NUMBER	NAME	DESCRIPTION
Location: Valcam Loadout Facility		
S-1	Valcam Wellhouse 1974	Wooden structure housing the well and pump and controls
S-1A	Storage Shed 1974	Wooden structure, metal siding and roof
S-1B	Storage Shed 1974	Wooden structure, metal siding and roof
S-2	Valcam Shop 1974	Wooden structure, metal siding and roof, and concrete floor
S-3	Valcam Shop 1974	High Voltage transformers and disconnects
S-4	Valcam Bathhouse/Office 1974	Adjoining Trailers
S-5	Western Coal Carriers Shop 1983	Metal building, concrete floor
S-6	Tin Shed 1974	Wooden structure
S-7	Oil Storage Shed 1974	Wooden structure
S-8	Water Tank 1974	Metal tank
S-9	Truck Scale 1983	Concrete housing, trailer
S-10	Truck Dump 1978	Concrete and steel structure
S-11	Conveyor 1975	Steel structure, concrete base
S-12	Transfer Building 1975	Steel structure, concrete floor
S-13	Valcam Firehouse 1975	Wooden structure
S-14	Conveyor 1975	Steel structure, concrete base
S-15	Crusher Building 1975	Steel structure, concrete floor, concrete footer
S-16	Conveyor 1975	Steel structure, concrete base
S-17	Stacking Tube 1975	Concrete cylinder
S-18	Reclaim Tunnel 1975	Concrete
S-19	Reclaim Conveyor 1975	Steel structure, concrete base
S-20	Valcam Loadout Sub-Station 1975	High Voltage transformers, and disconnects.
S-21	Valcam Loadout 1975	Steel structure, concrete base

NUMBER	NAME	DESCRIPTION
Location: General Office Area		
S-22	Valley Camp Office 1976	Wooden structure, concrete floor
S-23	Office Firehouse 1976	Wooden structure
Location: Belina Mine Site		
S-24	Oil Storage Shed 1983	Wooden structure
S-25	Wastewater Plant 1980	Metal structure, concrete stem walls, concrete floor, prefab concrete walls, concrete footers
S-26	Belina Wellhouse 1980	Wooden structure
S-27	Belina Mines Bathhouse/Office Complex 1980	Metal structure, concrete stem walls, concrete floor, prefab concrete walls
S-28	Belina Shop 1976	Metal structure, concrete floor, concrete footers
S-29	Garage (portable) 1989	Metal structure
S-30	Pumphouse 1976	Concrete block, concrete floor, concrete footers
S-31	Washbay 1986	Metal structure, concrete floor
S-32	Reclaim Belt and Truck Bin 1980	Steel structure, concrete base
S-33	Belina Truck Loadout 1980	Metal structure, concrete floor, concrete footers
S-34	Belina Loadout Sub-Station 1980	High Voltage transformers and disconnects, concrete retaining wall
S-35	Belina No. 1 Conveyor Gallery 1980	Steel structure, concrete base, concrete stem walls, concrete floor
S-36	Stacking Tube 1980	Steel structure
S-37	Reclaim Tunnel 1980	Concrete, concrete floor, aluminum
S-38	Belina No. 2 HAC 1990	Steel structure, concrete base
S-39	Belina No. 2 Conveyor 1980	Steel structure, concrete base
S-40	Transfer Building 1980	Steel structure, concrete stem walls, concrete floor

NUMBER	NAME	DESCRIPTION
S-41	Belina No. 1 Fan 1977	8 HU Jeffery Fan, prefab concrete, concrete footers, concrete floor
S-42	Belina No. 2 Fan 1980	8 HU Jeffery Fan, prefab concrete, concrete footers, concrete floor
S-43	Filter Pond 005A 1980	Concrete structure
S-44	Belina Mines Sub-station 1975	High Voltage transformers and disconnects

The mine structures and supporting facilities "As-built" details are also shown on the Valley Camp 50 scale contour base Maps and are found as the 527 series maps found in the MRP. Maps included in the MRP are listed below;

Valcam Loadout Facility

MAP 500. Map Index
MAP 527. Valcam Loadout Facility Reclamation - Sheet 1
MAP 527. Valcam Loadout Facility Reclamation - Sheet 2
MAP 527. Valcam Loadout Facility Reclamation - Sheet 3

General Office Area

MAP 527. General Office Area Reclamation - Sheet 4

Belina Haul Road

MAP 527. Belina Haul Road Reclamation - Sheet 5
MAP 527. Belina Haul Road Reclamation - Sheet 6
MAP 527. Belina Haul Road Reclamation - Sheet 7
MAP 527. Belina Haul Road Reclamation - Sheet 8
MAP 527. Belina Haul Road Reclamation - Sheet 9
MAP 527. Belina Haul Road Reclamation - Sheet 10
MAP 527. Belina Haul Road Reclamation - Sheet 11

Belina Mine Site

MAP527. Belina Mine Site Reclamation - Sheet 12
MAP 527. Belina Mine Site Reclamation - Sheet 13
MAP 527. Belina Mine Site Reclamation - Sheet 14

Reclamation channel design details are shown on Maps 527 Sheets 15 and 16. The mine structures, surface facilities are depicted on the above mentioned maps. Nomenclature symbols

for constructed features shown on the mapping includes a "C" for culvert, a "D" for runoff control ditch and an "S" for a structure.

MAP 527. Reclamation Channel Details - Sheet 15
MAP 527. Reclamation Channel Details - Sheet 16

At this time only one modification has taking place, it being an upgrade to the truck/train loadout belt conveyor. No new disturbance to the present area was required, as the new drive unit is directly under the existing belt conveyor, where approximately 30 cu. yds. of concrete were placed to mount the drive unit. The old feeders have been replaced with cone feeders to enhance the live storage of the Valcam coal stockpile. This upgrade will allow Valley Camp to load a unit train in just under two hours, as stipulated in the new coal contract.

526.100. MINE STRUCTURES AND FACILITIES.

Those existing facilities traversing through the Mine Permit Area are Questar Pipeline Co. pipe lines and UP&L transmission lines which are depicted the Subsidence Base Map and the Valcam Loadout Facility Map. Those facilities that are within the 100 feet of a public road were subject to public comment during the initial permit approval process. No public road was or will be relocated in conjunction with mining and reclamation activities.

526.200. UTILITY INSTALLATION AND SUPPORT FACILITIES.

All utility installations associated with Valley Camp coal mining and reclamation operations will be conducted in a manner which minimizes damage, destruction, or disruption of services provided by oil, gas, and water wells; oil, gas, and coal-slurry pipelines, railroads; electric and telephone lines; and water and sewage lines which pass over, under, or through the Mine Permit Area, unless otherwise approved by the owner of those facilities and the Division.

526.220. THROUGH 526.222.

The support facilities are and will continue to be operated in accordance with a permit issued for the mine or coal preparation plant to which it is incident or from which its operation results.

The support facilities are located, maintained, and used in a manner that prevent or control erosion and siltation, water pollution, and damage to public or private property; and to the extent possible using the best technology currently available to minimize damage to fish, wildlife, and related environmental values; and minimize additional contributions of suspended solids to stream flow or runoff outside the Mine Permit Area.

526.300. WATER POLLUTION CONTROL FACILITIES.

There are three sedimentation ponds (001A, 002A, and 003A) at the Valcam Loadout Facility and one (004A) at the Belina Mine Site. All were constructed on parallel lifts and meet OSM requirements. Also at the Belina Mine Site is a concrete filter pond (005A). All sedimentation ponds are used to protect the quality of surface water run-off and the filter pond is used to insure the quality of the mine water discharge, all of which are maintained by the

mine personnel. In addition to normal maintenance, any pond will be cleaned in which the sediment capacity is reduced by 60 percent. The sedimentation ponds within the Mine Permit Area will be removed and reclaimed at the end of the reclamation.

There are no overburden stockpiles in the Mine Permit Area. Earth material removed during the construction of the benches at the Belina No. 1 Mine pad was used to construct the Belina No. 2 Mine pad area.

526.400. AIR POLLUTION CONTROL FACILITIES.

527. TRANSPORTATION FACILITIES.

527.100. THROUGH 527.240.

All roads in the Mine Permit Area have been classified as primary according to UDOGM, however, the Truck/Train-Truck Dump Road (Primary Road No. 1) at the Valcam Loadout Facility and the Belina Haul Road (Primary Road No.1) are the only roads which are considered as improved, both are overlaid with asphalt concrete and are shown in their respective area on the "As-Built" 100 Scale 521.124 Maps, Sheets 1-4 respectively, also shown are all transportation facilities including rail, and conveyors.

The design and construction of roads within the permit area were made in such a manner as to protect the environment and minimize the impact on fish and wildlife by constructing fish ladders on Eccles Creek, improve haul roads with asphalt concrete, concrete ditch and culvert design, and by designing culverts drainages crossings with capacities match the immediate upstream and downstream conditions of the natural drainages.

Outlying roads are maintained annually, usually during late spring or early summer while there is still adequate moisture in the soils to promote compaction. The Belina Haul Road and the Truck\Train-Truck Dump Roads are maintained on an as needed basis. The concrete ditch is cleaned between major storms, chuckholes are repaired and Asphalt Concrete overlays are installed when the surface merits rehab.

Should the roads be damaged by a catastrophic event, such as an earthquake or a flood, repairs will be made as soon as possible. The Morrison-Knudsen Report (1993 Appendix 527) includes the geotechnical analysis of the Belina Haul Road. For specific reclamation work see the "Reclamation Plan" portion of the permit submittal.

528. HANDLING AND DISPOSAL OF COAL, OVERBURDEN, EXCESS SPOIL AND COAL MINE WASTE.

After coal is cut from the face, it is transported to the surface via a beltline, placed upon the raw coal storage pad at the Belina Mine Site where it is then loaded into bellydump (double) coal trucks and transported to the Valcam Loadout Facility coal storage pad. From that point it is either shipped by rubber or rail to the customer. See Section 520. At the time final reclamation of the Mine Permit Area occurs, the coal and coal fines which are considered unsalable (stockpile bases and short term coal storage area bases, roadways, etc.) after the marketable coal has been shipped, will be placed in a controlled manner to prevent combustion,

marketable coal has been shipped, will be placed in a controlled manner to prevent combustion, ensure stability and movement and environmental degradation after reclamation.

528.200. OVERBURDEN.

During the actual faceup and mine pad construction, all outcrop coal was harvested and shipped to the customer. The only coal not harvested was incidental to exposing the coal seam itself. That coal which became intermingled with the down-cast "overburden" should not create a problem in the future as that material became a composite blend through the handling process of the site construction.

528.300. SPOIL, COAL PROCESSING WASTE, MINE DEVELOPMENT WASTE, AND NON-COAL WASTE REMOVAL, HANDLING, STORAGE, TRANSPORTATION, AND DISPOSAL AREAS AND STRUCTURES.

Excess Spoil. As per the UDOGM definition, there are no Excess Spoil disposal areas within the Mine Permit Area. However, should it become necessary to create a waste disposal area, it will be accomplished in accordance with the requirements of the regulations, and other federal, state and local regulations.

Coal Mine Waste. There is no coal mine waste as per UDOGM definition. No coal mine waste will be disposed of except in an area approved by the Division. There are no coal processing facilities within the permit area and therefore no coal processing waste will be returned to the underground mine workings.

Refuse Piles. There is no large quantities of refuse materials generated within the Mine Permit Area as the only sources of refuse or coal waste materials are associated with the loadout and transportation facilities. This "refuse or waste" for the most part is fines which are returned to the raw coal pile at the Belina Mine Site or the coal pile at the Valcam Loadout Facility. There are no Refuse Piles as per UDOGM definition.

Burning and Burned Waste Utilization. All fires (intentional or unintentional) are extinguished in accordance with MSHA Regulations by personnel specifically trained in fighting fires. These people are trained according to an MSHA approved fire fighting plan.

Coal mine waste fires are extinguished in accordance with a plan approved by MSHA and the Division.

