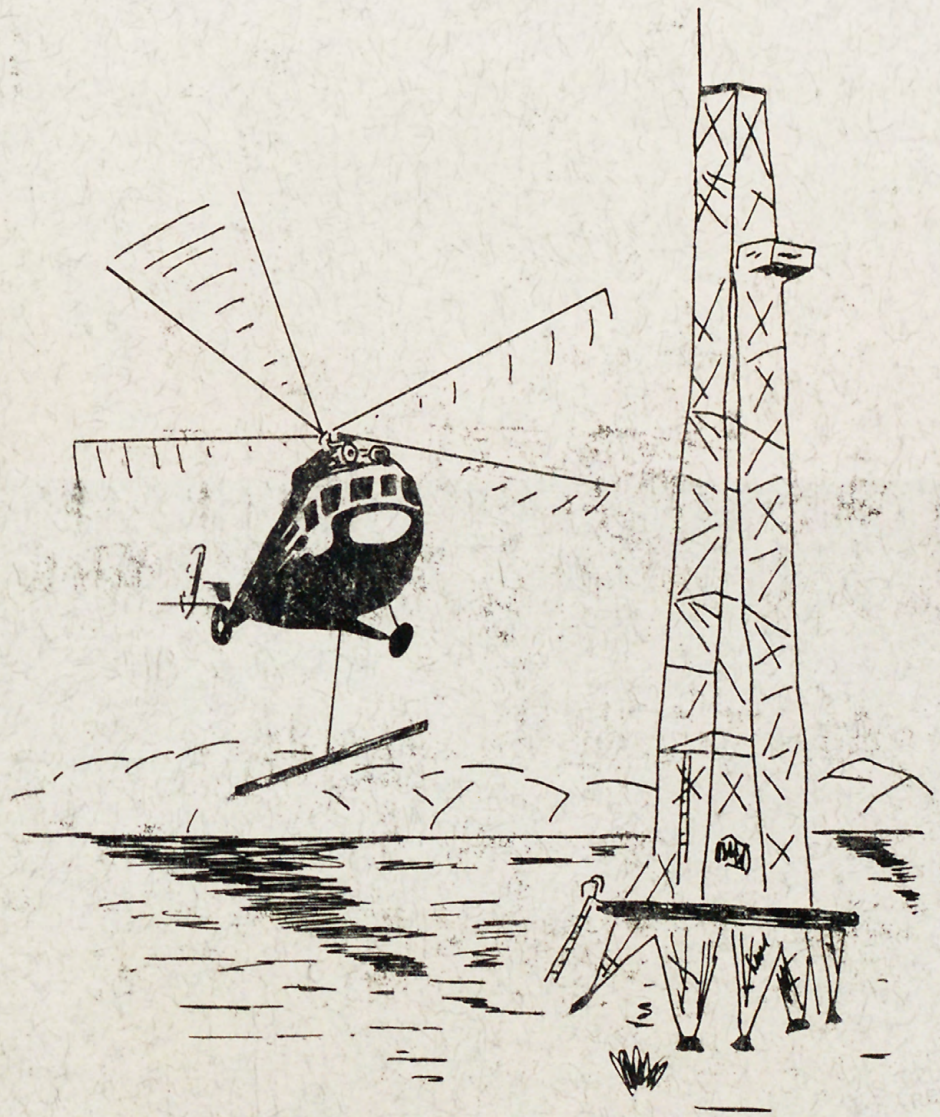
HELICOPTER MOBILIZATION of OIL and GAS DRILLING OPERATIONS in MOUNTAINOUS AREAS of WESTERN WYOMING



prepared by

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HELICOPTER MOBILIZATION
OF
OIL AND GAS DRILLING OPERATIONS
IN
MOUNTAINOUS AREAS OF WESTERN WYOMING

A Feasibility Study Prepared By:

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For

The Department of the Interior
United States Geological Survey
Denver, Colorado

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1.0 INTRODUCTION

1.1 STATEMENT OF THE PROBLEM:

GETTY RESERVE, INCORPORATED, OF DENVER, COLORADO, HAS APPLIED TO THE UNITED STATES GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR, FOR PERMISSION TO DRILL A SEVENTEEN-THOUSAND FOOT OIL AND GAS WELL IN PART OF THE BRIDGER-TETON NATIONAL FOREST THAT HAS BEEN RECOMMENDED FOR WILDERNESS DESIGNATION. ACCORDING TO GETTY RESERVE ESTIMATES, THE GEOLOGIC STRUCTURE IN AN AREA KNOWN AS THE BEAR THRUST UNIT (AT THE EDGE OF THE OVERTHRUST BELT) COULD CONTAIN 100 - 200 MILLION BARRELS OF OIL AND 2 - 4 TRILLION CUBIC FEET OF NATURAL GAS. THIS UNIT HAS NEVER BEEN DRILLED, HOWEVER, SO THE EXISTENCE OF COMMERCIAL QUANTITIES OF OIL AND GAS IS UNPROVEN.

GETTY RESERVE'S MINERAL LEASE AND ASSOCIATED DOCUMENTS STIPULATE THAT THE AREA'S SCENIC AND AESTHETIC VALUES BE PRESERVED AS MUCH AS POSSIBLE, CONSISTENT WITH AUTHORIZED USES. ALL ROADS CONSTRUCTED FOR THE CONVENIENCE OF THE LEASE-HOLDER MUST BE OBLITERATED WHERE REQUIRED AND RESTORED IN A MANNER THAT WILL ENCOURAGE REVEGETATION. THE LEASE AREA ALSO CONTAINS CRITICAL HABITATS FOR MANY WILDLIFE SPECIES AND IS HIGHLY VISIBLE FROM THE HIGH LINE HIKING TRAIL. THE DRILL SITE IS THREE MILES INSIDE THE PROPOSED GROS VENTRE WILDERNESS AND DECISIONS CONCERNING GETTY'S REQUEST WILL UNDOUBTEDLY AFFECT THE FUTURE MANAGEMENT OF THE AREA AND WILL PROBABLY BE 'PRECEDENT SETTING', NOT ONLY FOR THE BRIDGER-TETON NATIONAL FOREST, BUT FOR OTHER PLACES WHERE COMMERCIAL DEVELOPMENT MIGHT CONFLICT WITH OTHER USES.

THE FOREST SERVICE DRAFT ENVIRONMENTAL ASSESSMENT OF THE GETTY RESERVE PROPOSAL CONSIDERS FOURTEEN ALTERNATIVES FOR MINIMIZING EFFECTS ON THE AREA'S WILDERNESS CHARACTER. ALTERNATIVE 13 SUGGESTS THAT DRILLING ACTIVITIES BE PARTIALLY OR WHOLLY SUPPORTED BY HELICOPTER. IN CONSIDERING THIS

POSSIBILITY, QUESTIONS CONCERNING THE TECHNOLOGIC AND ECONOMIC FEASIBILITY OF HELICOPTER SUPPORT MUST BE ADDRESSED. IF THIS ALTERNATIVE WERE IMPLEMENTED, IT WOULD BE THE FIRST SUCH PROGRAM IN THE OVERTHRUST REGION.

ACCORDINGLY, A FEASIBILITY STUDY FOR HELICOPTER MOBILIZATION OF THE DRILLING ACTIVITIES WAS COMMISSIONED BY THE ENVIRONMENTAL IMPACT STATEMENT TASK FORCE. RESULTS AND CONCLUSIONS OF THE STUDY ARE PRESENTED HEREIN.

1.2 BACKGROUND DISCUSSION:

EVEN WITH SPECIFIC, WELL-DEFINED PROJECTS, COMPETENT GROUPS SOMETIMES PRODUCE SUBSTANTIALLY DIFFERENT COST AND FEASIBILITY ESTIMATES FOR THE SAME JOB. THE 'THREE ESTIMATE' APPROACH, FREQUENTLY CONSIDERED THE BACKBONE OF THE ESTIMATOR'S ART, IS CERTAINLY A WORTHY TOOL. BUT WHO, WITH EXPERIENCE IN THE FIELD, HAS NOT ENCOUNTERED PROJECT ESTIMATES SO DIVERGENT AS TO DECREASE, RATHER THAN INCREASE, CONFIDENCE IN THEIR RELIABILITY?

APART FROM ESTIMATE VARIABILITY, THE COMMERCIAL COMMUNITY IS ALSO VERY FAMILIAR WITH 'COST OVERRUNS'. WHILE OVERRUNS ARE FREQUENTLY ASSOCIATED WITH PUBLIC PROGRAMS, PRIVATE SECTOR ACTIVITIES ENJOY NO IMMUNITY, NOR ARE MAJOR PETROLEUM COMPANIES EXCEPTED.

THE SEPTEMBER 1980, ISSUE OF THE WESTERN OIL REPORTER FEATURED A ROUNDUP OF DRILLING ACTIVITY IN THE OVERTHRUST BELT. TWO ARTICLES * HIGHLIGHTED THE UNCERTAINTIES AND EXPENSE OF DRILLING IN THE OVERTHRUST REGION. ONE ARTICLE CITED COST OVERRUNS OF 260 PERCENT ON THE BOUNTIFUL LIVESTOCK WELL IN SUMMIT COUNTY, UTAH. NEARLY $8 MILLION WAS REQUIRED

* FOR THE CONVENIENCE OF THE READER, THE ARTICLES ARE REPRODUCED IN APPENDIX C.
1. IDAHO'S BALD MOUNTAIN: BEAUTIFUL SCENERY, EXPENSIVE LOCATION
2. BOUNTIFUL LIVESTOCK BATTLES CROOKED HOLE PROBLEMS

TO COMPLETE A DRILLING PROGRAM WHOSE COST HAD BEEN ESTIMATED AT $2.7 MILLION.

ANOTHER WELL, ON BALD MOUNTAIN IN BONNEVILLE COUNTY, IDAHO, IS BEING DRILLED IN A LOCATION SIMILAR TO GETTY'S BEAR THRUST SITE. ITS ESTIMATED COST IS MORE THAN $10 MILLION. BY JULY 1980, $2.5 TO $3.0 MILLION HAD BEEN SPENT AND, AT THAT TIME, THE COMPANY STILL HAD TO CONSTRUCT ABOUT 2.25 ADDITIONAL MILES OF ROADS AS WELL AS THE DRILL SITE, ITSELF. ROADWORK CONSTITUTED A LARGE PORTION OF TOTAL EXPENSES, PRIOR TO SPUDDING.

THE EXPERIENCE AT BALD MOUNTAIN MAY WELL BE REPEATED IN THE BEAR THRUST PROGRAM. A BRIEF COMPARISON OF THE PROJECTS WILL DEMONSTRATE THEIR SIMILARITIES (SEE TABLE 1.) EXCEPT FOR THE PROPOSED WILDERNESS DESIGNATION AND LOCAL GEOLOGIC DETAILS AT THE BEAR THRUST LOCATION, SETTINGS FOR THE TWO WELLS ARE REMARKABLY SIMILAR. AIRLINE DISTANCE BETWEEN THE SITES IS ABOUT 37 MILES.

THE OPERATOR OF THE BALD MOUNTAIN PROGRAM IS CONSIDERING CONVENTIONAL RIG MOBILIZATION AND SUPPORT DURING SUMMER BUT, BECAUSE DEEP SNOW MAY MAKE IT IMPOSSIBLE TO KEEP THE ROAD OPEN MUCH OF THE TIME, WINTER ACCESS FOR CREW CHANGES AND RESUPPLY MAY BE ACCOMPLISHED BY HELICOPTER OR SNOW VEHICLE. THE OPERATOR ALSO ANTICIPATES CONSIDERABLE ROAD MAINTENANCE EXPENSE BECAUSE OF THE CONSTANT 'POUNDING' BY HEAVY TRUCKS AND HAS NOT FULLY ASSESSED RESTORATION COSTS, IF RESTORATION IS REQUIRED.*

IF HELICOPTER SUPPORT OF WINTER DRILLING IS IMPLEMENTED, THE BALD MOUNTAIN VENTURE MIGHT BE A 'LIVING LABORATORY' TO STUDY ENVIRONMENTAL EFFECTS OF HELICOPTER OVERFLIGHTS PRIOR TO BEGINNING A MORE INTENSIVE PROGRAM IN THE GROS VENTRE.

* VERBAL COMMUNICATION

TABLE 1.

COMPARISON OF THE BALD MOUNTAIN AND BEAR THRUST PROJECTS

	BALD MOUNTAIN	BEAR THRUST
ELEVATION:	8,100 FT (EST)	8,400 FT.
HOLE DEPTH:	14,600 FT. ±	17,000 - 18,000 FT.
TERRAIN:	RUGGED MOUNTAINS, 2500-3000 FT RELIEF	RUGGED MOUNTAINS, 2500-3000 FT RELIEF
CLIMATE:	SUB-ALPINE TO ALPINE. SEVERE WINTER STORMS HEAVY SNOWS.	SUB-ALPINE TO ALPINE. SEVERE WINTER STORMS. HEAVY SNOWS.
JURISDICTION:	CARIBOU NATIONAL FOREST.	BRIDGER-TETON NATIONAL FOREST.
ENVIRONMENTAL SENSITIVITY:	HIGHLY SENSITIVE.	HIGHLY SENSITIVE.
AIRLINE DISTANCE FROM PAVED HIGHWAYS:	9.2 MILES.	4.5 MILES.
SITE ELEVATION ABOVE HIGHWAY:	2300 FT (APPROX)	2200 FT (APPROX)
SITE ACCESS:	ROAD AND HELICOPTER OR APPROPRIATE SNOW VEHICLE.	ROAD OR HELICOPTER OR COMBINATION TO BE DETERMINED.
ROAD CONSTRUCTION REQUIREMENTS:	9 MI. OF NEW CONSTRUCTION. 11 MI. OF IMPROVEMENT TO EXISTING ROADS.	3.5 TO 12 MI. OF NEW CONSTRUCTION. 1.8 MI. OF IMPROVEMENT TO EXISTING ROADS.
PERSONNEL FACILITIES:	WINTER CAMP.	WINTER/SUMMER CAMP. (TO BE DETERMINED)
WINTER ROAD ACCESS:	INTERMITTENT.	HIGHLY QUESTIONABLE.
ESTIMATED COSTS:	EXPENSES PRIOR TO SPUDDING: $2.5 MILLION. TOTAL COSTS: IN EXCESS OF $10 MILLION.	TO BE DETERMINED - (LIKELY IN EXCESS OF $10 MILLION).

1.3 Approach to the Feasibility Study:

Points in the preceding discussion which influenced our approach to this study are:

1. Cost estimates for a given project made by competent estimators can differ radically. Barring major errors, the cause often lies in an estimator's concept of the project. A complex undertaking can be conceived and developed in various ways, each with its particular costs.

2. As illustrated by the Bountiful Livestock Well, preparing estimates is a human undertaking to which Mother Nature often pays little heed. If the unique conditions she might impose can not be, or are not, fully appreciated, then belaboring 'nickle and dime' aspects of an estimate will not aid completion of a project within budget and cost overruns are likely.

3. Working in a rugged mountain environment, such as that in the study area, is expensive, even by oil industry standards. Individual operators might underestimate costs until they gain experience in such an environment. Combining winter conditions nearly as severe as those in the arctic with unusually rugged terrain presents a new challenge to the industry.

Because of the recognized uncertainties in cost estimates for pioneer projects, we have emphasized the cost <u>differential</u> of helicopter versus conventional drill mobilization and have subordinated drilling cost estimates, themselves. Because costs for any given location and well depth will vary with well design, program concept, and parameters which reflect the estimator's idea of how to do the job, our approach was to

DESIGN A SUITABLE WELL, HOLD THE DESIGN PARAMETERS AND DRILLING PROGRAM CONSTANT, THEN DEVELOP COMPARATIVE COSTS FOR MOBILIZATION AND SUPPORT USING CONVENTIONAL AND HELICOPTER TECHNIQUES.

WHILE WE ARE PRIMARILY CONCERNED WITH COST DIFFERENCES FOR THE TWO ALTERNATIVES, DRILL COSTS, THEMSELVES, MUST BE REASONABLE ESTIMATES OF WHAT IS LIKELY TO BE INCURRED. THE PROPOSED DRILLING PROGRAM IS PRESENTED IN DETAIL IN SECTIONS 4 AND 5.

THIS DISCUSSION OF THE PHILOSOPHY OF COST ESTIMATES INDICATES AN AWARENESS THAT COSTS WILL BE A CONTROVERSIAL ITEM IN ANY FEASIBILITY DETERMINATION. COST IS CERTAINLY NOT LESS IMPORTANT THAN LEGITIMATE ENVIRONMENTAL CONCERNS, NOR SHOULD COST OVERSHADOW TECHNICAL FEASIBILITY AND SAFETY ISSUES. THESE TOPICS WILL BE TREATED IN DEPTH AS THEY PERTAIN TO HELICOPTER MOBILIZATION. HOWEVER, THERE SEEMS TO BE A PRIOR ASSUMPTION THAT, SHORT OF DENYING PERMISSION TO DRILL, HELICOPTER SUPPORT WILL IMPOSE THE LEAST ENVIRONMENTAL STRESS OF ALL IDENTIFIED ALTERNATIVES. THERE IS LESS CONCERN ABOUT TECHNICAL FEASIBILITY BECAUSE OF SUCCESSFUL MOBILIZATION AND SUPPORT OF HEAVY RIGS IN OTHER REMOTE AREAS.

THE CONTENTION THAT HELICOPTER MOBILIZATION POSES THE LEAST ENVIRONMENTAL DANGER, SHORT OF PERMIT DENIAL, WILL BE THOROUGHLY DISCUSSED IN SECTIONS 9 AND 10.

1.4 ITEMS NOT CONSIDERED IN THE STUDY:

A MAJOR CONCERN TO OIL AND GAS PRODUCERS, WITH WHOM HELICOPTER MOBILIZATION HAS BEEN DISCUSSED, IS THE QUESTION OF WHAT HAPPENS IF OIL OR GAS IS FOUND IN COMMERCIAL QUANTITIES. BECAUSE A ROAD MIGHT THEN BE REQUIRED TO SUPPORT EFFICIENT DEVELOPMENT OF THE ENERGY RESOURCE, THE SEEMINGLY NON-PRODUCTIVE INVESTMENT IN HELICOPTER MOBILIZATION TO AVOID ROAD BUILDING

INITIALLY IS THEN COMPOUNDED BY THE NEED TO CONSTRUCT ONE. AFTER LENGTHY DISCUSSION, IT WAS DECIDED NOT TO ADDRESS THIS PROBLEM IN THIS STUDY.

THE SIGNIFICANT ADDED EXPENSE OF HELICOPTER MOBILIZATION WOULD CERTAINLY HAVE TO BE TREATED AS A SUNK COST IF DRILL TESTS WERE SUCCESSFUL AND THE LEASE DEVELOPED. PLACED IN PERSPECTIVE, HOWEVER, AGAINST ANTICIPATED DEVELOPMENT COSTS OF WELL OVER $100 MILLION FOR A NEW FIELD, HELICOPTER MOBILIZATION EXPENSES FOR WILDCAT WELLS WOULD LIKELY HAVE LITTLE EFFECT ON THE ULTIMATE POTENTIAL PROFIT. THERE IS ALSO A POSSIBILITY OF OBTAINING GOVERNMENT FINANCIAL SUPPORT FOR HELICOPTER MOBILIZATION BECAUSE TECHNIQUE AND SYSTEMS DEVELOPMENT DURING THE PROGRAM MIGHT BE CONSIDERED RESEARCH.

THERE IS, OF COURSE, SOME DIVERGENCE OF OPINION CONCERNING THE CONCLUSIONS REACHED IN THIS EVALUATION. APPENDIX 'D' CONTAINS SEVERAL LETTERS FROM INTERESTED GROUPS OR INDIVIDUALS WHO REVIEWED AN EARLY DRAFT OF THIS REPORT.

2.0 SUMMARY AND CONCLUSIONS:

2.1 FEASIBILITY OF HELICOPTER MOBILIZATION:

THE TECHNICAL FEASIBILITY OF MOBILIZING OIL DRILLING RIGS BY HELICOPTER HAS BEEN DEMONSTRATED IN MANY PARTS OF THE WORLD. UNIQUE ASPECTS OF A HELICOPTER-SUPPORTED PROGRAM IN THE GROS VENTRES ARE THE WELL'S DEPTH (18,000 FEET), THE DRILL SITE ELEVATION, THE RUGGED TERRAIN, AND SEVERE WINTER WEATHER. SUCCESSFUL OPERATIONS IN THE ARCTIC TESTIFY FOR HELICOPTER MOBILIZATION AND SUPPORT UNDER SEVERE CONDITIONS BUT NO ONE HAS YET ATTEMPTED SUCH A PROGRAM AT ELEVATIONS OF 8,000 - 9,000 FEET ABOVE SEA LEVEL.

THE STUDY DEMONSTRATES THAT HELICOPTER MOBILIZATION AND SUPPORT OF DRILLING OPERATIONS AT THE GETTY-RESERVE SITE ARE TECHNICALLY FEASIBLE ALBEIT AT ADDED COST. HOWEVER, A SINGULAR ELEMENT OF CONCERN, WHICH COULD CAUSE REEVALUATION OF THE ECONOMIC FEASIBILITY OF THE AIRLIFT ALTERNATIVE IS THE AVAILABILITY OF DRILLING WATER AT THE SITE.

ADEQUATE DRILLING WATER SUPPLIES (50 GPM) ARE CRITICAL TO THE OPERATION. IF AN ON-SITE WELL CANNOT PRODUCE THIS VOLUME OF WATER AND NO ALTERNATIVE SOURCE CAN BE FOUND, HELICOPTER SUPPORT WOULD NOT BE PRACTICAL. THE COST OF HAULING WATER BY AIR WOULD BE EXORBITANT. IF AN ON-SITE WELL CANNOT SUPPLY SUFFICIENT WATER, OTHER MEANS ARE AVAILABLE BUT PROBABLY NOT WITHIN THE COST ESTIMATES PRESENTED IN THIS REPORT. OUR CONCERN WITH WATER SUPPLY IS NOT LIMITED TO THE HELICOPTER ALTERNATIVE. WATER HAULAGE OR PUMPING WOULD BE A MAJOR COST ITEM IN THE ROAD ACCESS CASE AS WELL. WE RECOMMEND A WATER WELL BE DRILLED PRIOR TO IMPLEMENTING FULL-SCALE PROJECT MOBILIZATION.

OUR FEASIBILITY STUDY INDICATES THAT A PARKER TBA 2000 RIG, CAPABLE OF DRILLING TO 20,000 FEET, AND MOST ANCILLIARY EQUIPMENT AND SUPPLIES, CAN BE AIRLIFTED FROM A STAGING AREA AT THE BASE

OF THE MOUNTAIN TO THE DRILL SITE BY A BELL 214 MEDIUM-LIFT HELICOPTER. THE RIG, SPECIALLY DESIGNED FOR HELICOPTER TRANSPORT, BREAKS DOWN INTO APPROXIMATELY 4,000-POUND UNITS. EXCEPT FOR 19 LOADS, ALL SUPPORT EQUIPMENT AND SUPPLIES CAN ALSO BE ASSEMBLED IN UNITS WEIGHING LESS THAN 4,200 POUNDS. THE NINETEEN OVER-WEIGHT LOADS (9,000 TO 20,000 POUNDS EACH) CAN BE TRANSPORTED BY BOEING'S MODEL 234 CHINOOK HEAVY-LIFT HELICOPTER.

FIELD LOGISTICS CALL FOR RETAINING THE 214 FULL-TIME FOR ONE YEAR WHILE THE DRILLING OPERATION IS COMPLETED. THE CHINOOK WILL BE USED FOR ONLY A SHORT PERIOD AT THE BEGINNING AND END OF THE PROGRAM.

THE OPERATION CAN BE MOUNTED FROM A STAGING AREA AT THE CONFLUENCE OF LITTLE GRANITE CREEK AND ROUGH HOLLOW CREEK. AN EXISTING ROAD TO THE STAGING AREA WILL REQUIRE ONLY MODERATE UPGRADING FOR 1.7 MILES. THE 3.5 MILE FLIGHT PATH TO THE DRILL SITE WILL GO UP ROUGH HOLLOW AND RETURN VIA LITTLE GRANITE CREEK TO MINIMIZE CHANCE OF COLLISION WHEN TWO HELICOPTERS ARE OPERATING.

THE STAGING AREAS WILL HAVE FUEL-HANDLING FACILITIES FOR THE RIG AND HELICOPTERS, PARKING FOR 40 TRUCKS, AND A COMBINATION OFFICE/LIVING TRAILER. THE STAGING OPERATION REQUIRES ABOUT 5.8 ACRES AND HAS GOOD SECURITY DUE TO IT'S LOCATION AT THE END OF THE ACCESS ROAD ALONG LITTLE GRANITE CREEK. HOWEVER, A WATCHMAN WILL BE PRESENT DURING OFF-HOURS.

A 4-ACRE SITE FOR THE RIG AND ATTENDANT FACILITIES WILL BE CONSTRUCTED BY A D5B CATERPILLAR TRACTOR AND OTHER EQUIPMENT AIRLIFTED BY THE CHINOOK. CAMP FACILITIES FOR 55 MEN CAN BE PROVIDED WITH MINIMAL ADDITIONAL DISTURBANCE BECAUSE SLOPES AT THE SITE ARE GENTLE ENOUGH FOR LIVING AND SERVICE MODULES TO BE PLACED ON TIMBER FRAMEWORK RATHER THAN ON GRADED PADS.

MOBILIZATION AND RE-SUPPLY WILL REQUIRE 6,000 TO 7,000 HELICOPTER FLIGHTS TO AND FROM THE DRILL SITE. APPROXIMATELY 600 HEAVY TRUCK TRIPS TO THE STAGING AREA ARE ANTICIPATED.

DRILL SITE OPERATIONS CALL FOR 3 DRILLING CREWS WORKING 8-HOUR SHIFTS. DRILLING WILL BE SHUT DOWN ONLY DURING PERIODS OF VERY SEVERE WEATHER AND CREWS WILL BE ROTATED EVERY 10 DAYS.

2.2 Costs Compared with Road Access:

Dry hole and completed costs were estimated for helicopter and conventional mobilization and support. Items which differ considerably or are unique to a particular alternative are:

1. Rig day rate: Helicopter - $12,000
   Conventional $ 9,000
2. Staging area
3. Road construction
4. Helicopter flight-hour costs
5. Hole completion using completion rig versus the rotary rig

most other items are nearly the same in either case.

Estimated dry hole costs and completed well costs using helicopter mobilization are $15.9 million and $18.4 million respectively. Of this total, approximately $2.1 million is for helicopter charges.

Well costs via conventional mobilization and support were estimated at $13.7 million for dry hole and $15.6 million for a completed well. About $1.2 million is for road construction, maintenance, and restoration. Restoration will be difficult and costly.

Cost differences of the two alternatives are:

	Dry Hole	Completed Well
Helicopter	$15,896,579	$18,830,246
Conventional	$13,661,268	$15,579,435
Difference:	$ 2,235,311	$ 2,709,811

2.3 Affects on Environment:

Our study addressed only those environmental impacts unique to helicopter mobilization. Grading the drill site to accommodate helicopters, and other equipment which helicopter use might require, will disturb less than one additional acre of land compared to conventional mobilization. The staging area will disturb about six acres compared to a minimum of 30 to 35 acres which would be disturbed by road building.

Engine exhaust emission will be greater with helicopters but degradation of air quality will be at least partially offset by the absence of fugitive dust generated by road vehicles.

Noise may harass wildlife and aggravate recreational users but we expect gradual habituation of wildlife to repeated flights.

Considering trade-offs involved in helicopter versus conventional rig mobilization, the helicopter alternative appears to present less environmental threat.

3.0 DESCRIPTION OF AREA AND WELL SITE:

3.1 PHYSICAL FEATURES:

GETTY'S PROPOSED WELL SITE IS IN TETON COUNTY, WYOMING, IN THE SW 1/4 SW 1/4, SECTION 8, T39N, R114W (SEE FIGURE 1). THIS LOCATION, IN THE BRIDGER-TETON NATIONAL FOREST, IS ON THE SCENIC WESTERN RIDGE OF THE GROS VENTRE MOUNTAIN RANGE. THREE MILES INSIDE THE BOUNDARY OF A PROPOSED WILDERNESS AREA, WELL-SITE ELEVATION IS ABOUT 8,440 FEET.

THE TERRAIN IS CHARACTERIZED BY GENTLY ROLLING ALPINE AND SUB-ALPINE VALLEYS AND MEADOWS BROKEN BY PRECIPITOUS SLOPES OF SURROUNDING RIDGES AND PEAKS. THE HIGHEST PEAKS ARE OVER 11,000 FEET ABOVE SEA LEVEL. SLOPES AS STEEP AS 60% AND CROWNED BY VERTICAL CLIFFS ARE COMMON.

THE PROPOSED DRILL SITE IS DRAINED BY NUMEROUS INTERMITTENT AND THREE PERENNIAL STREAMS. LITTLE GRANITE CREEK AND ROUGH HOLLOW ARE PERENNIAL AND ARE TRIBUTARY TO GRANITE CREEK WHICH FLOWS INTO THE HOBACK RIVER APPROXIMATELY 12 MILES FROM ITS CONFLUENCE WITH THE SNAKE RIVER. SPRINGS NEAR THE DRAINAGE HEADWATERS PRODUCE NUMEROUS BOGS WITH THICK SOIL COVER. WATER QUALITY IN THESE STREAMS IS HIGH AND AIR QUALITY AROUND THE DRILL SITE IS VERY GOOD WITH LITTLE DEGRADATION FROM HUMAN ACTIVITY.

GROUND SLOPE AT THE SITE (SEE FIGURE 2 A, B, AND C) IS GENERALLY LESS THAN TEN PERCENT. NO DRAINAGE CHANNELS ARE IN THE IMMEDIATE VICINITY AND THE SITE IS ESSENTIALLY UNTIMBERED. EXCEPT FOR THE DRILL PAD AND RESERVE PITS, LITTLE EARTH MOVING WILL BE REQUIRED FOR THE DRILLING OPERATION.

NEARBY GEOLOGY HAS BEEN MAPPED BY DR. DAVID LOVE OF THE U. S. GEOLOGICAL SURVEY IN LARAMIE, WYOMING.

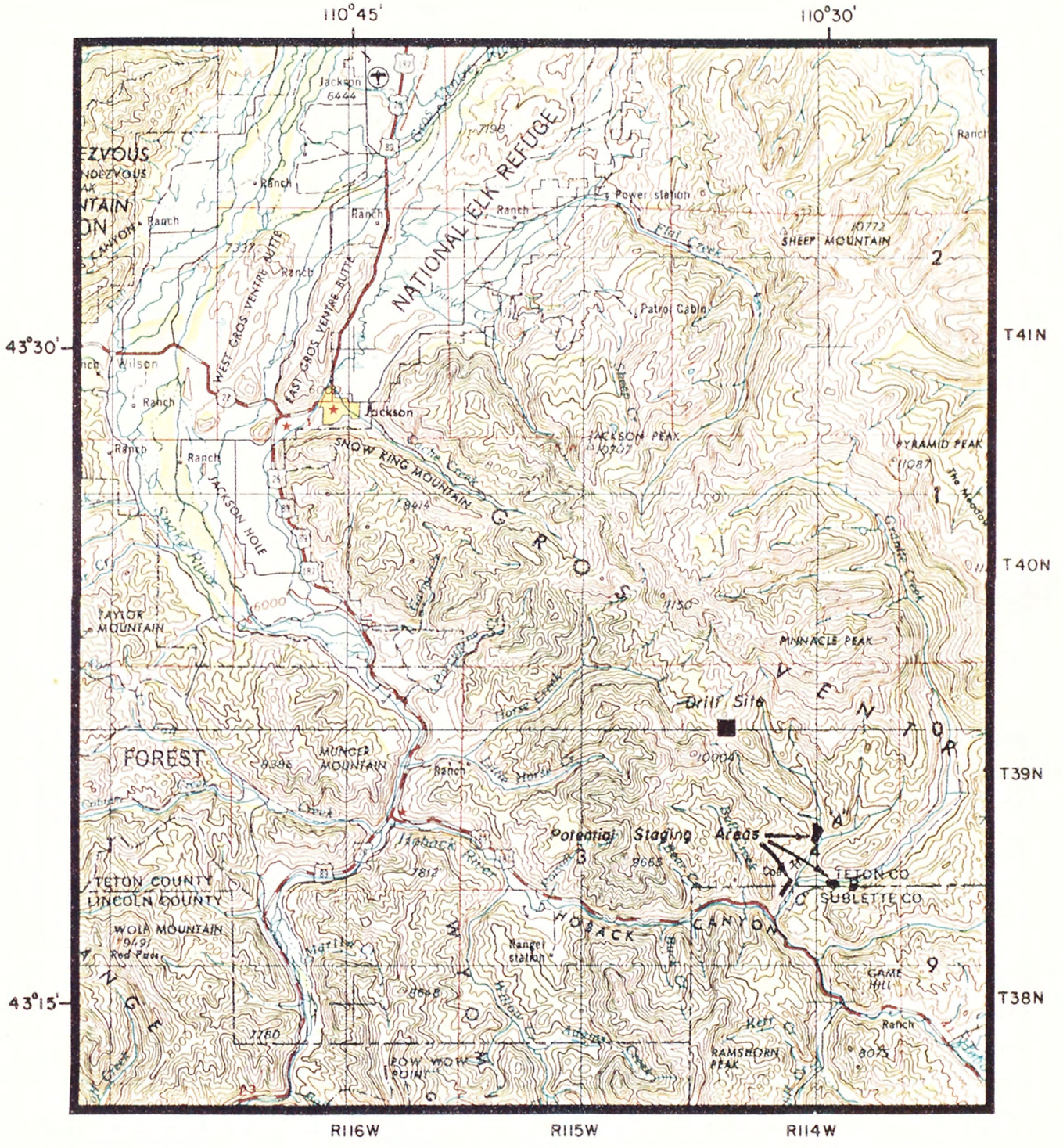


FIGURE 1.

AREA MAP - JACKSON, WYOMING, AND VICINITY

Scale 1:250,000

5 0 5 Statute Miles

5 0 5 Kilometres

A. DRILL SITE

B. DRILL SITE

C. DRILL SITE

D. TENT CAMP IN LITTLE GRANITE CREEK

FIGURE 2. - GENERAL SITE VIEWS

THE GEOLOGICAL PICTURE IS COMPLEX AND A FULL DESCRIPTION IS BEYOND THE SCOPE OF THIS REPORT. IN GENERAL, THERE IS A THICK SEDIMENTARY SEQUENCE FORMING AN ANTICLINAL STRUCTURE ABOUT 5 MILES LONG WHICH RESTS ON ACIDIC PRECAMBRIAN ROCKS. THE STRUCTURE IS COMPLICATED BY THE BEAR THRUST WHICH TRUNCATES AND OFFSETS THE CREST OF THE ANTICLINE. AT THE WELL SITE, THE PROJECTED DEPTH TO THE CAMBRIAN GROS VENTRE, THE OLDEST SEDIMENTARY UNIT, AND WHERE THE DRILL HOLE WILL STOP, IS 18,000 FEET.

SOILS NEAR THE WELL WERE EVALUATED BY THE SOIL RESOURCE INVENTORY FOR THE JACKSON HOLE PLANNING UNIT IN 1976. A COMPLETE INVENTORY IS ALSO CONTAINED IN THE ENVIRONMENTAL ASSESSMENT PREPARED BY FOREST SERVICE PERSONNEL OF BRIDGER-TETON NATIONAL FOREST WHICH STATES THAT:

> 'SOILS ON THE PAD SITE CONSIST OF A 9- TO 16-INCH LAYER OF SILTY LOAM FOLLOWED BY FRAGMENTS GENERALLY LESS THAN 20% OF THE UPPER HORIZON AND 35% AT THE LOWER.
>
> 'ACCESS UP THE LITTLE GRANITE CREEK DRAINAGE CROSSES MANY SMALL DEBRIS FLOWS AND SEVERAL WET SLUMPY AREAS. STABILITY SHOULD NOT BE A PROBLEM, BUT ANY ROAD CONSTRUCTION WILL REQUIRE MANY CULVERTS AND CAREFUL DESIGN'.

3.2 BIO-ENVIRONMENTAL FEATURES:

THE FISHERY OF LITTLE GRANITE CREEK IS LIMITED BECAUSE OF ANCHOR ICE FORMATION WHICH CREATES A HOSTILE WINTER ENVIRONMENT. THE CONTRIBUTION OF SPAWNING AND NURSERY HABITAT TO THE GRANITE CREEK SYSTEM IS QUESTIONABLE. HOWEVER, THE INTRODUCTION OF ADDITIONAL SEDIMENTATION TO THE DRAINAGE WOULD BE DETRIMENTAL TO THE GRANITE CREEK - HOBACK RIVER CUTTHROAT TROUT FISHERY.

A WIDE DIVERSITY OF WILDLIFE SPECIES IS FOUND WITHIN

THE PROPOSAL AREA. POPULATIONS AND SPECIES VARY SEASONALLY AND INCLUDE ELK, DEER, MOOSE, AND BLACK BEAR. SMALLER GAME SPECIES INCLUDE SNOWSHOE HARE, RED SQUIRRELS, GOPHERS, CHIPMUNKS, MARMOTS, COYOTES, BOBCATS AND WEASELS. BIRD SPECIES PRESENT INCLUDE ROBINS, MOUNTAIN BLUEBIRDS, CLARKS NUTCRACKER, DARK-EYED JUNCOS, COMMON FLICKERS, WESTERN TANAGERS, GRAY JAY, CROWS, RAVENS, RED-TAILED HAWKS, ROUGH-LEGGED HAWKS AND GOLDEN EAGLES.

THE AREA IS PARTICULARLY IMPORTANT AS A SUMMER RANGE FOR ELK. SUMMER ACTIVITY IS PRINCIPALLY AT THE HEADWATERS OF HORSE AND LITTLE GRANITE CREEKS WHERE SEVERAL HUNDRED ANIMALS UTILIZE THE TALL FORB VEGETATION. HIGH CARRYING CAPACITY, GOOD WATER DISTRIBUTION, AND REMOTENESS MAKE THE AREA ONE OF THE BEST SUMMER RANGES FOR ELK IN THE GROS VENTRE HOBACK REGION.

THE DRILL PAD AREA AND THE UPPER REACHES OF THE ROAD ACCESS IS HIGH ALPINE MEADOWLAND WITH PATCHES OF WHITEBARK PINE, SPRUCE, AND LODGEPOLE PINE. THE PROPOSED ACCESS ROUTE THROUGH THE LOWER 2/3 OF THE PROPOSAL AREA CROSSES SPRUCE AND RIPARIAN VEGETATION SUCH AS WILLOW.

3.3 LAND USE AND RECREATION:

RECREATIONAL ACTIVITY NEAR THE DRILL SITE AND ALONG LITTLE GRANITE CREEK AND ROUGH HOLLOW IS LIGHT TO MODERATE. IT INCREASES DURING HUNTING SEASON WHEN COMMERCIAL OUTFITTERS ESTABLISH TENT CAMPS AND HORSE CORRALS BY THE TRAIL ALONG LITTLE GRANITE CREEK (FIGURE 2D). THE DRILL SITE IS EASILY VISIBLE FROM THE HIGH LINE TRAIL WHICH IS A PRINCIPAL ACCESS ROUTE TO THE GROS VENTRE AREA. THE FOREST SERVICE HAS NO STATISTICS, BUT ESTIMATES MODERATE USE OF THE TRAIL. DURING A SITE VISIT IN OCTOBER 1980, ONLY HUNTERS WERE OBSERVED.

THE ONLY APPARENT COMMERCIAL USE OF THE AREA, OTHER THAN

OUTFITTING IS GRAZING. A HERD OF 32 CATTLE WERE SEEN WITHIN 300 YARDS OF THE PROPOSED DRILL SITE AND MANY OTHERS WERE ENCOUNTERED ALONG LITTLE GRANITE CREEK. GRAZING STATUS HAS NOT BEEN CONFIRMED WITH THE FOREST SERVICE BUT OUTFITTERS OPERATING THE CAMP BY LITTLE GRANITE CREEK HAVE BEEN ENJOINED FROM GRAZING THEIR HORSES, OSTENSIBLY BECAUSE OF THE GRAZING LEASE-HOLDER'S PRIOR RIGHTS.

4.0 DRILLING ANALYSIS

4.1 General Discussion:

In accordance with the study approach stated in Section 1.3 of the Introduction, petroleum engineers on the staff of K & A/Helton prepared a well design, casing profile, and drill program based on anticipated drilling conditions and geology.

After reviewing stratigraphic data, the initial plan for a 17,000 foot well was altered to 18,000 feet, a depth that could be required because of normal variation in geologic projections. We felt that in a feasibility study, the design, planning, and budgeting should tend toward a worst-case situation. Also, for helicopter mobilization to be practical as well as feasible, a well designer's options should not be unduly limited.

The adopted strategy was to plan a well for the geologic environment and drilling conditions without consideration for helicopter mobilization. Professionals in the field will realize that there are alternate, perhaps more economic, designs if one is willing to assume a greater risk of losing the hole. The proposed well, however, allows considerable latitude for remedial action should unexpected problems be encountered. A smaller diameter hole could restrict the Engineer's options if lost circulation, over-pressure, or other problems are encountered. Exxon Corporation recently had to abandon a well at 11,000 feet on their Sohare Unit, where no drilling problems were expected. The rig was skidded a short distance and the hole re-spudded.

4.2 Target Horizons:

Beneath the Bear Creek Thrust sheet, several sedimentary units that produce oil and gas in Western Wyoming should be encountered. They include the Bacon Ridge Sandstone,

Cody Shale, Frontier Formation, Muddy Sandstone, Twin Creek and Nuggett Sands, The Dinwoody and Phosphoria Formations, The Madison Lime and Big Horn Dolomite. The original application for Permit to Drill, filed in 1979, proposed an 8,000-foot hole which should have tested potentially productive intervals in the Bacon Ridge, Cody, and Frontier. For this study, all units with potential above the Cambrian are considered but the cost estimates assume completion and stimulation for only one interval if petroleum and/or natural gas is present.

4.3 Potential Drilling Hazards:

Geological hazards or problems that could be encountered while drilling the well are over-pressure zones, hydrogen sulfide gas in the deeper strata, crooked hole, and lost circulation. Of these, over-pressure zones and hydrogen sulfide present the only significant danger to human life.

Protection from dangerous over-pressure is provided by adequate blowout prevention devices at the well head. Normally over-pressure can be controlled by an adequate mud program. If this is unsuccessful, the troublesome zone can be cased and cemented. Over-pressure difficulties which can not be controlled by a mud program are not anticipated in this well.

Hydrogen sulfide (H_2S), a highly toxic gas, is sometimes encountered in lethal concentrations with methane in oil and gas wells. There is a possibility of striking H_2S in the Phosphoria, Ten Sleep, and Madison formations and, because of the extreme toxicity of this gas, H_2S monitors will be installed in the well and procedures complying with NTL-10 regulations will be employed. If H_2S is present in small amounts, scavenging agents, such as zinc carbonate, will be added to the drill mud. Greater H_2S levels associated

WITH UNEXPECTED GAS INVASIONS WOULD BE CONTROLLED BY IRONITE SPONGE, BUT EXCESSIVE QUANTITIES MIGHT FORCE TERMINATION OF DRILLING.

THE PREVAILING OPINION AT THE FOREST SERVICE IS THAT SOUR GAS PRODUCTION WOULD NOT BE ALLOWED BECAUSE OF THE LACK OF TREATMENT FACILITIES AND THE LOW PROBABILITY THAT CONSTRUCTION OF SUCH FACILITIES WOULD BE PERMITTED IN THE AREA. NO H_2S WELLS HAVE BEEN IDENTIFIED WITHIN 90 MILES OF THE BEAR THRUST UNIT.

LOST CIRCULATION AND CROOKED HOLES PRESENT NO THREAT TO HEALTH AND SAFETY. HOWEVER, EITHER PROBLEM CAN FORCE HOLE ABANDONMENT. LOST CIRCULATION OCCURS WHEN THE HOLE ENCOUNTERS A FAULTED, FRACTURED, OR HIGHLY PERMEABLE ZONE THAT ALLOWS DRILLING FLUID TO ESCAPE INTO THE SURROUNDING ROCK AT EXCESSIVE RATES. LOST CIRCULATION IS USUALLY CONTROLLED BY ADDITIVES TO THE MUD, SUCH AS FIBROUS OR GRANULAR MATERIAL, WHICH WILL 'PLUG' LEAKAGE PATHS. THESE ZONES CAN ALSO BE CASED AND CEMENTED IF THE PROBLEM IS SEVERE.

CROOKED HOLES ARE USUALLY CAUSED BY INCLINED STRATA COMBINED WITH THE TENDENCY FOR DRILL BITS TO 'DRIFT' UP OR DOWN THE STRUCTURAL DIP OF THE ROCKS. SEVERE DEVIATIONS OR SHARP BENDS, CALLED 'DOG LEGS', CAN MAKE DRILLING DIFFICULT AND EVEN FORCE A SHUTDOWN. DRIFT, SOMETIMES ON THE ORDER OF SEVERAL HUNDRED FEET, OFTEN CAUSES A HOLE TO MISS ITS TARGET. DRIFT IS DETECTED AND MEASURED BY DIRECTIONAL SURVEY INSTRUMENTS THAT ARE LOWERED ON WIRE LINES INSIDE THE DRILL PIPE OR INTO AN OPEN HOLE. THE ANGLE OF DEVIATION FROM THE VERTICAL AND ITS BEARING ARE MEASURED AND RECORDED.

A HOLE CROOKED ENOUGH TO MISS ITS TARGET CAN BE PUT BACK 'ON COURSE' USING A BENT SUB-ASSEMBLY AND TURBODRILL TO REDIRECT THE COURSE OF THE HOLE. DRIFT CAN BE MINIMIZED BY ADDING DRILL COLLARS AND STABILIZERS TO THE DRILL STRING AND BY CAREFULLY CONTROLLING WEIGHT ON THE BIT.

4.4 Well Design and Drilling Program:

Our casing profile, shown in Figure 3, was developed from geophysical and geological information and the recommendations of K & A's geologists and petroleum engineers. As stated earlier, the casing allows maximum flexibility should drilling problems occur. No abnormal conditions are anticipated but prudent drilling procedures require being ready for unanticipated conditions.

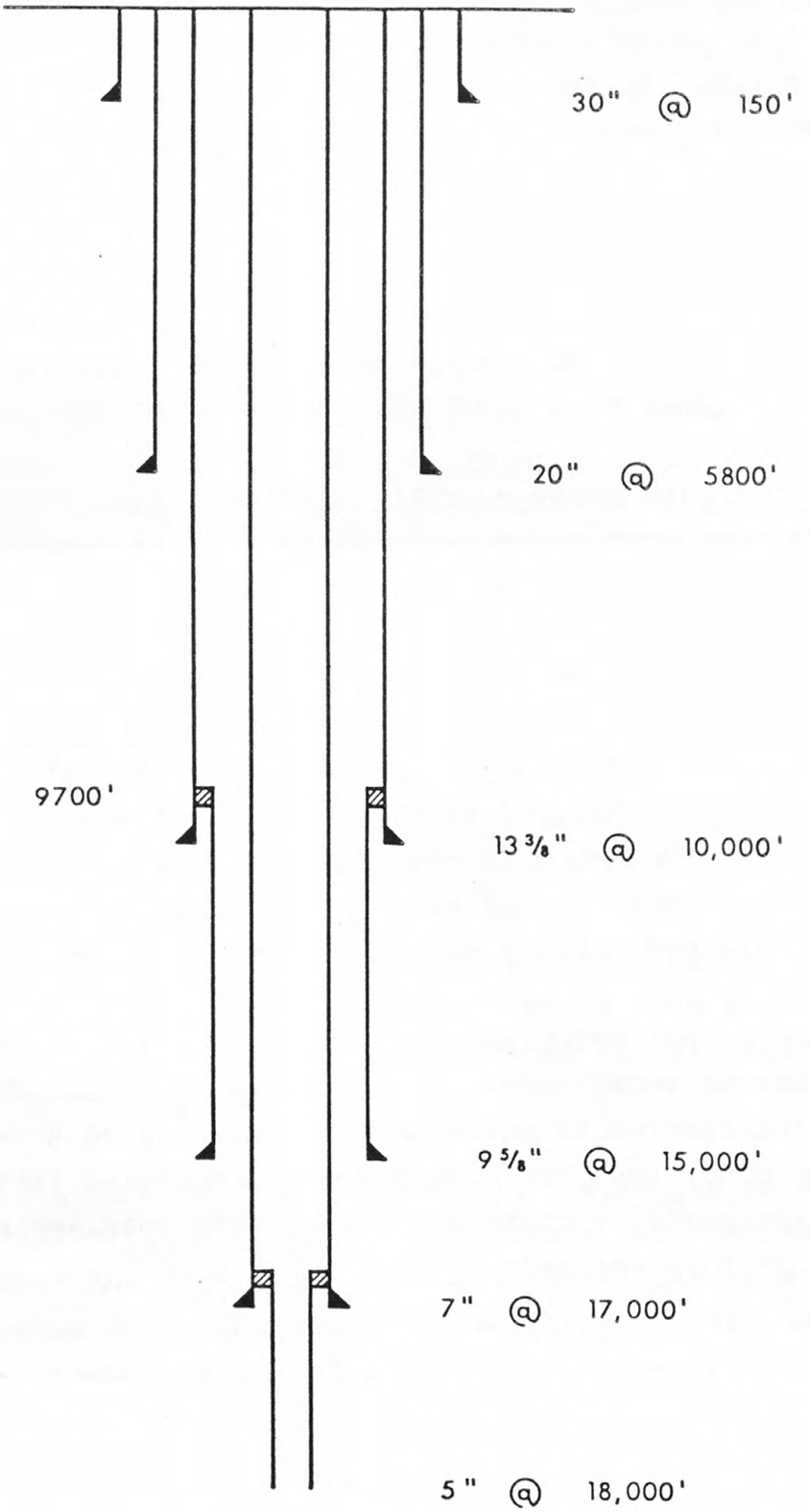
Should lost circulation or over-pressure become a problem, the large diameter of the surface casing and the first and second intermediates will allow remedial measures and yet not severely limit hole diameter toward the bottom of the well.

The basic drilling program could be handled with either a helicopter-supported or conventional rig. The plot of drilling time versus depth, shown in Figure 4, indicates an 18,000-foot hole should be completed in approximately 235 days. An additional 35 days is allowed for hole conditioning and testing. If the well is a producer, 60 more days on the hole for completion and stimulation are anticipated. For the helicopter rig, fourteen days will be required to move in and rig-up, plus 10 days for rig-down and move out. For budget purposes, we estimate that 10 days will be lost because of weather. Rig time is summarized in Table 2.

