APPENDIX R614-301-400

Land Use and Air Quality

Scott M. Matheson
Governor

James O. Mason, M.D., Dr.P.H.
Executive Director
801-533-6111

DIVISIONS
Community Health Services
Environmental Health
Family Health Services
Health Care Financing and Standards

OFFICES
Administrative Services
Health Planning and Policy Development
Medical Examiner
State Health Laboratory

STATE OF UTAH
DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110

Alvin E. Rickers, Director
Room 426 801-533-6121

533-6108
August 17, 1981

RECEIVED
AUG 21 1981
By

Trevor G. Whiteside
Valley Camp of Utah, Inc.
Scofield Route
Helper, UT 84526

RE: Air Quality Approval Order for Increase of Coal Production

Dear Mr. Whiteside:

On April 30, 1981, the Executive Secretary published a notice of intent to approve your increase in coal production from 1.2×10^6 tons/year to 2.25×10^6 tons/year. The 30-day public comment period expired on May 30, 1981 and no comments were received.

This air quality approval order authorizes the increase in production as proposed in your notice of intent dated March 26, 1981 with the following conditions:

1. The conveyor hood sections shall be securely positioned when transporting coal and be maintained in good operating condition.

2. The conveyor head chutes, reclaim tunnel feeder chutes and vibrator feeder discharge chutes shall be totally enclosed and maintained in good operating condition.

3. The conveyor skirtboards shall be properly positioned when transporting coal and be replaced as needed.

4. Stacker tube dust flaps shall be replaced as needed.

5. The 2.2 miles of haul road shared with other companies shall be paved no later than September 1, 1982. In the interim, the road shall be chemically stabilized to minimize fugitive emissions. A record/log of all treatments including date, amount and location shall be kept and made available to the Executive Secretary upon request.

6. The unpaved sections of haul roads not covered in condition #5 shall be chemically stabilized as necessary with dust suppressive material. A record/log of all treatments including date, amount and location shall be kept and made available to the Executive Secretary upon request.

7. All conveyor transfer points shall be equipped with water sprays.

8. The opacity of the crushing plant baghouse shall not exceed 20%. The baghouse shall be maintained in good operating condition.

9. No visible emissions, except from internal combustion engines, shall exceed 20% opacity as per Section 4.1.2, Utah Air Conservation Regulations (UACR). Visible emissions from diesel engines shall not exceed 20% opacity except for starting motion no farther than 100 yards or for stationary operation not exceeding three minutes in any hour according to Section 4.1.4, UACR.

10. All surge bins for loading of trucks or railroad cars shall be equipped with a telescoping chute to minimize the fall distance of the coal.

11. Total annual production of coal from the two mines and crushing plant throughput shall not exceed 2.25×10^6 tons without prior approval from the Executive Secretary according to Section 3.1, UACR.

12. The Executive Secretary shall be notified when monthly production reaches full capacity as a compliance inspection is required.

You are considered a minor source for purposes of the PSD regulations and will not require a permit from EPA/Region VIII. However, for State purposes you are a major source.

According to Section 3.9, UACR, a fee for the cost associated with processing this permit is required to be paid to the State of Utah upon receipt of this approval order. The final costs are attached.

Sincerely,

Brent C. Bradford
Executive Secretary
Utah Air Conservation Committee

DR:jw
cc: Southeastern District Health Dept.
EPA Region VIII (D. Kircher)
enclosure

Copy to Mary

SCOTT M. MATHESON
GOVERNOR

STATE OF UTAH
DEPARTMENT OF COMMUNITY AND
ECONOMIC DEVELOPMENT

Division of
State History
(UTAH STATE HISTORICAL SOCIETY)

MELVIN T. SMITH, DIRECTOR
307 WEST 2ND SOUTH
SALT LAKE CITY, UTAH 84101
TELEPHONE 801/533-5755

DIVISION OF
OIL, GAS & MINING

January 7, 1981

James W. Smith
Division of Oil, Gas and Mining
Department of Natural Resources
1588 West North Temple
Salt Lake City, Utah 84116

RE: Skyline Mine - Coastal State's Energy Company, Carbon County, Utah

Dear Mr. Smith:

The staff of the Utah State Historic Preservation Officer has received your letter of October 24, 1980. The staff, having reviewed the submitted report by Archeological Environmental Research Corporation, entitled "Archeological Surface Evaluations in the Skyline Project in Carbon and Emery Counties," has determined that the report is adequate to determine mitigation of impacts of the proposed operations on historic and cultural resources. Because of the limited number of resources and the described no adverse effect upon them in the Skyline Mine project, it is felt that this report could satisfactorily be submitted as part of a mining program as outlined by the Memorandum of Agreement between the Division of State History and the Division of Oil, Gas and Mining.

The Preservation Office is aware of the December 22, 1980 letter submitted to Coastal States Energy by the Office of Surface Mining concerning the adequacy of the report for submission. Our office agrees that there are many technical errors in the report. However, since the cultural resources are not eligible and there is no adverse effect, the mine plan should be approved.

The Office of Surface Mining has pointed out some serious problems with this report and others. The Preservation Office of Utah would like to suggest to Oil Gas & Mining and the Office of Surface Mining that a meeting be set up to determine some specific guidelines that can be dealt with on a systems basis rather than individual cases.

State History Board: Milton C. Abrams, Chairman • Thurion H. Luke • Ted J. Warner • Elizabeth Montague • Thomas G. Alexander • Dale G. Dalton

Should you need assistance or clarification, please call or write James L. Dykman, Cultural Resource Advisor, or Wilson G. Martin, Preservation Development Coordinator, Utah State Historical Society, Preservation Development, 300 Rio Grande, Salt Lake City, Utah 84101.

Sincerely,

Melvin T. Smith

Melvin T. Smith
Director and
State Historic Preservation Officer

JLD:jr:C942CB

cc: Office of Surface Mining, Attn: Bill Killiam, Brooks Towers, 1020 15th Street, Denver, Colorado 80202

INTENSIVE ARCHEOLOGICAL SURFACE EVALUATIONS IN THE PROPOSED WHISKEY CREEK CANYON-PLEASANT VALLEY PROJECT IN CARBON COUNTY, UTAH

Mine Plan Applicant:
Valley Camp of Utah, Inc.
(Coal Mine and General Service Facilities
Relative to Belina #1 and #2 and Utah #12 Mines)

F. R. Hauck, Ph.D., Principal Investigator

Report Prepared by:
F. R. Hauck, and D. G. Weder
ARCHEOLOGICAL-ENVIRONMENTAL
RESEARCH CORPORATION

PAPER NO. 21
September, 1980

Salt Lake City, Utah

ABSTRACT

In the summer of 1980, the Archeological-Environmental Research Corporation conducted an intensive cultural resource evaluation for Valley Camp Coal Company of Utah in the Pleasant Valley-Eccles Canyon locality south of Scofield, Utah. The survey consisted of a corridor evaluation extending from the proposed mine facilities in Whiskey Canyon to the Utah No. 2 Mine location.

A total of seven historic cultural resource sites is situated within, or adjacent to, the project area. These sites include four mine portal service areas, one sawmill site, and two cabin foundations. One of the seven sites is considered to meet the minimal criteria of eligibility under 36 CFR 60.6.

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Chapter I - INTRODUCTION

A. General Data on the Project

In the spring of 1980, the Archeological-Environmental Research Corporation (AERC) of Salt Lake City was contacted by Vaughn Hansen Associates, a Salt Lake City consulting firm, on behalf of Valley Camp of Utah, Inc. and contracted to perform an intensive cultural resource evaluation of mine portal areas, transportation corridors and service areas relative to the development of mine facilities in the Whiskey Canyon-Eccles Canyon-Pleasant Valley locality of Carbon County, Utah. Mine permits involved in this locality include Belina #1 and #2 and Utah #2. Vaughn Hansen Associates (VH) in conjunction with Valley Camp of Utah, Inc., desirous of preparing a mine plan application for submission to federal and state authorities, requested that cultural resource evaluations be conducted within the potential subsidence zone which would comply with pertinent government legislation, i.e., Executive Order 11593 "Protection and Enhancement of Cultural Environment" (Federal Register, Vol. 36, No. 95, May 15, 1971), and "The Archeological and Historical Data Conservation Act of 1974", which is an amendment of "The Reservoir Salvage Act of 1960" (74 Stat. 220). For additional information, please refer to the mine plan application prepared by Vaughn Hansen Associates.

AERC's field evaluations within this project area commenced in the summer of 1975 when F. R. Hauck began conducting proposed drill location evaluations for Valley Camp but in association with Sanders Associates, a consulting firm with offices in Kaysville, Utah. AERC's consulting for Sanders Associates (see report for June 13, July 17, October 13, November 28, 1975 and July 17 and August 23, 1976) featured

specific evaluations made within the general Scofield locality although no evaluations were actually conducted within the present project area.

Beginning in September, 1978, AERC began consulting for Coastal States Energy Company upon the Skyline Project which is situated on the west and adjacent to the Valley Camp project area (see Figure 1). Reports on AERC investigations in the Coastal States project area were furnished as CSEC-78-1 (10/2/78), CSEC-79-2 (7/23/79), CSEC-79-3 (8/10/79), CSEC-79-5 (9/18/79). In 1979, AERC conducted an intensive surface evaluation of the floor of Eccles Canyon extending from the mouth of that canyon on the west into the National Forest lands (see CSEC-79-2). That survey includes the entire floor of Eccles Canyon which will be included in the present mine plan permit application. During these preliminary cultural resource evaluations, only three cultural resource sites were recorded in the general locality. These sites included two historic campsites, AERC 270U/1 and 2, and one historic mine portal, service area, AERC 270N/1. All three sites are situated in Eccles Canyon; however, only the first two sites, 270U/1 and 2, need be considered in this report. Site 270N/1 is adjacent to the National Forest boundary up the canyon from the Valley Camp project area. No other cultural resources in the Eccles Canyon-Whiskey Creek locality had been recorded prior to AERC's surface evaluations being reported in this document.

From July 22-25, 1980, AERC personnel conducted intensive evaluations of the Whiskey Creek corridor and an extension of the Eccles Canyon corridor running north from the mouth of Eccles Canyon along the west bench of Pleasant Creek to the existing service area at the mouth of Green Canyon. Some four historic sites were recorded during this recent survey. Thus, a total of six historic cultural resource sites are situated within the Valley Camp mine plan permit area.

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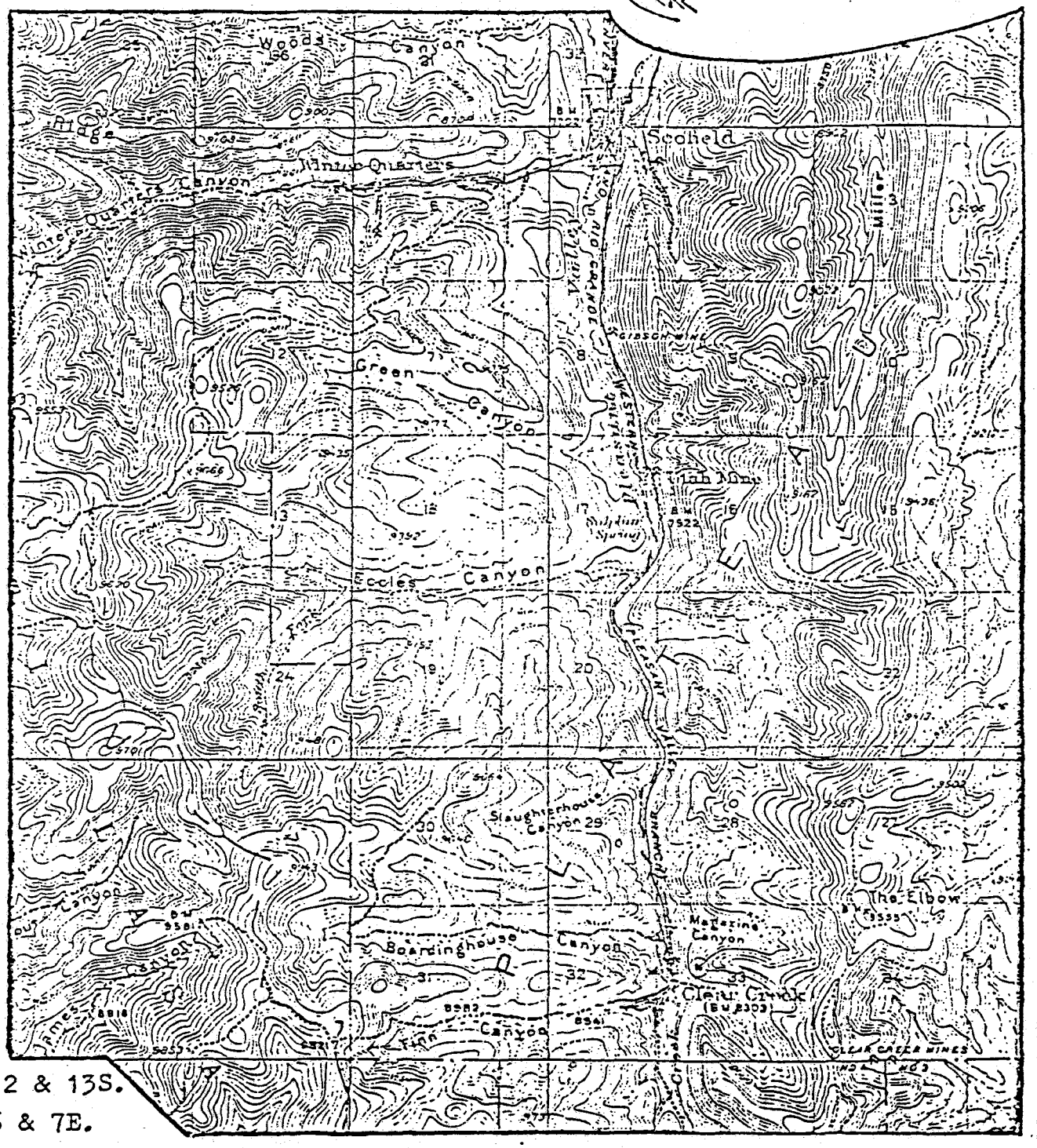

T. 12 & 13S.

R. 6 & 7E.

Meridian: Salt Lake B. & M.

Quad:

Scofield, Utah

15 Minute USGS

Project: VH-80-1

Series: Central Utah

Date: 9-17-80

Figure 1

GENERAL MAP
OF THE PROJECT AREA
IN THE
SCOFIELD LOCALITY
OF CARBON COUNTY, UTAH

Legend:

N

1 0 1 2 M.

0 1 2K.

Scale

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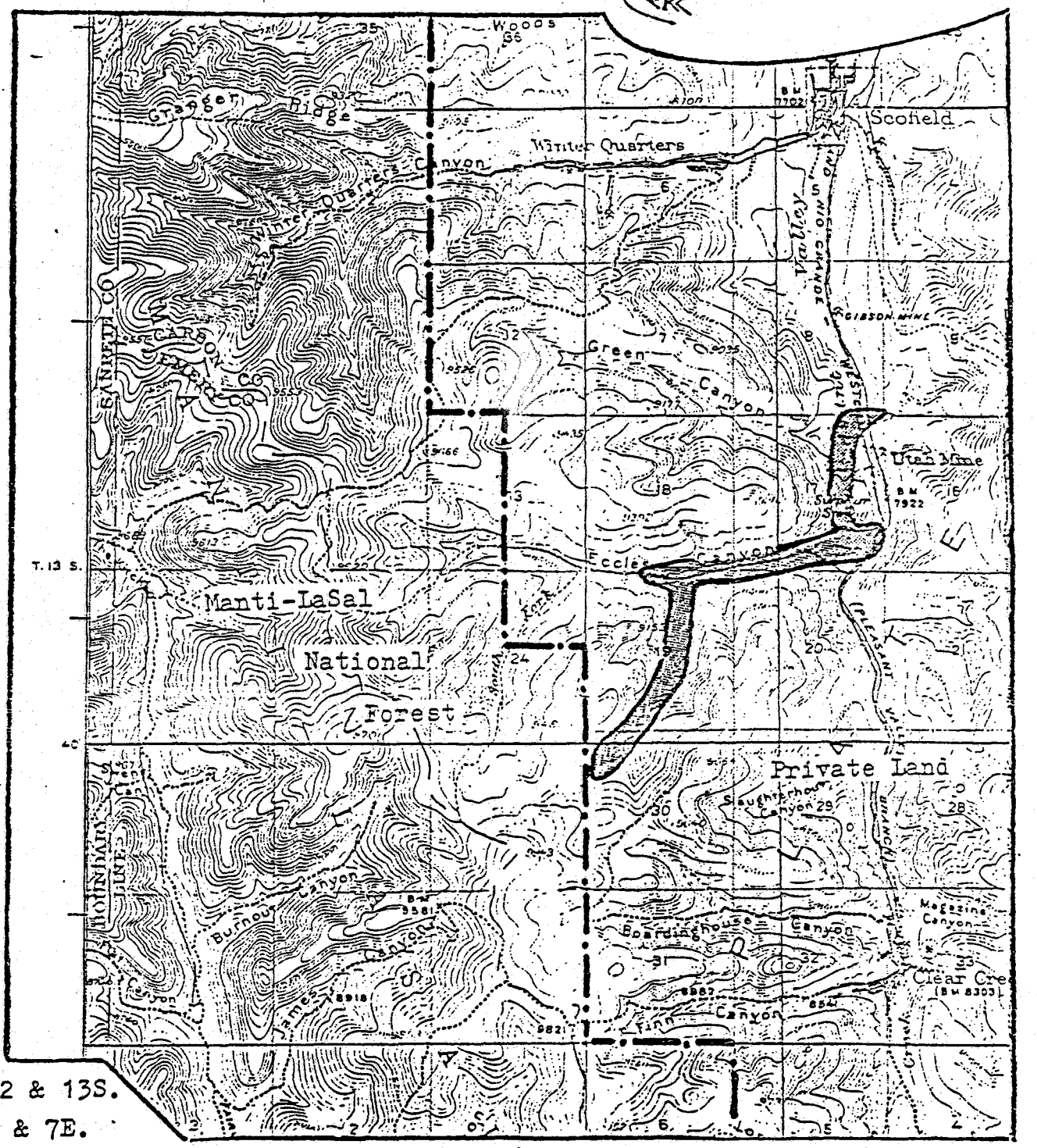

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Meridian: Salt Lake B. & M.

Quad: Scofield, Utah 15 Minute USGS

Project: VH-80-1

Series: Central Utah

Date: 9-17-80

Figure 2

SURVEY AREA AND LAND OWNERSHIP IN THE PROJECT AREA

Legend:

Survey Corridor

1 0 1 2 M.

0 1 2K.

Scale

Recommendations concerning site significance and mitigational techniques relative to those six sites are provided in this report.

All surveyed areas relative to the present mine plan permit are situated on privately owned lands and no federal antiquities permits have been procured to conduct the 1980 research.

The resource inventory area for the 1980 research involves about three miles of transmission corridor of 60 meters in width extending from the northwest quarter of Section 30 in Whiskey Creek north through the center of Section 19 into the bottom of Eccles Canyon and then east through Section 18 into Pleasant Valley and north in Section 17 to Section 8 and then east to the Utah No. 2 Mine location in the northeast quarter of Section 17, Township 13 South, Range 7 East, Salt Lake Base and Meridian. At special request from Valley Camp, AERC personnel also examined the Nicolitus Mine, the Green Canyon sawmill site and the Gibson Mine, all located in Pleasant Valley but outside the transmission corridor. This project area is situated about two miles south of Scofield, Utah, with the eastern corridor paralleling Utah State Highway No. 96 in Pleasant Valley. The Scofield, Utah, U.S.G.S. 15 Minute topographic map shows the project area.

All field notes and site data are filed at AERC headquarters in Bountiful, Utah. Site reports are being submitted to all relevant state and federal agencies as an appendix to this report. Artifacts collected during the survey are being curated at the Museum of Peoples and Cultures at Brigham Young University in Provo, Utah.

B. Environment and Locality

The project locality is situated in several narrow canyons which drain northwards into Scofield Reservoir via

Eccles Canyon Creek and Pleasant Valley Creek. The general elevation of the project area ranges between about 7750 feet at the Gibson Mine to about 9200 feet at the head of Whiskey Canyon.

The high elevations in the project area have a strong effect on the local climate. The precipitation amounts to about 30 inches annually, but most of this precipitation falls in the form of snow since the May to September precipitation is only eight inches (Utah Water and Power Board). Elevation and exposure also determine the freeze free growing period which is as low as 20 days per year at the highest elevation, but not greater than 60 days at the lowest elevations.

The surface geology of the project locality is relatively simple. The majority of the canyon's lower surfaces consists of an exposure of the Cretaceous age Star Point Sandstone, a formation of marine, deltaic and beach deposits of interbedded sandstone and shales. Above the Star Point is exposed the Black Hawk Group, a Cretaceous age deposit which consists of sandstone, mudstone, shale and coal.

The high elevation places the project locality within the Montane floral ecozone, but topographic factors create a mosaic of different plant communities. In the Montane ecozone, the following arboreal species are typically present in the project area (Johnson 1970):

Common Arboreal Species	
Limber pine	*Pinus flexilis*
Engelmann spruce	*Picea engelmannii*
Blue spruce	*Picea pungens*
Subalpine fir	*Abies lasiocarpa*
White fir	*Abies concolor*
Douglas fir	*Pseudotsuga menziesii*
Rocky Mountain juniper	*Juniperus scopulorum*

Common juniper	Juniperus communis
Mountain mahogany	Cercocarpus ledifolius
Aspen	Populus tremuloides
Serviceberry	Amelanchier spp.

Due to topographic factors, the east-facing side and bottom of Whiskey Canyon are predominately aspen whereas the west-facing side is a mixture of evergreen species.

The floral community along the Pleasant Valley Creek bottom include mixtures of willow Salix spp., sagebrush Artemisia tridentata, rabbit brush Chrysothamnus nauseosus and grasslands grading into mountain shrub communities.

The project locality is situated in the Northern High Plateau Subcenter of the Middle Rocky Mountain Faunal area and is characterized by a wide variety of species. The mammal species known to exist in the general project area according to Durrant (1952) include the following:

Order Insectivora

Shrews	Sorex spp.

Order Lagomorpha

Pika	Ochotona princeps
White-tailed jack rabbit	Lepus townsendii
Snowshoe rabbit	Lepus americanus
Cottontail rabbit	Sylvilagus nuttallii

Order Chiroptera

	Myotis spp.
Silvery-haired bat	Lasionycteris spp.
Big brown bat	Eptesicus spp.
Red bat	Lasiurus spp.
Long-eared bat	Corynorhinus spp.
Big free-tailed bat	Tadarida spp.

Order Rodentia

Squirrels	Citellus spp.
Chipmunks	Eutamius spp.

Northern pocket gopher	Thomomys talpoides
Beaver	Castor canadensis
Western harvest mouse	Reithrodontomys megalotis
Mouse	Peromyscus
Meadow mouse	Microtus spp.
Wood rat	Neotama cinerea
Big jumping mouse	Zapus princeps
Porcupine	Erethizon dorsatum
Marmot	Marmota flaviventer
Order Carnivora	
Coyote	Canis latrans
Wolf (formerly in area)	Canis lupus
Red fox	Vulpes fulva
Gray fox	Urocyon cinereoargenteus
Grizzly bear (formerly in area)	Ursus horribilis
Black bear	Ursus americanus
Ring-tailed cat	Bassaricus astutus
Ermine	Mustela erminea
Long-tailed weasel	Mustela frenata
Marten	Martes caurina
Badger	Taxidea taxus
Striped skunk	Mephitis mephitis
Spotted skunk	Spilogale gracilis
Canada lynx	Lynx canadensis
Bobcat	Lynx rufus
Mountain lion	Felis concolor
Order Artiodactyla	
Elk	Cervus canadensis
Mule deer	Odocoileus hemionus
Mountain sheep (formerly in area)	Ovis canadensis

The montane ecozone also supports a wide variety of avian species, some of which are summer migrants. Some of these species, according to Hayward et al (1976) include the following:

Local Avian Species

Coniferous Niche

Red-breasted nuthatch	Sitta canadensis	(summer)
Golden-crowned kinglet	Regulus satrapa	
Ruby-crowned kinglet	Regulus calendua	
Yellow-rumped warbler	Dendroica coronata	(summer)
Western tanager	Piranga ludoviciana	(summer)

Aspen Niche (Hole nesting)

Tree swallow	Tachycineata bicolor	
Violet green swallow	Tachycineata thalassina	(summer)
House wren	Troglodytes aedon	(summer)
Black-capped chickadee	Parus atricapillus	
Yellow-bellied sapsucker	Sphyrapicus varius	
Downy woodpecker	Picoides pubescens	
Common flicker	Colaptes auratus	
Chipping sparrow	Spizella passerina	(summer)
Cassin's finch	Carpodacus cassinii	(summer)
Black-headed grosbeak	Pheucticus melanocephalus	(summer)
Western wood pewee	Contopus sordidulus	(summer)
Mountain bluebird	Sialia currucoides	(summer)
Hermit thrush	Catharus gultatus	

Predators

Goshawk	Accipiter gentilis
Cooper's hawk	Accipiter cooperii
Red-tailed hawk	Buteo jamaicensis
Golden eagle	Aquila chrysaetos
Great horned owl	Bubo virginianus

Those species which migrate into the area from out of the state are indicated as summer residents. The other species are present during the entire year but generally migrate to somewhat lower elevations during the winter months.

C. Prehistory and History of the Region

The variety of human cultures which have inhabited the project region can be examined from several perspectives. The temporal continuum extending over a range of 12,000 years involves such diverse groups as the early prehistoric big game hunters, the archaic hunter-gatherers, the semi-horticultural Fremont, the Shoshonean bands, the early historic explorers and fur trappers, the Mormon colonists, the coal and cattle barons, the final influx of farmers, small town settlers, and merchants. Man's social and technological variations mirror the complexity of economic means used to exploit the necessary resources of his changing ecological system.

The Prehistoric Period

The prehistoric period within the project region can be subdivided into four main temporal phases: Paleo Indian, Archaic, Fremont and Shoshonean.

PALEO INDIAN PHASE

The Paleo Indian phase began at approximately 12,000 B.P. and terminated by about 7000 B.P., and is generally divided into three subphases which are known as the Llano, Folsom and Plano cultures (Jennings 1974:81).

The Llano culture was characterized by the hunting of mammoth during a time period between 12,000 B.P. and 10,000 B.P. Since the Llano culture has been defined primarily from the excavation of mammoth kill sites, very little is known about the overall subsistence activities of this culture.

Evidence of the Llano culture has been found over a widespread area in the Intermountain West and Southwest.

The Clovis point, a large, lanceolate, fluted spear point, is the only artifact which can be used confidently to infer the presence of the Llano hunters. Clovis points, in association with mammoth remains, have been found in New Mexico, Oklahoma, Colorado, Arizona and Wyoming.

Based on these sites, which are characterized by mammoth-Clovis point association, the core area of the Llano culture is limited to eastern Colorado, most of New Mexico and eastern Arizona. However, the Clovis point by itself has a much larger distribution. Clovis points, or very similar fluted points, have been found throughout the entire United States.

Within the project region of Utah, no characteristic Llano sites have been found, although several isolated Clovis points and one fluted point site have been reported. An isolated Clovis point was reported from Sevier County, Utah (Tripp 1966). Gunnerson (1956) performed a test excavation on a small rockshelter in Emery County (42Em8) from which a local collector had obtained a Clovis point. The test excavation did not, however, recover any additional Clovis points. An unusual fluted point very closely resembling the Cumberland fluted points commonly found east of the Mississippi River was found by an amateur collector in the San Rafael Swell and reported by Hauck in 1979 (42Em677).

The Folsom culture (ca. 11,000 B.P. to 9000 B.P.) immediately followed the Llano culture, but several differences in subsistence and artifacts allow a clear distinction to be drawn. Although the primary evidence of the Folsom culture is also from kill sites, the fauna hunted and the projectile points used are different from the Llano culture. The Folsom point is a lanceolate, fluted and usually eared projectile point generally smaller and thinner than the Clovis point. In addition, the Folsom point is associated at kill sites with the extinct Bison antiquus.

Folsom kill sites occur predominantly within the same region as the Llano core area but isolated Folsom points are not as widely distributed as Clovis points. Isolated Folsom points are almost entirely limited to the High Plains immediately east of the Rocky Mountains. A total of 11 Folsom points has been found in Utah but only one of these, found by an amateur collector somewhere in the San Rafael Swell, is known from the project region (Tripp 1967).

The Plano subphase of the Paleo Indian phase extends from ca. 9000 B.P. to 7000 B.P. The Plano culture, like the Llano and Folsom cultures before it, was economically partially dependent on large game, bison in particular. However, the Plano culture is characterized by a great diversity of projectile point types. Plano culture projectile points are typically lanceolate, precisely flaked and non-fluted.

A new hunting technique also became widespread during the Plano subphase, the jump-kill. The jump-kill hunting technique entailed the driving of a herd of bison over the edge of a cliff or arroyo in order to injure or kill the bison.

Evidence of Plano culture inhabitation is predominately limited to the High Plains east of the Rocky Mountains. The presence of Plano culture hunters in Utah is not widely acknowledged.

The presence of Paleo Indian cultures within Utah was minimal even during the Llano subphase and tended to decrease with time. The slight Paleo Indian utilization of Utah can possibly be tied to the relative scarcity of the large game species in Utah compared to the Great Plains east of the Rocky Mountains than on the eastern side and, as a result, the large herbivorous animals utilized by the Paleo Indian cultures were present on the Great Plains in considerably greater numbers.

ARCHAIC PHASE

Because of the relatively arid conditions of Utah and the Great Basin, large mammal hunting was not a viable subsistence technique in that area. The Great Basin and adjacent Colorado Plateau of eastern Utah were occupied at an early date by Indian groups who were engaged in a subsistence pattern dependent on smaller game animals and the gathering of wild plant foods.

The utilization of caves and rockshelters by Archaic cultures in Utah has resulted in good temporal sequences for the entire Archaic phase. Radiocarbon dates from Danger Cave (Jennings 1957) verify human inhabitation of the Great Basin as early as 10,000 B.P., but the artifacts retrieved from the lowest levels of Danger Cave are not diagnostic of any recognized culture group.

In addition to Danger Cave, Hogup Cave (Aikens 1970) in the Great Basin, Sudden Shelter (Jennings, Schroedl, Holmer 1980) in the southern Wasatch Mountains and Cowboy Cave (Jennings et al n.d.) in southeastern Utah, have all supplied important data pertinent to the development of a cultural sequence for the Archaic inhabitants of Utah. The Archaic has been divided into three phases based on changes in projectile point types.

The Early Archaic Period begins at approximately 8500 B.P. and continues until about 6000 B.P. Subsistence during this period was based on generalized gathering and hunting techniques. A large variety of plant, animal and insect resources was utilized. Hunting was primarily limited to deer and mountain sheep although antelope and bison were also utilized. The trapping of rabbits and small rodents was also an important source of protein.

The prevalent utilization of caves and rockshelters as habitations in conjunction with the aridity of the area has resulted in conditions suited to the preservation of normally perishable materials. Due to the excellent preservation, it

is known that the spear thrower (atlatl) was the implement used for hunting. The atlatl was used with a two or three component shaft and stone dart point throughout the Archaic phase. The Early Archaic Period was characterized by four types of dart points, the Pinto, Humboldt, Elko and the Northern Side Notch (Holmer 1978). During this time period, the Elko point type had a limited areal extent confined primarily to the northeastern Great Basin and the northern Colorado Plateau. The Pinto and Humboldt points, generally found in close association in archeological contexts, had the same distribution as the Elko points, but are also found in sites in southern and central Idaho at this time period. The Northern Side notch point had a very wide distribution during the Early Archaic period encompassing the northern Great Basin, Columbia Plateau, Northern Colorado Plateau and Great Plains.

The Middle Archaic Period began about 6000 B.P. and ended about 4500 B.P. Subsistence techniques and the utilization of caves were the same as during the Early Archaic but dart point styles changed and also diversified. Dart points such as the Rocker Side-notched, Sudden Side-notched, McKean Lanceolate and San Rafael Side-notched were characteristic of this period (Holmer 1978). The Elko point continued to be used during this period in the same areas as it had been during the Early Archaic period. Although the Rocker Side-notched and Sudden Side-notched points were limited in their distribution to central Utah, the McKean Lanceolate and San Rafael Side-notched styles had wider distributions including the Great Plains at this time. Another point style made its appearance during the Middle Archaic, the Gypsum point (Holmer 1978). This point style was very common in the southern Great Basin and northern Colorado Plateau and continued to be utilized through the end of the Late Archaic period.

The Late Archaic period began about 4500 B.P. and ended at roughly 1700 B.P. Subsistence techniques were essentially unchanged from the earlier Archaic periods and the utilization of the Elko and Gypsum points styles was continued although the latter style is generally limited in its occurrence to the southern half of Utah. At the end of the Late Archaic period, two new technological developments occurred which mark a significant change in prehistoric subsistence patterns: the introduction of corn and the bow and arrow.

Evidence of corn horticulture in the latter part of the Late Archaic period has been found at several locations: Cowboy Cave (Jennings et al in preparation), Cottonwood Cave in western Colorado (Hurst 1948) and Clyde's Cavern in central Utah (Winter 1973, Winter and Wylie 1974). At all three locations, corn caches were found which dated generally between 1600 B.P. and 2000 B.P. The very late portion of the Late Archaic period also witnessed the advent of the bow and arrow. At Cowboy Cave (Jennings et al n.d.b), Rose Springs arrowheads were recovered from the uppermost level and were dated about 1700 B.P.

The entire Archaic phase is characterized by a gathering and hunting subsistence mode and a sequence of dart point styles which have been defined through the analysis of excavated cave and rockshelter sites. Transient habitation of these caves during the annual migratory round is the most widely accepted interpretation of the Archaic subsistence pattern.

The atlatl was the universal Archaic hunting implement until the very last centuries of the Late Archaic period. However, the advent of the bow and arrow around 1700 B.P. does not seem to have eliminated the utilization of the atlatl during the late Archaic. Gypsum dart points continued to be manufactured even after the appearance of Rose Spring arrowheads at Cowboy Cave (Holmer in Jennings et al n.d.).

addition, Anasazi tradewares are considerably more prevalent in the Fremont culture sites than in the Sevier culture sites.

The unnamed plains-derived culture of northern and northeastern Utah existed from about 1300 to 650 B.P. (Madsen and Lindsay 1977). This culture was dependent upon hunting of bison and the collecting of wild plants. The dwellings are normally shallow basin structures without any clear evidence of the type of superstructure utilized. Unlike the coiled pottery of the Sevier, Fremont and Anasazi cultures, the unnamed culture produced pottery by the paddle and anvil techniques. It is important to note that there is a considerable spatial overlap of the unnamed culture and the Fremont culture traits in the northern portion of the latter's distribution. There is insufficient data at the present to determine whether the spatial trait overlap is due to alternate occupation, simultaneous occupation by the two cultures or a combination of these two possibilities.

Hunting activities among the Sevier, Fremont and unnamed cultures are evident from the many varieties of small arrowheads which have been recovered from excavations. Small stemmed corner notched (Rose Spring) arrow points are present in the earlier phases of all three cultures, but after about 1100 B.P., numerous regional variants developed. Side notch arrow point styles (Bear River Side-notched and Uinta Side-notched) were common in the northern part of Utah while Parowan Basal-notched and Bull Creek arrow point styles were common in the southwestern and south central portions of Utah respectively. The Bull Creek points are of particular interest because they are found in high frequencies at both Kayenta Anasazi sites in southern Utah and Fremont sites along the east side of the Wasatch Mountains (Coombs Village, Bull Creek sites, Snake Rock Village, Old Woman and Poplar Knob) and probably indicate the reciprocal exchange of males for matrimonial purposes (Holmer and Weder 1980).

Dart points, the Elko series and Gypsum, in particular, are also found in association with Fremont sites. This association has been used by Schroedl (1976) to verify the indigenous development of the Fremont culture from Archaic antecedents. Dart points, during the Archaic, were used as both projectile points and knives (Weder in Jennings et al n.d.) but their function in the Fremont context has not yet been evaluated.

In reference to Utah, the Mesa Verde and Kayenta variants of the Anasazi culture are of particular importance. The San Juan Anasazi culture was centered around the Four Corners area where Colorado, New Mexico, Arizona and Utah meet. The Kayenta Anasazi inhabited the extreme southern periphery of Utah from the San Juan River west to central Utah. As has already been noted, Kayenta influence is particularly evident in a narrow band of sites running from Coombs Village northwards past the Henry Mountains to the Snake Rock Village site adjacent to Interstate 70 on the east side of the Wasatch Plateau.