Coal stockpile fires are extinguished as quickly as possible, the hot spots are removed from the stockpile, spread out and cooled with water and the coal is promptly returned to the stockpile.

Non-coal Mine Waste. There are no Non-coal Mine Waste disposal site within the Mine Permit Area. The Non-coal Mine Waste is stored in metal hoppers prior to being transported to the Carbon County Landfill. The hoppers are covered while in transit. No Non-coal mine waste will be deposited in a refuse pile or impounding structure nor will there be an excavation for a non-coal mine waste disposal site closer than eight feet of any coal outcrop or coal storage area.

Underground Development Waste. There is no underground development waste sent out of the mines operated at Valley Camp of Utah, Inc..

529. MANAGEMENT OF MINE OPENINGS.

529.100. EXPOSED UNDERGROUND OPENINGS.

When approaching a suspected or known old workings (abandoned mine), MSHA Statutory Provisions of the 30 CFR Chapter 1, Subpart R-Miscellaneous, 75.1701 Abandoned areas, adjacent mines; drilling of boreholes, will be followed.

529.200. TEMPORARY SEALING OF MINE OPENINGS.

Any mine opening which is temporarily inactive will be properly guarded as per MSHA Statutory Provisions of the 30 CFR Chapter 1, Subpart R-Miscellaneous, 75.1701 Abandoned areas, adjacent mines; drilling of boreholes, or sealing of mines.

530. OPERATIONAL DESIGN CRITERIA AND PLANS.

531. GENERAL.

"As-Built" design drawings for all sediment ponds 001A-004A, the filter pond 005A, none of which are above any old or new mine workings are found and discussed within Hydrology Sections 733.130 and 742.221.

532. SEDIMENT CONTROL.

Sediment control measures are described in sections 732 and 742 of the permit.

532.100. DISTURBED AREA.

Incorporated within this section is the commitment to only disturbing the smallest practicable area at any one time during the operation and reclamation phases of the Mine Permit Area.

532.200. BACKFILL STABILIZATION.

The backfill operation will stabilize the material used to promote a reduction of the rate and volume of runoff in accordance with the requirements of the rules cited within this section. Regrading existing slopes will be such as to achieve stability, permanent features to enhance reclamation, regrading to achieve the approximate original contours, highwall elimination, minimize erosion and water pollution, spoil handling, and preparation of the final graded surfaces for replacement of the Vegetation-Supporting Material.

533. THROUGH 533.700. IMPOUNDMENTS, STABILITY, FOUNDATIONS, SLOPE AND EMBANKMENT PROTECTION, HIGHWALL LOCATION, MSHA AND NON-MSHA IMPOUNDMENTS.

For details see the following references in the permit: Impoundments - 733, Stability, Foundations, Slope and Embankment Protection, and Highway Location - 742.221, and MSHA and Non-MSHA Impoundments - 742.222.

534. ROADS.

534.100. LOCATION, DESIGN, CONSTRUCTION, MAINTENANCE AND RECLAMATION.

All roads are shown on Maps 521.124 Sheet 1 through Sheet 4.

The MK report found in the 1993 Appendix 527 exhibits non-compliance for the Belina Haul Road which constituted need for a Division "administration variance" (Final Approval Letter, March 14, 1989, originator Ms. Susan C. Linner, UDOGM, Reclamation Biologist/Permit Supervisor) requiring Visual Movement Indicators (VMI's). The VMI'S (installed October 1987) are located in the potentially "unstable" areas of the road, and are monitored during high precipitation cycles. There are 19 Visual Movement Indicator lines along the Belina Haul Road, these lines are mine roof bolts in line, driven to a supportive depth, approximately 25 feet apart, from the edge of the outslope to below the fill area of the outslope. The hub point of each line is shown on the Belina Haul Road Map 521.124., Sheet 2 and 3.

All roads within the Mine Permit Area are routinely inspected and maintained by a full time contractor. For the most part, the Belina Haul Road is traveled by the contractor on a daily basis, any abnormalities are reported to Valley Camp personnel and corrective actions taken. There has been no significant movement as can be verified by the asphalt concrete surface of the Belina Haul Road. Should significant movement occur, the Division will be notified immediately and a summary of the inspection and corrective measures taken will be included in the annual report submitted to UDOGM. Signs are posted warning the employees and the public of the potential hazards of the road, along with the standard regulatory sign required on public roads.

Refer back to 527 for a complete description of the roads within the Mine Permit Area. Also refer to Morrison-Knudsen Report found in the 1993 Appendix 527.

If the Belina Haul Road were to be put back to the Original Contour, it would not be stable as described in the stability analysis found in the aforementioned M-K Report. The Belina Haul Road was pioneered in 1975-76 and widened in 1977 has had two slides below the fill lines of the constructed toe, an earthquake and two years of +200 percent of normal precipitation. Valley Camp believes the Haul Road exhibits stability.

The Belina Haul Road will be reclaimed to a condition of stability commensurate with the surrounding slopes and should not be any more susceptible to failure than any other slopes within the adjacent area.

534.200.

The outlying roads within the Mine Permit Area are limited use roads, portions of which are roads which were built prior to the Valley Camp operation. Those roads include the Boardinghouse Canyon Road, the Questar Pipeline Co. pipe line access roads and the O'Connor Mine Road. The Boardinghouse Canyon Road is an unimproved road which passes through K&H, Milton Oman, and Jack Otani properties and ties into a Questar Pipeline Co./U.S. National Forest road near the O'Connor Mine. The Questar Pipeline Co. pipe line access roads are on the top of most ridge lines within the Mine Permit Area and all these roads are unimproved. The O'Connor Road was recently reclaimed by AMR segment of UDOGM.

The roads which are within the disturbed areas of the Mine Permit Area are the Valcam Loadout Facility truck/train loop road, General Office Area Road and the Belina Haul Road. These roads are shown on the Operations Maps listed in this section. All roads will remain for the duration of the mining phase of this operation. These roads all meet the requirements of the Regulations. The road surface is constructed of asphalt concrete and the culverts are CMP and were designed using ASTM standards, installed in accordance with UDOT Standard Specifications by General Coal Contractors, Helper, Utah and the placement was monitored by Centennial Engineering Inc., SLC, Utah, and having no failures as of December 1992, Valley Camp can only assume the culverts were designed and installed correctly.

The Belina Haul Road utilizes a concrete ditch with grated drop inlets and sediment traps. The primary use of these roads are for personnel access and the transportation of coal from the mine to the shipping point at the Valcam Loadout Facility. As shown on the Reclamation Maps, the railroad access road at the Valcam Loadout Facility will remain, the General Office Area Road will remain, while the Belina Haul Road will be reclaimed.

535. SPOIL.

535.100. DISPOSAL OF EXCESS SPOIL.

To date, there are no designated spoil disposal sites within the Mine Permit Area. Should it become necessary to construct a disposal site for Excess Spoil, the fill and appurtenant structures will be designed using current, prudent engineering practices and will meet any design criteria established by the Division.

535.110.

The Excess Spoil fill will met the requirements of 535.111 through 535.130.

536. COAL MINE WASTE.

No coal mine waste (as Defined in R645-100-200) has been generated to necessitate a disposal site for coal mine waste. Should it become necessary to construct such a disposal site during the operation phase, it will be accomplished through the approval process.

536.100. DISPOSAL FACILITIES.

Should a disposal facility be needed during the reclamation phase, it will be designed using current prudent engineering practices and will meet design criteria established by the Division. Actual location for this type of facility will be done during reclamation so to insure the most advantageous location can be utilized, with respect to AOC concerns, stability of existing foundations and or abutments, weak zones or groundwater effects upon the facility. The estimated amount of material which may require disposal can be found in 800.

536.200. COAL MINE WASTE PLACEMENT.

If a waste disposal facility becomes necessary, MSHA regulations which are applicable will be complied with. Mass stability will be paramount in the concerns of this type of facility.

536.300. COAL MINE WASTE DISPOSED OF IN EXCESS SPOIL FILLS.

There are no new or existing spoil fills within the Mine Permit Area, consequently, no coal mine waste will be disposed on or in excess spoil fills.

536.400. NEW AND EXISTING IMPOUNDING STRUCTURES CONSTRUCTED OF COAL MINE WASTE OR INTENDED TO IMPOUND COAL MINE WASTE.

There are no new or existing impounding structures which are constructed of coal mine waste and coal mine waste will not be used for construction of impounding structures.

536.500. DISPOSAL OF COAL MINE WASTE IN SPECIAL AREAS.

No coal mine waste materials from activities located outside the Mine Permit Area will be disposed of in the Mine Permit Area.

UNDERGROUND DISPOSAL

Any underground disposal of coal mine waste returned to the underground will be done in accordance with a plan approved by MSHA and the Division.

536.600. UNDERGROUND DEVELOPMENT WASTE.

Should coal mine waste be generated, it will be placed in such a manner as to comply with the MSHA regulations and ensure mass stability, prevent mass movement during and after construction, prevent combustion and not create a public hazard.

536.700. COAL PROCESSING WASTE.

There is no coal processing waste generated by this mining and reclamation operation, consequently, there are no plans for returning coal processing waste to the underground workings.

536.800. COAL PROCESSING WASTE BANKS, DAMS AND EMBANKMENTS.

No coal processing waste banks, dams or embankments exist within the Mine Permit Area.

536.900. REFUSE PILES.

No refuse piles exist within the Mine Permit Area.

537. REGRADED SLOPES.

All previously disturbed slopes which require regrading will be accomplished in accordance with the requirements of this section, unless otherwise approved by the Division.

537.100. GEOTECHNICAL ANALYSIS.

Upon Division approval for alternative specifications or for steep cut slopes, the requirements for section will be met. Just prior to final reclamation all areas which may be problematic, will be reviewed and geotechnical analysis will done for those areas in question.

537.200. REGRADING OF SETTLED AND REVEGETATED FILLS TO ACHIEVE APPROXIMATE ORIGINAL CONTOUR.

Areas which might fall into this category are depicted on Map 521.150 Sheets 1 through 4, showing the cuts and fills that are revegetating naturally. The Belina Haul Road is comprised of in-place materials and is for the most part, built on cut not fill. Several slope areas on the Belina Haul Road have deciduous and conifer growing adjacent to the concrete lined ditch and shoulder of the road. All disturbed area will be evaluated before any reclamation begins to verify areas which redisturbance would be unrealistic.

There is no spoil or underground development waste associated with the Primary road system.

540. RECLAMATION PLAN.

Information related to reclamation applicable to this section has been moved to the "Reclamation Plan" volume of this permit submittal.

550. RECLAMATION DESIGN CRITERIA AND PLANS

Information related to reclamation applicable to this section has been moved to the "Reclamation Plan" volume of this permit submittal.

560. PERFORMANCE STANDARDS.

Valley Camp will conduct their coal mining and reclamation operations in accordance with the approved permit and the requirements of 510 through 553.

