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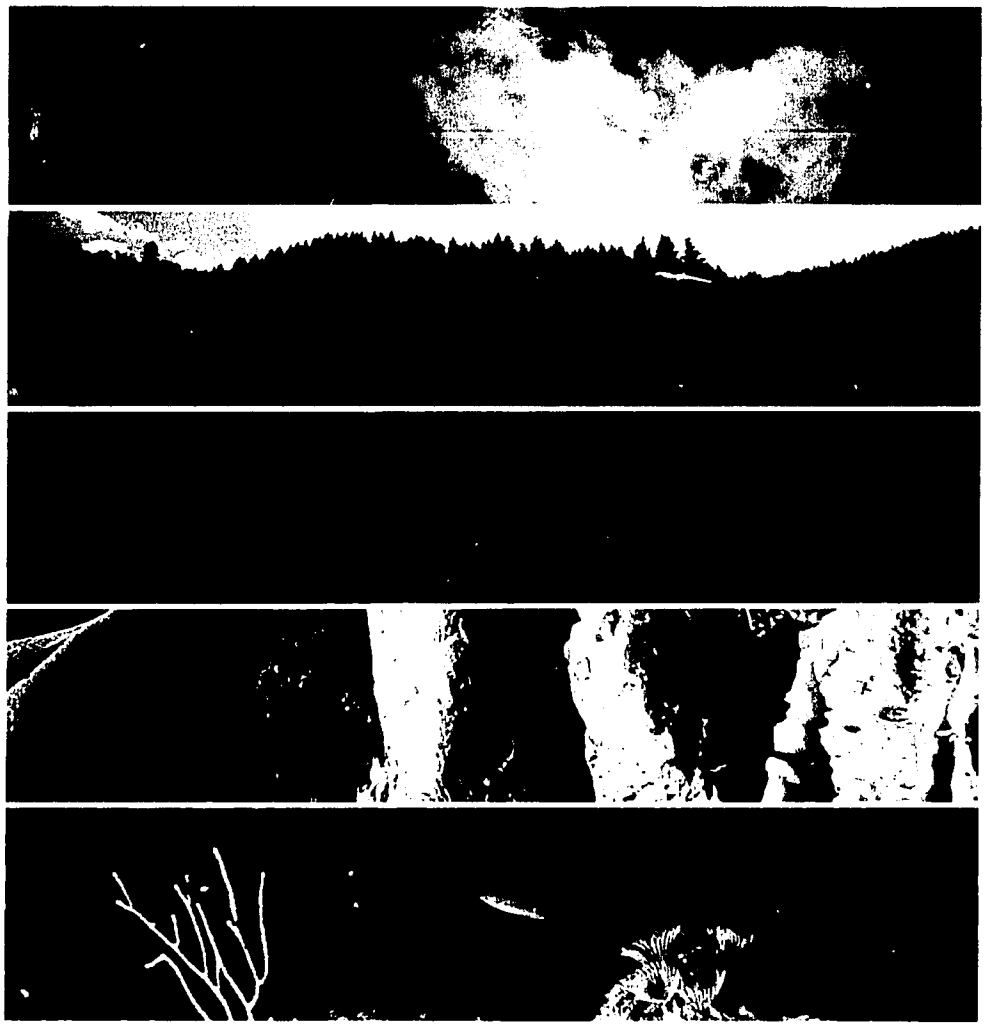

DAMES & MOORE

PDABC-046

FINAL EVALUATION
of the
MINERAL, PETROLEUM AND
GROUNDWATER ASSESSMENT PROGRAM (MPGAP)
PROJECT NO. 263 - 0105

September 13, 1990

Prepared by Dames & Moore
Cairo, Egypt

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September 13, 1990

Dr. Richard E. Rhoda, Director
Office of Science and Technology
U.S. Agency for International Development
Cairo Center Building
106, Kasr El Aini Street
Cairo, Egypt

Re: Contract No. PDC-5517-I-00-7136-00
Delivery Order No. 16
Project No. 263-0105
Transmittal of Final Report

Dear Dr. Rhoda:

Dames & Moore is pleased to transmit herewith ten (10) copies of its Final Report entitled, "Final Evaluation of the Mineral, Petroleum and Groundwater Assessment Program (MPGAP), Project No. 263-0105." This report incorporates comments on the Draft Final Report received from AID and the participating GOE agencies.

It has been a pleasure to serve the AID mission on this project and we stand ready to serve you in the future.

Yours very truly,
Dames & Moore

Douglas J. Lootens
Partner (Ltd)
Team Leader

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1.0 EXECUTIVE SUMMARY

USAID/Cairo initiated a Final Evaluation of the Mineral, Petroleum and Groundwater Assessment Program (MPGAP), Project 263-0105, in August 1990. The report, entitled "Final Evaluation of the Mineral, Petroleum and Groundwater Assessment Program (MPGAP), Project No. 263-0105," was submitted on September 13, 1990.

Given that Egypt has significant natural resources in the form of mineral and petroleum deposits, the MPGAP project's stated goal was to increase foreign and domestic investment in developing these potential sources of national wealth. As comprehensive and accurate information is a vital aspect of any investment decision, it was critical that it be made available to the marketplace. In pursuit of this objective, the purpose of MPGAP was to gather basic geotechnical information and to devise means for its dissemination to potential users. More specifically, the program was aimed at augmenting institutional capacity to gather data while improving the organization and use of current data and developing GOE institutional capacity in the management of such information.

This final evaluation of MPGAP assesses the degree to which the purposes and goals of the program were achieved. With this in mind, the Evaluation Team examined equipment procured and its state of use, reviewed reports and other outputs, and interviewed many of those involved in the management, implementation and related activities of the program. Specific areas of effectiveness were explored. These included programmatic achievements, contractor performance, present impact and sustainability, and interagency cooperation. Because private investment in the sectors targeted by the program may have a lag time, the Evaluation Team believes that any conclusions it makes in this regard must be considered preliminary.

The MPGAP Project No. 263-0105, was signed on September 28, 1980, and after some initial delays, project work was initiated in July 1982. The $37.2 million project provided for a very ambitious scope of work involving professional training, provision of equipment, specialist assistance provided by US experts, and a series of host country contracts for specialized field surveys designed to provide important basic geoscience information supportive of overall project goals.

Four Government of Egypt (GOE) agencies participated in the MPGAP project:

- Egyptian General Petroleum Corporation (EGPC): $21.100 million
- Egyptian Geological Survey and Mining Authority (EGSMA): $ 8.148 million
- Desert Research Center (DRC): $ 2.333 million
- Remote Sensing Center(RSC): $ 2.109 million

The $33.7 million final obligation represented a modest reordering and reduction of project tasks. Following several extensions, the final Project Assistance Completion Date was September 27, 1990.

From the outset, it was recognized that the MPGAP project was not only ambitious but extremely complex, including four separate and distinct GOE agencies and dozens of separate activities. Two of the agencies, EGSMA and EGPC, were under a single ministry, the Ministry of Petroleum and Mineral Wealth.

Management and coordination of project activities were correctly perceived as key elements in successful achievement of project objectives and maximizing the overall effectiveness of the program. For this reason, considerable pre-project effort was devoted to analysis of project management alternatives and development of what was seen to be a workable management scheme for both AID and GOE agencies.

Unfortunately, events showed that the planned management approach, particularly insofar as the GOE agencies were concerned, proved to be ineffective, resulting in a management and coordination vacuum on the GOE side and requiring much greater direct involvement by AID staff than had been anticipated. The key breakdown was the ineffectiveness of a GOE Coordinating Committee whose primary responsibilities were GOE project coordination and the assurance of interagency cooperation on the part of participating GOE agencies. This Committee was essentially non-functional from the outset.

The four participating GOE agencies were correctly perceived as being at different stages of development and hence having different needs related to project inputs. Egyptian General Petroleum Corporation (EGPC) was seen as a relatively mature and sophisticated agency requiring little project management assistance. In consequence, the bulk of MPGAP assistance to EGPC was in the form of AID-funded host country contracts to carry out a number of specific development-oriented studies.

In contrast, it was believed (correctly in the view of the Evaluation Team) that Egyptian Geological Survey and Mining Authority (EGSMA), Desert Research Center (DRC) and Remote Sensing Center (RSC) could benefit from the presence of an AID contractor to oversee and coordinate the multiplicity of inter-related project activities included in MPGAP. An AID contractor, Bendix, was engaged to manage the Minerals, Groundwater and Remote Sensing (MGRS) program which incorporated the majority of MPGAP-assisted activities for EGSMA, DRC and RSC.

On balance, the Evaluation Team concludes that the MPGAP project was executed effectively and that the results were very positive. The three primary objectives of MPGAP (data collection, data handling and management, and private sector investment) were substantially achieved, though all the fruits of MPGAP in private sector investment may not be apparent for several years, owing simply to the nature of the natural resource development business.

Key MPGAP achievements include the following:

- All agencies were provided with a broad range of in-country and overseas training experiences which have significantly increased their professional capability and capacity to effectively discharge their mandated responsibilities.

- A large amount of equipment and related training was provided. Much of this equipment was designed to enhance the ability of participating GOE agencies to catalog, retrieve and disseminate technical information.

- Building on a solid base, the Remote Sensing Center was provided equipment and training sufficient to create a remote sensing data processing center of world class standards.

- Through assistance provided by MPGAP, the Desert Research Center located and evaluated significant groundwater aquifers in the Eastern Desert and evaluated one in the Western Desert.

- The Egyptian Geological Survey and Mining Authority has successfully negotiated three mineral concession agreements requiring a minimum expenditure of $20.0 million over three years. Successful exploration results could lead to development expenditures in excess of $100 million per concession.

- EGPC has sold all or part of its MPGAP-funded aeromagnetic survey to six oil companies. Additionally, basin studies and seismic surveys carried out by MPGAP contractors have developed a wealth of positive

exploration information which will be very attractive to international oil companies.

On the other side of the equation, there were several elements of the MPGAP project which failed to meet expectations, including:

- The failure of the GOE Coordinating Committee, described above, which in the view of the Evaluation Team, seriously diminished cooperation and coordination among the participating GOE agencies.

- Despite many closely parallel programs, there was a disappointing lack of cooperation among GOE agencies, partly because of the failure of the GOE Coordinating Committee, but more as the result of long-standing competitiveness between agencies.

- Owing to not fully understood conflicts between EGSMA management, Bendix and AID, EGSMA was separated from the MPGAP project in April 1987, fully 3 1/2 years prior to completion of the project. This was a regrettable outcome to a problem which, in the Evaluation Team's view, could probably have been amicably resolved through sincere and continuing efforts on all sides to work toward an acceptable solution.

- Primarily as the result of contracting problems resulting in significant delays in the delivery of key equipment, the completion of the Landsat Atlas by RSC was delayed by at least three years. Owing to the perceived value of this Atlas to the other MPGAP agencies, this delay had a significant negative impact on several agency programs.

Apart from the overall achievements and shortfalls of the MPGAP project compiled above, the Evaluation Team reached a series of conclusions and, based on those, developed a parallel series of recommendations. Key conclusions reached by the Evaluation Team include:

- The MPGAP project was successful in providing the tools necessary for the participating GOE agencies to achieve their MPGAP objectives and better discharge their mandated responsibilities.

- Private sector involvement as a result of MPGAP initiatives is on the rise and can be expected to increase in the years to come.

- The GOE management structure designed for implementation of the MPGAP project was never implemented and resulted

in a management void which in turn reduced the impetus for interagency cooperation.

- The training program designed and implemented by Bendix for the MGRS agencies was a ringing success.

- Most EGPC programs were built around host country contracts for specific activities, which were highly successful and laid a sound foundation for future progress in the petroleum sector.

More specific conclusions are included in Section 2.1 of this report.

Growing out of these conclusions, the Evaluation Team developed a series of recommendations to guide future actions of AID and the GOE agencies. Details of these recommendations are included in Section 2.2 of this report, but key recommendations are compiled below.

- The contracting and procurement process needs much greater attention to ensure that participating host country agencies, as well as the contractors themselves are thoroughly familiar with the process and with host country needs.

- The failure of the GOE Coordinating Committee suggests the need for AID to re-examine its process of evaluating host country management and coordination practices.

- In order to ensure the sustainability of equipment-related MPGAP assistance, management of participating GOE agencies must recognize the need for ongoing servicing and maintenance of that equipment and be prepared to back up that recognition with regular and adequate budgetary allocations for required servicing and maintenance.

- GOE agencies have received significant assistance to upgrade library holdings. In order to derive maximum benefit from these library additions, journal subscriptions and access to the international technical press should be maintained. While this requires access to foreign currency, the investment is small, while the return is large.

Despite the length, size and complexity of the MPGAP project, the Evaluation Team did not identify any over-arching "lessons learned." While some issues could be approached from a lessons learned perspective, the Evaluation Team believes that any such issues are adequately addressed in the section on recommendations.

2.0 CONCLUSIONS AND RECOMMENDATIONS

2.1 CONCLUSIONS

Conclusions are based on the Report of Findings, presented in Section 3.0, and are separated into two parts. First are those related to programmatic aspects of MPGAP. Second are conclusions specific to each MPGAP agency, which may not have broad programmatic implications.

2.1.1 General Programmatic Conclusions

While all of the conclusions contained in this section clearly relate in one way or another to activities of AID and/or the participating GOE agencies, the focus is on conclusions of a generic nature, i.e., elements that speak directly to AID involvement in the MPGAP project or GOE agency-related items which are common to all or most of these agencies.

Key programmatic conclusions derived from the Evaluation Team's review of the MPGAP project include the following:

- On balance the MPGAP project successfully provided participating GOE agencies with a wide-ranging package of training, equipment and technical assistance which has assisted those agencies in moving strongly in the direction of full achievement of MPGAP project goals.

- All participating GOE agencies have benefitted significantly from MPGAP assistance and now possess substantially enhanced capacity to discharge their mandated responsibilities.

- Present and anticipated involvement of private sector in the development of Egyptian natural resources has been demonstrably enhanced through MPGAP activities. Further private sector involvement as a result of MPGAP assistance is a virtual certainty but will take time to be realized.

- The establishment of a GOE Coordinating Committee, envisioned in the Project Paper and Project Agreement, was never effectively implemented, resulting in less than expected interagency cooperation and coordination among the GOE participating agencies.

- In general, procurement of equipment is an area of contracting, both in terms of design of specifications suitable to the Egyptian situation, and in adherence to specifications and timeliness in procurement and

delivery, which deserves greater attention from AID, its contractors, and the GOE agencies.

- Given proper management involvement and budgetary support by the GOE agencies, the vast majority of training, equipment and programs provided through MPGAP assistance should be sustainable over the coming years.

- While substantial upgrading of library facilities was an integral part of the MPGAP project, the ability of the GOE agencies to continue to build their collections of scientific journals and other relevant international reports is severely hampered by the agencies' lack of access to foreign currency to make overseas purchases.

- MPGAP was not notably successful in improving coordination and cooperation between the participating GOE agencies, in part because of the failure of the GOE Coordinating Committee and in part because of long-standing interagency competitiveness.

2.1.2 Agency-Specific Conclusions

This section focuses on key conclusions which are specific to the participating GOE agencies, but which may not have broad programmatic implications.

2.1.2.1 Petroleum Agencies -- EGPC and GPC

Virtually all MPGAP assistance for the petroleum agencies was in the form of AID-funded host country contracts designed to accomplish specific objectives. Key conclusions to be drawn from a review of these programs include the following:

- With one exception, the Improved Petroleum Recovery, Inc. (IPR) contract, all contracts are anticipated to be successfully completed and will provide excellent results to the agencies. Contractor performance was rated as good to excellent by the Evaluation Team.

- While much of the IPR contract was successfully completed, the contractor has thus far been unable to complete the 3-D reservoir simulation at North Bakr field and the report thereon.

- Though training of Egyptian personnel was not a primary objective of most of the contracts, the training activities which were carried out were judged by EGPC and GPC to be extremely useful.

- The contract outputs have provided EGPC and GPC with valuable exploration information which can be used by them and/or made available to interested private sector oil companies, thus fulfilling one of the key objectives of MPGAP assistance to the GOE petroleum sector agencies.

- To date, six petroleum companies have purchased all or part of the aeromagnetic data provided under contract by Aero Service. This type of private sector interest could well lead to additional concession agreements.

- Working with the contractors over the course of the MPGAP project, EGPC and GPC gained valuable management and negotiating skills and received technical information which will allow them to undertake similar studies in the future without outside technical assistance.

- The feasibility study of enhanced oil recovery options in the Assran field can form the basis for a pilot project undertaken by GPC or a joint venture operator.

- Regardless of the final outcome of the current issue over the IPR 3-D reservoir simulation model, the gas injection pilot project presently underway in the North Bakr field will, when completed, demonstrate the viability of this enhanced oil recovery technology not only there, but potentially other Egyptian fields as well.