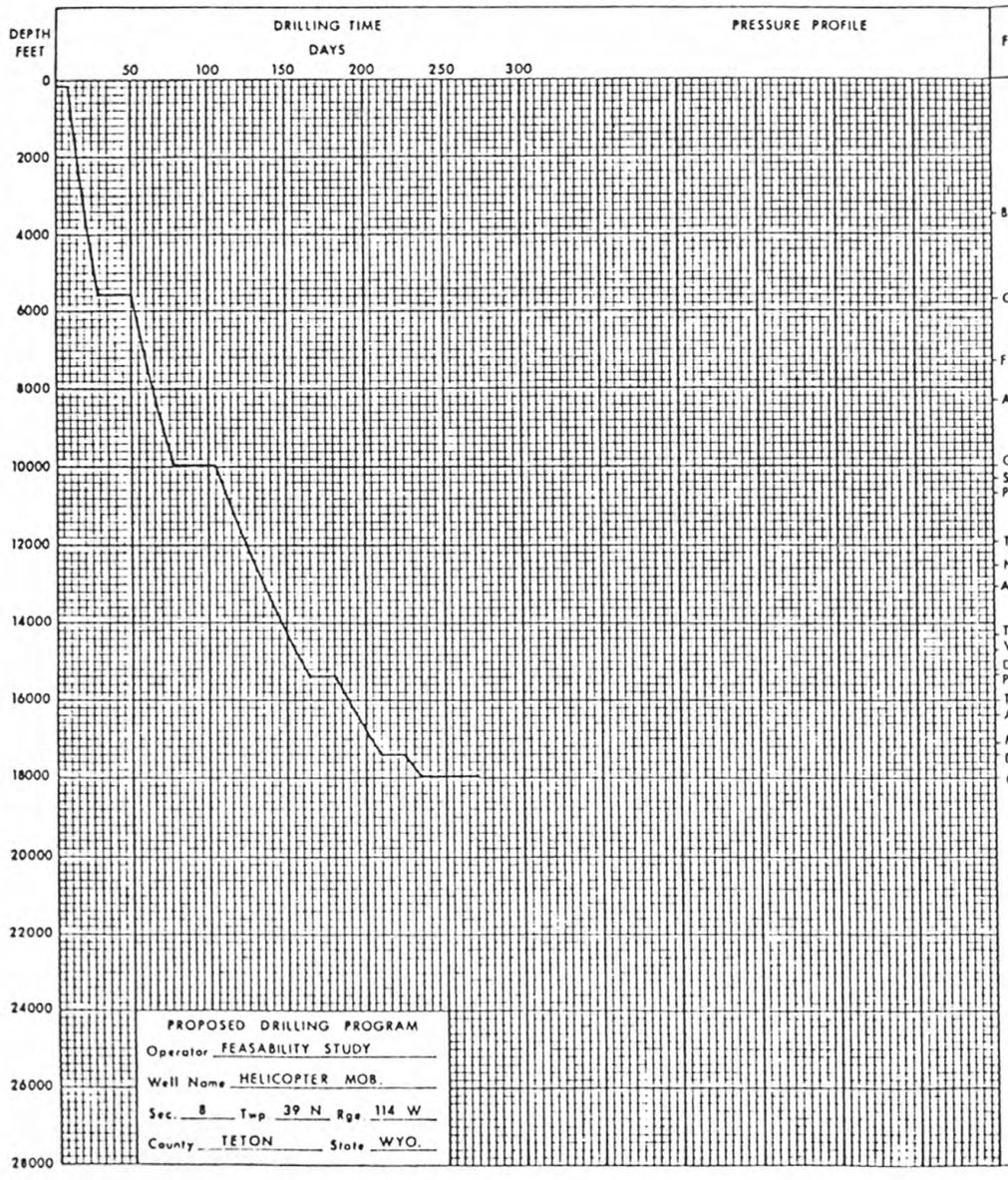
It is assumed that drilling will proceed smoothly with no problems beyond those normally expected with a hole of this depth in the overthrust environment. Response to emergency or unusual conditions are considered in following sections but the extraordinary costs associated with them are beyond the scope of this analysis.

FIGURE 3.

CASING PROFILE



K & A HELTON ENGINEERING AND GEOLOGICAL SERVICES



FORMATION	HOLE SIZE	CASING	PORE PRESS (psi)	MUD WT (ppg)	CRITICAL CASING SPECIFICATIONS & LOAD FACTORS						
					WT	GRADE	JOINT STRENGTH	COLLAPSE RATING	BURST RATING	JOINT	
		20"	8 1/2	9	169	N 80	2427	3000	3200	BUTT	30"
		13 3/4"	8 1/2	9	88.2	SS 95	1801	5930	6420	BUTT	
		7"		9	32	SS 95	860	10400	8460	BUTT	
BEAR CREEK THRUST		7"	8 1/2	9	32	SS 95	860	10400	8460	BUTT	
CODY	26"		10 1/2	10 1/2	169	N 80	2427	3000	3400	BUTT	20"
FRONTIER											
ASPEN										BUTT	
		13 3/8"	12 1/2	13	81.4	S 95	1946	4860	7140	BUTT	
GANNETT	17 1/2"	13 3/8"	12 1/2	13	88.2	S 95	1885	5930	7630	BUTT	13 3/8"
STUMP											
PRUESS	12 1/4"	9 5/8"	9 1/2	10	62.8	S 105	1437	11000	10490	BUTT	
		9 5/8"	9 1/2	10	62.8	S 105	1437	11000	10490	BUTT	
TWIN CK.											
NUGGETT											
ANKARETH											
THAMES											
WOODSIDE											
DINWOODY	12 1/4"	9 5/8"	9 1/2	10	53.5	S 95	1414	8850	9410		9 5/8"
PHOSPHORIA	8 3/4"	7"	8 1/2	9	29.0	S 105	859	11000	10500	BUTT	
TENSLEEP											
AMSDEN											
MADISON	8 3/4"	7"	8 1/2	9	32.0	S 95	947	9200	10050	BUTT	7"
DARBY T.											
GROS VENTRE	6"	5"	8 1/2	9	23	S 105	590	17600	11770	HYO	5"

FIGURE 4. PROPOSED DRILLING PROGRAM

TABLE 2.

RIG TIME REQUIREMENTS

ACTIVITY	DAYS REQUIRED	
DRY HOLE CASE	HELICOPTER	CONVENTIONAL
1. MOVE IN AND RIG-UP	14*	10**
2. DRILLING, CASING, CEMENTING	235	235
3. CONDITIONING, TESTING, P & A	35	35
4. RIG-DOWN AND MOVE OUT	10*	5**
5. DAYS LOST TO SEVERE WEATHER	10	10
	304	295

* NOT INCLUDED IN MOB/DEMOB COST ESTIMATES

** INCLUDED IN MOB/DEMOB COST ESTIMATES

PRODUCTION CASE		
1. COMPLETION AND STIMULATION	60 DAYS	60 DAYS WITH A COMPLETION RIG
TOTAL FOR COMPLETION	364 DAYS	295 DAYS
	ROTARY RIG TIME	ROTARY RIG TIME 60 DAYS COMPLETION RIG

4.5 Rig Selection:

As stated earlier, for helicopter mobilization to be practical as well as feasible, the well designer's options must not be unduly limited. This philosophy was applied to the drilling program also. An ideal 'fly-in' rig should be capable of drilling the specified well at an acceptable rate when compared with conventional rigs. In selecting a rig, conventional ones which MIGHT be broken down into units of: less than 1) 4,000 lbs., or 2) 20,000 lbs. were considered, as well as rigs designed specifically for helicopter mobilization.

Two conventional rigs selected for study were National Supply Company's Models 610-M and 1320-M. Their Model 610-M is light and capable of drilling about 10,000 feet, certainly not deep enough for Getty's well. It does, however, provide an example of the weight problems encountered in attempting to transport even a small conventional rig by helicopter. The Model 1320-M would be completely adequate, however, to drill the well as designed.

Component weights of both rigs are listed in Table 3. One might argue that the drawworks of the 610-M could be disassembled into less than 20,000 lb. units suitable for helicopter transport but major disassembly, involving cutting, would be required to meet the 4,000 lbs. limit. Rig owners contacted during the study found the cutting alternative unacceptable. Because of weight problems, the 1320-M was dismissed quickly with regard to helicopter mobilization.

National can build either rig in components no heavier than 20,000 lbs. but is skeptical about meeting the 4,000 lb. limitation.* To meet the 10-ton limit, however, would require extensive re-design and National could not provide

* See Appendix A. p. A.1 & 2.

TABLE 3

COMPONENT WEIGHTS

FOR

NATIONAL MODELS 610-M AND 1320-M RIGS

610-M RIG

UNIT	WEIGHT (LBS.)
610-M DRAWWORKS	33,600
C-275 ROTARY TABLE	12,000
540G250 HOOK BLOCK	11,600
P-300 SWIVEL	3,500
8-P-80 SLUGH PUMP POWER END	17,000
8-P-80 H SLUSH PUMP FLUID END	9,600

1320-M RIG

1320-M DRUM SECTION	42,729
1320-M TRANS. SECTION	32,990
10-P-130 SLUSH PUMP	42,750
12-P-160 SLUSH PUMP	54,700
C-375 ROTARY TABLE	12,310
P-500 SWIVEL	5,460
650G500 HOOK BLOCK	21,250
CAT. D398 DIESEL ENGINE	11,500

COST OR TIME ESTIMATES FOR THE WORK. CONVERSATIONS WITH OTHER RIG MANUFACTURERS AND DRILLING COMPANIES REVEALED NEAR CONSENSUS THAT DISASSEMBLY OF CONVENTIONAL RIGS FOR HELICOPTER TRANSPORT IS NOT FEASIBLE.

HELICOPTER-TRANSPORTABLE RIGS, BUILT BY PARKER DRILLING COMPANY, ARE OPERATED IN MANY REMOTE AREAS AROUND THE WORLD. DRILLING CAPABILITIES AND EASE OF HELICOPTER TRANSPORT FOR THE PARKER RIGS WERE EVIDENT AT THE BEGINNING OF THIS STUDY. INVESTIGATION OF THE TRANSPORTABILITY OF CONVENTIONAL RIGS WAS CONDUCTED MAINLY TO IDENTIFY MORE READILY-AVAILABLE ALTERNATIVES TO THE PARKER RIGS BECAUSE NONE ARE PRESENTLY OPERATING IN THE CONTERMINOUS UNITED STATES. HOWEVER, PARKER ESTIMATES A NEW RIG COULD BE BUILT, TO PROVEN DESIGNS, IN FOUR TO SIX MONTHS (APPENDIX A, P. A.3). THIS PRESENTS NO TIMING PROBLEM BECAUSE ENVIRONMENTAL PERMITTING ACTIVITIES PRECLUDE SPUDDING BEFORE THE SUMMER OF 1982.

ADMITTEDLY, SELECTED CONVENTIONAL RIGS COULD BE REDESIGNED AND CONSTRUCTED WITHIN THE SAME TIME FRAME BUT THE STAFF RESPONSIBLE FOR THIS STUDY FEELS THAT THE PARKER TBA 2000 HELICOPTER RIG IS THE MOST COST-EFFECTIVE CHOICE FOR THE TASK UNDER CONSIDERATION. THERE IS AN EXISTING, PROVEN DESIGN, IN WHICH COMPONENT WEIGHTS ARE LIMITED TO A MAXIMUM 4,125 LBS., WELL WITHIN THE RANGE OF MEDIUM-LIFT HELICOPTERS. EXPERIENCED PERSONNEL ARE AVAILABLE TO SUPERVISE, TRANSPORT, RIG-UP, AND OPERATE. FURTHERMORE, THIS MODEL HAS BEEN USED SUCCESSFULLY IN SEVERAL GEOGRAPHIC AREAS.

DETAILED SPECIFICATIONS FOR THE TBA 2000 ARE AVAILABLE THROUGH PARKER'S DENVER OFFICE:

PARKER DRILLING COMPANY
1620 DENVER NATIONAL BANK BUILDING
1125 SEVENTEENTH STREET
DENVER, CO 80202 (303) 825-5529
ATTENTION: T. L. WINGERTER

WITH SLIGHT MODIFICATION TO THE ANCILLARY EQUIPMENT PACKAGE, THE TBA 2000 IS CAPABLE OF DRILLING AND COMPLETING THE WELL AS DESIGNED FOR THIS STUDY. FOR INSTANCE, ITS STANDARD PACKAGE INCLUDES 13-5/8" BLOWOUT PREVENTION DEVICES WHICH WILL NOT ACCOMMODATE THE 17-1/2'' BITS REQUIRED TO DRILL THE INTERVAL FROM 5,800 TO 10,000 FEET. PROVISION FOR LARGER BLOWOUT PREVENTERS, 5,000 FEET OF 1-3/8'' DRILLING LINE AND ADDITIONAL SOLIDS-CONTROL EQUIPMENT IS INCLUDED IN THE DRILLING AND HELICOPTER COSTS ESTIMATES (SEE P. 113)

4.6 RIG BREAKDOWN AND SLING LOADS:

COMPONENT WEIGHTS, SLING LOADS, AND THE NUMBER OF ESTIMATED HELICOPTER FLIGHTS FOR MOBILIZATION OF THE TBA 2000 FROM THE STAGING AREA TO THE WELL SITE ARE ITEMIZED IN TABLE 4. THE LIST INCLUDES ONLY THE RIG AND ASSOCIATED SURFACE EQUIPMENT. ALL OTHER MATERIALS, SUPPLIES, AND EQUIPMENT WILL BE DESCRIBED AND LISTED IN SUBSEQUENT SECTIONS OF THIS REPORT.

TRANSPORTATION FROM STAGING AREA TO WELL SITE, ASSEMBLY, AND RIG-UP IS ESTIMATED TO REQUIRE 14 DAYS. ONE HELICOPTER AVERAGING FOUR ROUND-TRIPS PER HOUR CAN TRANSPORT THE RIG IN LESS THAN FIVE DAYS.

IN CONSIDERING THE LOGISTICS OF RIG MOVE IN, THE CONCEPT OF A MORE INTENSE AIRLIFT USING MORE THAN ONE HELICOPTER (CONTINUED USE OF THE HEAVY LIFT CHINOOK FOR INSTANCE) TO DELIVER RIG COMPONENTS TO THE SITE MORE QUICKLY WAS CONSIDERED. IN THE FINAL ANALYSIS HOWEVER, THE OPTION WAS NOT RECOMMENDED BECAUSE:

1. THE 14 DAY SET UP (ASSEMBLY) TIME IS AN AVERAGE FOR ASSEMBLY OF THE RIG AND PROBABLY WOULD NOT BE SHORTENED SIGNIFICANTLY BY ACCUMULATED COMPONENT DELIVERY TO THE SITE.

2. AIRLIFTING RIG COMPONENTS TO THE SITE AS NEEDED WILL MINIMIZE ON SITE STORAGE SPACE REQUIREMENTS AND HELP AVOID CONGESTION AND MULTIPLE HANDLING DURING RIG UP.

HOWEVER, ADDITIONAL HOURS FOR A HEAVY LIFT HELICOPTER AND CONTINGENCY OF $186,000 FOR ADDITIONAL SUPPORT WERE BUILT INTO THE COST ESTIMATES SHOULD AN ADDITIONAL HELICOPTER PROVE USEFUL DURING START UP.

ANOTHER OPTION RELATING TO RIG MOVEIN WHICH WAS CONSIDERED WAS PARTIAL ASSEMBLY OF THE RIG AT THE STAGING AREA IN 4 MODULE COMPONENTS WEIGHING ROUGHLY 16,000 LBS. AND AIRLIFTING THESE TO THE SITE WITH A HEAVY LIFT HELICOPTER. THIS APPROACH APPEARS TO BE A FEASIBLE ALTERNATIVE ALTHOUGH IT HAS SOME DRAWBACKS:

1. THE UNITS WEIGHT WOULD TAX THE CAPACITY OF ON SITE HANDLING EQUIPMENT AND WOULD REQUIRE THE HELICOPTER TO BE USED AS THE PRIMARY LIFTING DEVICE FOR FINAL ASSEMBLY. DURING WINDY PERIODS, THIS MIGHT BE TROUBLESOME.

2. THE PROCEDURE IS A DEPARTURE FROM THE NORMAL ASSEMBLY ROUTINE AND MAY ADD YET ANOTHER PLANNING AND LOGISTICS 'HEADACHE' TO AN ALREADY COMPLEX OPERATION.

ACCORDINGLY, WE RECOMMEND FOLLOWING THE NORMAL ASSEMBLY ROUTINE.

TABLE V

FEASIBILITY STUDY

Parker TBA-2000 Item	Minimum Dimensions	Minimum Unit Wt.	Total Weight Pounds	Loads Calc.	Loads Actual	Lifts Per Hour One Helicopter	Hours, One Helicopter	Total Hours
Front Section Sub-Base		3,550	7,100	2	2	4	.5	
Second Section Sub-Base		3,860	7,720	2	2	4	.5	
Third Section Sub-Base		3,760	15,040	4	4	4	1.0	
Fourth Section Sub-Base		3,780	7,560	2	2	4	.5	
Center Section D.W. Base		3,800	3,800	1	1	4	.25	
D.W. Frame		3,940	3,940	1	1	4	.25	
Drum for D.W.		3,840	3,840	1	1	4	.25	
Drum Shaft		3,300	3,300	1	1	4	.25	
Draw Works Line Shaft		3,620	3,620	1	1	4	.25	
Draw Works Line Shaft		3,840	3,840	1	1	4	.25	
Hydromatic Brake		3,975	3,975	1	1	4	.25	
A-Frame		3,550	7,100	2	2	4	.5	
A-Frame Floor Spreader		3,400	3,400	1	1	4	.25	
Rotary & Cathead Drive		3,630	3,630	1	1	4	.25	
Catheads & Shaft		3,200	3,200	1	1	4	.25	
A-Frame Top Spreader		3,980	3,980	1	1	4	.25	
Back Floor Spreader		3,380	3,380	1	1	4	.25	
Rotary Drive Gear Box		2,200	2,200	1	1	4	.25	
#1 Motor Sub w/Mid Line		3,680	3,680	1	1	4	.25	
#1 Motor		3,720	3,720	1	1	4	.25	
#1 Transmission		3,850	3,850	1	1	4	.25	
#1 Compound Section		4,000	4,000	1	1	4	.25	
#2 Motor Sub-Structure		3,200	3,200	1	1	4	.25	
#2 Motor		3,720	3,720	1	1	4	.25	
#2 Transmission		3,850	3,850	1	1	4	.25	
#2 Compound Section		3,100	3,100	1	1	4	.25	
#3 Motor Sub-Structure		3,200	3,200	1	1	4	.25	
#3 Motor		3,720	3,720	1	1	4	.25	
#3 Transmission		2,400	2,400	1	1	4	.25	
#3 Compound Section		3,100	3,100	1	1	4	.25	
#4 Motor Sub-Structure		3,300	3,300	1	1	4	.25	
#4 Motor		3,720	3,720	1	1	4	.25	
#4 Transmission		2,450	2,450	1	1	4	.25	
#4 Compound Section		3,000	3,000	1	1	4	.25	
#1 Pump Transfer Power End		3,990	3,990	1	1	4	.25	
#1 Gear End		4,000	4,000	1	1	4	.25	
#1 Fluid End		3,300	3,300	1	1	4	.25	
#2 Pump Transfer Power End		3,990	3,990	1	1	4	.25	
#2 Gear End		4,000	4,000	1	1	4	.25	
#2 Fluid End		3,300	3,300	1	1	4	.25	
#3 Pump Transfer Power End		3,990	3,990	1	1	4	.25	
#3 Gear End		4,000	4,000	1	1	4	.25	
#3 Fluid End		3,300	3,300	1	1	4	.25	
#4 Pump Transfer Power End		3,990	3,990	1	1	4	.25	
#4 Gear End		4,000	4,000	1	1	4	.25	
#4 Fluid End		3,300	3,300	1	1	4	.25	
Air Compressor & Water Pump		4,000	4,000	1	1	4	.25	
Light Plant		4,000	4,000	1	1	4	.25	
Light Plant		4,000	4,000	1	1	4	.25	
Light Plant		4,000	4,000	1	1	4	.25	
Top Dog House		3,100	3,100	1	1	4	.25	
Bottom Dog House		3,100	3,100	1	1	4	.25	
Water Tanks		3,300	13,200	4	4	4	1.0	
Fuel Tanks		3,300	33,000	10	10	4	2.5	
Mud Pits		3,400	27,200	8	8	4	2.0	
Thompson Shale Shaker		2,300	2,300	1	1	4	.25	
D330 Cat Engine w/cent. pump		3,600	14,400	4	4	4	1.00	
G-D FXF 4"x5" w/Booster Pump		3,700	3,700	1	1	4	.25	
Starting Legs		3,750	7,500	2	2	4	.5	
Rotary Beam		3,750	7,500	2	2	4	.5	
#1 Section Mast		3,980	7,690	2	2	4	.5	
Mast Spreader		3,400	3,400	1	1	4	.25	
#2 Mast Section		3,141	6,282	2	2	4	.5	
#3 Mast Section		3,141	6,282	2	2	4	.5	
#4 Mast Section		3,241	6,482	2	2	4	.5	
#5 Mast Section		2,450	4,900	2	2	4	.5	
Mast Top Section		2,375	4,750	2	2	4	.5	
Water Table, Top Section		3,800	3,800	1	1	4	.25	
Crown Sheave Cluster		3,500	3,500	1	1	4	.25	
Racking Board For Mast		3,000	3,000	1	1	4	.25	
Rig Light Box		4,000	4,000	1	1	4	.25	
Mast Bridle Line		2,500	2,500	1	1	4	.25	
Rotary Hose w/Air Line		2,500	2,500	1	1	4	.25	
							15.75	
SUBTOTAL			379,581		110			27.5

Parker TBA-2000 Item	Minimum Dimensions	Minimum Unit Wt.	Total Weight Pounds	Loads Calc.	Loads Actual	Lifts Per Hour One Helicopter	Hours, One Helicopter	Total Hours
BALANCE BROUGHT FORWARD			379,581		110			27.5
Cat Walks		3,300	6,600	2	2	4	.5	
Drilling Line		4,000	4,000	1	1	4	.25	
Travel Block		3,800	3,800	1	1	4	.25	
Hook		3,800	3,800	1	1	4	.25	
Side Plates		3,000	3,000	1	1	4	.25	
Stand Pipe & Mud Lines		3,900	3,900	1	1	4	.25	
Rotary Table		4,150	4,150	1	1	4	.25	
Floor Spreader Pipe Rack		3,890	3,890	1	1	4	.25	
Front Floor Spreader		3,400	3,400	1	1	4	.25	
300 Amp Welding Machine		3,300	3,300	1	1	4	.25	
B-44 Gray Swivel W/Kelly Spinner		3,900	3,900	1	1	4	.25	
Koomey 4 Value Closing Unit		3,700	3,700	1	1	4	.25	
13 5/8" LWS Series B.O.P.		3,750	7,500	2	2	4	.5	
13 5/8" Spherical B.O.P.		3,000	6,000	2	2	4	.5	
Spherical B.O.P. Head & Rubber		2,100	2,100	1	1	4	.25	
Choke Manifold		2,550	2,550	1	1	4	.25	
Pipe Racks		2,800	5,600	2	2	4	.5	
Kelly Slice		3,500	3,500	1	1	4	.25	
Kelly In Shuck		3,900	3,900	1	1	4	.25	
12 Cone Pioneer D-Silter		3,500	3,500	1	1	4	.25	
2 12" Cone Demco D-Sander		2,000	2,000	1	1	4	.25	
Halliburton Unit		3,500	3,500	1	1	4	.25	
Swaco Degasser		3,600	3,600	1	1	4	.25	
							6.75	
TOTAL			470,771		137			34.25

5.0 DRILLING SUPPORT REQUIREMENTS

5.1 WATER SUPPLY

SECURING AN ADEQUATE SUPPLY OF DRILLING WATER AT THE SITE IS A CRUCIAL FACTOR IN EVALUATING THE FEASIBILITY OF HELICOPTER MOBILIZATION BECAUSE THE COST OF TRANSPORTING WATER BY HELICOPTER WOULD BE EXORBITANT. DEVELOPING A SUITABLE ON SITE WATER WELL IS ALSO A MAJOR CONCERN EVEN WITH ROAD ACCESS BECAUSE OF THE SUBSTANTIAL ADDED COST AND UNCERTAINTIES INVOLVED IN TRUCKING.

WE FEEL THAT IF HELICOPTER MOBILIZATION IS TO BE PRACTICAL, IT WILL BE CONDITIONAL UPON COMPLETING A 50 GPM WATER WELL ON THE DRILL SITE. FAILURE TO COMPLETE SUCH A WELL SHOULD CONSTITUTE A MAJOR DECISION POINT FOR CONTINUING THE OPERATION. A SUPPLY OF ONLY 15 GPM MIGHT BE ADEQUATE IF IT COULD BE AUGMENTED IN THE EARLIER DRILLING STAGES WHEN WATER CONSUMPTION IS GREATEST AND EXPECTED TO AVERAGE 50 GPM.

THERE ARE ALTERNATIVES TO AN ON-SITE WELL, BUT THE PROBABLE COST IS HIGH WHICH, WITH THE ATTENDANT RISK OF INTERRUPTION OF WATER SUPPLY, MAKE A WELL THE MOST DESIRABLE OPTION.

THE NEAREST SURFACE WATER IS IN LITTLE GRANITE CREEK BUT TO OBTAIN THE VOLUME NEEDED FOR DRILLING, THE STREAM WOULD HAVE TO BE TAPPED WELL BELOW THE DRILL SITE. FURTHERMORE, LITTLE GRANITE CREEK FREEZES IN WINTER AND, THEREFORE, PROBABLY WOULD NOT BE A VIABLE SOURCE FOR YEAR-ROUND OPERATION. AN ALTERNATIVE IS GRANITE CREEK WHICH COULD PROVIDE ADEQUATE WATER YEAR-ROUND. HOWEVER, THE EXPENSE OF PUMPING AGAINST A 2,000 FOOT HEAD AND KEEPING ABOUT 4.5 MILES OF EXPOSED WATER LINE AND BOOSTER STATIONS FROM FREEZING IN WINTER MAKE PUMPING FROM GRANITE CREEK AN EXPENSIVE UNDERTAKING.

IF A WELL CANNOT SUPPLY THE WATER, AN ADEQUATE RESERVOIR WOULD HAVE TO BE CONSTRUCTED AND FILLED PRIOR TO SPUDDING. THE LARGER

RESERVE PIT ON THE DRILL SITE COULD SERVE THIS PURPOSE, BUT IT MUST BE EMPTIED FOR USE AS INTENDED AS DRILLING PROGRESSES. INITIAL FILLING COULD BE ACCOMPLISHED BY PUMPING FROM THE WELL AND/OR FROM THE UPPER REACHES OF LITTLE GRANITE CREEK DURING SPRING RUNOFF. EITHER WOULD REQUIRE ADDITIONAL TIME AND INCREASE COSTS. WE RECOMMEND CAREFUL REEVALUATION BEFORE PROCEEDING WITH THE HELICOPTER ALTERNATIVE OR EVEN WITH ROAD BUILDING IF A 50-GPM FLOW CANNOT BE OBTAINED FROM AN ON-SITE WELL.

IN DEALING WITH THE WATER SUPPLY QUESTION IT IS NECESSARY TO EMPHASIZE THAT A HYDROLOGICAL STUDY TO IDENTIFY POTENTIAL AQUIFERS IN THE AREA HAS NOT BEEN UNDERTAKEN. SUCH A STUDY IS OUTSIDE THE SCOPE OF THIS FEASIBILITY ANALYSIS. FOR COST ESTIMATING PURPOSES WE ASSUME THAT A 1000 FOOT WATER WELL MAY BE REQUIRED BUT WE HAVE NO CORROBORATIVE OR CONTRADICTORY HYDROLOGIC DATA TO SUPPORT THE ASSUMPTION. IT IS SIMPLY A REASONABLE ESTIMATE BASED ON GENERAL EXPERIENCE.

THE PRECEDING DISCUSSION ARGUES STRONGLY FOR DRILLING A WATER WELL AS A PRELIMINARY STEP BEFORE PROCEEDING WITH THE PROJECT. OUR RECOMMENDATION IS TO DRILL THIS WELL BEFORE CONSTRUCTING THE DRILL PAD OR RESERVE PITS. ASSUMING THAT TIMING OF ENVIRONMENTAL PERMITTING WILL PRECLUDE SPUDDING THE GETTY WELL BEFORE SUMMER, 1982, DRILLING A WATER WELL IN THE SUMMER OR FALL OF 1981, SHOULD BE CONSIDERED, IF THE REQUIRED PERMITS CAN BE OBTAINED. THEN THERE WOULD BE NO HURRY TO COMPLETE THE WELL WHICH COULD BE DRILLED WITH A LIGHT RIG, MOBILIZED AND SUPPORTED BY READILY-AVAILABLE, MEDIUM-LIFT HELICOPTERS. WITH WATER SUPPLY ASSURED, THE LEASEHOLDERS AND THE GOVERNMENT COULD PLAN MORE INTELLIGENTLY FOR OIL WELL DRILLING OPERATIONS IN 1982.

IF, FOR EXAMPLE, HELICOPTER MOBILIZATION IS CHOSEN OVER CONVENTIONAL ROAD ACCESS AND THE WATER SUPPLY PROBLEM IS UNRESOLVED, THE OPERATOR COULD LOSE A FULL YEAR AND INCUR APPRECIABLE COSTS AND PENALTIES IN HAVING TO CANCEL THE AIR-LIFT OPERATION IF THE WATER WELL WERE NON-PRODUCING. RECALL THAT PARKER WOULD REQUIRE SIX TO NINE MONTHS TO BUILD A HELICOPTER RIG FOR THIS WELL.

THEY WOULD CERTAINLY WANT A GUARANTEED CONTRACT FOR THIS.

A SUITABLE WATER WELL IS NEARLY AS IMPORTANT FOR THE CONVENTIONAL ROAD ACCESS CASE. HAULING WATER FROM GRANITE CREEK WOULD BE A SIGNIFICANT COST ITEM IN THE ESTIMATED PROJECT BUDGET. OUR FEASIBILITY ANALYSIS ASSUMES THE WATER-SUPPLY QUESTION IS RESOLVED SIX TO NINE MONTHS BEFORE PROJECT START-UP AND THAT 50 GPM IS AVAILABLE.

TWO PROPOSALS FOR DRILLING THE WATER WELL HAVE BEEN PROVIDED BY INDEPENDENT CONTRACTORS (APPENDIX B.P. 1-2). BOYLES BROTHERS PROPOSES TO USE A TOP DRIVE ROTARY RIG WHICH WOULD REQUIRE A HEAVY LIFT HELICOPTER FOR TRANSPORT. TER-RAY PROPOSES USING A CHURN DRILL RIG (CABLE TOOL) BECAUSE OF THE NEED FOR BREAK-DOWN INTO 4-5 THOUSAND POUND COMPONENTS FOR TRANSPORT BY MEDIUM LIFT HELICOPTERS. OTHER SUITABLE RIGS WOULD BE DISASSEMBLED FOR AIR LIFT BY MEDIUM LIFT HELICOPTERS.

EVEN THOUGH LIGHTER RIGS MAY REQUIRE LONGER TO DRILL THE WATER WELL, THEY ARE TRANSPORTABLE BY MEDIUM LIFT AIRCRAFT AND ARE RECOMMENDED BECAUSE OF THE CONSIDERABLE EXPENSE OF MOBILIZING HEAVY LIFT MACHINES TO THE SITE.

ESTIMATED TIME TO COMPLETE THE WELL USING THE CHURN DRILL SUPPORTED BY MEDIUM LIFT HELICOPTERS IS 40 DAYS MAXIMUM WITH THE PROBABLE AT 20 TO 30 DAYS.

COST ESTIMATES ARE OUTLINED BELOW:

RIG MOBILIZATION AND DEMOB TO STAGING AREA	$ 7,000
DRILLING TIME (30 DAYS X 16 HRS/DAY X $85/HR)	40,800
CASING, SUPPLIES, TUBING & PUMP	6,310
CATERING (4 MEN @ $35/MANDAY)	4,200
CAMP (5 MEN)	2,000
HELICOPTER (BELL 214 OR BOEING KV 107) (10 HRS @ $2,000/HR)	20,000
	$80,310

CONSIDERING THE OVERALL LOGISTICS OF THE PROGRAM, DRILLING THE WATER WELL ONE SEASON AND SPUDDING THE OIL WELL THE NEXT WOULD PROBABLY NOT RESULT IN INCREASING THE TIME REQUIRED TO COMPLETE THE ENTIRE PROJECT WHEN COMPARED WITH CONVENTIONAL ROAD ACCESS. THIS IS BECAUSE ROAD CONSTRUCTION WOULD ALSO HAVE TO BE STARTED THE SEASON BEFORE AND WOULD REQUIRE AT LEAST SIX MONTHS FROM MAY TO OCTOBER TO COMPLETE. UNLESS ONE WERE WILLING TO ATTEMPT A WINTER MOVE IN, WHICH WOULD ALSO BE DONE BY HELICOPTER, SPUDDING WOULD BE DELAYED UNTIL THE FOLLOWING SPRING.

5.2 Mud and Cement Programs:

At one time, drilling mud was used primarily to continuously remove cuttings from drill holes as the bit advanced. With progress in mud technology, additional functions were recognized and an originally simple fluid evolved into a complicated mixture of liquids, solids and chemicals. Now, drilling mud can:

1. Lift formation cuttings to the surface.
2. Control subsurface pressure.
3. Provide drill-string lubrication.
4. Clean the bottom of the hole.
5. Condition the hole for formation evaluation.
6. Protect formation productivity.

Improper use or composition of the mud can adversely affect drilling efficiency. Consequently, mud composition is now carefully controlled by skilled mud engineers. Major drilling operations require on-site engineers with test facilities to control mud weight, viscosity and gel strength, and water loss. Personnel and equipment for these activities are included in the expense estimates along with actual mud costs (see Section 12).

Quantities and compositions of drilling mud required for the proposed well are estimated in Table 5 and are related to downhole interval and hole diameter.

A closed mud system proposed by Sweco, Inc. relies on equipment that provides versatile solids control over a wide range of mud properties (Appendix A. P. A 37). It will remove an estimated 90 - 95 percent of the cuttings from the drilling fluid and allow recirculation with minimum water loss to the reserve pits. Two mud cleaners have a combined

TABLE 5.

MUD REQUIREMENTS

INTERVAL:HOLE SIZE	SACKS	WT./SKS.	TOTAL WT./LBS.	UNIT COST	$ TOTAL COST
180'35" Hole					
Gel	550	100	55,000	6.00	3,300
Lime	50	50	2,500	8.00	400
Cotton Seed Hulls	50	100	5,000	18.00	900
TOTAL	650		62,500		4,600
5,600'26" Hole					
Gel	5,150	100	515,000	6.00	30,900
Lime	212	50	10,600	8.00	1,696
Cypan	675	50	33,750	160.00	108,000
Caustic Soda	630	50	31,500	30.00	18,900
Soda Ash	260	100	26,000	35.00	9,100
TOTAL	6,360		593,450		168,596
10,000'17 1/2" Hole					
Barite	52,000	100	5,200,000	8.50	442,000
Gel	11,800	100	1,180,000	6.00	70,800
Drispac	1,200	50	60,000	210.00	252,000
Caustic Soda	1,125	50	56,250	30.00	33,750
Rayvan	2,325	50	116,250	40.00	93,000
Soda Ash	575	100	57,500	35.00	20,125
Sod. Bichromate	564	100	56,400	125.00	70,500
TOTAL	175,789		6,726,400		982,175
15,400'12 1/4" Hole					
Gel	9,460	100	946,000	6.00	56,760
Drispac	1,250	50	62,500	230.00	287,500
Caustic Soda	625	50	31,250	30.00	18,750
Soda Ash	325	100	32,500	35.00	43,875
Sod. Bichromate	315	100	31,500	125.00	39,375
Para-Formaldehyde	308	50	15,400	85.00	26,180
Rayvan	625	50	31,250	40.00	25,000
TOTAL	12,908		1,150,400		497,440
17,400'8 3/4" Hole					
Gel	6,830	100	683,000	6.00	40,980
Rayvan	605	50	30,250	40.00	24,200
Caustic Soda	261	50	13,050	30.00	7,830
Soda Ash	130	100	13,000	35.00	4,550
Sod. Bichromate	130	100	13,000	125.00	16,250
Para-Formaldehyde	136	50	6,800	85.00	11,560
Drispac HT	680	50	34,000	230.00	156,400
TOTAL	8,772		793,100		261,700
18,000'6" Hole					
Gel	3,220	100	322,000	6.00	19,320
Drispac HT	415	50	20,750	210.00	87,150
KX Polymer	195	50	9,750	485.00	94,575
Para-Formaldehyde	105	50	5,250	85.00	8,925
Chrome Allum	105	50	5,250	65.00	6,825
Caustic Soda	195	50	9,750	30.00	5,850
Soda Ash	97	100	9,700	35.00	3,395
Sodium Bichromate	97	100	9,700	125.00	12,125
TOTAL	4,429		392,150		238,165
GRAND TOTALS	208,908		9,718,000		2,152,746

CAPACITY OF 800 GPM. SEVERAL RIGS IN THE EVANSTON AREA OF THE OVERTHRUST HAVE USED THIS SYSTEM SUCCESSFULLY.

CEMENT, LIKE DRILLING MUD, HAS EVOLVED INTO A COMPLEX MIXTURE OF PORTLAND CEMENT PLUS CHEMICAL AND MINERAL ADDITIVES TO PRODUCE CHARACTERISTICS THAT FIT CONDITIONS FOR ITS INTENDED USE. 'OIL-WELL CEMENTING IS THE PROCESS OF MIXING AND DISPLACING A CEMENT SLURRY DOWN THE CASING AND THEN UP THE ANNULAR SPACE BEHIND THE PIPE WHERE IT IS ALLOWED TO SET, THUS BONDING THE PIPE TO THE FORMATION. NO OTHER OPERATION IN THE DRILLING OR COMPLETION PROCESS PLAY AS IMPORTANT A ROLE IN THE PRODUCING LIFE OF THE WELL AS DOES A SUCCESSFUL PRIMARY CEMENTING JOB'.*

CEMENTING JOBS ARE CLASSIFIED AS 'PRIMARY' OR 'SECONDARY'. PRIMARY CEMENTING IS PERFORMED IN THE MANNER DESCRIBED ABOVE IMMEDIATELY AFTER CASING IS RUN INTO THE HOLE. ITS OBJECTIVES ARE TO ISOLATE ZONES PENETRATED BY THE WELL AND TO HELP PROTECT THE PIPE ITSELF. CEMENTING ALSO:

1. BONDS THE PIPE TO THE FORMATION.
2. PROTECTS PRODUCING STRATA.
3. MINIMIZES BLOWOUT DANGER FORM HIGH PRESSURE ZONES.
4. SEALS OFF 'LOST CIRCULATION' ZONES OR OTHER TROUBLE-SOME STRATA AS A PRELUDE TO DEEPER DRILLING.

SECONDARY CEMENTING IS USUALLY A REPAIR TECHNIQUE THAT INVOLVES FORCING THE CEMENT SLURRY THROUGH HOLES IN THE CASING IN ORDER TO FILL CAVITIES BEHIND IT.

THE MATERIALS RECOMMENDED BY HALIBURTON FOR PRIMARY CEMENTING OF THE BEAR THRUST WELL ARE PRESENTED IN TABLE 6. PROCESS EQUIPMENT AND SERVICES ARE INCLUDED IN THE ESTIMATES (SEE SECTION 12).

CEMENT SLURRY SPECIFICATIONS ARE DESCRIBED BY HALIBURTON IN APPENDIX, A.P.5.

*D.K. SMITH, HALIBURTON RESEARCH

TABLE 6.

CEMENT AND ADDITIVES

CONDUCTOR	SAX.	WT./SX	TOTAL WEIGHT	
30"x36" 180' 100% 675 sks "G" 2% CaCl 1/4"/sk. Flocele Float Equipment	675.0 613.5 11.3	94.0 50.5 15.0	63,450 681 168 500 64,799	"G" CaCl Flocele
Surface: 20"x26" 5,600' 50% excess 5,000 sk lite 10#/sk Gilsonite, 1,000 sks "G" 1/4#/sk Flocele Float Equipment	5,000 500 1,000 250	87 50 94 15	435,000 25,000 94,000 3,750 500 558,250	Lite Gilsonite "G" Flocele Float Equip. Total
Intermediate: 13 3/8x17 1/2" 50% excess Fillup, 1,000, CS-2 Spacer 40 bbls 880 Sks G, 0.5% HLX-270 18% salt	40 880 0.5% HLX 158.4	325.9 94 By Wt. 71	13,036 82,720.0 413.6 11,246.4 500 107,916	CS-2 Spacer "G" HLX-270 Salt Float Equip. Total
1st Liner: 9 5/8"x12 1/4" Pre-Flush 40 bbl CS-2 1,760 sks "G", 18% salt 0.75% CFR-2, 0.5% HLX-270	40 1,760 316.8 8.8 0.5% HLX	325.9 94 71 43 By Wt.	13,036 165,440 22,492.8 379.3 827.2 202,175.3	CS-2 Spacer "G" Salt CFR-2 HLX-270 Total
Production Casing: 7"x8 3/4" 17,400' 50% excess 40 bbl spacer, 280 sks "G", 18% salt, 35% SSA-1, 0.75% CFR-2 0.5% HLX-270	40 280 50.4 98 210 0.5% HLX	325.9 94 71 70 43 By Wt.	13,036 26,320 3,578.4 6,860 9,030 131.6 500 59,006	CS-2 Spacer "G" Salt SSA-1 CFR-2 HLX-270 Float Equip. Total
2nd Liner: 5"x6" Pre-Flush 40 bbl CS-2, 70 sks "G" 18% Salt, 35% SSA-1, 0.75% CFR-2 0.5% HLX-270	40 70 12.6 24.5 5.8 0.5% HLX	325.9 94 71 70 43 By Wt.	13,036 6,580 894.6 1,715 248.3 32.9 22,507	CS-2 Spacer "G" Salt SSA-1 CFR-2 HLX-270 Total

5.3 Drill String Stabilization:

A major drilling problem, especially with long holes, is excessive hole deviation that can lead to lost drilling efficiency, hole abandonment, and missing the drill target. In Section 4.3, corrective measures were briefly discussed but prevention, rather than correction, is the goal of any well-planned drilling program. Stabilization devices, placed strategically in the string of drill collars above the bit, minimize and control deviation.

Oncor Corporation a drilling-tool supplier, prepared a detailed plan for drill-string stabilization. Their cost estimates and assembly drawings constitute a lengthy document, in itself, and readers are referred to Appendix A, p. A.13, for details.

Costs and weights of the recommended equipment are summarized below:

1. Unit weight limit - 4000 lbs. Transportable by helicopter.
2. Total weight - 12,000 lbs.
3. Estimated rental costs - $293,270
4. Freight - $756
5. GIN time - $140

5.4 Logging and Testing:

Electric logs of well bores provide the geologist with measurements of the physical parameters of formations encountered. These, together with chip samples and, on occasion, core samples, allow identification of: 1) stratigraphy, 2) lithology, 3) contacts, 4) potential for petroleum or natural gas occurrences.

Logging equipment is normally mounted in a truck that comes to the drill-site each time a 'run' is required. There might be as many as six or seven 'runs' for a single hole, depending on the complexity of the drilling program and the engineer's and geologist's need for log-derived information.

Logging is done by lowering a sensor to the bottom of the well and making measurements as it ascends. Signals are transmitted to the surface through a specially designed cable which, obviously, must be somewhat longer than the well is deep. For a deep well, the weight of the cable plus its drawworks to spool and unspool it, presents a challenge to helicopter mobilization.

Suitable equipment, designed for off-shore use, is modularized on skids rather than truck-mounted units. Service companies, such as Dresser-Atlas and Schlumberger provide both the equipment and services, but a helicopter capable of lifting 10,500 lbs. is required to transport the equipment modules from staging area to well site because disassembly is impractical. Because of high transport cost, we plan to leave all logging equipment at the well site for the duration of drilling.

Table 7. lists logs to be run and costs of service and equipment. The estimates were provided by Dresser-Atlas (see also Appendix A. p.a.33-34).

TABLE 7.

SUMMARY OF LOGGING PROGRAM

LOG	COST TO RUN				
	1ST	2ND	3RD	4TH	5TH
SET-UP	925	925	1265	1265	1265
DENSITY/CALIPER	3638	5096	7440	12812	12730
NEUTRON	3638	5096	7440	12812	12730
DUAL INDUCTION	3530	4990	7332	12772	12710
ACOUSTIC/CALIPER	3638	5096	7440	128L1	12730
GAMMA RAY	1047	1477	2166	4000	3860
TEMPERATURE	2622	4030	6206	12306	12690
DIPLOG	9184	10603	12594	9860	9060
INSTRUMENT PROTECTION	260	260	260	260	260
ISOLATED LOCATION	4290	4290	4290	4290	4290
TEMP. IN EXCESS OF 300				690	690
SUB-TOTAL	32772	41863	56433	83879	83015

TRUCKING CLS S23 SKID FROM TEXAS TO WYOMING:	5000
RENTAL CHARGE: 12 MONTHS @ 5500/MONTH	66,000
TOTAL JOB COST	$368,962

IF POTENTIAL OIL AND GAS ACCUMULATIONS ARE ENCOUNTERED, DRILL STEM TESTS (DST) WILL BE NEEDED. DETAILED PRESSURE INFORMATION OBTAINED FROM DST IS USED TO DETERMINE FORMATION PRODUCTIVITY. A 'PRODUCTIVITY INDEX' IS CALCULATED FROM THE AMOUNT OF FLUID RECOVERED DURING THE TEST AND FROM STATIC DOWNDOWN PRESSURES. TEST RESULTS OFTEN CONTAIN HIGH PROBABLE ERROR BECAUSE OF THE SHORT DURATION OF THE TESTS AND THE UNUSUALLY HIGH RESERVOIR DAMAGE WHICH MAY OCCUR ADJACENT TO THE BORE HOLE. DST ARE, NONETHELESS, SUFFICIENT TO INDICATE THAT A FORMATION MAY BE A GOOD PRODUCER WARRANTING FURTHER TESTING.

DRILL STEM TEST EQUIPMENT RECOMMENDED BY SCHLUMBERGER/JOHNSTON-MACCO (APPENDIX A. P.A. 34) CONSISTS OF A 15,000 PSI WP SURFACE CONTROL HEAD, A WP FLOOR MANIFOLD, MULTIFLOW EVALUATOR WITH SAMPLE CHAMBER, TWO PRESSURE RECORDERS, TWO OPEN-HOLE PACKERS, HYDRAULIC JARS, SAFETY JOINT, AND REVERSING SUB. FIVE DST REPORTS, COMPUTERIZED DATA ANALYSIS, AND 24 HOURS OF EQUIPMENT AND OPERATOR TIME ARE INCLUDED IN THE COST ESTIMATES SUMMARIZED IN TABLE 8.

TABLE 8.

DRILL STEM TEST COSTS

ITEM	COST
1. DEPTH 10,001 TO 11,000 FT.	$6,085
2. DEPTH 11,001 TO 16,000 FT.	5,945
3. DEPTH 18,001 TO 19,000 FT.	6,224
	$18,254

ADDITIONAL EQUIPMENT AND OPERATOR TIME IS QUOTED AT $20 AND $28 PER HOUR, RESPECTIVELY.

TIME REQUIREMENTS TO COMPLETE DRILL STEM TESTING AND MISCELLANEOUS COSTS ARE DIFFICULT TO PREDICT BECAUSE THE AMOUNT OF TESTING RELATES TO POTENTIAL PAY ZONES WHICH MAY BE ENCOUNTERED. TO COVER THIS UNCERTAINTY, $31,500 ARE INCLUDED IN TOTAL COST ESTIMATES FOR DST.

5.5 COMPLETION AND STIMULATION:

OUR FEASIBILITY STUDY ASSUMES THAT IF COMMERCIAL QUANTITIES OF OIL AND/OR GAS ARE ENCOUNTERED, THE TEST WELL WILL BE COMPLETED AND BASIC STIMULATION PROCEDURES UNDERTAKEN. THIS MAY NOT BE REQUIRED IF THE WELL FLOWS NATURALLY BUT,FOR STUDY PURPOSES, WE INCLUDED BOTH STIMULATION AND ARTIFICIAL LIFT EQUIPMENT. THIS ASSUMPTION APPLIES TO EITHER HELICOPTER OR CONVENTIONAL SUPPORT SCENARIOS. HOWEVER, IF THE WELL IS A PRODUCER, ACCESS ROADS WILL PROBABLY BE CONSTRUCTED TO DEVELOP THE FIELD. THEN IT MAY BE MORE COST EFFECTIVE, BECAUSE OF THE EQUIPMENT WEIGHT, TO POSTPONE STIMULATION UNTIL ROADS ARE COMPLETED. STIMULATION COSTS ARE INCLUDED IN BOTH CASES FOR COMPARISON.

COMPLETION CONSISTS OF SETTING, CEMENTING, AND PERFORATING 1200 FEET OF 5'' PRODUCTION CASING, RUNNING 2-7/8'' PRODUCTION TUBING, AND INSTALLING ARTIFICIAL LIFT EQUIPMENT AND A CHRISTMAS TREE. OTHER ITEMS ASSOCIATED WITH COMPLETION INCLUDE THE FLOW-LINE, TREATER, STOCK TANKS, AND TANK BATTERY. INSTALLATION OF THIS LATTER EQUIPMENT MIGHT ALSO BE POSTPONED BUT IT IS AGAIN INCLUDED FOR COMPARISON AND TO DEMONSTRATE THAT THE OPERATION COULD BE BROUGHT TO COMPLETION USING EITHER HELICOPTERS OR TRUCKS. WITH HELICOPTER SUPPORT, THE ROTARY RIG WOULD ALSO BE USED TO COMPLETE THE WELL.

THE MOST COMMON TECHNIQUES OF WELL STIMULATION ARE ACIDIZING AND FRACTURING. THE OBJECTIVE IS IMPROVED FLUID FLOW INTO THE WELL. DOWELL (SEE APPENDIX A. P. A36) HAS PROPOSED USING THEIR SKID-MOUNTED ACIDIZING PUMPS, EACH DELIVERING 750 HYDRAULIC HORSE POWER AT 15,000 PSI. THIS EQUATES TO A PUMPING RATE OF 2 BARRELS PER MINUTE PER PUMP. EACH PUMPING UNIT COULD BE BROKEN INTO TWO PIECES WEIGHING 17,000 POUNDS EACH.

ADDITIONAL EQUIPMENT REQUIRED FOR MIXING SPECIAL CHEMICALS AND PRESSURIZING CAN BE SEPARATED INTO COMPONENTS OF 12,000 POUNDS. ACID WILL BE TRANSPORTED IN INERT RUBBER BLADDERS SIMILAR TO THOSE USED BY THE MILITARY TO HAUL FUEL.

TOTAL ESTIMATED COST OF THE STIMULATION PROGRAM IS $300,500 PLUS HELICOPTER MOBILIZATION.

5.6 Fuels and Lubricants:

AVERAGE FUEL CONSUMPTION FOR THE PARKER TBA 2000 RIG AND ASSOCIATED SUPPORT EQUIPMENT (FORK-LIFTS, CRANES, GENERATORS, ETC.) IS ABOUT 1100 GALLONS PER DAY IN SUMMER AND 1500 GPD IN WINTER. WE CONSIDER 1200 GALLONS PER DAY A 'GOOD FIGURE'.

THE PREMISE FOR ESTIMATING OPERATING AND RESERVE FUEL REQUIREMENTS IS THAT WEATHER CONDITIONS MAY FORCE UP TO A TEN-DAY SHUTDOWN OF FLIGHT OPERATIONS WITH EXTERNAL LOADS, THUS INTERRUPTING FUEL REPLENISHMENT. AN OPERATING SUPPLY OF 12,000 GALLONS, WITH AN ADDITIONAL 12,000 GALLONS EMERGENCY RESERVE SUPPLY, IS RECOMMENDED. WINTER TEMPERATURES MAY RANGE AS LOW AS -50^{0}F. POSING SERIOUS DANGER TO PERSONNEL AND EQUIPMENT SHOULD FUEL RUN OUT.