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
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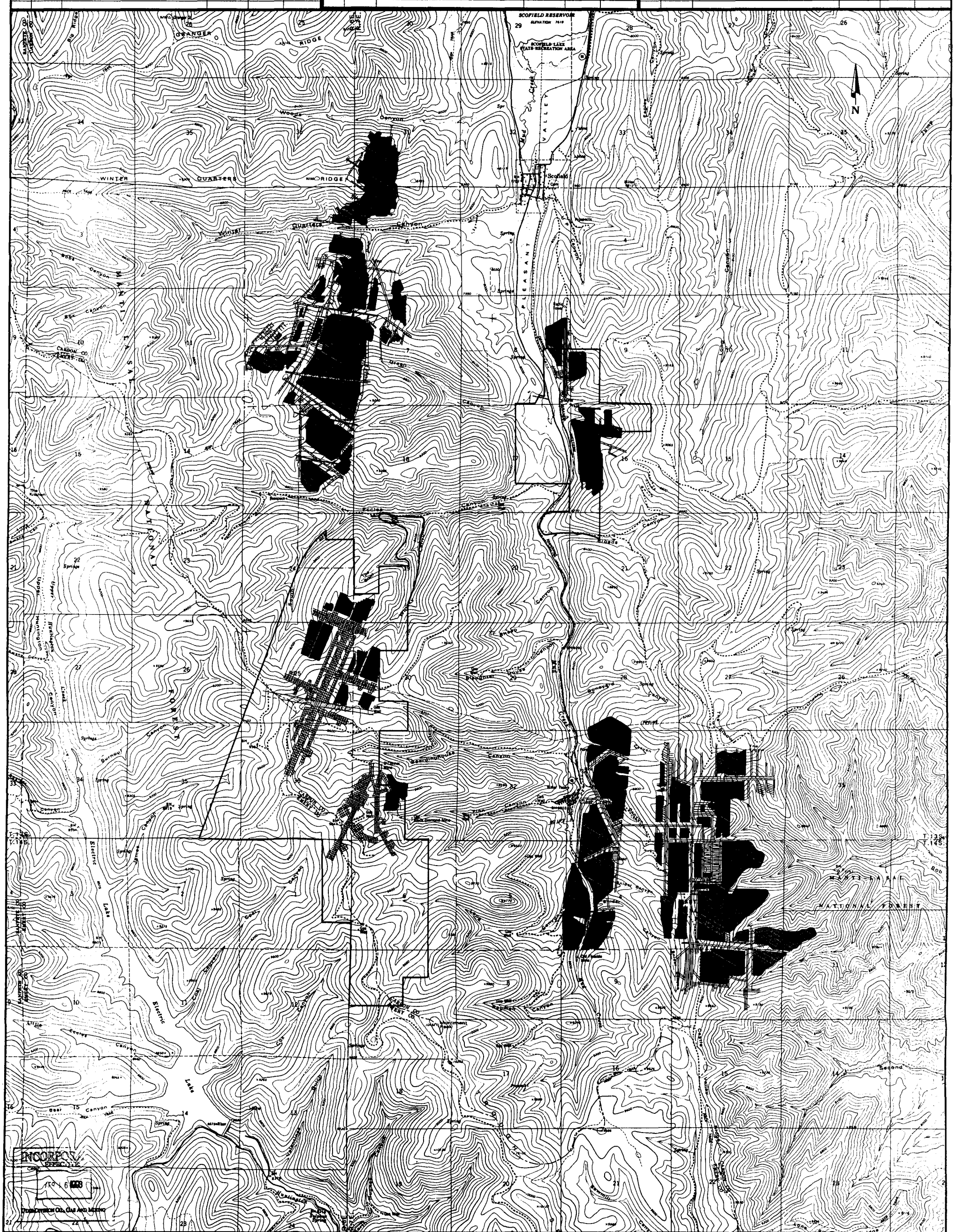

LEGEND:

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OIL GAS & MINING

VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE:
R645-301-521.111.
PLEASANT VALLEY
MINING DISTRICT

Drawn by: Ed Sanderson	Date: 12/17/89
Approval:	Date:
Drawing No. R645-301-521.111	Rev. 1 3/93

SAND DESIGN & GRAPHICS

SCALE: 1"=2000'

SHEET 1 of 1

ETS 5-89

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS

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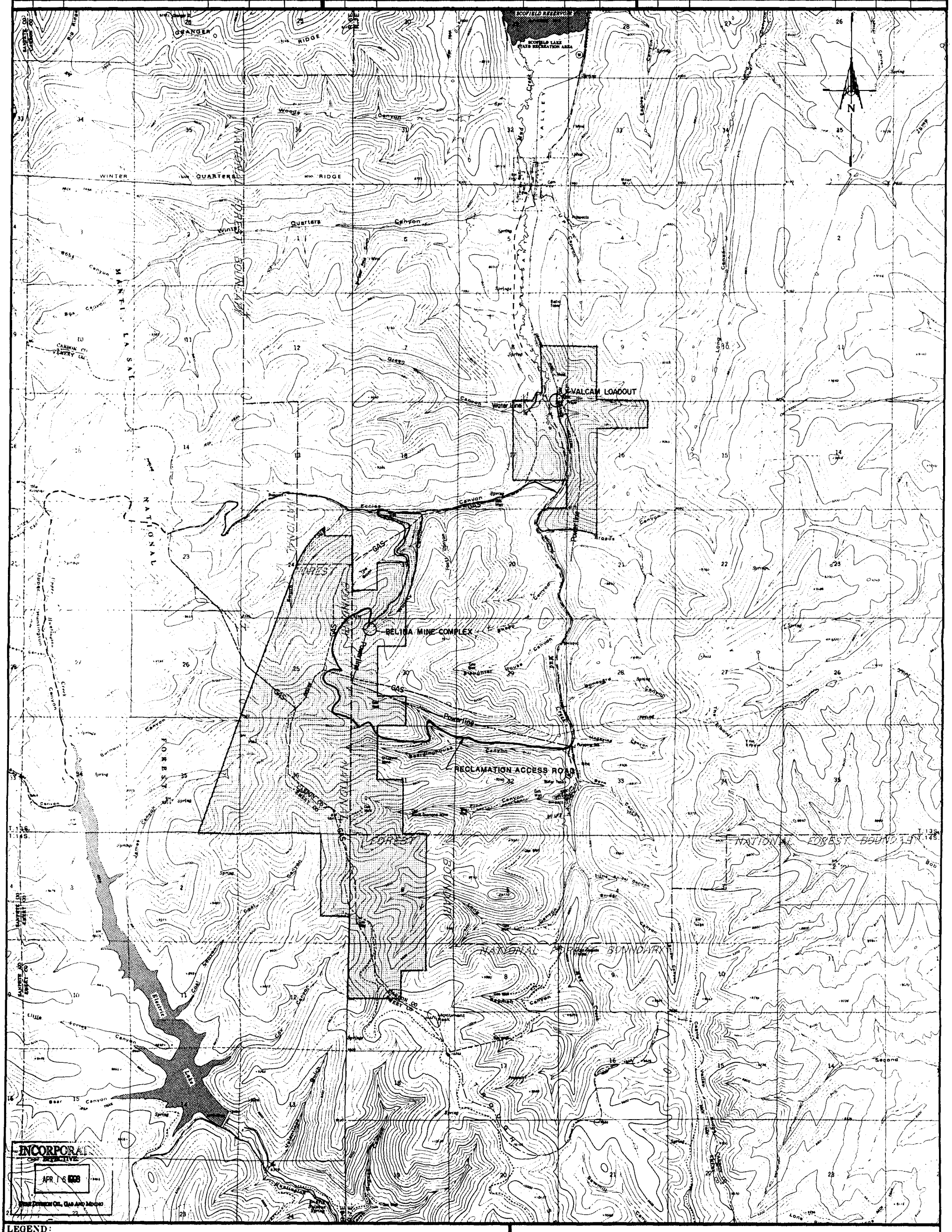

LEGEND:

Mine Permit Boundary
National Forest Boundary

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DIVISION OF
OIL GAS & MINING

REGISTERED PROFESSIONAL ENGINEER
No. 5323
EDWIN BROOKSHIRE FOUST
Mar 93
STATE OF UTAH

VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE:
R645-301-521.122
SURFACE FEATURES

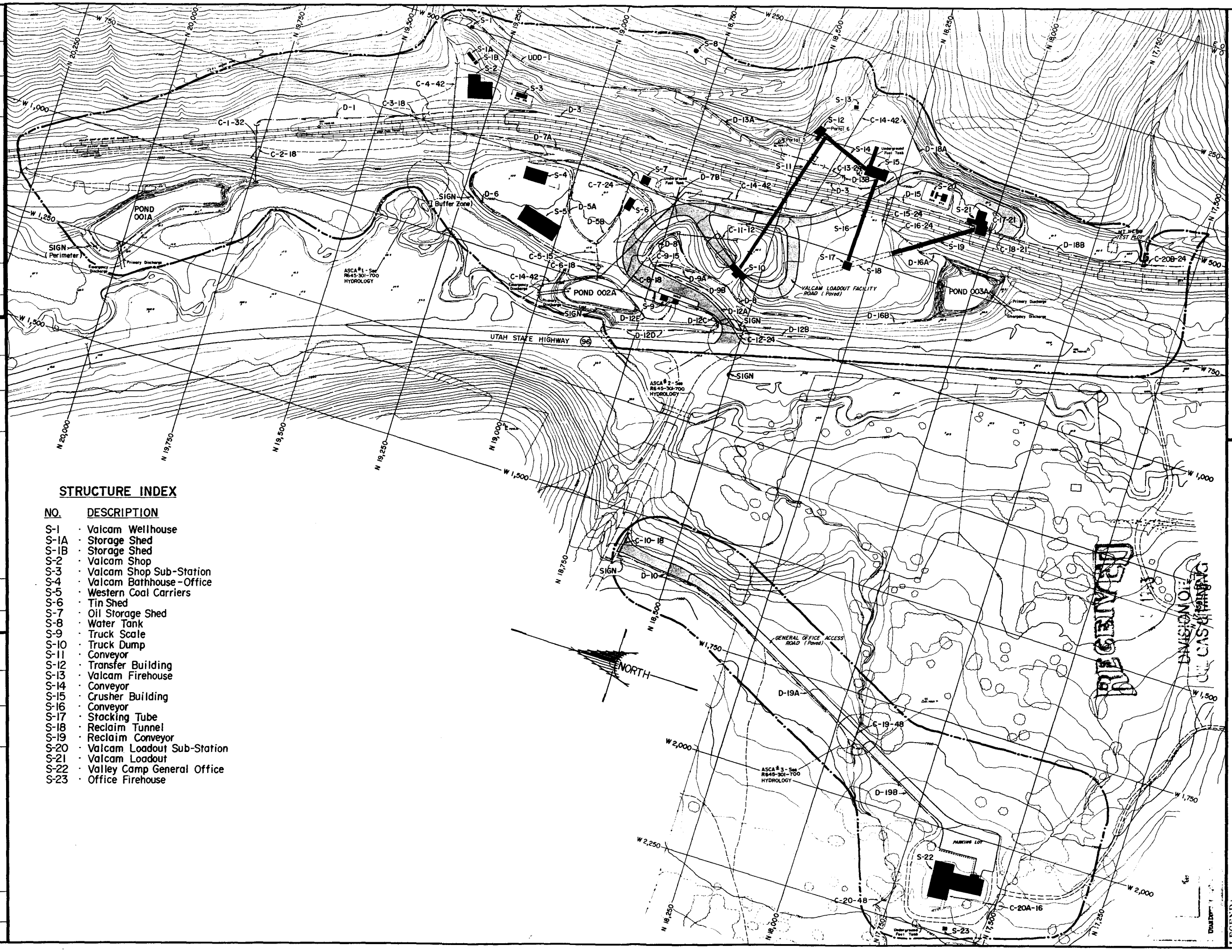
Drawn by: Ed Sanderson	Date: OCT. / 1990
Approval:	Date:
Drawing No. R645-301-521.122	Rev. 1 3/93

SAND DESIGN & GRAPHICS

SCALE: 1" = 2000'

SHEET 1 of 1

ETH-5-H9



STRUCTURE INDEX

NO.	DESCRIPTION
S-1	Valcam Wellhouse
S-1A	Storage Shed
S-1B	Storage Shed
S-2	Valcam Shop
S-3	Valcam Shop Sub-Station
S-4	Valcam Bathhouse-Office
S-5	Western Coal Carriers
S-6	Tin Shed
S-7	Oil Storage Shed
S-8	Water Tank
S-9	Truck Scale
S-10	Truck Dump
S-11	Conveyor
S-12	Transfer Building
S-13	Valcam Firehouse
S-14	Conveyor
S-15	Crusher Building
S-16	Conveyor
S-17	Stacking Tube
S-18	Reclaim Tunnel
S-19	Reclaim Conveyor
S-20	Valcam Loadout Sub-Station
S-21	Valcam Loadout
S-22	Valley Camp General Office
S-23	Office Firehouse

NO.	DATE	VALLEY CAMP ACT/007/001 REVISION DESCRIPTION	INCORPORATED INTO MRP BY DOGM REF. NO.	DATE	INITIALS
1	7/14/99	TITLE CHANGE			

NO.	DATE	VALLEY CAMP ACT/007/001 REVISION DESCRIPTION	INCORPORATED INTO MRP BY DOGM REF. NO.	DATE	INITIALS

NO.	DATE	VALLEY CAMP ACT/007/001 REVISION DESCRIPTION	INCORPORATED INTO MRP BY DOGM REF. NO.	DATE	INITIALS

NO.	DATE	VALLEY CAMP ACT/007/001 REVISION DESCRIPTION	INCORPORATED INTO MRP BY DOGM REF. NO.	DATE	INITIALS

VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE: R645-301-521.124. VALCAM LOADOUT FACILITY DISTURBANCE

Drawn by: Ed Sanderson — Date: Sept. 1990

Approval: — Date:

Drawing No. R645-301-521.124 — Rev. 1 3/93

SCALE: 1" = 100' — SHEET 1 of 4

SAND DESIGN & GRAPHICS — "AS BUILT"

PROFESSIONAL ENGINEER No. 5323 EDWIN STOCKSHIRE FOUST — STATE OF UTAH — Mar 9

NOTES:

1. For all Hydrology Information and structures see HYDROLOGY SECTION (700)
2. Disturbed Area Acres
   - Valcam Loadout Facility 33.5 ac.
   - General Office Area 1.0 ac.
   - Lower Section Balina Haul Road 23.0 ac.
   - Upper Section " " 25.5 ac.
   - Balina Mine Site 61.0 ac.

