The original documents are located in Box 7, folder: "Office of Strategic Petroleum Reserves" of the Frank Zarb Papers at the Gerald R. Ford Presidential Library.

I N D E X

TAB I

STATUS OF ORGANIZATIONAL ISSUES

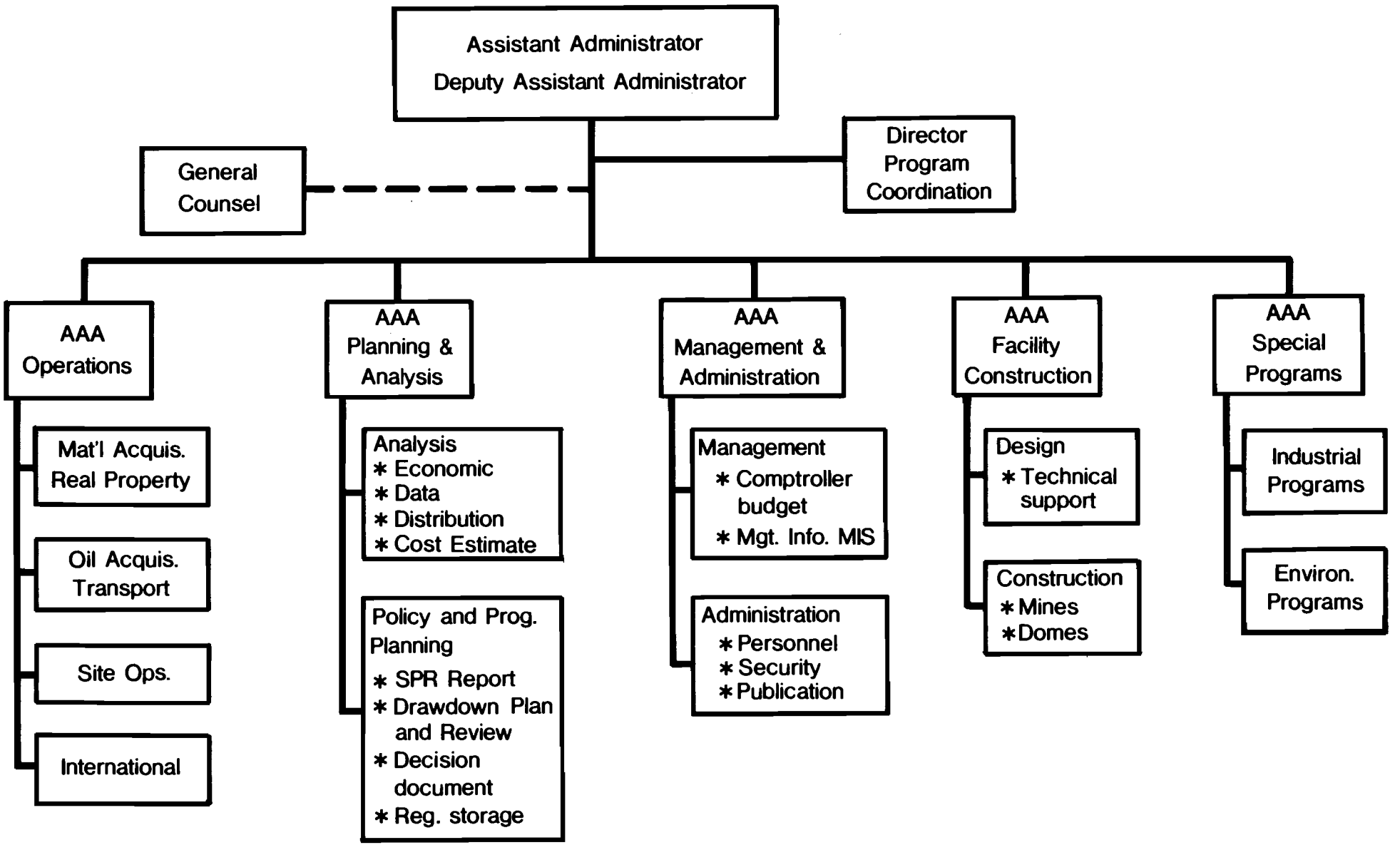
A

TAB A

SPRO ORGANIZATION

CHART

SPRO ORGANIZATION



B

TAB B

MISSIONS AND LEADERSHIP

I. ORGANIZATION

A. The SPR program has been expanded from four divisions to five and adds an Office of Program Coordination. The former organization had line and staff support functions intermingled. The new organization has clarified functional lines.

Bob Davies, who provided excellent leadership to the SPR during its formative stages, is and will continue to serve as my deputy. With his support and thorough familiarity with the program, I'm hopeful of not losing any valuable momentum during the reorganization period.

Director of Program Coordination

This office will serve as the principal adjunct to the Office of the Assistant Administrator and Deputy Assistant Administrator for the program. It is responsible for coordinating program plans and ensuring that outputs of one program activity which are required for other program activities are provided on time. The office identifies problem needs, trouble shoots them, and serves as "third party" evaluator for the program.

Mickey Gardner, who has been serving since December as the Director of Planning and Evaluation in M&A, will

be Director of Program Coordination. He was also a member of Hill's ad hoc management review task force this past Spring.

1. AAA for Operations

This office will prepare the design for the entire system, integrating the site designs of the Facility Construction Division. It will be responsible for logistic support to that division, including real and personal property (engineering material and equipment), oil acquisition, and transportation. This division will also manage the sites as construction is completed.

Fred Johnson, presently Regional Administrator in Atlanta, will be the AAA for Operations. He has wide experience in petroleum systems and supply shortage management earned at the Defense Fuel Supply Center (where he was Deputy Commander) and with FEA. Johnson was a key figure in FEO's startup.

2. AAA for Planning and Analysis

This office will prepare most of the program's "public paper" -- the Strategic Petroleum Reserve Plan, due to the Congress in December, annual program reports to the Congress, and other public documents. It will formulate the use plan of the

reserve during an embargo and perform the analyses required for program activities, such as that required for Regional Storage, various economic analyses, data analyses, distribution analyses, and cost estimating.

Carl Hystad, presently Chief of the Commerce Branch at OMB, will be the AAA for Planning and Analysis. Hystad has had an outstanding fourteen year career in Government. He has been with OMB since 1970.

3. AAA for Special Programs

This office is responsible for conducting all of the program's environmental studies, assessments, and formal Environmental Impact Statements. Because a comprehensive environmental statement is required for each site the program will employ, this activity is key to all subsequent procurement, design and construction activities. A Program Environmental Statement is being circulated in final draft form, the next to last step. It will be published in final form in October. Five site specific environmental impact statements will be published in final draft form in August.

The Special Program Office is also responsible for development of the Industrial Petroleum Reserve Issue so that a final decision can be incorporated in the December report. If the issue is resolved in the affirmative, the office will be responsible for developing regulations and the procedures necessary to enforce them. To this end, a public hearing will be held on 19-20 July to discuss the questions of whether there should be an Industrial Reserve and, if so, what its make-up should be.

Michael Carosella, who has been serving as Bob Davies' second-in-command, will be the AAA for Special Programs. His training in engineering, engineering administration (Masters), and law (JD, program management), as well as his experience with EPA and Navy particularly well qualify him for the position. Mike also has an intimate knowledge of the program which is most helpful during this period of reorganization.

4. AAA for Management and Administration

This office is responsible for all administrative support functions and management assistance. Its comptroller function includes budget and financial management responsibilities. It is responsible

for personnel, security, publications, and other housekeeping functions. Because of the magnitude of dollars invested in the program, the audit and comptroller functions are very important, and demand first rate attention from the outset.

Chuck Ebbecke, who has served in exemplary fashion as the Executive Officer of Policy and Analysis over the past two years, will be the AAA for Management and Administration. Before joining FEA, Ebbecke was the Executive Officer for ACTION/ International Operations and served as Deputy Director.

5. AAA for Facilities Construction

This office is reponsible for all design and construction activities associated with the program. This includes salt domes, converted mines, pipelines, docks, storage tanks, and other support facilities. By the end of FY 1977, the office will have completed design on 3 to 6 storage sites using architect engineering contractors. Also, construction will have begun using construction contractors either directly by the program, or through the good offices of the Corps of Engineers.

Sonny Caputo, who leaves his post as Deputy Director of the D.C. Department of General Services, will be the AAA for Facilities Construction. He has long experience in site planning and acquisition, program budgeting and management, and architect engineering design and construction management. In selecting this key player in the SPR organization, I checked with various key people at the Corps of Engineers as well as with the leadership of the D.C. based Federal City Council. In every case, Caputo came up with outstanding recommendations.

B. Legal Counsel

Program officials are presently working to improve the provision of legal counsel to the program office. Neither the program office nor the Office of General Counsel have found the relationship satisfactory to date. Problems of delays, occasioned at least in part by insufficient staffing, have occurrred, threatening program schedules. Mickey Gardner of the program office and Bob Goodwin of the Office of General Counsel have been working together to sort out the available options. Papers will be prepared by mid-July for John Hill's review. One thing is clear at this stage -- the legal requirements of

this program are very substantial, and unless they are met in a thorough yet timely fashion, the program's early development could be greatly impaired.

TAB II

BUDGET

BUDGET

- $762 million will be the total appropriation over the three year life of the program so far (1975-1977).
- $762 million is arrived at by:
  - 1 million planning and feasibility studies last year
  - 314 million appropriated for FY 76 and TQ
  - 447 million approved by Conference Committee for FY 77
- No funds are provided for Regional or Industrial storage
- This is all we requested with the exception of $110 million deferral by the House for the purchase of crude in FY 77. If the storage facilities can hold it, the House has invited us back for a supplemental.
- Only $81 million has been committed so far:
  - 1 million in FY 75 for planning
  - 5 million in FY 76 for additional planning and operations with a $2.5 million reimbursement to ERD
  - 75 million for the Corps of Engineers
- The balance of $681 million is planned to be spent as follows:
  - 225 site acquisition, facility design and construction in FY 76
  - 440 crude oil purchase in FY 77
  - 11 for FY 76 and 77 planning and analysis
  - 2 for FY 76 salaries and expenses
  - 4 for FY 77 salaries and expenses
- Only expected budget problem at this point, prior to site acquisition, is schedule of FY 78 OMB (September) submission and timing of decision process on Regional and Industrial storage (late October). Plan to submit full program to OMB and get the backup on Regional and Industrial to them after the submission.

FINANCIAL PLAN

I. OVERVIEW

	Appropriations	Obligations		Balance
FY 75		.9		.1
FY 76	313.4	2.5	Contracts	233.4*
		2.5	ERD Reimbursement	
		75.0	Corps of Engineers	
		80.0		
FY TQ	.6	-		.6
FY 77	447.7	-		447.7
Total	761.7	80.9		681.8

* 167.5 deferred pending environmental impact studies, site appraisals, and site configuration studies. Will be released by OMB when studies are completed.

II. PLANNED OBLIGATIONS ($M)

$225	FY 76	- site acquisition, design and facilities construction
440	FY 77	- crude acquisition
11	FY 76 & 77	- planning, operations and study contracts
2	FY 76	- salaries and expenses
4	FY 77	- salaries and expenses
$682	Total balance available	

TAB III

ISSUES

SUMMARY OF ISSUES

Ten major issues have been identified, eight of which will need resolution before the Strategic Petroleum Reserve Report can be drafted. These issues have been listed and grouped according to the importance of the issue to the resolution of other issues, and according to the level of authority needed for resolution. The list is arranged in order of importance, and each issue is marked to indicate whether a decison may be made--within Strategic Petroleum Reserve Office (SPRO); by the Administrator after consideration in the Federal Energy Administration (FEA) Issue Process; and by the Energy Resources Council (ERC) and the White House.

1. Regional Storage - ERC
2. Foreign Storage - ERC
3. Industrial - ERC
4. Use Plan - ERC
5. Fuel Types and Segregation - FEA (OMB is interested)
6. Sources of Oil - ERC or possibly only FEA & State
7. Site Decisions - SPRO
8. Economic Impact - SPRO
9. Size of Reserve - FEA (possibly NSC & DOD)
10. Security (Strategic Dispersal) - FEA

There are two options for consideration on the means of clearing the issues through the ERC and the White House. Either FEA

may decide all of the issues and write the report which would be our only submission to the ERC, or we may submit each major issue to the ERC as the pros and cons are developed. An option paper is attached which shows the pros and cons of the two options. Also attached are two timetables which correspond to the options and which would need to be followed to meet the December deadlines.

Attachment

STRATEGY FOR ISSUE RESOLUTION

The Strategic Petroleum Reserve Report can be written only after certain key policy decisions are made. These can be clustered according to the level of authority needed for decision. The decisionmaking levels internal to the Executive Branch are: FEA; FEA with OMB; FEA and the ERC; and the President. For planning purposes, we should assume that all issues posed to the ERC will require resolution at the Presidential level. There are two options for moving the issues through the decision chain.

Option I.

Each issue requiring ERC consideration can be resolved separately.

Pros

1. Each issue is thoroughly considered
2. The final report can be written with confidence in the Administration's position on each assumption.

Cons

1. The ERC and White House may not make decisions on the issues in time for SPRO to write the report.
2. Certain issues impact on other issues and resolution must be made in a sequential manner. The ERC cannot finish all the issues within the statutory time frame.

Option II

FEA can make decisions on all of the issues of the program, and we will present a finished report to the ERC and White House.

Pros

1. The decisions will be integrated.
2. We can have early resolution of the issues, and more time for essential analysis.
3. We are not likely to have the report rejected by the ERC or White House.
4. We can guarantee that FEA will meet its responsibilities under the statutory deadlines.

Cons

1. If the ERC or the White House rejects the finished report, and changes a major assumption, all of the analytical work would become obsolete.
2. The program is large enough to require political clearance of each major issue.
3. Regional and IPR issues will surface in FY 78 budget request.

	Issue	Option No. 1 Final Product	Option No. 2 Issue by Issue
1.	Regional	Zarb - Aug 27 '76	ERC-Ford - Aug 27 - Sep 10 '76
2.	Foreign	Zarb - Jul 30 '76	ERC-Ford - Jul 30 - Aug 13 '76
3.	Industrial	Zarb - Aug 27 '76	ERC-Ford - Aug 27 - Sep 10 '76
4.	Use Plan	Zarb - Sep 17 '76	ERC-Ford - Sep 17 - Oct 1 '76
5.	Fuel Types & Segregation	Noel - Sep 17 '76	Noel - Sep 17 - Oct 1 '76
6.	Sources of Oil	Zarb - Oct 1 '76	Zarb-Ford-Kissinger - Oct 1 - Oct 15 '76
7.	Site Decisions	Noel - Dec 15 '76	Noel - Dec 15 '76
8.	Economic Impact	Noel - Sep 24 '76	Noel - Sep 24 - Oct 22 '76
9.	Size of Reserve	Zarb - Jun '77	Zarb-Lynn - Jun '77
10.	Security	Zarb - 1977	Zarb - 1977

ISSUE DECISIONS DEADLINES

Option No. 1

Assuming that the final report is given to the ERC and the White House, after all of the issues have been decided within FEA, we must adhere to the following timetable. This schedule allows the ERC considerable time to review the final document, and for FEA to rewrite the document according to comments.

Internal Draft of Report	October 15, 1976
Rewrite Draft	October 18-31, 1976
Internal Final	November 3, 1976
ERC-White House Consideration	November 3, 1978
Rewrite w/Comments & Clearance	November 3 - December 9, 1976
Printing	December 9-15, 1976
Deliver to Congress	December 13, 1976

Option No. 2

Assuming the issues are presented to the ERC and White House on a staggered basis, the following timetable should be followed. This schedule reflects the time requirements of ERC to decide each issue. It allows for less review and rewrite time of the final document because it assumes no major changes from the draft.