2.1.2.2 Egyptian Geological Survey and Mining Authority (EGSMA)

- Overall, EGSMA benefitted significantly from participation in MPGAP though benefits were somewhat reduced due to the early separation of EGSMA from the MPGAP project.

- EGSMA professionals received a substantial amount of excellent training in field techniques, laboratory methods, library science and cartography and, as a result, now comprise a very professional geoscience organization.

- EGSMA received a large amount of equipment, as well as training in the operation of the equipment, which has significantly increased the agency's ability to fulfill its mandate.

- Through MPGAP assistance, EGSMA now has a first-class library and significantly improved cartographic

capability which will serve not only EGSMA, but other GOE agencies as well.

- Time-consuming manual processing of XRF/XRD data at the Dokki laboratory reduces the throughput and effectiveness of this sophisticated analytical equipment, a situation which could be rectified through the addition of a computer processor.

- One of the key objectives of MPGAP, production and distribution of focused mineral packages, was not achieved. Responsibility for this failure appears to lie jointly with the MGRS contractor, Bendix, and EGSMA.

- The Evaluation Team questions the wisdom of casting EGSMA in the dual, and possibly conflicting, roles of (1) an equity participant in mineral concessions, and (2) an agency charged with the task of actively promoting mineral resource development.

- EGSMA has executed three mineral concession agreements and is presently negotiating a fourth, concrete evidence of significant progress toward one of the key MPGAP goals.

- Long-term servicing and maintenance of equipment may be a problem if this function is not strongly supported and adequately funded by EGSMA management.

- Despite some evidence of interagency cooperation, there is still room for improvement in the areas of communication, coordination and cooperation between EGSMA and the other MPGAP agencies.

2.1.2.3 Desert Research Center (DRC)

- The DRC benefitted considerably from MPGAP through procurement of laboratory and field equipment and training of personnel in new field techniques.

- Improved field and laboratory data collection, analysis, and interpretation have resulted from MPGAP assitance. There is a need, however, for a laboratory designed to determine hydrologic properties of soil and rock materials.

- Two new groundwater reservoirs, Wadi Dara and Wadi El Nakheil, were discovered in the Eastern Desert, and the previously known groundwater reservoir in el Bahariya

Oasis in the Western Desert received a detailed systematic study.

- The new groundwater discovered in Wadi Dara was used immediately by an oil company needing water to start drilling. Additionally, the newly discovered groundwater reservoirs have potential for mineral, agriculture, tourism and urban development in both the Western and Eastern Deserts, thus demonstrating progress toward fulfillment of a key MPGAP objective.

- The timely discovery of new desert groundwater reservoirs was seriously impacted due to a series of delays in procurement of drilling equipment and drill rig parts.

- The DRC library needs to be further upgraded with up-to-date books and technical journals related to groundwater investigations.

- Approximately 150 DRC personnel received from 1 day to 9 months of training in Egypt or the US through MPGAP sponsorship. The trainees were well satisfied with the training and the trainers were impressed with their capabilities and dedication.

- Larger computer storage is needed by the DRC to handle its technical data and modeling needs, as well as administrative requirements.

- DRC prepares technically high quality reports and has published a semi-annual "DRI Bulletin" since 1951. However, comprehensive public information brochures are lacking.

- An excellent Geographic Information System has been acquired for DRC and is being used quite effectively for data interpretation and report preparation. Some expansion of these facilities is needed to provide adequate storage of the massive supply of interdisciplinary data related to hydrology, soils, vegetation, geology, etc.

- DRC has the potential for reimbursable work for other GOE agencies in borehole and well drilling, geophysical exploration, GIS services, and training in their specialties.

2.1.2.4 Remote Sensing Center (RSC)

- The RSC has significantly improved its capability to produce quality Landsat products on a timely and reliable basis.

- 800 copies of a Landsat Atlas, consisting of 80 quadrangle image maps at a scale of 1:250,000, were produced, thus fulfilling a key MPGAP objective.

- The above-stated capability and Atlas arrived too late to be utilized by most of the MPGAP agencies. However, the Atlas should be invaluable to these agencies and other institutions for future projects.

- As a direct result of MPGAP activity at RSC, a local trading company (Eight M) has decided to specialize in remote sensing activity, and a multi-sector Egyptian Remote Sensing Committee has been formed to improve communication in this field.

- RSC received excellent contract support although somewhat late due to contract negotiation difficulties.

- RSC has effectively marketed its services to other government agencies and the private sector. Approximately half of its current operating budget comes from these sources.

- RSC staff has obtained good and relevant training in system operation and application development, both in Egypt and the United States. In turn, RSC conducted three satellite image interpretation and application workshops for technology transfer to other agencies.

- As part of their computer system, RSC acquired software for managing data and information and are using it to good advantage.

- MPGAP provided RSC with the marginal resources (computer peripherals, software and training) needed to develop an excellent remote sensing service facility.

- While the Atlas uses low resolution Landsat MSS imagery suitable for reproduction at a scale of 1:250,000, RSC acquired through MPGAP the capability to process the higher resolution Landsat TM and Spot sensors which gives it a capability to make maps at scales up to 1:25,000.

- With aggressive marketing, RSC should be able to expand its contract work to the point where it becomes fully self-supporting. The MPGAP-funded marketing brochure will be an immensely valuable tool.

- RSC has a reasonably complete and useful library with good remote sensing textbooks and references. There is, however, a notable lack of continuity in technical journal subscriptions.

2.2 RECOMMENDATIONS

In preparing a final program evaluation, it is difficult to assess the extent to which recommendations for future work are appropriate. This is especially true in the case of the MPGAP final evaluation since the project, having reached its 10-year limit, will not be extended. Nevertheless, the Evaluation Team believes that recommendations growing out of its review can be of value both to AID and the participating GOE agencies.

As with the conclusions, the Evaluation Team's recommendations have been grouped into two categories: those which are of a programmatic nature and may assist AID in the design and execution of future programs of this type, and those which are specifically related to GOE agency programs. In the case of the agency-specific recommendations, they are designed to offer guidance for future agency activities.

2.2.1 Programmatic Recommendations

- Considerably greater attention should be paid to the contracting and procurement process to ensure that (1) any participating host country agencies are thoroughly familiar with the process, recognize and accept its complexities, and understand the limitations inherent in the process; and (2) US procurement contractors are thoroughly briefed on all aspects of the host country situation, such as electric current requirements, availability and quality of local suppliers, service and maintenance availability, etc.

- Where significant amounts of sophisticated electronic equipment are being acquired, such as was the case with the MGRS program, it is strongly recommended that a single contractor be responsible for both specifying the type and nature of equipment required, and the actual procurement, delivery and installation of the equipment.

- The failure of the GOE Coordinating Committee to function effectively in its planned role of GOE management coordinator points to a need to rethink this type of mechanism. While involvement of a host country management coordination role is to be encouraged, it is important that all members of such a host country management unit understand their role and have direct involvement in the project. In the case of MPGAP, placing the Academy of Scientific Research and Technology (ASRT) in charge of the GOE Coordinating Committee was, in retrospect, an error because ASRT had no direct role, i.e., no investment, in the success of the program.

2.2.2 Agency-Specific Recommendations

With respect to agency-specific recommendations, there are several recommendations which are common to all of the participating agencies, as well as a series of recommendations directed toward specific agencies.

2.2.2.1 General Agency Recommendations

- All participating GOE agencies received significant amounts of sophisticated equipment under the MPGAP project. Most of these acquisitions included varying amounts of service and maintenance under warranty. However, it is critically important that the management of each agency accept the necessity of regular servicing and maintenance of their equipment and regularly allocate sufficient budgetary funds to support such servicing and maintenance.

- MPGAP assistance provided significant upgrading of the libraries of participating agencies, including, in some cases, provision of scientific journals and other periodicals. In order to derive ongoing benefit from such journals and periodicals, the agencies must maintain annual subscriptions, normally payable only in foreign currency. Despite this impediment, every effort should be made to regularly acquire these journals and periodicals. Though access to foreign currency is required, the amounts are small, and the technical rewards are great.

- Many GOE professionals received technical training as part of the MPGAP project in state-of-the-art field, laboratory and data processing techniques. In order to maintain the value of that training, it must be periodically supplemented. The Evaluation Team

therefore strongly recommends that the participating GOE agencies give serious consideration to sending selected agency working professionals to international technical meetings to maintain and augment the training received through MPGAP assistance.

- Continuing efforts should be made on the part of all participating GOE agencies to improve the level of coordination and cooperation among agencies. Many of the activities of the agencies are complementary and can benefit significantly from a higher level of interagency cooperation.

2.2.2.2 Petroleum Agencies -- Egyptian General Petroleum Corporation and General Petroleum Company

- Software application programs purchased for AID activities should be fully operational and not be in the test phase. Careful preparation of contract specifications should minimize this problem.

- Electronic equipment purchased should be compatible with local electricity supply.

- EGPC should have several of its computer specialists present throughout the design and implementation of any future hardware/software system development in order to provide training to enable EGPC to do such work themselves.

- Electric log data base should have the capability to output tapes in LIS format.

2.2.2.3 Egyptian Geological Survey and Mining Authority

- EGSMA should consider acquisition of a computer (available through local suppliers in local currency) to expedite processing of complex data generated by the XRF/XRD equipment at the Dokki laboratory.

- EGSMA professionals should continue to participate directly in the field exploration and analytical laboratory activities conducted by mineral concession-holders to expedite transfer of technology in mineral exploration and development.

- EGSMA management and professional staff should continue to make efforts to improve the level of coordination and cooperation with other GOE agencies, particularly RSC and DRC. These three agencies pursue many closely

parallel field programs and their effectiveness could be materially enhanced through greater cooperative efforts.

- Consideration should be given to shifting responsibility for promoting private sector mineral resource development to an established GOE agency whose primary responsibility is industrial development and foreign investment augmentation, thus freeing EGSMA to concentrate on its primary role of geoscience data generation and evaluation.

2.2.2.4 Desert Research Center

- The Evaluation Team recommends that DRC sponsor an international symposium on desert hydrology, with cosponsorship and funding assistance from AID, UNESCO, UNDP, UNEP, WMO, FAO, and others. A cooperating organization could be the International Association of Hydrological Science (IAHS), which could publish the proceedings in English in their internationally distributed series of publications. This should be a week-long symposium (including one or two days of field trips), which could present the excellent scientific studies carried out by DRC under MPGAP, along with papers on deserts in other countries. This could provide some of the visibility needed by DRC for its high quality work in desert areas.

- In addition to the existing semi-annual "DRI Bulletin," DRC should embark on a systematic program of publicizing its activities and accomplishments. Such a program could include a comprehensive brochure describing the Center, a periodic list of new reports and regular press releases describing significant findings, new activities, etc.

- The water library should be expanded considerably. Books, movie films, and video tapes on hydrologic, modeling, remote sensing, geohydrology, hydrology, geophysics, geochemistry, and related subjects should be added to the library holdings. Continuing long-term subscriptions to technical journals on some of these subjects should be arranged so DRC staff can keep up with the latest research and technique developments throughout the world.

- By exchange agreements with organizations of other countries and with agencies of the UN, the publications of these other organizations could be received for the DRC library.

- DRC should organize an Arid Zone Hydrology Laboratory, which would include the facilities for laboratory analysis of water quality parameters, as well for determining the hydrologic and physical properties of aquifer, aquiclude, and vadose zone geomaterials.

- DRC should obtain larger computer storage in order to handle the increasingly difficult groundwater modeling problems and the huge accumulation of data from the completed MPGAP projects and projects of the future.

- DRC's GIS facilities and equipment should be further expanded to increase the capability of this important group.

- DRC should explore the possibility of doing reimbursable work, such as drilling, laboratory analysis, geophysical operation, GIS analyses, and training in DRC specialities for GOE agencies and other organizations.

2.2.2.5 Remote Sensing Center

- RSC is a first-class Egyptian institution which should serve many organizations by meeting their mapping and resource assessment needs. While the Center is market-oriented and confident that it will be able to support itself through contracted projects, it may need additional support, particularly in the form of foreign currency, to procure materials and supplies. AID should continue to monitor the status of this national asset and provide assistance should the RSC fail to meet its goal of becoming self-sufficient.

- Programs needing resource information and up-to-date planimetric maps should be encouraged to use RSC services provided they are competitive with other sources.

- RSC should prepare one large scale map with Spot or Landsat TM to demonstrate this capability and distribute it to all recipients of the Atlas.

- Satellite remote sensing, while relatively inexpensive compared with aerial photography, is considered expensive by most government agencies. RSC should explore every effort to make data available to those agencies at the lowest possible cost. This is particularly necessary in the early stages when the

agencies are exploring and assessing its value to their programs.

- RSC should continue to expand its communication with universities and user institutions through continued encouragement and support of such activities as the Egyptian Remote Sensing Committee.

3.0 REPORT OF FINDINGS

3.1 HISTORY AND BACKGROUND OF MPGAP

Growing out of a request from President Sadat to President Carter in 1979 for assistance in the assessment of Egypt's natural resources, USAID and the Government of Egypt (GOE) developed a program whose goals included the gathering of basic geotechnical information to attract investment for accelerated development of natural resources and devising effective means of disseminating that information to potential users. The program, identified as the Mineral, Petroleum and Groundwater Assessment Program (MPGAP) identified three key strategies to achieve project goals:

(1) Improve the organization of current data;

(2) Compile reports on newly-surveyed areas; and

(3) Develop GOE capacity to manage and disseminate this information.

Comprising a diverse package including training, equipment acquisition, and geologic and geophysical surveys, the assistance program targeted four GOE agencies with interest in or responsibility for mineral, groundwater and petroleum resource development. GOE agencies identified for assistance under MPGAP were:

- Egyptian General Petroleum Corporation (EGPC), together with General Petroleum Company (GPC);
- Egyptian Geological Survey and Mining Authority (EGSMA);
- Desert Research Institute (DRI), later renamed the Desert Research Center (DRC); and
- Remote Sensing Center (RSC).

GOE management coordination for MPGAP was to be provided by a Coordinating Committee chaired by the President of the Academy of Scientific Research and Technology (ASRT) and including the directors of the involved GOE agencies, a GOE project coordinator, the AID project officer, a project coordinator contracted by AID and GOE agency project officers.

The Project Agreement (Project No. 263-0105) between AID and GOE was signed on September 28, 1980. After delays caused by national security concerns over the availability of sensitive

information emanating from MPGAP activities, a $37.2 million assistance program was ratified by the Egyptian People's Assembly in April 1982. Later that year the first MPGAP activity was initiated. An airborne magnetic and radiometric survey for EGPC and EGSMA was conducted by Aero Service. This was followed in June 1983 with the signing of a technical assistance contract with Bendix Field Engineering Corporation (Bendix) to provide services to EGSMA, DRC and RSC.

Following a Ministerial change in 1985, EGSMA was moved from the Ministry of Industry and placed under the Ministry of Petroleum which was renamed as the Ministry of Petroleum and Mineral Wealth. From an organizational perspective, this realignment was useful to MPGAP activities because it brought two key GOE MPGAP agencies under a common ministry.

An interim evaluation of MPGAP was conducted in March 1986. It concluded that there was significant deviation from the management framework envisioned in the original project paper, stating that because ASRT had not taken a strong coordination role, no effective coordinating committee had materialized. The result was ineffective GOE program coordination and a failure to realize better interaction between MPGAP agencies. To correct this problem, the evaluation team recommended that AID hire a new project coordinator under a personnel services contract (the original incumbent resigned in 1985), and that the possibility of a GOE liaison officer be explored. Other recommendations included extending the Project Assistance Completion Date (PACD) through 1989, providing additional technical assistance to EGSMA in the preparation of mineral information packages, and continuing training and technical assistance for the computer facilities at MPGAP agencies.

For reasons outlined in the Project Evaluation Summary, AID chose not to implement several of the recommendations included in the interim evaluation, notably re-establishment of the GOE Coordinating Committee and re-appointment of the AID project coordinator.

In April 1987, after a series of management level disagreements between EGSMA and AID, further assistance to EGSMA under the MPGAP program was terminated by AID.

After further AID review of program progress in 1989, the PACD for MPGAP was extended to September 15, 1990. To allow for completion of certain important project activities, a final PACD of September 27, 1990 was established. The final funding level for MPGAP assistance, due to certain program re-orientations, was $33.7 million. This assistance was allocated between the participating GOE agencies as follows:

o	EGPC	-	$ 21.100 million
o	EGSMA	-	8.148 million
o	DRC	-	2.333 million
o	RSC	-	2.109 million
	Total	-	$ 33.700 million

3.2 EGYPTIAN GENERAL PETROLEUM CORPORATION (EGPC)

The Egyptian General Petroleum Corporation (EGPC) is a GOE agency established to monitor and administer exploration and exploitation of petroleum resources within Egypt. EGPC negotiates contracts with private companies and administers and makes recommendations on concession agreements submitted to the People's Assembly of Egypt for ratification. The Evaluation Team found EGPC management and staff to be highly professional and generally enthusiastic about the improvements in their capability and technical knowledge resulting from the MPGAP program. The MPGAP assistance provided to EGPC three major, but discrete activities, designed to improve the organization of current exploration, production and operation data.