FUEL WILL BE STORED ON-SITE IN TWO 12,000 GALLON COLLAPSIBLE RUBBER BLADDERS PLUMBED TO THE RIG'S FUEL SYSTEM, THE BOILER, AND THE CAMP GENERATORS. THE FUEL DUMP WOULD BE ADEQUATELY DIKED (OR DRAINED TO THE RESERVE PITS) SO THAT ANY SPILLS COULD BE CONTAINED ON-SITE FOR IMMEDIATE CLEAN-UP. SHOULD PROPANE BE REQUIRED FOR THE CAMP, AN 8,000-TO 10,000-GALLON SUPPLY WILL BE STORED IN 400-GALLON STEEL TANKS.

LUBRICANTS WILL BE STORED ON SITE IN SUITABLE CONTAINERS AND PERIODICALLY RESUPPLIED AS NEEDED. EMPTY CONTAINERS WILL BE FLOWN OUT REGULARLY AND RECYCLED AND/OR DISCARDED AT AN APPROVED WASTE SITE.

5.7 Safety Program:

The Senior Engineer on-site will be responsible for all aspects of site safety. Compliance with all federal and state regulations and industry standards will be strictly enforced.

As there is a probability of encountering H_2S gas in the Phosphoria and older geologic units, H_2S detection equipment will be installed on the rig and escape packs provided for all personnel. Instruction in equipment use and maintenance will be provided by qualified safety specialists with 'refresher' sessions and practice drills held at reasonable intervals during the operation.

It is strongly recommended that at least two persons on-site be trained in emergency first aid including treatment of frost bite and hypothermia.

Extrapolation of meteorological data suggests that helicopter access to the site for emergency evacuation could be interrupted by poor visibility or storms for up to four consecutive days. The little Granite Creek Trail will be imporved for emergency use, in lift-threatening situations, by snow machines or all-terrain vehicles. The trail could also be used for non-emergency access on foot or on horseback. In general, however, helicopter access may be more reliable than travel by conventional road vehicle because drifts and slides might block the road for days at a time, and ground blizzards prevent surface travel when flying is still possible.

For illness or injury requiring immediate medical treatment, personnel would be airlifted to one of several nearby hospitals. If necessary, medical personnel could also be brought to the site. The closest medical facility is

Saint John's Hospital in Jackson, about 13 miles (less than 10 minutes by air) from the well location. The Star Valley Hospital in Afton is about 45 miles from the site. Helicopter transport to hospitals in Idaho Falls and Pocatello would take about 45 minutes.

5.8 Personnel, Camp and Catering Facilities:

Operators and drilling contractors with whom the concept of helicopter mobilization has been discussed expressed varying opinions on personnel requirements. The differences stem from their personal concepts of the job and two alternatives emerged:

> Alternative 1. Provide full camp facilities for a maximum number of personnel and visitors that might reasonably be expected to 'overnight'.
>
> Alternative 2. Provide camp facilities for the basic work force only with scheduled daily mobilization of specialized service crews and visitors.

The first option provides maximum operational self-sufficiency by minimizing problems of interrupted site access. For winter operation, the additional crew facilities would lessen concerns for personnel safety should access be cut off for several days when the number of people on-site is swelled by service crews. Disadvantages are cost and environmental damage caused by increased space and sanitary facility requirements.

Alternative 2. would hold camp-related cost and environmental damage to a minimum but increase the risk of lost rig time or a lost hole if service contractors could be mobilized as required. In emergencies, extra personnel could be accommodated in the mess hall and lounge areas but this could create morale problems and heighten concerns for safety and well being if the rig were isolated for an extended period of time.

It is reasonable to assume that operating decisions would fall within the range of these alternatives and our analysis will consider the costs attendant to both. Selection is left to the reader. Although our cost estimates built around Alternative 1.

THE MINIMUM NUMBER OF WORKERS NEEDED TO MAINTAIN BASIC SITE OPERATIONS THROUGH THE WINTER IS ESTIMATED AT 32. IT IS ASSUMED THAT WORKING IN SEVERE WINTER COLD WILL PRECLUDE 12-HOUR SHIFTS, AND RIG OPERATIONS ARE BASED ON THREE DRILLING CREWS WORKING 8 HOURS EACH. REQUIREMENTS FOR BOILER OPERATORS, SNOW-REMOVAL CREWS, AND EXTRA ROUSTABOUTS SIMPLY TO KEEP THE OPERATION THAWED OUT AND FUNCTIONING ARE DICTATED BY THE WEATHER. THE MINIMUM SITE ROSTER RECOMMENDED FOR SAFE OPERATION UNDER ANTICIPATED WINTER CONDITIONS IS SHOWN BELOW:

TABLE 9.

MINIMUM SITE ROSTER

	FUNCTION	NO. ON SITE
1.	SUPERVISING ENGINEER	1
2.	GEOLOGIST	1
3.	TOOLPUSHER	2
4.	DRILLING CREWS, 3 @ 5 MEN EACH	15
5.	BOILER TENDER	2
6.	MUD LOGGER	2
7.	MUD ENGINEER	1
8.	LABORER & STOCKMEN	4
9.	CATERING CREW	4
10.	VISITORS	3
	TOTAL	35

IN ADDITION TO THE NORMAL OPERATING CREW, SERVICE CREWS WILL PERIODICALLY BE ON-SITE FOR CASING, LOGGING, DRILL STEM TESTING, RIG AND EQUIPMENT REPAIR AND PERFORMING OTHER SERVICES AS MAY BE REQUIRED. IT IS CONCEIVABLE THAT AN OVERLAP OF SERVICE PERSONNEL AND VISITORS COULD RAISE THE ON-SITE HEADCOUNT BY 20 RESULTING IN AS MANY AS 55 PERSONS REQUIRING ACCOMMODATIONS AT ANY GIVEN TIME.

CONSISTENT WITH CAMP ALTERNATIVES 1 & 2, COST FOR A 35-MAN CAMP PROVIDED BY PARKER DRILLING AND A 55-MAN CAMP TO BE PURCHASED AND RESOLD ARE ESTIMATED BELOW:

35-Man Camp

Note in Appendix, A.3, that the $12,000/day rate for the Parker TBA 2000 rig includes a 30-man camp.

Item	Operation: Drilling (304 days)	Operation: Completion (60 days)
1. Living quarters for 5 additional persons @ $150/day	$45,600	$9,000
2. Catering @ $35/day/man for 31 men	$329,840	$65,100
Totals	$375,440	$74,100
Grand total	$449,540	

55-Man Camp

Note that if the Parker camp is not used, the rig day rate would be about $450 less. This reduction is shown offsetting camp costs below.

Item	Operation: Drilling (304 Days)	Operation: Completion (60 days)
* 1. Living quarters, kitchen & lounge. (Laundry provided by Elder, Quinn & McGill, Inc) Appendix A. P.A.) FOB Jackson	$450,000	- -
2. Catering @ $35/day/man for 40 men (average)	$425,600	$84,000
3. Savings on rig day rate	(136,800)	(27,000)
Totals	$738,800	$57,000
Grand total	$795,800	

* Consists of 10 - 10' x 28' units for kitchen/diner, recreation /office and commissary
10 - 10' x 28' four man bunks
8 - 10' x 28' two man bunks
1 - 10' x 28' laundry (See Appendix P.A.)

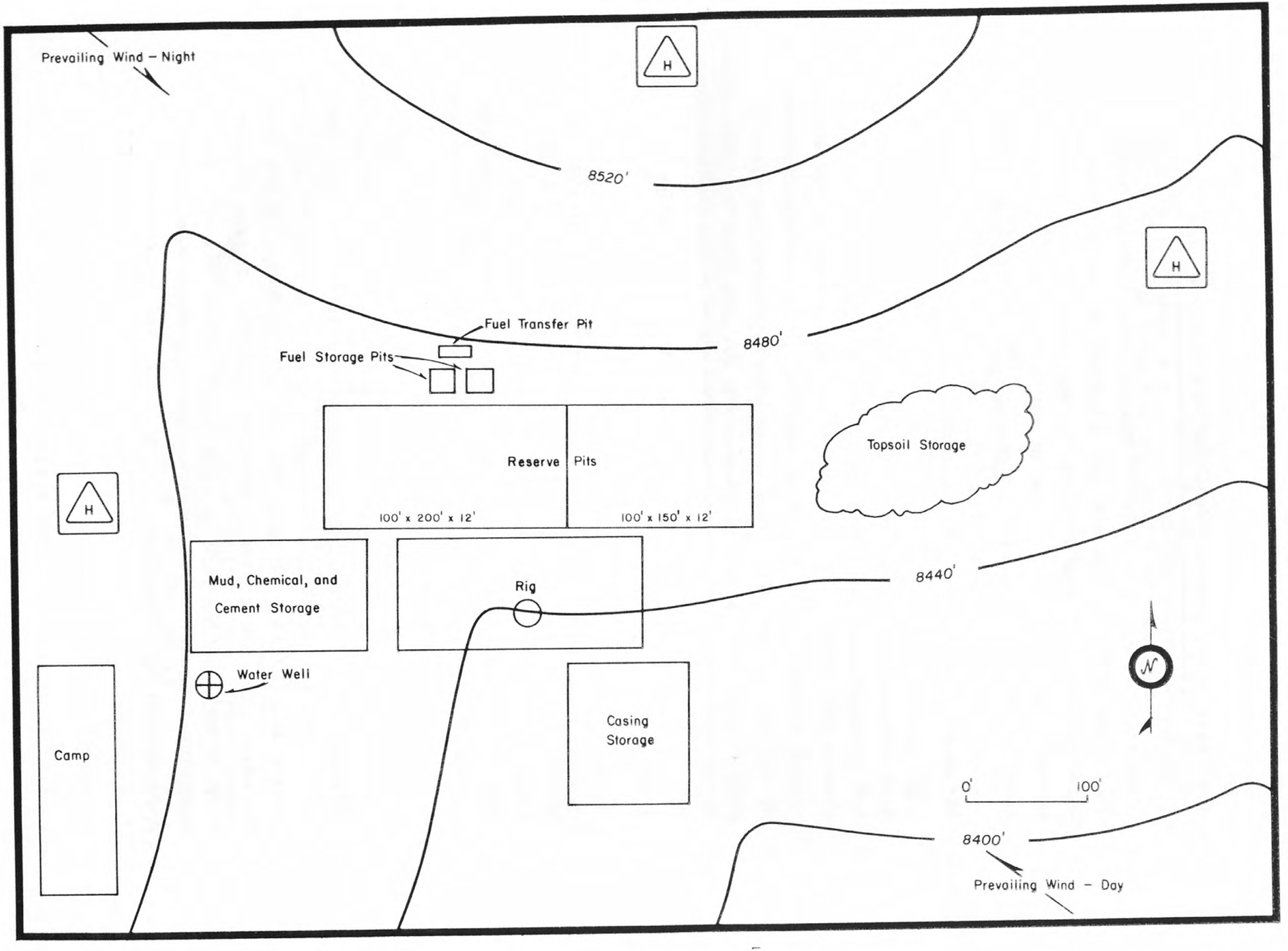
5.9 Site Plan, Construction and Restoration:

A proposed plan for the Getty Reserve well site is shown in Figure 5. The area was not surveyed so the plan is only conceptual. The reserve pit may require relocation on the downslope (fill) side of the rig if bedrock is encountered when the site is graded. It may also be expedient to locate fuel storage closer to the rig but the derrick and refueling location of the helicopter should be well separated.

Site topography will permit establishing camp facilities and overflow storage areas on natural surfaces, if mud is not a problem. Camp units can be set by helicopter on pre-erected timber frameworks to minimize grading and subsequent restoration. No monitoring has been done to ascertain prevailing wind direction at the site, but they tend to come from the northwest. Living units are placed with this in mind to minimize exposure to rig noise and to reduce the chance of lethal fumes or fire being blown into the camp in case of an accident.

Sewage will be treated in an approved vault-type system or retained in holding tanks for periodic transport to a disposal facility. To minimize waste-water treatment, a separate 'gray water' system for on-site disposal might be considered in conjunction with chemical toilets or facililies for toilets only.

The drill pad can be leveled and reserve pits excavated by a caterpillar D5B dozer. It's operating weight is 25,200 lbs., but tracks and blade weigh about 8,000 lbs. When broken down (blade and tracks removed), the D5B can be moved to the site by heavy lift helicopter. On-site equipment should include a 14,000-lb. capacity fork lift for material handling and a medium-weight, tractor-mounted backhoe/front-end loader combination for trenching, backfilling, and snow removal.


Prevailing Wind – Night
H
8520'
H
Fuel Transfer Pit
8480'
Fuel Storage Pits
Reserve Pits
100' x 200' x 12'
100' x 150' x 12'
Topsoil Storage
H
Mud, Chemical, and
Cement Storage
Rig
8440'
Water Well
Camp
Casing
Storage
N
0'
100'
8400'
Prevailing Wind – Day

PARKER DRILLING EQUIPS A D5 DOZER WITH A LIFTING BOOM FOR USE IN ASSEMBLING THE RIG. THIS SAME DOZER COULD BE EQUIPPED WITH A BUCKET FOR EXCAVATION. RESPECTIVE WEIGHTS OF THE FORK LIFT AND A RUBBER-TIRED BACKHOE/FRONT-END LOADER ARE 19,200 LBS. AND 15,000 LBS. DISASSEMBLY WOULD NOT BE REQUIRED.

SITE PREPARATION, INCLUDING STOCKPILING TOPSOIL, ERECTING TIMBER STAGING FOR CAMP UNITS, LAYING WATER AND SEWER LINES, AND INSTALLING WASTE-WATER FACILITIES AND A FUEL DUMP IS ESTIMATED TO REQUIRE FOUR TO FIVE WEEKS. COST, IF BLASTING OF BEDROCK IS UNNECESSARY, IS ESTIMATED AT $125,000 FOR CONSTRUCTION AND $50,000 FOR RESTORATION.

AVAILABILITY OF HEAVY-LIFT HELICOPTERS CAPABLE OF MOVING OVERWEIGHT EQUIPMENT (LOADS OF MORE THAN 4,200 LBS.) TO THE SITE IS LIMITED AND SCHEDULING PRESENTS LOGISTICS PROBLEMS WHICH, IF NOT CAREFULLY THOUGHT OUT, COULD GREATLY INCREASE PROJECT COSTS. CHARGES FOR FERRY TIME TO BRING THE AIRCRAFT TO THE WORK AREA COULD REACH $70,000 (10 HOURS @ $7,000/HR). MOVES OF HEAVY EQUIPMENT MUST BE ARRANGED SO THAT THE HEAVY-LIFT HELICOPTER MAKES ONLY TWO TRIPS TO THE AREA, ONE AT THE BEGINNING OF THE PROJECT AND ONE AT THE END.

ALL OVERWEIGHT EQUIPMENT LISTED IN TABLE 10. COULD BE MOVED IN 19 LOADS, BUT ITEMS 9. AND 10. WILL NOT BE NEEDED UNTIL THE END OF THE PROJECT AND ONLY THEN IF THE WELL IS A PRODUCER. WE ADDRESS THE HEAVY LIFTS IN THIS SECTION BECAUSE THEY INVOLVE SITE CONSTRUCTION EQUIPMENT WHICH CANNOT BE MOBILIZED EFFICIENTLY INDEPENDENT OF DRILLING SUPPORT EQUIPMENT.

THE RECOMMENDED PROCEDURE IS TO TRANSPORT ITEMS 1. THROUGH 8. (12 LOADS) TO THE WELL SITE ON THE DAY FIELD OPERATIONS BEGIN AND THEN IMMEDIATELY RELEASE THE HEAVY HELICOPTER FOR OTHER SERVICE. EXCEPT FOR THE D5 DOZER, ALL EQUIPMENT WOULD REMAIN ON-SITE FOR THE DURATION OF THE PROJECT.

TABLE 10.

OVERWEIGHT LOADS

	ITEM	TRANSPORTED WEIGHT
1.	BULLDOZER: CAT D5B (OPERATING WEIGHT 25,200 LBS.) LESS TRACKS AND BLADE -	17,200
2.	BLOWOUT PREVENTER	
	(A) DOUBLE RAMS	16,750
	(B) SINGLE RAM	9,652
	(C) SPHERICAL BOP	9,600
	(D) ACCUMULATOR (160 GALLON)	9,302
3.	FORK LIFT - 14,000 LB. CAPACITY	19,200
4.	BACKHOE/LOADER COMBINATION	15,000
5.	DRILLING LINE: 1-3/8" X 5000' @ 3 - 5 LBS/FT. 17,500 LBS. + SPOOL	19,500
6.	LOGGING EQUIPMENT	
	(A) DRUM AND CABLE	10,500
	(B) OPERATING COMPARTMENT/INSTRUMENTS	10,400
7.	MUD DATA UNIT	10,000
8.	HALLIBURTON CEMENTING UNITS	4,210
9.	TREATER (IF WELL IS COMPLETED)	20,000
10.	WELL STIMULATION EQUIPMENT - 6 MODULES	17,000 EACH

TOTAL OVERWEIGHT LOADS - 19

After rig-up, the cat can be walked out along Little Granite Creek Trail, upgrading the trail for emergency access as it goes. This procedure would get the cat off the site, saving at least nine months rental fees.

At the end of the project, the heavy-lift helicopter would return to move the cat back to the drill site for restoration work. If the well is to be completed and stimulated, the stimulation equipment and treater would also be flown in and the remaining heavy units taken away. Until stimulation was completed, the large helicopter would be retained on standby to demobilize the stimulation modules. The bulldozer would be walked out again, restoring the emergency access route as it went.

6.0 METEOROLOGY

6.1 General Discussion:

Meteorological parameters affecting helicopter operations are temperature, relative humidity, precipitation, wind speed and direction, visibility and thunderstorm activity. Temperature, relative humidity, and precipitation affect helicopter lift capabilities while wind speed, visibility and thunderstorms affect operational safety and bear directly on flight hours lost due to poor weather conditions.

Our discussion of meteorology is presented in two sections. The first addresses anticipated conditions at the staging area, and the second treats regional data extrapolated to the drill site environment.

6.2 Staging Area:

No weather data is available specifically for the staging area. However, it is located approximately 17 miles southeast of Jackson, Wyoming, and only 600 feet higher so weather conditions similar to Jackson's are anticipated.

Records for the Jackson Hole Airport indicate a temperature range from a mean low of 6.0°F in January to a mean high of 81.4°F in July. Mornings and evenings are cool even during summer, with the July mean low temperature below 40°F.

Weather records at the National Oceanographic and Atmospheric Administration for the period 1951 through 1974 show only infrequent, very severe weather conditions. Sub-zero temperatures have been recorded in all months from November through April with the coldest temperature -49°F recorded January 12, 1963. Temperatures lower than -30°F occur infrequently from December through March.

State of Wyoming Climatelogical records indicate a low average relative humidity reflecting the minimal amount of precipitation over the state. Although no records were available for Jackson, data from stations with similar precipitation patterns and locations suggest seasonal variations in relative humidity of 40 to 45 percent. Highest values occur in late spring, because of widespread rain fall. Mean high relative humidity reaches 70 to 80 percent at night, then falls to 30 to 40 percent during midday. Lowest relative humidity typically occurs in July/August due to higher temperatures and lower rainfall. At that time, night-time values are 60-70 percent and drop to about 30 percent during the day.

Average precipitation in Jackson is 15.29 inches annually. The most rain and snow falls in June and January, respectively, and precipitation for the rest of the year averages about 1 inch per month. Winter snow contains little water. January's mean snowfall for a 24-year period ending in 1974 was 23.7 inches. The maximum was 56 inches.

For staging area evaluation, the snowfall rate is probably more important than the amount. The Soil Conservation Service maintains seasonal snow measuring sites in the Snake River watershed and at the Bryan Flat, which is approximately 5 miles west of the proposed staging area, at an elevation of 6,420 feet (staging area elevation is 6640 feet). Records show that accumulation peaks during March and the forty-year average accumulation is 32 inches with maximum depths of 57 inches reported. Accumulation remains relatively stable during March and early April but drops significantly in late April and early May (see Figure 6).

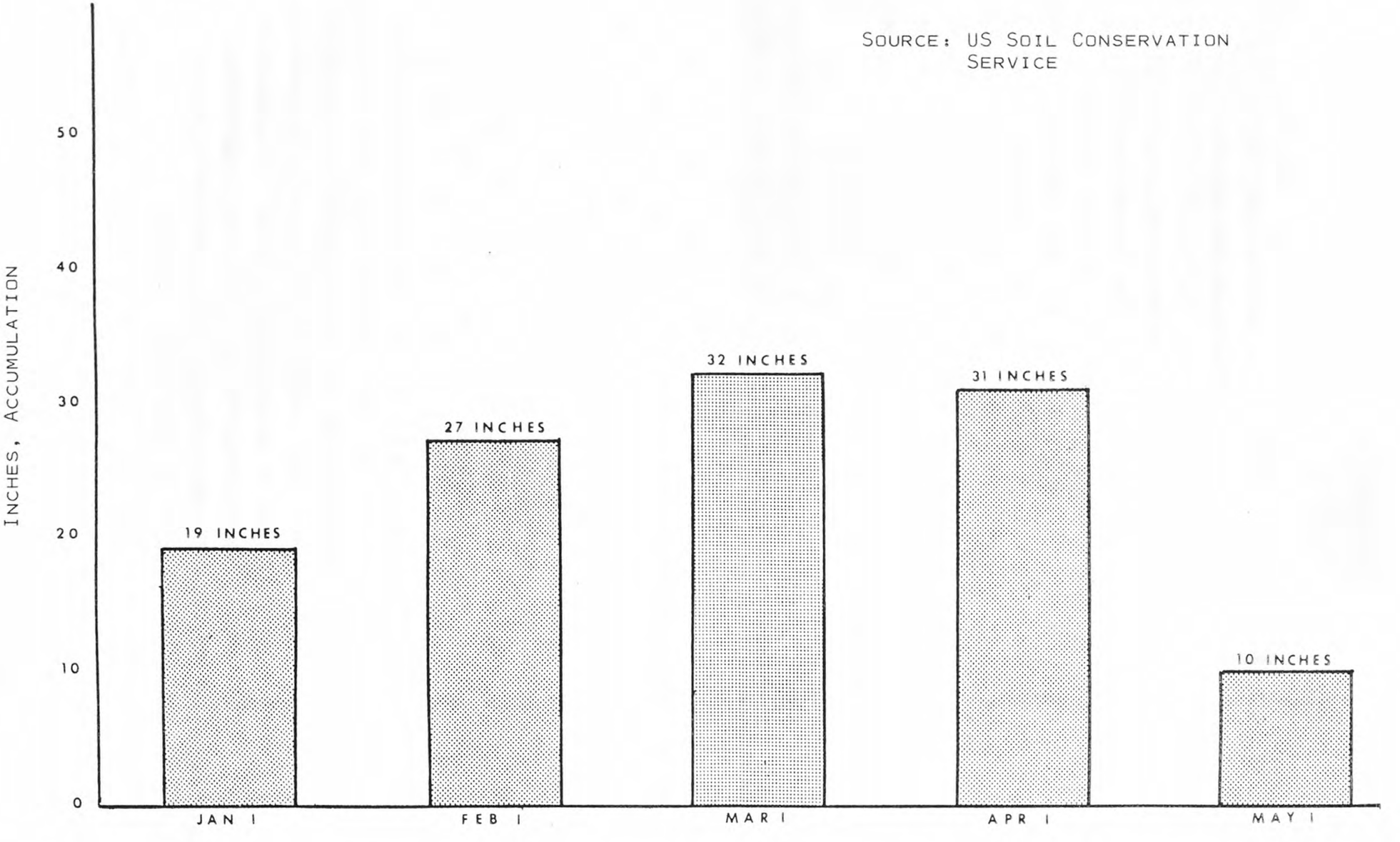


FIGURE 6. AVERAGE ANNUAL SNOWFALL ACCUMULATION, BRYAN FLAT

Wind data for the Jackson area are presented in detail in the E.I.S.. Winds are generally calm in the summer but increase slightly during the balance of the year. Orographic influences will be apparent at the staging area. Severe winds are not anticipated there.

Data furnished by the Jackson Hole Airport Board indicate visibility is quite good. Observations over a four year period provide a base for characterizing conditions at the helicopter staging area.

Measurements indicate visibility in excess of three miles at the airport 97 percent of the time. Flight operation ceilings were greater than 3,000 feet 85.5 percent of the time and between 1,000 feet and 3,000 feet 11.5 percent of the time. These data suggests flight operations at the staging area should be tenable 97 percent of the time. This translates to a 10 day per year loss of flight operations, based on a typical twelve-hour day.

Additional seasonal data indicate poor visibility is most likely between January and March due to winter storm fronts. During January, 63 observations were made when visibility was less than three miles. This accounted for 18 percent of the total monthly observations and was by far the month with poorest visibility.

Seasonal thunderstorms in the Jackson area are frequent due to orographic airmass lifting. In fact, towering cumulus clouds and thunderstorms are characteristic of a summer's day. Historical data indicates storm activity peaks during August with storms observed 21 percent of the daylight hours. Such storms are short in duration, typically lasting 2 - 6 hours.

Conclusions: Flight weather conditions at the Jackson Hole

AIRPORT ARE GENERALLY QUITE FAVORABLE, BUT WITH SOME SEASONAL PROBLEMS. DURING THE WINTER OF 1979 - 1980, THE AIRPORT WAS CLOSED BY FOUL WEATHER FOR ONLY ONE 8-HOUR PERIOD WHEN BLIZZARD CONDITIONS PREVAILED FROM 9:00 PM UNTIL 6:00 AM THE FOLLOWING MORNING.

DATA FOR COMMERCIAL FLIGHT OPERATIONS PRESENT A SIMILAR PICTURE WITH SOME INCREASE IN CONCERN OVER OPERATING MINIMUMS. FROM DECEMBER 1979 THROUGH APRIL 1980, 15 FLIGHTS WERE CANCELLED OUT OF THE ESTIMATED 700 FLIGHTS SCHEDULED. OF THE FLIGHTS CANCELLED, 25 PERCENT WERE DURING THE ONE DAY OF OFFICIAL AIRPORT CLOSURE DUE TO BLIZZARD CONDITIONS.

6.3 DRILL SITE:

THE PROPOSED GRANITE CREEK DRILL SITE IS APPROXIMATELY 2210 FEET HIGHER THAN JACKSON, AND CONSEQUENTLY, SHOULD HAVE A DIFFERENT CLIMATOLOGICAL PROFILE. THE OROGRAPHIC EFFECT CREATED BY THE MOUNTAINS WILL PROBABLY PRODUCE MORE SEVERE WEATHER RESULTING IN POORER FLYING CONDITIONS. NO METEOROLOGICAL DATA HAS BEEN TAKEN AT THE SITE. HOWEVER, BY APPLYING ACCEPTED METEOROLOGICAL PRINCIPALS TO DATA AVAILABLE FROM NEARBY WEATHER STATIONS AND PERSONAL EXPERIENCES OF HIGH LIFE HELICOPTER PILOTS WORKING THE JACKSON AREA, A GENERAL PROFILE CAN BE DEVELOPED.

THE GENERAL RELATIONSHIP BETWEEN TEMPERATURE AND ALTITUDE IS THAT TEMPERATURES DECREASE WITH INCREASING ALTITUDE. ALTHOUGH THERE ARE EXCEPTIONS, TEMPERATURES LOWER THAN THOSE AT JACKSON ARE EXPECTED AT THE PROPOSED DRILL SITE. CRITCH-FIELD STATES THAT TEMPERATURE TRADIONALLY DECREASES AT A RATE OF 3.3°F FOR EACH ADDITIONAL 1000 FEET OF ALTITUDE. [1]

1. CRITCHFIELD, HOWARD J., GENERAL CLIMATOLOGY, 1966.

This would suggest a mean low temperature for January at the drill site of approximately -1°F.

Snotel data from the Phillips Bench Monitoring Station, at 8200 ft. elevation, indicate temperatures less than -40°F are possible. Normal winter temperature patterns suggest daily lows about sunrise, prior to any thermal heating, rising to a high around noon. During January, 1979, Snotel measurement at the Phillips Bench site never climbed above 32°F. The warmest recorded January temperature was -40°C (24.8°F) on January 18, 1979.

Relative humidity at the proposed drill site is controlled by two variables: temperature and precipitation. Temperature was discussed in the previous section. Precipitation generally increases with elevation and moisture measurements in the area substantiate this fact. The combination of lower temperatures and greater precipitation indicate a higher relative humidity at the drill site than at Jackson.

That moisture generally increases with increasing elevation is perhaps an oversimplification of meteorological principles. Air, forced upward by high mountains, cools and tends to form clouds. A decrease in barometric pressure with increasing altitude further inhibits moisture retention and precipitation, typically on the windward side of a mountain, results. On occation however, horizontal winds carry precipitation to the leeward side.

Our proposed drill location should not be considered a high mountain because peaks surrounding the site tower several thousand feet higher. Nevertheless, the setting is appropriate for upslope conditions and the site does receive more precipitation than the staging area.

According to the E.I.S., precipitation at the well site is much heavier than at the staging area. This increase

IS BECAUSE OF THE WELL SITE'S HIGHER ELEVATION CAUSING A LARGER PORTION OF THE MOISTURE TO FALL AS SNOW. SNOWFALL OF 250 INCHES PER YEAR HAVE BEEN FORECAST FOR THE SITE. SNOTEL DATA IN FIGURE 7. SHOWS ACCUMULATIONS NORMALLY ENCOUNTERED ABOVE THE 8000-FOOT ELEVATION AND ILLUSTRATES THAT SNOW ACCUMULATIONS REACH THEIR MAXIMUM DEPTHS LATER IN THE YEAR THAN AT THE STAGING AREA. SNOW WILL PROBABLY BE ON THE GROUND AT, OR NEAR, THE DRILL SITE 8 TO 9 MONTHS OF THE YEAR.

THE DRAFT E.I.S. DISCUSSES WINDS IN THE CACHE CREEK AREA AND STATES THAT SOUTHEASTERLY'S ARE EXPECTED DURING THE DAY, BUT THAT NORTHWESTERLY WINDS PREVAIL AT NIGHT. FIGURE 8. EXPLAINS THE VALLEY/MOUNTAIN WIND PRINCIPAL AND THE OVERTURN OF AIRMASSES. THE NIGHTTIME MOUNTAIN BREEZES, OR KATABATIC WINDS, ARE UP TO 10 MPH AND ARE STRONGER THAN THE DAYTIME VALLEY BREEZE, OR ANABATIC WINDS. BOTH OF THESE WINDS CAN OCCUR UNDER QUIET CONDITIONS AND ARE CAUSED BY THERMAL CIRCULATION.

NORMAL SUMMER THUNDERSTORMS ARE CONVECTIVE AND USUALLY LAST 2 - 6 HOURS. AS THE STORM CELLS GROW, DOWNDRAFTS DEVELOP AND CAUSE SURFACE WINDS TO BECOME STRONG AND GUSTY AS THE CELL PASSES (SEE FIGURE 9).

WINTER STORMS GENERALLY LAST FROM 1 - 6 DAYS AND WINDS IN EXCESS OF 30 MPH SOMETIMES ACCOMPANY THE FRONT'S MOVEMENT THROUGH THE WYOMING ROCKIES. WHEN THERE ARE WESTERLY WINDS AT GROUND LEVEL ACCOMPANIED BY A SOUTH-TO-NORTH PRESSURE GRADIENT, WIND VELOCITIES WILL INCREASE WITH HEIGHT ABOVE GROUND WITH POSSIBLE ADVERSE EFFECT ON AIRCRAFT OPERATIONS.

VISIBILITY CONDITIONS EXTRAPOLATED FROM WIND ROSES PREPARED BY R. V. LORD & ASSOCIATES, SUGGEST THAT IN JACKSON, VISIBILITY WAS MORE THAN THREE MILES 85.5 PERCENT OF THE TIME, WITH A 3000 FOOT CEILING. BECAUSE CLOUD MASSES

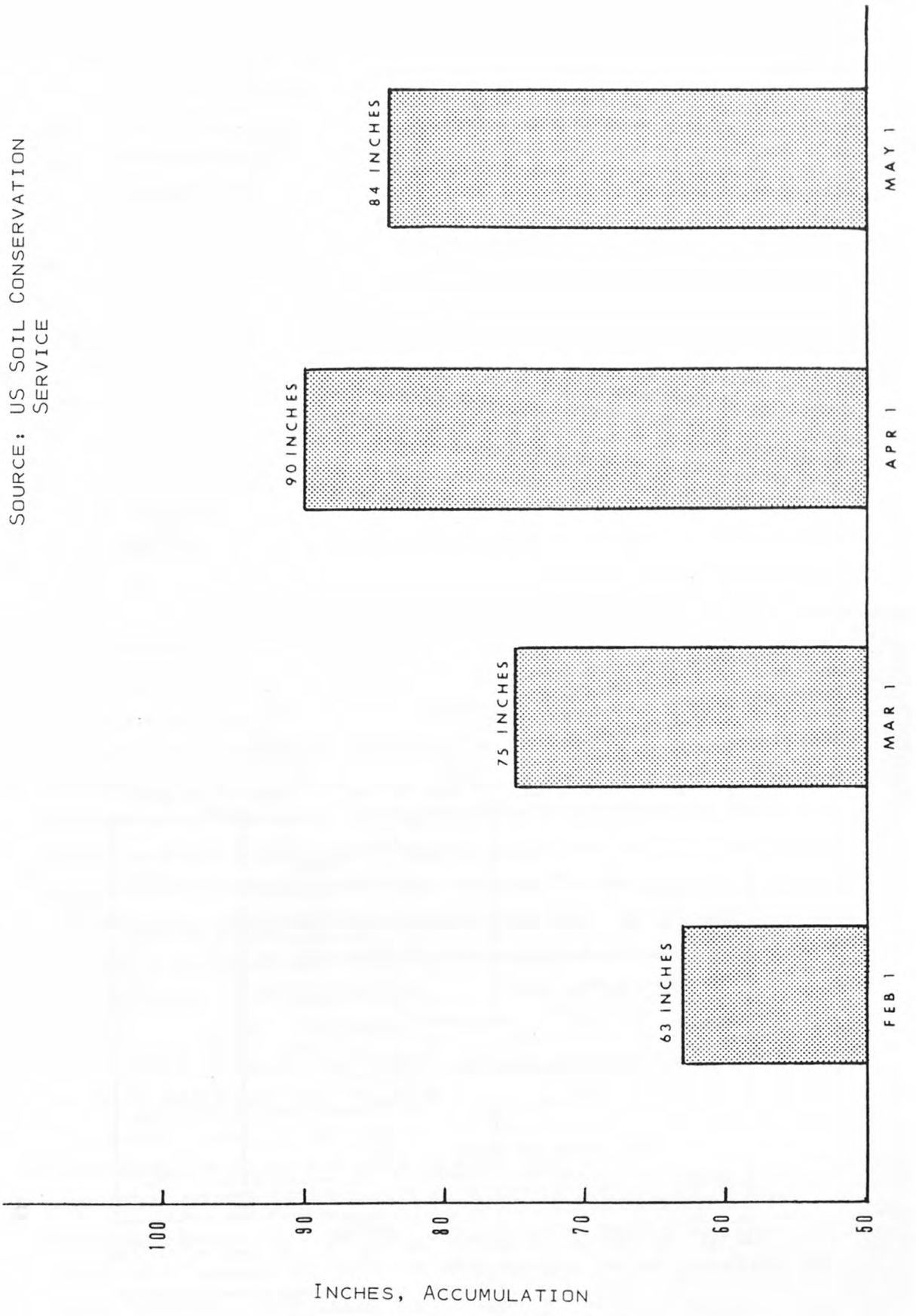


FIGURE 7. AVERAGE ANNUAL SNOWFALL ACCUMULATION, PHILLIPS BENCH

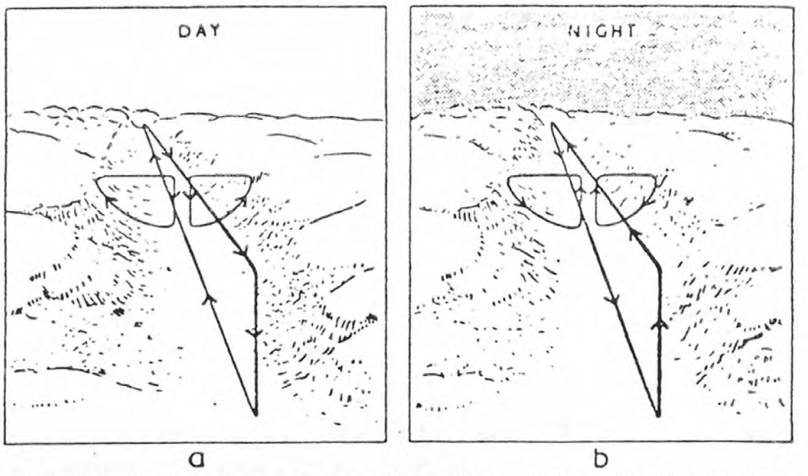


Fig. 8. Mountain and valley breezes. (*a*) Day-time. (*b*) Night-time. The arrowed lines indicate the longitudinal and lateral components of the circulations

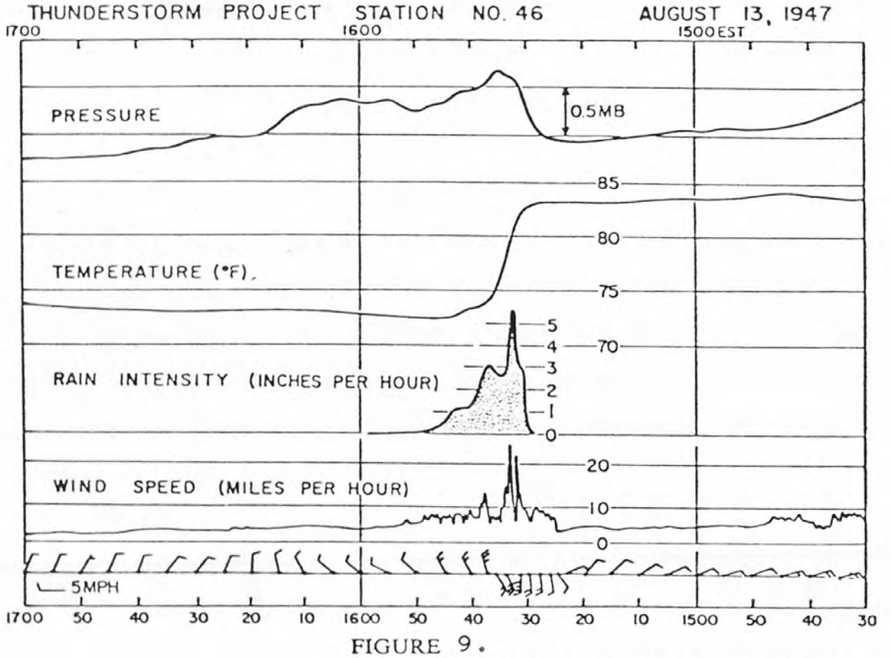


FIGURE 9.
Autographic records for passage of newly matured cell. Time runs from right to left.

GENERALLY MOVE HORIZONTALLY, A SITE 20 MILES AWAY SHOULD HAVE SIMILAR VISIBILITY CONDITIONS. HOWEVER, BECAUSE THE DRILL SITE IS APPROXIMATELY 2000 FEET HIGHER THAN THE JACKSON AIRPORT, THE CEILING THERE MIGHT BE REDUCED BY THIS AMOUNT, OR TO ABOUT 1000 FEET, AT THE PROPOSED WELL.

WIND ROSES WERE ALSO AVAILABLE FOR VISIBILITY CONDITIONS IN EXCESS OF THREE MILES WITH CEILINGS OF 1000 - 3000 FEET. THESE CONDITIONS OCCURRED AT JACKSON 11.5 PERCENT OF THE TIME AND WOULD PERMIT FLIGHT OPERATIONS FOR SOME PORTION THEREOF.

DETERIORATION OF WEATHER CONDITIONS FOR FLIGHT PURPOSES IS NOT LINEAR, AS NOTED FROM REVIEW OF DATA OBSERVATIONS. ALTHOUGH CEILING LIMITS BETWEEN 1000 - 3000 FEET WERE OBSERVED 11.5 PERCENT OF THE TIME, MORE THAN 50 PERCENT OF THESE OBSERVATIONS RECORDED CEILINGS IN THE 2500 - 3000 FEET RANGE.

CONSIDERING ALL VISIBILITY FACTORS, WEATHER CONDITONS AT THE SITE SHOULD BE ACCEPTABLE FOR HELICOPTER OPERATIONS AT LEAST 90 PERCENT OF THE TIME. MORE IMPORTANT THAN THIS PERCENTAGE, HOWEVER, IS THE MANNER IN WHICH POOR CEILING AND VISIBILITY CONDITONS OCCUR. THE PASSAGE OF A WINTER STORM FRONT THROUGH THE AREA TYPICALLY REQUIRES 1 - 2 DAYS AND PROHIBITS FLIGHT OPERATIONS FOR 24 - 48 HOURS. THIS SUGGESTS THAT, ALTHOUGH CEILING CONDITIONS WERE DOCUMENTED AS MARGINAL 11.5 PERCENT OF THE TIME ANNUALLY, THEY OCCURRED WITHIN A LIMITED TIME SPAN. OVERALL, IT IS ESTIMATED THAT HELICOPTER OPERATIONS SHOULD NOT BE HAMPERED FOR MORE THAN 10 DAYS PER YEAR DUE TO POOR CEILING AND VISIBILITY.

THUNDERSTORM ACTIVITY IN THE AREA WAS MENTIONED PREVIOUSLY AND SITE CONDITIONS SHOULD BE SIMILAR TO THOSE AT THE STAGING AREAS. THE ACTUAL IMPACT OF STORMS ON FLIGHT OPERATION SHOULD BE MINIMAL DUE TO THE SHORT DURATION OF EACH PASSING STORM CELL.

6.4 Conclusions:

Overall, meteorological conditions for flight operations appear quite favorable. Particular attention should be given to visibility, ceiling, and wind conditions between the staging area and drill site to assure that acceptable weather exists over the entire flight path.

Wind conditions deserve further mention with regard to chill factors and their impact on human and mechanical operations. Table 11. (reprint from the Aircraft Owners & Pilots Association's Handbook for Pilots), provides a computation showing how winds reduce effective temperatures. These factors must be considered in determining safe helicopter operating parameters.

Finally, we anticipate that acceptable flight conditions should prevail most of the time, with an estimated 15 days annually lost to poor weather conditions.

TABLE 11.

Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature

Estimated wind speed (in mph)	Actual Thermometer reading (F.)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	EQUIVALENT TEMPERATURE (F.)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-124
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
Wind speeds greater than 40 mph have little added effect.	LITTLE DANGER (for properly clothed person) Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh.			GREAT DANGER				

Source: NAVMED Bulletin 5052-29

Wind Chill Factors

This chart illustrates why it may feel a great deal colder, on a windy day, than the reported temperature. When planning your flight, dress appropriately for existing conditions. Remember that clothing that feels comfortable in the cockpit could prove less than adequate in the event of a forced landing.

7.0 HELICOPTER ANALYSIS

7.1 LOAD HANDLING REQUIREMENTS:

OUR APPROACH TO HELICOPTER ANALYSIS AND SELECTION WAS INITIALLY CONCEIVED AS AN ITERATIVE PROCESS IN WHICH LOADS TO BE TRANSPORTED WOULD BE WEIGHED AGAINST HELICOPTER AVAILABILITY, PERFORMANCE, AND FLIGHT-HOUR COSTS.

IT QUICKLY BECAME EVIDENT THAT THE PARKER TBA 2000 WOULD BE THE MOST COST-EFFICIENT RIG FOR THIS PROJECT. THE RIG WAS ORIGINALLY DESIGNED TO BE DISASSEMBLED FOR TRANSPORT INTO COMPONENTS WEIGHING ABOUT 4,000 POUNDS EACH. IT WAS SOON ESTABLISHED FURTHER THAT ALL OTHER SUPPORT EQUIPMENT AND SUPPLIES COULD BE PROVIDED IN LESS THAN 20,000 LB. UNITS. IN FACT, MOST ITEMS COULD BE PACKAGED IN LOADS WEIGHING NO MORE THAN 4,000 ($\pm$ 200) LBS. ONLY 19 LOADS OVER 4,200 LBS. ARE REQUIRED (SEE TABLE 10).

TWO LOAD CATEGORIES, NORMAL AND OVERWEIGHT, WERE ADOPTED FOR OUR ANALYSIS. NORMAL LOADS ARE LESS THAN 4,200 LBS. AND TECHNICALLY, OVERWEIGHT LOADS RANGE FROM 4,201 LBS. TO 20,000 LBS. HOWEVER, THE 4,210-LB. CEMENTING UNITS (ITEM 8. TABLE 10) WILL PROBABLY BE MOVED AS A NORMAL LOAD. WITH THIS EXCEPTION, OVERWEIGHT LOADS RANGE IN SIZE FROM ABOUT 9,000 TO 20,000 LBS.

WE CONCLUDED, THEREFORE, THAT MOBILIZING THE DRILLING OPERATIONS EFFICIENTLY, WILL REQUIRE A SUITABLE MEDIUM-LIFT HELICOPTER FULL TIME AND A HEAVY-LIFT AIRCRAFT ONLY IN THE INITIAL AND FINAL PROJECT PHASES. MINIMUM PAYLOAD CAPABILITIES REQUIRED OF THE MEDIUM AND HEAVY-LIFT HELICOPTERS ARE OUTLINED BELOW. THESE LIFT CAPABILITIES ARE IN ADDITION TO THE CREW, SUFFICIENT FUEL FOR A NINETEEN-

MINUTE FLIGHT, PLUS AN ADDITIONAL TWENTY-MINUTE FUEL RESERVE.*

PRESSURE ALTITUDE	TEMPERATURE	MEDIUM-LIFT HELICOPTER PAYLOAD (EXTERNAL)	HEAVY-LIFT HELICOPTER PAYLOAD (EXTERNAL)
9,000	70° F.	4,000 LBS.	18,000 LBS.
	50° F.	4,300 LBS.	20,000 LBS.

7.2 POTENTIALLY SUITABLE AIRCRAFT:

HELICOPTERS LISTED IN TABLE 12. WERE CONSIDERED. IN OUR MEDIUM-LIFT CATEGORY, SIKORSKY MODELS S61L AND S61N WERE DISQUALIFIED BECAUSE OF COST ($4,000,000 EACH) AND INEFFICIENCY AT HIGHER ALTITUDES. MODEL S58T IS TOO LIGHT FOR EVEN NORMAL LIFTS. AEROSPATIALE MODELS SA 315B AND SA 330 WERE BOTH TOO LIGHT AND TOO EXPENSIVE FOR NORMAL LIFTS. THE SUPER PUMA, COSTING ABOUT $4,000,000 WOULD BE EXCESSIVELY EXPENSIVE AND ITS AVAILABILITY IN THE UNITED STATES SEEMS TO BE POOR. OF THE BELL MODELS, ALL BUT THE 214 WERE DISQUALIFIED BECAUSE OF INSUFFICIENT CARRYING CAPACITY AT 10,000 FEET (ALLOWANCE WAS MADE FOR OPERATIONS AT 9,000 FT.). BOEING'S KV107 IS SLIGHTLY HEAVY FOR NORMAL LIFTS AND TOO LIGHT FOR THE HEAVY ONES.

CHOICE AMONG HEAVY-LIFT HELICOPTERS IS LIMITED TO THOSE PRODUCED BY SIKORSKY AND BOEING. THE S64 SKYCRANE IS USED FOR DRILL RIG MOBILIZATION AND SUPPORT THROUGHOUT THE WORLD BUT, FOR OPERATION AT 9,000 FEET, OPERATORS OF THE CRAFT EXPRESSED CONFIDENCE IN LIFTING ONLY 12,000 TO 13,000 LBS., CONSIDERABLY LESS THAN DATA IN TABLE 12. WOULD SUGGEST. EVERGREEN HELICOPTERS HAS A SKYCRANE AVAILABLE BUT THEIR STAFF DISCOURAGED ITS USE WITH LOADS GREATER THAN 12,000 LBS. AT 9,000 FEET.

* FOR SOME HELICOPTER MODELS, FLOWN IN A UTILITY CONFIGURATION, THE TWENTY-MINUTE RESERVE REQUIREMENT MIGHT BE LOWERED. FOR STUDY PURPOSES, HOWEVER, WE USE TWENTY MINUTES.

TABLE 12. HELICOPTERS EVALUATED FOR DRILLING SUPPORT AND MOBILIZATION

MODEL	COST	EMPTY WEIGHT	MAX GROSS WEIGHT	USEFUL LOAD @ SEA LEVEL	USEFUL LOAD @ 10,000 FT.
SIKORSKY					
S 61L	APPROX. $4 MILLION	11,704	TO 19,000	8,000 LBS	5,600/FUEL
S 61N	SAME AS ABOVE	12,510	TO 22,000	8,000 LBS	5,600/FUEL
(NO LONGER IN PRODUCTION - APPROX. 120 IN OPERATION WORLD WIDE)					
S 64	UNKNOWN	20,000	47,000	20,000 LBS	16,000 LBS
S 58T	$880,000(?)	7,900	13,000	5,000 LBS	2,500 LBS
AEROSPATIALE					
SA315B	$530,000	2,250	5,070	2,750 LBS	2,000 LBS
SA330	$3.2 MILLION	8,350	16,315	7,000 LBS	4,000 LBS
SUPER PUMA	$4 MILLION	8,500(EST)	UNKNOWN	8,800 LBS	UNKNOWN
BELL					
204	$525,000	5,100	8,500	3,400 LBS	2,000 LBS
(NO LONGER IN PRODUCTION)					
205	$895,000	5,197	9,500 INT 10,500 EXT	4,000 INT 5,000 EXT	3,000 LBS
212	$1,140,000	5,933	11,200	5,000 LBS	3,800(EST)
214	$1,800,000	7,827	16,000	6,000 INT 8,000 EXT	6,000 LBS
BOEING					
CHINOOK	$7.5 MILLION	20,655	51,000	28,000 LBS	22,000 LBS
KV107	$3.8 MILLION	11,280	19,000	7,720 LBS	6,620 LBS
(MANUFACTURED IN JAPAN)					

7.3 Helicopter Selection:

Recommended helicopters for mobilizing and supporting drilling operations at Getty-Reserve's site are: 1) Medium Lift - Bell 214; 2) Heavy Lift - Boeing Chinook, Model 234. The alternate medium lift helicopter which would be suitable but perhaps somewhat more expensive is the Boeing KV 107. It is a twin engine aircraft which may provide an additional margin of safety and lift offsetting some added cost. Lift capacity of the KV 107 at 9,000 feet/70°F is about 5,000 lbs. It could transport the normal loads in warmer air than the 214.

Initial cost of approximately $1,800,000, for the Bell 214 (compared with $4,000,000, for the Sikorsky series 61) significantly reduces flight-hour rates for the 214. Compared to the 61, the Bell craft is also nearly 4,000 pounds lighter and yet has nearly the same useful load and payload capabilities.

A detailed study of the Bell 214's performance in environment confirms that it can safely transport all normal loads. The Gross Weight and Payload-versus-temperature functions for a 9,000 ft. pressure altitude (shown in Figure 10) indicate a payload capability of about 4,000 lbs., in 70°F. Air and about 5,000 lbs. in 50° air, while hovering out of ground effect.