LEGEND:

- S-XX Structure
- Valley Camp Roads (Paved)
- C-XX-XX Culvert
- D-XX Ditch
- Disturbed Area Boundary

P:TM 5-99

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS
1	7/29/93	TITLE CHANGE			

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
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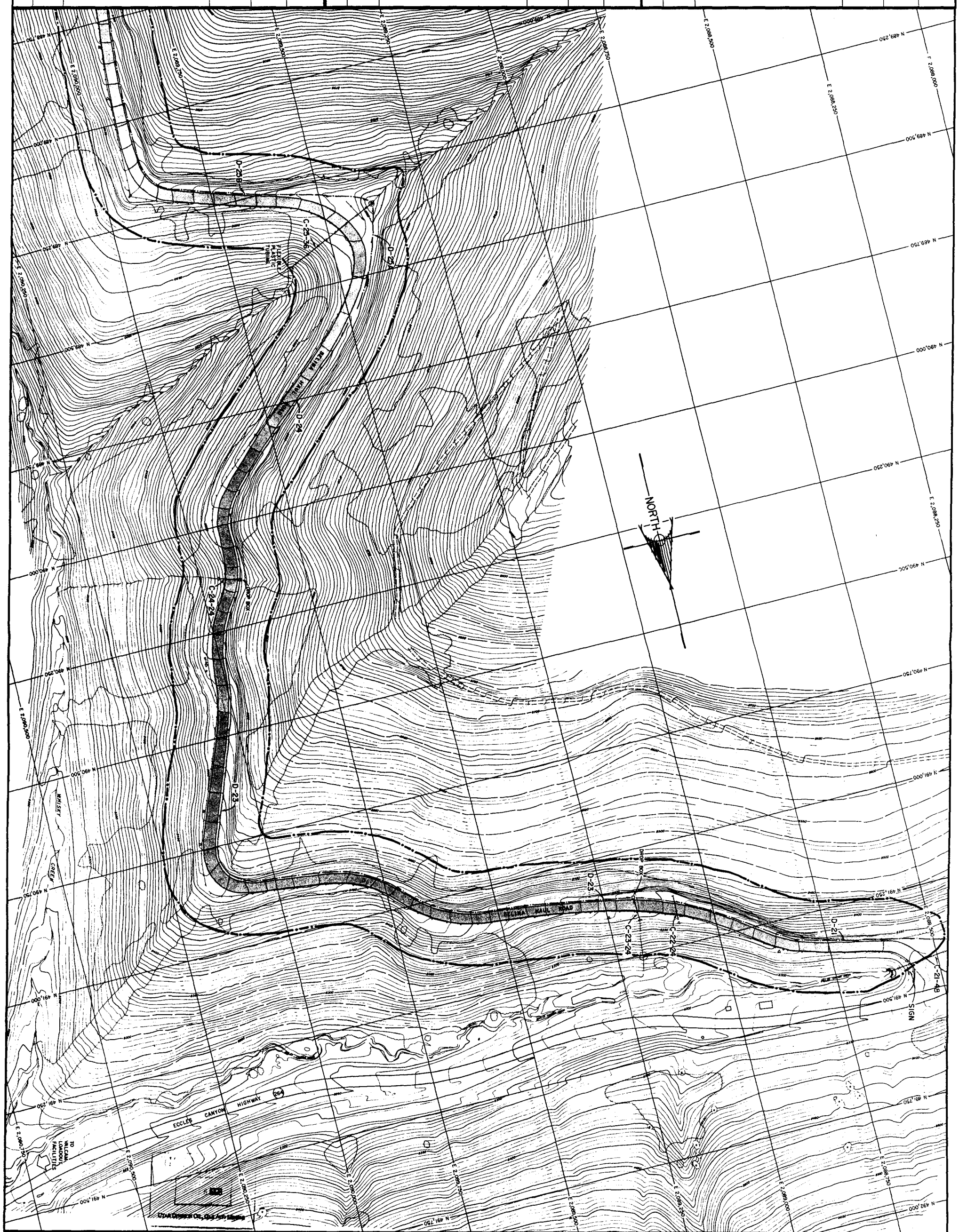

LEGEND:

Note: See Sheet 1

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REGISTERED PROFESSIONAL ENGINEER No. 5323 EDWIN BROOKSHIRE FOUST STATE OF UTAH

VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE: R645-301-521.124. BELINA HAUL ROAD-LOWER SECTION DISTURBANCE

Drawn by: Ed Sanderson	Date: Sept. 1990
Approval:	Date:
Drawing No. R645-301-521.124	Rev. 1 3/93

SAND DESIGN & GRAPHICS | "AS BUILT" | SCALE: 1" = 100' | SHEET 2 of 4

ETS-5-89

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS
1	7/29/93	TITLE CHANGE			

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
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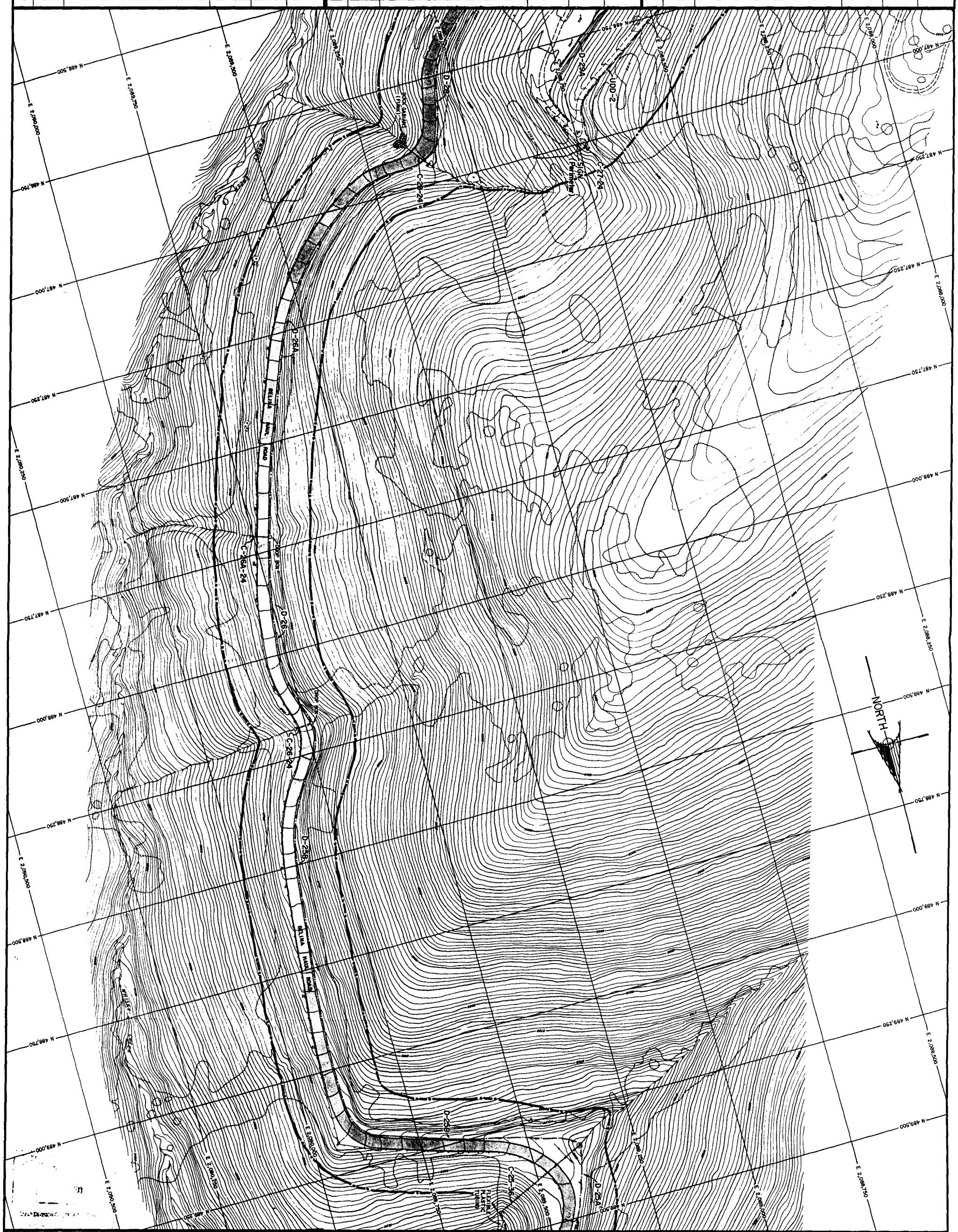

LEGEND:

Note: See Sheet 1

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DIVISION OF
OIL GAS & MINING

REGISTERED PROFESSIONAL ENGINEER
No. 5323
EDWIN BROOKSHIRE FOUST
Mar 93
STATE OF UTAH

VALLEY CAMP OF UTAH, INC.