SHOSHONEAN PHASE

The Shoshonean populations, who were the sole inhabitants of Utah at the time of Euro-American contact, have been in the northeastern Great Basin region since approximately 650 B.P. Their origin has been the subject of considerable controversy, however. Several hypotheses have been expressed.

One hypothesis maintains that the Shoshoneans came from the southwest of the Great Basin at about the time of the dispersal of the Sevier, Fremont and Anasazi agriculturalists (Madsen 1975b and Lamb 1958). Gunnerson's hypothesis (1962) states that the Fremont, Sevier and Virgin cultures were Shoshonean peoples who had taken up horticultural and ceramic techniques diffused from the Anasazi but later reverted to an Archaic subsistence style after a climatic change which made agricultural subsistence techniques unproductive.

Regardless of which hypothesis is correct, Shoshonean groups (Ute, Paiute, Shoshone and Bannock) were inhabiting the Great Basin into eastern Utah at ca. A.D. 1300 roughly coincident with the disappearance of the Fremont and Sevier cultures.

The Shoshonean subsistence pattern was quite similar to the Archaic adaptation. Small familial bands were engaged in a gathering and hunting subsistence utilizing a wide variety of nondomesticated plant, mammal, and insect species.

Very little archeological evidence is available for this time period. Two characteristic artifact types can generally be associated with the Shoshonean occupation of Utah. The bow and arrow was utilized for hunting and a type of arrowhead, the Desert Side Notch point, has been correlated with the Shoshonean occupation (Holmer and Weder 1980). The Shoshoneans also utilized ceramics to a small degree. Shoshonean ceramics are easily distinguished from Sevier, Fremont and Anasazi wares by the former's relative crudeness. Shoshonean ceramics are typically thick walled, have large temper particles, are poorly smoothed, exhibit little decoration and have been fired in an uncontrolled or oxidizing atmosphere.

The Protohistoric Period

The prehistoric Shoshonean occupation of the Intermountain West continued up to and through the period of Euro-American contact. The Indian groups inhabiting the area of eastern Utah within which the project locality is situated came to be called the Utes.

PRECONTACT

The Utes are a group belonging to the Shoshonean (Uto-Aztecan) linguistic family of which there are three branches: Ute-Chemehuevi, Shoshoni and Mono-Paviotso. The Ute-Chemehuevi branch includes those groups which came to be

known as the Utes, Southern Paiutes and Chemehuevi. Although there is little archeological evidence, the Utes probably were characterized by a social organization and subsistence mode quite similar to all of the other aboriginal groups in the Great Basin and Colorado Plateau. The Utes were pedestrian gatherers and hunters who utilized a relatively large area of western Colorado and eastern Utah (Steward 1974).

The Utes were grouped into loosely organized bands consisting of extended families. Leadership was present only for subsistence task groups. The Utes could be reliably distinguished from the other contemporary aboriginal groups only in terms of linguistic differences.

Group territoriality was developed only in a statistical sense. A particular Ute band might consider a certain area as a home, but the seasonal round of each band was highly variable from year to year. The area with which any band was most familiar was not exlusively utilized by that band. Intermarriage among the various Ute bands tended to maintain linguistic unity but blur the definition of territorial homeland for any particular band. Except for those Utes who were utilizing the aquatic resources around Utah Lake, local populations were small and mobile (Steward 1974).

EARLY CONTACT

The presence of the Spanish colony at Santa Fe by 1598 resulted in the first contact between the Utes and Euro-American groups. The relationship which developed between the Utes and the Spaniards was consistently friendly and resulted in the spread of the horse among the Ute bands. When the Utes obtained the horse, a change in their subsistence occurred. The equestrian Ute was able to travel more widely and more effectively and concentrate on bison hunting (O'Neill 1973).

The utility of the horse was strongly mitigated by environmental factors, however. The maintenance of a large

horse herd required substantial supplies of grass which generally limited the advantage of the horse to those areas where grass was plentiful such as western Colorado, the Uintah Basin and along the western slopes of the Wasatch Mountains. The supply of grass also determined the distribution of the bison. The horse was, therefore, not equally valuable to all of the Ute bands. The bands in Colorado were able to support their horses whereas those bands in Utah, eastern Utah in particular, were unable to utilized the horse effectively and were more likely to eat a horse than ride it.

Considerable trading activity with the Utes was occurring during the 17th and 18th Centuries. Of particular importance was slave trade (O'Neill 1973). The Utes were able to conduct slave raids on neighboring tribes (especially the Navajo) because of their equestrian status. They then exchanged their slaves for horses and other Spanish goods. Whether the slaves were exchanged with traders travelling into Ute territory or were driven by the Utes to Spanish settlements is unknown because of the lack of documented evidence. Until the 1770s, there was little official Spanish interest in the territory of the Utes. However, at that time, King Charles III of Spain decided that an exploration of the areas north of Santa Fe would be beneficial to Spanish control. His developing interest was a reaction to the growing influence and explorations by the British and French in the West. Charles III felt that it was important to ensure control of trade by the Spaniards since he considered the British and French traders as a threat to Spanish rule (O'Neill 1973).

The first documented Spanish exploration of the area north of Santa Fe was the Dominguez-Escalante Expedition of 1776-1777. This expedition was also the first officially

sponsored exploration, the purpose of which was to find a route between Santa Fe and the Spanish settlements in California. Although the expedition was unsuccessful in reaching its goal, it did extensively explore the territory occupied by the Utes who, in all recorded instances, welcomed the Spaniards.

A trail was eventually established between Santa Fe and California which came to be known as the Spanish Trail. The origins of the Spanish Trail are obscure; however, this trail was probably utilized in prehistoric times as evidenced by its association with archeological sites.

LATE CONTACT

Beginning in the early 1800s, the fur trade became active in Utah. The Arze-Garcia expedition traded for furs with the Utes at Utah Lake in 1813 and soon thereafter trappers began to actively exploit the area. Etienne Provost was a member of the Chateau-DeMun exploration of 1815 to 1817 and subsequently founded his own trapping company which operated primarily within Ute territory. He was subsequently killed by the Utes near the site of the city which now bears his name, Provo (O'Neill 1973).

During this time, more detailed information on the Shoshonean peoples of the area was recorded. In particular, specific Ute bands are mentioned with reference to their respective territories. Within the project region, the Weeminuche band conducted its yearly rounds (O'Neill 1973).

The Adams-Onis treaty of 1819, which gave Mexico its independence, resulted in an influx of Americans to Santa Fe. Most of the Americans came to engage in trapping. The newly arrived trappers caused a considerable increase in traffic along the Spanish Trail and an increase in competition for the available fur resources. This competition was not welcomed by the Utes, who were no longer consistently friendly with the Euro-Americans.

Although there were a large number of independent trappers operating in Utah, their activities have not been well documented. Antoine Robidoux was an important trapper who by 1824 was operating primarily in the Uintah Mountains. William Ashley and Peter Skene Ogden were trapping in the northern Ute territory during the summer of 1824 and, at about the same time, Jedediah Smith was exploring eastern Ute territories to evaluate their trapping potential (O'Neill 1973).

The growing traffic along the Spanish Trail had an important effect on the local Ute bands. Wakara, a Tumpanuwache leader, became quite powerful in the 1820s by conducting horse raids in southern California and returning to Utah by way of the Spanish Trail (Lyman and Denver 1970). He enhanced his power and wealth by exacting tribute from travelers along the trail and by the trading of stolen horses and Pahvant and Paiute slaves (O'Neill 1973). In addition, Wakara and his band actively engaged in fur trapping.

By the late 1830s, there was considerable competition for the fur resources of Utah and western Colorado. Robidoux established a permanent fort and trading center in 1837 near Whiterocks in the Uintah Basin to capitalize on the beaver-laden streams of the Uintah Mountains.

The prosperity of the fur trade was not destined to last very long, however. The fierce competition over trapping areas led to widespread disruptive conflicts and, most importantly, the demand for furs used to make the beaver skin hats which were fashionable in Europe and the eastern United States declined rapidly about 1840 as the fashions changed. Fort Robidoux was burned in 1844 by the Utes who apparently blamed the trappers for the declining value of their furs (O'Neill 1973; Lyman and Denver 1970).

The decline of the fur trade had a serious impact on the Ute bands of Utah. The entire economic base of the

Utes began to disintegrate after 1840. The trading activities with Santa Fe began to dwindle with the decline in the horse and slave trade. The termination of Mexican control of the area in 1846 and the subsequent loss of contact for slave trade into Mexico (Lyman and Denver 1970) were very disruptive to the relationships existing between Utah and Santa Fe.

During the declining years of the fur trade, the largest invasion of Ute territory occurred. Beginning in 1847, Mormon pioneers began to move into Utah and rapidly swelled their numbers through immigration. At first, there was little conflict with the Utes because the major Mormon settlement, Salt Lake City, was on the periphery of the Ute territory and the earliest Mormon expansion was to the north. In 1849, Fort Utah (later to become the town of Provo) was founded near Utah Lake on the traditional campsite of the Tumpanuwache band. Since the Tumpanuwache band, still under the leadersip of Wakara, had been forced to revert to their earlier mode of subsistence due to the decline of the fur trade, their utilization of the resources around Utah Lake became of vital importance. The conflicting interests in the Utah Lake vicinity escalated into a series of raids and counterraids during the 1850s which became known as the Walker War. In the end, the Utes were forced to leave the valley and moved east across the Wasatch Mountains (O'Neill 1973).

The next few years were difficult for the Utes, who were being gradually forced to split up into small bands and resume a subsistence mode similar to the precontact period. Some of the bands, however, chose to raid Mormon settlements and farms to obtain cattle so that they could avoid starvation. These raids became more prevalent during the 1860s. Raids were conducted on the Mormon settlers west of the Wasatch and the Utes returned to the unsettled areas east of the Wasatch with the stolen cattle (O'Neill 1973).

Although several bands were responsible for these raids, one man by the name of Black Hawk became the focus of the blame for all the raiding.

The areas east of the Wasatch Mountains remained under Ute domination for several years. A Mormon attempt to colonize at Moab was undertaken in 1855 but the Mormon settlers were harassed by the Utes and forced to return to Salt Lake City. It was not until 1877, by which time the Utes had been removed to the Uintah Reservation, that Mormon colonists were able to safely settle east of the Wasatch Mountains (O'Neill 1973).

The Historic Period

The history of the east-central coal areas of Utah begins with the exploration and colonization efforts of the Spanish during the last quarter of the 18th Century. East-central Utah was first explored and mapped by the Dominguez-Escalante Expedition of the 1776-1777 in its efforts to establish a line of communication between the Spanish settlements of New Mexico and Monterey, California (Miller 1968).

Though the Dominguez-Escalante Expedition failed to achieve this end, subsequent attempts from the New Mexico settlements and the travelings of Spanish and American fur trappers, traders and frontiersmen resulted in a connecting route known as the Old Spanish Trail (Miller 1968:Map 20). Along this route, which came up from Santa Fe through the San Juan country, across the Colorado River at Moab, over the Green River at the present site of Green River, across the San Rafael Desert into Castle Valley, then south through Salina Canyon to southwestern Utah and southern California, passed thousands of horses and numerous trading, trapping and Indian slave trade expeditions (Miller 1968).

By the 1830s, the trail was well established, portions of its route being followed in 1853 by explorer, John C. Fremont and government surveyor, John W. Gunnison, who reported several sets of well-worn tracks near Green River where Interstate 70 presently runs. Other sections of the trail still remain near the Big Hole Wash in Emery County. The primary route of the Old Spanish Trail, plus divergent trails to Utah Lake, Fort Robidoux and Fort Kit Carson, brought the first extended contact into the project area (Miller 1968: Map 20).

Though forts and trading posts were scattered sparsely through southern and central Utah, the first attempts at organized settlement were undertaken by the Mormon Church. In 1855, the Elk Mountain Mission passed southward through Castle Valley to the area of Moab intending to establish a permanent settlement, but Indian hostility forced a quick retreat. The combination of hostile Indians, the desolate appearance of the region, the hardships involved in securing sufficient water for irrigation and doubts about the quality of the soil caused further attempts at colonization of the eastern area of what was then Sanpete County to be dropped for over 20 years (McElprang et al 1949:16).

At a priesthood meeting at Mt. Pleasant on September 22, 1877, encouragement was given to settle Castle Valley; soon after 75 men from Sanpete Stake were called with Christian G. Larsen as leader. Very few responded, however, because of the aforementioned reasons. Orange Seely was subsequently given the responsibility of superintending the founding of settlements and another call for colonizers was issued by the Church in the fall of 1878. Some of the earliest settlers of the area who dwelt in dugouts in hills or washes until log houses could be erected were Elias and John Cox, Ben Jones, William Avery and Anthony Humbel. By the fall of 1878, the crops were sufficient and the situation stable

enough for the families of these men to join them, a sure sign of an intent to remain (McElprang et al 1949).

Work progressed on the agricultural settlements of Castle Valley and roads were built through the Wasatch Mountains to the more stable areas of western Sanpete County. Additionally, in the fall of 1878, the "Star-Mail Route" was opened between Salina and Ouray, Colorado; it followed the paths of the Old Spanish Trail and the "Gunnison" Trail of years before (McElprang et al 1949:19-21). In just three years the towns of Castle Dale, Wilsonville, Ferron, Green-river (Blake), Huntington, Lawrence, Molen and Orangewill had been established and the Legislative Assembly in February, 1880, created Emery Coutny, which embraced all of present-day Carbon, Emery and Grand Counties (Lever 1898:593).

Though the project region was settled for its agricultural and grazing possibilities, it was the area that inspired active settlement and set the mining-dominated industrial base that central and eastern Utah retains to the present.

The first recorded discovery of coal in eastern Utah was by the Gunnison Expedition of 1853 (Powell 1976:13) when they located deposits of coal approximately three miles east of present-day Emery. The isolated location of the Gunnison find, coupled with the hope that the deposits already discovered at Coalville and Wales would prove sufficient for the territory's needs, caused Gunnison's discovery to be forgotten. The subsequent failure of the efforts at Wales to produce good coking coal, and the Union Pacific Railroad's monopolization and price-fixing on the deposits at Coalville, caused a re-evaluation of the potential coal producing areas east of the Sanpete settlements (Powell 1976:13).

As a result, the first effort to exploit the newly found eastern coal deposits was undertaken in 1875 at Connellsville in the upper reaches of Huntington Canyon. The

Fairview Coal Mining and Coke Company was organized by men from New York, Salt Lake City and Fairview. Eleven coke ovens were constructed and the coke was hauled by wagon into Springville. The expense involved with the hauling and the questionable quality of the coke produced caused the failure and abandonment of Connellsville by 1878 after only three years of operation (Powell 1976:13).

The next development of coal resources was begun in the Pleasant Valley area, also in 1875. The Pleasant Valley Coal Company, headed by Milan O. Packard, constructed a wagon road from Springville up Spanish Fork Canyon to Pleasant Valley coal lands in 1876; 1877 saw the opening of the Number 1 Mine in Winter Quarters Canyon (Powell 1976:14). A narrow gauge rail line was completed from Springville through Spanish Fork Canyon in October of 1879 by the Pleasant Valley Railroad Company as the haul to Springville by the wagon road occupied four days in good weather while in winter the road was impassable. This Pleasant Valley area proved to be extremely productive. The first three large scale mines in eastern Utah were established in this area when the Mud Creek Mine was reopened in 1882 followed by the 1884 opening of the Union Pacific Mine at Scofield just east of Winter Quarters (Powell 1976:15).

From the earliest times, the railroads sought to control the supply of coal in the territory, e.g., the Coalville resources and Union Pacific Railroad's control over that source. During the early 1880s, the Denver and Rio Grande Railroad was extending its lines from Colorado through Utah. Though originally graded through Castle Valley and Salina Canyon, the route of the railroad was altered, going through Price and Spanish Fork Canyon and thus taking in the rich coal areas of what was to become Carbon County (McElprang et al 1949:22).

Further expressing its interest in eastern Utah coal, the Denver and Rio Grande Western (Denver and Rio Grande's Utah

holdings) purchased the independently owned Pleasant Valley Railroad Company and Pleasant Valley Coal Company in 1882. Shortly thereafter, Union Pacific Railroad Company (UPRR) penetrated the Pleasant Valley area in order to protect its threatened monopoly on Utah coal (Powell 1976:16). The UPRR formed the Utah Central Coal Company in 1882 and opened the Union Pacific Mine near Scofield in 1884. With the Denver and Rio Grande's Pleasant Valley Coal development (1882), the establishment of Utah Fuel Company in 1887 and the creation of Utah Central Coal of Union Pacific, the railroad companies almost totally dominated the ownership and production of the Utah mines until the early 1900s (Reynolds et al 1948:195).

In 1888, a mine was opened at Castle Gate on the Price River near the mouth of Price Canyon. In about 1899, a new mine began operations at Sunnyside just 24 miles east of present-day Price at the base of the Book Cliffs. The Sunnyside Number 2 Mine also began its production in 1899 with the coal obtained there, and also at Castle Gate, being utilized for coking purposes (Powell 1976:17-18).

In 1906, the first of the coal operations which would remain free from railroad control began production at Kenilworth, three miles east of Helper. This enterprise was financially backed by James Wade and F. A. Sweet and was called the Independent Coal and Coke Company because of its unique ownership status. Sweet, one of Utah's most prominent coal authorities, also opened a mine on the middle fork of Miller Creek in 1908 and named the camp Hiawatha (Reynolds et al 1948:213). This locality at the foot of Gentry Mountain, about 18 miles southeast of Price, was the scene of further coal mining development in 1911 when Black Hawk mine was opened by Brown and Eccles. Just a few miles to the south in northern Emery County, a small wagon mine was purchased by the Castle Valley Fuel Company and the town, Mohrland, named from the initials of the company's four major figures--Mays, Orem, Heiner

and Rice--was begun. Mr. W. H. Wattis undertook the last development in this area in 1916 at Wattis, several miles north of Hiawatha on the flank of Castle Valley Mountain.

The decade from 1911-1920 saw an increase in activity in the coal regions of east-central Utah with many new mines being opened in hitherto undeveloped areas within the Utah coal producing regions. In 1911, Frank Cameron prospected the region around Panther Canyon on the Price River, and in 1914, the first coal was shipped out by the Utah Fuel Company which had leased the properties to Cameron for development. Cameron also developed and opened a small camp at the base of Castle Rock, about five miles northwest of Helper. Located directly on the main line of the Denver and Rio Grande Western Railroad, the camp's name was changed many times as was its ownership. Originally known as Bear Canyon, it soon was called Cameron, for its developer, then Rolapp, and finally, Royal (Reynolds et al 1948:244).

In 1912, Jesse Knight, one of the most prominent men in Utah mining history, bought 1600 acres of coal land west of Helper to provide coal for his smelting operations in the Tintic District. His mine, at what eventually became known as Spring Canyon, began production in 1913 and was the first of many mines in the Spring Canyon District, one of the most prolific coal producing areas in eastern Utah. Soon after the establishment of Storrs (Spring Canyon), F. A. Sweet opened another mine in Spring Canyon at Standardville, so called because it was considered to be the standard for the development of future mining camps. The year 1914 saw the opening of the Latuda Mine and camp by Liberty Fuel Company while mines were opened in 1916 at Peerless and Rains. The last mining development undertaken in the Spring Canyon District was Mutual Coal Company's Mutual and Little Standard operations, begun in 1921 and 1925, respectively.

The final major coal producing area to be opened in east-central Utah was the Gordon Creek District. This region had first been prospected in 1908, but was really brought to prominence in 1920 by A. E. Gibson, the superintendent of the Spring Canyon Mine. Mines were developed in this area up until 1925 by Consumers Mutual Coal Company, National Coal Company and Sweet Coal Company. The operations of all three companies ceased by 1950 (Carr 1972:81).

After the development of the Gordon Creek area, further work on the coal regions was undertaken in areas that had been opened previously. In 1922, Columbia Steel Company opened a mine at Columbia near the location of Sunnyside in order to further exploit the excellent coking coal obtainable from that region. One very late development of the same coal veins that supported the Columbia operation was initiated in Horse Canyon in 1942 by the United States government to aid steel production at its Geneva plant (Reynolds et al 1948:252). Both mine and steel plant were taken over by U.S. Steel after WWII and continue in operation to the present.

Most of the mines in east-central Utah continued production through the heavy demand years of WWI and the years of prosperity that followed but a combination of overdevelopment, the increased use of other natural fuels, rising costs associated with expensive underground haulage and the Depression of the late 1920s and early 1930s caused several camps to be abandoned. Among the first mines to succumb were the long exploited Pleasant Valley mines. Winter Quarters, near Scofield, was closed down in 1928 while Scofield and Clearcreek experienced reductions of operations during the early 1920s and 1930s, respectively. Rains was also forced to cut back on operations in 1930. Despite these setbacks, as of

1929, there were 22 coal mines operating in Carbon, Emery and Grand counties, the production of these mines providing 98% of the state's output (Sutton 1949:852).

Economic and production difficulties continued to plague Utah's coal industry during the decade of the 1930s, forcing the closure of the Mutual and Mohrland mines in 1938. World War II brought a temporary respite to the general downward trend with many mines achieving their highest production levels during the war years and immediately thereafter.

The decade of the 1950s signalled the end for a great number of the eastern Utah coal mining operations as the adaptation of coal for new uses was insufficient to keep pace with this fuel's replacement in many of its traditional roles. The increasing use of natural gas for heating homes and heavy industry use and the railroad's switch to diesel power were among the developments which severely hurt the coal industry. This bleak picture has drastically changed with the advent of America's "energy shortage", and new technologies for coal use in the future have caused an upswing in coal production in east-central Utah. Mines which were closed, or kept running with skeleton crews, have begun to increase operations during the last decade and the possibility of a new sustained burst of coal mining activity definitely exists (Alexander 1963:244-247).

D. Previous Investigations in the Region

Archeological research in the Castle Valley locality began with the Claflin Emerson Expedition. In 1929, Noel Morss and Henry Roberts conducted explorations and limited test excavations under the auspices of this expedition along the Fremont River and as far north as the Muddy River in Emery County. Morss' work resulted in the original definition of the

Fremont cultural entity (Morss 1931, Gunnerson 1969). Morss' description of Fremont sites north of the Colorado River was an important contribution to the understanding of the prehistoric horticultural adaptation in the American Southwest.

With the exception of Reagan's description of the large petroglyph panel in Buckhorn Draw (Reagan 1935), there were no archeological investigations in the Castle Valley region for the next 15 years. Between 1952 and 1957, the University of Utah conducted a series of surveys in order to better define the nature of the Fremont occupation in Utah. A large number of Fremont sites was located along the east side of the Wasatch Plateau and several of the sites were subjected to limited test excavations, including 42Em5, the Emery Site (42Em47) and Snake Rock Village (42Sv5). Each of these three sites were Fremont habitations (Gunnerson 1957). In addition to these Fremont sites, Gunnerson also tested a shallow rock shelter on Silverhorn Wash (42Em8) as a result of a local collector's report that a fluted projectile point resembling the Clovis style had been found eroding from the shelter deposits. Little additional information was obtained by the excavation, however (Gunnerson 1956).

In the 1970s, there was a significant upsurge in archeological activity in the Castle Valley region. In 1970, three sites endangered by vandalism were excavated by the University of Utah. These sites, Windy Ridge Village (42Em73), Crescent Ridge (42Em74) and Power Pole Knoll (42Em75) all proved to be Fremont habitation sites (Madsen 1975a) dating between about 980 B.P. and 1260 B.P.

During the following year, the University of Utah conducted excavations at Clyde's Cavern (42Em177). Clyde's cavern was a locus of summer plant gathering activities during the Late Archaic period, but the majority of the cultural deposits was shown to be the result of summer maize cultivation and wild plant harvesting activities during the subsequent Fremont period (Wylie 1972, Winter and Wylie 1974).

The next site to be excavated in the study area was Joe's Valley Alcove (42Em693). During the summer of 1974, the United States Forest Service excavated this site which had cultural strata, dated by both radiocarbon and typological means, from the Early Archaic, Late Archaic and Fremont Periods (E. DeBloois, personal communication). That same summer, a University of Utah field school excavated the Innocents Ridge site, which proved to be yet another Fremont habitation locus (Schroedl and Hogan 1975).

During the early fall of 1975, the Antiquities Section, Division of State History (Utah) conducted an excavation of a small rockshelter as a part of the cultural resource mitigation program for Consolidation Coal Company of Denver, Colorado. This site, known as Pint Size Shelter (42Em625), had two main cultural strata, one dated to the Late Archaic and the other dated to the early Fremont Period. Both of these occupations were evidently the result of wild plant procurement activities (Lindsay and Lund 1976).

Other Fremont habitation sites, located farther to the south, have been excavated. These sites include Snake Rock Village (Aikens 1967), Old Woman and Poplar Knob (Taylor 1957) and the Old Road Site and Ivie Ridge Site (Wilson and Smith 1976). These five sites were all Fremont period habitation although Kayenta and Mesa Verde Anasazi ceramics were recovered at low frequencies indicating that there was contact with other cultural groups located further south.

In addition to these Fremont sites, a deeply stratified rockshelter (Sudden Shelter, 42Sv6) was found to contain occupational strata spanning the entire Archaic Period, ca. 8000 B.P. to 3000 B.P. (Jennings et al 1980). The original site report indicated that Fremont diagnostics were present on the site when it was originally documented, but these artifacts were no longer present when the excavations were begun. The

Sudden Shelter site is of particular importance to the local prehistory and the prehistory of the eastern Great Basin and northern Colorado Plateau because of its numerous well-defined occupational strata which has allowed a fine-grain correlation between certain diagnostic projectile point types and the temporal phases of the Archaic period.

A test excavation of two heavily vandalized rockshelter sites (42Em959 and 42Em960) in Cottonwood Canyon conducted by AERC in 1979 seem to mirror the results of the excavations at the nearby Joe's Valley Alcove. Radiocarbon analyses have not yet been completed, but projectile point correlations indicate that these two sites were occupied during the Early Archaic period, Late Archaic and, most heavily, during the Fremont period (Weder and Hauck, n.d.).

Since 1970, the level of survey intensity has increased drastically. The various cultural resource inventories conducted during the 1970s have generally been the result of natural resource development programs and are too numerous to summarize in the present context. Summaries of these inventories performed before 1978 can be found in Sargent (1977) and Hauck (1979). The combined inventory results as of 1977 indicate that the majority of the culturally identifiable sites in the general area are Fremont although Archaic sites are also well represented. Protohistoric Numic sites are present but rare (Hauck 1979a:110).

E. Research Design

AERC's research design which has been developed to aid in project planning and resource evaluation for the east slopes of the Wasatch Mountain Range in central Utah include the following factors:

1. The determination of presence or absence of a continual sequence of Paleo-Indian, Archaic,

Fremont and Shoshonean utilization of the project area and the local manifestations of these cultural phases when present;

2. the determination of presence or absence of cultural materials which demonstrate the prehistoric utilization of drainages as access routes across the mountain range;

3. the determination of whether any specific ecozone contained a preponderance of prehistoric cultural resource sites, thus demonstrating any diversity of preference for different ecozones;

4. the determination of which types of prehistoric cultural activity were conducted in the project area based upon patterns in artifact associations or predominance of particular types of sites;

5. the determination of presence or absence of early historic Euro-American habitation, trapping, trade or travel within the project area; and

6. the determination, on a regional level, of whether the sites in the project area contained any remains, demonstrating local interaction between the San Rafael and Sevier variants of the Fremont Culture.

Since all research conducted in the Eccles Canyon locality has been oriented to identifying, recording and analyzing the historic and prehistoric remains within the project locality, only marginal artifact collection and subsurface testing has been carried out. No floral, faunal, radiocarbon, pollen or flotation specimens have been obtained for laboratory analyses. Collections have involved only the retrieval of diagnostic historic artifacts from the vicinity of the Utah Mine.

Chapter II - METHODOLOGY

A. Field Research

During late July, 1980, an intensive cultural resource inventory of a transmission corridor was conducted by AERC for Valley Camp of Utah and the Vaughn Hansen Associates consulting firm of Salt Lake City, Utah. This corridor is associated with the Pleasant Valley-Whiskey Creek project area located near Scofield, Utah.

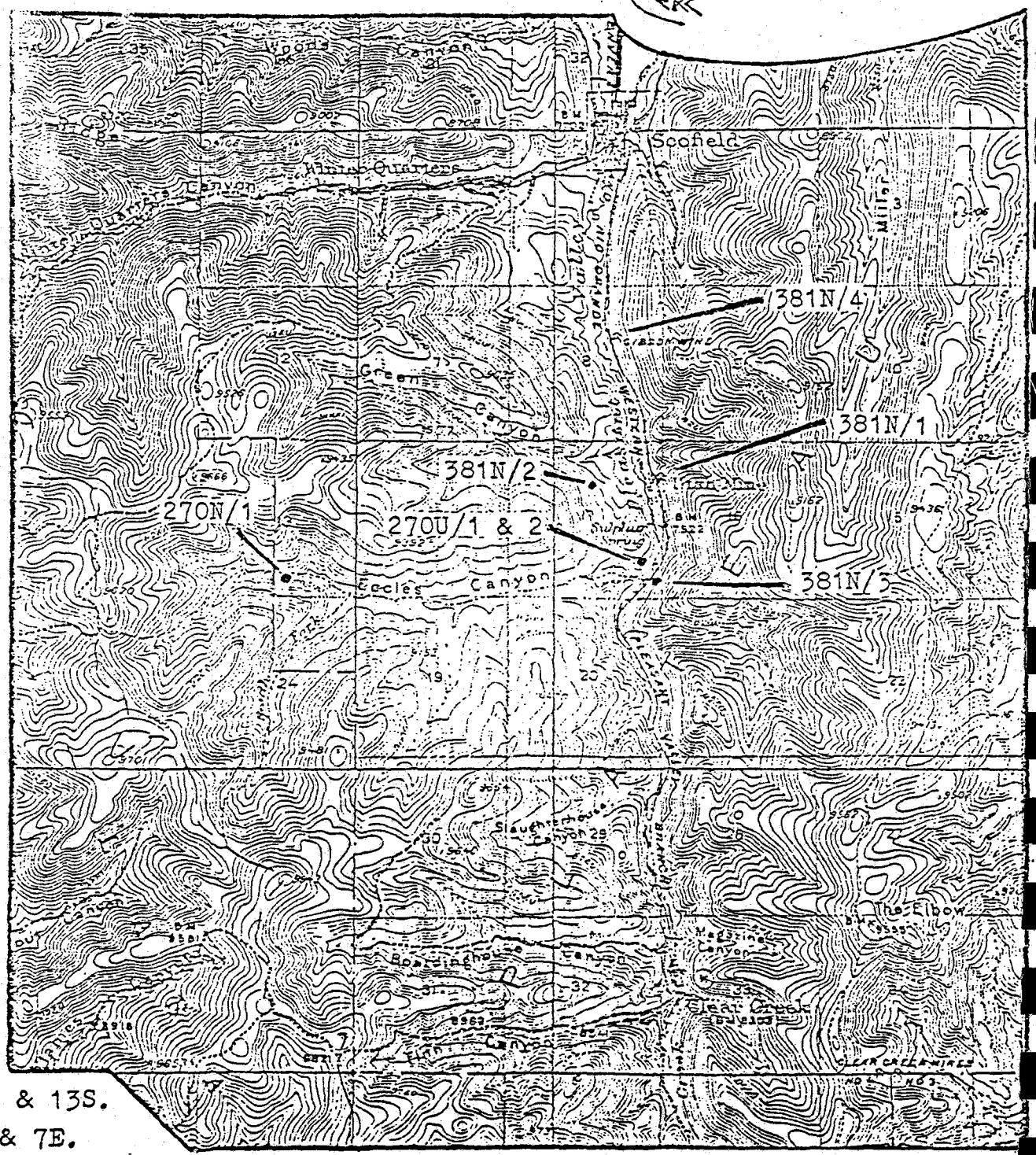
V. Garth Norman, a staff archeologist with AERC, was in charge of the field crew which included Monika Williams and Bunny Melendez. F. R. Hauck, president of AERC was principal investigator.

The survey area lies between the 7750 and 9200 foot elevations ASL within several narrow canyons where surface disturbance relative to transportation corridor development is planned. Location of the potential construction zones and the survey area is shown on Figure 3.

The purpose of the survey was twofold. An intensive evaluation of the Whiskey Canyon and Pleasant Valley corridor segments was conducted to assess the presence and significance of cultural resource sites which could be adversely affected by the development. These two corridors are linked by the eastern segment of the Eccles Canyon corridor which was evaluated by AERC in 1979 under contract to Coastal States Energy Company relative to that company's Skyline Project Mine Plan Permit application.

The second part of the survey was a surface examination and recording of three historic sites, all situated in Pleasant Valley. Although two sites, the Nicolitus Mine portals (AERC 381N/3), and the Gibson Mine (AERC 381 N/4), were evaluated by the AERC crew, they do not lie within the transmission corridor and no project-related adverse affect is planned for these sites.

ARCHEOLOGICAL-ENVIRONMENTAL RESEARCH CORPORATION



T. 12 & 13S.

R. 6 & 7E.

Meridian: Salt Lake B. & M.

Quad: Scofield, Utah 15 Minute USGS

Project: VH-80-1

Series: Central Utah

Date: 9-17-80

Figure 3

HISTORIC SITES IN THE PROJECT AREA

Legend:

Archeological Site or Historic Site

1 0 1 2 M.

0 1 2K.

Scale

Their evaluation was considered important in providing a complete statement on the presence of important cultural resources situated adjacent to the present project permit area.

All inventoried surfaces in Whiskey Canyon, Eccles Canyon and on the west bank of Pleasant Valley were examined by team members performing parallel transects with personnel spacing ranging between 15 and 25 meters. In this manner, a three mile long corridor of about 60 meters width was intensively evaluated. Shorter intervals and zigzag transects were utilized on specific locations judged to be of high site potential.

A total of four historic sites has been recorded in the corridor zone. These sites (AERC 270U/1 and 2) include two historic cabin foundations situated at the mouth of Eccles Canyon which were recorded by AERC in 1979 (see report for OSEC-79-2 dated 7/23/79). Site AERC 381N/1 is the historic Utah No. 1 Mine site which is situated at the northern end of the corridor zone. The Green Canyon Sawmill site (AERC 381N/2) is located near the mouth of Green Canyon.

Three other historic sites are situated in the general area but lie outside the construction corridor zone. These sites include the Eccles Canyon Coal Mine (AERC 270N/1) which is situated in the southeast quarter of Section 13, Township 13 South, Range 6 East; the Gibson Mine (AERC 381N/4) which is situated in the northeast quarter of Section 8, Township 13 South, Range 7 East; and the Nicolitus Mine portals (AERC 381N/3) which are situated in Pleasant Valley in the southeast quarter of Section 17, Township 13 South, Range 7 East. One mine portal on the Nicolitus site is situated on the west bank of Pleasant Creek and, therefore, lies within the corridor zone. The remainder of this

site is situated on the east slope of Pleasant Valley and is outside the potential construction zone.

All cultural resource sites were recorded, evaluated, photographed, sketched and their locations marked on a Scofield, Utah, 15 Minute U.S.G.S. topographic map. Site reports will be provided to all relevant agencies as an appendix to this report.

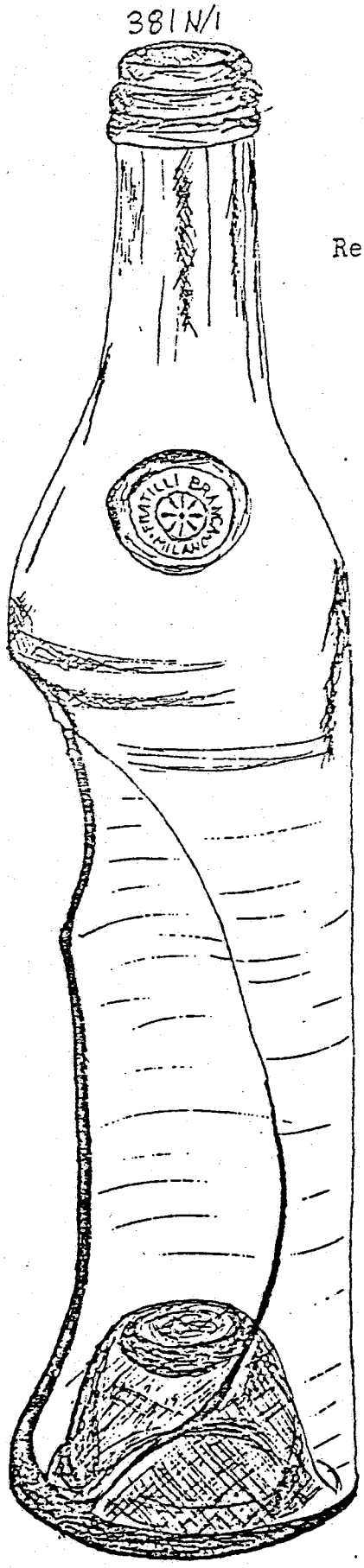
B. Laboratory Research

Laboratory analysis of artifacts was minimal since historic artifacts were minimally collected from only one site (381N/1). No other artifact or ecofact collections were made during the survey or during the 1979 survey when the Eccles Canyon segment of the corridor was evaluated.

