PACIFIC GAS AND ELECTRIC COMPANY

PG&E

245 MARKET STREET • SAN FRANCISCO, CALIFORNIA 94106 • (415) 781-4211 • TWX 910-372-6587

November 1, 1976

Mr. Jackson Moffitt, Area Mining Supervisor
U. S. Geological Survey
8102 Federal Building
125 S. State Street
Salt Lake City, Utah 84138

Dear Mr. Moffitt:

Pacific Gas and Electric Company herewith submits for your approval a Mining Plan (7 copies enclosed) for a coal mine in the Sage Point-Dugout Canyon area (T. 12 and 13 S., R. 12 and 13 E.), Carbon County, Utah. The project contains coal leases and coal ownership covering approximately 10,043 acres, of which 5,852 acres are under U. S. Coal Leases owned by Heiner Coal Company and Equipment Rental Service, Inc. and 2,416 acres are under U. S. Coal Leases owned by Kennecott Coal Company. Equipment Rental Service has subleased its interest to Island Creek Coal Company, and Island Creek and Heiner Coal (a wholly owned subsidiary of Island Creek) have assigned their interests to PGandE. Approval of these assignments has been requested. On April 25, 1975, Island Creek filed Designation of Operator forms under which PGandE, through its wholly owned subsidiary Natural Gas Corporation of California, has been operating on the leases.

The Mining Plan for the Sage Point-Dugout Canyon Project has been prepared in accord with 30 CFR 211. Simultaneously, Natural Gas Corporation of California is making application with the Bureau of Land Management for rights-of-way and land use necessary to service the mine, prepare and ship the coal to the power plant.

Yours very truly,

JOHN C. OSMOND
Supervisor
Coal Resource Development

Enclosures

JCO:sh

MINING PLAN

SAGE POINT-DUGOUT CANYON PROJECT

CARBON COUNTY, UTAH

November 1, 1976

Submitted By:

Pacific Gas and Electric Company
Coal Resource Development
245 Market Street
San Francisco, California 94106

To:

Area Mining Supervisor
U. S. Geological Survey
8102 Federal Building
125 S. State Street
Salt Lake City, Utah 84138

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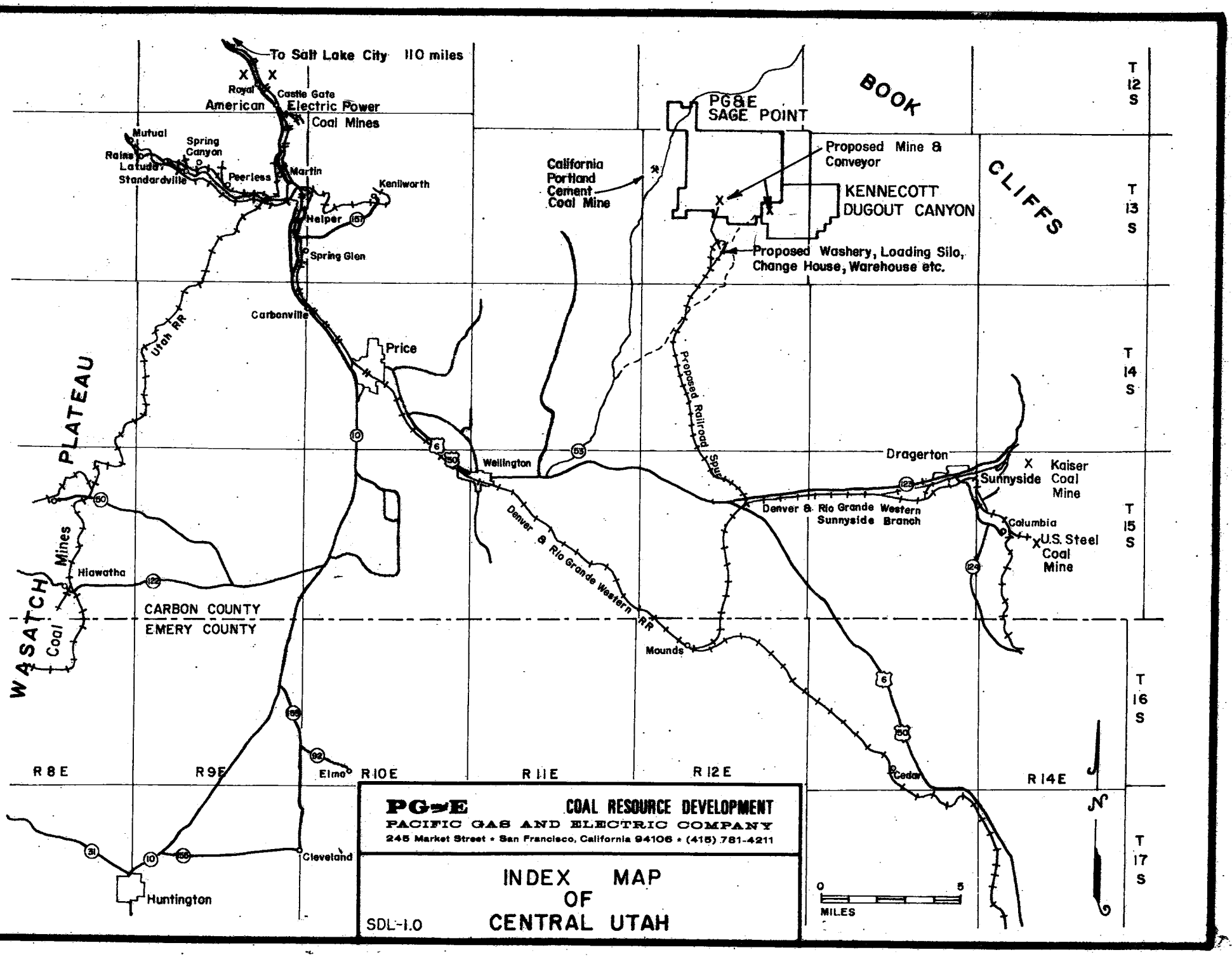
MINING PLAN
SAGE POINT-DUGOUT CANYON PROJECT
CARBON COUNTY, UTAH

1.0 Introduction

Natural Gas Corporation of California (NGC), a California corporation qualified to do business in Utah and a wholly owned subsidiary of Pacific Gas and Electric Company (PGandE) which supplies electricity and natural gas to Northern California customers, and Kennecott coal Company (KCC), a wholly owned subsidiary of Kennecott Copper Corporation, a multi-national resource producer, own leases and in fee certain coal properties in Central Utah, hereinafter referred to as the Sage Point-Dugout Canyon Project. The sites of these properties and of adjoining lands needed for the development and production of coal are shown on SDL-1.0. NGC hereby tenders to the U. S. Geological Survey a Mining Plan that describes in detail the ownership, exploration, development and production of two mines plus contiguous lands for rights-of-way and special land-use permits. The Sage Point-Dugout Canyon Project is a new coal mine having a capacity of 3,000,000 tons per year. The Mining Plan describes direct and ancillary actions to develop and produce coal; convey, wash and store said coal; bring, load and dispatch railroad unit trains; bring electricity, communications, hydraulic



PG&E COAL RESOURCE DEVELOPMENT

PACIFIC GAS AND ELECTRIC COMPANY

245 Market Street • San Francisco, California 94106 • (415) 781-4211

INDEX MAP OF CENTRAL UTAH

SDL-1.0

services; provide roads, conveyors, necessary buildings and parking areas; provide retention and storage of refuse; and do all such other activity necessary to conduct a coal mining operation that conforms to all Federal, State and local rules and regulations. Coincident with this tender, NGC submits to the Bureau of Land Management a Land-Use Plan in support of applications for rights-of-way and Special Land-use Permit.

2.0 Operator

Natural Gas Corporation of California
Attn: John C. Osmond, Supervisor, Coal Resources
245 Market Street
San Francisco, California 94106
Telephone (415)781-4211 ext. 4144

3,0 Need For Coal

Pacific Gas and Electric Company must plan to meet the electrical needs of its service area well in advance of furnishing added service. To acquire the permits for a coal-fired electric generating plant and to design and construct such a plant takes from 6 to 8 years. PGandE has no coal-fired generating plants. Its planning includes two 800Mw plants requiring 2 million tons of coal per year each of Sage Point-Dugout Canyon quality coal. Plans are for PGandE to build the plants in California and for NGC to supply the coal for one of these plants from the Sage Point property. The coal will be transported from Utah to the power plant by unit trains. The time required for mine permits, for design and construction, and for completion of mine development, ranges from 6 to 8 years.

The time frame for delivery of electric power from the new coal-fired generating plants in California equates to the period of mid-1984 to the end of 1985.

Kennecott Copper Corporation's metallurgical operations in Nevada and Utah were designed to use natural gas, fuel oil and/or coal for smelting and electric power generation. Present maximum annual demand is equivalent to 600,000 tons of coal. Currently, KCC is purchasing coal by contract and spot. Production at Sage Point-Dugout Canyon would assure Kcc of dependable and competitively priced coal

through production of coal it now owns or has under lease. Coal production from development is predicted to reach 750,000 tons during the fifth year after ground breaking. This coal would be unwashed. Washing of coal should commence during the fifth year.

4.0 Location

The Sage Point-Dugout Canyon Project is located 15 miles (airline) northeast of Price, seat of Carbon County, Utah. Road mileage is 22. The coal deposits and the adjoining land-use areas are within T. 12, 13, 14 and 15 S., R. 12 and 13 E.

5.0 History of Coal Production

There has been no coal production from the Sage Point deposits. There has, however, been production from coal beds that continue both to the east and west of Sage Point.

The Soldier Canyon Mine (formerly Premium Mine) to the west produced coal from pre-World War II to 1973 at a maximum of 100,000 tons per year. The mine was sold to California Portland Cement in 1974. California Portland rehabilited the mine and started production during the late spring of 1976.

The Dugout Canyon Mine (Knight-Ideal Mine) produced 1,326,000 tons, more or less, during the period 1940 to 1965 from both the Rock Canyon and Gilson seams. KCC purchased the mine in 1964 in order to obtain a guaranteed supply for its coal requirements in Nevada and Utah. KCC promptly closed the mine, sold the equipment and abandoned operations as coal could be purchased at costs that were lower than costs of production. The mine has remained closed and the portals are caved and/or plugged.

6.0 Schedule of Leases SDL-6.0

6.1 Federal Coal Leases

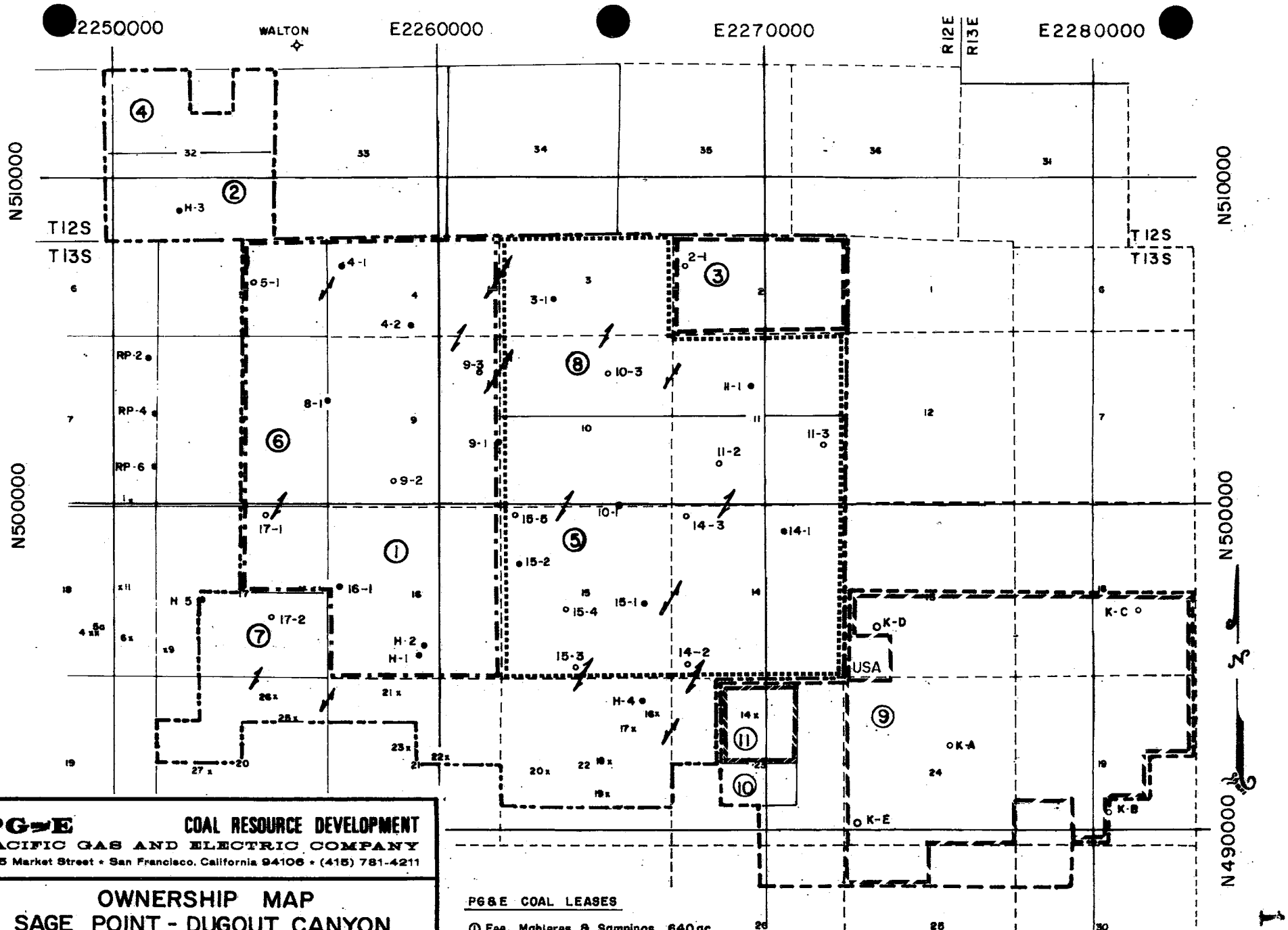
6.1.1 Sage Point

6.1.1.1 Lease No. U-07746
Date of Lease: June 3, 1957
Lessees: Equipment Rental Service, Inc. and Heiner Coal Company (undivided one-half interest of Equipment Rental Service, Inc. subleased to Island Creek Coal Company); assignment to PGandE filed for approval August 4, 1976.
Lands covered by Lease:
T. 13 S., R. 12 E., Carbon County, Utah
Sec. 10: S½
Sec. 11: S½
Sec. 14: All
Sec. 15: All
Sec. 22: N½, N½S½
Sec. 23: W½NW¼
Containing: 2,480.00 acres

6.1.1.2 Lease No. U-089096
Date of Lease: July 1, 1962
Lessee: Heiner Coal Company; assigned from Minerals Development Corporation of Colorado; assignment to PGandE filed for approval August 4, 1976.
Lands covered by Lease:
T. 13 S., R. 12 E., Carbon County, Utah
Sec. 8: E½
Sec. 17: NE¼
Containing: 480.00 acres

6.1.1.3 Lease No. U-092147
Date of Lease: December 1, 1962
Lessee: Heiner Coal Company; assignment to PGandE filed for approval August 4, 1976.
Lands covered by Lease:
T. 13 S., R. 12 E., Carbon County, Utah
Sec. 17: E½SW¼, SE¼
Sec. 20: S½NW¼, NE¼NW¼, N½NE¼
Containing: 680.00 acres

6.1.1.4 Lease No. U-0144820
Date of Lease: September 1, 1966



PG&E COAL RESOURCE DEVELOPMENT
PACIFIC GAS AND ELECTRIC COMPANY
245 Market Street • San Francisco, California 94106 • (415) 781-4211

OWNERSHIP MAP
SAGE POINT - DUGOUT CANYON PROJECT
Carbon County, Utah

0 5280'
1mile

SDL-6.0 Nov., 1976

PG&E COAL LEASES

① Fee, Mahleres & Sampinos 640 ac.
② State ML-21994 (8-64) 320 ac.
③ State ML-22590 (1-65) 375.52 ac.
④ State ML-22675 (2-65) 280.00 ac
⑤ U.S. U-07746 (6-57) 2480 ac.
⑥ U.S. U-089096 (7-62) 480 ac.
⑦ U.S. U-092147 (12-62) 680 ac.
⑧ U.S. U-0144820 (9-66) 2212 ac

KENNECOTT COAL LEASES

⑨ U.S. U-07064-2336.14 ac.
⑩ U.S. U-027821-80 ac.
⑪ Fee, Kennecott 160 ac.

SURFACE OWNERSHIP

Harry Mahleres
John Mahleres
John Sampinos
Milton Thayne
Kennecott

17-1 ○ Proposed Drill Hole
4-1 ● Drill Hole
⊕ Oil & Gas Test Well

Lessee: Heiner Coal Company; assignment to PGandE filed for approval August 4, 1976.
Lands covered by Lease:
T. 13 S., R. 12 E., Carbon County, Utah
Sec. 3: Lots 1,2,3,4, S½ (All)
Sec. 4: Lots 1,2,3,4, S½ (All)
Sec. 5: Lots 1,2, SE¼
Sec. 9: All
Sec. 10: N½
Sec. 11: N½
Containing: 2,212.00 acres

6.1.2 Dugout Canyon

6.1.2.1 Lease No. U-07064
Date of Lease: January 1, 1957
Lessee: Kennecott Coal Company
Lands covered by Lease:
T. 13 S., R. 12 E., Carbon County, Utah
Sec. 13: S½
Sec. 23: E½E½, SW¼SE¼
Sec. 24: All
Sec. 25: N½N½
Sec. 26: N½NE¼
T. 13 S., R. 13 E., Carbon County, Utah
Sec. 18: S½
Sec. 19: Lots 1,2,3,4, E½W½, NE¼, NW¼SE¼
Sec. 30: Lot 1
Containing: 2,336.14 acres

6.1.2.2 Lease No. U-027821
Date of Lease: September 1, 1958
Lessee: Kennecott Coal Company
Lands covered by Lease:
T. 13 S., R. 12 E., Carbon County, Utah
Sec. 23: NW¼SE¼, NE¼SW¼
Containing: 80 acres

These two leases were consolidated May 16, 1960 and approval of assignment was granted on December 1, 1965.

Total acreage: 2,416.14

6.2 State of Utah Coal Leases

6.2.1 Lease No. ML-22590
Date of Lease: January 25, 1965
Lessee: Pacific Gas and Electric Company
Lands covered by Lease:
T. 13 S., R. 12 E., Carbon County, Utah
Sec. 2: Lots 1,2,3,4, S½ (All)
Containing: 375.52 acres

6.2.2 Lease No. ML-22675
Date of Lease: February 23, 1965
Lessee: Pacific Gas and Electric Company
Lands covered by Lease:
T. 12 S., R. 12 E., Carbon County, Utah
Sec. 32: NE¼NE¼, S½NE¼, NW¼
Containing: 280.00 acres

6.2.3 Lease No. ML-21994
Date of Lease: August 6, 1964
Lessee: Pacific Gas and Electric Company
Lands covered by Lease:
T. 12 S., R. 12 E., Carbon County, Utah
Sec. 32: S½
Containing: 320.00 acres

6.3 Fee Coal

6.3.1 Mahleres and Sampinos Lease
Date of Lease: August 6, 1963
Lessee: Pacific Gas and Electric Company
Lands covered by Lease:
T. 13 S., R. 12 E., Carbon County, Utah
Sec. 16: All
Containing: 640.00 acres

6.3.2 Kennecott Coal Company
Lands covered by Lease:
T. 13 S., R. 12 E., Carbon County, Utah
Sec. 23: W½NE¼, E½NW¼
Containing: 160.00 acres

6.4 Surface Ownership

The Ownership Map, SDL-6.0, shows the areas covered by the coal leases and the ownership of the surface. The names and addresses of the surface owners are:

6.4.1 Estate of Harry Mahleres
John H. Mahleres, Executor
426 East 2 North
Price, Utah 84501

6.4.2 John H. Mahleres
426 East 2 North
Price, Utah 84501

6.4.3 John S. Sampinos, et al
228 N. Carbon Avenue
Price, Utah 84501

6.4.4 Milton Thayne
Wellington, Utah 84542

6.4.5 Kennecott Coal Company
Kennecott Copper Corporation
P. O. Box 11299
Salt Lake City, Utah 84111

6.5 Description of Rights-of-Way and Land Use SDL-6.5

Lands that are required by the Sage Point-Dugout Canyon Project include corridors or rights-of-way that are limited to 50 feet each side of the center line of the right-of-way. Rights-of-way might be combined. The railroad spur right-of-way will determine rights-of-way for other facilities.

A preliminary study by Towill, Inc. (Appendix A) considers possible routes for rail service from the Denver and Rio Grande Western Railroad to the mine. Included are four routes. Evaluation of the routes favors Routes G and H and this report to the Bureau of Land Management considers these as viable alternates.

Routes G and H pass over Federal, State and Fee lands. In this preliminary study, U.S. Geological Survey 7.5 minute quadrangles (2,000 feet per inch) at 20 and 40-foot contour intervals were used for selecting rail routes. Towill has outlined the areas where aerial mapping for new topographic maps at 100 and 200 scale and 5 and 20-foot contour intervals will provide base information for detailed railroad selection and design. NGC intends to do this aerial mapping before winter.

Separate letter applications are being submitted to the Bureau of Land Management to cover rights-of-way for the different functions of the project. Each is

covered under the Congressional Acts as tabulated below:

6.5.1 Act of March 3, 1875
43 USC 934
Railroads

The 43 USC 934 railroad right-of-way includes 50 feet on each side of the center line of the selected alignment. Description will be by "metes and bounds" rather than by legal subdivision. The Towill report (Appendix A) shows the G and H alternative routes as well as profile and typical cross section of construction. Destination is a rail loop in Section 28, T. 13 S., R. 12 E.

6.5.2 Act of January 21, 1895
43 USC 956
Roads, Surface Conveyors

The 43 USC 956 road(s) and surface conveyors rights-of-way also 100 feet wide might be combined, at least partially, with the railroad right-of-way.

6.5.3 Act of February 15, 1901
43 USC 959
Water Pipelines, Water Plant Sites,
Telephone and Telegraph Lines,
Electrical Distribution Lines

The 43 USC 959 rights-of-way can be combined insofar as possible with the USC

934 and 956 rights-of-way. All of these are linear rights-of-way covering 15 miles or more in length.

Special Land-Use Permit Application is planned to serve the two mine sites, the central yard site and the refuse disposal dam site. (SDL-6.5 and SDL-10.4 show typical arrangements for the surface facilities to mine and central yard.) The total area of these sites is 2,400 acres and are described by legal subdivision in the application.

Dames and Moore investigated refuse disposal areas. Four sites are available. Site C is preferred, with Site A as an alternative. Details of these sites are covered in Appendix B.

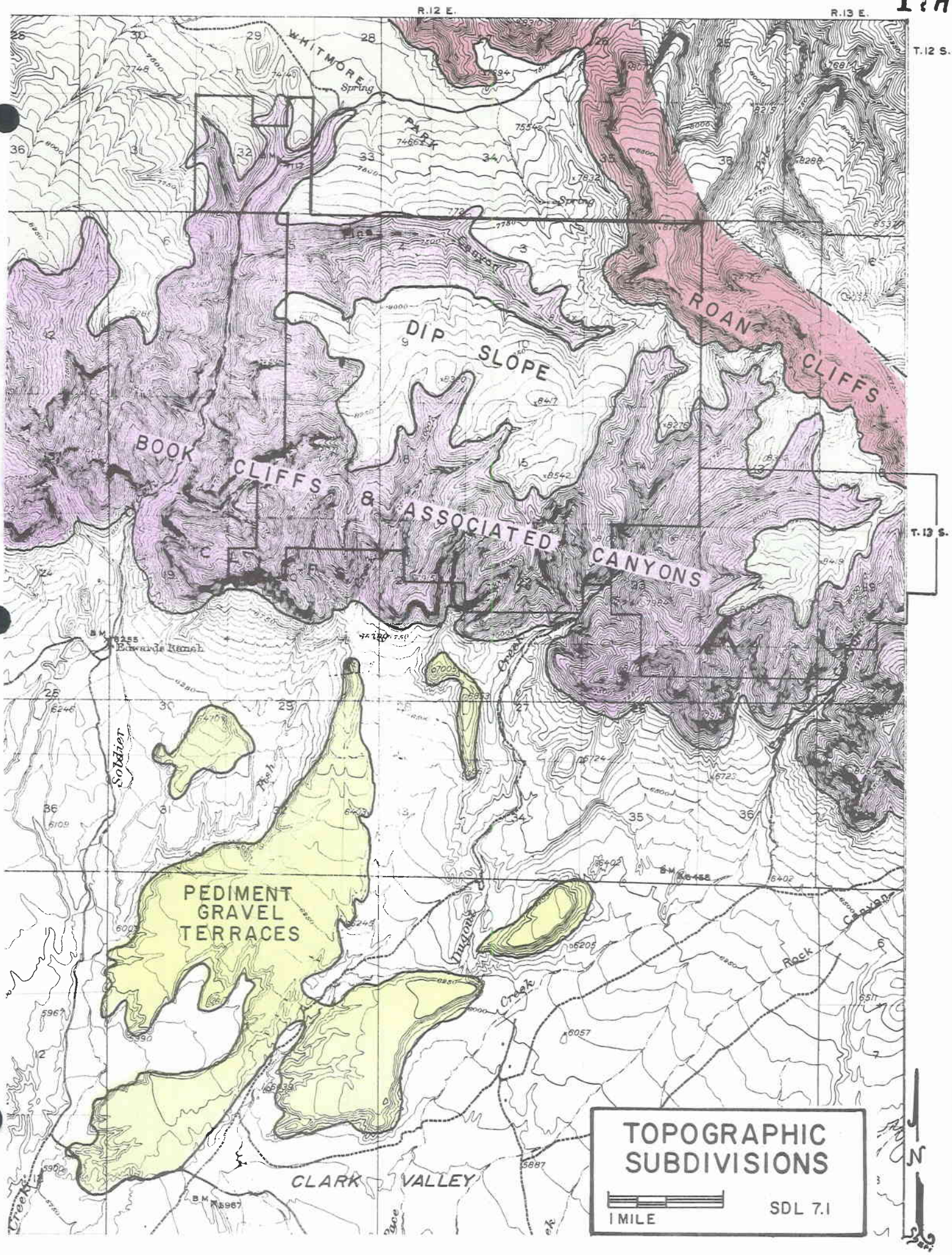
7.0 The Environment

7.1 Topography

The Sage Point-Dugout Canyon property is located in the western Book Cliffs. The Book Cliffs run from Helper, Utah east into Colorado with a general east-west trend. The cliffs are steep with slopes from 15 to 90 degrees and face the south. From west to east across the property, Soldier Creek, Fish Creek, Dugout Creek and Pace Creek are the main drainages that cut canyons into the rugged cliffs. The general trend of these canyons is north-south. An exception is Pine Canyon which lies back of the escarpment and follows the trend of the cliffs. The Book Cliffs range in elevation from 6,700 feet to 8,400 feet.

Above and capping the Book Cliffs is the dip slope (SDL-7.1). The slope follows the structure of the area and slopes or dips to the north at about 7 degrees. The surface is rolling hills that steepen to form the canyons along the Book Cliffs. The elevation ranges from 7,200 feet to 8,500 feet.

The Roan Cliffs rise up from the dip slope to elevations of 8,900 feet. The trend of the Roan Cliffs generally follows that of the Book Cliffs. Slopes range from 15 to 50 degrees, becoming steepest at the top. The Roan Cliffs are cut on the west by the north-flowing Nine Mile Creek and on the east by south-flowing Pace


R.12 E.
R.13 E.
T.12 S.
T.13 S.
WHITMORE PARK
Spring
Canyon
DIP SLOPE
ROAN CLIFFS
BOOK CLIFFS & ASSOCIATED CANYONS
Edwards Ranch
Soldier Creek
PEDIMENT GRAVEL TERRACES
Ingoms Creek
Rock Canyon
CLARK VALLEY
TOPOGRAPHIC SUBDIVISIONS
1 MILE
SDL 7.1
N

Creek. Between these two drainages the cliffs form the highest ridge in the area.

The area below the Book Cliffs is made up of pediment terraces that have been eroded and cut by the drainages from the cliffs. These gravel terraces are gently sloping to the south or away from their source, the cliffs. The top surface is relatively flat with some small gullies. The edges of the terraces are steep, up to 30 degrees, and break to the valley floor of alluvium, often exposing the Mancos shale in the cut banks and bluffs. The area between the dissected pediments consists of broad alluvial valleys with steep-banked and narrow stream channels. Grades in these valleys are generally 2 percent or less. Clark Valley is the largest of these areas of alluvial deposits and lies on the eastern edge of the area of interest. Elevations range from 5,300 to 7,000 feet.

7.2 Soils

Soils on the coal lease area consist of three associations: Badland-Rockland Association; Argic Cryoborolls-Pachic Cryoborolls-Cryic Paleborolls Association; and Typic Argiborolls-Lithic Argiborolls-Typic Haploborolls Association. Their distribution is shown on SDL-7.2.

Badland-Rockland Association consists of mostly bare rock outcrop, but also includes some shallow soils over bedrock. The shallow soils are on benches or mesas where the topography is undulating to rolling. The relief is steep to very steeply dissected escarpments and breaks along canyons. Runoff is rapid to very rapid and sediment production is very high. Control of soil loss and the resultant heavy sediment production is a major problem.

Argic Cryoborolls-Pachic Cryoborolls-Cryic Paleborolls Association consists of dark gray and brown silt loams, clay loams, cobbly in places. The soils in the association are moderately well to somewhat excessively drained. Permeability is slow to rapid. Runoff is medium to slow and sediment production is moderately low. The topography ranges from rolling to very steep.

Typic Argiborolls-Lithic Argiborolls-Typic Haploborolls Association (5) occurs in the northernmost extent of the leases. The slopes are steep to very steep. This soil is neutral to moderately alkaline, and of silty clay loams, with a red subsoil. These soils are well-drained with slow to moderate permeability. Runoff is medium to rapid and sediment production is low.

Lying below the coal leases, in the area of future access and surface facilities are two other major soil associations, Castle Valley-Kenilworth and Chipeta-Persayo, with minor occurrences of Ravola-Billings-Penoyer and Sanpete-Minchey.

Castle Valley-Kenilworth Association consists of shallow, very calcareous, well-drained, stony, moderately to coarsely textured, sloping to steep soils on upland benches and old, dissected outwash-plains. These soils have formed from weathering sandstone and shales of the Mesaverde group. A typical profile: The surface is brown to pale brown, very calcareous, stony to sandy loam about 7 inches thick. The subsoil is gravelly, very fine, sandy loam, very calcareous, and can contain up to 50% cobblestones. The mean annual soil temperature is 47° to 54°F and has a frost-free season of 110 to 130 days.

Typic Torriorthents (shallow) - Lithic Calciorthids - Lithic Natrargids

*Chipeta-Persayo Association is calcareous, well-drained, moderately fine-textured, and gently rolling to moderately steep. They occupy shale hills and have formed in residuum that weathered from alkaline, gypsum-bearing, marine Mancos shale. The mean annual soil temperature is 47° to 54°F and the frost-free season is 110 to 160 days. In a typical profile, the upper 1 to 5 inches is light brownish clay and silty loam. The underlying material is silty, clay loam, often with a saline and/or gypsiferous layer. Bedrock is 12 to 17 inches from the surface.

Typic Torrifluvents - Typic Torriorthents

Ravola-Billings-Penoyer Association consists of nearly level to gently sloping, deep, well-drained and moderately well-drained medium-textured and moderately fine-textured soils on alluvial fans and flood plains and in alluvial valleys.

Xerollic Calciorthids Ustollic

Sanpete-Minchey Association consists of gently sloping, deep, well-drained, medium-textured to moderately fine-textured soils over gravel on mesas, benches and old alluvial fans.

7.3 Geology

7.3.1 Stratigraphy

The coal within the property boundaries lies in the upper portion of the Blackhawk formation of Upper Cretaceous age (SDL-7.3(a) and SDL-7.3(b)). The Blackhawk is the remains of a series of transgressions and regressions of an ancient shoreline that was fed sediment from the northwest. Behind the shoreline were peat swamps cut by low energy streams winding through tropical swamps. As time progressed toward the close of the Cretaceous the shoreline regressed farther and farther to the southeast, taking the peat-bearing swamps with it. This ended the deposition of peat in the area of central Utah.

The Masuk Tongue of the Mancos shale is exposed below the Book Cliffs. The formation consists of gray to dark gray, slightly calcareous, gypsiferous, and carbonaceous marine mudstone, with occasional thin siltstones and fine grained sandstones.