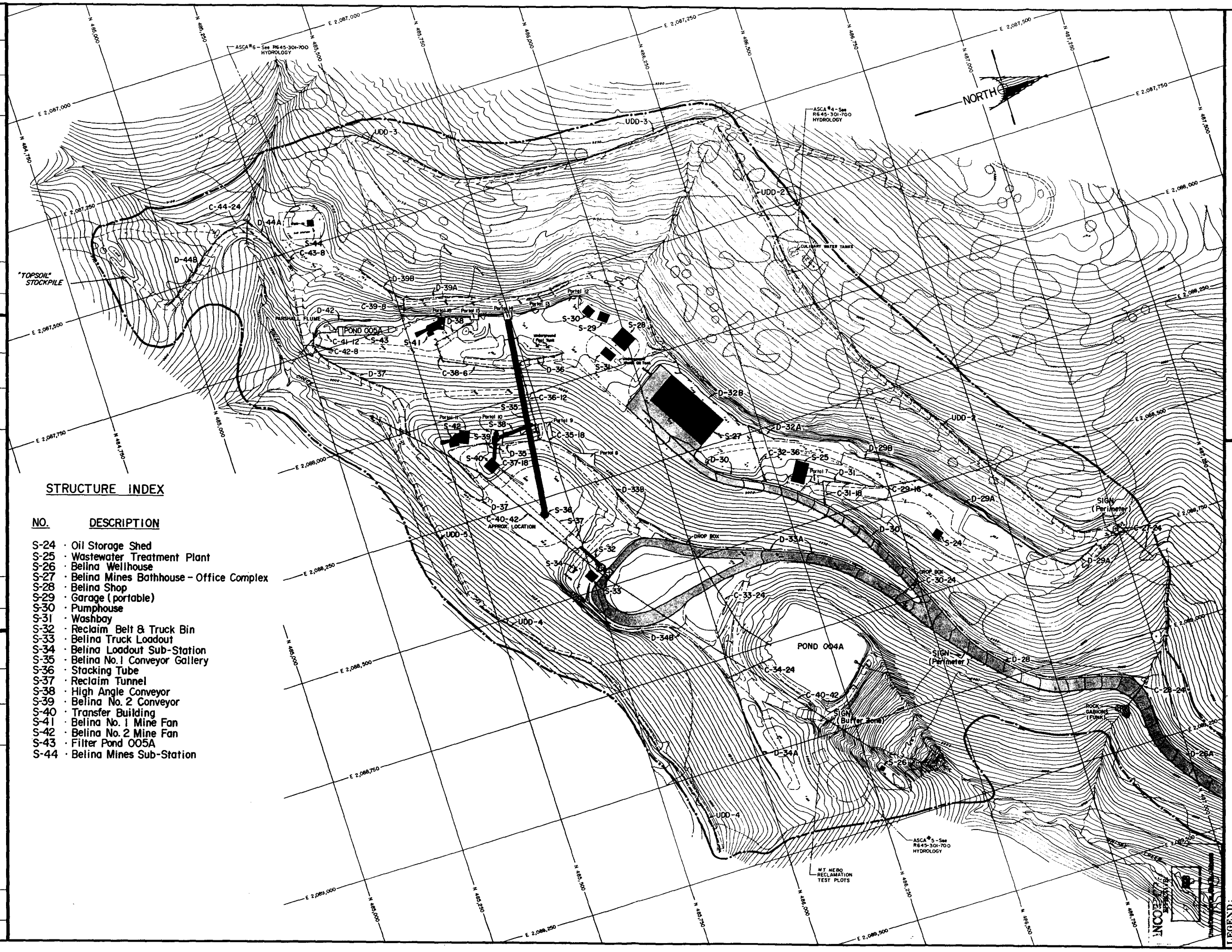
SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE:
R645-301-521.124
BELINA HAUL ROAD-UPPER SECTION DISTURBANCE

Drawn by: Ed Sanderson	Date: Sept. 1990
Approval:	Date:
Drawing No. R645-301-521.124.	Rev. 1 3/93

SAND DESIGN & GRAPHICS | "AS BUILT" | SCALE: 1" = 100' | SHEET 3 of 4

ET8-5-89


NORTH
"TOPSOIL" STOCKPILE
POND 005A
POND 004A
MARSHALL FLUME
DROP BOX
CULINARY WATER TANKS
SIGN (Perimeter)
SIGN (Buffer Zone)
ROCK GABIONS (FUNK)
MT HEBO RECLAMATION TEST PLOTS
ASCA #6 - See R645-301-700 HYDROLOGY
ASCA #5 - See R645-301-700 HYDROLOGY
C-40-42 APPROX. LOCATION
UDD-1
UDD-2
UDD-3
UDD-4
UDD-5
D-44A
D-44B
C-44-24
S-44
C-43-8
D-39B
D-39A
C-39-8
D-42
C-41-12
S-43
C-42-8
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C-38-6
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C-35-18
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C-40-42
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D-26A
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Portal 6
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Portal 13
Portal 14
Portal 15
Underground Pump Room
Underground Oil Tank
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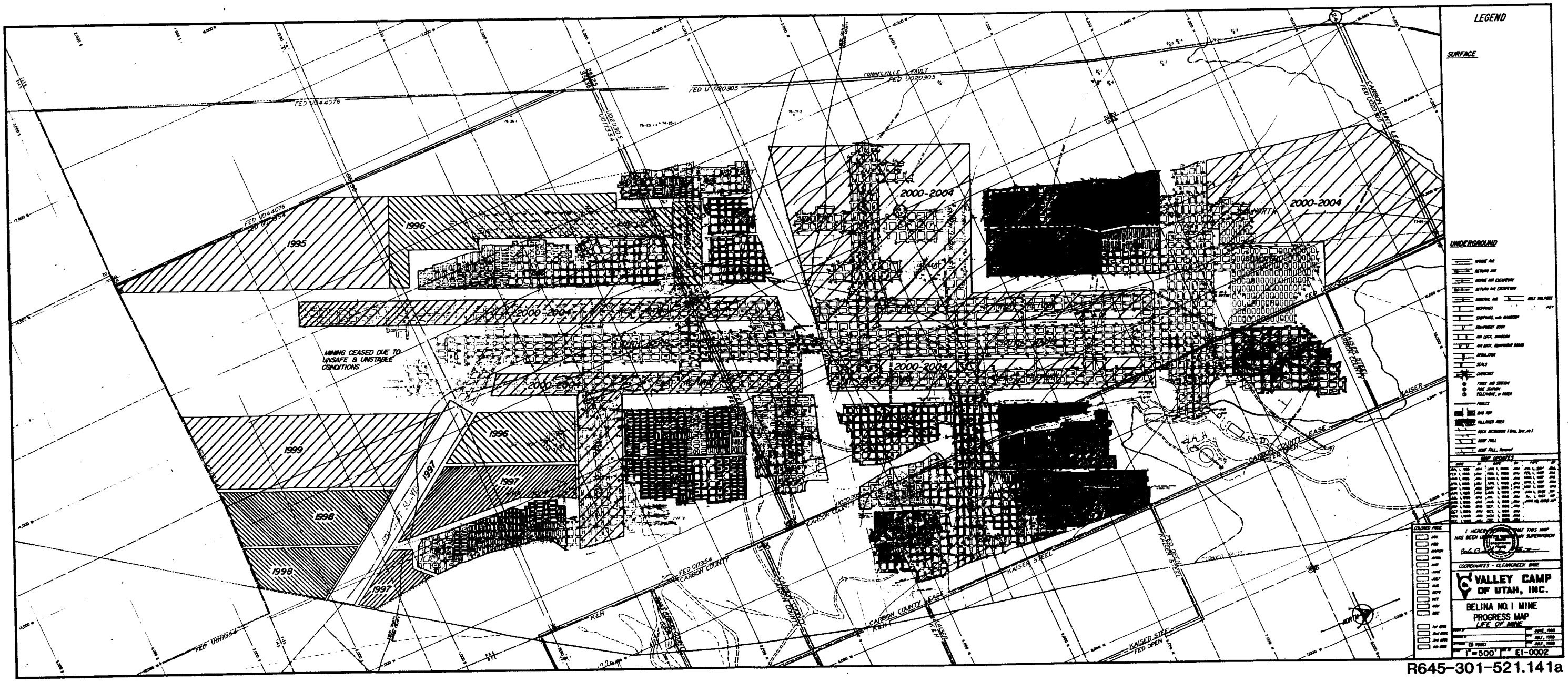

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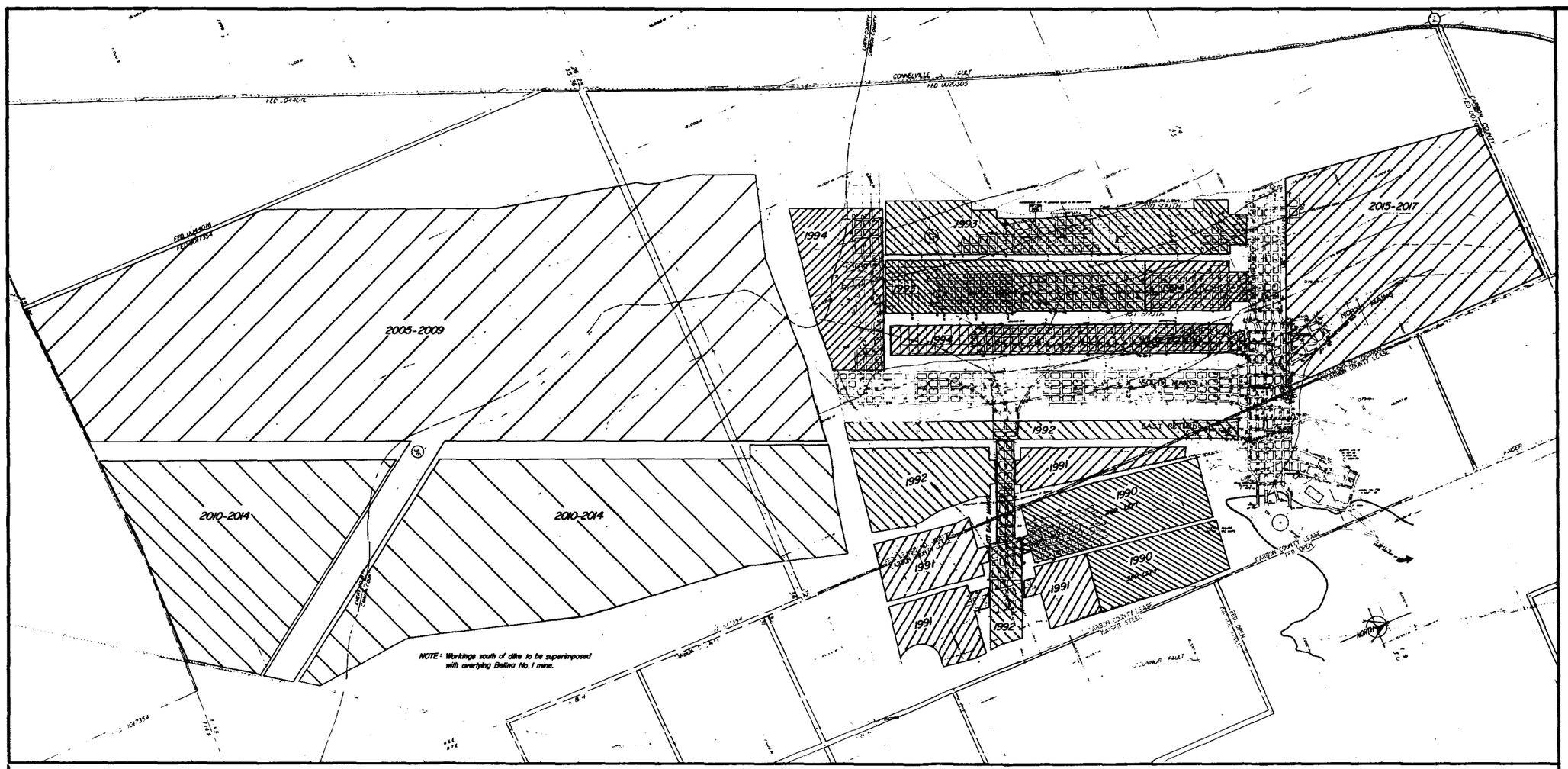


LEGEND

SURFACE:

- SECTION LINE
- 1/4 SECTION LINE
- 1/16 SECTION LINE
- SECTION CORNER
- DRILL HOLE
- DRILL HOLE, dry hole
- SURFACE ELEVATION
- STREAM
- SPRING
- ROAD, Improved
- ROAD, Unimproved
- POWERLINE
- SURFACE FACILITIES
- TRIANGULATION STATIONS
- GAS LINE
- FEDERAL COAL LEASE
- CARBON COUNTY COAL LEASE
- FEDERAL OPER
- KAISER STEEL COAL

I HEREBY CERTIFY THAT THIS MAP WAS BEEN UPDATED UNDER MY SUPERVISION

UNDERGROUND:

- BRIDGE AIR
- RETURN AIR
- BRIDGE ESCAPE
- RETURN ESCAPE
- NEUTRAL AIR
- STOPPINGS
- MANDOOR
- FRAMP DOOR
- AIR LOCK
- REGULATOR
- SEAL
- OVERCAST
- SURVEY STA
- PROGRESS DATE
- FIRE STATION
- TELEPHONE
- FAMP AND STA.
- BAD TOP
- PILLARED AREA
- ROCK INFRASION
- ROOF FALL
- ROOF FALL, Re-mined
- STEEL SETS
- FAULT, verified
- FAULT, unverified
- OUTCROP, verified
- OUTCROP, unverified