C. Artifact Inventory and Analysis

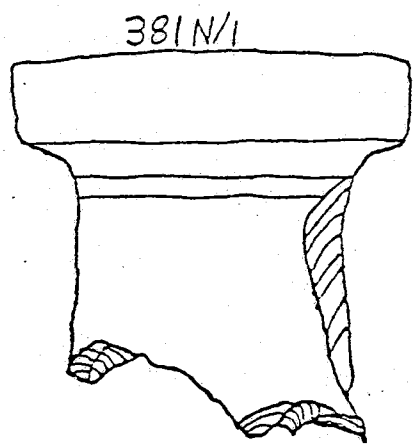
The following historic artifacts were collected at the Utah No. 1 Mine site (AERC 381N/1):

1. One green wine bottle manufactured in Milan, Italy, by the Fratilli Branca Company. This bottle was manufactured using a three piece mold, a technique used in the United States between 1809 and 1885 A.D. The striations on the body of the bottle indicate a turn mold was used for that portion. Twin molds were in use in the United States between 1880 and 1900 A.D. These factors indicate that this bottle was probably constructed between 1880 and 1915 (c.f. Vienneau 1973:45-46).
2. Two pieces of a historic ceramic were collected in which the trademark show D. MEAKIN Ltd., -----, (E)ngland.



Reduced by 30%

Figure 4



Actual Size

3. One fragment of a purple, square bottle was collected which carries the trademark --POLEON, Olive Oil.

4. One blue glass insulator was collected which shows the trademark -ingray-42.

5. One brass, portable gas lantern top was collected which has the trademark --OY'S DROPPER, Pat. 5.26.14, 1916.

6. One brown bottle rim was collected.

7. One steel spoon was collected.

8. One square bottle fragment was collected. This fragment contains the trademark --FIC SYRUP CO., __FIC, (PR)ODUCTS (INC.), --(O)R.

9. One wooden mount for an insulator was collected.

Sketches of the wine bottle and the brown bottle rim are shown on Figure 4.

March 10, 1982

Chapter III - CULTURAL RESOURCE DESCRIPTIONS

A. Site Analyses

A total of seven historic cultural resource sites is situated in the general project area. Five of these sites are either in the potential construction corridor (AERC 270U/1 and 2) or are partially within the corridor (AERC 381N/1, 2, and 3). These five endangered sites are indicated on Table 1.

Based upon the definitions of cultural resource significance (see Chapter IV), none of the seven historic sites listed in Table 1 are considered eligible for nomination to the National Register of Historic Places (NRHP) based upon an archeological evaluation. The significance of these sites is provided on Table 2. Site 381N/1, the Utah No. 1 Mine is a potential candidate for nomination to the NRHP, based upon the available historic information on the Mine. This site has been given a CRRS:S-2 rating (see Chapter IV). The other three sites are not considered as having NRHP potential. The Nicolitus Mine has been rated a CRRS:S-3 while the two cabin foundations were originally rated at the equivalent of CRRS:S-4. Should additional historic data upon these four sites provide information indicating that any site has a greater cultural value than presently assigned, the site rating will be adjusted accordingly.

Site locations are shown on Figure 3. This map can be coordinated with Figure 2 to demonstrate the spatial relationship of these sites to the corridor zone. Additional information on these sites is provided in the site reports which are being provided to all relevant government agencies as an appendix to this report.

Table 1

Cultural Resource Site Summary

AERC Site No.	Permanent Site No.	Site Type	Culture	Land Ownership
270N/1	----	Mine	Euro-American	Private
270U/1*	----	Cabin, Stone foundation	Euro-American	Private
270U/2*	----	Cabin, Stone foundation	Euro-American	Private
381N/1	----	Mine	Euro-American	Private
381N/2	----	Saw mill, corral	Euro-American	Private
381N/3	----	Mine	Euro-American	Private
381N/4	----	Mine	Euro-American	Private

*Sites situated in the corridor zone which could be directly affected by transportation corridor development.

B. Comparative Resource Analysis

Of the five sites situated in the transmission corridor zone, and therefore susceptible to adverse affect during the construction period, site 381N/1, the Utah No. 1 Mine, is the most important. The Utah No. 1 Mine was originally begun between 1875 and 1880 when it was known as the Mud Creek Mine. This mine "opened on the Castlegate 'A' coal bed. The south of the mine is at tipple height above the railroad, and in 1923 the coal, which was then being mined for railroad use, was dumped from the mine cars without screening into railroad cars. This mine was idle for many years after it was opened and the workings are less extensive than those of the other old mines of the district" (Spieker 1931:96). Extensive surface modification in the site area conducted during the past 100 years has altered much of the historic nature of the site. Some historic foundation rubble and depressions are presently discernable as are limited trash and rubble accumulations situated between the railroad track and the paved highway.

The Green Canyon Sawmill site (AERC 381N/2) includes a cement foundation and wooden rails for the log track. A corral and an abandoned roadbed are associated with this site which lies behind the Valley Camp of Utah offices.

The Nicolitus Mine site (381N/3) includes two portals situated on both the east and west slopes of Pleasant Valley. This site is situated at the mouth of Eccles Canyon and is visible from the highway. The mine portals were opened in the early 1920s by John Nicolitus and were worked for about five years. Joe Williams obtained the lease from Nicolitus and worked the portals in 1931 and 1932 but without success. Williams subsequently sold the lease to John Stone for $1100,

who unsuccessfully solicited John Staley and Joe Podbevsek to reopen the mine. The mine was never again worked because the veins were too thin to be profitable. No coal was ever sold from the mine (personal interviews conducted with Tom Biggs and John Staley in Scofield on August 29, 1980 by V. Garth Norman).

Sites AERC 270U/1 and 2 include two historic cabin foundations situated on the north ridge at the mouth of Eccles Canyon. These sites were originally recorded in 1979 by AERC while consulting for Coastal States Energy Company (CSEC-79-2). Both sites are limited, consisting of stone alignments and minimal construction materials. No trash area was discernible. Both sites may have been temporary campsites utilized during the construction of the west portal of the Nicolitus Mine (381N/3).

No prehistoric cultural resource sites or isolated artifacts have been observed or recorded in the general project locality.

Chapter IV - EVALUATIONS AND RECOMMENDATIONS

A. Resource Significance Evaluations:

An evaluation of site significance for the four sites situated within the mine plan permit area is presented in Table 2. Here the site quality indicators are presented with a statement on site condition. The field assessment of significance utilizing the CRRS system is provided in the fourth column. The CRRS system is best explained by quoting from the BLM definition sheet:

> Cultural Resource Rating System
>
> The following criteria are established as guidelines. The Bureau recognizes that the assignment of a particular rating is a professional judgment; however, the rationale of these judgments will be explicitly documented as part of the evaluation process.
>
> Assign an evaluation rating (S1, S2, S3, S4) to each site according to the following guidelines and record on the BLM form 6400-3:
>
> S1. S1 sites are those sites which are worthy of preservation *in situ*. In general, they are sites in relatively good condition with integrity (both internal and external); and are unique or representative; and/or have associations with important events or personages; and/or have yielded, or have a clear potential for yielding, highly significant scientific or educational information.
>
> S2. S2 sites are those sites which contain important scientific or educational data but yet are not worthy of preservation *in situ*. They are generally not particularly unique, representative, nor do they have important associations. Many contemporary sites may be S2 sites because, although they cannot be clearly and immediately assessed as such, they may become highly significant when evaluated from a future historical perspective.
>
> S3. S3 sites are those sites whose main worth are their potential for contributing data in regards to solving larger problems, such as reconstruction of

Table 2

Site Significance

Site	Quality	Condition	CRRS Value Rating
270N/1	a, g	Poor	3
270U/1*	----	Poor	4
270U/2*	----	Poor	4
381N/1 (First mine in area)	a, c, g, h	Poor	2
381N/2 (Saw mill for 381N/1)	g, h	Poor	3
381N/3	g	Poor	3
381N/4	g	Poor	3

*Sites situated in the corridor zone which could be directly affected by transporation corridor development.

AERC Quality indicators are:

a) size or layout is unique;
b) quantity and/or quality of artifacts is unique;
c) indication of depth;
d) environmental location is unique;
e) existence of unique artifacts, architecture, art or structure;
f) condition is excellent for preservation of materials or data;
g) site contains specific cultural data revelant to temporal and spatial identifications;
h) site is scene of an important event; and
i) site is associated with an important person.

paleo-environments and human use patterns. These kinds of sites generally show little concentration of artifacts, few features, no important associations, and little or no uniqueness or representativeness.

S4. S4 sites are those sites which have minimal information retrieval possibilities, or which have no integrity, uniqueness, representativeness, or no important associations.

No sites were accorded CRRS:S-1 significance.

Only one site is rated as CRRS:S-2 while one site is of CRRS:S-3 value. The remaining two sites have been given a CRRS:S-4 rating.

The site (AERC 381N/1) has been given an S-2 value based on the potential for additional information through archeological excavation. Should future research on any one of these sites provide new data relative to significance, the CRRS rating will be appropriately upgraded.

B. National Register Criteria of Eligibility:

Application of the National Register Criteria of Eligibility, defined under 36 CFR 60.6, to each of the four sites that are situated in the mine plan permit area provides the following information:

a) None of the four sites is associated with events that have made a significant contribution to the broad patterns of our history; or

b) none of the four sites is associated with the lives of persons significant in our past; or

c) none of the four sites embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; and,

d) site 381N/1 could yield information of value to the history of the region. Extensive surface modification of this site, however, precludes the Utah mine from consideration as an important and

intact historic site. Any information of value to the history of the region would have to be obtained through oral history research and through archeological excavation. This site should, therefore, be considered as meeting the standards of criteria "d" of 36 CFR 60.6. The other three sites (270U/1, 2, and 381N/3) are not eligible under the criteria outlined above.

C. Discussion of Impact Potential on Cultural Resource Sites

Direct impact, i.e., project-related disturbance of the four cultural resource sites located adjacent to the potential disturbance zone could result during surface modification for road and conveyor belt line development. The cabin foundations (270U/1 and 2), the Utah No. 1 Mine site (381N/1), and the sawmill site (381N/2) can be easily avoided during the construction period. The endangered west portal of the Nicolitus Mine (381N/3) is of marginal historic value and disturbance could occur without causing a loss of valuable information or historic materials.

Indirect impact of these four sites through vandalism can be considered a minimal threat to their historic value. Any valuable or useful lumber or construction materials which provide an identity to these sites has already been removed, discarded or destroyed on site.

Table 3 provides a summary of the basic adverse affect potential for all seven historic sites situated in the general project area.

Table 3

Cultural Resource Impact Potential

Site	CRRS Status	Direct Impact	Indirect Impact	Impact Agent	Figure Reference
270N/1	3	No	No	-----	2
270U/1*	4	Not probable	Possible	Vandalism	2
270U/2*	4	Not probable	Possible	Vandalism	2
381N/1	2	Not probable	No	Coal Mine Development	2
381N/2	3	No	Possible	Vandalism	2
381N/3	3	Not probable	Possible	Transmission Corridor Development & Vandalism	2
381N/4	3	No	No	Vandalism	2

*sites situated in the corridor zone

D. Recommendations

AERC recommends that whenever possible, site avoidance procedures be implemented as a means of preserving the historic resources of the general area (see Table 3). Should total destruction of any one of these sites become necessary, a complete photographic documentation of the site should be conducted prior to disturbance.

AERC would also recommend that an archeologist be present to monitor the disturbance of any large trash areas or midden accumulations since such localities could contain historically diagnostic artifacts.

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APPENDIX R614-301-500

Engineering

Valley Camp of Utah

Belina Haul Road Reclamation Plan

January 1987

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY

BELINA HAUL ROAD RECLAMATION PLAN

Prepared For

Valley Camp of Utah, Inc.
Helper, Utah

Prepared By

Morrison-Knudsen Engineers, Inc.
Boise, Idaho

January, 1987

0842h/1

ENGINEERING CERTIFICATION

I, J. Carl Dille, have reviewed Section 2 and 3 and the following Tables, Figures and Exhibits in the Belina Haul Road Reclamation Plan.

REGISTERED PROFESSIONAL ENGINEER
No. 5538
J. CARL DILLE
STATE OF UTAH

J. Carl Dille, P.E.

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Figure 2-9	Slope Stability Analysis of Current
Figure 2-10	Slope Stability Analysis of Reclaimed Haul Road
Figure 3-1	Small Drainage Hydraulic Data
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SECTION 1.0 - INTRODUCTION

1.1 General

The following reclamation plan is for Valley Camp of Utah's Belina Haul Road which supports their coal mining operation located on Whiskey Creek in Carbon County, Central Utah.

The haul road is constructed on a cut/fill bench having a total road width of thirty-four feet with very steep natural slopes above and below the road. These two facts create several unique problems when considering reclamation of the road.

This reclamation plan addresses the removal of the road surface materials and associated structures and the recontouring of the area to facilitate the return of the disturbed lands to its pre-mining land use of limited rangeland and wildlife habitat.

1.2 Objectives

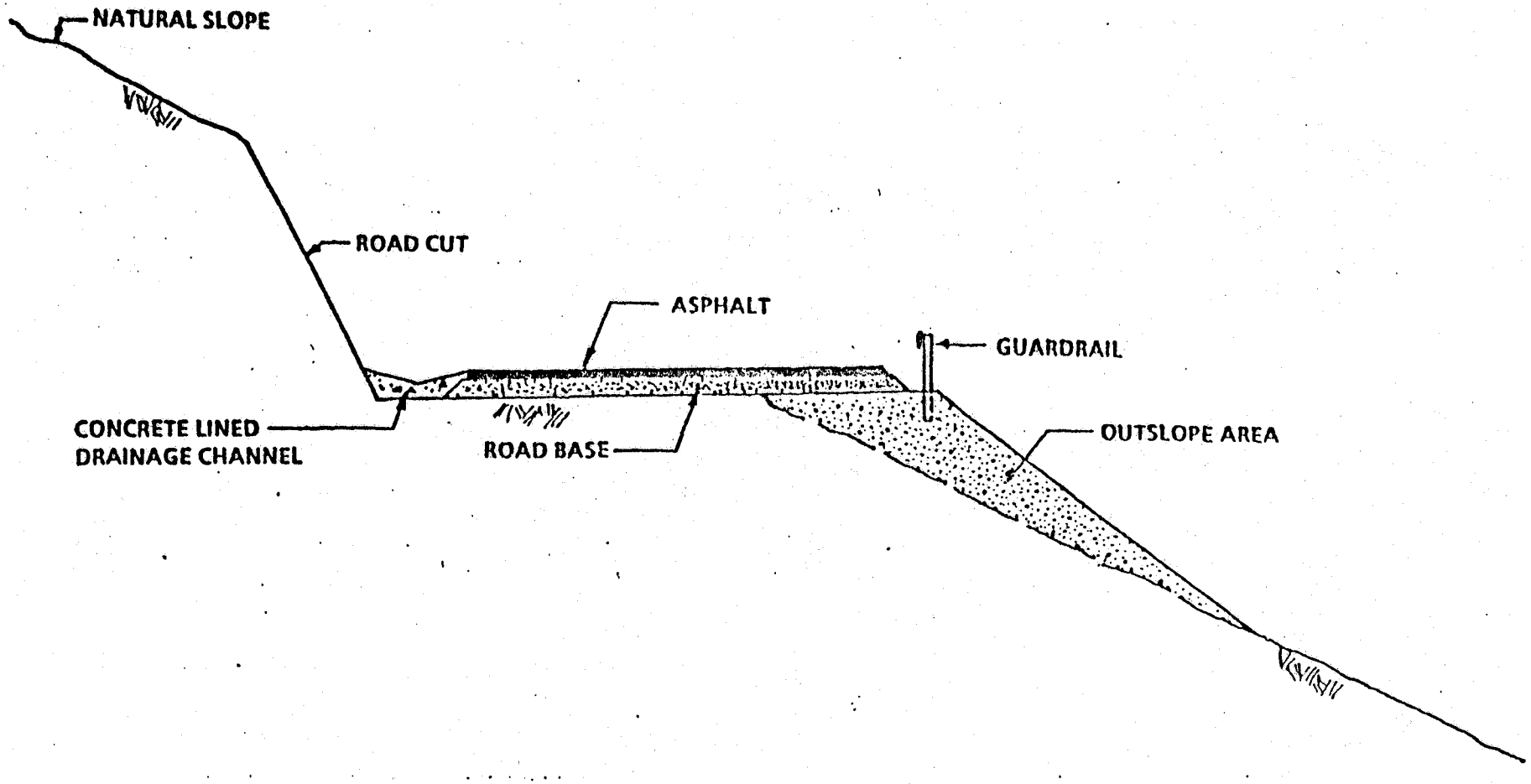
The objectives of this reclamation plan are to eliminate the permanent road surface and support structures and return the disturbed land to a condition capable of supporting the pre-mine land use of limited rangeland and wildlife habitat. These objectives will be obtained by recontouring the road surface to re-establish a drainage pattern comparable to pre-mining conditions; by replacing the soil medium and re-establishing an effective permanent vegetation cover.

The affective area consists of a strip of land approximately 100 feet wide and 1.5 miles long. Although the right-of-way (ROW) is approximately 100 feet wide, this reclamation plan will only address the road surface (34 feet wide); the outslope areas having

questionable slope stability and the area to be re-disturbed to re-establish the natural drainages. Figure 1-1 is a typical cross section illustrating the construction of the Belina Haul Road. Approximately ten acres will require recontouring and/or reclamation activities. The majority of the road outslope areas are considered stable as final reclamation, as discussed in Section 2.0, and therefore will not be disturbed. Determination of slope stability is discussed in detail in Section 2.0. The results of a limited geotechnical evaluation concerning the road outslopes and drainage fills are shown in Table 2.1. Only the potentially unstable slopes and their corresponding station location are shown on this table. These station locations were determined from plan and profile sheets showing the general road location and grade. Survey station locations were shown on the map beginning at the mine portal going towards the Eccles Canyon intersection and ending at Station 83+52.

Reclamation activities will be conducted in a manner that will minimize the potential adverse impacts to the air, water, vegetation, wildlife, and general aesthetics of the area. This proposed reclamation plan will establish a permanent, diversified vegetation cover capable of self-regeneration and soil stabilization that will support the post-mining land use of limited rangeland and wildlife habitat.

VALLEY CAMP OF UTAH
BELINA HAUL ROAD RECLAMATION
TYPICAL HAUL ROAD CROSS SECTION
Figure 1-1



SECTION 2 - GEOTECHNICAL INVESTIGATION

2.1 General

The geotechnical investigation for the Belina Haul Road was performed in three phases. Phase I was a site evaluation of the natural talus in the local region. Phase II identified the areas considered to be critical. Phase III was the slope stability analysis for typical sections of the road before and after reclamation. Conclusions were then based upon all three phases.

Soils in this region are considered young and primarily consist of weathered rock high in quartz. The Unified Soil Classification System would consider this material as SP since it is gravelly sand which is poorly graded and has very few fines. This type of soil has essentially no cohesion; therefore, it is considered a pure phi (Ø) soil which will control the type of slope failures and geometry of the natural talus slopes.

2.2 Natural Talus Evaluation

Natural talus slopes in the haul road area widely vary between 30 percent to over 100 percent. By considering the friction angling (Ø) of the soil to be constant across the region, the depth to bedrock will control the natural talus slope stability. Shallow soils are stable at greater slopes than deep soils. The length of run also plays a major role in the stability of the slopes. The natural talus in the region was self-stabilizing due to small failures creating a terracing effect across the hillside. The stabilizing of the natural talus slopes is still occurring and numerous natural slope failures

may be seen around the vicinity of the Belina Haul Road. The friction angle of the talus was derived from the geometry of a recent natural slope failure. This failure analysis produced a friction angle equal to 31°. This value is very typical for SP classified soils.

2.3 Critical Fill Areas

Critical fill areas are defined for this discussion as areas which have localized evidence of recent slope failures, slopes which exceed the friction angle of the soil, or slopes that have similar characteristics of recent failures in the region, such as deep soil horizons. These critical areas are listed in Table 2.1:

TABLE 2.1

POTENTIALLY UNSTABLE SLOPES*

AREA	Station Location	Linear Distance	Slope Pre-Construction	Slope Post-Construction
1	21+10 to 22+70	160'	63%	70%
2	24+06 to 29+34	520'	63%	72%
3	30+40 to 32+00	160'	55%	68%
4	37+18 to 44+00	682'	63%	70%
5	51+17 to 52+75	158'	65%	75%
6	61+00 to 64+12	312'	70%	80%
7	73+00 to 75+60	260'	84%	128%
8	77+18 to 82+46	528'	84%	143%

TOTAL = 2,780 Feet

*Typical Geometries for each one of these reaches are illustrated in Figures 2.1 to 2.8.

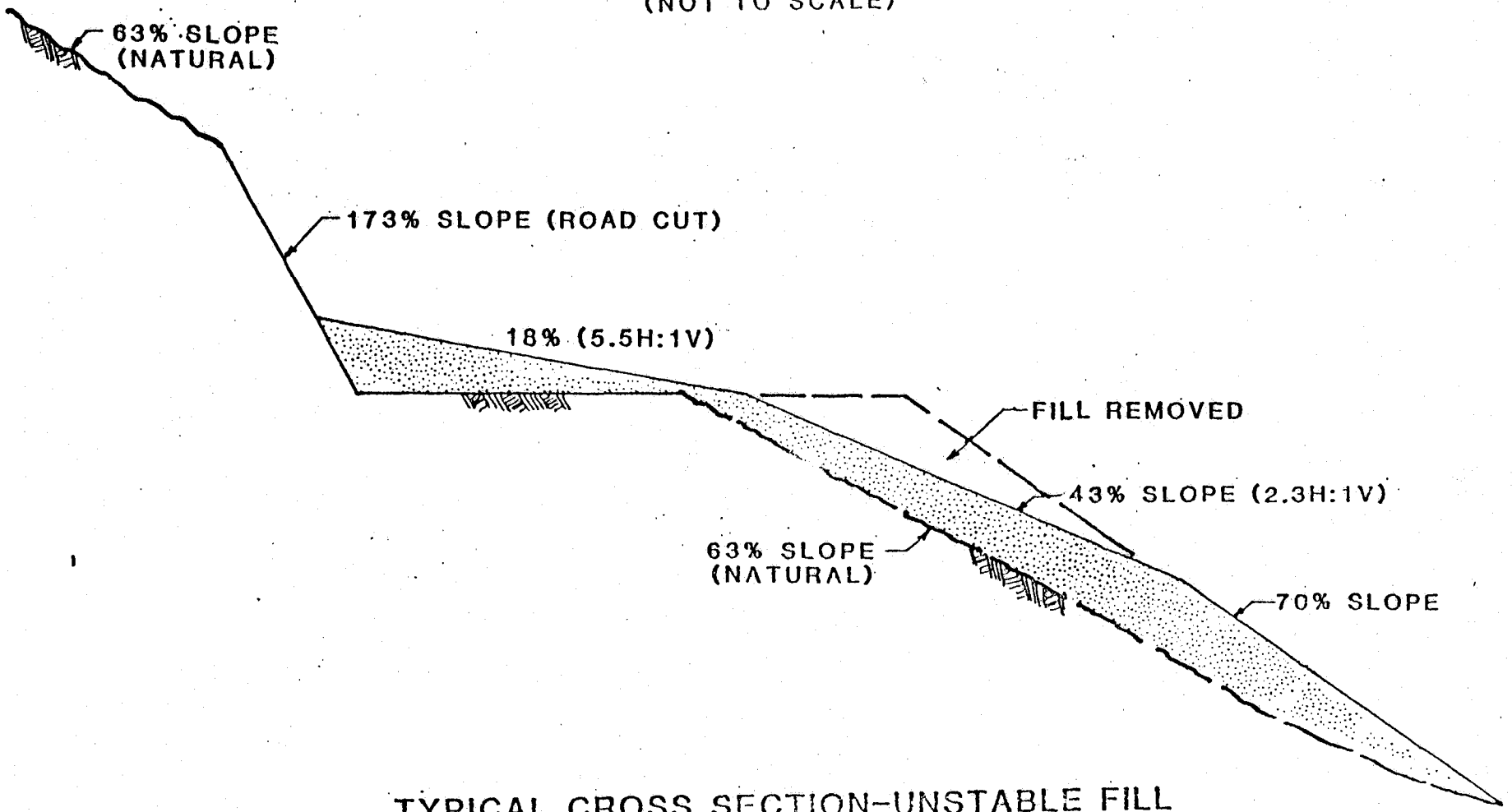
VALLEY CAMP OF UTAH

BELINA HAUL ROAD RECLAMATION

FINAL CONTOURED SURFACE

Figure 2-1

(NOT TO SCALE)



TYPICAL CROSS SECTION-UNSTABLE FILL

STA 21 + 10 TO 22 + 70

AREA 1

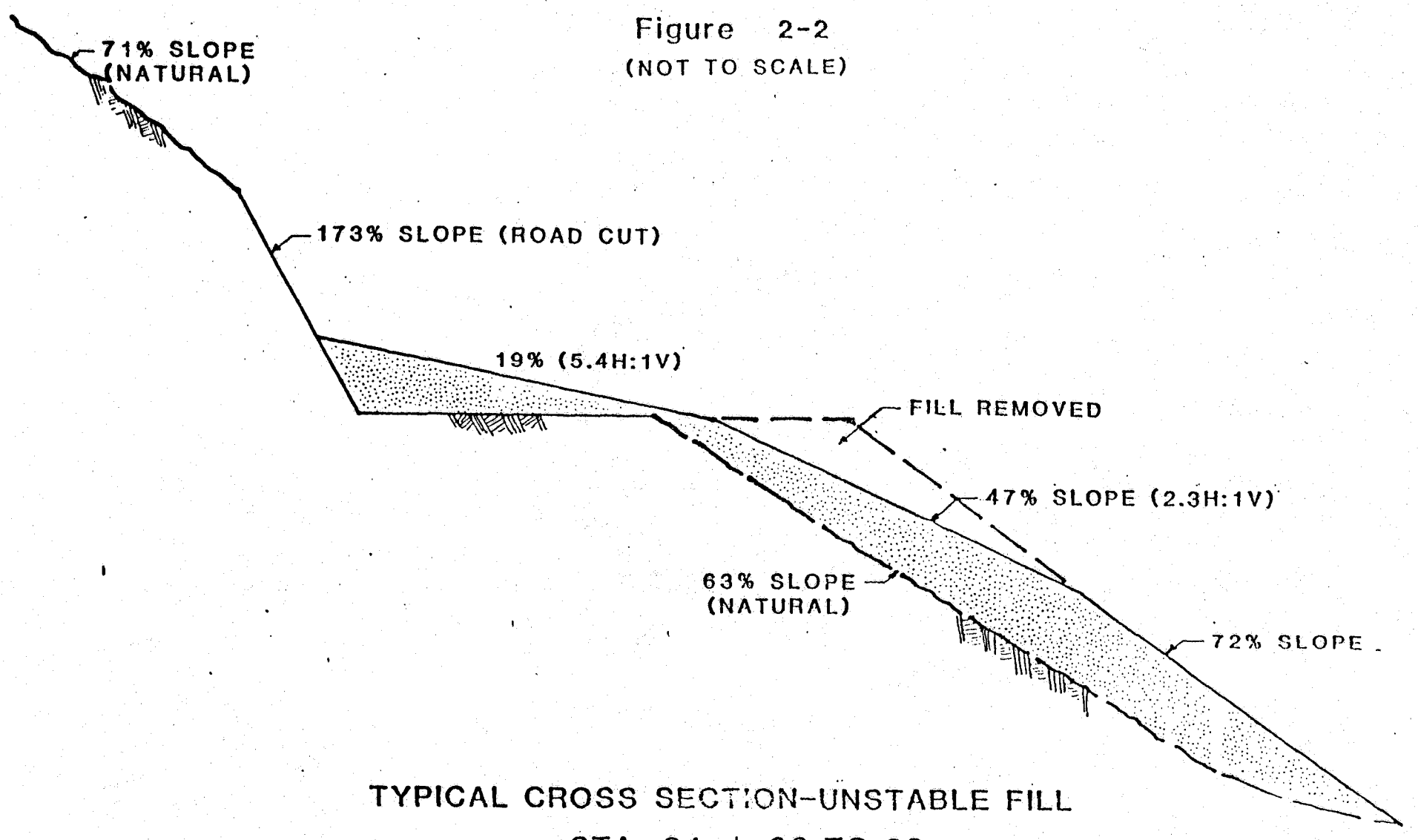
VALLEY CAMP OF UTAH

BELINA HAUL ROAD RECLAMATION

FINAL CONTOURED SURFACE

Figure 2-2

(NOT TO SCALE)



TYPICAL CROSS SECTION-UNSTABLE FILL

STA. 24 + 06 TO 29 + 34

AREA 2

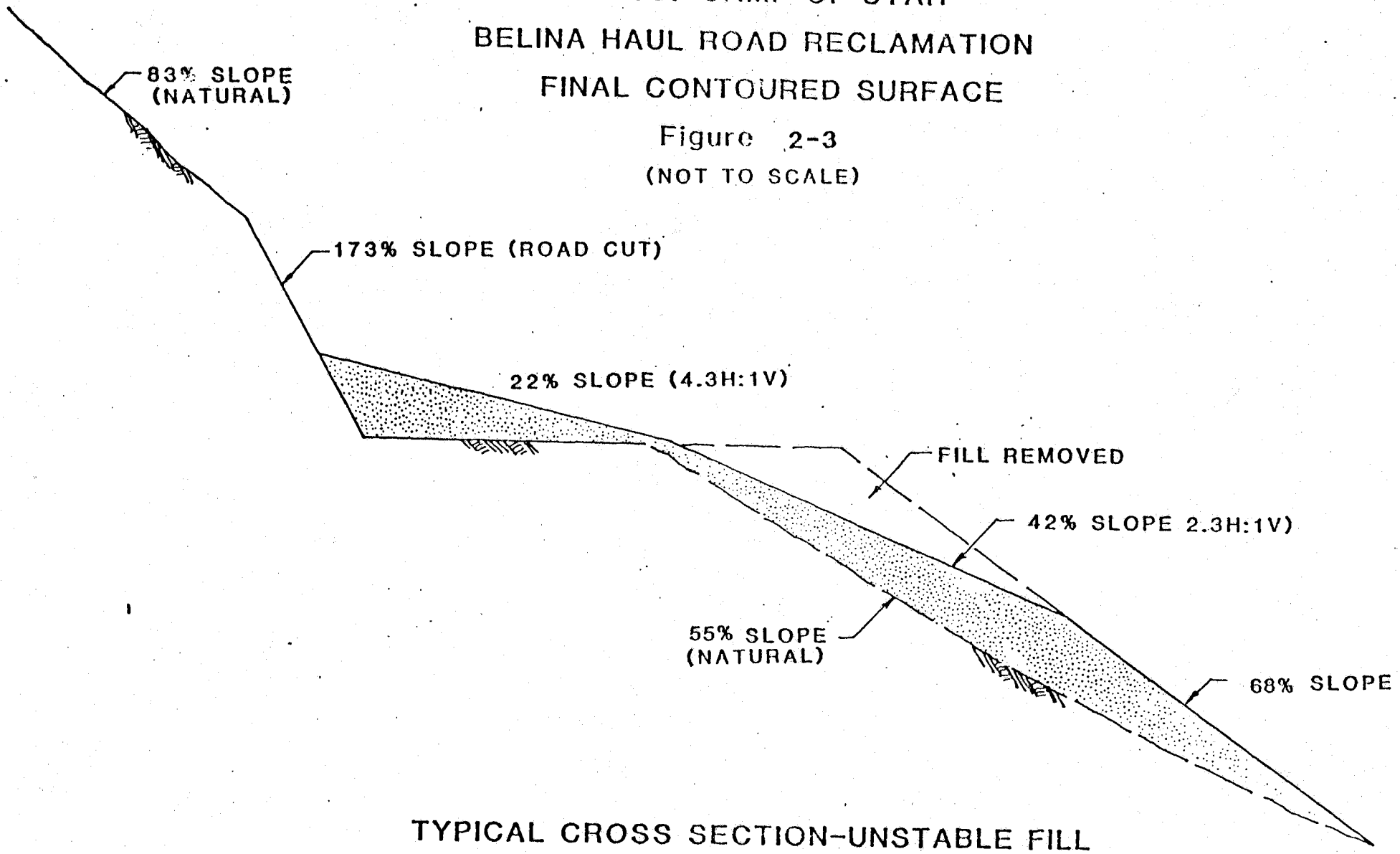
VALLEY CAMP OF UTAH

BELINA HAUL ROAD RECLAMATION

FINAL CONTOURED SURFACE

Figure 2-3

(NOT TO SCALE)



TYPICAL CROSS SECTION-UNSTABLE FILL

STA. 30+40 TO 32+00

AREA 3

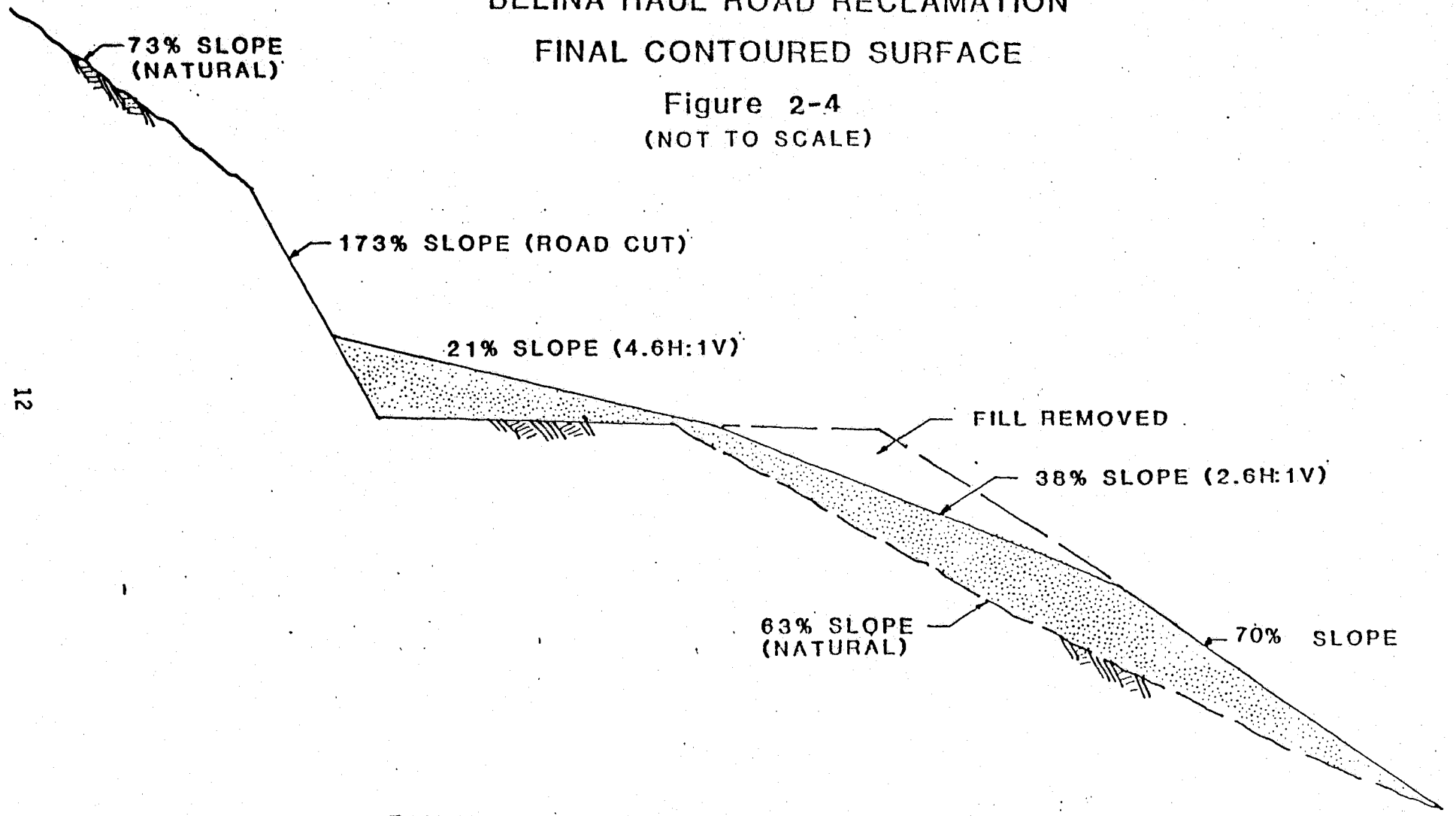
VALLEY CAMP OF UTAH

BELINA HAUL ROAD RECLAMATION

FINAL CONTOURED SURFACE

Figure 2-4

(NOT TO SCALE)