Internal Draft of Report	November 8, 1976
Rewrite Draft	November 12-19, 1976
Internal Final	November 19, 1976

ERC-White House Consideration	November 19, 1976
Rewrite w/Comments & Clearance	November 19 - December 9, 197
Printing	December 9-15, 1976
Deliver to Congress	December 15, 1976

TAB IV

TAB IV

DRAFT REPORT TO CONGRESS ON

EXPLORATION, DEVELOPMENT

AND PRODUCTION OF NPR-4

THE EXPLORATION, DEVELOPMENT, AND PRODUCTION OF NAVAL PETROLEUM RESERVE-4

Prepared for:

The Committees on Interior and Insular Affairs
of the Senate and House of Representatives

Prepared by:

Federal Energy Administration
Office of Strategic Petroleum Reserves
and Office of Oil and Gas

July 6, 1976

EXECUTIVE SUMMARY

PROPOSED FEA RECOMMENDATIONS

The Naval Petroleum Reserves Production Act (NPRPA) mandates government exploration of the Naval Petroleum Reserve No. 4 (NPR-4), but authorizes no development or production of petroleum discoveries. Although maximum private sector involvement in NPR-4 exploration, development, and production is preferred, private industry will not be interested in exploring NPR-4 without assurance of the right to develop and produce any discoveries made. Obtaining the necessary legislative authority to lease, performing environmental impact studies, and setting a leasing procedure in motion will consume approximately 2-3 years. But since the potential economic and social benefits from NPR-4 oil and gas resources decline with time, a 1-year delay in realizing the $3.9 billion net national benefits expected from NPR-4 development would cost the nation approximately $312 million, assuming an 8-percent discount rate and constant real world oil prices.

Therefore, in recognition of the substantial benefits to be realized from timely development of NPR-4 petroleum resources, the following recommendations are proposed to be submitted to the Congress in compliance with Section 164 of the Energy Policy and Conservation Act of 1975 (EPCA):

I. The comprehensive study required by NPRPA Section 105(b) should begin as soon as possible, with subsequent findings and recommendations presented to Congress as early as June 1, 1977, but no later than January 1, 1978.

II. The study required by Section 105(b) should specifically focus on pipeline utilization, access to pipelines, and mechanisms for setting tariffs for TAPS and other potential pipelines, as well as on leasing procedures and other Federal actions that facilitate private sector development of NPR-4.

III. DOI should prepare to request statutory authority to lease NPR-4 to private industry as soon as is practicable.

IV. A Government exploration program, similar to the Department of the Navy's, should be continued during the period required to implement a leasing program.

- A project office should be established within the DOI to carry out this program.

- All necessary reconnaissance seismic and detailed seismic and drill on most of the major structures throughout the Reserve should be completed in 2 to 3 years.

- Initial appropriation of funds for this exploration effort should cover the entire 2- to 3-year program.

V. The Federal Government should assure that State and North Slope Borough governments suffer no negative net economic impact as a result of NPR-4 development.

VI. The measures for mitigating potential adverse environmental and socioeconomic impacts outlined in the contractor's report should be implemented.

VII. In all matters pertaining to the exploration, development and production of NPR-4 petroleum resources, the DOI should work closely with the various agencies of the State of Alaska.

MAJOR FINDINGS IN THE CONTRACTOR REPORT

I. Recoverable resources, based on the Department of the Navy's current exploration data (previously unavailable), are estimated to be 5 billion barrels of liquid hydrocarbons and 14.3 trillion cubic feet (Tcf) of natural gas. Previous estimates were:

- United States Geological Survey (USGS) 1969, 10 billion barrels oil and 32 Tcf natural gas.

- Arctic Institute of North America (AINA) 1971, 4 to 14 billion barrels of oil.

II. Although numerous, attractive, hydrocarbon prospects exist within NPR-4, there is as yet no indication of massive structures with reserve potential of the magnitude found at Prudhoe Bay.

- Nine structures are estimated to have in excess of 500 million barrels in oil equivalent capacity.

- Another 11 structures are estimated to have an oil equivalent capacity of 250 to 500 million barrels.

- There are 26 structures estimated to have 100 to 250 million barrels of oil equivalent capacity each.

III. Given the study team's best estimates of market prices, costs, wildcat probabilities, and operating factors, a minimum field size of 460 million barrels of recoverable oil would be required to allow the nation as a whole to realize an 8-percent discounted rate of return on investment. With reasonable variations in assumptions, minimum field size could vary from 280 million barrels to 930 million barrels of oil.

IV. The number of exploratory wells that will have to be drilled to maximize net national economic benefits varies according to the level of resources found.

- Overall, if NPR-4 were as productive as reservoir assumptions indicated, 111 exploratory wells will have to be drilled to maximize net national economic benefits.

  -- Capital requirements are estimated at $1.3 billion.

  -- Manpower requirements are estimated at nearly 2,000 man-years.

  -- Total net national economic benefits are estimated at $3.9 billion, of which $447 million (11 percent) are energy-independence benefits.

- Assuming discouraging results--that is, there are no commercial discoveries and no favorable signs for drilling additional structures-- the minimum number of wells needed to confirm NPR-4 as economically unattractive is estimated at 13, spread fairly evenly throughout the zones.

  -- The capital requirements are estimated at $182 million.

  -- The minimum number of wells necessary is extremely sensitive to all major assumptions and could vary from as few as four (under conditions of a $10-per-barrel imported oil price) to as many as 28 (under low trans-NPR-4 pipeline costs, or a $16-per-barrel imported oil price), with proportionate capital requirements.

V. Nine development scenarios were evaluated using oil prices at $10, $13, and $16 per barrel, coupled with field sizes of 500-million-, 1-billion-, and 3-billion-barrels.

- All of the scenarios except the 500-million-barrel field at $10 per barrel showed a net national economic benefit for development.

- Private sector development revealed a profit to the private sector as a whole in all cases except the 500-million-barrel field at $10 and $13 per barrel, assuming existing pipeline tariff and OCS leasing procedures, and current tax laws.

- Under five of the scenarios, the profitability of NPR-4 development, given existing institutional arrangements, to the private developer, is highly uncertain. Although net benefits to the private sector as a whole would be positive, expected benefits to the field developer would be negative. To make NPR-4 leasing attractive to private developers not currently involved in North Slope operations, the Federal Government may have to relax existing pipeline tariff procedures and, to a lesser extent, fixed royalty requirements.

VI. There is general agreement that the state and local economic, social and environmental impacts of NPR-4 development will be significant, but there is no concensus, even among Natives, on whether the net effects will be advantageous or adverse.

- Economic

  -- State employment impacts range from 4,000 jobs (peak year) for a 500-million-barrel field to 13,000 jobs (peak year) for a 3-billion-barrel field.

  -- Under private development, the state would realize no net fiscal impact for a 500-million-barrel field*, a gain of $151 million

*Assuming a $13-per-barrel oil price and conventional leasing, a 500-million-barrel field could not be profitably developed by the private sector. If a field of that size were developed by the government, it is assumed that the state would be reimbursed for infrastructure costs.

for a 1-billion-barrel field, or a gain of $473 million for a 3-billion-barrel field.

-- Population impacts in the North Slope Borough would likely range from 500 to 2,400 people over the range of assumed discoveries.

-- Local government cost increases could range from $30 million to $120 million for the three assumed scenarios; local revenues were not estimated.

- Social

-- Major local and Native lifestyles/cultural concerns focused on issues such as:

1. Would oil and gas development activities interfere with surface resources on which Native life depends?

2. Where would base camps be located?

3. What restrictions would be imposed on nonresident, temporary workers?

4. Would the Natives be given a voice in development decisions?

5. What would happen after the development boom?

-- The Natives are concerned that NPR-4 exploration and development could impose substantial new demands on already over-taxed community facilities and services, espeially housing, health care, education, air services, and power and water supplies.

-- The Natives desire a significant participation in employment opportunities arising from NPR-4 exploration and development, especially through Native-owned corporations.

- Environmental

  -- The major environmental impacts associated with NPR-4 exploration and development are related to terrain/soils and permafrost, surface and subsurface drainage systems, water quality, and tundra and aquatic plant and animal population.

  -- Most of the potential environmental impacts can be mitigated satisfactorily through compliance with existing environmental regulations. In some cases, however, certain environmentally sensitive areas must be set aside from oil and gas operations.

TABLE OF CONTENTS

EXHIBITS

EXHIBITS (Continued)

NAVAL PETROLEUM RESERVE NO. 4 REPORT*

Naval Petroleum Reserve No. 4 (NPR-4),** to be renamed the National Petroleum Reserve in Alaska upon transfer of jurisdiction on June 1, 1977, to the U.S. Department of the Interior (DOI), is thought to contain oil and gas resources that could contribute significantly to increasing the national income and reducing our dependence on imported energy supplies. NPR-4 was created in 1923 and placed under the jurisdiction of the Department of the Navy as a national defense reserve. However, in view of the continuing dependence of the United States on costly imported oil, the possibility and advisability of developing NPR-4 oil and gas resources are being considered. Specifically, the Naval Petroleum Reserve Production Act of 1976 (NPRPA) has authorized the exploration of the Reserve to define more precisely the amount of resources that can be developed.

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* This report is submitted by the Administrator of the Federal Energy Administration (FEA), in cooperation and consultation with the Secretary of the Navy and the Secretary of the Interior, to the Committees on Interior and Insular Affairs of the Senate and the House of Representatives in fulfillment of the requirement of Section 164 of the Energy Policy and Conservation Act, as amended by Section 105(a) of the Naval Petroleum Reserves Production Act of 1976.

** NPR-4 was established by President Harding and consists of about 37,000 square miles, or over 23 million acres (approximately the size of the State of Indiana), located on the North Slope of Alaska.

The natural gas and petroleum potential of NPR-4 is not entirely unknown. Located north of the Arctic Circle on the North Slope of the Brooks Range (see Exhibit 1), NPR-4 has hosted limited previous oil and gas exploration, and exploration has occurred east of the Reserve, both preceding and following the Prudhoe Bay discovery. In fact, more than 68 wildcat and test wells have been drilled north of the Brooks Range. (See Exhibit 2.) However, the only commercial discovery of any significance has been Prudhoe Bay.

Between 1923 and 1944, most of the exploratory work in NPR-4 consisted of geological surveys. In 1944, in preparation for a possible oil shortage in the event the Second World War continued for several more years, the Navy "Seabees" (and later, contractors) undertook an ambitious exploration and drilling program that continued until 1953. In all, the program included 36 test wells* and 44 core tests, over 3,400 line miles of seismic coverage, geologic mapping of 21,000 square miles by reconnaissance, and gravity meter assessment of 26,000 square miles.

Nine oil and gas fields were found after an exploration expenditure of about $40 million. The largest oil field discovered, Umiat, is thought to contain an estimated 70 million barrels of recoverable oil, while the Simpson Oil Field is

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* However, as subsequently determined, most of the test wells were not deep enough to be of significant value.

estimated to contain some 12 million barrels of recoverable oil. The largest gas field discovered that is wholly within NPR-4 is the Barrow Gas Field, then estimated to contain some 17 billion cubic feet of recoverable gas.

Since 1955, two exploratory wells and eight South Barrow Gas Field development wells have been drilled to provide natural gas to the residents and government operations located at Barrow. Another field, at Gubik, lying mostly outside NPR-4, is thought to contain an estimated 295 billion cubic feet of recoverable gas. But none of these oil and gas fields (except the Barrow Gas Field for local consumption) is economically recoverable; that is, the cost incurred in producing these oil and gas deposits would greatly exceed any reasonable price that could be obtained.

Finding oil and gas is the direct result of successfully proving a geological hypothesis on the incidence of oil and gas accumulations in a particular area. The hypothesis must cover the source of the oil and gas (e.g., which sediment contained marine deposits in sufficient quantity to spawn the hydrocarbons), the migration of oil and gas through and within sedimentary formations, and the mechanism for trapping and holding such accumulations. The hypothesis will vary widely from area to area, basin to basin, and structure to structure.

Prior to the NPR-4 exploratory program beginning in 1974, the hypothesis was that oil and gas would most likely be found in relatively shallow and geologically young Cretaceous sands. Even though no commercial accumulations were found, the discovery of oil in the Umiat and Simpson fields seemed to bear out this hypothesis. However, these "red herring" discoveries kept attention focused on the younger zones, rather than on the older, deeper sands later found to be productive at Prudhoe Bay. Industry, working from the results of the Navy program, began drilling wildcat wells into the Cretaceous zone south of Prudhoe Bay. At first, no commercial deposits were found. But the drilling proceeded northward, until Arco's Prudhoe Bay State No. 1 exploratory well was drilled into the deeper and geologically older sediments, and the Sadlerochit pool in the Triassic-Permian formation was discovered in 1968.* This discovery, the largest ever on the North American continent, naturally had an encouraging effect on Arctic oil and gas exploration. As a result, oil companies have drilled both in the immediate area of the Prudhoe Bay discovery and south and east of the reservoir. In the immediate vicinity, two other pools, the Lisburne (below the main producing reservoir at Prudhoe Bay) and the Kuparuk (Cretaceous formation above the Triassic-Permian, located west of the main reservoir) have been discovered. Drilling south and farther east has resulted in a string of dry holes.

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* It is almost certain that the oil and gas found at Prudhoe Bay originated in the Cretaceous formation lying above the truncating unconformity that traps the Prudhoe Bay accumulation.

In 1974, Congress directed the Navy to resume its exploration program in NPR-4. To date, the program has consisted of conducting and interpreting reconnaissance seismic and other geophysical activities, and drilling three wells.

In the reconnaissance seismic program, designed to give a broad picture of the structural characteristics of the geology of the Reserve, slightly over 5,000 line miles of reflection seismic and gravity data gathering had been completed through May 1976.* Of this, about 3,500 line miles, principally in the northern and eastern parts of the Reserve, have been interpreted.

The Navy has also completed the drilling of three wells. The Iko Bay well, located 22 miles east-southeast of Barrow, was drilled in February 1975 to find additional gas reserves to meet the increasing demand in the Barrow area. The well was completed on March 8, 1975, as a marginal gas well. A second well, Cape Halkett No. 1, located 100 miles east-southeast of Barrow, was spudded March 24, 1975. This well penetrated the same pre-Cretaceous formations found to be so productive in the Prudhoe Bay Field. The third well, East Teshekpuk

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* Approximately 3,000 line miles are scheduled for Fiscal Year (FY) 1977 (in the southeast and south-central sectors). An additional 2,400 line miles of seismic exploration are scheduled for the remainder of the program.

No. 1, completed in April 1976, was drilled to 10,664 feet on the eastern shoreline of Lake Teshekpuk. Neither of these latter two wells, which were drilled to basement rock, discovered commercial hydrocarbons.*

Exploration and subsequent development of NPR-4 are not, and will not be, easy tasks because of the area's unique features, including:

- Location. NPR-4 is located in the most isolated area of the United States, far from large marketplaces for petroleum products. Such a location obviously exerts upward pressure on exploration, development, production, and, particularly, transportation costs.
- Environment. NPR-4 is located in one of the most untouched environments in the country. This environment is easily damaged and requires long periods of recovery from intensive use. In turn, the fragile environment, coupled with the harsh climate, places severe operating constraints on any activities carried on within its bounds.
- Culture. The Reserve is the home of the largest Eskimo settlement in the United States. Some of the people

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* The Cape Halkett and Teshekpuk Lake wells are located in Zone A of NPR-4. (See Exhibit 2.) The Navy plans to drill five more medium-depth exploratory wells in Zone A in FY 1977, prior to transfer of jurisdiction to DOI. Drilling activities are limited to Zone A until an Environmental Impact Statement for exploration in other zones is completed, probably sometime in late 1976 or early 1977.

native to the area still maintain a subsistence-level lifestyle and are greatly dependent on natural resources for existence; furthermore, they can be greatly affected by non-Natives living in their community.

Congress recognized these unique factors of the Reserve in describing the contents of the report required by Section 164 of the Energy Policy and Conservation Act (EPCA). Specifically, the Administrator of the Federal Energy Administration (FEA), in cooperation and consultation with the Secretary of the Navy and the Secretary of the Interior, was directed to recommend to Congress: (1) procedures for the exploration, development, and production of NPR-4; (2) procedures for protecting the economic, social, and environmental interests of Alaskan Natives residing within NPR-4; and (3) arrangements for the participation of private industry and capital, including private-industry leasing.