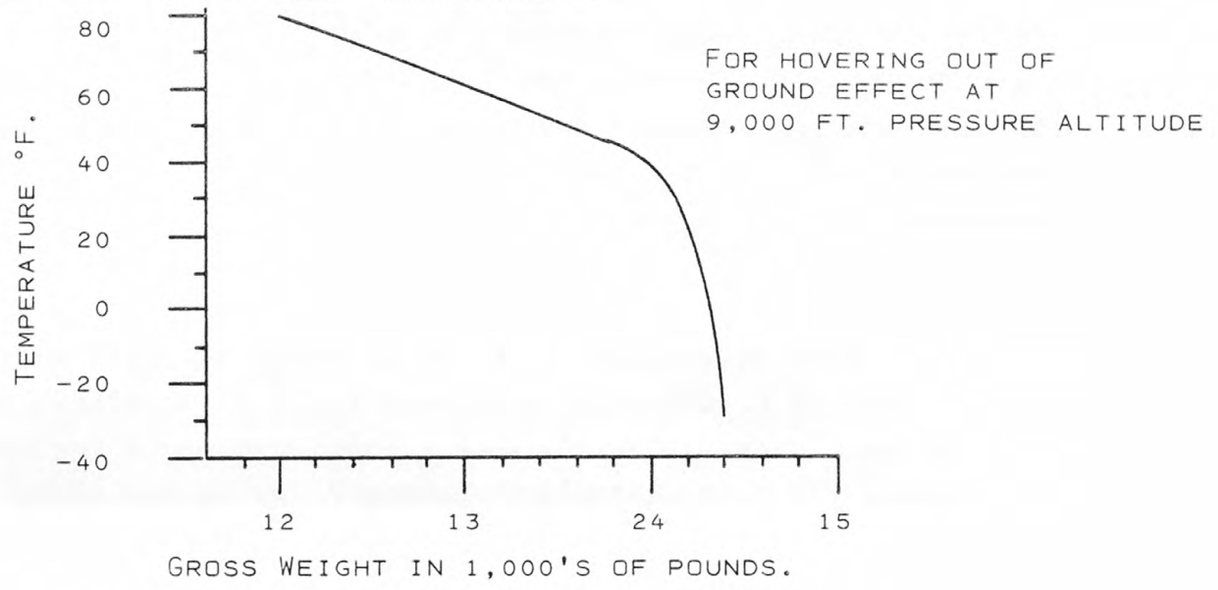
For this evaluation, we used a conserative estimate of 4 round trips per hour between the staging area and drill site. More could be made but this allows for unforseen, but probable, delays in planned lift cycles and for liberal amounts of pilot rest time. Such an intense flying schedule, with repeated pick-ups and drop-offs, can be unusually tiring. Time to periodically get out of the aircraft to 'stretch the legs' and relax will contribute to safe operation with no significant cost penalty. In addition, too rapid delivery of material to the site can cause as many problems as delayed deliveries.

FIGURE 10.

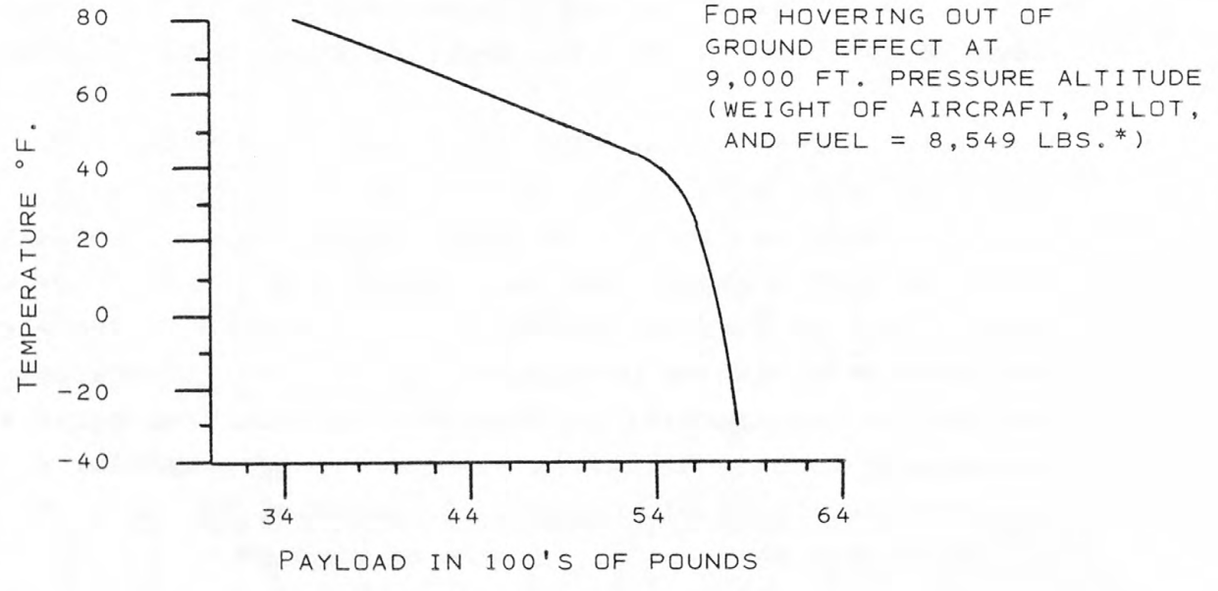
GROSS WEIGHT AND PAYLOADS AT 9,000 FT. PRESSURE ALTITUDE

BELL 214B AND 214B-1

A. GROSS WEIGHT VS. TEMPERATURE



B. PAYLOAD VS. TEMPERATURE



* INCLUDES TWENTY MINUTE FUEL RESERVE

WE RECOMMEND THE MISSION PROFILE SHOWN BELOW:

HOURLY MISSION PROFILE: 4 ROUND TRIP/HOUR

		Fuel load, Pounds	Elapsed Time, Minutes	Cumulative Flight Time, Min.
1)	WARM UP AND TAKE OFF	654	2.0	2.0
2)	HOGE PICK UP EXT. LOAD #1		1.5	3.5
3)	CRUISE OUTBOUND @ 75 MPH 3.5 MILES		3.0	6.5
4)	HOGE DEPOSIT LOAD #1		1.0	7.5
5)	CRUISE INBOUNT, NO LOAD @ 75 MPH		3.0	10.5
6)	HOGE PICK UP EXT. LOAD #2		1.5	12.0
7)	CRUISE OUTBOUND		3.0	15.0
8)	HOGE DEPOSIT LOAD #2		1.0	16.0
9)	CRUISE INBOUND		3.0	19.0
10)	LAND WITH 20 MIN. RESERVE & REFUEL (ADD 19 MIN. FUEL = 47.5 GAL., 319 LBS.)	335	7.0	-
11)	WARM UP AND TAKEOFF	654	2.0	21.0
12)	HOGE PICK UP EXT. LOAD #3		1.5	22.5
13)	CRUISE OUTBOUND		3.0	25.5
14)	HOGE DEPOSIT LOAD #3		1.0	26.5
15)	CRUISE INBOUND		3.0	29.5
16)	HOGE PICK UP LOAD #4		1.5	31.0
17)	CRUISE OUTBOUND		3.0	34.0
18)	HOGE DEPOSIT LOAD #4		1.0	35.0
19)	CRUISE INBOUND		3.0	38.0
20)	LOAD WITH 20 MIN. RESERVE SERVICE AIRCRAFT - PILOT REST PERIOD	335	15.0	-

TOTAL ELAPSED TIME 60 MINUTES: FLIGHT TIME 38 MIN.

AT FIRST GLANCE, THE 20-MINUTE FUEL RESERVE REQUIREMENT MAY SEEM EXCESSIVE, CONSIDERING THE AIRCRAFT IS NEVER MORE THAN 4 TO 5 MINUTES FROM A REFUELING PAD.

HOWEVER, MOST HELICOPTERS ARE EQUIPPED WITH A 20-MINUTE FUEL WARNING LIGHT WHICH PRODUCES A 'PREDICTABLE AND INGRAINED' PILOT REACTION WHEN IT COMES ON. HELICOPTER MANUFACTURERS ALSO WARN THAT CERTAIN MANEUVERS PERFORMED WITH LESS THAN A 20-MINUTE SUPPLY CAN CAUSE THE FUEL PUMPS TO SUCK AIR RESULTING IN FLAMEOUT IN TURBINE AIRCRAFT. A MODEST PAYLOAD REDUCTION OF ABOUT 335 LBS., IS REQUIRED TO MAINTAIN A 20-MINUTE FUEL RESERVE AND WE RECOMMEND FOLLOWING THE PROCEDURE STRICTLY. CARGOS THAT MIGHT REQUIRE DECREASING THE FUEL LOAD SHOULD BE RE-SCHEDULED FOR TRANSPORT DURING COOLER PERIODS WHEN LIFT IS SIGNIFICANTLY INCREASED.

FUEL REQUIREMENTS HAVE BEEN DEVELOPED THAT ARE CONSISTENT WITH FLIGHT TIMES SHOWN IN THE MISSION PROFILE AND THE 20-MINUTE RESERVE RECOMMENDATION:

FUEL REQUIREMENT: 19 MIN. FLIGHT + 20 MIN. RESERVE = 39 MINUTES OF FUEL

FUEL CONSUMPTION: BELL 214 - 150 GALLONS/HOUR @ 6.71 LBS/GALLON (2.5 GALLONS/MINUTE)

AMOUNT & WEIGHT OF FUEL: 39 MINUTES X 2.5 GPM = 97.5 GALLONS
97.5 GALLONS X 6.71 LBS/GALLON = 654 LBS.

WE HAVE USED THIS FUEL WEIGHT AND BELL'S ESTIMATED WEIGHT OF THE 214 IN EXTERNAL LOAD CONFIGURATION TO PREPARE THE PAYLOAD VS TEMPERATURE DIAGRAM (FIGURE 10. B).

AIRCRAFT WEIGHT (EXTERNAL LOAD CONFIGURATION)	7715 LBS.
PILOT	180
FUEL	654
	8549 LBS.

THE ALLOWABLE GROSS WEIGHT FOR HOVERING OUT OF GROUND EFFECT AT 9,000 FEET MINUS 8549 LBS. REPRESENTS THE PAYLOAD. THE GROSS WEIGHT-VERSUS-TEMPERATURE FUNCTION SHOWN IN FIGURE 10.A WAS DEVELOPED USING BELL HELICOPTER'S DATA.

PERFORMANCE OF THE BOEING CHINOOK HAS BEEN ESTABLISHED FROM THE MANUFACTURER'S SPECIFICATIONS.

EMPTY WEIGHT OF THE UTILITY MODEL CHINOOK IS 21, 112 LBS. ITS FUEL CONSUMPTION IS 413 GALLONS PER HOUR. WE HAVE CALCULATED THE CHINOOK'S PAYLOAD FOR THE SAME MISSION PROFILE AND FUEL REQUIREMENTS USED FOR THE MEDIUM HELICOPTER.

FUEL REQUIREMENT: 19 MINUTE FLIGHT + 20 MIN. RESERVE = 39 MINUTES

FUEL CONSUMPTION: 413 GALLONS/HOUR @ 6.71 LBS/GALLON
6.88 GAL/MIN.)

AMOUNT & WEIGHT OF FUEL: 6.88 GAL/MIN. X 39 MIN. = 269 GALLONS
269 GALLONS X 6.71 LBS/GALLON = 1805 LBS.

BOEING'S PERFORMANCE DATA FOR HOVERING OUT OF GROUND EFFECT INDICATE AN ALLOWABLE GROSS WEIGHT OF ABOUT 45,000 LBS., AT A PRESSURE ALTITUDE OF 9,000 FEET AND A STANDARD TEMPERATURE OF 23.5°C (74.3°F)*. PAYLOAD IS CALCULATED BELOW.

ALLOWABLE GROSS WEIGHT	45,000 LBS.
AIRCRAFT WEIGHT	-21,112
FUEL	- 1,805
PILOT	- 180
PAYLOAD	21,903 LBS.

THE CHINOOK CAN EASILY TRANSPORT ALL OVERWEIGHT ITEMS LISTED IN TABLE 10.

*DETAILED PERFORMANCE-VERSUS-TEMPERATURE SPECIFICATIONS WERE NOT AVAILABLE TO US DURING THE STUDY. HOWEVER, LIFT WILL INCREASE AS TEMPERATURE DROPS. IF THE BOEING 234 MEETS THE REQUIREMENTS AT 74.3°F, IT WILL EXCEED THEM AT LOWER TEMPERATURES.

7.4 Estimated Flight-Hour Costs and Availability:

A survey of companies providing Bell 214 helicopters revealed a confusing array of price schedules. Rates depend on length of time an aircraft is used and the number of flight-hours involved.

Short-term use of a 214 costs about $2000 per flight hour. Longer term use is billed at $90,000 per month plus $800 per flight hour. Several companies were willing to negotiate fixed fee for a year's contract.

None of the companies contacted were willing to offer a quote for a 1982 starting date, but a planning number of $1,600,000 for a 12-month contract of roughly 1700 flight-hours emerged. This amount is substantially lower than the quoted monthly rates:

Regular Rate:

12 months	@ 90,000	=	$1,080,000
1700 hrs	@ 800	=	$1,360,000
			$2,440,000

Negotiated Rate:

12 months	$1,600,000
1700 hrs	included
	$1,600,000

Considering that the purchase price of a Bell 214 is about $1,800,000, the negotiated rate seems reasonable in light of normal amortization, operating and maintainance costs, and profit ascribed to an aircraft by commercial operators.

At present, there are no Boeing Chinooks in commercial operation in the United States. Boeing representatives indicate the company's production of Chinooks is committed through 1981 and that prospects of diverting a unit, even for a short period of time, are discouraging. The company, itself, sought purchaser approval to divert a unit for display at the annual Paris Air Show but was rejected.

With regard to availability in 1982, however, Boeing reports that options held by two U.S. commercial operators have been converted to firm contracts for delivery in '82. We agreed not to identify the firms but both are credible companies that provide reliable commercial service.

Pending a quote from the firms, themselves, probable flight-hour costs of $7,500 were estimated by Boeing. This compares favorably with Evergreen Helicopters rates for their Skycranes. Scheduling the Chinooks must be done well before project start-up, but maximum cooperation of the operators is expected because of the potential market for support services in oil and gas production.

Estimated project costs include 16 hours use of the Chinook plus two ferry runs of 10 hours each. Sixteen hours is more air time than is required to mobilize overweight loads but, as the drilling operator may wish to transport other equipment and supplies while the heavy air craft is available, we have included some extra time.

Estimated costs of helicopter support are outlined below:

HEAVY-LIFT HELICOPTER: BOEING CHINOOK MODEL 234
AVAILABLE 1982 COST: APPROX. $8,000,000

FLIGHT TIME:	16 HRS.@ $7,500	$ 120,000
FERRY TIME:	20 HRS @ $7,000	140,000
	SUBTOTAL:	$ 260,000

MEDIUM-LIFT HELICOPTER: BELL MODEL 214
AVAILABLE 1981 COST: APPROX. $1,800,000

12 MONTH CONTRACT FOR 1700 HRS.	$1,600,000
SUBTOTAL:	$1,860,000
CONTINGENCY @ 10%	186,000
TOTAL ESTIMATED COST:	$2,046,000

7.5 RISK:

THE NATIONAL HELICOPTER ASSOCIATION PROVIDED ACCIDENT, INJURY, AND FATALITY STATISTICS FOR HELICOPTER OPERATIONS. * FEDERAL REGULATIONS REQUIRE ALL ACCIDENTS, REGARDLESS OF THE AMOUNT OF DAMAGE OR SERIOUSNESS, TO BE REPORTED. CONSEQUENTLY, ACCIDENT RATES APPEAR QUITE HIGH. SERIOUS ACCIDENTS, RESULTING IN MAJOR DAMAGE AND INJURY, AND FATAL ACCIDENTS ARE INCLUDED IN THE TOTALS BUT, BECAUSE OF THEIR OBVIOUS IMPORTANCE IN ASSESSING PERSONNEL RISK, THEY ARE ALSO REPORTED SEPARATELY.

* SEE TABLE 13.

TABLE 13.

ACCIDENT, INJURY, AND FATALITY STATISTICS FOR HELICOPTER OPERATIONS

1979

TOTAL HOURS FLOWN	2,555,235	(ESTIMATED)
ACCIDENTS	279	
SERIOUS ACCIDENTS, CRASHES, RESULTING IN INJURY OR DEATH	67	
ACCIDENTS RESULTING IN INJURY	33	
NUMBER OF PEOPLE INJURED	64	
ACCIDENTS RESULTING IN FATALITIES	34	
NUMBER OF DEATHS	61	
ACCIDENT RATE	10.91	(PER 100,000 HOURS)
CRASH FREQUENCY	2.62	
ACCIDENT WITH INJURY RATE	1.29	
INJURY RATE	2.50	
FATAL ACCIDENTS RATE	1.33	
FATALITY RATE	2.39	

1980

TOTAL HOURS FLOWN	2,800,000	(ESTIMATED)
ACCIDENTS	299	
SERIOUS ACCIDENTS, CRASHES, RESULTING IN INJURY OR DEATH	81	
ACCIDENTS RESULTING IN INJURIES	36	
NUMBER OF PEOPLE INJURED	60	
ACCIDENTS RESULTING IN DEATH	45	
NUMBER OF DEATHS	94	
ACCIDENT RATE	10.68	(PER 100,000 HOURS)
CRASH FREQUENCY	2.89	
ACCIDENT WITH INJURY RATE	1.29	
INJURY RATE	2.14	
FATAL ACCIDENT RATE	1.61	
FATALITY RATE	3.36	

RISK ESTIMATES CONNECTED WITH HELICOPTER MOBILIZATION AND SUPPORT OF DRILLING GETTY-RESERVE'S BEAR THRUST WELL ARE BASED ON 1720 FLIGHT HOURS. THE PILOT WILL BE FLYING ALONE 85 PER CENT OF THAT TIME.

PILOT AND CARGO ONLY	1462 HOURS
PILOT AND PASSENGERS	258 HOURS
TOTAL HOURS	1720

WITH ONLY THE PILOT IN THE HELICOPTER, INJURY AND DEATH RATES ARE PROJECTED FROM THE 'ACCIDENT-WITH-INJURY' AND 'FATAL ACCIDENT' RATES. WHEN PASSENGERS ARE ABOARD, THE OVERALL INJURY AND FATALITY RATES ARE USED TO PROJECT PROBABLE 'HAPPENINGS'. A SAMPLE CALCULATION OF THE 'ADJUSTED' INJURY RATE FOR THESE CIRCUMSTANCES IS SHOWN BELOW:

PILOT ONLY	1.29 X 1462 =	1885.98
PILOT & PASSENGERS	2.14 X 258 =	552.12
	1720	2438.10

ADJUSTED RATE = 2438.10÷1720 = 1.42 PER 100,000 HOURS

THE ADJUSTED FATALITY RATE IS A SIMILAR CALCULATION

BASED ON 1980 STATISTICS, OUR ESTIMATES OF THE NUMBER OF ACCIDENTS, CRASHES, INJURIES, AND DEATHS WHICH MIGHT OCCUR WITH HELICOPTER MOBILIZATION IS:

ACCIDENTS = 10.68 ÷ 100,000 X 1720 = 0.184
CRASHES = 2.89 ÷ 100,000 X 1720 = 0.050
INJURIES = 1.42 ÷ 100,000 X 1720 = 0.024
DEATHS = 1.87 ÷ 100,000 X 1720 = 0.032

MAKING A 'NUMBERS GAME' OF HUMAN INJURY OR DEATH CAN SEEM AN UNCONSCIONABLE EXERCISE, YET THE NEED TO ANALYZE RISK IS UNDENIABLE. UNFORTUNATELY, THE ONLY TOOLS WE HAVE ARE NUMBERS.

TO PLACE RISK IN PERSPECTIVE, THE STATISTICAL DATA CAN BE STATED ANOTHER WAY. IF THE PROPOSED HELICOPTER MOBILIZATION WERE REPEATED 5.43 TIMES, ONE ACCIDENT MIGHT OCCUR; REPEAT IT 20.0 TIMES AND ONE CRASH MIGHT BE EXPECTED; 41.66 TIMES AND SOMEONE MIGHT BE INJURED; 31.25 TIMES AND A FATALITY COULD RESULT.

THE READER MUST BEAR IN MIND THAT THESE RISK LEVELS REPRESENT THE HELICOPTER INDUSTRY'S OPERATIONS AS A WHOLE, AND ARE NOT A FUNCTION OF A PARTICULAR HELICOPTER USED IN THIS PARTICULAR APPLICATION. STRICT ADHERENCE TO PROVEN SAFETY PROCEDURES CAN CUT THIS RISK BY AT LEAST 50%.

8.0 PROJECT LOGISTICS

8.1 Sling Load Breakdown:

Sling load breakdown for all ancillary drilling equipment and supplies are tabulated in Table 14. Drilling components were listed previously in Section 4.6. Cost estimates for each item are included for easy reference.

TABLE 14. SLING LOAD BREAKDOWN - EQUIPMENT AND SUPPLIES

Item	Minimum Dimensions	Minimum Unit Wt.	Total Weight Pounds	Loads @ 4,000# Or Under Calc.	Loads @ 4,000# Or Under Actual	Unit Cost	Total Cost	F.O.B. Cost Jackson Wyoming	Lifts Per Hour One Helicopter	Hours, One Helicopter	Total Hours
Stabilization 26" Hole											
2 Non-Rotating Stab. Mandrel	8"x8'	1,160	2,320			$ 410.00		$ 820.00			
2 Non-Rotating Sleeves	26"x18"	150	300			1,525.00		3,050.00			
1 Equalizer	8 1/4"x7 1/2'	1,190	1,190	1	1			6,000.00	4	.25	
			3,810			NET 30 DAYS RENTAL		$9,870.00			.25
Stabilization 20" Hole											
2 Non-Rotating Stab. Sleeves	20"x18"	125	250			$ 410.00		$ 820.00			
						NET 30 DAYS RENTAL		9,870.00			
Stabilization 17 1/2" Hole											
Non-Rotating Stab. Sleeves	17 1/2"x18"	84	168			$ 950.00		$ 1,090.00			
4 Knockout Blade Stabilizer Body	17 1/2"x8'	2,060	8,240					3,900.00			
4 Sets Stabilizer Blades, Install.		384	1,536			3,360.00		13,440.00			
12 Sets Stabilizer Blades, replace.		384	4,608			3,360.00		40,320.00			
2 Short Drill Collars	8"x10'	1,508	3,016			1,015.00/30 Days		2,030.00			
2 3-Pt. Roller Reamers	17 1/2"x7 1/2'	2,300	4,600			1,400.00		2,800.00			
8 Sets Hard Cutters		239	1,912	6.1	7	4,960.00		39,680.00	4	1.75	
			24,330					$101,230.00			1.75
Stabilization 12 1/4" Hole											
2 Non-Rotating Stab. Sleeves	12 1/4"x18"	60	120			$ 590.00		$ 1,180.00			
4 Knockout Blade Stabilizer Bodies	12 1/4"x8'	1,700	3,400			475.00		1,900.00			
16 Sets Replacement Blades		384	6,144			3,360.00		53,760.00			
2 6-Pt. Roller Reamers	12 1/4"x13'	2,230	4,460			1,400.00		2,800.00			
2 Sets Hard Reamer Cutters Installed		140	280			2,510.00		5,020.00			
6 Sets Replacement Cuters (Med.)		136	816			1,350.00		8,100.00			
6 Sets Replacement Cutters (Hard)		140	840			2,510.00		15,060.00			
			16,060	4.1	5			$87,820.00	4	1.25	1.25
Stabilization 8 3/4" Hole											
4 Blade Stabilizers	8 3/4"x6'	630	2,520			$ 350.00		$ 1,400.00			
4 Sets Blades Installed		120	480			1,760.00		7,040.00			
12 Sets Replacement Blades		120	1,440			1,760.00		21,120.00			
2 Short Drill Collars	6 1/4"x8'	724	1,448			530.00/30 days		1,060.00			
2 6-Pt. Roller Reamers w/Cutters	8 3/4"x10'	1,160	2,320			1,050.00		2,100.00			
2 Sets Rollers Installed Med.		45	90			710.00		1,420.00			
2 Sets Rollers Installed Hard		44	88			1,300.00		2,600.00			
6 Sets Replacement Rollers Med.		45	270			710.00		4,260.00			
6 Sets Replacement Rollers Hard		44	264			1,300.00		7,800.00			
			8,920	2.2	3			$48,000.00	4	.75	.75
Stabilization 6" Hole											
2 6-Pt. Roller Reamers	6"x8'9"	492	984			$1,050.00		$ 2,100.00			
4 3-Pt. Roller Reamers	6"x5'6"	242	968			450.00		1,800.00			
6 Roller Reamer Cutters Installed		18	108			585.00		3,510.00			
2 Reamer Cutters Hard		17	34			1,240.00		2,480.00			
18 Reamer Cutters Medium		18	324			585.00		10,530.00			
6 Reamer Cutters Hard		17	102			1,240.00		7,440.00			
2 Short Drill Collars	4 1/8"x8'	315	630			425.00/30 days		850.00			
			3,150	1	1			$13,420.00	4	.25	.25
Drill Stem Test Tools			10,000	2.5	3	$4,500.00		$31,500.00	4	.75	.75
Flange Spool & Slips-1			3,755	1	1				4	.25	.25
11-8" Drill Collars	1-8"x25'	3,925	43,175	11	11				4	2.75	
10-6" Drill Collars	1-6"x31'	2,573	25,730	10	10				4	2.5	
24-4" Drill Collars	1-4"x31'	3,255	26,040	8	8				4	2	
TOTALS			94,945								7.25
18,000' 4 1/2" Drill Pipe 16.60	7-4 1/2"x31'	3,602.2	298,800	82.9	83				4	20.75	
18,000' 3 1/2" Drill Pipe 15.50	8-3 1/2"x31'	3,999	279,000	69.8	70				4	17.50	
								TOTAL D.P.			38.25
CASING											
						PER 100'					
Franklin 180'30" 157.6#	1-30"x25'	3,940	28,368	7.2	8	5,475.00	9,855.00	10,374.36	4	2	
Boviard 5,600'20" 169#	1-20"x23'	3,887	946,400	243.5	244	13,065.00	731,640.00	781,515.30	4	61	
Lone Star 8,400' 13 3/8-88.2	1-13 3/8"x45'	3,969	740,880	186.7	187	9,205.38	773,245.20	817,372.10	4	46.75	
800' 13 3/8-81.4	2-13 3/8"x24'	3,907	65,120	16.7	17	7,636.40	61,091.20	64,969.20	4	4.25	
800' 13 3/8-88.2	1-13 3/8"x45'	3,969	70,560	17.8	18	8,271.26	66,170.10	70,372.00	4	4.50	
3,000' 9 5/8-62.8	2-9 5/8"x31'	3,893	188,400	48.4	49	6,057.84	181,735.20	192,954.60	4	12.25	
3,400' 9 5/8-53.5	2-9 5/8"x37'	3,959	181,900	45.9	46	3,876.15	131,789.10	142,621.50	4	11.50	
16,000' 7" 29.0	4-7"x34'	3,944	464,000	117.6	118	2,173.38	347,740.80	369,612.80	4	29.50	
1,100' 7" 32.0	3-7"x41'	3,936	35,200	8.9	9	3,062.80	33,690.90	35,538.90	4	2.25	
Boviard 1,200' 5"-23	5-5"x34'	3,910	27,600	7.1	8	3,183.00	38,196.00	38,196.00	4	2	
TOTAL			2,748,428	699.8	704		$2,375,153.50	$2,613,526.76			176.00

TABLE 14. (CONTINUED)

Item	Minimum Dimensions	Minimum Unit Wt.	Total Weight Pounds	Loads @ 4,000# Or Under Calc.	Loads @ 4,000# Or Under Actual	Unit Cost	Total Cost	F.O.B. Cost Jackson Wyoming	Lifts Per Hour One Helicopter	Hours, One Helicopter	Total Hours
1 36" Hole Opener	36"x84"	2,600	2,600	1	1	$ 3,400.00	$ 3,400.00	$ 3,400.00	4	.25	
8 26" Mill Tooth Bits	26"x36"	1,204	9,632	2.4	3	8,899.00	71,192.00	71,192.00	4	.75	
8 20" Mill Tooth Bits	20"x36"	653	5,224	1.3	2	5,247.00	41,976.00	41,976.00	4	.5	
6 17 1/2" Mill Tooth Bits	17 1/2"x30"	536	3,216	1	1	4,763.00	28,578.00	28,578.00	4	.25	
6 17 1/2" Insert Bits	17 1/2"x30"	569	3,418	1	1	10,742.00	64,452.00	64,452.00	4	.25	
6 12 1/4" Mill Tooth Bits	12 1/4"x24"	192	1,152	1	1	1,963.00	11,778.00	11,778.00	4	.25	
16 12 1/4" Insert Bits	12 1/4"x24"	224	3,584	1	1	5,137.00	82,192.00	82,192.00	4	.25	
3 8 3/4" Mill Tooth Bits	8 3/4"x18"	90	270	-	-	905.00	2,715.00	2,715.00	-	-	
5 8 3/4" Insert Bits	8 3/4"x18"	90	450	-	-	3,317.00	16,585.00	16,585.00	-	-	
1 6" Mill Tooth Bit	6"x12"	36	36	-	-	787.00	787.00	787.00	-	-	
2 6" Insert Bits	6"x12"	39	78	-	-	2,345.00	4,690.00	4,690.00	-	-	
2 6" Diamond Bits	6"x12"	50	100	-	-	9,000.00	18,000.00	18,000.00	-	-	
2 6" Core Heads	6"x12"	25	50	1	1	7,500.00	15,000.00	15,000.00	4	.25	
1 Core Barrel (2 pieces)	5"x30'	2,000	2,000	1	1	6,000.00	6,000.00	6,000.00	4	.25	
			31,806	10.7	12		$367,345.00	$367,345.00			3
Fishing Tools	-	2,000	2,000	1	1			$ 38,000.00	4	.25	.25
800' Water Well Casing	5-7"x40'	4,000	16,000	4	4	$ 847.00	$ 8,470.00	$ 9,310.00	4	1	1
Mud Cleaner	8'x10'x4'	3,500	3,500	1	1	$ 170.00	$ 62,075.00	$ 62,075.00	4	.25	
Mud Cleaner Pump	8'x10'x4'	3,500	3,500	1	1	55.00	20,050.00	20,050.00	4	.25	
			7,000	2	2		$ 82,125.00	$ 82,125.00			.5
H_2S Safety Oilind	60"x80"x50"	3,950				$ 432.00		$108,000.00			
Extra Escape Packs		750	4,700	1.2	2 Supvn.	575.00		14,375.00	4	.5	
								$122,375.00			.5
Mud Tanks - 15	5'x6'x20'	3,450	51,750	15	15	$3,400	$51,000	$61,200.00	4	3.75	3.75
Pipe Racks - 20	36"x36"x30'	4,000	10,000	2.5	3	$ 750	$15,000	$18,000.00	4	.75	.75
Fuel:Tanks Storage											
2 Rubber Storage	5'x5'x12'	670	1,340	1	1	$6,617.50	$13,235.50	$14,000.00	4	.25	.25
5-Fuel Tanks, Supply	42"x82" Empty	1,000				$1,586.50	$ 7,932.50	$ 8,195.00			
Fuel	400 gal.	3,920	3,197,400	815.7	816	.95/gal.		$416,100.00	4	204	204.25
TOTAL								$438,295.00			
MUD: 180'36" Hole	35 sacks gel equiv.	4,000	62,500	15.6	16	SEE DETAIL SHEET		$ 4,600.00	4	4	4
5,600'26" Hole	35 sacks gel equiv.	4,000	593,450	148.4	149	SEE DETAIL SHEET		$168,596.00	4	37.25	37.25
10,000'17 1/2" Hole	35 sacks gel equiv.	4,000	6,726,400	1,681.6	1,682	SEE DETAIL SHEET		$982,175.00	4	420.5	420.5
15,400'12 1/4" Hole	35 sacks gel equiv.	4,000	1,150,400	287.6	288	SEE DETAIL SHEET		$497,440.00	4	72.0	72.0
17,400'8 3/4" Hole	35 sacks gel equiv.	4,000	793,100	184.8	185	SEE DETAIL SHEET		$261,770.00	4	46.25	46.25
18,000'6" Hole	35 sacks gel equiv.	4,000	392,150	98	98	SEE DETAIL SHEET		$238,165.00	4	24.5	24.5
TOTALS			9,718,000					$2,152,746.00			604.5
Propane Tanks - 25	37"x37"x10'	2,976	74,400	25	25	366.60	7,665.00	15,683.52	4	6.25	
									Total Propane		6.25
Liner Hanger											
13 3/8" x 9 5/8"	4'x3'x9'	2,000	2,000		1			29,676.00	4	.25	
7" x 5"	4'x3'x9'	2,000	2,000		1			11,680.00	4	.25	
								$41,356.00	Total Liner Hanger		.5

TABLE 14. (CONTINUED)

		Minimum Dimensions	Minimum Unit Wt.	Total Weight Pounds	Loads @ 4,000# Or Under Calc.	Loads @ 4,000# Or Under Actual	Unit Cost	Total Cost	F.O.B. Cost Jackson Wyoming	Lifts Per Hour One Helicopter	Total Hours, One Helicopter	Total Hours
	CEMENT & CEMENT EQUIP.											
HOWCO	2 total units cement pump equipment	20'x4'		17,440	4	4)	650.00/day for 365 days		$237,250.00	4	1.00	
	1 mixing unit	20'x4'	4,000	4,000	1	1)				4	.25	1.25
	Cement 30"x36"	35sx"G"	4,000	64,801	16.2	17	(including float equip.)		$ 14,150.00	4	4.25	4.25
	Cement 20"x26"	35sx"G"	4,000	558,250	139.6	140	(including float equip.)		$118,900.00	4	35	35
	Cement 13 3/8"x17 1/2"	35sx"G"	4,000	107,916	27.0	27	(including float equip.)		$ 27,900.00	4	6.75	6.75
	Cement 9 5/8"x12 1/4" Liner	35sx"G"	4,000	202,175	50.5	51			$ 64,000.00	4	12.75	12.75
HOWCO	Cement 7"x8 3/4"	35sx"G"	4,000	59,006	14.8	15	(including float equip.)		$ 23,200.00	4	3.75	
	Cement 5"x6" Liner	35sx"G"	4,000	22,507	5.6	6			$ 15,700.00	4	1.5	
	TOTALS			1,070,375	263.7	266			$263,850.00			66.5
	CAMP: 55 PEOPLE											
	18-BUNK UNITS	10'X28'X8'	4,000	72,000	18	18	(SELL ITEM)		$450,000	4	4.5	
	11-SERVICE UNITS	10'X28'X8'	4,000	44,000	11	11	(SELL ITEM)		INC. ABOVE	4	3.75	
	133-6X6X10' TIMBERS	2'X2'X10'	4,000	13,200	3.3	4	$620/MBF		$ 3,200	4	1.0	
	2-100KW GENERATORS		4,000	8,000	2	2	$100/DAY		$ 36,500	4	0.5	
	CATERING	ESTIMATED AVERAGE OF 40		MEN PER DAY			$35/DAY X 364		$509,600			
				137,200	34.3	35			$999,300		9.75	
roduction Tubing -80-10.7#/ft.		9-2 7/8"x41'	3,948	192,600	48.8	49	$ 1,560.00	$280,800.00	$290,912.00	4	12.3	12.3
ools, Rental & Purchased			4,000	4,000	1	1			$ 5,000	4	.25	.25
Correlation & Perforating			4,000	4,000	1	1			$ 80,000.00	4	.25	.25
Rental Equipment			4,000	4,000	1	1			$ 5,000.00	4	.25	.25
Flowline			4,000	4,000	1	1			$ 5,000.00	4	.25	.25
Valves & Meters			4,000	4,000	1	1			$ 5,000.00	4	.25	.25
Christmas Tree:												
Casing & Tubing Head			4,000	4,000	1	1				4	.25	
Upper Section			4,000	4,000	1	1				4	.25	
Miscellaneous Valves			1,500	1,500	1	1	$170,000.00	$170,000.00	$174,000.00	4	.25	
TOTAL				9,500		3			$174,000.00			.75
Acid, 15,000 gal.@9#/gal.		333 gal.	4,000	135,000	45	45	$ 2.50		$ 37,500.00	4	11.25	
Discharge Pipe & Hoses			4,000	8,000	2	2				4	.5	
Acid Storage Bladders		5'x5'x12'	670	1,340	1	1	$ 6,617.50	$ 13,235.00	$ 14,000.00	4	.25	
TOTAL				144,340		48			$ 51,500.00			12
CALCIUM CHLORIDE		45 sacks @80#	3,600	400,000	111.1	112	$ 30.00	$150,000.00	$1,500,000.00	4	28	28
Stock Tanks 500 bbl		60 pcs. @ 200# ea.	4,000	12,000	3.0	2	$30,000.00	$ 60,000.00	$ 60,630.00	4	.75	

HEAVY LOADS

Wire Line Logging												
Cable & Drum 7 Conductor		10,500		1	1					4	.25	
20,000 Line												
Operating Compartment		10,400		1	1					4	.25	
Drum Support Etc.		3,460	24,360	1	1					4	.25	
TOTALS				3	3				$368,962.00			.75
Drilling Line												
5,000' Spool 1 3/8" @3.5#/ft,		18,000	18,000	1	1					4	.25	
TOTALS				1	1							.25

TABLE 14. (CONTINUED)

	Minimum Dimensions	Minimum Unit Wt.	Total Weight Pounds	Loads Calc.	Loads Actual	Unit Cost	Total Cost	Cost Jackson Wyoming	Lifts Per Hour One Helicopter	Total Hours, One Helicopter	Total Hours
Bulldozer											
D5B 105 H.P.	6'4"x7'1"x11'11"	17,200	25,200	1	(20,000)1				4	.25	
Tracks		5,200		1	1				4	.25	
BLADE		4,000		1	1				4	.25	
Forklift 14,000# Cap.	98 1/2"x143"x84"	19,200	19,200	1	1				4	.25	
											1
Data Unit - 1	8'x9 1/2'x20'	10,000	10,000	1	1	$900.00/day @ 365 days		$328,500.00	4	.25	
											.25
BOP Stack - 1	63 7/8"x41 1/2"x 117 1/4"	16,750	16,750	1	1				4	.25	
Double	34 5/8"x 37 3/4"x										
Single - 1	117 1/4"	9,652	9,652	1	1				4	.25	
Koomey - 1	56"x82"x71"	9,302	9,302	1	1				4	.25	
Spherical B.O.P. - 1	42 1/2"x49"	9,600	9,600	1	1				4	.25	
TOTAL				4	4						1
2-HOWCO Cementer Modules	20'x4'	4,210	8,420	2	2				4	.5	
											.5
Water Well Rig		20,000									
Truck Mount B-80		8,000	28,000	2	2	220.00/HR	30-10 hr. day	$66,000.00	4	.5	.5
Treater	22'x7'x11'	14,660	14,660	1	1			$20,000.00	4	.25	.25
Acidizing Pumps		17,000	102,000	6	6			$20,000.00	4	1.5	1.5

PERIODIC RESUPPLY ITEMS

	Minimum Dimensions	Minimum Unit Weight	Total Weight	Number Loads Calc.	Number Loads Actual	Unit Cost	F.O.B. Jackson Wyoming	Lifts Per Hour Helicopter	Hours	Total Hours Per Day	Helicopter Hours/ Week	Helicopter Hours/ Month	Helicopte Hours/ Year
Diesel Fuel	486 gal. tank	4,000	12,000	3		Per gal. .95	$2,280.00	4	.75				
3 Loads per day	TOTALS						$2,280.00			.75	5.25	21.0	252.00
Lubricants, as needed		4,000	4,000	1				4	.25	.25		2.0	24.0
Food, Resupply		4,000	4,000	1				4	.25	.25	.25	1.0	12.0
Personnel Transfer (Round Trip)		4,000	4,000	1				4	.25	.5	3.5	14	168.0
Propane-8 tanks/mo.		4,000	4,000	1		Per gal. .599	$1,917.00	4	.25	.25	.25	2	24 / 478

8.2 Potential Staging Area Locations:

Poor staging area selection can so adversely affect the feasibility of rig mobilization by helicopter that it becomes a singularly important item in the analysis.

The lifting capacity of any helicopter is significantly impaired at high altitude. Therefore, in selecting a staging area, it is important that the projected flight path to the drill site not require the aircraft to fly unnecessarily high. For example, a flight path that required clearing an 11,000-foot ridge to deliver cargo at a 9,000 foot site should be considered only as a last resort, if at all. If cargo is delivered to a point higher than the staging area, the ideal flight path would be a straight line of constant gradient connecting the two.

Site Selection: Our philosophy in selecting staging areas was to come as close to ideal as conditions allow. We investigated potential areas with regard to:

1. Length and 'quality' of flight path
2. Road access by heavy truck
3. Hazards to safe operations
4. Diurnal and seasonal weather conditions and surface winds
5. Soil load-bearing capacity
6. Requirements for construction or upgrading
7. Proximity to populated areas and dwellings
8. Proximity to animal habitats (breeding grounds, migration routes, etc.) and visual aesthetics
9. Size (storage and marshalling areas and helipads)
10. Site security

For safety, and to reduce visual impact, no sites were considered that would require crossing a major highway. A maximum flight distance of about six miles was chosen to keep flight time to a minimum.

LOCATION AND CONCEPT OF OPERATION: THREE POTENTIAL STAGING AREAS, SHOWN ON FIGURE 1, ARE DESIGNATED AS SITES A, B, AND C. EACH SITE HAS POTENTIAL ADVANTAGES AND DISADVANTAGES THAT WILL BE DISCUSSED BELOW. WE RECOMMEND SITE A AS THE BEST STAGING AREA FOR THE OPERATION.

AT THE SELECTED STAGING AREA, LAYOUT AND OPERATIONS SHOULD BE CONDUCTED SO THAT:

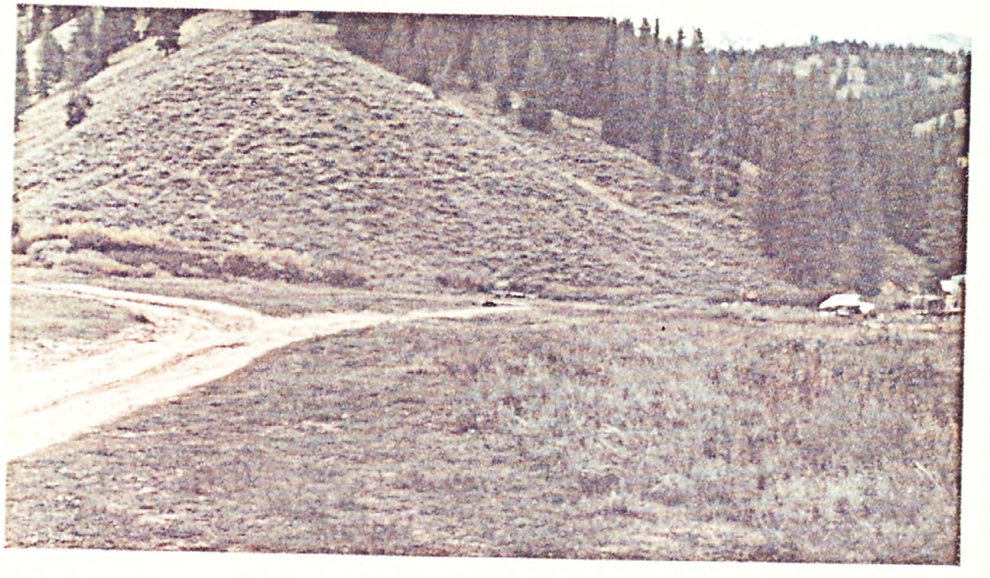
1. FLIGHT PATHS DO NOT CROSS STORAGE PADS OR AREAS WHERE PEOPLE WILL BE WORKING, EXCEPT AT THE PICKUP POINT.
2. THERE IS MINIMUM REHANDLING OF LOADS. WHEREVER POSSIBLE, CARGO SHOULD BE LIFTED DIRECTLY FROM TRUCK BEDS.
3. FUEL HANDLING TAKES PLACE IN AN ISOLATED AREA.
4. ALL SURFACE DRAINAGE IS COLLECTED IN A RETENTION POND SO THAT ANY TOXIC MATERIALS ARE TRAPPED BEFORE THEY CAN ENTER THE SURFACE WATER SYSTEM.
5. TOPSOIL IS STORED FOR RE-USE IN THE RECLAMATION PROGRAM.
6. A QUALIFIED LOADMASTER IS ON SITE DURING ALL ACTIVITIES AND IS RESPONSIBLE FOR SAFE AND ENVIRONMENTALLY SOUND OPERATIONS.
7. A ROUGH-TERRAIN FORK-LIFT IS AT THE STAGING AREA. THIS FORK-LIFT SHOULD BE EQUIPPED WITH A BYPASS VALVE IN THE HYDRAULIC SYSTEM THAT LIMITS ITS LIFTING CAPACITY TO JUST BELOW THAT OF THE HELICOPTERS. THE LIMITING SYSTEM SHOULD BE EQUIPPED WITH A MANUAL OVERRIDE.

SITE 'A' DESCRIPTION:

SITE A STRADDLES THE ROAD ALONG LITTLE GRANITE CREEK AT ITS INTERSECTION WITH ROUGH HOLLOW DRAW (SEE FIGURE 11). THIS LOCATION IS ABOUT 3.4 AIR MILES SOUTHEAST OF THE DRILL SITE.

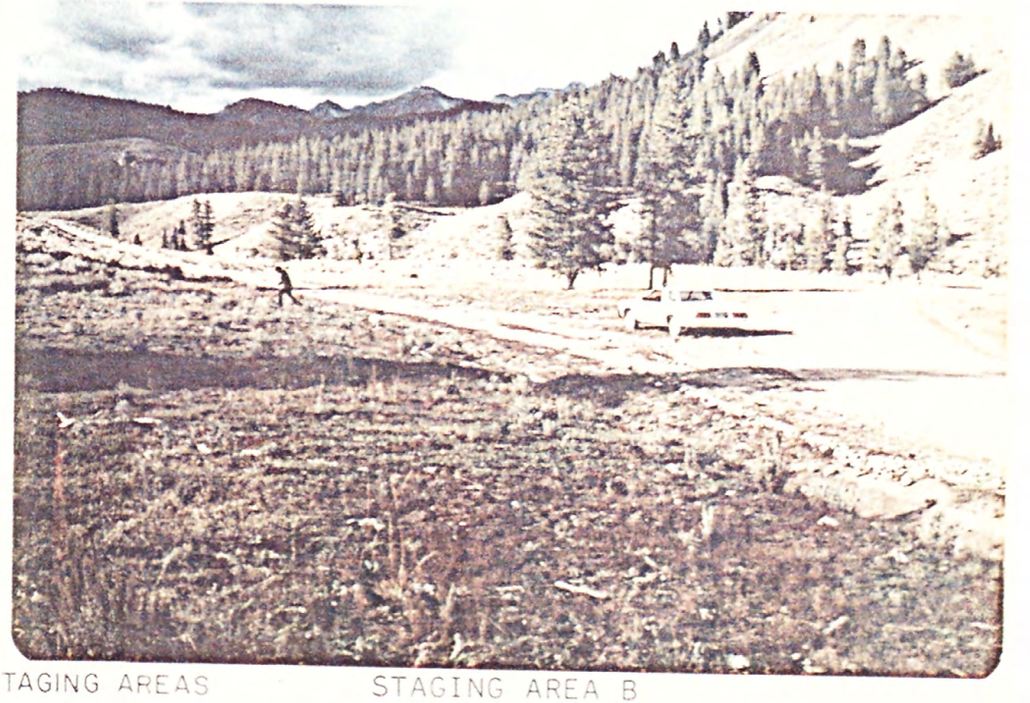
THE AREA IS IN A GENTLY SLOPING, Y-SHAPED MEADOW OVER 1,000 FEET

STAGING AREA A



STAGING AREA A

STAGING AREA B



STAGING AREA B

VIEWS of POTENTIAL STAGING AREAS

FIGURE 11.

LONG FROM NORTH TO SOUTH AND ABOUT 200 FEET WIDE. LITTLE GRANITE CREEK, A PERENNIAL STREAM, FLOWS ALONG THE EAST SIDE OF THE SITE AND IS JOINED FROM THE WEST BY A STREAM FLOWING FROM ROUGH HOLLOW.

VEGETATION CONSISTS OF GRASSES WITH RIPARIAN SCRUB AND SCATTERED PINE TREES. THE MEADOW IS RIMMED BY PINES AND THE SOIL CONSISTS OF ORGANIC SILT AND CLAY. THERE IS A CABIN ON ONE OF SEVERAL PLACER MINING CLAIMS COVERING THE SITE. THERE IS ALSO A TRAILER HOUSE NEARBY THAT WE UNDERSTAND WILL BE MOVED OUT DURING 1981. ALL SURFACE RIGHTS, BEYOND THE PLACER CLAIMS, ARE CONTROLLED BY THE FOREST SERVICE.

THE MAJOR ADVANTAGES AND DISADVANTAGES OF THIS SITE ARE:

ADVANTAGES

- SHORT FLIGHT PATH, WELL SUITED TO MULTIPLE HELICOPTER OPERATIONS.
- REASONABLE ROAD ACCESS.
- MINIMUM HAZARDS TO SAFE HELICOPTER OPERATIONS.
- MINIMUM VISUAL AND NOISE IMPACT OUTSIDE IMMEDIATE STAGING AREA.
- MORE THAN ADEQUATE SPACE FOR OPERATIONS.
- GOOD SECURITY. ACCESS ROAD DEAD-ENDS AT THIS SITE.

DISADVANTAGES

- THE PLACER CLAIMS AND CABINS ARE IN THE STAGING AREA.
- MILES OF ROAD WILL REQUIRE UPGRADING.
- SOME AREAS WITH POOR SOIL WILL REQUIRE EXPENSIVE WORK TO SUPPORT TRUCKS.
- WINTER ACCESS MORE DIFFICULT THAN AT OTHER SITES.
- THE SITE WILL REQUIRE MORE EXTENSIVE SPCC PLAN BECAUSE OF POTENTIAL FOR STREAM POLLUTION.

Site 'B' Description:

Site B is on the south side of Granite Creek about one mile upstream from its confluence with Little Granite Creek. This area is 5 air miles from the drill site and lies about 100 feet above creek level. It is reached from the Granite Creek road by an access road to another nearby oil well.

The site is nearly level and approximately circular with a diameter of about 500 feet. It is bounded on the west and north by Granite Creek and on the east by the access road. Vegetation consists of grass and a few scattered pine trees. Soil is predominantly organic gravely silt. A REA power/telephone line trends approximately north-south bisecting the site which is on Forest Service Land.

The prime advantages and disadvantages of this location are:

Advantages

- Acceptable flight path.
- Excellent road access that requires no improvement.
- Winter access is good. The road will require a minimum plowing distance and has open shoulders.
- Good soil conditions for supporting trucks.
- Very few problems with upgrading. Minimal amount of earthwork required.

Disadvantages

- Longer flight path to drill site.
- Increased flight hazards (i.e. road crossing, dropoff at edge of staging area, etc.)
- Requires moving power/telephone line.
- Small area available for the site.