TYPICAL CROSS SECTION-UNSTABLE FILL

STA. 37 + 18 TO 44 + 00

AREA 4

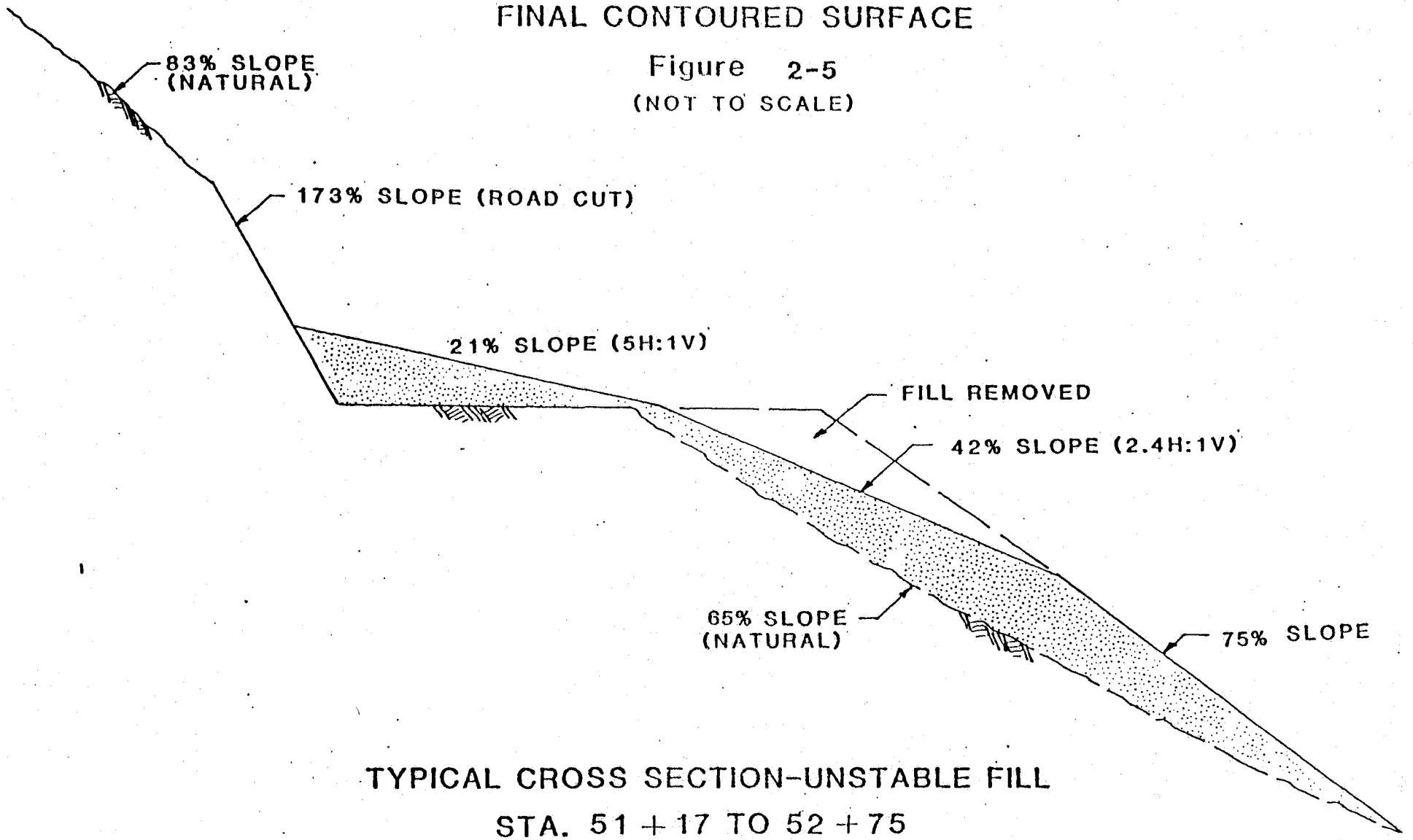
VALLEY CAMP OF UTAH

BELINA HAUL ROAD RECLAMATION

FINAL CONTOURED SURFACE

Figure 2-5

(NOT TO SCALE)



TYPICAL CROSS SECTION-UNSTABLE FILL

STA. 51 + 17 TO 52 + 75

AREA 5

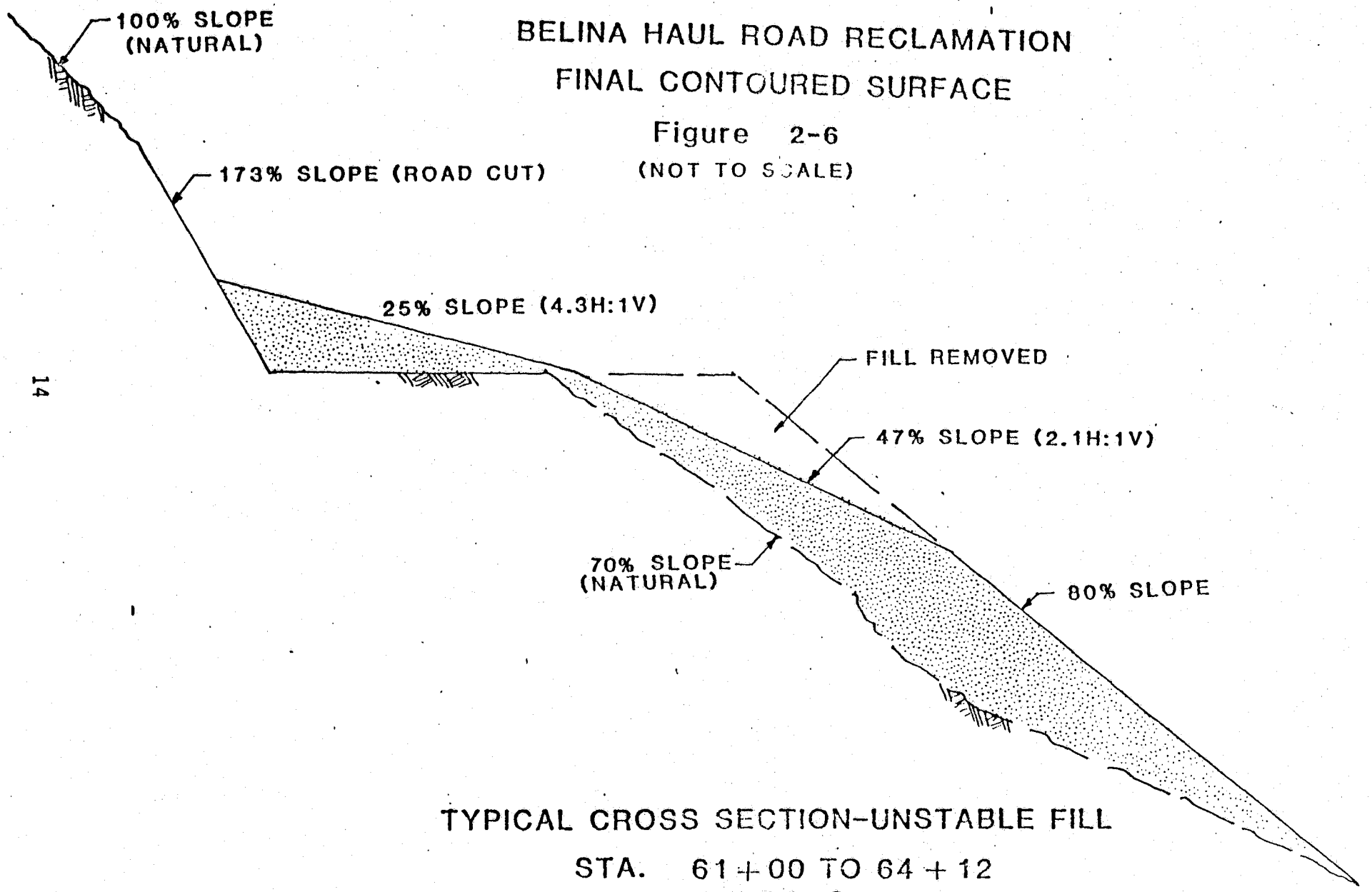
VALLEY CAMP OF UTAH

BELINA HAUL ROAD RECLAMATION

FINAL CONTOURED SURFACE

Figure 2-6

(NOT TO SCALE)



TYPICAL CROSS SECTION-UNSTABLE FILL

STA. 61+00 TO 64+12

AREA 6

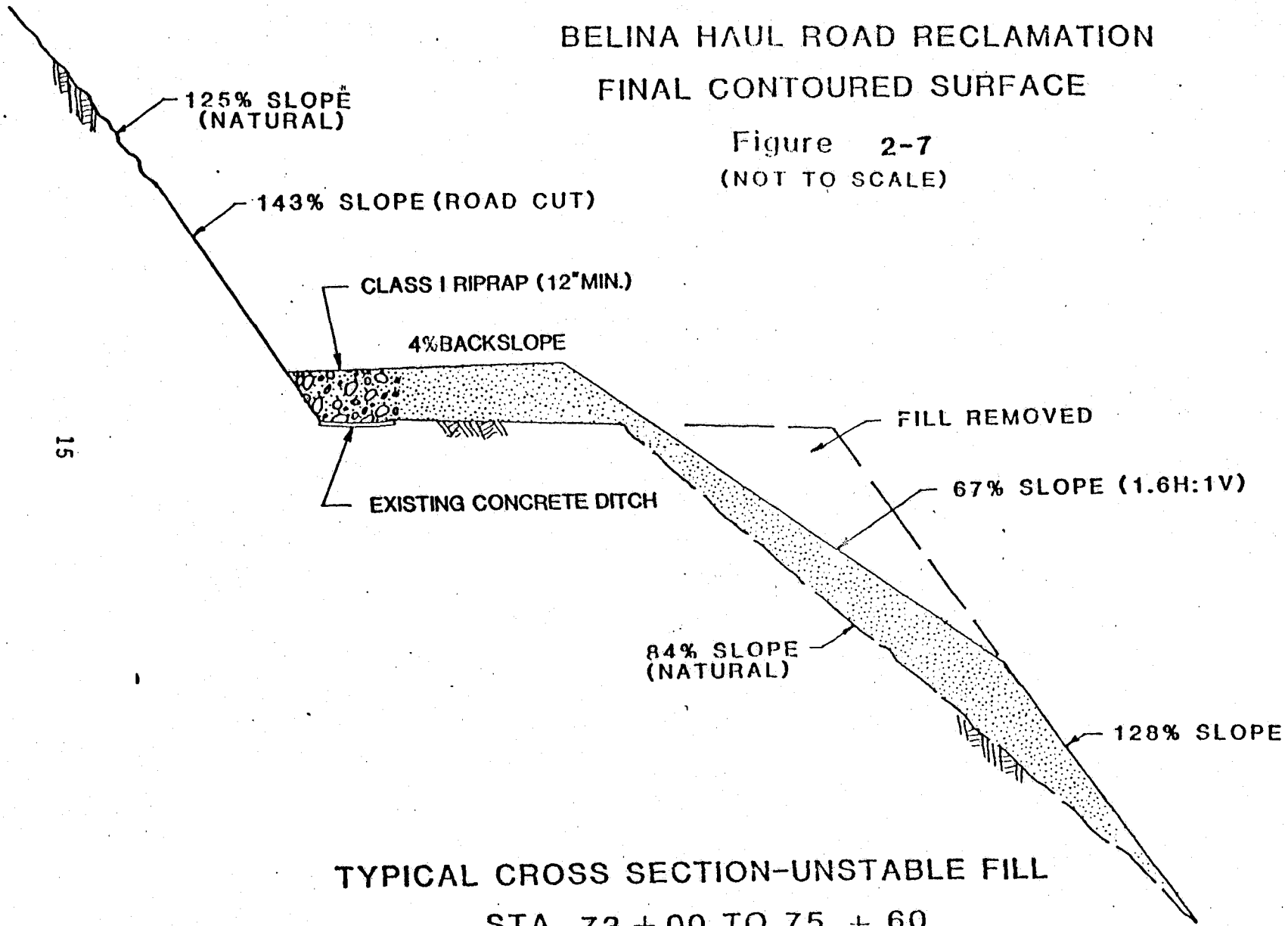
VALLEY CAMP OF UTAH

BELINA HAUL ROAD RECLAMATION

FINAL CONTOURED SURFACE

Figure 2-7

(NOT TO SCALE)



TYPICAL CROSS SECTION-UNSTABLE FILL

STA. 73 + 00 TO 75 + 60

AREA 7

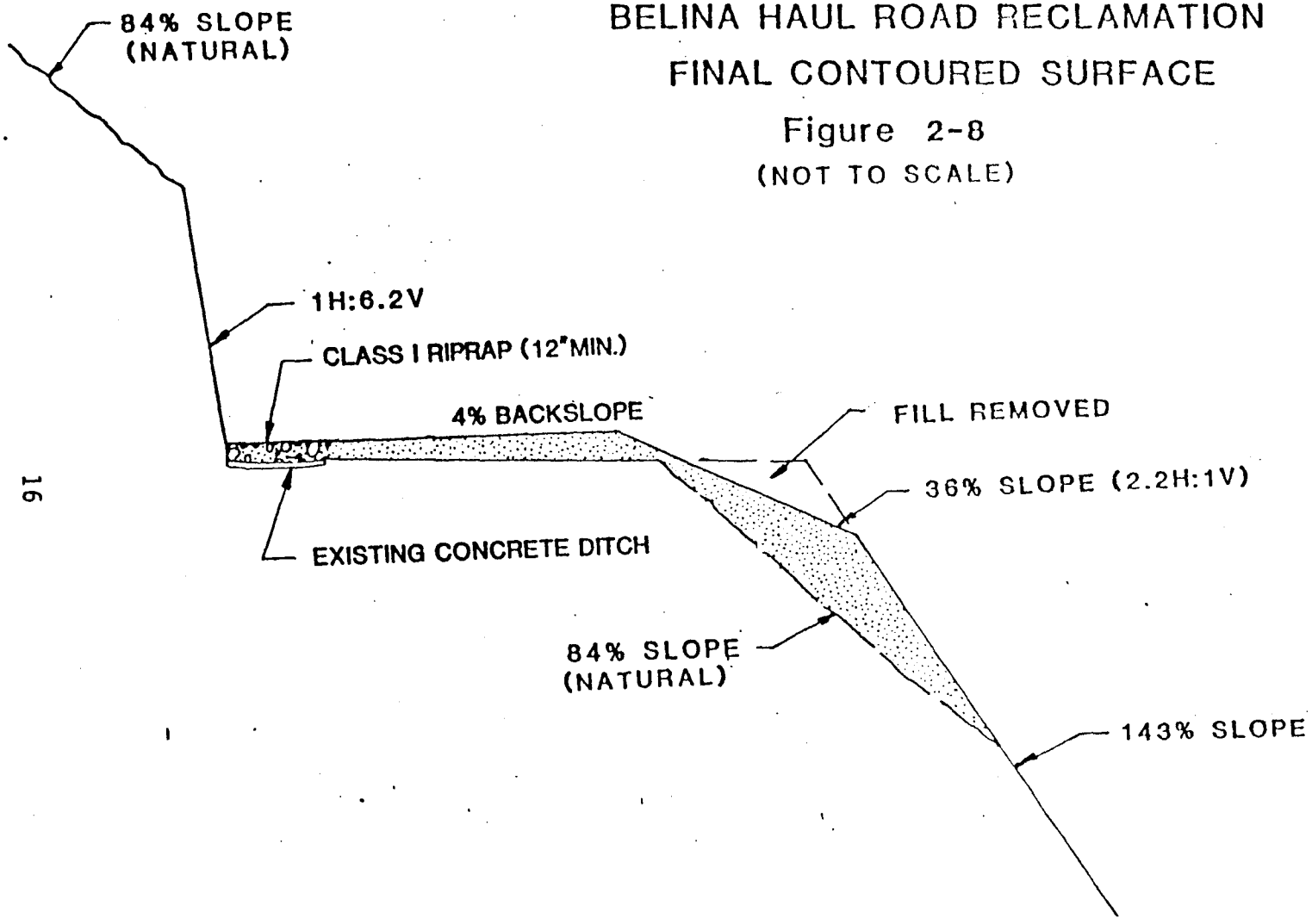
VALLEY CAMP OF UTAH

BELINA HAUL ROAD RECLAMATION

FINAL CONTOURED SURFACE

Figure 2-8

(NOT TO SCALE)



TYPICAL CROSS SECTION-UNSTABLE FILL

STA. 77+18 TO 82+46

AREA 8

The Bowel Crossing has not been considered to be a critical fill area due to the reclamation plans in this reach. By removing the top portion of the fill, this region does not present a slope stability problem and should remain stable.

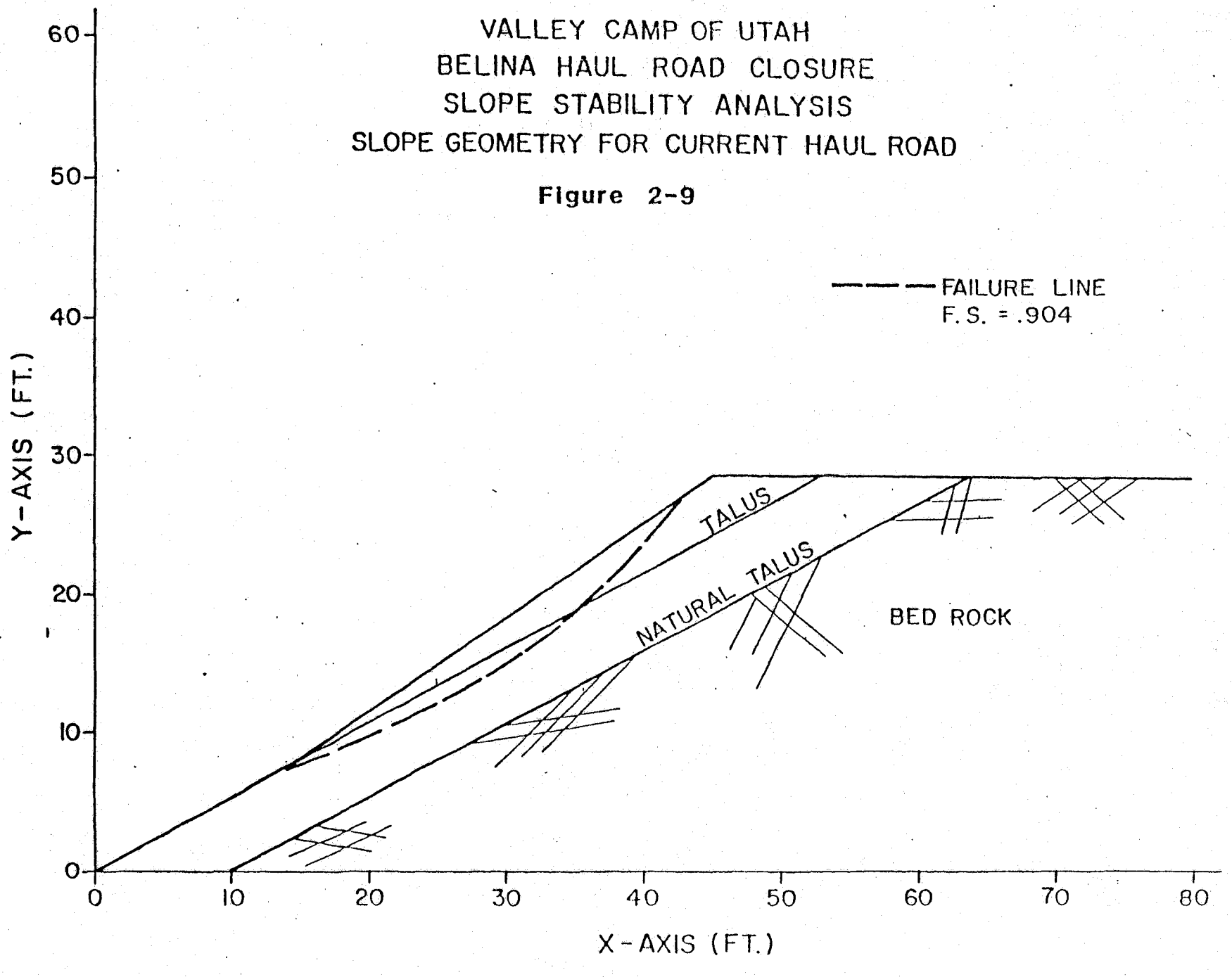
2.4 Methods and Results of the Slope Stability Analyses

The slope stability analysis was performed using the computer model STABL 5. Typical geometries before and after reclamation of the Belina Haul Road are illustrated in Figures 2.9 and 2.10. The natural talus slope used for model input was set equal to 53 percent and the talus slope to 68 percent. The reclamation slope was based upon the capability of a backhoe to reach downslope 25 feet. The soil density was assumed to be 100 pounds per cubic foot with a phi value of 31°.

The factor of safety for the talus on the current haul road was estimated to be .904, which is reasonable since the talus' phi value input is 31° and no adjustment was made for the irregular bedrock formation. The factor of safety after reclamation was estimated to be 1.08, which increases the factor of safety from the original haul road geometry by 19 percent. This increases the factor of safety to be greater than most of the natural talus since many of the natural slopes are unstable. Most natural talus slopes in the region have a factor of safety equal to 1.00 for their given geometry. Note that the failure plane configuration produced by the model shows shallow, circular failures which are predominant in this region. The very steep slopes noted in this study were made up of coarser sands and gravels which have considerably higher friction angles than the soil used for the typical section modeling. This non-homogeneity is common in young, shallow soils with some deviation in parent material and weathering exposure.

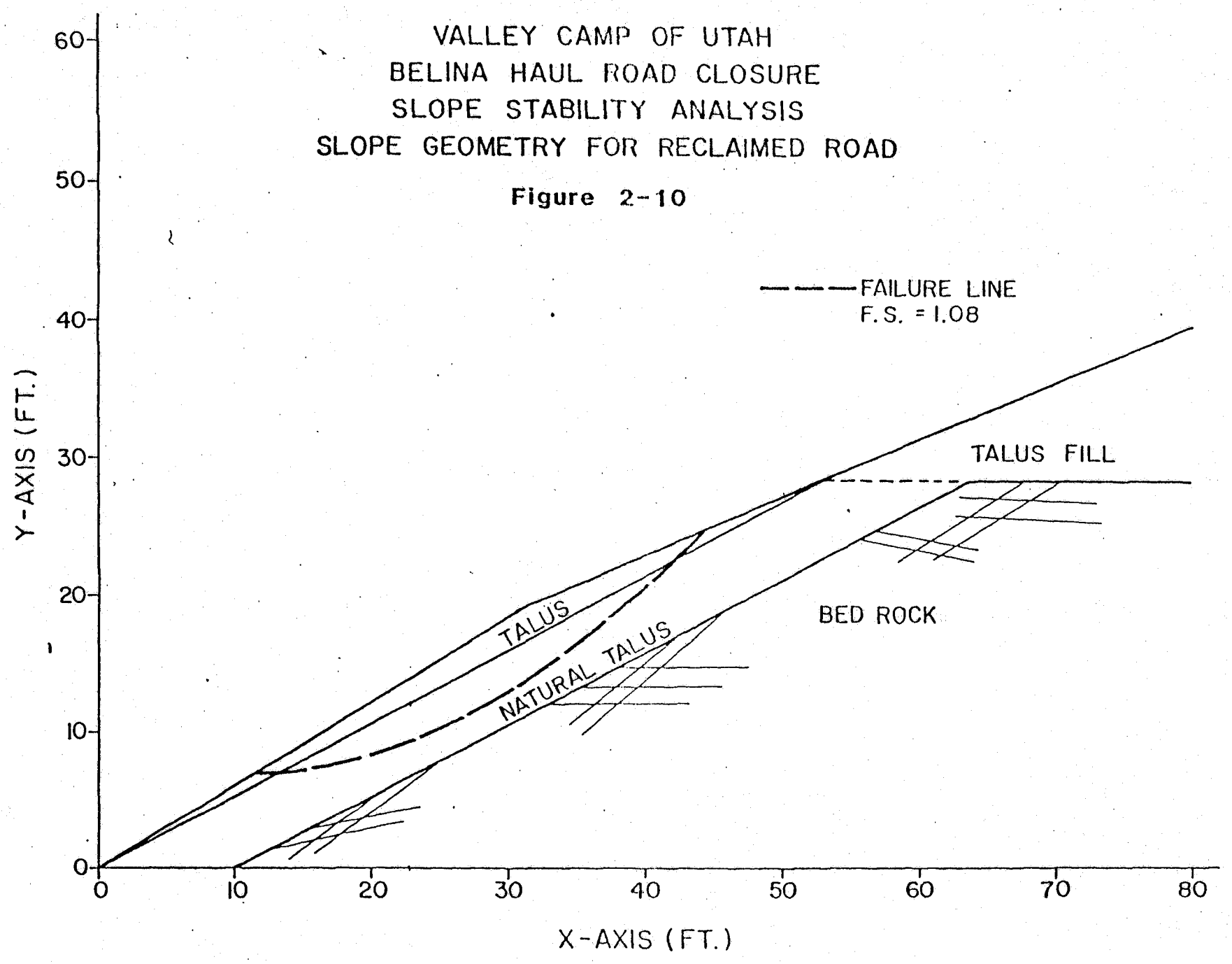
VALLEY CAMP OF UTAH
BELINA HAUL ROAD CLOSURE
SLOPE STABILITY ANALYSIS
SLOPE GEOMETRY FOR CURRENT HAUL ROAD

Figure 2-9



VALLEY CAMP OF UTAH
BELINA HAUL ROAD CLOSURE
SLOPE STABILITY ANALYSIS
SLOPE GEOMETRY FOR RECLAIMED ROAD

Figure 2-10



SECTION 3.0 SURFACE HYDROLOGY/HYDRAULICS

3.1 General

Surface water runoff was determined for the seven small drainages on the Belina Haul Road using the Soil Conservation Service (SCS) curve number method and the TR-20 Computer Program. Once flows were determined for each of the drainages, typical channels were developed and the velocity was determined so that the riprap sizing could be developed. Also included as part of the surface water design are the water bars to be constructed along the recontoured road.

3.2 Design Flows

The design storm for the seven drainages shown on Exhibit 3-1 was the 100 year, 24 hour, which has a rainfall amount of 3.65 inches. This is based on information developed for the Clear Creek Summit, Utah. Table 3-1 shows the precipitation depths versus return period for the Clear Creek Summit Site. The flows were developed based on a Type II rainfall distribution and are shown in Table 3-1.

The major parameters used in determining the runoff with the TR-20 model are the drainage area, time of concentration and CN. The time of concentration is defined as the time required for water to travel from the most hydraulic point of the watershed to the point of interest. It is computed by adding together the time for various segments of the conveyance system. For the mountainous drainage along the Belina Haul Road the time was estimated following the steps outlined in the SCS TR-55 publication and consist of three parts, sheet flow, shallow concentrated flow and open channel flow. The time of travel for each segment was computed and added together to determine the time of concentration for the drainage.

TABLE 3-1

Estimated precipitation depths for various return periods and durations at Clear Creek, Summit, Utah (from Richardson (1971).

RETURN PERIOD (years)	DURATION 5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.10	.16	.20	.28	.35	.46	.57	.84	1.08	1.33
2	.12	.19	.25	.34	.43	.57	.70	1.04	1.34	1.65
5	.16	.24	.31	.43	.54	.72	.90	1.34	1.73	2.14
10	.19	.29	.37	.51	.65	.86	1.06	1.55	1.99	2.45
25	.24	.38	.48	.66	.84	1.08	1.31	1.88	2.39	2.92
50	.25	.38	.48	.67	.85	1.13	1.40	2.07	2.67	3.29
100	.27	.42	.53	.73	.93	1.24	1.54	2.29	2.96	3.65

Runoff curve number (CN) are based on hydrologic soil group, cover type, and antecedent moisten condition of the soil. The soils and vegetation maps from Valley Camps' approved mining permit application (UT-0013) were used to determine the CN value for each of the drainages. The USFS has recently completed classifying their lands and assigning CN values and was contacted to see how values compared. In general the values computed for the haul road agreed quite closely and were slightly higher giving a more conservative estimate of the flow and were judged to be reasonable for forest lands. Table 3-2 below shows the date used to compute the design flows for each of the drainages.

TABLE 3.2

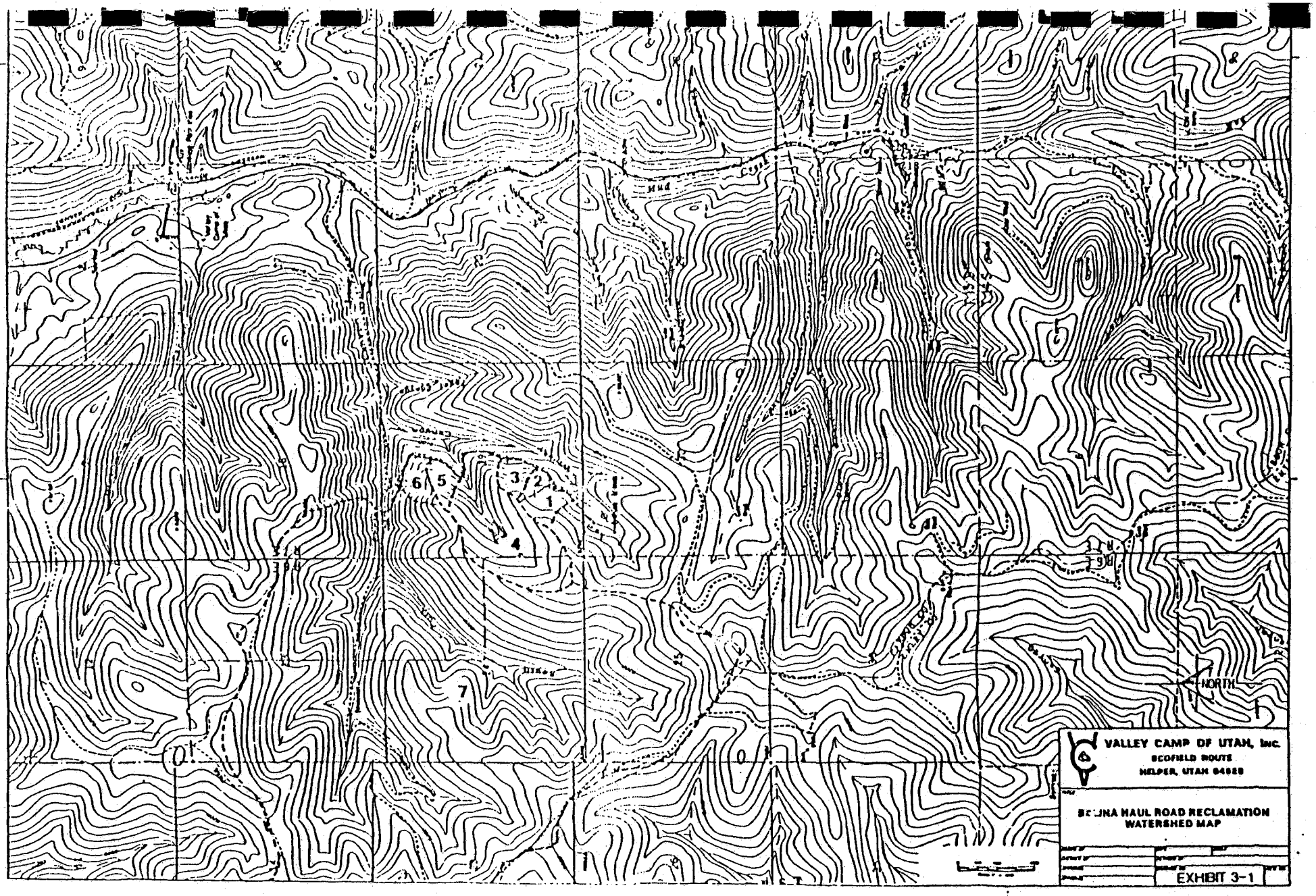
WATERSHED SIZE AND FLOW CHARACTERISTICS

Watershed #	CN	tc hrs.	Area, AC	Q cfs
1	60	.49	18.8	6.7
2	60	.35	9.6	4.3
3	60	.74	11.8	3.2
4 (Bowl Crossing)	60	.71	147.8	44.0
5	60	.71	14.2	4.0
6	60	.56	25.0	8.3
7 (Eccles Creek)	60	1.37	2087.0	378.

3.3 Channel Design

It is proposed in the reclamation plan that the existing culverts be removed and the ephemeral channels reestablished at their original slope and be protected with riprap. Figure 3.1 shows a typical section through the road after regrading and contouring and the various hydraulic data.

The slope will vary from about 15 percent across the road to a maximum of 65-70 percent along the slope face. To replace the culverts on five of the smallest drainages, a small "V" ditch will


1
2
3
4
5
6
7
NORTH
VALLEY CAMP OF UTAH, Inc.
SCOFIELD ROUTE
HELPER, UTAH 84526
BOUNA HAUL ROAD RECLAMATION
WATERSHED MAP
EXHIBIT 3-1

be constructed to carry the flow from each of the small drainages through the road sections. These small ditches will be protected with riprap and a typical section is shown on Figure 3-1.

Velocities were computed using the Manning's equation. The channel roughness coefficient, n, was estimated based on values for small mountain streams where the depth of flow is small when compared to the size of bed material. In Open-Channel Hydraulics, Chow suggested n values range from .040 to .070 for small, steep mountain streams with cobbles and boulders. Values were also determined from the paper Two Approaches for Estimation of Manning's n in Mountain Streams, by Weache, et al. at the Wyoming Water Research Center. Based on their method, n is estimated to range from .065 to .085. A value of .06 was used in all of the computation. It was felt that the turbulence would be very high since the average depth of flow would range from .5 feet to 1.0 feet and the riprap size would range from 1.0 feet to 2.0 feet.

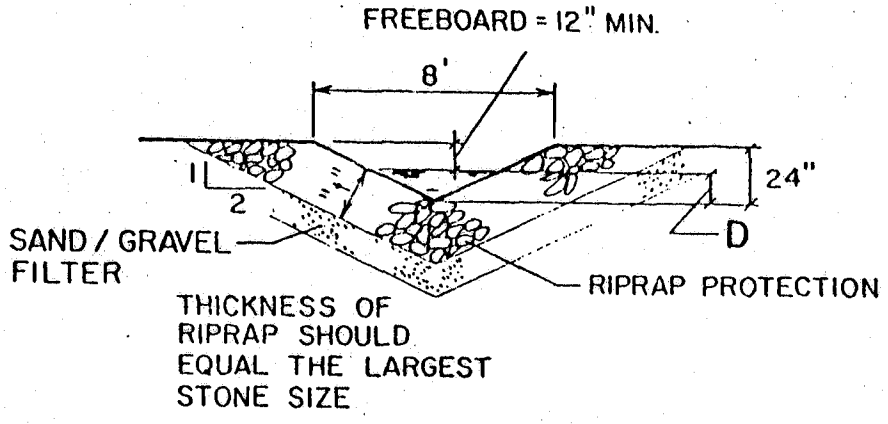
While this value is higher than those typically used, (.035 - .045), it is felt justified because the depth of flow is much greater than the stone size and this is not the case for the Belina Haul Road drainages.