The development of these recommendations was effected through a formal study, and while this study was being conducted, further legislation affecting NPR-4 was passed. In April 1976, the NPRPA was approved by Congress and signed into law by President Ford. Six provisions of the law are especially relevant:*

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* The Act also requires DOI to provide natural gas to the Government facilities located in Barrow and the Village of Barrow.

- Working with DOI, the Department of the Navy will continue exploration until June 1, 1977, at which time jurisdiction for such activity will be transferred to the DOI. In effecting this transfer of responsibility, the Navy will cooperate with the DOI.
- Exploration near the Utukok River, the Teshekpuk Lake, and other areas designated by the Secretary of the Interior will include measures to protect surface values.
- DOI will establish a task force composed of North Slope Natives, representatives of the State of Alaska, and DOI officials to develop recommendations to Congress on the best uses for the lands contained in NPR-4, taking into consideration Native subsistence needs; wilderness, scenic, historical, and recreational values; fish and wildlife habitats; mineral potential; and other values of the lands.
- Government exploration is mandated; however, development leading to production must be authorized by Congress.
- Executive departments, in consultation with the State of Alaska, will study NPR-4 resource development, production, transportation, and distribution (Section 105(b)). They will provide periodic reports to the Congress and will present a final report (NPRPA study) with recommended procedures and any proposed legislation, no later than January 1, 1980.

- The Secretary of the Interior is authorized to assist, through existing Federal programs, communities in meeting the cost of increased municipal services and facilities if he determines that unfair and excessive financial burdens are a direct result of exploration and study activities.

To fulfill the requirements mandated by Section 164 of the EPCA, the FEA decided to undertake a comprehensive study that would involve both other government agencies and outside contractors. FEA has enjoyed the full cooperation of the Department of the Navy and the Department of the Interior. An interagency study team was established, headed by FEA's Office of Strategic Petroleum Reserves and including representatives from FEA's Office of Oil and Gas, the Department of the Navy's Office of Naval Petroleum and Oil Shale Reserves, and the Department of the Interior's Energy and Minerals Staff and U.S. Geological Survey (USGS). In addition, although not required by the EPCA, representatives of the State of Alaska were invited to participate fully in the study. The state, through its Department of Revenue and Department of Natural Resources, accepted this invitation and has participated in the study to a limited extent.

Because of the tight timeframe for the study, FEA retained an outside contractor* to assist in the compilation of information and make substantive organizational and editorial suggestions for this report. The contractor's findings are contained in a report to FEA that is submitted concurrently with this document. The interagency study team has worked very closely with this contractor in:

- Reviewing published materials and correspondence related to NPR-4
- Interviewing Federal and state (Alaska) officials, Congressional staff members, oil and gas executives, and residents of the North Slope Borough
- Holding public hearings in Anchorage, Fairbanks, and Barrow, Alaska, on April 7, 8, and 10, 1976, respectively, and obtaining written as well as oral comments*
- Analyzing various issues.

This report contains FEA's conclusions and the recommendations that flow from these conclusions, as required by Section 164 of the EPCA.

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* The contractor selected was Resource Planning Associates, Inc. (Cambridge, Massachusetts); two subcontractors - LaRue, Moore & Schafer (Dallas, Texas) and Dames & Moore (Anchorage, Alaska) - were also retained.

** The comments obtained at the hearings were carefully considered in preparation of this report as well as of the contractor's document.

CONCLUSIONS

The results of the studies mandated by the NPRPA will undoubtedly influence future NPR-4 exploration and development decisions; in addition, the conclusions of this report could change considerably as more knowledge is obtained through further exploration. The conclusions reached in this report reflect the limited amount of time available to prepare it. Specifically, to complete the effort within the time period mandated by Congress, simplifying assumptions had to be made about a number of complex issues, and some needed, but time-consuming, analyses could not be carried out. In particular, the analysis did not explicitly treat the uncertainty in estimates of reserves, prices, and costs, and in operating factors. However, the analytical effort associated with this report produced a number of important results on which preliminary conclusions concerning exploration requirements, development requirements, management programs, and socioeconomic and environmental impacts were made.

Exploration Requirements

We have drawn four major conclusions on issues and areas related to exploration requirements:

- Resource estimates. Although any estimate of NPR-4 prospects is uncertain because of the limited drilling

to date, the most likely levels of undiscovered, recoverable resources in NPR-4 are estimated at 5 billion barrels of liquid hydrocarbons (oil and gas condensate) and 14.3 trillion cubic feet of gas. (See Exhibit 3.)

- Early (late 1968 and early 1969) USGS estimates* of 10 billion barrels of oil and 32 trillion cubic feet of gas and the Arctic Institute of North America's (AINA) estimate in 1971 of 4-14 billion barrels of oil appear too high.
- A more recent, informal USGS estimate of 2-8 billion barrels of oil and 7-25 trillion cubic feet of gas appears to be more reasonable.**
- The new estimate is based on current information that is an order of magnitude better than that previously available to either USGS or AINA, which was used in a Jones reservoir model. (See Exhibit 4 for detailed reservoir assumptions.)*** Specifically, that information included:
  - Prospect and closure maps, prepared at the direction of the Department of the Navy, from the first 3,500 line miles of seismic data

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* Unpublished USGS internal memorandum, Oil and Gas Resources Estimate for Petroleum Reserve No. 4.

** It is anticipated that USGS will release a new, formal estimate for NPR-4 resources sometime in 1976.

*** A description of this model is contained in Appendix A of the contractor's report. A limitation of this methodology is that the resource estimates have not explicitly treated uncertainty. However, neither the Department of the Navy, or DOI study representatives took exception to the study team's revised resource estimates.

- The well log from all wells drilled in NPR-4 through the 1974-1975 drilling season, including the Cape Halkett No. 1 well log
- The results of oil companies' deep-exploration wells east of NPR-4 at the Colville River Delta and south of Prudhoe Bay
- Syntheses of geological studies carried out over the last 30 years.

- Structures distribution. Although numerous attractive hydrocarbon prospects exist with NPR-4, there is as yet no indication of massive structures with reserve potential of the magnitude found at Prudhoe Bay.*
  - There are nine structures estimated to have in excess of 500 million barrels capacity. (Natural gas has been included on an oil-equivalent-Btu basis.) (See Exhibit 5.)

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* The size and distribution of petroleum prospects in the entire Reserve have been inferred from the Navy's seismic data in an area representing approximately one-third the areal extent of NPR-4. (The reconnaissance seismic work was conducted in this area because it was closest to the Prudhoe Bay area east of the Reserve, an area for which exclusive geophysical data existed.) In addition, the study team assumed that the northwest portion of the Reserve will resemble the Navy's Administration Zone A in geology and have the same structure size distribution, and that the foothills and western portions of the Reserve will have the same structure size distribution that prevails in Zone B (at depths less than 13,000 feet). Although the study team believes its assessment of the northwest, foothills, and western portions of the Reserve is relatively optimistic, the exclusion of possible stratigraphic plays lessens this optimistic outlook somewhat.

- Another 11 structures are estimated to have an oil-equivalent capacity of 250-500 million barrels.
- There are 26 structures estimated to have 100-250 million barrels of oil equivalent capacity each.

- Minimum Field size. Using a methodology that assessed the present value of net national economic benefits* and base-case assumptions that reflected the study team's best estimates of market price, costs**, wildcat probabilities, and operating factors (see Exhibit 6), a minimum field size of 460 million barrels of recoverable oil would be required to allow the nation as a whole to realize an 8-percent discounted rate of return on investment. The minimum field size necessary for economic development

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* Net national economic benefits is a measure of the sum of the benefits to the people of the United States, regardless of who receives them. Net national economic benefits include: (a) increases in national income, measured as the difference between the value of oil and gas produced less all resource costs; and (b) increases in energy independence, measured as the decrease in carrying costs for the nation's strategic petroleum reserve.

** All costs are valued on a resource basis; thus, income transfers such as royalties, taxes, and bonuses are excluded. Transportation cost assumptions used in computing minimum field size necessary for commercial development are based on the assumption that the initial field must bear the full cost of a spur pipeline. To the extent multiple fields are found, all but the initial field will bear only the marginal cost of a far shorter spur pipeline, and, hence, the field could be significantly smaller in size than the minimum field size of the initial field.

depends to a great extent on the economics of development, production, and transportation. With reasonable variations in these cost factors from base-case assumptions, the minimum field size could vary from 280 to 930 million barrels of oil.

Exploration programs. The study team used a Monte Carlo simulation model* to develop appropriate exploration programs in terms of number of wells required to maximize net national economic benefits; capital and manpower requirements; and expected benefits for three levels of exploratory results - expected, encouraging, and discouraging.

- Expected results. Overall, if NPR-4 were as productive as reservoir assumptions indicate, 111 exploratory wells will have to be drilled to maximize net national economic benefits. (See Exhibit 7.)
  - Capital requirements are estimated at $1.3 billion.
  - Manpower requirements are estimated at nearly 2,000 man-years.

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* A description of this model is contained in Appendix A of the contractor's report. A limitation of the model was that it did not take into consideration the relative likelihood of the encouraging and discouraging scenarios. As can be seen from an analysis of the expected results, the "encouraging results" scenario is far more likely to occur than the "discouraging results" scenario. In addition, the "encouraging results" and "discouraging results" scenarios reflect "extreme" exploration results. However, an analysis of these "extreme" situations was important because they reflect minimum and maximum resource requirements.

Total net national economic benefits are estimated at $3.9 billion, of which $447 million (11 percent) are energy-independence benefits. (See Exhibit 8.)

Delaying these expected benefits a year, assuming an 8-percent discount rate, would cost the nation $312 million.

- Encouraging results. Assuming encouraging results - that is, all structures larger than the size necessary to amortize delineation and development wells are drilled and a minimum size field is found in each zone - the number of exploratory wells required will be 123. (See Exhibit 7.)

  - Capital requirements are estimated at $1.5 billion over the life of the exploration program. (See Exhibit 9.)
  - Over 2,100 man-years of effort would likely be required.
  - The total number of wells required is highly sensitive to the probability of exploration success, ranging from 80 (low oil prices and net pay) to 136 (less than 45-percent probability of success), with proportionate capital and manpower requirements. (See Exhibit 10.)

- Discouraging results. Assuming discouraging results - that is, there are no commercial discoveries and no favorable signs for drilling additional structures - the minimum number of exploratory wells needed to confirm NPR-4 as economically unattractive

is estimated at 13, spread fairly evenly throughout the zones. (See Exhibit 7.)*

- The capital requirement, estimated at $182 million (see Exhibit 11), represents the expected maximum outlay that would be required without a commercial discovery.
- Manpower requirements would total 300 man-years.
- The minimum number of wells necessary is extremely sensitive to all major assumptions and could vary from as few as four (under conditions of a $10 per barrel imported oil price) to as many as 28 (under low trans-NPR-4 pipeline costs, or a $16-per-barrel imported oil price), with proportionate capital and manpower requirements. (See Exhibit 12.)

Development Requirements

Should oil and gas be found in NPR-4 in quantities equal to or in excess of minimum field size, and should development leading to production be approved by Congress, these reserves will, in all likelihood, be produced and transported to Lower-48 markets. The rate at which these reserves will be produced

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* Although 13 appears to be an extremely small number of dry holes to condemn an area the size of the State of Indiana (e.g., 50 dry holes were drilled in the North Sea before major oil discoveries were made), this minimum expected exploratory well requirement reflects the extremely unfavorable economics of Arctic exploratory drilling. Thirteen dry holes would not mean NPR-4 is definitely unproductive; it would mean the expected costs of further exploratory drilling exceed expected benefits.

and the concomitant resource (i.e., capital and manpower) requirements will be functions chiefly of the size of the discoveries and prevailing market prices. Therefore, to develop rate and resource requirement estimates, the contractor created nine scenarios, representing three different field sizes - 500 million, 1 billion, and 3 billion barrels of oil equivalent - and three different market prices - $10, $13, and $16 per barrel.*

Four conclusions resulted from the analysis of these scenarios and other development-related factors:

- Development and production activity. Peak production would be nearly 100,000 barrels per day (64 wells) for the 500-million-barrel scenario, nearly 200,000 barrels per day (128 wells) for the 1-billion-barrel scenario, and nearly 600,000 barrels per day (378 wells) for the 3-billion-barrel field.
- Capital costs. On an undiscounted basis, capital costs for development would range from $1.7 billion for the

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* No attempt was made in this study to relate these development scenarios to the expected exploration results. Rather, the development scenarios were created to illustrate a range of resource requirements, benefits, and impacts associated with reasonable field sizes and market conditions. A limitation of the contractor's report is a lack of quantification of the likelihood of each of these three field sizes and a lack of analysis of multiple fields and varying field sizes.

500-million-barrel field, to $2.5 billion for the 1-billion-barrel field, and to $5.3 billion for the 3-billion-barrel field.

- Manpower requirements. Peak manpower needs for field development and pipeline construction for all field sizes occur in the fourth year after discovery, with the 500-million-barrel field requiring peak direct employment of approximately 1,500, the 1-billion-barrel field requiring 2,400 employees, and the 3-billion-barrel field requiring nearly 5,000 employees.
- Net national economic benefits. The net national economic benefits vary widely for the nine scenarios evaluated.
  - The 500-million-barrel field at a $10-per-barrel world price is the only nonprofitable development scenario. (See Exhibit 13.)*
  - A 1-billion-barrel field would create benefits ranging from $0.7 to $3.3 billion. (See Exhibit 13.)
  - A 3-billion-barrel field would result in significantly larger benefits, ranging from $4.9 billion to $12.9 billion, depending on world oil prices. (See Exhibit 13.)

There are four external issues, however, that may affect the pace and level of NPR-4 development: (1) boundary disputes;

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* The contractor has assumed that the oil equivalent of natural gas discoveries has been included in the field size assumptions for each of the development scenarios; that is, a 1-billion-barrel field includes both oil and the oil equivalent of natural gas discoveries.

(2) land settlements; (3) availability of corridors and public easements; and (4) the development of other North Slope petroleum.

Two separate boundary disputes now being contested in NPR-4 could slow the pace of Reserve development. First, the dispute over whether the Colville River bed is within or outside the Reserve could delay using its critical gravel resources to construct access roads, camps, and other development-related facilities. Second, the dispute over whether the Arctic coast boundary of the Reserve is the highest high water mark or mean high water mark and the inclusion or exclusion of certain bays in the Reserve could delay exploratory drilling in Harrison Bay and other promising bays along the coast.

Pursuant to the Alaskan Native Claims Settlement Act, Native villages, Native regional corporations, and the State of Alaska have chosen or are in the process of choosing land on the borders of NPR-4. (See Exhibit 14.) After selection, these parties may explore along these borders for oil and gas. Discovery of structures underlying both NPR-4 and Native- or state-owned acreage, may detrimentally affect the pace of development of NPR-4 resources since the government would be forced to protect its resources against potential drainage from wells on adjacent lands.

The extent to which the Federal Government can use its power of eminent domain, by allowing public easements for pipeline corridors and roads across Native-land/or state-owned lands also will determine how rapidly development can occur. However, the government's right of eminent domain has been challenged; state and Native groups have indicated they will oppose, through court action, recent Bureau of Land Management rulings that permit floating easements for future transportation of resources. Such lawsuits could delay the development of NPR-4, particularly if NPR-4 were to be leased.

Finally, during the next 5 years, oil and gas exploration will undoubtedly take place in North Slope areas other than NPR-4. Indeed, federal lease sales are planned for the Beaufort Sea and the Chukchi Sea. In addition, the State of Alaska may lease Beaufort Sea acreage in 1977-1978, and Native groups have contracted for onshore exploration in areas near NPR-4. These other North Slope developments could affect NPR-4 onshore and offshore activities either adversely or beneficially. On the one hand, they may compete for skilled personnel and other critical exploration resources. On the other hand, if timing were properly coordinated, the existence of several exploration projects might accelerate the development of an industry infrastructure that would, in turn, accelerate development of NPR-4.