MAP UPDATES

MAR 1, 1990	JP	AUG 1, 1990	JP	SEP 1, 1990	JP
DEC 1, 1990	JP	JAN 1, 1991	JP	FEB 1, 1991	JP
MAR 1, 1991	JP	APR 1, 1991	JP	MAY 1, 1991	JP
JUN 1, 1991	JP	JUL 1, 1991	JP	AUG 1, 1991	JP
SEP 1, 1991	JP	OCT 1, 1991	JP	NOV 1, 1991	JP
DEC 1, 1991	JP	JAN 1, 1992	JP	FEB 1, 1992	JP

VALLEY CAMP OF UTAH, Inc.
SCOFIELD DIVIS
HELPER, UTAH 84526

BELINA NO.2 MINE
PROGRESS MAP
LIFE OF MINE

DATE: 1/1/2000 SCALE: 1" = 1000'
DRAWN BY: [illegible]
CHECKED BY: [illegible]
DRAWING NO. 02-0060

R645-301-521.141b

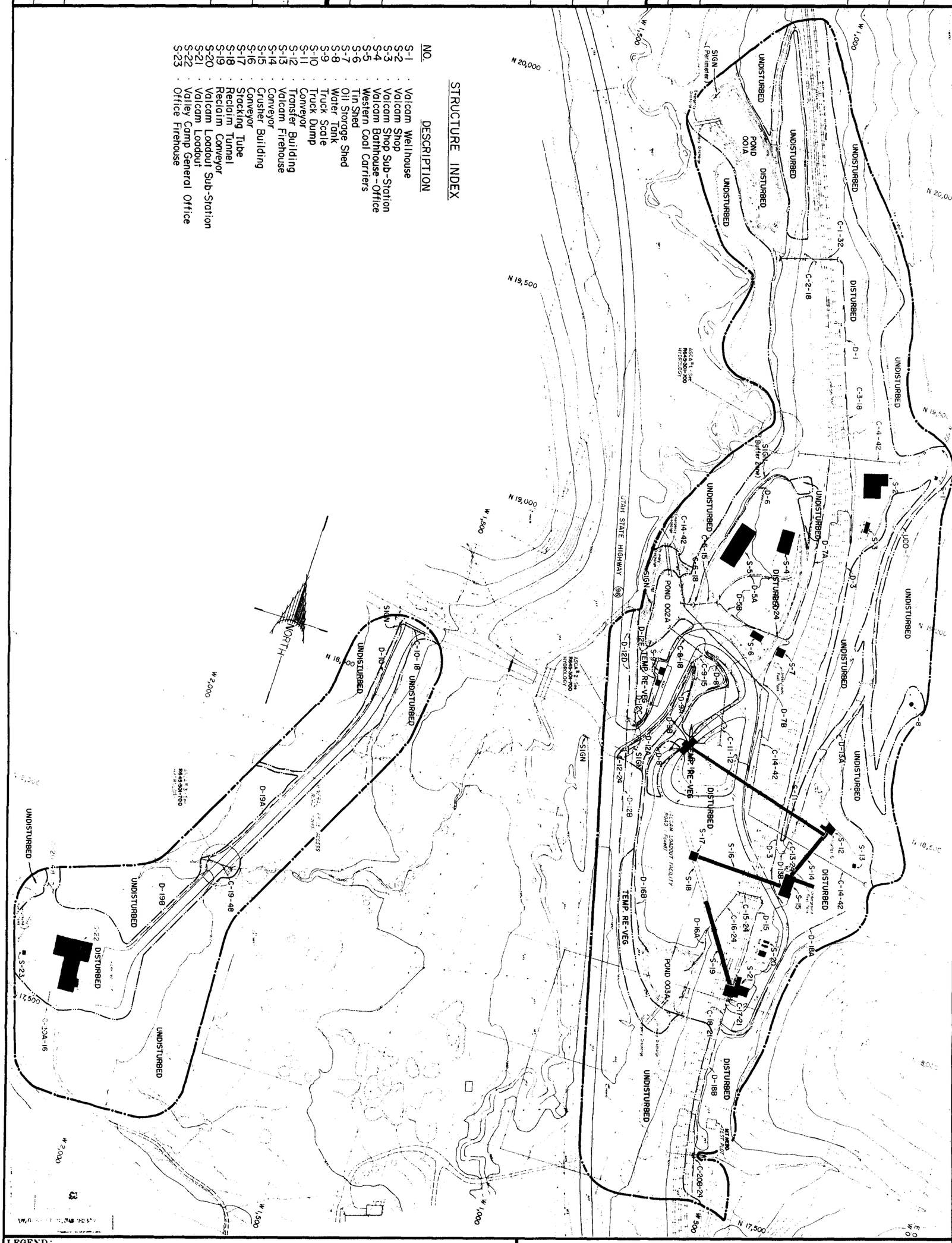
VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS
1	7/29/92	TITLE CHANGE			

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS

STRUCTURE INDEX

NO.	DESCRIPTION
S-1	Valcam Wellhouse
S-2	Valcam Shop
S-3	Valcam Shop Sub-Station
S-4	Valcam Bathhouse-Office
S-5	Western Coal Carriers
S-6	Tin Shed
S-7	Oil Storage Shed
S-8	Water Tank
S-9	Truck Scale
S-10	Truck Dump
S-11	Conveyor
S-12	Transfer Building
S-13	Valcam Firehouse
S-14	Conveyor
S-15	Crusher Building
S-16	Conveyor
S-17	Stacking Tube
S-18	Reclaim Tunnel
S-19	Reclaim Conveyor
S-20	Valcam Loadout Sub-Station
S-21	Valcam Loadout
S-22	Valley Camp General Office
S-23	Office Firehouse



LEGEND:

- DISTURBED AREA BOUNDARY
- SEGMENT LINES
- GAME TRAIL

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REGISTERED PROFESSIONAL ENGINEER
No. 5323
EDWIN BROOKSHIRE FOUST
Mar 93
STATE OF UTAH

VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE:
R645-301-521.150.
VALCAM LOADOUT
SURFACE FACILITIES

Drawn by: Ed Sanderson	Date: 6/10/90
Approval:	Date:
Drawing No. R645-301-521.150	Rev. 1 3/93

SAND DESIGN & GRAPHICS | "AS BUILT" | SCALE: 1" = 100' | SHEET 1 of 4

ETS-5-89

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM			VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM			VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS	NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS	NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS
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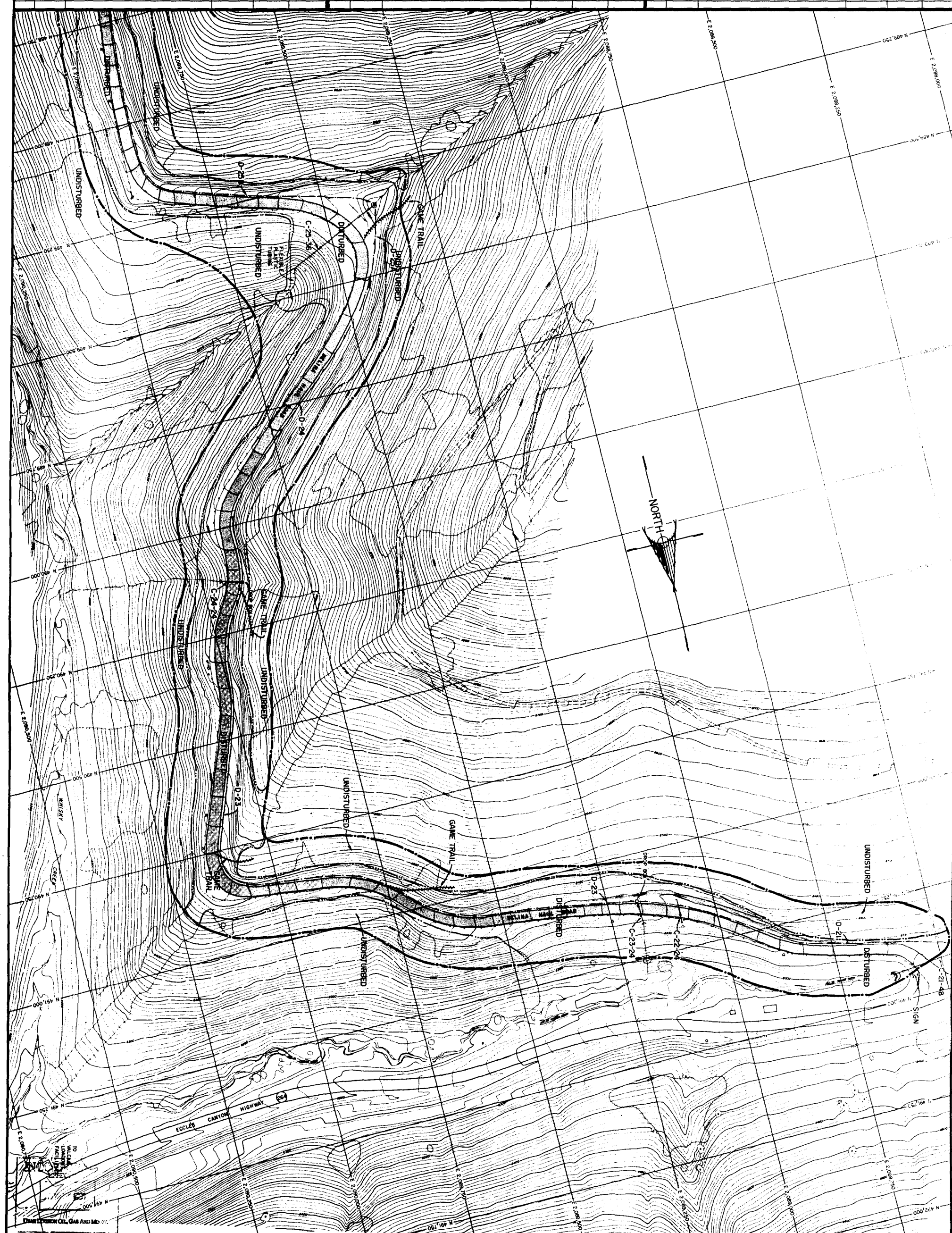

LEGEND:

Note: See Sheet 1

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No. 5323
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Mar 93
STATE OF UTAH

VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE:
R645-301-521.150.
BELINA HAUL ROAD-LOWER SECTION SURFACE FACILITIES

Drawn by: Ed Sanderson	Date: 6/10/90
Approval:	Date:
Drawing No. R645-301-521.150.	Rev. 1 3/93

SAND DESIGN & GRAPHICS | "AS BUILT" | SCALE: 1" = 100' | SHEET 2 of 4

ETS-5-HO

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS
1	1/27/93	TITLE CHANGE			

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NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS

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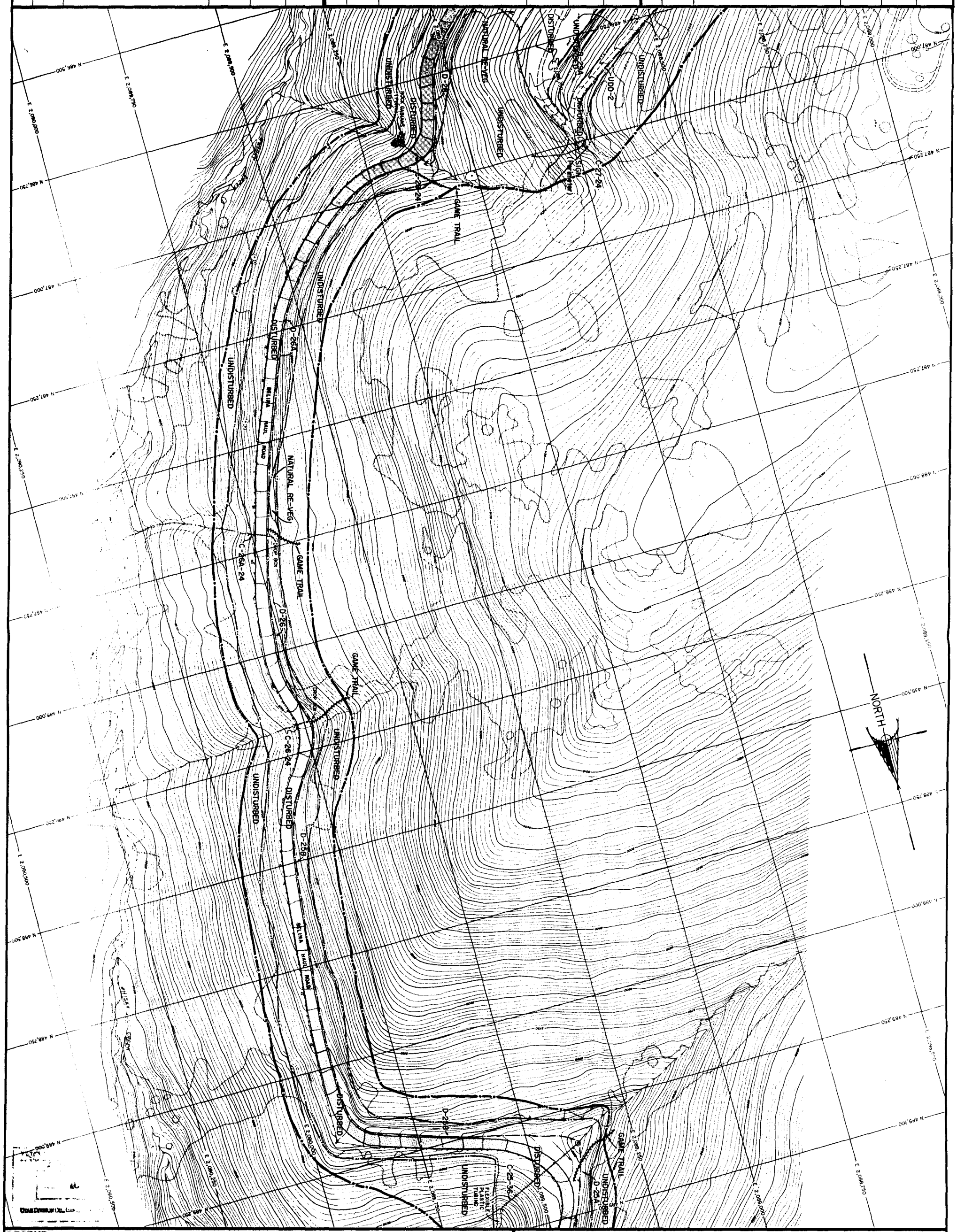
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS



LEGEND:

Note: See Sheet 1

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AUG 05 1993

DIVISION OF OIL GAS & MINING

REGISTERED PROFESSIONAL ENGINEER No. 5323 EDWIN BROOKSHIRE FOUST Mar 93 STATE OF UTAH

Edwin Foust

VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE:

R645-301-521.150.
BELINA HAUL ROAD–UPPER SECTION SURFACE FACILITIES

Drawn by: Ed Sanderson	Date: 6/10/90
Approval:	Date:
Drawing No. R645-301-521.150.	Rev. 1 3/93

SAND DESIGN & GRAPHICS | "AS BUILT" | SCALE: 1" = 100' | SHEET 3 of 4

ETS-5-89

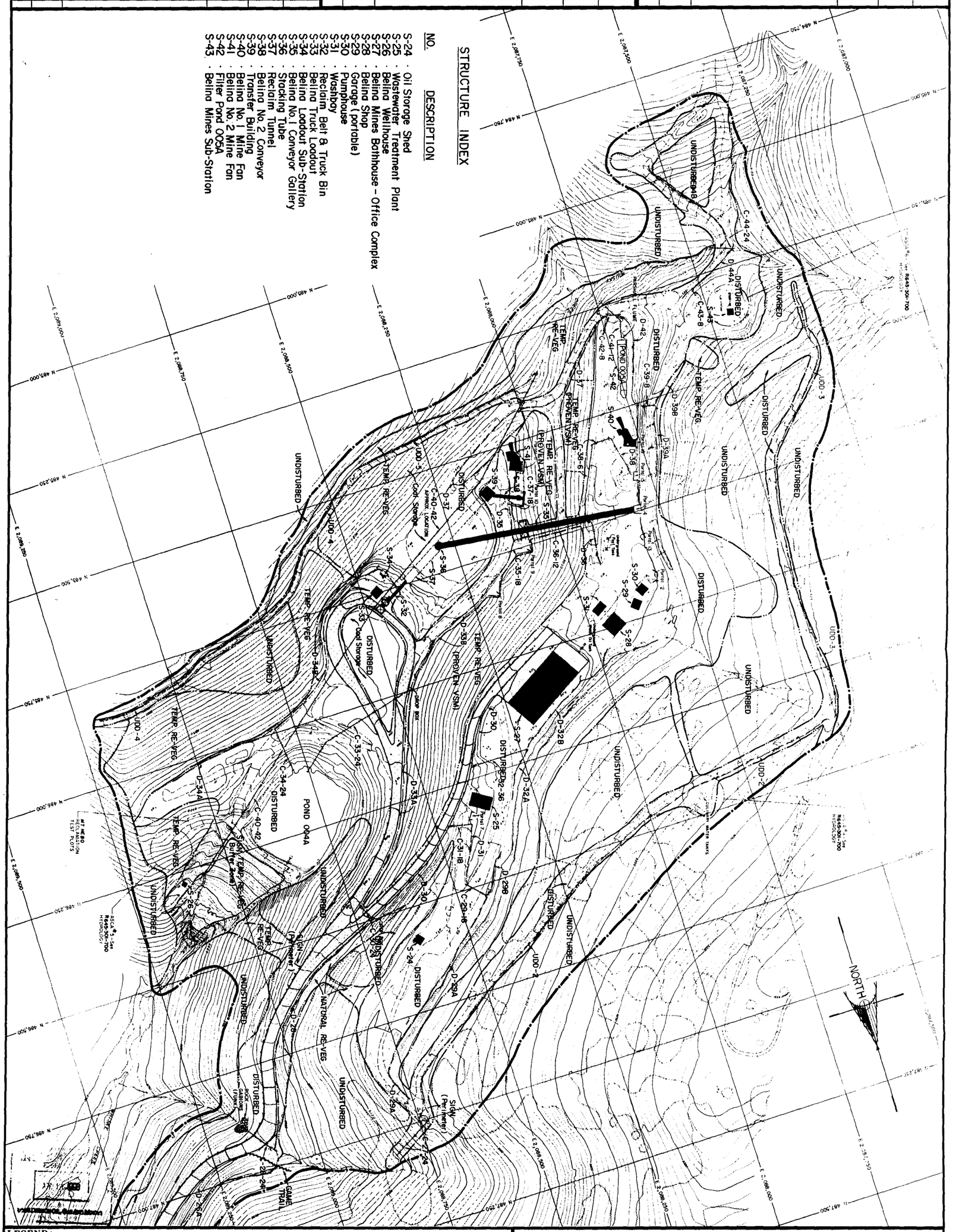
VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS
1	7/29/93	TITLE CHANGE			

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS

VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS

STRUCTURE INDEX

NO.	DESCRIPTION
S-24	Oil Storage Shed
S-25	Wastewater Treatment Plant
S-26	Belina Wellhouse
S-27	Belina Mines Bathhouse - Office Complex
S-28	Belina Shop
S-29	Garage (portable)
S-30	Pumphouse
S-31	Washbay
S-32	Reclaim Belt & Truck Bin
S-33	Belina Truck Loadout
S-34	Belina Loadout Sub-Station
S-35	Belina No.1 Conveyor Gallery
S-36	Stacking Tube
S-37	Reclaim Tunnel
S-38	Belina No. 2 Conveyor
S-39	Transfer Building
S-40	Belina No. 1 Mine Fan
S-41	Belina No. 2 Mine Fan
S-42	Filter Pond 005A
S-43	Belina Mines Sub-Station



LEGEND:

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REGISTERED PROFESSIONAL ENGINEER
No. 5323
EDWIN BROOKSHIRE FOUST
Mar 93
STATE OF UTAH

VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE:
R645-301-521.150.
BELINA MINE SITE
SURFACE FACILITIES

Drawn by: Ed Sanderson	Date: 6/10/90
Approval:	Date:
Drawing No. R645-301-521.150.	Rev: 1 3/93

SAND DESIGN & GRAPHICS | "AS BUILT" | SCALE: 1" = 100' | SHEET 4 of 4

ETS-5-HB

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620.	ENVIRONMENTAL DESCRIPTION	600-19 of 20
630.	OPERATION PLAN	600-20 of 20
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622.400a	LOCAL GAS WELL DATA	600-7 of 20
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622.200k.	Geologic/Hydrologic Cross Section N-N'	600-5 of 20
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621a.	General Geologic Map	600-2 of 20
622.100a.	Drill Hole and Gas Well Locations with Coal Seam Data	600-2 of 20
622.200a.	Geologic Cross Sections, Coal Outcrop & Forest Service Subsidence Monitoring Location Map	600-5 of 20
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622.200c.	Isopach Map from the Botton of the Upper O'Connor to the top fo the Lower O'Connor	600-5 of 20
622.200d.	Isopach Map of the Lower O'Connor Coal Seam	600-5 of 20
622.200e.	Isopach Map from the top of the Upper O'Connor Coal Seam to the Surface	600-5 of 20

R645-301-600. GEOLOGY.

610. INTRODUCTION.

A description of the geology and other related information is presented below for the Mine Permit Area.

611. thru 612. GENERAL REQUIREMENTS.

A description of the geology within and adjacent to the Mine Permit Area is presented within Sections 621 through 627 and the proposed operation within the mine area is presented in Section 630. All maps, plans and cross sections required by 622 have been certified and are presented in their appropriate section.

620. ENVIRONMENTAL DESCRIPTION.

The Mine Permit Area is located on the northern end of the Wasatch Plateau to the south and southwest of the town of Scofield in central Utah. The Geology Map 621a shows the location of the Mine Permit Area with respect to the town of Scofield. The Mine Permit Area lies in a rugged mountainous region characteristic of elevation ranges between approximately 7,800 feet and 10,200 feet above sea level. The Mine Permit Area is within the Wasatch Plateau coal field as well as partially within the Clear Creek gas field.

621. ENVIRONMENTAL REQUIREMENTS.

The Mine Permit Area lies in the northern end of the Wasatch Plateau, on the west flank of the Clear Creek Anticline (Doelling, 1972). As such, the dip of the strata is generally towards the west, ranging from about four to eight percent (two to five degrees).

With the exception of local alluvial deposits, all of the units exposed on and immediately adjacent to the Mine Permit Area are Cretaceous members of the Mesaverde Group. The Star Point Sandstone, which is exposed at the surface in the east canyons, is approximately 1000 feet thick and nearly devoid of shale (Doelling, 1972). This yellow-gray (salt and pepper) beach sandstone is massive and medium-grained (Spieker, 1931).

Immediately overlying the Star Point Sandstone is the Blackhawk Formation, an interbedded formation of sandstones and shales which is Utah's chief coal producer. The sands in this 1500-foot thick member are fine to medium grained and cemented by either calcite or silica with some iron discoloration. Sandstones of the Blackhawk Formation are more irregular than the sandstones of the Star Point. They also tend to be generally discontinuous in nature, local in extent, and have locally high clay contents (Spieker, 1931; Doelling, 1972). An exception to this is the Aberdeen Sandstone, a coarse-grained, light-colored sand with a thickness of 20 to 90 feet, which can be traced throughout the region (Spieker, 1931).

Spieker (1931) had identified three types of shale in the Blackhawk Formation, all continental in origin. The three types identified are, a common clay shale which is soft and granular, a carbonaceous shale, and a smoke-gray shale usually associated with local coal. As was the case with the sandstones, the shales are irregularly bedded (Spieker, 1931).