3.3.1 Small Drainages

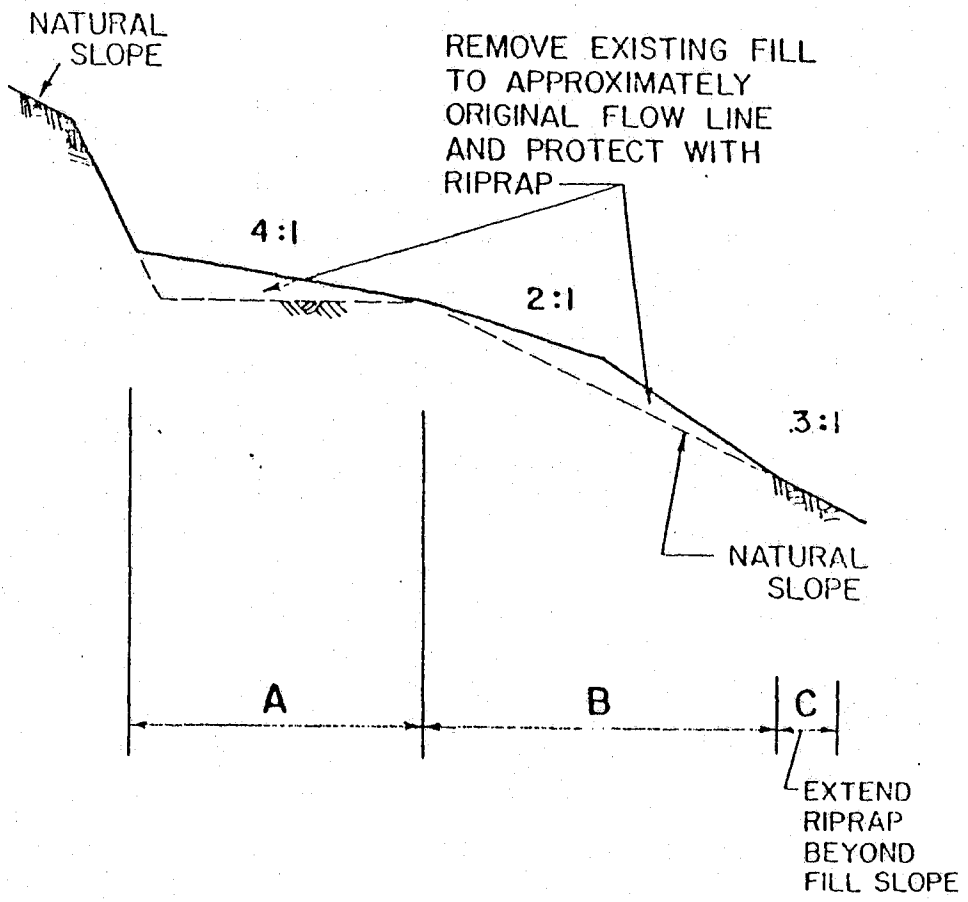
Flows vary from 3.2 to 8.3 cfs for the five smallest drainages. The small "V" ditches were designed based on the maximum flow of 8.3 cfs. This will provide a conservative design and will standardize them making construction easier. The velocity will vary from about 4 feet per second for the 15 percent slope to about 10 ft/sec. on the steeper slope of 70 percent. Details for each of the crossings are shown on Figure 3-1.

VALLEY CAMP OF UTAH
BELINA HAUL ROAD RECLAMATION
SMALL DRAINAGE
HYDRAULIC DATA

Figure 3–1



TYPICAL "V" DITCH
FOR SMALL DRAINAGES



TYPICAL STREAM CROSSING
FOR SMALL DRAINAGES

VALLEY CAMP OF UTAH
BELINA HAUL ROAD RECLAMATION
SMALL DRAINAGE
HYDRAULIC DATA
Figure 3–1a

AREA	DRAINAGE	CHANNEL SLOPE	Q In cfs.	*D Depth Ft.	VELOCITY Ft./Sec.	RIPRAP CLASS
*A	1	15%	6.7	.85	5	I
	2	15%	4.3	.70	4	I
	3	15%	3.2	.65	4	I
	5	15%	4.0	.70	4	I
	6	15%	8.3	.90	5	I
*B	1	63%	6.7	.65	9	II
	2	63%	4.3	.55	8	II
	3	55%	3.2	.50	7	II
	5	70%	4.0	.50	8	II
	6	70%	8.3	.70	10	II
*C	ALL					II

*SEE FIGURE 3-1
FOR LOCATION

3.3.2 Bowl Crossing

Design of the channel for the Bowl Crossing drainage (Area 4) was done in a similar manner. The 100 year design flood is estimated at 44 cfs. It is proposed that a small overland flow channel be constructed through the rock fill after the soil fill has been removed, (See Section 4.3.1) which will have a bottom width of four feet. Figure 3-2 shows a typical section through the fill. The existing culvert will remain in place and will carry the smaller flows. The new overland flow channel will carry the flood flows for the more infrequent storms and also if the culvert should become clogged. The velocity in the new channel will vary from 8 ft/sec. across the rock fill where the slope is about 15 percent to 13 ft/sec. down the steeper natural slope. Details of the channel and hydraulic data are shown on Figure 3-2.

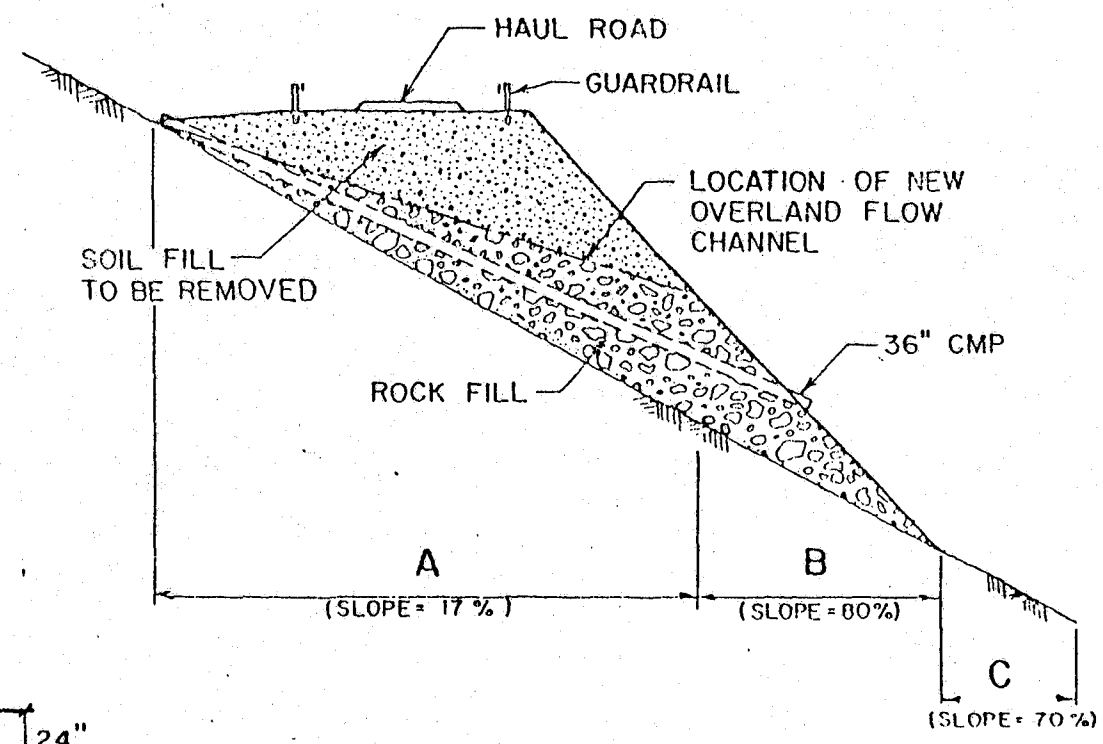
The design for Eccles Creek drainage is covered in Section 3.5.

3.4 Riprap Design

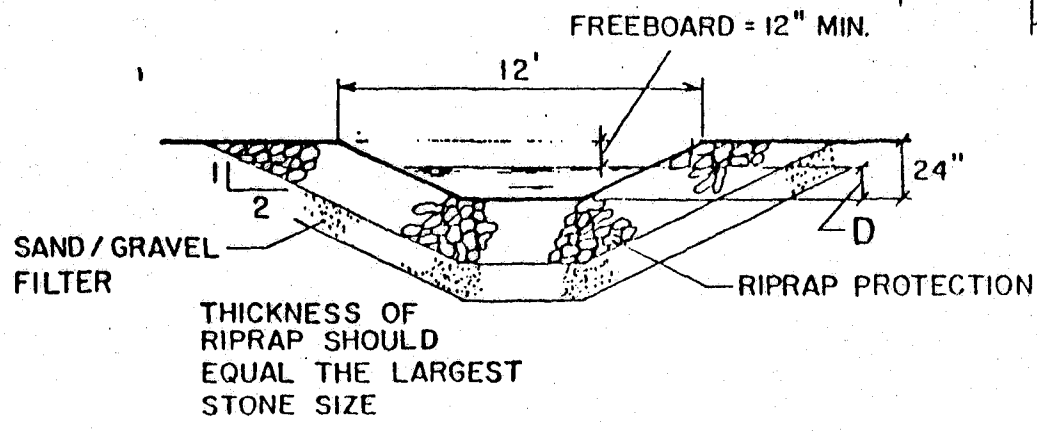
Rirrap sizing was selected based on the above velocities using USBR Engineering Monograph #25 and FHWA Hydraulic Engineering Circular #11. The d_{50} size is four inches on the flatter slopes (Class I) and is nine inches on the steeper slopes (Class II). Gradation for the different classes of riprap are shown in the Table 3.3.

VALLEY CAMP OF UTAH
BELINA HAUL ROAD RECLAMATION
BOWL CROSSING
HYDRAULIC DATA
Figure 3-2

AREA	D Depth Ft.	VELOCITY Ft./Sec.	RIPRAP CLASS
A	1.0	8	II
B	.70	13	II
C	.70	13	II



SECTION THRU BOWL CROSSING



TYPICAL DITCH FOR BOWL CROSSING
DESIGN Q = 44 cfs.

TABLE 3.3

RIPRAP DESIGN

Class	Max.	Size, In d_{50}	Min.
I	8	4	1 1/2
II	24	18	6
III	36	24	8

Riprap should be reasonably well graded from the maximum size down to the minimum. The concrete removed from the project will be used as part of the riprap protection and will be broken so as not to be larger than the d_{50} size and will not makeup more than 15 percent of the volume. The riprap will extend beyond the toe of the fill slopes a minimum of five feet to provide energy dissipation at the termination of the riprap channels, the energy dissipator will be small mounds of riprap approximately 18"-24" high to help spread the flows out and reduce erosion.

A filter blanket will be constructed and placed between the riprap and the native material. The filter will be constructed of a well-graded gravel with a minimum size of about 3/16" up to a maximum required by the riprap class and is shown below in Table 3.4.

TABLE 3.4

RIPRAP FILTER DESIGN

RIPRAP CLASS	MAX, in	MIN, in	THICKNESS, in
I	*		
II	4	3/16	9
III	6	3/16	9

*Not required; native material acceptable

3.4.1 Small Drainages

The existing native material appears to be sandy gravelly material based on field inspections. The gradation is estimated to be from 3 inches down to less than 1/8" with a d_{50} size of about 3/8". This material will meet the requirements for a filter material for the Class I riprap, since the d_{15} Riprap/d_{85} Base is less than 5.

3.4.2 Bowl Crossing

Based on field observations and discussions with the mining operation people, it appears that the blast rock in the Bowl crossing fill has a maximum size of 18 inches to 36 inches. This would provide adequate protection based on the above velocities. If, when the soil fill is removed and the channel is constructed, it is determined that the actual blast rock is not large enough, additional riprap protection (Class III) will be provided.

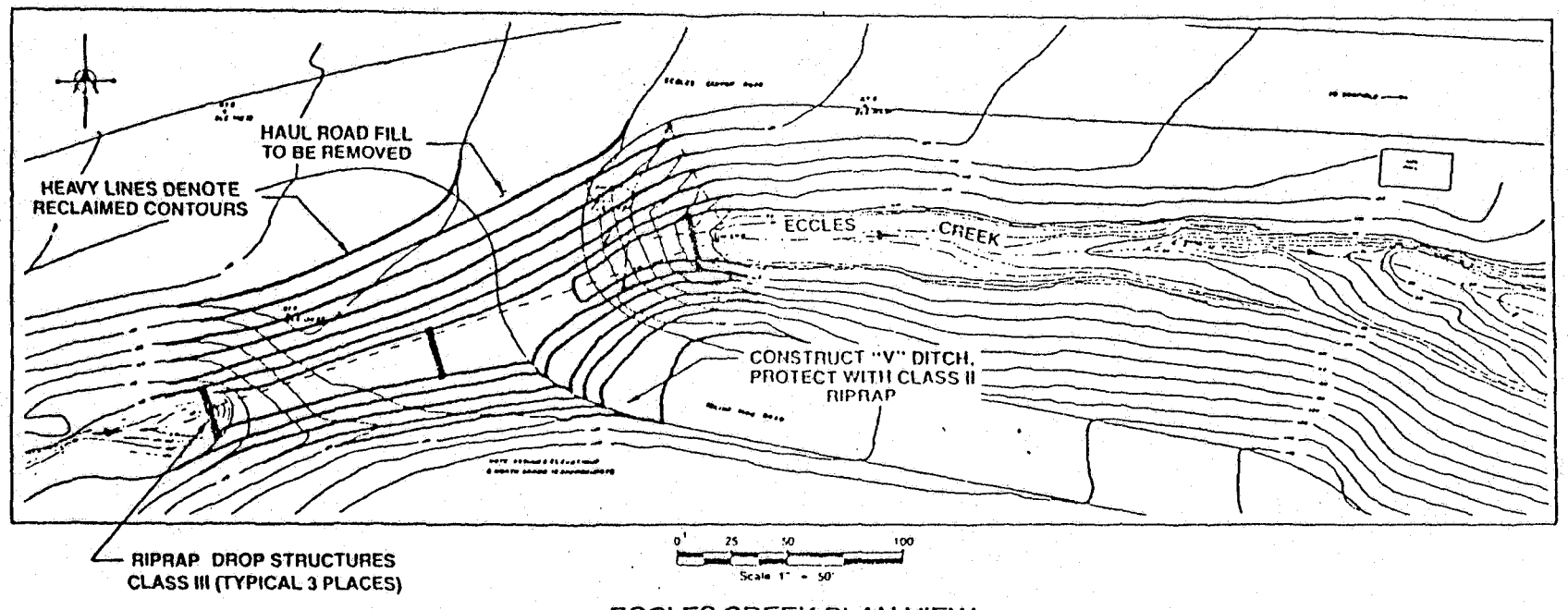
After excavating the soil fill at the Bowl Crossing the base material will be examined to determine if it meets the filter criteria. If it does not, a filter will be constructed meeting the gradation shown in Table 3-4.

3.5 Eccles Creek

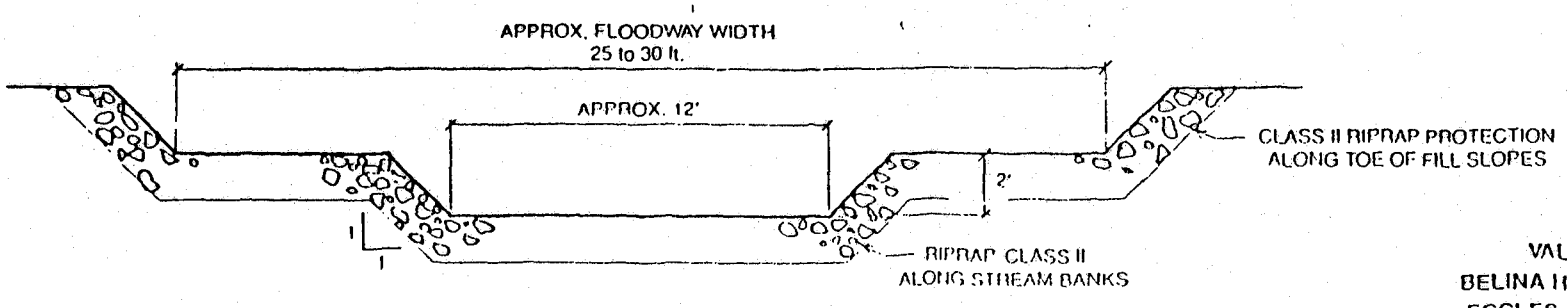
The drainage above the Belina Haul in Eccles Creek is the largest with an area of 2,047 acres. The 100 year 24 hour storm is estimated to be about 378 cfs. The channel slope in this area is estimated to be 2 - 2.5 percent. This channel will have a low flow section with a width of 12 feet. The velocity for the 100 year storm will be approximately 6.6 feet per second with depth varying from about 1.5 feet in the floodway to 3.5 feet in the main channel. A Manning's n of .060 was used in computing the flow depth and velocities for Eccles Creek. Based on this velocity and depth of flow, the Class II (24 inch)

riprap will be required. The channel will be constructed with similar geometry to the recently reconstructed channel below the Belina Haul Road turnout. A typical section through this channel is shown in Figure 3-3. The design of this channel will be similar to the recently completed channel reconstruction just downstream. This will maintain continuity in the channel design. The channel will include several drop structures to maintain a reasonable stream gradient of 2.5 percent or less. These drop structures will be constructed of large rock so that they will maintain a natural appearance. Figure 3-3 shows a plan view of the proposed new alignment after the fill is removed.

The velocity and depth were also computed for the average annual flow to evaluate the effects on fish passage, and are presented in Table 3.3. The average annual flow is estimated to be about 28 cfs. This flow was computed using the USGS report, "Methods for Estimating Peak Discharges and Flood Boundaries of Streams in Utah", WRI 83-4129. In addition to the average annual flow, depths and velocities were computed for several other flows.



ECCLES CREEK PLAN VIEW



TYPICAL SECTION THROUGH ECCLES CREEK

VALLEY CAMP OF UTAH
BELINA HAUL ROAD RECLAMATION
ECCLES CREEK CHANNEL DESIGN
PLAN AND SECTION
Figure 3-3

TABLE 3.3

ECCLES CREEK CHANNEL HYDRAULICS

Discharge, cfs	Depth,Ft.	Velocity, Ft./Sec.	Channel Slope %
15	.55	2.2	2.0
20	.65	2.5	2.0
28*	.80	2.8	2.0
30	.85	2.9	2.0

*Average annual flow

These are within the reported sustainable swimming speed for trout, which is two to six feet per second as reported in Fisheries Handbook, by Milo C. Bell, 1986. These velocities were not related to depth of flow in Milo C. Bell's report.

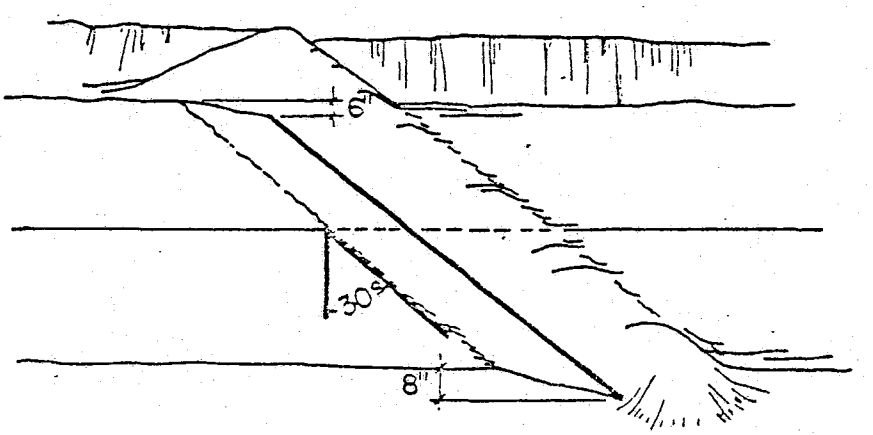
3.6 Concrete Ditch: Sta 71+00 to 82+00

A riprap ditch will be constructed at the base of the cut slope from about Sta. 71+00 to Sta. 82+00 where the haul road intersects Eccles Creek as shown on Figure 2-7 and Figure 2-8. Class I riprap will be placed over the existing concrete ditch with a minimum depth of about 12 inches. The reclaimed back slope of the road surface will contain the design flows. The last 100 feet of this ditch has a slope of about 35 percent where it drops down into Eccles Creek. This reach will be constructed similar to those in Figure 3-1. The ditch will have side slopes of 2H:1V and be protected with Class II riprap.

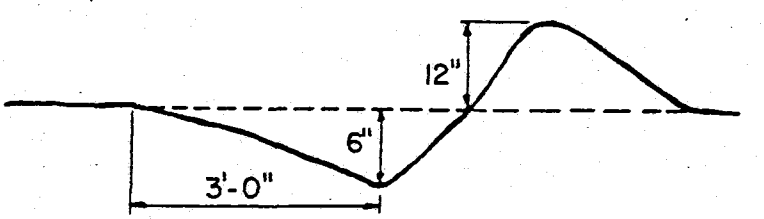
3.7 Water Control Bars

Water control bars will be constructed to reduce erosion of the recontoured haulroad. Figure 3-4 shows a typical waterbar. These structures will be spaced approximately 100 feet apart along the road. Waterbars will be placed more frequently if, during the final reclamation work it is determined they would be necessary to control runoff. Class I riprap protection will be included in the construction of the water control bars. The riprap will be placed at the point where the flow breaks over the edge of the old road bed.

VALLEY CAMP OF UTAH
BELINA HAUL ROAD RECLAMATION
TYPICAL WATERBAR
DETAILS
Figure 3-4



PLAN



SECTION

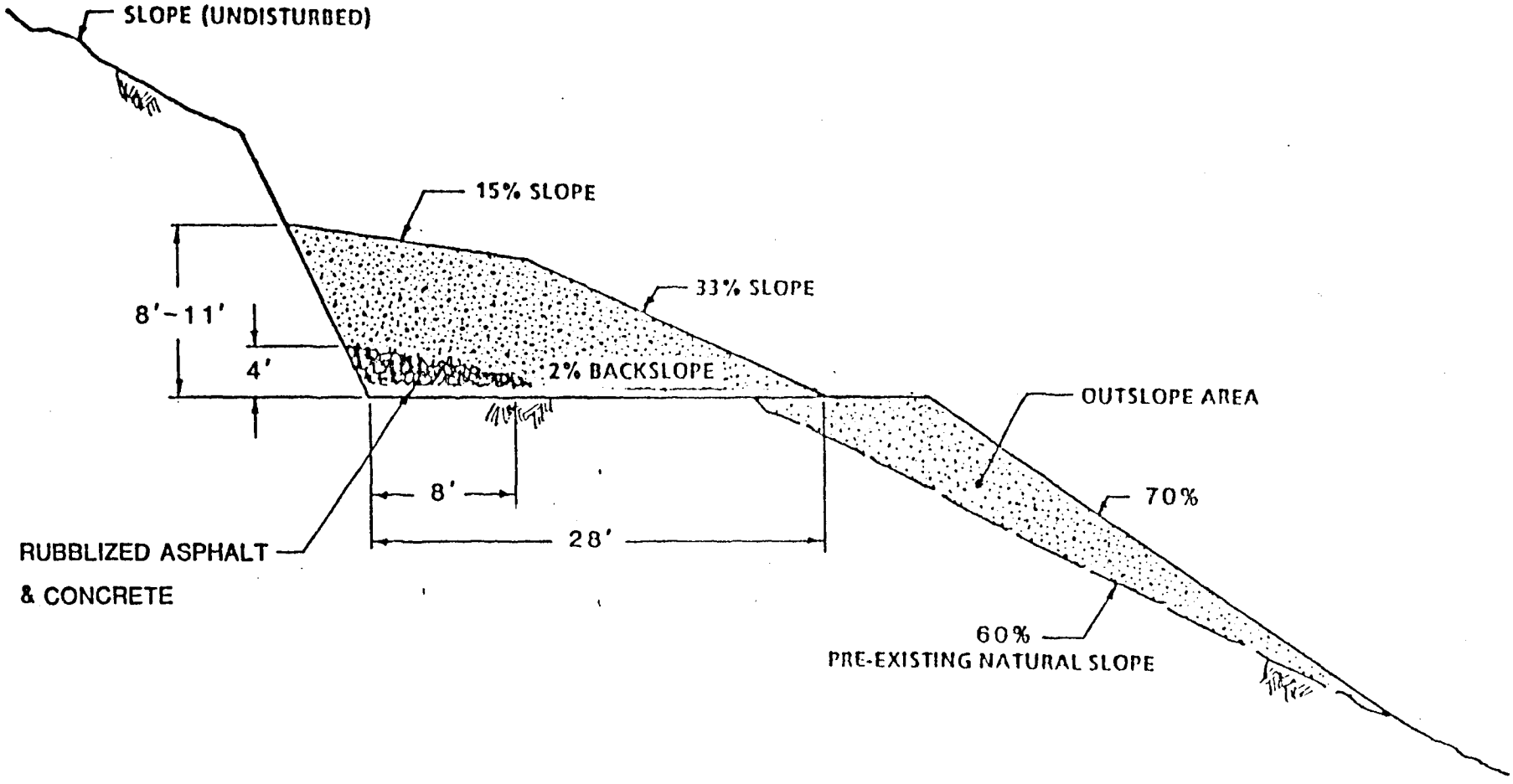
SECTION 4.0 - RECLAMATION PROCEDURES

4.1 Road Surface Removal

Reclamation of the road will begin with the removal of the asphaltic concrete road surface and the Portland cement concrete lining of the water control ditch which is located at the toe of the road cut slope. A portion of the cement concrete ditch (from station 71+00 to station 82+00) will be left in place and backfilled with riprap, as discussed in Section 3.6. After the road surface is reclaimed and the recontoured surface sloped back towards the hill at approximately four percent, this water control structure will convey water to Eccles Creek. Leaving this portion of the concrete ditch in place will minimize infiltration to the fractured rock hillside, thereby lessening the chance of slope failure. This water control structure will be monitored for bond release for the same period as the rest of the reclamation. The cement concrete lining will be rubblized to eliminate any slippage surface when it and the asphaltic concrete and fill material are placed for disposal. The larger pieces of cement concrete will be salvaged and used as riprap if they meet the specifications for riprap discussed in Section 3.4.

The asphaltic concrete will then be broken and will be placed against the toe of the cut slope over the previously placed broken Portland cement concrete. The asphaltic concrete will be piled approximately four feet deep adjacent to the cut slope and graded to ground level seven to eight feet out from the toe of the slope (Figure 4-1). There are approximately 3,500 in place cubic yards of asphaltic concrete to dispose of. To insure a competent fill and prevent piping, the asphaltic concrete will be placed in an engineered manner and compacted. The asphalt will be broken by ripping it with the

VALLEY CAMP OF UTAH
BELINA HAUL ROAD RECLAMATION
TYPICAL CROSS SECTION - STABLE FILL
FINAL CONTOURED SURFACE
Figure 4-1
(NOT TO SCALE)



scarifiers on a motor grader or equivalent machine. The scarifiers are approximately 17-20 inches apart. It is expected, therefore, that their use will create pieces of asphalt less than two-feet square. If necessary a dozer will be walked over the ripped asphalt to further reduce the size. The rubblized asphalt will then be bladed to the toe of the cut slope by a motor grader or equivalent equipment. The asphalt will be compacted in one foot lifts. Once the asphaltic concrete surface has been removed, the gravel road base material will be ripped or disked to eliminate compaction and to promote water infiltration and root penetration.

After the asphalt is placed and compacted it will be covered with soil removed from the out slope fill portions of the road, to a sufficient depth to prevent it from being exposed to the atmosphere. The surface of the replaced soil will be contoured as shown in Figure 4-1 to reestablish a drainage pattern similar to that which was present prior to mining.

4.2 Corrugated Metal Pipe Removal

Seven of the eight corrugated metal pipe (CMP) culverts buried in the Belina haul road will be removed during reclamation. These channels, which include Eccles Creek, will be cleared of fill material, recontoured and riprapped as necessary to prevent excessive erosion. The riprap material will consist of large competent rock and/or broken pieces of cement concrete as discussed in Section 3.4 of this report. The removed CMP will be salvaged if possible, or disposed of in a section of the underground mine workings as detailed in Section 784.13 of Valley Camp's approved Mining and Reclamation Plan Permit Number UT0013.

The remaining CMP is the large culvert through the fill in the Bowl. As agreed to during a site visit with UDOGM personnel, this CMP will be left in place unplugged. The reconstruction of a channel through the fill will provide a significant overflow safety factor in the unlikely event that the CMP would become dammed or plugged.

4.3 Recontouring

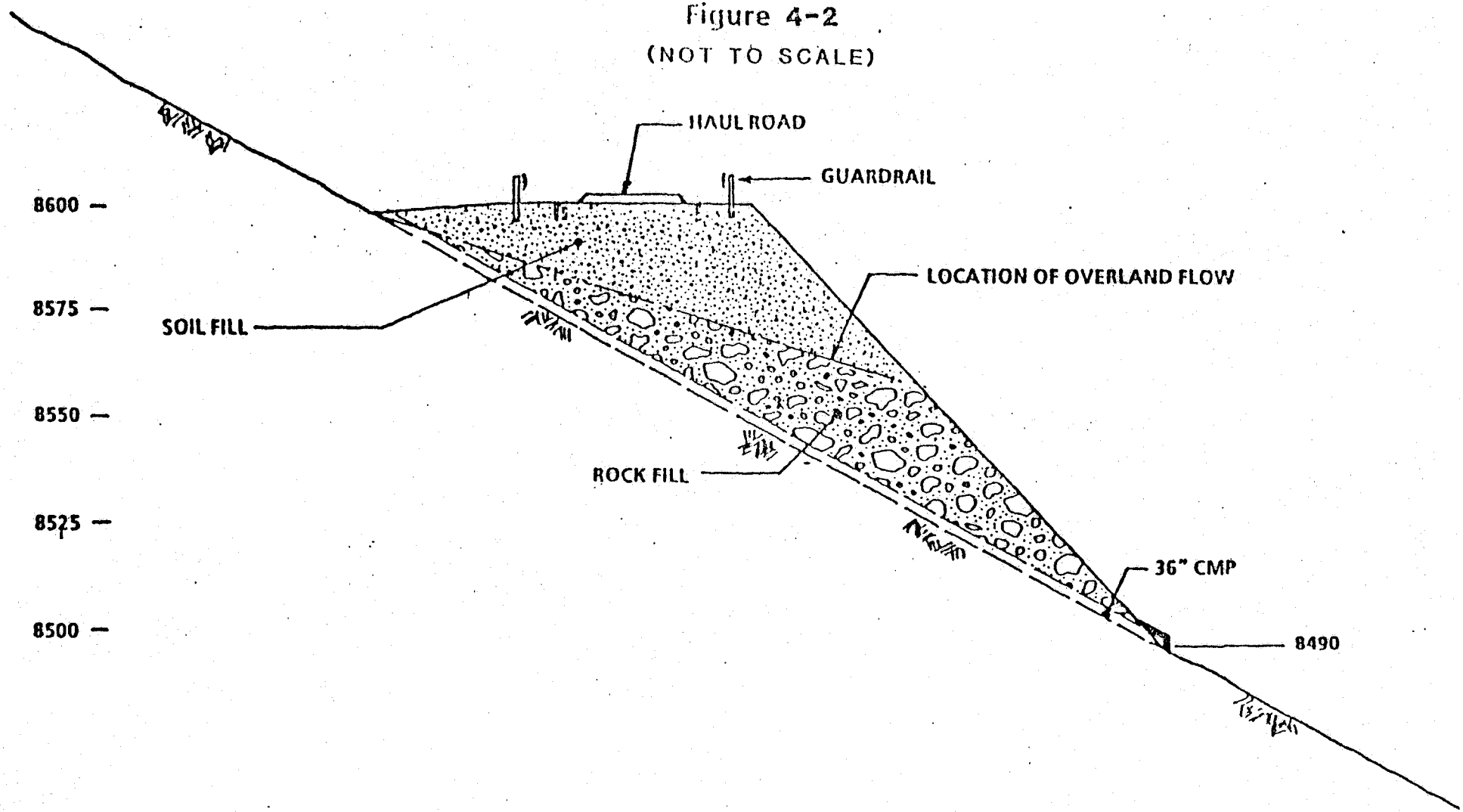
The recontoured areas will be developed by placing soil material excavated from two major fill areas (the Bowl crossing and the Eccles Creek crossing) on the "cut" portions of the road against the cut slopes as buttress fills. Additionally, portions of the road outslope fill areas are considered to be of questionable stability and will therefore also be excavated and placed in the buttress fills. Approximately 30,000 to 35,000 cubic yards of material will be excavated and placed during this recontouring effort. Drainage crossovers will be constructed across this recontoured surface to shorten the slope length and prevent excessive erosion (refer to Section 3.6 for details). These cutouts or crossovers will be riprapped to prevent the development of rills and gullies.

The reclaimed surface of the haul road will in most cases, slope to the outside. In some cases, however, it will slope back to the hill. Approximately the first 1,100 feet of the road, (from station 82+00 to station 71+00 on the CEI, 9/83 drawings) has a very steep outslope (approaching 120 percent) toward Eccles Creek. To keep water off of the face of this area and protect Eccles Creek the recontoured surface will pitch into the hill at approximately four percent (Figure 2.8). Runoff will be collected in a riprapped ditch constructed at the base of the road cut slope and will be conveyed down the hill and released to Eccles Creek approximately at the haul road/creek junction. The design of this ditch is addressed in Section 3.5 of this report.

4.3.1 Bowl Crossing

The largest fill is located near the midpoint of the haul road. It consists of blast rock on the bottom and soil on the top. The soil portion (approximately 15,000 yd^3) will be excavated and an overland channel will be developed through the remaining rock. The CMP will be left in place unplugged. This new drainage will be a permanent

VALLEY CAMP OF UTAH
BELINA HAUL ROAD RECLAMATION
THE BOWL CROSSING
Figure 4-2
(NOT TO SCALE)



structure constructed from competent rock which meets riprap specifications. In addition, energy dissipaters will be utilized, if necessary, to control the flow of water until it reaches the natural drainage channel. Figure 4.2 is a cross section showing the present road surface, fill slopes, and the projected location of the overland flow channel.

4.3.2 Eccles Creek Crossing

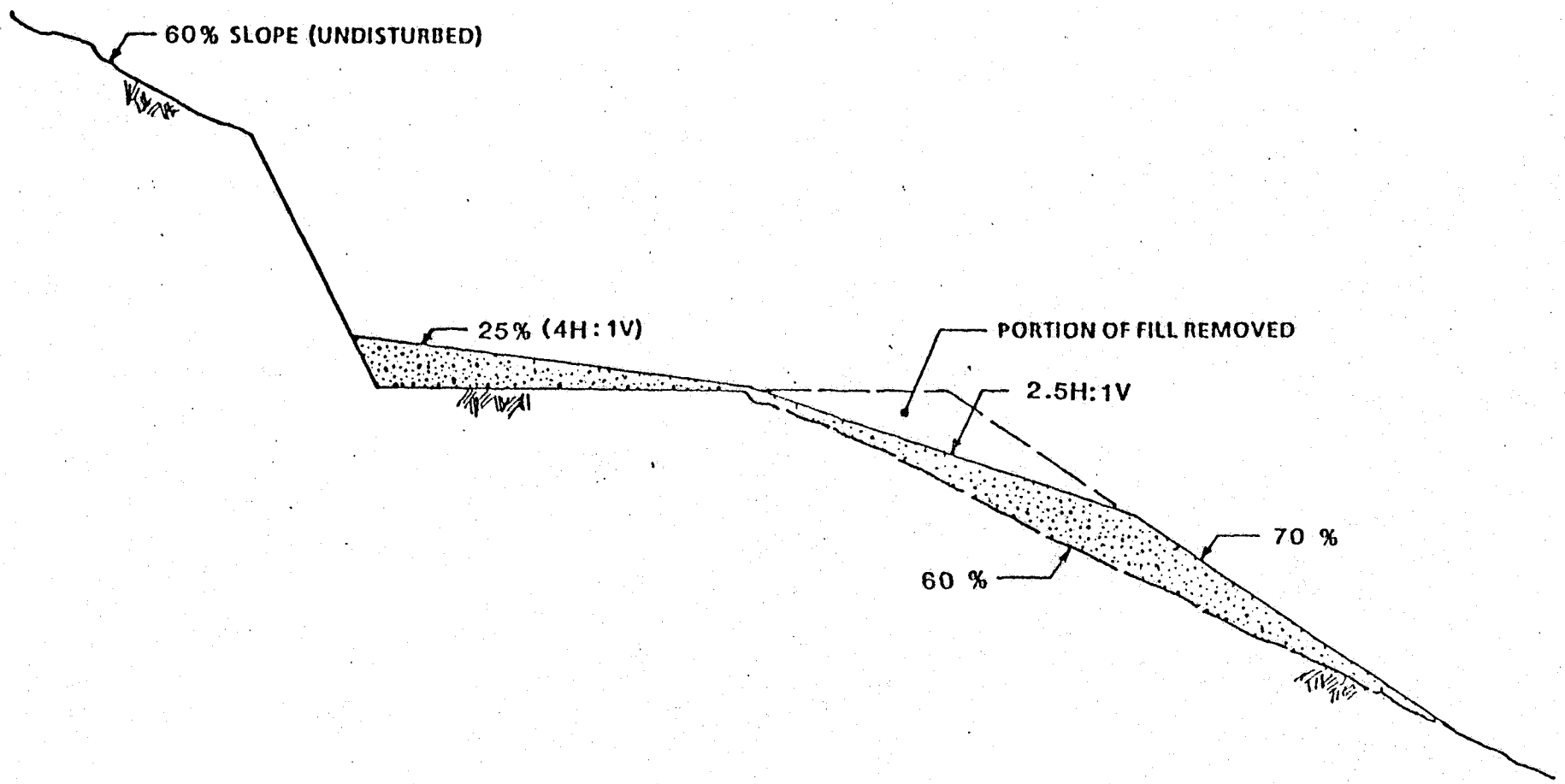
The second major fill is located at the intersection of the Belina Haul Road and the Eccles Canyon Road. This fill consists primarily of blast rock from the development of the first section of the haul road and is covered with soil. Again, only the soil portion will be removed. The remaining rock will be used as riprap for the rehabilitation of Eccles Creek, provided it meets riprap specifications. Any unused rock will be disposed of as discussed in Section 784.13 of Valley Camp's approved mining and reclamation plan (UT 0013). The corrugated metal pipe will be removed and disposed of similarily. These activities will allow Eccles Creek to return to its natural channel.