Management Programs

Because NPR-4 is a public resource, the Federal Government must ensure that any exploration and development of that area yield the maximum economic benefits to the nation as a whole, without producing unduly adverse environmental and socioeconomic impacts. The appropriate resource management program for NPR-4 oil and gas exploration and development has been an issue in Congress and the involved federal agencies for several years. Consequently, this issue was directly addressed by analyzing the two basic program management approaches under consideration.

1. Government leasing to private industry for exploration, development, production, and transportation. To date, oil and gas reserves on all public lands except the Naval Petroleum Reserves have been developed under variations of this arrangement.

   a. Conventional leasing. Federally owned, onshore lands have largely been leased under the noncompetitive provisions of the Mineral Lands Leasing Act of 1920. The potentially more significant offshore oil and gas areas have been leased through bonus payment and royalty competition under the Outer Continental Shelf (OCS) Lands Act of 1953. Although neither alternative is authorized under the NPRPA, Section 164 of the EPCA required the PEA to consider such leasing alternatives.

b. Alternative leasing arrangements. A myriad of other leasing arrangements, including competitive bidding on a bonus or royalty basis, profit sharing, and work plan competition have been analyzed.

Calculations were made to determine the relative net national economic benefits and ultimate oil recovery realized by the various leasing methods. The major conclusion drawn from this quantitative analysis is that any method employing a declining royalty will yield greater net national economic benefits and higher ultimate oil recovery than a fixed royalty system, due to the tendency to abandon declining production under the latter system.

The bonus bidding system has the disadvantage of high front end costs that may tend to limit the number of companies able to participate actively in the bidding. The royalty bidding and profit sharing concepts, on the other hand, have the advantage of low front end capital requirements. However, these methods have the disadvantage of attracting naive speculators who, after acquiring leases, may find they cannot affort to proceed and, therefore, abandon their leases after wasting time and material resources.

A discounted cash flow analysis of past lease sales, which was not performed as part of this study, would be useful as a means of determing whether industry has realized excessive profits under the conventional leasing system. The study required by Section 105(b) of the NPRPA should appropriately address this issue.

2. Substantial government activity and involvement. The NPRPA mandates federal exploration of NPR-4, but does not authorize development or production. Nevertheless, if found to be desirable, there are several potential ways in which the government could participate in NPR-4 development, including:

a. Government exploration, development, and production, with auction sales. This alternative, which is being used in developing NPR-1 (Elk Hills), would require government financing of the exploration, development, and production phases with auction sales either at the wellhead, which implies private financing of spur pipelines, or at the juncture of a government-financed pipeline with the trans-Alaska pipeline.

b. Government exploration with private development, production, and transportation. Two possibilities exist. First, the government could limit its exploratory activities to a geophysical program. Second, the government could conduct a drilling program (either on-structure or off-structure), as well as geophysical activities. Under this alternative, if government exploratory activities proved the existence of commercial reserves, the government would issue competitive leases to private industry to develop, produce, and transport reserves to market.

c. Government development and production of oil and gas structures explored and rejected by private industry. Under this alternative, private industry would be granted competitive leases to explore and develop NPR-4; however, a government development program would be launched to delineate and develop structures private industry evaluates as unprofitable, but which are deemed by government to have positive net national economic benefits.

Although a definitive evaluation of the merits of each of these alternatives was not possible within the timeframe of this study, the preliminary analysis that was carried out allowed us to draw several important conclusions about each of the two basic approaches to NPR-4 program management. These conclusions should be examined more closely in the study required by Section 105(b) of the NPRPA.

Overall, FEA favors private sector conduct of NPR-4 exploration, development, production, and transportation activities for reasons of efficiency. First, government may not be able to develop NPR-4 efficiently because, given current limitations on Federal Government pay scales, it lacks the ability to recruit and retain the necessary, highly talented, petroleum industry personnel. Second, the annual federal appropriations process may inhibit an efficient exploration and development program by limiting

investment flexibility. Third, even if federal funding were available on a multiple-year basis, a government operation may be unduly constrained in carrying out its management role by the lengthy administrative review process that would likely accompany an NPR-4 program involving annual government expenditures of $200-600 million. Finally, a single operator, whether the government or a single oil company, is probably not capable of mounting the multiple-perspective exploration approach that, historically, has been successful in finding oil and gas.*

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*The U.S. has only very limited experience with quasi-government companies. To gain some understanding of the advantages and disadvantages of such operations, the FEA analyzed the experience of six other countries that have operated government oil companies - Pemex (Mexico), Petrobras (Brazil), YPF (Argentina), ENI (Italy), ELF (France), and Pertamina (Indonesia) - and compared their performance with six U.S. oil companies - Exxon, Texaco, Gulf, Standard Oil of California, Atlantic Richfield, and Mobil.

The analysis compared performance in terms of net income as a percent of revenues and equity, barrels per day of production per employee, barrels per day of refining per employee, annual revenues per employee, and assets per employee. Although there were some analytical inconsistencies, (e.g., in many cases, the government companies enjoyed certain competitive advantages such as no lease and royalty payments, or no income taxes), in general, the government companies were less efficient than private companies. (See Exhibits 15 and 16.) This marked difference between private sector and government efficiency suggests caution in considering government conduct of NPR-4 operations.

Aside from the fact that there are no statutory provisions authorizing development of NPR-4, there are other problems associated with private sector development of NPR-4. Several economic factors and institutional barriers could limit the extent to which the private sector would develop NPR-4. (See the Table.)

For instance, with a 500 million barrel find and $13-per-barrel oil price, there is a positive net national benefit to be realized for developing NPR-4, however, the field would probably not be developed by the private sector under conventional leasing arrangements. Royalty payments and taxes would burden the private operator to the extent that it would be unprofitable to proceed with development.

There are other instances wherein the expected benefits to the private sector as a whole would be positive, but the field operator may not realize a profit. Specifically, although net benefits to the private sector as a whole would be positive, expected benefits to the field developer would be negative. This situation occurs when one assumes the cost of using the Trans-Alaskan Pipeline System (TAPS) to North Slope developers would be the same as for Prudhoe Bay users (with the tariff set by the Interstate Commerce Commission), and that an initial NPR-4 find would bear the full cost of a North Slope spur pipeline to TAPS.

Consequently, to make NPR-4 development reasonably profitable to the field developer under some circumstances, some of the institutional barriers would have to be relaxed. If such

TAB[illegible]

Comparison of NPR-4 Net Benefits for Resource Basis Simulation and Private Operation with Conventional Leasing Simulation[1]

(in Millions of Dollars)

[illegible]	[illegible]	RESOURCE BASIS			PRIVATE OPERATION WITH CONVENTIONAL LEASING[2]										
		[illegible]	[illegible]	[illegible]	TOTAL PRIVATE SECTOR	FIELD DEVEL-OPER	NPR-4 PIPELINE OPERATOR	TAX[illegible]	PRUDHOE BAY DEVELOPERS	TOTAL PUBLIC SECTOR	TAXES (State and Federal)	ROYAL-TIES	ENERGY INDE-PENDENCE	NATIONAL BENEFITS	DECREASE IN NNPB FROM RESOURCE BASIS
[illegible]	[illegible]	-193	[illegible]	-353	-570	-940	155	21	193	-438	-432	0*	24	-987	634
	[illegible]	[illegible]	[illegible]	270	-178	-730	197	13	322	168	118	0*	50	- 11	287
	[illegible]	[illegible]	71	940	[illegible]	-465	211	19	342	590	526	0*	64	707	233
[illegible]	[illegible]	[illegible]	81	669	37	-501	241	63	636	291	215	0*	76	330	339
	[illegible]	1,847	111	1,955	518	-455	260	74	970	1,221	889	224	108	1,740	215
	[illegible]	3,162	140	3,302	921	- 40	270	78	682	2,137	1,562	439	136	3,129	173
[illegible]	[illegible]	4,[illegible]	[illegible]	4,[illegible]	1,7[illegible]	-[illegible]	364	171	1,789	2,817	1,997	601	219	4,552	333
	[illegible]	[illegible]	[illegible]	8,[illegible]	2,[illegible]	673	319	233	1,[illegible]	3,[illegible]	3,[illegible]	1,440	332	8,419	356
	[illegible]	13,[illegible]	[illegible]	12,919	4,[illegible]	2,053	[illegible]	242	1,714	8,264	5,742	2,108	414	12,626	293

[1] [illegible] barrels per day per well. Discounted (at 8%) present value.

[2] [illegible]

[illegible]

[illegible] pipeline ownership

[illegible]

[illegible] negotiating strength of participating parties. If this amount remains with Prudhoe developers, approximately 1/2 goes [illegible] to Federal tax.

[illegible] production schedule with introd[illegible] of taxes. For example, with taxes and royalties, field would be shut [illegible] oil would be produced. In addition, [illegible] use of associated facilities (e.g., pipeline) may not occur.

* [illegible]

** [illegible] of natural gas recovery.

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regulatory relaxation were not forthcoming, the Federal Government would have to accept the possibility, and its competitive implications, that existing Prudhoe Bay operators would be the only firms interested in developing NPR-4.

Even if development of NPR-4 is profitable to the private operator and production is achieved, it is likely that as much as $173 - $356 million (See Exhibit 15.) in net national benefits will not be realized. This loss would result from the premature cutoff of production by a private operator because of the potential impact of nonresource costs, such as pipeline tariffs, taxes, and royalties on his profitability.

The royalty and tax issues that may make some development ventures unprofitable to the private sector and result in premature abandonment of producing resources are not unique to NPR-4 development. These same issues are revelant to present and future oil production on all Government lands. The tariff sharing of TAPS is unique to NPR-4 and is a significant issue that will have to be resolved by future study and action.

Although the inefficiencies of total government involvement in all phases of NPR-4 exploration, development, production, and transportation probably outweigh the benefits, some form of government involvement appears to be appropriate.

There are no existing statutory provisions authorizing NPR-4 development or leasing it to private industry. Private industry can not be expected to conduct an exploration effort without being given the right to develop and produce petroleum. In

that the effort to obtain legislation to lease, promulgate regulations, and complete environmental impact statements will take at least 2 to 3 years, the only way to continue exploration of NPR-4 in the short-term is by government sponsorship.

There may also be the situation wherein some fields are not profitable for the private sector to develop, but would nevertheless show a net national benefit for development due to national security credits.

For the above reasons, the following two forms of government involvement deserve further review and evaluation in the NPRPA study:

- A limited government exploration program in which the government would drill in the most promising spots over the next 3 years, freely disseminate these findings to all potential bidders, and proceed with the necessary leasing to the private sector as soon as legislation is obtained. By thus reducing the investment risk for the private sector, the government would increase both bidding competition and the probability that excess profits, if they occur, would be transferred to the public sector.
- Government delineation and development of resources discovered by private industry, but rejected for production because of their lack of profitability, if the net national economic benefits from developing those reserves were positive.

Economic, Social, and Environmental Impacts

An extremely important issue in the determination of whether or not to develop the oil and gas resources of NPR-4 is the potential effect all related activity would have on the economy of the State of Alaska and North Slope Borough, the culture and lifestyle of the Alaskan Natives who reside on the North Slope, and the unique environmental components within the Reserve. There is general agreement that the economic, social, and environmental impacts of NPR-4 development will be significant, but there is no consensus, even among the Natives, on whether the net effects will be advantageous or adverse.

Many of the expected impacts have been quantified in this report; others, however, remain to be quantified in the NPRPA study.

- Economic. Oil and gas development in NPR-4 could have a major impact on the economy and government operations of the State of Alaska and of local governments,

especially the North Slope Borough. For example, the cost of expanding government services to support population increases could be substantial because of the remoteness of the state. In addition, if uncompensated by private developers or the Federal Government, that cost would weigh proportionately more heavily on Alaskan taxpayers than a similar development in other states would on their populations because Alaska is very sparsely populated.

To help plan for the potential economic impacts as well as to provide further input into the NPR-4 development decision, the effects that either private or government development of a 500-million, a 1-billion, and a 3-billion-barrel oil field would have on the state and local population, employment, and fiscal affairs were projected.*

- State impacts.
  - Population. Development of NPR-4 resources could have a moderate to large impact on the state's population, depending on field size. For a 500-million-barrel

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* An exploratory program that would result in no commercial discovery would have relatively minor state and local employment, population, and fiscal impacts. For instance, state fiscal losses would not exceed $1 million. As a result, state and local impacts of this scenario have not been explicitly quantified.

field,* peak incremental population gains could exceed 9,000 people in the fifth year of development, with a longer term impact of around 1,400. (See Exhibit 17.) The 1-billion-barrel field could have a peak impact (fourth year) of almost 15,000 people, and a long-term component of 3,000. The 3-billion-barrel field could produce a much greater impact; at its peak (sixth year), it could induce an incremental population increase of over 33,000, with a long-term effect of 7,000-8,000 people.

Employment. The development of NPR-4 could also create substantial employment in the state. The 500-million-barrel field could create 3,700 jobs at its development peak (fifth year), with a long-term need of 520 incremental employees. (See Exhibit 18.) The 1-billion-barrel field could create over 5,700 new jobs at its peak (fifth year), with over 1,100 permanent, new jobs in the long term. For the largest field size considered, 3 billion barrels, peak needs could be 12,700 new jobs (sixth year), with over 2,800 in the long term.

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* Under private sector operation, this sized field would not be developed.

Fiscal. Without NPR-4 development, the state would have a substantial budget surplus because of Prudhoe Bay production. Specifically, state projections show that, by 1985, the general fund would show a cumulative positive balance of $3.3 billion after contribution to a permanent fund of $2.9 billion.* (See Exhibit 19.) This surplus would compensate for the budget deficit that has existed over the last 5 years, deficits that have been financed largely by drawdowns of the state's general fund.

With NPR-4 development, the fiscal impacts on the state would vary significantly, depending on whether private or government development occured. Under private development, the state would realize fiscal gains of at least $150 million with a 1-billion-barrel field and nearly $500 million with a 3-billion-barrel field.** (See Exhibit 20.) Under a complete government-development scenario, the state, if uncompensated by the Federal Government, could suffer a net fiscal loss

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* The Alaska Legislature has endorsed a plan whereby 25 percent of state oil- and gas-related dollars is put into a permanent, protected fund to be used for future needs.

** A 500-million-barrel field would not be developed.

(infrastructure costs in excess of net state revenues) of about $40 million for a 500-million-barrel field, a loss of nearly $70 million for a 1-billion-barrel field, and a loss of nearly $160 million for a 3-billion-barrel field. (See Exhibit 20.)

- Local impacts.

  . Population. Population impacts from NPR-4 development will also occur at the local level. Although the actual location of these impacts would depend, of course, on where development occurred, Fairbanks (major transportation hub for the interior of Alaska), Anchorage (the state's principal trade and commerce center), and Barrow (largest community on the North Slope) would almost certainly be affected regardless of where the find were made in NPR-4. Specifically, about half of the development-related population increase is estimated to occur in Anchorage; 15 percent, in Fairbanks; and the remainder, in other parts of the state. These projections imply that peak, incremental, development-related additions to the Anchorage population would range from 4,700 for the 500-million-barrel field to over 16,000 for the 3-billion-barrel field. Fairbanks population additions would range from 1,400 for the 500-million-barrel field to 5,000 for a 3-billion-barrel field. In the North Slope Borough, we

would expect peak population additions of 500 for the 500-million-barrel field and 2,400 for the 3-billion-barrel field.

Fiscal. Population increases at the local level would increase public expenditures. If, on average, it cost local governments $900 to support each additional resident, then the present discounted value of local population increases, based on Exhibit 17, would be about $30 million for the 500-million-barrel field, $50 million for the 1-billion-barrel field, and $120 million for the 3-billion-barrel field. Increased tax revenues and transfers from federal and state government to local jurisdiction were not estimated. However, they would undoubtedly ease these cost impacts.

