg/l. The diameters of the 3,000 mg/l, 250 mg/l, and the 10 mg/l isochlor contours were 350 feet, 650 feet, and 1,000 feet, respectively.

At approximately ten years, the chloride concentration dropped to less than 3,000 mg/l. This was mainly a result of the thickness of the aquifer. Actual concentrations would be higher. After a simulated time of 25 years, the maximum simulated chloride concentration was approximately 1,000 mg/l. The diameters for the 250 mg/l and 10 mg/l isochlor contours were 1,400 feet and 2,500 feet, respectively (See Figure 10). The plume migration was limited due to the low groundwater velocities. The shape of the plume became more concentric.

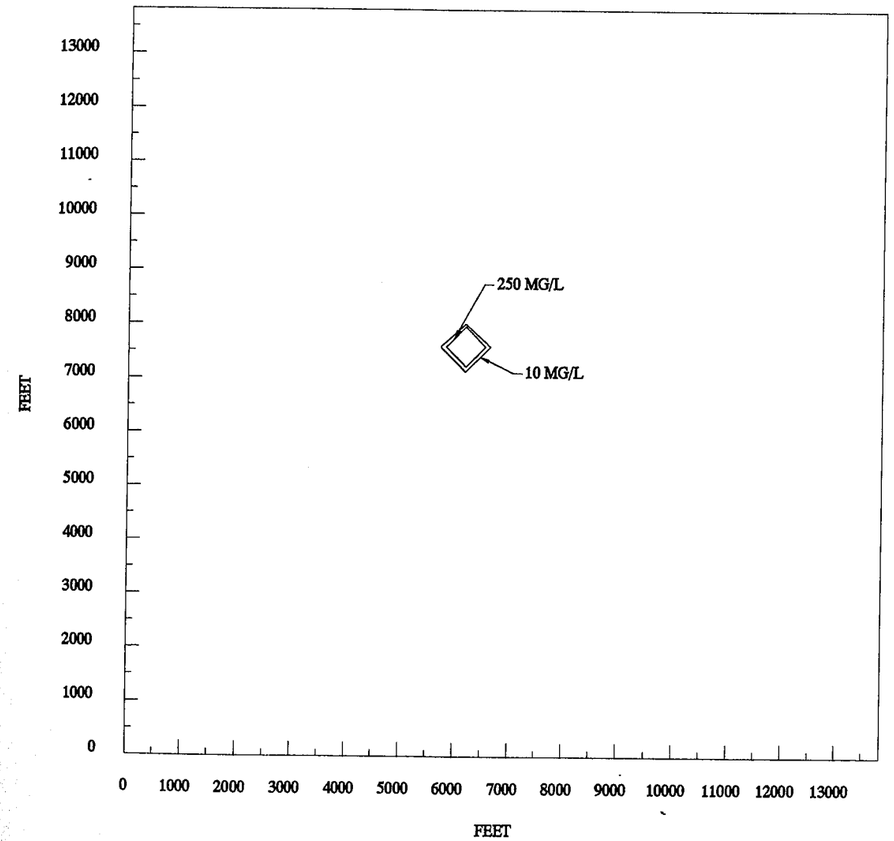
At the end of the final time step of 100 years, the maximum simulated chloride concentration was 300 mg/l. The plume enlarged and remained concentric due to low groundwater velocities (See Figure 11). The diameters of the 250 mg/l and 10 mg/l isochlor contours were approximately 2,300 feet and 4,900 feet.

3.4 Interpretation and Summary of Results

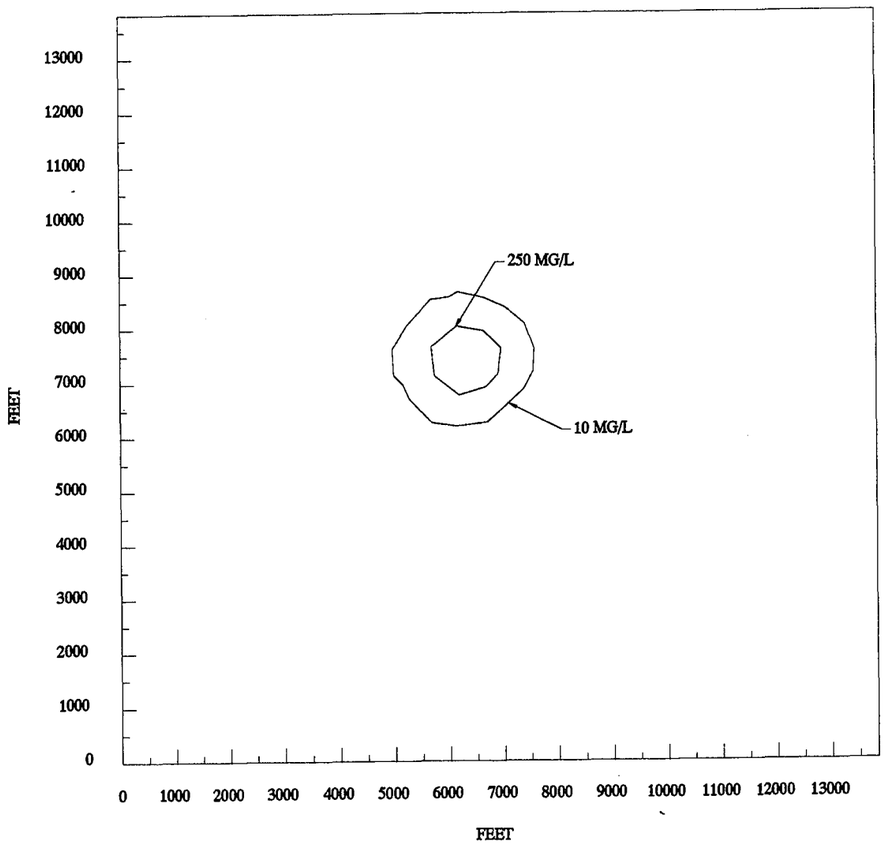
All of the aquifers had extremely small hydraulic gradients, and low groundwater velocities. Simulations for the different aquifers did not show significant movement of the brine plume. The gray limestone aquifer had the highest groundwater velocity and consequently, the brine plume moved the farthest distance; approximately 4,900 feet over a time period of 100 years.



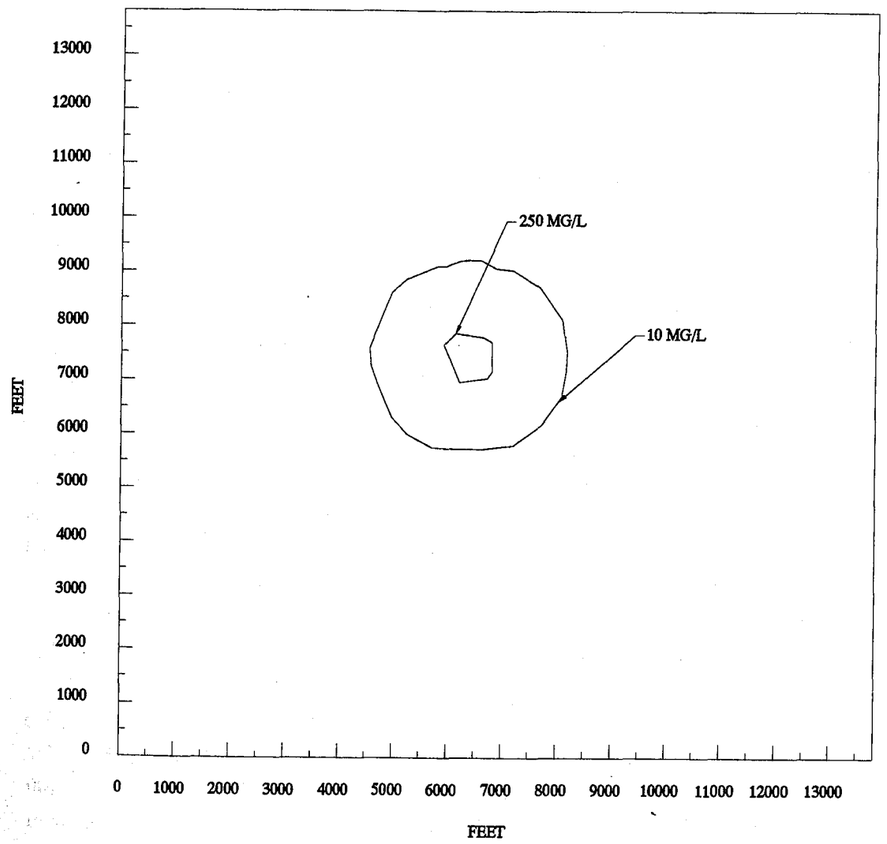
Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	100 YEAR ISOCHLOR CONTOURS OF GRAY LIMESTONE AQUIFER	FIGURE 8 D&M JOB No. 13501-072-049 AUTOCAD FILE: 100R_GLAQ.WG



Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	30 DAY ISOCHLOR CONTOURS OF UPPER FLORIDAN AQUIFER	FIGURE 9 D&M JOB No. 13501-072-049 AUTOCAD FILE: 30DY_UFA.DWG



Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	25 YEAR ISOCHLOR CONTOURS OF UPPER FLORIDAN AQUIFER	FIGURE 10 D&M JOB No. 13501-072-049 AUTOCAD FILE: 25YR_UFA.DWG



Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	100 YEAR ISOCHLOR CONTOURS OF UPPER FLORIDA AQUIFER	FIGURE 11 D&M JOB No. 13501-072-049 AUTOCAD FILE: 100R_UFA.DWG

A simulated two million gallon brine spill in the surficial aquifer did not laterally spread after 100 years simulation. The simulated plume shape was concentric, with the diameter of the 250 mg/l isochlor approximately 3,300 feet after 100 years. Initially, the simulated heads were above land surface, thus flooding would occur due to the initial brine release slowly infiltrating into the aquifer. After the fluid source nodes simulating the brine spill were turned off, the water level in the aquifer returned to normal. The maximum simulated chloride concentration was 46,000 mg/l. The 250 mg/l isochlor contour of the brine plume surrounded the drill pad in all directions by only 1,650 feet even after a hundred years. The maximum chloride concentration after 100 years was 1,000 mg/l. No potable water wells are finished in this aquifer, therefore, impacts would not affect potable water supply. The brine plume could leak into the L-28 canal. Surface water would further dilute the remnants of the spill. These waters would remain in the canal unless pumped by the S-140 pump station. Due to the slow groundwater velocities, remedial action would be effective for any type of spill in the surficial aquifer. Leakage into the underlying gray limestone aquifer is possible due to the semi-confining layer overlying the aquifer, but again, the movement of the slug would be slow enough to allow adequate time for recovery of the brine by standard remedial methods. In the second spill scenario within the gray limestone aquifer, an injection node simulated the injection of over seven million gallons of brine for a time period of 30 days. After 30 days, the fluid source node was turned off. No appreciable rise in the water level occurred. The maximum chloride concentration was 95,000 mg/l. After a simulated 20 years the brine slug moved to the southeast, a result of higher groundwater velocities. At the end of the simulation of 100 years, the brine slug moved to the edge of the model domain, approximately 5,000 feet. The maximum simulated chloride concentration was 800 mg/l. Even though the gray limestone aquifer has the highest groundwater velocity when compared to the surficial and Upper Floridian aquifers, the groundwater velocity was still low compared to most aquifers in Florida. Any leak into this aquifer, even after several years, could be cleaned up with standard remedial methods, due to the slow movement of the plume and the distance to the nearest downgradient potable well (over two miles to the south).

The Upper Floridan aquifer is not used as a potable water source because the groundwater in this aquifer is brackish. The scenario for this aquifer is the same used for the gray limestone aquifer, with the injection of over seven million gallons of brine into the aquifer over a 30 day period. No appreciable rise in the water level occurred. The simulated brine plume moved little during the 100 year simulation time period. After 30 days, the maximum simulated chloride concentration was 50,000 mg/l. After 100 years, the simulated plume did not likely spread more than 650 feet from the drill pad. The maximum simulated chloride concentration after 100 years was 300 mg/l. Since this aquifer is not used for any potable water, any leakage occurring in this aquifer would probably not require cleanup.

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APPENDIX A-8

GROUNDWATER OIL SPILL SIMULATIONS

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APPENDIX A-8

GROUNDWATER OIL SIMULATIONS

1.0 INTRODUCTION

A three-dimensional finite-difference transport model was employed to simulate oil leakage into the underlying aquifers at the drill site. The Geotrans, Inc. SWANFLOW (Simultaneous Water, Air, and Nonaqueous phase liquid [NAPL] FLOW) model was used because of its ability in simulating the flow movement of water and oil which is an immiscible fluid. The model is employed in situations requiring the analysis of immiscible flow, such as simulating the migration of many organic chemicals, analyzing the effects of remedial technologies at hazardous waste sites where immiscible fluids are encountered. Recently, the EPA used SWANFLOW to evaluate the migration of a fuel oil plume and assessing NAPL recovery by purge wells (Geotrans, Inc., 1991). The governing equations are a simplified subset of the three phase flow equations commonly used in petroleum reservoir simulation. The three-dimensional equations for flow are approximated by finite differences solving each vertical cross section (slice) of the grid separately. The resulting numerical model is very stable and potentially applicable to many problems associated with immiscible contaminants in groundwater.

Several scenarios were simulated to assess the possible impacts to the groundwater at depth during drilling or during the operation of the well. The first scenario is a surface spill, in which oil is released into the groundwater of the surficial aquifer. The second and third scenarios simulate a constant leak of oil into the gray limestone aquifer and the Upper Floridan aquifer, respectively, due to postulated faulty well construction. The volume of oil released in these scenarios are the "worst case" possibilities, therefore any smaller spills would have less of an impact than the model simulations.

2.0 MODEL DEVELOPMENT

A two-dimensional model was setup to simulate all aquifers simultaneously to evaluate the impacts of an oil spill. The aquifers of concern are the surficial aquifer, the gray limestone aquifer, and the Upper Floridan aquifer which are described in Section 3.11. The model simulates flow in the vertical direction and in the principal direction of groundwater flow for the aquifers (all of the aquifers generally have the same hydraulic gradient). From top to bottom, the layered system consists of one layer representing the surficial aquifer, one layer representing a semi-confining clay unit, four layers representing the gray limestone aquifer, one layer representing the Hawthorn confining clay unit, and the last layer representing the Upper Floridan aquifer. Four layers were defined for the gray limestone aquifer, as compared to one layer for the other aquifers, so that a contaminant plume could be modeled with fine resolution, because of the importance of the gray limestone as a source of potable water.

A single injection point (node) is used to simulate the oil brine leaking from the well and multiple nodes are used to simulate a berm break or leakage from the drill pad area. Such a setup reflects the situation where a surface spill would spread on the land surface prior to percolating to the groundwater in the surficial aquifer. However, spillage in any of the lower aquifers would probably result from leakage from defective well casing.

2.1 Initial Parameters

A two-dimensional finite-difference grid was developed after reviewing the existing hydrogeologic conditions at the site and surrounding areas. The modeled area is 13,800 by 1,500 feet and the model grid developed consists of 30 columns, 1 row, and 8 layers.

Data input for the model includes fluid properties, solid matrix properties, and variables that define initial conditions in the aquifers. Values for these properties were obtained by conducting a literature and data search on information pertaining to the local conditions and by relating the local conditions to information obtained elsewhere. For example, if the local conditions indicated a clay layer, then soil properties for clay were utilized.

The fluid properties required for the model are the density of water, density of NAPL, dynamic viscosity of water, and dynamic viscosity of NAPL. The values for water density, and viscosity were based on published information by Freeze and Cherry (1979). The values of density and viscosity of the NAPL were based on information published by GeoTrans, Inc., (1991).

The material matrix data set includes intrinsic permeabilities in the x, y, and z direction, compressibility, porosity, and capillary pressure-relative permeability-saturation relationships. Values for intrinsic permeability in the x and y directions were converted from the values of hydraulic conductivities obtained from Fish (1988), and Meyer (1989). Permeabilities in the z direction were assumed to be an order of magnitude less than that in the x and y direction. Values of compressibilities were assumed from Freeze and Cherry, (1979) based on the lithology of the model layers. Porosity values were based on relationship between rock formation and porosity as published by Walton (1984), and Freeze and Cherry (1979). Capillary pressure-relative permeability-saturation relationship was obtained from the SWANFLOW manual (Geotrans, 1991) for clay and sand/bedrock formations. The lack of site specific data for capillary pressure and relative permeabilities is one of the main limitations of the model. Geotrans, however, tabulates some values based on the rock formation. Table 1 provides the values for the above-mentioned parameters.

Variables that define the initial groundwater level conditions are non-aqueous fluid pressure, and water saturation. Initial non-aqueous fluid pressures were calculated according to procedures documented in the SWANFLOW manual by subtracting the water pressure from the capillary pressure at the initial water saturation (initial water saturation is assumed to be 1.0). Water pressure was based on the hydraulic head

for the aquifers as discussed for the brine modeling. The confining unit between the surficial and gray limestone aquifers was assumed to have the same water level as the surficial aquifer, and a water level reported by Meyer (1989) for an intermediate aquifer located in the confining unit between the gray limestone and Upper Floridan was used to calculate starting hydraulic pressures.

TABLE 1
SWANFLOW INPUT PARAMETERS FOR BRINE SPILL SIMULATIONS

PARAMETER	UNITS	SURFICIAL AQUIFER	CONFINING UNIT	GRAY LIMESTONE AQUIFER	HAWTHORN CONFINING UNIT	UPPER FLORIDAN AQUIFER
Water Density	Kilograms/ meters^3	1000.0	1000.0	1000.0	1000.0	1000.0
Water Viscosity	Kilograms/ meters* seconds	0.001	0.001	0.001	0.001	0.001
NAPL Density	Kilograms/ meters^3	950.0	950.0	950.0	950.0	950.0
NAPL Viscosity	Kilograms/ meters* seconds	0.001	0.001	0.001	0.001	0.001
Porosity	Dimension-less	0.25	0.40	0.30	0.40	0.30
Aquifer Compressibility	Pascals^{-1}	1×10^{-8}	1×10^{-7}	1×10^{-9}	1×10^{-7}	1×10^{-9}
Intrinsic Permeability	Meter^2	5.75×10^{-12}	5.75×10^{-14}	3.24×10^{-10}	2.19×10^{-14}	1.80×10^{-11}

In addition to the above variables, source/sink rates are also defined. Rates of sinks (injections) were calculated to mimic the scenarios listed in Section 3.0. Simulated injections of about two million gallons of oil into the surficial aquifer, and approximately seven million gallons of oil into the gray limestone and Upper Floridan aquifers were modeled.

3.0 IMPACT ANALYSES

Two scenarios were selected to simulate "worst case" spills. The first scenario involved a spill of two million gallons of oil entering the surficial aquifer via multiple node injections over 14 days. Two million gallons is the maximum volume capacity of the bermed drill site; thus the scenario simulates 100 percent infiltration of the oil into the underlying surficial aquifer. The second scenario simulates a seven million gallon leak from a single node (well) into the gray limestone or Upper Floridan aquifers over a period of 30 days.

A spill due to a postulated casing leak in the Subfloridan carbonate formations is possible but has not been analyzed using the SWANFLOW model. The Subfloridan carbonates are very impermeable, non-water bearing, rock formations. As a result, any leaked oil would remain in the immediate vicinity of the well bore. There would not be any significant movement of the oil either vertically or horizontally away from the spill site.

An impermeable confining layer also seals the lower surface of the aquifer zone at a depth of about 3,800 feet. This confining layer would prevent the vertical movement of spilled oil into the Floridan Aquifer.

3.1 Surficial Aquifer

The surficial aquifer was subjected to a total of a two million gallon spill over 14 days. After 14 days, the injection sources were turned off and the subsequent plume migration was modeled for 100 years. The following paragraphs describe the oil plume and its migration.

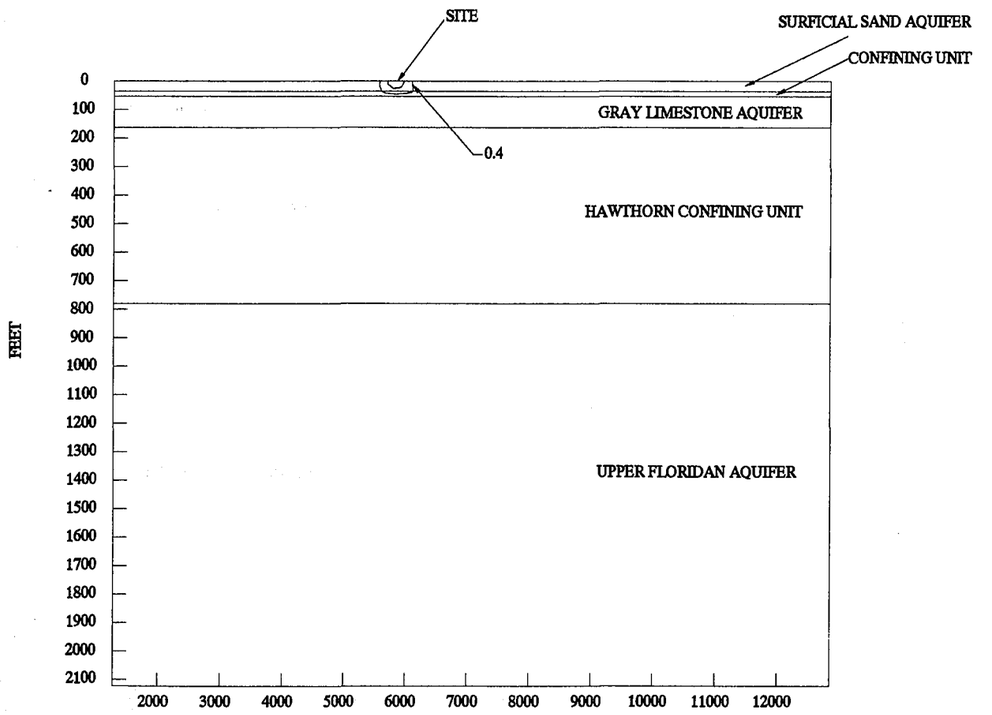
Contours of simulated NAPL saturation after 14 days are shown in Figure 1. The maximum simulated NAPL saturation reached is 0.07. The model simulated the injection of the NAPL throughout the entire thickness of the surficial aquifer. The length of the plume was influenced by the distance between the four injection nodes.