3.2.1 Assessment of Petroleum Resources in the Western Desert, Nile Delta and North Sinai

A host country contract to assess the petroleum resources in the Western Desert was competitively awarded to Scientific Software Intercomp (SSI) for $2.05 million and LE 1.05 million. The purpose of the study was to compile geological and geophysical information from the Western Desert north of latitude 28 degrees and make qualitative and quantitative estimates of the petroleum resources. EGPC personnel did most of the work (70-75 percent) under the supervision of SSI. In November 1989 EGPC amended the SSI contract, adding the Nile Delta and North Sinai to the study area and increasing the contract amount to $2.5 million and LE1.3 million. In September 1990 EGPC added $50,000 to the SSI contract for enhanced training activities. Work will be completed by September 27, 1990.

This contract comprised several separate tasks beginning with a review and analysis of all published and unpublished literature relevant to the study area. The review incorporated all data supplied by EGPC, including the previous interpretations of that data.

A qualitative appraisal of the hydrocarbon resources of each basin in the study area utilized all pertinent geological and geophysical data. Stratigraphic, structural and hydrocarbon generation models and a method for determining risk factors for

individual prospects were developed. The products of this phase of the project particularly pleased EGPC management.

The quantitative aspect of the study involved the procurement of computer hardware and software and the development of techniques to appraise the amount of undiscovered petroleum resources in the study area. As a result of the contract, EGPC gained the capacity to perform economic modeling, incorporating such variables as interest rates, inflation and oil prices and their impact on economics. The contract included four IBM PSII's, two PC 80's with hard disk upgrade, one MicroVAX with three VAX terminals, additional peripheral equipment, and numerous software packages.

Concurrent with the development of the above-mentioned qualitative and quantitative assessment methods was the development of a geotechnical data base and an index data base. According to EGPC, these data bases will accommodate continued usage by their personnel including the input of future exploration and production information. EGPC was very satisfied with the work performed.

Training of EGPC technical staff constituted an important and successful aspect of the contract. Two geologists and two geophysicists obtained four weeks of US training in surface geological, petrophysical and economic courses. In all, 13 people from EGPC attended 14 SSI courses, plus on-the-job training.

Sustainability and private sector involvement both offer considerable promise as they relate to the project. Future private sector investment in the form of exploratory wells drilled, new field development and installation of production facilities will come as a result of contract achievements. The effectiveness of MPGAP assistance will be seen for many years to come as the positive economic impact of hydrocarbon resource development moves forward. The assessment will help in the marketing of these concessions in the Western Desert.

3.2.2 Petroleum Information System

The purpose of this activity was to develop and implement data bases for exploration and production to cover electric well logs, technical control of agreements, and training on a reservoir simulation system. In 1986, EGPC competitively awarded this host country contract to Integrated Technologies (IT), formerly Core Laboratories, both of which are divisions of Western Atlas International. The value of the contract including amendments was $1.58 million and LE 0.248 million. In the opinion of EGPC personnel, the rating of IT's performance in executing the contract was rather mixed.

3.2.2.1 Achievements and New Capabilities

Through the implementation of this contract, IT helped EGPC achieve a number of important goals and new capabilities. A number of PC-based petroleum engineering software packages were provided to EGPC for greater efficiency and accuracy. EGPC established a Wireline Log Data Base which involved the digitizing and/or reformatting of electrical logs of more than 500 wells. To improve control of geological and geophysical data, IT created an Exploration Index Data Base. In addition, IT worked with EGPC to install a custom-designed Exploration Agreements Data Base. Unfortunately, this task was completed nearly one year after the delivery date because: (1) it was discovered rather late that RBASE, the software initially chosen for the task, was inadequate for this job, and (2) lack of continuity of IT personnel (three different IT experts were involved in this task).

IT designed and installed a Local Area Network (LAN) to allow EGPC more efficient access to three newly created data bases and engineering/geological application programs and to allow controlled access between EGPC's and GPC's data base. The LAN seems to be working well, but some EGPC personnel complained that adding more PC's is a problem because to link into the LAN requires a special circuit card which is relatively expensive and difficult to obtain.

The Reservoir Characterization System (RCS), a self-contained reservoir/field system which has an automatic interface with Radian's CPS-PC mapping system and Terrasciences T-Log petrophysical system, is IT's own software package. Though CPS-PC, T-Log, and other vendors' software worked from the start, RCS software required nearly three years and a number of versions before it functioned properly; after one month of testing, the latest version seems to be working properly. EGPC has been extremely pleased with the non-IT vendors' software, but because of IT's inability to deliver a usable version of RCS, the MPGAP-funded maintenance agreements with the other vendors have expired although the entire system has only been fully functional for one month. In addition, EGPC personnel were critical of the inability of RCS to output tapes of wireline logs in Schlumberger's LIS format, the industry standard. IT has not yet completed this item which the Evaluation Team considers to be very important because it affects EGPC's ability to exchange log data with other companies.

GPC personnel complained that the PC's delivered to them were for US electrical systems not Egyptian, and it took nearly six months to purchase and deliver the transformers necessary to make the PC's operate. This situation should have been anticipated and avoided.

3.2.2.2 Training

The training provided by IT was generally well-regarded by EGPC and GPC managers and staff and included:

- Reservoir Characterization System (RCS) (2 weeks in Egypt)
  EGPC - 2 geologists and 2 geophysicists
  GPC - 3 geologists and 1 engineer

- CPS-PC (1 week in Egypt)
  GPC - 1 geologist

- Production Software and ADS (1 week in Egypt)
  GPC - 1 engineer

- Petroleum Engineering Software (15 days in US)
  EGPC - 8 engineers

- Black Oil Simulation Model and VIP (4 weeks in Egypt)
  EGPC - 22 engineers

- RDMS on-the-job training (6 months in Egypt)
  EGPC - 6 engineers

- Novelle SFT Netware System (2 weeks in Egypt)
  EGPC - 1 geologist
  GPC - 1 geologist

Though generally good, EGPC personnel felt that IT's Novelle course was incomplete and might have been better if taught by Novelle personnel. GPC expressed the desire to have QC software training since it was not included in the training program.

3.2.2.3 Impact and Sustainability

Now that data bases have been created, geoscience and engineering application software installed, users trained, and the LAN working, EGPC's ability to access and disseminate information and to perform more complex exploration, production and administrative operations is more rapid and efficient. It is already evident that EGPC personnel believe that much has been accomplished and will continue to expand and build on their new computer capabilities. The Evaluators find that EGPC's and GPC's new computer capabilities will improve their ability to function efficiently in a highly technical industry.

3.2.3 Management Information System (MIS) and Upgrade of the EGPC Library

The purpose of this activity was to design, develop, and test a pilot-scale Management Information System (MIS) for EGPC exploration, production, and operation divisions. This was followed by an upgrade of the EGPC library. AID signed a direct contract buy-in work order with Bechtel Corporation (Bechtel) in July 1989; with two subsequent amendments, the total contract value increased to $1.48 million. Bechtel's task included integrating the systems installed by IT and SSI in separate parts of the MPGAP project with limited funds allocated to the task. Though not all objectives were achieved, Bechtel and EGPC reach solutions satisfactory to both parties. EGPC rated Bechtel's overall performance to be good to very good.

The operations, exploration and development departments of EGPC have had their needs in MIS researched and addressed, and now have a data base that they can expand and develop. However, EGPC did comment that one of the tasks in the project, to coordinate the hardware and software installed by SSI and IT, could have been better executed. According to the contract, EGPC felt that an interface should have been installed between the VAX and IBM mainframe and that a means by which data could be transferred between the data base and the IT system should have been installed by IT. This task has yet to be completed.

Bechtel has refurbished the EGPC library, where the agency is now preparing to place books and periodicals on their new shelves. EGPC personnel noted the training provided by Bechtel was excellent. Five information system specialists each received five weeks of training in the US, plus more on-the-job training when EGPC personnel worked with Bechtel experts in Egypt.

EGPC is continuing data base entry format and between 60 and 70 percent of this is now completed. EGPC has plans to create a petroleum data base center that will allow the 42 joint venture companies to have controlled data access. This will make their data base much more useful to the joint venture companies, while maintaining the necessary confidentiality.

3.3 GENERAL PETROLEUM COMPANY (GPC)

The General Petroleum Company (GPC) conducts exploration and production activities on concessions that it holds solely, or jointly with private companies. On behalf of GPC, EGPC negotiates, approves and signs all contracts which GPC executes. Contract management is provided by a joint EGPC/GPC committee. Because GPC is active in exploration, it is prevented by EGPC from accessing data from concessions in which it is not a partner. The Evaluation Team found GPC management and staff to

be highly professional and enthusiastic about the improved capabilities and skill resulting from MPGAP. GPC worked with US contractors funded by MPGAP to implement six major activities.

3.3.1 Aeromagnetic and Radiometric Survey in the Eastern Desert

A comprehensive radiometric and aeromagnetic survey was conducted over 212,000 line kilometers by Aero Service, a division of Western Geophysical Company, between 1982 and 1986. Maps, reports and an interpretation of the entire area were obtained by GPC from Aero Service. Aero Service was highly rated for its performance in completing this $7.1 million contract. In the Evaluators' view, Aero Service did an excellent job in fulfilling the purpose of the MPGAP project in attracting private investment and technology transfer.

The survey, encompassing 80 percent of the Eastern Desert, is an aid to petroleum and minerals exploration. A second phase of the project comprised compilation of newly acquired aeromagnetic data and digitization of vintage data in the Western Desert. This project led to the publication of an aeromagnetic map of Egypt (which EGPC markets) and the establishment of an aeromagnetic data base within EGSMA.

A total of 25 technical people from EGPC, EGSMA, GPC, and the Nuclear Materials Corporation (NMC) participated in the Aero Service training program in Egypt. The program itself was divided into three separate courses and workshops - aeromagnetic data acquisition (1 week), processing (1 week), and interpretation (1 week). The training provided by Aero Service was considered to be very helpful and improved GPC's capability in conducting aeromagnetic work. In addition, an Egyptian steering committee, composed of one representative each from EGPC, EGSMA, GPC, and the NMC, visited Houston on three separate occasions to oversee the progress of the work.

As a result of this successful contract, GPC has upgraded the Potential Methods Section that includes a ground magnetic crew which has the capability of conducting detailed field surveys. In addition, GPC personnel enhanced their skills to a level necessary to plan and execute their own aeromagnetic survey contracts in the future.

GPC commented that AID host country contract selection criteria and requirements were extremely tedious. However, some of the AID contracting criteria have been adopted by GPC and are now being applied for contractor selection in non-AID jobs.

Six international oil companies have purchased the aeromagnetic map of Egypt, which may lead to future oil and

mineral exploration. In addition, aeromagnetic contractors will be hired in the acquisition and processing phases when new surveys are carried out. While not representing a true foreign investment, such data processing is a necessary precursor to subsequent private sector investment.

3.3.2 Seismic Survey of the Asyut/Qena Area

EGPC, on behalf of GPC, awarded a host country contract to Geosource in August 1986 for a seismic survey of the Asyut/Qena area of Upper Egypt. The study further delineated a basin whose existence had been confirmed earlier by gravity and aeromagnetic investigations. The study comprised several distinct tasks including a review of existing data, reprocessing of previously recorded seismic data, acquisition and processing of new seismic data, and interpretation of all data culminating in the generation of a final report. Geosource incorporated other relevant non-seismic data (i.e., subsurface geological and geochemical information) into the final interpretation. Work under the $2.17 million contract was completed at the end of 1987.

The contractor performed its function well and generally did a good job. Contents of the final report are considered by GPC geophysicists and management to be very useful in the development of an oil and gas exploration program. Owing to a lack of time to thoroughly review the report, the Evaluation Team could not reach a definitive conclusion regarding long-term impact.

Soon after the study was completed, a technical presentation highlighting the study results was given in EGPC offices and attended by over 150 oil company representatives. The extent to which the Asyut/Qena basin appears attractive to international oil and gas exploration companies is already becoming evident as several companies are currently negotiating for concessions. The evaluation revealed an optimism on the part of GPC personnel that the study area contains suitable reservoir rocks, thermally mature source rocks and perhaps geologic structures conducive to the accumulation of commercial hydrocarbon deposits. These factors alone should result in industry interest sufficient to warrant the drilling of some exploratory wells. Further oil and gas discoveries in the area will obviously generate additional private sector interest.

Technical training for GPC and EGPC personnel associated with this project was quite extensive. A number of geologists and geophysicists received both field training (i.e, during data acquisition phase), as well as classroom training in geochemistry (vitrinite reflectance, pyrolysis) and reservoir geology. Technical committee members (6 from GPC and 1 from EGPC) monitored project activity in the United Kingdom and in the

United States for a total of 180 days. A 5-day technical seminar in August 1987 was attended by 30 explorationists from EGPC and GPC. The seminar, held at GPC facilities in Cairo, was presented by seismic processing and interpretation specialists and geological experts.

3.3.3 Seismic Survey in the West El Guindi Basin

As a follow-up to the Asyut/Qena survey, a comprehensive 1004 kilometer seismic survey was conducted across a 23,000 square kilometer area in the West El Guindi basin southwest of Abou El Gharadik in the Western Desert. As in the previous survey, the contractor selected was Geosource, which GPC rates as having done an excellent job. The Evaluators noted the enthusiasm of GPC personnel in their description of the project and appreciation of newly acquired skills in executing a multi-discipline basin analysis.

Training under this contract included:

- Field acquisition (2 weeks in Egypt) - 12 geophysicists
- Global Basin Classification (5 days in Egypt) - 30 geologists and geophysicists
- Reservoir Geology (3 days in Egypt) - 30 geologists and geophysicists
- Geochemistry (5 days in Egypt) - 8 geochemists
- Technical Seminar (3 days in Egypt) - 35 geologists and geophysicists

Also, for project monitoring, a technical committee composed of 5 GPC and 1 EGPC representative spent a total of 180 days in the US and UK in addition to the 180 days under the Asyut/Qena contract.

The $1.3 million Geosource contract involved interpretation of seismic data and surface geology, reinterpretation of core, geochemical, log, land gravity and land magnetic data. The seismic data quality was better than in the Asyut/Qena survey primarily because the terrain was better. GPC has enhanced their ability to conduct the administration, training, planning and contractor relations for interdisciplinary projects such as this one, and believes that it is now better able to carry out such studies.

A number of oil companies, including Amoco, Exxon, Mobil and Shell have expressed interest in purchasing the seismic data which will be highlighted in EGPC's Exploration and Production Convention to be held in November, 1990. The marketing and future sales of the seismic data to oil companies may lead to more concession acquisition and exploration. Through this study, GPC has been able to high-grade certain areas, which they will

recommend for more detailed studies on their own or with joint venturers.

3.3.4 Enhanced Oil Recovery (EOR) Feasibility Study and Pilot Injection Test

In November 1985, EGPC awarded a $0.46 million competitive host country contract to Improved Petroleum Recovery, Inc. (IPR) to determine the most appropriate method of enhanced oil recovery. In October 1986, IPR completed the study which recommended a gas injection pilot test activity at the North Bakr field. EGPC developed the scope of work for the pilot test during 1987. In March 1988, EGPC signed a $4.6 million and LE380,000 host country contract with IPR to implement the gas injection pilot test. The pilot test injection program was designed to assess the technical and economic feasibility of implementing gas injection fieldwide. At the time of this writing, not all of the tasks included in this project had been completed. A key task which remains unfinished is a 3-D computer simulation of the Eocene limestone reservoir at the North Bakr field.

Interviews of GPC and IPR personnel yielded conflicting information regarding the reasons for the lateness of the 3-D model. The complexity of the faulted and fractured reservoir and the provision of incorrect reservoir data (such as porosity and relative permeability) by IPR to an earlier 3-D model is not disputed by either party. IPR admits that erroneous input parameters used by their technical staff during cross-section modeling pushed the entire project back by six to nine months. A total of nearly ninety 3-D computer simulation runs have been made over the last 7 months, and an acceptable history match between theoretical and observed reservoir performance has yet to be obtained. Model results indicate a sharp increase in water cut followed by a continual decline over the 20+ year history of the field. Field performance water cuts are substantially higher than model results indicate.