Site 'C' Description:

Site C is immediately west of the Granite Creek road about 1 mile north of its intersection with U.S. Highway 187 - 189. This area is about 5.2 airline miles from the drill site.

The site is a very large, moderately sloping, open area bounded on the west by steeper slopes and on the east by the Granite Creek road.

Because of extensive earth moving requirements, longer and more difficult flight paths, and greater visual impact, this site is recommended only if technical problems with other sites, such as land ownership or pollution, make them unusable.

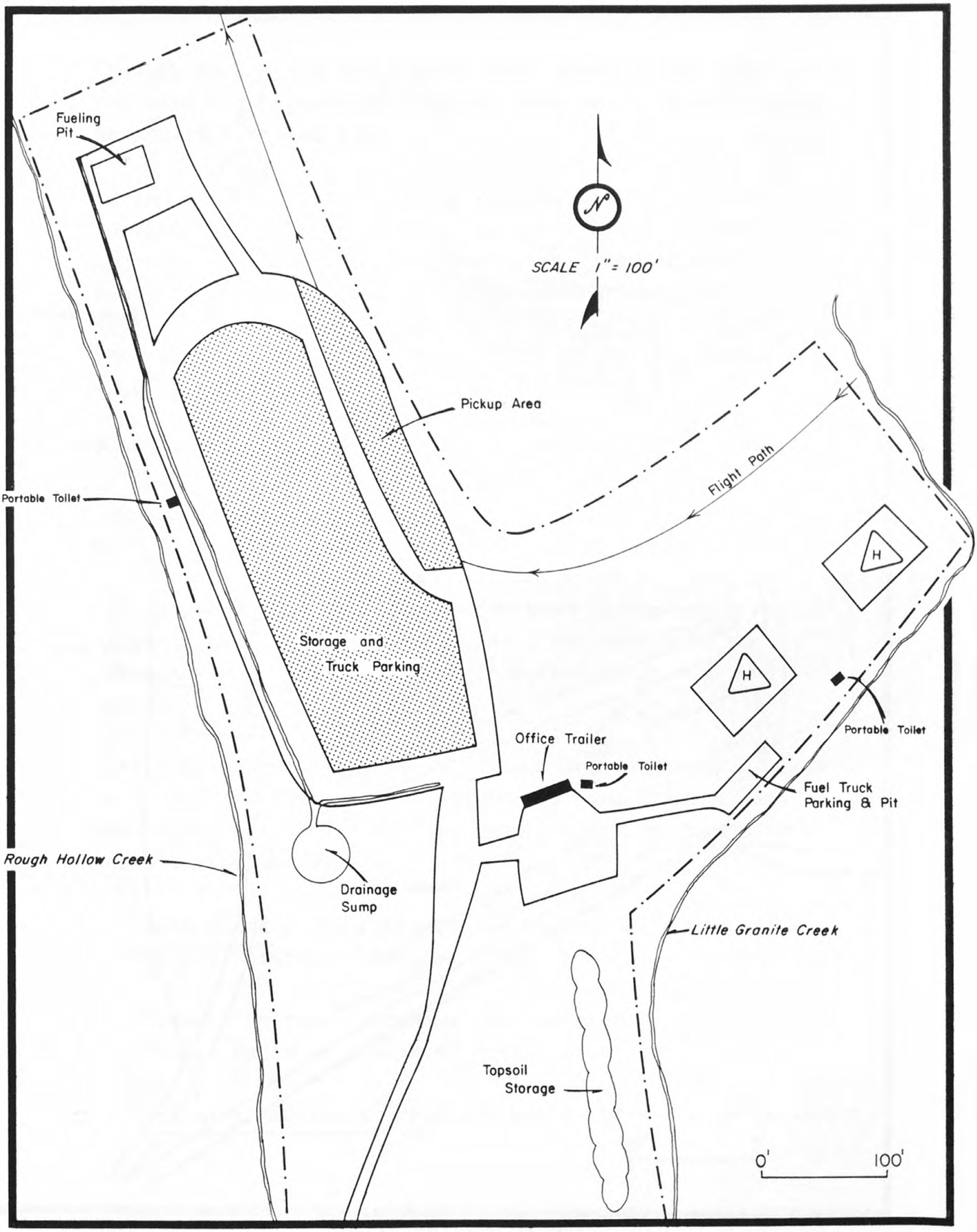
8.3 Staging Area Construction:

Generalized staging area layouts for sites A and B are shown in Figures 12 and 13 , respectively. These layouts are intended to show the concept behind the staging area selection and operation.

Construction in the staging area will be limited to earth work required for all-weather movement and parking of heavy trucks (18,000 lb. axle loads), containment and separation of potential fuel spills and undesirable runoff, and to minimize fugitive dust and potential damage by foreign objects to equipment during helicopter operations. Standard gravel road construction is suitable for all areas except those where helicopter operations are conducted (helipads and pickup areas). There, metalized surface, washed gravel or crushed rock, surface oiling, or other dust stabilizing treatments are required. All topsoil from developed areas should be stored for use during Reclamation.

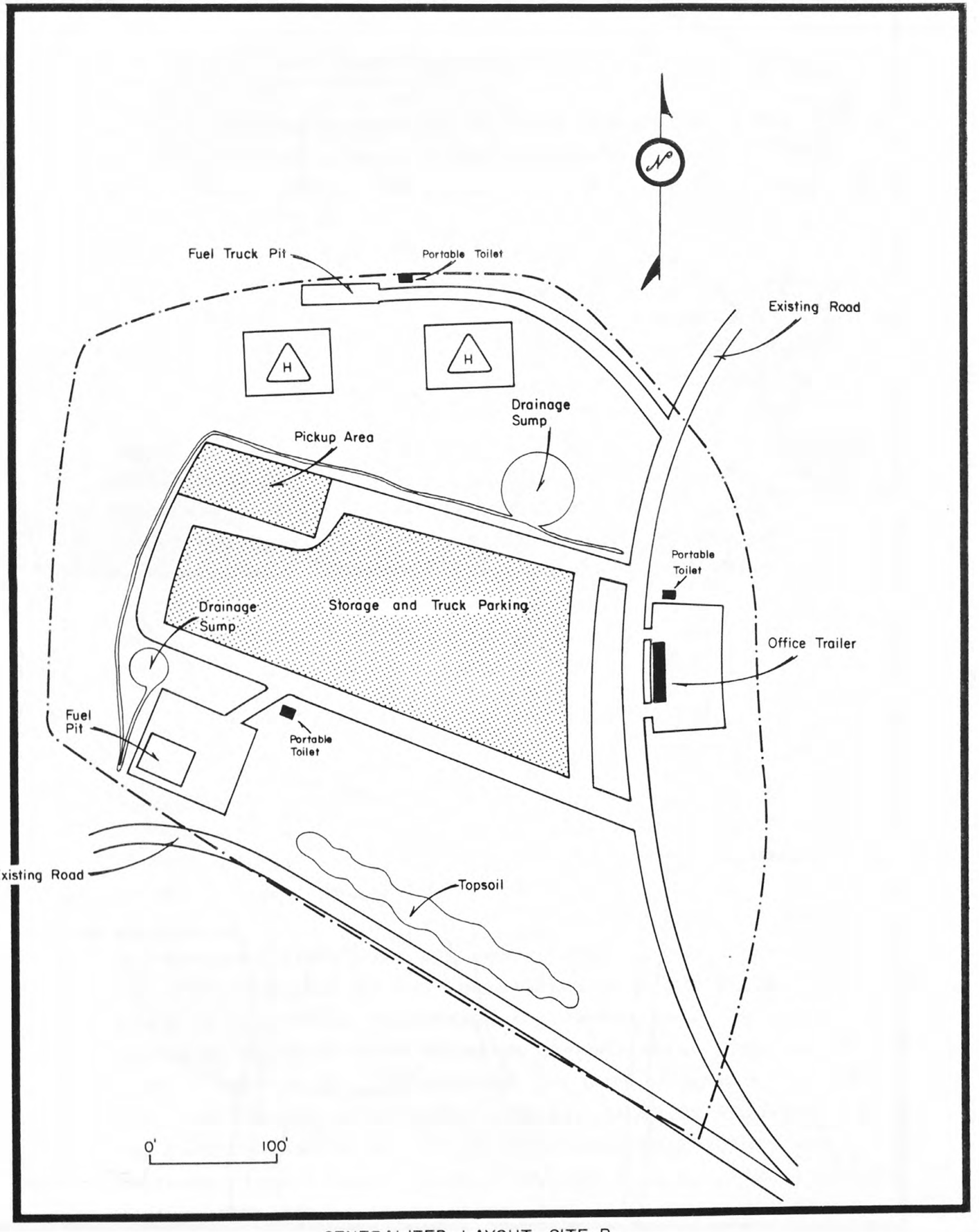
All three sites,but especially Site A (because of the proximity of streams), will need a plan for comprehensive spill prevention and control counter-measures. This plan will require containment areas around all fuel storage sites and will probably require that all runoff from the storage areas be retained, settled, and tested prior to being put into the surface water system.

No permanent structures are anticipated in the staging areas. An office trailer for the Loadmaster and night security officer would be positioned to oversee all operations. This trailer should be provided with means of communicating with the drill site, operating helicopters, and the outside community. Heat and lighting for night operations will also be required. With the expected amount of use of this area, power lines and telephones are probably warranted. At Site A, approximately 2 miles of lines would be needed. A power/telephone line



GENERALIZED LAYOUT, SITE A

FIGURE 12



GENERALIZED LAYOUT, SITE B

FIGURE 13

CROSSES SITE B AND WOULD HAVE TO BE MOVED TO THE EDGE OF THE SITE FOR OPERATIONS. SEVERAL PORTABLE TOILETS SHOULD BE PROVIDED AT THE SITE.

DURING WINTER, EXTENSIVE SNOW REMOVAL WILL BE REQUIRED BETWEEN THE STAGING AREA AND THE JUNCTION OF HIGHWAY U.S. 187 - 189. THIS WILL REQUIRE A ROTARY SNOW PLOW OR A HEAVY BLADE-PLOW BACKED UP BY A TRACTOR DOZER. ON-SITE SUPPLY STORAGE SHOULD BE MINIMIZED DURING THE WINTER TO FACILITATE SNOW REMOVAL. A MOTOR PATROL (GRADER) WILL BE REQUIRED YEAR-ROUND TO MAINTAIN THE ROAD NETWORK AS WELL AS THE STORAGE AREA. A ROUGH-TERRAIN FORK-LIFT WILL BE NEEDED ON-SITE AT ALL TIMES. HOWEVER, IF CARGO IS LIFTED DIRECTLY FROM THE TRUCKS, ONLY ONE LOADER WILL BE REQUIRED. THE CAT 966C, WITH 20,000 LB. LIFT CAPABILITY, IS RECOMMENDED TO INSURE SMOOTH OPERATIONS.

FLIGHT OPERATIONS WILL BE SUPPORTED BY A FUEL TRUCK AND AN ON-SITE MECHANIC. POWER, LIGHT, AND HEAT WILL BE NECESSARY FOR MAINTENANCE AND COLD-WEATHER STARTING OF AIRCRAFT.

DURING HIGH ACTIVITY PERIODS (RIG-UP AND RIG-DOWN), A TEAM OF 10 TO 12 PEOPLE WILL BE REQUIRED AT THE STAGING AREA. NORMALLY, ONLY 4 TO 6 WILL BE NEEDED. KEY POSITIONS AND RESPONSIBILITIES ARE:

LOAD MASTER - RESPONSIBLE FOR OVERALL SITE OPERATION, SAFETY, AIRCRAFT LOADING, SPILL PREVENTION AND CONTROL.

CLERK - TO TALLY INCOMING AND OUTGOING LOADS AND INSURE PROPER ORDER OF TRANSPORT DURING HIGH ACTIVITY PERIODS.

AIRCRAFT MECHANICS - FUELING AND MAINTENANCE OF HELICOPTERS.

Equipment Operators (2 - 4) - to operate loaders, graders, dozers, etc.

Other personnel (2 - 4 men) will be required to attach loads to helicopters, transfer fuel to bladders for transport, direct truck traffic, assist equipment operators and provide other assistance as needed.

During off hours, a security officer should be present to insure against theft and vandalism.

9.0 ROAD ACCESS

9.1 ROUTE:

THE MOST SUITABLE ROUTE TO THE DRILL SITE IS ALONG LITTLE GRANITE CREEK ROAD AND LITTLE GRANITE CREEK PACK-TRAIL ONTO THE RIDGE EAST OF THE DRILL SITE. THE ROAD COULD THEN FOLLOW THE NORTH SIDE OF THE RIDGE ONTO THE PROPOSED LOCATION. THIS ROUTE OPTIMIZES DISTANCE AND GRADE AND MINIMIZES ENVIRONMENTAL DAMAGE.

THE MOST DIRECT ACCESS IS UP ROUGH HOLLOW DRAW FROM THE LITTLE GRANITE CREEK ROAD. HOWEVER, THE EXTREMELY STEEP GRADIENT AT THE UPPER END OF THIS ROUTE IMPOSES DIFFICULT ENVIRONMENTAL AND RECLAMATION PROBLEMS. CONSEQUENTLY, THIS APPROACH IS LESS SUITABLE THAN THE LONGER ONE ALONG LITTLE GRANITE CREEK.

THE PACK-TRAIL ROUTE FOLLOWS THE EAST SIDE OF LITTLE GRANITE CREEK FOR ABOUT 4-1/2 MILES. IT THEN CROSSES THE RIDGE 1,000 FEET EAST OF THE DRILL LOCATION. THE PROPOSED ROAD REQUIRES MOSTLY SIDE-HILL CUTS WITH MOST OF THE CROSS-GRADES ABOVE 50% AND SOME IN EXCESS OF 100% (45°).

SURFACE SOILS ALONG THE ROUTE VARY FROM ALLUVIAL AND COLLUVIAL CLAYS AND SILTS TO LANDSLIDE AND GLACIAL DEPOSITS CONTAINING MANY BOULDER-SIZED ROCKS. LITTLE BEDROCK IS EXPOSED NEAR THE TRAIL. WHERE IT IS EXPOSED, THE ROCKS ARE GRAY SILTSTONE AND SHALE AND A BROWNISH-GRAY, WELL-CEMENTED CONGLOMERATE.

MOST OF THE PACK-TRAIL ROUTE IS FORESTED. IN MANY OF THE STEEPER AREAS VEGETATION HOLDS SURFACE MATERIALS ON SLOPES ABOVE THE ANGLE OF REPOSE.

9.2 Construction and Restoration:

Although the optimal available route follows Little Granite Creek, this approach will also present severe challenges for construction and reclamation. Many of the road cuts will be in unstable surficial materials including clays, silts, and landslide debris. Many slopes are at the angle of repose and are only stabilized by vegetation. Removal of material from these slopes will likely cause slumping and damage well above the actual road cuts. This damage will be difficult to reclaim from the access route and will cause problems in road maintenance, particularly during spring and fall.

Road construction and maintenance will be difficult. However, roads have been built in terrain as demanding as this. The biggest problem in this instance is that the road must be constructed so that it can be reclaimed without conspicuous evidence of its having existed. Because ordinary construction techniques would probably induce landslides, and produce excessive amounts of downslope fill, environmental damage can be expected several hundred feet above and below actual road cuts.

Extreme care will also be required with drainage structures to prevent over-saturation of downhill soil that might cause slumping below the road. Location of topsoil storage sites and careful balancing of cut and fill volume is imperative.

Road construction to the drill site and reclamation of areas to Forest Service standards might well be the biggest difficulty in drilling this hole. That reclamation efforts can meet these standards, at a reasonable cost, is in serious question and accounts for the extreme estimates based on 'experience factor' mentioned in the next section.

9.3 Construction and Maintenance Costs:

Construction, maintenance, and reclamation cost data were obtained from several sources including the U. S. Forest Service District Office, and a private construction contractor who actually visited the site (see Appendix, A.58). Estimates varied widely, due to the difficult construction and reclamation requirements and the lack of soil, rock, and surveying data. We have used, with modification, the highest estimate submitted. It is summarized below:

Activity	Time For Completion	Estimated Cost
Survey, Design, Stake	3 Months	$ 75,000
Construct New Access Road	7 Weeks	410,000
Improve Existing Access Road	1 Week	30,000
Road Maintenance	Duration of Drilling	30,000
Access Road Restoration	8 Weeks	360,000
	TOTAL	$905,000

Exxon Corporation experienced drill road maintenance cost up to $50,000 per month for a site in the Uintah Mountains. Top soil removal and stockpiling for restoration and gravel surfacing wet portions of the road for spring and summer use will also add to costs. We recommend a minimum 30% contingency be added to the estimate bringing total road costs to about $1,175,000. Some estimates by knowledgeable individuals, but based more or less on the 'experience factor', have run as high as $2.5 to $3.0 million for road construction, maintenance and restoration.

The contractor's estimate parameters are listed in Table 15.

EXHIBIT II
PRELIMINARY COST ESTIMATE
ESTIMATED PARAMETERS TO COST ESTIMATE

STATION	INTERVAL FEET	MAXIMUM GRADE, %	CROSS SLOPE, %	TIMBER AREA, ACRES	18" DIA. CULVERT, FT.	CULVERT DIA. IN.,	CULVERT LENGTH FT.	SURFACE EVIDENCE OF ROCK	RESTORATION DIFFICULTY	COMMENT
0+00										BEGIN ROAD AT FORMER MINE SITE
	3500	8 ±	0 to 25	0.6	180	84	60	None	Easy	
35+00										
	800	5 ±	0 to 33	None	30	36	36	None	Easy	
43+00										
	2800	10 ±	40	2.9	150	72	54	Light	Severe	SIDE HILL SECTION ABOVE TRAIL
71+00										
	1400	5 ±	33 t0 0	1.1	90		_	Light	Moderate	
85+00										
	900	10 ±	0 to 33	None	60	72	54	Light	Moderate	CMP INSTALLATION DOWN STREAM OF CONFLU-ENCE SIDE HILL SECTION ABOVE TRAIL.
94+00										
	800	10 ±	40	0.7	30	24	30	Moderate	Severe	
102+00										
	1100	10 ±	40	None	60		_	Moderate	Severe	
113+00										
	600	5 ±	0	0.3	30		_	Moderate	Easy	
119+00										
	3000	10 ±	33	3.4	150	60	46	Heavy	Severe	SWITCH BACKS TO ASCEND SLOPE
149+00										
	3500	10 ±	25 to 0	2.8	210		_	Heavy	Moderate	SWITCH BACKS TO ASCEND SLOPE
184+00										
	2500	5 ±	25 to 0	0.6	150		_	Moderate	Easy	
209+00										
	1800	10 ±	0	None	90	48	40	Light	Easy	
227+00										
	500	10 ±	25	None	30		_	None	Easy	
232+00										
	700	10 ±	40	None	30		_	Light	Severe	
239+00										
	1300	5 ±	25 to 0	None	60		_	None	Easy	
252+00										
	1700	12 ±	40	1.1	90	24	50	None	Severe	
269+00										
	3500	10 ±	25 to 0	None	150		_	None	Easy	
304+00										END ROAD AT WELL SITE
				13.5 A.	1590 FT.					

TABLE 15. COST ESTIMATE PARAMETERS FOR ROAD CONSTRUCTION

10.0 ENVIRONMENTAL ISSUES

10.1 General Comments:

Our feasibility study addresses only those environmental issues unique to helicopter mobilization and support of drilling operations. For the readers' convenience, environmental issues incident to drilling in the Gros Ventre, regardless of mobilization and support alternatives, are outlined here.

10.2 Air and Water Quality:

Air and water quality in the area of the proposed drill, access lanes, and proposed staging areas are very good. Major concerns are air quality degradation due to:

1. Fugitive dust from vehicular traffic and wind erosion of bare areas pending restoration.

2. Dust generated by helicopter rotor blast at the drill site and staging areas.

3. Exhaust particulates spewing from rig power plants, trucks, and turbine helicopters.

4. Accidental gas releases.

and water quality degradation from:

1. Silting caused by road construction and maintenance.

2. Subsequent erosion of denuded areas.

3. Chemical contamination from fuel and drilling fluids.

10.3 Vegetation and Wildlife:

Destroyed forest vegetation requires 20 to 30 years, even with the best restoration efforts, to re-establish itself so that the reclaimed area is no longer noticeable. Disturbed grass and forbe growth on steep slopes is frequently difficult to re-establish because of erosion of newly seeded areas. Myriad problems can accrue in ecologically fragile areas denuded during construction of roads and facilities necessary to support energy development.

Most wildlife species in the area should adjust to the anticipated disturbances but some may abandon the area completely. Excessive denudation could significantly reduce available forage and sustained human activity disrupt normal breeding and migration patterns.

10.4 Land Use and Visual Aesthetics:

The predominant land use is recreational hiking, camping, and hunting. Because of the area's remoteness, however, few individuals use it. Consequently, human activity has little impact on wildlife. Road access might increase recreational use and adversely affect animal populations.

Visual aesthetics are important to recreational users. The introduction of roads, drill rigs, helicopters, and possible oil-gas and gas-production installations is certain to cause concern.

10.5 Noise:

The proposed drill site is sufficiently remote that noise caused by existing human activity is minimal, or negligible. Noise associated with the drilling, itself, and the operation of heavy trucks and helicopters over extended periods is a major concern of recreational users. It may also have an

ADVERSE EFFECT ON WILDLIFE.

10.6 Socio-Economic Concerns:

Residents of the Jackson area have expressed the opinion that industrial development, if not carefully controlled, could become incompatible with established lifestyles and the tourist-based economy, itself. A large influx of workers might further strain public services which are already requiring annual funding increases of 11.5 - 27 percent. There is substantial concern regarding energy development in general but the unique impact of helicopter versus conventional mobilization is negligible.

The broader subject of area-wide socio-economic impact is thoroughly addressed in Project EIS.

11.0 ENVIRONMENTAL EFFECTS OF HELICOPTER MOBILIZATION

11.1 WELL SITE:

AT THE WELL SITE, THE UNIQUE IMPACT OF HELICOPTER MOBILIZATION IS MANIFESTED BY: 1) INCREASED NOISE, 2) DUST GENERATED BY ROTOR BLAST, AND 3) CONSTRUCTION OF HELIPADS.

NOISE IS A CONCERN BECAUSE OF ITS POTENTIAL ADVERSE EFFECT ON WILDLIFE AND ITS LIKELY PERCEPTION AS AN AGGRAVATION TO RECREATIONAL USERS WHO ENJOY THE SOLITUDE OFFERED BY REMOTE AREAS.

IN EVALUATING THE ADDED IMPACT OF HELICOPTERS' NOISE, IT IS IMPORTANT TO ALSO REMEMBER THE SUSTAINED NOISE FROM THE DRILLING OPERATION ITSELF. NOISE LEVELS IN THE IMMEDIATE AREA WILL BE INCREASED SIGNIFICANTLY BY DIESEL ENGINES POWERING THE DRILLING RIG, GENERATORS, AND PUMPS.

NOISE FROM A TYPICAL RIG CAPABLE OF DRILLING THE GETTY WELL HAS A MEASURED AMPLITUDE OF 64 TO 68 DECIBELS AT 1,000 FT. IN FLAT TERRAIN. UNDER CERTAIN CONDITIONS, SOUNDS FROM A LARGE RIG MAY BE HEARD MORE THAN A MILE AWAY.

HELICOPTERS HOVERING AND LANDING AT THE SITE WILL INCREASE NOISE LEVEL BUT WE ANTICIPATE MINIMAL ADDITIONAL EFFECT ON ANIMAL POPULATION.

A REPORT BY VALERIUS GEIST OF THE UNIVERSITY OF CALGARY ENTITLED 'HARASSMENT OF LARGE MAMMALS AND BIRDS' CITES THREE CATEGORIES OF STIMULI CAUSING HARASSMENT:

1. 'STIMULI THAT DEPART FROM THE PREDICTED OR FAMILIAR PHYSICAL AND SOCIAL MILIEU OF THE ANIMAL;

2. 'STIMULI THAT ARE BASED ON 'STIMULUS CONTRAST' (SUDDEN CHANGES IN THE ANIMAL'S VICINITY SUCH AS

QUICK MOVEMENT, LOUD OR PENETRATING SUDDEN NOISES, CLOUDS OF PUNGENT ODORS, OR SUDDEN TACTILE STIMULI);

3. 'STIMULI TO WHICH THE ANIMAL RESPONDS INNATELY WITH ALARM'.

GEIST ADDRESSED RESPONSE TO THE AUDITORY AND VISUAL STIMULI OF AIRCRAFT OVER-FLIGHTS AND OF NOISE IN GENERAL. HIS PREDICTED REACTIONS HAVE BEEN CONFIRMED BY EXPERIENCED HELICOPTER PILOTS WHO HAVE OBSERVED FIRST-HAND THE EFFECT ON SOME PREDATORS, UNGULATES AND FISH.

FOUR CONCLUSIONS RESULT FROM THE COMBINED OBSERVATION OF GEIST AND THE PILOTS:

1. ANIMALS APPEAR TO QUICKLY HABITUATE TO A STATIONARY NOISE SOURCE (SUCH AS A DRILLING RIG) AND, AFTER SOME INITIAL WARINESS, MAY EVEN BE ATTRACTED TO THE SOUND SOURCE.

2. A NOISE SOURCE (OR VISUAL STIMULUS) THAT APPROACHES RAPIDLY BUT THEN MOVES ON, PRODUCES A SOMETIMES VIOLENT INITIAL REACTION BUT REPETITION SEEMS TO PRODUCE ACCOMMODATION. IT IS COMMON TO SEE DEER AND ELK GRAZING WITHIN A FEW FEET OF A BUSY HIGHWAY AND EVEN NEAR AIRPORT RUNWAYS.

3. SOUNDS THAT APPROACH RAPIDLY AND CONTINUE TO FOLLOW FLEEING ANIMALS HAVE A SEVERE IMPACT AND SERIOUSLY AFFECT WILDLIFE. THE SAME ANIMALS THAT GRAZE BY THE HIGHWAY WILL FLEE IN PANIC IF APPROACHED AND CHASED BY A VEHICLE.

4. PILOTS REPORT THAT PREDATORS ARE 'SPOOKED' BY OVERFLIGHTS MUCH MORE EASILY THAN UNGULATES AND SEEM TO REQUIRE A LONGER TIME TO GROW ACCUSTOMED TO THE INTRUSION.

Based on these conclusions, expected wildlife reaction to the drill rig will be minor resulting in temporary abandonment of open areas within about 1/2 mile of the drill site. There would probably be no additional reaction to helicopter activity at the well site, because avoidance of the rig would tend to provide a buffer keeping animals outside the zone of harassment by the aircraft.

Enlargement of the drill site to accommodate helicopter support will involve additional surface disturbance of approximately 1/2 acre, at most. The landing pad immediately north of the camp location (Figure 5.) will be leveled, and if necessary, surfaced with military-type runway mats but the auxiliary helipads will be located in naturally level areas and merely brushed. Their purpose is to provide pre-identified emergency landing sites should an accident, fire, or gas release, preclude using the main pad. They are also unobstructed by the rig and facilities and can be used for emergency landings when maneuverability is limited.

Dust from rotor blast can be controlled by applying any of several chemical dust depressants to areas over which helicopters are expected to hover.

11.2 Flight Lines:

Any significant wildlife harassment is likely to occur along flight lines up Rough Hollow and down Little Granite Creeks. These heavily-timbered areas with abundant water may serve as daytime 'sanctuaries' for deer and elk and, unfortunately, flight operations must be conducted during daylight.

To minimize harassment, initial over-flights should be made as high above ground as possible, decreasing gradually to allow habituation to noise and visual stimuli of the aircraft.

If periodic re-evaluation of disturbance to wildlife indicates possible abandonment or excessive harassments, use of one of the two flight paths can be discontinued when only one helicopter is in service. The proposed logistics schedule calls for two helicopters only during start-up and completion.

11.3 Staging Areas:

Staging areas are necessarily accessible by existing roads so the impact on the wilderness character is moot. There is already significant human and vehicle activity at both the proposed and the alternate staging locations. Main environmental concerns at the staging areas are visual impact, surface disturbance, air and water contamination, and noise.

The recommended staging area discussed in Sections 8.2 and 8.3 assures minimum visual impact. It is at the end of a road so visual Effects on passing traffic is not a concern. The site is not visible from the highway or from Granite Creek Road.

The site is already used as an unofficial parking area by persons using Little Granite Creek Trail and there is additional surface disturbance around a cabin and house trailer that are currently on placer claims covering the area. Legitimacy of both claims and habitations is questionable.

At the staging area, approximately 5.8 acres would be disturbed and require restoration. Disturbance would consist of minor grading and leveling of parking and storage areas and helipads, and the excavation of protective ditches and sumps to prevent contamination of Little Granite and Rough Hollow Creeks. Contamination could result from chemical and fuel spills and erosion of denuded areas. Diking of fuel

DUMPS WILL BE NECESSARY. RESTORATION PRESENTS NO UNUSUAL PROBLEMS BUT CARE MUST BE TAKEN TO PREVENT SILTING OF CREEK WATER DURING CONSTRUCTION, OPERATION AND RECLAMATION.

SOME SURFACING OF DRIVEWAYS AND PARKING AREAS WITH GRAVEL OR CRUSHED STONE WILL PROBABLY BE NECESSARY TO SUPPORT THE WEIGHT OF TRUCKS AND EQUIPMENT.

THE STAGING AREA IS LOCATED IN A RELATIVELY DEEP, STEEP-WALLED, FORESTED CANYON WHICH SHOULD ATTENUATE HELICOPTER AND TRUCK NOISE. WITH THE EXCEPTION OF THE CABIN AND HOUSE TRAILER NOW ON THE SITE, THERE ARE NO INHABITED DWELLINGS WITHIN TWO MILES OF THE PROPOSED STAGING AREA.

ADDITIONAL AIR QUALITY DEGRADATION AT THE SITE, OVER AND ABOVE THAT RESULTING FROM THE EXHAUST AND DUST OF TRUCKS, WILL BE CAUSED BY JET ENGINE EXHAUST AND DUST RAISED BY HELICOPTERS. FUGITIVE DUST CAN BE CONTROLLED BY WATERING OR CHEMICALLY TREATING ROADS, PARKING AREAS, AND HOVERING AND LANDING SITES, BUT EXHAUST EMISSIONS WILL HAVE TO BE TOLERATED. NO LONG TERM EFFECTS ARE EXPECTED, HOWEVER, AND AIR QUALITY SHOULD QUICKLY RETURN TO ITS PRIOR LEVEL WHEN OPERATIONS ARE CONCLUDED.

A MITIGATING EFFECT OF HELICOPTER MOBILIZATION SHOULD BE AN OVERALL SIGNIFICANT REDUCTION IN FUGITIVE DUST WHEN COMPARED WITH CONVENTIONAL ROAD ACCESS.

11.4 HELICOPTER AND VEHICLE TRAFFIC:

MOBILIZATION AND SUPPORT OF DRILLING OPERATIONS FOR ONE YEAR WILL REQUIRE FROM 6,000 TO 7,000 TRIPS BY HELICOPTER BETWEEN THE STAGING AREA AND DRILL SITE. ABOUT 1,750 HOURS OF FLIGHT TIME WILL ACCRUE DURING WHICH THE AIRCRAFT WILL CONSUME AN ESTIMATED 263,000 GALLONS OF TURBINE FUEL.

DELIVERY OF THE RIG, ANCILLIARY DRILLING EQUIPMENT AND SUPPLIES TO THE STAGING AREA, AND SUBSEQUENT DEMOBILIZATION OF THE OPERATION WILL REQUIRE ABOUT 600 TRIPS TO THE STAGING AREA BY HEAVY TRUCKS.

AN AVERAGE OF SEVEN TRIPS PER DAY (2555/YEAR) BY LIGHT VEHICLES FOR TRANSPORTATION OF FLIGHT CREWS, YARD MEN AND DRILLING PERSONNEL ARE EXPECTED.

11.5 HELICOPTER NOISE:

THE FOLLOWING DATA ON NOISE LEVELS OF REPRESENTATIVE HELICOPTER MODELS WAS COMPILED FOR THE STUDY:

1. BELL 214 - TAKE OFF 94 dBA
   - CRUISE 88 - 90 dBA

2. BOEING VERTOL MODEL 234 (CHINOOK)
   NO MEASUREMENTS AVAILABLE.
   MEETS INTERNATIONAL CIVIL AVIATION STANDARDS.

3. SIKORSKY MODEL S-64 (SKY CRANE)
   CLIMBING POWER MEASURED @ 500' 101 dBA
   CRUISE 98 dBA

NOISE LEVELS FOR A WIDER RANGE OF AIRCRAFT ARE PRESENTED IN TABLE 16.

THE ACTUAL CONDITIONS OF MEASUREMENT ARE UNKNOWN AND THE READINGS FOR BELL'S 214 ARE ASSUMED TO MEASURE COCKPIT NOISE. A REASONABLE ESTIMATE OF NOISE PERCEIVED BY AN OBSERVER IMMEDIATELY OUTSIDE OF THE AIRCRAFT IS 130 - 140 DECIBLES, ROUGHLY EQUIVALENT TO A JET AIRPLANE.

FOR COMPARATIVE PURPOSES, MEASURED NOISE LEVELS AT SELECTED POINTS AROUND A NATIONAL 58 DRILLING RIG HAVE BEEN PROVIDED BY THE FOREST SERVICE (TABLE 17). TABLE 18. GIVES NOISE LEVELS ASSOCIATED WITH OTHER FAMILIAR SOUNDS.

TABLE 16.

HELICOPTER NOISE LEVELS

Aircraft Type	Test Weight Lbs.	NOISE LEVELS EPNdB					
		Take-Off		Approach		Level Fly-Over	
		Measure	Limits	Measure	Limits	Measure	Limits
H300C	1,804	-	86.1	-	87.1	80.6	85.1
H500C	2,250	85.1	87.1	87.7	88.1	85.8	86.1
SA 3305	16,280	97.8	95.7	96.1	96.7	93.6	94.7
S-61	22,050	95.9	97.0	94.0	98.0	92.6	96.0
MI-8	25,212	-	97.6	99.6	98.6	97.3	96.6
SA 321F	25,300	98.4	97.6	98.6	98.6	92.0	96.6
S-65	37,000	95.7	99.2	99.9	100.2	97.1	98.2
CH-47 (Boeing Vortol 114)	40,920	-	99.7	105.4	100.7	107.6	98.7
S-64	42,812	-	99.9	98.6	100.9	96.7	98.9
MI-6A	88,440	-	103.0	107.4	104.0	103.4	102.0

EPNdB - Effective Perceived Noise Decibels

Source: Federal Register, July 19, 1979

TABLE 17.

MEASURED NOISE LEVELS AT SELECTED POINTS AROUND A NATIONAL 58 DRILLING RIG WITH TWO CATERPILLAR D-353 ENGINES, IN DECIBELS, A-WEIGHTED SCALE.

Location	Sound Level
In front of engines	103
At light plant	102
Door from doghouse to rig floor	100
Rig floor	92
At standby pump	91
At end of catwalk, V door open	82
At end of catwalk, V door closed	80
Top of doghouse steps	82
1,000 feet north of rig	68
1,000 feet south of rig	64

TABLE 18.

NOISE LEVELS OF FAMILIAR SOUNDS IN DECIBELS, A-WEIGHTED SCALE.

Familiar Sounds	Sound Level
Painful sounds	130 - 140
Airplane (jet)	140
Airplane (piston)	120
Thunder	80 - 110
Heavy traffic	80
Conservation	65 - 75
Low street noise	40

12.0 COST ESTIMATES

12.1 General Discussion:

Summary cost estimates for helicopter mobilization and support of drilling operations at Getty Reserve's site have been developed from data included in previous sections. If a choice was involved, as in the case of camp facilities, the higher figure was always used.

Estimates of dry hole and completed well costs for both helicopter and conventional alternatives are summarized in Tables 19. and 20.

12.2 Cost Differential:

Costs for a dry hole and a completed well for both mobilization alternatives are:

	Dry Hole	Completed Hole
Helicopter Mobilization	$15,896,579	$18,370,246
Conventional Mobilization	$13,661,268	$15,579,435
Difference:	$ 2,235,311	$ 2,790,811

Mobilization by helicopter would add an estimated 16.4 percent to dry hold costs, and 17.9 percent to a completed hole when expenses are based on the rationales and scenarios presented in this study. An intuitive estimate of increased costs which might accrue from helicopter mobilization if other approaches were used is 10 to 35 percent.

12.3 Pros and Cons of Helicopter Mobilization:

The principal advantage of helicopter mobilization is minimal adverse environmental effect. Any increases in noise and exhaust particulates (helicopters consume more fuel than

TABLE 19.

WELL COST ESTIMATE: HELICOPTER MOBILIZATION

ITEM		TANGIBLE COSTS	INTANGIBLE COSTS	HELICOPTER HOURS IN & OUT H= HEAVY LIFT
1.	BONDS & FEES		15,000	
2.	STAGING AREA: BUILD & RESTORE		45,000	
3.	UPGRADE ROAD TO STAGING AREA		30,000	
4.	WELL SITE: BUILD & RESTORE		175,000	6.0 H
5.	RIG MOBIL & DEMOBIL		320,000	68.5
6.	CASING HEAD/TREE	10,000		0.5
7.	SURFACE CASING	1,744,603		114.0
8.	INTERMEDIATE CASING	830,728		60.0
9.	CEMENT & SERVICES		248,150	65.0
10.	RIG= DAY RATE $12,000 X 280 DAYS		3,360,000	
11.	RIG= MOBIL RATE $9,500 X 24 DAYS		228,000	
12.	FUEL 462,000 GAL. @$0.95/GAL.		438,900	204.25
13.	BITS & REAMERS		367,345	6.0
14.	FISHING		38,000	0.5
15.	MUD & CHEMICAL		2,152,746	604.5
16.	WATER WELL (1,000 FT.)		80,310	10.0
17.	LOGGING		368,962	1.5 H
18.	D.S.T.		31,500	0.5
19.	CORING		25,000	0.5
20.	GEOLOGICAL		124,000	
21.	ENGINEERING		47,000	
22.	SUPERVISION 425 DAYS @$680/DAY		289,000	
23.	STAGING AREA LABOR 3 @$25,000/YR.		75,000	
24.	MUD LOGGING		328,500	0.5 H
25.	CAMP & CATERING 55 MEN		738,800	9.75
26.	RENTALS (SURFACE) MUD CLEANER		82,125	1.0
27.	RENTALS (SUBSURFACE) STABILIZERS		207,210	8.5
28.	SAFETY/ENVIRONMENTAL		122,375	1.0
29.	CONTINGENCIES @10%	258,533	993,792	
30.	PLUG & ABANDON		75,000	
31.	HELICOPTER CHINOOK			
	FERRY TIME 20 HRS. @$7,000/HR.		140,000	
	FLIGHT TIME 16 HRS. @$7,500/HR.		120,000	
32.	HELICOPTER BELL 214		1,600,000	RESUPPLY 491.0
33.	CONTINGENCY (HELICOPTER) @10%		186,000	
	DRY HOLE COSTS	$2,843,864	$13,052,715	TOTAL DRY HOLE $15,896,579
34.	PRODUCTION CASING	49,876		2.0
35.	CEMENT & SERVICES		15,700	1.5
36.	PRODUCTION TUBING	290,912		8.0
37.	TOOLS, RENT & PURCHASE	5,000	45,000	.25
38.	ARTIFICIAL LIFT EQUIPMENT	100,000		.25
39.	CHRISTMAS TREE	174,000		.75
40.	RIG TIME 60 DAYS @$2,000/DAY		720,000	
41.	CORRELATION LOSS		50,000	
42.	PERFORATING		75,000	
43.	STIMULATION		300,500	1.50 H
				12.0
44.	EQUIPMENT RENTAL		25,000	.25
45.	TRUCKING	10,000	15,000	
46.	FLUID		150,000	28.0
47.	ENGINEERING 20 DAYS @$500/DAY		10,000	
48.	SUPERVISION 60 DAYS @$680/DAY		40,800	
49.	FLOWLINE	5,000		.25
50.	TREATER	20,000		.25 H
51.	STOCK TANKS	60,000		.75
52.	VALVES & METERS	15,000		.25
53.	TANK BATTERY INSTALLATION	15,000		1,700 HRS. BELL 214
54.	CATERING		57,000	9.5 HRS. CHINOOK 234
55.	CONTINGENCY @10%	74,479	150,400	(USE 16 HRS.)
56.	HELICOPTER COSTS		INCLUDED IN DRY HOLE COSTS	
	COMPLETION COSTS	$ 819,267	$ 1,654,400	TOTAL $2,473,667
	TOTAL COMPLETED WELL COST	$3,663,131	$14,707,115	
				GRAND TOTAL COMPLETED WELL $18,370,246

TABLE 20.

WELL COST ESTIMATE: CONVENTIONAL MOBILIZATION

ITEM		TANGIBLE COST	INTANGIBLE COST	40,000 LOADS
1.	ROAD & LOCATION - BUILD & RESTORE		1,365,000	
2.	BONDS, FEES & DAMAGES		15,000	
3.	MOBIL & DEMOBIL		500,000	40
4.	CASING HEAD	10,000		1
5.	SURFACE CASING	1,744,603		48
6.	INTERMEDIATE CASING	830,727		23
7.	CEMENT & SERVICES		248,150	27
8.	RIG= DAY RATE $9,000 X 280		2,520,000	
9.	FUEL 442,000 GAL. @0.95		419,900	74
10.	BITS & REAMERS		367,345	1
11.	FISHING		38,000	1
12.	MUD & CHEMICAL		2,152,746	243
13.	WATER		80,310	2
14.	LOGGING		368,962	5
15.	D.S.T.		31,500	7
16.	CORING		25,000	1
17.	GEOLOGICAL		124,100	
18.	ENGINEERING		47,000	
19.	SUPERVISION		132,600	
20.	MUD LOGGING		328,500	1
21.	CAMP 55 MEN @$600/DAY X 295 DAYS		177,000	12
22.	CATERING 40 MAN AVERAGE X $35/DAY X 295 DAYS		413,000	
23.	RENTALS (SURFACE) MUD CLEANER		82,125	1
24.	RENTALS (SUBSURFACE) STABILIZERS		207,210	
25.	SAFETY/ENVIRONMENTAL		122,375	
26.	CONTINGENCIES @10%	258,533	976,582	
27.	PLUG & ABANDON		75,000	
	DRY HOLE COSTS	$2,843,863	$10,817,405	TOTAL $13,661,268
28.	RIG ANCHORS		2,000	
29.	PRODUCTION CASING	49,876		1
30.	CEMENT & SERVICES		15,700	1
31.	PRODUCTION TUBING	290,912		5
32.	TOOLS RENTAL & PURCHASE	5,000	45,000	1
33.	ARTIFICIAL LIFT EQUIPMENT	100,000		
34.	CHRISTMAS TREE	174,000		1
35.	COMPLETION RIG 60 DAYS @$2,500/DAY		150,000	1
36.	CORRELATION LOGS		50,000	1
37.	PERFORATING		75,000	1
38.	STIMULATION		300,500	3
39.	EQUIPMENT RENTAL		25,000	
40.	FLUID		150,000	3
41.	ENGINEERING 20 DAYS @$500/DAY		10,000	
42.	SUPERVISION 60 DAYS @$680/DAY		40,800	
43.	FLOWLINE	5,000		
44.	TRUCKING	10,000	15,000	
45.	TREATER	20,000		1
46.	STOCK TANKS	60,000		1
47.	VALVES & METERS	15,000		
48.	TANK BATTERY INSTALLATION	15,000		
49.	CAMP 60 DAYS @$600/DAY		36,000	
50.	CATERING 40 MEN X $35 X 60 DAYS		84,000	
51.	CONTINGENCIES @10%	74,479	99,900	
	COMPLETION COSTS	$ 819,267	$ 1,098,900	TOTAL $1,918,167
	COMPLETED WELL COST	$3,663,130	$11,916,305	GRAND TOTAL $15,579,435

TRUCKS TO MOVE THE SAME LOAD), INCIDENT TO THE AIRLIFT, SHOULD BE MORE THAN OFFSET BY DECREASES IN SURFACE DISTURBANCE, FUGITIVE DUST FROM VEHICLES, AND POTENTIAL DRAINAGE SILTING.

SITE ACCESS BY HELICOPTER WILL PROBABLY BE MORE RELIABLE THAN BY CONVENTIONAL VEHICLES IN WINTER MONTHS AND IN SPRING WHEN ROADS ARE MUDDY, EVEN IF THE ROAD COULD BE KEPT 'OPEN'. ROAD GRADES OF 12 TO 14 PERCENT MAY BE NECESSARY UP LITTLE GRANITE CREEK AND WILL SEVERELY LIMIT ACCESS BY HEAVY TRUCKS WHEN THE ROAD IS SNOW-PACKED, ICY, OR EXCESSIVELY MUDDY. THEN, TRUCKS MIGHT HAVE TO BE CHAINED TO HEAVY CATERPILLAR TRACTORS AND TOWED OR WINCHED UP STEEPER ROAD SECTIONS.

THE PRINCIPAL DISADVANTAGE OF HELICOPTER MOBILIZATION IS COST. THE PERCENTAGE DIFFERENCE CITED IN THE LAST SECTION DOES NOT APPEAR PARTICULARLY ONEROUS, BUT ONE SHOULD REMEMBER THAT THESE ARE PERCENTAGE DIFFERENCES BASED ON A RATHER EXPENSIVE WELL. HELICOPTER COSTS WILL PROBABLY NOT DECREASE IN DIRECT PROPORTION TO WELL COSTS AND CARE MUST BE USED IN EXTRAPOLATING 'PERCENT ADDED COSTS' FOR THIS SPECIFIC WELL TO OTHER CASES.

HELICOPTER-SUPPORTED OPERATIONS WOULD REQUIRE MORE DETAILED ADVANCED PLANNING AND SCHEDULING THAN CONVENTIONAL ALTERNATIVES AND, UNTIL OPERATORS GAIN EXPERIENCE, LOGISTICAL DIFFICULTIES COULD PROVE COSTLY.

AIR-LIFT OPERATIONS APPEAR TO PRESENT ADDED RISK TO PERSONNEL INVOLVED BUT ESTIMATES OF THE DEGREE OF ADDED RISK ARE SUBJECTIVE. SAFETY STATISTICS WOULD, NO DOUBT, SHOW GREATER INJURY AND DEATH RATES RELATED TO HELICOPTERS THAN TO HEAVY TRUCK TRANSPORT. HOWEVER, SAFETY STATISTICS FOR TRUCKS ARE DOMINATED BY THE TREMENDOUS DISTANCES TRUCKS TRAVEL OVER MAJOR HIGHWAYS.

No safety statistics for truck haulage under the study conditions were available. It seems reasonable, however, that winter truck operations to the proposed site would pose greater risk than highway travel.

NATIONAL SUPPLY COMPANY
DIVISION OF ARMCO STEEL CORPORATION

ADDRESS REPLY TO
1455 WEST LOOP SOUTH
HOUSTON, TX 77027
TELETYPE 910 881 - 1648
CABLE ENESCODRIL

October 28, 1980

Mr. Paul McKissen
K. A./Helton
2200 Security Life Building
1616 Glenarm
Denver, Colorado 80202

Dear Mr. McKissen:

After reviewing your request with the Manager of Drilling Equipment for National, we must inform you that National is unable to provide a helicopter rig for either the 1320-M or the 610-M. The bare frames for the mud pumps alone weigh more than 4000 pounds. National had made a study for an application similar to yours several years ago, and it was determined to be entirely impossible. The cost of such a project would be astronomical in our opinion.

You might consider the use of a trailer rig built for cross-country travel. National has built large trailer drilling rigs before and is capable of doing so now.

If I may assist you in this or any other project, please feel free to contact me in Houston or a representative at our Denver office.

Very truly yours,

Robert D. Carrell
Application Engineer

RDC:dm

NATIONAL SUPPLY COMPANY
DIVISION OF ARMCO STEEL CORPORATION

ADDRESS REPLY TO
1455 WEST LOOP SOUTH
HOUSTON, TX 77027
TELETYPE 910 881 - 1648
CABLE ENESCODRIL

November 3, 1980

Mr. Paul McKissen
K & A/Helton
2200 Security Life Building
1616 Glenarm
Denver, Colorado 80202

Dear Mr. McKissen:

Regarding our phone conversation of October 31, 1980, please find below a listing of weights for standard 610-M and 1320-M rigs. These are representative of the average land rig. Also find enclosed a composite catalog.

National Supply would be capable of building these size rigs which could be broken down into components no larger than 20,000 pounds. At this time, we do not have the necessary engineering hours available to furnish a complete listing of rig components on a conceptual basis. We will be glad to discuss this project further in greater detail once you have determined which course to take.

Please contact us if we may be of further assistance.

Very truly yours,

R. D. Carrell
Applications Engineer

RDC;dm
Enclosures

T. L. Wingerter
1620 Denver National Bank Bldg.
1125 Seventeenth Street
Denver, Colorado 80202
303/825-5529

December 3, 1980

Mr. Paul McKissen
K&A Helton
1616 Glenarm Place
2200 Security Life Bldg.
Denver, Colorado 80202

RE: Helicopter Rig Operations
Jackson, Wyoming

Dear Paul,

We are pleased to provide you with information regarding use of a helicopter transportable drilling rig to drill in the Rocky Mountains.

a. Current Rig Availability

There are currently no Parker Helicopter rigs operating in the lower 48 states. We do have a few operating in Alaska and Canada, however, these are committed to long term work (2-3 yrs). To drill your well would require a new rig to be constructed which would take 4 to 6 months and at least a two year term contract.

b. TBA 2000 Approximate Dayrate - $12,000±

This includes rig, camp facilities for 30 men, five man drilling crew, two toolpushers, one roustabout at current labor rates, and is based on a two year term contract. Not included are fuel, water, and catering.

c. Initial Mobilization from Odessa, Texas: $160,000±

This figure is for trucking only from Odessa to Jackson, Wyoming - 1176 miles. This does not include any cost to move from the staging area to the location. The complete rig inventory weighs about 1,700,000 pounds.

d. Rig Move from Staging Area to Location: $250,000±

This estimate is based on 14 days to move in and rig up at $10,000 per day, helicopter cost at 80,000/month plus $650/hour flying time. I have estimated 200 loads for rig and camp. No estimate of standby supplies, fuel stockpile, mud, chemicals, or casing was made.

e. Fuel Consumption: ±1100 GPD Summer
±1500 GPD Winter

This includes fuel for D-5 cats on location.

f. Camp Catering: ±$750/day

This cost would be third party billed back to Operator. The above cost is based on 25 man minimum and includes catering, linens, janitorial service, mobilization and demobilization of camp supplies, and transportation to the staging area.

g. D-5 Cats for Location Work: $800/day

This cost includes personnel to operate the cranes which will be equipped with side cranes for rig up work.

h. Helicopter Support: $80,000/month plus
$650/flying hour

This is based on a recent quote from Rocky Mountain Helicopters for a Bell 214. The 214 is capable of moving the rig and equipment and has a payload capacity of 5,000 lbs ± at 9000' elevation. The quote is for one unit and pilot and all maintenance. If a second helicopter was required for rig up, I would recommend contracting it on an hourly basis which would be $1650± per flying hour.