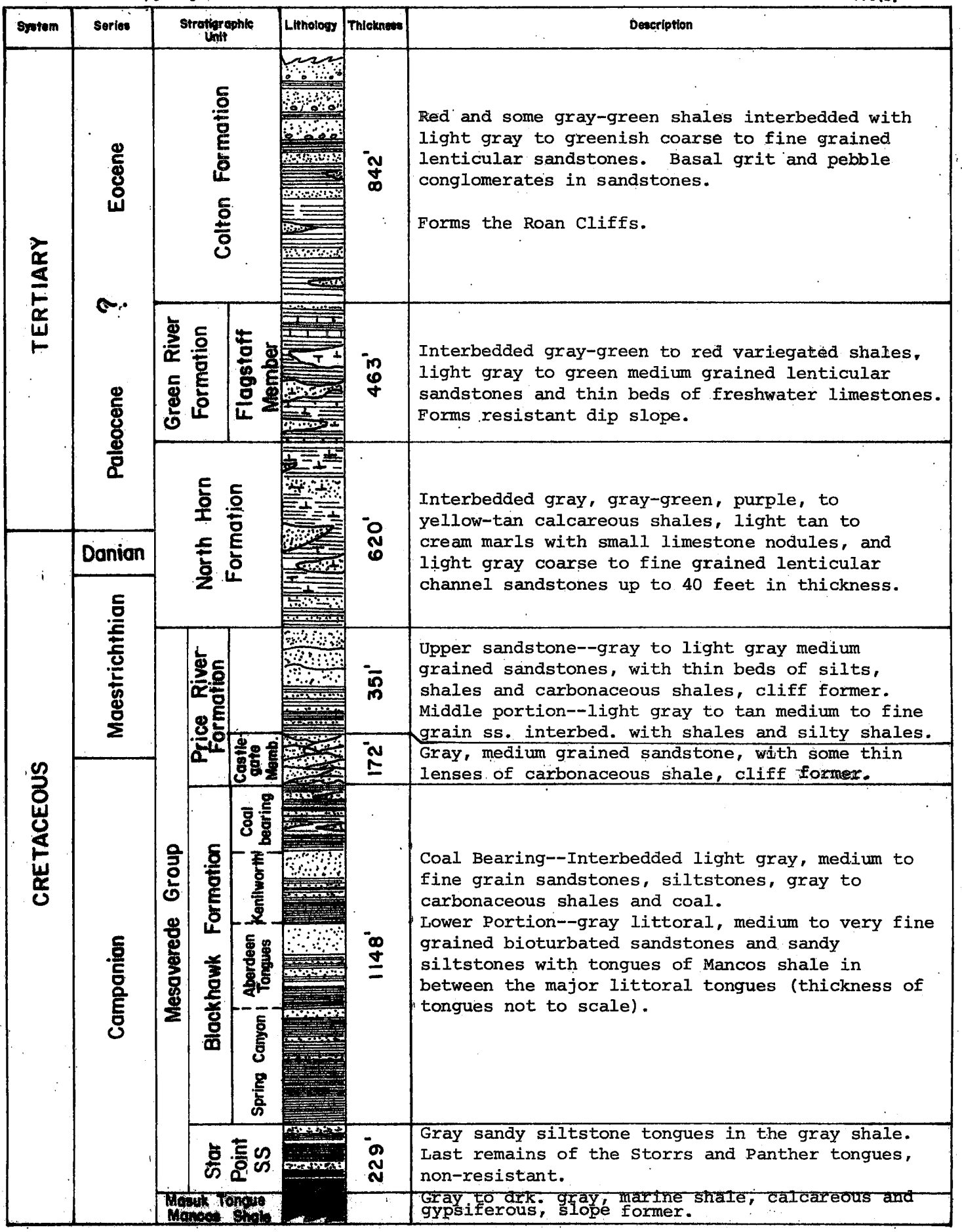
The Mancos supports little to no vegetation and is exposed where the overlying pediments are eroding back and forming steep slopes, or in the flat valley bottoms where streams have cut through

STRATIGRAPHIC SECTION

SAGE POINT-DUGOUT CANYON PROJECT, CARBON CO., UTAH

P.B. Andersen, geologist

7.3(b)



the alluvium. The clays of the Mancos make acceptable soils for agricultural use when mixed with sands to change its texture. The Mancos shale is notorious among those who attempt to construct roads or railroads upon it due to its tendency to shrink and swell. This is an engineering problem that must be considered in construction procedures.

The Mancos shale is approximately 5,000 feet thick. The uppermost tongue in the Mancos is called the Ferron Sandstone and is exposed south of the property in the Farnham Anticline. The Ferron Tongue is from 200 to 250 feet thick in the area.

The Star Point Sandstone was named in the area of Helper, Utah where it contains two well developed clastic deltaic tongues, Panther and Storrs. These tongues have been traced to the east as far as Fish Creek. At Fish Creek they are thin beds of gray siltstones, representing the distal ends of the deltas. They pinch out between Fish and Dugout Creeks.

The contact between the Mancos shale and the Blackhawk formation has always been a topic of some disagreement. The difficulty has developed

due to the intertonguing of shoreline facies (siltstones to medium grained sandstones) with the marine facies of the Mancos shale. There are several major regressive coarse clastic tongues extending to the east, with corresponding records of transgression as tongues of marine mudstones to the west.

Depending on whose nomenclature is used, these tongues can be included or excluded from the Blackhawk formation. Maberry (1971, p.23) presented a comparison of several authors' nomenclature. Because Young's work dealt with the entire Book Cliffs and not an isolated section his system is used here. (See diagram on the following page.)

The Spring Canyon tongue has its type section in Spring Canyon, near Helper, Utah. As this tongue is followed eastward it breaks into five smaller tongues, three of which pinch out into the Mancos shale between Soldier and Dugout Canyons. The tongues and marine mudstones make up 383 feet of the Blackhawk formation at Fish Creek.

Moving up in section the next tongue is the Aberdeen and is the lowest tongue that contains a complete regressive shoreline facies sequence.

Clark (1928) Castlegate, Wellington, and Sunnyside quadrangles		Fisher (1936) Book Cliffs, south of Sunnyside		Young (1955) Book Cliffs, Utah-Colorado		Fisher, Erdmann, and Reeside (1960) Central and eastern Book Cliffs		This report	
Price River formation Castlegate sandstone member		Price River formation Castlegate sandstone member		Price River formation Castlegate sandstone member		Price River Formation		Price River Formation	
						Castlegate Sandstone		Castlegate Sandstone	
Blackhawk formation	Coal-bearing member	Blackhawk formation	Upper member	Blackhawk formation	Desert member	Blackhawk Formation	Upper member	Blackhawk Formation	Upper mudstone member
					Grassy member				
			Middle sandstone member		Sunnyside member		Middle sandstone member		Sunnyside Member
	Aberdeen member		Middle shale member		Kenilworth member		Middle shale member		Lower mudstone member
									Kenilworth Member
			Lower sandstone member		Aberdeen member				Mancos Shale / Aberdeen Member
Star Point sandstone	Spring Canyon tongue	Not recognized			Spring Canyon member		Lower sandstone member		Mancos Shale
	Storrs tongue			Star Point sandstone	Storrs tongue				
	Panther tongue				Panther tongue				
Mancos shale		Mancos shale		Mancos shale		Mancos Shale			

Beginning from the base and working up the normal complete cycle is as follows: mudstone, gray, marine Mancos; interbedded marine mudstone and finely laminated thin beds of fine grained sandstone, bioturbated; lower shore facies, fine grained sandstone, lensy, calcareous, contains carbonaceous material and very abundant trace fossils, horizontal and hummocky bedding; upper shore facies, fine to medium grained sandstone, coarsest and most porous of the sequence, often shows "swiss cheese" weathering, trough cross stratified, minor bioturbation; beach or foreshore facies, fine grained sandstone, commonly weathers white but is gray when fresh, contains carbonaceous material and root casts, low angle cross stratified and horizontal bedding.

The Aberdeen tongue actually records several regressive events which are represented in the section as complete or a partially complete series of shoreline facies. Those incomplete tongues lack the upper units of the complete facies pattern. Collectively the tongues are 183 feet thick.

The Kenilworth tongue is one complete cycle of shoreline facies beginning with the marine mudstone and up through the beach or foreshore sandstone. In Fish Creek the Kenilworth tongue is

128 feet thick of which 55 feet is sandstone. The sandstone section of this tongue is a resistant cliff former and easily mappable on the surface.

In the Sage Point-Dugout Canyon area the top of the Kenilworth sandstone marks the change from marine to near-shore swamp and fluvial environments. This is the environment of deposition of the three mineable coal seams.

There are three seams or zones of economic importance in this area. They are, from bottom to top, the Gilson, Rock Canyon and Sunnyside. All three seams are never everywhere mineable showing lenticularity typical of Mesaverde coals.

Starting at the base of the coal-bearing section or the top of the Kenilworth sandstone, the first correlatable coal is the Kenilworth. This coal is typically about two feet thick along the outcrop and thinning to less than a foot in the subsurface to the north. On the outcrop the Kenilworth coal is about 20 feet above the top of the beach deposits of the Kenilworth tongue. This coal never attains mineable thicknesses on the property.

Above the Kenilworth coal are a series of thin to medium beds of restricted marine, swamp,

and fluvial deposits. These deposits often contain abundant carbonaceous material, a few marine invertebrate fossils and numerous conifer and dicot plant fossils. Lithology varies from medium grained sandstones to black carbonaceous mudstone. Minor amounts of pyrite are disseminated among much of these sediments. This lithology is typical of the sediments that separate the coal seams throughout the remaining Blackhawk section.

The Gilson coal is the next coal in the section and is mineable (4.5 feet thick or greater) in most places on the property. There are one or two coals in the 40-foot interval above the Kenilworth coal but the coals are usually less than one foot thick and difficult to correlate. The Gilson seam follows the typical pattern for a fluvial-type coal. It is lenticular and problematic in its correlation from hole to hole. Its thickness varies from just over a foot to 15 feet. When the seam is mineable its average thickness is about 7 feet.

The rock interval between the Gilson and next economic seam, the Rock Canyon, varies from 34 to 88 feet. This interval is often difficult to correlate because it consists of lenticular,

interbedded siltstones, sandstones, mudstones and coal. From lack of marine fossils and presence of land fossils, this entire interval is considered to be of non-marine fluvial and fresh water swamp environments. The coals in this interval are referred to by Clark (1928) as the Fish Creek seam for exposures in the area of Fish Creek. The Fish Creek seam, or better expressed as a zone, is a fluvial coal and highly lenticular. It comes and goes in the west portion of the property and has pinched out completely in the Dugout-Pace Canyon area. The coal is too thin and lenticular to be of economic importance.

The Rock Canyon seam lies at the top of the previously discussed interval. The Rock Canyon bed is presently mined by California Portland Cement Company in the Soldier Canyon Mine immediately west of Sage Point in Sections 7 and 18, T. 13 S., R. 12 E. On the Sage Point-Dugout Canyon property the seam varies from 2.7 to 9.0 feet thick showing lenticularity with some splitting and rock partings.

Continuity appears to be better in this seam than both the Gilson and Sunnyside seams. Preliminary data from outcrop work by John Balsely (oral communication and unpublished data, 1976) indicates

that the Rock Canyon seam is a transgressive coal from sections measured in Soldier Canyon, Fish Creek and Dugout Canyon. In each case the coal is covered by restricted marine facies indicating a change from terrestrial to marine environments. This uniform change of environment over the Rock Canyon coal explains its better continuity. The gradual subsidence of the swamps kept up with the accumulation of peat until over-flooding by the invading sea stopped peat formation.

The peat forming often resumed for a short time in local areas and appears in the section as thin "stringers" above the Rock Canyon seam. Fluctuations from restricted marine to fresh water swamps continued for a short time and amounts to about 20 feet of sandstones, siltstones and mudstones above the Rock Canyon coal.

The interval from the Rock Canyon to the Sunnyside coal zone varies from 86 to 165 feet and records two marine invasions and a return to swamp and peat-forming conditions. These marine invasions are referred to as tongues similar to the Kenilworth and Aberdeen and are here called the lower and upper Sunnyside tongues. The upper tongue develops between Coal Creek to the west and Soldier Creek. By Pace Creek on the east the

tongue has pinched out. Each of the tongues contains facies from lower, upper and foreshore environments. These sandstones are resistant and usually are well exposed on the outcrop.

The lower Sunnyside tongue is correlated with the Sunnyside tongue at Sunnyside, Utah by Doelling (1972, pp. 256-57). The coal that lies atop the tongue in the Sunnyside area is of coking quality and fairly continuous in its stratigraphic position. In the area of Soldier Canyon there is a half foot of coal lying five feet above the lower tongue, but this is not present in the Fish Creek area. This is the only true Sunnyside coal.

Above the lower tongue lies 20 feet of swamp deposits consisting of siltstones and mudstones, above which the upper tongue develops through the normal sequence of prograding shoreline facies. Regression continued through the restricted marine facies and back again to swamp and fluvial environments, and the formation of coal. The marine facies are represented by black shales 10 to 20 feet thick. These are excellent subsurface markers throughout the Sage Point property.

The Sunnyside zone on the property lies above the top of the second marine tongue and therefore

is fairly continuous in its relative stratigraphic position. It is not a true Sunnyside coal, but rather lies above this local and anomalous upper tongue. There are several thin coals above the Sunnyside zone all of unmineable thicknesses and in previous work have been referred to as the Upper Sunnyside. These coals are highly lenticular and spotty as individual beds, but retain a uniform position as a zone. They lie from 20 to 60 feet above the Sunnyside zone.

The Sunnyside coal zone is thin on the south, which is where it outcrops. In the south the zone is made up of one to three coal beds, the thickest of which is about three feet. The zone varies from 3 to 15 feet thick. General thickening takes place to the northwest with the thickest single bed being 11.5 feet, but the seam still maintains moderate lenticularity.

The remaining uppermost Blackhawk formation ranges from 130 to 150 feet. The sediments are interbedded sandstones, siltstones, and mudstones. They represent an environment of fluvials, back swamps and a few small lakes. The top of the Blackhawk has been eroded prior to the deposition of the Price River formation.

Not uncommon in western coals are the development of wants, which are areas of marked thinning to complete absence of coal at its normal stratigraphic position. From the drilling that has been completed up to this time, a want with a northeast-southwest trend has been mapped. The outline of the want can best be seen by studying the isopach maps of the Gilson and Rock Canyon seams, and the Gilson-Rock Canyon interval.*

There is room for several interpretations as to the cause of such occurrences. From outcrop work and drill hole data the most appealing explanation seems to be related to depositional environments.

The isopach of the interval between the Gilson and Rock Canyon shows a thickening in the want area. Point bar deposits have been noted on the outcrop in east Soldier Canyon area where the want projects onto the outcrop. The deposition of these thicker-than-normal meandering stream deposits would cause both contemperaneous destruction of any peat-forming environments and a later thinning of coals over the tops of these buried channels due to differential compaction. The general paleoslope (Balsely, 1976 oral communication) is to the southeast which makes the trend of the want run at 90 degrees to it, but

*SDL-10.0(d),(e)and(f)

in such a low energy environment as flat swamps such an alignment over a few miles does not seem improbable.

The Castlegate sandstone is part of the Mesaverde Group of Upper Cretaceous age and is a fine to medium grained sandstone, off-white to gray and weathers light tan-brown. The unit is cemented with argillaceous material and some calcium carbonate, but remains semi-porous to porous. Sorting is poor with grains ranging from sub-rounded to sub-angular quartz. The sandstone is massive with trough and some tabular cross-bedding and small-scale graded beds one-half inch to two inches thick. Occasionally there are lenticular thin beds of siltstones and mudstones that contain the most abundant supply of carbonaceous and plant material. These finer grained units are most common in the lower and upper parts of the section. Small pyritic nodules, clay interclasts and coalified material are also present in small amounts.

The Castlegate sandstone is an easily mappable unit and an excellent marker bed. It is resistant and forms a cliff in most places. The unit is 172 feet thick in Fish Creek, and has good lateral

continuity across the entire property. The environment of deposition is dominantly fluvial.

The Upper Member marks the top of the Mesaverde Group and can be topographically and lithologically divided into two units. The lower section is a series of interbedded sandstones, sandy mudstones and gray mudstones. This type of lithology is 133 feet thick near Fish Creek. The sandstones are similar to the Castlegate with less porosity and more carbonaceous material. This section is almost always a slope former that separates the lower cliff-forming Castlegate and the upper cliff-forming sections of the Price River formation.

The uppermost section of the Price River is a thick bedded to massive sandstone, light gray to off-white and weathers the same. The sandstones are medium to fine grained quartz, fair sorted, with some coarse porous sandstones at the base of beds which become finer upwards. The sand grains are sub-rounded to sub-angular, moderately cemented, some beds are calcareous and some contain disseminated carbonaceous material, casts of tree stems and trucks, and some minor bioturbation. The sandstones show horizontal hummocky stratification, ripple marks and trough cross-bedding. The thick and

massive sandstones are broken by beds of gray to dark gray mudstones and siltstones that are less resistant slope formers. This uppermost unit is 218 feet thick giving a total thickness for the entire Price River formation of 522 feet.

The North Horn formation lies conformably above the Price River formation and forms moderate to steep slopes near the top of the Book Cliffs. The unit is about 620 feet thick with some variability due to the nature of the contact with the overlying Flagstaff Member. The North Horn section contains the boundary between the Cretaceous and Tertiary periods, but its exact position is unknown. The upper contact is in the Paleocene epoch of the Tertiary.

The North Horn formation was deposited in flood plain and lacustrine environments. The base of the formation shows similarity to the fluvial environment of the Price River, but the sandstones are finer grained and medium to thinly bedded. Calcium carbonate content of the rocks increases upwards in the section. In the lower half are interbedded sandstones and gray to gray-green calcareous mudstones. The sandstones throughout the unit are fluvial in origin and often are conglomeratic at the base with a fining upwards trend.

The color is gray to light gray and some "salt and pepper" beds. They weather to brown and tan. The sandstones are very lenticular with lateral continuity from a few hundred feet to over a thousand feet. The individual channel sands are up to 50 feet thick.

The fine grained rocks in the upper part of the formation are yellow-tan to gray marls with numerous small limestone nodules that weather out. There are also occasional beds of carbonaceous mudstones and in Soldier Canyon there is a thin (0.3') local coal bed exposed. The upper contact is transitional and shows no topographic expression.

In a recent U.S. Geological Survey publication Fouch (1976) re-defined the lower Tertiary stratigraphy in the Uinta Basin and part of the change was placing the Flagstaff in the Green River formation. The Flagstaff in the Sage Point-Dugout Canyon area is a series of interbedded sandstones, mudstones, marls and limestones. The sandstones are fluvial in origin, lenticular, calcareous, medium to fine grained, of a tan to brown color on outcrop, and gray to gray-green when fresh. The mudstones are dominantly gray-green and calcareous with some red variegated mudstones toward the top

of the member. The limestone beds are thin, never more than four feet thick. They are generally fossiliferous with fresh water gastropods, pelecypods and ostracods. When the limestone occurs in beds of a foot or less they are generally poorly bedded in the sense that they are almost a layer of nodules. This causes the thin limestones to be non-resistant on outcrop and difficult to locate when occurring with mudstones.

The lower contact of the Flagstaff was arbitrarily chosen at the lowest pure limestone bed. This bed is always fossiliferous as long as it retains its purity. The mapping of the contact was difficult due to the lenticularity of these lower limestones. While tracing such a bed, it would sometimes grade into a light yellow-tan to gray marl. This is why the contact has been dashed on the map. The thickness is also of some variability but where measured it was 463 feet thick.

The unit forms a dip slope on top of the Book Cliffs and the upper beds of limestones and calcareous sandstones protect and slow the retreat of the cliffs. This protective cap begins to break down at the extreme eastern edge of the property.

From Pace Creek eastwards the Flagstaff and North Horn have been mapped as the North Horn formation.

The Colton formation contains the youngest rocks exposed in the area and is dated as late Paleocene and early Eocene age. This is the formation that makes up the Roan Cliffs.

The lower contact is conformable with the Flagstaff Member. It has been drawn at the break in slope at the base of the Roan Cliffs. This corresponds to a thin resistant gray-green calcareous sandstone. This contact is important in coal mining in the area because it marks the addition of approximately an extra 1,000 feet of cover, putting everything north of the contact well below the 3,000 foot cover line. The upper contact with the Green River formation is north of the property and the 842 feet of Colton is not a representative figure of its entire thickness but just that which is exposed on the face of the Roan Cliffs.

The lithology consists of interbedded sandstones, siltstones and red mudstones. The color of the unit is red to light brown. As with the other Tertiary units the beds are very lenticular and the sandstones show a variety of sedimentary structures typical of a fluvial origin.

7.3.2 Structure

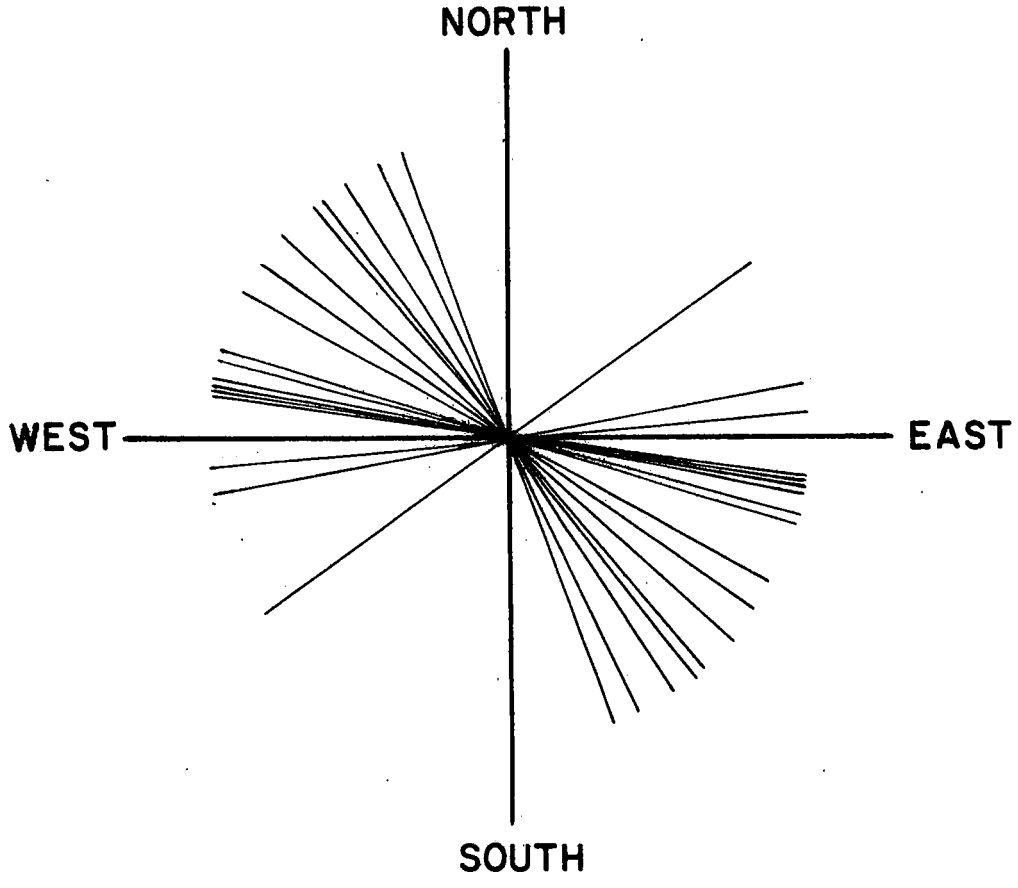
The structure is very simple on a large-scale basis. The strike and dip of the beds is generally in the area of N 80° W, 7° N, with minor variation of a few degrees. Small undulations in structure, such as "rolls," are expected to be encountered in mining. This is common in coals due to the paleogeography and differential compaction of the varied types of sediment between coals.

There are no known faults located in the area of calculated reserves that have displacements sufficient to cause any major difficulties in extraction of the coal. The only fault found with a displacement greater than a foot was in the mouth of Fish Creek Canyon. The maximum displacement observed was two feet, with a 1.8 foot brecciated zone filled with sandstone and large calcite crystals. The wide brecciated zone was traceable for about 200-300 feet along the strike. The strike of the fault was N 83° W, which is almost the strike of the beds. The fault is probably related to slumping or the breaking away of large blocks of sediment from the cliff face as the softer Mancos is eroded out from under it.

There are two faults lying to the northeast of the property which were taken from Doelling's map (1972, p. 396). These faults lie in the Roan Cliffs north of any mineable reserves.

During our 1975 drilling program there were numerous cores that showed slickensides and fracturing, indicating some movement at depth. The lack of any significant displacement on the surface indicates that these movements have all been on a very minor scale and should pose no problem in mining.

Seventeen measurements of fractures have been taken on rocks throughout the stratigraphic section in different areas of the property. The results have been plotted on a rose diagram (SDL-7.3(c)) which follows. The dips of all the fractures were within 5^{o} of vertical with the exception of one which dipped 60^{o} to the south.



SDL-7.3(c) Rose diagram of fractures on Sage Point – Dugout Canyon property. Each line represents one measurement.

7.3.3 Economic Geology

The only known commodity of any economic interest on the property is coal.

The area is leased and has been studied and drilled by the petroleum industry in the past. The only well north of the Book Cliffs in this area is in Section 28, T. 12 S., R. 12 E. Below the Book Cliffs the interest has been more intense. The northern extension of the Farnham Anticline was the structure and the sandstone tongues of the Mancos were the target. The locations of all wells drilled for oil and gas in the vicinity of the Sage Point-Dugout Canyon project are shown on SDL-6.5. The only producing well is on Farnham Dome (Section 12, T. 15 S., R. 11 E.) and produces CO_2 which is used to manufacture dry ice.

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7.4 Geologic Hazards

The geologic hazards to surface operations are minimal; to underground operations the hazards are greater comprising roof falls, methane seepages and water flooding. Precautions taken in the course of mining are aimed at minimizing such underground hazards.

Tests of coal cores from each seam by the U. S. Geological Survey and the Utah Geological and Mineralogical Survey during 1975 disclosed the presence of methane gas in each seam. Adequate ventilation is planned to mitigate any methane hazard.

Subsidence: Types and patterns of subsidence depend on mine geometry, strengths of rocks, thickness and configuration of overburden and the methods and percent extraction of coal.

The mineable coal deposits of the Rock Canyon and Gilson seams extend from the outcrops over a distance of 20,000 feet to a depth of 3,000 feet. The uppermost Sunnyside seam does not become mineable until a depth of 1,200 feet is reached.

There is a risk of subsidence when mining coal under the sharp and steep scarp of the Book Cliffs. Sloughing has occurred under such conditions at both Kaiser and U. S. Steel to the east. Such sloughing

is the result of subsidence attributable to mining too much coal too near the outcrops. To alleviate or avoid this happening at Sage Point-Dugout Canyon, a 50% extraction rate will be enforced near the cliffs.

About 200 feet above the coal seams is the massive Castlegate sandstone, 200 feet thick. This strong sandstone member will resist subsidence, especially as multiple longwall panels are extracted, subsidence will occur possibly at a rate that might be expressed in inches per year rather than feet per year. Subsidence will not be uniform. Over the rock tunnel and the mains, subsidence may not be detectable.

Sage Point-Dugout Canyon Mine plans call for the columnization of workings on the three seams so far as is possible.

The land-use areas are outside the Book Cliffs scarp and there are no landslide hazards. Similarly, all operations on these areas are surface operations and subsidence is not a hazard as it is in the underground operations. A possible hazard is that of flooding during and after a major storm. This hazard is not considered severe as the maximum recorded rainfall at Price is 1.24" in 24 hours. The main slurry storage pond will be designed to contain 10,000,000 cubic yards.

7.5 The Coal

Mineable coal occurs in seams: the upper, Sunnyside; the middle, Rock Canyon; and the lowest, Gilson. As a result of drilling by NGC and KCC, in-place reserves of 222,000,000 tons have been defined. NGC reserves 142,000,000 tons and KCC reserves 80,000,000 tons. The logs of all drilled holes have been furnished to the U. S. Geological Survey. Analyses of coal cores reveal the following qualities:

PROXIMATE ANALYSIS

Dry Basis	Run-of-Mine Range %	Average %
Ash	12.2 - 20.5	13.80
V.M.	33.2 - 40.98	35.86
F.C.	44.9 - 53.15	47.82
Sulfur	.5 - 1.0	.64*
Btu	11,860 - 12,375	12,405

ULTIMATE ANALYSIS

C	65.7 - 70.1	68.19
H	4.8 - 5.6	4.79
N	1.2 - 1.4	1.28
Ch	.03 - .05	.04
Sulfur	.6 - 1.0	.64*
Ash	12.2 - 20.5	16.32
Btu	11,860 - 12,375	12,192

*Incomplete data from 5 KCC drill holes indicate high sulfur in coal from the Rock Canyon seam. In actual mining, this coal would not be commingled with other

coals of the Sage Point-Dugout Canyon Mine that are to be washed. Sunnyside and Gilson seam coals of KCC appear comparable in sulfur content with Sage Point coals.

Plans call for washing run-of-mine coal by gravity separation. Quality of coal should be upgraded by nearly 10%. Rejects will be stockpiled behind storage dams and the washery water system will be a closed one.

Sage Point-Dugout Canyon coal has minor coking quality (free swelling index ranges from 2.5 to 4.0). Coal will be used by PGandE for electric generation in California and for KCC's use in Utah and Nevada.

7.6 Climatology SDL-7.6

Annual precipitation above the coal deposits ranges up to 20 to 25 inches. The summer season is short with temperature ranges of 40 to 80 degrees. Fall and spring seasons are erratic with snow as early as September and as late as June. Winters often are severe with temperatures occasionally as low as minus 30 degrees. Most snow falls during January, February and March. The average frost-free period extends from May 10 to September 10, a span of 140 days.

Reference: Monograph Series No. 3 1972
Utah Geological & Mineralogical Survey

S.D.L. – 7.6

Rainfall map, Book Cliffs coal field (isohyetals in inches).

7.7 Hydrology

7.7.1 Surface Water SDL-7.7.1

All surface waters on the Sage Point-Dugout Canyon property are part of the Price River drainage system, a part of the Colorado River Basin. Soldier Creek, Dugout Creek, Pace Creek and Pine Creek are the only perennial streams on the properties. Pace Creek borders the most eastern boundary of the project.

Soldier Creek runs to the west of the property except where it passes across leased Section 32, T. 12 S., R. 12 E., in the extreme northwest corner of the property. The stream's headwaters are in Whitmore Park, which drains the south slope of the relatively bare Roan Cliffs with elevations of just over 8,000 feet. The Roan Cliffs are made up of red mudstones and tan sandstones from the Colton formation, which have eroded down into Whitmore Park as a red, sandy, clay alluvium. These deposits are subject to high erosion during occasional heavy rains in the summer months and hence the sediment load of Soldier Creek is higher than that of the other drainages on the property. The creek bottom is typically red and, where water collects, pools have banks of red sands and clays.

As the stream drops into Soldier Canyon it descends across outcrops of the Flagstaff member of the Green River formation, the North Horn formation, the coal-bearing Blackhawk formation and, finally, just below the Soldier Creek Mine, the channel cuts into the Mancos shale.

Soldier Creek drains approximately 24 square miles north of and including the Book Cliffs. The gradient from Whitmore Park to the base of the cliffs is 35.2 feet vertical/1000 feet horizontal (3.52%). The channel in the upper portions of Soldier Canyon is about 85 feet wide with steep but few high and vertical banks. Below the confluence with Pine Creek the stream channel narrows to about 20 to 40 feet wide and often cuts vertical banks up to 50 feet high in colluvium and Mancos shale.

The lower portion of Soldier Creek drainage (below the cliffs) includes approximately 19 square miles, all in terrace gravels and Mancos shale. The stream gradient in the lower drainage area is 15.6 vertical feet/1000 horizontal feet (1.56%). The stream channel is cut into alluvium to a depth of approximately 10 to 20 feet below the flood plain with near vertical banks. The width of the channel is 20 to 40 feet.

Soldier Creek joins the Price River near the eastern limits of Wellington, Utah.

According to data gathered in August of 1976 by the U. S. Geological Survey, Division of Water Resources, Soldier Creek has a mean annual discharge of 5,872 acre-feet/year, where the stream emerges from the cliffs. This estimate made by stream geometry is accurate only within ± 34%.

Dugout Creek lies on the eastern side of the Sage Point property, with the right fork draining most of the KCC property. Dugout also has its headwaters in the Roan Cliffs, but unlike Soldier Creek the upper drainage is not as prone to large flash flooding and high sediment loads. This is due to the increase in elevation of the Roan Cliffs to near 9,000 feet, and the narrowing to almost disappearance of the Flagstaff dip slope. There is more vegetation at these higher elevations, resulting in less erosion and lower runoff during thundershowers. In the upper drainage, in and above the Book Cliffs, the stream channel is narrow (5 to 20 feet) and often deeply cut (10 to 15 feet) into alluvium. The banks are steep but well vegetated and show only minor scouring from flooding. The creek bottom is rocky with mostly gray and green

muds. The creek runs through the same stratigraphic sequence as Soldier Creek.

Dugout Creek in its upper portion (Book Cliffs and above) drains approximately 8.4 square miles with a stream gradient of 76.9 vertical feet/1000 horizontal feet (7.69%).