A quality control contractor (QCC), Mr. Daylon Walton, was hired by AID to provide technical assistance to EGPC, GPC and AID in monitoring the progress of the contract with IPR and in maintaining a quality assurance program for the different deliverable items. Mr. Walton concurs with the opinion of the Evaluation Team that a proper history match between modeled and measured water production volumes has not yet been achieved. The Evaluation Team believes that IPR will not achieve a successful history match by the September 27, 1990 MPGAP completion date. The Evaluation Team understands that EGPC and IPR will successfully negotiate an agreement to complete the pilot test activity after MPGAP assistance ceases on September 27, 1990.

IPR defends their position in part by claiming that events beyond their control (namely mechanical failure of a gas compressor) have hampered their ability to accurately monitor field performance of the pilot operation. Also, the complex reservoir geometry has made it more difficult to adequately define the boundary conditions of the reservoir than originally anticipated. Suspected reservoir communication, either laterally across a fault that was thought to be sealing or vertically through the overlying Nullipore reservoir, has greatly complicated the task of tracking water migration pathways.

GPC contends that the principal reason for the project not being completed on time is the lack of continuity of IPR personnel. Only one IPR simulation engineer has been with the project since its inception and he is a junior team member with no prior reservoir modeling experience. Other more senior people have apparently been involved in the project on an intermittent basis or terminated their employment with the company in "mid stream".

Aspects of the study that met with somewhat more success were those of technology transfer and training. GPC benefitted from its exposure to state-of-the-art equipment, instrumentation and software. IPR provided four weeks of training at their Dallas corporate headquarters and operational on-the-job training for five GPC engineers and three EGPC engineers. Comments received from GPC management indicated that the quality control system implemented on this project also worked well.

Programmatic achievements and their sustainability are difficult to fully assess due to the incompleteness of the project.

3.3.5 Feasibility Study of Assran Oil Field

EGPC awarded a host country contract for a feasibility study of the Assran oil field to Scientific Software Intercomp (SSI) in October 1989. The purpose of the study was to determine the feasibility of utilizing enhanced recovery methods to produce heavy oil at Assran field in the Gulf of Suez. SSI also addressed methods for improving procedures to process and treat the oil in this field. The study was completed in April 1990 at a cost of $80,000.

A variety of enhanced recovery methods were studied, including water flood, gas injection and steam flood. The relative merits of each method were evaluated and the determination was made that producing the 13 degree API gravity oil would be best facilitated by steam flooding. This method is expected to improve recovery of oil in place from one percent to a much more acceptable 46 percent over a 20-year or greater

project life. The recoverable reserves from the upper dolomite member would therefore increase to 290 million barrels of the 631 million barrels of oil in place. Using a price of $12.43 per barrel, the added value of oil produced using steam flooding versus primary depletion would be over $3.6 billion. All of the contractor goals were successfully met and contractor performance was judged by GPC personnel interviewed to be very good.

GPC should now have the capability to carry out the recommendation of SSI to design a steam injection pilot project. If done properly, the greatest possible ultimate recovery of oil and financial return can be realized. The planning should be carried out to optimize the amount and quality of information that can be derived from the next stage of any fieldwork. This will yield good and interpretable field data which will lead to better interpretations of the results and better decisions on the future development of the field. The execution of the pilot project by GPC without outside technical assistance will require about two years and $2.5 million for capital investment and operating costs. Monitoring and evaluation of this pilot project is necessary and would require still more funding. Total elapsed time for the entire project is approximately four years from decision to design the pilot project to the final evaluation of results. Total cost would be approximately $3.15 million.

Private sector involvement resulting from the implementation of the SSI study recommendations will undoubtedly be considerable, especially during the initial phases. One possible scenario would have GPC initiate and execute pilot activity with private investors financing subsequent field development. In any case, the installation of field equipment and maintenance thereof will require private sector involvement.

The MPGAP contribution to GPC through this program is judged to be very significant. The assistance provided will benefit both GPC and the Egyptian government as its petroleum resources are developed in an efficient and effective manner.

3.3.6 Strengthening and Rebuilding of GPC Library

A project designed to organize and upgrade the library at GPC was undertaken by Bendix as part of a long-term technical assistance contract. The work essentially consisted of procurement and installation of library shelving, the purchase of some books and periodicals and the installation of a data retrieval system. One AT&T PC was also purchased with MPGAP funds. Almost all of the reports in the library are internal reports. The work was recently finished and is generally considered by GPC to have been done well.

Some training was included in the contract, and two GPC employees were trained in library science in the US for ten weeks. Much of the training centered on development of a computerized data base for library materials.

One obvious benefit to the modernization process is the speed of access to library materials via computerization. Some interagency benefit was also realized as EGSMA and DRC personnel along with university students utilize the new library facilities.

One problem voiced by the GPC manager in charge of this project was the access to funds available for the purchase of periodicals. Subscriptions for these technical journals require payment "up front" and in foreign currency. The lack of access to foreign currency and the apparent reluctance of GOE to provide funds for important technical journal subscriptions makes for an untenable situation. The cost of such subscriptions is relatively small and a way should be found to purchase them.

3.4 EGYPTIAN GEOLOGICAL SURVEY AND MINING AUTHORITY (EGSMA)

The Egyptian Geological Survey and Mining Authority (EGSMA) was formed in 1896 and since that time has functioned as the primary generator of basic geologic and mineral resource information concerning Egypt.

Over the more than 80 years prior to the initiation of the MPGAP project, EGSMA personnel were responsible for the generation of thousands of reports, maps and other documents describing the geology and mineral resources of Egypt and its adjacent waters. Cataloging, storage and retrieval of this body of information became an increasingly serious problem.

In addition, over the past 25 years, great strides have been made in the methodology, techniques and increasingly sophisticated equipment available to geoscientists. Unfortunately, EGSMA scientists had been largely unable to access much of this new technology.

The need to improve information storage, retrieval and dissemination, an ability to access and use state-of-the-art technology, and a desire to accelerate mineral resource development through greater private sector participation formed the basis for MPGAP assistance to EGSMA.

3.4.1 Programmatic Accomplishments and Shortfalls

EGSMA participated in MPGAP as part of the Minerals, Groundwater and Remote Sensing (MGRS) program, which was managed

by an AID direct contractor, Bendix Field Engineering Corporation (Bendix). This program was designed to provide equipment, training (both in-country and overseas) and facilities upgrades to EGSMA. In addition to MGRS, EGSMA participated in the large aeromagnetic survey under a $7.11 million host country contract that EGPC awarded to Aero Service.

In general, progress by EGSMA toward the programmatic goals of MPGAP has been substantial, though the early (April 1987) separation of EGSMA from the program resulted in a diminution of the final programmatic results achieved. This problem is discussed in more detail below.

The aeromagnetic survey was completed on time and on budget, and the maps, overlays and related documents generated by the survey have provided EGSMA with a wealth of basic information and a long list of potentially significant anomalies which require field follow-up.

EGSMA has initiated systematic field evaluations of these anomalies on a priority basis with, in several cases, encouraging results. This field program will be continued and, given the number of significant anomalies to be evaluated, several years of intensive field investigation will be required.

MGRS provided EGSMA with a substantial amount and variety of equipment, including 28 field vehicles, induced polarization (IP) geophysical equipment, analytical laboratory equipment, computers and related peripheral equipment, cartographic equipment, including a large format camera, and a substantial number of library volumes and furnishings.

As far as could be determined, all equipment called for under the MGRS program was provided, though there are some unresolved questions regarding the compatibility of some of the computer systems and related peripheral equipment. Additionally, long-term maintenance and servicing of equipment is an ongoing concern of EGSMA and the Evaluation Team.

The training provided through MGRS was a major positive accomplishment. This area is discussed in more detail subsequently, but it can be said here that, with few exceptions, the training program, both in-country and overseas, provided a significant enhancement to the technical capability of EGSMA professionals.

Refurbishing of the EGSMA library facilities, provision of a significant number of new library volumes, development of a computer-based bibliographic data cataloging and retrieval system, and training of library staff have resulted in a high quality library system with first-class facilities and a sound basis for future growth.

Perhaps the major disappointment of the EGSMA program was the inability to develop proper, focused mineral packages designed to attract the interest and involvement of private sector investors. In the Evaluators' view, this was due initially to the inability of Bendix to provide EGSMA with proper technical guidance in the preparation of such documents.

However, late in 1986, Bendix arranged for the services of a US expert in mineral economics and natural resource commercialization. Over a period of two months, the expert conducted a series of seminars on mineral economics and resource development, reviewed mineral commodity reports prepared by EGSMA, prepared a plan to assist EGSMA in commercializing Egyptian mineral resources and reviewed and commented on the gold concession agreement executed with Minex, a British mining concern.

Actual preparation of the mineral packages was to be done with the assistance of the Bendix resident editor who did not have proper mineral economics background to provide effective guidance to EGSMA.

Despite inadequate assistance in mineral resource development, EGSMA has made significant progress in commercializing Egyptian mineral resources. A model mineral concession agreement was developed. Several advertisements were placed in international financial journals such as the Financial Times and the Wall Street Journal. These activities were pursued in parallel with, but outside of, MPGAP.

Three mineral concession agreements have been signed. Minex of London signed an agreement for a gold concession in March 1986 and Freeport Sulphur of the US signed agreements for sulfur concessions in the Sinai area (July 1987) and the Gulf of Suez (March 1988). EGSMA is currently negotiating with BHP-Utah for a potash concession.

Interest in the potash areas grew out of fieldwork carried out by EGSMA as a part of MPGAP, and while Minex had been interested in gold exploration in Egypt prior to the initiation of MPGAP activities, it was not until the completion of the model concession agreement that negotiations were successfully consummated.

It should be noted that, though focused mineral packages were not developed, EGSMA has produced five information packages on various commodities. These documents provide a wealth of technical information on the occurrence and preliminary evaluation of specific commodities and would be a most useful adjunct to a focused mineral package.

While the information packages contain substantial amounts of useful technical information, they lack the economic investment focus necessary to be effective in attracting private sector interest.

Over the course of the MGRS contract problems developed between the contractor, Bendix, and EGSMA management. Some of these were project-related, i.e., the inability of Bendix to provide timely and qualified specialist assistance for development of mineral packages, while other problems related to personal animosities which developed over time between the Bendix resident project director and EGSMA management.

This situation was exacerbated by a change in the Chairmanship of EGSMA in mid-program. The new Chairman sought to reorient the priorities and direction of the EGSMA involvement in MPGAP, thus coming into conflict with both Bendix and AID staff.

The net result of these difficulties was the separation of EGSMA from MPGAP in April 1987, six months ahead of the completion of the MGRS program and more than three years prior to the completion of the MPGAP project.

Lacking the ability to interview Bendix personnel, it is difficult for the Evaluation Team to fully assess this situation. It appears that personality conflicts were at the heart of much of the problem. This is unfortunate because it suggests that the problem could have been resolved with more effort on both sides.

3.4.2 Contractor Performance

The primary contractor guiding EGSMA involvement in MPGAP was Bendix. Through the MGRS program, Bendix was to serve a variety of functions including:

- Negotiation and agreement with EGSMA on equipment and training packages to be provided through MPGAP;
- Identification and retention of short-term US specialists and training programs in the US;
- Handling the management and logistics involved with bringing US specialists to Egypt to provide training, and bringing Egyptian professionals to the US for training;
- Overall management of the MGRS program including development of interagency communications, cooperation and coordination;

- Development of systems to encourage private sector investment in mineral resource development; and

- Organization and implementation of periodic MPGAP information dissemination meetings, newsletters and other means to publicize MPGAP activities.

Review of available documents and interviews with relevant EGSMA staff suggest that Bendix carried out its tasks with mixed results.

A major element of the MPGAP project for EGSMA was technical training, both in-country and in the US. Bendix did an excellent job of identifying highly qualified US specialists to provide a variety of training experience for Egyptian professionals in-country. Likewise, a large number and variety of training courses in the US were organized and carried out. While there were a few instances where, for various reasons, training was ineffective, on balance the Bendix training effort was highly successful.

Under the auspices of the Bendix training program, the following EGSMA training was provided:

In-country training:
- English language training - 77 personnel
- Computer training - 28 personnel
- Report writing - 11 personnel

US training:
- 58 professional staff received 142 person-months of technical training
- 4 management personnel received 4 person-months of senior training
- 10 senior personnel attended seminars totalling 5 person-months

For an organization like EGSMA, diverse training requirements exist. For field geologists, two types of training are required: (1) in-country field studies provided by visiting US specialists, and (2) US study tours led by US experts of relevant ore deposits, mining districts and operating mines.

For equipment-focused professionals (MIS/GIS computer specialists, instrumental laboratory professionals, cartographic specialists, etc.), in-country training on EGSMA equipment is far more valuable. For professionals responsible for editing and report publication, training at the American University of Cairo, supported by short-term involvement of visiting US specialists is a very effective combination.

Bendix recognized this diversity of training requirements and successfully tailored its training program to meet those needs.

The performance of Aero Service in providing the aeromagnetic/aeroradiometric survey to EGSMA and EGPC was well-handled and well-executed, and EGSMA was provided with all contracted deliverables on time. This subject was discussed in greater detail in Section 3.1.

According to the MPGAP project plan, Bendix had the responsibility to negotiate with EGSMA and the other MGRS agencies to define in detail the packages of equipment to be acquired. Actual procurement and delivery, however, were the responsibility of EGSMA. This divided responsibility worked to the detriment of overall MPGAP project success and should be avoided in future projects of this type. The Evaluation Team believes that the overall timeliness and adequacy of the provision of equipment packages to MPGAP agencies would have been improved had Bendix been responsible for both the definition of equipment packages <u>and</u> their procurement.

EGSMA pointed out several instances where (1) equipment was non-functional or in need of repair or adjustment, with no local service or maintenance capability available, and (2) parts of computer packages designed to work together were incompatible.

3.4.3 Training Programs

The MPGAP project provided a large and diverse training program for EGSMA. The thrust of this program was: (1) improving the capability of EGSMA to organize, catalog, store and retrieve the large amount of geoscience information already in its possession, (2) enhancing the capabilities of its professionals to use the latest mapping and evaluation techniques, (3) developing field and office capability with state-of-the-art geophysical equipment and techniques, (4) upgrading the analytical capability of EGSMA to handle more sophisticated laboratory equipment and techniques and to provide a broader range of analytical services in support of EGSMA field programs, and (5) enhancing the capability of EGSMA to produce high-quality maps through improved cartographic skills.

As was mentioned previously, the Evaluation Team believes this program was, overall, highly successful. Training was an integral part of equipment acquisition and a number of EGSMA professionals were trained to handle the variety of equipment provided with MPGAP assistance.

There were individual instances where specific training efforts were felt by EGSMA to be too short or inadequately

focused to EGSMA's needs, or where individual trainees did not function well in the culture of the US. Further, a case can always be made for more training, whether that be training for a larger number of individuals or longer, more in-depth training efforts. On balance, however, the Evaluation Team is satisfied that the MPGAP training program for EGSMA was highly successful. Further, EGSMA management reported a virtual total retention of professionals who received training with MPGAP assistance.

3.4.4 Data Management and Handling

Through MPGAP assistance, the EGSMA library was completely renovated. Significant numbers of new volumes and periodicals were added, and a computer-based bibliographic and data management and retrieval system was put into place. EGSMA staff, trained under MPGAP, are now working steadily on the enormous task of cataloging the huge volume of existing geoscience information available in the library and have the capability to incorporate new information as it is generated.

EGSMA has organized the voluminous data provided by Aero Service in such a way that individual data sheets are readily accessible for review. Original flight tapes, as well as processed tapes are cataloged and stored, though the Evaluation Team is concerned that tape storage facilities may be inadequate for long-term preservation of these data.

3.4.5 Information Exchange and Interagency Cooperation

The original MPGAP plan called for a GOE Coordinating Committee to act as the focal point where the GOE agencies would be drawn together, where interagency problems would be resolved and where the communication and coordination sought as a part of MPGAP would be fostered.

For reasons elaborated very adequately in the interim evaluation report (1986), the GOE Coordinating Committee never became a functional entity. This was extremely unfortunate, though perhaps predictable, because the diversity of agencies involved and the broad spectrum of activities included, really required an effective body acting on the GOE side to function as a clearinghouse and point of resolution for interagency problems.

Coupled with the ineffectiveness of the GOE Coordinating Committee, the early departure of the US coordinator, Dr. David Snow, an AID Personal Services Contractor, without a replacement being appointed also inhibited the enhancement of interagency coordination and communication.

There has been good cooperation between EGSMA and EGPC/GPC with respect to the utilization of the aeromagnetic survey data. There appears to have been reasonable cooperation and communication between EGSMA and DRC, at least during the period of direct participation by EGSMA in the MPGAP project. As is frequently the case in governmental agencies the world over, individual one-on-one contacts between agency personnel continue to be the most effective means of information exchange.