4.3.3 Unstable Fill Slopes

The third area from which backfill material will be obtained is from the portions of the outslope road fills that have been determined to be potentially unstable (Table 2.1). A sufficient quantity of fill will be removed from each of these fill slopes to reduce the potential of the slope failing. To initiate reclamation of these fill slopes, the guard rails will be removed and the support post and metal rails will be salvaged or disposed of.

The excavated material (Figure 4.3) will be removed using a backhoe or a similar machine to reach down the slope to retrieve material. As a result of this operation, the road edge will be cut back toward the

VALLEY CAMP OF UTAH
BELINA HAUL ROAD RECLAMATION
TYPICAL CROSS SECTION - UNSTABLE FILL
FINAL CONTOURED SURFACE
Figure 4-3
(NOT TO SCALE)



toe of the cut slope ten to fifteen feet. With the removal of this material the final surface will have an approximate slope of 2.5H:1V. The excavated material will be placed on the remaining road surface thereby creating an outslope of approximately 4H:1V.

The quantity of fill material estimated to be removed from the various sources and the estimate of the storage capacity that can be developed from utilizing the road surface is given in Table 4.1.

TABLE 4.1

VALLEY CAMP OF UTAH

BELINA HAUL ROAD RECLAMATION

SOIL DISPOSAL VOLUMETRICS

Fill Material To Remove:

o Eccles Creek Fill	4,000 $yd^3 \pm$
o The Bowl Crossing Fill	15,000 $yd^3 \pm$
o Haul Road Outslopes	6,000 $yd^3 \pm$
o Remaining CMP Removal	1,500 $yd^3 \pm$
o Asphaltic Concrete and Broken Cement Concrete	5,000 $yd^3 \pm$
GRAND TOTAL	31,500 $yd^3 +$

Storage Capacity:

o Haul Road with Stable Outslopes (3,470 feet)	25,000 $yd^3 \pm$
o Haul Road with Portion of Outslopes Removed (2,780 feet)	6,000 $yd^3 \pm$
o Backslope Section of Road (1,250 feet)	3,000 $yd^3 \pm$
GRAND TOTAL	34,000 $yd^3 +$

4.4 Topsoiling

During the construction of the haul road the overlaying topsoil and subsoils were excavated and stockpiled where possible, sidecast or used as fill. During the reclamation of the haul road some of the material which was sidecast and/or used for fill material will be excavated and used to recontour the road. The suitability of this material as a growth medium is evidenced by the vegetation currently growing on it and in fact very similar material has already been approved for use as topsoil at this mine by the Utah Division of Oil Gas and Mining. Prior to using this material as topsoil however, it will be analyzed for pH, texture, electrical conductivity, calcium, magnesium, sodium, organic matter, phosphorous and potassium. Because this material is a mixture of topsoil and subsoil and because no segregated topsoil stockpiles exist at this mine "topsoil" will not be placed on the regraded surface.

4.5 Seed Bed Preparation

The soil removed from the large fills will be replaced using dozers and scrapers. Soil removal from the potentially unstable outslopes will be accomplished using a backhoe or similar equipment. The soil replaced by scrapers and dozers will be scarified to a depth sufficient to allow root penetration whereas the soil placed by the backhoe will not require loosening since it will be subject only to limited packing. The final recontoured surface will then be disked or tracked on the contour prior to seeding.

4.6 Seeding

Seeding will follow the procedures and seed mixes outlined in Valley Camp's approved Mining and Reclamation plan, Permit Number UT 0013.

Areas of the haul road outslopes and cut slopes which will not be disturbed by reclamation activities will be subjected to a statistically valid vegetation survey at the time to determine the adequacy of the existing vegetation when compared to reference areas identified in Mining Permit Number UT-0013. If it is determined necessary, these undisturbed areas will be interseeded or interplanted with shrubs.

4.7 Fertilizing

A chemical analysis will be performed on samples of the soil which will indicate the nutrients and amounts necessary for proper plant growth. Fertilizer will be applied either just prior to or immediately following seeding.

4.8 Mulching

Mulch will be applied at approximately 2,000 pounds per acre, depending on the material of choice, and will follow application of the seed and fertilizer. The mulch will be straw or any of the other commonly used mulch materials. At the time of reclamation, where it is deemed necessary, a tackifying agent or some other means will be used to hold the mulch in place.

4.9 Erosion Control and Maintenance

During reclamation activities, interim erosion control measures such as filter fabric and straw bales will be used to control water flow. Once a drainage channel is established, these interim structures will be removed and the disturbed areas will be seeded, fertilized and mulched. At the conclusion of reclamation activities, runoff will be slowed by the proper placing of straw bales, filter fabric fences, riprap or mulch, in potential

problem areas. If runoff channels develop in excess of nine inches, the most applicable erosion control technique will be selected. For example, small erosion channels will be blocked with a filter fabric fence, a straw bale or some other material to slow the water and allow vegetation to establish.

4.10 Revegetation

The revegetated area will be monitored closely to ensure that a diverse, permanent vegetation cover capable of self-regeneration is developed. Revegetation success of the newly reclaimed haul road areas will be determined by following the techniques developed in Section 817.116 of Valley Camp's approved mining and reclamation plan, Permit Number UT-0013.

4.11 Reclamation Costs

Reclamation costs are summarized by task for the purpose of bonding costs. These cost estimates are made with the knowledge that the efficiency of workers and machinery may far exceed the normal rate because of the very limited work space, and the difficulty in scheduling of crews. The reclamation cost estimates are given in Table 4.2.

TABLE 4.2

RECLAMATION COST ESTIMATES

Remove Concrete and Asphaltic Concrete:			
Rip Portland Cement Concrete and Breakup Asphaltic Concrete			$ 3,500
Remove and Place Asphaltic Concrete (40 hrs. @ $87.50/hr.)			2,800
Compact Asphaltic Concrete			1,600
Break and Remove Concrete Ditch			6,500
Rip/Scarify Road Base Material (65 acres) (8 hrs. @ $75.00/hr.)			600
Remove corrugated Metal Pipes			8,000
Remove and Dispose Guard Rails, Posts, and Signs			5,800
Remove and Place Fill Material:			
20,000 yd^3 (Intersecting Drainage Fills)			50,000
7,000 yd^3 (Road Outslope Fills) (80 hrs. @ $100/hr.)			8,000
Recontour Road Surface:			
10.0 Acres ± (80 hrs. @ $100.00/hr.			8,000
Construct Riprap Drainage Channels:			
8 each (@ 200 feet each)			32,000
Redistribute Topsoil Substitute (10 Acres x 6" Deep):			
8,100 yd^3 ± (@$2.50/yd.)			20,000
Seedbed Preparation (Scarification, Disking, Harrowing)			1,000
Fertilizing, Seeding, and Mulching:			
Seed:	(10 acres @ 24.0 lbs/acre @ $15.00/P.L.S. lb.)	$3,600	
Fertilizer:	(10.0 acres @ $425.00/acre)	$4,250	
Mulching:	(10.0 acres @ $500.000/acre	$5,000	
Equipment and Labor:		$2,000	
Total			14,850
Monitoring			1,000
TOTAL			$163,650
10% Mobilization and Demobilization			16,365
15% Profit and Administration			24,548
Maintenance-10 Acres @ $100.00/ac/yr.			1,000
TOTAL BONDING COST			$205,563

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY

WESTERN REGION OFFICE
MINERALS AND ENVIRONMENTAL DIVISION
720 PARK BLVD./P.O. BOX 79
BOISE, IDAHO U.S.A. 83707
PHONE: (208) 386-5000 TELEX: 368439

APPENDIX R614-301-622.100

Selected Drill Hole Logs

(CONFIDENTIAL)

HANSEN ALLEN & LUCE inc

APPENDIX R614-301-623.100

Soils Analyses

HANSEN ALLEN & LUCE inc

September 16, 1986

TO: Technical File

FROM: James S. Leatherwood, Reclamation Soils Specialist JSL

RE: Substitute Topsoil Suitability, Belina Complex, Valley Camp of Utah, Inc., ACT/007/001, Folder #2, Carbon County, Utah

Pursuant to Conditions #5 and #6, the operator has submitted analytical data for the Utah No. 2 and Belina Pad materials. This information has been presented to determine the suitability of these materials as substitute topsoils. The following delineates the submitted data with a corresponding topsoil substitute suitability rating as defined in Table 2 of the Draft Topsoil and Overburden Guideline (enclosed).

BELINA PAD

Sample Site No. 1
Overall Rating = Good-Fair

Parameter	Depth	Data	Rating(5)	Parameter	Depth	Data	Rating
pH				Texture			
	0-2	7.5	G		0-2	sl	G
	2-4	7.4	G		2-4	scl	G
	4-6	7.5	G		4-6	c	P
	6-8	7.8	G		6-8	c	P
$CaCO_3$%				EC(1)			
	0-2	0.45	G		0-2	0.80	G
	2-4	0.35	G		2-4	0.77	G
	4-6	0.29	G		4-6	0.85	G
	6-8	0.36	G		6-8	0.95	G

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Memo to Tech. File
ACT/007/001
Substitute Topsoil
September 16, 1986

BELINA PAD

Sample Site No. 1 (Cont'd.)
Overall Rating = Good-Fair

Parameter	Depth	Data	Rating(5)
SAR(2)			
	0-2	0.047	G
	2-4	0.064	G
	4-6	0.087	G
	6-8	0.100	G
SAT%(4)			
	0-2	22.5	P
	2-4	21.9	P
	4-6	19.3	P
	6-8	24.6	P

Parameter	Depth	Data	Rating
OM%(3)			
	0-2	4.7	
	2-4	3.9	
	4-6	4.5	
	6-8	3.4	

BELINA PAD

Sample Site No. 2
Overall Rating = Good-Fair

Parameter	Depth	Data	Rating(5)
pH			
	0-2	7.2	G
	2-4	7.3	G
	4-8	7.5	G
$CaCO_3$%			
	0-2	0.21	G
	2-4	0.39	G
	4-8	0.44	G
Texture			
	0-2	sil	G
	2-4	l	G
	4-8	cl	F
Sat%(4)			
	0-2	23.4	P
	2-4	18.7	P
	4-8	25.7	F

Parameter	Depth	Data	Rating
EC(1)			
	0-2	0.90	G
	2-4	0.75	G
	4-8	0.69	G
SAR(2)			
	0-2	0.039	G
	2-4	0.062	G
	4-8	0.063	G
OM%(3)			
	0-2	3.6	
	2-4	5.4	
	4-8	4.8	

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Memo to Tech. File
ACT/007/001
Substitute Topsoil
September 16, 1986

BELINA PAD

Sample Site No. B-5
Overall Rating = Good-Fair

Parameter	Depth	Data	Rating(5)
pH			
	0-2.5	7.2	G
	2.5-5.0	7.4	G
	5.0-7.5	7.8	G
	7.5-10.0	7.3	G
	10.0-12.5	7.5	G
	12.5-15.0	7.8	G
	15.0-17.5	7.4	G
	17.5-20.0	7.9	F
	20.0-22.5	7.5	G
	22.5-25.0	7.5	G
	25.0-27.5	7.4	G
	27.5-30.0	7.4	G
CaCO%			
	0-2.5	0.46	G
	2.5-5.0	0.42	G
	5.0-7.5	0.38	G
	7.5-10.0	0.39	G
	10.0-12.5	0.37	G
	12.5-15.0	0.35	G
	15.0-17.5	0.30	G
	17.5-20.0	0.41	G
	20.0-22.5	0.36	G
	22.5-25.0	0.32	G
	25.0-27.5	0.40	G
	27.5-30.0	0.40	G
Texture			
	0-2.5	c	P
	2.5-5.0	cl	F
	5.0-7.5	c	P
	7.5-10.0	scl	G
	10.0-12.5	c	P
	12.5-15.0	sl	G
	15.0-17.5	sl	G
	17.5-20.0	l	G
	20.0-22.5	sl	G
	22.5-25.0	scl	G
	25.0-27.5	scl	G
	27.5-30.0	sl	G

Parameter	Depth	Data	Rating
EC(1)			
	0-25	0.75	G
	2.5-5.0	0.80	G
	5.0-7.5	0.84	G
	7.5-10.0	0.90	G
	10.0-12.5	0.78	G
	12.5-15.0	0.88	G
	15.0-17.5	0.92	G
	17.5-20.0	0.88	G
	20.0-22.5	0.76	G
	22.5-25.0	0.80	G
	25.0-27.5	0.74	G
	27.5-30.0	0.75	G
SAR(2)			
	0-2.5	0.08	G
	2.5-5.0	0.06	G
	5.0-7.5	0.08	G
	7.5-10.0	0.10	G
	10.0-12.5	0.05	G
	12.5-15.0	0.06	G
	15.0-17.5	0.05	G
	17.5-20.0	0.06	G
	20.0-22.5	0.06	G
	22.5-25.0	0.08	G
	25.0-27.5	0.06	G
	27.5-30.0	0.06	G
OM%(3)			
	0-2.5	3.3	
	2.5-5.0	4.6	
	5.0-7.5	8.2	
	7.5-10.0	5.9	
	10.0-12.5	7.7	
	12.5-15.0	5.5	
	15.0-17.5	6.8	
	17.5-20.0	4.9	
	20.0-22.5	10.5	
	22.5-25.0	6.8	
	25.0-27.5	4.9	
	27.5-30.0	4.9	

Parameter	Depth	Data	Rating(5)	Parameter	Depth	Data	Rating
Sat%(4)							
	0-2.5	24.5	P				
	2.5-5.0	21.8	P				
	5.0-7.5	24.6	P				
	7.5-10.0	23.8	P				
	10.0-12.5	31.5	G-F				
	12.5-15.0	27.1	F				
	15.0-17.5	20.7	P				
	17.5-20.0	21.5	P				
	20.0-22.5	28.2	F				
	22.5-25.0	20.4	P				
	25.0-27.0	25.1	F				
	27.5-30.0	19.7	P				

UTAH NO. 2 PAD

Sample Site No. 1
10-ft. Depth
Overall Rating = Good

Parameter	Data	Rating(5)	Parameter	Data	Rating
pH	7.3	G	Texture	l	G
Sat%(4)	34.3	G-F	EC(1)	0.79	G
SAR(2)	0.65	G	OM%(3)	1.9	

UTAH NO. 2 PAD

Sample Site No. 2
8-ft. Depth
Overall Rating = Good

Parameter	Data	Rating(5)	Parameter	Data	Rating
pH	7.4	G	Texture	sl	G
Sat%(4)	30.5	G-F	EC(1)	1.08	G
SAR(2)	0.59	G	OM%(3)	2.5	

page 5
Memo to Tech. File
ACT/007/001
Substitute Topsoil
September 16, 1986

Sample Site No. 3
6-ft. Depth
Overall Rating = Good-Fair

Parameter	Data	Rating(5)	Parameter	Data	Rating
pH	5.5	F	Texture	1	G
Sat%(4)	32.2	G-F	EC(1)	0.31	G
SAR(2)	0.92	G	OM%(3)	4.5	

(1) Electrical Conductivity (mmhos/cm @ 25°C)

(2) Sodium Adsorption Rates

(3) Organic matter percent (Organic matter suitability ratings are undetermined at this time. Data is presented for information purposes only.

(4) Saturation Percent (Data on the Belina Pad materials is misleading. In some cases there is a high clay content and low saturation percentage- See Sample Site No. 1, 4-6 and 6-8 feet samples).

(5) Ratings:

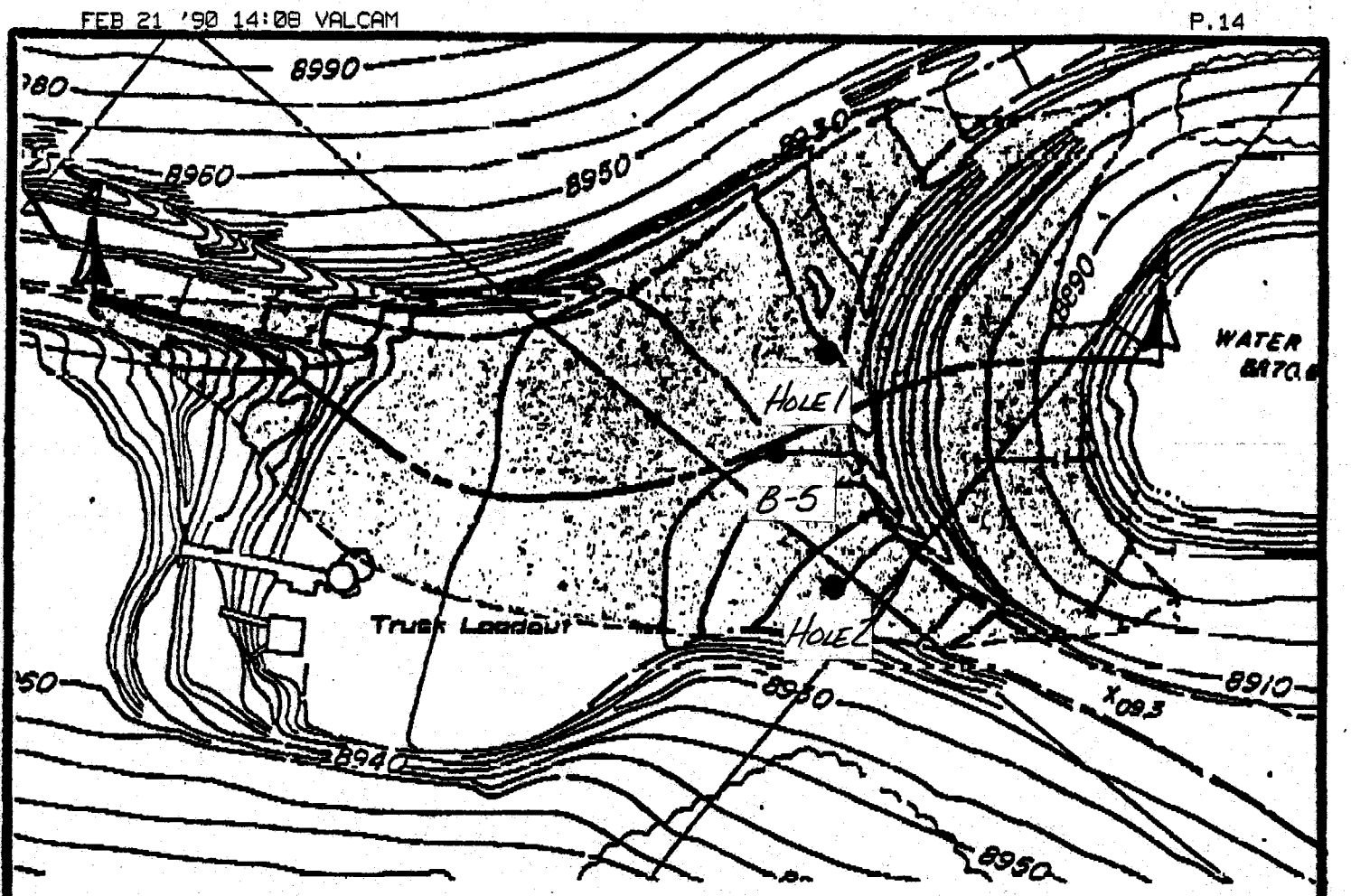
Good = G
Fair = F
Poor = P
Unsuitable = U

Enclosure(s)
JSL/djh
cc: S. Linner
L. Kunzler
0798R/6

Table 2. Suitability Limits for Rating Topsoil Substitutes*

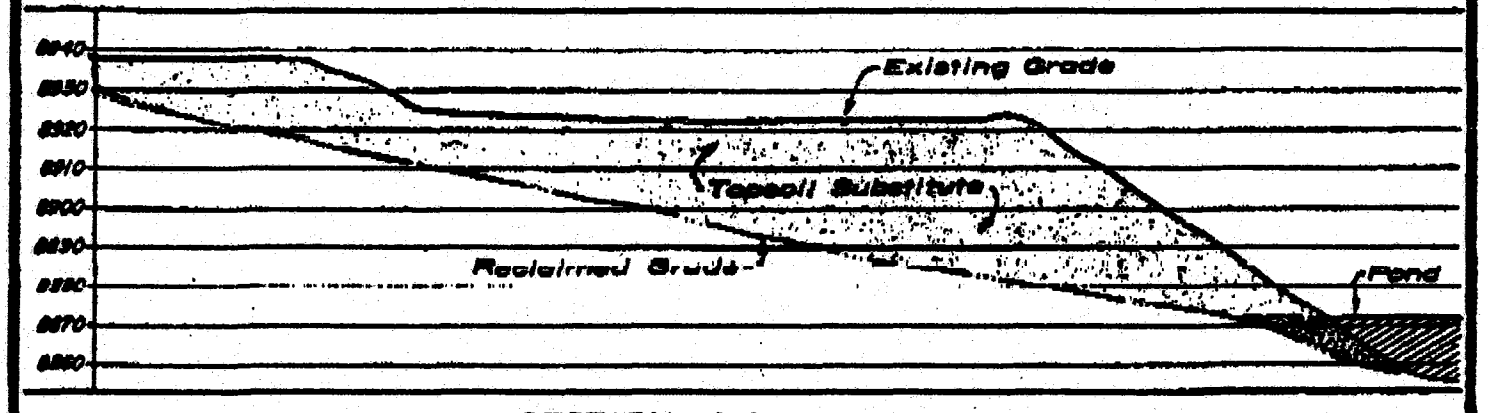
	Good	Fair	Poor	Unsuitable
Available water capacity	>0.10	0.05-0.10	<0.05	
pH	6.1-7.8	5.1-6.1 7.9-8.4	4.5-5.0 8.5-9.0	<4.5 >9.0
USDA Textural Class	SL L, SiL SCL VFSL FSL	CL,SICL, SC,LS LFS	SIC S, SC, C COS, FS, VFS	G, VCOS
Slope (%)	<8	8-15	>15	
Electrical Conductivity	0-4	5-8	9-15	>16
Sodium Adsorption Ratio (SAR)	5	6-10	10-12 Fine Texture 10-15 Coarse Texture	>12 Fine Texture >15 Coarse Texture
Boron	<5.0			>5.0
Selenium	<0.1	>01		
Rock Fragments (% Volume)				
3 inches	0-15	15-25	25-30	30
3-10 inches	0-15	15-25	25-30	30
More than 10 inches	0-3	3-7	7-10	10
Alkalinity as Calcium Carbonate %	0-15	15-25	25-40	>40
Saturation Percentage (%)			<25 >80	

* Many native species have their roots in soils that are determined poor to unsuitable by these values. Therefore, plant growth trials may be needed where re-establishment of native species is desired.



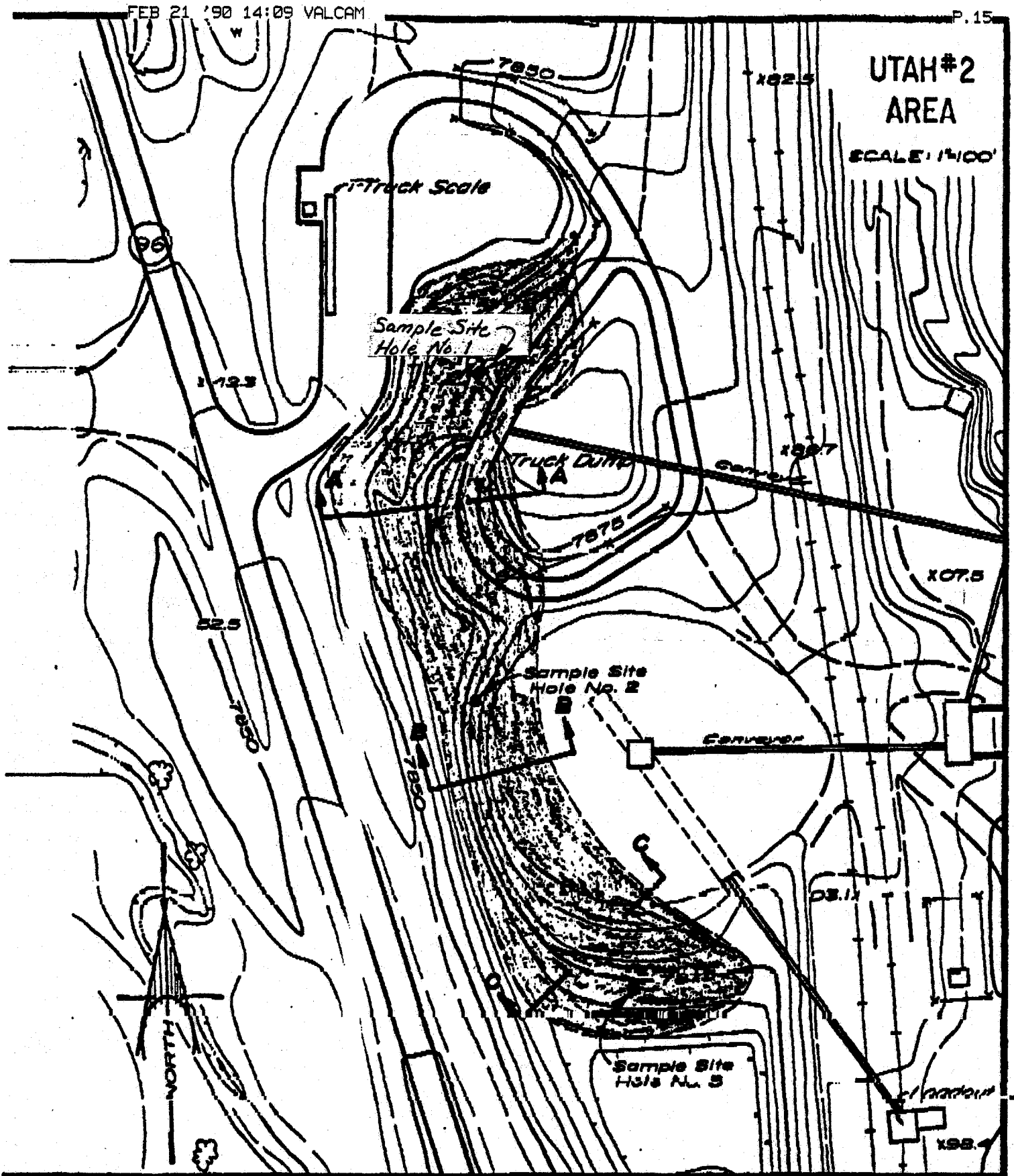
PLAN VIEW
SCALE: 1" = 100'

Approx. Topsoil Substitute = 54,000 Tons
600' x 200' x 6.2' = 984,000 CU. FT.
(110 lbs. per cu. ft.)



SECTION A-A
SCALE: Horz. - 1" = 100'
Vert. - 1" = 50'

DRAWN BY: Ed Sanderson	DATE: Oct. 13, 1983	VALLEY CAMP of UTAH SCOFIELD ROUTE HELPER, UTAH 84526
CHECKED BY:	DATE:	
REVISED BY:	SCALE: "As Noted"	
APPROVAL ENG.:		
APPROVAL SAFETY:	TITLE: BELINA SUBSTITUTE TOPSOIL AREA	DRAWING NO. A5-0075 / REV. NO. 2
APPROVAL MINE:		



BY: Ed Sanderson	DATE: Dec. 12, 83	VALLEY CAMP of UTAH SCOFIELD ROUTE HELPER, UTAH 84526
D BY:	DATE:	
S BY:	SCALE: "As Noted"	
AL ENG:		
L SAFETY:	TITLE: UTAH #2 SUBSTITUTE TOPSOIL	DRAWING NO. B5-0013 / REV. NO. 0
AL MINE:		

Ford Chemical
LABORATORY, INC.
Bacteriological and Chemical Analysis
40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 466-8761

Test Hole No. 1

DATE: 12/29/83

CERTIFICATE OF ANALYSIS

VALLEY CAMP OF UTAH
SCOFIELD ROUTE
HELPER, UTAH
84526

83-006765

SAMPLE: SOIL SAMPLES FROM BELINA PAD #1 COLLECTED 9-23-83 RECEIVED 9-23-83 FOR ANALYSIS UNDER P.O. #30-83-10-007831.

	0 - 2 FT.	2 - 4 FT.	4 - 6 FT.	6 - 8 FT.	
1-Clay % USDA 18	12.80	28.20	85.50	60.20	
Sand % USDA 18	65.80	53.50	27.50	27.30	
1-Silt % USDA 18	21.40	18.30	14.00	12.50	
Acid/Base Pot.Tons/1000 Tons	.43	.41	.39	.46	
Boron Sol.ppm USDA 60	.057	.119	.089	.008	
Ca.Carbonate Tons/1000Tons	4.50	3.45	2.87	3.60	
Calcium Carbonate ppm USDA 60	4,500.00	3,450.00	2,870.00	3,600.00	3855
Calcium Sol. Meq/l USDA 60	130.73	108.78	117.26	122.00	
Conductivity µ hos/cm @ 25	.80	.77	.85	.95	
Copper ppm AB DTPA 1	.250	.100	.300	.050	0.18
Iron ppm AB DTPA 1	66.500	68.300	59.200	77.500	67.9
Magnesium Sol. Meq/l USDA 60	15	15.33	14.26	17.26	15.7
Manganese ppm AB DTPA 1	14.500	12.600	10.500	6.650	11.1

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SALT LAKE CITY, UTAH 84115
PHONE 466-8781

Test Hole No. 1

CERTIFICATE OF ANALYSIS
83-006765

	0 - 2 FT.	2 - 4 FT.	4 - 6 FT.	6 - 8 FT.	
Moisture %	19.80	22.50	36.40	33.20	
Molybdenum ppm AB DTPA 1	.075	.036	.055	.028	
Neut./Potential Tons/1000Tons	4.07	3.04	2.48	3.14	
Nitrate NO3-N ppm USDA 60	3.30	4.20	5.40	6.70	
Organic Material % (WB)	4.70	3.90	4.50	3.36	
PH USDA 60	7.50	7.40	7.45	7.80	
Phosphorus ppm AB DTPA 1	20.60	31.40	4.50	16.20	18.2
Potassium ppm USDA 60	114.00	95.00	81.00	110.00	100.0
Pyritic Sulfur % ASTM D2492	.0140	.0133	.0125	.0150	
Saturation %	22.50	21.90	19.30	24.60	
Selenium ppm AB DTPA 1	.015	.010	.006	.002	
Sodium Absorption Ratio	.047	.064	.087	.100	
Sodium Sol.Meq/l USDA 60	.42	.51	.72	.85	0.63
Zinc ppm AB DTPA 1	1.650	2.400	1.900	2.300	2.1

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40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 466-8761

Test Hole No. 2

DATE: 12/29/83

CERTIFICATE OF ANALYSIS

VALLEY CAMP OF UTAH
SCOFIELD ROUTE
HELPER, UTAH
84526

83-006766

SAMPLE: SOIL SAMPLES FROM BELINA PAD #2 COLLECTED 9-23-83
RECEIVED 9-23-83 FOR ANALYSIS UNDER P.O. 30-83-10-007831.

	0 - 2 FT.	2 - 4 FT.	4 - 8 FT.	
1-Clay % USDA 18	10.50	19.50	30.80	
Sand % USDA 18	20.00	50.00	37.70	
1-Silt % USDA 18	69.50	30.50	31.50	
Acid/Base Pot.Tons/1000 Tons	.38	.37	.36	
Boron Sol.ppm USDA 60	.058	.013	.112	
Ca.Carbonate Tons/1000Tons	2.07	3.87	4.39	
Calcium Carbonate ppm USDA 60	2,700.00	3,870.00	4,390.00	3653
Calcium Sol. Meq/l USDA 60	95.30	117.26	127.64	
Conductivity mmhos/cm @ 25	.90	.75	.69	
Copper ppm AB DTPA 1	.200	.270	.300	0.26
Iron ppm AB DTPA 1	51.500	45.600	44.900	47.3
Magnesium Sol. Meq/l USDA 60	21.41	15.65	17.28	18.1
Manganese ppm AB DTPA 1	4.900	8.600	9.300	7.6

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40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 486-8761

Test Hole No. 2

CERTIFICATE OF ANALYSIS
83-006766

	0 - 2 FT.	2 - 4 FT.	4 - 6 FT.	
Moisture %	23.00	34.60	40.20	
Molybdenum ppm AB DTPA 1	.008	.010	.009	
Neut./Potential Tons/1000Tons	2.32	3.50	4.03	
Nitrate NO3-N ppm USDA 60	2.40	4.60	5.10	
Organic Material % (WB)	3.60	5.40	4.80	
pH USDA 60	7.20	7.30	7.50	
Phosphorus ppm AB DTPA 1	16.50	26.40	25.40	22.8
Potassium ppm USDA 60	110.00	86.00	79.00	91.7
Pyritic Sulfur % ASTM D2492	.0123	.0120	.0115	
Saturation %	23.40	18.70	25.10	
Selenium ppm AB DTPA 1	.025	.017	<.001	
Sodium Absorption Ratio	.039	.062	.063	
Sodium Sol.Meq/l USDA 60	.30	.51	.54	0.45
Zinc ppm AB DTPA 1	.950	1.850	1.990	1.60

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LABORATORY, INC.
Bacteriological and Chemical Analysis
40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 466-8761

Test Hole No. B-5

DATE: 12/29/83

CERTIFICATE OF ANALYSIS

VALLEY CAMP OF UTAH
SCOFIELD ROUTE
HELPER, UTAH
84526

83-006763

SAMPLE: SOIL SAMPLES FROM BELINA PAD COLLECTED 9-15-83 RECEIVED 9-23-83 FOR ANALYSIS UNDER P.O. 30-83-10-007831.