Contours of NAPL saturations after a simulated 100 years are shown in Figure 2. There is no change in the configuration of the plume or in the simulated NAPL saturation levels after of 100 years.

3.2 Gray Limestone Aquifer

This scenario simulates a well leak of approximately seven million gallons of oil into the gray limestone aquifer over a time period of 30 days. The leak was simulated by a single injection node in the third layer of the four layer gray limestone aquifer model configuration. After 30 days, the injection node was turned off and the model simulated the migration of the plume for approximately 100 years. The following is a description of the plume and it's migration.

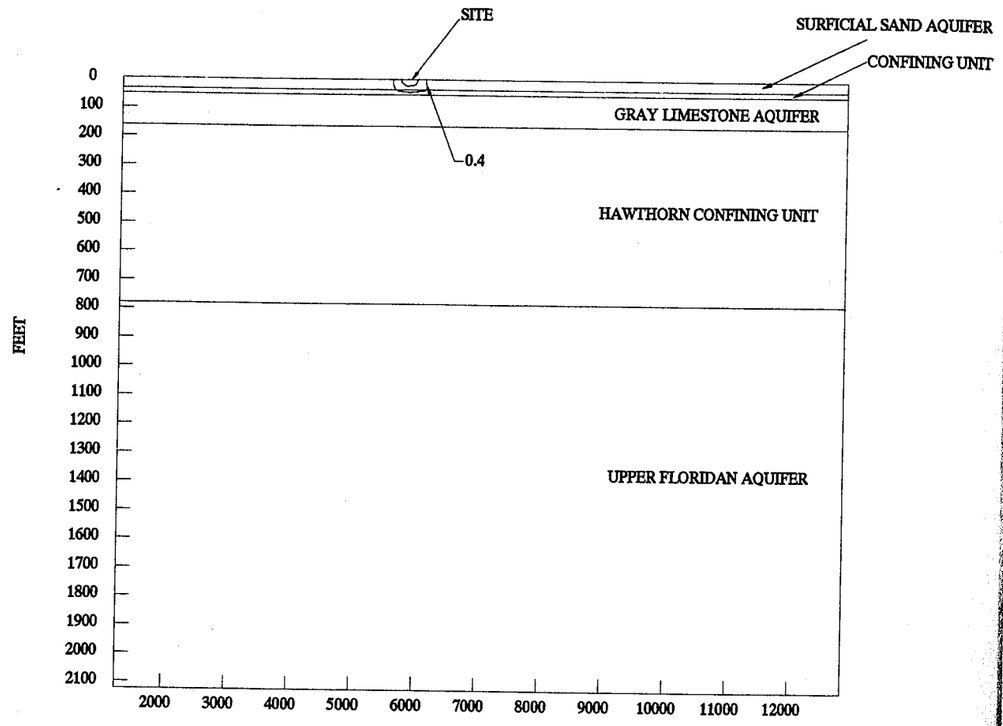
The simulated 30-day NAPL saturation contour levels are shown on Figure 3. The maximum simulated NAPL saturation is immediately below the upper confining unit and is approximately 0.34. The plume rose to the upper confining unit and spread out approximately 100 meters. The simulated NAPL saturation level at the injection node is 0.2. The simulated 40-year NAPL saturation contour levels are shown on Figure 4. The plume size has increased, but the NAPL saturation levels decreased to a maximum level of 0.1. The plume has spread out approximately 200 meters.



NOTE: DATUM IS IN FEET, NGVD.

CROSS SECTION OF SITE
ILLUSTRATING CONTOURS OF EQUAL NAPL SATURATION

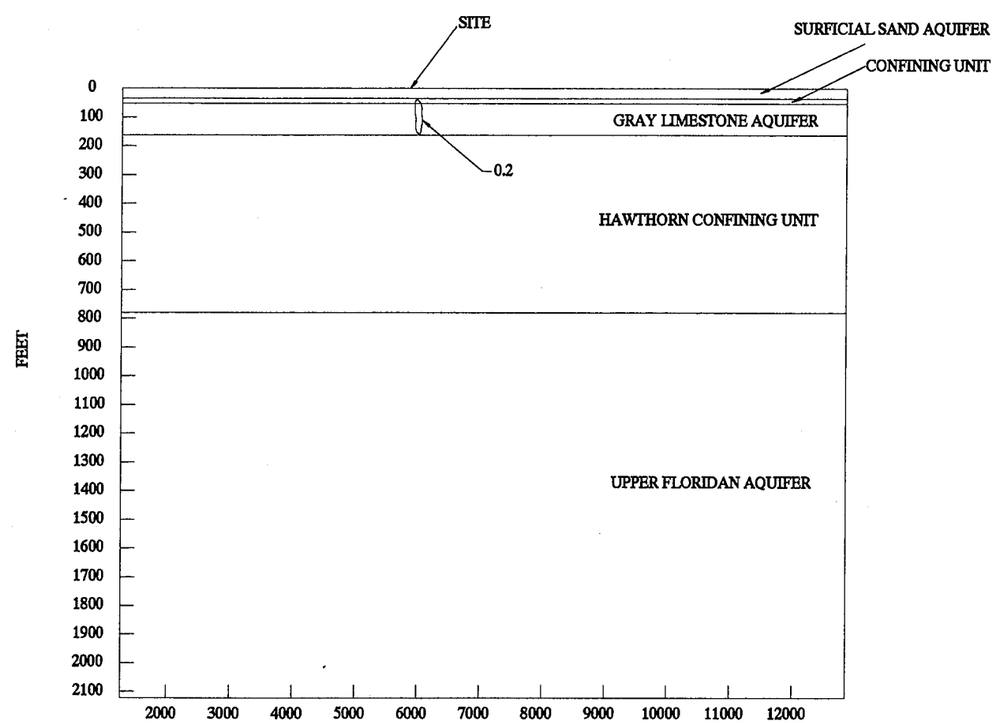
Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	OIL SPILL SIMULATION SURFICIAL AQUIFER 14 DAY	FIGURE 1 D&M JOB No. 13501-072-049 AUTOCAD FILE: OIL_SA14.DWG



NOTE: DATUM IS IN FEET, NGVD.

CROSS SECTION OF SITE
ILLUSTRATING CONTOURS OF EQUAL NAPL SATURATION

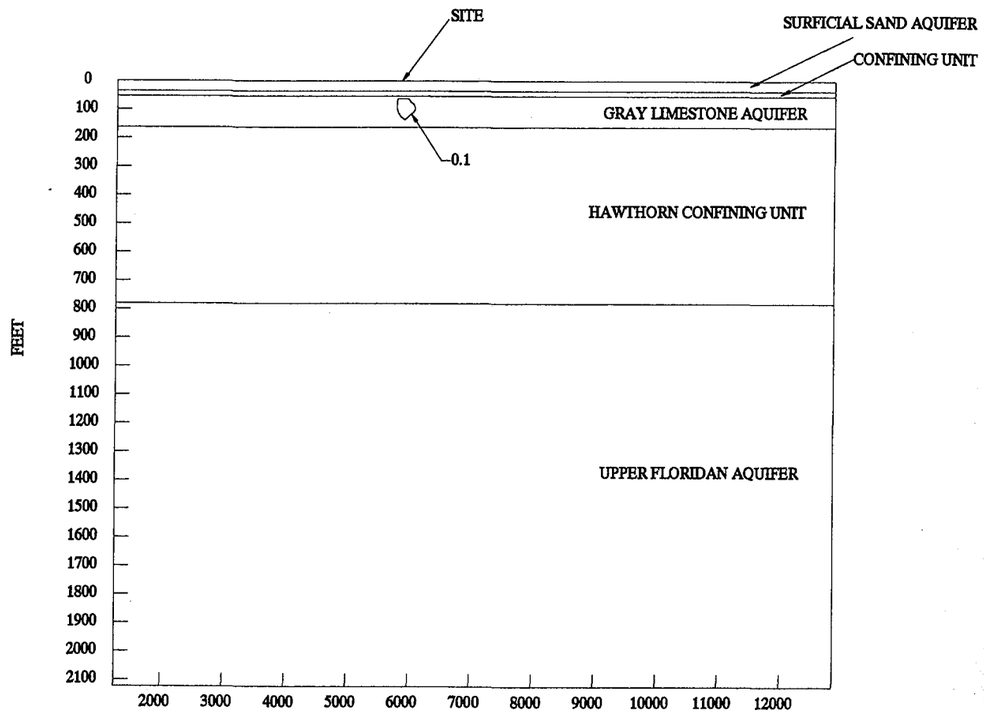
Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	OIL SPILL SIMULATION SURFICIAL AQUIFER 100 YEAR	FIGURE 2 D&M JOB No. 13501-072-049 AUTOCAD FILE: SA_100YR.DWG



NOTE: DATUM IS IN FEET, NGVD.

CROSS SECTION OF SITE
ILLUSTRATING CONTOURS OF EQUAL NAPL SATURATION

Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	OIL SPILL SIMULATION GRAY LIMESTONE AQUIFER 30 DAY	FIGURE 3 D&M JOB No. 13501-072-049 AUTOCAD FILE: GL_30DAY.DWG



NOTE: DATUM IS IN FEET, NGVD.

CROSS SECTION OF SITE
ILLUSTRATING CONTOURS OF EQUAL NAPL SATURATION

Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	OIL SPILL SIMULATION GRAY LIMESTONE AREA 40 YEAR	FIGURE 4 D&M JOB No. 13501-072-049 AUTOCAD FILE: GL_40YR.DWG

The simulated 100-year NAPL saturation contour levels are shown on Figure 5. The plume has shifted approximately 100 meters to the east due to prevailing groundwater flow conditions. The NAPL saturation levels have remained approximately the same since the 40 year time step.

3.3 Upper Floridan Aquifer

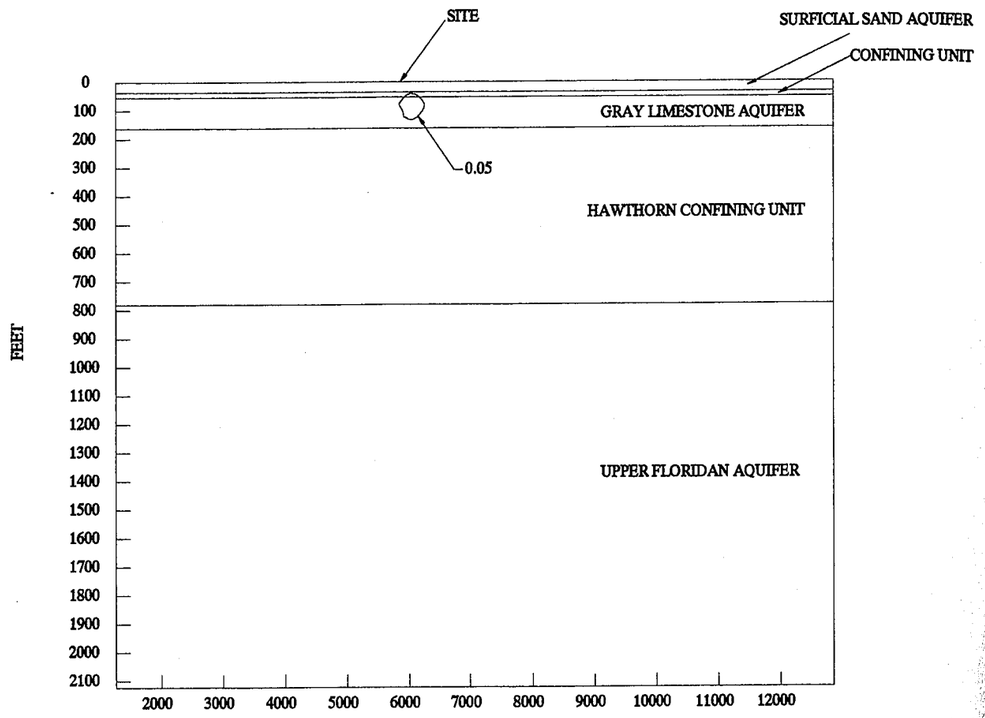
This scenario simulates a well leak of approximately seven million gallons of oil into the Upper Floridan aquifer over a time period of 30 days. The leak was simulated by a single injection node. After 30 days, the injection node was turned off and the model simulated the migration of the plume for approximately 100 years. The following is a description of the simulations.

Due to the thickness of the simulated aquifer (200 meters) and the small groundwater velocities, NAPL saturation is restricted to only the one injection node cell for the entire model run. Vertical migration would occur, but the NAPL did not spread out further than 30 meters (width of injection node cell). The NAPL saturation is only 0.03 throughout the 100 year simulation.

3.4 Interpretation and Summary of Results

All of the aquifers have extremely small hydraulic gradients, thus the groundwater velocities are very small. Therefore, the simulations for the different aquifers did not show any significant movement of the oil slug. The gray limestone aquifer has the highest groundwater velocity. The oil slug moves the farthest in the gray limestone, approximately 200 meters over a simulated time period of 100 years.

For all of the aquifers, movement of the oil slug was minimal throughout the 100 year simulation. Vertical migration occurs due to the lighter density of oil compared to water. However, no migration through the confining layers occurs and the oil remains an immiscible fluid. Remedial clean-up efforts would be very effective, due to the slow rate of flow and the effectiveness of the confining unit inhibiting upwards migration.



NOTE: DATUM IS IN FEET, NGVD.

CROSS SECTION OF SITE
ILLUSTRATING CONTOURS OF EQUAL NAPL SATURATION

Dames & Moore	SWEPI MICCOSUKEE 3-1 EXPLORATORY OIL WELL BROWARD COUNTY, FLORIDA	OIL SPILL SIMULATION GRAY LIMESTONE AQUIFER 100 YEAR	FIGURE 5 D&M JOB No. 13501-072-049 AUTOCAD FILE: GL_100YR.DWG

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APPENDIX A-9

WILDLIFE REPORT

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LAW ENVIRONMENTAL

WILDLIFE EVALUATION FOR
A SITE IN THE MICCOSUKEE
INDIAN RESERVATION,
WESTERN BROWARD COUNTY,
FLORIDA

PREPARED FOR:

SHELL WESTERN E & P INC.
HOUSTON, TEXAS

PREPARED BY:

LAW ENVIRONMENTAL, INC.
FORT LAUDERDALE, FLORIDA

PROJECT NUMBER 51-0508

MARCH 1990

LAW ENVIRONMENTAL, INC.
CYPRESS PLAZA-SUITE 320
6365 N.W. 6TH WAY
FT. LAUDERDALE, FL 33309
305-771-2147

March 12, 1990

Mr. David Smith
Shell Western E & P Inc.
200 North Dairy Ashord
Houston, Texas 77079

Dear Mr. Smith:

We are pleased to transmit our report entitled, "Wildlife Evaluation for a Site in the Miccosukee Indian Reservation Western Broward County, Florida". We trust that you will find this report useful in the pursuit of authorizations for your proposed project.

If you have any questions, please do not hesitate to contact us.

Sincerely,

LAW ENVIRONMENTAL, INC.

For Hilburn O. Hillestad, Ph.D.
Corporate Consultant

Thomas E. Lodge, Ph.D.
Senior Environmental Scientist

HOH:TEL:em

Enclosure

WILDLIFE EVALUATION FOR A SITE IN THE MICCOSUKEE INDIAN RESERVATION, WESTERN BROWARD COUNTY, FLORIDA

PREPARED FOR:

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INTRODUCTION

This assessment of wildlife is for a location in western Broward County, Florida, just northwest of the intersection of State Road 84/I-75 (Alligator Alley) and Levee 28. The proposed project site is about one thousand feet northwest of this intersection, but the area of interest for wildlife activity, identified in the contract, is a larger rectangle identified in Figure 1, the "project vicinity".

METHODS

This assessment was conducted first by viewing and photographing the project vicinity from an airplane, flying at about 800 feet. Subsequently, the area was evaluated from ground level, with most time spent specifically on and very near the proposed site. Direct evidence of wildlife activity was obtained by sightings and by the presence of scat and animal tracks. Aerial and ground level work was conducted on March 5, with additional ground level work on March 8, 1990. In support of this field work, appropriate references concerning wildlife of the region were checked, including published reports and personal communications concerning wildlife activity in the general area. Habitat characteristics (vegetation, surface water) were also evaluated as they pertain to wildlife occurrence.

SURVEY RESULTS

The general site area lies on land which was previously part of the westernmost edge of the Everglades ecosystem, immediately next to the Big Cypress Swamp. The specific site has now been partitioned from these physiographic regions by: 1) Levee 28 and its parallel north-south canal to the east, which mark the western edge of the Everglades Conservation Area No. 3A; 2) Alligator Alley (State Road 84/I-75) to the south, and 3) Snake Road to the west. The site and areas for some distance to the north and west, within these boundaries, have been extensively drained and converted into pasture land. Currently, the area is grazed by cattle and numerous cows were in the immediate area during field work.

Beyond the man-made boundaries mentioned above, the vegetation has been much less altered by direct land improvements, but water management modifications have generally altered conditions. These characteristics of the project vicinity and project site are shown in the series of photographs, Figures 2 through 7.

A list of the wildlife species documented or expected to occur on or very close to the project site (i.e. within several hundred feet) is presented in Table 1. This list was developed using direct evidence from field observations and from listings presented for "prairie" habitat of the Big Cypress Swamp area by Duever et. al. (1986). The prairie habitat described by this reference is for open field-like areas with some degree of flooding but not so frequent as for freshwater marsh habitat. Principally aquatic species included in the latter listings were omitted from Table 1 since the proposed project site is obviously less prone to flooding than the prairie habitat described by Duever. The presence of beard grass (Andropogon glomeratus) and wax myrtle (Myrica cerifera) indicate that flooding is probably only temporary and very shallow during the height of the wet season. Also, some species were added because of the presence of tree islands, including two nearby willow heads. These habitats offer cover for several species which might utilize the open pasture habitat for feeding but would not be resident in the area. For example, bobcats and raccoons would likely utilize the willow heads for cover but would feed in the prairie at night. Raccoon scat was found in the immediate area, and cotton rats were seen. The latter species is potential prey for bobcats. Evidence (feeding "holes") of armadillo activity was also identified on the project site.

It should be recognized that the wildlife listing in Table 1 does not include species which would occur principally in the large drainage canals adjacent to the site. The closest canal, parallel to Levee 28, is separated from the site by a levee on its west side. Another canal to the south, parallel to I-75, is not isolated by a levee, but is completely overgrown by water hyacinth. These were investigated briefly and several alligators were seen in addition to some water birds including common moorhens and a great blue heron.

A listing of threatened or endangered species which may potentially occur on, or in the vicinity of the project site is presented in Table 2. This listing is more inclusive of adjacent habitats than is the listing of characteristic wildlife in Table 1. Also, the threatened and endangered categories for both state (Florida) and Federal programs are identified in this list. Specific comments on each species are included below. By checking available range information for invertebrates (Franz, 1982) and fishes (Gilbert, 1978) against listings, no species are of concern for these groups.

American Alligator. Large increases in population levels of alligators have resulted in downgrading its protected status. However, Federal listing has been maintained as "threatened" only because of the alligator's resemblance to the American crocodile, an endangered species. Crocodile distribution is almost entirely coastal in extreme southern Florida (McDiarmid, 1978), so the probability of confusing an alligator for a crocodile in the vicinity of this project is negligible.

Eastern indigo snake. Indigo snakes occur in the Big Cypress Swamp, but usually in hammock (upland forest) and pineland habitats (Duever et al., 1986). Thus, their occurrence near the site is not likely.

Florida scrub jay. This species is highly specific in its habitat requirements, utilizing dry oak scrub habitat in Florida and avoiding wet habitats. Nearly all areas utilized by scrub jays in Florida lie north of Lake Okeechobee in the interior of the state, or on the coastal ridge along the east coast of the state (Kale, 1978). Thus, there is essentially no probability that scrub jays ever occur in or near the project vicinity since there is no acceptable habitat in the general region.

Arctic peregrine falcon. Peregrine falcons are winter, non-breeding migrant residents in Florida. Duever et al. (1986) states that their primary habitats in Florida are coastal. The occurrence of peregrine falcons on or near the project site is probably very infrequent.

Southeastern American kestrel. This subspecies is a race of the American kestrel--previously known as the sparrow hawk. It is restricted to the southeast, including essentially all of Florida. Its preferred habitats include "pineland with large trees and coastal areas" (Kale, 1978). Its occurrence in the Big Cypress Swamps is poorly known because of confusion with the migratory subspecies (Duever et al., 1986) which is virtually identical in appearance. Because of its habitat preference, its occurrence near the project site would be unusual.

Florida sandhill crane. This non-migratory subspecies of the sandhill crane occurs in the Big Cypress Swamp, with populations roughly estimated to be 200 individuals. It is known to prosper on prairies managed for cattle (Duever et al., 1986). Two individuals were seen flying near the site during the present field survey. Feeding on and near the project site from time to time is to be expected based on

habitat considerations. Nesting habitat--large open marshes or other shallow water areas (Kale, 1978)--is not available close to the site.

Bald eagle. Most bald eagles in Florida utilize coastal (mangrove) habitats, but they do occur in the Big Cypress Swamp, occasionally nesting there. Nests have also been documented in cypress trees along the L-28 canal (Duever, et al., 1986). Eagles principally eat fish and utilize water bodies for feeding including even shallow marshes and ponds in dry prairie habitats (Kale, 1978). While eagles may feed in the canals adjacent to the site, and possibly utilize isolated wetland areas near the site, there appear to be no trees large enough for nesting within at least a few miles of the site.

Wood stork. Wood storks feed in a large variety of wetlands, including flooded pastures and ditches (Kale, 1978). A month prior to field work for the present project, this writer noted numerous wood storks feeding in temporarily flooded construction areas of I-75 a short distance west of the project site, in very close proximity to high speed traffic. They undoubtedly feed in the small isolated wetlands and drainage ditches near the project site during times of the year when dry-down is occurring locally so that prey becomes concentrated (trapped). On the other hand, the canals are probably not utilized because the feeding technique of wood storks is poorly suited to the steep slopes of the canal banks and bottom. Wood stork nesting areas in southern Florida have been extensively studied (Duever et al., 1986). None of the areas are located near the project vicinity.