Interaction and data exchange between EGSMA and RSC has been minimal. Reasons for this are discussed in more detail in Section 3.6. Additionally, EGSMA has had direct access to Landsat imagery and analysis through a program funded by the British Overseas Development Agency (ODA). This has reduced the need for and likelihood of direct interaction between EGSMA and RSC, although RSC has processed tapes provided by ODA.

3.4.6 Impact and Sustainability of MPGAP Activities

Clearly, MPGAP has had a significant impact on the ongoing activities of EGSMA. Details of equipment, training and related development have been elaborated above and need not be repeated here. That EGSMA is a more competent, better-equipped, more effective agency as a result of MPGAP inputs can be clearly observed.

The major impacts of MPGAP assistance to EGSMA were in the areas of field training of EGSMA geologists, refurbishing of the library, equipment and training provided to the EGSMA analytical laboratory facilities and cartographic department, provision of field vehicles and the aeromagnetic survey.

EGSMA notes that the induced polarization (IP) equipment provided to EGSMA has yet to be used in the field owing to a lack of training of field operators. The requisite training was provided to senior EGSMA staff, but EGSMA management needs to transfer this technology to field operating personnel so that effective utilization of this valuable exploration equipment can be initiated.

The extent to which MPGAP-assisted programs will be sustainable over the long term depends in large part on EGSMA management decisions. In this respect it is important to remember that MPGAP was not designed to provide any funds for EGSMA's operating budget. Thus, normal programmatic activities were, and will continue to be, funded through the existing GOE budgeting process.

Some MPGAP-assisted activities will clearly be sustainable. Training of individual professionals will have ongoing impact on the success of EGSMA programs. To the extent that training

provided is passed on from one individual or group to another, the impact and sustainability of the training will be further enhanced. EGSMA management is strongly urged to continue to encourage internal technology transfer. This could take the form of regularly-scheduled internal seminars, field trips and other mechanisms to encourage technology transfer.

The EGSMA library has been put on a firm, professional footing and an excellent foundation on which to build has been established. Sustainability should be viewed in terms of (1) continuing to expand the holdings of the library, and (2) continuing the already-established system of bibliographic data processing.

With regard to the first item, EGSMA should continue to acquire international geoscience periodicals in order to keep pace with evolving thought and technology in the geosciences. This will require a regular and ongoing subscription program for which access to foreign currency funds will be required.

To sustain the library data processing function will require annual operating funds for personnel and supplies and, very importantly, regular servicing and maintenance of data processing equipment.

Throughout EGSMA one of the key elements affecting the sustainability of MPGAP-assisted activities is the regular servicing and maintenance of equipment. Almost without exception, this is a concern raised in every department of EGSMA.

While it is clear that such regular servicing and maintenance of equipment is essential to the long-term viability of both the equipment and the programs supported by the equipment, it is less clear if EGSMA management has a full appreciation of this need and a determination to provide the ongoing budgetary resources necessary to support this essential program. This need cannot be emphasized too strongly.

3.5 DESERT RESEARCH CENTER (DRC)

3.5.1 Background for MPGAP DRC Program

Of major importance to the success of MPGAP, is the availability of groundwater for the development and processing of the country's petroleum and mineral resources. To be fully successful the quantity and quality of groundwater available for such purposes must be such that the mining and petroleum development does not infringe on groundwater use for agriculture and public supply, especially in the desert.

The Desert Research Center (formerly Desert Research Institute in previous MPGAP reports) had responsibility for the groundwater phase of MPGAP. DRC is located organizationally under the Ministry of Agriculture and Land Reclamation. Under the MPGAP project, the training, equipment, and supplies provided to DRC were designed to upgrade the organization so it could continuously produce the required geologic, hydrologic, and geochemical data needed to find new, or to evaluate old, groundwater reservoirs near the locations of potential natural resource developments.

The proposed DRC program under MPGAP included the following:

(1) Surface and subsurface exploration and mapping of areas in the Eastern and Western Deserts where petroleum and mineral resources are known to occur;

(2) Analysis and evaluation of the groundwater potential, including quantity and quality, in those desert areas and preparation of reports, maps, and groundwater mathematical models;

(3) Upgrading laboratory facilities and field equipment related to groundwater quantity and quality studies;

(4) In-country and US training of DRC staff in hydrogeology and related disciplines, and in the proper operation, maintenance, and repair of laboratory and field equipment related to groundwater studies; and

(5) Organization of the library and basic data collection in a computerized file such that data and data interpretations could be made readily available to researchers and commercial investors.

The review of DRC activities and accomplishments under MPGAP was carried out by study of MPGAP reports; interview of many DRC staff at all levels; inspection of existing laboratory facilities and laboratory and field equipment; review of technical library and facilities of the computer data and geographic information system centers; study of project reports and investigative methods; and evaluation of training through discussions with trainees and their supervisors.

3.5.2 DRC Staff

The DRC staff consists of 861 people, 139 of whom are professor and assistant professor researchers (PHD), 75 are research assistants and assistant researchers (MSc or BSc), and the remaining 647 are technicians, administrative staff, technical assistants, and laborers. DRC has a very

interdisciplinary staff and has 40 years experience in Egyptian deserts. The management and staff members at all levels were enthusiastic and appreciative of the benefits of the MPGAP input to DRC. The staff has an excellent professional attitude, an eagerness to learn new techniques and perseverance in applying those techniques to problems related to MPGAP objectives and beyond. The Evaluation Team was impressed with the capabilities of the DRC professional staff at all levels.

Management at DRC appears to be delegated down from the Director to the Head of the Geologic and Geophysics Department, and the Head of the Drilling Department, as well as the heads of other departments not involved directly in MPGAP. Details of the degree of delegation below those levels were not available, but it was noted that various personnel at lower levels were given the opportunity to personally describe and demonstrate their activities and accomplishments.

3.5.3 Programmatic Achievements

As a result of MPGAP, DRC is much better equipped to carry out field and laboratory data collection and generation and to analyze and interpret the information quantitatively. The computerized data system provides faster production of complicated groundwater analyses, and the geographic information system (GIS) permits analyses and relationships to be produced in a form ready for publication. The GIS center is well-equipped and staffed with competent people and should be useful not only to DRC but also to other GOE agencies and national and foreign investors.

DRC had the MPGAP task of finding groundwater supplies in the Eastern and Western Deserts to support future oil well drilling and the mills and camps needed to develop new petroleum reservoirs or mineral deposits. Three project areas were selected for groundwater assessment in the Eastern Desert on the basis of potential value to mineral and petroleum development: I- Quseir-Mersa Himeira; II- Ras Gharib - Ras Gemsa; and III- Wadi Araba. One area was selected for groundwater assessment in the Western Desert - the Al Bakariya Oasis. Following DRC inventory, sampling, and geophysical logging of existing wells in these areas, resistivity geophysical exploration of the subsurface materials were carried out. Based on these preliminary investigations, a detailed groundwater drilling program was carried out between May 1986 and March 1990, with a total of 28 wells drilled in the Eastern Desert projects and 5 wells drilled in the Western Desert project. A total of 4,500 meters of well and test hole drilling were completed. Approximately 500 water quality samples were collected in the Eastern and Western deserts over the period of study and were analyzed for a large suite of chemical constituents in DRC laboratories.

As a result of DRC's detailed geologic mapping, geophysical and geochemical investigations, and groundwater well-drilling program, two significant groundwater reservoirs were discovered in the Eastern Desert - Wadi Dara (southwest of Gharib) and Wadi El Nakheil (northwest of El Quseir). Marathon Oil Company was waiting for a water supply to start drilling on the eastern coast and immediately started hauling water from the wells in Wadi Dara.

In the Western Desert, previous investigations in the Al Bahariya Oasis indicated a high potential and significant fresh groundwater reservoir. DRC's detailed systematic studies under the MPGAP project revealed a fresh groundwater aquifer of such size that it likely would permit future expansion of agriculture, tourism and mining activities. For example, this water may permit iron ore dressing at the El Gedeida mines (near the northeast end of the Oasis) rather than at the factory in Helwan, which currently adds to the pollution of the Nile.

3.5.4 Programmatic Shortfalls

DRC had requested purchase of a drill rig, but a programmatic decision was made to rely on EGSMA for well drilling. Because of a delay by EGSMA in carrying out the drilling, DRC was given the approval to purchase its own drilling rig. The procurement and delivery added an additional delay of 20 months to this activity. Furthermore, adequate supplies of operating spares were not delivered with the drilling rig, necessitating additional orders for spare parts, some of which were not received until September 1990. The delay was regrettable because the drill rig was vital to DRC groundwater exploration.

Although some books and journals were procured under MPGAP for DRC, in general the library is quite deficient and out of date for both books and journals dealing with hydrology, geophysics, geochemistry and hydrogeology.

3.5.5 Contractor Performance

Bendix, the MPGAP AID direct contractor, completed a creditable job, apparently often under some very trying circumstances. However, one problem was the simultaneous travel to Egypt of a number of needed groundwater specialists and the last minute implementation of a training program for the Head of the Drilling Department, all in the last month or two of the Bendix contract. Bendix sent computer data processing, computer groundwater modeling, and groundwater planning and investigation experts to DRC, making it difficult for anyone to spend adequate

time with DRC staff members. Of course, there may have been extenuating circumstances, but similar actions should be avoided in future contracts.

3.5.6 Private Sector Investment and Involvement

As mentioned earlier, Marathon Oil Company is already involved in buying needed water from wells drilled by DRC in an aquifer discovered by DRC scientists. There is now opportunity for other petroleum or mineral development because of the several other groundwater reservoirs already discovered in the Eastern and Western Deserts. In addition there may be long-term commercial use of the water supply for new agricultural development for potential new tourist resorts along the seacoast, or for existing tourist resorts, which now must truck or pipe their water long distances.

Apparently there are already some negotiations underway to use the geographic information system to demonstrate groundwater capabilities for urban development in some desert area. This kind of activity possibly could develop into a sizable program.

3.5.7 Training

During the period of the MPGAP project, seven DRC staff members obtained 7 to 9 weeks of hydrogeologic training at the USGS National Training Center in Denver and other USGS offices in the US. In addition, five DRC staff members received 2-4 weeks of specialized geophysical, drilling, management, or geochemistry training at USGS or other offices in the US. Trainees were pleased with this training and have passed on some of their training to other staff members through short seminars. Staff members also have been rotated among different jobs for varied experiences.

Bendix brought about a dozen specialists to Egypt for one or more months to provide special training programs, lectures, demonstrations, or evaluations on groundwater planning and investigations, drilling and well installation practice, borehole geophysical methods, computer data processing, computer groundwater modeling, information systems development, and geographic information system design and operation. Approximately 130 DRC scientists, information specialists, and librarians were trained in Egypt. In addition, on-site training at DRC of other GOE agency people was provided in some of these subjects.

DRC has high-quality, motivated personnel that took well to advanced courses and were considered outstanding trainees by the instructors. In general, the trainees and their supervisors were

well-satisfied with the instruction received, whether inside or outside of Egypt. All DRC personnel receiving either US or in-country training have remained on the staff.

3.5.8 Management Information System (MIS) Development

The Computer Center, which had been air conditioned as a result of earlier recommendations, is being used extensively for administrative functions (payroll, budget, personnel records) and library bibliographic records, as well as for groundwater related data manipulations and modeling. However, the system is becoming overloaded and additional storage capacity is needed. Overall, the establishment of a computerized MIS has been a great asset to many aspects of DRC operations and activities.

3.5.9 Information Exchange and Interagency Cooperation

Because DRC is a research and service organization primarily responsible for groundwater aspects of MPGAP, the organization has not been directly involved in development of private sector investments. However, groundwater resources are vital to any future mineral, petroleum, or agricultural developments in the Eastern and Western Deserts and also the development and sustainability of tourism on the coast of the Eastern Desert. The mass of information obtained from DRC's MPGAP studies and its importance to future commercial developments makes it imperative that availability of the data and analytical/interpretive information be widely known among other GOE agencies and also among Egyptian and international commercial development organizations. DRC should develop a professional quality brochure describing DRC activities and a regular system of announcing availability of study results and published works for sale to interested individuals or commercial firms.

DRC has done a very professional job of preparing and editing their reports. Now that DRC has computer word processing capability, they should be able to provide an even greater variety of type styles and variety of illustrations that will provide even more attractive publications.

Previous reviews of MPGAP noted a lack of cooperation, between some of the MPGAP agencies. On the other hand, DRC appears to have had good cooperation with EGPC, EGSMA, and RSC at various stages of MPGAP. Apparently cooperation with EGSMA was diminished when their participation in MPGAP ceased. There was some concern with unavailability of RSC's remote sensing Atlas in time to be useful for MPGAP agency responsibilities, as well as with the seemingly high cost of RSC products. DRC has been successful in exchanging information and expertise with the

petroleum organizations and also with some institutes of the Water Resources Center.

3.5.10 Impact of MPGAP Programs

Some impact of the DRC's groundwater phase of MPGAP has been described in other sections. In summary, the full value of the groundwater studies and aquifer discoveries has not been fully recognized by people outside of DRC. Such groundwater supplies can be a vital element in the development not only of mineral and petroleum supplies but also for agriculture, tourism, manufacturing, and even desert urban areas. The success of DRC's investigations indicates the advisability of accelerating detailed groundwater studies in other areas of the Eastern and Western Deserts. The mass of data and information available and the flexibility and capability of the DRC geographic information system offer good potential for providing GIS services to other GOE agencies and commercial organizations. These capabilities resulting from DRC's participation in MPGAP could provide considerable service to a wide clientele.

3.5.11 Sustainability of MPGAP Initiatives

Budgets must be developed such that operation, maintenance, and repair of equipment provided to DRC through MPGAP are adequate to (1) keep equipment operating efficiently, (2) maintain collections of high quality data, and (3) produce professional reports. The particular expertise presently available, partly as a result of MPGAP-sponsored training, is quite adequate to sustain the drilling and geophysical studies, laboratory analytical work, and computer modeling/GIS activities. The number and extent of field studies, as well as the sustainability of the presently qualified and experienced staff, depends on the availability of adequate operating funds in future years.

There are several potential areas that could be used to provide income to offset any budget shortfall. First is the drilling and borehole geophysical capability. A number of other GOE agencies contract for borehole and well drilling and down-hole exploration. Perhaps arrangements could be made to contract for such services from DRC, when their equipment and personnel are not occupied with DRC exploration projects. Agencies might include EGSMA and various institutes of the Water Research Center. Another possible source of income could be DRC's GIS Center. As implied earlier, some of the DRC capabilities could be of interest to other GOE agencies and commercial organizations, and perhaps a fee structure could be established for providing GIS services. It is recognized that there may be

GOE regulations that would not permit these activities. However, the idea is worth studying.

3.6 REMOTE SENSING CENTER (RSC)

The Remote Sensing Center (RSC) is an entity of the Academy of Scientific Research and Technology. It was formed in 1971, and through funding of the GOE and US National Science Foundation it had acquired a significant capability to conduct:

- o airborne photographic and multispectral surveys;
- o computer processing and analysis of both airborne and Landsat data; and
- o investigative studies using remote sensing data, especially in the area of geology.

Facilities included:

- o A Beech King aircraft with a 9-inch aerial camera and a Bendix Multispectral Scanner;
- o A DEC PDP 11/35 based image processing and data analysis system (M-DAS) capable of digitizing aerial photography and generating hard copy black and white and color images from digital computer tapes; and
- o A photographic facility for generating black and white and color products in sizes up to 40 inches.

While the above system was capable, on occasions, of generating excellent products, it was not capable of undertaking a large-scale image mapping project as envisioned by the MPGAP project. Accordingly, the MPGAP project provided a mechanism for significantly improving RSC capability by upgrading the facility through acquisition of hardware, software, and library facilities and training the staff abroad and in-country.

In turn RSC was to provide workshops to personnel of MPGAP agencies on image interpretation and use of Landsat imagery. It was to generate Landsat image maps of all of Egypt at a scale of 1:250,000. About eighty maps are required to produce an Atlas of Egypt. The Atlases were to be provided to MPGAP and other GOE agencies and institutions free of charge. Other imagery was to be provided at a nominal cost.

3.6.1 Programmatic Achievements and Shortfalls

RSC has developed an in-house capability for satellite image processing and analysis which would be the envy of many US institutions. Unfortunately, for reasons described in the sections which follow, Landsat image maps were produced too late to be of use to most of the MPGAP agencies. RSC did provide,

however, 10 image maps to EGPC in early 1989. Thanks to a 12-day time extension of the MPGAP project, RSC and the printing contractor report that the Atlas will be printed before the close of the project. For efficiency in setting-up and running the presses, the printer is holding up the press run until he receives the last few maps. These are scheduled to be delivered on September 14, 1990.