	0 - 2.5	2.5 - 5	5 - 7.5	7.5 - 10	10 - 12.5
-Clay % USDA 18	54.50	38.60	51.90	22.50	48.90
-Sand % USDA 18	33.50	39.80	31.50	56.50	25.50
-Silt % USDA 18	12.00	21.60	16.60	21.00	25.60
Acid/Base Pot.Tons/1000 Tons	.39	.42	.34	.37	.57
Boron Sol.ppm USDA 60	.258	.168	.241	.165	.117
a.Carbonate Tons/1000Tons	4.60	4.20	3.77	3.92	3.70
Calcium Carbonate ppm USDA 60	4,600.00	4,200.00	3,770.00	3,920.00	3,700.00
alcium Sol. Meq/l USDA 60	127.74	123.75	115.26	118.26	128.74
Conductivity mmhos/cm @ 25	.75	.80	.04	.90	.78
Copper ppm AB DTPA 1	.020	.090	.100	.150	.280
ron ppm AB DTPA 1	56.500	54.200	63.500	74.100	58.900
Magnesium Sol. Meq/l USDA 60	14.79	14.40	13.76	13.57	13.11
anganese ppm AB DTPA 1	9.200	6.800	4.900	8.300	9.500

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40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 466-8761

Test Hole No. B-5

CERTIFICATE OF ANALYSIS
83-006763

	0 - 2.5	2.5 - 5	5 - 7.5	7.5 - 10	10 - 12.5
Moisture %	19.80	21.50	22.40	22.50	34.50
Molybdenum ppm AB DTPA 1	.166	.175	.116	.150	.1[illegible]
Neut./Potential Tons/1000Tons	4.21	3.78	3.43	3.55	3.[illegible]
Nitrate NO3-N ppm USDA 60	2.10	4.60	1.80	2.50	1.95
Organic Material % (WB)	3.30	4.60	8.20	5.90	7.[illegible]
pH USDA 60	7.70	7.40	7.80	7.80	7.50
Phosphorus ppm AB DTPA 1	12.90	15.60	8.70	16.20	11.[illegible]
Potassium ppm USDA 60	112.00	95.00	86.00	69.00	72.[illegible]
Pyritic Sulfur % ASTM D2492	.0125	.0136	.0110	.0120	.0185
Saturation %	24.50	21.80	24.60	20.00	01.[illegible]
Selenium ppm AB DTPA 1	.005	.001	.001	<.001	<.001
Sodium Absorption Ratio	.001	.042	.000	.006	.05[illegible]
Sodium Sol.Meq/l USDA 60	.69	.52	.65	.78	.[illegible]
Zinc ppm AB DTPA 1	1.770	1.950	1.800	7.100	7.500

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SALT LAKE CITY, UTAH 84115
PHONE 466-8761

Test Hole No. B-5

CERTIFICATE OF ANALYSIS
89-006763

	12.5 - 15	15 - 17.5	17.5 - 20	20 - 22.5	22.5 -25
1-Clay % USDA 18	15.30	14.00	20.00	24.20	31.50
1-Sand % USDA 18	60.20	54.50	33.50	24.50	58.60
1-Silt % USDA 18	24.50	31.50	46.50	51.30	9.90
Acid/Base Pot.Tons/1000 Tons	.38	.51	.56	.42	.38
Boron Sol.ppm USDA 60	.098	.258	.410	.165	.157
Ca.Carbonate Tons/1000Tons	3.49	2.96	4.13	3.59	3.15
Calcium Carbonate ppm USDA 60	3,490.00	2,960.00	4,130.00	3,590.00	3,150.00
Calcium Sol. Meq/l USDA 60	109.73	99.10	122.50	114.42	102.79
Conductivity mmhos/cm @ 25	.88	.92	.88	.76	.80
Copper ppm AB DTPA 1	.030	.050	.100	.240	.250
Iron ppm AB DTPA 1	66.900	71.400	75.200	61.500	59.500
Magnesium Sol. Meq/l USDA 60	10.52	13.57	15.24	13.68	14.42
Manganese ppm AB DTPA 1	11.600	9.500	8.500	6.750	8.500
Moisture %	18.50	23.50	21.50	24.60	20.50
Molybdenum ppm AB DTPA 1	.085	.025	.016	.025	.185
Neut./Potential Tons/1000Tons	3.11	2.45	3.57	3.17	2.77
Nitrate NO3-N ppm USDA 60	2.80	4.40	3.50	1.80	2.85

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Bacteriological and Chemical Analysis
40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 466-8761

Test Hole No. B-5

CERTIFICATE OF ANALYSIS
83-006763

	12.5 - 15	15 - 17.5	17.5 - 20	20 - 22.5	22.5 -24
Organic Material % (WB)	5.50	6.80	4.85	10.50	6.80
PH USDA 60	7.80	7.44	7.90	7.50	7.4[illegible]
Phosphorus ppm AB DTPA 1	10.50	14.50	21.60	15.50 14.72	11.5[illegible]
Potassium ppm USDA 60	105.00	120.00	119.00	88.00 102.2	79.0[illegible]
Pyritic Sulfur % ASTM D2492	.0122	.0165	.0180	.0135	.01[illegible]
Saturation %	27.10	20.70	21.50	28.20	20.40
Selenium ppm AB DTPA 1	<.001	<.001	<.001	<.001	<.00[illegible]
Sodium Absorption Ratio	.060	.050	.060	.064	.09[illegible]
Sodium Sol.Meq/l USDA 60	.47	.38	.50	.52 .50	.65
Zinc ppm AB DTPA 1	2.200	1.300	1.450	1.220 1.05	2.10

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Ford Chemical
LABORATORY, INC.
Bacteriological and Chemical Analysis
40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 466-8751

Test Hole No. B-5

DATE: 12/29/83

CERTIFICATE OF ANALYSIS

VALLEY CAMP OF UTAH
SCOFIELD ROUTE
HELPER, UTAH
84526

83-006764

SAMPLE: SOIL SAMPLES FROM BELINA PAD COLLECTED 9-15-83 RECEIVED 9-23-83 FOR ANALYSIS UNDER P.O. 30-83-10-007831.

	25 - 27.5	27.5 - 30		TOTAL AVG
1-Clay % USDA 18	22.00	17.10		
-Sand % USDA 18	49.50	53.50		
1-Silt % USDA 18	28.50	29.40		
Acid/Base Pot.Tons/1000 Tons	.37	.34		
Boron Sol.ppm USDA 60	.066	.098		
Ca.Carbonate Tons/1000Tons	4.02	3.96		
Calcium Carbonate ppm USDA 60	4,025.00	3,960.00	3993	3791
Calcium Sol. Meq/l USDA 60	120.25	119.01		
Conductivity mmhos/cm @ 25	.74	.75		
Copper ppm AB DTPA 1	.420	.460	.44	0.20
Iron ppm AB DTPA 1	45.500	43.800	44.65	60.9
Magnesium Sol. Meq/l USDA 60	14.53	15.24	14.89	13.90
Manganese ppm AB DTPA 1	11.200	10.850	11.03	8.8

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LABORATORY, INC.
Bacteriological and Chemical Analysis
40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 466-8761

Test Hole No. B-5

CERTIFICATE OF ANALYSIS
83-006764

	25 - 27.5	27.5 - 30		TOTAL ACE
Moisture %	31.40	29.50		
Molybdenum ppm AB DTPA 1	.118	.037		
Neut./Potential Tons/1000Tons	3.65	3.62		
Nitrate NO3-N ppm USDA 60	6.40	5.30		
Organic Material % (WB)	4.65	4.91		
PH USDA 60	7.35	7.40		
Phosphorus ppm AB DTPA 1	30.70	29.20	29.95	16.53
Potassium ppm USDA 60	96.00	91.00	93.5	94.33
Pyritic Sulfur % ASTM D2492	.0119	.0110		
Saturation %	25.10	19.70		
Selenium ppm AB DTPA 1	<.001	<.001		
Sodium Absorption Ratio	.056	.061		
Sodium Sol.Meq/l USDA 60	.45	.50	0.48	0.55
Zinc ppm AB DTPA 1	1.700	1.800	1.75	2.06

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Valley Camp of Utah, Inc.
Belina Mine Site
Clear Creek, Utah 84526

MINE: UTAH No. 2 AREA. ~~Belina Mine~~

ANALYSIS BY: INTER-MOUNTAIN LABORATORIES, INC.

DATE: September 24, 1983
PAGE: 1 of 2

FEB 21 '90 14:07 VALCOM

Lab No.	Hole No.	Depth Interval Ft.	pH	Cond. mmhos/cm @ 25°C	Saturation %	Particle Size Sand %	Silt %	Clay %	Texture	Soluble Cations Ca Meq/l	Mg Meq/l	Na	SAR (1)
22093	1	10 feet [illegible]	7.3	0.79	34.3	50.4	38.9	10.7	Loam	5.29	1.71	1.22	0.65
22094	2	[illegible]	7.4	1.08	30.5	59.5	30.7	9.8	Sandy Loam	7.75	2.35	1.32	0.59
22095	3	[illegible]	5.5	0.31	32.2	44.0	42.5	13.5	Loam	1.81	0.41	0.97	0.92

Footnotes: (1) Sodium Adsorption Ratio

Valley Camp of Utah, Inc.
Belina Mine Site
Clear Creek, Utah 84526

MINE: ~~Belina Mine~~ UTAH NO. 2 PRED

ANALYSIS BY: INTER-MOUNTAIN LABORATORIES, INC.

DATE: September 24, 1983
PAGE: 2 of 2

Lab No.	Hole No.	OM% (13)	K+ (14)	PO4 (15)	Fe ppm (2)	Zn ppm (3)	B ppm (4)	N ppm (5)	Mo ppm (6)	Cu ppm (7)	Mn ppm (8)	TS % (9)	AB (10)	NP (11)	ABP (12)
22093	1	1.9	123.	17.4	15.1	1.09	0.84	7.13	0.09	0.51	9.35	0.05	1.56	22.3	20.7
22094	2	2.5	69.	13.7	16.6	1.12	0.85	5.71	0.08	0.41	13.3	0.05	1.56	57.1	55.5
22095	3	4.5	68.	8.74	59.3	0.66	0.76	4.30	0.05	0.80	7.52	0.05	1.56	11.9	10.3

Footnotes:
(13) Organic Matter
(14) Potassium
(15) Phosphate as P
(2) Iron DTPA
(3) Zinc DTPA
(4) Boron
(5) Nitrate Nitrogen
(6) Ammonium Extractable Molybdenum
(7) Copper DTPA
(8) Manganese DTPA
(9) Total Sulfur Per Cent
(10) Acid Base
(11) Neutralization Potential
(12) Acid Base Potential in Tons Calcium Carbonate per 1000 Tons of Soil

8 March 1983

MIDECO

420 CHIPETA WAY - SUITE 260
UNIVERSITY OF UTAH RESEARCH PARK
SALT LAKE CITY, UTAH 84108
TELEPHONE: (801) 582-3136
TWX 910-925-5258

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	47009
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-1, 0'-5'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	8.7
Specific Conductivity	145 umhos/cm
Alkalinity	5,600 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	27 2827	0.0027
Calcium	11,500	1.15
Copper	18	0.0018
Sodium	250	0.025

David W. Gayer
Environmental Lab Director

ph

8 March 1983

MIDECO
420 CHIPETA WAY - SUITE 280
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SALT LAKE CITY, UTAH 84108
TELEPHONE: (801) 582-3136
TWX 910 926-5258

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	47001
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	DD 1, 5'-6.6'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	7.9
Specific Conductivity	155 umhos/cm
Alkalinity	4,400 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	23	0.0023
Calcium	5,600	0.56
Copper	16	0.0016
Sodium	360	0.036

David W. Gayer
Environmental Lab Director

ph

... CONTROL, INC. D.B.A. MIDECO, ARE FOR THE EXCLUSIVE USE OF THE CLIENT TO WHOM IT IS ADDRESSED AND SUCH OT... EXPRESSLY AUTHORIZ...

8 March 1983

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SALT LAKE CITY, UTAH 84108
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ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	47005
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-1, 6.6'-10'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	8.8
Specific Conductivity	135 umhos/cm
Alkalinity	2,600 mg/kg as $CaCO_3$

	mg/kg	Appxmt. %
Boron	41	0.0041
Calcium	37,300	3.73
Copper	16	0.0016
Sodium	150	0.015

David W. Gayer
Environmental Lab Director

ph

8 March 1983

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TWX 910-925-5256

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	46995
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-1, 10'-15'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	8.1
Specific Conductivity	130 umhos/cm
Alkalinity	2,400 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	34	0.0034
Calcium	21,700	2.17
Copper	8	0.0008
Sodium	100	0.010

David W. Gayer
Environmental Lab Director

ph

8 March 1983

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TWX 910-925-5259

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	46999
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	DP-1, 15'-20'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	7.8
Specific Conductivity	130 umhos/cm
Alkalinity	2,800 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	24	0.0024
Calcium	8,900	0.89
Copper	6	0.0006
Sodium	90	0.009

David W. Gayer
Environmental Lab Director

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8 March 1983

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SALT LAKE CITY, UTAH 84108
TELEPHONE: (801) 582-3136
TWX 910-925-5258

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	47002
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-1, ROOFLOC 25'-26'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	7.2
Specific conductivity	110 umhos/cm
Alkalinity	2,800 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	20	0.0020
Calcium	700	0.07
Copper	10	0.0010
Sodium	90	0.009

David W. Gayer
Environmental Lab Director

ph

8 March 1983

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SALT LAKE CITY, UTAH 84108
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TWX 910-925-5258

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	47008
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-1, LOCROOF 26'-27'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	8.4
Specific Conductivity	78 umhos/cm
Alkalinity	1,600 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	43	0.0043
Calcium	1,800	0.18
Copper	20	0.0020
Sodium	110	0.011

David W. Gayer
Environmental Lab Director

ph

8 March 1983

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SALT LAKE CITY, UTAH 84108
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TWX 910-925-5258

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	47000
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-1, LOCROOF 27'-28'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	8.1
Specific Conductivity	62 umhos/cm
Alkalinity	2,200 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	18	0.0018
Calcium	1,000	0.10
Copper	14	0.0014
Sodium	35	0.0035

David W. Gayer
Environmental Lab Director

ph

8 March 1983

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ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	46997
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-1, LOCROOF 28'-29'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 mar 83

****

TEST REQUESTED	RESULTS
pH	7.5
Specific Conductivity	82 umhos/cm
Alkalinity	2,400 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	24	0.0024
Calcium	4,400	0.44
Copper	21	0.0021
Sodium	110	0.011

David W. Gayer
Environmental Lab Director

ph

8 March 1983

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SALT LAKE CITY, UTAH 84108
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TWX 910-925-5258

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	46998
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-1, LOCROOF 29'-30'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	8.0
Specific Conductivity	50 umhos/cm
Alkalinity	2,800 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	18	0.0018
Calcium	1,900	0.19
Copper	22	0.0022
Sodium	140	0.014

David W. Gayer
Environmental Lab Director

ph

8 March 1983

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420 CHIPETA WAY - SUITE 260
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SALT LAKE CITY, UTAH 84108
TELEPHONE: (801) 582-3136
TWX 910-925-5255

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	47003
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-1, LOCFLOOR 40'-41.5'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS	
pH	7.9	
Specific Conductivity	170 umhos/cm	
Alkalinity	2,400 mg/kg as $CaCO_3$	
	mg/kg	Approx. %
Boron	39	0.0039
Calcium	33,700	3.37
Copper	12	0.0012
Sodium	120	0.012

David W. Gayer
Environmental Lab Director

ph

8 March 1983

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SALT LAKE CITY, UTAH 84108
TELEPHONE: (801) 582-3136
TWX 910-925-5258

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	46996
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-2, 0'-3'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	7.9
Specific Conductivity	69 umhos/cm
Alkalinity	2,570 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	20	0.0020
Calcium	1,500	0.15
Copper	14	0.0014
Sodium	30	0.0030

David W. Gayer
Environmental Lab Director

ph

8 March 1983

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SALT LAKE CITY, UTAH 84108
TELEPHONE: (801) 582-3136
TWX 910-925-5258

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	46994
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-2, 5'-8'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	7.7
Specific Conductivity	65 umhos/cm
Alkalinity	2,800 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	21	0.0021
Calcium	1,300	0.13
Copper	14	0.0014
Sodium	60	0.006

David W. Gayer
Environmental Lab Director

ph

8 March 1983

MIDECO

420 CHIPETA W
UNIVERSITY OF U
SALT LAKE CIT
TELEPHONE: (
TWX 910-925-52

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	47006
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-2, 8'-13'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	8.2
Specific Conductivity	65 umhos/cm
Alkalinity	2,800 mg/kg as Ca

	mg/kg	Approx.
Boron	16	0.0016
Calcium	500	0.05
Copper	17	0.0017
Sodium	86	0.0086

David W. Gayer
Environmental L

ph

8 March 1983

MIDECO
420 CHIPETA WAY - SUITE 280
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SALT LAKE CITY, UTAH 84108
TELEPHONE (801) 582-3136
TWX 910-925-5258

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	47004
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-2, 13'-18'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

****

TEST REQUESTED	RESULTS
pH	8.5
Specific Conductivity	69 umhos/cm
Alkalinity	2,400 mg/kg as $CaCO_3$

	mg/kg	Approx. %
Boron	15	0.0015
Calcium	700	0.07
Copper	7	0.0007
Sodium	37	0.0037

David W. Gayer
Environmental Lab Director

ph

8 March 1983

MIDECO
420 CHIPETA WAY SUITE 280
UNIVERSITY OF UTAH RESEARCH PARK
SALT LAKE CITY, UTAH 84108
TELEPHONE: (801) 582-3136
TWX 910-925-5258

ENVIRONMENTAL LAB ANALYSIS

LAB NUMBER	47007
SPONSOR	Valley Camp of Utah
SAMPLE IDENTIFICATION	BP-2, 18'-23'
STARTING DATE	25 Feb 83
COMPLETION DATE	01 Mar 83

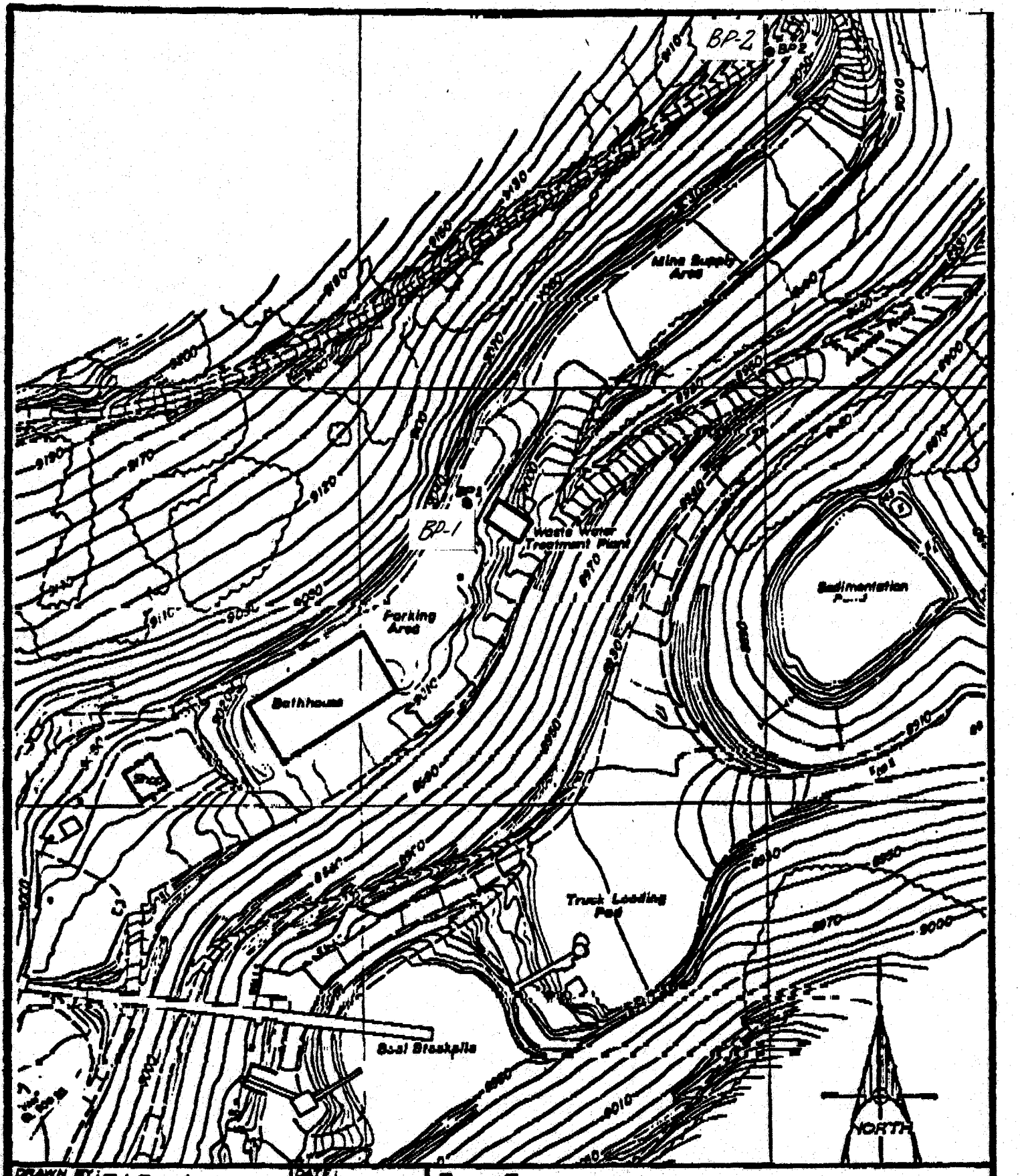
****

TEST REQUESTED	RESULTS	
pH	8.1	
Specific Conductivity	71 umhos/cm	
Alkalinity	2,290 mg/kg as $CaCO_3$	
	mg/kg	Approx. %
Boron	30	0.0030
Calcium	800	0.08
Copper	6	0.0006
Sodium	110	0.011

David W. Gayer
Environmental Lab Director

ph

8 March 1983



DRAWN BY: Ed Sanderson	DATE: March 7, 83	VALLEY CAMP of UTAH SCOFIELD ROUTE HELPER, UTAH 84526
CHECKED BY:	DATE:	
REVISED BY:	SCALE: NONE	
APPROVAL ENG.:		
APPROVAL SAFETY:	TITLE: SURFACE SOIL SAMPLES Drill Sites	DRAWING NO. A5-0054 / REV. NO. 0
APPROVAL MINE:		

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

December 2, 1988

RECEIVED
DEC - 6 1988
VALLEY CAMP OF UTAH, INC.

Valley Camp of Utah, Inc.
Scofield Route
Helper, Utah 84526

Attn: Steve Tanner:

Sample 1 & 5
Soil Classification - Sandy Clay (CL)

Pn (PSF)	500	1000	1500
At Peak % Load	15.9	20.5	34.1
(PSF) Shear Strength	763	984	1637
M.C.i	15.2	15.8	14.7
γ di	115.7	113.4	120.1
MC f	17.3	16.9	15.8
γ df	108.2	120.4	126.4

Sample 2
Soil Classification - Very fine sand (ML)

Pn (PSF)	100	200	400
At Peak % Load	6.1	7.1	8.6
Shear Strength (PSF)	293	341	413
M.C.i	42.7	40.6	32.0
γ di	76.4	78.8	83.8
MC f	44.6	41.6	38.5
γ df	75.4	80.4	85.9

MC = Moisture Content
γf = Dry Unit Weight

Sincerely,

Tom McNamee
Lab Manager

cc: Randy Harten
Div of Oil,Gas,Mining

National Voluntary Laboratory Accreditation Program
NVLAP
United States Department of Commerce Accredited
Member: ASTM, ACI, AGC

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

RECEIVED 1988 VHA

December 2, 1988

Valley Camp
Scofield Route
Helper, Utah 84526

Attn: Steve Tanner

Gentlemen,

Enclosed are the in place density, direct shear, soil classification and cohesion properties of samples taken from Valley Camp Pond #1.

The pond bottom is a light brown sandy clay with some silt. The south and west sides have a gray silty sand. The color change could be natural but is probably the result of coal dust deposited in the pond over the years.

Samples were taken by driving (by hand) a thin walled aluminum tube into cut outs from the embankment approximately 2 feet above the water and 2 feet in from the surface.

Samples #1 & #5, and #2 & #3, were so similar that only one direct shear was done per set. Sample #4 was disturbed and no direct was performed but the torvane shear in the field was 200 psf.

As to the request of Randy Harten, Division of Oil, Gas and Mining, no engineering analysis has been performed , only the testing of the samples. If you have any questions regarding this information please do not hesitate to call.

Sincerely,

Tom McNamee
Lab Manager

cc: Randy Harten
Division of Oil, Gas,Mining

National Voluntary Laboratory Accreditation Program

NVLAP

United States Department of Commerce Accredited

Member: ASTM, ACI, AGC

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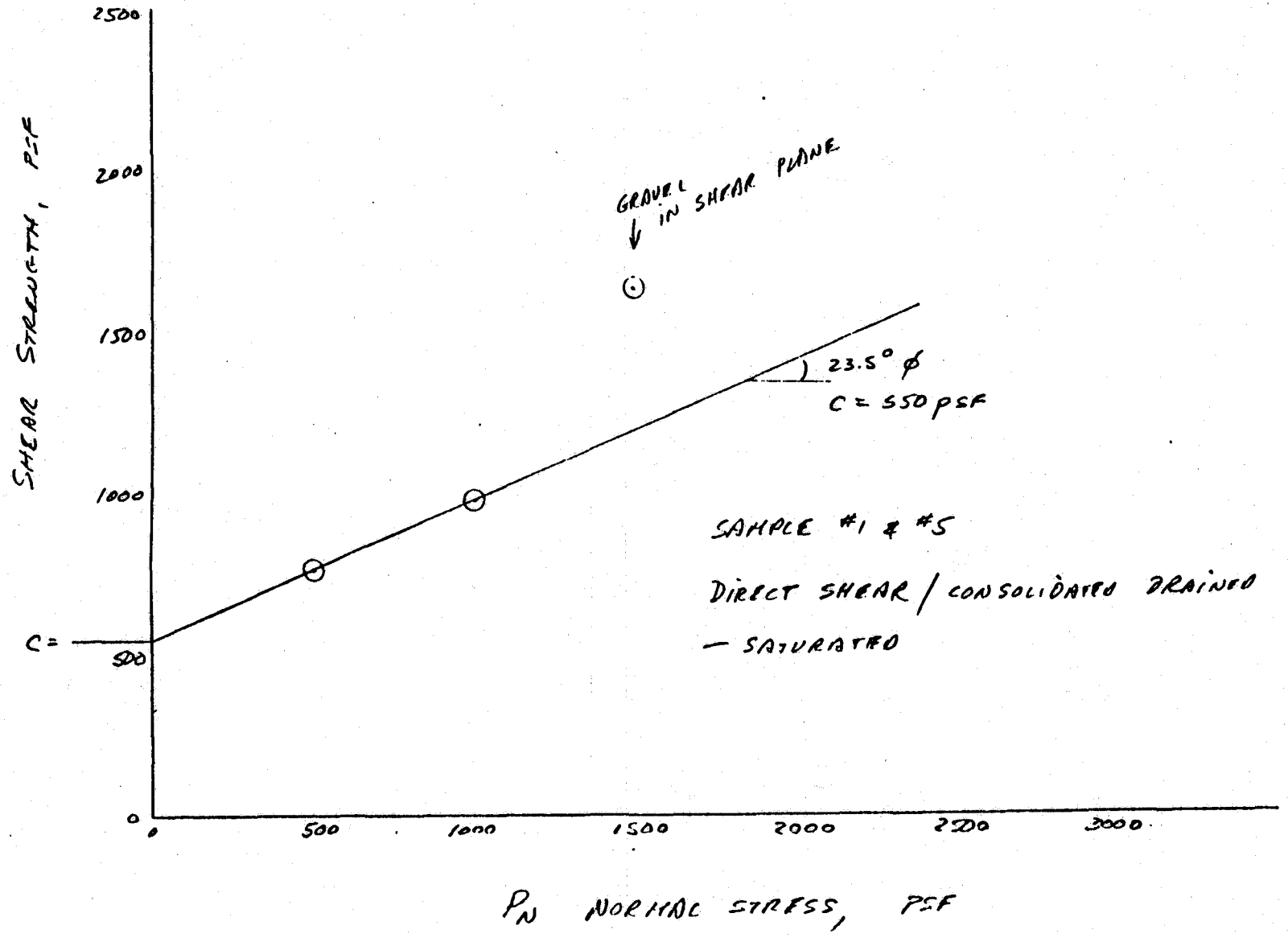

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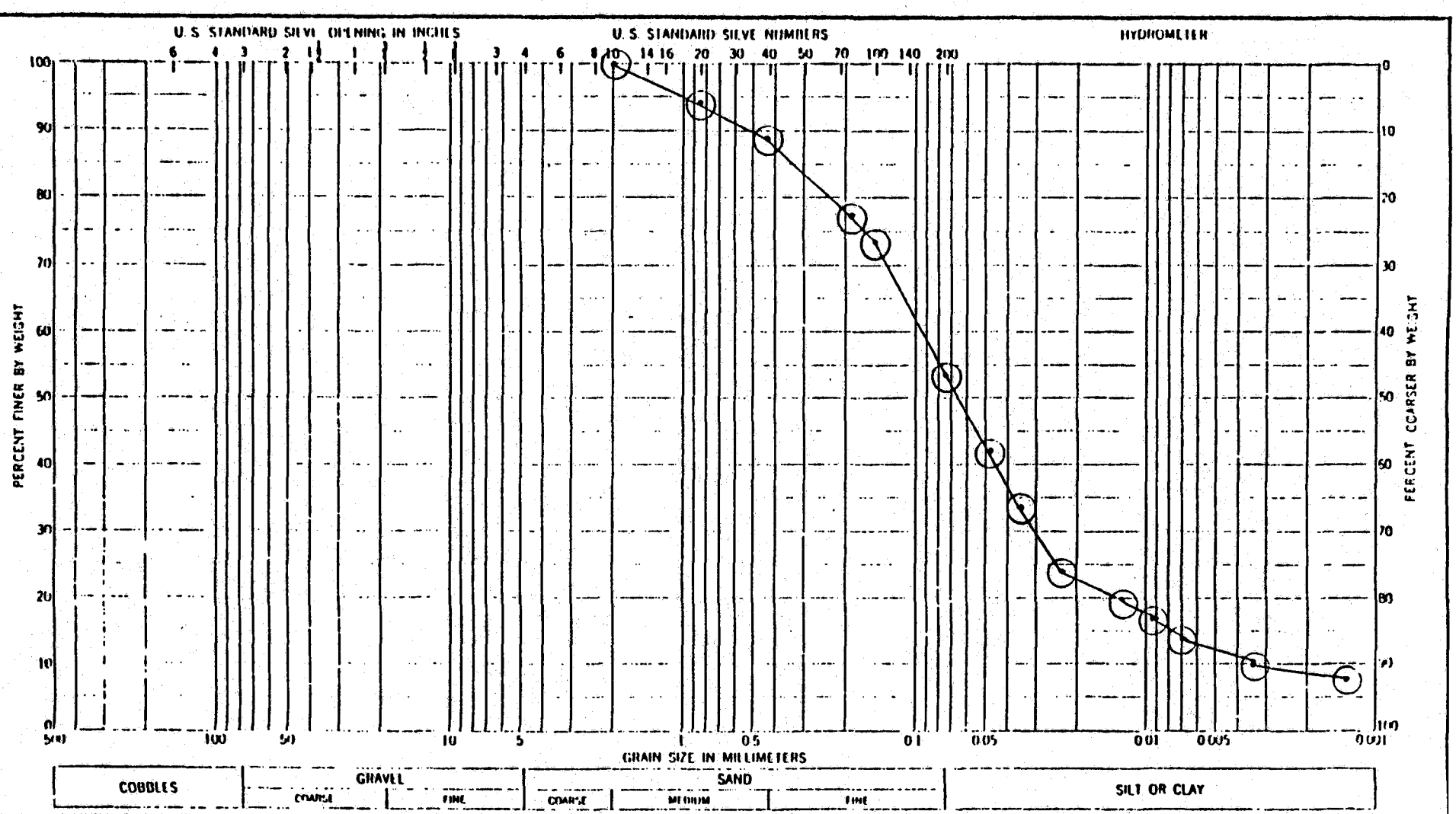


Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
1		SANDY CLAY (CL)		18	16	2

Project VALLEY CAMP

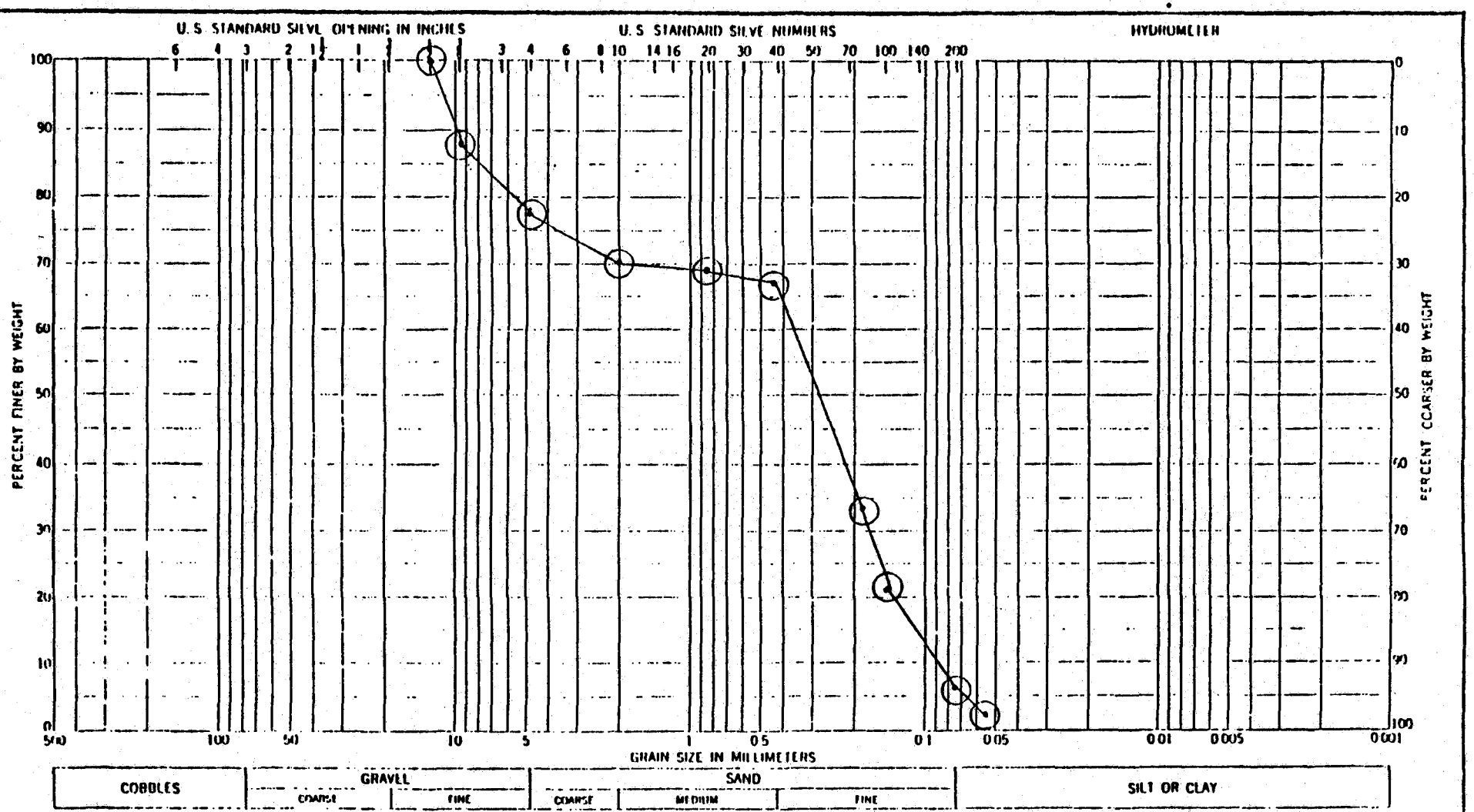
Area POND #1

Boring No 1

Date

GRADATION CURVES

ENG FORM 1 MAY 63 2087



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
4	—	SILTY SAND (SM) WELL GRADED SAND (SW)		NON-PLASTIC		

Project VALLEY CAMP

Area POND #1

Boring No 4

Date

GRADATION CURVES

ENG FORM 1 MAY 63 2087

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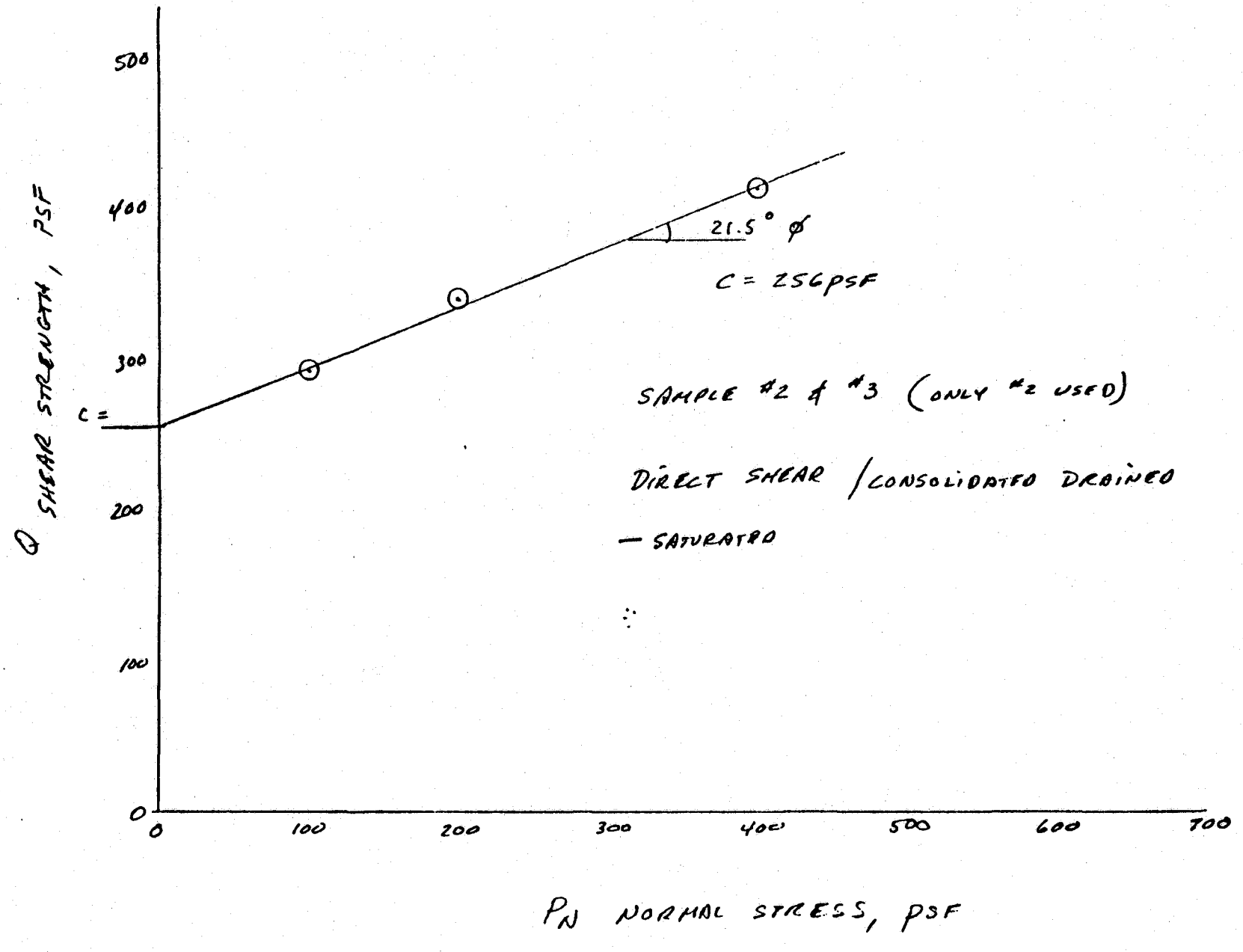
BY DATE TO EO
BY DATE TO EO