The lower drainage area of Dugout Creek (below the Book Cliffs) is in the Mancos shale and terrace gravels. In the lower portion the drainage is divided into two smaller drainages. The eastern half consists of Dugout Creek as it emerges from the Book Cliffs. This drainage then flows southerly into Pace Creek in Section 10, T. 14 S., R. 12 E. The western half begins in Section 28, T. 13 S., R. 12 E. and is joined by Pace Creek in Section 32, T. 14 S., R. 12 E. Dugout Creek flows into Grassy Trail Creek about 1/4 mile north of Sunnyside Junction, and Grassy Trail Creek flows into the Price River. The approximate area of drainage of the entire lower portion of Dugout Creek is 15.7 square miles with a gradient of 20 vertical feet/1000 horizontal (2%).

Pine Creek is a tributary to Soldier Creek and drains about half of the surface within the

Sage Point property boundaries. It drains the Flagstaff dip slope and flows east to west rather than the north-south direction typical of streams in the area. The channel is small (5 to 15 feet wide) and somewhat rocky and muddy. There are some areas where the banks are cut to near vertical in the valley alluvium, but generally the creek bottom is well-vegetated and not deeply incised. This stream is similar to Dugout Creek in that the drainage area is well-vegetated and not subject to extreme flooding or high sediment content as in Soldier Creek. Pine Creek drains only 4 square miles, which also makes it less likely for large runoff amounts. The stream gradient is 59.2 vertical feet/1000 horizontal feet (5.92%).

Pace Creek, north of the confluence with Dugout Creek, drains the eastern boundary of the Kennecott property with small tributaries draining parts of the eastern section. The creek drains terrain similar to Dugout Creek and is similar in profile and character.

7.7.2 Intermittent Streams

There are numerous small streams that flow intermittently during the early spring and during heavy rains, but two of these are of more interest than the rest. Fish Creek and Little Pine Creek usually flow at their mouths during late spring and early summer. As the summer months pass, the stream flows diminish and retreat up the canyons. Fish Creek has a small amount of water flowing where the sub-channel flow in the colluvium is forced to the surface at the contact with the Mancos shale in the vertical wall of the deep depression at the mouth of the canyon.

The bottoms of these canyons lie on or very close to bedrock and consist mostly of large boulders. The gradients are in the range of 127 vertical feet/1000 horizontal feet (12.7%) and this steep gradient causes the streams to wash clean of most of the very fine-grain sized sediment.

The intermittent drainages below the cliffs are totally dependent on precipitation for flow. They are moderately to deeply incised.

7.7.3 Ground Water

There are numerous springs on the property, but none with a great amount of flow. Springs found flowing in June of 1976 are shown on SDL-7.7.3. Most of these springs occur in the Flagstaff member of the Green River formation and in the North Horn formation. These two rock units contain impervious limestones or well-cemented sandstones that act as aquitards. The most likely aquifers are the Castlegate and other sandstones in the Price River formation and the Kenilworth and Aberdeen sandstones of the Blackhawk formation. The dip of these beds is to the north at 5 to 7 degrees and as the streams run over these formations their flows decrease which could indicate charging of the units with water. No springs were found in the Price River-Blackhawk formations, but some small flows were noted at the Blackhawk-Mancos contact in Fish Creek and the unnamed canyon to the east of Fish Creek.

From the experience of Kaiser's Sunnyside Mine and the neighboring Soldier Canyon Mine, only small amounts of water will be derived from underground operations. The most likely spot for encountering this water will be in the areas underlying Fish and Dugout Creeks.

Adjacent to the western edge of the property, in Soldier Creek, are numerous small cold water sulfur-smelling seeps and springs. All of the sulfur springs flow from the North Horn formation. Some of these exposures appear to be on fractures that run northwest-southeast. The flow on these springs is almost constant showing only a small decrease through the summer of 1976.

7.7.4 Water Quantity

Beginning in June 1976, a water quantity monitoring program was started. SDL-7.7.3 shows the locations of all springs on the Sage Point Property that were flowing in June 1976. The measurements were made with a V-notch weir, a 3" Parshall flume, and for very small flows a cup and watch. From the first months' measurements 14 locations were chosen as sites of representative flows and are listed on Table 7.7.4. These sites will be measured monthly for at least one year. Of the 14, permanent measuring devices have been installed at 4 locations as noted on Table 7.7.4.

TABLE 7.7.4 Water Flow Measurements
Sage Point - Dugout Canyon Project
Carbon County, Utah

Location Number (shown on Map SDL-		Flow in cfs 6-76	7-76	8-76	9-76
*22	Soldier Creek above Pine Creek	0.183	0.93	0.072	0.132
*23	Mouth of Pine	0.259	0.078	0.036	0.036
* 7	Mouth of Left Fork of Dugout Creek	0.262	0.080	0.025	0.036
** 5	Dugout Creek est.	0.546	0.216	0.057	0.070
21	Fish Creek	0.068	0.026	0.005	0.007
14	Rt. Fork Fish Creek Spring	0.0185	0.003	dry	dry
30	Spring (south of DH 9-1)	0.011	0.0095	0.008	0.007
31	Left Fork Fish Creek Spring	0.0032	0.001	dry	dry
39	Little Pine Creek Spring	0.0105	0.0047	0.002	0.002
37	Little Pine Creek	0.022	0.0042	dry	dry
42	Pine Creek Spring	0.029	0.020	0.012	0.008
4	Spring (southeast of 3-1)	0.052	0.033	0.013	0.010
44	Left Fork Dugout Creek Spring	0.033	0.020	0.013	0.011
8	Sulphur Spring	0.008	0.008	0.0075	0.0075

* Permanent flow measuring devices installed.

** Permanent flow measuring device will be installed under S.L.U.P. for which application was made August 27, 1976.

7.7.5 Water Quality

Water quality sampling began in late August 1976. SDL-7.7.3 shows those locations that were sampled by PGandE and by the U.S.G.S., Water Resources Division. The results of PGandE's sampling are shown in Appendix C. Data from Vaughn Hansen Associates 208 Water Quality Study on Central Utah contain measurements of the discharge and quality at the mouth of Soldier Creek near Wellington. These data are tabulated on the following page.

Plans are to continue to sample and analyze every 6 months for the next two years. Depending on the results of the present sampling program, the program will be expanded or reduced. Plans have also been made to turn three of the 1976-77 proposed drill holes into water monitoring wells after the holes have been completed. The proposed holes and zone perforation follow the Vaughn Hansen Water Quality Study.

WATER ANALYSIS AND FLOW MEASUREMENT OF SOLDIER CREEK AT WELLINGTON

Vaughn Hansen Associates:
208 Water Quality Study

	1/26/76 (9:45)	4/28/76 (16:15)
Flow cfs	2	0.4
Temp. air		18°C
Temp. water		13°C
ph		8.4
Dissolved oxygen		9.3
Sulfate as SO_4 (MG/L)	215	160
Hydroxide as OH (MG/L)		<0.01
T.D.S. (MD/L)	745	765
Spec. Cond. (μMHOS/CM)		2.70
Bicarbonate Alk. as HCO_3 (MG/L)		356.2
Total Alk. as $CaCO_3$ (MG/L)		292
Total Hardness as $CaCO_3$ (MG/L)		278
Arsenic Diss. (MG/L)	0.060	0.017
Calcium Diss. (MG/L)		36.0
Chloride Diss. (MG/L)		14.0
Fluoride Diss. (MG/L)	0.55	0.59
Iron Total (MG/L)	0.145	0.286
Lead Diss. (MG/L)	0.017	
Magnesium Diss. (MG/L)		45.1
Manganese Diss. (MG/L)	0.058	0.095
Potassium Diss. (MG/L)		2.03
Selenium Diss. (MG/L)		0.190
Sodium Diss. (MG/L)		156

GROUND WATER MONITORING WELLS

Hole Number	Est. Perf. Int.	Form. To Be Perf.	Est. Surface Elev.	Depth	Castlegate Sandstone Est. Top	Thick	Est. Base
5-1	1050-1200	Castle-gate ss.	7,135	5,900	1,045	190	1,235
11-3	2300-2500	Black-hawk form.	8,180	6,250	1,930	110	2,040
15-4	900-1100	Price River form.	8,530	7,220	1,310	170	1,480

7.7.6 Water Use

Soldier Creek is presently used by two ranchers (John Sampinos and John Mahleres) for irrigating hay and corn and supporting livestock just below the cliffs. During the summer all of the normal flow of the creek at the mouth of Soldier Canyon is diverted by canal into Anderson Reservoir in Section 36, T. 13 S., R. 11 E. from which it is used to irrigate the fields along Soldier Creek in Sections 1 and 12, T. 14 S., R. 11 E.

Water from Dugout Creek is also used for irrigation by Nick Marakis and John Marakis, Estate.

Pine Creek and all springs are used as water for livestock that spend the summer on the dip slope. Several small stock ponds have been constructed by the ranchers in gullies and below springs to collect flows.

References: U.S.G.S., Water Resources Division, Robbin Upton
Water Quality 208 Study, Vaughn Hansen Associates

7.8 Flora and Fauna

Flora: The flora have been divided and mapped according to the most dominant and largest plant of the community (see SDL-7.8).

Douglas Fir Community: This community occurs on northwest facing slopes in the steep canyons of the Book Cliffs and in Pine Canyon where the trees were once logged. Elevations range from 6,800 to 9,000 feet. Douglas fir (Pseudotsuga menziisii) is the major tree species with minor Quaking Aspen (Populus termuloides), Pinyon pine (Pinus edulis), Utah juniper (Juniperus osteosperma), and Ponderosa pine (Pinus ponderosa). Shrubs consist of Serviceberry (Amelanchier alnifolia), Mountain mahogany (Cercocarpus montanus), and Snowberry (Symphoricarpus oreophilis). Understory grasses consist of Great Basin wildrye (Elymus cinereus), Western wheatgrass (Agropyron smithii), Indian ricegrass (Oryzopsis humeniodes), Bluebunch wheatgrass (Agropyron smithii), and Bluegrass (Poa spp.).

Pinyon-Juniper Community: This community dominates the area below the escarpment of the Book Cliffs and is present on the southeast facing slopes of the canyons. It occurs in the area from elevation of 5,600 to 8,000 feet.

As the name implies, Pinyon pine (Pinus edulis)

and Utah juniper (Juniperus osteosperma) are the dominant species.

Shrubs in this community include Mountain mahogany (Cercocarpus montanus), Serviceberry (Amelanchier alnifolia), Big sagebrush (Artemisia tridentata), Mormon Tea and Rabbit brush.

Grasses include Bearded wheatgrass (Agropyron subsecundum), Bluebunch wheatgrass (Agropyron spicatum), Western wheatgrass (Agropyron smithii), Squirreltail (Sitanion hystrix), Big bluegrass (Poa ampla) and Indian ricegrass (Oryzopsis hymenoides).

Mixed Pinyon-Juniper and Douglas Fir Community: In the canyons along the cliffs this community was mapped due to the near 50-50 relationship of the two individual communities just discussed. Contents of the community are a mixture of all elements of the two.

Quaking Aspen Community: This unit occurs from 7,400 to 9,000 feet. Quaking Aspen (Populus tremuloides) dominates with understory grasses and small shrubs similar to the Douglas Fir community.

Ponderosa Pine Community: This community is present on the high benches of the cliffs. Ponderosa pine (Pinus ponderosa) is the major tree with mixing of Pinyon pine, Utah juniper, and Douglas fir. There is usually a thin growth of mountain shrubs and grasses similar to the Pinyon-Juniper Community.

High Shrub Community is predominantly found on the dip slope with elevations around 7,500 feet. The main constituents are Mountain mahogany (Cercocarpus montanus), Serviceberry (Amelanchier alnifolia) and Snowberry (Symphoricarpus oreophilis). There are minor amounts of sagebrush, cliffrose, rabbit brush, bitterbrush and Mormon Tea. Grass species common in this community include Great Basin wildrye (Elymus cinereus), Indian ricegrass (Oryzopsis hymenoides), Bluebunch wheatgrass (Agropyron spicatum), Western wheatgrass (Agropyron smithii), and Bluegrass (Poa spp.).

Sagebrush Community: This group is present on the dip slope (7,200 to 9,000 feet) and in the low benches below the cliffs. Big sagebrush (Artemisia tridentata) dominates with the common grasses that occur in the other communities. On top there are numerous species of mountain wildflower with Bluebonnet (Lupinus sericeus) and Scarlet Gilia (Gilia aggregata) being two of the most common. In the low benches, Big sagebrush is joined by rabbit brush, greaswood, shadscale, black sagebrush, salt brush and grasses to make up the community.

Deciduous Bottom Community: This community is found in the bottom of most canyons on the lease area. Cottonwood (Populus fremontii), Streambank willow

(Salix spp.), Rocky Mountain maple, and gamble oak make up the trees. Shrubs consist of Chokecherry (Prunus virginiana), cliffrose, wild raspberry, and some sagebrush. Common understory plants are stinging nettle (Urtica spp.), Horsetail (Equisetum spp.), Holly-Grape (Mahonia repens) and grasses.

Fauna: None of the streams or small stock ponds in the area contains any fish.

The major game animal is the mule deer (Odocoileus hemionus). They inhabit the dip slope in the summer in small numbers and move down below the cliffs when the winter snows cover their feed. Other mammals inhabiting the area are black bear, mountain lion, bobcat, coyote, snowshoe rabbit, cottontail rabbit, jack rabbit, marmot, weasel, tree and ground squirrel, field mouse, and prairie dog. In Dugout Creek there are beaver.

There are numerous songbirds, ruffed grouse, Steelers Jay, Harry woodpeckers, Yellow Bellied sap-suckers, Scott's Orioles, Mountain bluebirds, Swainson's hawks, Goshawks, Turkey vultures, Common nighthawks and hummingbirds.

Reptiles are represented by lizards and a few Gopher snakes.

The American Peregrine falcon is an occasional visitor to this area. There are no other threatened or endangered species known to migrate through or inhabit the general area.

7.9 Livestock SDL-7.9

Agriculture including cattle grazing and growing hay is the important activity of the project lands. There are three cattle allotments, namely: Soldier Canyon, Dugout Creek and Clark Valley.

Pine Canyon allotment is privately controlled and will be virtually unaffected once the exploration phase is over.

Soldier Canyon Allotment lies below the cliffs and development work around the portal and surface facilities will affect grazing. The total acreage is 23,120 and total AUM's is 1,080.3. A breakdown, by section, follows this page.

BREAKDOWN OF ACREAGE AND AUM's ON SAGE POINT-DUGOUT CANYON PROJECT

T. 13 S., R. 12 E.

Section	Acreage	AUM
19	492	11.6
20	336	7.5
21	334	3.8
22	60	2.1
30	236*	12.2
	400	13.6
29	480*	31.9
	160	5.7
28	640	33.4
27	597	18.7
31	195*	10.5
	438	23.3
32	640	26.1
33	640	47.6
34	548	17.7

T. 14 S., R. 12 E.

6	678	23.2
5	585	13.8
4	548	43.6
3	195	7.9
7	683	26.0
8	80	3.6
18	549	29.3
19	485	19.0

T. 14 S., R. 11 E.

13	120*	5.9
	520	29.4
24	40*	1.6
	600	33.5
25	640	35.1
26	368	18.4
35	425	26.8
36	640*	35.3

*Private Land

Clark Valley Allotment would be affected by the railroad spur. This allotment contains an acreage of 6,767 and AUM's of 532.7. It breaks down as follows:

T. 15 S., R. 12 E.

Section	Acreage	AUM
8	260	35.1
9	448	50.7
6	319	39.1
5	645	81.9
4	644	36.9
3	612	66.6
10	199	17.7

T. 14 S., R. 12 E.

31	309	25.5
32	640	37.8
33	640	22.0
34	640	34.3
35	175	8.6
30	326	29.6
29	640	30.2
19	75	7.4
18	195	9.3

7.10 Air Quality

Air quality over the Sage Point-Dugout Canyon leased area is excellent except during periods of high wind velocity (35 mph or more) when dust and pollen become wind-borne. Such contamination is greater over the land-use areas especially as Sunnyside Junction is approached. Prevailing winds are from the west-southwest and average velocity is below 35 mph. Peak wind velocity occurs during June and July.

Automobile and truck traffic is scarce and so contamination from these sources is minimal. Statements from Kaiser Steel's Application of July 21, 1975 for coal lease modification, "Based on available data, the concentrations and particulates are far below State and Federal air quality standards. Available data indicate 96% of particulates samples are natural dust particles. The remaining 4% consist of fly ash and soot. Data from Huntington Canyon air monitoring study indicate sulfur dioxide concentrations in the area are below the detectable level of .005 ppm."

A coal mining operation at Sage Point-Dugout Canyon will affect the air quality of the area. There are three periods of activity. First, during pre-permit period of 2 to 4 years activity is of an exploration

form. Mapping, surveying, and surface rotary and core drilling of the coal beds takes place. During this period there will be some road construction, site excavation and traveling by truck and car to conduct the work. This work will be confined to the area of the coal deposits. The reduction in air quality will be minimal. The second period is that of construction estimated to last five years from the granting of mining permits and rights-of-way. Construction and excavation of roads and rail spur; surface sites at the two mine portals and the central yard for coal washery; unit-train loading facilities as well as buildings, refuse dams, communications facilities and pipelines will generate airborne dust and small amounts of hydrocarbon contamination on an intermittent basis (during the 40 hours per week of construction activity).

The third period of activity will last 35 years until the exhaustion of coal reserves or by closure of mining operations for some other reason. This is the operation during which the combined daily production (230 days per year) averages 13,000 tons (washed coal). Some deterioration of air quality is expected from these four sources: the mines, central yard activity, mobile equipment movement and the natural pollution due to wind activity.

Mine pollution consists of exhaust fan discharge, machine shop and internal combustion discharge and natural wind-borne contamination. In the course of underground mining, dusts are generated by continuous mining and longwall and other coal handling equipment. Most dusts are wetted and thereby allayed. Against this is the use of rock dust (98% or more non-silica dust) in continuous miner sections applied to newly opened workings to form non-combustible inert coal-dust mixtures. Most of these mixtures settle in the returns. A small portion consisting of micron or sub-micron particles is discharged by fans to the atmosphere. Prevailing breezes and winds disperse these discharges to the uninhabited higher elevations of the project.

Central yard air pollution can be expected from the coal washery. Coal dusts are generated by coal breakers. As a part of coal washing the first action is to wet the incoming raw coal. Dust collectors are used throughout the plant to capture most dust. There is also contamination by vacuum pump discharge. Both of these contaminants are minor. No toxic substances are used in the coal washing process. The only additive used in the washing process is magnetite which is inert.

Activity within the rail spur consists weekly of 7 trains of 85 cars of 100-ton capacity or 10 trains of 85 cars of 70-ton capacity. Trains would operate 7

days per week. Turn-around time to California is 4 days. Expected activity is less than 2 trains per day and less than 4 hours residence per train. This activity is intermittent and less than 12% total time. Possibly the major contamination is due to natural dusts and pollens becoming temporarily wind-borne. There will be contamination from the diesel-powered motive equipment but this will be no more than what occurs whenever a train passes. Reference: Draft EIS, Development of Coal Resources in the Eastern Powder River Basin of Wyoming, vol. III, pp. II-87 and 88.

Deterioration of air quality throughout the project from anticipated exploration, construction and operation should be minor and resulting air quality should be well within Federal and State standards.

7.11 Noise

There are two levels of noise during the life of Sage Point-Dugout Canyon. First is the construction phase expected to last five years. Excavations for yards, roads, railroad, surface conveyors and the construction of facilities at the mine and at the central yard will contribute noise. The area is so vast that noise can be expected to dissipate rapidly. Second is the operating phase that may extend 30 to 35 years. Surface-placed ventilation fans, shop activity, road equipment and heavy haulage trucks all create high noise levels. The coal washing plant with its coal breakers, vibrating screens, coal transfer chutes, compressors and vacuum pumps all produce excessive noise that can be reduced. Sound attenuators and silencers will be used. Noise control in the future will conform with the rules and regulations covering noise abatement of both State and Federal agencies.

7.12 Archaeology

See Appendix D entitled, "The Archaeological Potential of the Sage Point Coal Mine, Surface Facilities and Railroad Spur, Central Utah," Dale L. Berge, September 1976.

7.13 Ecological Interrelationships

The proposed area of the Sage Point-Dugout Canyon Project covers 13,000 acres, more or less, between elevations 5,400 to 8,000 feet. Eight vegetative communities are found. Five soil associations are recognized. As underground methods will be used to extract coal, there will be no disturbances of the 10,000 acres of leases except for the minor ones associated with exploration and development drilling. There will, however, be disturbances on the land-use area for the surface facilities of mine and central yard plants and the rail spur. These disturbances will be due to excavations of soils, sub-soils, and bedrock. Soil is shallow and forage production is limited.

Wildlife species, while considerable in variety, are limited in number especially the mammalian species. Birds of all kinds are well dispersed and of limited numbers. Reptiles and lizards are not common.

Since mining activity which constitutes 65% of human activity takes place underground, disturbance to soil, flora and fauna will be minimal and limited to a period of 40 years.

8.0 Socio-Economic Considerations

8.1 Population, Employment, Local Economy

Coal demand directly affects the population, employment and the local economy of Carbon County. The rising coal demand of the mid-1970's has resulted in a population shift from rural to urban areas with 57% of the population now residing in urban areas. (Urban areas are defined as having a population of 2,500 or more.)

The population of Carbon County was 18,000 in 1973 and is now estimated at 21,000 (May 1976). The population of Price is 7,500. The closest town is Wellington, about 16 miles southwest of Sage Point with a population of 1,600.

Government, the trade industries and mining are the leading employers within the county with 1,443; 1,335; and 1,338 workers, respectively. Mining is slated to increase most rapidly and to become the employer of the greatest number of workers. Payroll wages for miners during 1974 were 50% greater than for government payrolls. This margin should increase. As recently as 1973 Carbon County was a labor-distressed area. Rapid expansion in coal mining has alleviated this condition while giving promise of still further economic benefits.

8.2 Social Services and Project Employees

The project is expected to employ between 850 and 950 persons. These employees and their families are expected to reside in communities already established in Carbon County. Wellington is the closest; Price and East Carbon cities are 6 to 8 miles farther away. Depending on circumstances in effect during the first six years of mine planning, transportation to the mine by means of busses, car pools or separate cars may all be viable methods.

Housing is not now available for as many as 900 employees. Once again, depending on circumstances then in effect, housing will be an important factor in project planning. If the supply of labor is tight, housing will be more important than if labor is in adequate or over-supply. Markets for coal of Carbon County will have to expand greatly if housing is to be the critical factor that appeared to be the case during 1975. The community facilities of all utilities, sewage, schools, recreation, police and fire protection, of Carbon County are expanding and will continue to expand in an orderly fashion. The state legislature is considering imposing a severance tax on coal, such tax to contribute to and support community development. Applicant plans to cooperate in community planning.

NGC intends to participate, indirectly or directly, in providing sufficient and adequate housing. Ways of doing this vary. A direct, hands-off policy between NGC as landlord and its employees should be avoided. There are builders who specialize in providing housing projects. These projects should include facilities for singles and homes for families. There are companies, such as Boise Cascade and York, that offer mobile homes designed and erected as modular components that can be converted readily from mobile to permanent homes. One practice is to place a mobile home on a small lot and when the demand for homes increases, combine two mobile homes to make one permanent home. Some government funding is available for housing and ancillaries.

The Table on the following page is a reasonable estimate of housing needs. The assumption is that it will require 950 employees to mine 3 million tons per year. The Table is based on furnishing housing for 75 percent of employees; the other 25 percent would find housing among facilities otherwise available. Maximum employment of single persons will take place during the fourth and fifth years. At the end of the eighth year, when capacity is reached, there would be 105 singles facilities, 456 facilities termed "doubles" (mobile home type), and 151 homes of 5 to 7 rooms each.

TABLE OF HOUSING

Year	Mobile Homes Singles	Mobile Homes Doubles	5-7 Room Homes	Total Units
1				
2				
3	94	63	15	172
4	131	114	30	275
Cum. total	225	177	45	447
5		60	8	68
Cum. total	225	237	53	515
6	(30)	75	8	53
Cum. total	195	312	61	568
7	(50)	75	45	70
Cum. total	145	387	106	638
8	(40)	70	45	75
Cum. total	105	457	151	713

A useful indication of cost appeared in Coal News (#4333, September 10, 1976). A $1.4 million comparable project equates to $12,000 per unit. Applying this cost to Sage Point-Dugout Canyon Project produces $8.6 million.

8.3 Transportation

Carbon County is served by the Denver and Rio Grande Railroad which connects with the Western Pacific and Southern Pacific serving Nevada and California to the West, and in Denver with rail service to the East. A rail spur of 14 miles is required to serve the Sage Point-Dugout Canyon Mine. U. S. Highways 6 and 50 connect Price and other Carbon County towns with Salt Lake City to the north and with towns to the south, east and west of Price. Numerous paved roads crisscross the county providing good traveling conditions. Sage Point is accessible by 10 miles of oiled road plus 10 miles of unimproved dirt road from Highways 6 and 50 at a point 2 miles east of Wellington.

9.0 The Impacts

9.1 Atmospheric Resources

Proposed action will have negligible impact on climate.

The impacts on air quality by reason of the proposed action appear to be minor and any deterioration will not lower air quality to such a degree that Federal air quality standards are exceeded.

Some increase in noise is anticipated but noises will be concentrated in the immediate areas of activity. Noise dispersion will be rapid and hence should have little impact.

9.2 Land Resources

The coal deposits will be mined by underground methods and with time some subsidence will be noted. Subsidence may cause some springs to dry and, if mining is too close and recovery too high, there may be subsidence and sloughing of high points. There are no landslide hazards.

The proposed action will have no effect on soils other than the local disturbance of excavations. Soil erosion will not be affected.

The granting of permits and subsequent implementation of the project will result in mining of coal to be used for the generation of electrical power and the peaceful and beneficial use of America's most abundant energy source.

Water quality will not be affected as there will be a closed hydraulic system with no discharges to natural drainage.

9.3 Living Components

There will be some impacts on the flora of the project area by reason of excavations for roads, mine portal sites and central yard, and rail spur construction.

Livestock grazing will suffer only minor impacts. Any reduction in animal units will be slight. The total of animal units is more likely to be affected by drought or other natural phenomena.

The greatest impacts on wildlife will be the movement of mobile vehicles and trains over the right-of-way areas. The increases expected in the population of Carbon County are apt to have greater impact on wildlife than the employees and their families associated with the Sage Point-Dugout Canyon Project.

10.0 Scope of the Project

The operation of the Sage Point-Dugout Canyon Project consists of two parts. First is the design and construction of facilities to develop and produce coal, and the second is the subsequent mining, handling, preparation and shipment of coal to markets. Coordination of both parts is the function of the PGandE management organization.

Details of the Mining Plan are covered in a Mining Plan to United States Geological Survey filed coincident with this Land-Use Plan to the Bureau of Land Management.

Descriptions of land uses are contained in three Applications for Rights-of-Way and a Special Land-Use Permit submitted coincident with this Land-Use Plan to the Bureau of Land Managmment.

Ground breaking at Sage Point-Dugout Canyon will depend on completion and acceptance of the Central Utah Regional EIS, approval of the Mining Plan, and granting of permits and rights-of-way.

10.1 The Mining Plan

10.1.1 Exploration

Natural Gas Corporation of California (NGC), a wholly owned subsidiary of PGandE, conducted an exploration program during the period of July to December 1975 inclusive. Eleven combination rotary-core holes plus one re-drill hole penetrated from the surface to below the Gilson seam. The leases and the exploratory drill holes are shown on SDL-6.0, Ownership Map of Sage Point-Dugout Canyon Project.

Each drill hole was logged, lithologically and geophysically, and the coal cores were analyzed by Commercial Testing and Engineering Company of Denver, Colorado. Mineable coal cores were composited and washability tests conducted. Logs of drill holes and analyses of coal cores sampled were furnished to the U. S. Geological Survey as they became available.

Drill holes were spaced at one-mile centers. Correlation of drill results was aided by prominent stratigraphic markers. Splits, especially in the Rock Canyon-Fish Creek system, complicated correlation.

Using computer and conventional methods, the in-place reserve of mineable coal was established

as 142,000,000 tons. NGC developed the list of drawings that appears on the following page to evaluate the coal property.

The Dugout Canyon property was drilled by Kennecott Coal Company during the 1960's. Drill data are incomplete. The Sunnyside seam shows no mineable coal. KCC reports an in-place reserve of 80,000,000 tons in the Rock Canyon (8 feet) and Gilson (12 feet) seams. The total reserve of 222,000,000 tons which at an annual production of 3,000,000 tons will last PGandE and KCC for 37 years.

NGC has commenced drilling hole 17-1 and plans to also drill hole 9-2 before winter forces a stop to the drilling. In November 1976, NGC plans to expose the coal seams in Fish Creek, Canyon X and Dugout Canyon. Samples will be obtained at these sites by horizontal auger.

MAPS USED IN EVALUATING THE SAGE POINT COAL PROPERTY

CARBON COUNTY, UTAH

SDL-10.0(a)	Topographic Map
SDL-10.0(b)	Planimetric Map
SDL-10.0(c)	Sunnyside Coal Thickness
SDL-10.0(d)	Rock Canyon Coal Thickness
SDL-10.0(e)	Gilson Coal Thickness
SDL-10.0(f)	Combined Coal Thickness
SDL-10.0(g)	Sunnyside Coal Seam Structural Map
SDL-10.0(h)	Rock Canyon Coal Seam Structural Map
SDL-10.0(i)	Gilson Coal Seam Structural Map
SDL-10.0(j)	Sunnyside Seam Overburden
SDL-10.0(k)	Rock Canyon Seam Overburden
SDL-10.0(l)	Gilson Seam Overburden
SDL-10.0(m)	Seam Parting Between Sunnyside and Rock Canyon
SDL-10.0(n)	Seam Parting Between Rock Canyon and Gilson
SDL-10.0(o)	Geologic Cross Section of Mineable Seams

10.1.2 Design, Engineering, Construction

Completion of the final report of the Central Utah Regional EIS is scheduled for June 30, 1978. Permits to mine, approvals of land-use plans, grants or rights-of-way and compliance with state and local laws and regulations point to ground breaking no earlier than January 1, 1979. The time prior to this date will be used for planning, design and engineering of the project and completion of the second drilling program. Negotiations for fee and state lands required by the project will be initiated.

Preliminary design and engineering for the two mines, based on 1975 exploration, have progressed during 1976. Over forty drawings have been prepared to cover the scope of the project. Each is mentioned individually in this report and copies are enclosed. Map SDL-6.5 shows the locations of the two mines, the surface facilities and alternate transportation and utility corridors as well as the coal properties. The concept starts with an underground coal mine and carries through mining, coal preparation, shipment of clean coal by unit train to PGandE in California and shipment of coal that may or may not be washed to KCC at its Utah and Nevada operations.

The project is designed to maximize recovery and efficiency and will be engineered and operated to maximize safety, dependability and long-term performance.

The design of the two mines is covered under SDL-10.1(a),(b)and(c), General Arrangements and Cross Sections, Fish Creek Mine, and SDL-10.1(d)and(e), General Arrangements and Cross Sections, Dugout Canyon Mine. The entry facility to the Fish Creek Mine is shown on SDL-10.1(f), General Arrangement of the Tunnel Construction.

Preliminary railroad spur studies by Towill, Inc. are covered in Appendix A. The routes proposed by Towill are shown on SDL-6.5. The central yard, a preliminary conceptual arrangement, is shown on SDL-10.4. Refuse storage study by Dames and Moore is covered in Appendix C. Possible slurry pond sites are shown on SDL-6.5. Electrical service requirement is shown on SDL-10.7. Alternative proposals are submitted principally because basic data are inadequate for precise selections. In finalizing railroad selection after new aerial topography is available, input from D&RGW will be included. Dames and Moore and Towill, Inc. have considered alternatives.

NGC, in each case, has nominated its preference.

NGC intends to have a limited feasibility study conducted by a qualified firm. This study will take place after completion of the 1976-77 program. The purpose of the study is to evaluate the Mining Plan and cost estimates.

While the design concept is well advanced, the engineering by which the concept is translated to construction has not yet started. Engineering should commence after completion of the feasibility study. If ground breaking is to start by January 1, 1979, many purchase orders should be issued in advance of that date. Items such as continuous miners face two-year delivery dates. The first continuous miners at Fish Creek could be needed during the third year.

The coal washing plant can be deferred until as late as the sixth year of the program as shown on SDL-11.0. Coal produced during development, if sold as produced, would reduce capital drain. Coal could be trucked to a rail loading ramp. Coal washing could start when shipments to California begin. KCC will determine whether washing will be specified for the coal it takes, and California Portland Cement Company may elect

to have some of the production of its Soldier Canyon Mine cleaned in the proposed washery.

Construction is estimated to begin during the third year of the project. Schedules should aim toward completion of this phase during the eighth year and should coincide with schedules of power plant needs in California.

10.1.3 The Mining Operation SDL-10.1(g) and (h)

10.1.3.1 General Description

The Sage Point-Dugout Canyon Project is the combination of two mines, the Fish Creek Mine and the Dugout Canyon Mine. The mining methods planned are similar for both mines. For this reason the Mining Plan is combined in a single report covering both mines. The only difference is that the Sunnyside seam may not be mineable in the Dugout Canyon Mine.