The Atlas is an impressive undertaking and clearly demonstrates RSC's capability and the potential usefulness of satellite imagery for resource assessment and mapping. As noted above and in the interim evaluation report, the Atlas will not be of use to the MPGAP project itself. It will, of course, be valuable for future projects of the MPGAP agencies as well as other institutions.

The recent delay in the Atlas publication (scheduled for 18 months after the system upgrade which was completed in October 1987) resulted not from the processing of satellite imagery. Rather, the current delay was largely caused by poor quality control in generating the collar information which surrounds the image map.

RSC acquired the capability to make Landsat thematic mapper (TM) and Spot image maps only in the last month of the MPGAP project. Data from these sensors can be used to generate larger scale maps with more detail than those in the Atlas. In discussions concerning the importance of large scale maps, the director stated that RSC will make at least one image map at 1:50,000 scale or greater and distribute copies to all the recipients of the Atlas to demonstrate this recently acquired capability.

In addition to the Atlas, RSC is preparing a color marketing brochure. Like the Atlas, it is behind schedule but should be printed before the close of the project.

3.6.2 Contractor Performance

Unlike some of the other MPGAP agencies, RSC was fortunate in having continuous and excellent technical support from a single computer system contractor, ERIM, utilizing staff who were involved in the delivery of the pre-MPGAP image processing system. This continuity assured compatibility of all system upgrades (software and hardware) as they were direct copies of upgrades the contractor had made to its own facility in the US.

On the other hand, most of the contracting was indirect as services were provided through an intermediary contractor. The procurement suffered inordinate delays which necessarily impacted the schedule of the Atlas. Much of this delay can be attributed

to AID's contracting procedures. Correspondence indicates that the procurement of the image processing system upgrade was initiated immediately upon the start of the MPGAP program in late 1982. The contract was negotiated in July 1985, and delivery was completed in October 1987. Negotiations of a second contract for additional upgrade of the facility and the printing of the maps (800 copies of 80 maps) were aborted after six months by the selected contractor who agreed that his company did not have the expertise to manage the job. A contract was then negotiated with ERIM in February 1990 to do this task. While this last contract was in the critical path for publishing the Atlas, it should be noted that the current impediment is the generation of the map collars, an RSC responsibility.

3.6.3 Private Sector Investment and Involvement

RSC's goal is to produce the highest possible quality remote sensing products. To do this requires modern, expensive equipment. RSC's facility maintenance alone costs about LE 15,000 per month, and their annual operating budget is about LE 1.8 million. Approximately half of this is supplied by ASRT, and the remainder is acquired through projects from outside institutions. Approximately 15 percent of the current budget comes from private sector contracts. The RSC Director is well aware that continued system maintenance, upgrade and operation cannot be met by relying on procurements funded out of the budgets of most GOE agencies as RSC services are considered to be expensive. Projects currently provide half of their funding and they expect to see this increase when the community sees the usefulness and quality of their Atlas.

3.6.4 Training

MPGAP training for RSC fell into two categories, RSC staff as trainees and RSC staff as trainers. Training received by RSC staff in facility maintenance, operation, and its use appears to have been very good. As noted in Section 3.1.2, they have had continuity in system support from a single contractor since the start of the program. Training has been performed by ERIM which has a similar image processing system. Thus, training on the system in the US can be directly applied upon the trainees return to Egypt. In a number of situations, such as the GIS (Geographic Information System) training currently being held at RSC, the staff is trained in-house on their own facility. Training has included generation of image maps, the use of new equipment and software, the generation of color products from black and white film separates, and geologic applications of satellite imagery.

Eight Egyptians were trained in remote sensing technology in the United States (at ERIM). All of these are still working in remote sensing although two are working in other Arab countries.

RSC prepared and conducted three six-week workshops on satellite image interpretation and applications. These workshops, held in November 1986, May 1987, and April 1988, were attended by 35 scientists; 20 from MPGAP agencies, 8 from universities, and 7 from other institutions. Because the workshops were not oversubscribed by the MPGAP agencies, RSC invited other agencies and institutions to participate.

While not a requirement of MPGAP, RSC published about 30 reports and articles in the 1982-1990 timeframe. Many of these were prepared in association with other institutions. The publications clearly demonstrate that RSC is disseminating its capability and the results of its project studies.

3.6.5 Management Information System (MIS) Development

RSC has large computers (MicroVAX II and VAX 8250) with terminals in each of the offices of their staff. RSC is conscious of the need to transfer data among agencies when such transfer is desirable. For example, their recently acquired GIS capability (ERDAS and ArcInfo) will be used mainly on their large computers, but they also acquired PC capability in order to be compatible with the other GIS systems in Egypt. Landsat computer tapes are logged in the system by date of acquisition and scene location, but they do not have a logging system for identifying the type of processing which has been performed or the nature and location of the final product. ERIM volunteered that they will supply a copy of their software for doing this to RSC.

RSC has a small, but reasonably complete and useful library, although there are serious gaps in technical journals. The director reported that RSC does not have foreign currency except through donor projects and continuity in journal subscriptions will be intermittent until the government budgets provide them with some foreign currency. It is ironic that RSC's funding allows then to procure costly, modern computer systems (bought on the local market) but not technical journals from foreign countries.

RSC is cataloging its library holdings and will input the data into their management information system.

3.6.6 Information Exchange and Interagency Cooperation

RSC reports good cooperation with government agencies as is evidenced by the fact that 50 percent of their support comes from

outside their parent organization (ASRT). Information exchange and cooperation within the MPGAP program, however, appears to have been less satisfactory. The Evaluation Team was unable to assess the validity of many of the complaints heard from the other MPGAP agencies. Nonetheless, there is a general perception among the MPGAP agencies that there exists a lack of cooperation. Most of the complaints revolve around the absence of the Atlas and RSC's charging for image products and tapes. The Atlas was scheduled to be completed 18 months after system upgrade. Unfortunately the upgrade was not completed until October 1987. Hence, the earliest delivery would have been April 1989, too late to be of much value to the MPGAP field surveys.

The project paper clearly states that RSC would charge nominal prices for interim image products. For a high tech operation like RSC which has a facility maintenance cost of LE 15,000 per month, their "nominal" costs were high. Interviewed staff of the MPGAP agencies felt RSC's charges were not in concert with the spirit of the project even though these charges were to be paid out of the Bendix contract and not agency funds.

The Evaluation Team believes that the reported poor cooperation of RSC stems largely from a lack of communication and mis-communication among the project agencies. It is most unfortunate that the team was unable to discuss this problem with the US project coordinator and the MGRS project advisor. As noted in the interim evaluation report, ASRT did not provide an aggressive advisory role, and the project coordinator had resigned. Shortly thereafter the Bendix-supplied MGRS advisor left, and none of these advisory/coordinating activities were replaced. Thus no intermediaries remained, and cooperation was dependent upon the initiative of project personnel. While the Evaluation Team does not believe cooperation can be mandated by a coordinator, it does believe a coordinator can improve dialog and understanding among the participating agencies through "shuttle diplomacy." This type of coordinating function could probably be best performed by an individual from outside the participating agencies such as an AID subcontractor.

3.6.7 Impact of MPGAP Programs

As an Egyptian service organization, RSC has developed a capability which should be of extreme value to Egyptian development projects. It is capable of making topographic maps and aerial photographic surveys and excellent planimetric image maps from satellite data. Unfortunately their quest for excellence before releasing image maps coupled with inadvertent delays in contracting for their system upgrade, resulted in the Atlas not being available to service the MPGAP agencies in a timely manner.

It should be noted that MPGAP's contribution to the RSC remote sensing capability is highly visible, necessary and important to the generation of high quality products. MPGAP provided special hardware peripherals, software, and training. These elements are extremely important and make the difference between a mediocre capability and a superb capability. Other funds provided computer upgrade and facility maintenance costs. For example, in the course of the MPGAP project, the mainframe system for image processing underwent continual upgrading from a PDP 11/35 single-user system to their current MicroVAX II and VAX 8250 based multi-user system. Most of the facility upgrades were necessary to increase throughput, reliability and quality, as well as to accommodate multiple users. MPGAP provided all the associated and necessary peripherals, software and training to meet this need.

As a direct result of MPGAP, RSC has the following capabilities:

- Processing and enhancing data from all current earth observation satellite sensors: Landsat MSS, Landsat TM, Spot Pan, and Spot XS;
- Geometric correction and mosaicing multiple scenes of data;
- Overlaying other data on satellite imagery for the purpose of generating better information (Geographic Information System);
- Production of high quality color products; and
- A cadre of well-trained staff.

3.6.8 Sustainability of MPGAP Initiatives

RSC is a service organization designed to provide remote sensing data, information, and expertise to other organizations. To this end, MPGAP assisted RSC in developing an impressive capability which should allow the Center to meet the country's needs for resource mapping, management and development. In addition, it can supply these services to both the private and public sectors on a competitive basis domestically and internationally. The Director of RSC recognizes the critical need for supplying excellent products to meet the needs of GOE agencies, donor agencies, and the private sector. While the current cost for products and services may appear high, comparable products and services purchased from foreign sources would be a factor of two or perhaps three times higher.

RSC should be capable of continuing its activity without the MPGAP support. They will need to increase their marketing effort, and the Atlas and marketing brochure will go a long way in advertising their capability.

Two activities came to the attention of the Evaluation Team which are indicators that remote sensing is taking hold in Egypt. Both of these are directly attributable to the MPGAP activity. First, a trading company by the name of Eight M learned about the potential of remote sensing from an RSC staff member who received training in the US under MPGAP. As a result, this company is now the representative of four US remote sensing organizations (including EOSAT, the US government-subsidized contractor for Landsat operation) and is in the process of changing its name to Environmental and Remote Sensing Service Center. This organization has an ERIM subcontract to print the Atlas.

Second, at the encouragement of ASRT, an Egyptian Remote Sensing Committee has been formed. Members are from all sectors, and its chairman is Professor El-Etr of Ain Shams University. They have met four or five times and plan to establish an Egyptian Remote Sensing Society which will publish a journal, hold technical seminars and meetings, and promote remote sensing activity.

APPENDICES

Appendix	A	Statement of Work
	B	Reports Reviewed
	C	Individuals Contacted
	D	Contracts and Contractors
	E	Acronyms
	F	Methodology and Team

APPENDIX A - Statement of Work

Attachment 1

SCOPE OF WORK

A. BACKGROUND:

The Mineral, Petroleum and Groundwater Assessment Program (MPGAP) Project 263-0105 was implemented from September 28, 1980 to September 14, 1990. The original Project Grant Agreement was signed on September 28, 1980 between USAID with the ministries representing the following Egyptian institutions:

- Ministry of Petroleum on behalf of The Egyptian General Petroleum Corporation (EGPC)
- Ministry of Industry and Mineral Wealth on behalf of Egyptian Geological Survey and Mining Authority (EGSMA).
- Ministry of Agriculture and Land Reclamation on behalf of Desert Research Institute (DRI)
- Ministry of High Education and Scientific Research on behalf of The Academy of Scientific Research and Technology (ASRT) and the Remote Sensing Center (RSC)

The total authorization was for $37.2 million. The initial obligation was 20.7 million, with an initial Project Assistance Completion Date (PACD) of March 21, 1987. An additional obligation of $9.0 million for EGPC was signed on May 13, 1985 and the PACD extended to September 30, 1987. Finally, on August 31, 1987, an additional $4.0 million was obligated to EGPC with a PACD extension of September 15, 1990. Thus, the total obligation todate is $33.7 million. A summary of AID contribution to the four agencies is as follows:

Implementing Organization	1980 $(000)	1985 $(000)	1987 $(000)	Total Todate $(000)
Egyptian General Petroleum Corporation	8,110	9,000	4,000	21,100
Egyptian Geological Survey and Mining Authority	8,148	--	--	8,148
Desert Research Institute	2,333	--	--	2,333
Remote Sensing Center	2,109	--	--	2,109
TOTAL	20,700	9,000	4,000	33,700

B. DESCRIPTION OF THE PROJECT:

Approved in 1980 and initiated in July 1982, the MPGAP has pursued the following goal and purposes:

1. Goal: To increase foreign and domestic investment in developing Egypt's natural resources.

2. Purpose: To gather basic geotechnical information that will attract capital, and to devise means of disseminating this information to potential users through:

   a) Improving the organization of current data on existing and potential mineral, petroleum and groundwater resources necessary for their development.

   b) Compiling reports on newly-surveyed areas of potential mineral, petroleum and related groundwater resources.

   c) Developing GOE institutional capacity to acquire, organize, analyze, store, retrieve and disseminate data on potentially commerical mineral and petroleum resources.

The objectively verifiable indicators which show that the purpose has been achieved are:

1. The improved organization of data on existing and potential natural resources in the four institutions.

2. Significant use of the MPGAP information in the investment sector.

3. Ability of these four institutions to acquire organize, analyze, process and disseminate data on natural resources.

C. ACTIVITY SUMMARY:

As indicated, MPGAP was scheduled to be implemented as of September 1980. The project was delayed for two years because the Project Grant Agreement (ProAg) could not be ratified by the Egyptian People's Assembly. The reason of this delay emanated from a GOE concern that information on national resources is sensitive and should be adequately controlled. After the Pro Ag was amended to include a clause providing for information ownership by the GOE, the project was ratified April 1982 with the understanding that USAID and the four MPGAP agencies will review the technical inputs of the project.

In July 1982, a two-man team (McCauley and Stancioff) met for a month with the representatives of the MPGAP agencies to review the technical inputs of the project. Their report, (which is on file in HRDC/S&T), indicated that technical changes requested are consistent with the framework and budget of the original project. In the petroleum sector, a major emphasis was put on the organization of petroleum information, enhanced oil recovery as well as on the exploration and analysis of areas of secondary oil potential such as the Eastern desert, which could lead to further foreign investments.

The first MPGAP implementation activity was initiated in December 1982 with a $7.9 million contract to conduct an airborne magnetic and radiometric survey for EGPC and EGSMA. This contract that was implemented by Aeroservice Division of Western Atlas Geophysical Company, was followed in June 1983 by the signing with Bendix Field Engineering Corporation (BFEC) of $5.0 million, technical assistance contract for EGSMA, DRI and RSC. Since that time, a series of other contracts and activities followed. These are described ~~the~~ the next section.

In 1985, following a ministerial change, EGSMA was put under the Ministry of Petroleum which was renamed as the Ministry of Petroleum and Mineral Wealth. The Ministry of Industry ceased to play a role in MPGAP.

In March 1986, a four-man team carried out an interim evaluation of the project. The major recommendations as approved by USAID were:

1. Extend the PACD through 1989.

2. Explore with the Ministry of Petroleum the possibility of appointing a GOE Liaison Officer with full time ministerial responsibilities.

3. Arrange for additional technical assistance with EGSMA in the preparation of mineral information packages.

4. Continue current training and technical assistance to strengthen management of computer facility at MPGAP agencies.

In August 1987, the GOE and USAID agreed that EGSMA activities under MPGAP will end. At that time, from an amount of $8.141 million which was obligated for EGSMA, only $7.2 million was committed to specific technical assistance activities. The balance of $900.000 was still left in the EGSMA's budget, but could be used by EGPC for further studies or activities, since both agencies belonged to the same Ministry of Petroleum. This balance of $900,000 was therefore, fully committed later to carry out EGPC's studies.

D. Implementation of MPGAP activities:

The following major activities were implemented with the assistance of U.S. contractors. These are classified in accordance with the project purpose elements.

I Improvement of the organization of the current data:

EGPC

1. Assessment of petroleum resources in the Western Desert, Nile Delta and North Sinai. The purpose of this study was to compile in a data base format all the geological, geophysical information of the western desert above latitude 28 and to estimate qualitatively and quantitatively the oil reserves. The contract was awarded to Scientific Software Intercomp. (SSI) for $2,513,857 and LE 1,260,228. This activity will be completed on 9/14/90.

2. Petroleum Information System. The purpose of this activity is the development and implementation of data bases for electric well logs, oil agreements exploration and production as well as training on reservoir simulation systems. The Contract was awarded to Integrated Technologies (IT) for $1,108,418 and LE 212,659. This activity will be completed on 8/31/90.

3. Management Information System (MIS) and upgrade the EGPC library. The purpose of this activity is to design, develop and test a pilot scale on Management Information System (MIS) for EGPC exploration, production and operation divisions. This was also followed by an upgrade of EGPC library. The contract was awarded to Bechtel for $1,2000,000. This activity will be completed on 9/15/90.

4. Strengthening and rebuilding of the library at the General Petroleum Company. This was part of the Bendix long term Technical Assistance contract to EGSMA, DRI, and RSC.

EGSMA

1. Upgrading the library of EGSMA, as well as the establishment of mineral information system.

2. Preparation of mineral commodity packages on gold, dolomite and clays.

Both activites were conducted with the assistance of Bendix.