- Social. As one step in preparing this report, public hearings were conducted in Anchorage, Barrow, and Fairbanks to solicit testimony, viewpoints, and opinions from Alaskan Natives and non-Natives on a range of social issues - e.g., the participation of local and Native groups in NPR-4 development plans, and possible government actions to accommodate Native interests. A substantial amount of valuable and useful information was obtained during these hearings as a result of many Alaskan citizens' expressing their feelings about the social changes that

might occur in Alaska and, more specifically, within the North Slope Borough with oil and gas exploration and development. The Alaskan people seem to have three important social concerns:

- Changes in Native lifestyles/culture. Some Natives, particularly those in and around Barrow, are fearful that, with the advent of oil and gas development in NPR-4, their culture and their people may be absorbed into modern society. The issues of gravest concern to the Natives are:
  - Would oil- and gas-development activities interfere with surface resources on which Native life depends? The Natives are particularly concerned about the effect on fish, of the explosives used during seismic operations, and the impact on the migration of caribou and other game animals of construction of snow roads.
  - Where would base camps be located? Some of the Natives want staging operations and employee housing located in several of the smaller North Slope communities (Exhibit 21 is a map of these communities) because of the positive effects these factors would have on the economy of each village; others, especially those in the Barrow area, would prefer the camps be placed near actual exploration or development activity.
  - What restrictions, if any, would be imposed on non-resident, temporary workers? Although the influx of

money and the opportunity to gain new skills appeal to some, the Native community generally believes a new tide of residents would impact adversely on present villagers. They are particularly concerned about crime, increased alcoholism, the use of drugs, and violations of hunting and fishing rights.

- Would the Natives be given a voice in development decisions? Assuming development would inevitably follow the verification of any reasonable amount of oil and gas beneath NPR-4, the Natives want assurance that development would be compatible with the Inupiats' desire to retain their subsistence lifestyle. In addition, consistent with its own land-use plans, the borough government wants NPR-4 to be developed in phases, reasonably paced to allow for adequate planning and preparation. It advocates federal-state coordination to ensure development in NPR-4 begins to increase as Prudhoe Bay development begins to decline.

- What would happen after the development boom? The Natives would like to be assured before oil and gas development occurs that steps would be taken to alleviate the post-boom unemployment in industries established to accommodate development activity, and

that all equipment (e.g., vehicles, containers) no longer in use would be removed from the area.

- Demands on local infrastructure. The infrastructures (i.e., housing, sewage facilities, water supply facilities, and airstrips) of most of the North Slope villages cannot accommodate even their comparatively small populations. And although both the individual villages of the North Slope and the government of the North Slope Borough are expending considerable effort in establishing an adequate infrastructure, much remains to be done.

The Natives are concerned that NPR-4 exploration and development could impose substantial new demands on already over-taxed community facilities and services. The most significant of these demands would be:

- Housing. The most important, initial, infrastructure demand generated by oil and gas development in the North Slope Borough would be for housing. Although the borough is constructing new housing in all NPR-4 villages, including Barrow, the existing need already far exceeds the amount of new housing that has been funded through federal agencies. The problem of providing adequate residential housing in the Arctic is compounded by the need to build all structures with

minimal impact on the unique soil and ground conditions; by the very high costs of construction materials, which must be flown in or barged to the villages; and by the need to insulate the structures exceptionally well because of the harsh climate.

Health care. Certainly oil and gas development would affect the demand for health care services. At present, hospital facilities are very limited (Barrow's hospital, operated by the Public Health Service, provides care to the entire North Slope area) and would not be able to handle additional requirements unless considerable expansion occurred.

Education. The school system would probably not be affected significantly by petroleum development because most workers involved in primary activities would not move their families to the area. However, if a considerable service industry developed on the North Slope, the school-aged population might increase. In that case, the educational facilities and programs in most of the villages, which are somewhat limited, would probably be pushed to their limits.

Air services. The landing strips at several of the North Slope villages are constructed of snow and ice, thus making summer service impossible. And although

other villages have year-round gravel landing strips, any significant additional traffic at any of these village airports would necessitate improving the runway and lighting system.

Power supply. At present, the cost of fuel (both refined and unprocessed) is extremely high on the North Slope. Barrow citizens feel they are being charged excessive rates for natural gas that is supplied from the Sourth Barrow Gas Field only several miles away. The villages are also concerned that their fuel supply (e.g., gasoline) will be diverted to oil-development activities. Most likely, however, this latter concern is unjustified, since oil operators will undoubtedly bring in their own supplies.

Water supply. Because fresh water is in limited supply on the North Slope, development activities may compete with villages for this rather precious commodity. At present, most residents must haul their water from a local source (e.g., lake) or from a village storage tank; running water is available only in a limited number of buildings in the Barrow area.

- Employment opportunities. Natives have been particularly interested in the employment opportunities that may result from NPR-4 exploration, development, and production because of their generally favorable experience with the Prudhoe Bay development. Indeed, chronic unemployment that has plagued Alaska in general and the North Slope in particular could be lessened with NPR-4 development, and Native groups have indicated an interest in participating in all aspects of NPR-4 exploration and development, including providing comprehensive support services through Native-owned corporations (e.g., the Arctic Slope Regional Corporation and its subsidiaries).

o Environmental. NPR-4 is often referred to as one of the largest expanses of pristine wilderness in North America. The particularly fragile environmental components of that wilderness are likely to be affected by each phase of oil and gas development. Because of the similarities between NPR-4 and the Prudhoe Bay region, recent oil and gas exploration and development at Prudhoe Bay provide tangible examples of what those environmental changes might be in NPR-4, especially those related to terrain/soils and permafrost, surface and subsurface drainage systems, water quality,

tundra plant and animal populations, and aquatic plant and animal populations.*

- Terrain/soils and permafrost.

  . Impacts. The most important impacts of petroleum activities on the terrain and soils of NPR-4 would probably be vegetation damage or destruction; soil excavation; soil erosion; mud flows; and degradation of the permafrost layer, which is particularly sensitive to surface disturbance, through: (1) insufficient insulation beneath roads, pads, and the like; (2) blockage of natural drainage lines and ponding of water by roads and pads; (3) off-road traffic (particularly numerous passes of tracked vehicles in summer); (4) the discharge of warm effluent onto tundra; and (5) gravel extraction.

  . Mitigating measures. The most obvious mitigating measure to permafrost degradation is compliance with existing federal and state regulations and stipulations on construction practices, off-road traffic, and oil and gas operations. In addition, further requirements on engineering design and construction practices could be adopted to ensure minimal damage to terrain and vegetation.

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* Lesser environmental implications such as air quality, noise and solid waste are described in the contractor's report.

- Surface and subsurface drainage systems.

  Impacts. Petroleum-related activities could alter natural drainage patterns and cause floodplain modification. More specifically, road construction during spring break-up could cause washouts, flooding, bank erosion, and the deposit of substantial amounts of siltation in streams and lakes. In addition, off-road vehicular traffic could disturb the terrain, redirect runoff, and cause gullying.

  Runway construction would also alter drainage patterns. In addition, because of the predominance of lakes in NPR-4, it is likely that several would be drained or filled during construction of a major, permanent aviation facility. If construction activities were carried out adjacent to water bodies during these periods, siltation could occur.

  Gravel pads constructed for drilling rigs and support facilities would also alter surface drainage patterns, but to a lesser degree than road or runway construction. If not properly constructed, they could cause siltation if they were located near bodies of water.

  Gravel extraction (for the construction of roads, work pads, runways, and various support facilities), which

would usually occur along river floodplains where most large reserves of unfrozen gravel are located, would alter riverbeds, thereby causing siltation and associated downstream sedimentation; gravel extraction along lake and ocean beaches could accelerate erosion. Pipeline construction would adversely affect crossings and river hydraulics because extensive trenching and dike construction are required to bury the pipeline at sufficient depths to ensure safety.

Mitigating measures. To minimize these impacts on the surface/subsurface drainage system of NPR-4, construction, especially of pipelines, within floodplains should be severely limited. In addition, properly designed and maintained snow roads and ice bridges could be used to provide short-term access to development areas. Where gravel roads were required, they could be constructed parallel to prevailing winds to minimize snow drifts. Culverts should be cleared of ice and drifted snow prior to break-up to minimize ponding and/or subsequent road washouts. Where possible, roads, work pads, and runways should be located on surface water drainage basin divides or other topographic high points, thereby minimizing the possibility of altering drainage patterns.

Water quality.

- Impacts. Many of the activities associated with the exploration and development of petroleum resources could adversely affect the quality of NPR-4's water supply, particularly if they are considered cumulatively. For example, any construction activity that causes terrain disturbance and permafrost degradation by thermal erosion has the potential for causing siltation in rivers, streams, and lakes, thus affecting the quality of the water. In addition, sewage disposal, drilling fluid disposal, and oil spills could degrade the quality of the water. Sewage disposal could also reduce dissolved oxygen levels in receiving waters.

  Drilling fluids, with their high, immediate, dissolved oxygen demand and high concentrations of organic carbon, total nitrogen, phosphorous, solids, chemical demand, and chromium, are extremely toxic to fish, while oil spills could introduce hydrocarbons and other toxic substances into water masses.

- Mitigating measures. To minimize these potential adverse impacts, withdrawal of surface and groundwater from streams and streambeds should be restricted to the summer and fall months, when these water

supply sources are replenished naturally. Water supplies for the winter and spring months could be obtained if ponds were artificially deepened to allow water below the ice (i.e., at depths of 6-7 feet) to surface. In addition, great care should be given to minimizing and monitoring the effects of drilling fluid discharge and oil spills.

- Tundra plant and animal populations.

  Impacts. Plants and animals of the Arctic tundra would be affected by winter seismic surveying, exploration and development drilling, field activities, and, especially, pipeline construction. Specifically, winter seismic surveying, which involves drilling shot holes and detonating explosives, injures plants and decreases the insulative effects of snow, which, in turn, causes the plants to freeze. Small mammals could also be killed in this way, which could also in turn, disrupt caribou and polar bear feeding and movement. Seismic surveying could also destroy portions of the habitat and organisms - mainly microflora, microfauna, and invertebrates - overwintering at these sites.

  During summer months, off-road traffic would destroy birds' nests, eggs, and young and small mammal nests.

Frequently, used roads and raised pipelines would affect the movements of animals, especially cow caribou with calves, and wolves hunting caribou. Tall structures, such as buildings, drill rigs, and flaring towers, represent a hazard to flying birds, especially under foggy conditions in the flat, coastal region.

Aircraft traffic, especially low-flying helicopters, would flush birds, disrupting their breeding and nurturing activities. Air traffic would also disturb mammals, especially caribou during calving, and fox and wolverine during spring denning.

- Mitigating measures. Because many of the negative impacts occur as a result of violations of operating regulations or guidelines, educating field personnel and enforcing the regulations would certainly help reduce the adverse effects. In addition, animal habitats with special environmental importance, such as the upper Utukok River caribou calving grounds and Teshekpuk Lake and the surrounding area, should be identified.

- Aquatic plant and animal populations.

  - Impacts. Depending on the magnitude of development, North Slope fisheries and waterfowl populations could

experience very significant direct and indirect impacts. The most damaging direct impacts would occur as a result of the filling in of marshes, ponds, and lakes to construct airstrips, roads, work pads, and camp facilities, and of the disposal of drilling fluids and solid wastes, which would eliminate the aquatic organisms and their habitat, and waterfowl nesting and feeding habitats. Gravel removal from aquatic habitats, especially streams and rivers, would affect those systems by physically disrupting natural bottom configurations and by causing siltation and erosion.

Mitigating measures. Surveys of aquatic ecosystems within the most vulnerable areas should be conducted in the initial phase of development. If certain areas were found to be exceptionally important (e.g., critical spawning or overwintering habitat for anadromous fish or critical waterfowl habitat), those areas might be excluded from development until ways were found to mitigate the negative impacts.

RECOMMENDATIONS

Based upon the findings and conclusions drawn from our analysis, we recommend the following:

I. The comprehensive study required by NPRPA, Section 105(b), should begin as soon as possible, with subsequent findings and recommendations presented to Congress as early as June 1, 1977, but no later than January 1, 1978.

Section 105(b) of the NPRPA requires the President to direct appropriate Executive departments and/or agencies, in consultation with the State of Alaska, to conduct a study to determine the best overall procedures for the development, production, transportation, and distribution of petroleum resources in NPR-4. In examining these procedures, the study is to include consideration of economic and environmental consequences of each. Periodic progress reports are required, and a final report with recommended procedures and any proposed legislation is to be submitted to the Committees on Interior and Insular Affairs of the Senate and the House of Representatives not later than January 1, 1980.

The apparent intent of the Congress in requiring both FEA's report under Section 164 of EPCA and the comprehensive study under Section 105(b) of NPRPA is that any further

decision regarding the disposition of petroleum resources in NPR-4 should be based upon a thorough analysis of the available options. In order to assure the timely development of NPR-4 oil and gas resources, which requires Congressional action, it is critically important that this analysis be provided to the Committees at the earliest possible date.

Any delay in submission of the Section 105(b) study to the Congress will result in a similar delay in the development of NPR-4 oil and gas resources. Our study has shown the expected net national economic benefits from NPR-4 development to be estimated at $3.9 billion. With the assumption of an 8-percent discount rate and constant real world oil prices, each year of delay in realizing these benefits would cost the Nation approximately $312 million.

II. The study required by Section 105(b) should specifically focus on pipeline utilization, access to pipelines, and mechanisms for setting tariffs for TAPS and other potential pipelines, as well as on leasing procedures and other Federal actions that facilitate private sector development of NPR-4.

In the analysis performed by RPA concerning the net benefits associated with a variety of potential find sizes and world oil prices, there were a number of cases in which although net benefits to the private sector as a whole were positive, benefits to the field developer were not. The significant variable in these scenarios was the cost of transporting the oil--the construction of a spur pipeline to the TAPS and the tariff charged for utilization of TAPS.

Further study of the institutional contraints to petroleum transport from any finds in NPR-4 is warranted. Such study should examine the feasibility of providing additional TAPS capacity to NPR-4 field developers at incremental cost.

III. DOI should prepare to request statutory authority to lease NPR-4 to private industry as soon as is practicable.

As indicated in the report, petroleum development by private industry would provide greater efficiency and thus a larger net national benefit than development by Government. Even if a Governmental operation could be considered as efficient as private industry operation, it is doubtful that a single operator, whether it is Government or a single oil company, is capable of mounting the multiple-perspective exploration approach

that, historically, has been successful in finding oil and gas. Statutory authority to lease will be required before industry participation in NPR-4 can be realized, since the industry will not be interested in exploration unless there is assurance of the right to develop any petroleum finds.

DOI should coordinate its plans to request leasing authority with the State of Alaska. Although no leasing would take place in any event until appropriate environmental studies have been completed, State concerns should be considered as part of the legislative process.

IV. A Government exploration program, similar to the Navy's, should be continued during the period required to implement a leasing program.

- A project office within the DOI should be established with this explicit purpose.
- A minimum objective should be to complete all necessary reconnaissance seismic and to conduct detailed seismic and drill on most of the major structures throughout the Reserve in 2 to 3 years.
- Appropriation of funds for this exploration effort should be made initially to cover the entire 2-to-3-year program.

The Congressional intent regarding Government sponsored exploration is quite clear and is enunciated in the NPRPA Sec. 104. Paragraphs (c) and (d) read, in part, as follows:

(c) The Secretary of the Navy shall continue the ongoing petroleum exploration program within the reserve until the date of the transfer of jurisdiction specified in Section 103(a).

(d) The Secretary of the Interior shall commence further petroleum exploration of the reserve as of the date of transfer of jurisdiction specified in Section 103(a).

As noted above, private industry exploration and development are desired and are considered more efficient than Government involvement. The processes of acquiring legislative authority to lease to private industry, performing environmental impact studies, and setting a leasing procedure in motion will consume approximately 2 to 3 years. Since the potential benefits from NPR-4 oil and gas resources decline with time, allowing this period to lapse without continuing constructive activity in NPR-4 would be an economic waste. A 1-year delay in realizing the expected net national economic benefits from NPR-4 development would more than equal the cost of a 2-3 years Government exploration program.

The recommendation for such Government involvement should not be construed as a long term commitment to Government operations, it is intended, rather, as a stop-gap measure. For this reason, we are recommending that a special project office be set up within DOI that can draw on expertise and experience from not only the USGS and the Department of the Navy, but from other offices and agencies as well.