10.1.3.2 Entries From Surface

In the Fish Creek Mine is projected a rock tunnel with invert "U"-shaped cross section (SDL-10.1(f) and SDL-10.1.3(d)) starting at or below the Gilson seam and driven on a 2% plus grade intersecting all three seams. The total distance of tunnel will be 1,800 feet, at which point the Sunnyside seam in intersected. The tunnel will carry main belt on the top and haulage track on the bottom, divided by steel divider in middle to protect the track from coal dust coming from the main belt.

This tunnel is going to be the single entry of coal, man and supply haulage for

SDL-10.1(g) SCHEDULE OF PRODUCTION (FISH CREEK MINE)

6 Years Projection (Raw Coal)

Sunnyside Seam

Year	- 1 -			- 2 -			- 3 -			- 4 -			- 5 -			- 6 -		
Month	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons
Jan.					1	8,000		3	42,400		5	63,000	1	6	105,400	2	6	140,400
Feb.					1	8,000		3	42,400		5	72,000	1	6	108,900	2	6	140,400
March					1	8,000		3	44,000		5	76,000	1	6	112,400	3	6	154,400
April		Tunnel			1	11,400		3	45,600		5	80,000	1	6	114,400	3	6	157,900
May					1	11,400		4	49,600		5	80,000	1	6	115,900	3	6	161,400
June					1	15,200		4	53,200		5	80,000	1	6	115,900	3	6	164,900
July					2	19,000		4	57,000		5	80,000	1	6	115,900	3	6	164,900
Aug.		1	3,000		2	23,200		4	64,000		6	83,800	2	6	129,900	3	6	164,900
Sept.		1	3,500		2	27,200		4	64,000		6	87,600	2	6	133,400	3	6	164,900
Oct.		1	3,300		2	30,400		4	64,000		6	90,000	2	6	136,900	3	6	164,900
Nov.		1	3,800		2	34,400		4	64,000		6	91,200	2	6	140,400	3	6	164,900
Dec.		1	3,800		2	38,400		4	64,000		6	91,400	2	6	140,400	3	6	164,900
Total	-	①	17,800		②	230,600	-	④+①	654,000	-	⑥	980,000	②	⑥	1,469,800	③	⑥	1,908,800

ROCK CANYON SEAM

Month	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons
Jan					2	8,000		2	30,700		2	30,700		2	30,700		2	30,700
Feb.					2	11,400		2	30,700		2	30,700		2	30,700		2	30,700
March					2	11,400		2	30,700		2	30,700		2	30,700		2	30,700
April					2	13,200		2	30,700		2	30,700		2	30,700		2	30,700
May					2	19,000		2	30,700		2	30,700		2	30,700		2	30,700
June		1	3,000		2	20,900		2	30,700		2	30,700		2	30,700		2	30,700
July		1	3,800		2	24,000		2	30,700		2	30,700		2	30,700		2	30,700
Aug.		1	5,500		2	30,000		2	30,700		2	30,700		2	30,700		2	30,700
Sept.		1	12,300		2	30,000		2	30,700		2	30,700		2	30,700		2	30,700
Oct.		1	15,800		2	30,000		2	30,700		2	30,700		2	30,700		2	30,700
Nov.		1	15,800		2	30,000		2	30,700		2	30,700		2	30,700		2	30,700
Dec,		1	15,800		2	30,000		2	30,700		2	30,700		2	30,700		2	30,700
Total	-	①	72,000	-	2	257,000	-	2+1*	368,000	-	2	368,000	-	2	368,000	-	2	368,000
Total Mine		②	89,800		④	437,600		⑥+2*	1,023,000		⑧	1,348,000	②	⑧	1,337,000	-	⑧	2,276,300

L.W.-Longwall mining *Spare Unit Equipment= 8 continuous miner operating + ③ C.M. spare
C.M.-Continuous mining = 3 longwalls operating

SDL-10.1(h) SCHEDULE OF PRODUCTION (DUGOUT CANYON MINE)

6 Years Projection (Raw Coal)

Rock Canyon Seam

Year	- 1 -			- 2 -			- 3 -			- 4 -			- 5 -			- 6 -		
Month	L.W.[1]	C.M.[2]	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons
Jan					1	8,000		1	14,000		2	17,800	1	3	59,000	1	3	69,000
Feb.					1	8,000		1	14,000		2	28,000	1	3	62,000	1	3	69,000
March		Surface			1	8,000		1	14,000		3	31,000	1	3	66,000	1	3	69,000
April		facility			1	11,400		1	14,000		3	31,000	1	3	68,000	1	3	69,000
May					1	11,400		1	14,000		3	44,000	1	3	69,000	1	3	69,000
June		1	3,000		1	14,000		1	14,000		3	45,000	1	3	69,000	1	3	69,000
July		1	3,500		1	14,000		1	14,000		3	45,000	1	3	69,000	1	3	69,000
Aug.		1	3,500		1	14,000		1	14,000		3	45,000	1	3	69,000	1	3	69,000
Sept.		1	3,800		1	14,000		1	14,000		3	45,000	1	3	69,000	1	3	69,000
Oct.		1	3,800		1	14,000		1	14,000		3	45,000	1	3	69,000	1	3	69,000
Nov.		1	3,800		1	14,000		2	17,000		3	45,000	1	3	69,000	1	3	69,000
Dec.		1	3,800		1	14,000		2	17,000		3	45,000	1	3	69,000	1	3	69,000
Total	-	①	25,200	-	①	144,800	-	②	174,000	-	③	466,800	①	③	807,000	①	③	828,000

Gilson Seam

Month	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons	L.W.	C.M.	Tons
Jan																	1	3,800
Feb.																	1	3,800
March													Surface				1	6,000
April													facility				1	6,000
May																	1	6,000
June																	1	8,000
July																	1	8,000
Aug.																	1	8,000
Sept.														1	3,000		1	12,000
Oct.														1	3,000		1	12,000
Nov.														1	3,000		1	14,000
Dec.														1			1	14,000
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	①	9,000	-	①	89,600
Total Mine	-	①	25,000	-	①	144,800	-	②	174,000	-	③	466,800	①	④	816,000	1	④	917,600
Total- Sage Point - Dugout Canyon Mine	-	③	114,300		⑤	582,400		⑧ + ② SP	1,197,000		⑪	1,814,800	③	⑫	2,153,000	4	⑫	3,193,900

② C.M.=Continous mining. ① L.W.=Longwall mining 1 Total unit 14 C.M. + 3 L.W.

DRAWINGS USED IN SCOPE OF MINING OPERATION

SDL-10.1.3(a)	Sunnyside coal seam mining projection
SDL-10.1.3(b)	Rock Canyon coal seam mining projection
SDL-10.1.3(c)	Gilson coal seam mining projection
SDL-10.1.3(d)	Temporary ventilation of Tunnel and Rock Canyon seam
SDL-10.1.3(e)	Rock Canyon main headings development and ventilation
SDL-10.1.3(f)	Sunnyside seam main headings development and ventilation
SDL-10.1.3(g)	Sunnyside seam final form of main headings
SDL-10.1.3(h)	Track and belt transition on Sunnyside seam
SDL-10.1.3(i)	General plan of longwall system - advancing
SDL-10.1.3(j)	General plan of longwall system - retreating
SDL-10.1.3(k)	Room and pillar system - pillar splits
SDL-10.1.3(l)	Proposed roof control for main headings and panels
SDL-10.1.3(m)	Proposed roof control on room entry
SDL-10.1.3(n)	Mining plan book and ventilation on six-entry system
SDL-10.1.3(o)	Mining plan book and ventilation on longwall panels
SDL-10.1.3(p)	Sequence of face cut

both the Rock Canyon and Sunnyside seams at the Fish Creek Mine.

In addition to this tunnel there will be three more entries driven from inside the Rock Canyon seam to outside. In one of these entries will be constructed the main fan and the two others will be used for intake air entries. Other mine construction will take place inside the Fish Creek Mine by drilling two air shafts each 12 feet in diameter. These shafts will connect the Rock Canyon with the Sunnyside seam. Location of these two air shafts is shown on SDL-10.1.3(g).

The outside entries on the Gilson seam at the Fish Creek Mine as well as the Rock Canyon and Gilson seams at the Dugout Canyon Mine will start directly on coal outcrops of the respective seams. There will be a minimum of four entries opening from surface per seam (SDL-10.1.3(a),(b)and(c).

Rock from surface and underground excavation will be stored to form stable and near-flat surfaces for mine yards. Work from underground excavation that will produce waste rock are brushing top or bottom, providing overpasses or underpasses, shafts between the

seams and, where seams are void or nearly void of coal, the drives connecting coal workings.

10.1.3.3 Underground Mine Development

The proposed mining methods planned for Sage Point-Dugout Canyon Project are a combination of continuous miners for main, butt and panel development and longwall methods for panel extraction.

Except under limited conditions, coal will be mined to a minimum thickness of 4.5 feet.

SDL-10.1.3(k) shows room and pillar system and pillar splits. This method will be used where the coal depths are less than 2,000 feet. By pillar splits, coal can be extracted in a range of 60 to 80%. In a few areas where it will be necessary to protect a surface pipeline and cliffs, the extraction will be less than 50%.

The main and sub-main headings which require longer life will be driven 16 to 17 feet wide at 90-foot centers. Cross-cuts are also driven 16 to 17 feet wide at 120-foot centers. SDL-10.1.3(e),(f)and(g) show the

size and shape of entries and pillars for main headings. Panels of room and pillar system are an average of 2,000 feet long and requiring shorter life will be driven 16 to 17 feet wide at 60-foot centers. Cross-cuts will be driven 16 to 17 feet wide at 80-foot centers. Rooms are planned to be driven 20 feet wide at 60x60-foot centers.

SDL-10.1.3(k) shows the shape and size of panels, rooms and methods of room splits.

In all room and pillar systems, coal is mined by continuous mining machine then hauled by shuttle cars from the continuous miner to a breaker-feeder that reduces lumps to easily handled size and is transported to surface over one or more conveyor belts.

In the room and pillar systems there will be two methods of mining. In the case where panels will be advanced along the seam pitch, the rooms will be mined on both sides of the panel and along the strike (SDL-10.1.3(a)). If the panels are advanced along seam strike, the rooms will be mined only on pitch side of the panels.

The longwall panels which will be

developed by continuous miner are 2,500 to 6,000 feet long. A three-entry system, with rooms 16 to 17 feet wide at 60-foot centers and cross-cuts 16 to 17 feet wide at 80-foot centers, is proposed.

Based on the very deep cover of coal seams in this area, up to 3,000 feet, the longwall system is the only safe and efficient method of mining.

The mining projection (SDL-10.1.3(a), (b) and (c)) shows longwall extraction in areas with up to 2,500 feet cover, but our goal will be to mine deeper than 2,500 feet.

Longwall mining is a continuous method. The block or panel of coal to be mined, usually 300 to 600 feet wide by 2,500 to 6,000 feet long, is first developed by driving entries on all four sides of the block. Preliminary planning specifies three entries for longwall panels, but in the future, if the conditions of mining require less, we may go to two or even single-entry panels.

Longwall mining takes place by shearing the full coal seam along the short face in 27-inch cuts. As a cut proceeds from one

longwall face to another, the chocks are advanced to provide full roof support. As the chocks are advanced the unsupported roof caves in.

The seam thicknesses planned for longwall are 4.5 to 10.0 feet.

At Sage Point-Dugout Canyon Project the longwall system is planned to be mined on the retreat. However, in some areas there will be an alternating system, advancing and retreating. SDL-10.1.3(i)and(j) show this longwall system. By using the alternating system, time is saved in transporting longwall equipment at the completion of each panel.

More than 90% of longwall panels are planned so that their faces are along the pitch. Within the northwest part of the property the face will be along the strike. In this last case the extraction of the panel will be from lower to higher elevation to keep the water flow away from the face.

10.1.3.4 Ventilation

The Fish Creek Mine ventilation covers 3 stages. Stage 1 provides ventilation for main rock tunnel to the Sunnyside workings

and connections of Rock Canyon with its outcrop. A surface installed fan of 100 hp operating up to 4" water gauge will exhaust through a 36" diameter pipe a total of 150,000 cfm air. SDL-10.1.3(d) and(e) illustrate this temporary ventilation.

When the Rock Canyon seam outcrop is reached and rock excavation completed, the second stage is placed on standby. A 600 hp fan operating up to 10" water gauge and exhausting 400,000 cfm will thereafter ventilate the Rock Canyon and Sunnyside seams by means of the two interior shafts from the Rock Canyon to Sunnyside seam. The fan will be equipped with variable pitch blades and will be designed to operate at 7,000 feet elevation. The fan will be direct-driven.

Rock Canyon development in the Fish Creek Mine consists of driving westerly from the main rock tunnel to a point from where the main west will be driven northward.

From the strike-driven entries connections to the outcrop will be advanced to the left fork of Fish Creek. The third stage of ventilation will then begin. A duplicate (fan #3) of the large fan set on the surface

at Rock Canyon seam outcrop will be installed. Thenceforth, fan #3 will ventilate the Rock Canyon seam while the #2 fan will ventilate the Sunnyside seam workings.

In Dugout Canyon Mine the ventilation will be less complicated. The ventilation for each seam will be separated. Fan #4 will be installed on surface on Rock Canyon outcrop and fan #5 will be installed at Gilson outcrop. The fans #4 and #5 will have similar characteristics to fans #2 and #3.

By keeping ventilation separated for each seam of each mine, safety is improved and fire hazard is reduced.

The seams are gassy and careful attention to ventilation design is stressed.

The Sunnyside seam is more difficult to ventilate because this seam has no mineable coal outcrop. To give this seam the necessary air we designed the main headings somewhat differently from those of the other seams.

Main development of Sunnyside seam consists of 6 entries driven on the right

side of a 200-foot pillar and 5 entries driven on the left side. Intake air is along the 3 right entries. Neutral air (belt, track) is along the middle 3 entries and the return is along the 5 left entries. Escapeways through the pillar at 500-foot intervals are planned. Automatic doors, concrete and/or metal stoppings, cross-overs and other devices will be installed as required. SDL-10.1.3(f) and(g) illustrate the temporary and final ventilation of Sunnyside seam main headings.

In the Rock Canyon and Gilson seams the main headings are driven with 2 entries intake on the right side, 2 neutral (belt, track) in the middle and 2 or 3 returns on the left side.

Face ventilation on continuous mining is designed to deliver separate air splits for each working face, delivering not less than 25,000 cfm to the first cross-cut and not less than 9,000 cfm to the last cross-cut. Air will be directed to the face by brattice. Not less than 6,000 cfm will be delivered to working face; other

idle faces not less than 3,000 cfm. Neutral (belt, track) air will be shunted to the return by means of regulators.

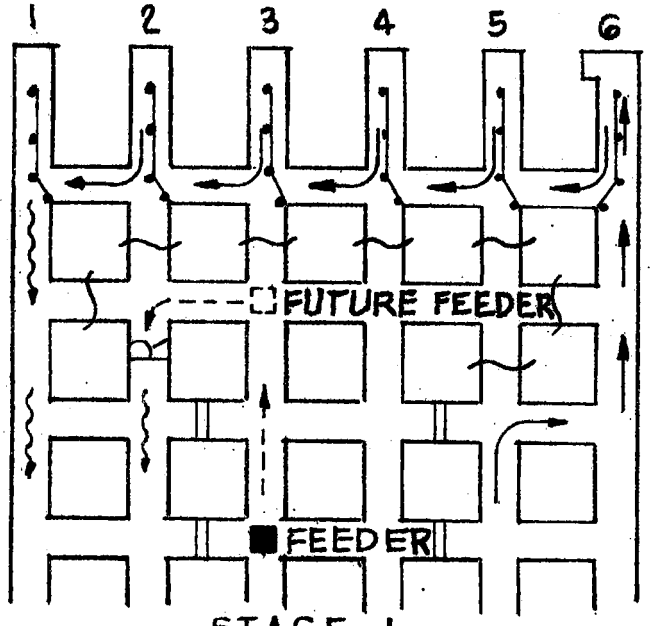
To illustrate the ventilation at the face and to explain changes during the sequence of the face cuts, SDL-10.1.3(n), (o) and (p) are included.

In longwall ventilation, the quantity of air will be 25,000 cfm at headgate and not less than 10,000 cfm at tailgate. Some air bleeding through the gobs will be directed through bleeders on return airways.

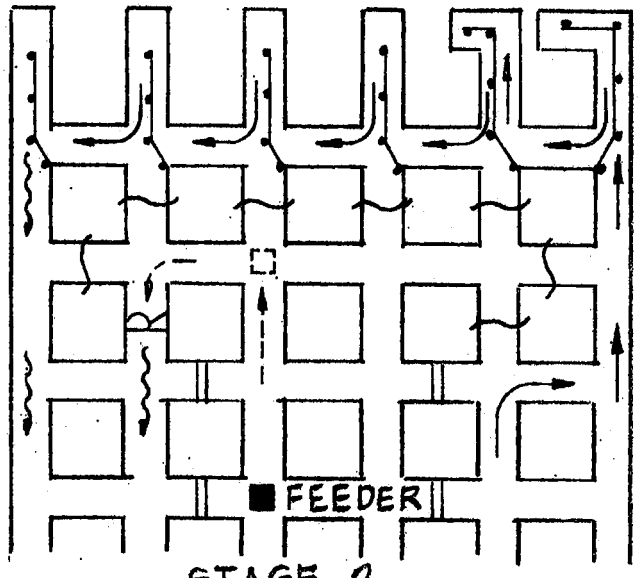
SDL-10.1.3(i) and (j) show the air direction of the longwall system.

10.1.3.5 Equipment

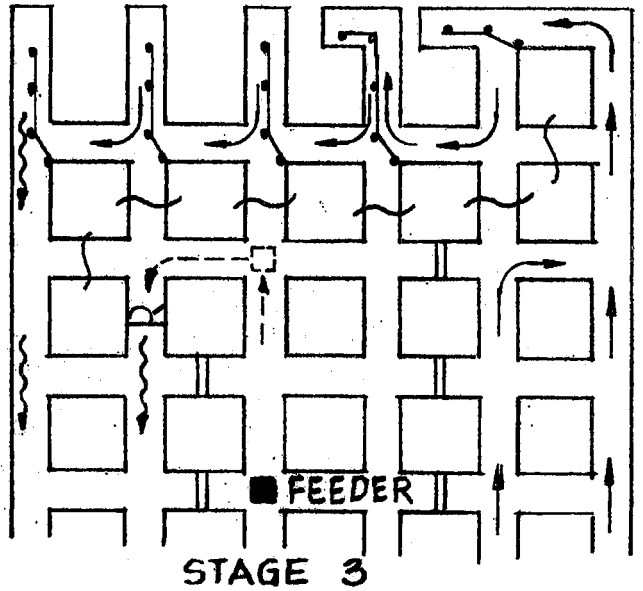
The proposed Sage Point Mine is to be equipped to maximize safety, productivity, quality of product and cost. Included, but not exclusively, in the list of equipment are the items on the following page.



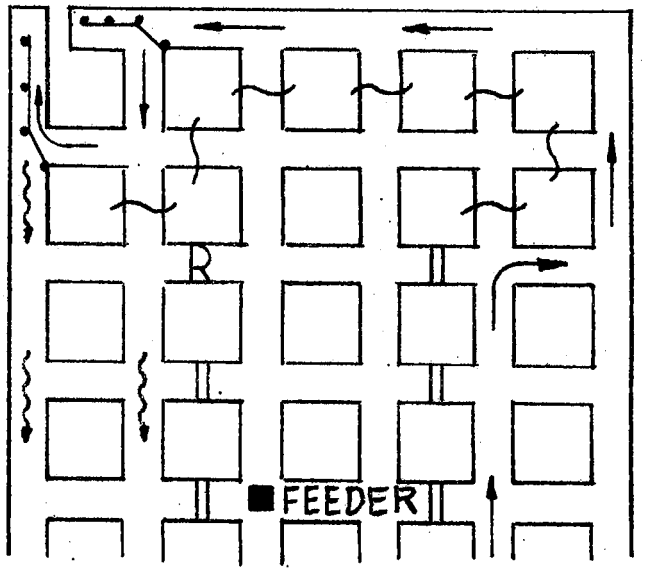
STAGE 1



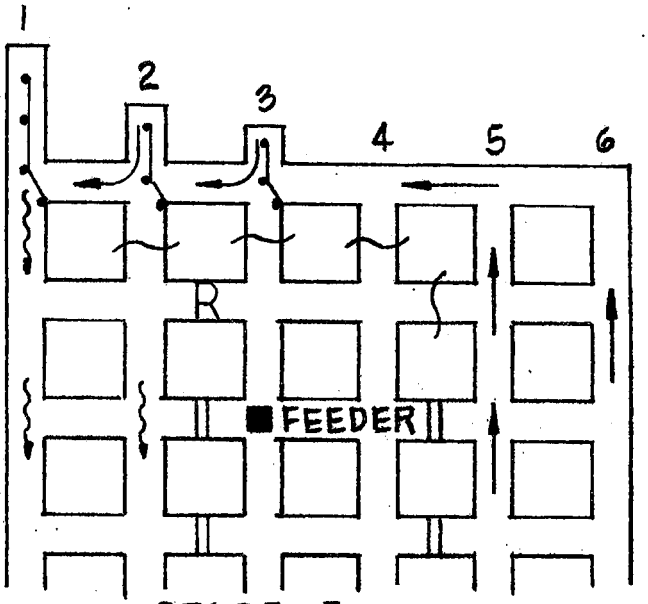
STAGE 2



STAGE 3



STAGE 4

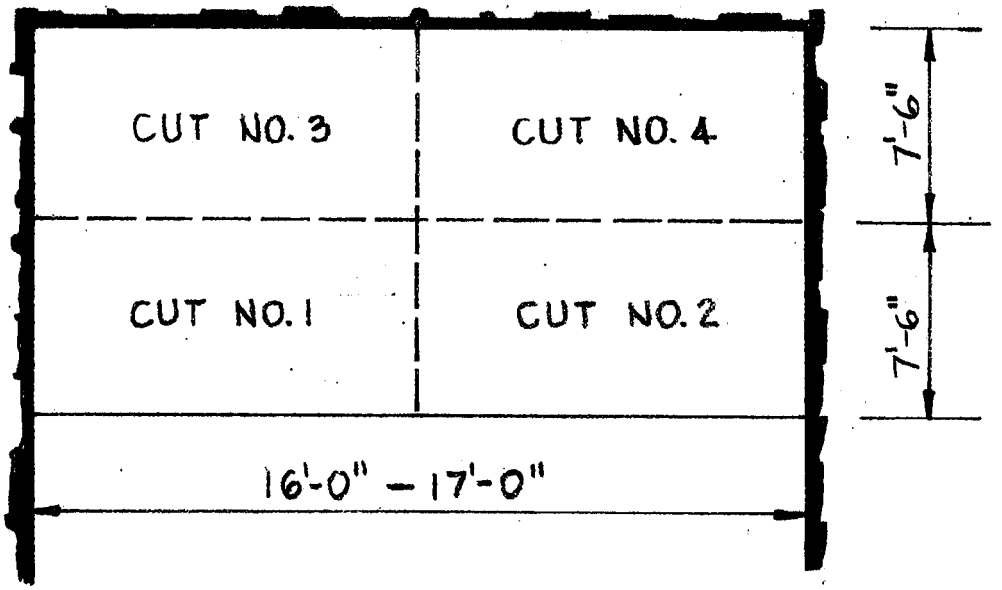


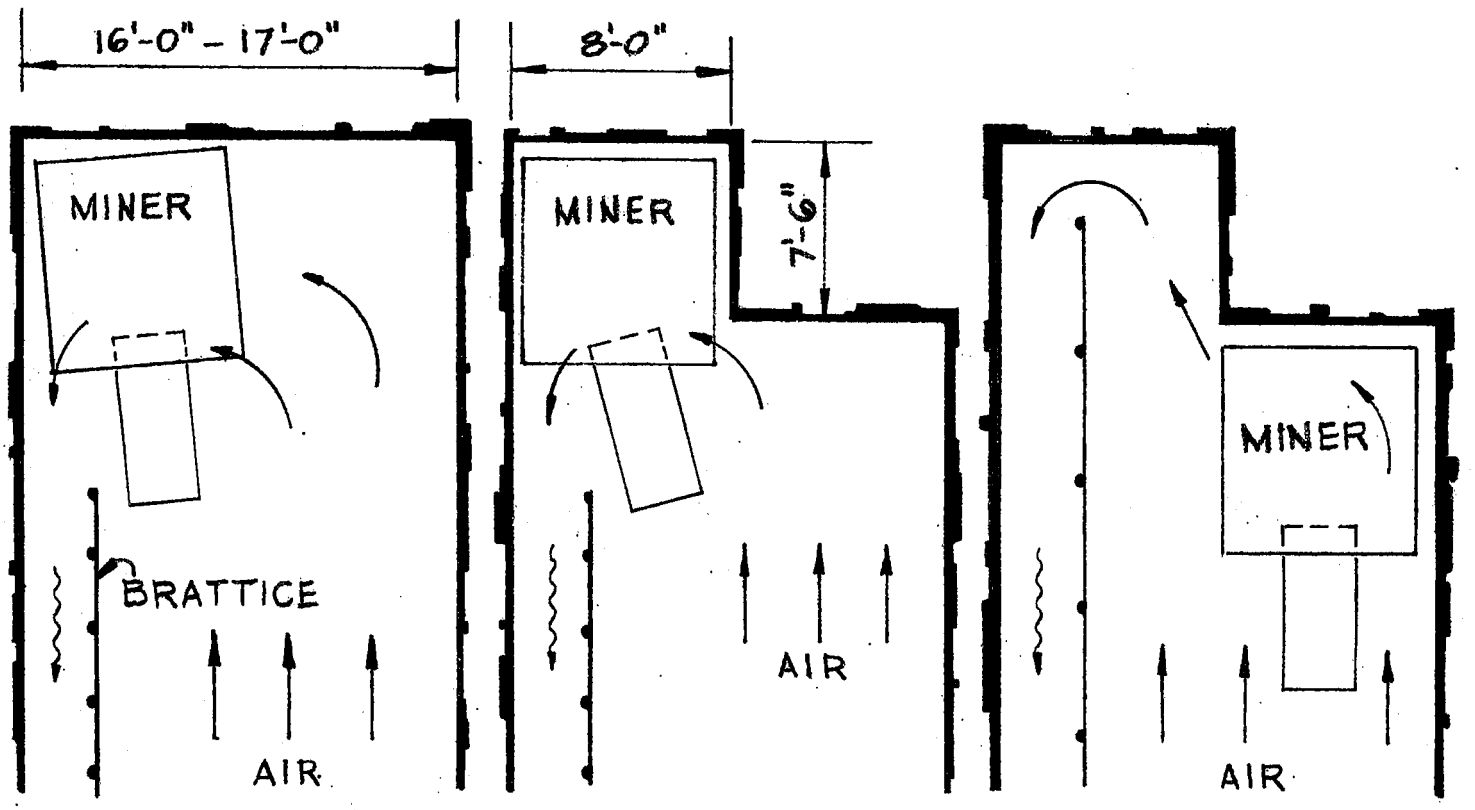
STAGE 5

LEGEND

- INTAKE AIRWAY
- RETURN AIRWAY
- NEUTRAL AIRWAY
- CONCRETE STOPPING (PERMANENT)
- CHECK CURTAIN
- BRATTICE
- R AIR REGULATOR

MINING SEQUENCE
ENTRIES, ROOMS & CROSS CUTS





STARTING POSITION | END FIRST CUT | STARTING SECOND CUT

NOTE:

AFTER THE CUTS NO. 1 & NO. 2 ARE MADE
THE MINER MOVES TO NEXT ENTRY.
THE BOLTER STARTS TO ROOF BOLT THE AREA.

DWG. NO. SDL-10.1.3(P)

EQUIPMENT LIST

General Items

Main fans
Auxiliary fans
Buildings: office, dry, safety & mine rescue, shops, oils and greases; all equipped
Rock dust storage & handling facilities
Front-end loader
Fork lift - portable crane
Bulldozer
Road grader
Utility truck
Pickup trucks
Conveyor belt winder
Mechanical-electrical jeeps
Personnel jeeps
Supply motors
Supply cars
Conveyor belts & drives (overland and underground)
Weightometer
Power center
Hydraulic system of tanks, piping, pumps and controls
Sub-station
Communication systems; telephones, radios
Cable; switch gear; couplers
Cutting & welding equipment & supplies
Oxygen breathing apparatus
All service masks
Fire protection: surface & underground
Portable water system
Yard lights
Methane detectors
Ambulance
Self-rescuers
Stretchers
Safety lights
Fire extinguishers
Chemical fire car
Miners' lamps

EQUIPMENT LIST, cont'd

CM - Longwall Sections

Continuous miners
Longwalls: Chocks, headgate & tailgate, armored conveyor, double-ended shearer, transfer conveyors, hydraulic power center, hydraulic props
Shuttle cars
Roof bolters
Feeder breakers
Scoop & tractor; batteries & charger
Fans & tubing
Track haulage including rail, ties, power cable, power converter
Conveyors, complete
Rock dusters
Communications & lighting system
Sanitary toilets

10.1.3.6 Roof Support

Roof control is based on full roof bolting with timbers and steel used as needed. The rock tunnel will be supported by steel arches constructed on 4-foot centers. Roof bolting will be on 4 or 4.5-foot centers. On main heading wire meshes will be added if needed to maximize the resistance of entry.

The longwall face will be supported by self-advancing chocks. For head and tailgates, 20 tons hydraulic props will be used. The hydraulic props with ropes will be used on pillar splits. Depth of bolts will depend on roof bolts isopach.

SDL-10.1.3(l)and(m) show in detail the tentative roof control plan for the mains, panels and room entries.

The air shaft support will depend on rock formations. Support will be furnished as needed based upon rock mechanic analyses of cores and will vary with underground conditions.

10.1.3.7 Haulage

Men and supplies will be transported by a system of track haulage and roadways using trolley-powered motors and cars as well as rubber-tired, diesel and battery-powered vehicles.

10.1.3.8 Conveyor System

All the coal of Sage Point-Dugout Canyon Project will be transported by means of belt and cable conveyors.

On panels and rooms 2,000-foot conveyors will be used. On the longwall panels 4,000 and 2,000-foot belt conveyors will be used.

In the longwall face the coal will be transported by a single-chain conveyor which will dump the coal on a stage-chain conveyor installed at the headgate. The stage conveyor will be equipped with coal breaker and will dump coal on the panel conveyor.

The overland belts will be 48" wide equipped with a protective cover.

Pages 116 to 119, inclusive, reserved for use in the Land-Use Plan and are not included in the Mining Plan.

10.2 The Coal Preparation

As a part of the 1975 drilling program, composite samples of recovered cores of drill holes were subjected to sink-float washability tests. These tests covered one-third of coal intercepts. The small diameter cores are not truly representative of the coal; they do, however, give an indication of what washing run-of-mine coal can accomplish.

The coal cores do not foretell the run-of-mine analysis principally because mining dilution is not included. The experience at Kaiser suggests that mining dilution is important. Kaiser reported (visit of 1975) that the ash in run-of-mine coal varied from 11% to 21%. Sage Point can reasonably assume the same variation for its coal.

Ash collection and disposal in California will be expensive. The freight on each pound of waste represents one-half cent. The savings in freight will off-set partially the costs of coal preparation.

Based on Kaiser practices and review of plans of nearby Braztah operation, washing of run-of-mine coal at Sage Point is planned. Production of 2 million tons of clean coal per year represents 10,000 tons per day of run-of-mine coal. Washery capacity requirement is 800 tons per hour. If all coal is to be washed, the washery capacity is 1,050 tons per hour.