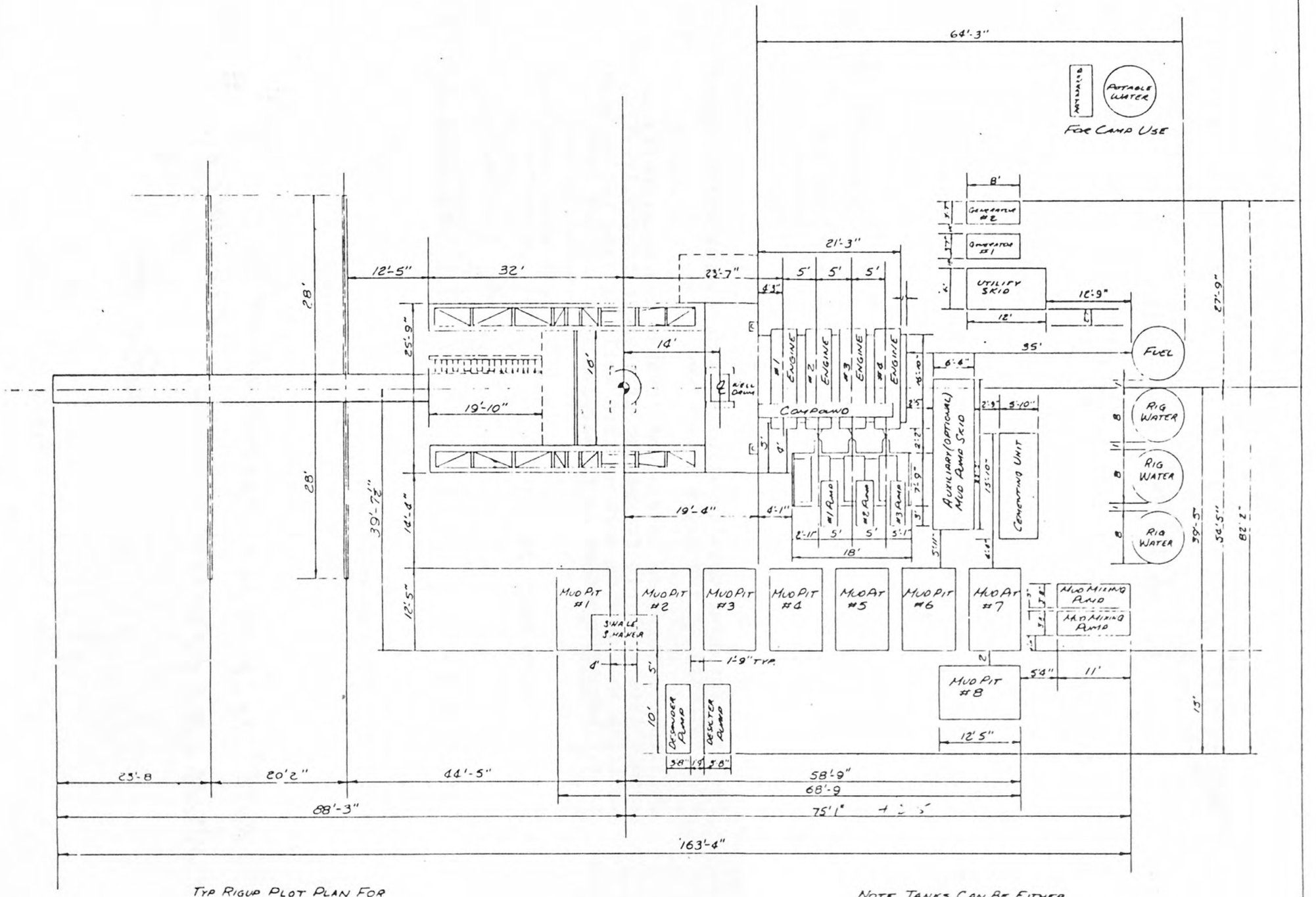
Paul, all these quotes are estimates and subject to fluctuation. Please use these for AFE purposes and if the operation looks feasible, we will work on final numbers. Please note that if no other work for this type rig can be found, we would have to incorporate a demobilization clause in the contract.

If I can be of futher assistance, please advise.

Sincerely,

Thomas L. Wingerter

Thomas L. Wingerter
Contract Manager



TYP RIGUP PLOT PLAN FOR
STD TBA 2000

NOTE TANKS CAN BE EITHER
VERTICAL OR HORIZONTAL

HALLIBURTON SERVICES

SUITE 440, 410 17TH STREET, DENVER, COLORADO 80202
(303) 893-9565

SERVICE SALES DEPARTMENT

October 29, 1980

Mr. Paul McKisson
Keppliner and Associates
2200 Security Life Building
Denver, Co

Re: Cement Proposal
Jackson Hole Area
Teton County, Wyoming

Dear Paul:

Enclosed for your consideration is a cementing analysis and cost estimate on the above referenced well.

Halliburton Services is pleased to have the opportunity to submit this analysis for your consideration and earnestly solicits the service work on this well. Please let us know if further information is required.

Respectfully submitted,

J F Callahan

J. F. Callahan
Service Sales Engineer

JFC/mls
Enclosure
cc: Denver Division Office
Rock Springs District Office
File

NOTE: TELE PHONE CONVERATION
MIXING UNIT & PUMPING UNITS, = $650.00/DAY

D.E.M.

CONDUCTOR CASING:

Casing - 30"
Hole size - 36"
Depth - 180'
Excess - 100%

CEMENT SLURRY:

675 sks. Class G, 2% calcium chloride, 1/4#/sk. Flocele.

SLURRY PROPERTIES:

Weight - 15.8#/gal.
Volume - 1.15 ft^3/sk.
Water requirements - 5.0 gal/sk.

Inner string cementing should be used for this casing string.

Floating equipment - 30" Super Seal Float shoe

COST ESTIMATE: $ 14,150.00

SURFACE CASING:

Casing - 20"
Hole size - 26"
Depth - 5,600 ft.
Excess - 50%

CEMENT SLURRY:

5,000 sks. Halco light with 10#/sk. Gilsonite.

1,000 sks. Class G, 1/4#/sk. Flocele

SLURRY PROPERTIES:	Light	Class G	
Weight	12.4	15.8	#/gal.
Volume	1.99	1.15	ft^3/sk.
Water requirements	9.9	5.0	gal/sk.

Inner string cementing should be used for this casing string. A two stage design could also be considered.

Floating equipment - 20" Buttress
1-Super Seal Float shoe
1-Super Seal Float collar
12-Centralizers
Clamp and Halco Weld

COST ESTIMATE: $ 118,900.00

INTERMEDIATE CASING:

Casing - 13-3/8"
Hole size - 17-1/2"
Depth - 10,000 ft.
Fillup - 1,000 ft., 50% excess
Preflush - 40 bbls. CS-2 spacer

CEMENT SLURRY:

880 sks. Class G, 0.5% HLX-270, 18% salt, retarder sufficient for 5 hours

SLURRY PROPERTIES:

Weight	-	16.0	#/gal.
Volume	-	1.2	$ft^3/ft.$
Water requirements	-	5.0	gal/sk.

Floating equipment - 13-3/8" Buttress
1-Differential fill float shoe
1-Differential fill float collar
10-Centralizers
Clamp and Halco Weld

COST ESTIMATE: $ 27,900.00

FIRST LINER:

Liner size - 9-5/8"
Hole size - 12-1/4"
Depth - 15,600 ft.
Last casing - 10,000 ft.
Preflush - 40 bbls. CS-2 spacer

CEMENT SLURRY:

1,760 sks. Class G with 18% salt, 0.75% CFR-2, 35% SSA-1, 0.5% HLX-270, retarder sufficient for 5 hours.

SLURRY PROPERTIES:

Weight	-	15.8#/gal.
Volume	-	1.6ft^3/sk.
Water requirements	-	6.6 gal/sk.

COST ESTIMATE: $ 64,000.00

PRODUCTION CASING:

Casing size - 7"
Hole size - 8-3/4"
Depth - 17,400 ft.
Excess volume - 50%

Preflush - 40 bbl. CS-2 spacer

CEMENT SLURRY:

280 sks. Class G with 18% salt, 35% SSA-1, 0.75% CFR-2, 0.5% HLX-270, retarder sufficient for 4 hours pumping time.

FLOATING EQUIMENT - 7" Buttress

1-Differential fill float shoe
1-Differential fill float collar
16-Centralizers
Clamp and Weld

COST ESTIMATE: $ 23,200.00

2ND LINER:

Liner size - 5"
Hole size - 6"
Depth - 18,000 ft.
Last Casing - 17,400 ft.

Preflush - 40 bbl. CS-2 spacer

CEMENT SLURRY:

70 sks. Class G with 18% salt, 35% SSA-1, 0.75% CFR-2, 0.5% HLX-270, retarder sufficient for 4 hours pumping time.

COST ESTIMATE: $ 15,700.00

COST ESTIMATE FOR ENTIRE WELL: $263,850.00

This proposal is designed primarily as a cost estimate. No consideration was given to the actual equipment and storage facilities required for a helicopter operation. The cement volume required for the 20" and 9-5/8" jobs, as you requested, would probably be economically impossible. The cementing unit would have to be leased and left on location for the entire project.

As work on this project continues extensive planning will be required in regard to the cementing service. The mechanical limitation on the operation will be severe and normal design rules will be stretched to their safe limits.

The unit prices stated in this proposal are based upon our current published prices. The projected equipment, personnel, and material needs are estimates only based upon information about the work presently available to use. At the time the work is actually performed, conditions then existing may require an increase or decrease in the equipment, personnel, and/or material needs. Charges will be based upon unit prices in effect and/or materials actually utilized in the work. Taxes, if any, are not included.

We are pleased to have the opportunity to present this proposal for your consideration. If you accept our proposal, all materials and equipment furnished and services performed will be under our General Terms and Conditions and pursuant to our applicable Work Order Contract (whether or not executed by you). Copies of the General Terms and Conditions and applicable Work Order Contract will be furnished upon request.

SERVICE POINT: Rock Springs, Wyoming
(307) 362-6311

November 20, 1980

K & A / HELTON
22 Security Life Building
16th and Glenarm
Denver, Colorado 80202
Attn: Paul McKissen

Dear Mr. McKissen:

To follow is a quote on the different drilling assemblies for the different hole sizes to be drilled in the well at Jackson Hole.

Please be aware that variation in drilling assemblies, or drilling conditions will cause either an increase or decrease in stabilization cost. The assemblies were designed for maximum effectiveness with a range of versatility to eliminate any down time. All the equipment was recommended with a maximum helicopter lift capacity of 4000 lbs. in mind. Estimated total weight is 62,090 lbs. Estimated maximum cost is $293,270.00. Estimated transportation charges from Evanston, Wyoming, ONCOR's closest stockpoint, to Jackson Hole, Wyoming, will be $756.00. Minimum gin time of four hours totaling $140.00.

I appreciate this opportunity to quote this equipment. If I can be of further assistence, please contact me.

Sincerely,

Michael R. Glosson
Sales Representive

QUOTATION

TELEPHONE (713) 443-7181

REPLY TO:

Oncor Corporation
P.O. Box 60945
Houston, Texas 77205

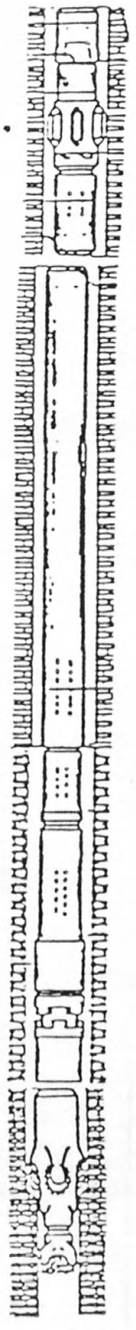
TO:

Date:
Quotation No.:
Your Order No.:
Inquiry No.:
Terms:

FOB: EX-PLANT
Plant:
Sched. Del.:
B/L:
Destination:

ITEM	QUANTITY	DESCRIPTIONS	UNIT PRICE	TOTAL
		26" HOLE SIZE		
1	2	Non-Rotating Sleeve-Type Stabilizer 8" Drill Collar necks. 7 1/2" OD Mandrel. 2 13/16" Bore. 8' Long. 1160 lbs. each.		
		Rental price at $410.00 per well per tool.		$ 820.00
2	2	Non-Rotating Stabilizer Sleeves 26" Hole Size x 7 1/2" Mandrel x 4 Ribed. Sleeve length 18". Approximate weight 150 lbs. each.		
		Sale price at $1525.00 per sleeve.		$3,050.00
3	1	ONCOR Equalizer 8 1/4" OD x 2 1/4" ID x 7 1/2' Long. Approximate weight 1190 lbs.		
		5 day min. rental at $1000.00 per well per tool. Each add'l day ran at $200.00 per day per tool. Standby charge at $80.00 per day per tool for tool on location, but not in hole generating daily rentals.	Net 30 days rental.	$6,000.00
		Total weight of equipment: 3810 lbs.		
		Note: Prices subject to change without notice.		

26" HOLE SIZE



6 5/8 Reg. Box

N/R Stab.

6 5/8 Reg. Pin

6 5/8 Reg. Box

25' Drill Collar
8" OD

6 5/8 Reg. Pin

6 5/8 Reg. Box

8 1/4" OD
Equilizer

6 5/8 Reg. Box

6 5/8 Reg. Pin

26" Hole Opener

6 5/8 Reg. Box

N/R Stab.

6 5/8 Reg. Pin

6 5/8 Reg. Box

25' Drill Collar
8" OD

6 5/8 Reg. Pin

BOTTOM HOLE DRILLING ASSEMBLY

npany _____ Contractor _____

ation _____ State _____ County _____ By _____ Date _____

QUOTATION

TELEPHONE (713) 443-7181

REPLY TO:

Oncor Corporation
P.O. Box 60945
Houston, Texas 77205

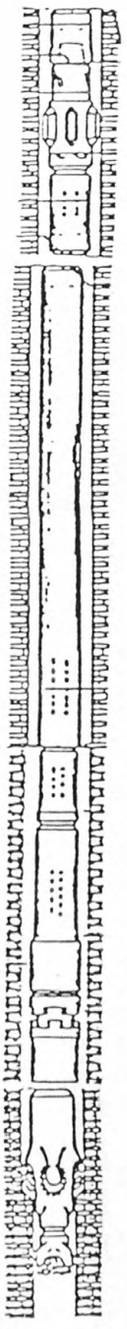
TO:

Date:
Quotation No.:
Your Order No.:
Inquiry No.:
Terms:

FOB: EX-PLANT
Plant:
Sched. Del.:
B/L:
Destination:

ITEM	QUANTITY	DESCRIPTIONS	UNIT PRICE	TOTAL
		20" HOLE SIZE		
1	2	Non-Rotating Sleeve-Type Stabilizer 8" Drill Collar necks. 7 1/2" OD Mandrel. 2 13/16" Bore. 8' Long. 1160 lbs. each.		
		Rental price at $410.00 per well per tool.		$ 820.00
2	2	Non-Rotating Stabilizer Sleeves 20" Hole Size x 7 1/2" Mandrel x 4 Ribed. Sleeve length 18". Approximate weight 125 lbs. each.		
		Sale price at $1145.00 per sleeve.		$2,290.00
3	1	ONCOR Equalizer 8 1/4" OD x 2 1/4" ID x 7 1/2' Long. Approximate weight 1190 lbs.		
		5 day min. rental at $1000.00 per well per tool. Each add'l day ran at $200.00 per day per tool. Standby charge at $80.00 per day per tool for tool on location, but not in hole generating daily rentals.	Net 30 days rental.	$6,000.00
		Total weight of equipment: 3760 lbs.		
		Note: Prices subject to change without notice.		

20" HOLE SIZE



6 5/8 Reg. Box

N/R Stab.

6 5/8 Reg. Pin

6 5/8 Reg. Box

25' Drill Collar
8" OD

6 5/8 Reg. Pin

6 5/8 Reg. Box

8 1/4" OD
Equilizer

6 5/8 Reg. Box

6 5/8 Reg. Pin

20" Hole Opener

6 5/8 Reg. Box

N/R Stab.

6 5/8 Reg. Pin

6 5/8 Reg. Box

25' Drill Collar
8" OD

6 5/8 Reg. Pin

BOTTOM HOLE DRILLING ASSEMBLY

Company _____ Contractor _____

Location _____ State _____ County _____ By _____ Date _____

Oncor Corporation • P.O. Box 60945, Houston, Texas 77205 • (713) 443-7181 • Telex 77-

QUOTATION

TELEPHONE (713) 443-7181

REPLY TO:

Oncor Corporation
P.O. Box 60945
Houston, Texas 77205

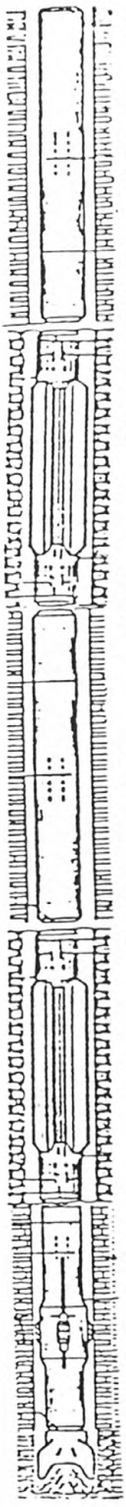
O:

Date:
Quotation No.:
Your Order No.:
Inquiry No.:
Terms:

FOB: EX-PLANT
Plant:
Sched. Del.:
B/L:
Destination:

ITEM	QUANTITY	DESCRIPTIONS	UNIT PRICE	TOTAL
		17 1/2" HOLE SIZE		
1	2	Non-Rotating Sleeve-Type Stabilizer 8" Drill Collar necks. 7 1/2" OD Mandrel. 2 13/16" Bore. 8' Long. Weight figured on separate page. Rental charge N/C if tool used on larger hole size. Standby charge of $200.00 per well per tool if tools not ran at all on location.		
2	2	Non-Rotating Stabilizer Sleeves 17 1/2" Hole Size x 7 1/2" Mandrel x 4 Ribed. Sleeve length 18". Approximate weight 84 lbs. each. Sale price at $950.00 per sleeve.		$ 1,900.00
3	4	ONCOR Knockout Blade Stabilizer 17 1/2" Hole Size x 3" ID x 8' Long. 8" Drill Collar necks. Weight per body at 2060 lbs. Rental charge at $975.00 per well per tool. Standby charge at $450.00 per well per tool for any bodies not ran.		$ 3,900.00
4	sets 4	Knockout Stabilizer blades installed in the above four bodies. Sale price at $3360.00 per set per body. Weight at 384 lbs. per set.		$13,440.00
5	sets 12	Knockout Stabilizer replacement blade sets for above bodies. Sale price at $3360.00 per set. Three extra sets per body. Weight at 384 lbs. per set.		$40,320.00
6	2	10' Short Drill Collars 8" OD x 2 13/16" ID 15 day min. rental at $550.00 per well per tool. Each add'l days rental at $31.00 per day per tool. Service charge per well for Short Collars not used at $100.00 per tool. Weight at 1508 lbs. per body.	net 30 day rental	$ 2,030.00

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
		Continuation of 17 1/2" Hole Size Quotation.		
7	2	3pt. Roller Reamers 17 1/2" Hole Size x 3" ID x 7 1/2' Long. Weight per body at 2300 lbs. with weight of set of cutters. Rental charge at $700.00 per well per tool. Standby charge at $350.00 per well per tool if body not ran.		$ 1,400.00
8	set 2	Roller Reamer cutters for Hard Formation. Sale price for cutters installed in bodies at $4960.00 per set. Weight at 239 lbs. per set.		$ 9,920.00
9	set 6	Roller Reamer replacement cutters for Hard Formation. Sale price at $4960.00 per set. Weight at 239 lbs. per set.		$29,760.00
		Total weight of equipment: 23,602 lbs.		
		Note: Prices subject to change without notice.		



6 5/8 Reg. Box

10' Short D.C.
8" OD

6 5/8 Reg. Pin
6 5/8 Reg. Box

K/O Blade Stab.

6 5/8 Reg. Pin
6 5/8 Reg. Box

10' Short D.C.
8" OD

6 5/8 Reg. Pin
6 5/8 Reg. Box

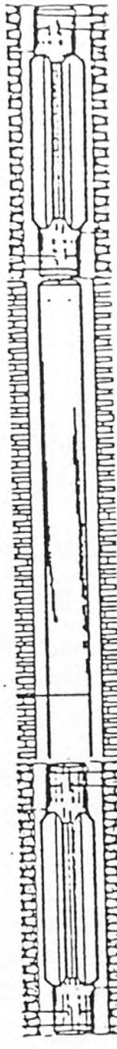
K/O Blade Stab.

6 5/8 Reg. Pin
6 5/8 Reg. Box

3pt. RMR
"K" Cutters

6 5/8 Reg. Box
Drill Bit

17 1/2" HOLE SIZE



6 5/8 Reg. Box

K/O Blade Stab.

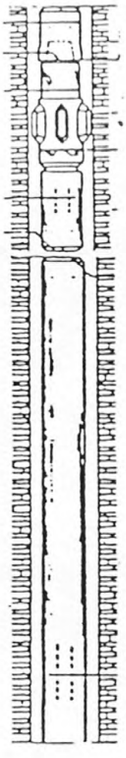
6 5/8 Reg. Pin
6 5/8 Reg. Box

25' Drill Collar
8" OD

6 5/8 Reg. Pin
6 5/8 Reg. Box

K/O Blade Stab.

6 5/8 Reg. Pin



6 5/8 Reg. Box

N/R Stab.

6 5/8 Reg. Pin
6 5/8 Reg. Box

25' Drill Collar
8" OD

6 5/8 Reg. Pin

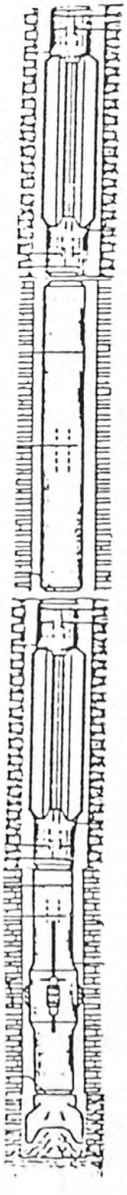
BOTTOM HOLE DRILLING ASSEMBLY

Company _____ Contractor _____

Location _____ State _____ County _____ By _____ Date _____

Oncor Corporation • P.O. Box 60945, Houston, Texas 77205 • (713) 443-7181 • Telex 77-4304

17 1/2" HOLE SIZE



6 5/8 Reg. Box

K/O Blade Stab.

6 5/8 Reg. Pin

6 5/8 Reg. Box

10' Short D.C.
8" OD

6 5/8 Reg. Pin

6 5/8 Reg. Box

K/O Blade Stab.

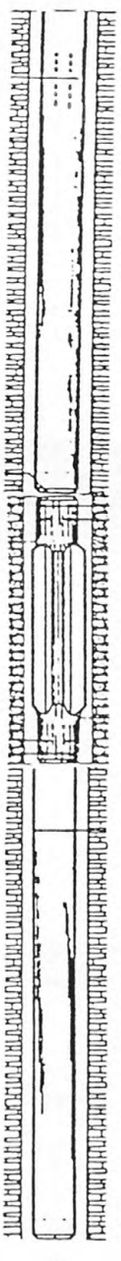
6 5/8 Reg. Pin

6 5/8 Reg. Box

3pt. RMR
"K" Cutters

6 5/8 Reg. Box

Drill Bit



6 5/8 Reg. Box

25' Drill Collar
8" OD

6 5/8 Reg. Pin

6 5/8 Reg. Box

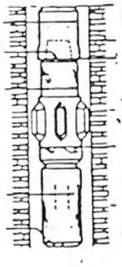
K/O Blade Stab.

6 5/8 Reg. Pin

6 5/8 Reg. Box

25' Drill Collar
8" OD

6 5/8 Reg. Pin



6 5/8 Reg. Box

N/R Stab.

6 5/8 Reg. Pin

BOTTOM HOLE DRILLING ASSEMBLY

Company _____ Contractor _____

Location _____ State _____ County _____ By _____ Date _____

Oncor Corporation • P.O. Box 60945, Houston, Texas 77205 • (713) 443-7181 • Telex 77-4304

QUOTATION

TELEPHONE (713) 443-7181

REPLY TO:

Oncor Corporation
P.O. Box 60945
Houston, Texas 77205

TO:

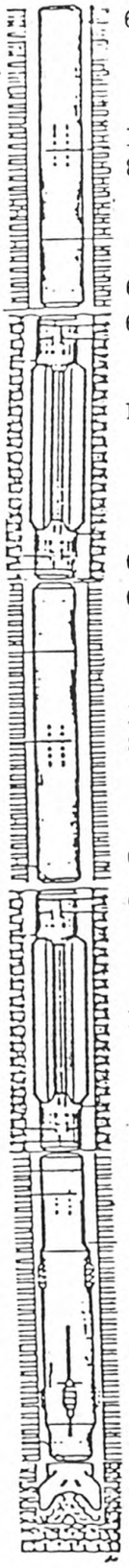
Date:
Quotation No.:
Your Order No.:
Inquiry No.:
Terms:

FOB: EX-PLANT
Plant:
Sched. Del.:
B/L:
Destination:

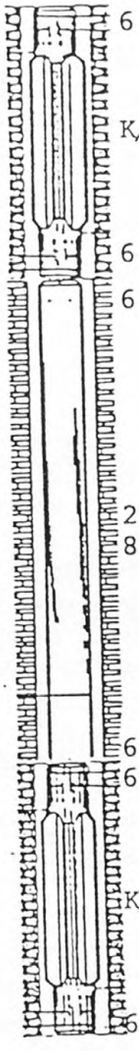
ITEM	QUANTITY	DESCRIPTIONS	UNIT PRICE	TOTAL
		12 1/4" HOLE SIZE		
1	2	Non-Rotating Sleeve-Type Stabilizer 8" Drill Collar necks. 7 1/2" OD Mandrel. 2 13/16" Bore. 8' Long. Weight figured on separate page. Rental charge N/C if tool used on larger hole size. Standby charge of $200.00 per well per tool if tools not ran at all on location.		
2	2	Non-Rotating Stabilizer Sleeves 12 1/4" Hole Size x 7 1/2" Mandrel x 4 Ribed. Sleeve length 18" Approximate weight 60 lbs. each. Sale price at $590.00 per sleeve.		$ 1,180.00
3	4	ONCOR Knockout Blade Stabilizer 12 1/4" Hole Size x 2 13/16" ID x 8' Long. 8" Drill Collar necks. Weight per body at 1700 lbs. Rental charge at $475.00 per well per tool. Standby charge at $230.00 per well per tool for any bodies not ran.		$ 1,900.00
4	sets 4	Knockout Stabilizer blades installed in the above four bodies. Sale price at $3360.00 per set per body. Weight at 384 lbs. per set.		$13,440.00
5	sets 12	Knockout Stabilizer replacement blade sets for above bodies. Sale price at $3360.00 per set. Three extra sets per body. Weight at 384 lbs. per set.		$40,320.00
6	2	10' Short Drill Collars 8" OD x 2 13/16" ID 15 day min. rental at $550.00 per well per tool. Each add'l days rental at $31.00 per day per tool. Service charge per well for Short Collars not used at $100.00 per tool. Weight figured on separate page.	net 30 day rental	$ 2,030.00

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
		Continuation of 12 1/4" Hole Size Quotation.		
7	2	6pt. Roller Reamers 12 1/4" Hole Size x 2 13/16" ID 13' Long. Weight per body at 2230 lbs. with weight of cutters. Rental charge at $1400.00 per well per tool. Standby charge at $700.00 per well per tool if body not ran.		$ 2,800.00
8	sets 2	Roller Reamer cutters for Medium Formation. Sale price for cutters installed in bodies at $1350.00 per set. Weight at 140 lbs. per set.		$ 2,700.00
9	sets 2	Roller Reamer cutters for Hard Formation. Sale price for cutters installed in bodies at $2510.00 per set. Weight at 136 lbs. per set.		$ 5,020.00
10	sets 6	Roller Reamer replacement cutters for Medium Formation Sale price at $1350.00 per set.		$ 8,100.00
11	sets 6	Roller Reamer replacement cutters for Hard Formation Sale price at $2510.00 per set.		$15,060.00
		Total weight of equipment: 19060 lbs.		
		Note: Prices subject to change without notice.		

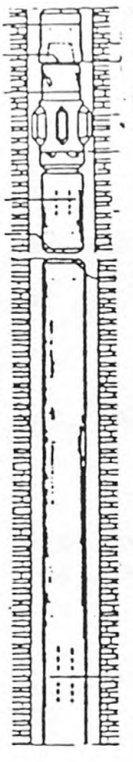
12 1/4" HOLE SIZE



6 5/8 Reg. Box
10' Short D.C.
8" OD
6 5/8 Reg. Pin
6 5/8 Reg. Box
K/O Blade Stab.
6 5/8 Reg. Pin
6 5/8 Reg. Box
10' Short D.C.
8" OD
6 5/8 Reg. Pin
6 5/8 Reg. Box
K/O Blade Stab.
6 5/8 Reg. Pin
6 5/8 Reg. Box
"Q" Cutters
6pt. RMR
"K" Cutters
6 5/8 Reg. Box
Drill Bit



6 5/8 Reg. Box
K/O Blade Stab.
6 5/8 Reg. Pin
6 5/8 Reg. Box
25' Drill Collar
8" OD
6 5/8 Reg. Pin
6 5/8 Reg. Box
K/O Blade Stab.
6 5/8 Reg. Pin



6 5/8 Reg. Box
N/R Stab.
6 5/8 Reg. Pin
6 5/8 Reg. Box
25' Drill Collar
8" OD
6 5/8 Reg. Pin

BOTTOM HOLE DRILLING ASSEMBLY

Company _____ Contractor _____

Location _____ State _____ County _____ By _____ Date _____

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12 1/4" HOLE SIZE

6 5/8 Reg. Box

K/O Blade Stab.

6 5/8 Reg. Pin

6 5/8 Reg. Box

10' Short D.C.
8" OD

6 5/8 Reg. Pin

6 5/8 Reg. Box

K/O Blade Stab.

6 5/8 Reg. Pin

6 5/8 Reg. Box

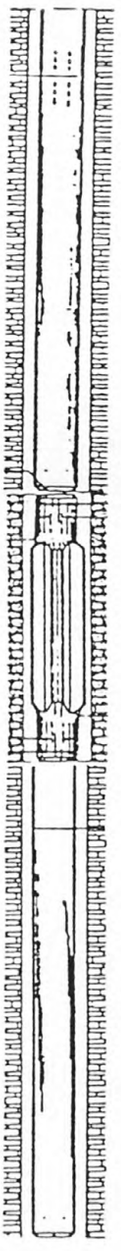
"Q" Cutters

6pt. RMR

"K" Cutters

6 5/8 Reg. Box

Drill Bit



6 5/8 Reg. Box

25' Drill Collar
8" OD

6 5/8 Reg. Pin

6 5/8 Reg. Box

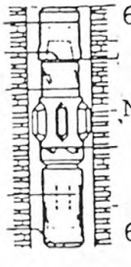
K/O Blade Stab.

6 5/8 Reg. Pin

6 5/8 Reg. Box

25' Drill Collar
8" OD

6 5/8 Reg. Pin



6 5/8 Reg. Box

N/R Stab.

6 5/8 Reg. Pin

BOTTOM HOLE DRILLING ASSEMBLY

Company _____ Contractor _____

Location _____ State _____ County _____ By _____ Date _____

QUOTATION

ELEPHONE (713) 443-7181

REPLY TO:

Oncor Corporation
P.O. Box 60945
Houston, Texas 77205

O:

Date:
Quotation No.:
Your Order No.:
Inquiry No.:
Terms:

FOB: EX-PLANT
Plant:
Sched. Del.:
B/L:
Destination:

ITEM	QUANTITY	DESCRIPTIONS	UNIT PRICE	TOTAL
		8 3/4" HOLE SIZE		
1	4	ONCOR Knockout Blade Stabilizer 8 3/4" Hole Size x 2 1/4" ID x 6' Long. 6 1/4" Drill Collar necks. Weight per body at 630 lbs. Rental charge at $350.00 per well per tool. Standby charge at $175.00 per well per tool for any bodies not ran.		$ 1,400.00
2	sets 4	Knockout Stabilizer blades installed in the above four bodies. Sale price at $1760.00 per set per body. Weight at 120 lbs. per set.		$ 7,040.00
3	sets 12	Knockout Stabilizer replacement blade sets for above bodies. Sale price at $1760.00 per set. Three extra sets per body. Weight at 120 lbs. per set.		$21,120.00
4	2	8' Short Drill Collars 6 1/4" OD x 2 1/4" ID 15 day min. rental at $290.00 per well per tool. Each add'l days rental at $16.00 per day per tool. Service charge per well for Short Collars not used at $100.00 per tool. Weight at 724 lbs. per tool.	net 30 day rental	$ 1,060.00
5	2	6pt. Roller Reamers 8 3/4" Hole Size x 2" ID 10' Long. Weight per body at 1160 lbs. with weight of cutters. Rental charge at $1050.00 per well per tool. Standby charge at $525.00 per well per tool if body not ran.		$ 2,100.00
6	sets 2	Roller Reamer cutters for Medium Formation. Sale price for cutters installed in bodies at $710.00 per set. Weight at 45 lbs. per set.		$ 1,420.00

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
		Continuation of 8 3/4" Hole Size Quotation.		
7	sets 2	Roller Reamer cutters for Hard Formation. Sale price for cutters installed in bodies at $1300.00 per set. Weight at 44 lbs. per set.		$ 2,600.00
8	sets 6	Roller Reamer replacement cutters for Medium Formation Sale price at $710.00 per set.		$ 4,260.00
9	sets 6	Roller Reamer replacement cutters for Hard Formation Sale price at $1300.00 per set.		$ 7,800.00
		Total weight of equipment: 8742 lbs.		
		Note: Prices subject to change without notice.		
10	13	Charge for non-standard drill collar connections to be cut on 8 3/4" Hole Size equipment. Connections at $61.00 for each 4 H 90 connection cut.		$ 793.00

8 3/4" HOLE SIZE

4 H 90 Box

K/O Blade Stab.

4 H 90 Pin

4 H 90 Box

8' Short D.C.
6 1/4" OD

4 H 90 Pin

4 H 90 Box

K/O Blade Stab.

4 H 90 Pin

4 H 90 Box

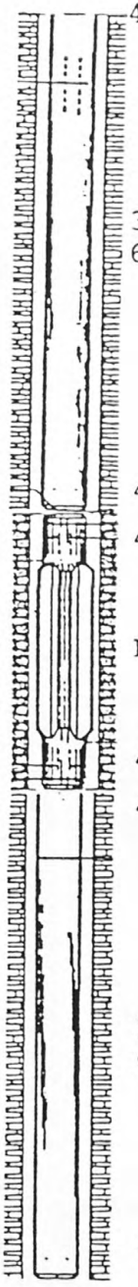
"Q" Cutters

6pt. RMR

"K" Cutters

4 1/2 Reg. Box

Drill Bit



4 H 90 Box

30' Drill Collar
6" OD

4 H 90 Pin

4 H 90 Box

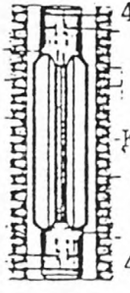
K/O Blade Stab.

4 H 90 Pin

4 H 90 Box

30' Drill Collar
6" OD

4 H 90 Pin



4 H 90 Box

K/O Blade Stab.

4 H 90 Pin

BOTTOM HOLE DRILLING ASSEMBLY

Company _____ Contractor _____

Location _____ State _____ County _____ By _____ Date _____

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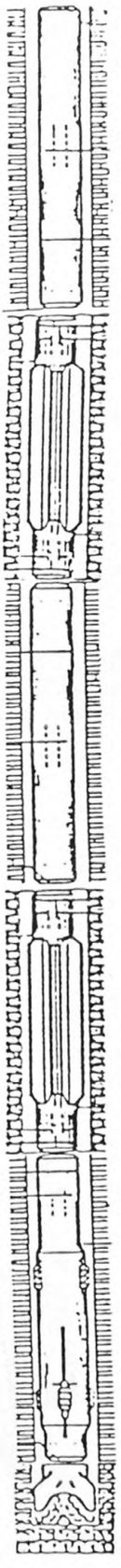


4 H 90 Box

8' Short D.C.
6 1/4" OD

4 H 90 Pin

4 H 90 Box

K/O Blade Stab.

4 H 90 Pin

4 H 90 Box

8' Short D.C.
6 1/4" OD

4 H 90 Pin

4 H 90 Box

K/O Blade Stab.

4 H 90 Pin

4 H 90 Box

"Q" Cutters

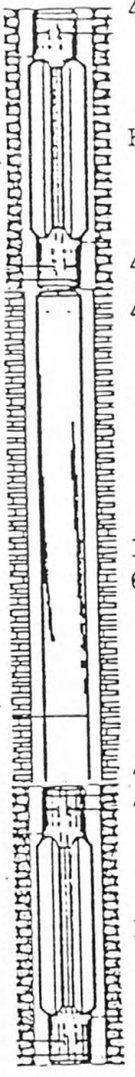
6pt. RMR

"K" Cutters

4 1/2 Reg. Box

Drill Bit

8 3/4" HOLE SIZE



4 H 90 Box

K/O Blade Stab.

4 H 90 Pin

4 H 90 Box

30' Drill Collar
6" OD

4 H 90 Pin

4 H 90 Box

K/O Blade Stab.

4 H 90 Pin

BOTTOM HOLE DRILLING ASSEMBLY

Company _____ Contractor _____

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QUOTATION

ELEPHONE (713) 443-7181

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Date:
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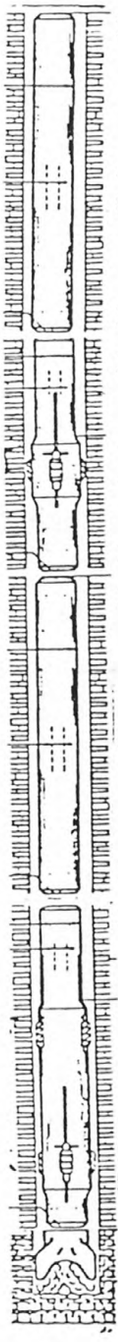
Terms:

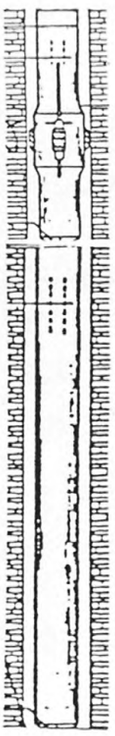
FOB: EX-PLANT
Plant:
Sched. Del.:
B/L:
Destination:

ITEM	QUANTITY	DESCRIPTIONS	UNIT PRICE	TOTAL
		6" HOLE SIZE		
1	2	6pt. Roller Reamers 6" Hole Size x 1 1/4" ID x 8 3/4' Long. Weight per body at 510 lbs. with weight of cutters. Rental charge at $1050.00 per well per tool. Standby charge at $525.00 per well per tool if body not ran.		$ 2,100.00
2	4	3pt. Roller Reamers 6" Hole Size x 1 1/4" ID x 5 1/2' Long. Weight per body at 260 lbs. with weight of cutters. Rental charge at $450.00 per well per tool. Standby charge at $225.00 per well per tool for any bodies not ran.		$ 1,800.00
3	sets 6	Roller Reamer cutters for Medium Formation. Sale price for cutters installed in bodies at $585.00 per set. Weight at 18 lbs. per set.		$ 3,510.00
4	sets 2	Roller Reamer cutters for Hard Formation. Sale price for cutters installed in bodies at $1240.00 per set. Weight at 17 lbs. per set.		$ 2,480.00
5	sets 18	Roller Reamer replacement cutters for Medium Formation Sale price at $585.00 per set.		$10,530.00
6	sets 6	Roller Reamer replacement cutters for Hard Formation Sale price at $1240.00 per set.		$ 7,440.00

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
		Continuation of 6" Hole Size Quotation.		
7	2	8' Short Drill Collars 4 1/8" OD x 1 1/2" ID 15 day min. rental at $230.00 per well per tool. Each add'l days rental at $13.00 per day per tool. Service charge per well for Short Collars not used at $100.00 per tool. Weight at 315 lbs. per tool.	net 30 day rental	$ 850.
8	13	Charge for non-standard drill collar connections to be cut on 6" Hole Size equipment. Connections at $59.00 for each 2 3/8 IF connection cut.		$ 767.
		Total weight of equipment: 3116 lbs.		
		Note: Prices subject to change without notice.		

6" HOLE SIZE





BOTTOM HOLE DRILLING ASSEMBLY

Company _____ Contractor _____

Location _____ State _____ County _____ By _____ Date _____

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DRESSER ATLAS DIVISION, DRESSER INDUSTRIES, INC. 1532 METROBANK BUILDING DENVER, COLORADO 303/629-0294

November 4, 1980

CLS SKID UNIT

	1ST	2ND	3RD	4TH	5TH
SET UP	925.00	925.00	1265.00	1265.00	1265.00
DENSITY/CALIPER	3638.00	5096.00	7440.00	12812.00	12730.00
NEUTRON	3638.00	5096.00	7440.00	12812.00	12730.00
DUAL INDUCTION	3530.00	4990.00	7332.00	12772.00	12710.00
ACOUSTIC/CALIPER	3638.00	5096.00	7440.00	12812.00	12730.00
GAMMA RAY	1047.00	1477.00	2166.00	4000.00	3860.00
TEMPERATURE	2622.00	4030.00	6206.00	12306.00	12690.00
DIPLOG	9184.00	10603.00	12594.00	9860.00	9060.00
INSTRUMENT PROTECTION	260.00	260.00	260.00	260.00	260.00
ISOLATED LOCATION	4290.00	4290.00	4290.00	4290.00	4290.00
TEMP. IN EXCESS OF 300				690.00	690.00
SUB-TOTAL	32772.00	41863.00	56433.00	83879.00	83015.00

TRUCKING CLS S23 SKID FROM TEXAS TO WYOMING: 5000.00

12 MONTHS @ 5500 = 66,000

TOTAL JOB COST: 368,962.00

JOHNSTON-MACCO
Schlumberger

November 20, 1980

K & A Helton Engineering & Geological Services
2200 Security Life Building
1616 Glenarm Place
Denver, Colorado 80202

Attention: Mr. Paul McKissen

As per your request, Johnston-Macco is submitting the enclosed costs for drill stem testing in Western Wyoming. All general terms and conditions as set forth in our current Rocky Mountain Price Schedule dated April 1, 1980, apply.

Thank you for allowing us the opportunity to submit this proposal, and if we can be of further assistance, please advise.

Sincerely,

E.C. McKnight
1745 Stout, Suite 300
Denver, Colorado 80202
(303) 623-0760

ECM:ch

Attachment

Drill Stem Test Costs:

1.	Depth, 10,001 - 11,000 feet in 12¼ hole.	$6,085
2.	Depth, 15,001 - 16,000 feet in reduced hole.	$5,945
3.	Depth, 18,001 - 19,000 feet in reduced hole.	$6,224

The above costs include 10,000 psi WP surface control head, 10,000 psi WP floor manifold, Multi-Flow Evaluator with sample chamber, two pressure recorders, two open hole packers, hydraulic jars, safety joint, reversing sub, five DST reports, Computerized Data Analysis and 24-hours of equipment and operator time.

Any additional equipment and operator time will be $20/hour and $28/hour, respectively. A mileage charge of $1/mile round trip is not included in above.

578-D

DOWELL DIVISION OF DOW CHEMICAL U.S.A.

SERVICE RECOMMENDATION

Denver, Colorado
December 2, 1980

Mr. Paul McKissen
K & A Associates
Suite 2200
Security Life Bldg.
Denver, Colorado 80202

PROPOSED PROJECT - N.W. WYOMING

Assuming that some form of stimulation equipment would have to be brought to location by helicopter and that a maximum load would be 20,000# -

We would propose using three skid mounted units each capable of delivering 750 HHP at 15000 psi; this is 2 BPM/unit.

Each unit would be broken in two pieces, each piece weighing about 17000#.

An additional piece of equipment will be required for mixing special chemicals and pressurizing - this will be separated into two 12000# pieces.

Discharge pipe and hoses can probably be transported in two loads. (4000)

Estimated mobilization and de-mobilization (from helicopter pick-up point) at today's prices would be $200,000.

Estimated cost for pumping each acid job would be $35,000.00; standby time (non-pumping) would be $10,000.00/day with a minimum of 30 days.

Acid cost to helicopter pick-up point would be about $2.50/gallon. (15,000 gal.)

To prepare this equipment will require at least one year lead time and prices would be re-quoted at the time designed.

Yours, very truly,

John D. Woodward
Regional Sales Supervisor

j.m.

SWECO, INC. P.O. Box 335, Casper, Wyoming 82602 Tel: (307) 237-3702

November 25, 1980

Mr. Paul McKissen
K.A. Keplinger Engineering
Suite 2200
1616 Glenarm
Denver, Colo. 80202

Dear Mr. McKissen,

After our phone conversation on Monday, November 24, 1980, I worked up a proposal for solids control equipment on the helicopter feasibility study. Enclosed, please find a copy of that proposal and prices.

We have a house at Alpine Junction and in anticipation of the drilling activity in that area, we are moving a man from Casper to Alpine Junction in the very near future.

If there are any questions, please give me a call.

Regards,

Archie L Bost

Archie L. Bost

SWECO, INC. P.O. Box 335, Casper, Wyoming 82602 Tel: (307) 237-3702

PROPOSAL FOR HELICOPTER FEASIBILITY STUDY

We at SWECO propose a total solids control system consisting of one dual 48" shale shaker and two 48" 8-cone mud cleaners. We feel this would give you total versatility and handle any solids control problems no matter what the mud properties.

The dual 48" shale shaker will make a finer cut at the flow line (spudding with at least a 60 mesh screen depending on the size of the hole and rate of pennetration), thus taking the load off of the mud cleaners to allow them to make a finer cut. After the mud goes through the shale shaker and sand trap, both mud cleaners would then pick up out of the next compartment, the cone overflow, returning to the system as close to the rig suction as possible to accommodate surface system mud cleaning when the mud is not circulating. Screen underflow will return to the sand trap to settle out any concentrated solids, then return and run through the system again.

With the combined capacity of the two mud cleaners (800 GPM), mud weight and drilled solids can be kept to a minimum, even during high volume conditions of surface hole drilling. These units are extremely versatile. They can be used as disilters on surface hole if needed, but if water is a problem, their use as a conventional mud cleaner is recommended. These units can also be easilty changed to a two screen configuration to allow the recovery of LCM.

As the well deepens and the circulation rate decreases below 350 GPM, the mud cleaners can be split and used in series to allow maximum cone efficiency. This entails the first mud cleaner's cone overflow to be dumped into the next compartment and then picked up and processed again by the second mud cleaner. This can easily be accommodated for by an extra suction valve and tee installed when units are rigged up. We are using this type of system on four rigs in the Evanston area of the Overthrust with great success (Chevron-3 rigs, Wexpro-1 rig).

SWECO, INC. P.O. Box 335, Casper, Wyoming 82602 Tel: (307) 237-3702

With this type of system, while keeping drilled solids to a minimum, will also lose very little liquid to the reserve pit, reducing any water and waste hauling costs that are usually required in remote locations.

In remote locations, especially inaccessible ones, we feel you would be money ahead to prepare for any condition. Attached you will find a flow schematic of the described system.

We will provide service once a week and instruction to your rig personnel on maintaining the equipment. Your company will provide helicopter service when needed, at no cost to SWECO; all cost will be as stated in the enclosed price sheet. The equipment will be FOB Casper.

SWECO, INC. P.O. Box 335, Casper, Wyoming 82602 Tel: (307) 237-3702

RATES PER DAY

	monthly	3 month	yearly
1 Dual Shaker	$155.00	$145.00	$125.00
1 Mud Cleaner	175.00	165.00	155.00
1 Diesel Pump	80.00	75.00	70.00
1 Electric Pump	65.00	60.00	55.00

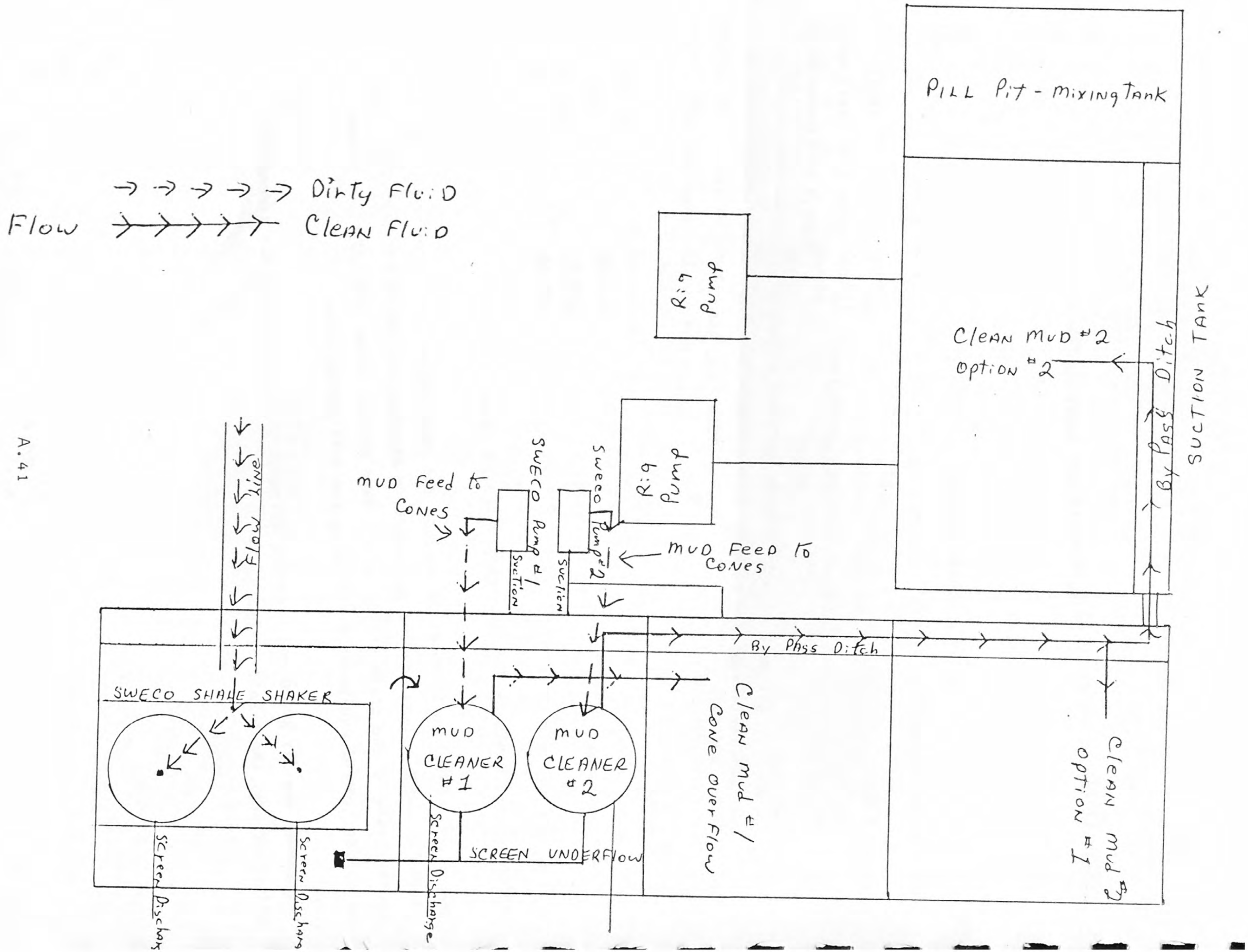
EQUIPMENT IN PROPOSAL

*1 Dual Shaker	$120.00	$110.00	$ 90.00
**2 Mud Cleaners	260.00	245.00	230.00
2 Electric Pumps	130.00	120.00	110.00
TOTAL	510.00	475.00	430.00

A diesel pump would be $15.00 more per day per pump.