Red-cockaded woodpecker. This species requires pine forest habitat where there are mature pines infected with red heart disease in order to construct its nesting cavities. The birds tend to live in colonies (clans) where they become established (Kale, 1978). Several colonies of red-cockaded woodpeckers are known in various areas of the Big Cypress Swamp (Duever, 1986). However, there is no acceptable habitat in or near the proposed project vicinity. Thus its potential occurrence at the project site is extremely low, if any.

Aubudon's crested caracara. While the project vicinity would appear to offer acceptable habitat--open country including prairie and improved pasture lands--there are no records of the occurrence of this species in Broward County. The center of population is in Central Florida (Kale, 1978). Thus, there is essentially no probability of occurrence of this species on the site.

Snail kite. Formerly known as the Everglades kite, this species now utilizes the Everglades conservation areas for most of its feeding (exclusively on apple snails) and nesting. However, its former range included a much wider area, including the project vicinity according to range maps of Kale (1978). This species may occur on or near the project site from time to time, and may occasionally feed in the adjacent canals, but its occurrence there would be irregular.

Florida panther. A small population of Florida panthers exists in the Big Cypress Swamp area (Duever et al., 1986). The preferred prey of this species is deer (Layne, 1978) and wild hog (Maehr, personal communication). Data on panther activity collected by trackers, including use of radio telemetry (a number of specimens have been fitted with radio transmitter collars) indicate that the project site is not preferred, with most panther activity at least several miles to the south and west. However, a male panther is currently known to be utilizing the Snake Road area on a regular basis, and a female visits that area occasionally (Maehr, personal communication). Thus, the project vicinity is within the range of panther activity, but the project site lies slightly to the east of the closest areas of known panther movement.

Everglades mink. This subspecies is found only in southern Florida, primarily from the Lake Okeechobee area south and southwestward. It occurs in the Big Cypress Swamp and in the Everglades, with its general range including extreme western Broward County. Everglades mink utilize freshwater wetlands, streams, and lakes where they are semi-aquatic, taking prey (ranging from fish and crayfish to rabbits and birds) under water as well as on land (Layne, 1978). While the Everglades mink may potentially occur in the project vicinity, the main areas of documented sitings are west and south of the area.

Big Cypress fox squirrel. Also known as the mangrove fox squirrel, this subspecies is currently confined to southwestern Florida, generally southwest of Lake Okeechobee in the Big Cypress Swamp region. It occurs only in forested areas including the drier cypress areas and hammocks, but is most abundant in mature pinelands (Layne, 1978). A lack of acceptable habitat in or near the project vicinity would preclude its occurrence in the area.

Florida black bear. This species occurs in numerous areas of Florida, including essentially all of the Big Cypress Swamp region where it only inhabitants areas near dense cover (Layne, 1978). They travel considerable distances in their normal activity (Duever et al., 1986),

and at least one individual has been recently noted in the vicinity of Snake Road (Maehr, personal communication). However, the lack of substantial cover in the project vicinity should make its potential for occurrence at the project site highly unlikely.

CONCLUSIONS

The project vicinity has been greatly altered, indirectly by drainage and directly by preparation for, and use as pasture for grazing cattle. With these changes, the general habitats for wildlife have changed from the original marsh lands (Everglades) principally into marginal uplands but with isolated pockets of wetland, and aquatic habitats available in drainage ditches and canals. Animal populations have changed accordingly, with species such as the meadowlark and bobwhite now being abundant in the immediate area of the project site. Formerly, these species would not have occurred in the area.

Several threatened and endangered species utilize the project vicinity to some degree. However, the Florida sandhill crane is the only species listed in these protected categories which may regularly visit the specific project site. While this species would not find acceptable nesting habitat in the area of the project site, it would likely feed in the area. With the close proximity of I-75 (Alligator Alley), and a major pumping station on the adjacent canal, the project site and its immediate vicinity could not be considered as critical habitat for this or any other protected species.

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FIGURES

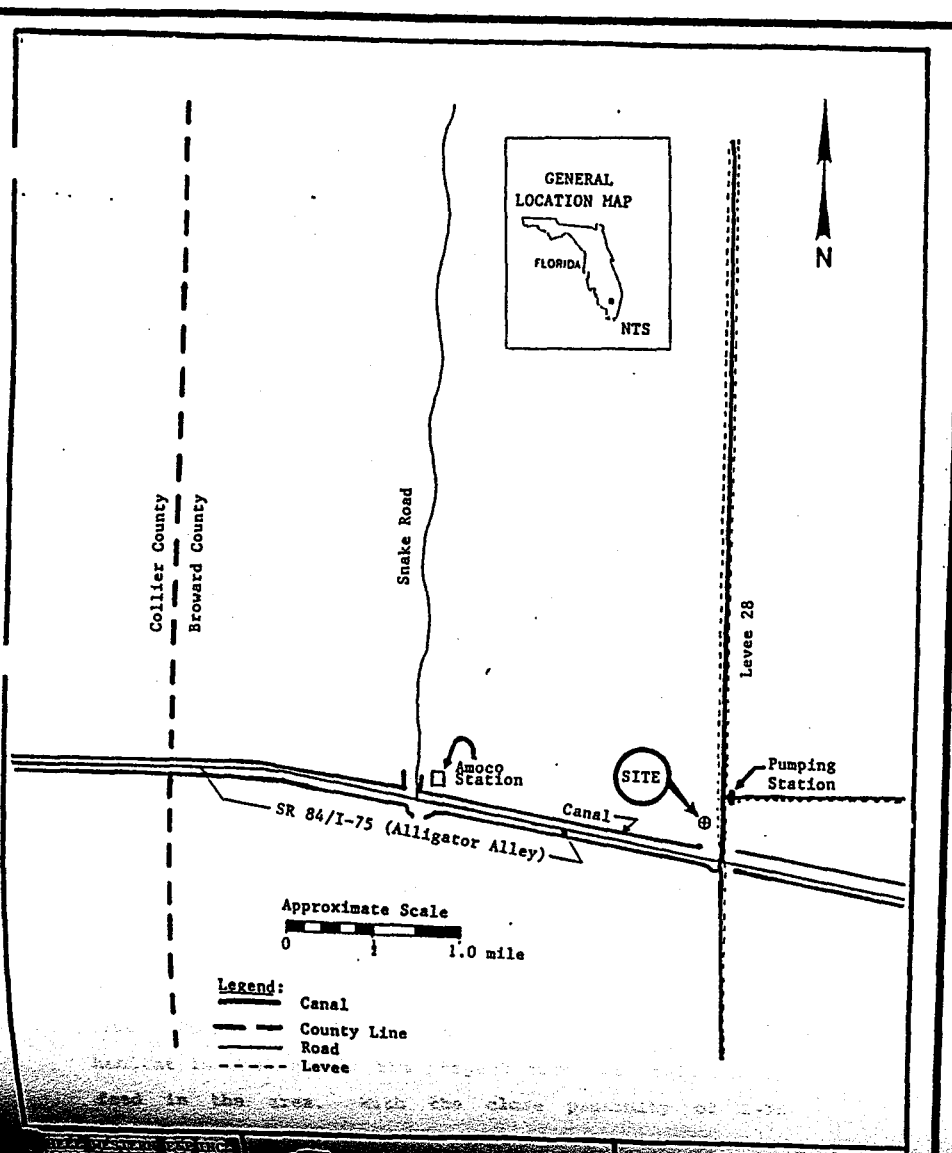


FIGURE 1. LOCATION MAP

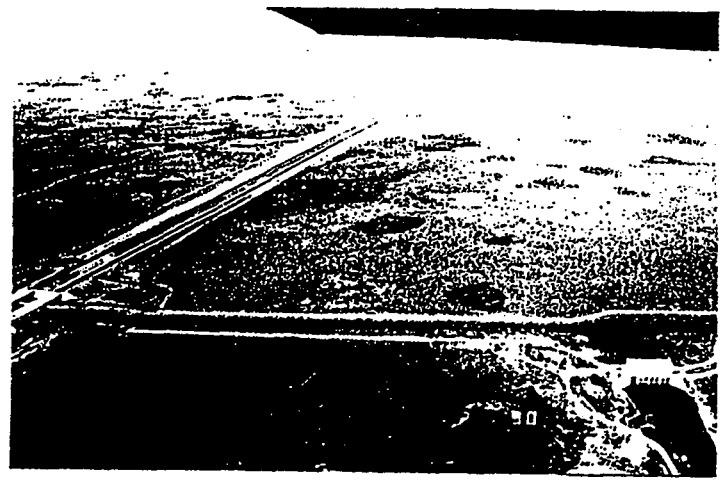


FIGURE 2. Looking west over Levee 28 and canal. The project site is at the center where a patch of light brown vegetation can be seen (principally beard grass (Andropogon sp.). Alligator Alley (SR 84/I-75) at left, pump station at lower right, and the clearing for Amoco station at Snake Road (upper right) are visible land marks.



FIGURE 3. Looking northeast from the site toward the willow head (tree island) and pumping station (upper right).



FIGURE 4. Looking northwest; compare to Figure 2 for site location. Note isolation of the site by canals and I-75 from habitats to the south and east.



FIGURE 5. Looking northwest, extension of Levee 28 (dirt road) in foreground, with parallel canal. Note greater diversity in less disturbed habitats to south of I-75, (left portion of photo).

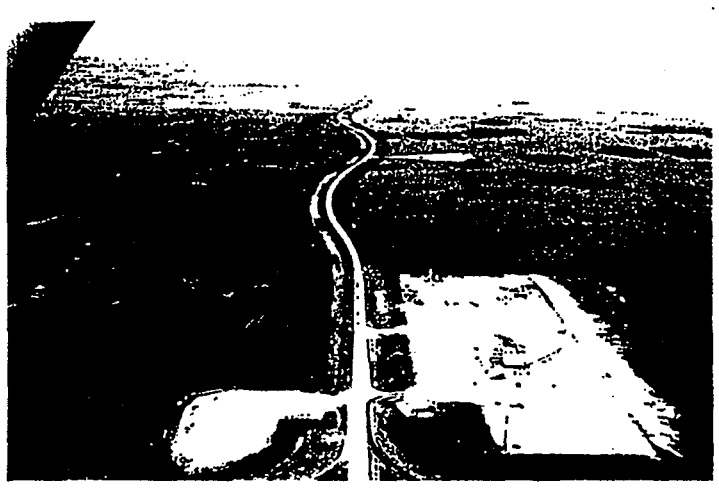


FIGURE 6. Looking north over Snake Road, I-75 just out of view below, Amoco station at lower right. Note altered habitat for cattle (right) and more natural condition to left (grading into pasture farther north).

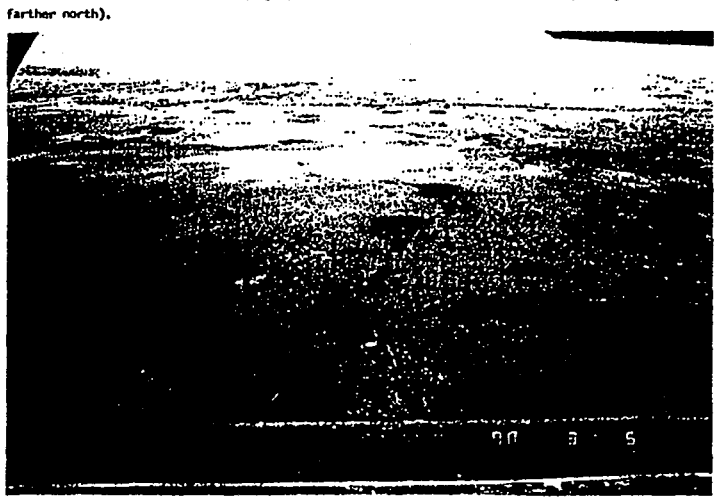


FIGURE 7. Looking west over Levee 28 and canal, area just north of the site. Note pasture improvements including drainage ditch (center) and apparent fence line (left).

TABLES

Table 1. Major wildlife species of known or expected occurrence on the site.

Amphibians
- southern toad
- oak toad
- Florida cricket frog
- green tree frog
- squirrel tree frog
- little grass frog
- eastern narrow-mouth toad
- southern leopard frog

Reptiles
- green anole*
- eastern garter snake
- South Florida ribbon snake
- southern black racer
- Everglades racer
- rough green snake
- Florida kingsnake
- duskly pygmy rattlesnake

Birds (non-breeders)
- Sharp-shinned hawk
- northern harrier*
- peregrine falcon
- kestrel
- American bittern
- Virginia rail
- sora
- common snipe
- whip-poor-will
- tree swallow*
- long-billed marsh wren
- short-billed marsh wren

Birds (breeders)
- turkey vulture*
- black vulture*
- red-tailed hawk*
- red-shouldered hawk
- bobwhite*
- cattle egret*
- sandhill crane*
- black-necked stilt
- killdeer

Table 1. (Continued) Major wildlife species of known or expected occurrence on the site.

Birds (Continued)
- barn owl*
- barred owl
- chuck-will's widow
- common nighthawk
- purple martin*
- yellowthroat
- eastern meadowlark*
- red-winged blackbird*
- common grackle
- boat-tailed grackle*
- cardinal*

Mammals
- opossum
- least shrew
- raccoon*
- spotted skunk
- striped skunk
- gray fox
- bobcat
- cotton mouse
- rice rat
- hispid cotton rat*
- marsh rabbit
- eastern cotton tail
- white-tailed deer
- wild hog
- armadillo*

* These species were either seen or evidence of their occurrence was identified on or near the site during field work.

Table 2. List of threatened or endangered species possibly occurring on/or adjacent to the site.

Group/Species	Status* State	Federal
Invertebrates		
(none)	-	-
Fishes		
(none)	-	-
Amphibians and Reptiles		
American alligator (*Alligator mississippiensis*)	SSC	T(S/A)
eastern indigo snake (*Drymarchon corais couperi*)	T	T
Birds		
Florida scrub jay (*Aphelocoma coerulescens coerulescens*)	T	T
Arctic peregrine falcon (*Falco peregrinus tundrius*)	E	T
southeastern American kestrel (*Falco sparverius paulus*)	T	UR 2
Florida sandhill crane (*Grus canadensis pratensis*)	T	-
bald eagle (*Haliaeetus leucocephalus*)	T	E
wood stork (*Mycteria americana*)	E	E
red-cockaded woodpecker (*Picoides borealis*)	T	E
Audubon's crested caracara (*Polyborus plancus audubonii*)	T	T
snail kite (*Rostrhamus sociabilis*)	E	E
Mammals		
Florida panther *Felis concolor corvi*	E	E
Everglades mink *Mustela vision evergladensis*	T	UR 2
Big Cypress fox squirrel *Sciurus niger avicennia*	T	UR 2
Florida black bear *Ursus americanus floridanus*	T	UR 2

* State status is by the Florida Game and Fresh Water Fish Commission (FGFWFC); Federal status is by the U.S. Fish and Wildlife Service (FGFWFC, 1989):

E = Endangered; T = Threatened; T(S/A) = Threatened due to similarity of appearance to another species; SSC = Species of special concern; UR 2 = Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking.

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APPENDIX A-10

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN

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SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN

AND

OIL SPILL CONTINGENCY PLAN

FOR

SWEPI MICCOSUKEE #3-1 WELL
BROWARD COUNTY, FLORIDA

SHELL WESTERN E&P INC.

CENTRAL DIVISION

JANUARY 1, 1991

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SECTION 1.0 - INTRODUCTION

1.1 Authority

Under authority of the Federal Water Pollution Control Act of 1972, the Environmental Protection Agency (EPA) regulations of Title 40, Code of Federal Regulations, Part 112 (40 CFR 112) entitled "Oil Pollution Prevention - Non-transportation Related Onshore and Offshore Facilities" require the preparation and implementation of Spill Prevention Control and Countermeasure (SPCC) Plans for all non-transportation related onshore facilities which, due to their location, could reasonably be expected to discharge oil in harmful quantities into or upon the navigable waters of the United States.

1.2 Purpose

Due to the presence of oil (i.e. diesel fuel, lubricating oils, hydraulic fluids, and potentially crude oil) at this drilling location, and the location's proximity to waters of the United States, this SPCC Plan is established to assist Operations in compliance with EPA Oil Pollution Prevention regulations. This Plan provides for a coordinated response by Shell Western E&P Inc. (SWEPI) to protect the environment from the effects of pollution discharges.

The Plan provides for (1) an equipment inspection and maintenance program to minimize the possibility for oil spills occurring; (2) a system of surveillance and reporting designed to insure the earliest possible detection of oil spills and the notice of such discharges to appropriate Agencies; (3) the assignment of duties and responsibilities among SWEPI drilling personnel; and (4) training sessions to acquaint SWEPI and contract employees with the emergency response procedures of the Plan to assure a coordinated effort in handling an abnormal condition such as an oil spill.

1.3 Objective

The objective of Federal Water Pollution Control Act and this management-endorsed SPCC Plan is to prevent the discharge of oil in harmful quantities into the navigable waters of the United States or adjoining shorelines. To accomplish this objective, (1) employees shall be adequately trained to reduce the number of human errors that often cause spills; (2) inspection procedures shall be implemented; (3) when appropriate, pollution prevention equipment shall be installed and maintained; (4) secondary containment shall be provided, where practicable, to contain any oil that may be spilled; and (5) an Oil Spill Contingency Plan shall be developed where secondary containment is not feasible.

The emphasis of this SPCC Plan is upon oil spill prevention as well as spill containment and cleanup. The SWEPI Drilling Foreman is responsible for Plan implementation and will be familiar with the Plan so that effective spill prevention and abatement can be achieved.

1.4 Format

The general format of this SPCC Plan follows applicable sections of American Petroleum Institute Bulletin D16, "Suggested Procedure for Development of Spill Prevention Control and Countermeasure Plans", Second Edition, dated August 1, 1989.

SECTION 2.0 - SPILL REGULATIONS

2.1 Federal Water Pollution Control Act

A. Oil Discharges

The Federal Water Pollution Control Act prohibits the discharge of oil in harmful quantities into or upon the navigable waters of the United States or adjoining shorelines. Discharges of such quantities of oil, determined to be harmful to the public health or welfare of the United States, include discharges which:

1. Violate applicable water quality standards;
2. Cause a film or sheen upon, or discoloration of the surface of the water or adjoining shorelines; or
3. Cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.

B. Hazardous Substance Releases

The Federal Water Pollution Control Act also prohibits the discharge of hazardous substances, other than oil, into the navigable waters of the United States.

Effective June 12, 1978, any spill of a harmful quantity of a hazardous substance must be reported to the same authorities as an oil spill. Since that time, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) has been enacted and requires the reporting of any hazardous substance spill which equals or exceeds a designated reportable quantity.

The Environmental Protection Agency has now designated more than 700 substances as hazardous. Each of these substances has been evaluated for its hazardous properties and has been assigned a reportable quantity ranging from one pound to 5,000 pounds. Any spill which releases or threatens to release a hazardous substance into the environment (i.e.: to the air, land or water) in a

quantity equalling or exceeding its reportable quantity must be reported as soon as possible.

C. Extremely Hazardous Substance Releases

Under the regulatory framework of the Superfund Amendments and Reauthorization Act (SARA), certain materials have been identified as Extremely Hazardous Substances. In addition, Local Emergency Planning Committees (LEPC's) and State Emergency Response Commissions (SERC's) have been established as a focal point for emergency response planning and release reporting.

A list of CERCLA hazardous substances and SARA Extremely Hazardous Substances which may possibly be used or encountered in this drilling operation, along with their Reportable Quantities, can be found in Table I below.

TABLE I

CERCLA HAZARDOUS SUBSTANCES
AND
SARA EXTREMELY HAZARDOUS SUBSTANCES

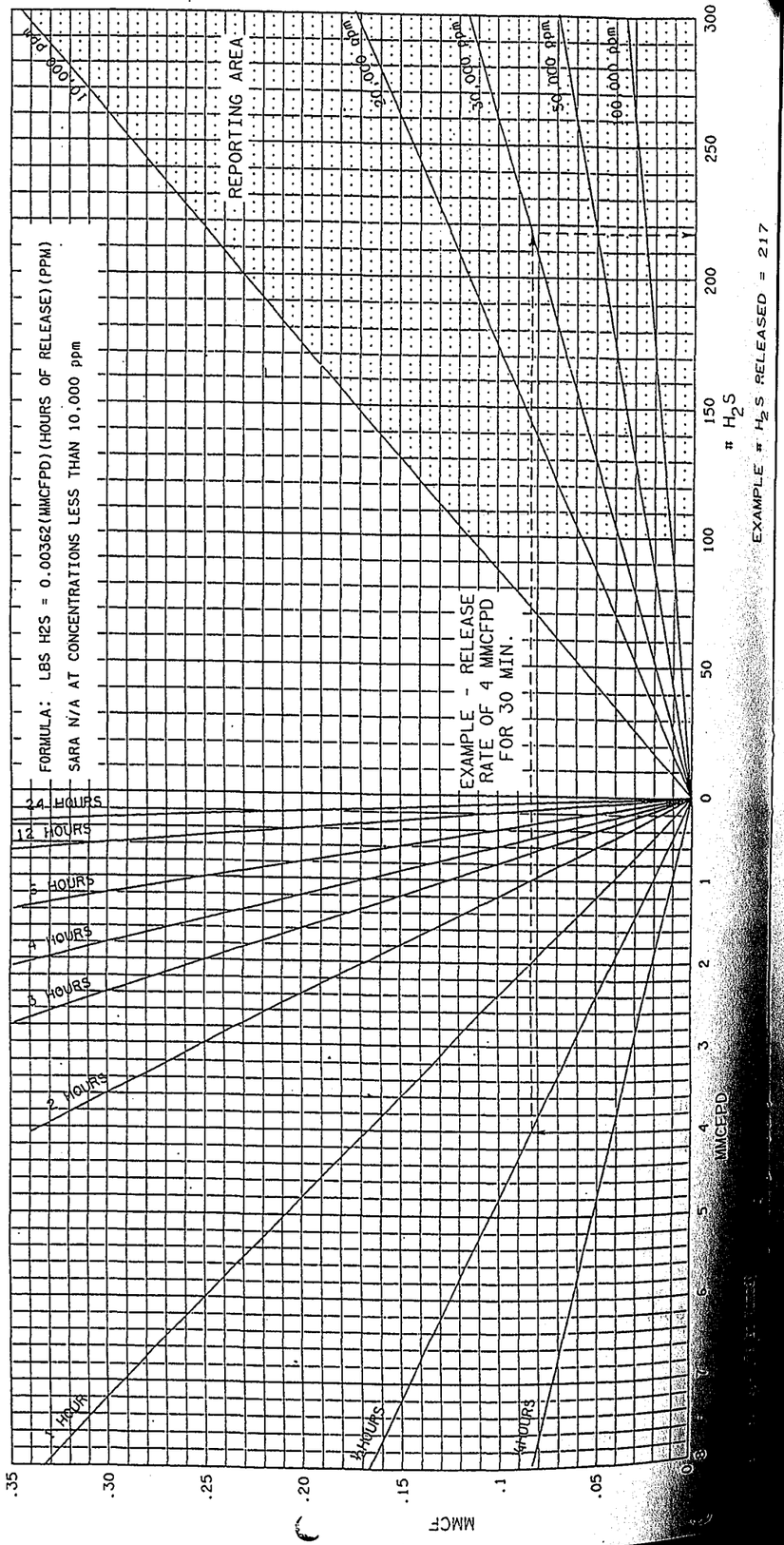
SUBSTANCE	CERCLA REPORTABLE QUANTITY (pounds)*	SARA REPORTABLE QUANTITY (pounds)*
** Hydrogen sulfide	100	100
Sulfur dioxide	NA	1

NA = Not Applicable

* Amount released in any 24-hour period.