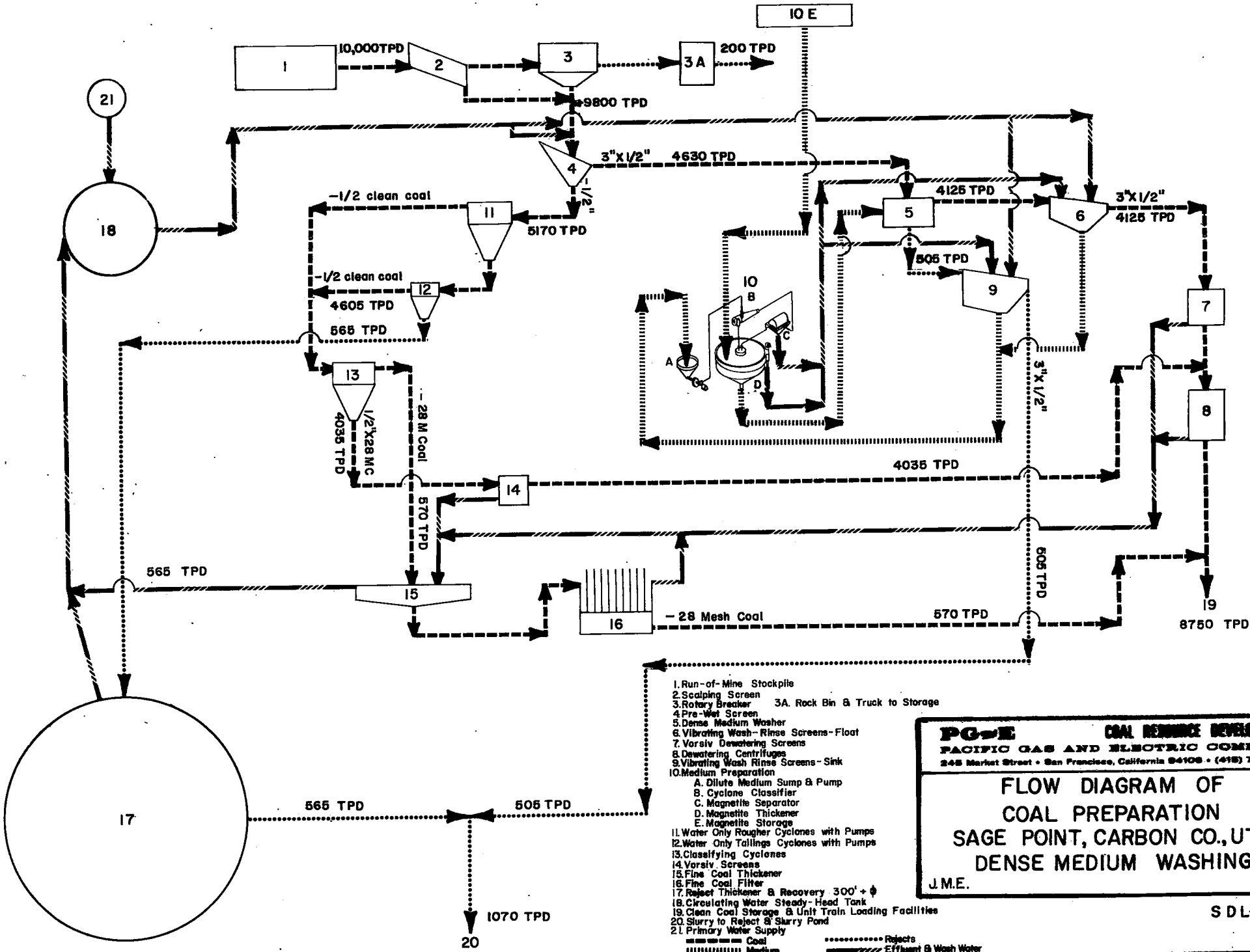
Preliminary proposal of Sage Point-Dugout Canyon flowsheet is summarized as follows:

1. Conveyor belt delivery from mine to preparation plant (open storage and/or surge bin)
2. Rotary breaker - reduction to 3"
3. Pre-wet screens (separation at ½")
4. Plus ½" to dense medium washing (Magnetite); magnetite separation and recovery coal to centrifuge and final product
5. Minus ½" to cyclone recovery; coal separation in 2-stage water-only cyclones; clean coal to final classification, filter, centrifuge, and final product; coal reject to thickening for water recovery
6. Final clean coal 8,750 tons per day; reject 1,250 tons per day
7. Slurry pond and overflow storage pond - rejects stored; water settling pond - clear overflow pumped to washery steady-head tank; see Appendix B entitled, "Report of Feasibility and Siting Studies, Coal Slurry Ponds Near Wellington, Utah," Dames and Moore, 1976.

8. Near complete water recovery;
losses are due to evaporation
plus seepage into soils
isolated from natural drainage

Both minus and plus one-half inch clean coal are discharged from the washery to conveyor belt for delivery to open and for silo storage for transfer to unit trains. Storage capacity at the central yard is thirty days.

Flow diagram of preparation of coal from the Sage Point part of the project (SDL-10.2) depicts coal and refuse tonnages and the kinds of equipment contemplated. Tonnage meets PGandE's needs; if KCC requires washed coal preparation plant capacity will be raised. Final design must wait upon more complete washability determinations.



1. Run-of-Mine Stockpile
2. Scalping Screen
3. Rotary Breaker 3A. Rock Bin & Truck to Storage
4. Pre-Wet Screen
5. Dense Medium Washer
6. Vibrating Wash-Rinse Screens-Float
7. Vorsiv Dewatering Screens
8. Dewatering Centrifuges
9. Vibrating Wash Rinse Screens-Sink
10. Medium Preparation
    - A. Dilute Medium Sump & Pump
    - B. Cyclone Classifier
    - C. Magnetite Separator
    - D. Magnetite Thickener
    - E. Magnetite Storage
11. Water Only Rougher Cyclones with Pumps
12. Water Only Tailings Cyclones with Pumps
13. Classifying Cyclones
14. Vorsiv Screens
15. Fine Coal Thickener
16. Fine Coal Filter
17. Reject Thickener & Recovery 300' + ϕ
18. Circulating Water Steady-Head Tank
19. Clean Coal Storage & Unit Train Loading Facilities
20. Slurry to Reject & Slurry Pond
21. Primary Water Supply

Coal ..... Rejects
Medium ////// Effluent & Wash Water

PG&E COAL RESOURCE DEVELOPMENT
PACIFIC GAS AND ELECTRIC COMPANY
245 Market Street • San Francisco, California 94106 • (415) 781-4211

FLOW DIAGRAM OF COAL PREPARATION SAGE POINT, CARBON CO., UTAH DENSE MEDIUM WASHING

J.M.E. Nov. 76

S D L-10.2

10.3 Rail Spur and Unit Train Facilities

Unit train loading capacity is 2,000 tons, plus or minus, per hour. Because of adverse grades between Price and Salt Lake City and over the Sierras, train capacity may vary from 70 to 85 cars, from 70 to 100 net tons each. Train turn-around time is 4 days.

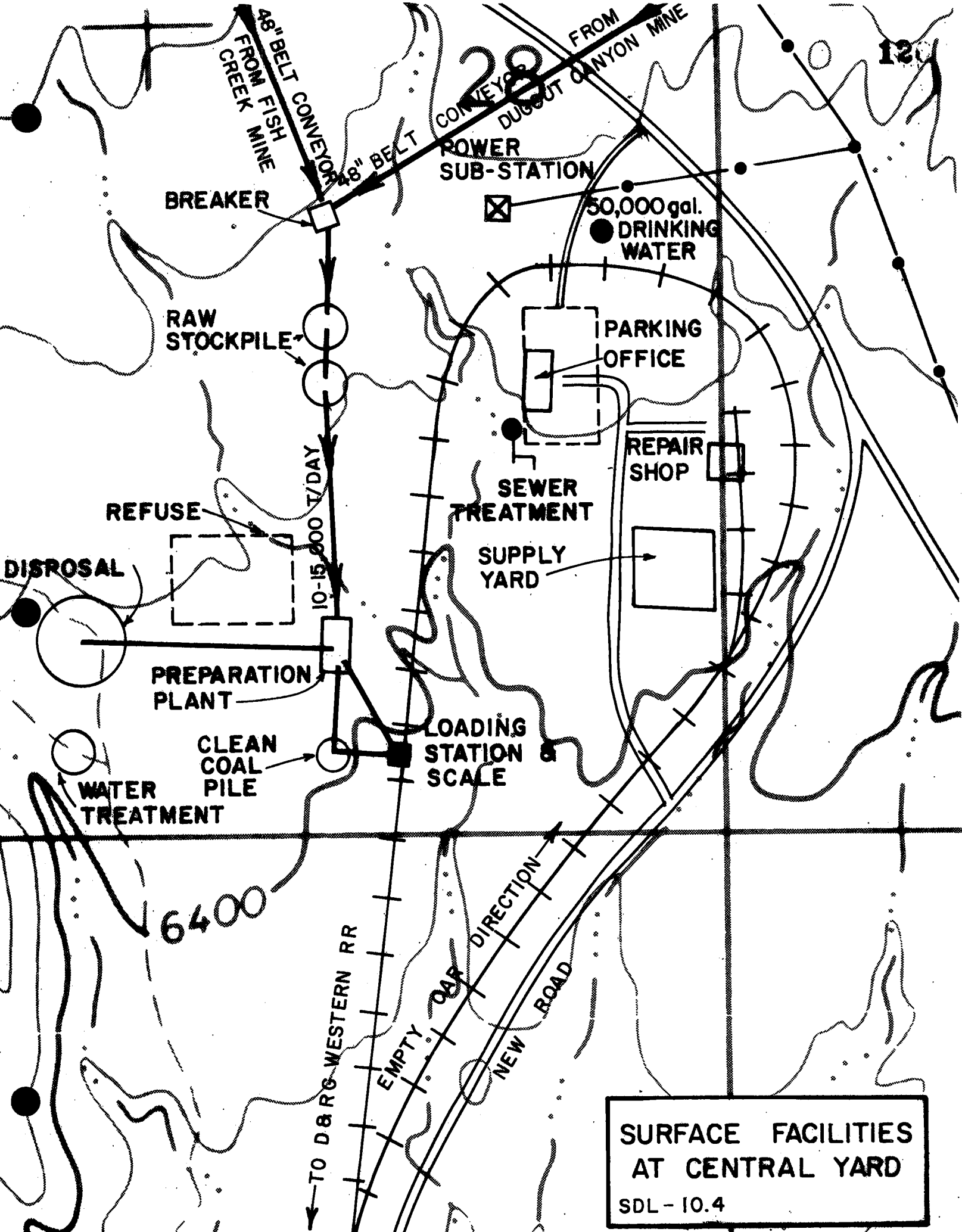
Proposed siting of washery requires a railroad spur originating from the Sunnyside branch of the Denver and Rio Grande Railroad of 1.4 miles, more or less. Location of the washery in proximity to the terminous of the rail spur is standard practice. See Appendix A entitled, "Preliminary Railroad Route Study, Sage Point - Wellington Area," Towill, Inc., 1976.

Based on most recent U. S. Geological Survey topography (Pine Canyon and Sunnyside Junction, 7½' quadrangles) preliminary alignment is shown. Average grade from point of diversion to central yard is 2%.

10.4 Surface Facilities SDL-6.5 and SDL-10.4

The structures, buildings and equipment to be provided on the land-use area requested in this application include, but not exclusively, the following:

- Rail spur and loading loop
- Roads
- Power and telephone lines
- Pipelines: potable, industrial, slurry
- Overland conveyor
- Enclosing fence
- Central yard:
  - Mine buildings:
    - Offices - management & services
    - Warehouse & storage yard
    - Machine & electrical shops
    - Mine rescue & safety
  - Parking areas
  - Sub-station & power distribution center
  - Run-of-mine coal storage
  - Coal washing plant:
    - Water recovery thickener
    - Preparation plant water supply tank (re-use and incoming water)
- Clean coal storage and loading silo(s)
- Preparation plant refuse dam and holding area for run-off and spill
- Solid and sanitary disposal
- Potable water supply tank
- Sewage treatment plant



SURFACE FACILITIES AT CENTRAL YARD

SDL - 10.4

10.5 Health, Safety, Sanitation

The mine will be organized with special attention to health, safety and accident protection and will be equipped with all necessary safety devices. Policies and practices will conform to the 1969 Coal Mine Health and Safety Act and amendments made thereto. New employees will be trained in health, safety, job procedures and work efficiency.

Facilities for the collection, treatment and disposal of human wastes meeting all State, Federal and local codes and regulations will be provided. Effluent water will not be discharged into the natural stream drainages. Portable toilets are required for each underground section and collection of wastes must be a regular routine. Water treatment ponds will be fenced, either individually or through the fencing of the entire operations area, to reduce the hazard to public, livestock and wildlife safety.

In a similar fashion the wastes from mechanical maintenance (rags, oils and greases) will be collected and disposed of (buried) in a way that will not pollute or contaminate either the air or the water quality.

Fire protection is provided for both surface and underground installations. The 1969 Coal Mine Health and Safety Act prescribes actions for prevention and suppression of underground fires. For sections producing

over 300 tons per day, a system providing at least 50 gallons per minute at 50 pounds per square inch must be provided. In addition, portable dry-type extinguishers must be placed at electrical sub-stations, switch houses, conveyor load centers, and important outlets. Both Fish Creek and Dugout Canyon Mines will be designed to meet the fire protection standards and regulations of the 1969 Act.

Surface fire protection will be based on a high-pressure system supplemented by liberal use of portable extinguishers. Industrial water will be used for this system. Large storage tanks and reservoir capacity will be provided. A system of potable and industrial water pipelines of proper capacity and design will interconnect the two mines and the central yard.

10.6 Hydraulic System

Water requirements consist of potable or culinary water and what can be termed as industrial water.

Culinary water is that used for human consumption and certain limited plant uses where quality water is required such as in analytical processes. Industrial water is used above ground in the washery for cleaning the coal, and underground for water sprays on continuous miners and longwall shearers, as well as for fire protection, especially for conveyors. Industrial water has a greater use in the central yard and for roads. The estimated water requirements for culinary and industrial water are shown in the Table of Water Requirements on the following page.

Water supplies are at this date undetermined. Potable water may be obtained from springs or wells drilled into aquifers. The roughly 60,000 gallons per day is only 42 gallons per minute. Industrial water demands are roughly 372 gallons per minute. Possible sources are surface run-off of Pine Canyon, Soldier Creek, Dugout Creek and groundwater wells such as one to reach the Ferron sandstone.

The Price River Water Improvement District has advised NGC that they will be able to sell it the necessary amount of culinary water.

TABLE OF WATER REQUIREMENTS

	Daily Volume Gallons Per Day
Culinary Water:	
Human - 50x900	45,000
Dry Houses - 7x900	6,300
Office	1,000
Misc. & Contingency	7,845
Sub-total:	60,145
Industrial Water:	
CM Units:	
12x30x60x3x2	129,600
LW Units:	
4x70x60x3x2	100,800
Washery:	
270x60x14.5	234,900
Misc. & Contingency 15 percent	69,795
Sub-total:	535,095

Total Daily Consumption: 595,240 gallons
Total Annual Consumption: 136,905,200 gallons
Average Second-Feet: 0.56
Total Annual Acre-Feet: 421
Equivalent Gallons Per Minute: 414
Culinary: 42
Industrial: 372

Collection and distribution of water supplies will require a system of pumps, pipelines, settlement and treatment plants, storage tanks and reservoirs. The system should have electrical and manual controls and serve the two mines and central yard.

The mine is not expected to develop water until some time between 5 and 10 years after ground breaking. Continuous mining machines use 30 gallons per minute in the sprays that suppress dust. Longwall machines use 70 gallons per minute. Water lines must parallel all conveyors to afford fire protection. All this water must be pumped from the surface. Eventually, when the mine makes water, pumps must be provided to move this water to treatment so that the water may be re-used.

Water re-use and conservation will be the watchwords of mine water policy. There is not enough water to allow waste. The hydraulic system has not yet been designed. This will be done during the one to two-year period prior to receipt of mining permits.

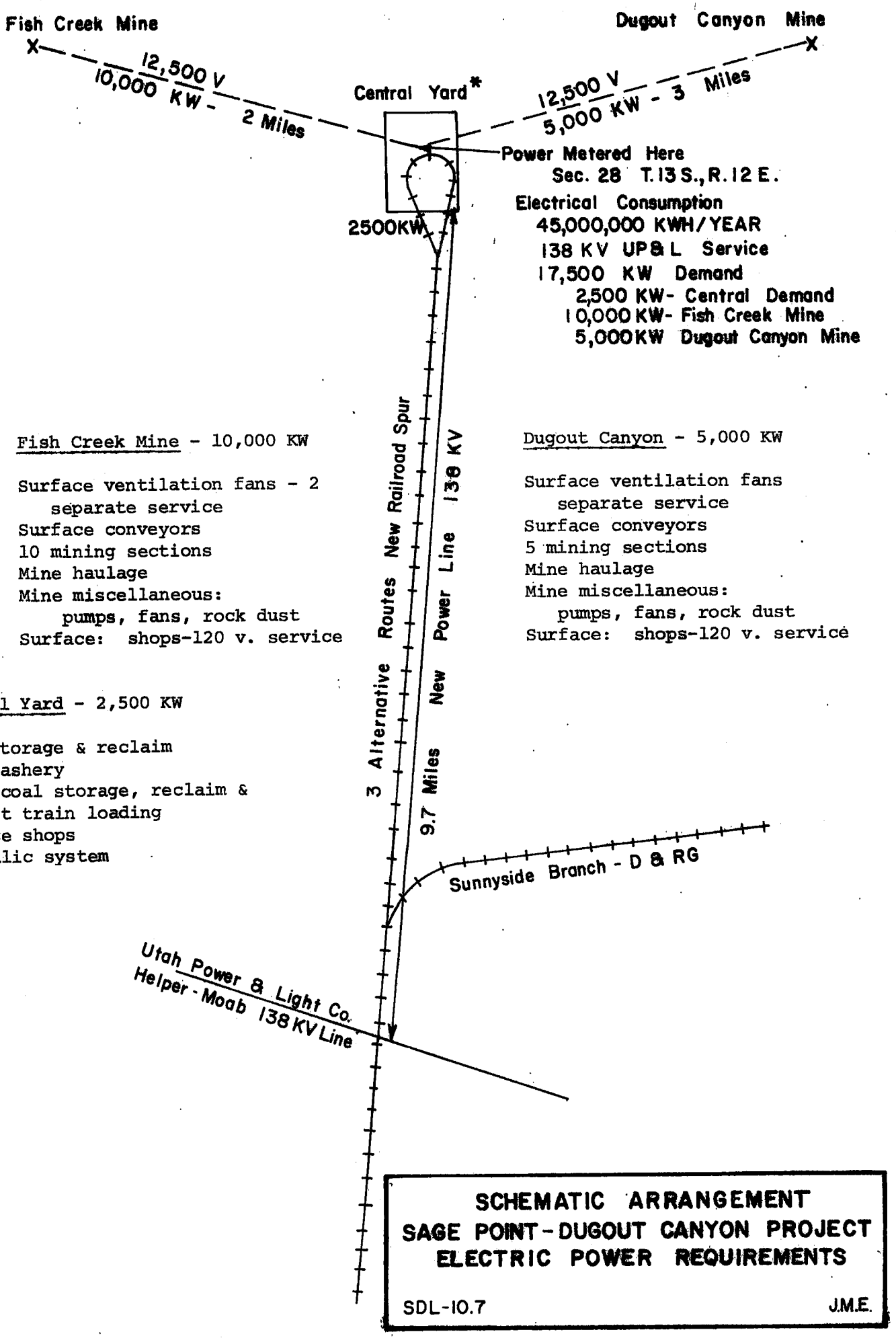
Water losses will be the result of evaporation and seepage. Water, whether potable or industrial, will not be discharged to natural drainage. Refuse-slurry dams will be sited to avoid natural drainage.

The Utah State Engineer has the authority to issue permits for the use of water. PGandE intends to seek the requisite permit as soon as water requirements and sources have been established.

10.7 Electrical and Communications Systems

The electrical system is based on power purchased from Utah Power and Light Company (UP&L). New power lines from the high-voltage Helper-Moab 138 KV line to the central yard will be provided by UP&L at NGC's cost. The preliminary cost estimate is $522,000. Power will be delivered to NGC's primary substation through one meter. NGC will "step-down" incoming voltage to 12,500 volts and other lower voltages to suit its needs. SDL-10.7 is a schematic arrangement of electrical service.

UP&L proposes three power line extensions. The one most favored would "take off" from the Helper-Moab line where it crosses from Section 7 to Section 8, T. 15 S., R. 12 E., follows northward until it meets the rail spur, and then more or less follows the rail spur to the central yard in Section 28, T. 13 S., R. 12 E. A second proposal is to "take off" in the northwest corner of Section 16, T. 15 S., R. 12 E. and extend 8 miles northeast along a proposed railroad in Clark Valley to Section 2, T. 14 S., R. 12 E. The third proposal is to "take off" from a point where the line crosses from T. 14 S., R. 12 E. into T. 15 S., R. 12 E., follow a proposed railroad alignment,



Fish Creek Mine - 10,000 KW

Surface ventilation fans - 2
separate service
Surface conveyors
10 mining sections
Mine haulage
Mine miscellaneous:
pumps, fans, rock dust
Surface: shops-120 v. service

Dugout Canyon - 5,000 KW

Surface ventilation fans
separate service
Surface conveyors
5 mining sections
Mine haulage
Mine miscellaneous:
pumps, fans, rock dust
Surface: shops-120 v. service

Central Yard - 2,500 KW

Coal storage & reclaim
Coal washery
Clean coal storage, reclaim &
unit train loading
Surface shops
Hydraulic system

SCHEMATIC ARRANGEMENT
SAGE POINT - DUGOUT CANYON PROJECT
ELECTRIC POWER REQUIREMENTS

SDL-10.7 J.M.E.

and extend 8.4 miles northeast to destination in the southwest corner of Section 29, T. 13 S., R. 12 E.

The estimated power requirements are: Sage Point Mine, 10,000 KW; Dugout Canyon Mine, 5,000 KW; and Central Yard 2.5 KW. These estimated power requirements are based on two factors. First is an average electrical consumption of 15 KWH per ton of coal produced ; second, the connected load of electrically powered equipment to which a utilization factor is applied. The mine and plant electrical system will be designed to conform to the stipulation contained in Title 30, Mineral Resources, Chapter 1, Bureau of Mines, Department of the Interior, Sub-chapter O, Coal Mine Health and Safety, Part 75, Mandatory Safety Standards. Detailed regulations are as follows:

Subpart F: Electrical Equipment
Subpart G: Trailing Cables
Subpart H: Grounding
Subpart I: Underground High-Voltage Distribution
Subpart J: Underground Low and Medium-Voltage Alternating Current Circuits

New communications systems will have to be provided. Connection with Mountain Bell Telephone

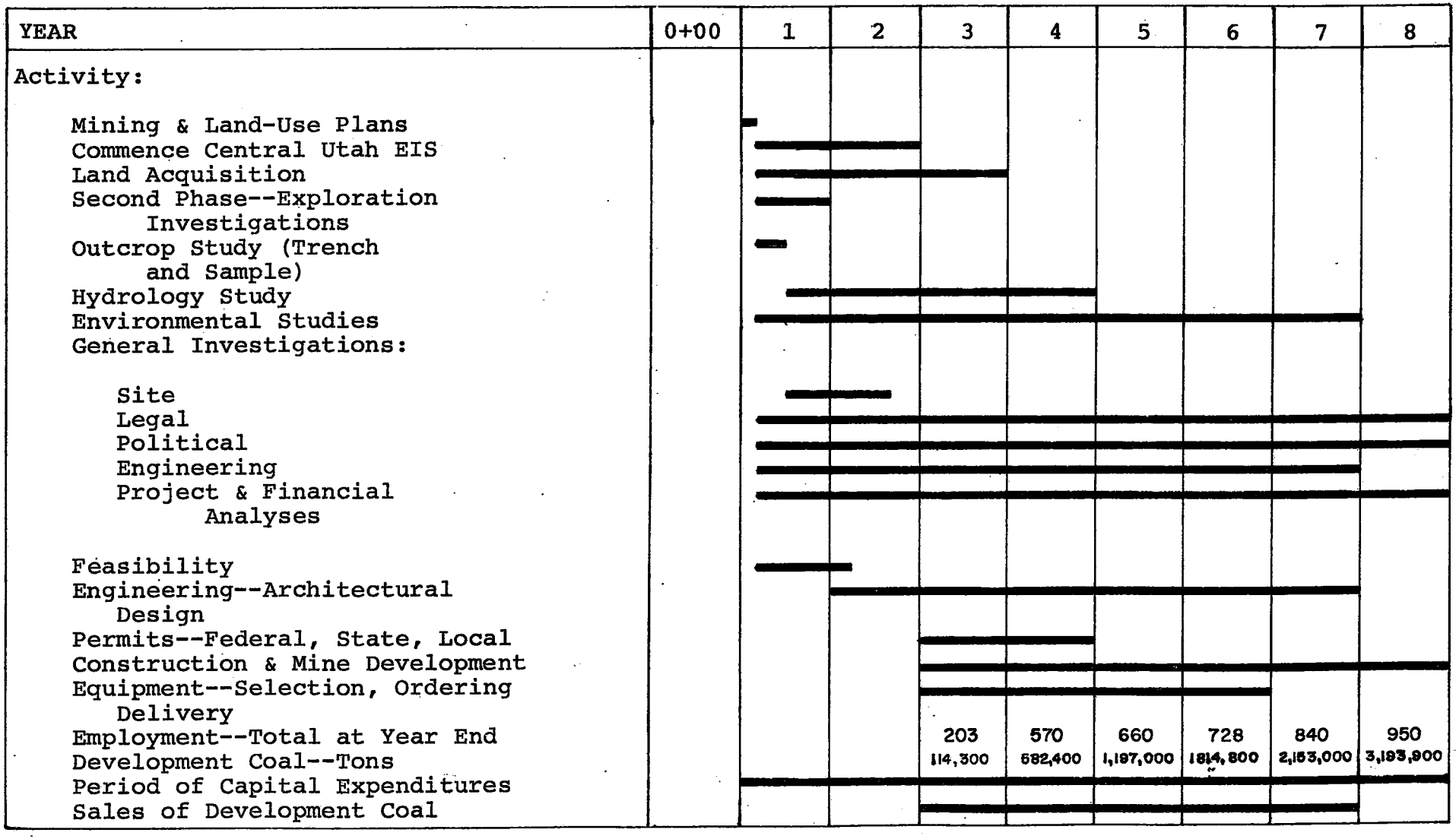
at Wellington is one possibility and Motorola micro-wave communication system is another. Each system is expected to cost $60,000. The telephone communications system may be required because of the need to serve at least three points spaced several miles apart.

11.0 Schedule of Operations

Ground breaking for the proposed Sage Point-Dugout Canyon Mine is subject to approval of Mining Plan by the U. S. Geological Survey and the Land-Use Plan and Rights-of-Way Application by the Bureau of Land Management, and obtaining all other necessary approvals and permits, but is not expected to commence prior to January 1, 1979.

Six years are allowed before the production of 3 million tons per year is reached. Rather than assume definite dates, all references are to the year since starting date. Full demand for coal coincides with the period July 1, 1984 to June 30, 1985. The accompanying Bar Graph (SDL-11.0) shows projected progress.

SCHEDULE OF DEVELOPMENT SAGE POINT - DUGOUT CANYON MINE



JME: November 1976

SDL - 11.0

12.0 Reclamation

The Sage Point-Dugout Canyon Project calls for two periods of reclamation. The first is after the completion of construction (5 years), estimated to take place during 1984. The second, and by far the most important, is exhaustion of coal reserves, estimated during the decade of the 2020's.

After completion of construction at each site, the area would be policed to remove all debris. Surfaces of lay-down areas not to be used permanently would be graded to minimize erosion and to conform to natural contours. Re-vegetation would be attempted by mulching, if required, and by re-seeding with species suitable for the area. All construction equipment not adaptable to the coal mining operation would be dismantled and removed from the project site at the end of the construction phase.

Within 2 years after the exhaustion of mineable coal or the cessation of coal mining, whichever occurs first, all the area will be reclaimed. Support facilities such as rail spur; buildings; structures and fences; electric, communications and hydraulic lines; and all other equipment will be modified or abandoned in accord with legislation and regulations in effect at that time. Roads and rail-spur foundations will be graded, bridges removed and construction sites graded as required. Refuse dams and reservoirs will

be graded and covered with soil. Dams will have been built to maximum slopes of 2:1 and hence should be stable.

Reclamation of the two mine surface areas will require special attention. Because of large rock excavations required to provide sufficient space (horizontal to vertical ratio of 2:1), these areas will be graded to conform to the natural topography as closely as possible. Drainages will be restored. Mine portals and all other openings to the surface will be permanently sealed. Surface drill holes and water wells, except those for which further use has been arranged, will be plugged.

Re-vegetation will commence as soon as practical. Mulchers and fertilizer along with re-seeding of native flora will take place.

To predict what might happen over a span of forty years is risky. In the event that circumstances might result in closing one or both of the mines and substituting other entries from the surface, say a new portal or even a shaft, reclamation of the abandoned facility will commence promptly.

NGC intends to conform insofar as possible to Federal and State rules and regulations in effect at the time of reclamation.

13.0 The Effects of the Sage Point-Dugout Canyon Project On Carbon County

13.1 Positive Effects

Employment gains will be important to the economy of Carbon County and the State of Utah. The project will employ from 850 to 950 persons, an increase of 15% over present employment in the County. Annual payrolls will total $15 million. Power and supplies will exceed $10 million.

Coal production of 3 million tons per year represents a 43% increase over Utah's 1975 production and a one-half of one percent increase in the United States 1975 consumption.

The investment to bring about the project will approach $125 million. Tax benefits to the county will be appreciable. The Governor of Utah has proposed a severance tax. Whatever form this tax takes, the revenues will add appreciably to State funds.

An even larger amount is Utah's share of Federal royalty. Eighty-five percent of the coal to be mined from the Sage Point-Dugout Canyon Project is federally owned. This coal may bear a royalty of 12.5 percent (BLM has the right to impose a lower royalty). At $20 per ton sale price, the royalty is $2.50 per ton. Of this, 52.5 percent of $1.31 per ton reverts to the State.

13.2 Negative Effects

Large increases in employment have adverse effects especially as the increases must be accomplished by drawing people from outside the area. There is no large unemployed mine labor force in Carbon County. There are unemployed who are not qualified to work in coal mines. Some, however, can be trained.

Community services are at present reaching limits. Schools, hospitals and medical services, police, fire, utilities and municipal maintenance services have expanded but there is no excess capacity. Further expansion is costly and funds are tight. Expansion of housing and sewage must take place concurrently with construction and mine development.

The limited recreational facilities of the area will require expansion. Expansion at Sage Point-Dugout Canyon, when considered with other Carbon-Emery expansions, will crowd fishing and hunting locations. Additional recreational vehicles will cause crowded road conditions. Libraries, parks, museums, theaters and other educational and recreational centers will receive greater attention. The College of Eastern Utah at Price will expand. Training courses aimed at coal mine training, especially for mechanics, electricians, technicians and foremen, will be expanded.

The College will be a greater part of both educational and recreational life of the community.

13.3 Mitigating Actions

Natural Gas Corporation of California recognizes the impacts of this project on the nearby communities, their services and their people, and intends to address itself to the mitigation of these impacts. A first step is to invite the public and all interested agencies to meetings at which NGC will describe its proposed project in great detail and will reply to questions. Of particular interest will be schedules for construction, development and production; personnel requirements; provisions for the environment; socio-economic considerations; and the impacts upon the area. NGC, in turn, will learn of the problems and concerns of the people in this area. Among these common concerns resulting from increased employment will necessarily be:

1. Housing
2. Schools
3. Community Services:
   - Public Safety
   - Health
   - Water Supplies
   - Sanitation and Sewage
   - Streets
4. Land Use
5. Traffic
6. Taxes

Communities can sustain growth rates of 4 to 5 percent per year provided that funding is available. Population of Carbon County (May 1976) was 21,000. The Table of Population Growth on the following page estimates county growth attributable to the future Sage Point-Dugout Canyon Project.

TABLE OF POPULATION GROWTH

Year	Added Employment	Added Persons	Percent Growth
1			
2			
3	230	806	3.8
4	367	1,286	5.9
5	90	315	1.4
6	68	238	1.0
7	112	392	1.9
8	110	386	1.6

Effects of other projects are not considered. Only during the third and fourth years does the concern of growth indicate sensitivity. The earliest for year one is 1977. Years one and two may represent 1977 and 1978. During these years mine engineering and design, feasibility studies, washability, acquisition of lands, water supplies, power and communications, negotiation of contracts and other pre-ground breaking endeavors can be undertaken.

Funding is required to mitigate the impacts of the project. Among ways to ease the financial burdens are: pre-payment of taxes with down-stream credits; revenue bonding with its low interest payments; and transfer of tax receipts from the county to the community. This is an effort to equalize costs when a plant is located outside the communities when the major impacts are borne by the communities.

APPENDIX A

Preliminary Railroad Route Study
Sage Point-Wellington Area

by

Towill, Inc.

TOWILL, INC.

PRELIMINARY RAILROAD ROUTE STUDY
SAGE POINT - WELLINGTON AREA

PACIFIC GAS & ELECTRIC COMPANY
COAL RESOURCES DEVELOPMENT

SUBMITTED BY TOWILL, INC.

Towill, inc.

CIVIL ENGINEERS SURVEYORS HYDROGRAPHERS
AERIAL PHOTOGRAPHERS PHOTOGRAMMETRIC ENGINEERS

608 HOWARD STREET, SAN FRANCISCO, CALIFORNIA 94105 • TELEPHONE 415 • 982-1758

October 5, 1976

Mr. John C. Osmond
Supervisor, Coal
Resource Development
Pacific Gas & Electric Company
245 Market Street
San Francisco, California 94106

Re: Sage Point - Wellington Railroad

Dear Mr. Osmond:

We have completed the preliminary corridor study for routing the proposed coal railroad spur from the Denver and Rio Grande Western mainline in the vicinity of Wellington, Utah, and submit the accompanying information for your review.

During the study, the feasibility of six separate alignments were investigated. Line H, tieing to the D&RGW near Sunnyside Junction, appears to be the most favorable route, and Line G, originating near Wellington, is selected as a possible alternate.

Final selection of the design location will depend upon several factors, including the following:

Feasibility of routing the conveyor from the mine to the loading point.

Total cost of the railroad and conveyor system.

Operating and maintenance costs.

Right-of-way and permit considerations.

Soil conditions.

Need and availability of water for construction and operations.

Drainage and flood protection.