*Whenever a SWECO dual shaker is used on the same rig as two (2) or more other pieces of SWECO solids control equipment, a discount of $35.00 per day will apply to the price of the shale shaker on all days when at least two (2) other pieces of solids control equipment are drawing the full rental rate.

**Whenever two (2) SWECO mud cleaners are used on the same rig, the second unit will cost only about half of the first.


Dirty Fluid
Flow
Clean Fluid
PILL Pit - mixing Tank
Rig Pump
Rig Pump
Clean mud #2
option #2
By Pass Ditch
SUCTION TANK
Flow Line
mud Feed to Cones
SWECO Pump #1
Suction
SWECO Pump #2
Suction
mud Feed to Cones
By Pass Ditch
SWECO SHALE SHAKER
mud CLEANER #1
mud CLEANER #2
Clean mud #1
Cone Overflow
Clean mud #3
option #1
SCREEN UNDERFLOW
Screen Discharge
Screen Discharge
Screen Discharge

E|Q&M

ELDER/QUINN&McGILL INC.
P. O. Box 16159 • 4800 Race Street
Denver, Colorado 80216 • (303)292-4800

November 3, 1980

K & A / Helton
Mr. Paul McKissen
2200 Security Life Bldg.
Denver CO 80202

Dear Mr. McKissen:

Enclosed, please find drawings of camp units similar to the ones we discussed. The units we discussed would be 10'x28' and would be as follow:

10 - 10'x28' (100'x28') Kitchen/Diner
Recreaton/office & commissary

15 - 10'x28' Four-man bunks

8 - 10'x28' Two man bunks

1 - 10'x28' Laundry

Total, F.O.B. Jackson, Wyoming $537,000.00

We have figured that it would take approximately 40 trips to move the camp on site. Catering for a camp of this type would probably cost $30-35.00 per man per day.

If you have any questions, please feel free to call.

Sincerely,

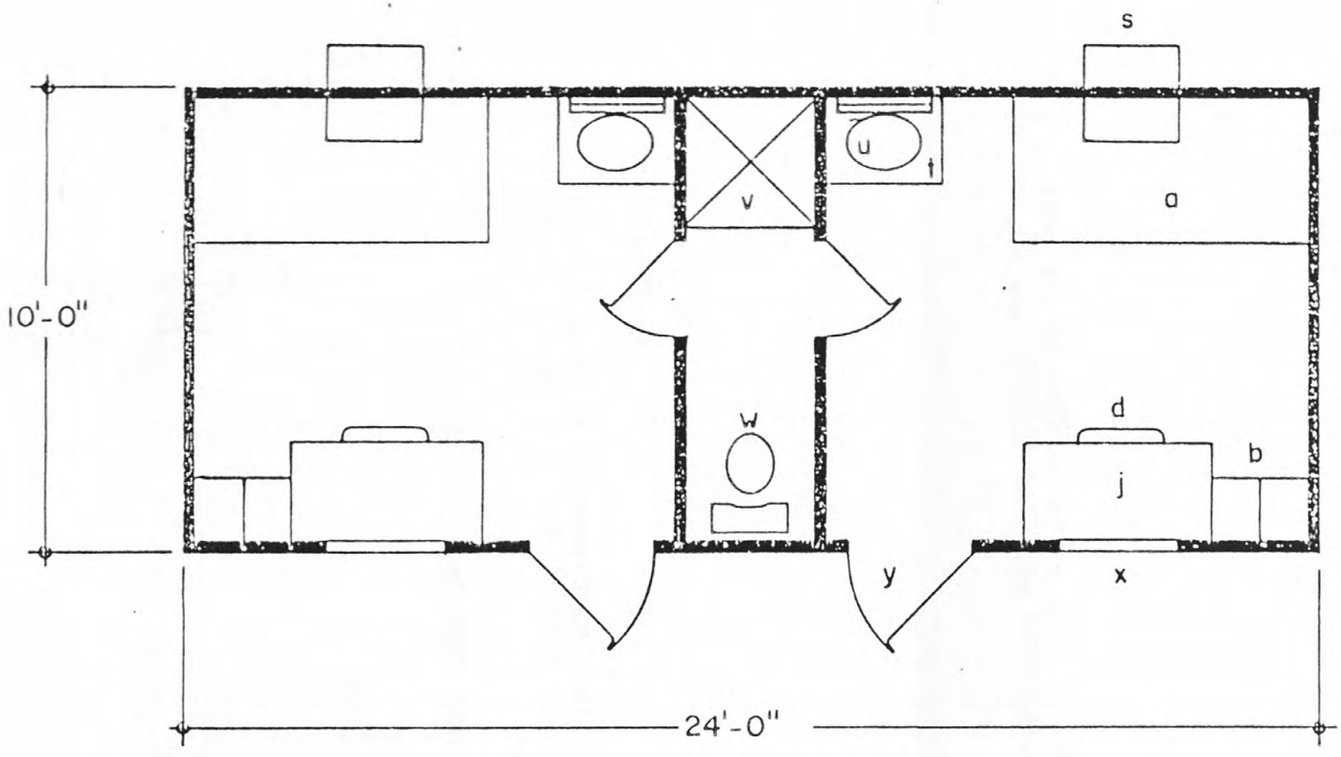
ELDER/QUINN & McGILL, INC.

Chilton Leach

Chilton Leach,
Sales Representative

CL/dat

Enclosures



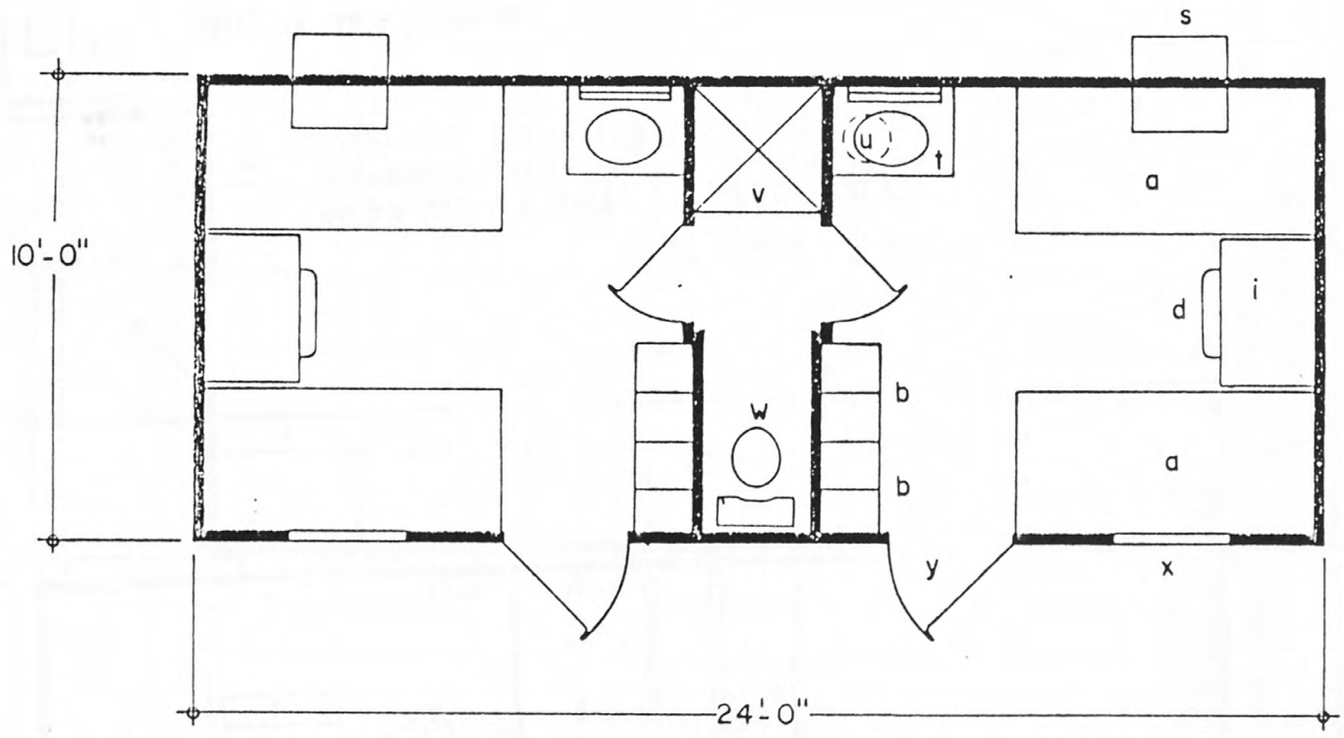
A.43

SHIPPING WEIGHT:	5000 /LB	2268 /KG
SHIPPING CUBE (KD):	684 /FT3	19.4 /M3
SHIPPING CUBE (PE):	2178 /FT3	61.6 /M3

CLIFF

INDUSTRIES INC

MODEL: SB1024-K-2	**TYPE:** TWO MAN SLEEPER/BATH	**DWG:** S012

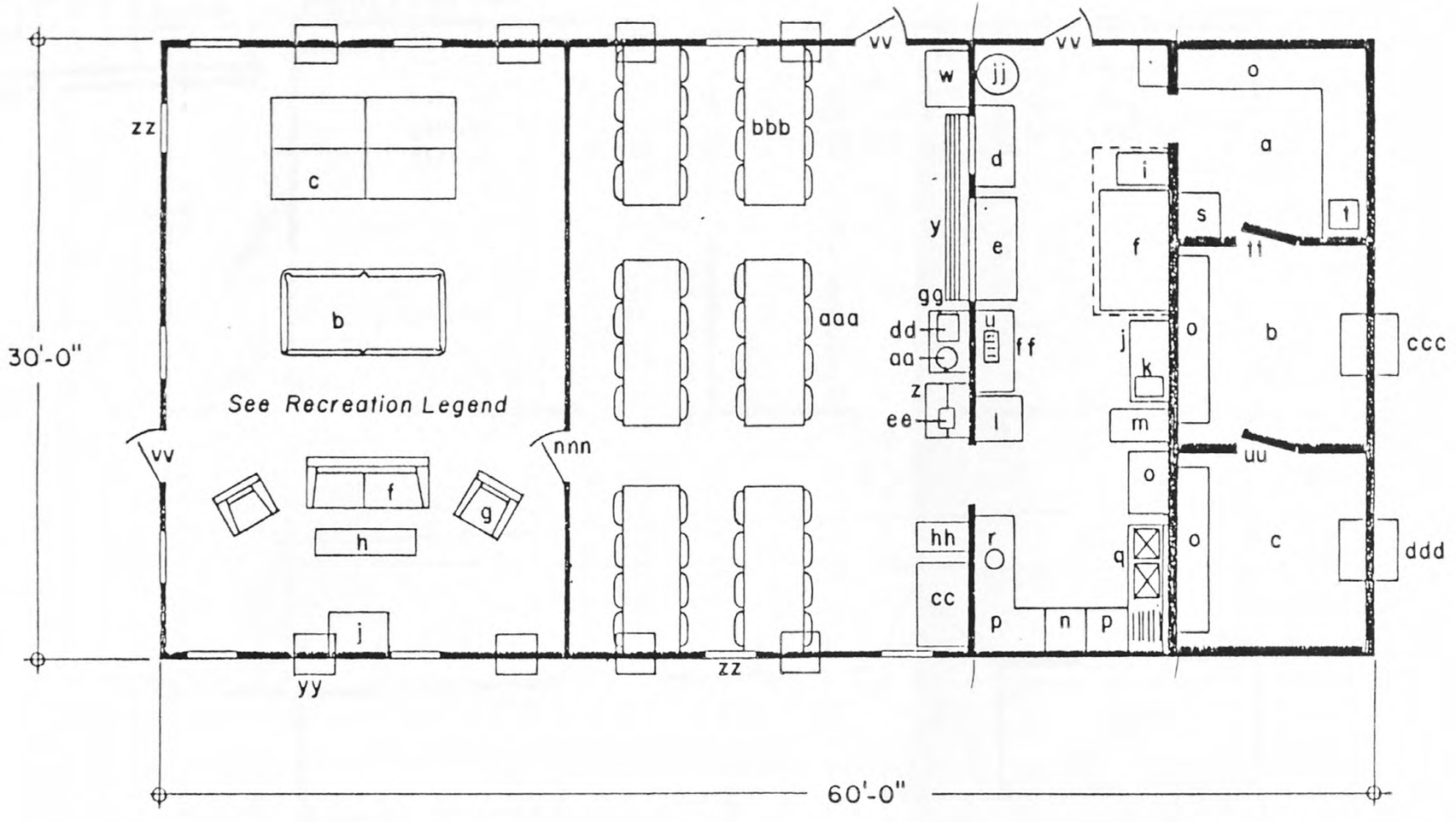


A.44

SHIPPING WEIGHT:	5000/LB	2268/KG
SHIPPING CUBE (KD):	684/FT^3	19.4/M^3
SHIPPING CUBE (PE):	2178/FT^3	61.6/M^3

CLIFF INDUSTRIES, INC.

MODEL: SB1024-K-4	**TYPE:** FOUR MAN SLEEPER/BATH	**DWG:** S014

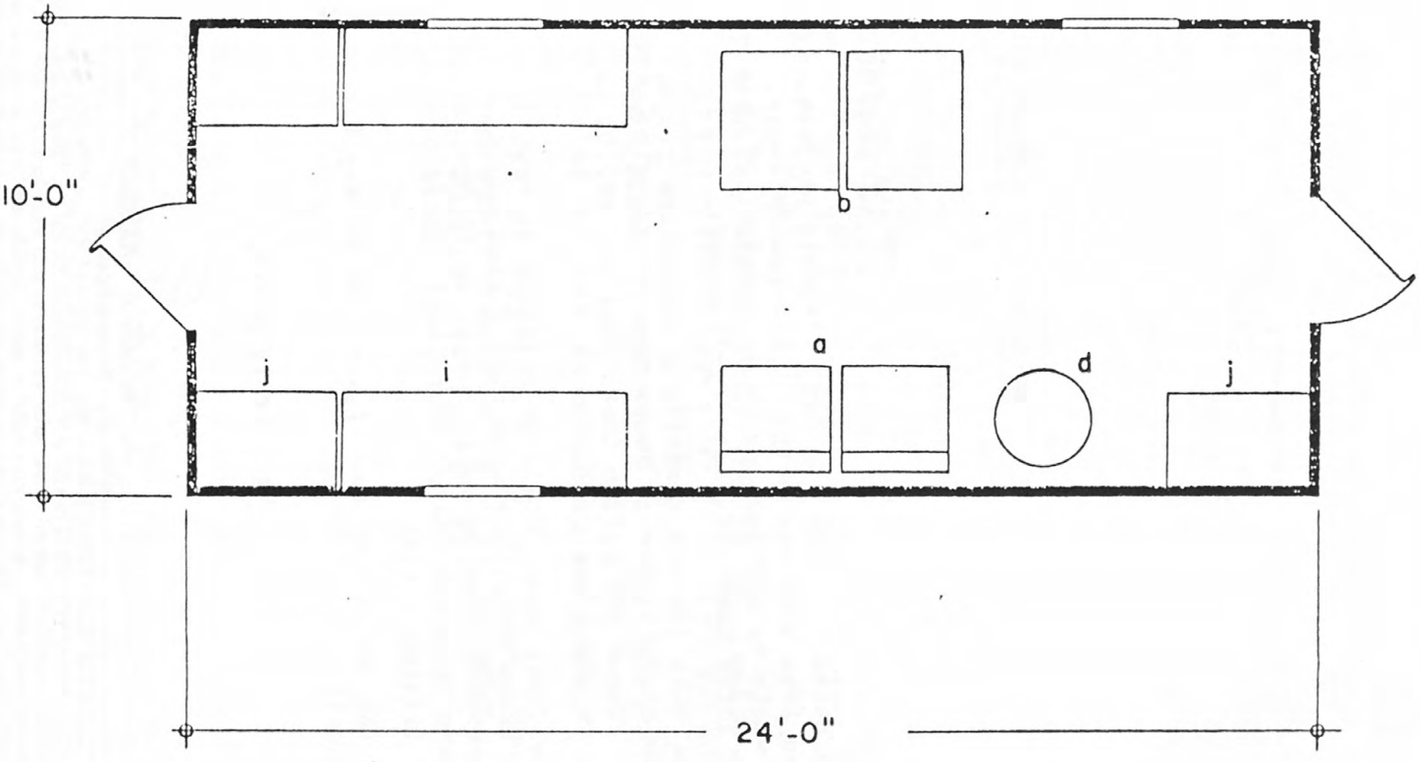


A.45

SHIPPING WEIGHT:	75000/LB	34020/KG
SHIPPING CUBE (KD):	4085/FT3	115.6/M3
SHIPPING CUBE (PE):	6026/FT3	170.5/M3

CLIFF

MODEL: MHR3060-4K-2P-50	**TYPE:** 50 MAN MESS HALL/RECREATION	DWG: MH002



A.46

SHIPPING WEIGHT:	9000/LB	4082/KG
SHIPPING CUBE (KD):	/FT^3	/M^3
SHIPPING CUBE (PE):	2123/FT^3	60.0/M^3

CLIFF INDUSTRIES, INC.

MODEL: L1024-P-50	**TYPE:** FIFTY MAN LAUNDRY	DWG: L006

WYOMING MONTANA COLORADO NORTH DAKOTA SOUTH DAKOTA UTAH NEBRASKA

BUTANE POWER & EQUIPMENT CO.

GENERAL OFFICES: P.O. BOX 2639 PHONE 234-8985
CASPER, WYOMING 82602

October 29, 1980

K. A. Helton Engineering
2200 Security Life Building
1616 Glenarm Street
Denver, CO 80202

Attn: Mr. Paul McKessen:

In reply to your phone call the other day, I did some checking on propane tank sizes and weights.

It appears that 500 gallon tanks would be the best for this project. They are 37" in diameter and ten feet long and weigh 1,280 pounds empty. Filling the tank to 80%, which would be 400 gallons @4.24 pounds (60^{o}) per gallon, would be 1,696 pounds - Total tank and gas: 2,976 pounds.

You did not mention whether this job was strictly a summertime project or just what months they plan to operate, but it looks like it would take 20 to 25 propane tanks on site. These 500 gallon tanks rent for $67.00 per year. Today's price of propane is .59 9 per gallon.

We did not discuss just how these tanks would be refilled as needed. It would be difficult to have a truck available each time a tank would be brought in for refill. It is possible that we could supply an 18,000 gallon trailer with a pump at the staging area and one of your people could be trained in the proper method of filling a tank.

I hope this is the information you wanted and if I can be of any further assistance, please do not hesitate to call me.

Very truly yours,

John D. Edmondson

CASPER DENVER SALT LAKE CITY

EATON METAL PRODUCTS CO.

4800 YORK STREET DENVER, COLORADO 80216

PHONE 825-7204

Manufacturers - Distributors

Oil Handling Equipment—Gasoline Pumps—Compressors
Hoists—Lubrication Equipment—Liquified Petroleum Gas Equipment
SPECIAL STEEL FABRICATION

Quotation

Quot'n No. 4323-BN

Page 1 of 1

To K&A Helton
2200 Security Life Building
Denver, Colorado 80202

Date 11-6-80

Attention: Mr. Paul McKissen

Terms Net 10

F.O.B. Denver, Colorado

References:

Gentlemen: We take pleasure in submitting the following proposal for your acceptance.

Quantity	Description	Unit Price	Extension	Est. Weight
1	400 gallon 42" Ø x 82" OAL x 10 gauge with one baffle, domed heads, skids, lifting bands, 3- 2" NPT and prime paint	$1670.00	$1670.00	
	The price would be $1586.50 if tanks were bought in quantities of five (5) or more.			
	Delivery is 10 weeks after receipt of order.			
	No sales or use taxes are included.			
	Interest of 1½% per month will be charged on all accounts overdue 30 days or more. Interest not to exceed the lawful rate.			

Delivery _____ Weeks After Receipt of Order and or Approved Drawings.

ALL SALES AND CONTRACTS MADE BY US ARE EXPRESSLY SUBJECT TO THE CONDITIONS SHOWN BELOW AND ON THE BACK HEREOF, INCLUDING THOSE LIMITING WARRANTIES. The terms of this Quotation may not be varied by purchaser's acceptance or purchase order. In the event of any inconsistency, the terms hereof shall control, and purchaser shall be deemed to have assented to the same in full. This Quotation shall be of no effect unless written acceptance in the space provided below is received by seller within 30 days from the date hereof. Acceptance by mail shall be effective as an acceptance only when actually received by seller. Seller reserves the right to withdraw this Quotation prior to acceptance without any liability whatsoever to purchaser. Progress Payments may be required by Eaton Metal Products Company pursuant to terms of Paragraph 8 hereof.

Accepted _____

By _____

Date _____

Respectfully submitted,
EATON METAL PRODUCTS COMPANY

By Bob Nielsen JM

Bob Nielsen

Date 11/6/80

Franklin

Please send reply to the above address

QUOTATION

TO K&A Helton
2200 Security Life Bldg.
1616 Glenarm
Denver, CO 80202

ATTN. Mr. Paul McKissen

Quotation No. QT350-00127
Date 10-28-80
Your Inquiry Verbal
Dated 10-28-80

With reference to your above inquiry, we are pleased to quote as follows:

Item	Quantity	Description	Unit price	Total
			CFT	
1	180'	30" O.D. .500 Wall 157.53# API-5L Grade B PEB Line Pipe		
		Domestic Material	5475.00	9855.00
		Foreign Material	5247.00	*9444.60
		F.O.B. - Jackson, Wyoming	CWT	
		Domestic material from St. Louis, MO.	5.74	1627.60
		Foreign material from Wagner, OK.	5.32	*1508.51
		Freight rates are based on 36,000# minimum and include 13% fuel surcharge		
		Availability of material subject to prior sale.		
		Price in effect at time of shipment will apply.		

RECEIVED
OCT 31 1980
K & A HELTON
DENVER ACCTG.

F.O.B.	Terms	Delivery	Grand Total
Jackson, WY.	Net 30 Days	Presently in Stock	$11,482.60
			*$10,953.11

FRANKLIN SUPPLY COMPANY

By Jim McCarthy (303) 292-0050
Ass't Regional Purchasing Manager

LSS DENVER MSG # 14 DRH 17:10 CDT 10/24/80

ATTN GLEN NEIDERT

QUOTATION NO. 01-22391

QUOTATION TO K&A ENGINEERING COMPANY

DESTINATION JACKSON, WYOMING VIA TRUCK

QTY.	ITEM DESC.	DLVD. PRICE C.W.T.	DISC. P&E C.W.T.
8400'	13-5/8 88.20 S595 BTC R3 (370 TONS)	59,730.62	59,905.38
800'	13-1/2 81.40 S95 BTC R3 (33 TONS)	8,121.15	7,636.40
200'	13-5/8 88.20 S95 BTC R3 (35 TONS)	8,796.50	8,271.26
3000'	9-7/8 62.80 S105 BTC R3 (94 TONS)	6,451.32	6,057.84
3400'	9-5/8 53.50 S95 BTC R3 (91 TONS)	4,194.75	3,976.15
16000'	7 29.00 S105 BTC R3 (232 TONS)	2,310.08	2,137.38

PRICE BASIS:LONE STAR BASE PRICE TRUCK
95.27 C.W.T.PLUS FUEL SURCHARGE.DLVRD.PRICE
INCLUDES SURCHARGE.

IF QUANTITIES ORDERED VARY FROM THOSE SET OUT IN THIS QUOTATION, WE RESERVE THE RIGHT TO REVISE OUR QUOTATION IF NECESSARY.

DELIVERY: QUOTED FOR INFORMATION ONLY.
SUBJECT TO PRIOR SALE.

THANK YOU.
D.R.HAMPICK

DR

LSS DALLAS
LSS DENVER

10-27-80
9:45 am

BAKERLINE

A DIVISION OF BAKER INTERNATIONAL CORPORATION
3390 Peoria, Suite 303
Aurora, Co. 80010
TELEPHONE (303) 340-8360

Keplinger Companies
555 17th Street
Denver, Co. 80202

Attn: Paul McKissen

Oct. 24, 1980

Dear Paul;

Thank-you for the inquiry about our Bakerline Liner Hanger for future use.

All our hangers are C-95 material compatible, therefore there won't be any additional charges for special material.

The 13 3/8 x 9 5/8 Hanger poses some questions:

1. The 13 3/8 88.2#/1 is non API we would need an ID to be sure the hanger is full opening.

2. Even using a double set of slips on the hanger, the liner weight of 370,300#, many times forces the hanger slips through the 13 3/8 casing. This would be eliminated by setting the hanger in V-150 grade casing or attaching an external sleeve on the 13 3/8 S-95 intermediate casing where the hanger is set.

These things would not effect the Liner Hanger, priced as follows:

EQUIPMENT	PRICE
13 3/8 x 9 5/8 Liner Hanger double slip	$ 10,530.00
Pack off	$ 5,600.00
Tie back recepticle (72")	$ 3,450.00
Tie back nipple (72")	$ 6,400.00
Plugs (260-53 & 260-62)	$ 1,800.00
Buttress License Thread	$ 550.00
RENTAL ITEMS	
Setting Tool (266-01) (per run)	$ 940.00
Stand by per day	$ 48.00
Plug dropping head (260-38)	$ 240.00
Stand by per day	$ 15.00

BAKERLINE

A DIVISION OF BAKER INTERNATIONAL CORPORATION
3390 Peoria, Suite 303
Aurora, Co. 80010
TELEPHONE (303) 340-8360

RENTAL ITEMS CONT.

Misc. cross overs to make up equipment (three day min. additional days 35.00 ea)	$ 75.00

SERVICE

Service man's time $29.00 /hr. eight hr. min.	$ 232.00
Car milage Powell, Wyo. to Jackson at 90¢ 240 miles round trip	$ 216.00
Crated and packaged for Helo transport	$ 1,200.00

The 7 x 5 Liner hanger S-95 compatible equipment:

EQUIPMENT	PRICE
Single slip hanger	$ 1,400.00
Pack Off	$ 1,800.00
Tie back recepticle (72")	$ 2,070.00
Tie back nipple	$ 3,300.00
Plugs	$ 600.00
Hydrill License thread	$ 550.00

RENTAL ITEMS

Setting tool (266-01)(per run) stand by $17.00 per day	$ 830.00
Plug dropping head (260-38) stand by $15.00	$ 240.00
Misc. cross overs to make up equipment (three day minimum) stand by additional days $35.00	$ 75.00

SERVICE

Service mans time $29.00 per hour eight hour min.	$ 232.00
Car milage Powell, Wyo. to Jackson at 90¢ 240 miles round trip	$ 216.00
Crated and packaged for Helo Transport	$ 367.00

BAKERLINE

BAKER
A DIVISION OF BAKER INTERNATIONAL CORPORATION
3390 Peoria, Suite 303
Aurora, Co. 80010
TELEPHONE (303) 340-8360

Paul, these prices are current price book. They will hold for ninety days. I can't forecast price increases over time.

You'll also notice "Misc. cross overs" which can't be priced exactly unless we know drill pipe size and thread.

Finally please bear in mind these prices are estimates and can vary as much as 10%. As the time approaches to run these tools we will need to work out all the details and procedures to insure a first class job.

We at Bakerline are anxious to provide this equipment.

Sincerely,

Dan J. Divan
City Sales

DD;jh
cc

FORTIER & ASSOCIATES

INDUSTRIAL CAMPS CATERING

HEAD OFFICE:
3050 PARSONS ROAD, EDMONTON, ALBERTA T6N 1B1
OTHER OFFICES: CALGARY, ALBERTA
SALT LAKE CITY, UTAH
DENVER, COLORADO

TELEPHONE:
(403) 463-2323
(403) 263-3622
(801) 355-4157
(303)893-0914

Glenn Callahan
2530 Security Life Building
Denver, CO 80202
(303) 893-0914

November 21, 1980

K & A/Helton
2200 Security Life Building
1616 Glenarm Place
Denver, CO 80202

BID #725

JACKSON HOLE,

WYOMING

CATERING

Fortier & Associates will supply catering services as set out in Schedule A. Such services to include a staff of seven including cooks, cook's helpers, and camp attendants with personnel F.O.B. the site and groceries F.O.B., Jackson Hole, Wyoming. Fortier & Associates will be reimbursed for these services as follows:

Daily minimum guarantee 75 men. Cost per man per day $22.50.

Transportation of groceries $1.00 per running mile.

CAMP

Fortier & Associates will supply camp facilities as follows subject to terms and conditions as set out in Schedule C:

14 units side by side
$2,500.00 set-up charges (one time only) for technical representative to direct K & A/Helton labor force for camp assembly.

Fortier & Associates will be reimbursed for the 14-unit facilities at $775.00 per day, minimum guarantee would be for one year, camp is F.O.B. Casper, Wyoming, and the facilities must be returned to Casper, Wyoming upon completion of the job.

To furnish power skid units with camps, will run $75.00 per day for each unit generating 65 KW. Each power skid unit will consist of a steel shed covered diesel engine- generator of 65 KW with 2- 1,000 gallon propane tanks and 2- 1,000 gallon diesel tanks. The number of power skid units needed and the operation of the power skid units is the sole responsibility of K & A/Helton.

CLIENT'S RESPONSIBILITIES

ITEM 1

Client shall furnish a site dimension adequate for a 14-unit camp, located on the up-wind side of the rig. Usually west or northwest in this area.

ITEM 2

Client is to arrange movement of the camp and furnish personnel to assemble camp. Fortier & Associates will provide an adviser for up to 24 working hours for set up.

ITEM 3

Client to furnish adequate generator or power source before camp arrives, and an electrician for hook up.

ITEM 4

Client to furnish adequate propane tank (usually baffled) with adequate lead. Approximate monthly consumption- 900 gallons propane per month per 20 men.

ITEM 5

Client to furnish adequate water supply with water storage tank. Average use per day- 45 gallons per man.

ITEM 6

Client to furnish sump pit for long-term camp, pump out type.

ITEM 7

Any Third Party services furnished by Fortier will carry 15 percent surcharge on building.

We appreciate this opportunity to handle your camp and catering needs for the Jackson Hole, Wyoming project.

Regards,

FORTIER & ASSOCIATES

Glenn Callahan
Director of Marketing

lg

PRELIMINARY COST ESTIMATE
for
CONSTRUCTION AND RESTORATION OF ACCESS ROUTE
to
GETTY RESERVE DRILLING SITE
in the
LITTLE GRANIT CREEK AREA

Prepared by: Steven A. Grosch
P. E. Grosch Construction, Inc.

SCOPE:

This preliminary estimate of construction and restoration cost of the access route has been prepared for comparative analysis to other transportation modes only.

Data gathered for use in preparation of the estimate is based upon a tour of the proposed route on September 24, 1980 and map inspection of the USGS Bull Creek Quadrangle. The tour furnished information in general terms, such as:

1. Timber size and density.
2. Surface evidence of rock or soil.
3. Apparent severity of grades and cross slopes.
4. Possible variations to pack trail alignment.
5. Topographic severity of drainage crossings.

Time nor the scope of the work allowed any actual field survey.

Map inspection then was the only source of information available to yield data such as:

1. General alignment.
2. Existing cross slopes to the proposed alignment.
3. Length of access.
4. Grades of constructed access.
5. Clearing limits and therefore timber area.
6. Culvert size, length and quantity.
7. Feasibility of alignment change from the pack trail.

The result of the map inspection and general observations are tabulated on Exhibit II. Exhibit I illustrates the proposed alignment. The map has a scale of 1" = 2000' and contour interval of 40 feet.

Clearly, the data tabulated on Exhibit I are approximations only. They may serve our present purpose of a preliminary estimate. However, a final estimate would necessarily have to be based upon data yielded by an actual field survey. Indeed, prior to commencement of construction, a field survey must be completed. According to the Roading Guidelines for Oil and Gas Exploration and Development prepared by Bridger-Teton National Forest in 1980 states: "Roads shall be designed by or under the direct supervision of a Registered Professional Engineer. As in survey, design standards and techniques should be modified to be consistent with the prescribed end product. Techniques may vary from (1) a full design with complete plans and profiles, (2) a line diagram and typical cross section, and (3) field staking of drainage facilities or spot surfacing along a generally acceptable in-place facility." It states further that "Construction control will be staked on the ground for all roads. Staking will be in accordance with standard practices and include a marked centerline,

P. I.'s , clearing limits, cut and fill stakes, drainage structures, and reference hubs. The degree of construction staking will be determined by the Forest Service engineer. Minimum staking should include a referenced centerline, staked culverts and dips, and the cut catch points on slopes over 40 percent. Construction staking shall be done as described in Forest Service Standard Specifications for Roads and Bridges. NO WORK SHALL COMMENCE UNTIL FOREST SERVICE APPROVAL OF CONSTRUCTION STAKING IS COMPLETED." In Section 20 the guidelines state: "All road and bridge construction and associated work shall be performed under the inspection of a Professional Engineer licensed in the State of Wyoming. Said Engineer shall certify that all work is accomplished in conformance with the applicable specifications and provisions."

QUALIFICATIONS TO PRELIMINARY ESTIMATE

Several assumptions are made in preparation of the estimate:

1. Traveled way width is to be 14 feet with intervisible turnouts.
2. Culverts to be installed in drainages and on required intervals.
3. Culbert dimensions per Exhibit II are approximations, actual dimensions and quantity would be determined by road design and hydrological study.
4. Survey, design and staking work to be completed in August, 1981.
5. Construction of access route to be completed by October, 1981.
6. Drilling Activity to be completed during the summer months of 1982.
7. No gravel surfacing anticipated for summer drilling operations.
8. Road maintenance during drilling operations is estimated to require only occasional surface blading.
9. Survey and design of access route shall consist of minimum staking complemented by full design in critical areas.
10. Restoration activity, if required, shall be completed during the summer months of 1983.
11. Restoration technique and completion shall conform to the stipulations of those required on the Getty Oil test on Fall Creek.

SURVEY, DESIGN AND STAKING

At peak activity it is estimated that seven men would be involved. Estimated time for completion is three months. With weather permitting and actual construction staking proceeding just ahead of construction, construction activity could begin on or before August 15, 1981. The estimated cost is $75,000.

CONSTRUCTION ESTIMATE:

MACHINE UTILIZATION

QUANTITY	DESCRIPTION
1	Cat. D9H Dozer with ripper

QUANTITY	DESCRIPTION
3	Cat. D8K Dozers with rippers
1	Cat D7G Dozer with ripper
2	Cat. 627B Tandem Powered Scrapers
2	Cat. 14G Motorgraders with rippers
1	Rubber Tired Backhoe
1	Rubber Tired Skidder

CREW REQUIREMENTS

At peak construction activity eleven machine operators, two sawyers, five men for culvert, timber and grade control operations, and one supervisor will be required.

NEW ACCESS ROAD - ESTIMATED TIME AND COST

Seven weeks is estimated as necessary for construction. The estimated cost for construction of the new access road is $410,000.

EXISTING ACCESS ROAD - ESTIMATED TIME AND COST

One week is estimated as required to improve the 1.7 miles of existing access road and install the required culverts. The estimated cost is $30.000. It is therefore estimated that the project could be completed from May 15, 1981 to October 15, 1981 prior to closure by winter conditions.

MAINTENANCE - NEW AND EXISTING ACCESS ROAD

It is estimated that the access road will require blading prior to and immediatly following mobilization of drilling equipment. Regular blading during the drilling operation and following rig de-mobilization will also be necessary. The estimated cost of maintenance during the summer of 1982 is $30,000.

RESTORATION ESTIMATE:
MACHINE UTILIZATION

QUANTITY	DESCRIPTION
2	Cat. D8K dozers with rippers
1	Cat. D7G Dozer with rippers
2	Cat. 627B Tandem Powered Scrapers
1	1.5 Cubic Yard Dragline
1	Track Mounted Excavator
1	14G Cat. Motorgrader

CREW REQUIREMENTS

At peak restoration activity eight machine operators, three men for culvert removal, and seeding operations, and one supervisor will be required.

RESTORATION - ESTIMATED TIME AND COST

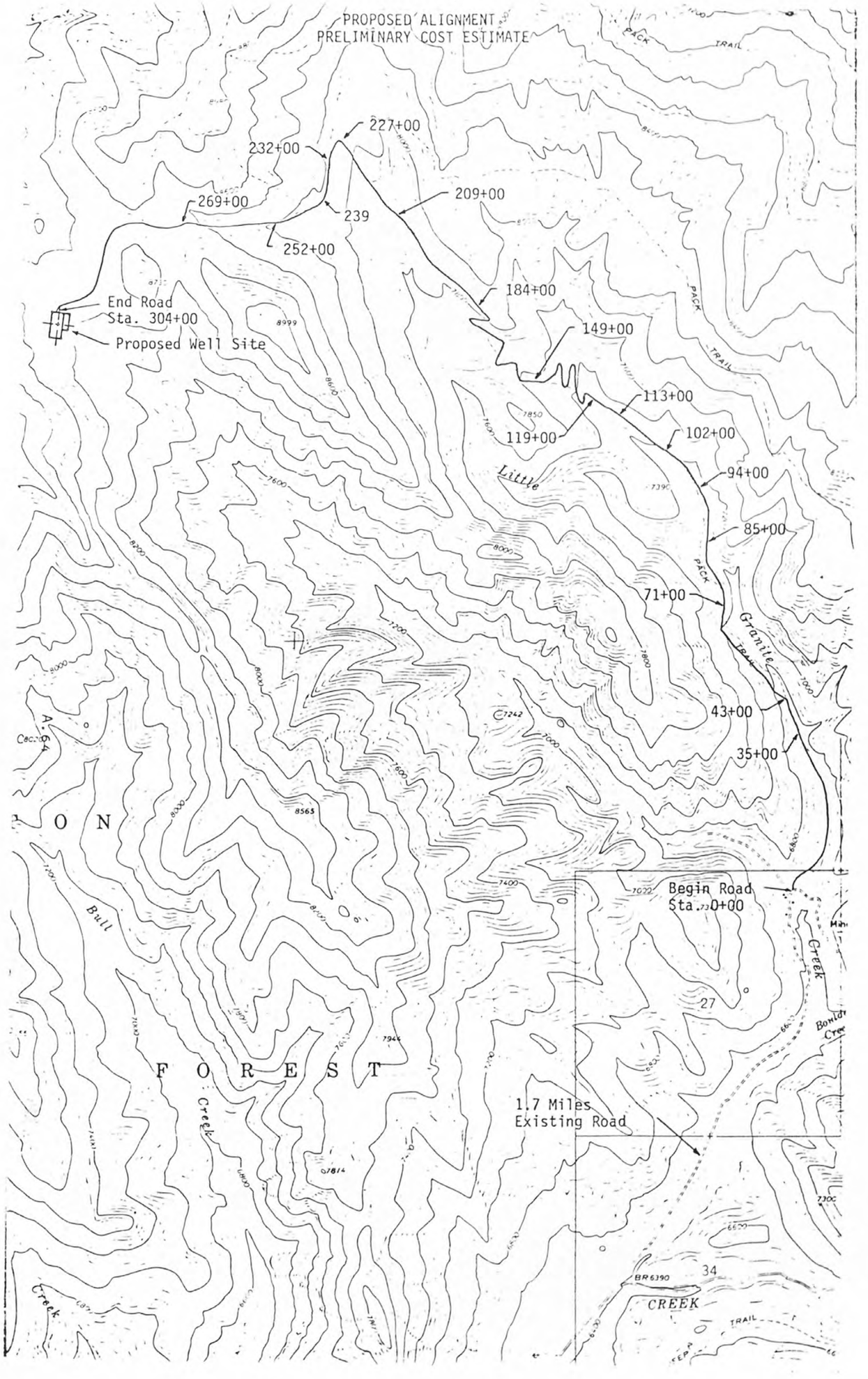
Eight weeks is estimated as required to complete restoration. The estimated cost of restoration is $360,000.

SUMMARY:

ACTIVITY	TIME FOR COMPLETION	ESTIMATED COST
Survey, Design, Stake	3 Months	$ 75,000.
Construct New Access Road	7 Weeks	$410,000.
Improve Existing Access Road	1 Week	$ 30,000.
Road Maintenance	Duration of Drilling	$ 30,000.
Access Road Restoration	8 Weeks	$360.000.

EXHIBIT II
PRELIMINARY COST ESTIMATE
ESTIMATED PARAMETERS TO COST ESTIMATE

STATION	INTERVAL FEET	MAXIMUM GRADE, %	CROSS SLOPE, %	TIMBER AREA, ACRES	18" DIA. CULVERT, FT.	CULVERT DIA. IN., LENGTH FT.		SURFACE EVIDENCE OF ROCK	RESTORATION DIFFICULTY	COMMENT
0+00										BEGIN ROAD AT FORMER MINE SITE
	3500	8 ±	0 to 25	0.6	180	84	60	None	Easy	
35+00										
	800	5 ±	0 to 33	None	30	36	36	None	Easy	
43+00										
	2800	10 ±	40	2.9	150	72	54	Light	Severe	SIDE HILL SECTION ABOVE TRAIL
71+00										
	1400	5 ±	33 t0 0	1.1	90		—	Light	Moderate	
85+00										
	900	10 ±	0 to 33	None	60	72	54	Light	Moderate	CMP INSTALLATION DOWN STREAM OF CONFLU-ENCE SIDE HILL SECTION ABOVE TRAIL.
94+00										
	800	10 ±	40	0.7	30	24	30	Moderate	Severe	
102+00										
	1100	10 ±	40	None	60		—	Moderate	Severe	
113+00										
	600	5 ±	0	0.3	30		—	Moderate	Easy	
119+00										
	3000	10 ±	33	3.4	150	60	46	Heavy	Severe	SWITCH BACKS TO ASCEND SLOPE
149+00										
	3500	10 ±	25 to 0	2.8	210		—	Heavy	Moderate	SWITCH BACKS TO ASCEND SLOPE
184+00										
	2500	5 ±	25 to 0	0.6	150		—	Moderate	Easy	
209+00										
	1800	10 ±	0	None	90	48	40	Light	Easy	
227+00										
	500	10 ±	25	None	30		—	None	Easy	
232+00										
	700	10 ±	40	None	30		—	Light	Severe	
239+00										
	1300	5 ±	25 to 0	None	60		—	None	Easy	
252+00										
	1700	12 ±	40	1.1	90	24	50	None	Severe	
269+00										
	3500	10 ±	25 to 0	None	150		—	None	Easy	
304+00										END ROAD AT WELL SITE
				13.5 A.	1590 FT.					


PROPOSED ALIGNMENT
PRELIMINARY COST ESTIMATE
227+00
232+00
209+00
269+00
239
252+00
184+00
End Road
Sta. 304+00
Proposed Well Site
149+00
113+00
119+00
102+00
94+00
Little
85+00
71+00
Granite
43+00
35+00
A.64
O N
F O R E S T
Bull
Creek
Begin Road
Sta. 0+00
27
1.7 Miles
Existing Road
34
BR6390
CREEK
PACK
TRAIL

HIGH LIFE HELICOPTER FEASIBILITY STUDY

BITS

	ITEM	UNIT COST $	TOTAL COST $	UNIT WEIGHT (LBS.)	TOTAL WEIGHT (LBS.)
1	36" Hole Opener	$ 3,400.00	$ 3,400.00	2,600	2,600
8	26" Mill Tooth	8,899.00	71,192.00	1,204	9,632
8	20" Mill Tooth	5,247.00	41,976.00	653	5,224
6	17 1/2" Mill Tooth	4,763.00	28,578.00	536	3,216
6	17 1/2" Insert	10,742.00	64,452.00	569	3,414
6	12 1/4" Mill Tooth	1,963.00	11,778.00	192	1,152
16	12 1/4" Insert	5,137.00	82,192.00	224	3,584
3	8 3/4" Mill Tooth	905.00	2,715.00	90	270
5	8 3/4" Insert	3,317.00	16,585.00	90	450
1	6" Mill Tooth	787.00	787.00	36	36
2	6" Insert	2,345.00	4,690.00	39	78
2	Diamond Bits	9,000.00	18,000.00	50	100
2	Core Head	7,500.00	15,000.00	25	50
1	Core Barrel	6,000.00	6,000.00	2,000	2,000
	TOTAL		$367,345.00		31,806

HIGH LIFE HELICOPTERS FEASIBILITY STUDY

MOVE RIG, CASING, MUD AND CAMP BY TRUCK

AMERICAN DRILLING CO. RIG 2 OIME 1800 ITEM	WEIGHT POUNDS	DRAYAGE PRICE PER C WT.	F.O.B. JACKSON WYO.	TRUCKLOADS 40,000# ± CALC.	ACTUAL
Junk Basket	36,000	$9.36	$ 3,369.60		1
Fuel Tank	36,520	9.36	3,418.72		1
B.O.P. Suitcase & Catwalk	49,080	9.36	4,593.89		1
Substructure	59,340	9.36	5,554.22		1
Water Tank	45,560	9.36	4,264.42		1
Motors	66,780	9.36	6,250.61		1
"V" Door & Miscellaneous	40,140	9.36	3,757.10		1
Substructure	52,960	9.36	4,957.06		1
Pump	54,320	9.36	5,084.35		1
Compound & Table	45,600	9.36	4,268.16		1
81 Drill Pipe (4 1/2")	47,000	9.36	4,399.20		1
81 Drill Pipe (4 1/2")	47,000	9.36	4,399.20		1
10 8" Drill Collars	42,000	9.36	3,931.20		1
Matting & Suitcase	53,560	9.36	5,013.22		1
Dog House	45,080	9.36	4,219.49		1
Mats & "A" Legs	51,720	9.36	4,804.99		1
Mats & Rig Flooring	47,600	9.36	4,455.39		1
Boiler	37,110	9.36	3,473.50		1
Crown & Drilling Line	45,920	9.36	4,298.11		1
Derrick & Motor Shed	49,920	9.36	4,672.51		1
15 7" Drill Collars	51,600	9.36	4,829.76		1
Pump	51,520	9.36	4,822.27		1
Generators	61,960	9.36	5,799.46		1
Junk Rack	40,700	9.36	3,809.52		1
81 Drill Pipe 4 1/2"	47,000	9.36	4,399.20		1
Mud Tank	62,220	9.36	5,823.79		1
Shed Rack	49,600	9.36	4,642.56		1
Mud Tank	60,380	9.36	5,651.57		1
Miscellaneous Load	47,600	9.36	4,455.36		1
9 7" Drill Collars, Kelly & Subs	39,500	9.36	3,697.20		1
Draw Works	65,540	9.36	6,134.54		1
Dog House	46,660	9.36	4,367.38		1
Catworks & Choke House	52,420	9.36	4,906.51		1
Floor & Miscellaneous	39,820	9.36	3,727.15		1
81 Drill Pipe 4 1/2"	47,000	9.36	4,399.20		1
Junk Rack, Suitcases & Shaker	43,880	9.36	4,107.17		1
Pushers House	35,000	9.36	3,276.00		1
75 Drill Pipe 4 1/2"	47,000	9.36	4,399.20		1
75 Drill Pipe 4 1/2"	47,000	9.36	4,399.20		1
Forklift	36,000	9.36	3,369.60		1
	1,925,610		180,237.55		40

HIGH LIFE HELICOPTERS FEASIBILITY STUDY

TRUCK MOVE

ITEM	TOTAL WT./LBS. TRUCKLOADS	COST Per 100'	F.O.B. JACKSON WYO.	TRUCKLOADS 40,000# CALC.	ACTUAL
180' 30" 157.6# Casing	28,368	$ 5,475.00	$ 10,374.36	0.7	1
5,600' 20" 169# N-80 Casing	946,400	13,065.00	781,515.30	23.7	24
8,400' 13 3/8" 88.2# SS-95 Casing	740,880	9,205.38	817,372.10	18.5	19
800' 13 3/8" 81.4# S-95 Casing	65,120	7,636.40	64,969.20	1.6	2
800' 13 3/8" 88.2# S-95 Casing	70,560	8,271.26	70,372.00	1.8	2
3,000' 9 5.8" 62.8# S-105 Casing	188,400	6,057.84	181,735.20	4.7	5
3,400' 9 5/8" 53.5# S-95	181,900	3,876.15	142,621.50	4.5	5
16,000' 7" 29.0# S-105	464,000	2,173.38	369,612.80	11.6	12
1,100' 7" 32.0# S-95	35,200	3,062.90	35,538.90	0.9	1
1,200' 5" 23# S-105	27,600	3,183.00	38,196.00	0.7	1
TOTAL	2,748,428		$2,613,526.76	68.7	72
1 Liner Hanger 13 3/8"x 9 5/8"	2,000		27,276.00	0.05	
	2,000		11,313.00	0.05	
TOTAL	4,000			.1	1
Cement & Float Equipment					
30"x36"	64,801		14,150.00	1.6	2
20"x26"	558,250		118,900.00	13.96	14
13 3/8"x17 1/2"	107,916		27,900.00	2.7	3
9 5/8"x12 1/4" (Liner)	202,185		64,000.00	5.1	6
7"x8 3/4"	59,006		23,200.00	1.5	2
5"x6" (Liner)	22,507		15,700.00	0.6	1
(Totals include pump trucks)	1,070,375		$263,850.00	25.5	28
Flange Spool & Slips	3,155			0.1	1
Wire Line Logging					
First Run			29,220.00	1	1
Second Run			38,311.00	1	1
Third Run			52,881.00	1	1
Fourth Run			80,327.00	1	1
Fifth Run			79,463.00	1	1
TOTAL			$280,202.00	5	5
Propane Supply					
2-6,100 gal. tanks Drayage each		600.00	1,200.00	2	2
Rental per month ea. (12 mo.)		75.00	1,800.00	-	-
Propane First Fill		0.599	7,307.80	-	-
TOTAL			10,307.80	2	2

HIGH LIFE HELICOPTERS FEASIBILITY STUDY

TRUCK MOVE

ITEM	TOTAL WT./ LB.	UNIT COST	F.O.B. JACKSON WYO.	TRUCKLOADS 40,000# CALC.	ACTUAL
Mud:					
180' 36" Hole	62,500	SEE DETAIL	$ 4,600.00	1.6	2
5,600' 26" Hole	593,450	SEE DETAIL	168,596.00	14.8	15
10,000' 17 1/2" Hole	6,726,400	SEE DETAIL	982,175.00	168.2	169
15,400' 12 1/4" Hole	1,150,400	SEE DETAIL	497,440.00	28.8	29
17,400' 8 3/4" Hole	793,100	SEE DETAIL	261,770.00	19.8	20
18,000' 6" Hole	392,150	SEE DETAIL	238,165.00	9.8	10
(MUD) GRAND TOTALS	9,718,000		$2,152,746.00	243.0	245
Camp:					
27,375 Man Day		22.50	$ 615,938.00		
14 Units camp equip. 1 yr. min. per day		775	282,875.00		
Support per mile (70 miles)		1.00	25,550.00		
14 Units Transportation Casper & Return		1,500	21,000.00		14
			$ 945,363.00		14
Sweco Mud Cleaner					
Double Tub	3,500	170.00	$ 62,050.00		
Pump Electric	3,500	55.00	20,075.00		1
			$ 82,125.00		1
Water Well Rig	28,000	220.00/HR	$ 66,000.00	1	1
Mob/Demob			5,000.00		
Water Well Casing	16,000	847.00/100'	9,310.00	1	1
			$ 80,310.00		2

IAMOND CORE DRILLING
TARY DRILLING
OUTING
UNDATION TESTING
IAMOND DRILLING EQUIPMENT
RILLING ADDITIVES

Boyles Bros.
DRILLING COMPANY

General Offices and Plant
1624 Pioneer Road P.O. Box 25068 Phone (801) 972-3333
SALT LAKE CITY, UTAH 84125
Cable: BOYLESCO
Telex: 388-321

BRANCH OFFICES
PHOENIX, ARIZONA
GOLDEN, COLORADO
SPARKS, NEVADA
SPOKANE, WASHINGTON
MURFREESBORO, TENN.
SPRINGFIELD, MISSOURI
SANTIAGO, CHILE
cable: BOYLESBROS
LIMA, PERU
cable: BOYLESCOP
MEXICO CITY, MEXICO
telex: 001774546

November 19, 1980

K & A Hetlon Engineering
1616 Glenarm Ave., Suite 2200
Denver, Colorado 80204

Attention: Paul McKissen

Re: Your Helicopter Water Well Project, Jackson Hole, Wyoming

Dear Paul:

We anticipate using an in-house mobile B-80 top drive drill with a down-hole hammer. Charges would be $220.00 per hour for all time except breakdown time incurred from commencement of tearing drill down at staging area to finish of reassembling of parts at staging area after completion of hole.