** Reference Attachment 2.0-1 for assistance in estimating the amount of hydrogen sulfide released.

Attachment 2.0-1
Hydrogen Sulfide Releases



Source: Shell Western E&P Inc.
Everett L. Pace and Roger W. Zygmunt, P.E.
October 1987

SECTION 3.0 - SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN

3.1 Management Approval

This SPCC Plan, and the accompanying Oil Spill Contingency Plan, will be implemented as herein described.

Signature: _____

Name: D. G. Grosz

Title: Division Operations Manager, Central Division

3.2 Plan Certification

I hereby certify that I have examined the facility, and being familiar with the provisions of 40 CFR, Part 112, attest that this SPCC Plan has been prepared in accordance with good engineering practices.

(To be provided following facility construction and examiniation by Professional Engineer)

_____
Printed name of Registered Professional Engineer

(Seal)

_____
Signature of Registered Professional Engineer

Date: _____ Registration No.: _____ State: _____

[Response to statements should be: YES, NO, or NA (Not Applicable)]

3.3 General Information

A. Name of facility: (Drilling Rig to be Named)

B. Type of facility: Contract Onshore Drilling Rig

C. Location of facility: Section 3, T50S-R35E, Broward Co., Florida

D. Name and address of owner or operator:

Name: (To be Named)
Address: _____

E. Designated person accountable for oil spill prevention at facility:

Name and title: (To be named), SWEPI Drilling Foreman

F. Facility experienced a reportable oil spill event during the twelve months prior to Jan. 10, 1974 (effective date of 40 CFR, Part 112). No

G. Potential Spills - Prediction & Control:

Source	Major Type of Failure	Total Quantity* (bbls)	Rate (bbls/hr)	Direction of Flow	Secondary Containment
Engines & Pumps	Minor Spills or Leaks	< 5	< 5	Variable	Plastic-lined Berm
Diesel Fuel Tank	Rupture	500	1000	Variable	Plastic-lined Berm & Earthen Drill Pad Ring Levee
Lube Oil Tank	Rupture	50	100	Variable	Plastic-lined Berm & Earthen Drill Pad Ring Levee
Hydraulic Fluid Tank	Rupture	25	50	Variable	Plastic-lined Berm & Earthen Drill Pad Ring Levee
Well	Blowout	Unknown	< 25 (Estimate)	Variable	Earthen Drill Pad Ring Levee

Discussion:

* Total quantities shown represent capacities typical of onshore drilling rigs. Actual quantities may vary slightly, depending on the specific drilling contractor and rig employed.

Due to the exploratory nature of the well, oil volumes potentially available for release in a well blowout scenario are best-estimates based on available reservoir information. In the unlikely event of a well blowout, the earthen ring levee surrounding the drill pad may be incapable of complete spill containment. Therefore, an Oil Spill Contingency Plan is attached and will be implemented in the event that a well blowout is threatened.

H. Containment or diversionary structures or equipment to prevent oil from reaching navigable waters are practicable. No

If No, a strong Oil Spill Contingency Plan is attached. Yes

I. Inspections and Records

1. The required inspections follow written procedures. Yes

2. The written procedures and a record of inspections, signed by the appropriate supervisor or inspector are attached. Yes

Discussion: Rig equipment, which upon failure or malfunction could cause an oil spill, is visually inspected during rig-up to assure satisfactory condition. Rig equipment is also visually inspected for signs of leaks or spills on a routine 24-hour per day basis during drilling operations by the SWEPI drilling Foreman or contract drilling employees. See Subsection 3.5 for detailed facility inspection procedures. Weekly inspections are documented on the enclosed Facility Inspection Record (Attachment 3.0-2). Equipment problems requiring maintenance or repair are recorded on the enclosed Facility Repair Record (Attachment 3.0-3).

3. A copy of this SPCC Plan, including all inspection records, is maintained at the drill site during the drilling operation and in SWEPI Division files for three years thereafter. Yes

J. Personnel Training and Spill Prevention Procedures

1. Personnel are properly instructed in the following:

a. Operation and maintenance of equipment to prevent oil discharges. Yes

b. Applicable pollution control laws, rules, and regulations. Yes

Describe procedures employed for instruction:

A summary of applicable laws, rules, and regulations is included with this SPCC Plan. On-the-job training is used to instruct employees concerning correct methods and use of equipment required at this location. Equipment inspection procedures will be reviewed prior to well spudding.

2. Scheduled prevention briefings for the operating personnel are conducted frequently enough to assure adequate understanding of the SPCC Plan. Yes

Describe briefing program:

The Drilling Foreman will brief appropriate SWEPI and contract personnel prior to well spudding. The briefing will include a discussion of the applicability of the SPCC Plan, potential spill sources, facility inspections and maintenance, and general spill response procedures. The briefing will be documented on the enclosed Training Record (Attachment 3.0-1). The SPCC Plan will be retained at the drill site for reference by SWEPI and contract personnel.

3.4 Design and Operating Information

A. Facility Drainage

1. Drainage from undiked storage areas is controlled as follows:

   Major rig components and oil storage tanks will be underlain by a plastic-liner (12 mil minimum thickness with fiber reinforcement). The lined area will be encompassed by a 1-foot berm and trenched to drain to the well cellar such that rain water and any other fluids can be collected and removed for use in the drilling mud system.

2. The procedure for supervising the drainage of rain water from secondary containment into a storm drain or an open water course is as follows (include description of (a) inspection for pollutants, and (b) method of valving security):

   Rain water will not be drained from the drill site. Rain water which accumulates within the earthen ring levee surrounding the drilling location will be utilized, to the extent feasible, as make-up fluid to the drilling mud system, or disposed, following visual inspection for oil, through the well annulus into the boulder zone (lost circulation zone).

3. Field drainage ditches, road ditches, and oil traps, sumps, or skimmers, if such exist, are inspected at regularly scheduled intervals for accumulations of oil. NA

   Describe inspection procedures, intervals, and methods employed to remove oil:

   Not applicable.

B. Bulk Storage Tanks

1. Describe tank design, materials of construction, and fail-safe engineering features:

   Storage tanks for diesel fuel, lubricating oils, and hydraulic fluids are typically constructed of welded steel plates and may be built-in to the rig substructure. (Details of storage tanks will be provided prior to start-up of drilling operations)

2. Describe secondary containment design, construction materials, and volume:

   In addition to the plastic-lined and bermed area beneath the major rig components and oil storage tanks, an earthen ring levee surrounds the drilling location. The levee is constructed from locally-obtained limerock. Levee containment capacity (approximately 51,000 bbls) is designed primarily for rain water retention and significantly exceeds onsite oil storage volumes (approximately 600 bbls). Reference Attachment 3.0-4 for site construction details.

3. Describe tank examination methods and procedures:

   See Subsection 3.5, Facility Inspection Procedures.

C. Facility Transfer Operations

1. Describe scheduled fuel and lubricating oil transfers:

   Oil storage tanks are located above ground. If necessary, the tanks will be re-filled from an oil transport truck, under the direct supervision of the truck driver.

D. Blowout Prevention

1. A blowout preventer (BOP) assembly and well control system is installed before drilling below any casing string. Yes

2. The BOP assembly is capable of controlling any expected wellhead pressure. Yes

3. Casing and BOP installations conform to applicable State or Federal regulatory agency requirements. Yes

3.5 Facility Inspection Procedures

A. During Rig-up

1. Perform visual inspections during rig-up to assure the satisfactory condition of storage tanks, piping, fittings, and other rig equipment which normally contain oil such as diesel fuel, lubricating oil, and hydraulic fluid, during drilling operations.

2. Inspect secondary containment areas for integrity.

B. Routine Daily

1. During drilling operations, all operators will be observant for signs of spills or leakage and the need for equipment maintenance.

2. Record equipment repair or maintenance on the Facility Repair Record (Attachment 3.0-3) following this Subsection.

C. Weekly

1. Inspect all oil tank seams for leakage.

2. Inspect oil tank surfaces for signs of excessive external corrosion which may lead to tank failure.

3. Inspect the base of oil tanks for signs of bottom leaks.

4. Check piping and connections for leaks.

5. Inspect valves for proper position and locks, if applicable.

6. Document inspection results on the Facility Inspection Record (Attachment 3.0-2) and the Facility Repair Record (Attachment 3.0-3) following this Subsection.

ATTACHMENT 3.0-1

SPCC PLAN
AND
OIL SPILL CONTINGENCY PLAN

TRAINING RECORD

Date / Time: _____

Topic: _____

Session Leader: _____

Attendees

Name	Title	Employer

(Copy this page and use for additional records, if necessary)

ATTACHMENT 3.0-2

FACILITY INSPECTION RECORD

Reference Subsection 3.5, Facility Inspection Procedures.

Inspection Date	Name of Inspector	Inspector's Initials	Followup Repair Required (Yes* or No)

* If Yes, complete Form 3.0-3, Facility Repair Record.

(Copy this page and use for additional records, if necessary)

ATTACHMENT 3.0-3

FACILITY REPAIR RECORD

Reference Subsection 3.5, Facility Inspection Procedures.

Equipment requiring maintenance or repair will be recorded below along with the corrective action taken.

Date: _____

Inspector Name: _____

Equipment ID: _____

Condition Noted: _____

_____

_____

Action Taken: _____

_____

_____

Date Completed: _____

Date: _____

Inspector Name: _____

Equipment ID: _____

Condition Noted: _____

_____

_____

Action Taken: _____

_____

_____

Date Completed: _____

ATTACHMENT 3.0-3

FACILITY REPAIR RECORD
(Continued)

Date: _____

Inspector Name: _____

Equipment ID: _____

Condition Noted: _____

_____

_____

Action Taken: _____

_____

_____

Date Completed: _____

Date: _____

Inspector Name: _____

Equipment ID: _____

Condition Noted: _____

_____

_____

Action Taken: _____

_____

_____

Date Completed: _____

(Copy this page and use for additional records, if necessary)

Name of Facility: (To be Named)
Operator: (To be Named)

Attachment 3.0-4
Facility Plot Plan
Rev. 2/4/93

WATER MANAGEMENT DATA

ON-SITE STORAGE:

Total Site Area 320' x 615' = 202,950 sq. ft.

On-Site Retention Areas

Main Retention Area (Elev. 12.0' – 13.5')
84.5' x 378.5' x 1.5' = 38,184 cu. ft.

Perimeter Swale (Elev. 12.0' – 13.5')
Gross Area = 11,253 sq. ft.
11,253 sq. ft. x 850' = 10,658 cu. ft.

Drill Cuttings Area (Elev. 12.0' – 13.5')
34.5' x 204.5' x 1.5' = 10,553 cu. ft.

Total Storage to Elev. 13.5' 60,469 cu. ft.
(Rainfall Storage = 60,469/202,950 = 0.30 ft. = 3.6 in.)

Storage Between Elevation 13.5' and 15.0' (top of berm)

Gross Area Inside Berm
286.5' x 386.5' x 1.5' = 165,733 cu. ft.

Less Stepped Equipment Area
1/2(233.5' x 0.5') + 1/2(211.5' x 0.5') = 118 cu. ft.

Less Interior Berm
Cross sectional area = 18 sq. ft.
18 sq. ft. x 320' = (4,780 cu. ft.)

Total Storage Between Elev. 13.5' and 15.0' 159,837 cu. ft.

TOTAL STORAGE ON-SITE 220,322 cu. ft.
(Rainfall stage = 220,322/202,950) = 1.09 ft. = 13 inches)

STORM VOLUMES:

First Inch 1" x 320' x 615' = 16,400 cu. ft.
Avg. Annual Max 6" x 320' x 615' = 82,000 cu. ft.
25 yr. 24 hr. 7" x 320' x 615' = 114,800 cu. ft.
25 yr. 72 hr. 10" x 320' x 615' = 164,000 cu. ft.
100 yr. 3 day 12" x 320 x 615 = 164,000 cu. ft.

FILL REQUIREMENTS

Pad bottom 320' x 615' = 202,950 sq. ft.
Pad top 304' x 599' = 182,096 sq. ft.
Height 15.0' x 11.0' = 4 ft.
Volume of truncated pyramid = 757,538 cu. ft.
Volume of inside open area = 220,322
Net fill = 537,214 cu. ft.
= 19,897 cu. yds.
With 15% compression factor = 23,000 cu. yds.

NOTE:
PRECISE LOCATION OF ENTRANCE RAMP TO BE LOCATED AT TIME OF CONSTRUCTION

SHADING IN PLAN VIEW DENOTES AREA OF PLASTIC LINER

ELEVATIONS IN FEET ABOVE NGVD 1929

PERIMETER SWALE
PERIMETER BERM

615'

320'

WELL STAKE

FLARE PIT

DRILL CUTTINGS STORAGE
30' X 200' AT BASE
(ELEV. 12.0')

STORM WATER RETENTION AREA
90' X 272' AT BASE
(ELEV. 12.0')

TYPICAL BERM SLOPE

SECTION A–A

SECTION B–B

NOTE:
VERTICAL SCALE EXAGGERATED

DATE:	1/28/93
SCALE:	1" = 100'
PROJECT:	T-334
SHEET:	

MICCOSUKEE WELL SITE 3-1
SHELL WESTERN E&P, INC.

FLORIDA ENGINEERING SERVICES CORPORATION
2024-D North Point Blvd. Tallahassee, FL 32308

APPROVED BY
George M. Cole
Florida P.E. # 38581

SECTION 4.0 - OIL SPILL CONTINGENCY PLAN

4.1 Introduction

Potential spill sources and type of secondary containment are listed in Subsection 3.3, Item G of the SPCC Plan.

While the drilling rig and drill site are well designed to protect against pollution, in the unlikely event of a well blowout due to loss of well control and failure of the blowout preventer, the earthen ring levee surrounding the drill site may be incapable of complete spill containment. Therefore, an Oil Spill Contingency Plan has been prepared.

4.2 Purpose

The purpose of this Oil Spill Contingency Plan is to (1) outline procedures for a coordinated response to accidental oil spills or hazardous substance releases; (2) summarize reporting requirements to assure the appropriate reporting of spills or releases to appropriate Agencies having regulatory responsibility over drilling activities; and (3) provide for notification of SWEPI management in the event of a spill.

To accomplish these goals, the following sections outline specific procedures and responsibilities for proper response and reporting of oil spills and CERCLA Hazardous Substance releases. As a reference for drilling personnel, saltwater spills and SARA Extremely Hazardous Substance releases are also addressed. Reporting requirements are detailed for spills contained on land as well as spills reaching waters of the United States.

The SWEPI Drilling Foremen will conduct briefing sessions for drilling personnel prior to well spudding, and at intervals frequent enough to assure proper understanding and effective implementation of this contingency Plan.

4.3 Written Commitment of Manpower

SWEPI Management approval included in Subsection 3.1 of the preceding SPCC Plan authorizes commitment of the personnel, equipment and materials required to arrest and expeditiously clean up any spills at this drilling location.

4.4 Definitions

A. Discharge

Discharge includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying or dumping.

B. Oil

Oil means oil of any kind or in any form including, but not limited to, petroleum, fuel oil, sludge, oil refuse, vegetable oil and oil mixed with wastes other than dredged spoil.

C. Waters of the United States

In general, the term "waters of the United States" refers to any water that can be utilized for commercial, industrial or recreational purposes such as boating or fishing, including lakes, rivers, ponds and streams, plus the tributaries of these waters even though the flow may be intermittent and not utilized for commerce or recreation.

More specifically, "Waters of the United States" includes:

1. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

2. All interstate waters, including interstate "wetlands";

3. All other waters such as intrastate lakes, rivers, streams, intermittent streams, mudflats, sandflats, "wetlands", sloughs, prairie potholes, wet meadows, playas lakes, or natural ponds the use, degradation, or destruction of which could affect interstate or foreign commerce including any such waters:

   a. Which are or could be used by interstate or foreign travelers for recreational or other purposes;

   b. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

   c. Which are used or could be used for industrial purposes by industries in interstate commerce;

4. All tributaries of the waters identified above.

4.5 Spill Control

When a spill is detected, the SWEPI Drilling Foreman or highest ranking supervisor at the drill site will take charge and direct activities to:

A. Immediately isolate and shut off the source of the material being released.

B. Control the spread of land spills by constructing a retaining dike from dirt, boards, synthetic sorbents, hay or straw, etc.

C. Activate contract assistance for deployment of containment booms for spills to surface waters.

D. Employ vacuum trucks, sorbents, oil skimmers, or other materials to recover as much of the spilled material as possible.

E. Restore the spill area to the extent feasible.

4.6 Spill Reporting Procedures

This subsection provides specific instructions for the reporting of spills to the appropriate regulatory Agencies, the Miccosukee Tribe of Indians of Florida (Miccosukee Tribe), and SWEPI management. The type of spill and the area affected will determine who must be notified.

A. General

1. The SWEPI Drilling Foreman or delegated personnel is responsible for notifying the appropriate regulatory Agencies, Miccosukee Tribe, and SWEPI Drilling Superintendent and Division HS&E Manager.

2. If the spill could have a significant impact on the environment, the Drilling Superintendent shall notify the Division Operations Manager, and he in turn, shall notify the Division Production Manager.

3. The following attachments are provided for quick reference and use in spill reporting:

   a. Attachment 4.0-1 - Notification and Reporting Flowchart is a simplified chart for reporting spills, showing SWEPI internal contacts and telephone numbers.

   b. Attachment 4.0-2 - Spill Reporting Summary is a quick reference for notification requirements to regulatory Agencies and other groups.

   c. Attachment 4.0-3 - Contact List is a listing of addresses and telephone numbers for spill notifications.

   d. Attachment 4.0-4 - Internal Spill Report for internal documentation of spill reporting.

4. For all reportable spills or releases, an Internal Spill Report (Attachment 4.0-4) shall be submitted by the Drilling Foreman or delegated personnel to the Drilling Superintendent and a copy to the Division HS&E Manager within three (3) days after the spill incident. One copy of the report shall be retained with the SPCC Plan at the drill site.

5. All written correspondence to outside agencies or other parties will be coordinated by the Drilling Superintendent and Division HS&E Manager.

6. When reporting by telephone spills of oil, or releases of Hazardous Substances and Extremely Hazardous Substances which remain within the facility boundaries, the following information shall be provided:

   a. Name of the company and facility from which the spill originated.

   b. Name of the person reporting the spill and the telephone number where the caller may be reached.

   c. Time and date the spill occurred.

   d. Type, amount, and location of the spill, including any affected waters.

   e. Action taken to control the spill.

7. When reporting by telephone releases of Hazardous Substances and Extremely Hazardous Substances which leave the facility boundaries the following information shall be provided:

   a. Name of the company and facility from which the release originated.

   b. Name of the chemical substance released.

   c. Whether or not the released substance is an Extremely Hazardous Substance.

   d. Estimate of the quantity of chemical released.

   e. Time and duration of the release.

   f. The medium or media into which the chemical is released.

   g. Known or anticipated acute or chronic health impacts.

   h. Precautions to take as a result of the release.

   i. Name and telephone number of the Facility Emergency Response Coordinator or his/her surrogate.

8. Oil Spills from Outside Sources

   a. If an oil slick or other spill is sighted moving into the area of SWEPI operations, an Internal Spill Report (Attachment 4.0-4) shall be completed and transmitted to the Drilling Superintendent and the Division HS&E

Manager. A copy of the report shall be retained with the SPCC Plan at the drill site.

b. If the operator causing the intrusive slick or spill can be readily identified, they should be notified and given the opportunity to report the spill to the proper regulatory Agencies.

c. If the operator responsible for the spill cannot be identified and notified, the Drilling Foreman or delegated personnel should report the spill to appropriate regulatory Agencies per Subsections 4.6 B and 4.6 C.

B. National Response Center (NRC)

1. The Drilling Foreman or delegated personnel shall immediately notify the National Response Center after a spill of:

a. Oil into the Waters of the United States in an amount which is sufficient to cause:

(i) A film, sheen, or discoloration of the water or adjoining shoreline, or

(ii) A sludge or emulsion to be deposited beneath the surface of the water or upon the adjoining shorelines.

b. CERCLA Hazardous Substance to land, air or water in an amount equal to or exceeding the CERCLA Reportable Quantity (See paragraphs A.6 or A.7 above for information to be reported).

c. SARA Extremely Hazardous Substance to land, air or water if also listed as a CERCLA Hazardous Substance and released in an amount equal to or exceeding the CERCLA Reportable Quantity (See paragraphs A.6 or A.7 above for information to be reported).

2. It is not necessary to file a written report with the National Response Center.

3. Field personnel shall decline to sign all U.S. Coast Guard forms including the Statement of Suspected Party to an Incident, and the Statement of Witness to an Incident. Refer all such matters to the Drilling Superintendent.

C. Bureau of Land Management (BLM)

1. The Drilling Foreman or delegated personnel shall notify as soon as practical, but within a maximum of 24 hours, the District Office of the BLM of:

a. Oil, saltwater, or toxic liquid spills, regardless of the volume spilled.

b. Gas venting or fires.

c. Accidents which involve a fatal injury.

d. Blowouts.