After you review the proposed alignments with your soils and geological engineers, we recommend that the following steps should be taken to initiate preliminary design:

1. Conduct control surveys and obtain new aerial photography of mine portal area, potential conveyor routes and preliminary railroad alignments F, G and H. This should be suitable for preparation of 1"=100' scale topographic maps with 5' contours on the portal sites, and 1"=200' scale topographic maps with 5' contours on the conveyor and railroad routes.

   During control surveys, all existing property corners within a 7200' corridor along the railroad and conveyor routes should be premarked for aerial photography, and tied into the survey. Benchmarks should be established at ±one-mile intervals along the selected railroad corridors.

2. Prepare 1"=200' topographic maps with 5' contours on railroad routes G and H.

3. Prepare 1"=200' topographic maps with 5' contours on potential conveyor routes.

4. Prepare 1"=100' topographic maps with 5' contours on the mine portal sites.

5. Confirm feasibility of selected railroad alignment and select tentative conveyor routes.

6. Conduct preliminary drainage study to determine approximate culvert/bridge type and dimensions.

7. Conduct preliminary soils and geological study for selected railroad and conveyor routes.

8. Conduct preliminary design study and develop local alternate routing for railroad and conveyor.

9. Prepare preliminary cost estimates for railroad routes to determine most favorable alternate. Cost estimates should consider construction, right-of-way, operating and maintenance costs.

10. Prepare right-of-way base maps on selected route, using record information and survey data acquired during control surveys. Preparation of final right-of-way maps, as required by the U. S. Bureau of Land Management in Section SB-1 (General Information for Filing Applications for Right-of-Way) may require additional surveys and should be deferred until completion of final railroad and conveyor route location.

Item 1 will provide all data necessary for the preparation of maps needed through preliminary design, and will also suffice for determining earthwork quantities and for most of the requirements for final design maps. If it is intended that preliminary planning and/or design should proceed in the near future, we recommend that Item 1 should be authorized prior to October 15 to ensure that mapping Items 2, 3 and 4 can be prepared as needed.

The following data is submitted:

1. 1"=2,000' topographic map showing location of lines E, F, G and H and location of proposed bridges and culverts.

2. Description of lines E, F, G and H.

3. Ground profiles and tentative grades for lines F, G and H.

4. Summary of preliminary route data, lines E, F, G and H.

5. Typical sections.

6. Mylar overlay (1"=2,000') showing recommended flight plan for aerial photography.

7. Scope of work for surveys, aerial photography, mapping, digital cross-sectioning and other surveying and mapping.

Very truly yours,

TOWILL, INC.

William S. Robinson, P.E.

WSR:cj

Enclosures

PRELIMINARY ROUTE DATA

		LINE E	LINE F	LINE G	LINE H
Total Length to Load Point		62,000'	43,000'	67,500'	62,500'
Total Length of Track		74,000'	53,000'	76,000'	71,000'
Lowest Elevation		5,340'	5,530'	5,340'	5,530'
Highest Elevation		6,350'	6,025'	6,470'	6,470'
Rise with Load (Cumulative)		0'	0'	0'	0'
Fall with Load (Cumulative)		1,010'	495'	1,130'	940'
Average Grade		1.44%	1.14%	1.68%	1.50%
Maximum Grade		2.20%	1.70%	2.50%	2.50%
No. of Curves (including Loop)		11	7	11	8
Length of Curves:	1°	14,500'	19,500'	17,200'	20,900'
	2°	3,700'		7,000'	0'
	3°	5,000'		5,000'	5,000'
	4°		5,000'(loop)		
Total Length of Curve		23,200'	24,500'	29,200'	25,900'
No. of Culverts		20	16	22	25
No. of Bridges		9	3	2	4
Stream Training Structures		1-2	0	0	0
No. Major Road Crossings		1	1	1	1
Elevated/Depressed Crossings		1	0	1	0
Grade Crossings		0	1	0	1
Loading Trackage		6,000' spurline + 6,000' parallel siding	10,000 loop return	8,500' loop return	8,500' loop return
Maximum Cut		50'	20'	40	50'
Maximum Fill		55'	25'	80	50'
Distance, Load Point to Conveyor Terminus		12,500'	13,000'	500'	500'
Difference Elevation to Conveyor Terminus		160'	480'	40'	40'
Mainline Distance to Wellington		± 1.5 miles	± 15 miles	± 1.5 miles	± 15 miles

LINE E

Line E connects with the D&RWG Railroad approximately 1.5 miles east of Wellington, Utah, and proceeds northerly along Soldier Creek, roughly paralleling Highway 53. It is routed to minimize disruption to agriculture in the Wellington area, and to occupy private lands where possible.

The route crosses Interstate Highway 50 about 4 miles easterly from Wellington. Grade crossing is not applicable. Approximately 800' of Highway 50 will require reconstruction, and construction of a permanent highway overpass structure will be necessary. In addition, a relocation of U. S. 50 is proposed, and an additional overpass structure will be required on the new roadway if and when it is built. The route flows through highly erodible soils in the Soldier Creek drainage, and may be subject to some flash flooding on the main stream and tributaries of Soldier Creek.

The terminus of the line anticipates a parallel siding to accommodate loading. The location selected for the loading track is relatively regular, and grade of the 1-mile loading track can be adjusted to plus, level or minus grade to suit operating requirements.

LINE F

Line F connects with the D&RWG Railroad about 1/2-mile easterly from Sunnyside Junction. It parallels the existing track in passing under Interstate Highway 50, utilizing the existing highway overcrossing bridge. It proceeds northerly, crossing Route 123 at grade, and passes through the Bear Creek and adjacent drainages approximately normal to stream flow. The Bear Creek and adjacent streams drain a substantial watershed, and bridging may be required in this area to guard against flash flooding. The route continues northerly into Clark Valley, generally along ridges between minor drain channels and terminates in a loading loop in the vicinity of the headwaters of Pace Creek.

Although this line is shorter, and has less grade than several of the other routes considered, it adds approximately 15 miles of mainline travel, and will require a conveyor system of approximately 4 miles in length.

Parts of the line traverse areas of shales and highly erodible soil, and may require extensive import for embankment.

LINE G

Line G connects with the D&RWG Railroad approximately 1.5 miles east of Wellington, Utah, and proceeds northerly along Soldier Creek, roughly paralleling Highway 53. It is routed to minimize disruption to agriculture in the Wellington area, and to occupy private lands where possible.

The route crosses Interstate Highway 50 about 4 miles easterly from Wellington. Grade crossing is not applicable. Approximately 800' of Highway 50 will require reconstruction, and construction of a permanent highway overpass structure will be necessary. In addition, a relocation of U. S. 50 is proposed, and an additional overpass structure will be required on the new roadway if and when it is built. The route flows through highly erodible soils in the Soldier Creek drainage, and may be subject to some flash flooding on the main stream and tributaries of Soldier Creek.

Approximately 1½ miles northerly from Interstate Highway 50 the proposed route leaves Soldier Creek and climbs in a northeasterly direction to the ridge between Soldier Creek and Dugout Creek, proceeding along this ridge northeasterly to the proposed conveyor terminus.

Line G - Continued

The line terminates in a loading loop in the near proximity of the conveyor terminus.

Line G is common with Line E from Wellington to station 270 + 00, and is common with Line H from station 480 + 00 to the loading loop.

LINE H

Line H connects with the D&RWG Railroad about ½-mile easterly from Sunnyside Junction. It parallels the existing track in passing under Interstate Highway 50, utilizing the existing highway over-crossing bridge. It proceeds northerly, crossing Route 123 at grade, and passes through the Bear Creek and adjacent drainages approximately normal to stream flow. The Bear Creek and adjacent streams drain a substantial watershed, and bridging may be required in this area to guard against flash flooding. The route continues northwesterly to the ridge between Soldier Creek and Dugout Creek, and continues along this ridge in a northeasterly direction to a loading loop in the near proximity of the conveyor terminus at the head of Dugout Creek.

Line H is common with Line F from Sunnyside Junction to station 80 + 00, and is common with Line G from station 380 + 00 to the loading loop.

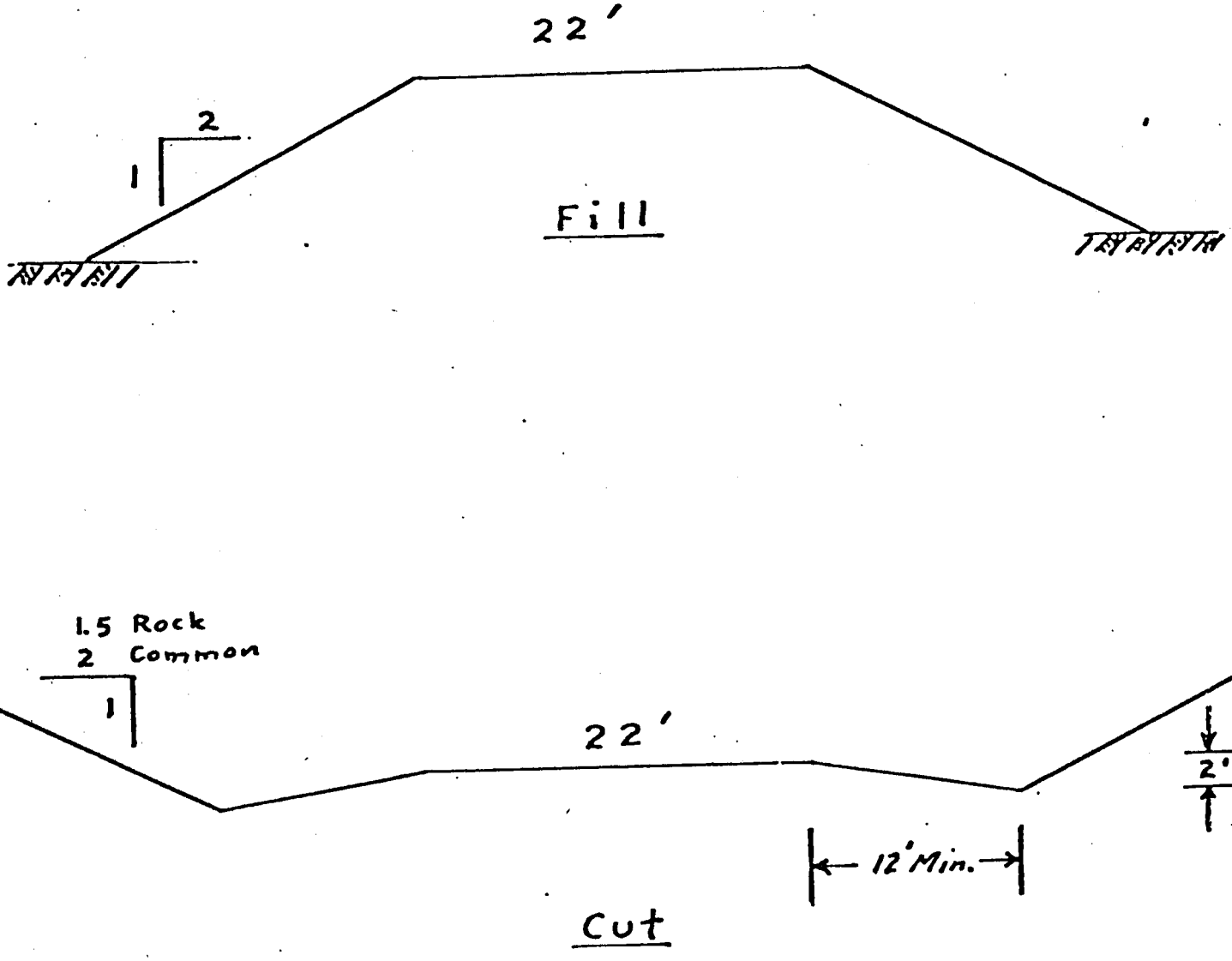
Although Line H is tentatively considered to be the most favorable of all routes studied, it adds approximately 15 miles of mainline travel over that required by Line G, the second most favorable route.

Line H - Continued

Although this line is shorter, and has less grade than several of the other routes considered, it adds approximately 15 miles of mainline travel, and will require a conveyor system of approximately 4 miles in length.

Parts of the line traverse areas of shales and highly erodible soil, and may require extensive import for embankment.

Towill, inc.



SAGE POINT - WELLINGTON RAILROAD SPUR

TYPICAL SECTIONS: EARTHWORK

Towill, inc.

Scope of Work: Mapping and Surveys for Preliminary Design

A. Surveys

1. Establish 30" (iron pin or "T" bar) monuments at approximate 2-mile intervals in the mapping corridors on railroad lines F, G and H, and on the conveyor route.

2. Conduct 1:10,000 horizontal surveys, and third order levels to determine coordinates and elevations on all monuments.

3. Calculate coordinates of all monuments, based on published coordinates of existing USC&GS monuments in the area. Coordinates shall be modified for mapping purposes to mean project elevation of 6,000'.

4. Calculate elevations of all monuments and TBMs based on published Mean Sea Level elevation of existing USC&GS or USGS benchmarks in the area.

5. Prepare field book sketches and descriptions of all monuments and TBMs established or recovered in the survey.

6. Establish supplemental photo control as required for analytic aerotriangulation and/or independent model control.

   Prior to photography, panel all survey monuments and recoverable property corners within the photo corridor on the railroad and conveyor routes.

B. Aerial Photography

Obtain black and white aerial photography in accordance with the accompanying flight plan, using a certified cartographic camera, 6" focal length (Wild A-8, A-10, Zeiss RMK"A" 15/23 or equivalent).

Aerial photography shall meet the specification defined in Section 21, subsections 21.101 through 21.502 of the U. S. Department of Transportation Reference Guide Outline, "Specifications for Aerial Surveys and Mapping by Photogrammetric Methods for Highways", 1968 edition.

SCOPE OF WORK - Continued

C. Map Compilation

1. Prepare pencil manuscripts of 4,000' wide corridor centered on proposed alignments of railroad lines G & H. 1"=200' scale with 5' contours. Spot elevations shall be shown on saddles and depressions and in a regular 2" grid pattern in areas where contours are more than 2" apart.

2. Prepare pencil manuscripts of 4,000' wide corridor centered on proposed alignment of conveyor routes. 1"=200' scale with 5' contours.

   Manuscripts shall show roads, drains, trees, property corners, control survey or other paneled positions, and all other natural or cultural features visible on the aerial photographs. Manuscript lineweight shall be suitable for reproduction by diazo (blue ozalid) process. The modified grid shall be shown at 10" intervals.

3. Map Accuracy: 90% of all contours shall be within 30% of the basic contour interval, and all contours shall be within 60% of the basic contour interval. 90% of all spot elevations shall be within 20% of the basic contour interval.

Delivery Items:

1. Control diagram showing monumented survey positions, photo control and level routes.
2. Summary of elevations and coordinates of all surveyed positions.
3. Copy of field notes.
4. Aerial negative film.
5. Aerotriangulation results.
6. Two sets of 9"x9" contact prints, on semi-matte double weight paper.

Delivery Items - Continued

7. Pencil drafted mylar manuscripts of railroad lines G and H, and conveyor routes.

8. One set of blue ozalid reproductions of item 7 above.

9. Film or plate diapostiives used for aerotriangulation and compilation.

SCOPE OF WORK - Continued

After the engineer has located the selected railroad alignments on the finished 1"=200' topographic manuscripts, the following additional work will be required:

A. Digital Cross-Sectioning

1. Determine centerline profile at 100' intervals plus profile breaks. Profile data should be on IBM data cards, in a format compatible with the engineer's program for CALCOMP plotting.

2. Determine cross-sections at 100' (even stations) normal to the centerline. Sections will extend an average 300' each side of centerline with data points at 100' intervals plus breaks. An additional 10-15% of the total number of sections will be required to provide data on curves. Profile data should be on IBM data cards, in a format compatible with the engineer's program for earthwork computation.

B. Final Sheet Preparation

Final ink-draft 1,000' mapping corridor as directed by engineer, and composite into standard plan/profile sheet.

C. Additional Requirements

1. Conduct additional surveys and design scale mapping as required by the engineer on mainline-spur connections, bridge sites, road crossings, loading areas and other areas requiring detailed information for design.

2. Conduct right-of-way surveys, and prepare right-of-way maps, deed descriptions, etc., as needed for right-of-way acquisition.

3. Stake railroad, conveyor, loading area, bridges, culverts, etc., for construction.

4. Conduct as-built survey for final pay quantities.

5. Establish control surveys for mine construction and operation.

6. Conduct boundary survey to define mine property boundaries.

APPENDIX B

Report of Feasibility and Siting Studies

Coal Slurry Ponds near Wellington, Utah

by

Dames & Moore

REPORT OF FEASIBILITY AND SITING STUDIES

DAMES & MOORE #00160-185-06, SEPTEMBER 21, 1976

Since authorization of this Study, Kennecott Copper Company has agreed to inclusion of its Knight-Ideal property (T. 13 S., R. 12 and 13 E.) with the Sage Point properties of Pacific Gas and Electric Company in application(s) for Rights-of-Way and Land-Use Plan to be filed not later than November 8, 1976 with the Bureau of Land Management.

Joint production from the two properties is estimated at 2.75 to 3 million tons per year. At this time, there is no assurance that Kennecott coal will be washed. The following Table estimates the products of 2 and 3 million tons per year of clean coal:

TABLE OF PRODUCTS

Coal		2 million tpy	3 million tpy
Run-of-Mine		2,254,000	3,381,000
Clean Coal:	3"x 1½"	948,750	1,432,125
	½"x 28M	928,050	1,392,075
	28M x 0	131,100	196,650
Sub-total		2,007,900	3,011,850
Rejects		246,100	369,150
Total rejects-40 years		9,844,000	14,766,000

Dames & Moore estimated total rejects at 11,500,000 tons over 40 years. Should the Kennecott coal be washed, the storage volume of tailings ponds will be increased.

JACK M. EHRHORN
Consultant
Coal Resource Development
Pacific Gas & Electric Co.

REPORT OF FEASIBILITY AND SITING STUDIES

COAL SLURRY PONDS

NEAR WELLINGTON, UTAH

FOR PACIFIC GAS AND ELECTRIC COMPANY

Dames & Moore Job No. 00160-185-06
Salt Lake City, Utah

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September 21, 1976

Pacific Gas and Electric Company
245 Market Street
San Francisco, California 84106

Attention: Mr. John C. Osmond, Supervisor
Coal Resource Development

Gentlemen:

Report of Feasibility and
Siting Studies
Coal Slurry Ponds
Near Wellington, Utah
For Pacific Gas and Electric
Company

Herewith transmitted are twelve copies of our report titled "Report on Feasibility and Siting Studies, Coal Slurry Ponds, Near Wellington, Utah, For Pacific Gas and Electric Company." The purpose and scope of our study were arranged in discussions between Mr. John Osmond of PG&E and Messrs. George Toland and Steven Vick of Dames & Moore, and were also presented in our proposal to PG&E dated August 16, 1976.

oOo

We appreciate the opportunity of performing this study for you. If you have any questions or require additional information, please contact us.

Yours very truly,

DAMES & MOORE

George C. Toland

George C. Toland
Partner
Professional Engineer No. 2311
State of Utah

Steven Vick

Steven Vick
Staff Engineer

GCT/SV/pc

Attachments

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REPORT
ON
FEASIBILITY AND SITING STUDIES
COAL SLURRY PONDS
NEAR WELLINGTON, UTAH
FOR
PACIFIC GAS AND ELECTRIC COMPANY

INTRODUCTION

This report presents the results of our feasibility and siting studies for proposed coal slurry ponds to be constructed in conjunction with PG&E's Sage Point coal mine. The proposed project is located near Wellington, Utah as shown on Plate 1, Vicinity Map.

The purpose and scope of this study were arranged in discussions between Mr. John Osmond of PG&E and Messrs. George Toland and Steven Vick of Dames & Moore, and were also presented in our proposal to PG&E dated August 16, 1976.

SUMMARY

We have estimated that storage of coal slurry waste over the lifetime of the mine will require about 10,560 acre-feet of storage capacity. Four separate alternative pond systems have been identified which could contain the required volume. Two alternatives are located on State or Fee (private) lands, while the other two are located on U. S. Government (Bureau of Land Management) property.

Three of the alternatives examined would require extremely large quantities of fill for construction of the containment

dams. However, one site located largely on BLM lands, designated as Alternative C in this report, is situated very favorably from a topographic standpoint and could be constructed with a relatively small quantity of dam fill.

A detailed description of the alternative sites, comparison of their characteristics, and criteria used for site evaluation are presented in subsequent sections of this report.

PURPOSE AND SCOPE

The purpose of our study was to identify on a preliminary basis sites which appear feasible for containing the entire mine output of coal slurry wastes. The following general alternatives were investigated:

1. Damming Fish Creek in T13S, R12E, Sec. 29 or 32.
2. Damming tributaries to Fish Creek within T13S, R12E, Secs. 29 and 32.
3. Constructing ponds in T14S, R12E, Secs. 2, 10, 11.
4. Constructing ponds at other locations on BLM lands.

In accomplishing this purpose the following scope has been followed:

1. A general surface reconnaissance of the site vicinity in T13S, R12E, Secs. 33, 32, 29, 28, and 21.
2. Identification of four alternative pond sites.
3. Compilation of the following basic data for each alternative site:

a. available pond volume

b. maximum pond area

c. surface drainage area

d. dam length and maximum height

e. dam fill volume

f. approximate distance from mine portal.

4. Comparison of the various sites, including a discussion of the engineering and economic criteria which bear upon the site selection decision.

5. A discussion of design and construction considerations.

6. Recommendations for future design studies.

7. The compilation of this final summary report.

The scope of this study has been limited to an examination of available USGS topographic maps which are relatively small-scale. All quantity estimates are therefore very approximate and are intended for comparative purposes only. We should also point out that none of the sites has been evaluated on the basis of its specific geotechnical or environmental characteristics, features which could be important in the ultimate site selection decision.

PROPOSED CONSTRUCTION

Design and layout of the Sage Point mine is still in the conceptual stages. However, the essential elements of the mine as presently contemplated will include a conveyor system, washing plant, slurry line, and railroad spur. The mine portal will be

located in T13S, R12E, Sec. 16 at the head of Fish Creek. Raw coal will be transported from the portal by conveyor to the washing plant, located at a site yet to be determined. At the washing plant, shale and coal dust will be separated from the raw coal feed. The washed coal will be transported via another conveyor to loading facilities at the railhead. The shale and fine coal residue will be transported by a slurry pipeline and discharged into a slurry pond. In the pond, the wastes will be allowed to settle from suspension, and the clear water will be decanted and recycled for plant use.

Information provided to us by PG&E indicates that the mine will produce a total of 11.5 million dry tons of waste over its 40-year lifetime. Of this amount, nearly all will be in the form of slurry wastes from the washing plant; little or no coarse refuse will be produced. Fine coal will comprise a significant amount of the slurry wastes. Because of the low specific gravity of coal and because the fine-grained sediment settles to a low density in the pond, it takes an unusually large volume to store a given dry weight of coal slurry waste. Published data indicates that coal slurry typically settles to a dry density of about 50 pounds per cubic foot (Busch, et.al., 1975). Using this value, storage of 11.5 million dry tons of waste will require a total ultimate pond volume of 10,560 acre-feet.

SITE CONDITIONS

SURFACE

The proposed mine portal lies at the foot of a very steep mountain front known locally as the Roan Cliffs. Beneath the cliffs are plateaus which slope gently downward to the southwest. These plateaus are deeply incised by stream channels and dry washes having steep walls and generally broad floodplains. Although many of the stream channels are dry during most of the year, they generally drain large areas and would therefore have a high potential for flash flooding.

Surface vegetation on the plateaus and lower cliffs consists largely of Pinion-Juniper trees and sagebrush typical of the region. Sage and bunchgrass cover the stream channel floodplains and the more gently-sloping terrain to the south of the immediate site vicinity.

CLIMATOLOGY

The site vicinity is located in a "cold desert" climatological region. Mean monthly temperatures at the nearest reporting station in Price, Utah range from 23°F in January to 74°F in July, with an annual average of about 50°F (U. S. Weather Bureau, 1960). The area experiences roughly 60 days of below-freezing temperatures annually.

The vicinity is arid, with evaporation normally exceeding precipitation. The average annual precipitation at Price, Utah

is about 9.8 inches, while the estimated average annual lake evaporation rate is about 49 inches (Utah State Climatologist, 1976).

ENGINEERING GEOLOGY

The primary geologic units present in the site vicinity are sandstones, shales, and coals of the Blackhawk Formation; pediment gravels; and shales of the Mancos Formation. The strata strike generally east-west and dip about eight degrees to the north. Alluvial and colluvial deposits derived from these units blanket stream channel and dry wash floodplains. The primary geologic units and structural features in the site vicinity are shown on the Geologic Overlay to Plate 1, Vicinity Map.

Sandstones and coals of the Blackhawk Formation outcrop along the cliffs above roughly the 7200 elevation contour; the mine portal is located in this outcrop. The tops of the plateaus to the south are blanketed by a cap of poorly-consolidated pediment gravel which varies in gradation from silty sand to boulders. Underlying the pediment gravels is the Mancos shale, a formation notorious for its tendency to shrink, swell and slake due to moisture variations or exposure to air. Mancos shale is exposed on steep slopes at the head of Fish Creek and tributary drainages.

A north-trending fault about 1.5 miles in length bisects the Mancos shale and pediment gravel near the location of alternative site C. No other faults are known to exist in the immediate site vicinity. However, a series of northeast-trending thrust

faults is present approximately midway between Wellington and Sunnyside Junction. The northern end of these faults lies at a point about eight miles south of the proposed mine portal.

SEISMICITY

The site vicinity is located in a region of moderate seismic activity and has been classified as a Zone 2 seismic area, where moderate expected earthquake damage could occur (Coffman and von Hake, 1973). Relatively small earthquakes, ranging from 4.0 to 4.9 Richter Magnitude, are common in the area. Approximately eight such earthquakes have occurred in historic times within a 20-mile radius of the site (Cook and Smith, 1967). The closest such earthquake was epicentered about five miles south of the site.

POTENTIAL SLURRY POND SITES

CRITERIA

Two primary criteria were used in identifying potential sites and in laying out the individual dams and ponds. These are:

1. The presence of a natural topographic basin to minimize required dam fill.
2. The presence of a relatively small upstream drainage area to minimize runoff storage and/or diversion requirements.

The significance of the first criterion is apparent in that the cost of the dam can be reduced by constructing it across a pre-existing basin. In cases where no such basin exists, a series of small, square ponds is most efficient in terms of required dam fill. For ponds of unequal storage volumes, a relative measure of the cost of the dam is the ratio of the dam fill divided by the pond volume. Higher values of this ratio (which is analagous to a stripping ratio in mining operations) indicate greater relative dam construction costs.

The second criterion, to minimize the upstream drainage area, has an effect on the cost of runoff-control measures. Normal practice in this region is to design the dam with adequate freeboard to contain major floods, and to provide means (such as a decant system) to remove the stored water within a short period of time. In addition, Federal regulations require that a permanent spillway be constructed at the time the pond is abandoned (MESA, 1975). The costs of additional dam freeboard, decant structures, and spillways can be a significant portion of the total pond cost. These costs can be minimized if the drainage area can be kept small in relation to the size of the pond. A useful measure of the relative amount of runoff which will have to be handled is the ratio of the total drainage area of the pond divided by the surface area of the pond itself. Higher values of this ratio indicate higher relative costs for handling runoff.

ALTERNATIVE LOCATIONS

Four alternative pond locations have been evaluated. They have been identified as Alternatives A, B, C, and D as shown on Plate 1, Vicinity Map. Each of the alternative sites is capable of providing the required total storage volume of 10,560 acre-feet; however, for most alternative sites more than one pond is necessary to achieve the total required storage volume.

Alternative A, as shown in detail on Plate 2, consists of two separate ponds located on State and Fee lands in T13S, R12E, Secs. 29 and 32. This alternative site is located on tributaries to Fish Creek about two miles south of the proposed mine portal.

Alternative B, as shown in detail on Plate 3, consists of two separate ponds located immediately west of Alternative A on BLM and State lands. Specifically, the ponds are located in T13S, R12E, Secs. 30, 31, and 32.

Alternative C is shown in detail on Plate 4. It consists of a single pond located on BLM and State lands in T13S, R12E, Secs. 34 and 35, and T14S, R12E, Secs. 2 and 3. The pond is located on a tributary to Pace Creek.

Alternative D, as shown in detail on Plate 5, consists of five separate ponds located on State and Fee lands in T14S, R12E, Secs. 2, 10, 11, and 15.

Two other alternative locations were considered, but were not evaluated in detail. Damming Fish Creek within T13S, R12E,

Sec. 29 or 32 was considered. However, such a site would drain a very large area in relation to the size of the pond. Because of the technical difficulty and expense which would result from handling the large inflows of surface runoff, this possible site was not considered to be feasible.

Several incised canyons at the head of Fish Creek in T13S, R12E, Secs. 9 and 15 were also considered. However, there would be technical problems resulting from the facts that: the canyons are located about 1,000 feet uphill from the mine portal; the ponds would be located over potential mine workings; sufficient fill for dam construction would probably not be readily available; and dam construction would be difficult in the steep, narrow canyons. For these reasons, this area was not considered in detail.

A tabulation of the physical characteristics of the four alternatives which were considered in detail is shown on Table 1 at the end of this report. For comparative purposes, Table 1 also includes a tabulation of the dam fill/pond volume ratio and the drainage area/pond area ratio for each individual pond. The alternative sites are compared in the following section.

COMPARISON OF ALTERNATIVES

Of the possible sites considered, Alternative C is clearly superior in terms of dam fill costs, requiring about 1,650,000 cubic yards of fill to obtain the approximate needed storage capacity. This is about 2,190,000 cubic yards less than the second most efficient alternative (Alternative B), and about

2,950,000 cubic yards less than the least efficient alternative (Alternative D). Assuming a cost of $2.50 per cubic yard for in-place dam fill, the fill quantity advantage of Alternative C translates into a savings of about 5.5 to 7.4 million dollars. The drainage area/pond ratio of 1.9 is moderate, and an attractive site for the abandonment spillway exists in the extreme western end of the pond through a natural topographic saddle.

Alternative D is the least favorable site considered. With a combined dam fill/pond volume ratio of 447, it is the most expensive in terms of required dam fill. Although the drainage area/pond area ratio of 1.1 is small, the overall costs for abandonment spillway works would be high since five separate spillways would be required.

Alternatives A and B are similar in terms of dam fill costs. The dam fill/pond volume ratios of 391 and 378, respectively, are only slightly lower than for Alternative D. Drainage area/pond area ratios for both alternatives are moderate to high.

DESIGN AND CONSTRUCTION CONSIDERATIONS

As previously indicated, the alternative sites have not been evaluated on their relative geotechnical merits. However, certain factors of design and construction will be common to dams at all of the alternative sites.

The most feasible method of constructing dams containing coal slurry waste is by the so-called "downstream" method of

construction as illustrated on Plate 6. Initially, a starter dike is constructed. The dam is subsequently raised in increments according to the increase in elevation of the impounded coal slurry by adding fill on the crest and downstream face of the previous dam stage. A cutoff extending down to relatively sound and impervious materials will be required beneath the dam to reduce seepage losses.

Some portion of the total quantity of dam fill can probably be taken from within the pond area, but additional external borrow areas may also be required. At least two types of soil will be required for use in the dam: a relatively impervious material for an upstream core, and a clean, granular material to provide drainage within the downstream portion of the dam. Pediment gravels can probably be used for the downstream drainage zone, and Mancos shales or soils derived from them can probably be used in the impervious core.

Mancos shales and their derivative soils may be susceptible to severe shrinkage and swelling due to moisture changes. The material also deteriorates rapidly upon exposure to air. Special care will be required in making cutoff trench and other excavations, and spillway cuts through the Mancos shales may have to be concrete-lined. Clays derived from the Mancos shales may also be "dispersive" or susceptible to internal erosion. This would require special protection of the dam core by granular filters. In summary, the properties of the dam fill and foundation

materials may pose technical problems, but we feel that these problems can be solved by thorough design and careful construction practices.

RECOMMENDED ADDITIONAL STUDIES

No matter which site is ultimately selected, we recommend that a detailed design study be carried out. The study will have to be thorough and complete for a dam or dams of the contemplated size, and will additionally have to satisfy a comprehensive set of regulations on design, operation, and abandonment of coal waste disposal facilities by MESA. We recommend a program generally following the outline given below:

1. A reconnaissance program consisting of general surficial inspection, and an examination of stereo-pair aerial photographs for use in geologic interpretation of faults and other significant features.

2. A field exploration program consisting of:

    a. The drilling of borings along the dam alignment. The purpose of the borings would be to investigate dam foundation conditions, and some borings should be cored into sound bedrock. The total number, depth, and spacing of the borings will depend upon the site selected and the soils encountered in the field. Dozer roads will probably have to be cut for drillrig access, and a

suitable source of drilling water will have to be located.

b. The excavation of roughly 15 to 25 test pits for the purpose of providing supplementary information on dam foundation conditions, and to investigate borrow sources for fill materials.

3. A laboratory testing program to determine the strength, permeability, dispersion, compressibility, and swelling characteristics of the dam foundation and fill materials.

4. A detailed study of the seismicity of the area, and determination of an appropriate design seismic acceleration.

5. A detailed hydrologic analysis, including:

   a. Determination of the design flood inflow.

   b. Design of provisions to handle runoff, including determination of freeboard, determination of decant capacity requirements, and design of abandonment spillways.