Mobilization and demobilization will be $5,000.00 to staging area.

You would provide or be charged for:

a. Fuel
b. Compressors
c. Water (if required for injection)
d. Special hammers, if required
e. Bits and casing
f. $25.00 per day per man Per Diem, estimate two men for 30 days
g. All materials required
h. All helicopter support service required.

We estimate 16 days drilling and casing time, seven days to break equipment down, fly in, and set up, and seven days to remove and reassemble.

Should problems occur using this drill as to weight specifications, we could provide a core drill which will drill as required. It would drill appreciably slower but would probably cost less per hour. Another factor would be for us to rent a drill for this project, you would pay rent and we would supply crews.

We estimate that it would require two trips in and two out to move the drill, two in and two out for compressors, one in and one out for drill pipe with the big helicopter plus six to ten trips with the small one.

These are budgetary figures only. Should you have any questions or require further information do not hesitate to contact us.

Thank you.

Very truly yours,

Jerrold Culp

Jerrold R. Culp
Pricing Administrator

JRC:bg

cc: L. R. Fleming

TER-RAY DRILLERS INC.

May 2, 1981

Water Wells
Jackholes
Pumps

"we go where the water is"

Terry Olsen

292-0808

Golden, Colorado 80401

Dear Sir:

On behalf of Ter-Ray Drillers Inc. we would like to thank you for affording us the opportunity of submitting our proposal for drilling a water well at Gross Venture, Wyoming oil well site.

Our rig is a Walker-Neer WS-31 rated for 1,200 feet of 6 inch hole using a 2,500 lb. tool. We are confident it will break down very easily for 5,000 lb. helicopter loads.

This proposal would be for intention of drilling the well this summer. Should starting date be put off until next year our rates would have to be escaladed to cover inflation.

Mobilization and Demobilization to staging area.....	$7,000.00
Operating Hours.....	85.00/hr
Standby Hours.....	65.00/hr
Subsistance per day/per man.....	35.00

Muds, additives, casing, welding rod, oxygen,acetylene or any consumable items requested for Ter-Ray to supply will be third party invoice plus freight plus 15% for handling.

All time spent dismantling, moving and to reassemble the drill to and from drill site will be charged at standby hourly rate of $65.00 per hour.

All other costs of dismantling and reassembling rig incurred, will be charged at third party plus 15%.

Camp, radio communication, transportation of fuel, water, or crews to be supplied at no cost to Ter-Ray Inc.

Our equipment list at these rates include: arc welder, acetylene torch, drill rig, 2,500 lb. drill tool, bits and necessary tools.

All costs of permits, bonds and licenses required to drill in Wyoming will be charged.

We would want to negotiate a minimum charge before signing a contract.

Again we thank you for giving us the opportunity of quoting this project and do trust you will find our prices competitive.

Should you have a need of more information please feel free to contact us.

Sincerely,

Terry D. Olsen
TER-RAY DRILLERS INC.

VENDOR AND DATA SOURCE

HELICOPTER: High Life Helicopters.

ROAD & LOCATION: P.E. Grosch Construction, Inc.

MOBIL/DEMOBIL: Truck Move: American Drilling.
Helicopter: Parker Drilling.

CASING HEAD: W-K-M Catalog.

SURFACE CASING: Franklin Supply, Boviard Supply.

INTERMEDIATE CASING: Lone Star Steel.

CEMENT & SERVICES: Halliburton.

RIG: Truck Move: American Drilling.
Helicopter: Parker Drilling.

FUEL: Current price other rigs, supply modules, Eaton Metal Products.

BITS/REAMERS: Hughes Tool Co., Reed Bit Co., Smith Tool Co.

FISHING: ACME Tool, Catalog.

MUD & CHEMICAL: Catalog.

WATER WELL: Boyles Brothers.

LOGGING: Dresser Atlas.

D.S.T.: Johnston Testors.

CORING: Christiansen Diamond, Catalog.

GEOLOGICAL: K & A/Helton.

ENGINEERING: K & A/Helton.

SUPERVISION: K & A/Helton.

MUD LOGGING: IMCO Data Unit, Catalog.

CAMP: Helicopter: Elder/Quinn & McGill.
Truck: Fortier & Associates.
Propane: Butane Power & Equipment Co.

RENTALS: (Surface) Sweco.

RENTALS: (Subsurface) Oncor.

ENVIRONMENTAL/SAFETY: Oilind, Catalog.

PRODUCTION CASING: Boviard Supply, Bakerline.

CHRISTMAS TREE: W-K-M Catalog.

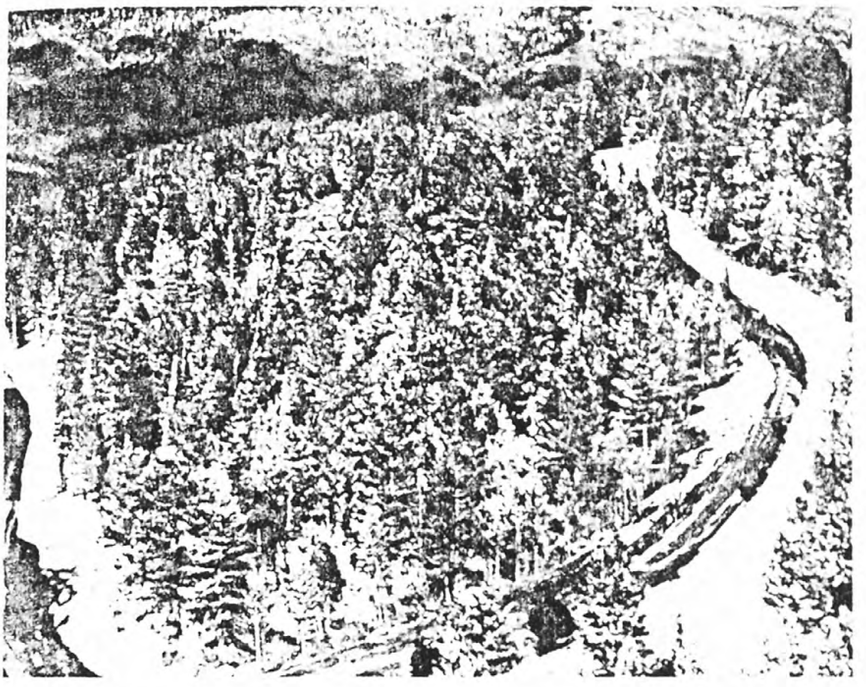
CORRELATION LOGS: Dresser Atlas Catalog.

PERFORATING: Dresser Atlas Catalog.

STIMULATION: Dowell.

TREATER: Catalog.

DRAW WORKS COMPARISON: National Supply.



The biggest expense to date has been the roadwork which involved upgrading a Forest Service path and about nine miles of road pioneering up and over the mountain's summit.

Idaho's Bald Mountain: beautiful scenery, expensive location

by Russ Rountree

From the top of Bald Mountain in Bonneville County, Idaho, you can see the rugged Teton Mountains of Wyoming and about a third of eastern Idaho. That's the view drilling crews can enjoy this fall and winter as they drill an Amoco Production Co. prospect near the summit of the mountain in NW NE 5-4s-45e.

If the site is superb for scenery, it isn't the most accessible drilling location in the world. It has taken nearly a year and a half of seismic work, planning, permitting and preparation to get ready to drill. Amoco expected to move a rig up the mountain and be on location in late September or October.

Although the figures were not available in late July, Martin Zimmerman, Amoco superintendent for the Salt Lake district, expected the cost of the venture would be $2.5 to $3 million before the test was spudded. At that time, the company had yet to construct about two and a quarter miles of road plus the drillsite. Total cost, including drilling, is expected to be in excess of $10 million.

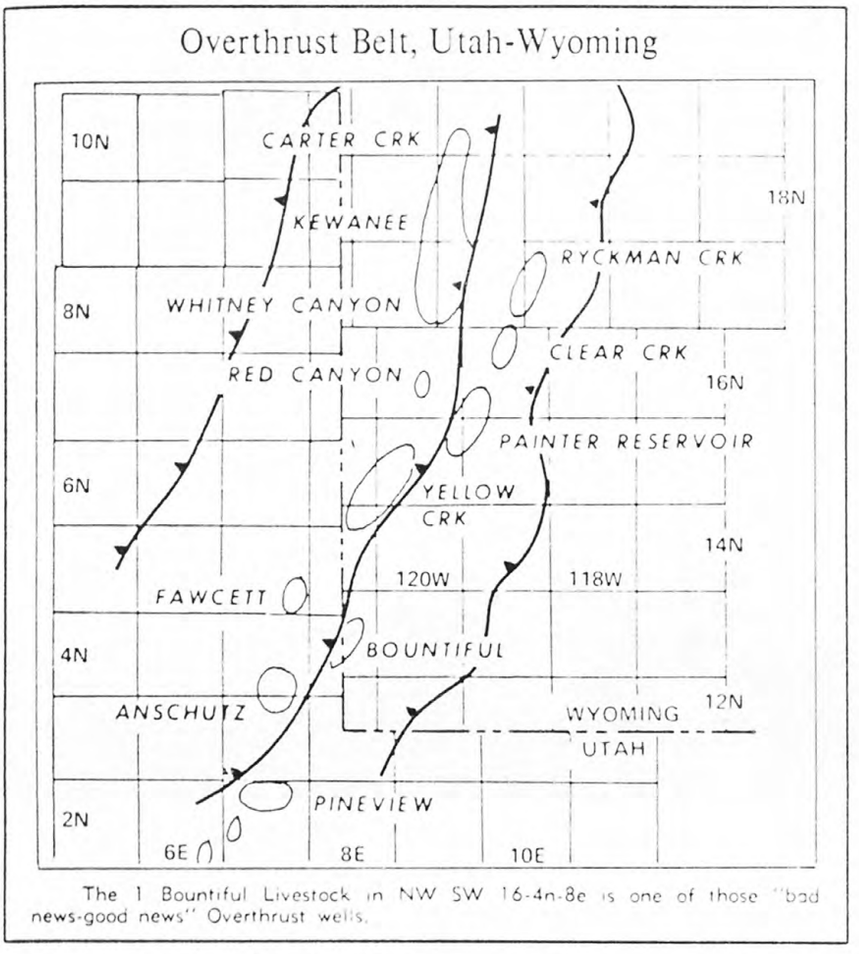
The big expense to date has been the roadwork. It includes upgrading a Forest Service road and about nine miles of road pioneering up and over the summit of the mountain—a total of more than 20 miles altogether. Although the company planned to begin drilling in the spring this year, new seismic data prompted a change from the original location and additional permitting and roadwork.

The Bald Mountain venture will be a camp operation during winter months that may resemble operations in the Arctic. Zimmerman points out that deep snow will make it impossible to keep the road open to traffic much of the time. As a result, during the summer the company began stockpiling drillpipe, mud, equipment, water, fuel and food at a camp storage area. Crew changes during the winter months will be accomplished by helicopter or appropriate snow vehicles.

The Bald Mountain well is projected as a 14,600-ft test of Paleozoics and, obviously, the potential of the area is believed to be significant. It is Amoco's first Overthrust test in Idaho.

Success in the area would, of course, present future production problems, particularly during winter months, and development work may call for extended negotiations for permits for pipelines, as well as for roads and drilling locations. The site is in Caribou National Forest and is subject to very careful environmental scrutiny.

At the same time, a significant discovery on Bald Mountain might serve as further evidence that more federal lands should be opened for exploration on the Overthrust Belt.



The 1 Bountiful Livestock in NW SW 16-4n-8e is one of those "bad news-good news" Overthrust wells.

Bountiful Livestock battles crooked hole problems

by Russ Rountree

Amoco Production Co.'s Bountiful Livestock well in Summit County, Utah, has been described as a "very significant" discovery. It is the apparent opener for what well may be another prolific oil and gas field along the Ryckman Creek-Painter Reservoir trend on the Utah-Wyoming portion of the Overthrust Belt.

The 1 Bountiful Livestock, in NW SW 16-4n-8e, is one of those "bad news-good news" Overthrust wells. The bad news is that the projected cost of the well, before drilling, was about $2.7 million and the final cost was approximately $8 million. The good news is that the well tested for nearly 1,500 bo/d and 8.5 MMcf of gas/day from four zones of Jurassic Nugget to establish Anschutz Ranch East field.

The well is on acreage acquired from Bountiful Livestock Co. in 1974 by Tom Brown Inc. Later, Brownlie, Wallace, Armstrong & Bander acquired a 50% farmout on some 2,300 acres from Tom Brown Co. In 1978, Amoco went to both companies and negotiated a 50% farmout from each.

Amoco Western division exploration manager Vince Matthews and others in the company indicate the Bountiful location represents the success of new seismic acquisition techniques being used in the area, as well as advances in seismic data processing and interpretation.

The well was spudded on March 29, last year, and was the first test for Bomac Drilling Co.'s new Rig 44, a Gardner-Denver 800 rated for 16,000 ft. Twenty-in. surface casing was set to 2,040 ft.

As can be expected in any Overthrust well, drilling problems included dealing with steep dips that tend to change angles as drilling progresses. Crooked hole problems can, and often do, result. Except for a minor fishing job or two for equipment lost in the hole, no serious problems were encountered at the Bountiful until the Pruess (Jurassic) salt section was encountered.

Similar salt sections have been encountered in a number of Overthrust areas. They range to 1,000 ft or more in thickness. Matthews described the salt as being "like toothpaste." Because it has a tendency to flow and swell, operators plan to drill through the salt bed as rapidly as possible and to set heavy casing into the underlying Twin Creek. At Bountiful, Amoco found the top of the salt at 10,790 ft

and the top of the Twin Creek at 11,109 ft.

Once into the Twin Creek, the company attempted to set 9⅝-in. casing at 11,800 ft but due to salt and shale swelling it was not possible to work the casing below 11,070 ft and a portion of the salt section was left open. That section caused problems that resulted in a fishing operation at 11,353 ft. It was eventually decided to plug back for a sidetrack hole and a window was cut in the casing at 10,790 ft.

A new hole was drilled through the salt section and 7⅝-in. liner was set from 10,350 ft to 11,310 ft. With no more trouble, the hole was drilled to actual depth and 4½-in. liner was set from 10,505 to 14,045 ft.

The basic mud program for the test was a low solids, nondispersed mud to the top of the salt, with weights ranging from 9 lb to 9.5 lb. Through the salt section a salt-saturated, slightly dispersed mud system was used, with weights ranging to 12 lb/gal. After the liner was set through the salt, the company went back to the original mud program with weights ranging from 8.5 to 9 lb/gal to TD.

Vince Matthews, Amoco.

Around the first of this year, the well was completed for a flow of 240 bbl of 45 gravity oil and 1,000 Mcf of gas daily from intervals in Nugget between 13,400-13,430 ft and 13,500-13,515 ft. Subsequent testing uphole resulted in a flow of 885 bo/d and 5,173 Mcfd of gas from an interval between 13,172-77 ft. And a test higher in the formation, 12,822-28 ft, was gauged at 418 bo/d and 2,311 Mcfd. The gross Nugget pay section has been estimated to be 700 ft or more thick.

Amoco planned further development of the Anschutz Ranch East field this year and next. In early August, the company was drilling offsets to the discovery, one in NE NE 16-4n-8e and the others in Sections 21 and 29 of the same township. Anschutz Corp. was also drilling offset, one in Section 20 and another in NW SW 26-13n-121w, Lincoln County, Wyoming, to the southeast.

At one time during the drilling of the well, Matthews indicated it would have been easy to write the test off as a dry hole. He pointed out that the Nugget was encountered some 2,200 ft lower than was anticipated.

There is some speculation that Anschutz Ranch East production may be connected to production at Amoco's 1 Millis WI Unit in NW NE 10-14n-120w, Uinta County, Wyoming. A drillstem test of a Nugget interval in the Millis well flowed some 10,000 Mcfd of gas. The horizon tested was about 1,200 ft low to the same horizon in the Bountiful well.

Further drilling will be necessary to establish the connection and the extent of Anschutz Ranch East. The oil production from the Bountiful well is the deepest Nugget oil yet found in the Overthrust area and is obviously a significant find that could aid in future exploration.

East Anschutz Ranch could well be one of the more prolific fields, on a well-to-well basis along the Mesozoic trend in Utah and Wyoming.

C.3

United States Department of the Interior
GEOLOGICAL SURVEY
BOX 25046 M.S._____
DENVER FEDERAL CENTER
DENVER, COLORADO 80225

IN REPLY REFER TO:

April 3, 1981

High Life Helicopters, Inc.
Attn: Mr. Robert Rodriquez
Mineral Engineering Division
14616 W. 6th Avenue
Golden, Colorado 80401

Dear Mr. Rodriquez:

Technical evaluations have been received by James Saufley concerning the draft report submitted by High Life Helicopters entitled "Helicopter Mobilization of Oil and Gas Drilling Operations in Mountainous Areas of Western Wyoming" under USGS Contract No. 14-08-0001-18817.

Enclosed for your information is a copy of Mr. Saufley's memo to Mr. John Matis which summarizes the Technical Officer's evaluation of the draft report.

Mr. Matis, Mr. Saufley and I would like to schedule a meeting with you as soon as possible to discuss the details necessary for completion of the final report. I will contact you early next week to arrange an appointment.

Sincerely yours,

Lynda H. Carlson

Lynda Harig Carlson
Contract Administrator
Central Region

Enclosure

cc: Mr. Frank Joseph
High Life Helicopters, Inc.
167-15 South Meridian
Puyallup, Washington 98371

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

In Reply Refer To:
EGS-Mail Stop 630

noted 4/2/81 JM

Memorandum

To: John Matis, Chairman, Cache Creek EIS Task Force

From: Technical Officer, Helicopter Mobilization Study

Subject: Technical Evaluation of High Life Helicopters Draft Report

1.) Kaman K-1200 Boeing Vertol

The draft report is basically sound, and I would recommend only a few changes be given further consideration. They have little or no impact on the overall costs, as estimated by High Life. I would recommend the use of the KU-107, rather than the Bell 214. The costs of the two are relatively the same, but the KU-107 gives a considerable margin of safety in that it has a better sling load capacity at 9,000 feet and is a twin engine helicopter. This is an operation in a remote and highly sensitive area, and I would prefer to have the extra margin of safety.

check Parker for 16,000# HKV-16K

I cannot agree with the rig-up and rig-down load schedules. The standard practice in the industry is to change pilots during refueling and keep the machine moving, rather than shutting down to give the pilot a break. Any operator coming in to do the job, especially one of this nature, will bring his own trained load masters to have at each end for both safety reasons and efficiency of operations. The rate of four round trips per hour is very conservative and does not reflect a very efficient or effective utilization of the helicopter.

The High Life report does not reflect that the helicopter would perform as the crane for much of the equipment transported to the drill site. It would be positioned and set in the exact position where it is to be utilized. A more appropriate or more common operating practice would have a drastic impact on the 14 day rig-up and 10 day rig-down times indicated for the helicopter alternative.

I have enclosed the reports received from Getty, Chevron, and Boeing on the draft report. The Boeing report is the only one of real substance with supporting data for comments and recommendations. They, as I, agree with High Life's report with only a few recommended minor changes, all of which I do concur.

The Getty report reflects the same ideology they have portrayed from the outset. They just do not want to use helicopters, period. They have indicated considerable cost differences, but offer nothing to support it

other than their opinion. Without supporting data, I cannot give serious consideration to their recommendations.

The Chevron report reflects primarily differences or errors in technical terminology for phases or methods of conducting drilling operations. These comments are outside my area of expertise and should be reviewed by an appropriate person. The final report should contain the correct terminology.

Overall, High Life has provided us with a technically and economically sound report which should require only minor changes. From that report, it is my opinion that the helicopter alternative is a technically and economically viable one that should be given serious consideration. As we have discussed previously, the really limiting factor is the availability of an adequate water supply.

In considering environmental factors, I believe the effects of a short period of noise pollution would dissipate much sooner than the scars of physical damage to the terrain. The completion aspects for a road or pipeline must also be considered, both environmentally and as a cost to the oil company. I cannot address the environmental effects of the issue, but I would feel the discovery of a producible well would adequately cover the additional costs incurred.

As you know, I am currently in a training program which will run through April 10. Should you need to contact me for any reason, call my secretary, Sandy Artis, at FTS 928-6483. I will be back in my office on April 13, 1981.

James K. Saufley

James K. Saufley

Enclosures

cc: Frank Lanzetta

BOEING VERTOL COMPANY

215 522-3365

Date: February 27, 1981
Ref: 8-1230-40-7
From: D. G. Brown

TO: C. M. Wax

CC: R. P. Kolar
J. Liiva

SUBJECT: CACHE CREEK OIL RIG: HELICOPTER MOBILIZATION STUDY

1. CONCLUSIONS:

I have completed my analysis of the Cache Creek study. One Bell 214B cannot complete the tasks as scheduled - two are required for the first 80 days in order to meet deliveries for the planned drilling schedule. The balance of the year can be handled by one Bell 214B at a utilization of 2.2-2.6 hours/day. Total cost is $2,600,000.

An alternate plan would be to contract one KV-107II from Columbia Helicopters. This helicopter not only has 1000 pounds more lift, but also twin engine reliability/safety. The first 80 days would require 5.8 hours per day. The balance 1.7-1.9 hours/day. Total cost is $2,400,000, not significantly different from the 214B. However, I have more confidence in the latter number since we got a good price quotation for it and the 214B is only a "planning" number.

One BV234 would be needed, as the study indicates, to lift heavy equipment. Cost for this is included in the above figures.

Study cost = $2.046 million (p. 75)

2. COMMENTS:

2.1 MISSION DESCRIPTION: p68-70

The mission described should use two pilots, not one. This decreases fuel available by 180 lbs. Flight time should be 60 minutes continuous for one crew. Crew changes will take place during a refueling sequence. All refuels and crew changes will be with engines on. My assumption is 3 minutes for a refuel without crew changes and 5 minutes when crew change is involved. The cruise and hover times shown appear reasonable.

2.2 ENVIRONMENT: see p 53, p 57

Temperature probability (on an annual basis) for 9000' pressure altitude above Jackson, Wyoming is shown in figure 1. This shows that 70°F should be used as a planning temperature to assure adequate performance of the tasks.

2.3 214B PERFORMANCE:

In-house data, although dated 1975, gives approximately the same data as p 69. (The author should know that performance breaks at a power limit, not bend as shown). At 9000 feet, 70°F, the curve shows a take-off weight of 12500 lbs. Fuel flow averages 146 gal/hr for this mission so the following tabulation shows that refuel must be each round trip.

Gross Weight	9000'/70°F	12500 lbs
W.E.	~~7827~~ *7827	
FUL	360	
Payload	4000	12187
Max Fuel		313
One Round Trip		138.75
Reserve		174.25 (= 11.6 minutes!)

* Helicopter Blue Book, Jan. 1981

Using 8.5 minutes of cruise/hover per trip, plus 3 minutes refuel per trip, a 214B can get 5 round trips per hour:

5 trips x (8.5 + 3) minutes + 2 minutes/crew = 59.5 minutes

Average load for the 214B appears to be 3900 lbs. Delivery rate is 5 x 3900 = 19,500 lbs 1 hour. Normal maximum utilization for planning is usually 5 hrs/day. Therefore 1 Bell 214B can deliver 97,500 lbs/day.

2.4 BOEING 234 PERFORMANCE: p 72

At 9000'/70°F, the 234UT performance is as follows:

Gross Weight		40231 lbs
W.E.	21150	
FUL	457	
80 Minutes fuel	3297	24904
Maximum Payload		15327
Fuel Burn for 6 Trips		+ 2155
Max Payload @ 9000'/70°F		17482

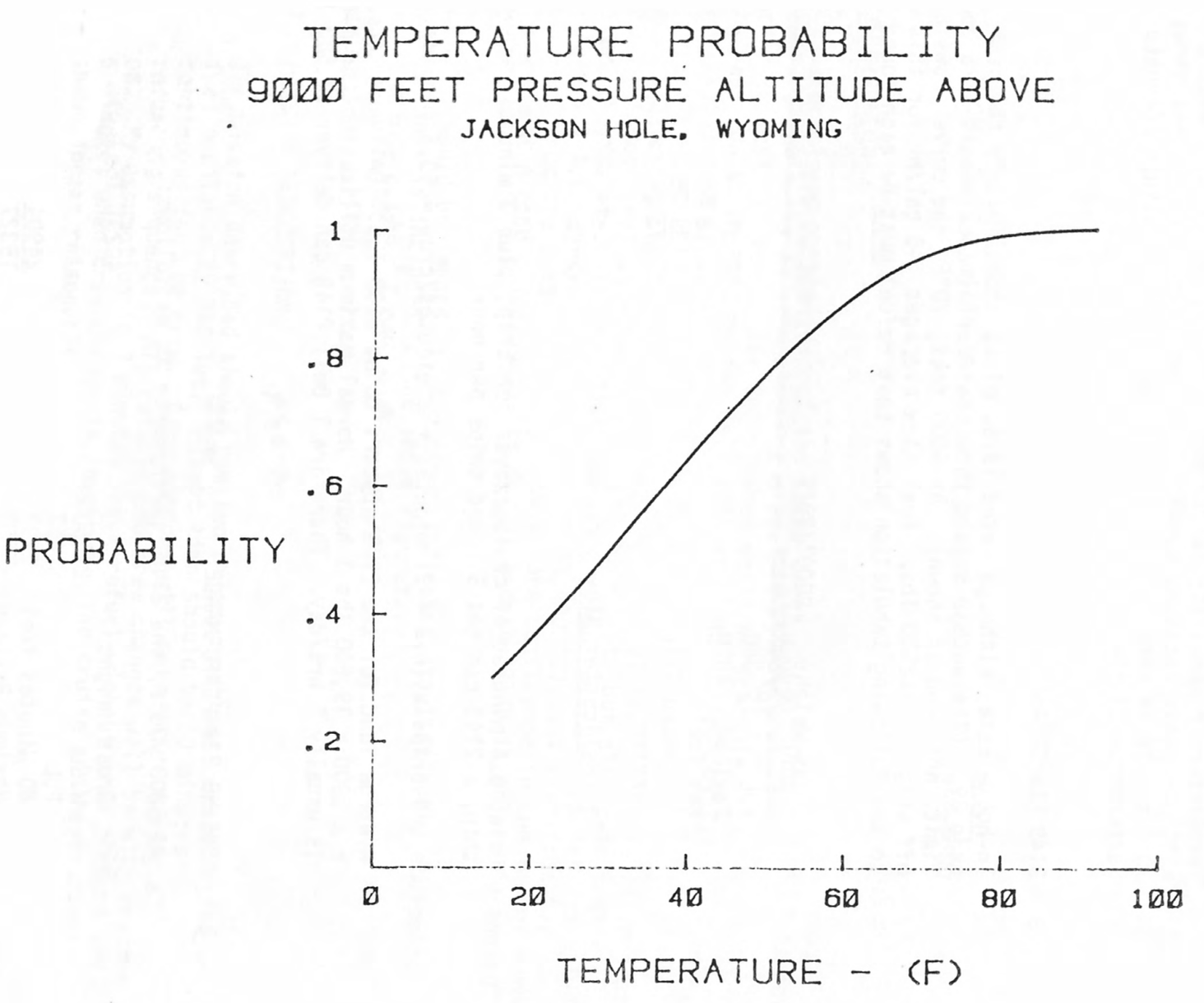

TEMPERATURE PROBABILITY
9000 FEET PRESSURE ALTITUDE ABOVE
JACKSON HOLE, WYOMING
PROBABILITY
1
.8
.6
.4
.2
0
20
40
60
80
100
TEMPERATURE - (F)

Figure D.6

As temperature decreases, payload will increase about 140 lbs/°F. Heavy lift loads can all be done, but some may have to be early in the day at lower temperatures and/or with fuel for only 1 round trip. Round trips per hour are:

$$\frac{(60 - 5) \text{ minutes}}{8.5} = 6.47$$

Seven can be used if reserve is reduced to 4.5 minutes.

Average load from above is 16763 lbs. Using 16000 lbs average, delivery rate is:

7 trips/hr x 16000 lbs x 5 hrs/day = 560,000 lbs/day

2.5 KV-107II PERFORMANCE:

An alternate to the Bell 214B is the KV-107II of Columbia Helicopters Inc. Columbia quotes an operational lift capability of 6300 lbs at 9000'/50°F. Factoring for gross weight lapse with temperature yields a lift of 5000 lbs at 9000'/70°F. The study too quickly dismissed this aircraft as being not right, but indications are that it has a better marginal performance than the 214. If temperatures ever exceed 70°F (5% probability) the 214 cannot perform the tasks, but the 107 can.

Assuming an average load of 4900 lbs, delivery rate is:

6 trips/hr x 4900 lbs x 5 hrs/day = 147,000 lbs/day

2.6 RIG AND EQUIPMENT DELIVERY PROFILE - NORMAL LIFTS:

The equipment loads from Table 14 of the study (p 80-83) were matched to the drilling schedule assuming a 7 day lead time. (It appears the authors have included fuel twice. The list 326,400 gallons of fuel on page 81 in supplies and again the list 490,000 gallons in periodic resupply. The study indicates that 1200 gallons per day is required - (432,000 gallons/year). Using 1200 gallons per day for fuel, I have constructed the delivery profile of figure 2. From this we establish three capability rates.

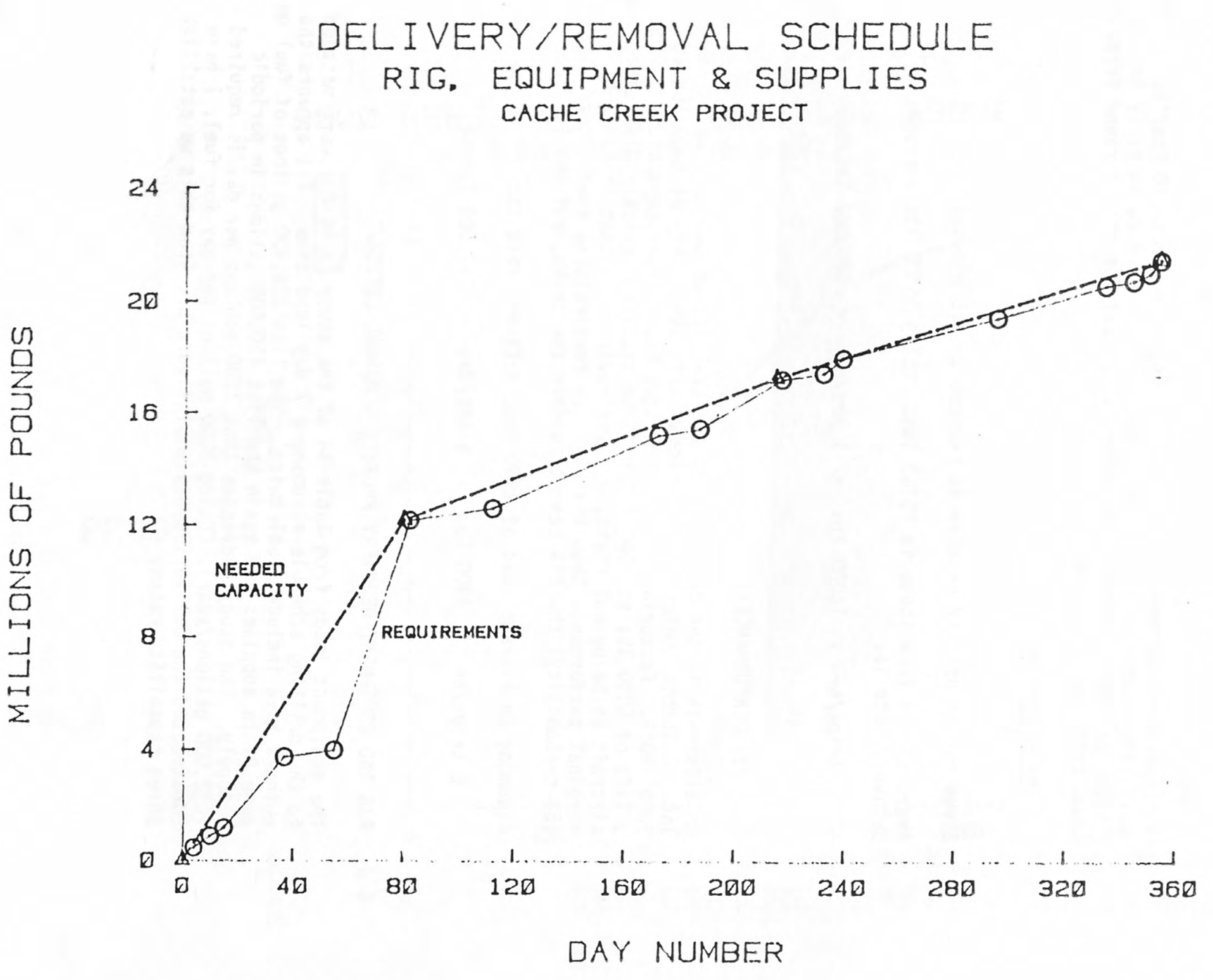

DELIVERY/REMOVAL SCHEDULE
RIG, EQUIPMENT & SUPPLIES
CACHE CREEK PROJECT
MILLIONS OF POUNDS
24
20
16
12
8
4
0
NEEDED CAPACITY
REQUIREMENTS
0
40
80
120
160
200
240
280
320
360
DAY NUMBER

Figure D.8

a. In the first 80 days, deliver 12.15 million pounds plus provide .63 flight hours/day for periodic resupply of food and people.

b. In the next 135 days, deliver 5.05 million pounds plus provide .63 hours/day for periodic resupply.

c. In the final 139 days, transport 4.2 million pounds plus provide .63 hours/day for periodic resupply.

The capability of each aircraft to meet these is in the table below:

	PERIOD I	PERIOD II	PERIOD III
REQUIREMENT (Excluding heavy lifts)	151,875 lbs/day	37,408 lbs/day	30,216 lbs/day
BV234	1 @ 2 hrs/day (40%)	1 @ 1 hr/day (20%)	1 @ 1 hr/day (20%)
BELL 214B	2 @ 4.2 hrs/day (84% each)	1 @ 2.6 hrs/day (52%)	1 @ 2.2 hrs/day (44%)
KV-107II	1 @ 5.8 hrs/day (116%)	1 @ 1.9 hrs/day (38%)	1 @ 1.7 hrs/day (34%)

2.7 HELICOPTER COSTS:

Helicopter rental costs are estimated below. Costs are assumed to include 2 crews for high utilization.

	LONG TERM (1 Year)	MEDIUM TERM (2 - 3 Months)	SPOT
BV234 (1)	$ 210,000/Mo $ 3,000/Hr	$ 51,300/Wk + $ 3,000/Hr	$ 7,500/Hr
BELL 214B (2)	$ 1,750,000 For 1 $ 97,500/Mo } For +$ ~~$50 966~~/Hr } 2nd	$ 23,800/Wk + $ 850/Hr	$ 2,000/Hr
KV-107II (3)	$ 106,000/Mo +$ 966/Hr	$ 25,900/Wk + $ 966/Hr	$ 2,000/Hr ($10,000 minimum)

(1) Extrapolated from 214 and KV-107

(2) From study and factored for extra crew. Medium term factored up by KV-107 quotation ratio

(3) Telephone quotation

At lower utilization levels (< 3 hours per day) I assume rates would decrease $50 an hour and $7500 per month.

2.8 MISSION COSTS:

Two possible fleets are examined:

FLEET	FERRY $	HEAVY LIFT $	PERIOD COSTS			TOTAL $
			I	II	III	
A 1-BV234	150,000	120,000				
1-214B	20,000	-	557,600	-	-	
1-214B	-	-	———	1,750,000	———	2,597,600
B 1-BV234	150,000	120,000	-	-	-	
1-KV107	20,000	-	727,800	706,700	702,200	2,426,700

Plan B is slightly better and, considering better marginal performance, would be preferred.

2.9 ACCELERATED DELIVERY:

Even if all the equipment and supplies could be stored at the drilling site, moving all equipment with a 234 and using a 214B to provide daily resupply, including fuel, costs are essentially the same.

FLEET	FERRY $	HEAVY LIFT $	EQUIPMENT		FUEL AND RESUPPLY ($)	TOTAL $
			MOVE IN ($)	REMOVE ($)		
BV234	150,000	120,000	691,500	150,000	-	
214B	20,000	-	-	-	1,380,000	2,511,500

Note that in all the schemes, $1,400,000 (approx) is required to 1) station a helicopter for one year, and 2) handle the heavy lift. The balance is in flight hour/additional helicopter costs to move the equipment and supplies.

3.0 SUMMARY:

Although some analytical errors occur in the study, one can conclude that helicopter mobilization would cost approximately $2,500,000. USGS should not rely on a 214B to provide the lift. Performance is marginal at 9000 feet on a warm day and single engine reliability is involved. Contract should call for a twin engine helicopter with a minimum of 5000 lbs lift at 9000 feet/70°F

D. G. Brown

Chevron U.S.A. Inc.
700 South Colorado Blvd., P. O. Box 599, Denver, CO 80201

March 16, 1981

Draft Final Report - Helicopter
Mobilization Alternative
Cache Creek EIS

Mr. James K. Saufley
U.S.G.S.
Conservation Division
630 National Center
Reston, Virginia 22092

Dear Mr. Saufley:

Our Production Department has reviewed the captioned draft for the Helicopter Mobilization Alternative. Enclosed is the complete copy you forwarded to us on February 10, 1981.

We believe the report is of sufficient detail and has considered all aspects of the project. As presented, this alternative appears to be feasible but do not believe it can be accomplished at the costs estimated. It is more likely the costs will be twice those stated because there are just too many contingencies that cannot be covered.

The data and the procedures used appear to be valid from a technical standpoint. In some instances the presentation was over simplified but for the purposes of this study maybe that was necessary.

The following comments probably do not have a bearing on the overall feasibility but believe you would appreciate them nevertheless.

1. Page 9, last paragraph. This part recites - "drill site operations call for three drilling crews working eight hour shifts." It is suggested that 12 hour tours (shifts) for crews rotating every seven days be used. This would require four crews working seven days on and seven days off.

2. Page 19, last paragraph. This part covers the hydrogen sulfide as a potential drilling hazard. We disagree with the remoteness of the possibility of encountering H_2S in the Phosphoria, Ten Sleep and Madison formations. It is a very real possibility in this area.

3. Page 20, last paragraph. This paragraph mentions the use of a whipstock to correct the course of a deviating drill pipe. It is a small point, but "whipstocks" are seldom if ever used anymore as the technology of drilling now uses more efficient equipment and procedures..

4. Page 20, last paragraph. It is mentioned in the last line that the weight on the bit sometimes exceeds 100,000 pounds. It is believed that this weight is seldom encountered. It is generally between 30,000 and 50,000 pounds.

5. Page 31, second paragraph. It is stated in the paragraph that "mud loggers" are used to control mud weight in the drilling of a well. This is not technically correct because the term "mud logging" is applicable to evaluation of the substances coming up out of the hole, and is used as an evaluation tool. Usually on a well a mud engineer is charged with the responsibility of maintaining proper mud weight and content.

6. Page 36, first paragraph. The word "Geophysical" is used of logs of well bores. It is believed the word "Electrical" is more correct.

7. Page 36, fourth paragraph. The company name "Dresser-Atlas" is used. It is mentioned that "Schlumburger" also provides these services.

8. Page 39, third paragraph. The paragraph recites various equipment that would be used for completion and stimulation. It is believed some of this equipment would not necessarily be needed immediately upon completion. Further, if the well flowed naturally, this equipment would not be required for completion.

9. Page 44, first paragraph. Same comment as No. 1, above, regarding 12 hour tours.

10. Page 45. 35-Man camp paragraph, Item 2. We believe the amount "365/day/man" should be "35/day/man."

We appreciate the opportunity to review this draft. If we can be of further assistance please advise.

Very truly yours,

R. L. Hodges

RLH:js
Enclosure

Getty Oil Company | Three Park Central, Suite 700, 1515 Arapahoe St., Denver, CO 80202 • 303/623-4200

T. L. Ditmore, District Production Manager
Denver Exploration and Production District

March 13, 1981

Technical Project Officer
U.S. Geological Survey
Conservation Division
630 National Center
Reston, VA 22092

RE: DRAFT FINAL REPORT FOR HELICOPTER MOBILIZATION ALTERNATIVE
CACHE CREEK EIS; USGS CONTRACT NO. 14-08-0001-18817

Gentlemen:

At your request we have reviewed the subject report. Critical factors related to helicopter mobilization are:

1. Cost
2. Rig Availability
3. Helicopter Availability
4. Environmental Damage

We will address these factors as they relate to the report and the proposed Bear Thrust Unit well.

Costs were covered in great detail in this report. Mobilization and demobilization using helicopters will cost millions of dollars more than would conventional methods. If the exploratory well is successful and development ensues, the relative cost would again be increased by millions of dollars. At that point it would be necessary to decide on either total committment to the use of helicopters or to the construction of roads. Total reliance on helicopters would be very costly. Construction of roads and their eventual restoration would also be costly, but would be significantly less. Actual differences in cost can't be determined at this time because no one can predict the scope nor extent of development in the area. As pointed out in the draft report, if a road is subsequently required, the added expense of helicopter mobilization will have been wasted. Even without roads, pipelines would be necessary and would have a similar effect on the environment.

Due to the rapid and varied escalation rate for costs, it would have been impossible for the authors to accurately detail costs for future events. A few of the drilling costs used in the report appear to be low when compared to our recent experiences. All costs can be expected to increase by 12-25 percent before this project could be completed. We believe the added cost of a dry hole drilled with a helicopter rig would be at least $4,176,000 rather than the $2,235,311 figure in the Draft Report.

Factors in the report that would have the most effect on increasing the cost differential appear to be an under estimate of helicopter usage and of the drilling time. Most other under estimates or oversights would be common to either helicopter or conventional mobilization. A very precise schedule for helicopter time was prepared. This schedule seems to be overly optimistic and would require an almost herculean and superbly orchestrated effort by all parties. We believe that a maximum of three round trips per hour is more realistic than the four per hour used in the report when considering the complexity of the mobilization, inexperience of personnel and potential weather factors. The same factors will likely result in more down time than predicted. A helicopter company experienced in moving Parker TBA 2000 rigs estimates two round trips per hour using a Boeing KV107 helicopter.

There are certain inconsistencies regarding helicopter capabilities at the 9000' elevation. Table 12 (page 67) doesn't appear to accurately portray the true capability of the helicopters at sea level and at 10,000'. For example, Table 12 shows that a Sikorsky S64 has a useful load of 16,000 pounds at 10,000', whereas, operators of this model rate it for 12,000 pounds at 9000'. Figure 10 (page 69) shows that a Bell 214 has a payload of 4000 pounds at 70°F and 9000', while Table 12 shows a useful load of 6000 pounds at 10,000'. While Table 12 shows a correct useful load of 6620 pounds at 10,000' for a Boeing KV107; the useful load at sea level should be closer to 11,000 pounds than the indicated 7720 pounds. It is concluded that Table 12 is misleading and should be corrected or eliminated. It also raises doubts as to the correct capability of the Boeing Chinook, which may be much lower than the indicated 22,000 pounds at 10,000'.

As to the rig move, it appears there would be 65-100 more loads. They would include items such as boilers, miscellaneous parts, valves, pipe and skids plus sheds to house equipment, mud and cement. Some of the loads may be heavier than shown and a larger helicopter than the Bell 214 would be required. Costs to use a larger more expensive helicopter could be partially offset by moving fewer, but heavier loads. This would also reduce some of the disassembly and assembly time and cost. Further study will be required before a more exact cost estimate for helicopter usage can be determined.

To mobilize a water well drilling rig will require a large helicopter and considerable disassembly and reassembly. A dozer will be required to build a staging area and rig location in order to carry out this operation. More than one well may be necessary to find an adequate supply. Therefore, the water well costs will be significant and far greater than presumed in the Draft Report. If the rig suggested were used, a Boeing Chinook helicopter would be required, but availability is highly questionable.

The Draft Report assumes a difference of $3000 per day for a helicopter rig over a conventional drilling rig. The actual differential may be more because it will be necessary to build a new rig and the rates for new rigs are normally higher. In fact, it may be necessary to design a completely new rig with greater capabilities which may be impossible with present technology. Bonus costs will result if the rig can not be used elsewhere in the area upon completion of this well as

Parker Drilling Company requires a two-three year contract. There is some question as to rig size and capability. The high elevation will reduce the rig's power and cold temperatures will affect the structural strength. A larger rig may be required and a close analysis of these factors should be made. Our experience suggests that a Parker TBA 2000 rig may be too light for this well as designed.

The drilling time used in the Draft Report appears to be too short for a well of this depth, in this area and with the proposed casing design. It is believed that an optimistic minimum drilling time would be one year, the maximum two years and most likely 1-1/2 years. Getty is presently drilling a well in similar geologic situations to the south. This well, Willow Creek No. 15-3X, is located in Section 15-24N-116W. After six months, 20-inch surface casing has been set at 2087' and a 17-1/2-inch hole is being drilled at 3100'. It was necessary to drill the surface hole with air mist due to lost circulation problems. An initial attempt was lost due to caving and circulation problems. The rig was moved over and the well was restarted. In 1979, Getty completed drilling the Teton Well No. 1 in Section 8-T39N-R117W to the west in a similar geologic situation. That well was drilled to 9300' in seven months. Drilling was slow due to loss of circulation and a natural tendency of the hole to drift. It was necessary to drill slow to maintain a reasonable drift angle so as to not miss the targeted objective. Similar problems should be anticipated on the Bear Thrust Unit. A review of drilling records for other wells in the general area further supports an estimate of 550 days rig use.

With anticipated circulation problems, it is reasonable to assume that mud usage will be greater than anticipated in the report. This will increase the mud cost and the cost to transport same by helicopter.

It is assumed that total rig usage time will be more nearly 550 days versus the 270 days in the report plus 24 days to move in and out in either case. Using the minimum $3000 per day differential, the additional 280 days would increase the rig cost by $840,000. Using the most favorable cost ($1,600,000 per year) for a Bell 214 as a support vehicle, the extra 280 days would cost $1,227,000. There seems to be no provision for moving the water well drilling rig in and out. Due to the weight, a Boeing Chinook helicopter would be required at a minimum estimated cost of $300,000. The added time would increase the cost for the logging unit and cementing unit by $310,000 plus $66,000 incorrectly charged to the conventional rig logging costs and $197,600 for cementing units not charged to the estimate for a helicopter rig. These items would increase the cost of a helicopter rig by $2,940,600 over the original differential of $2,235,311 for a dry hole for a total of $5,175,911. On the other hand, the cost of a road could be $1,000,000 more than the estimate in the report considering ultimate restoration, maintenance during the drilling operation and snow removal. Therefore, use of a helicopter rig for a dry hole may cost $4,176,000 more than a conventional rig.

Availability of a helicopter rig is uncertain at this time. It would probably be necessary to build a rig for use on this well. Assuming this can be done, Getty Oil Company would have to make a contract committment to Parker Drilling Company in the very near future to assure that the rig would be available by mid-1982.

The deadline for making this committment and the cost of the rig are unknown at this time as are other terms of the contract. It can be assumed that the same situation holds true for most of the ancillary equipment that will be required to drill the well.

Bell 214 and Boeing KV107 helicopters may satisfy most requirements. Both should be available; however, it may be necessary to consummate a contract for either or both in the near future to insure availability when needed. A Boeing Chinook helicopter may be needed to mobilize a water well drilling unit in the fall of 1981 and again in 1982 to help mobilize the rig and again during demobilization. It is unlikely that one will be available in 1981 and other arrangements will be necessary to drill the water well. It is uncertain whether or not one would be available in 1982. Again, some action may be necessary soon in order to obtain the use of a Chinook helicopter for rig mobilization. At present there is no way to be certain that one would be available when needed.

Environmental concerns were discussed at length in the draft report and appear to be correctly stated. While there might be some short term disturbance of animals, a road poses the only long term threat to the environment along with the drill site and staging area. The latter might be converted to long term use by back packers and hunting parties. Similarly, the drill sight could be restored to near original conditions or restored for a level camp site. Therefore, a road is the major concern along with the ability to restore that roadway to original condition. This has been done elsewhere with highly satisfactory results. A good example would be Getty's Teton No. 1, which was drilled in rugged terrain in the Teton Mountains.

One compromise solution might be to upgrade the Little Granite Creek Trail, mentioned in the Draft Report, to a rough roadway. A bull dozer could do this and use it for access. The few loads too heavy for Bell 214 or Boeing KV107 helicopters might then be moved in and out over this roadway. This would also provide an emergency route that could be used by all terrain vehicles or snow mobiles when helicopters could not fly. This might cause less damage to the environment than a full use road and require less restoration. The Forest Service might even wish to leave this for a trail and other use. It is doubtful that this would make any significant difference in the cost but might eliminate the need for Boeing Chinook helicopters that may not be available.

As to safety, there would seem to be a greater potential for helicopters crashing in this area than where normally used. The helicopters would be heavily loaded due to their lowered power at this elevation. Mountainous areas are more subject to sudden wind gusts and up or down drafts. Increases in temperature near midday significantly reduce a helicopter's power. An increase in temperature from $50^{o}F$ to $70^{o}F$ reduces the load carrying capacity of a Bell 214 helicopter from 5000 to 4000 pounds. Being heavily loaded, the helicopter would be less able to cope with sudden wind gusts or drafts.

While no one has ever used helicopter mobilization and support at elevations of 8000-9000', it does appear to be possible in theory. Complete mobilization would be dependent upon the availability of a Boeing Chinook helicopter, which could delay the project for one or more years and increase the cost. Actual performance of the project would depend upon obtaining a water well rig that can be moved by helicopter, building a new helicopter rig and acquiring numerous other pieces of equipment designed especially for helicopter transport. This would require an element of luck, lots of planning, additional manpower and a lot more money. We are not in a position to answer whether or not this is really necessary environmentally or if the Company's management would approve such a venture. There is no doubt that Getty Oil Company's management is dedicated to protection of the environment. There may be a question in many minds as to whether or not enforced use of helicopter mobilization represents over-protection.

Due to the magnitude of the additional costs plus the uncertainties regarding equipment availability; use of helicopter mobilization and support cannot be recommended. It should be used only as a last resort for protection of an overly sensitive environment or where it is a better economic alternative. The latter would be the case where excessively long roads would be needed through difficult terrains such as mountains, swamps or tundra.

Yours very truly,

T. L. Ditmore
District Production Manager

TLD/CWL:bs

cc: Mr. Pat Tracy