2. The Drilling Superintendent or Division HS&E Manager shall submit a follow-up written report, in duplicate, no later than 15 days following the incident to the District Office of the BLM. The written report shall provide the following:

a. Date and time of the incident, and date and time the incident was reported to the BLM District Office.

b. Location where the incident occurred, including surface ownership and lease number.

c. Specific nature and cause of the incident.

d. Description of the resultant damage.

e. Action taken and the length of time required for control of the incident, for containing the discharged fluids, and for subsequent cleanup.

f. Estimated volume discharged and the volume lost.

g. Cause of death when fatal injuries are involved.

h. Actions that have been or will be taken to prevent a recurrence of the incident.

i. Other Federal or State agencies notified of the incident.

j. Other pertinent comments or additional information as requested by the District Office.

D. State Emergency Response Commission (SERC) and Local Emergency Planning Committee (LEPC)

1. The Drilling Foreman or delegated personnel shall immediately notify by telephone the State Emergency Response Commission and Local Emergency Planning Committee after the release of:

a. CERCLA Hazardous Substance in an amount equal to or exceeding the CERCLA Reportable Quantity and which leaves the facility boundary.

b. SARA Extremely Hazardous Substance in an amount equal to or exceeding the SARA Reportable Quantity and which leaves the facility boundary.

2. The Drilling Superintendent or Division HS&E Manager shall submit a follow-up written report as soon as practicable (i.e.: no more than 10 days after the release) to the State Emergency Response Commission and the Local Emergency Planning Committee setting forth:

a. Action taken in response to the release.

b. Known or anticipated acute or chronic health impacts.

c. Where appropriate, advice regarding medical attention necessary for exposed individuals.

E. Miccosukee Tribe

1. The Drilling Foreman or delegated personnel shall notify the Miccosukee Tribe by telephone as soon as practical following any reportable incident, providing information consistant with that required by the regulatory Agencies.

4.7 Spill Cleanup

The four basic steps to initiate in the event of a spill are:

1. Locate and shut off the spill source,
2. Contain the spill,
3. Remove oil from water or land areas, and
4. Restore contaminated land areas.

The remainder of this Subsection contains information regarding spill cleanup operations, including onsite cleanup equipment, cleanup contractors, collecting agents, aquatic research organizations, and waterfowl cleanup.

Recovery of oil requires containment followed by collection. On land, oil can be contained by constructing retaining dikes of dirt, boards, synthetic sorbents, hay or straw, etc. and collected with vacuum trucks or portable pumps and containers, followed with an appropriate absorbent and restoration of the land. The Division HS&E Manager should be consulted for guidance regarding collection and land restoration. On water, oil can be contained by use of portable booms and/or chemical collection agents and removed with vacuum trucks or skimmers. It is emphasized that approval from the Federal On-Scene Coordinator must be obtained prior to the use of any chemical agents in water.

A. Onsite Cleanup Equipment

Following is a list of representative equipment to be available at the drill site for immediate use by onsite personnel in response to small spills, and for initial spill containment and cleanup efforts in response to larger spills that may require additional contractor assistance.

- o Two 100' permanent booms (4"-7" float, 6"-12" skirt) and anchors
- o 10 bales absorbent pads (approx 17" x 19" x 3/16 or 3/8")
- o 10 bales absorbent sweep (100' x 19")
- o One 2-inch pump with hose
- o One case of disposal bags
- o Assortment of shovels, rakes, etc.

B. Spill Cleanup Contractors

Listed below are several local and/or national contractors and associations that are available to assist in cleanup operations should a spill event occur.

1. Oil

a. Florida Well Service
P.O. Box 30
Felda, Florida 33930
(813) 675-2622
or (813) 675-1125
Willy Roberts
or (813) 369-1574
(24-Hours)

b. Danmark Environmental Services
P.O. Box 4685
Princeton, Florida 33092
(305) 258-2827
Brian Finney
(24-Hours)

c. Cliff Berry, Inc.
P.O. Box 13079
Port Everglades Station
Fort Lauderdale, Florida 33316
(305) 763-3390
Gerald Struth

d. O. H. Materials Company
405 Mohawk Road
P. O. Box 1190
Clermont, Florida 32711
(904) 394-8601

e. General Technology Applications, Inc.
7720 Mason King Court
Manassas, Virginia 22110
(703) 631-6655
Jerry Trippe

f. Clean Gulf Associates (504) 588-4630
Contact - Shell Offshore, Inc.
Manager - Health, Safety and Environment

2. Oil and Hazardous Substances

a. Riedel Environmental Services (800) 334-0004
Portland Division (24-hours)
Foot of N. Portsmouth
Portland, OR 97217
John H. Peterson, Sales Rep. (503) 286-4656

C. Collecting Agents

This paragraph contains information regarding the use and application of collecting agents for the containment and cleanup of oil spills. In the event that the use of a collecting agent is contemplated, the Drilling Superintendent should consult with the Division HS&E Manager. In all instances, approval from the Federal On-Scene Coordinator (OSC) is required prior to the use of any collecting agent. OSC approval should be documented on the Authorization to Apply Collecting Agent form, Exhibit 2 of this Subsection.

1. Oil Herder

Oil Herder is a surface active agent (surfactant) which, when applied to the water surface, can effectively control and contain the spread of oil. When applied to water, the surfactant spreads out over the water surface as a thin monomolecular film. The tendency of the oil to spread on the water is reduced since the spreading force of the surface active agent is greater than that of the oil. Oil Herder is stocked by and can be obtained through Clean Gulf Associates as listed in this subsection.

2. Elastol

Elastol is a non-toxic finely powdered high molecular weight polymer, polyisobutylene (PIB), and water-insoluble coatings, tricalcium phosphate and calcium sterate. Elastol is insoluble in water, but dissolves rapidly in oil making it viscoelastic. Oil treated with Elastol resists water in oil emulsification and dispersion in water. By improving oil cohesiveness, Elastol enhances oil/water separation and recovery effectiveness. Elastol can be obtained on a 24-hour response basis from General Technology Application, Inc., as listed in this section.

Exhibit 1, located at the end of this subsection lists some technical specifications and application techniques for both Oil Herder and Elastol.

EXHIBIT 1

SPECIFICATIONS AND APPLICATION TECHNIQUES

OIL HERDER

Oil Herder can be used on any petroleum or vegetable oil that has not been modified by chemical treatment or by the inclusion of additives, and as long as the oil is in a liquid state. It can be used in either salt or fresh water, and over a wide temperature range. Also, it can be applied successfully even at air temperatures below 36 degrees F if kept warm to avoid solidification. Some physical properties of Oil Herder are listed below.

Specific gravity at 77 degrees F (25 degrees C)...	0.86
Density, lb./gal. at 77 degrees F (25 degrees C)..	7.2
Flash point, degrees F.....	172
Pour point, degrees F.....	36
Viscosity, cs at 77 degrees F (25 degrees C).....	8
Spreading pressure, dynes/cm.....	42

Research has shown Oil Herder to be biodegradable and non-toxic to marine life and water fowl, even when applied in excess of the recommended rates. It is also nonflammable, and will not emulsify oil into water. Oil Herder will not adversely affect crude or other oils which are subsequently recovered and refined.

The recommended application rate for Oil Herder is two (2) gallons per linear mile of spill perimeter. It can be reapplied if necessary every six hours, subject to a maximum of 3 applications in any 24-hour period. If the Federal On-Scene Coordinator is not amenable to the recommended application rate, Oil Herder should be applied at that rate specified by him. Once approval to apply Oil Herder has been granted, the Drilling Foreman or delegated personnel must make sure approval is documented on the authorization form, Exhibit 2.

ELASTOL

Elastol is a non-toxic finely powdered high molecular weight polymer, polyisobutylene (PIB), and water-insoluble coatings, tricalcium phosphate and calcium sterate. Elastol is insoluble in water, but dissolves rapidly in oil making it viscoelastic. It can be used in either salt or fresh water over a wide temperature range. Elastol is nonflammable (530 degree F flash point) and will not adversely affect crude or other oils which might be subsequently recovered and refined. Elastol has a bulk density of approximately 35 lb/cubic foot and a viscosity of 0.56.

EXHIBIT 1

SPECIFICATIONS AND APPLICATION TECHNIQUES
(Continued)

The preferred method of application is as a slurry of the Elastol powder in water, however powder application can also be used where dust does not create a problem. Effective dosages of Elastol are directly related to the viscosity of the oil being treated, ranging from 200-1000 ppm for medium and heavy crudes, 1000-1500 ppm for light crudes and diesel, and 2000-3000 ppm for gasoline. Prompt application is essential for maximum effectiveness.

If the Federal On-Scene Coordinator is not amenable to the recommended application dose, Elastol should be applied at that dose specified by him. Once approval to apply Elastol has been granted, the Drilling Foreman or delegated personnel must make sure approval is documented on the authorization form, Exhibit 2.

EXHIBIT 2

AUTHORIZATION TO APPLY COLLECTING AGENT

I,_____, acting as the Federal On-Scene Coordinator, authorize_____, of Shell Western E&P Inc. to apply_____ (Chemical name) at the rate and dosages described below:

_____

_____

_____

_____

_____

_____

Location:_____

Date_____ Signed_____
(Federal On-Scene Coordinator)

Date_____ Signed_____
(Shell Western E&P Inc.)

D. Aquatic Research Companies

In case of a major spill, it may be desirable to utilize an independent marine research company to determine the effect of a spill on aquatic flora and fauna. As a spill initially moves toward shore, foresight should be exercised and appropriate "pre-damage" surveys made in those areas where the spill might result in contamination. These companies could also be used to recommend procedures for cleaning any contaminated waterfowl. Listed below are two aquatic research companies.

1. Gulf South Research Institute (504) 766-3300
   7600 GSRI Avenue
   Baton Rouge, LA 70820

2. Pacific Northwest Laboratories (509) 375-2121
   Division of Battelle Memorial Institute
   904 Battelle Boulevard
   Richland, WA 99352

The appropriate departments of local universities may also have individuals with talents that might be utilized in marine research studies.

E. Waterfoul Cleanup

Under the U.S. "National Oil and Hazardous Substances Pollution Contingency Plan", the Department of the Interior is designated as the responsible agency for waterfowl affected by a spill. The Department's Fish and Wildlife Service is specifically charged with protecting fish and wildlife resources and their habitats, and coordinating waterfowl rehabilitation activities under the service's "Pollution Response Plan for Oil and Hazardous Substances". Many state wildlife agencies have similar contingency plans that function in concert with the federal program.

In the event of waterfowl contamination resulting from a spill, the Division HS&E Manager will notify the U.S. Fish and Wildlife Service at the regional office listed below.

1. U.S. Fish and Wildlife Service (404) 331-6343
   Region 4
   75 Spring Street SW, Room 1276
   Atlanta, Georgia 30303
   Richard H. Dawson, Oil Spill Response Coordinator
   or, if Dawson is unavailable,
   Charles F. Facemire, Environmental Contaminants Coordinator

It is <u>illegal</u> to capture and hold migratory birds or waterfowl, for cleaning or any other purpose, without a permit from the appropriate state wildlife agencies and the U.S. Fish and Wildlife Service. Permits usually take a lengthy time to process, and are

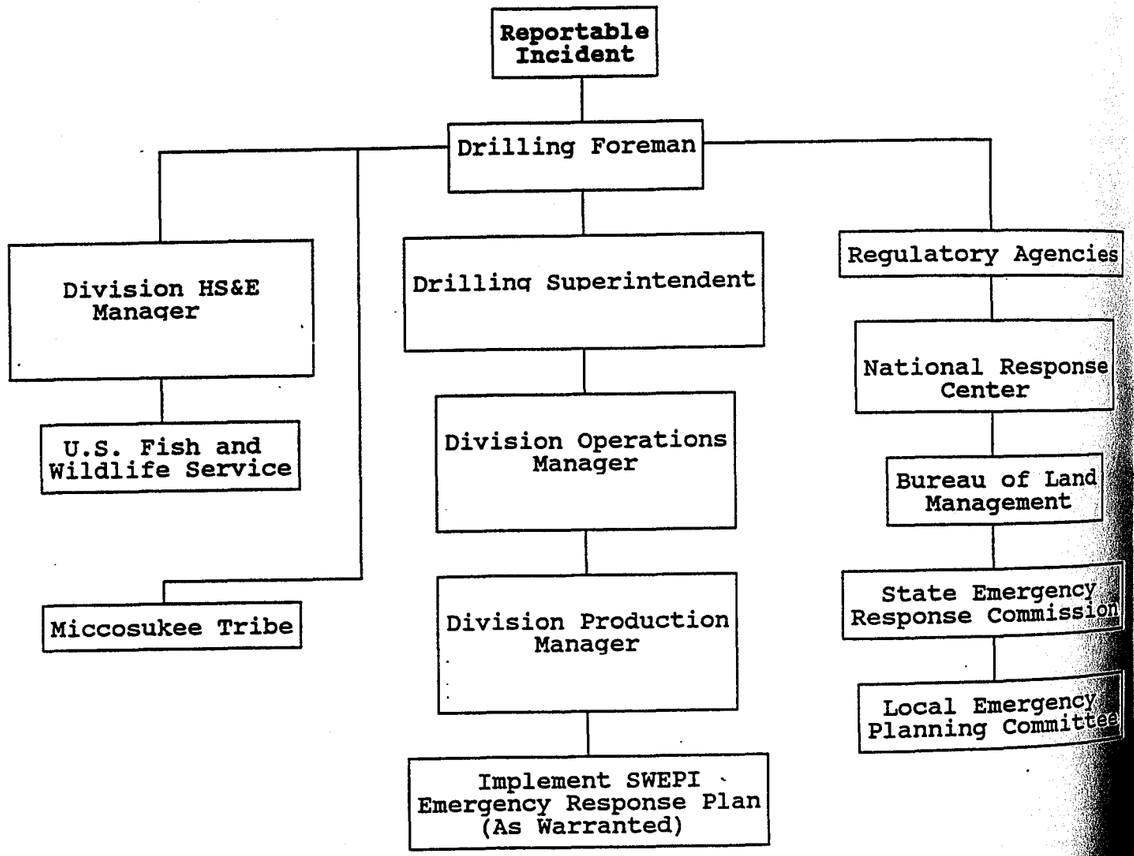
issued on a limited basis. However, since the application for a permit and the simultaneous recovery of oil-contaminated waterfowl is impossible, restrictions are usually relaxed in an oil spill emergency. All oiled birds should be delivered as soon as possible to designated bird care reception centers under the supervision of State or Federal officials.

Knowledge of methods to clean contaminated waterfowl is limited, as is actual cleaning experience. In most cases, the Fish and Wildlife Service will request an on-scene coordinator from their office to supervise waterfowl cleanup operations.

Clean Gulf Associates has assembled and maintains a Waterfowl Rehabilitation Center at Grand Isle, LA. In the event of a spill which threatens waterfowl, trained professional and volunteers can staff the Clean Gulf facilities and conduct waterfowl cleanup according to methods approved by the U.S. Fish and Wildlife Service.

ATTACHMENT 4.0-1

NOTIFICATION AND REPORTING FLOWCHART



Note: See the Contact List (Attachment 4.0-3) for addresses and telephone numbers of regulatory Agencies and the Miccosukee Tribe.

ATTACHMENT 4.0-2

SPILL REPORTING SUMMARY

SPILL LOCATION	OIL SPILL (ANY AMOUNT)	SALTWATER SPILL (ANY AMOUNT)
To Waters of U.S.	1. Verbal to NRC 2. Verbal to BLM 3. Written to BLM 4. Verbal to MT	1. Verbal to BLM 2. Written to BLM 3. Verbal to MT
On Land	1. Verbal to BLM 2. Written to BLM 3. Verbal to MT	1. Verbal to BLM 2. Written to BLM 3. Verbal to MT

SPILL LOCATION	CERCLA * HAZARDOUS SUBSTANCE RELEASE (REPORTABLE QUANTITY OR GREATER)	SARA * EXTREMELY HAZARDOUS SUBSTANCE RELEASE (REPORTABLE QUANTITY OR GREATER)
To Land, Water, or Air	1. Verbal to NRC 2. Verbal to BLM ** (Any Amount) 3. Written to BLM ** (Any Amount) 4. Verbal to SERC and LEPC *** 5. Written to SERC and LEPC *** 6. Verbal to MT ** (Any Amount)	1. Verbal to NRC (If ≥ CERCLA RQ) 2. Verbal to BLM ** (Any Amount) 3. Written to BLM ** (Any Amount) 4. Verbal to SERC and LEPC *** 5. Written to SERC and LEPC *** 6. Verbal to MT ** (Any Amount)

* Releases of CERCLA Hazardous Substances or SARA Extremely Hazardous Substances during a 24-hour period in an amount equaling or exceeding the Reportable Quantity listed in Subsection 2.1, Table I.

** Report all releases, even if less than CERCLA or SARA Reportable Quantity. Also report all toxic liquid spills, gas venting, fires, blowouts, and any accidents involving a fatal injury.

*** SERC and LEPC reporting only required for CERCLA or SARA releases greater than Reportable Quantities and which leave the facility boundary.

Abbreviations

NRC - National Response Center
BLM - Bureau of Land Management
SERC - State Emergency Response Commission
LEPC - Local Emergency Planning Committee
MT - Miccosukee Tribe of Indians of Florida
RQ - Reportable Quantity

ATTACHMENT 4.0-3

CONTACT LIST

NRC -	**National Response Center** Washington, D.C.	1-(800) 424-8802 or (202) 267-2675	(24-hours) (24-hours)
	If unable to reach either NRC number above, call		
	U.S. Coast Guard District 7 Miami, Florida	(305) 536-5611	(24-hours)
	If unable to reach the USCG-District 7 number above, call		
	U.S. Environmental Protection Agency Region IV 345 Courtland St., NE Atlanta, Georgia 30308	(404) 347-4062	(24-hours)
BLM -	**Bureau of Land Management** U.S. Department of the Interior Jackson District Office 411 Briarwood, Suite 404 Jackson, Mississippi 39206	(601) 977-5400	(Work-days)
SERC -	**Florida Emergency Response Commission** 2740 Centerview Drive Tallahassee, Florida 32399-2149 (Office Phone: (904) 488-1472)	(904) 488-1320	(24-hours)
LEPC -	**Local Emergency Planning Committee** Broward County Anita Tallarico South Florida Regional Planning Council 3440 Hollywood Blvd., Suite 140 Hollywood, Florida 33021	(305) 961-2999	
MT -	**Miccosukee Tribe of Indians of Florida** Steve Terry, Land Resources Manager P.O. Box 44021 Tamiami Trail Miami, Florida 33144	(305) 223-8380	
Misc -	South Florida Water Management District Pump Station (L-28 Canal & I-75)	(407) 346-6695	

ATTACHMENT 4.0-4

INTERNAL SPILL REPORT

1. Location
   (a) Name of Production Unit or Plant _____
   (b) Facility Involved _____
   (c) Latitude and Longitude of Spill _____

2. Spill Details
   (a) Material Spilled _____
   (b) Volume Spilled _____
   (c) Spilled to (check): Land _____ Air _____ Water _____
   (d) Date and Time of Spill (or beginning of leak), if known _____
   (e) Cause of Spill _____

3. Environment
   (a) Wind Direction (from) and Velocity _____
   (b) Land Areas or Water Endangered _____

4. Control, Containment and Cleanup
   (a) Date and Time Spill Shutoff _____
   (b) Means of Shutoff _____
   (c) Equipment and Procedures Used to Contain Spill _____
   (d) Equipment and Procedures Used to Pickup Spill _____
   (e) Amount of Spilled Material Recovered _____
   (f) Chemicals Used (name of chemical, amount, name of person or Agency authorizing use) _____
   (g) Date and Time Cleanup Completed (or estimated time for slick to disperse naturally) _____
   (h) Cleanup Costs (not including repairs) _____

5. Agencies and Persons Notified
   Name _____ Agency _____ Date _____ Time _____
   Name _____ Agency _____ Date _____ Time _____
   Name _____ Agency _____ Date _____ Time _____
   Additional Notes: _____

Submit to appropriate Superintendent, with a copy to Division HS&E Manager, for any reportable (verbal or written) spill incident. Retain one copy at the Prod. Unit, Plant, or drill site.

Signed _____
Title _____
Date _____

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APPENDIX A-11

HURRICANE PREPARATION AND EVALUATION PLAN

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HURRICANE PREPARATION AND EVACUATION PLAN

SWEPI MICCOSUKEE #3-1 OPERATIONS

BROWARD CO., FLORIDA

OCTOBER 23, 1992

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SHELL WESTERN E&P INC.
CENTRAL PRODUCTION DIVISION

SECTION I

HURRICANE PROCEDURES
GENERAL POLICY

Central Division-Shell Western E&P Inc.'s hurricane procedures are for the purpose of providing maximum safety for all Operating employees and protection of the environment in the event that any installation is threatened by a storm. It is intended that all precautions will be taken sufficiently in advance to prevent increased risk to personnel in shutting in the well, securing equipment, evacuating the location, or any other activity inherent to preparing for hurricanes.

The effectiveness of these procedures depends on the careful planning and close cooperation of several groups of people. In all cases, the primary considerations in implementing this program in order of importance are:

1. SAFETY OF PERSONNEL
2. PREVENTION OF POLLUTION
3. PROTECTION OF EQUIPMENT

The Hurricane Procedures cover the actions which will be taken in the event of storm or hurricane activity in the nearby Atlantic Ocean or the Gulf of Mexico. They include five time-oriented phases based on the anticipated approach of a hurricane.

PHASE I - PREPARATION

This covers action taken prior to June 1 to prepare for the hurricane season.

PHASE I - WARNING TIME

Actions taken when a hurricane enters the Gulf of Mexico or approaches in the nearby Atlantic Ocean.

PHASE III - HURRICANE ALERT

Actions taken once a Division Production Manager has declared an alert.

PHASE IV - SECURE AND EVACUATE

Actions taken once the order to secure and evacuate has been issued by the Division Production Manager.

PHASE V - RETURN TO WORK

Actions taken to return operations, equipment, and personnel to work.

WHAT ARE HURRICANES?

HURRICANES are large revolving storms accompanied by violent destructive winds, heavy rains, high waves and tides, and are one of nature's most destructive manifestations.

Hurricanes originate in tropical ocean areas and usually move from lower to higher latitudes with increased speed, size, and intensity.