6. A program of geotechnical design, including:

   a. Detailed dam layout.

   b. Determination of suitable fill materials and sources.

c. Design of the dam cross-section and internal zoning, including consideration of construction staging.

d. Analyses of dam stability under both static and earthquake loading.

e. Calculation of seepage losses, probable seepage pathways, seepage water quality, and possible effects of seepage on ground or well water quality in the vicinity.

f. Analysis of expected dam settlement or movement, with consideration to cracking and internal erosion.

Design of slurry discharge and decant water systems should also be performed concurrently with dam design studies. After completion of dam design studies and approval by regulatory agencies, plans and specifications for construction should be prepared.

oOo

The following table and plates are attached and complete this report:

Table 1 - Summary of Alternative Site Characteristics

Plate 1 - Vicinity Map and Geologic Overlay

Plate 2 - Alternative A

Plate 3 - Alternative B

Plate 4 - Alternative C

Plate 5 - Alternative D

Plate 6 - Dam Construction Staging

Respectfully submitted,

DAMES & MOORE

George C. Toland
Partner
Professional Engineer No. 2311
State of Utah

Steven Vick
Staff Engineer

GCT/SV/pc

Attachments

LIST OF REFERENCES

Busch, R.A., et.al., 1975, "Physical Property Data on Fine Coal Refuse", Report of Investigation 8062, U. S. Bureau of Mines.

Coffman, J.L., and von Hake, C.A., 1973, "Earthquake History of the United States", U. S. Department of Commerce, NOAA.

Cook, K.L. and Smith, R.B., 1967, "Seismicity in Utah, 1850 through June 1965", Bull. Seis. Soc. of America, vol. 57, no. 4.

MESA, 1975, "Design Guidelines for Coal Waste Structures", U. S. Bureau of Mines, MESA Technical Support Center, Denver.

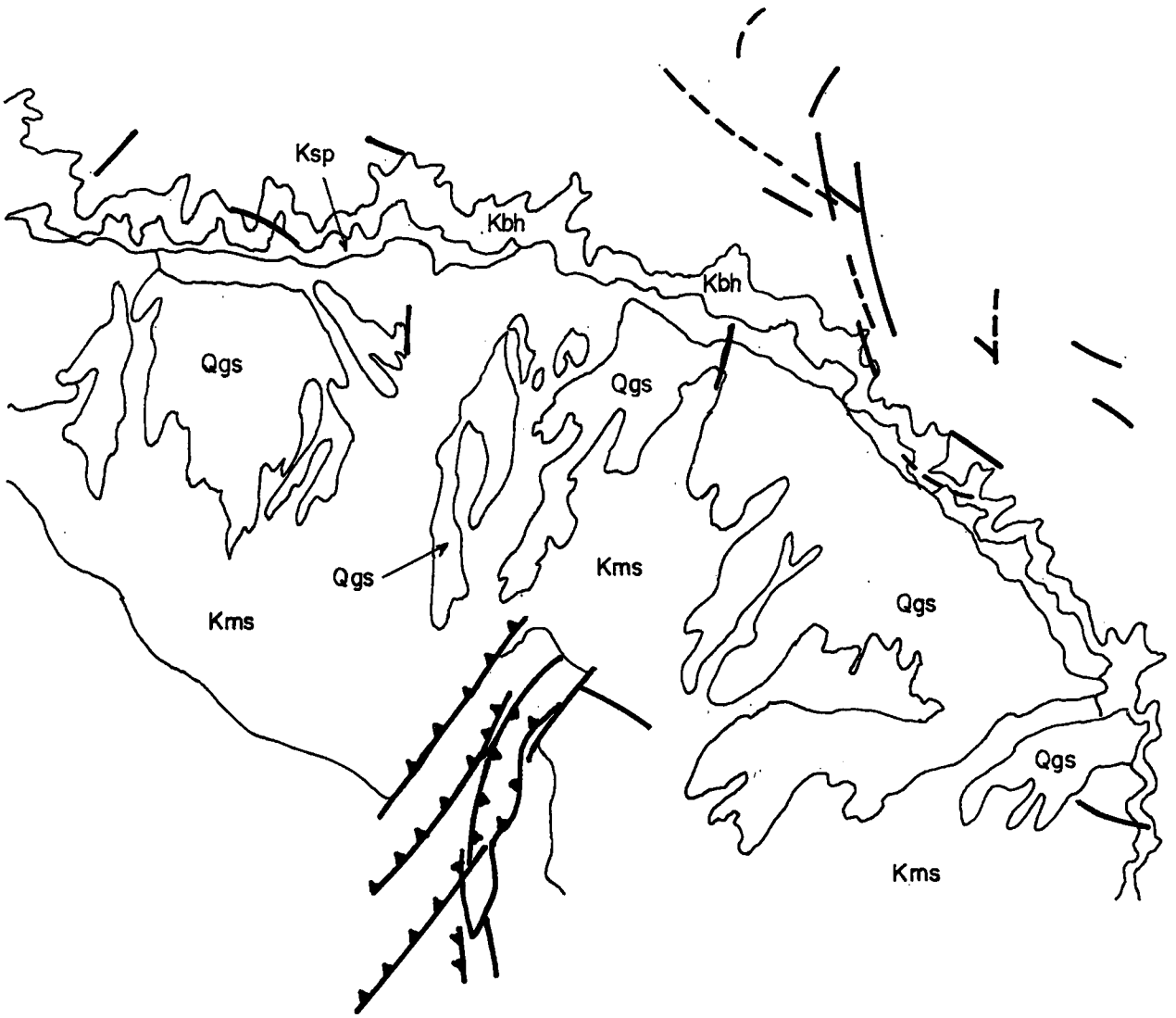
U. S. Weather Bureau, 1960, "Climates of the States - Utah", Climatography of the United States, No. 60-42.

Utah State Climatologist, Sept. 16, 1976, personal communication.

TABLE 1 - SUMMARY OF ALTERNATIVE SITE CHARACTERISTICS

Alternative	Pond	Pond Volume (A-ft)	Max. Pond Area (Ac)	Surface Drainage Area (Ac)	Drainage Area/ Pond Area	Dam Length (ft)	Max. Dam Height (ft)	Dam Fill Volume (yd^3)	Dam Fill/Pond Volume (yd^3/A-ft)	Straight-Line Distance From Canyon Mouth (ft)*	Present Land Ownership
A	A-1	7,180	138	529	3.8	4,400	100	1,707,000	237	7,000	Fee
	A-2	3,140	55	78	1.4	4,900	130	2,330,000	742	9,000	State
	Total	10,320	193	607	3.1	9,300	-	4,037,000	391	-	
B	B-1	5,300	74	120	1.6	3,250	200	1,890,000	357	11,000	BLM/State
	B-2	4,861	92	294	3.2	3,350	110	1,950,000	401	10,000	BLM
	Total	10,160	166	414	2.5	6,600	-	3,840,000	378	-	
C	C	10,880	221	423	1.9	2,900	110	1,650,000	152	16,000	BLM/State
D	D-1	1,300	57	75	1.3	4,200	60	452,000	348	24,000	Fee
	D-2	2,990	120	120	1.0	6,350	50	904,000	302	23,000	Fee
	D-3	2,540	85	85	1.0	5,800	60	1,170,000	460	22,000	Fee/State
	D-4	1,660	55	55	1.0	4,900	60	1,045,000	629	21,500	Fee/State
	D-5	1,790	60	83	1.4	5,350	60	1,028,000	574	20,500	State
	Total	10,280	377	418	1.1	26,600	-	4,599,000	447	-	

* distance measured from 6800 ft. elevation contour on Fish Creek.



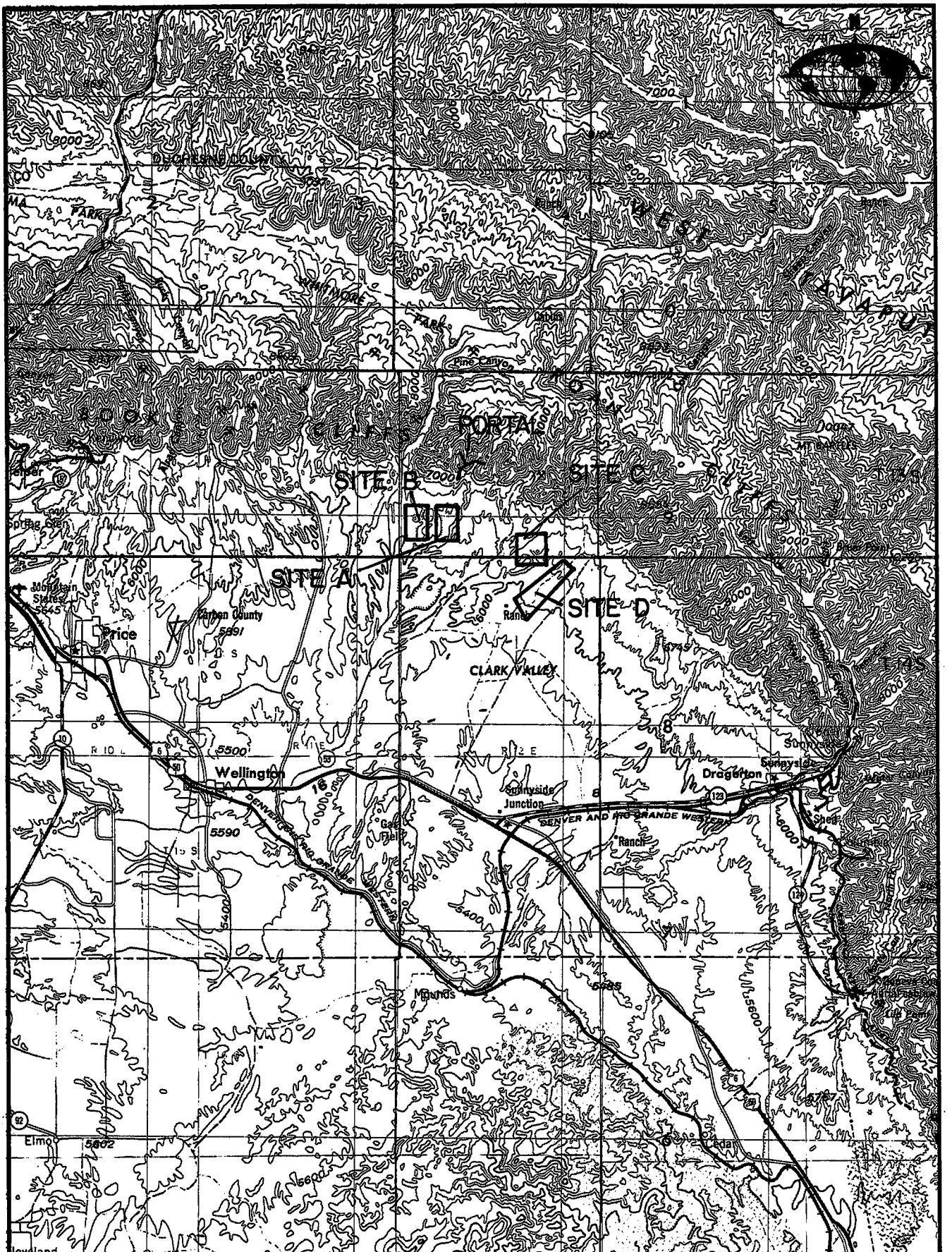
KEY:

Kbh	BLACK HAWK SS
Ksp	STAR POINT SS
Qgs	PEDIMENT GRAVEL
Kms	MANCOS SH
- - -	INFERRED FAULT
———	FAULT

REFERENCE:

GEOLOGIC MAP OF UTAH, N.E. QUARTER,
COLLEGE OF MINES UNIVERSITY OF UTAH 1961.

GEOLOGIC OVERLAY



REFERENCE:

U.S.G.S. MAP ENTITLED "PRICE, UTAH", 1:250,000.

4 0 4 MILES

VICINITY MAP

DAMES & MOORE

PLATE 1

REVISIONS

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CHECKED BY _____ DATE _____

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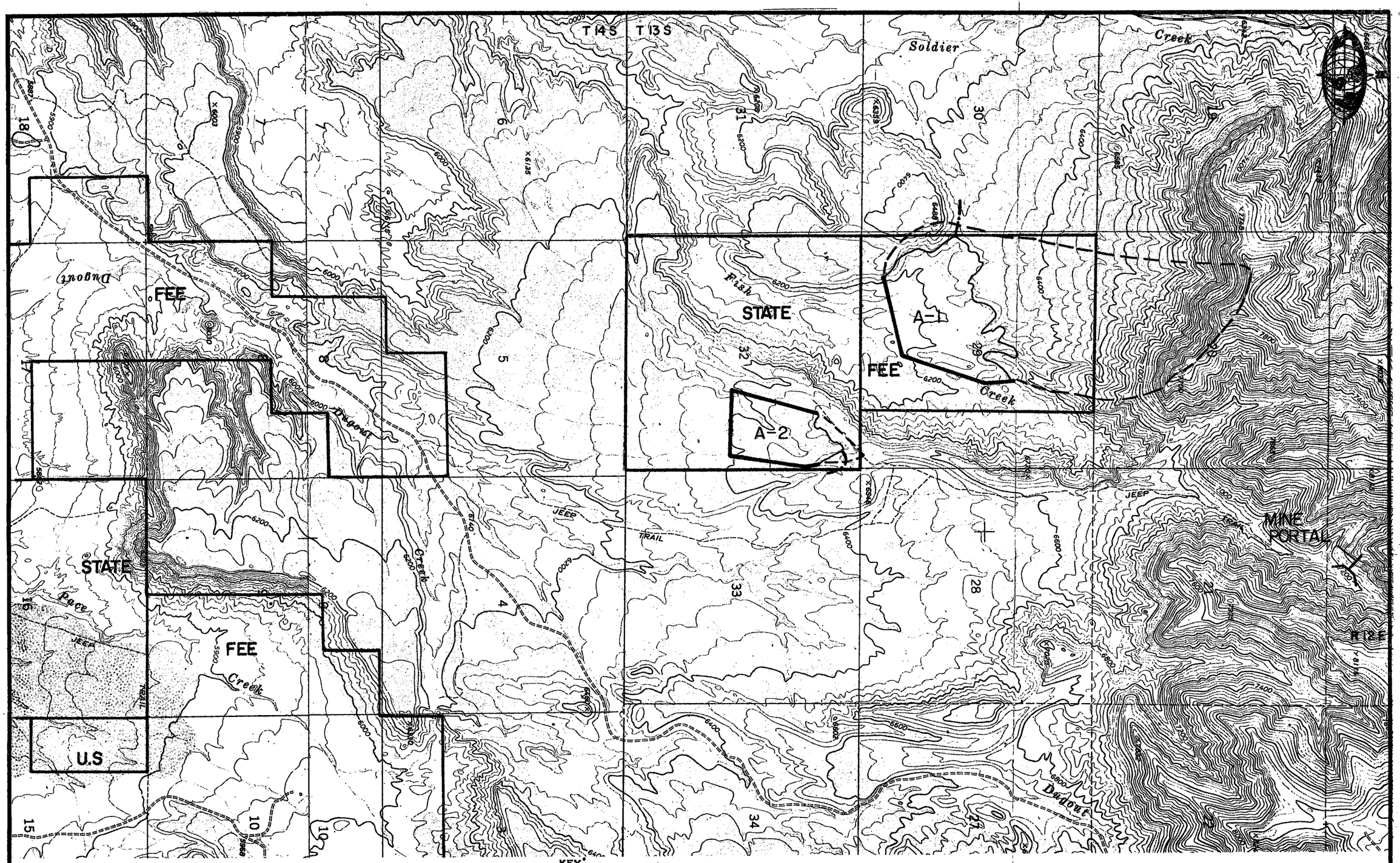

REFERENCE: U.S.G.S. QUADRANGLE SHEETS ENTITLED "PINE CANYON, UTAH AND SUNNYSIDE JUNCTION, UTAH" DATED 1972.

ALTERNATIVE A

DAMES & MOORE

PLATE 2

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BY ____ DATE ____
CHECKED BY ____ DATE ____

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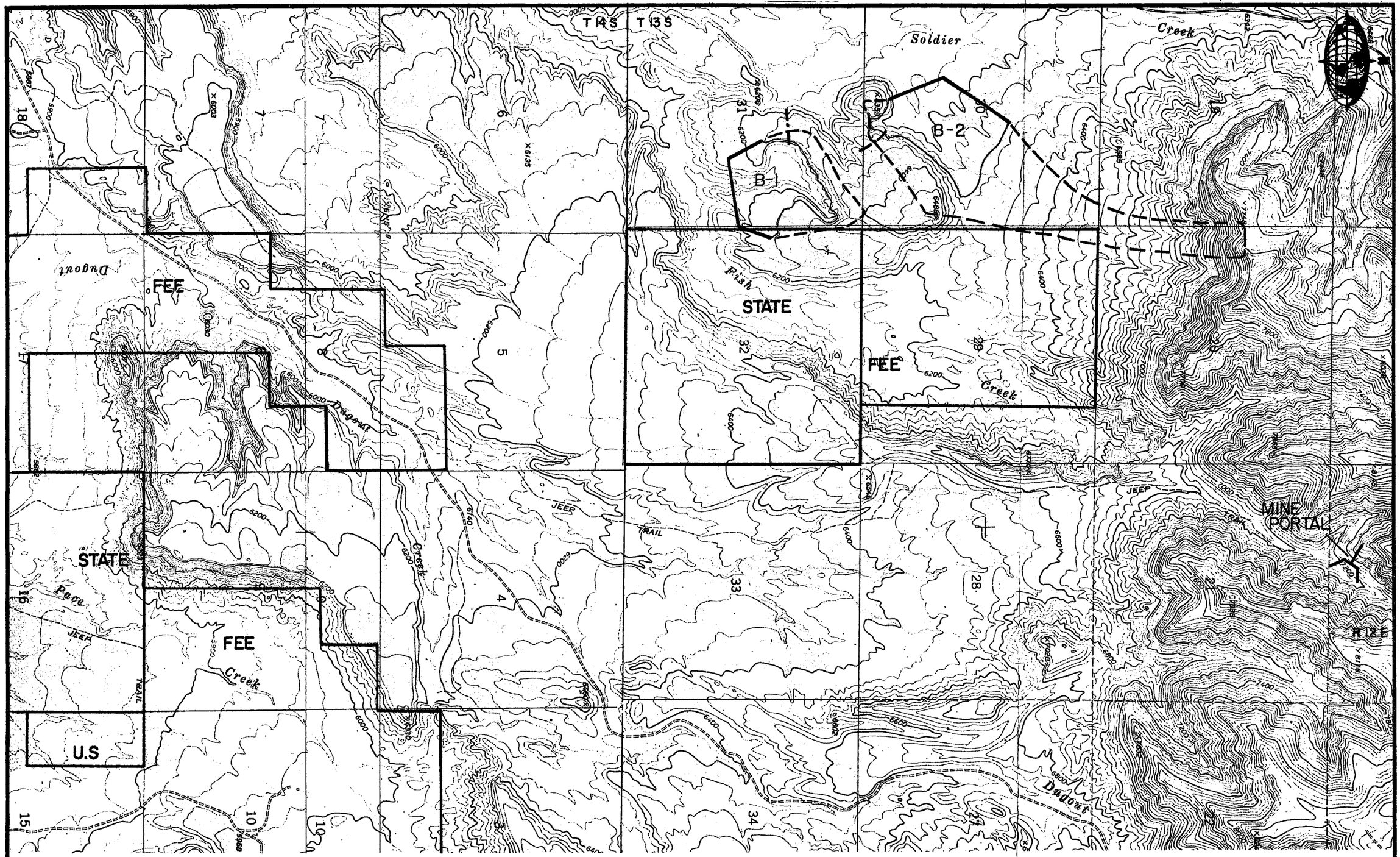

REFERENCE: U.S.G.S. QUADRANGLE SHEETS ENTITLED "PINE CANYON, UTAH AND SUNNYSIDE JUNCTION, UTAH" DATED 1972.

ALTERNATIVE B

DAMES & MOORE

PLATE 3

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BY ____ DATE ____
BY ____ DATE ____
BY ____ DATE ____
PLATE ____ OF ____

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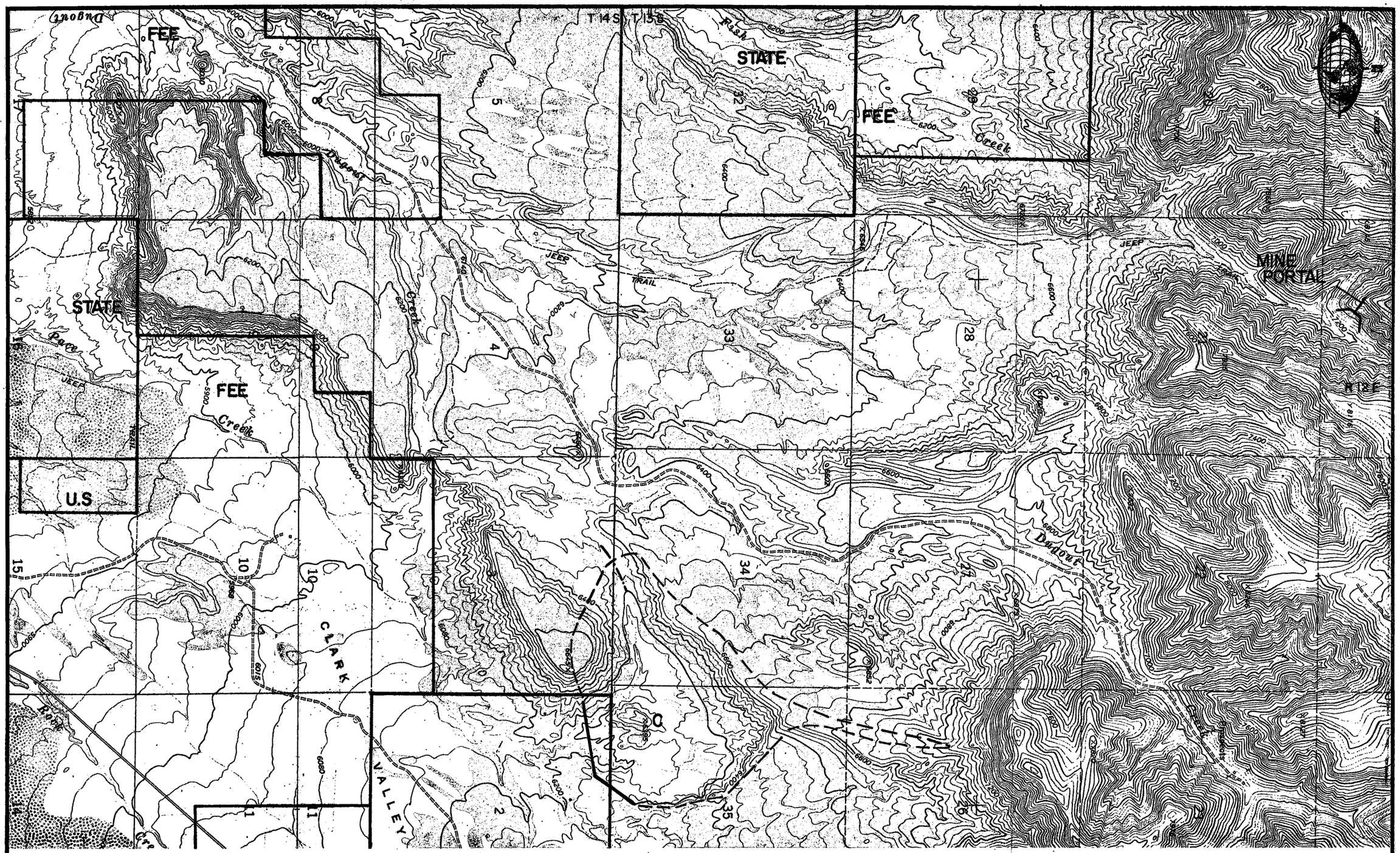

KEY:

- DAM
- MAXIMUM POND ELEVATION
- POND DRAINAGE AREA
- POSSIBLE ABANDONMENT SPILLWAY LOCATION

REFERENCE: U.S.G.S. QUADRANGLE SHEETS ENTITLED "PINE CANYON, UTAH AND SUNNYSIDE JUNCTION, UTAH" DATED 1972.

2000 0 2000 FEET

ALTERNATIVE C

DAMES & MOORE

PLATE 4

REVISIONS
BY ____ DATE ____
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BY ____ DATE ____
PLATE ____ OF ____

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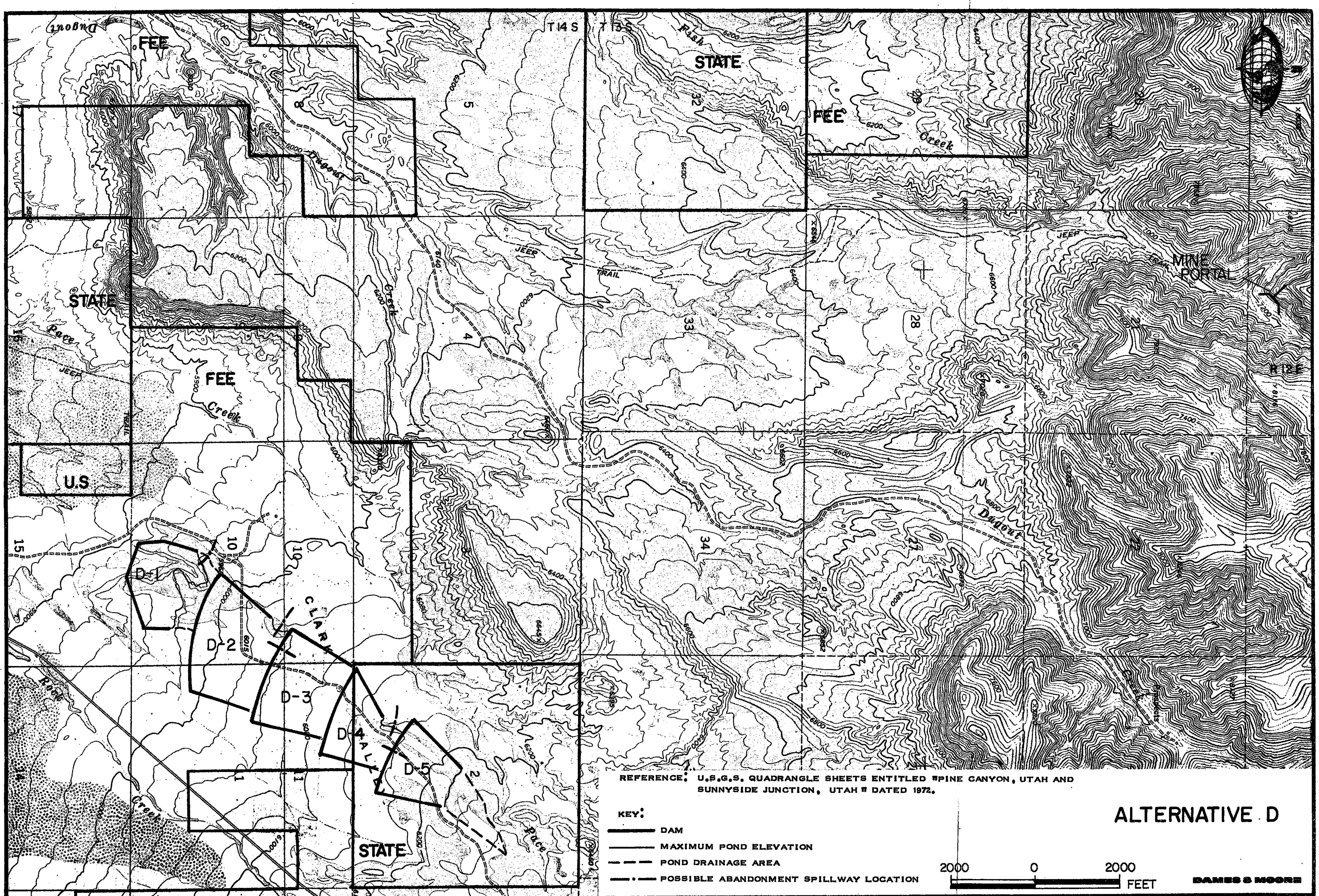
BY ____ DATE 1/85
CHECKED ____ DATE ____

466.12 (4-64)



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KEY:

- DAM
- MAXIMUM POND ELEVATION
- POND DRAINAGE AREA
- POSSIBLE ABANDONMENT SPILLWAY LOCATION

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ALTERNATIVE D

DAMES & MOORE

PLATE 5

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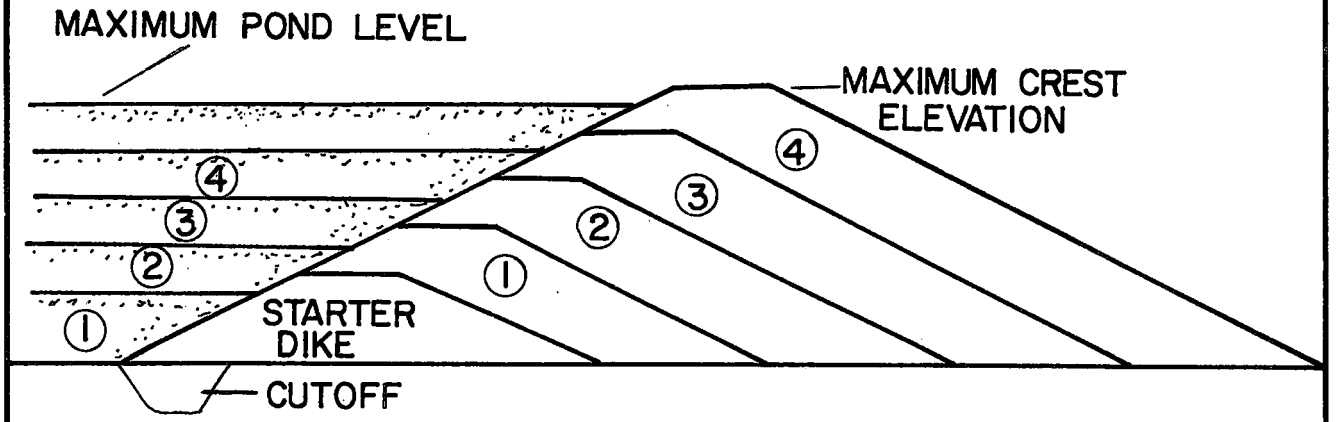

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DAM CONSTRUCTION STAGING

SCHEMATIC - NOT TO SCALE

DAMES & MOORE

PLATE 6

REVISIONS BY DATE

FILE D160-485

BY CHECKED BY DATE 9-16-76

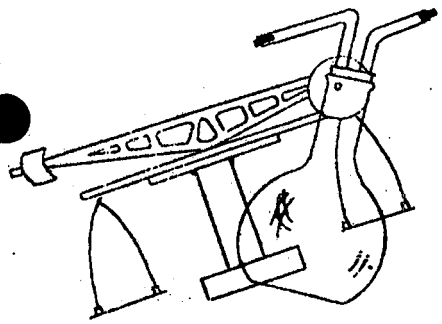
946.7 (REV. 6-61)

APPENDIX C

Analyses of Water Sampled by PGandE in the Sage Point Area

Carbon County, Utah

Ford Chemical Laboratory, Inc.