DRI

- Establishment of a groundwater information system as well as geographic information system. This was made with the assistance of Bendix as well as Integrated Technologies under the same EGPC contract but for an additional $472,622 and LE 35,302.

RSC

- Landsat Atlas of Egypt. An Atlas of Egypt consisting of 80 colored landsat scenes radiometrically and geometrically corrected is being prepared. This is currently made with the assistance of the Environmental Research Institute of Michigan under a contract of $516,134. This activity will end on September 14, 1990.

II Compilation of Reports of Newly Surveyed Areas:

EGPC

1. Aeromagnetic and radiometric survey in the Eastern desert. A comprehensive radiometric and aeromagnetic survey using aircrafts was conducted over 90,000 line kilometers. Maps, reports as well as interpretation report for the whole area were obtained. The contract was awarded to Aeroservice for $7.9 million and was completed on 2/26/86.

2. Seismic survey of the Assiut Quena. A comprehensive field seismic survey was conducted in approximately 800 line kilometers in order to delineate this basin. The contract was awarded to Geosource for $2,168,083 million and the activity ended on 12/31/87.

3. Seismic survey in the west El Guindi basin. As an extension to the previous Assiut-Quena, a comprehensive seismic survey was conducted over an area of 13,000 kms^2 in El Guindi basin south west of Abou El Gharadik in the Western Desert. The work was performed by Geosource for $1,782,463 and LE 676,500 and the activity was completed on 3/31/90.

4. Enhanced Oil Recovery (EOR) feasibility study and pilot test injection. The study was undertaken in the North Bakr field in the Gulf of Suez and was aimed at determining the most economical and suitable EOR methods to increase oil yield through injection of gas. Both feasibility and pilot test studies were undertaken by Improved Petroleum Recovery (IPR) at $5.2 million. The pilot test injection will end on September 14, 1990.

5. Feasibility Study of Assran Oil Field. The purpose of this study is to provide cost effective methods for processing and treating heavy crude oil at Assran field in the Gulf of Suez. This study was contracted to Scientific Software Inc. (SSI) for $80,000 and was completed on 4/13/90.

DRI

- Assessment of Groundwater Potential in the Eastern Desert. Groundwater evaluation as well as a comprehensive drilling program

in three main areas in the Eastern Desert were conducted by DRI with technical assistance from Bendix Field Engineering Corporation. However, all field work, analyses and interpretation was conducted by DRI. Two new groundwater reservoirs in Wadi Dara and El Nekheil were discovered.

III Strengthening of Institutional Capability:

1. Training

Formal and on-the-job training were planned and implemented by each of the EGPC contractors. Most of the training was conducted in Egypt by U.S. instructors. Following are the details:

EGPC

Contractor	U.S.	In Egypt	Subject
Aeroservice	5	60	Geophysics, aeromagnetic survey
Geosource	10	120	Seismic survey
IT	7	50	Database design, reservoir simulation
SSI	4	300	Database design, qualitative and quantitative assessment of oil and gas reserves
IPR	15	45	Reservoir engineering and enhanced oil recovery systems
Bechtel	10	40	Management Information Systems, system analysis and database software
TOTAL	51	615	

Following are the details of U.S. and in Egypt training for EGSMA, DRI, and RSC:

	Contractor	U.S.	In Egypt	Subject
EGSMA	Bendix	58	24	Geophysics and geochemistry, library, computer training
DRI	Bendix	10	100	Groundwater hydrologic techniques, library training, information systems
DRI	IT	2	30	Well log database
RSC	Bendix/ERIM	4	30	Remote sensing basic principles, advance remote sensing applications, geographic information systems
TOTAL		74	184	

59

2. Equipment procurement

The following table summarizes the equipment procured for the four implementing agencies under MPGAP.

	EGPC	DRI	RSC	EGSMA
Computer software, hardware & supplies	1,115,000	420,000	1,170,000	212,800
Geophysical & geochemical, drilling, EOR	2,400,000	767,000	-	631,888
Vehicles	-	217,000	-	873,000
Library and miscellaneous equipment	20,000	36,000	20,000	51,200
TOTAL	3,535,000	1,440,000	1,190,000	1,768,888

E. PURPOSE OF EVALUATION:

The purpose of this impact evaluation is to determine the benefits and impacts of MPGAP. This evaluation will provide information on achievements and lessons learned.

F. METHODS AND PROCEDURES:

1. The evaluation will provide a description and analysis of impacts of MPGAP, with reference to specific examples, will quantify impacts/benefits where appropriate, will distinguish between actual and potential impacts/benefits. Impacts should include: use of information generated from the project for in-house and private/public sectors use, improved capabilities of MPGAP agencies in compiling, acquiring, and organizing information, interest of private/public sectors investment in the MPGAP information.

2. The evaluation team will review, project documentation, interim evaluation, as well as interim and final contractors' reports.

3. The evaluation team will interview appropriate MPGAP counterpart staff and in particular those of EGPC, GPC, DRI and RSC, representative of oil operating companies and U.S. contractors that have implemented this project.

4. The team will also develop an estimate of economic impacts/benefits of studies undertaken in the petroleum sector where feasible and appropriate.

5. The team will prepare an evaluation report which will include, but not limited to the following:

   - Status of completion of project elements (eg. EGPC studies, DRI and RSC technical activities, EGSMA previous activities).
   - Change in the project outputs during implementation (including a comparison between revised and actual outputs).
   - An assessment of the extent to which MPGAP has fulfilled the purpose of this project (i.e. achievement of the initial purpose).
   - Recommendation for continuing or post project monitoring AID responsibilities.
   - A review of data collection results and evaluations to be undertaken.
   - A survey of lessons learned from MPGAP that may be relevant to programming, design and implementation of other activities.

G. STATEMENT OF WORK:

The evaluation team will address the following key issues:

1. Impact of Information Resulting From MPGAP.
2. Enhanced Perception of MPGAP Activities.
3. MPGAP Sustainability.
4. Relative Cost of MPGAP Activities.
5. Development of Human Resources Base.

1. Impact of Information Resulting From MPGAP:

A. The evaluation team will seek information on the following issues:

   - What have been the impacts of: acquiring, improving, and generating information of commercial relevance in the field of oil operation, exploration and production, as well as, groundwater resources for mining and oil development?

- Does the studies undertaken address EGPC's and DRI's exploration and production problems?
- Is the quality of studies acceptable to be able to be used in the private sector?
- Do the results have potential applications? Are they being used? Are they likely to generate additional interest in acquiring oil concessions or groundwater development?

B. The evaluation team will also

- Determine whenever possible, the current and potential new investments in the oil sector attributable to the availability of information generated under this project.
- Develop estimates of net economic impact/benefits of the studies and activities, where possible.
- Assess the level of information available and extent its diffusion.
- Address problems of MPGAP that hinder the progress and diffusion of information to the oil companies.

2. <u>Enhanced Perception of MPGAP Studies and Activities</u>:

- What evidence is there that studies funded by MPGAP in the oil, groundwater, remote sensing and possibly mining sectors are now more valued by the user community (private/public sector, ministries, and universities) than it was before MPGAP inception?
- To what extent can any changes in perception be attributed to MPGAP, as opposed to other interventions? Changes in perception may be reflected in: change of internal organization in EGPC, DRI, RSC and EGSMA to accommodate for the establishment of information systems, creation of new positions, or responsibilities for MPGAP staff to be able to generate information relevant to investors ... etc.
- What evidence is there that information generated by MPGAP in the field of oil, groundwater and remote sensing are more rightly valued by the current user than they were before MPGAP? Are there any indications that such situation has changed?

3. Sustainability of MPGAP:

- What are the prospects for continuing EGPC, DRI and RSC studies related to oil, groundwater exploration and remote sensing application. Are EGPC, DRI and RSC likely to build on the reservoir simulation and/or geographic information system which was established in this project and be contracted by the private/public sector to perform such work? Is the RSC likely to undertake to market its products and provide training so that it can become a self sustainable user-oriented center.

- Is it realistic to expect that private sector funding with possible GOE budgetary support will increase as a result of MPGAP intervention?

4. Relative Cost of MPGAP Activities:

- What studies/activities under MPGAP have generated foreign exchange or local cost as a result of information acquired by MPGAP? What is the ratio between the costs of studies funded by USAID and the funds generated as a result of selling of maps, reports or services acquired under MPGAP?

- Do certain MPGAP activities demonstrate that one can successfuly undertake these types of studies at an economically acceptable level.

- Are there other methods (such as cost sharing of studies between EGPC and oil operating companies, or speculative studies sponsored by the oil operating companies) that could be considered as a substitute for AID direct assistance to EGPC?

5. Development of Human Resource Base:

The purpose of this project is to increase the institutional capability of the MPGAP agencies, with particular emphasis on training its MPGAP staff.

- Has MPGAP effectively involved a significant core of EGPC/GPC, EGSMA, DRI, and RSC members in the different MPGAP activities?

- Has the participation of the MPGAP staff postively affected the quality of the work?

- To what extent is the level of application of principles learned during training, effective to achieve the project purpose?

- To what extent is the equipment purchased, appropriate and effective to the specific studies? Examine the degree of competance achieved in equipment utilization as well as degree of usage of equipment.

- Provide specific examples of ways in which institution building have helped EGPC, DRI and RSC in different departments to increase knowledge in modern exploration/production, and maps production.

H. TEAM COMPOSITION: [illegible]

The evaluation team will be conducted by a multi-disciplinary team consisting of five members.

1. A Team Leader (45 workdays), shall be responsible for overall management of the evaluation, preparation of the report, and liaison with USAID, participating Egyptian agencies and contractors. This person will be broadly knowledgeable in the area of A.I.D., evaluation, and management/implementation of AID-funded development projects. It is desirable that this person has an economic background in the field of petroleum or mining.

2. A Petroleum Geologist/Geophysicist (40 workdays), with extensive experience in petroleum exploration, production, marketing and data base management systems, as well as, familiarity with oil investment, marketing and leasing agreements.

3. A Hydrologist/or Groundwater Specialist (35 workdays), with extensive experience in groundwater investigations and applications.

4. A Remote Sensing Specialist (35 workdays), with extensive experience in information processing of Landsat data and development of earth resources applications.

5. An Economist (40 workdays), with experience in petroleum economics, oil and mining leasing agreements, and economic forecasting of oil of gas reserves.

I. DURATION:

The evaluation will be conducted in Cairo and will require six weeks commencing o/a August 1st, 1990. N/A

J. REPORTING REQUIREMENTS:

- The evaluation team will be briefed by USAID/S&T and the evaluation staff upon their arrival.
- Within one week, the evaluation team leader will submit a detailed plan of work to the S&T office.
- The team will submit a draft report to USAID approximately five weeks after they commence work.
- The team will submit 10 copies of the final evaluation report to USAID within one week of receiving written comments on the draft report.

The format for the report should be as follows:

- Executive Summary, in narrative form, not to exceed three single-spaced pages.
- Listing of Major Conclusions and Recommendations. This section should briefly summarize the most important conclusions and recommendations in the evaluation, in bulletized or matrix format.
- Main Report. This section should include information and evidence on which conclusions and recommendations are based. The information obtained through the required tasks, described above should be qualitatively and quantitatively analyzed, and integrated to respond directly to the key questions in the Statement of Work. The report should not exceed twenty five single-spaced pages. The details on the content of the main reports are included in section F5 of this Statement of Work.
- Annexes, as appropriate, including the evaluation statement of work, a bibiography of documents consulted, a list of individuals interviewed and their agency affiliation, and other information considered appropriate by the team.

The team will conduct debriefings for USAID personnel to present their major findings, conclusions and recommendations.

Appendix B: Reports Reviewed

Bendix Field Engineering Corporation (BENDIX)

Lepley, L.K., and Burger, J.A., Final Report (and appendicies)- Period from June 14, 1983 to September 30, 1987 - Contract No. 263-0105-C-00-3039-01

Desert Research Center (DRC)

Misak, R., Preliminary Geologic Report- Geomorphology- Ras Gharib Area, 1986

Himida, I.H. and Sewidan, A.S., Pumping Test Analysis and Evaluation of Hydraulic Parameters for El-Zaafarana Locality (Wadi Araba), 1989

Himida, I.H. and Sewidan, A.S., Pumping and Recovery Test Analysis and Hydraulic Parameters Evaluation for Wadi Dara (Gulf of Suez), 1988

Himida, I.H., Overview over Desert Research Center Computer Facilities, 1990

Egyptian General Petroleum Corporation (EGPC) and General Petroleum Company (GPC)

EGPC, Information Systems Planning and Implementation Project Final Report, Bechtel Corporation, June 1990

EGPC, Final Report, Seismic Survey/Basin Evaluation, Assuit/Quena Region, Nile Basin, Upper Egypt, Geosource Company, Ltd.

EGPC, System Design Document, Intergrated Technologies and Western Atlas International, October 1989

GPC, Feasibility Study for Improved Oil Recovery in Issaran (Assran) Heavy Oil Field Final Report, Scientific Software Intercomp, April, 1990

Egyptian Geological Survey and Mining Authority (EGSMA)

El Din, Moheb N., Report on the Reconnaissance Field Excursions in USA Regarding Evaporites and Some Industrial Ore Deposits Mining and Manufacturing, January 1986

Gypsum Exploration Along the Red Sea Coast, March 1985

Limestone and Dolomite in Egypt: A Commodity Package, MPGAP, January 1986

Clay Deposits in Egypt: A Commodity Package, MPGAP, May 1986

Gold in Egypt: A Commodity Package, MPGAP, April 1986

Potential Mineral Resources of Egypt, Proceedings of the Second Seminar of MPGAP, Cairo, November 1984

Young, John, Recommendations for Upgrading the EGSMA Geophysics Department, December 1986

"Gold Concession Area in Egypt," Advertisement in International Ahram, January 1988

"Gold Concession Area in Egypt," Advertisement in Wall Street Journal, January 1988

"Gold Concession Area in Egypt," Advertisement in The Financial Times, January 1988

"Sulfur Concession Area," Advertisement in Wall Street Journal Europe, April 1986

Comments and Recommendations on the Interim Evaluation of the MPGAP, March 1986

Model of Concession Agreement for Exploration and Exploitation

Concession Agreement Between the ARE and EGSMA and Minex Minerals (Egypt) Ltd. for the Exploration and Exploitation of Gold and Associated Minerals in Central Eastern Desert of Egypt, March 1986, Confidential.

Concession Agreement for Sulphur Exploration and Exploitation in the Gulf of Suez Area among the ARE and EGSMA and Freeport Egyptian Sulphur Company, March 1988, Confidential.

Mineral, Petroleum and Groundwater Assessment Program (MPGAP)

MPGAP Newsletter, May 1984

MPGAP Newsletter, October 1985

Remote Sensing Center (RSC)

While not a requirement of the MPGAP program, the RSC prepared a goodly number of reports. Approximately half of these were prepared in association with other institutions. The Evaluation Team was given 6 reports published by the Remote Sensing Center and 22 papers which were presented and published at symposia

during the MPGAP time frame. All but four of the publications reported on applications of satellite remote sensing data. Some of these are listed below:

El Rakaby, M.L. et al, Exploratory Studies on White (Glass) Sands in Egypt Using Remote Sensing Techniques, 1990

El Rakaby, M.L. et al, Discrimination of Lithologies in Southwestern Sinai Peninsula, Egypt, Using Landsat Thematic Mapper Enhanced Data, 1988

Hady, M. Abdel, et al, Landsat Digital Data Processing for Estimation of Agricultural Land in Egypt, 1983

El Shazly, E.M. et al, Field and Laboratory Specifications of Marble Types at Wadi El Allaqi Area, Eastern Desert, Egypt, October 1985

El Shazly, E.M. et al, Potential Petroleum Source Rocks in Sinai, Egypt, and their Relation to the Peninsula Sedimentary Basins, March 1984

El Shazly, E.M. and Hady, M.A., Earthquake Studies in Aswan Environs, Egypt, Applying Space-Borne Imagery Interpretation and Other Techniques, March 1984

El Shazly, E.M., Reconnaissance Studies on Earthquake Effects in Aswan Area, Egypt, February 1982

Issawi, B. and El Hinnawi, M., Kharga Oasis: A Case Study, February 1982

United States Agency for International Development (USAID)

Egypt: Project 263-0105, Mineral, Petroleum and Groundwater Assessment Grant, July 1980

Status Report: United States Economic Assistance to Egypt, November, 1989

MPGAP Interim Evaluation, March 1986

Project Agreement between the Arab Republic of Egypt and the United States of America for Mineral, Petroleum and Groundwater Assessment, September 28, 1980

First Amendment to Project Agreement between the Arab Republic of Egypt and the United States of America for Mineral, Petroleum and Groundwater Assessment, December 28, 1981

Second Amendment to the Project Agreement between the Arab Republic of Egypt and the United States of America for Mineral, Petroleum and Groundwater Assessment, May 13, 1985

Third Amendment to Grant Agreement between the Arab Republic of Egypt and the United States of America for Mineral, Petroleum and Groundwater Assessment, June 30, 1987

Water Research Center (WRC)

Gasser, Mohamed M., Technical Bulletin for the Activities of the Institute, Hydraulics and Sediment Research Institute, 1985

Water Research Center, Information Bulletin '89, 1989

Research Institute for Groundwater, Hydrogeologic Map of Egypt, 1:2,000,000, Water Research Center, Ministry of Public Works and Water Resources, 1988

The Evaluation Team also reviewed all available technical service procurement contracts.