Hurricane winds whirl counterclockwise, with the highest speeds in a circular band beginning at the edge of the "eye" and extending out 20 to 30 miles or more.

The area of destructive winds along the path of a hurricane may be from 25 to 500 miles wide. After a hurricane sweeps into a northward path, the forward speed usually increases and in extreme cases may reach 50 miles an hour or more . The ocean level may rise six feet or more in less than thirty minutes.

Most hurricanes are accompanied by torrential rains.

As soon as there are definite indications that a hurricane is forming, even though it is a thousand miles from the mainland, the storm is given a name and the Weather Bureau begins issuing advisories.

A HURRICANE ALERT means that there is not immediate danger, but that everyone should stand by for further reports and be ready to take precautionary action if necessary.

A STORM WARNING may be issued for some coastal sections to warn all concerned that winds and tides will be dangerous and that preliminary precautions should be taken.

A HURRICANE WARNING means that all precautions should be taken immediately against the full force of the storm.

Weather Bureau advisories, alerts, storm warnings, and hurricane warnings are issued every six hours or as necessary. In addition, bulletins for press, radio, and television are issued every hour or so to keep the public informed of the progress of the storm when it is near the mainland. State and local civil defense and cooperating government agencies will disseminate warnings by every available means.

REMEMBER however - hurricanes are one of the few natural disasters which we know of well in advance.

ADEQUATE PREPARATIONS can be made prior to the storm's actual movement overland - IF PRECAUTIONARY MEASURES ARE TAKEN.

Revised 5/86

— Texas Safety Association

PERSONAL SAFETY RULES FOR HURRICANES

1. Keep your radio or television on and listen for latest Weather Bureau alerts, warnings, and advisories. If power fails, use your car radio.
2. Pay no attention to rumors.
3. Get away from low-lying beaches or other locations which may be swept by high tides or storm waves. If passage to high ground is over a road likely to be under water, leave early. Don't run the risk of being marooned.
4. Be alert for high water in areas where streams or rivers may flood after heavy rains.
5. If your house is out of danger from high tides and is well built, then it is probably the best place to weather the storm.
6. Board up windows or put storm shutters in place. When you board up, use good lumber securely fastened. Makeshift boarding may do more damage than none at all. Have strong bracing for outside doors.
7. Get extra food, especially things which can be eaten without cooking or with very little preparation. Remember that electric power may be off and you may be without refrigeration.
8. If emergency cooking facilities are necessary, be sure they are in working order.
9. Sterilize the bathtub, jugs, bottles, cooking utensils, and fill with drinking water, as city water service may be interrupted.
10. Have flashlights and/or other emergency lights in working condition and keep them handy.
11. Be sure to have gasoline in your car. If electric power is off, filling stations may not be able to operate pumps for several days.
12. Check on everything that might blow away or be torn loose. Garbage cans, garden tools, signs, porch furniture, awnings, and other objects become weapons of destruction in hurricane winds. Store them all inside if possible.
13. Be sure that a window or door can be opened on the lee side of the house - the side opposite the one facing the wind.
14. If the center or "eye" of the storm passes directly over, there will be a lull in the wind lasting from a few minutes to half an hour or more. Stay in a safe place. Make emergency repairs during the lull if necessary, but remember the wind will return suddenly from the opposite direction, frequently with even greater violence.
15. Be calm. Your ability to meet emergencies will inspire and help others.

Revised 5/86

— Texas Safety Association

SECTION II

HURRICANE PROCEDURES
SWEPI MICCOSUKEE #3-1 OPERATIONS
(JUNE 1 THROUGH OCTOBER 31)

A. GENERAL POLICY

SWEPI's hurricane procedures are for the purpose of providing maximum safety for all employees and protection of the environment in the event that the operation is threatened by a storm. It is intended that all precautions will be taken sufficiently in advance to prevent increased risk to personnel shutting in the well, securing equipment, evacuating the location, or any other activity inherent to preparing for hurricanes. Because of the unpredictable nature of hurricanes, this will require careful planning and cooperation by appropriate Drilling Operations personnel and Management. In all cases, personnel safety will be the foremost consideration, with prevention of pollution and protection of equipment following in order.

At the rig the Person in Charge (PIC) of securing and evacuation operations will normally be the Drilling or Reconditioning Foreman. The Drilling Asset Manager (the Division Production Manager's authority will be delegated to the Drilling Asset Manager for this operation) will place the operation on Hurricane Alert and give the order to Secure and Evacuate. If communications break down between field and office, however, the PIC will assume these responsibilities.

The PIC is responsible for making on-site inspections of conditions as needed to determine whether emergency precautions should be initiated prior to the time forecast by weather advisories. Any indication of worsening local conditions should be reported by the PIC to the Drilling Asset Manager or Division Drilling Superintendent.

B. PHASE I - GENERAL HURRICANE SEASON PRECAUTIONS AND PREPARATIONS

1. Weather conditions are most favorable for hurricane development between June 15 and October 15.

2. Prior to June 1, hurricane procedures will be reviewed with the Foreman by the Division Drilling Superintendent. It will be the responsibility of the Superintendent to assure that proper preparations for hurricane season are made. In turn, each Foreman is responsible for reviewing the procedure with contract personnel in on-the-job safety meetings. Contract personnel hired between June 1 and October 31 should be briefed individually in conjunction with other required safety training.

3. The Drilling Foremen and HS&E Technicians will make a safety inspection of the rig prior to June 1 and report to the Superintendent. The inspection shall include overall condition of operations and other pertinent items.

4. Prior to beginning operations, an updated phone list, Attachment A, Key Personnel Data, will be distributed. The list should include staff and critical Division office numbers. The list will be kept current during hurricane season.

5. Loose material shall be kept to a minimum and adequately stored and secured where possible.

6. All operations should be planned with the possibility of a hurricane in mind, and provisions for safely suspending operations should be included. Insure that all mobile homes are anchored in accordance with applicable local codes.

7. Stocks of materials needed to secure equipment will be checked and replenished, if necessary, prior to June 15. The Drilling or Reconditioning Foremen will see that sufficient polyethylene cloth is on hand at all locations to wrap exposed critical equipment to keep water out.

8. Keep any produced fluids from production testing operations at the lowest practical level.

C. PHASE II - HURRICANE WARNING

1. The increased number of weather stations, improved meteorological techniques, and more effective communications virtually preclude the possibility of an unpredicted hurricane. A hurricane warning will take effect any time there is a hurricane in the Gulf or nearby Atlantic.
2. When weather bulletins and consultant advisories indicate a storm might follow a path near the operation, the Drilling Asset Manager will schedule meetings with Division personnel to review and evaluate each bulletin. The Drilling Superintendent should make frequent contacts with the operation and keep the PIC advised of any new situations or developments.

D. PHASE III - HURRICANE ALERT

1. The Drilling Asset Manager has the authority to place the operation on Hurricane Alert. He will notify the Division Production Manager. Subsequently, the Drilling Superintendent shall notify the PIC of the Hurricane Alert.

HURRICANE ALERT - This is when the gale force winds from a named storm are within 48 hours of our operations. Gale force winds are defined as greater than 34 knots. This alert may coincide with the Hurricane Warning when the hurricane is approaching from the Atlantic Ocean.

The PIC is responsible for making an on-site inspection of conditions as needed to determine whether emergency precautions should be initiated prior to the time forecast by weather advisories. Any indications of worsening local conditions should relayed to the Division by the PIC.

2. When the operation is notified of the Hurricane Alert, the following procedures will be completed where appropriate:

a. The PIC will maintain a hurricane map following first notice. A map showing the storm course and the latest weather bulletin will be posted where it can be observed by all employees.

b. The PIC shall keep a time-documented log of events in chronological order, relating to evacuation, standby, return and start-up. The log will be sent to the Drilling Superintendent after normal operations have been resumed.

c. Non-essential contract labor personnel will be released with approval of the Drilling or Reconditioning Foreman.

d. No field or rig operation that will take over 24 hours to complete will be started without prior Division concurrence. Initiate any time-consuming activity needed to achieve a condition of readiness for evacuation on short notice.

e. Notify the Drilling Superintendent of any unusual developments immediately.

f. Fill gas/diesel tanks of all appropriate motor vehicles.

g. All loose material around living quarters, including fire and safety equipment, etc., will be moved under cover or firmly secured.

h. All empty mud cans, drums, oxygen or acetylene containers and other loose equipment and materials will be secured.

E. PHASE IV - SECURE & EVACUATE

1. GENERAL PLANS

It should be pointed out that these plans are necessarily flexible, as much depends on the severity of the storm and weather in advance of the storm. This applies particularly to the time when the decision to secure the operation will be made. Without exception, however, SWEPI is dedicated to stopping any operation in ample time to assure personnel safety and to protect the environment.

When it appears that a hurricane could possibly endanger field personnel and equipment, the Drilling Asset Manager, following consultation with the PIC, will plan appropriate action with regard to securing and evacuating. Evacuation will normally commence 24-36 hours prior to gale force winds. The authority to evacuate will be delegated to the Drilling Asset Manager for this operation.

2. SUPERVISORY COMMUNICATIONS

a. Field/Office

After the Division declares a Hurricane Alert, the PIC will coordinate an around-the-clock watch. He will be advised of the appropriate home numbers for contact during this period.

b. Press Relations

The general policy for press relations in emergencies is based on SWEPI's recognition that the communication media have a legitimate interest in any disaster that affects a Company facility. The press (including all news media) is the Company's liaison with the public. Accordingly, the Drilling Asset Manager shall notify External Affairs of any operation shut down and evacuation. All inquiries should be referred to External Affairs.

3. FIELD OPERATIONS

a. Drilling/Completion Rig

NOTE: The following are general instructions for planning purposes. Specific rig plans and timing will be generated to fit the specific operation as storms approach the site.

If drill pipe is in hole, pull into casing, laying down extra drill pipe. The method of hanging the drill pipe and securing the well will be decided by the Drilling Superintendent. If the drill pipe is to be hung in the slips, install safety valve, (TIW or equivalent) inside BOP, one joint of drill pipe and safety valve on top of drill string. Bottom safety valve to be left in the open position, top safety valve in closed position. Lower to rotary table, set slips in rotary and tie down slip handles. Close pipe rams and Hydril. Do not close on tool joints. If drill pipe is to be hung in casing bowl using a CIW Boll Weevil tester (or equivalent), install an inside BOP one joint below tester and a full opening safety valve just below the inside BOP. This valve is to be run in the open position. Close BOP blind rams and secure locking screws. Close kill and choke line valves at BOP.

If drill pipe is out of the hole, go in the hole to bottom of casing and hang drill pipe as above. Close and secure BOP's as above. Lay down all excess drill pipe.

If time does not permit laying down excess drill pipe secure pipe in derrick to prevent excessive movement during high winds.

If the derrick is the jack-knife type, lay it down, time and conditions permitting. Otherwise, secure traveling block and lines to prevent damage by whipping. Any loose material should be securely tied down.

b. Production Testing Operations

In all cases of wells with perforations open to a hydrocarbon bearing zone capable of sustained flow, at least one string of tubing must be left in the well with a back pressure valve placed at least 100 feet below the surface. The back pressure valve may be either an inside preventer or pump through-type tubing plug set in a position nipple. A full opening safety valve (TIW or equivalent) in the open position will be run immediately below the back pressure valve if the tubing is run in the hole for the purpose of evacuation.

The tubing should be hung on a test plug or a tubing hanger and locked down. The blowout preventers should be closed and locked. Excess tubing may be either run in the hole or laid down and secured. If excess tubing is run in the hole as a second string, it should also be equipped as described above.

c. Specific Requirements

a. Shut in the well at the master valve.

b. Secure all loose gear, equipment and materials.

c. Move motor vehicles and portable equipment to a safe area.

d. If possible, reduce oil levels in tankage to minimize pollution potential. Then fill and equalize all production storage tanks with water for ballast. Oil may be used to fill tanks only if water is not available in sufficient quantities.

e. Maintain accurate records of all personnel evacuated.

f. Bleed pressure off all flowlines, separators and dehydrators. Leave flowline manifolds open to separators.

g. Shut down all internal combustion engines. All portable generators shall be stored inside buildings and protected for use immediately after the storm.

h. Report to Division office that the operation is ready to be evacuated.

i. Evacuate the field when the order is given. Where communications have failed, the PIC, shall be responsible for deciding when to evacuate.

j. Notify Division of the results of evacuating all personnel.

F. POST HURRICANE

RETURN TO WORK

The Drilling Superintendent should stay in contact with the various Contract Superintendents. The PIC should keep the various Contract Foremen advised of return-to-work plans and maintain communication with the Drilling Superintendent.

G. REPORTING PROCEDURE - ESTIMATED HURRICANE LOSSES

Division Management requires information regarding hurricane damages and estimated repair costs as soon as possible but no later than one week following the occurrence. These data are essential for immediate appraisal of damages and will serve as of fiscal notification to our insurance carriers and meet other Head Office reporting requirements. The following will be reported to the Division Superintendent for each field, gas plant, and drilling or workover rig:

1. Repair and/or partial replacement costs.

2. Cleanup, debris removal and dismantling costs.

3. Abnormal operating costs.

4. Fire fighting and well control expenses.

5. Pollution abatement expenses.

6. Facilities, installations or major items of equipment damaged beyond repair. This would include such items as buildings, storage tanks, docking facilities, platforms, etc.

Field supervisors cannot in all instances maintain detailed records concerning the above items. However, every effort should be made to report the best available estimates by phone or radio to the Division as soon as possible for relay to the Finance Department Budget Supervisor.

H. ATTACHMENT A

KEY PERSONNEL DATA

PRODUCTION - CENTRAL DIVISION

Note: Prior to beginning operations (which may be conducted during hurricane season), an updated list will be provided.

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APPENDIX A-12

CONSULTATION CORRESPONDENCE

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FEB 4 1994

3100 (020)

RETURN RECEIPT REQUESTED
CERTIFIED NO. P 396 367 358

Ms. Valerie Boyd
South Florida Water Management Board
3301 Gun Club Road
P.O. Box 24680
West Palm Beach, Florida 33416-4680

Dear Ms. Boyd:

By letter dated April 30, 1993, the South Florida Water Management District provided its comments on the Draft Environmental Impact Statement (EIS) for the SWEPI Miccosukee 3-1 exploratory well proposed for the Miccosukee Federal Indian Reservation in Broward County, Florida.

Comment #4 of that letter relates to access routes. In part, the comment states that the District is "extremely concerned" about the use of rights-of-way. Further the comment states that the applicant is requested to consult with the District to determine the extent of right-of-way encroachment and, if appropriate, submit an application for a permit.

The Miccosukee Tribe has informed Shell Western E & P, Inc (the applicant) that the Tribe has the sole right to authorize use of the berm road along the west side of the L-28 canal, as proposed by Shell Western and as presented as Alternative A in the Draft EIS. The Tribe's position is supported by the Bureau of Indian Affairs (BIA) and accepted by this office.

The BIA and this office are proceeding with the preparation of the Final EIS with the position that South Florida Water Management District lacks authority to control access on the berm road on the west side of L-28. If the EIS is finalized with Alternative A remaining the preferred alternative and if the application-to-drill is approved by this office, a permit application would not be filed with the South Florida Management District.

Should berm road improvement and use occur; however, Shell Western and the Tribe would keep South Florida Management District advised so that any use of the road by the District would not interfere with the construction and drilling operations.

We request that the South Florida Water Management District acknowledge the Tribe's stated right to provide access rights to Shell Western along the west side of the L-28 canal. Alternatively, please provide viable records to us that prove your alleged right to control use of access on the west side of the L-28 canal on the Miccosukee Federal Indian Reservation.

With the Final Environmental Impact Statement due for public review in May 1994, we need your response by February 25, 1994. Without a response by that date, we will assume that you agree with the position we have taken in supporting the Miccosukee Tribe and finalize the EIS accordingly.

If you have any questions, please contact me at (601) 977-5400.

Sincerely,

(Orig. Signed)-Robert Abbey

Robert V. Abbey
District Manager

cc: Billy Cypress
Chairman
Miccosukee Tribe

Tilford C. Creel
South Florida Water District
Executive Director

Bill Ott
Eastern Area Office
Bureau of Indian Affairs

South Florida Water Management District
3301 Gun Club Road • P.O. Box 24680 • West Palm Beach, FL 33416-4680 • (407) 686-8800 • FL WATS 1-800-432-2045

LAN 12-14 RF# 94160
Your File: 3100 (020)

RECEIVED
FEB 18 1994
BUREAU OF LAND MANAGEMENT
JACKSON DISTRICT OFFICE

February 18, 1994

Mr. Robert V. Abbey
District Manager
United States Department of the Interior
Bureau of Land Management
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206

Dear Mr. Abbey:

Subject: L-28 Canal - Miccosukee Tribe - Shell Western E & P, Inc.

District Governing Board Chairperson Valerie Boyd has asked me to respond to your letter of February 4, 1994.

We do not concur with the assertion that the Miccosukee Tribe has sole authority to authorize the use of the berm road along the west side of the L-28 borrow canal. Please provide us with a complete copy of all information in support of the Bureau of Indian Affairs' position and rationale.

The L-28 right of way (which includes the west canal maintenance berm) was acquired by our predecessor, the Central and Southern Florida Flood Control District as local sponsor for the U.S. Army Corps of Engineer's Central and Southern Florida Flood Control Project (C&SFFCP). The C&SFFCP was authorized by Public Law 858, 80th Congress, 2nd Session and Public Law 516, 81st Congress, 2nd Session. As local sponsor the District was required to obtain all necessary rights of way and land interests to construct the canal and levee system of the C&SFFCP which are referred to as "the project works".

According to our records the District's title to the L-28 right of way comes from a grant by the Board of Commissioners of State Institutions as contained in District Deed No. 188 a copy of which is attached. The rights accruing to the District include:

> "... the surface rights to the lands hereinafter described, including the right to permanently or intermittently flood all or any part of said land within established water conservation areas and to construct, operate and maintain works of flood control thereon."

Governing Board:
Boyd, Chairman
Williamson, Jr., Vice Chairman
Betancourt
William Hammond
Betsy Krant
Allan Milledge
Eugene K. Pettis
Nathaniel P. Reed
Leah G. Schad
Tilford C. Creel, Executive Director
Thomas K. MacVicar, Deputy Executive Director

Pursuant to Chapter 373.086 Florida Statutes, the District has the authority to acquire land for "district works" and may adopt "works of the district" pursuant to Chapter 373.086(2) F.S. L-28 was adopted as a work in District Resolution No. 538. The District also has the authority to prescribe the manner in which others may make use of the District's works and can issue permits for use of the works pursuant to Chapter 373.085 F.S. Detailed rules and criteria for the use of District rights of way are contained in District Rule 40E-6.

Based on the foregoing the District has the authority to require Shell Western E & P, Inc. to apply for permits to utilize any portion of the L-28 right of way.

Sincerely,

Tilford C. Creel
Executive Director
South Florida Water Management District

TCC/pm

Enclosure

c: Ms. Valerie Boyd, Chairman, Governing Board
Mr. Woodie VanVoorhees, SFWMD
Jim Karas, SFWMD

MAR 4 1994

3100 (020) SV

Ms. Valerie Boyd
South Florida Water Management Board
3301 Gun Club Road
P.O. Box 24680
West Palm Beach, Florida 33416-4680

Dear Ms. Boyd:

We appreciate your quick response to our letter of February 4, 1994 relating to access routes for the oil well proposed on the Miccosukee Reservation. We note your request for information relating to our position that a permit from your agency is not required to use the L-28 berm road. We have forwarded a copy of your letter to the Bureau of Indian Affairs and the Miccosukee Tribe.

Information provided to us by all parties will be used in determining the preferred alternative in the Final Environmental Impact Statement for the proposed well.

Again, we appreciate your quick response.

Sincerely,

(Orig. Signed) Robert Abbey

Robert V. Abbey
District Manager

HOBBS, STRAUS, DEAN & WILDER
LAW OFFICES
1819 H STREET, N.W., SUITE 800
WASHINGTON, D.C. 20006
(202) 783-5100
TELECOPIER (202) 296-8834

CAROL L. BARBERO (DC)
S. BOBO DEAN (DC, NY)
SANDRA L. FERGUSON (OR)
CHARLES A. HOBBS (DC)
FRANCES L. HORN (DC)
MATTHEW S. JAFFE (DC, MD)
ROBIN-EVE JASPER (DC, NY)
MARSHA KOSTURA (DC, PA)
MICHAEL L. ROY (DC, MA)
JUDITH A. SHAPIRO (DC)
CHRISTOPHER T. STEARNS (DC, NJ)
JERRY C. STRAUS (DC)
GEOFFREY D. STROMMER (AZ, OR)
HANS WALKER, JR. (DC, ND)
LEROY W. WILDER (OR, DC, CA)

PORTLAND OFFICE:
0225 S.W. MONTGOMERY STREET, #10
PORTLAND, OREGON 97201
(503) 242-0705

HAROLD P. GREEN (DC, MD, IL)
KAIGHN SMITH, JR. (ME)
DEAN B. SUAGEE (DC)
JAY W. UNGERMAN (TX)
OF COUNSEL

LEGISLATIVE AFFAIRS:
KAREN J. FUNK
CINDY DARCY

March 24, 1994

Mr. Robert V. Abbey
Director
Jackson District Office
Bureau of Land Management
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206

RECEIVED
MAR 29 1994
BUREAU OF LAND MANAGEMENT
JACKSON DISTRICT OFFICE

Re: Miccosukee Tribe of Indians of Florida

Dear Mr. Abbey:

The Tribe has asked us to respond to the February 18, 1994 letter you received from Tilford Creel on behalf of the South Florida Water Management District regarding access to the road on the berm to the west of the L-28 Canal on the Miccosukee Reservation. This berm road would be used to access the drill site for the exploratory oil well planned for the Reservation by the Tribe's lessee, Shell Western E & P, Inc.

Mr. Creel's letter asserts that the SFWMD has the authority to require the Tribe's lessee to obtain a permit "to utilize any portion of the L-28 right of way". It appears as though Mr. Creel also asserts that the western berm road is within the District's L-28 right of way. The extent or measure of the asserted right of way is not described in the letter, however, and since Mr. Creel did not enclose a copy of the "Resolution 538" referenced in his letter, we do not know the measure of the "L-28 work" that he states is the subject of that resolution.