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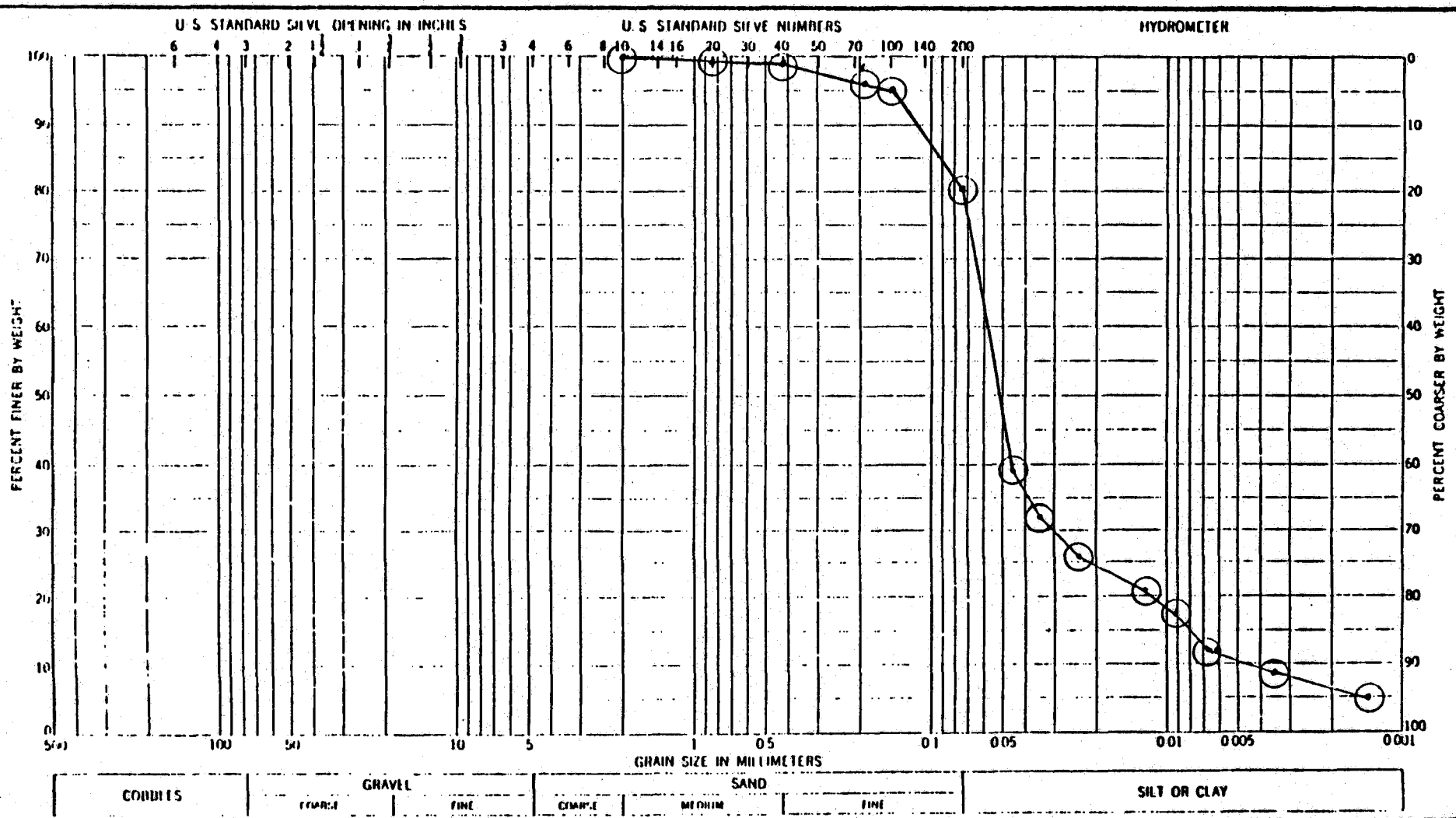


Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	–	VERY FINE SAND (ML)		NON-PLASTIC		

Project VALLEY CAMP

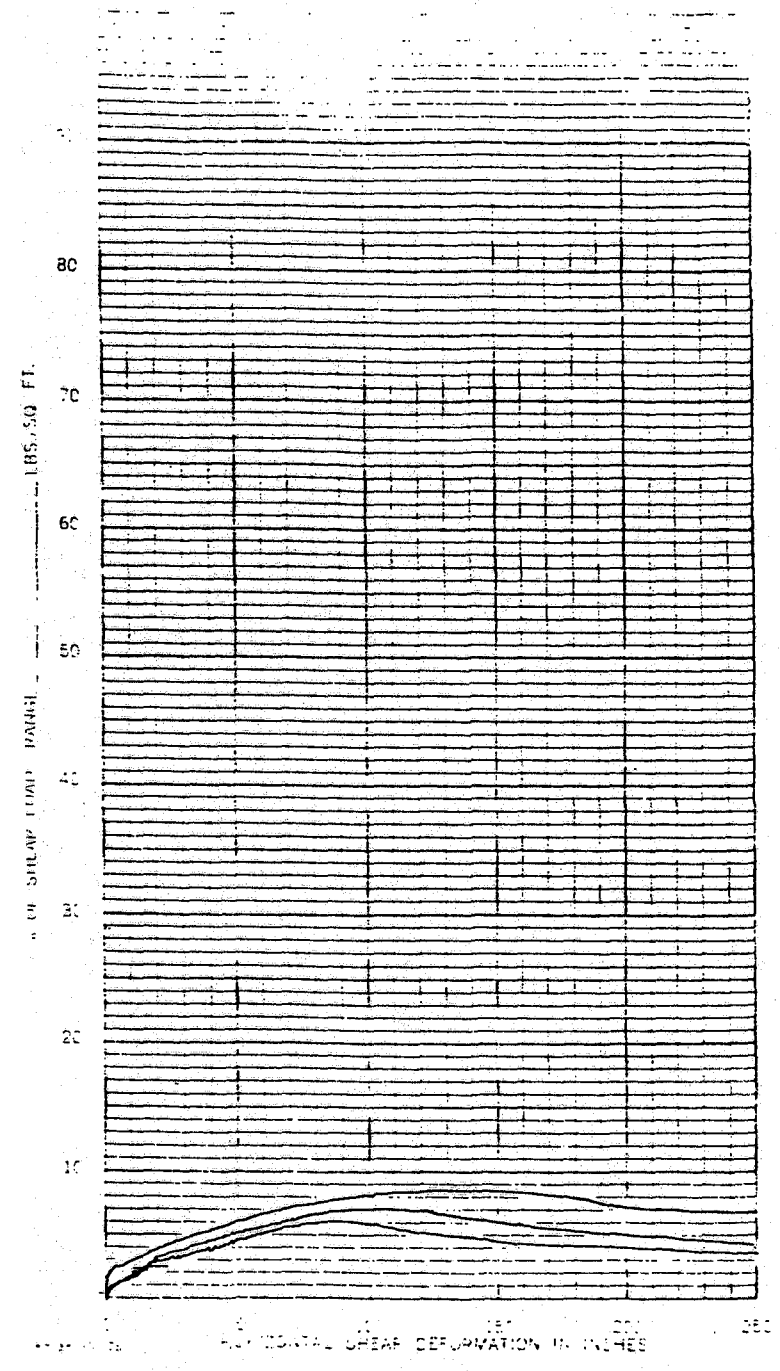
Area POND #1

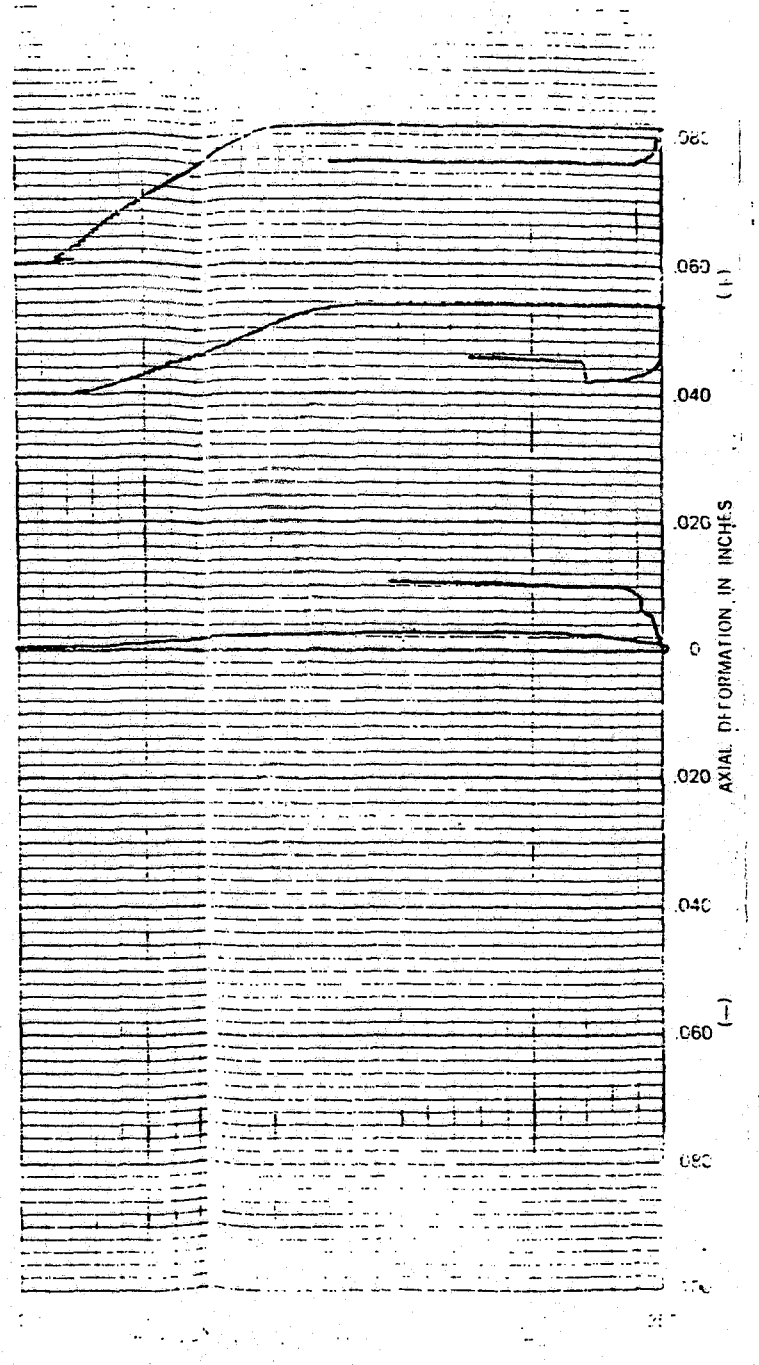
Boring No 2

Date

GRADATION CURVES

ENG FORM 1 MAY 63 2087





DIRECT SHEAR TEST
Sheet 1 of 2

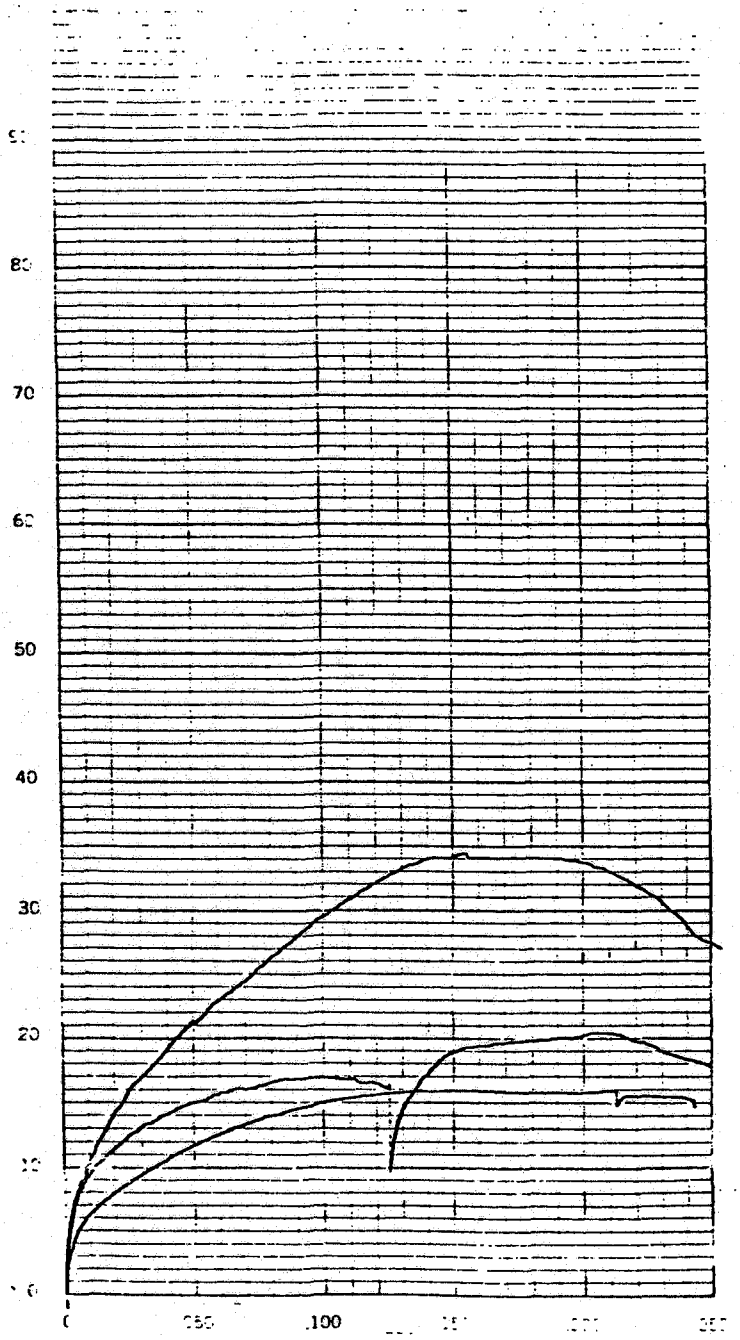
PROJECT Valley Camp PROJECT NO. 50
LOCATION SLC
BORING — SAMPLE 2 DEPTH (FT.)
SAMPLED BY GARCO TESTED BY
SOIL IDENTIFICATION Gray si clay 2 on

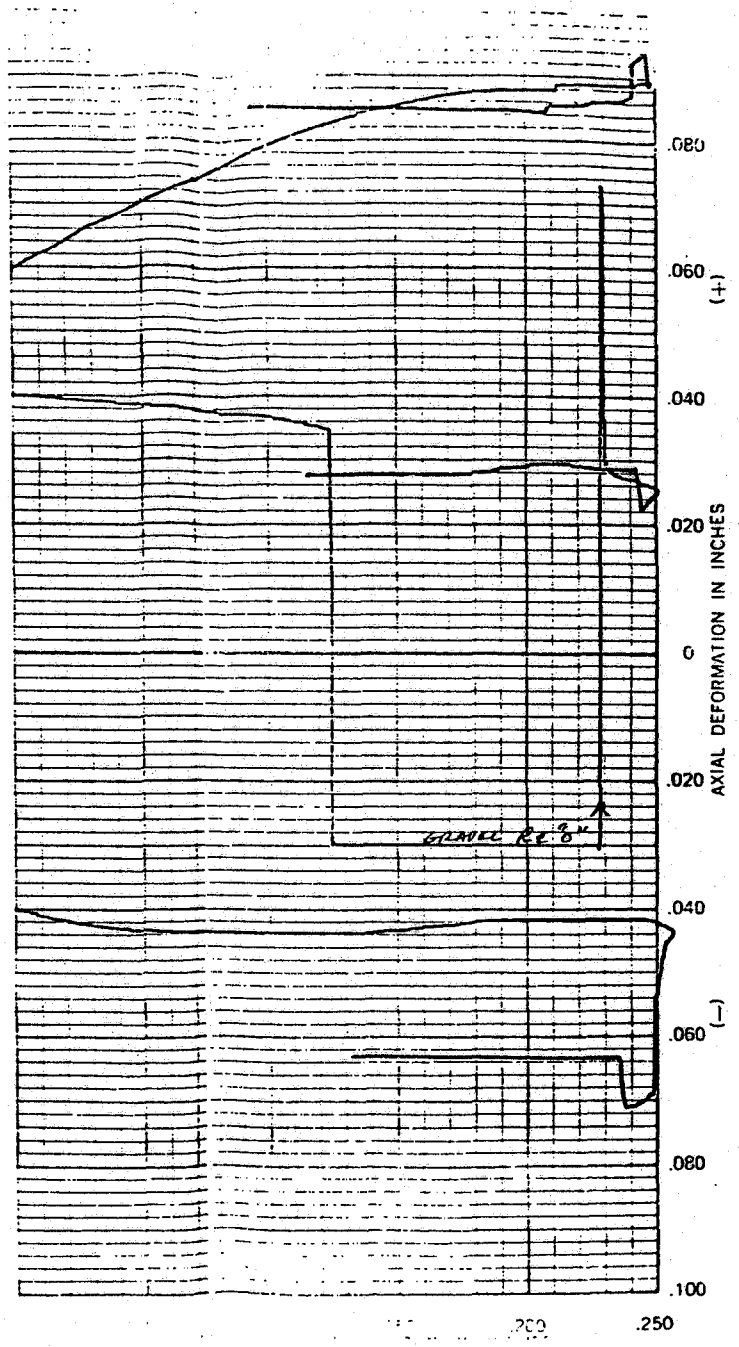
TYPE OF TEST DS/CD
SHEARING RATE .012 in/min
NORMAL PRESSURE psi = 4800
LOAD RANGE USED 40(12K) = 48

	PEAK	ULTIMA
% SHEAR LOAD		
SHEAR STRENGTH (psf)		
HORIZONTAL DEFORMATION (in.)		

PN	100	200	400
REMARKS At Peak % LOAD	6.1	7.1	8.6
SHEAR STRENGTH	293	341	413
M.C.i	42.7	40.6	32.0
γdi	76.4	78.8	83.8
M.C.f	44.6	41.6	38.5
γdf	75.4	80.4	85.9

OFFICE NUMBER 31 RECORDER NUMBER 743
SHEAR EQUIPMENT NUMBER: 7327 B
RECORDER CALIBRATION CHECKED 8/84
RECORDER PERFORMANCE CHECKED 8/84
EQUIPMENT PERFORMANCE CHECKED 8/84
EQUIPMENT CHECKED BY EEC DATE 11/13





DIRECT SHEAR TEST DATA SHEET

Sheet 1 of 2

PROJECT Valley Camp PROJECT NO. 5266

LOCATION SLC

BORING — SAMPLE 5 DEPTH (FT.) —

SAMPLED BY CARLO TESTED BY EGL 11 E. SL

SOIL IDENTIFICATION BoFi-C SA CLAY OCC TR Fi GVL

TYPE OF TEST: DS/CD

SHEARING RATE: .012 in./hr.

NORMAL PRESSURE: psi = 4800

LOAD RANGE USED: 20 = 48. psi

	PEAK	ULTIMATE
% SHEAR LOAD		
SHEAR STRENGTH (psf)		
HORIZONTAL DEFORMATION (in.)		

PN	500	1000	1500
~~REMARKS~~ At Peak % LOAD	15.9	20.5	34.1
SHEAR STRENGTH	763	984	1637
M.C.i	15.2	15.8	14.7
γdi	115.7	113.4	120.1
M.C.f	17.3	16.9	15.8
γdf	108.2	120.4	126.4

OFFICE NUMBER: 31 RECORDER NUMBER: 7434

SHEAR EQUIPMENT NUMBER: 7327B

RECORDER CALIBRATION CHECKED: 8/84

RECORDER PERFORMANCE CHECKED: 8/84

EQUIPMENT PERFORMANCE CHECKED: 8/84

EQUIPMENT CHECKED BY EGL DATE 1/13/86

ROLLINS,
BROWN and
GUNNELL,
INC. professional engineers

November 16, 1988

NOV 17 1988

VALLEY CAMP OF UTAH, INC.

Barry Barnum
Scofield Route
Helper, UT 84526

Gentlemen:

We have completed the required testing of soil samples obtained from two test pits excavated at Valley Camp near Scofield, Utah. The location of the test pits are shown in Figure No. 1 with their logs presented in Figure No. 2. It will be observed that the subsurface materials in both areas consist of a brown gravelly sandy silty clay.

Sampling of the test pits occurred at three-foot intervals throughout the depth investigated. Each sample was classified according to the Unified Soil Classification System. The symbols designating the soil type are shown on the logs.

The in-place unit weight and natural moisture content are also shown on the logs ranging from about 90 pounds per cubic foot to about 110 pounds per cubic foot and 6% to 11% respectively for Test Hole No. 1 and from 91 pounds per cubic foot to 97 pounds per cubic foot and 8.6% to 21.5% respectively for Test Hole No. 2.

The saturated unit weight for samples obtained from about 6 feet below the ground surface in Test Hole No. 1 is 118.2 pounds per cubic foot.

1435 WEST 820 NORTH
POST OFFICE BOX 711
PROVO, UTAH 84603

PROVO 374-5771
SALT LAKE CITY 521-5771
AREA CODE 801

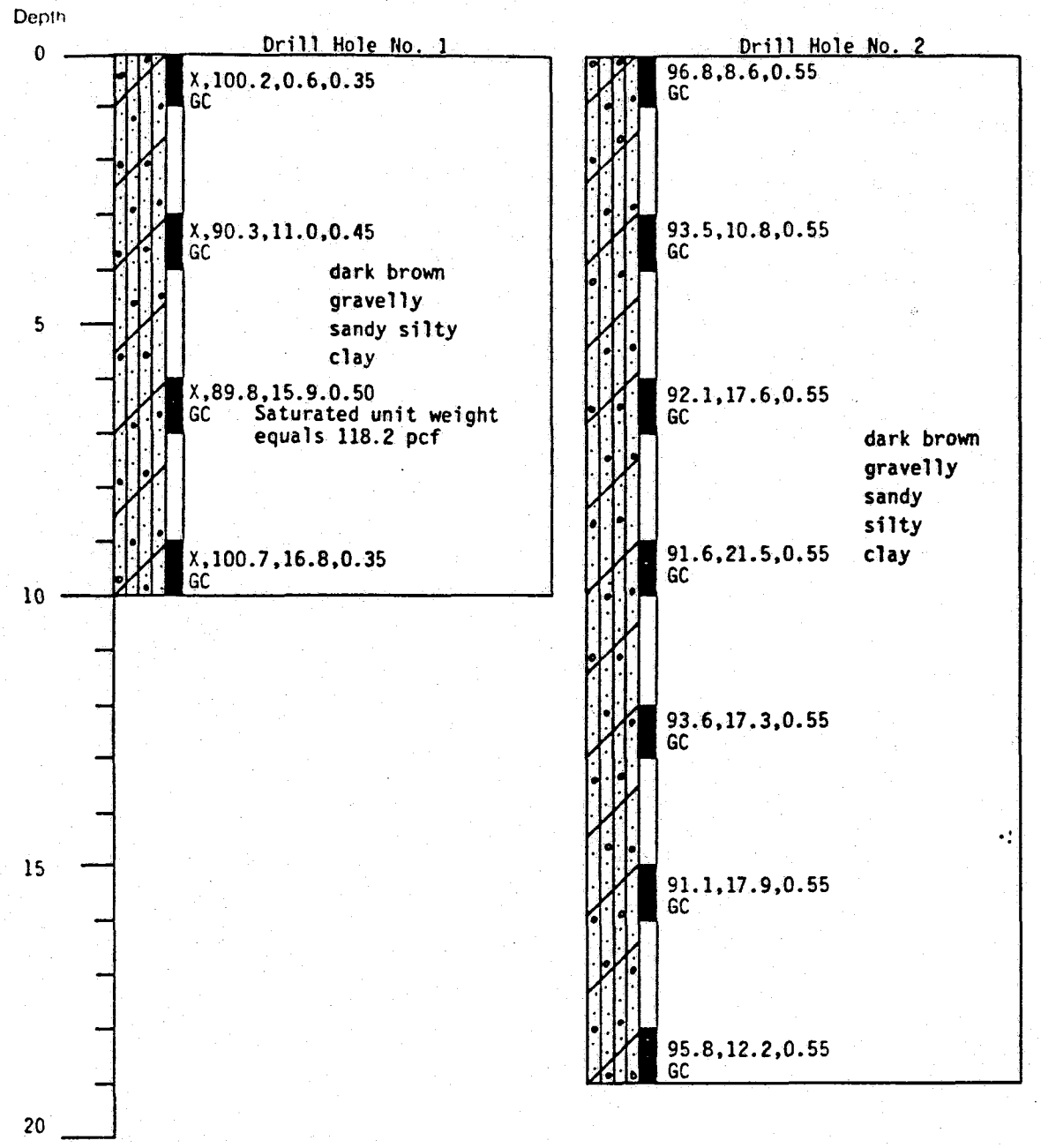
A consolidated drained direct shear test was performed on the samples from a depth of 6 feet in Test Hole No. 1. The results are shown in Figure No. 3 in the form of a Mohr envelope. The results indicate a friction angle of 38.5 degrees and a cohesion of 1 psi.

If you have any questions regarding the information contained herein, please contact me.

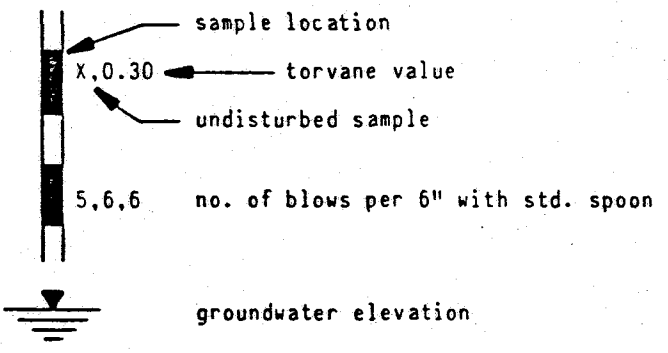
Yours truly,

Steven L. Smith

SLS:jsh



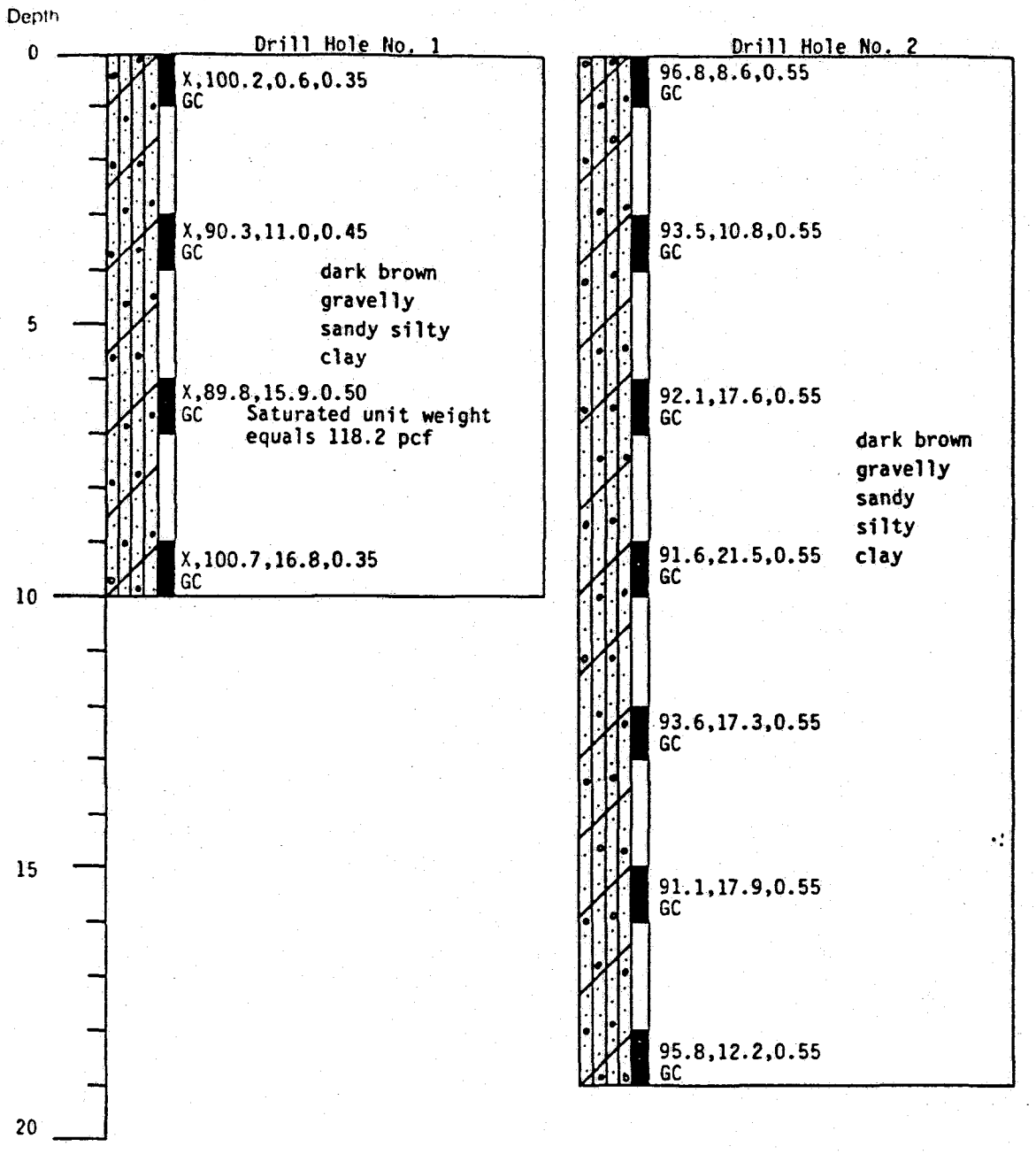
KEY



ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

Log of Borings for:
Valley Camp of Utah

Figure No. 2



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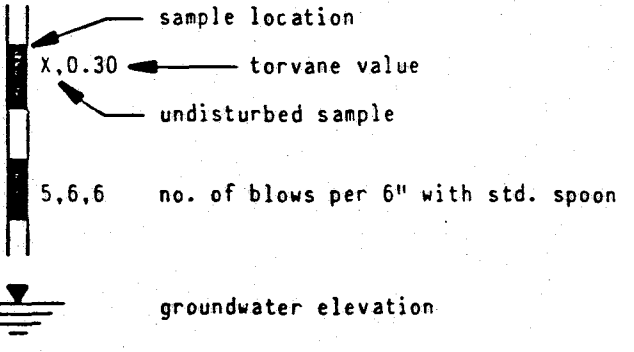

ROLLINS, BROWN AND GUNNELL, INC.
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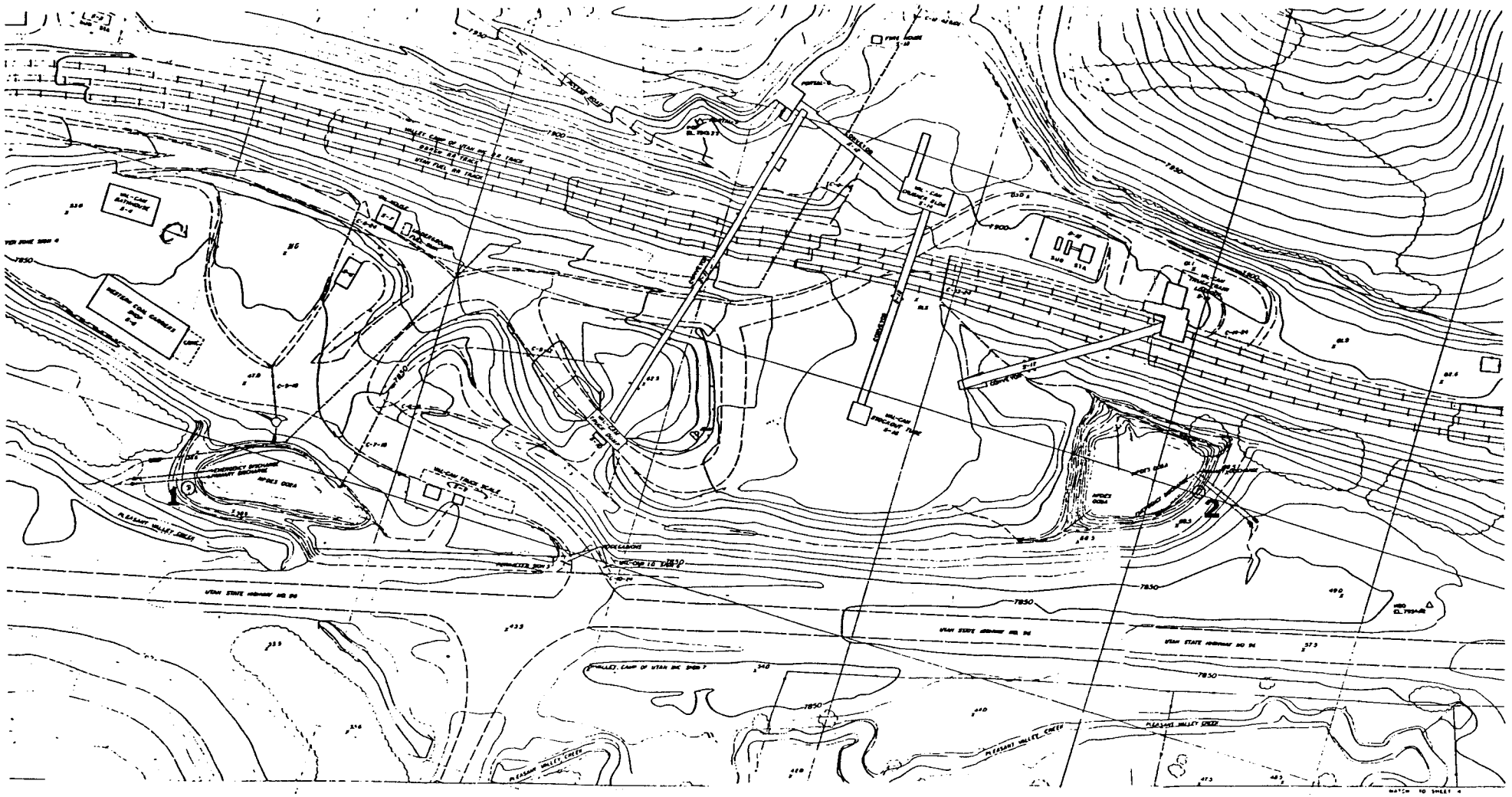
Log of Borings for:
Valley Camp of Utah

Figure No. 2



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Site Plan and Location of Drill Holes
Valley Camp of Utah

FIGURE NO 1