Appendix C: Individuals Contacted

Desert Research Center (DRC)

Dr. Mohamed El Shazly, Director
Dr. Sami S. Mohamed Soliman, Head, Geology and Geophysics Department
Dr. Ibrahim Hassan Himida, Head, Hydrology and Geochemistry Department
Dr. Fathy A Hammad, Prof. of Groundwater Geology and Geomorphology
Dr. Raafat F. Misak, Chief, Eastern Desert Group (Recipient of USGS Training (USGST))
Mr. Mahmoud Fouad, Geochemistry Department
Mr. Yehia Loutfy, Geochemistry Department
Mr. Saber Bastwig Mahmoud, Geochemistry Department
Dr. Abdel Motaal A. Abdel Baki, Hydrology Department (USGST)
Dr. Mahmoud Kamel Sallouma, Hydrology Department (USGST)
Dr. Ahmed Safwat Sewidan, Hydrology Department
Prof. Ismail M. El Ramly, Head, Western Desert Group
Mr. Samer El Mufti, Head, Technical Department
Dr. Salah M. Abdel-Mogheeth, Head, Drilling Department (USGST)
Dr. Bouthina M.M. Moussa, Geology/Geophysics Department
Mr. Ahmed Ali Youssif, Geographic Information System Center
Ms. Soussan Mousilhi, Geographic Information System Center
Ms. Nadia Abdel Mounim, Geographic Information System Center
Mr. Houssin Ezz El din, Geographic Information System Center
Mr. Soyhir Mohamed Labib, Geographic Information System Center
Mr. Arboulis Atef, Geographic Information System Center
Mr. Ibrahim Mohamed Nasr, Eastern Desert Group
Mr. Mokhtar Abdul Aziz Sayed, Geology/Geophysics Department (USGST)
Mr. Said Mahmoud Atwa, Geology/Geophysics Department (USGST)

Egyptian General Petroleum Corporation (EGPC)

Mr. Salah Hafez, Vice Chairman, Exploration and Agreements
Dr. Assem Hegazy, General Manager, Exploration Studies and Operations
Mr. El-Sayed Moussa, Exploration Studies Department Head
Mr. Alaa Abul Azaeim, Sector Manager, Geological and Geophysical Information
Mr. Anwar Salama, Sector Manager, Programs Follow-up
Mr. Mostafa El Hadidy, General Manager, Information Systems

Egyptian Geological Survey and Mining Authority (EGSMA)

Dr. Atif Dardir, Director General
Mr. Mohamed El Hinnawi, MPGAP Project Manager
Mr. Baha Eldin Elhakim, Director, Magnetic, Gravity and Seismic Prospecting Department
Mr. Abdel Aziz El Shimy, Director of Libraries
Mr. Farag Ismail, Librarian
Mr. Makram Rafla, Computer Section
Mr. Ihab Abdel Badee, Computer Section
Dr. Samih Shaaban, Director, Central Analytical Laboratory-Dokki
Mr. Adel Wadie Messiha, XRF/XRD Laboratory - Dokki
Dr. Wasel Bahr, Director, Ore Dressing Laboratory - Dokki
Mrs. Mary Zaky, Director, Chemical Laboratory - Dokki

General Petroleum Company (GPC)

Mr. Hussein Kamel, Chairman
Mr. Mahmoud I. Farid, Exploration General Manager
Mr. Hamdi El Dewake, Production General Manager
Mr. Adel H. El-Emam, Senior Geophysicist
Dr. Adel F. Nakhla, Geophysics Operations Manager
Mr. Mohamed Abd El Fatah, Reservoir Engineer
Mr. Hani Siam, Reservoir Engineer
Mr. Nazier M. Abdel Moneum, Information Division Manager
Mr. Mohamed Nader Abbass, Information Department Manager
Mrs. Effat Ebd El Magid, Planning Manager
Mr. Mohamed Hamdy Shehata, Manager, Training & Career Development Sector

Improved Petroleum Recovery, Inc. (IPR)

Dr. M.K. Dabbous, President
Mr. Mark A. Cocker, Manager, Geo-Consulting Services
Mr. Kenneth E. Goltz, General Manager, Egypt

Remote Sensing Center (RSC)

Mr. Ahmed S. Ayoub, Director
Dr. Hussein El Shazly, Cartographer

United States Agency for International Development (USAID)

Dr. Richard Rhoda, Office Director, Science & Technology, AID/C
Ms. Salwa Wahba, Program Assistant, Science & Technology, AID/C
Ms. Laila Victor, Secretary, Science & Technology, AID/C
Dr. Robert Ichord, AID/W
Mr. Bert Porter, AID/W
Mr. Thomas Stephens, Contracts, AID/W
Dr. Mohamed Nasr Allam, Research Engineer, Water Office, AID/C

Water Resources Center (WRC)

Dr. M. Samir Farid, Deputy Director, Groundwater Research Institute (GWRI)
Dr. Ahmed R. Khater, Research Civil Engineer, GWRI
Dr. Madiha Moustafa, Research Civil Engineer, GWRI
Dr. Hassan Ibraheim, Director, Water Resources Research Institute (WRRI)
Dr. Mohamed Osama Nassef, Research Engineer, WRRI
Dr. M.M. Gasser, Director, Hydraulics and Sediment Research Institute, Water Research Center
Mr. Abd El-Hafez Hassan Mohamed, Hydrogeologist, WRRI (Recipient of USGS Training (USGST))
Mr. Ahmed Hassan Fahmi, Hydrogeologist, WRRI (USGST)
Mr. Shawki Sami Hassan, Hydrogeologist, WRRI (USGST)

Other Contacts

Dr. Sherif Arif, Environmental Specialist, The World Bank, Washington

Dr. Hussein Younes, Professor of Soils and Remote Sensing, National Research Centre, Cairo

Mr. Hesham M. Tokali, Technical Representative, Intergrated Technology, Western Atlas International (Litton/Dresser Co.), Cairo

Mr. A.R. Montasser, Managing Director, Egyptian ABROAD Investment and Development Corp., Cairo

Mr. Khaul El Nemr, Assistant Director, Egyptian ABROAD Investment and Development Corp., Cairo

Mr. Adrian W. Zevenbergen, Remote Sensing Specialist, IWACO (Consultants for Water and Environment), Rotterdam, The Netherlands

Mr. Barry MacRae, ERIM

Dr. Hassam Fawzy, General Manager, Eight M Company

Mr. Daylon L. Walton, Petroleum Engineer, Walton Engineering

Prof. Hassan El-Etr, Geology Department, Ain Shams University, and Chairman, National Remote Sensing Committee

Appendix D: Contracts and Contractors

Egyptian General Petroleum Corporation (EGPC)

CONTRACTOR: Core Laboratories / Integrated Technologies
PURPOSE: Electrical well log data base
START DATE: December 24, 1986
END DATE: August 31, 1990
CONTRACT TYPE: Host country
AMOUNT: $ 2,174,261

CONTRACTOR: Bechtel Corporation
PURPOSE: Management Information System and upgrade of EGPC library
START DATE: June 1, 1989
END DATE: September 15, 1990
CONTRACT TYPE: Direct
AMOUNT: $ 1,480,000

CONTRACTOR: Aero Service
PURPOSE: Aeromagnetic and radiometric survey in the Eastern Desert
START DATE: December 16, 1982
END DATE: June 15, 1989
CONTRACT TYPE: Host country
AMOUNT: $ 7,419,513

CONTRACTOR: Geosource
PURPOSE: Seismic survey in the West El Guindi Basin
START DATE: July 8, 1986
END DATE: March 31, 1990
CONTRACT TYPE: Host country
AMOUNT: $ 4,188,868

CONTRACTOR: Improved Petroleum Recovery (IPR)
PURPOSE: Enhanced oil recovery, North Bakr field
START DATE: November 1985
END DATE: September 1990
CONTRACT TYPE: Host country
AMOUNT: $ 5,231,454

CONTRACTOR: Scientific Software Intercomp (SSI)
PURPOSE: Processing/treating heavy crude, Assran field
START DATE: September, 1989
END DATE: April, 1990
CONTRACT TYPE: Host country
AMOUNT: $ 80,000

CONTRACTOR: Scientific Software Intercomp (SSI)
PURPOSE: Petroleum resource assessment, Western desert, Nile basin, North Sinai
START DATE: July, 1988
END DATE: September, 1990
CONTRACT TYPE: Host country
AMOUNT: $ 3,071,795

CONTRACTOR: Geosource
PURPOSE: Basin study, Asyut/Qena
START DATE: August, 1986
END DATE: December, 1987
CONTRACT TYPE: Host country
AMOUNT: $ 2,143,729

Desert Research Center (DRC)

CONTRACTOR: Speedstar
PURPOSE: Drill rig
START DATE: July 31, 1985
END DATE: March 5, 1986
CONTRACT TYPE: Direct
AMOUNT: $ 466,237

CONTRACTOR: EG&G Mt. Sopris
PURPOSE: Borehole logger
START DATE: April 27, 1986
END DATE: December 31, 1986
CONTRACT TYPE: Host country
AMOUNT: $ 86,531

CONTRACTOR: Technicon
PURPOSE: Autoanalyzer
START DATE: March 19, 1986
END DATE: December 1, 1986
CONTRACT TYPE: Host country
AMOUNT: $ 94,078

CONTRACTOR: Zonge Engineering
PURPOSE: Time and frequency domain
START DATE: July 9, 1986
END DATE: January 31, 1987
CONTRACT TYPE: Host country
AMOUNT: $ 85,044

Egyptian Geological Survey and Mining Authority (EGSMA)

CONTRACTOR: LogEtronics
PURPOSE: Cartographic camera
START DATE: June 26, 1986
END DATE: March 30, 1987
CONTRACT TYPE: Host country
AMOUNT: $ 99,303

CONTRACTOR: Dynatech
PURPOSE: Thermal conductivity instrument
START DATE: June 26, 1986
END DATE: October 30, 1986
CONTRACT TYPE: Host country
AMOUNT: $ 27,637

CONTRACTOR: Zonge Engineering
PURPOSE: Time and frequency domain, IP equipment
START DATE: August 7, 1986
END DATE: June 1, 1987
CONTRACT TYPE: Host country
AMOUNT: $ 126,304

CONTRACTOR: Philips
PURPOSE: X-Ray diffraction (XRD) and X-Ray fluorescence (XRF)
START DATE: August 7, 1986
END DATE: May 30, 1987
CONTRACT TYPE: Host country
AMOUNT: $ 378,645

Remote Sensing Center (RSC)

CONTRACTOR: Wimvex
PURPOSE: M-DAS upgrade and training
START DATE: March 1984
END DATE: March 1988
CONTRACT TYPE: Host country
AMOUNT: $ 561,891

CONTRACTOR: ERIM
PURPOSE: Equipment, training, and printing of Atlas
START DATE: February 27, 1990
END DATE: September 15, 1990
CONTRACT TYPE: Host country
AMOUNT: $ 516,134

Mineral Groundwater Remote Sensing (MGRS)

CONTRACTOR: Bendix Field Engineering Corporation
PURPOSE: Project management and services
START DATE: June 14, 1983
END DATE: September 30, 1987
CONTRACT TYPE: Direct
AMOUNT: $ 5,032,026

Other Contracts

PURPOSE: Field vehicles (GSA)
CONTRACT TYPE: Direct
AMOUNT: $ 1,089,787

CONTRACTOR: David Snow
CONTRACT TYPE: Direct
AMOUNT: $ 233,586

PURPOSE: Interim Evaluation
CONTRACT TYPE: Direct
AMOUNT: $ 50,000

CONTRACTOR: Daylon Walton
CONTRACT TYPE: Direct
AMOUNT: $ 98,000

PURPOSE: Grant to RSC
CONTRACT TYPE: Direct
AMOUNT: $ 186,807

CONTRACTOR: Dames & Moore
PURPOSE: Final evaluation
CONTRACT TYPE: Direct
AMOUNT: $ 99,735

Appendix E: Acronyms

AID	United States Agency for International Development
ARE	Arab Republic of Egypt
ASC	Airborne Survey Contractor
ASRT	Academy of Scientific Research and Technology
CBD	Commerce Business Daily
COP	Chief of Party
CP	Conditions Precedent
DRC	Desert Research Center
ED	Eastern Desert
EDU/TNG	Office of Education and Training
EGPC	Egyptian General Petroleum Corporation
EGSMA	Egyptian Geological Survey and Mining Authority
ENSTINET	Egyptian National Scientific and Technical Information Network
ERIM	Environmental Research Institute of Michigan
FMO	Financial Management Office
GOE	Government of Egypt
GPC	General Petroleum Company
GS	Gulf of Suez
GUPCO	Gulf of Suez Petroleum Company
GWRI	Groundwater Research Institute
HRDC/ST	Human Resources Development Cooperation/Science and Technology
IPR	Improved Petroleum Recovery
IT	Integrated Technologies (previously Core Laboratories)
MALR	Ministry of Agriculture and Land Reclamation
M-DAS	Multispectral Data Analysis System
MGRS	Mineral, Groundwater, Remote Sensing
MPGAP	Minerals, Petroleum, and Groundwater Assessment Program
MPMW	Ministry of Petroleum and Mineral Wealth
MSR	Ministry of Scientific Research
NMC	Nuclear Materials Corporation
PASA	Participating Agency Service Agreement
PBS	Professional Business Services
PIC	Petroleum Information Corporation
PIO/C	Project Implementation Order for Commodities
PIO/P	Project Implementation Order for Participants
PIO/T	Project Implementation Order for Technical Assistance
PM	Program Manager
PP	Project Paper
PRO AG	Project Agreement
PSC	Personal Services Contract
RFP	Request for Proposals
RSC	Remote Sensing Center
SSI	Scientific Software Intercomp.
SUCO	Suez Canal Oil Company
USAID/C	AID Mission in Cairo
USAID/W	AID Washington Offices
USG	United States Government

USGS	United States Geological Survey
WD	Western Desert
WRC	Water Research Center

Appendix F: Methodology and Team

The evaluation was conducted by:

Douglas Lootens	- Team Leader / Economic Geologist
George Pavloff	- Economic / Petroleum Geologist
Ivan Johnson	- Hydrologist
Donald Lowe	- Remote Sensing
Eric Barton	- Economic / Petroleum Geologist
Shane Rosenthal	- Project Implementation

All team members followed the same methodological approach for the GOE agency for which they had specific responsibility. To the extent that the role and function of each agency differs, the approach to that agency was modified appropriately.

For example, since the RSC and DRC are primarily service organizations, their evaluation involved little emphasis on private sector involvement. However, since they are service-oriented, considerably greater emphasis was placed on the evaluation of cooperation with other GOE agencies, development of effective information management systems and effective and timely dissemination of their information.

DOCUMENT REVIEW

AID/Cairo assembled a large number of documents related to MPGAP for the use of the Evaluation Team. These documents included historical background reports, MPGAP contracts and procurement documents and a number of reports which are agency specific.

This set of documents was reviewed by team members. In addition, during the course of contacts with various GOE agencies, contractors and users, additional documentation was reviewed on-site or acquired for study at the project office.

A log of all documents obtained or reviewed was maintained, and is included in the evaluation report as Appendix B.

PERSONAL INTERVIEWS

Individual team members spent a large part of their data gathering and evaluation time in personal interviews with key individuals involved with MPGAP. Classes of people interviewed included:

1) AID management and technical staff;

2) Management and technical staff of each GOE agency involved in MPGAP;

3) Contractors who provided services under MPGAP; and

4) Users of MPGAP-generated data, whether they be other GOE entities or private sector organizations.

These interviews were designed to dig into MPGAP, probing both tangible and intangible results of the project. In addition, team members reviewed and/or acquired relevant reports and other documents during the interviewing process.

A log of all individuals interviewed was maintained, and is included in the evaluation report as Appendix C.

Based on the information collected and evaluated by the Evaluation Team, a draft final report was prepared for review by AID staff and the involved GOE agencies. Following receipt of AID and GOE comments, the Evaluation Team prepared and submitted its final evaluation report on September 13, 1990.