Although we envision this office to be temporary, it is recommended that an appropriation large enough to conduct 3 years of exploratory effort be granted in the first year. Such a method of funding should eliminate some of the inefficiencies and uncertainties that hamper Government operations.

The size of the appropriation required is dependent on the amount of drilling that will be conducted. It is recommended that a minimum objective should be to complete all necessary reconnaissance seismic and to conduct detailed seismic and drill on most of the major structures throughout the Reserve in 2 to 3 years. If the area is found to be dry, it will probably only be necessary to drill about 13 wells at a cost of about $180 million over a period of 2 years. If some encouraging signs result in additional drilling but still no significant finds, as many as 24 wells may have to be drilled. The latter case may take $350 million and 3 years to complete, but it would represent the maximum Government risk.

V. The Federal Government should assure that State and North Slope Borough governments suffer no negative net economic impact as a result of NPR-4 development.

During the exploration phase, the NPRPA, in Section 107(b), directs the Secretary of DOI to assist Alaskan communities adversely affected by exploration activities through the use of existing Federal programs.

Although it can be projected from our analysis that the State of Alaska will be adequately compensated for its expenses in the form of oil and gas tax revenues once development is underway, it may be necessary for the Federal Government to offer loans or loan guarantees to the State in order to provide compensation for the initial impacts of such development prior to receipt of tax revenues.

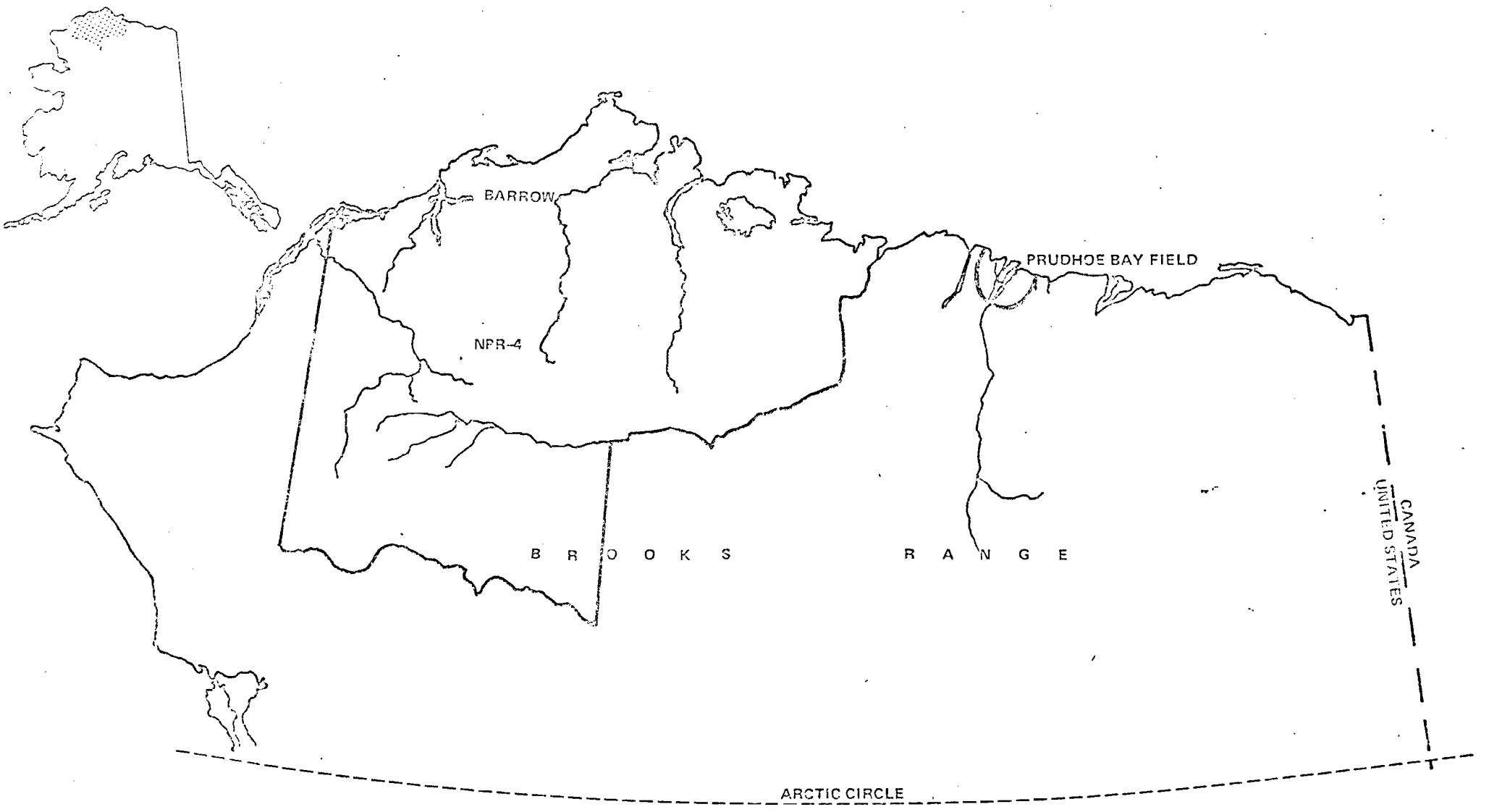
VI. The measures for mitigating potential adverse environmental and socioeconomic impacts outlined in the contractor's report should be implemented.

VII. In all matters pertaining to the exploration, development and production of NPR-4 petroleum resources, the DOI should work closely with the various agencies of the State of Alaska.

Close coordination of Federal policies with the interested State agencies is especially important in DOI's preparations for leasing to private industry and in

the planning and implementation of measures to mitigate any adverse environmental, social, or economic impacts on the State of petroleum-related activities in NPR-4.

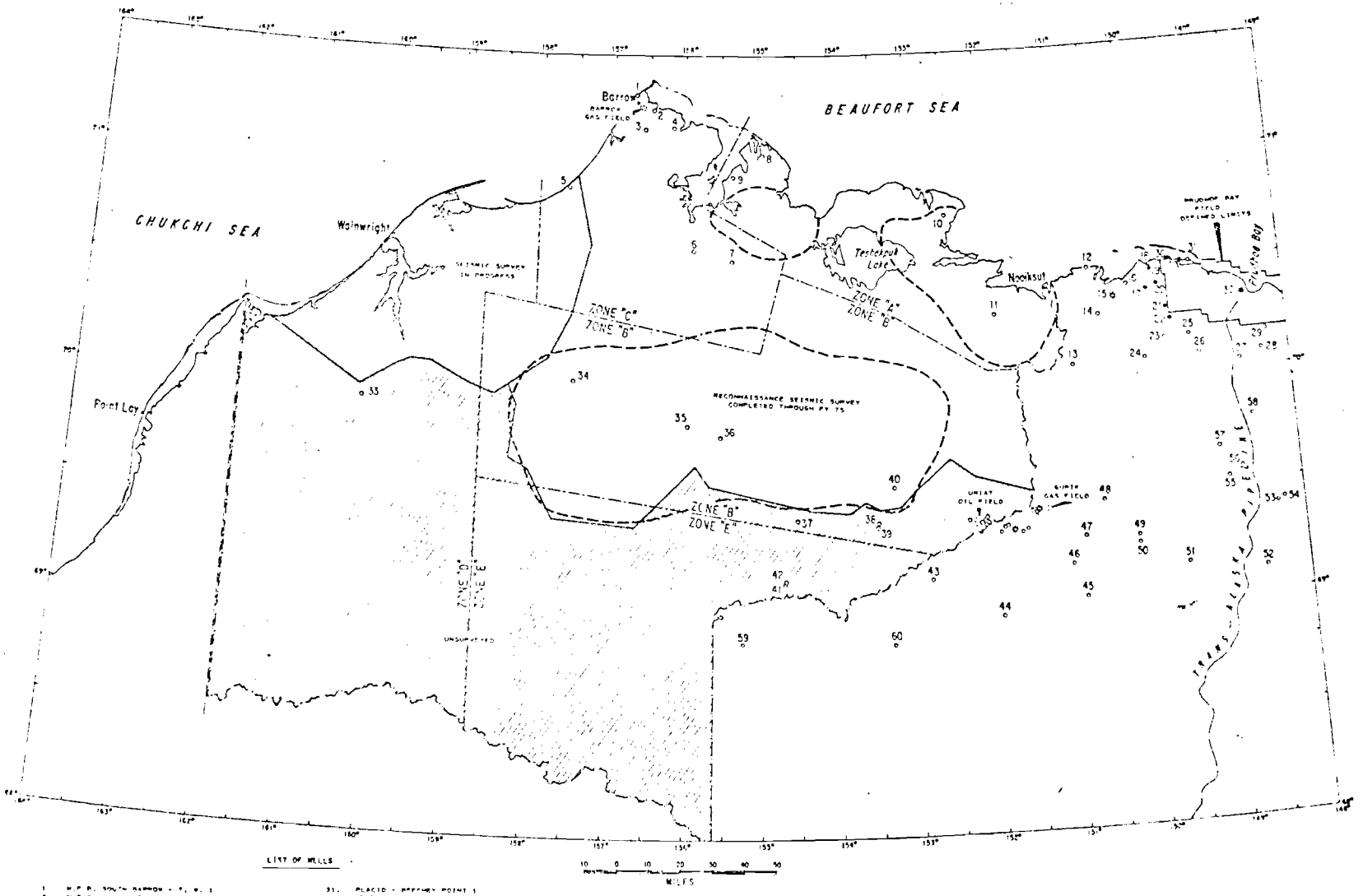
OUTLINE MAP OF NORTH SLOPE ALASKA



SOURCE: Resource Planning Associates, Inc.

Exhibit 1

NORTH SLOPE DRILLING ACTIVITY AND NPR-4 AREAS OF INTEREST



LIST OF WELLS

AREAS OF INTEREST INDICATED BY SEISMIC CLOSURES

SOURCE: LaRue, Moore and Schafer, subcontractors to Resource Planning Associates, Inc.

Exhibit 2

PRELIMINARY ESTIMATES OF UNDISCOVERED RESOURCES - NPR-4*

Less Than 13,000 Feet

Age / Geographic Zone	Volume of Rock in Structures: Mi^2-Ft	Volume of Rock in Structures: Ac-Ft (1000's)	Fraction of Structures Which Is Net Pay	Fraction of Traps Containing Petroleum	Oil Recovery Factor (bbls/ac ft)	Recoverable Oil (Billions of bbls)	Gas-Oil Ratio (Mcf/bbls)	Recoverable Gas (Trillions of cu ft)
Upper Cretaceous								
B	165,572	105,966	.10	.15	150	.24		
D	4,226	2,705	.10	.15	150	.04		
E	25,960	16,614	.10	.15				
Total	195,758	125,285				.28	1.5	.42
Lower Cretaceous								
A	35,501	22,721	.40	.40	150	.55		
B	19,739	12,633	.40	.40	150	.30		
C (Barrow)	979	627			-			
C (Other)	2,311	1,479	.40	.40	150	.04		
E	8,561	5,479			-			
Total	67,091	42,939				.89	1.5	1.34
Triassic/Permian								
A	10,357	6,628	.50	.40	320	.42		
B	4,463	2,856	.30	.30	150	.06		
C	2,940	1,882	.30	.30				
Total	17,760	11,366				.48	2.0	.96
Carboniferous (Lisburne)								
A	18,137	11,608	.40	.30	150	.26	3.0	.78
B	1,821	1,165	.40	.30				
C	2,463	1,576	.40	.30				
Total	22,421	14,349						
Total in Surveyed Structures						1.91		3.50
Increases to Account for: Unsurveyed Western Portion of Reserve						.95		1.70
Unsurveyed Southern Foothills						.50		.90
Stratigraphic Traps Outside of Structures						1.50		2.70
Total						4.86		8.80

* Estimates do not fully consider availability of source material for the listed subunits.

SOURCE: LaRue, Moore & Schafer, subcontractor to Resource Planning Associates, Inc.

Exhibit 3

PRELIMINARY ESTIMATES OF UNDISCOVERED RESOURCES - NPR-4*

Greater Than 13,000 Feet

Age / Geographic Zone	Volume of Rock in Structures Mi^2-Ft	Volume of Rock in Structures Ac-Ft (1000's)	Fraction of Structures Which Is Net Pay	Fraction of Traps Containing Petroleum	Condensate/ Gas Ratio (bbls/MMcf)	Recoverable Condensate (Billions of bbls)	Gas Recovery Factor (Mcf/ac ft)	Recoverable Gas (Trillions of cu ft)
Lower Cretaceous								
B	6,236	3,991	.20	.20	50	0.01	800	0.21
E	3,911	2,503						--
Triassic/Permian								
B	39,560	25,318	.15	.20	50	0.03	800	0.61
D	768	492						--
E	3,397	2,174						--
Carboniferous								
B	89,174	57,071	.20	.20	30	0.05	800	1.83
Devonian								
B	205,362	131,444	.10	.10	10	0.01	800	1.05
Total in Surveyed Structures						0.10		3.70
Increase to Account for Unsurveyed Western Portion of Reserve						0.05		1.80
Total						0.15		5.50

* Estimates do not fully consider availability of source material for the listed subunits.

SOURCE: LaRue, Moore & Schafer, subcontractor to Resource Planning Associates, Inc.

Exhibit 3
(Continued)

RESERVOIR ASSUMPTIONS USED

IN EXPLORATION MODEL

ZONE	FORMATION	NET PAY (%)	OIL RECOVERY (BBLS/ACRE-FOOT)	ASSOCIATED GAS (MCF/BBL)	NONASSOCIATED GAS RECOVERY (MCF/ACRE-FOOT)*
A	Lower Cretaceous	40	150	1.5	-
	Triassic/Permian	50	320	2.0	-
	Carboniferous	40	150	3.0	-
B	Upper Cretaceous	10	150	1.5	-
	Lower Cretaceous	40	150	1.5	800
	Triassic/Permian	30	150	2.0	800
	Carboniferous	40	150	3.0	800
	Devonian	10	-	-	800
C	Lower Cretaceous	-	-	-	-
	Triassic/Permian	30	150	2.0	-
	Carboniferous	40	150	3.0	-

* At depths exceeding 13,000 feet.

SOURCE: LaRue, Moore, & Schafer.

SIZE DISTRIBUTION OF STRUCTURES*

SIZE OF STRUCTURE	ZONE						
	A	B(<13,000 ft)	B(>13,000 ft)	C	Northwest	Foothills	Totals
Over 500 MM bbls.	1	2	3	-	1	2	9
250-500 MM bbls.	2	2	3	-	2	2	11
100-250 MM bbls.	7	5	2	-	7	5	26
50-100 MM bbls.	7	7	6	2	7	7	36
25-50 MM bbls.	7	5	3	1	7	5	28
Less than 25 MM bbls.	14	10	18	17	14	10	83

* Natural gas has been included on an oil-equivalent-Btu basis.

SOURCE: Resource Planning Associates; LaRue, Moore, & Schafer.

Exhibit 5

MAJOR MODEL ASSUMPTIONS

Factor	Assumptions: Low Variation	Base Case	High Variation
Imported Oil Price ($ per barrel)	$ 10	$ 13	$ 16
Cost of Capital (Percent in constant dollars)	6%	8%	10%
Resource Cost of TAPS Capacity Additions (Dollars per barrel)	none	$ 1.50	none
Resource Cost of Transportation for Spur Connection to TAPS ($ per barrel)*	$ .95**	$ 1.90**	$2.85**
Well Production Rate (Barrels of oil per day)	750	1,500	2,250
Fixed Field Development Costs (Millions of present value dollars, discounted at 8 percent)	$458	$573	$688
Wildcat Chance of Success (Percent)	5-45% (in 5-percent increments), depending on well location	20-38% dependency on well location	(See Low Variation)
Exploration Well Costs (millions of dollars)			

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* The base case assumption of resource costs of transportation from Prudhoe Bay to Los Angeles includes 85 cents per barrel for a 300,000 barrel per day capacity addition (if required) for TAPS, 5 cents per barrel marginal operating and maintenance costs of excess TAPS capacity; and 60 cents per barrel tanker costs from Valdez to Los Angeles. The TAPS excess capacity resource costs should not be confused with the full costs anticipated to be borne by industry, which were estimated in the June 14, 1976, Oil and Gas Journal as $4.50 per barrel from Prudhoe Bay to Valdez.