Ford Chemical
LABORATORY, INC.
Bacteriological and Chemical Analysis
40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 485-5761

September 15, 1976

CERTIFICATE OF ANALYSIS
76-5545

Pacific Gas and Electric
245 Market Street
San Francisco, CA 94106

ATTENTION: Mr. John Osmont

Gentlemen:

The following analysis is on samples of water received on August 27, 1976:

Samples: Water collected by Paul Anderson

	#5 Dugout Creek	#8 Sulfur Spring	#21 Fish Creek
Aluminum as Al (Dissolved) ug/1	70.0	120.0	150.0
Ammonia as NH3-N (Dissolved) mg/1	0.49	0.12	0.34
Arsenic as As (Dissolved) ug/1	<1.0	<1.0	<1.0
Bicarbonate as HCO3 mg/1	295.2	592.9	270.8
Carbonate as CO3 mg/1	<0.01	<0.01	<0.01
Boron as B (Dissolved) ug/1	<1.0	<1.0	<1.0
Bismuth as Bi (Dissolved) ug/1	<1.0	<1.0	<1.0
Calcium as Ca (Dissolved) mg/1	36.94	27.33	42.11
Chloride as Cl (Dissolved) mg/1	4.0	6.0	4.0
Total Dissolved Solids at 180° C. mg/1	493.0	980.0	430.0
Fluoride as F (Dissolved) mg/1	0.19	0.26	0.25

	#5 Dugout Creek	#8 Sulfur Spring	#21 Fish Creek
Iron as Fe (Dissolved) ug/1	157.0	300.0	134.0
Magnesium as Mg (Dissolved) mg/1	31.70	19.10	34.00
Manganese as Mn (Dissolved) ug/1	6.0	38.0	7.0
Kjeldahl Nitrogen mg/1	0.14	1.20	0.20
Nitrate as NO3-N (Dissolved)mg/1	0.03	0.02	0.02
Phosphorus (Total) as P mg/1	0.175	0.235	0.215
Phosphorus (Ortho) as P mg/1	0.065	0.035	0.075
Potassium as K (Dissolved) mg/1	3.05	3.28	2.67
Silica as SiO2 (Dissolved) mg/1	11.60	5.80	9.40
Sodium as Na (Dissolved) mg/1	45.0	206.0	31.0
Sulfate as SO4 (Dissolved) mg/1	81.0	124.0	87.0
Strontium as Sr (Dissolved ug/1	<1.0	<1.0	<1.0
Barium as Ba (Dissolved) ug/1	15.0	13.0	18.0
Beryllium as Be (Dissolved) ug/1	<1.0	<1.0	<1.0
Cadmium as Cd (Dissolved) ug/1	<1.0	<1.0	<1.0
Chromium as Cr (Dissolved) ug/1	<1.0	<1.0	<1.0
Copper as Cu (Dissolved) ug/1	7.0	4.0	13.0
Chemical Oxygen Demand mg/1	5.0	8.0	6.0
Germanium as Ge (Dissolved) ug/1	<1.0	<1.0	<1.0
Gallium as Ga (Dissolved) ug/1	<1.0	<1.0	<1.0
Lead as Pb (Dissolved) ug/1	<1.0	<1.0	<1.0
Lithium as Li (Dissolved) ug/1	<1.0	<1.0	<1.0
Molybdenum as Mo (Dissolved)ug/1	2.0	6.0	3.0
Mercury as Hg (Dissolved) ug/1	<0.2	<0.2	<0.2
Nickel as Ni (Dissolved) ug/1	<1.0	<1.0	<1.0

	#5 Dugout Creek	#8 Sulfur Spring	#21 Fish Creek
Oil and Grease mg/l	<1.0	<1.0	<1.0
Selenium as Se (Dissolved) ug/l	2.0	8.0	15.0
Silver as Ag (Dissolved) ug/l	6.0	5.0	7.0
Sulfide as S (Dissolved) mg/l	<1.0	<1.0	<1.0
Titanium as Ti (Dissolved) ug/l	<1.0	<1.0	<1.0
Vanadium as V (Dissolved) ug/l	<1.0	<1.0	<1.0
Zinc as Zn (Dissolved) ug/l	31.0	55.0	15.0
Zirconium as Zr (Dissolved) ug/l	<1.0	<1.0	<1.0
Gross Alpha pic/l	<3.5	<3.5	<3.5
Gross Beta pic/l	<1.5	<1.5	<1.5
Conductivity umhos/cm	750.0	1,500	660.0
Total Organic Carbon mg/l	6.0	8.0	5.0
Total Carbon mg/l	9.0	10.0	8.0
Total Inorganic Carbon mg/l	3.0	2.0	3.0
Cesium as Cs ug/l	<1.0	<1.0	<1.0
Cobalt as Co ug/l	9.0	2.0	14.0
Thorium as Th ug/l	<1.0	<1.0	<1.0
Yttrium as Y ug/l	<1.0	<1.0	<1.0
Uranium as U_2O_8 ug/l	<1.0	<1.0	<1.0
Tin as Sn ug/l	<1.0	<1.0	<1.0
Color pt.-co units	0	5	5
Aldrin ug/l	0.00	0.00	0.00
Lindane ug/l	0.00	0.00	0.00
Chlordane ug/l	0.0	0.0	0.0
DDD ug/l	0.00	0.00	0.00

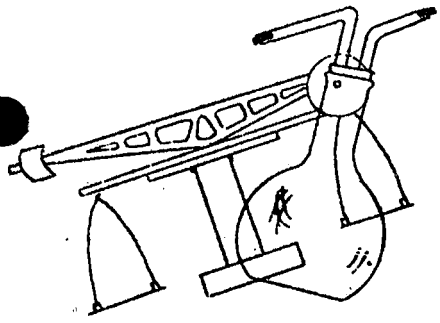
	#5 Dugout Creek	#8 Sulfur Spring	#21 Fish Creek
DDE ug/l	0.00	0.00	0.00
DDT ug/l	0.00	0.00	0.00
Dieldrin ug/l	0.00	0.00	0.00
Endrin ug/l	0.00	0.00	0.00
Toxaphene ug/l	0.0	0.0	0.0
Heptachlor ug/l	0.00	0.00	0.00
Heptachlor Epoxide ug/l	0.00	0.00	0.00
PCB ug/l	0.0	0.0	0.0
2-4-D ug/l	0.00	0.00	0.00
2-4-5-T ug/l	0.00	0.00	0.00
Silvex ug/l	0.00	0.00	0.00

Sincerely,

FORD CHEMICAL LABORATORY, INC.

Lyle S. Ford

LSF:lh



Ford Chemical
LABORATORY, INC.
Bacteriological and Chemical Analysis
40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 485-5761

September 15, 1976

CERTIFICATE OF ANALYSIS
76-5546

Pacific Gas and Electric
245 Market Street
San Francisco, CA 94106

ATTENTION: Mr. John Osmont

Gentlemen:

The following analysis is on samples of water received on August 27, 1976:

Samples: Water collected by Paul Anderson

	#22 Soldier Creek	#23 Pine Creek	#30 9-1 Spring
Aluminum as Al (Dissolved) ug/1	40.0	90.0	110.0
Ammonia as NH3-N (Dissolved) mg/1	0.78	0.12	0.19
Arsenic as As (Dissolved) ug/1	<1.0	<1.0	<1.0
Bicarbonate as HCO3 mg/1	368.4	314.8	348.9
Carbonate as CO3 mg/1	<0.01	<0.01	<0.01
Boron as B (Dissolved) ug/1	<1.0	<1.0	<1.0
Bismuth as Bi (Dissolved) ug/1	<1.0	<1.0	<1.0
Calcium as Ca (Dissolved) mg/1	28.93	38.79	9.22
Chloride as Cl (Dissolved) mg/1	14.0	4.0	2.0
Total Dissolved Solids at 180°C. mg/1	690.0	510.0	540.0
Fluoride as F (Dissolved) mg/1	0.50	0.29	0.28

	#22 Soldier Creek	#23 Pine Creek	#30 9-1 Spring
Iron as Fe (Dissolved) ug/1	197.0	310.0	285.0
Magnesium as Mg (Dissolved) mg/1	30.20	29.00	23.00
Manganese as Mn (Dissolved) ug/1	14.0	10.0	4.0
Kjeldahl Nitrogen mg/1	0.10	0.15	0.85
Nitrate as NO3-N (Dissolved) mg/1	0.04	0.02	0.10
Phosphorus (Total) as P mg/1	0.250	0.260	0.535
Phosphorus (Ortho) as P mg/1	0.085	0.088	0.250
Potassium as K (Dissolved) mg/1	4.10	1.49	0.97
Silica as SiO2 (Dissolved) mg/1	12.10	13.50	11.60
Sodium as Na (Dissolved) mg/1	118.0	55.0	104.0
Sulfate as SO4 (Dissolved) mg/1	130.0	75.0	56.0
Strontium as Sr (Dissolved) ug/1	<1.0	<1.0	<1.0
Barium as Ba (Dissolved) ug/1	21.0	17.0	16.0
Beryllium as Be (Dissolved) ug/1	<1.0	<1.0	<1.0
Cadmium as Cd (Dissolved) ug/1	<1.0	<1.0	<1.0
Chromium as Cr (Dissolved) ug/1	<1.0	<1.0	<1.0
Copper as Cu (Dissolved) ug/1	12.0	9.0	5.0
Chemical Oxygen Demand mg/1	9.0	4.0	5.0
Germanium as Ge (Dissolved) ug/1	<1.0	<1.0	<1.0
Gallium as Ga (Dissolved) ug/1	<1.0	<1.0	<1.0
Lead as Pb (Dissolved) ug/1	<1.0	<1.0	<1.0
Lithium as Li (Dissolved) ug/1	<1.0	<1.0	<1.0
Molybdenum as Mo (Dissolved) ug1	15.0	5.0	13.0
Mercury as Hg (Dissolved) ug/1	<0.2	<0.2	<0.2
Nickel as Ni (Dissolved) ug/1	<1.0	<1.0	<1.0

	#22 Soldier Creek	#23 Pine Creek	#30 9-1 Spring
Oil and Grease mg/l	< 1.0	< 1.0	< 1.0
Selenium as Se (Dissolved) ug/l	3.0	< 1.0	14.0
Silver as Ag (Dissolved) ug/l	8.0	8.0	9.0
Sulfide as S (Dissolved) mg/l	< 1.0	< 1.0	< 1.0
Titanium as Ti (Dissolved) ug/l	< 1.0	< 1.0	< 1.0
Vanadium as V (Dissolved) ug/l	< 1.0	< 1.0	< 1.0
Zinc as Zn (Dissolved) ug/l	50.0	45.0	63.0
Zirconium as Zr (Dissolved) ug/l	< 1.0	< 1.0	< 1.0
Gross Alpha pic/l	< 3.5	< 3.5	< 3.5
Gross Beta pic/l	< 1.5	< 1.5	< 1.5
Conductivity umhos/cm	1,060	780	830
Total Organic Carbon mg/l	10.0	15.0	8.0
Total Carbon mg/l	13.0	18.0	12.0
Total Inorganic Carbon mg/l	3.0	3.0	4.0
Cesium as Cs ug/l	< 1.0	< 1.0	< 1.0
Cobalt as Co ug/l	11.0	20.0	3.0
Thorium as Th ug/l	< 1.0	< 1.0	< 1.0
Yttrium as Y ug/l	< 1.0	< 1.0	< 1.0
Uranium as U_2O_8 ug/l	< 1.0	< 1.0	< 1.0
Tin as Sn ug/l	< 1.0	< 1.0	< 1.0
Color pt.-co units	0	0	5
Aldrin ug/l	0.00	0.00	0.00
Lindane ug/l	0.00	0.00	0.00
Chlordane ug/l	0.0	0.0	0.0
DDD ug/l	0.00	0.00	0.00

	#22 Soldier Creek	#23 Pine Creek	#30 9-1 Spring
DDE ug/1	0.00	0.00	0.00
DDT ug/1	0.00	0.00	0.00
Dieldrin ug/1	0.00	0.00	0.00
Endrin ug/1	0.00	0.00	0.00
Toxaphene ug/1	0.0	0.0	0.0
Heptachlor ug/1	0.00	0.00	0.00
Heptachlor Epoxide ug/1	0.00	0.00	0.00
PCB ug/1	0.0	0.0	0.0
2-4-D ug/1	0.00	0.00	0.00
2-4-5-T ug/1	0.00	0.00	0.00
Silvex ug/1	0.00	0.00	0.00

Sincerely,

FORD CHEMICAL LABORATORY, INC.

Lyle S. Ford

LSF:lh

APPENDIX D

The Archaeological Potential of the Sage Point Coal Mine, Surface Facilities and Railroad Spur, Central Utah

by

Dale L. Berge

THE ARCHAEOLOGICAL POTENTIAL OF THE SAGE POINT COAL MINE, SURFACE FACILITIES AND RAILROAD SPUR, CENTRAL UTAH

by

Dale L. Berge

Department of Anthropology and Archaeology
Brigham Young University
Provo, Utah

Submitted to

Pacific Gas and Electric Company
245 Market Street
San Francisco, California 94106

September 1976

The purpose of this report is to define the archaeological problems which may be encountered by the Sage Point Coal Mine project and associated facilities proposed by Pacific Gas and Electric Company, San Francisco, California.

The project area is northeast of Wellington, Utah in Carbon County and south of the Book Cliffs.

In order to adequately understand the types of archaeological problems any company involved in soil disturbance acticities in Utah may encounter, a brief outline of the people who lived in the project area is presented.

The earliest cultural remains in Utah with adequate documentation is known as the Desert Culture. This desert orientation persisted into historic times and has allowed the archaeologist to project back from similar ethnohistoric groups the ways of life of their ancient forebearers. The basic social unit was the family, consisting of a man, his wife or wives, and children. The pattern of life was cyclic wandering from place to place in search of available food resources, including a variety of plants and animals. Their personal belongings were few and had to be functional, durable or easily manufactured. Their dependence on small seeds was widened by their use of baskets and flat milling stones. Their diet was further supplemented by every desert

animal that could be trapped, snared, clubbed or killed by a variety of other weapons.

These desert dwellers were more seasonal gatherers, extensively exploiting the environment, living in caves as they passed through areas. The dryness of these protected sites has yielded an extensive inventory of their technology which includes basketry, cordage, netting, matting, fur cloth, sandals, and a great variety of stone tools.

Around 3,000 B.C., a transition took place, evidenced by archaeological specialized subsistence base, along with the old characteristic traits. In the Northwest Columbia Plateau, there was a change to cultures dependent upon the food resources of the rivers. Whereas, the people living on the Colorado Plateau were introduced to primitive corn. Significant changes did not occur until around A.D. 1, when a new hybrid of corn from Mexico ushered in a completely new subsistence based on agriculture. Some people became sedentary, dependent on full corn agriculture, while others practiced horticulture, while still others continued the old pattern of seasonal hunting and gathering.

North of the Colorado River lived a horticultural people known as the Fremont Culture.. The Fremont Culture emerged as a separate archaeological entity about A.D. 500 and disappeared approximately A.D. 1300. However, radio-carbon dates reveal a slightly broader range. These people had reached a stage of incipient agriculture, but never

progressed further due to the lack of more advanced technology to control their environment. Although they depended upon corn, beans, and squash, they never became totally committed to horticulture but retained many of the techniques of hunting, gathering and processing wild food.

The Fremont developed a distinctive culture in Utah which is manifested in elaborate pictographs, figurines, and a variety of decoration techniques on pottery. They lived in structures built in the open, under rock shelters, and most often in semi-subterranean houses called "pithouses." Fremont villages were small, near water and tillable land. Rock shelters were used as temporary, seasonal shelters. Many sites consist of only a room or two.

In small villages the main social unit was probably no larger than the extended family. Their religion was not as highly organized as more advanced agriculturalists and their rock art seems to indicate a form of anthropomorphic worship. Horned figures, hump-backed flute players and other distinctive figures are possible indications of their religious beliefs. Clay figurines, most of which depicted human females, were quite elaborate and found in wall niches as if they were sacred. Another distinguishing feature is a unique form of grinding stone, called the Utah-type metate. This is a shovel-shaped stone with a deep trough and a platform at one end containing a secondary depression.

Previous works in the project area reveal that the Fremont people were very active in the Book Cliffs of Central Utah. Nine Mile Canyon, located to the north of Wellington

and the Book Cliffs has not been adequately surveyed, but several authors have indicated the importance of sites in the canyon. Reagan (1931a; 1931b; 1933), Beckwith (1931; 1932), and Gillin (1938; 1941) and others have reported specific archaeological finds from Nine Mile Canyon. Most of these pertain to the rich abundance of petroglyphs found in the canyon. Gillin (1938) excavated at least eight major sites after a preliminary surface survey. The most famous example of these sites is a site known as Shy House. Gunnerson (1962) reports wooden shovels from Nine Mile Canyon as well as his work in other areas (1957; 1969).

To the west of the project area some survey work has been done with limited results. The state archaeologist, Dr. David Madsen, excavated a Fremont site near Hiawatha.

In Castle Valley, south of Wellington, many Fremont sites have been recorded by myself (Berge, 1974) and Gunnerson (1969).

To the east of the project area almost nothing archaeologically has been done. Morss (1931) passed by the Fremont River and only briefly mentions the area.

A search of other records including those of the state archaeologist and the regional Bureau of Land Management archaeologist reveal no known sites in the specific project area. However, the area has never been surveyed for sites.

Conversations with some local people does indicate a tremendous number of sites in the Price area.

I have conducted three limited surveys in the area: two on the Book Cliffs above the project area for coal drilling operations; and one near East Carbon City. None of these surveys recorded any sites.

With regards to the specific project, namely the coal mine, surface facilities and the railroad spur, there is a significant potential for archaeological sites in the area. This assumption is based on the high density of sites both to the north and south of Wellington. In addition, there is a good water source near by as well as vegetation which provide food sources. The pinyon-juniper forest will most likely contain more sites than grassy or sagebrush areas.

Wherever PG&E plan operations which will cause soil disturbances, there will be a potential for the destruction of sites. Therefore, to avoid impact to any sites, an intensive archaeological survey should be conducted in those areas where the ground will be disturbed. It may not be necessary to survey the entire area unless further disturbance will be required. As I see the project at this point, those areas which should be examined are the mine portals, building facilities, the conveyors and the railroad right-of-way.

Once the sites have been identified an evaluation of

their significance should be made as to how to determine mitigation. These are two alternatives if the sites are important: (1) they can be avoided, or (2) they can be salvaged through excavation.

An archaeological project will require more than just the location of sites and the collection of artifacts. The objects recovered through survey and/or excavation will have to be analyzed in the laboratory, written into a report and published. An estimate of the cost will be provided whenever one is needed.

REFERENCES

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Berge, Dale L.

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Ferguson, C. W., Jr.

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Gunnerson, James H.

1957 An Archaeological Survey of the Fremont Area. University of Utah Anthropological Papers, No. 28. Salt Lake City.

1962 Unusual Artifacts from Castle Valley, Central Utah. University of Utah Anthropological Papers, No. 60, pp. 67-92. Salt Lake City.

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Morss, Noel
1931 The Ancient Culture of the Fremont River in Utah. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, Vol. 12, No. 3.

Reagan, A. B.
1931a Some Archaeological Notes on Nine Mile Canyon, Utah. El Palacio, Vol. 31, No. 4, pp. 45-71. Santa Fe.

1931b Ruins and Pictographs in Nine Mile Canyon, Utah. Transactions of the Illinois Academy of Science, Vol. 24, No. 2, pp. 369-370. Springfield.

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DECISION DOCUMENT

Sunoco Energy Development Company

Sage Point-Dugout Canyon Mine

7 Letters of Concurrence and Consultation

8 Permit with Conditions

9 Technical Analysis (TA)

- Technical Analysis (March 16, 1983)
- Technical Analysis Addendum (July 14, 1983)
- Supplement No. 1 - Technical Analysis (Sept, 15, 1983)
- Supplement No. 2 - Technical Analysis (Feb. 17, 1983)

10 Notifications

- Affidavit of PAP Publication
- Notice of Pending Decision

United States Department of the Interior
OFFICE OF SURFACE MINING
Reclamation and Enforcement
BROOKS TOWERS
1020 15TH STREET
DENVER, COLORADO 80202

MAR 26 1984

MEMORANDUM

TO: Director, Office of Surface Mining

FROM: Administrator, Western Technical Center

SUBJECT: Recommendation for Approval of Sunoco Energy Development Company's Sage Point-Dugout Canyon Mine Mining Plan and Permit Application, Carbon County, Utah, Federal Leases: U-07746; U-092147; U-0144820; U-07064-027821.

I. Recommendation

I recommend approval with conditions of the Sunoco Energy Development Company's (Sunedco) Sage Point-Dugout Canyon mine permit for an underground operation. This is an application for a new mine. The permit term is for five years and the permit area is 4,475 acres. Sunedco's permit application package (PAP) was reviewed under the Federal Lands Program and the approved Utah State Program. My recommendation is based on the technical analysis and environmental assessment of the complete PAP as updated through January 4, 1984. The permit with conditions included with this memorandum will be in conformance with the applicable Federal regulations, the Utah State Program, and the Mineral Leasing Act as amended.

The Utah Division of Oil, Gas and Mining (UDOGM) and the Office of Surface Mining (OSM), identified elements of the applicant's proposal which require conditions to comply with State and Federal law. The State permit ACT/007/009 with conditions will be issued separately from the proposed Federal permit UT 0041, 3/84. The State Regulatory Authority will issue its permit concurrently with the Federal permit.

Portions of 4 Federal coal leases are included within the proposed mining plan and initial SMCRA permit areas. These include U-7746; U-092147; U-0144820; U-07064-027821. In addition, two areas of fee (private) coal are proposed for mining. Federal coal constitutes 86.5 percent of the coal in the initial SMCRA permit area and Fee coal constitutes 13.5 percent. Sunedco's proposed area of mining plan approval is 3,080 acres and constitutes those portions of the four Federal coal leases included within the initial SMCRA permit area. A portion of a 5th Federal lease (#U-089096) is included within the proposed life of mine area.

The BLM found Sunedco's revised PAP (4,475 acres) to be in compliance with 43 CFR 3480 on March 15, 1984. Accordingly, I also recommend that you advise the Assistant Secretary for Land and Minerals Management, under 30 CFR 746.14, that the Sunedco's Sage Point-Dugout Canyon 3,080-acre mining plan is ready for approval.

I concur that a performance bond in the amount of $611,875 is adequate. The bond amount required of the applicant will be increased annually to account for inflation.

II. Background

The proposed Sage Point-Dugout Canyon underground coal mine project is located 15 miles northeast of Price in Carbon County, Utah. Surface ownership of the proposed initial SMCRA permit area is 42.7 percent Federally-owned (1910 acres), 55.4 percent privately-owned (2480 acres) and 1.9 percent (85 acres) is owned by Carbon County.

In December 1982, Sunedco requested approval of a permit application package (PAP) for approximately 40 years of underground coal mining. This application was originally submitted in December 1980 by Eureka Energy Co. The size of this life-of-mine application was 18,242 acres. Several letters were sent to the applicant by the regulatory authorities in 1983 which resulted in Sunedco submitting PAP revisions in June and December 1983 and in January 1984. On November 2, 1983, after considerable discussion with Sunedco and UDOGM, OSM indicated that four major problem areas remained with Sunedco's PAP.

On December 21, 1983, and on January 4, 1984, Sunedco responded to OSM's concerns by addressing the major problems areas, and by substantially revising their SMCRA permit application. This revision provided for a greatly reduced scale of operations. The area of initial SMCRA permit approval being sought was reduced from 18,242 acres (476.5 acres of surface disturbance) to 4,475 acres (70 acres of surface disturbance). Sunedco removed the proposed central facilities area and proposed Fish Creek mine portals area and accompanying facilities from their proposed initial permit area and considerably lessened the area from which they initially planned to remove coal. (See accompanying maps labeled Permit Boundaries, and Life of Mine Permit Area). Sunedco's December 21, 1983 and January 4, 1984 submittals specifically included:

> Updated right-of-way information for the initial (4,475 acre) SMCRA permit area, including documentation that the company had been issued Industrial Occupancy Lease #U-52808 by the BLM. This 740-acre lease allows Sunedco to disturb the necessary surface for the construction of the facilities needed to initially commence mining activity in the Dugout Canyon area. This BLM lease satisfies the right-of-entry requirements of Sunedco's revised SMCRA permit area.

Revised permit term information indicating that while the applicant proposes to operate the Sage Point-Dugout Canyon project for 40 years, the subject PAP is only for 5 years. The revised PAP states that within the initial SMCRA permit area, no mine-related activity will occur on the Soldier Creek alluvial valley floor and sufficient water will continue to be available to irrigate this area. Revised permit maps were also submitted.

An exact legal description of the Dugout Canyon County road that will be permitted for mine access in this permit term.

Revised alternative water supply information justifying that coal mining and related activities would have no adverse effects on the quantity of the water supply in the project area.

Revised and complete reclamation procedures and related information for the Dugout Canyon waste rock disposal site. This information included: final slope configurations for the durable rock fill, soil descriptions, soil salvage depths and procedures, soil replacement procedures, revegetation methods, the methods by which the fill would be constructed, revised drawings of the fill, and the revised cost estimates for reclamation of the fill area.

A geotechnical analysis of the highwall stability of the Dugout Canyon portal.

The Sage Point-Dugout Canyon operation encompasses high quality wildlife habitat. Environmentally sensitive areas within the permit boundaries are raptor nesting sites, and mule deer critical winter range.

Approximately 120 miners will be employed at the mine for this permit term (5 years). Both room and pillar and longwall mining methods will be used to mine the Sunnyside, Rock Canyon and Gilson coal seams. During the initial years of mining, maximum coal production should not exceed 1.2 million tons annually. This production level may increase depending on future coal sales. Newly mined coal will be transported from the mine mouth by truck and would be hauled approximately 20 miles via county road and state highway to an existing railroad siding. All underground mining operations are scheduled to cease around the year 2026 according to Sunedco's life-of-mine plan.

Sunedco has indicated that it intends to submit a revised PAP for the life-of-mine area within 2-3 years after receiving its initial permit approval.

The Sage Point-Dugout Canyon mine permit application was reviewed by the Office of Surface Mining and UDOGM, using the approved Utah State Program and the Federal Lands Program (30 CFR Chapter VII, Subchapter D). The Mineral Leasing Act portion of the plan was also reviewed for compliance with the applicable portion of 43 CFR Part 3480 (i.e., requirements and responsibilities of the Minerals Management Service). The technical analysis for this mine application was prepared by UDOGM and the environmental assessment was prepared by OSM. These documents, other documents prepared by UDOGM, the company's application, and other correspondence developed during the completeness and technical reviews are part of OSM's mining plan and permit application file. The UDOGM and OSM developed proposed conditions to assure compliance with State and Federal regulations.

A chronology of events related to Sunedco's PAP is enclosed. After Sunedco published the newspaper notice as required, no written comments, objections, or requests for an informal conference were received. There was no informal conference or hearing requested on Sunedco's application and no issues have been raised by the public.

Written concurrence was provided by the Bureau of Land Management (BLM). Conditions were incorporated from comments of the BLM, USFWS, Utah State Department of Community and Economic Development, and the State Historic Preservation Office.

The information in the PAP, as well as other information documented in the recommendation package and made available to the applicant, has been reviewed by the UDOGM staff in coordination with the OSM Project Leader. Other information included: the 1979 U.S. Geological Survey Final Environmental Impact Statement (FEIS) titled "Development of Coal Resources in Central Utah".

United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
WASHINGTON, D.C. 20240

APR 2 4 1984

Memorandum

To: Assistant Secretary for Land and Minerals Management

From: Director, Office of Surface Mining

Subject: Recommendation for Approval of the Sage Point-Dugout Canyon Mine Mining Plan, Sunoco Energy Development Company, Carbon County, Utah, Federal Leases U-07746; U-092147; U-144820; U-07064-027821

I am prepared to approve a permit for the Sage Point-Dugout Canyon mine pursuant to the Surface Mining Control and Reclamation Act and subject to approval of the mining plan. My decision to approve the Sunoco Energy Development Company's permit is based on: (1) the applicant's complete permit application, (2) our permit conditions, (3) public participation, (4) review of the application by the Office of Surface Mining, (5) review of the application by the State as required by the approved Utah State Program, and (6) compliance with the National Environmental Policy Act. The OSM permit incorporates the State's permit. The proposed operation will be in compliance with all applicable laws and regulations.

The Secretary may approve a mining plan for Federal lands under 30 U.S.C. 207(c) and 1273(c).

I recommend the Sage Point-Dugout Canyon mine mining plan updated through January 4, 1984, be approved.

Approval:

I approve this proposed mining plan:

Lena A. Pourc
ACTING Assistant Secretary for Land and Minerals Management

4/26/84
Date

STATE OF UTAH
NATURAL RESOURCES
Oil, Gas & Mining

State Office Building • Salt Lake City, UT 84114 • 801-533-5771

Scott M. Matheson, Governor
Temple A. Reynolds, Executive Director
Dr. G. A. (Jim) Shirazi, Division Director

February 17, 1984

Mr. Allen D. Klein, Administrator
Western Technical Center
Office of Surface Mining
Brooks Towers
1020 Fifteenth Street
Denver, Colorado 80202

RE: Revisions to Technical Analysis
and Recommendations for Approval
Sunoco Energy Development Company
Sage Point-Dugout Canyon Mine
ACT/007/009, Folder No. 2
Carbon County, Utah

Dear Mr. Klein:

Since the Division transmitted the final Technical Analysis (TA) for the Sage Point-Dugout Canyon Mine in March of 1983, several changes have occurred in the Permit Application Package (PAP) that have required corresponding changes in the TA. A Technical Analysis Addendum was submitted in July of 1983 and Supplement I to the Technical Analysis analyzing the PAP's compliance with regulations that were found not to have been legally suspended by the State of Utah, was submitted in September.

This letter and its attachments serve to notify you of further changes in the TA, brought about by changes to the PAP submitted by Sunoco Energy Development Company (Sunedco) on December 21, 1983 and January 4, 1984.

A major change in the permit area has occurred with this latest submittal. Sunedco had originally requested a life-of-mine permit for a permit area covering a total of 18,242 acres. Due to Sunedco's inability to gain legal right-of-entry to the entire permit area at this time, the permit has been revised to a five-year permit with a total permit area of 4,475 acres. Approximately 70 surface acres will be disturbed during the five-year permit term. Maps D03-002A and B (attached) show the boundaries of the originally proposed life-of-mine permit area and the five-year permit area currently proposed.

The December 21, 1983 submittal also addressed several technical issues that were of concern to the regulatory authority. These issues included Alternative Water Supply, Reclamation of the Dugout Canyon Waste Rock Disposal Site, the Alluvial Valley Floor issue and Stability of Highwalls. The technical adequacy of this submittal in these four areas is addressed in Supplement II to the Technical Analysis (February 17, 1984).

The recent changes to the PAP have also necessitated changes to certain of the original Findings, to the Mine Plan Information form, to the Stipulations list and to the Bond. Updated Findings and Mine Plan Information sections have been prepared accordingly. A revised Final Stipulations List and Bond Estimate are included in Supplement II to the Technical Analysis.

It is the Division's opinion that Sunedco has answered all requirements for a five-year permit, and the Division is ready to issue a five-year permit with conditions. It is recommended that the Office of Surface Mining do the same at this time. The Division will be happy to provide any additional information or clarification to make this possible.

Sincerely,

James W. Smith, Jr.
Coordinator of Mined
Land Development

JWS/SCL:btb

Enclosures

cc: Shirley Lindsay, OSM
Charlie Durrett, Sunedco
S. Linner, DOGM

MINE PLAN INFORMATION FORM

February 17, 1984

Mine Name: Sage Point-Dugout Canyon Mine State ID: ACT/007/009

Operator: Sunedco Coal Company County: Carbon

Controlled By: Sunoco Energy Development Company

Contact Person(s): Charles Durrett Position: Environmental Coordinator

Telephone: (303) 989-9280

New/Existing: New Mining Method: Room & Pillar; Longwall

Federal Lease No(s).: U-07746; U-092147; U-0144820; U-07064-027821
Legal Description(s): See attached sheet.

State Lease No(s).: None.
Legal Description(s): None.

Other Leases (identify): Fee Coal (Fish Creek Canyon); Fee Coal (Dugout Canyon).
Legal Description(s): T. 13 S., R. 12 E., Sec. 16: E1/2; T. 13 S., R. 12 E., Sec. 23: W1/2 NE1;4, E1/2 NW1/4

Ownership Data:

Surface Resources (acres)	Existing Permit Area	Total Life of Mine Area	Proposed Permit Area
Federal	NA	6,999	1,910
State		960	0
Private		10,243	2,480
Other (County)		40	85
TOTAL		18,242	4,475
Coal Ownership (acres):			
Federal	NA	15,186	3,080
State		2,256	0
Private		800	480
Other			0
TOTAL		18,242	3,560

Coal Resource Data	Total Reserves (1981)	Total Recoverable Reserves (1981)
Federal		
State		
Private		
Other		
TOTAL		

Recoverable Reserve Data	Name	Thickness	Depth
Seam	Sunnyside	4.4 feet	150-200 feet
Seam	Rock Canyon	6.8 feet	300-350 feet
Seam	Gilson	7.3 feet	350-400 feet
Seam			
Seam			
Seam			

Mine Life: 49 years
Average Annual Production: 2,430,469 tons Percent Recovery: 52%
Date Projected Annual Rate Reached: 1993
Date Production Begins: 1986 Date Production Ends: Unknown
Reserves Recoverable By: (1) Surface Mining: None
(2) Underground Mining: 100%
Reserves Lost Through Management Decisions: Unknown
Coal Market: Unknown

None

LEGAL DESCRIPTIONS OF FEDERAL LEASES

Lease No. U-07746

T. 13 S., R. 12 E., Sec. 10: S1/2; Sec. 11: S1/2; Sec. 14: All; Sec. 15: All; Sec. 22: N1/2, N1/2 S1/2; Sec. 23: W1/2 NW1/4

Lease No. U-092147

T. 13 S., R. 12 E., Sec. 17: E1/2 SW1/4, SE1/4; Sec. 20: E1/2 NW1/4, SW1/4 NW1/4, N1/2 NE1/4; Sec. 21: N1/2 NW1/4, NE1/4

Lease No. U-0144820

T. 13 S., R. 12 E., Sec. 3: Lots 1, 2, 3, 4 S1/2 (All); Sec. 4: Lots 1, 2, 3, 4, S1/2 (All); Sec. 5: Lots 1, 2, SE1/4; Sec. 9: All; Sec. 10: N1/2; Sec. 11: N1/2

Lease No. U-07064-027821

T. 13 S., R. 12 E., Sec. 13: S1/2; Sec 23: E1/2 E1/2, W1/2 SE1/4, NE1/4 SW1/4; Sec. 24: All; Sec. 25: N1/2 N1/2; Sec. 26: N1/2 NE1/4,

T. 13 S., R. 13 E., Sec. 18: Lots 3, 4, E1/2 SW1/4, SE1/4; Sec. 19: Lots 1, 2, 3, 4, E1/2 W1/2, NE1/4, NW1/4 SE1/4; Sec. 30: Lot 1