Thus, it is impossible for the Miccosukee Tribe to identify or comment on the measure of the right of way or works claimed by the District. Since Mr. Creel did not supply a copy of the District Rule 40E-6 to which he refers, we cannot comment on the relevance or authority of that item, either.

Nonetheless, the Tribe does have a number of comments to offer about the pending matter.

First, we note that the District claims that the origin of its right of way is Resolution No. 188, generally called the

"flowage easement", by which certain surface rights were dedicated to the Central and Southern Florida Flood Control District (predecessor to SFWMD) by the Florida's Board of Commissioners of State Institutions. The portion of that Deed quoted by Mr. Creel is accurate, but we would point out the relevance of several other parts of that resolution:

•CSFFCD was granted the surface rights therein described "for the purposes for which said District was created", not for unlimited purposes. The second Whereas clause of the resolution describes those purposes as "flood control, reclamation, conservation and allied purposes".

•The authorized uses of the surface rights dedicated to the CSFFCD are --

1. *permanent or intermittent flooding of the part of the land that is within an established water conservation area.* The western berm at issue here is not subject to any flooding activity, and it is not within the confines of the water conservation area.

2. *to construct, operate and maintain works of flood control.* The western berm road is not used for any operation and maintenance of any of the SFWMD's flood control works, and Mr. Creel does not assert that it is. Construction of flood control works has, of course, been completed long ago.

•The resolution conditions the dedication to the District on the right expressly reserved to the State Board "to explore for and to develop, mine and dispose of any phosphate, oil, gas or other minerals or thing of value in, on or under said lands". This reserved right, together with all other right, title and interest of the State of Florida in what is now the Miccosukee Alligator Alley Reservation, was transferred by deed to the United States on behalf of the Tribe. The District has no more authority to interfere with the Tribe's exercise of this reserved right than it would have to interfere with the State's exercise of that right if it were still the possessor thereof.

•The resolution further expressly conditions the dedication to the District by stating that "the right of the Indians to make use of said land shall not be impaired".

•Both of these conditions were subject to regulations imposed by the District "for the construction, maintenance, operation and protection of the works of said District." Again, we must note that no use whatsoever is made by the District of the western berm road; thus, we fail to see what regulations the SFWMD would have authority to issue regarding road access now.

Historical documentation reveals that the western berm was actually built *for the benefit of the Indians* by the Corps of Engineers. After consulting with the county agricultural

officials, the Corps decided to drain the land west of the Canal to achieve "improved pasture" use. The agricultural officials advised that allowing flooding of the pasture for two weeks per year would not seriously impede this use. [See U.S. Army Corps of Engineers Design Memorandum, Addendum 1 to Part I -- Supplement 30, p. 8; and Addendum 2 to Part I -- Supplement 30, at p. 4.]

The Plan of Improvement document also refers to Levee 28, the canal and the 4-foot western berm, including the water flow control purpose for which the berm was constructed:

> Inlet structures are planned at points of existing and proposed local inflow. Mounds or continuous berms would be provided through the length of the canal to 4 feet above ground to restrict inflow to the points where inlet structures would be provided.

Thus, the 4-foot western berm and the inlet structures (culverts and ditches) were constructed specifically to control water flow on the intended Indian pasture land to the west. They were not constructed as a part of the flood control objective that led to the L-28 canal, the levee to the east of the canal and the flooded water conservation area.

It is significant to note that the initial Plan of Improvement called for a 4-foot berm to be constructed along the full length of the L-28 Canal. This did not happen. The berm only extends along the small portion of the canal on the Miccosukee Reservation bordered on the south by I-75 and the Seminole Big Cypress Reservation on the north. No berm exists south of I-75 or along the part of the canal on the Seminole Reservation. It is likely that berm construction was limited to this area because only that portion of the two reservations was used for farming and grazing. Absent a need to control water flow on these other reservation areas west of the canal, there was no reason to extend the berm to the north or the south.

On a more contemporary note, it is a fact that only the Miccosukee Tribe and its lessees (cattle and microwave tower owners) use the western berm road. They are also the sole source of maintenance for the culverts and ditches and berm road. Within the past few years, the Tribe has spent several hundred thousand dollars on implementing a surface water management system which includes maintenance and rehabilitation of the berm road. SFWMD performs no maintenance on the road; this is not surprising, as they do not use the road and therefore are not aware when maintenance is needed.

We note that Mr. Creel does not assert that District personnel either use or maintain the western berm road. Indeed, he makes no suggestion that the berm road has any role in operation and maintenance of the "L-28 works".

All of the foregoing information about the western berm road has previously been conveyed to SFWMD in connection with the

District's decision to release to the Tribe portions of the flowage easement that are not needed by the District. Because the Tribe believes the western berm road falls into that category, it asked that that road be included in the release. The Water District has not agreed to this request.

On the basis of the foregoing, the Tribe repeats its position that neither the Tribe nor any of its lessees, including Shell Western E & P, Inc., need to obtain a permit from the Water District for use of the western berm road. It will continue to so instruct its lessees.

The Tribe's position is obviously contrary to the position asserted by the Water District. Nonetheless, the Tribe does not believe that it is necessary to resolve this difference in the context of its immediate objective -- to determine if its reservation has mineral potential. Since there is an acceptable alternative road to the drill site which does not raise any jurisdictional conflicts, the Tribe recommends that BLM and BIA consider making the route involving this road the preferred alternative. This road, described in the draft Environmental Impact Statement as "Alternative B West Access Route", originates just near the Miccosukee Service Plaza (intersection of I-75 and Snake Road) and runs east to the proposed drill site.

The Tribe would greatly appreciate consideration of this recommendation by BLM and BIA. Please let us know if you have any questions concerning this matter.

Sincerely yours,

HOBBS, STRAUS, DEAN & WILDER

By: Carol L. Barbero

Enclosures

cc: Chairman Billy Cypress
B.D. Ott, Eastern Area Director
Bureau of Indian Affairs

United States Department of the Interior

GEOLOGICAL SURVEY

WATER RESOURCES DIVISION
9100 N.W. 36th STREET
MIAMI, FL 33178

April 22, 1991

Memorandum

To: District Manager, BLM, Jackson, Mississippi

From: Roy S. Sonenshein, Hydrologist, USGS, WRD, Miami, Florida

Subject: Review of Preliminary Analysis of the Hydrologic and Geologic Characteristics of the Miccosukee Indian Reservation, Broward County, Florida

I have reviewed the subject report and find it to be a summary of the hydrologic and geologic data that has been collected in the vicinity of the reservation. The majority of the report consists of this summary with very little additional analysis. The last section is an analysis of the potential for contamination from brine and oil spills. The authors' conclusion is that brine spills would apparently have some effect but based on the data available would not travel very fast or far within the groundwater and would be contained by the levees in the surface water. Their conclusion is also that oil spills would apparently have a greater effect but would not impact any municipal wellfields or the Everglades Natinal Park. These conclusions from the report are based strictly on an analysis of existing data and the authors' knowledge of the area. This was only a brief analysis with no modeling or other techniques used to support the conclusions. These analyses need to be done to properly determine the potential effects of oil and brine spills on the environment.

If you have any questions concerning this review please contact me at FTS 350-5382.

Roy S. Sonenshein

#212

United States Department of the Interior

GEOLOGICAL SURVEY

WATER RESOURCES DIVISION
9100 N.W. 36th STREET
MIAMI, FL 33178

May 4, 1992

Mr. Robert V. Abbey
District Manager
Bureau of Land Management
411 Brianwood Drive, Suite 404
Jackson, Mississippi 39206

Dear Mr. Abbey:

This is in response to your letter dated April 28, 1992, requesting the U. S. Geological Survey (USGS) to assist the BLM and BIA in conducting an environmental analysis of a proposal for an oil and gas well on the Miccosukee Reservation of Broward County. The USGS Miami office would be willing to work as a Cooperating Agency in this analysis by providing technical review of the associated environmental impact statement (EIS) to be drafted. Technical assistance, if required, may be limited due to present personnel and budgetary constraints.

Thank you for requesting the USGS to participate in this project. For further related information or discussion, please contact Ed Koszalka, Chief of Hydrologic Investigations for this office at (305) 594-0655.

Sincerely,

William B. Scott

William B. Scott
Subdistrict Chief

WBS:dr

cc: Ed Koszalka
Sid Vogelpohl

FLORIDA GAME AND FRESH WATER FISH COMMISSION

DON WRIGHT, Orlando
QUINTON L. HEDGEPETH, DDS, Miami
MRS. GILBERT W. HUMPHREY, Miccosukee
JOE MARLIN HILLIARD, Clewiston
BEN ROWE, Gainesville

ROBERT M. BRANTLY, Executive Director
ALLAN L. EGBERT, Ph. D., Assistant Executive Director

FARRIS BRYANT BUILDING
620 South Meridian Street
Tallahassee, Florida 32399-1600
(904) 488-1960

October 20, 1992

NOV 13 93
DAMES & MOORE

Mr. Mark Davis
U.S. Bureau of Land Management
411 Briarwood Drive, Suite 404
Jackson, MS 39206

Mr. Davis:

Per your recent request, I have reviewed the Endangered and Threatened Species section (Section 2.2.3, pages 11-20) of the draft Biological Assessment for the Shell Western E&P Miccosukee 3-1 exploratory oil well in Broward County. Enclosed is a copy of that section with my comments and editorial suggestions annotated throughout. I hope they are legible and useful. I have forwarded the remainder of the document to Mr. Brian Millsap, Chief of our Nongame Wildlife Bureau, for possible further review.

We appreciate your consulting us in this matter.

Regards,

Don A. Wood
Endangered Species Coordinator

G:\Share\Wordproc\W666\666-2049\tls
ESC 6-1 (Broward County)
Enclosure
cc: Mr. Brian Millsap

RECEIVED
OCT 23 1992

Recycled Paper

6840 (020) FW

OCT 16 1992

Donald Wood
Endangered Species Specialist
Florida Game and Freshwater Fish Commission
620 South Meridian Street
Tallahassee, Florida 32399 - 1600

Dear Mr. Wood:

Please find enclosed for your review a copy of the biological assessment completed as part of the Environmental Impact Statement for a proposed oil and gas well in Broward County, Florida. The site is located on land under the jurisdiction of the Bureau of Indian Affairs, Miccosukee Tribe.

We have included Audubon's crested caracara in the analysis, as you requested. However, based on conversations with Jim Layne, of the Archbold Biological Station, we do not expect the project to affect the species. The site specific wildlife and vegetation surveys and previous correspondence with the U.S. Fish and Wildlife Service are included in the Appendix for your information.

We would like to receive your comments within 30 days so that they may be incorporated in the draft EIS. If you have any questions concerning this project please feel free to contact my staff biologist, Faye Winters, at (601) 977-5400.

Sincerely,

Mark Davis
Assistant District Manager
Division of Lands & Renewable Resources

(Orig. Signed)-Mark H. Davis

Enclosures
cc: JDO RF & CF
ES RF
Mike Nagy - Dames & Moore
ESO - Endangered Species Coordinator (ES-931)
ADM Minerals
ADM L&RR
ES020:sb:FWinters:10-15-92:MICCOSUK.FBA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
P.O. BOX 2676
VERO BEACH, FLORIDA 32961-2676

October 30, 1992

RECEIVED
NOV 5 1992
BUREAU OF LAND MANAGEMENT
JACKSON DISTRICT OFFICE

Mr. Mark Davis
Assistant District Manager
Lands and Renewable Resources
Bureau of Land Management
411 Briarwood Drive, Suite 404
Jackson, MS 39206

Dear Mr. Davis:

Your memorandum, dated October 16, 1992, forwarded a copy of a Biological Assessment for the Miccosukee 3-1 exploratory oil well in Broward County, Florida. After reviewing the information provided, the Fish and Wildlife Service can concur with your determination that the project is not likely to adversely affect Federally-listed species. We have assigned FWS Log Number 4-1-93-212 to this informal consultation.

We have one conservation recommendation. To further reduce the likelihood of any adverse effect on the Florida panther, we recommend that a gate be kept locked where the road to the exploratory well exits the corner of the Miccosukee gasoline station. This will not promote increased access by off-road vehicles to the east of the gasoline station. Off-road vehicle use is a major source of disturbance for the Florida panther, and recreational access off I-75 is being regulated by the National Park Service at discrete points along the highway.

Although this does not constitute a Biological Opinion described under Section 7 of the Endangered Species Act, it does fulfill the requirements of the Act, and no further action is required. If modifications are made in the project or if additional information involving potential impacts on listed species becomes available, please notify our office (407-562-3909).

If you have further questions on this matter, please contact Mr. Robert Pace of my staff (407-562-3909).

Sincerely yours,

David L. Ferrell
Field Supervisor

cc:
FWE, Atlanta, GA
FWS, Jacksonville, FL
Florida Panther Coordinator, Gainesville, FL

6840 (020) FW

OCT 16 1992

Memorandum

To: Field Supervisor, Vero Beach, U.S. Fish and Wildlife Service

From: Assistant District Manager, Lands & Renewable Resources

Subject: Request for Concurrence on Miccosukee Biological Assessment

We would like to request your concurrence on the following biological assessment. The proposed project involves the drilling of an exploratory oil and gas well on the Miccosukee Reservation in Broward County, Florida. Previous correspondence and related biological opinions have been included in the appendix of the document.

Based on the biological assessment, we have determined that the project may temporarily affect a potential alligator nesting site. However, because the alligator is listed "due to similarity of appearance" we do not feel the project will significantly affect this species. No other impacts to federally listed species are anticipated. We have also added Audubon's crested caracara in the analysis based on recent conversations with Jim Layne, of the Archbold Biological Station. He had records of caracara in northwestern Broward County in 1988 and 1989.

The site specific wildlife and vegetation surveys and previous correspondence with the U.S. Fish and Wildlife Service are included in the Appendix for your information. Both Jane Tutton and Bob Pace of your office are familiar with this project. If you have any questions please feel free to call Faye Winters, my staff biologist, at (601) 977-5431.

Enclosures (Orig. Signed)-Mark H. Davis
cc: JDO RF & CF
ES RF
Mike Nagy - Dames & Moore
ESO - Endangered Species Coordinator (ES-931)
ADM Minerals
ADM L&RR
ES020:sb:FWinters:10-15-92:MICCOSUK.FBA

FLORIDA DEPARTMENT OF STATE
Jim Smith
Secretary of State

DIVISION OF HISTORICAL RESOURCES
R.A. Gray Building
500 South Bronough
Tallahassee, Florida 32399-0250
Director's Office (904) 488-1480
Telecopier Number (FAX) (904) 488-3353

July 28, 1992

Ms. Jackie L. Fry
Dames & Moore
1211 Governors Square Blvd.
Suite 300
Tallahassee, Florida 32301

In Reply Refer To:
Susan M. Herring
Historic Preservation Planner
(904) 487-2333
Project File No. 922053
910318

RE: Cultural Resource Assessment Request
Well 3-1 Proposed Access Roads
Broward County, Florida

Dear Ms. Fry:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the above referenced project(s) for possible impact to archaeological and historical sites or properties listed, or eligible for listing, in the National Register of Historic Places. The authority for this procedure is the National Historic Preservation Act of 1966 (Public Law 89-666), as amended.

We have reviewed the three alternative access roads for Well 3-1 and have the following comments. Should the chosen alternative cross any hardwood hammocks, it is the recommendation of this agency that the hardwood hammock areas be subjected to a cultural resources assessment survey prior to any land clearing or ground disturbing activities. The resultant survey report must be forwarded to this agency in order to complete the process of reviewing the impact of this project on significant archaeological and historic resources.

In addition, a review of the Florida Site File indicates that there is a potentially significant archaeological site, 8BD1439, adjacent to road "B", as shown on the enclosed map. Should road "B" be the chosen alternative route, it is the recommendation of this agency that this site be avoided and any necessary project related road improvements take place on the north side of the road.

Thus, conditioned upon the above referenced stipulations, it is the opinion of this agency that project activities will have no effect on any archaeological or historic sites or properties listed, or eligible for listing, in the National Register of Historic Places, or otherwise of historical value.

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest in protecting Florida's historic properties resources is appreciated.

Sincerely,

Laura A. Kammerer for
George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer

GWP/Hsh
Enclosure

FLORIDA DEPARTMENT OF STATE
Jim Smith
Secretary of State
DIVISION OF HISTORICAL RESOURCES
R.A. Gray Building
500 South Bronough
Tallahassee, Florida 32399-0250
Director's Office (904) 488-1480
Telecopier Number (FAX) (904) 488-3353

February 11, 1991

Mr. Ed Roberson
Assistant District Manager
Division of Lands and
Renewable Resources
Bureau of Land Management
U.S. Department of the Interior
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206

In Reply Refer To:
Robert C. Taylor
Historic Preservation
Planner
(904) 487-2333
Project File No. 910318

RE: Cultural Resource Assessment Request
Proposed Drilling of Well No. 3-1, Lease No. 7F9008904
Section 3, T50S-R35E, Broward County, Florida

Dear Mr. Roberson:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the above referenced project(s) for possible impact to archaeological and historical sites or properties listed, or eligible for listing, in the National Register of Historic Places. The authority for this procedure is the National Historic Preservation Act of 1966 (Public Law 89-665), as amended.

A review of the Florida Master Site File indicates that no significant archaeological or historical sites are recorded for or considered likely to be present within the project area. Furthermore, it is the opinion of this agency that because of the project location and/or nature it is considered unlikely that any such sites will be affected. Therefore, it is the opinion of this office that the proposed project will have no effect on any sites listed, or eligible for listing in the National Register of Historic Places. The project may proceed without further involvement with this agency.

RECEIVED
FEB 14 1991
BUREAU OF LAND MANAGEMENT
JACKSON DISTRICT OFFICE

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest in protecting Florida's archaeological and historical resources is appreciated.

Sincerely,

George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer

GWP/rt

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
DAVIE FIELD OFFICE
6191 ORANGE DRIVE
(S.W. 45TH ST) ROOM 6179-0
DAVIE FL 33314

****

July 20, 1992

Mr. Michael D. Nagy
Dames & Moore
6400-A Congress Avenue, Suite 2500
Boca Raton, FL. 33487

Dear Mr. Nagy:

The 5 acres on well pad located 53, T50S, R35E is in pasture land, and is not prime or unique farmland. I don't have the flood plain maps for this area.

If I can be of any further assistance, please call me. (305) 584-1306.

Sincerely,

Thaddeus Hamilton

Thaddeus Hamilton
District Conservationist

TH:dc

DEPARTMENT OF THE ARMY
MIAMI FIELD OFFICE, 8410 NW 53RD TERRACE MONTEREY BLDG., SUITE 225
MIAMI, FLORIDA 33166-4565

REPLY TO ATTENTION OF

CESAJ-RD-SM
Miami Regulatory
Field Office
199430251

March 4, 1994

Dames & Moore
6400-A Congress Ave. Suite 2500
Boca Raton, Florida 33487

Dear Mr. Nagy:

Reference is made to the correspondence relating to the issue regarding Department of the Army jurisdiction over a porposed access road and fill pad through the Miccosukee Indian Reservation north of Alligator Alley and west of L28 canal in Broward County, Florida.

The delineation shown on the attached drawing represents the approximate upland/wetland boundary for purposes of determining the U.S. Army Corps of Engineers jurisdiction line and must be field staked prior to the placement of fill material. Please be advised that this jurisdictional delineation shown reflects current policy and regulations and is valid for a period no longer than 3 years from the date of this letter. If after the 3-year period, this jurisdictional determination has not been specifically revalidated by the Corps of Engineers, it shall automatically expire. Any reliance upon jurisdictional correspondence beyond that time may lead to incorrect planning and design efforts as well as possible violations of current Federal laws and/or regulations. You may revalidate or update the jurisdiction guidance as appropriate for your project duration. Any revalidation or updating will then reflect current Federal laws and regulations.

The jurisdictional areas are regulated by the U.S. Army Corps of Engineers pursuant to Section 404 of the Clean Water Act. Any activities undertaken in these areas may require Department of the Army authorization. Other federal, state or local permits may also be required.

Thank you for your cooperation with the U.S. Army Corps of Engineers Regulatory Program. If you have any questions regarding this letter or the Corps of Engineers regulations, please contact Mr. Charles Schnepel at the Miami Field Office, telephone number (305) 591-1302.

Sincerely,

Charles A. Schnepel

Charles A. Schnepel
Chief, Miami Field Office



13501-068-5

DEPARTMENT OF THE ARMY
MIAMI FIELD OFFICE, 8410 NW 53RD TERRACE MONTEREY BLDG., SUITE 225
MIAMI, FLORIDA 33166-4565

REPLY TO ATTENTION OF

June 20, 1991

Regulatory Section
Miami Field Office
199130884

Billy Cypress
Tribal Chairman
Miccosukee Tribe
P.O. Box 440021
Tamiami Station
Miami, Florida 33144

Gentlemen:

This is a follow up to our recent field survey and office meeting on March 14, 1991 concerning the Shell Western drill site located on the Miccosukee Indian Reservation north of SR 84 and east of L28 Canal in Broward County, Florida.

The general area in question has been used for over 20 years for the pasturing of cattle. It is our understanding that past practices have allowed Hemarthria attissima (green Alta) to be planted throughout this area. This forage species presently dominates most of the vegetative community. It is not listed as a wetland plant species.

The soil at the proposed site has been previously identified by the Soil Conservation Service as Hallandale fine sand. The National Technical Committee for Hydric Soils classifies this series as hydric. The local representative of the Soil Conservation Service considers this particular series to be nonhydric.

Ground water elevation is controlled by L-28 Levee and pump station S-140. Water levels in the immediate area are maintained at 10.5 feet.

Based on all information available, the Shell Western drill site is not considered to be a jurisdictional wetland subject to Section 404 of the Clean Water Act.

The project as proposed will not require a Department of the Army permit in accordance with Section 404 of the Clean Water Act as it will not involve the discharge of dredged or fill material into waters of the United States. Providing the work is done in accordance with the enclosed drawings, Department of the Army authorization will not be required.

This letter does not give absolute authority to perform the work as specified on your application. The proposed work may be subject to local building restrictions mandated by the National Flood Insurance Program. You should contact your local office that issues building permits to determine if your site is located in a flood prone or floodway area, and if you must comply with the local building requirements mandated by the National Flood Insurance Program. If the local office cannot provide you the necessary information, you may provide this office a letter with a small scale map showing the location of the site, requesting a flood-hazard evaluation of the site. The request should be addressed to the Chief, Flood Control and Floodplain Management Branch, Jacksonville District, U.S. Army Corps of Engineers, P.O. Box 4970, Jacksonville, Florida 32232-0019.