** Piecewise linear approximation, evaluated at 3-billion-barrel field, discounted at 8 percent.

BASE-CASE EXPLORATION

WELL REQUIREMENTS

Zone	Number of Wells Drilled		
	Discouraging Results	Expected Results	Encouraging Results
A	3	36	37
B (oil)	2	16	20
B (gas)	3	7	9
C	-	-	-
Northwest	3	36	37
Foothills	2	16	20
	13	111	123

EXPECTED NET NATIONAL

ECONOMIC BENEFITS AND RESOURCE RECOVERY

Zone	Net National Economic Benefits (In Millions of Dollars)			Oil Recovery (In Millions of Barrels)	Gas Recovery (In Millions of Barrels of Oil Equivalent)
	Energy Independence	Producers' Surplus	Total		
A	$ 124	$ 1,129	$ 1,243	954	305
B (<13,000 ft.)	75	525	600	601	151
B (>13,000 ft.)	49	169	218		570
Northwest	124	1,119	1,243	954	305
Foothills	75	525	600	601	151
Totals	$ 447	$ 3,457	$ 3,904	3,110	1,482*

* Represents 9.6 trillion cubic feet

Exhibit 8

CAPITAL REQUIREMENTS UNDER

"ENCOURAGING RESULTS" EXPLORATION SCENARIO

Zone	Capital Requirements (In Millions of Dollars)* Recon Seismic	Detailed Seismic	Exploration Wells	Delineation Wells
A	$ -	$ 10.6	$ 222	$ 56
B (<13,000 ft.)	-	7.2	300	49
B (>13,000 ft.)	-	7.6	180	24
C	-	-	-	-
Northwest	-	10.6	222	56
Foothills	19.2	7.2	300	49
Totals	$ 19.2	$ 43.2	$ 1,224	$ 234
Program Total		$ 1,520.4		

* Present value based on discount rate of 8 percent, and valued as of June 1, 1977.

NUMBER OF WELLS REQUIRED UNDER

"ENCOURAGING RESULTS"* EXPLORATION SCENARIO

ENSITIVITY FACTOR	ZONE						
	A	B (<13,000')	B (>13,000')	C	North-west	Foot-hills	Total
ensitivity Analysis Base Case	37	20	9	-	37	20	123
low Rate Per Well: +50%	38	20	11	-	38	20	127
low Rate Per Well: -50%	33	16	6	-	33	16	104
orld Oil Price: $16/bbl	38	21	14	-	38	21	132
orld Oil Price: $10/bbl	24	16	0	-	24	16	80
resent Value Discount Rate: 6%	38	21	13	-	38	21	131
resent Value Discount Rate: 10%	34	16	7	-	34	16	107
et Pay: +50%	38	24	11	-	38	24	135
et Pay: -50%	26	14	0	-	26	14	80
rans-NPR-4 Pipeline Cost: -50%	38	20	11	-	38	20	127
rans-NPR-4 Pipeline Cost: +50%	36	19	0	-	36	19	110
ield Fixed Costs: -20%	37	20	9	-	37	20	123
ield Fixed Costs: +20%	37	20	9	-	37	20	123
robability of Wildcat Success: .45	38	23	14	-	38	23	136
robability of Wildcat Success: .40	38	21	13	-	38	21	131
robability of Wildcat Success: .35	37	21	13	-	37	21	129
robability of Wildcat Success: .30	36	20	11	-	36	20	123
robability of Wildcat Success: .25	35	20	11	-	35	20	121
robability of Wildcat Success: .20	35	20	9	-	35	20	119
robability of Wildcat Success: .15	28	17	7	-	28	17	97
robability of Wildcat Success: .10	21	16	7	-	21	16	81

Assumes minimum fieldsize is attained in each zone. Drilling contains for all structures large enough to amortize variable development expenditures on a probability-weighted basis.

Exhibit 11

CAPITAL REQUIREMENTS UNDER

"DISCOURAGING RESULTS" EXPLORATION SCENARIO

ZONE	CAPITAL REQUIREMENTS (IN MILLIONS OF DOLLARS)			
	Recon Seismic	Detailed Seismic	Exploration Wells	Delineation Wells
A	$ -	$ 1.7	$ 18	-
B (<13,000')	-	.8	30	-
B (>13,000')	-	1.7	60	-
C	-	-	-	-
Northwest	-	1.7	18	-
Foothills	19.2	.8	30	-
Totals	$19.2	$ 6.7	$ 156	-
Program Total		$ 181.9		

* Present value based on discount rate of 8 percent, and valued as of June 1, 1977.

MINIMUM NUMBER OF WELLS REQUIRED
UNDER "DISCOURAGING RESULTS" EXPLORATION SCENARIO

SENSITIVITY FACTOR	ZONE						
	A	B (<13,000')	B (>13,000')	C	North-west	Foot-hills	Total
Sensitivity Analysis Base Case	3	2	3	-	3	2	13
Flow Rate Per Well: +50%	4	3	3	-	4	3	17
Flow Rate Per Well: -50%	1	1	1	-	1	1	5
World Oil Price: $16/bbl	7	4	5	-	7	4	27
World Oil Price: $10/bbl	1	1	0	-	1	1	4
Present Value Discount Rate: 6%	6	4	4	-	6	4	24
Present Value Discount Rate: 10%	1	1	1	-	1	1	5
Net Pay: +50%	6	4	4	-	6	4	24
Net Pay: -50%	1	1	0	-	1	1	4
Trans-NPR-A Pipeline Cost: -50%	8	4	4	-	8	4	28
Trans-NPR-A Pipeline Cost: +50%	1	1	0	-	1	1	4
Field Fixed Costs: -20%	4	3	3	-	4	3	17
Field Fixed Costs: +20%	2	2	2	-	2	2	10
Probability of Wildcat Success: .45	4	4	5	-	4	4	25
Probability of Wildcat Success: .40	3	3	5	-	3	3	17
Probability of Wildcat Success: .35	2	3	4	-	2	3	14
Probability of Wildcat Success: .30	2	3	4	-	2	3	14
Probability of Wildcat Success: .25	1	2	4	-	1	2	10
Probability of Wildcat Success: .20	1	2	3	-	1	2	9
Probability of Wildcat Success: .15	1	1	3	-	1	1	7

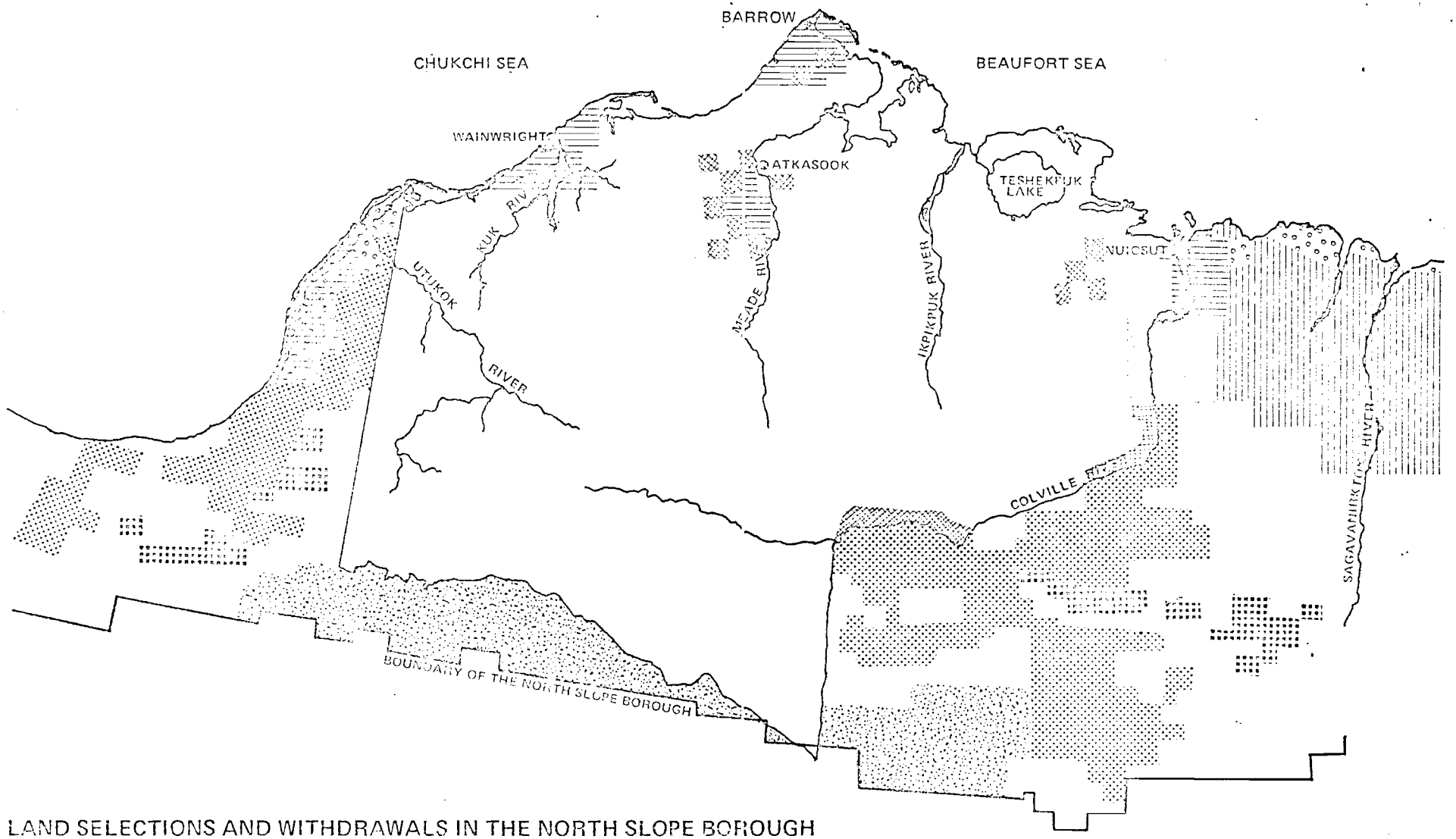
NET NATIONAL ECONOMIC BENEFITS

Scenario	Per Barrel Price Assumption	Field Size Assumption (In Billions of Barrels)	Net Economic Benefits (In Millions of Dollars)*
1	$10	0.5	$ (353)
2	10	1.0	669
3	10	3.0	4,855
4	13	0.5	276
5	13	1.0	1,955
6	13	3.0	8,855
7	16	0.5	940
8	16	1.0	3,302
9	16	3.0	12,919

---

* Present value discounted at 8 percent. These values differ from those shown in Exhibit 8 for a number of reasons.

- Benefits shown in Exhibit 8 are the net of exploration costs. Here, exploration expenditures are not included because it has been assumed these field sizes have been found; therefore, exploration expenditures are a sunk cost.
- In Exhibit 8, each zone is assumed to require an incremental pipeline of up to 200 miles in length. Here, only one pipeline is considered since there is only one field.
- Benefits in Exhibit 8 include associated gas benefits. No gas production is treated explicitly here.



LAND SELECTIONS AND WITHDRAWALS IN THE NORTH SLOPE BOROUGH

- Native Village Selection
- Native Regional Selection, Surface
- Native Regional Selection, Surface and Subsurface
- Native Regional Selection, Subsurface
- State of Alaska, Patented Selections
- State of Alaska, Tentatively Approved Selections
- State of Alaska, Applications
- Withdrawal for Possible Inclusion in the Four National Systems, (D-2)

COMPARATIVE EVALUATION OF PRIVATE AND FOREIGN GOVERNMENT OIL COMPANY PERFORMANCE

Performance Indicator	Average of Six Private Company Values	Average of Six Government Company Values
Net Income as a Percent of Gross Revenues	8.4	3.1
Net Income as a Percent of Equity	12.3	3.5
Barrels Per Day of Production Per Employee	44.2	6.6
Barrels Per Day of Refining Per Employee	36.4	14.1
Annual Revenues Per Employee ($000)	135	43
Asset Value Per Employee ($000)	168	73

SOURCE: An Evaluation of a Federal Oil and Gas Corporation, a staff paper prepared by FEA's Office of Oil and Gas, 1975.

COMPARATIVE EVALUATION OF PRIVATE AND FOREIGN GOVERNMENT OIL COMPANY PERFORMANCE*

Oil Company	Net Income As a Percent of Gross Revenues	Net Income As a Percent of Equity	Barrels Per Day of Production of Employee	Barrels Per Day of Refining Per Employee	Annual Revenues Per Employee ($000)	Asset Value Per Employee ($000)
Private Companies						
Exxon	8.5	14.3	34.5	38.2	152	159
Texaco	11.2	15.6	50.0	39.2	122	161
Gulf	7.6	9.4	56.4	34.4	124	174
Standard Oil of California	10.2	11.8	73.5	50.2	152	200
Atlantic-Richfield	6.0	8.8	21.3	26.6	131	185
Mobil	6.8	13.9	27.5	29.7	128	127
Average	8.4	12.3	44.2	36.4	135	168
Government Companies						
Pemex (Mexico)	0.5	0.5	5.8	7.1	18	33
Petrobras (Brazil)	8.6	8.9	4.8	17.2	47	72
YPF (Argentina)	Loss**	Loss**	7.9	No Refining	26	36
ENI (Italy)	0.7	1.2	3.8	6.9	39	93
ELF (France)	5.6	8.0	15.3	33.6	114	156
Pertamina (Indonesia)	5.1	2.5	7.1	5.7	14	45
Average	3.1***	3.5***	6.6	14.1	43	73

* Except for footnoted exceptions, data are for 1971, 1972, and 1973.

** Data available for only 1 year.

*** Data available for only 2 years.

SOURCE: An Evaluation of a Federal Oil and Gas Corporation, a staff paper prepared by FEA's Office of Oil and Gas, 1975.

Exhibit 16

STATEWIDE POPULATION IMPACTS OF DEVELOPMENT*

DEVELOPMENT YEAR	SIZE OF FIELD		
	500 MILLION BARRELS	1.0 BILLION BARRELS	3.0 BILLION BARRELS
1	615	703	1,032
2	1,006	1,150	1,689
3	3,563	5,231	10,453
4	8,816	14,755	27,884
5	9,473	13,538	32,265
6	8,426	13,714	33,163
7	6,319	10,968	28,596
8	4,736	8,541	23,022
9	3,637	6,594	17,886
10	3,145	5,697	15,481
11	2,186	4,225	11,193
12	1,658	3,125	8,849
13	1,486	3,166	8,091
14	1,428	3,077	7,233
15	1,407	3,046	7,743

* Based on a statewide employment and population model developed for the State of Alaska by Human Resources Planning Institute.