This letter does not obviate the requirement to obtain any other Federal, State or local permits which may be necessary for your project.

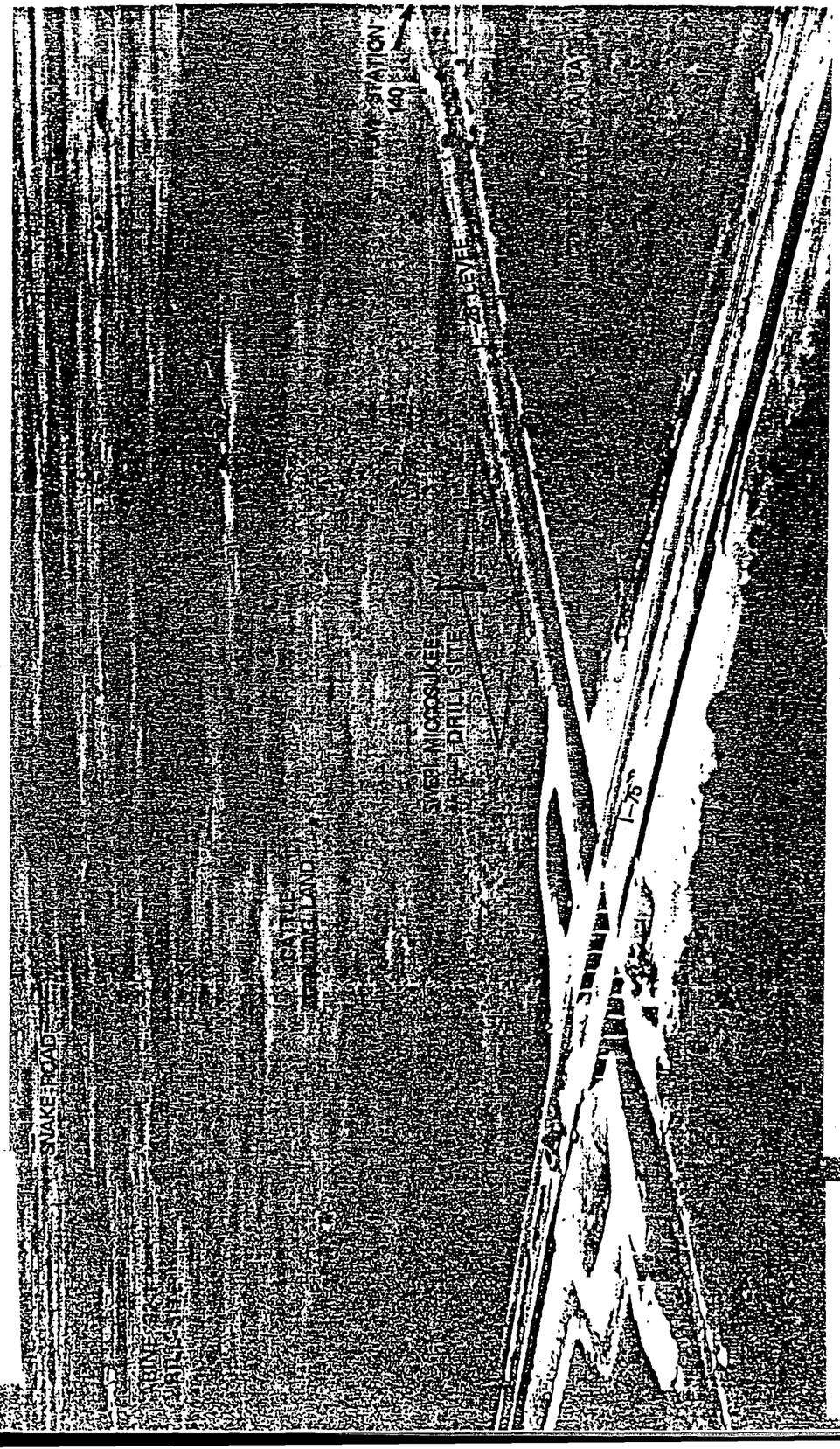
Thank you for your cooperation with our permit program.

Sincerely,

Charles A. Schnepel

Charles A. Schnepel
Chief, Regulatory Section
Miami


2-7-80
USDA 40
12011 278 - 228
CREEK
ROAD
GREAT


STATION
140
ANTA
LEVEE
MICCOSUKEE
DRILL SITE
SWEETWATER
I-75
CATTLE
SNAKE ROAD
PINE
DRILL SITE

United States Department of the Interior

NATIONAL PARK SERVICE
SOUTHEAST REGIONAL OFFICE
75 Spring Street, S.W.
Atlanta, Georgia 30303

IN REPLY REFER TO:

A38(SER-PC)

JUN 4 1992

Mr. Robert V. Abbey
District Manager
Bureau of Land Management
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206

Dear Mr. Abbey:

This correspondence is in response to your offer of cooperating agency status on the proposed oil and gas well (3-1) on the Miccosukee Reservation in Broward County, Florida. As the record indicates, we have been very concerned about the potential environmental impacts from the proposed exploration and associated activities at this site. We are very much interested in being able to participate in the review of the required environmental documentation for this proposal. We stand ready to offer our assistance in transferring research and resources management findings from the wells which we have permitted in the Big Cypress. However, our activities in review of records and information transfer will be limited by the existing personnel and budget. We would prefer to provide this assistance as an interagency courtesy rather than as an official cooperating agency.

Please feel free to contact our minerals management specialist (Rick Dawson 404-331-4916) here in Atlanta or the park Superintendent (Wally Hibbard 813-695-2000) for any information or assistance.

Thank you for the opportunity to participate in this program.

Sincerely,

FOR James W. Coleman, Jr.
Regional Director
Southeast Region

RECEIVED
JUN 8 1992
BUREAU OF LAND MANAGEMENT
JACKSON DISTRICT OFFICE

DAMES & MOORE

ONE NORTH DALE MABRY HIGHWAY, SUITE 700, TAMPA, FLORIDA 33609
(813) 875-1115 FAX: (813) 874-7424

RECEIVED
JUL 06 92
DAMES & MOORE

July 1, 1992

Mr. Billy Cypress
Tribal Chairman
Miccosukee Tribe of Indians of Florida
P.O. Box 440021
Tamiami Station
Miami, FL 33144

RE: Request for tribal Religious and Socioeconomic information for Environmental Impact Statement (EIS) for the Shell Western E&P, Inc. 3-1 Exploratory Oil Well.

Dear Chairman Cypress:

As part of the EIS for the referenced project, impacts of the proposed exploratory oil well on Miccosokee religious concerns and socioeconomic conditions must be addressed. This letter request that the tribe release such information to me as soon as possible in order for me to prepare these sections of the EIS document.

Please instruct Mr. Steve Terry to provide this information. Your immediate attention to this matter would be greatly appreciated.

Should you have any questions please don't hesitate to call.

Sincerely,

Michael E. Nelson
Project Planner

cc: Mr. Steve Terry - Miccosokee Tribe
Mr. Dave Smith - SWEPI
Mr. Mike Nagy - D&M

13501-072-7050-049
cypr0701.ltr

DAMES & MOORE
6400-A CONGRESS AVENUE, SUITE 2500, BOCA RATON, FLORIDA 33487
(407) 994-6500 FAX: (407) 994-6524

July 29, 1992

Mr. Ernie Gallego
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33416

RE: Data Request for SWEPI Project

Dear Mr. Gallego:

We hereby respectfully request the following data for the period of record:

WATER LEVEL STATIONS - SURFACE WATER		
STATION NAME	**ID NUMBER**	**PERIOD OF RECORD**
S-190 (upstream)	261711-805650	'78, 1/84 - Present
S-190 (downstream)	261711-805650	'78, 1/84 - Present
3A-11	261304-804439	1/81 - Present
S-140 (upstream)	261017-804942	9/85 - Present
S-140 (downstream)	261017-804942	9/85 - Present

WATER LEVEL STATIONS GROUNDWATER		
STATION NAME	**ID NUMBER**	**PERIOD OF RECORD**
HE-862	261735080534002	12/77 - Present
C-54	26100008052001	2/52 - Present

DISCHARGE STATIONS		
STATION NAME	**ID NUMBER**	**PERIOD OF RECORD**
S-140	261017-804942	1/70 - Present

RAINFALL STATIONS		
STATION NAME	**ID NUMBER**	**PERIOD OF RECORD**
S-8	261955-804630	9/62 - Present
S-140	261017-804942	1/88 - Present
3A-S	260459-804105	6/71 - Present

We would like to obtain the information on 3.5" high density diskettes in ASCII format.

Sincerely,

DAMES & MOORE

Roberto L. Sanchez for RLS
Project Engineer

RS:dl

cc: Hans Zarbock (TPA)
M. Nagy (BOC)
G. Nemeth (BOC)

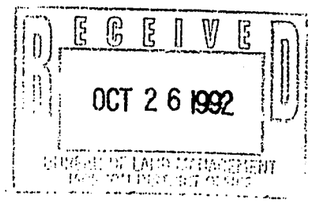
U.S. Department of Transportation
Federal Highway Administration

Florida Division Office

227 N. Bronough St.
Room 2015
Tallahassee, Florida 32301

October 21, 1992

IN REPLY REFER TO HDA-FL



Mr. Robert V. Abbey
U. S. Department of the Interior
Bureau of Land Management
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206

Dear Mr. Abbey:

Subject: Florida - Oil Well Exploration Site Access from I-75

Reference is made to your letter dated October 6, 1992, concerning my August 5, 1992, letter to the Ft. Lauderdale office of the Florida Department of Transportation (FDOT) that denied a request for access from I-75 to a proposed well drilling site for Shell Western E&P, Inc.

The matter of possible oil and gas exploration was a concern during the development of the Environmental Impact Statement for I-75. Because of the environmental and land-use issues involved, the Federal Highway Administration (FHWA) and the FDOT agreed that it was necessary to tightly control the access to I-75. Individual access points would be granted only after applicable Federal and State engineering and environmental studies have been completed.

In carrying out the access policy, FHWA grants access to an Interstate facility only when there is a justification that shows, beyond a doubt, that this type of access is the only access to a parcel of land; and it is in the public interest to grant such approval. Also, this would only be granted when it is shown that there would not be an adverse impact on the safety and operation of the facility or the environment, and that all necessary environmental permits can be obtained from the appropriate agencies. In a case where there is existing access to a parcel other than from the Interstate, FHWA would not normally grant access from the Interstate facility. Any proposal for access to an Interstate facility would have to show extreme hardship imposed on an applicant before direct access would be considered.

-more-

In response to your specific question as to whether we would approve direct access from I-75 if a determination were made that direct access would have the least environmental impact, we would consider the environmental effects, alternatives to direct access, and the safety and operational effects of direct access on I-75 if a request for access approval were requested. Since there are existing roads that now provide access to the site, it would take a very unusual situation to warrant I-75 access approval.

If there is any other information we may be able to furnish you or if you have any questions regarding this matter, please feel free to contact this office.

Sincerely yours,

J. R. Skinner
Division Administrator

cc: Mr. Rick Chesser, FDOT, District 4

U.S. Department of Transportation
Federal Highway Administration

Florida Division Office

227 N. Bronough St.
Room 2015
Tallahassee, Florida 32301

August 5, 1992

IN REPLY REFER TO: HA-FL

Mr. R. E. Chesser
District Secretary
Florida Department of Transportation
780 S. W. 24th Street
Ft. Lauderdale, Florida 33315-2696

Attention: Mr. William A. Lewis

Dear Mr. Chesser:

Subject: Florida - Proposed Access for Shell Western E & P, Incorporated, Exploratory Oil Well I-75 Alligator Alley

Reference is made to Mr. Lewis' letter dated July 28, 1992, requesting approval for Shell Western to be allowed access from I-75 to their proposed Exploratory Oil Well site at the L-28 canal. This access would be through the locked-gate access, provided for the South Florida Water Management District (SFWMD).

These locked-gate access points were allowed to enable the SFWMD access to areas north and south of I-75 for maintenance purposes, which in most cases would be rare. The design of the access points took this into consideration, and thus are not of high standards. These points were allowed only because they would rarely be used and the gates kept locked. To allow others use of these access points is not in keeping with the intended purpose and; thus, should not be encouraged or permitted because it could become a safety hazard. We, therefore, cannot approve the use of these access points as requested. We note from the sketch submitted, the drill site has access from the north via an existing dirt road that connects to Snake Road. Access to the drill site should be by this route in lieu of access from I-75 through the access control fence.

Sincerely yours,

R.V. Robertson

J. R. Skinner
Division Administrator

RCH:kro/dw1
cc: RCH & RVR
File: I-75 Broward Co.

FLORIDA
LAWTON CHILES
GOVERNOR

DEPARTMENT OF TRANSPORTATION
BEN G. WATTS
SECRETARY

TRAFFIC OPERATIONS - DISTRICT 4
780 Southwest 24th Street
Ft. Lauderdale, Florida 33315-2696
Telephone (305) 797-8520

July 28, 1992

Mr. J.R. Skinner
Division Administrator
Federal Highway Administration
227 North Bronough Street
Room 2015
Tallahassee, Florida 32302

ATTN: Mr. R.V. Robertson ATTN: Mr. R. Clifton Holler

Dear Mr. Skinner:

Re: State Section 86075, State Road 93 (I-75)
Access Alternates to the Shell Western E & P, Inc.
Exploratory Oil Well Site Adjacent to I-75

Enclosed for your review and comment are documents pertaining to the referenced subject. Presently there is an exit ramp westbound and an entrance ramp eastbound on the east side of the L-28 Canal. These exit and entrance ramps (Access Alternate "B") were constructed to allow access to the existing South Florida Water Management District's facility. If South Florida Water Management District has no objection to the use of the access or to the construction of a bridge across the L-28 canal then the Department has no objection to the applicant using the above mentioned entrance and exit ramps.

There is an existing driveway in the north west quadrant of I-75 and the L-28 Canal (Access Alternate "A"). There is not a deceleration or acceleration lane nor is there room for a deceleration lane to this drive. The sight distance is very poor because of the close proximity to the bridge. The Department objects to the use of this access.

In the south west quadrant there is also an existing driveway (Access Alternate "C"). This drive does not have a deceleration or acceleration lane. There is no room for an acceleration lane due to the close proximity to the bridge. Therefore, the Department objects to the use of this access also.

Access Alternate "D" uses the existing interchange at Snake Road. Even though this access may be the least convenient for Shell Oil, it is the safest.

Please review and comment on this plan at your earliest convenience. Should you have any questions or comments, please do not hesitate to contact Ms. Beth Coe at (305) 797-8527 or Suncom 423-8527.

Sincerely,

William A. Lewis, Jr., P.E.
District Traffic Operations Engineer

WAL/csa

cc: Beth Coe, FDOT Permits

AUG-18-'92 09:36 ID:DAMES AND MOORE TPA TEL NO:8138761142 #395 P03

TOTAL P.03

DAMES & MOORE

1211 GOVERNORS SQUARE BOULEVARD, SUITE 300, TALLAHASSEE, FLORIDA 32301
(904) 942-5615 FAX: (904) 942-5619

MEMORANDUM

TO: Mike Nagy

FROM: Jackie Fry

SUBJECT: Shell EIS, FNAI report

DATE: June 8, 1992

As requested, I checked the FNAI records for the Shell project site. Two Florida panthers were reported in the vicinity. One was seen approximately 4 miles southwest (on the Everglades 3 NE quad) and the other was observed approximately 3 1/2 miles southwest on the Everglades 3 NW quad. A bird rookery of little blue herons and great egrets was reported approximately 6 miles west on the Everglades 3 NW quad. The Everglades 3 NW quad map is the area immediately west of the project site.

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APPENDIX A-13

BUREAU OF LAND MANAGEMENT
STANDARD CONDITIONS OF APPROVAL
FOR PERMIT TO DRILL

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U. S. Department of The Interior
Bureau of Land Management
411 Briarwood Drive, Suite 404
Jackson, MS 39206

STANDARD CONDITIONS OF APPROVAL FOR PERMIT TO DRILL

Contacts and Phone/Fax Numbers:
U. J. Parikh (Authorizations/Daily Reports/Emergencies)
Office: (601) 977-5400 Home: (601) 825-7272
Daryl Nations Office: (601) 977-5400 Home: (601) 833-9611
Ray Boteler (Field Compliance Inspections)
Office: (601) 977-5400 Home: (601) 845-8095
Office Fax: (601) 977-5440
****
Surface Management Agency (SMA) Contact: U. S. Forest Service, Gloster District
Hunter Howell
Phone: (601) 225-4281
****
WELL NAME/NUMBER: USA "CF" # 2
OPERATOR NAME: Anandale Production Company
LEASE SERIAL NUMBER: MSES-40582
LOCATION: Section 29, T. 5 N., R. 1 W., Adams County, MS
UNIT/COMMUNITIZATION AGREEMENT NUMBER: N/A
The above information is required on well sign.
****
CERTIFICATION BY OPERATOR: Sign and return this page to the BLM prior to initiating surface disturbance. Signature provides your agreement to abide by these conditions and any conditions attached by the SMA. Please provide State Permit Number and API Well Number below.
****

I certify that I have read and accept these conditions and those of the SMA on this approved Permit to Drill.

_____ _____ _____
Authorized Signature Title Date

State Permit #: _____ API Well #: _____
****

POSTING: A copy of the approved permit and a copy of all the Conditions of Approval must be posted in a conspicuous place on the drilling rig.

DRILLING DEADLINE: This approval is valid for one year. Renewal of this approval is required for operations to commence after one year of the approval date.

PLAN CHANGES: The operator must obtain approval prior to changing the surface use or drilling plans approved by this permit. Requests for approval are made by submitting "Sundry Notices and

Reports on Wells" Form (3160-5) and any attachments.

ARCHAEOLOGICAL SITES: The operator is responsible for informing all persons working at the drill site that they are subject to prosecution for knowingly disturbing historic or archaeological sites, or for collecting artifacts. If historic or archaeological materials are uncovered during construction, the operator is to immediately stop work and contact the BLM at the above number. Within five working days the BLM, in consultation with the SMA and the State Historic Preservation Officer, will inform the operator as to options available and how/if operations in the area of the historic or archaeological materials may proceed.

REQUIRED NOTIFICATIONS: Surface Disturbance: At least two days before surface disturbance begins, the operator must notify the SMA.

Drilling Operations: Notify BLM (Ray Boteler) on the day the well is spudded.

Daily Drilling Report: File a daily drilling report (FAX or Call in) with BLM (U. J. Parikh) from spud date until filing of the "Well Completion or Recompletion Report " Form (3160-4). Written weekly summaries of daily reports must also be filed if daily drilling reports are phoned in.

Well Operations: Notify the BLM (Ray Boteler) at least 48 hours in advance of plug backs, formation testing, water shut-off testing, and running and cementing casing (other than conductor string). File Form 3160-4 as specified at 43 CFR 3162.3-2.

Undesirable Events: Report any undesirable event to the BLM (U. J. Parikh) and the SMA as specified in "Reporting of Undesirable Events" (NTL 3A).

Well Plugging: At the time of well plugging, the BLM (Ray Boteler) is to be notified 48 hours in advance.

Surface Restoration: Contact and the SMA prior to beginning surface restoration.

Production: No later than the fifth business day after any well begins production on which royalty is due anywhere on a lease or allocated to a lease, or resumes production in the case of a well which has been off production for more than 90 days, the operator shall notify this office by letter or on Form 3160-5, or orally to be followed by written confirmation, of the date on which such production has begun or resumed, as required by the Federal Oil and Gas Royalty Management Act of 1982.

Oil wells commence or resume production on the date when liquid hydrocarbons are: 1) sold or shipped from a temporary storage facility, such as a test tank, and for which a run ticket is required to be generated or 2) produced into a permanent storage facility; whichever occurs first.

Gas wells commence or resume production on the date when associated liquid hydrocarbons are: 1) sold or shipped from a temporary storage facility, such as a test tank, and for which a run ticket is required to be generated or 2) produced into a permanent storage facility whichever occurs first.

Failure to comply with this requirement in the manner and time allowed will result in civil penalty liability of up to $10,000 per violation for each day such violation continues, not to exceed a maximum of 20 days as provided at 43 CFR 3163.3(e).

BLOWOUT PREVENTER TESTING: Blowout preventers must be tested at the time of installation, following repairs, prior to drilling-out each casing shoe, and at least every 30 days.

Annular-type preventer tested to at least 50% of rated working pressure.

Ram-type preventer tested to the rated working pressure of the stack or to 70% of the internal yield of the casing; whichever is less.

WELL COMPLETION: Within 5 days after well completion, two copies of Form 3160-4 are required to be submitted to the BLM at the above address for each well (dry or productive). One copy of other data compiled (core description and analysis, directional surveys, drill stem test, electric logs, geophysical logs, etc.) will be submitted with the Form 3160-4.

PRODUCTION FACILITIES: Facilities not included in the approved permit must have approval by the BLM before construction. Included are equipment or facilities such as flow lines, tank batteries, measuring stations and disposal facilities whether on or off lease. Application is made on Form 3160-5.

PRODUCED WATER: An application (Form 3160-5) to BLM is required for disposal of produced water as provided by "Disposal of Produced Water" (NTL-2b).

PLUGGING: BLM approval is required prior to plugging the well. The operator may request a verbal approval from the BLM (U. J. Parikh), with a follow-up written request required on Form 3160-5.

REGULATIONS, ORDERS, NOTICES AND LEASE TERMS: The operator is responsible for knowing and abiding by all pertinent regulations, orders, notices and lease terms.

LEASE RIGHTS: Approval of this application does not warrant or certify that the operator holds legal or equitable title to the lease rights which allow operations to be conducted on the lease.

****

Special Conditions:

1. As per 30 CFR Part 216.50, a completed form, MMS-3160, must be filed with the Minerals Management Service for each calendar month beginning with the month in which drilling operations for this well are initiated and ending when the well is permanently plugged. The MMS address is:

   Minerals Management Service
   P. O. Box 17110
   Denver, CO 80217

2. The Surface Management Agency Conditions are attached.