STATEWIDE EMPLOYMENT IMPACTS OF NPR-4 DEVELOPMENT

Development Year	Size of Field (In Millions of Barrels) 500	1000	3000
1	262	562	444
2	402	460	678
3	1505	2222	4350
4	3678	5652	11615
5	3718	5785	12657
6	3232	5259	12759
7	2365	4118	10782
8	1771	3196	8613
9	1359	2456	6639
10	1185	3323	5783
11	797	1550	4064
12	605	1260	3412
13	547	1171	2954
14	527	1176	4139
15	520	1131	2836

STATE OF ALASKA FISCAL PROJECTIONS
BEFORE NPR-4 DEVELOPMENT
(in millions of current dollars)

FISCAL YEAR	TOTAL UNRESTRICTED GENERAL FUND REVENUE BEFORE CONTRIBUTION	TOTAL REVENUE SUBJECT TO PERMANENT FUND CONTRIBUTION	25% CONTRIBUTION TO PERMANENT FUND PER YEAR	PERMANENT FUND BALANCE	TOTAL UNRESTRICTED GENERAL FUND REVENUE AFTER CONTRIBUTION	TOTAL UNRESTRICTED GENERAL FUND EXPENDITURES + ALASKA NLC	GENERAL FUND SURPLUS (DEFICIT)	GENERAL FUND BALANCE
FY75	333.4	---	---	---	333.4	490.0	(156.6)	379.3
FY76	650.0	68.6	17.2	17.2	632.4	626.4	6.4	385.7
FY77	728.7	63.5	15.9	33.1	712.8	705.9	6.9	392.6
FY78	986.4	688.7	172.2	205.3	814.2	871.6	(57.4)	335.2
FY79	1,181.5	874.3	218.6	423.9	962.9	990.8	(27.9)	307.3
FY80	1,493.0	1,193.9	299.8	723.7	1,193.2	1,124.6	68.6	375.9
FY81	1,871.3	1,374.9	343.7	1,067.4	1,527.6	1,240.9	286.7	662.6
FY82	2,111.7	1,526.4	381.6	1,449.0	1,730.1	1,259.8	470.3	1,132.9
FY83	2,403.8	1,757.1	439.3	1,888.3	1,964.5	1,300.0	664.5	1,797.4
FY84	2,651.7	1,931.0	482.8	2,371.1	2,168.9	1,400.0	768.9	2,566.3
FY85	2,819.8	2,018.5	504.6	2,875.7	2,315.2	1,500.0	815.2	3,381.5

Source: Alaska Department of Revenues.

Exhibit 19

NET PRESENT VALUE OF STATE FISCAL IMPACTS FROM NPR-4 DEVELOPMENT

(In Millions of Dollars)

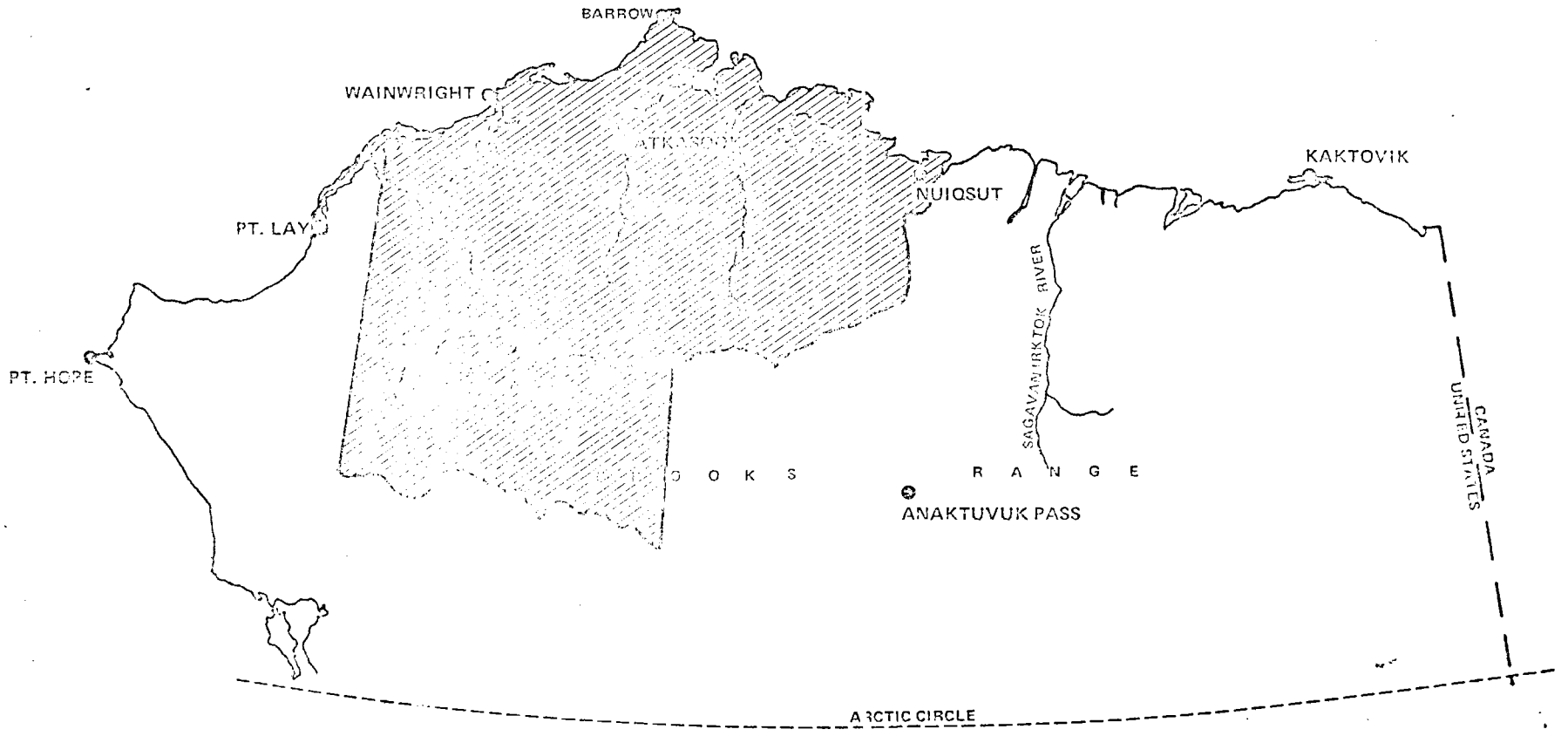
Revenue/Cost Item	Field Size: 500 Million Barrels	1 Billion Barrels	3 Billion Barrels
Private Development*			
Increased Revenues			
- Personal Income Taxes	$ 0	$ 23	$ 53
- Oil and Gas Corporate Taxes	0	218	632
- Other Corporate Income Taxes	0	4	9
Total Increased Revenues	$ 0	$245	$ 694
Increased Costs**	$ 0	$ 94	$ 221
Net Impact	$ 0***	$151	$ 473
Government Development****			
Increased Revenues			
- Personal Income Taxes	$ 14	$ 22	$ 53
- Other Corporate Income Taxes	2	4	9
Total Increased Revenues	$ 16	$ 26	$ 62
Increased Costs**	$ 57	$ 94	$ 221
Net Impact	$(41)	$(68)	$(159)

* Assumes private development of all facilities. These results represent a minimum benefit to the state. In addition, the state would receive some proportion (approximately 25 percent) of any increase in wellhead price accruing to Prudhoe Bay developers as a result of lower average transportation costs.

** Assumes a state-services cost of 1,630 per person.

*** At $13 per barrel, the field producer could suffer a loss. We have assumed the field would not be developed.

**** Assumes government ownership of all facilities, including all new pipeline facilities, and marginal cost pricing privileges for excess TAPS capacity. This is the worst-case assumption for the state, since it is unable to collect any tax revenues on direct oil- and gas-related activity, yet must provide services.



NORTH SLOPE COMMUNITIES

NPR-4

Exhibit 21

TAB V

TAB V

CURRENT ISSUES

TAB C

CORPS OF ENGINEERS

CORPS OF ENGINEERS

- Memorandum of Understanding: providing for Corps to perform site acquisition for SPR (in book).
  - have negotiated for about three months
  - MOU is 99 percent complete
  - OGC is looking into the legal aspects of the Corps acting not as FEA's agent, but the principal party in the acquisition
  - funds were requested last week ($75,000,000)
  - Project Review Board will meet this week
  - when funds are approved, Corps of Engineers will:
    - sign MOU
    - request interagency funds transfer of $75,000,000
  - MOU covers
    - storage, related site acquisition
    - port facilities acquisition
    - pipeline rights-of-way
- Other matters being discussed with Corps and Navy:
  - support for A/E design selection
  - support in pre-design and design state
  - construction management will be the Corps or the Navy or private firm(s) (Private industry will do the actual construction.)

MEMORANDUM OF UNDERSTANDING
Between
The Federal Energy Administration
(Strategic Petroleum Reserve Office)
and the
Department of the Army (Corps of Engineers)

This Memorandum of Understanding, entered into under the authority of 31 USC 686 and P.L. 89-298, Section 219, this _____ day of _____, 1976, by and between the Federal Energy Administration, hereinafter referred to as the FEA, and the Department of the Army, acting through the Corps of Engineers, hereinafter referred to as the Corps.

Whereas: The Administrator of the Federal Energy Administration, pursuant to the Energy Policy and Conservation Act, Public Law 94-163, 89 Stat. 887, 42 USC 6239, approved December 22, 1975, hereinafter referred to as the Act, is authorized to exercise authority over the establishment, management, and maintenance of the Strategic Petroleum Reserve provided for in the Act.

Whereas: The Act provides under Section 159(f) that the Administrator may, among other things, acquire by purchase, condemnation, or otherwise, land or interests in land for the location of storage and related facilities; and construct, purchase, lease, or otherwise acquire storage and related facilities.

Whereas: The Corps has the capability and is willing to acquire real estate interests, including improvements and structures, needed for the Strategic Petroleum Reserve as

authorized by the FEA, in accordance with the terms of this Memorandum of Understanding.

Now, therefore in consideration of the faithful performance of each party of the mutual covenants and agreements hereinafter set forth it is mutually agreed as follows:

Article I

The purpose of this agreement is to establish policies and procedures relating to the acquisition of lands and interests therein by the Corps for 10 storage sites, approximately 222 miles of pipeline rights-of-way and six port facilities on behalf of FEA.

Article II

The Corps will furnish real estate services for the acquisition of port facilities, pipeline rights-of-way and storage sites, as directed by FEA. Such services will include, but not be limited to, planning, mapping and surveying, appraising, and acquiring the necessary interests in land, generally in accordance with priorities and schedules to be established by the FEA. Monthly progress reports with respect to these services will be delivered by the Corps to the FEA.

Article III

The work to be performed under this Agreement will be performed by the Division and District Engineers operating in the areas where real estate interests are to be acquired, under the supervision of the Office, Chief of Engineers, Department of the Army, Washington, D.C.

The Energy Policy and Conservation Act (Public Law 94-163) provides that in order to reduce the impacts of disruptions in supplies of petroleum products, and to carry out the obligations of the United States under the international energy program, 150 million barrels of petroleum products are to be in storage by December, 1978. The Corps, recognizing that its performance of the obligations undertaken in this Memorandum is the essential first concrete step toward accomplishing the objectives of the Act, undertakes, to the extent practicable, to order its resources and priorities so that the lands and interests therein are acquired as expeditiously as possible.

The Corps will acquire all land and interests therein in accordance with normal Corps procedure and in accordance with the requirements of the Energy Policy and Conservation Act, the FEA enabling legislation, and of the Uniform Relocation and Real Property Acquisition Policies Act of 1970 (P.L. 91-646). The Corps will provide the relocation assistance provided for by this latter Act.

All lands and interests therein to be acquired will be identified by FEA. The Corps has primary negotiating responsibility for the acquisition of those properties identified by FEA. However, in view of FEA's expertise in the oil storage technology, and its intimate knowledge of the primary and alternative construction designs for each site, FEA attorneys and technical personnel shall be present, as FEA determines appropriate, and shall participate with the Corps in discussions and negotiations with the owners of the interests to be acquired. The Corps will ensure that FEA personnel have timely advance notification of meetings, discussions and negotiations. FEA shall designate the estate and acreage to be acquired for each project site, subject to modification by FEA, after consultation with the Corps in response to counter-proposals offered in the course of negotiations. A copy of each appraisal report obtained by the Corps in connection with these proposed acquisitions shall be provided to FEA immediately upon approval by the Corps. After consultation with FEA on each project site, the Corps shall have the authority to make the final determination of the price to be paid for each interest in land to be acquired, and shall make the final determination as to when condemnation is required.

Article IV

The Administrator of the FEA or his delegatee will execute and forward to the Corps all requests for condemnation and related documents. The Corps is responsible for delivery of requests to the Department of Justice for initiation of a suit in condemnation, for assisting the Department of Justice in the prosecution of that suit, and for all administrative matters connected with the suit. The Corps after consultation with FEA, has the final authority to concur in proposed pre-judgment settlements and awards in connection with these suits.

If other lawsuits should arise in connection with the acquisition of lands and interests therein and other activities of the Corps as provided for in this Memorandum, the Corps will immediately notify FEA's Office of the General Counsel, which shall consult with the Corps and participate in the prosecution or defense of these lawsuits to the extent agreed upon.

Article V

The Corps will recruit and assign, as necessary, all real estate acquisition personnel required to adequately staff the projects. Either party may terminate this agreement by providing the other party with three months written notice; excepting however, that should the primary mission

requirements of the Corps require removal of personnel from this project in a shorter period of time, the Corps will immediately notify the FEA, and FEA shall then have the option of either furnishing sufficient and appropriate personnel to the Corps, or of terminating this Memorandum without the obligation of giving three months written notice.

Article VI

This agreement shall become effective on _____ and shall continue for a period of three years from that date unless extended for a longer period by mutual agreement. It may be amended by agreement of both parties to include additional work by the Corps for FEA, or such other matters as may be mutually agreed upon.

Article VII

The Corps and the FEA will jointly develop a land acquisition and staffing schedule for each fiscal year for the lands and interests to be acquired, on which the FEA's annual budget submission will be predicated.

It shall be the responsibility of the FEA to program, budget and obtain appropriations of funds required for the acquisition of lands and interests therein, costs, payment of benefits under Public Law 91-646, and other administrative costs and expenses associated with its responsibilities under this Memorandum. The Corps will assist the FEA in presenting testimony to the appropriate committees of the Congress or others in support of its annual budget.

FEA will transfer to the Office, Chief of Engineers, by SF 1080, funds sufficient to cover the Corps' administrative costs, the costs of appraisals, title evidence, and relocation costs, and the costs of the property acquisitions. Obligations and outlays of these funds will be in accordance with quarterly limitations established by the FEA.

A report on obligations, expenditures, etc., will be furnished to the FEA monthly on SF 133, "Report on Budget Execution," in accordance with OMB Circular A-34.

Funds transferred to the Corps may not be reprogrammed by the FEA where the Corps may be legally or morally committed to action on behalf of the FEA unless directed by the President, the Congress, or OMB. No funds may be withdrawn without prior approval of the Corps. Funds excess to Corps requirements will be promptly reported to the FEA for reprogramming prior to the close of each fiscal year.

Article VIII

All Corps records relating Corps land acquisitions under this Memorandum will be available for periodic inspection by FEA.

Article IX

The Corps will provide a final opinion of title for each parcel to the FEA within 21 days of the closing of direct-

purchases, along with closing papers and all muniments of title. Final opinions of title prepared by the Department of Justice for parcels acquired by condemnation will be forwarded directly by Justice to FEA, in accordance with normal Justice procedures.

IN WITNESS WHEREOF, The Federal Energy Administration and the Department of the Army have caused this Memorandum of Understanding to be executed as of the date and year first-above written.

FEDERAL ENERGY ADMINISTRATION

BY: _____

DEPARTMENT OF THE ARMY

_____

TAB D

REGIONAL STORAGE

D

REGIONAL STORAGE

- have completed identification of eight potential underground storage sites in the East Coast Regions (2 in each Region)
- feasibility studies will be performed by Acres American with Regional Offices
  - test concept of storing #4 in Regions
  - reports will be made around Labor Day
- Boston meeting June 30, 1976
  - last two sites selected (in New England)
    - Quincy, Massachusetts
    - New London, Connecticut
  - study strategy agreed to by
    - State geologists, energy officials of New England States (except New Hampshire) and FEA Regions I - IV

TAB E

PUBLIC INFORMATION SYSTEM

E

PUBLIC INFORMATION SYSTEM

- realize at this point that such a program is necessary
- developing a multiple information program to educate the general public where Davies and Noel will articulate the program nationwide
- preparing fact sheet suitable for both distribution on the Hill and for letters of inquiry
- PR plan is being finalized and will be ready in 10 days
    - to include:
        - extensive explanation of program which Noel and Davies will articulate nationwide
        - speaking engagements, slides, movies, media interviews, etc.
- John Donnelly, experienced Public Information Officer , has been with FEA Public Affairs Office for 2 1/2 years (since early days of FEO) handling news media inquiries, preparing news releases, and maintaining liaison with national print and news media