Most of the faults in the Mine Permit Area have a northerly trend. The faults within the Blackhawk Formation occur basically as zones (Doelling, 1972) with individual slips usually being clean, sharp displacements with little gouge. Both major fault zones in the Mine Permit Area are downdropped to the west and tend to die out to the north (U.S. Geological Survey, 1979). However, some smaller faults have the opposite displacement and create local horsts and grabens. The Connelville Fault forms the western boundary of the Belina Permit Area with a drop which varies from 190 feet at the western central permit boundary to 75 feet near Eccles Canyon (U.S. Geological Survey, 1979). The other major fault in the area, the O'Connor Fault, extends through the center of the Belina Permit Area and has a drop of about 350 feet (U.S. Geological Survey, 1979). The Pleasant Valley Fault generally runs parallel to Mud Creek and lies toward the western boundary of the Valcam Loadout Facility. General Geologic Map 621a is inserted to illustrate local geology.

MAP 621a. General Geologic Map

The dominant soils in the area are loamy and are moderately deep (20 to 40 inches) with thin, dark surface horizons (high in organic matter), medium-textured (loamy) surface layers, and moderately fine-textured (clay loam) subsoils. Coarse fragment contents tend to be high (35 to 50 percent). A small portion of the area also consists of gravelly and stony colluvial slopes, rock outcrops, and very shallow soils.

622. CROSS SECTIONS, MAPS AND PLANS.

The maps, plans and cross sections needed to clarify the geologic data required are presented within the appropriate section and were compiled utilizing the best information available. A summary of geologic mapping included within the permit is shown in Table 622a.

622.100. TEST BORINGS AND CORE SAMPLINGS.

The locations and elevations of all drill holes in the Mine Permit Area are shown on Map 622.100a and summarized in Table 622.100a. Drill hole logs are available for those holes identified by a "*" in the table. Selected drill hole log information has been provided as part of this MRP according to the request made by UDOGM during a meeting held on October 24, 1989. Logs selected for inclusion (as requested by UDOGM and agreed by the applicant) in this mine permit include 73-24-1, 74-6-1, 75-6-1, 75-24-4, 75-25-3, 75-30-3, and 75-36-1. Copies of these well logs are identified in the 1993 Appendix 622.100 (marked confidential). The applicant considers all information related to these well logs to be confidential, and therefore has submitted this appendix separately from the remaining appendices of the mine permit.

MAP 622.100a. Drill Hole and Gas Well Locations with Coal Seam Data

TABLE 622a
LIST OF GEOLOGIC MAPS

MAP or FIGURE	COMMENTS
621a	General Geologic Map.
622.100a	Map showing location and elevation of drill holes and Coal Seam thickness and depth, and Gas Well Locations.
622.200a	Geologic Cross Sections, Coal Outcrop and Forest Service Subsidence Monitoring Location Map.
622.200b	Isopach Map of the Upper O'Connor Coal Seam.
622.200c	Isopach Map from the bottom of the Upper O'Connor to the top of the Lower O'Connor.
622.200d	Isopach Map of the Lower O'Connor Coal Seam.
622.200e	Isopach Map from the top of the Upper O'Connor Coal Seam to the surface.
622.200f	Stratigraphic Geologic cross section A-A'
622.200g	Stratigraphic Geologic cross section B-B'
622.200h	Stratigraphic Geologic cross section C-C'
622.200i	Stratigraphic Geologic cross section D-D'
622.200j	Geologic/Hydrologic cross section M-M'
622.200k	Geologic/Hydrologic cross section N-N'
622.200l	Geologic/Hydrologic cross section O-O'
622.200m	Geologic/Hydrologic cross section P-P'

TABLE 622.100a
LIST OF EXPLORATION DRILL HOLES

DRILL HOLE NO.	LOCATION (SLB&M)	ELEVATION
EC-1	T13S,R6E SWNW Sec. 25	9076
EC-2	T13S,R6E NESW Sec. 24	8790
EC-3	T13S,R6E SENW Sec. 24	8763
EC-4	T13S,R6E NESW Sec. 24	8854
EC-5	T13S,R6E NESW Sec. 24	8857
EC-6	T13S,R6E SESW Sec. 24	8862.4

DRILL HOLE NO.	LOCATION (SLB&M)	ELEVATION
EC-7	T13S,R6E SESW Sec. 24	8904
73-19-1	T13S,R7E SWSW Sec. 19	9367.7
73-24-1**	T13S,R6E NENE Sec. 24	9255
73-30-1	T13S,R7E NWSW Sec. 30	9476
73-31-1	T13S,R7E SWNW Sec. 31	9276
73-31-4	T13S,R7E SWSW Sec. 30	9195
74-1-1	T14S,R6E NENE Sec. 1	9824
74-1-2	T14S,R6E NENE Sec. 1	9810†
74-1-3*	T14S,R6E NESE Sec. 1	8989
74-6-1**	T14S,R7E SWSW Sec. 6	9710
74-25-1	T13S,R6E SWSW Sec. 25	9561
74-36-1	T13S,R6E SWSW Sec. 36	9873
74-36-2*	T13S,R6E SENW Sec. 36	9676
75-6-1**	T14S,R7E NENW Sec. 6	9918.6
75-7-1	T14S,R7E SWSW Sec. 7	9770
75-7-2*	T14S,R7E SWSW Sec. 7	9823
75-24-4**	T13S,R6E SESE Sec. 24	9432.7
75-25-2*	T13S,R6E NENE Sec. 25	9379.4
75-25-3**	T13S,R6E SWSE Sec. 25	9897
75-30-1	T13S,R7E NWNW Sec. 30	9240
75-30-2	T13S,R7E NWNW Sec. 30	9214
75-30-3**	T13S,R7E NWNW Sec. 30	9179
75-31-1	T13S,R7E SWNW Sec. 31	9423.1
75-31-2	T13S,R6E SENE Sec. 36	9195
75-31-5	T13S,R7E SWSW Sec. 31	9730
75-36-1**	T13S,R6E SWSW Sec. 36	9872.3
75-36-2*	T13S,R6E NESW Sec. 36	9939.5
75-36-3	T13S,R6E SESE Sec. 36	9896.2

DRILL HOLE NO.	LOCATION (SLB&M)	ELEVATION
76-24-1*	T13S,R6E SESW Sec. 24	8862.4
76-25-1*	T13S,R6E SWSW Sec. 25	9561
76-25-2	T13S,R6E NESW Sec. 25	9506
76-36-1	T13S,R6E NWNW Sec. 36	9582

* Drill holes for which log information is available.
** Drill holes for which log information is provided in 1993 Appendix 622.100 (marked confidential).
\+ Approximate Elevation.

622.200. NATURE, DEPTH AND THICKNESS OF STRATUM.

Information relating to the size, shape, thickness, depth and other information relating to the coal seams is contained on Maps and Figures 622.100a, and 622.200a through 622.200m. Additional information is presented through geologic logs to be discussed in Section 624.310. Section 624.100 contains a detailed stratigraphic description of a representative geologic section.

MAP 622.200a. Geologic Cross Sections, Coal Outcrop & Forest Service Subsidence Monitoring Location Map
MAP 622.200b. Isopach Map of the Upper O'Connor Coal Seam
MAP 622.200c. Isopach Map from the Botton of the Upper O'Connor to the top fo the Lower O'Connor
MAP 622.200d. Isopach Map of the Lower O'Connor Coal Seam
MAP 622.200e. Isopach Map from the top of the Upper O'Connor Coal Seam to the Surface
FIGURE 622.200f. Stratigraphic Geologic Cross Section A-A'
FIGURE 622.200g. Stratigraphic Geologic Cross Section B-B'
FIGURE 622.200h. Stratigraphic Geologic Cross Section C-C'
FIGURE 622.200i. Stratigraphic Geologic Cross Section D-D'
FIGURE 622.200j. Geologic/Hydrologic Cross Section M-M'
FIGURE 622.200k. Geologic/Hydrologic Cross Section N-N'
FIGURE 622.200l. Geologic/Hydrologic Cross Section O-O'
FIGURE 622.200m. Geologic/Hydrologic Cross Section P-P'

622.300. COAL STRIKE, DIP AND CROP LINES.

The outcrop zone of the coal is depicted on Geologic Cross Section Map 622.200a and is based on the best information available. The strike and dip differs in different parts of the Mine Permit Area. However, the typical dip within the mine is 2.1 degrees in approximately a 225 degree direction. Additional information can be found by reviewing the coal contours shown on the Belina No. 1 and No. 2 Mine Progress Maps as well as through a review of the geologic cross sections presented in section 622.200.

622.400. GAS AND OIL WELLS.

There are four gas wells, part of the Clear Creek gas field located within the Mine Permit Area. These four wells are all operated by Cordillera Corp. and only the most northern well, in Section 19, is currently producing. The other three are shut in at the present time. Well locations and depths are shown on Map 622.100a and summarized in Table 622.400a.

TABLE 622.400a
LOCAL GAS WELL DATA

LOCATION (SLBM)	DEPTH (ft)	STATUS	COMMENT
T13S, R7E, Sec. 19 NENW	4390	producing	producing from the Ferron
T13S, R7E, Sec. 30 SWSW	5820	shut-in	gas from the Ferron
T13S, R7E, Sec. 31 SWSW	9225	shut-in	gas from the Ferron
T14S, R7E, Sec. 6 SWSW	6222	shut-in	gas from the Ferron

623. ADDITIONAL GEOLOGIC INFORMATION.

The general geology of the Mine Permit Area is summarized in 621 and a more detailed stratigraphic description is given in 624.100. Additional information requested by this section is given within the applicable section to follow.

623.100. POTENTIALLY ACID OR TOXIC FORMING STRATA.

The rocks contained in the Blackhawk Formation, within which all units involved in the mining activity are a part, are made up of interbedded sandstone, sandy shale, shale and coal. Data available at this time do not suggest that there are any chemical problems with any of these rock types which would be potentially acid or toxic forming.

There have been no data assembled for the rock units above, between and below the coal seams at the Belina Mines. However, there has been limited soil sampling work completed in the Belina Mine Area, as well as more extensive sampling and testing within the adjacent Coastal States Energy Mines (located to the west of the Belina Mines on the west side of the Connelville fault). The sample results from the Belina Mines give a good indication of the general chemical makeup of the strata as far as the analysis was done. The soil material which was sampled and analyzed was generated during the facing-up of the coal seams in preparation for mining. This material, therefore, is made up of the strata above, below, and between the coal seams so the soil samples discussed herein should be representative of these strata. A selected summary of data collected is presented in Table 623.100a, and sampling locations and original data sheets are included as 1993 Appendix 623.100a. A letter dated September 16, 1986 from James S. Leatherwood (a reclamation soils specialist) indicating the suitability of the Belina pad materials

as a topsoil substitute can be found in 1993 Appendix 221. In his letter, Mr. Leatherwood also indicated that material located at the Valcam Loadout Facility would also serve as a topsoil substitute (Vegetation-Supporting Material) if needed.

1993 Appendix 623.100a contains the results of analysis of two sets of samples. The first set of samples was taken from bore holes BP-1 and BP-2 and were analyzed by MIDECO in early 1983. These results show unusually high concentrations of boron and copper. The second set was taken from test holes No.1, No.2, and No.5. These samples were analyzed by Ford Chemical Laboratory in late 1983 and show normal low concentrations of boron and copper. The reason for the abnormally high concentrations reported for the first set of samples is not known and can probably not be determined because MIDECO is no longer in business.

Information gleaned from the Coastal States Energy Permit Application (applicable to the area west of Valley Camp of Utah's operation) indicates that 1) the lithology of the strata immediately below the minable coals vary from drill hole to drill hole, 2) that the clay content varies from nearly 100% in pure claystones to less than 5% in sandstones, and 3) a slight alkalinity and low sulfur content exists in the roof strata. For more information the reader is referred to the Coastal States Energy Permit Application on file with the regulatory agency.

The soil sample work discussed above indicates that the molybdenum levels are below 0.185 ppm, selenium levels are below 0.025 ppm, acid-base potentials range from 10.3 to 55.5, and that pH of the soil samples range from 7.2 to 8.8 with one exception where the pH reached a low of 5.5. Additional information can be gleaned from the data presented in 1993 Appendix 623.100a.

Normal mining operations at Valley Camp result in coal being left on the roof and the floor of mine openings because the equipment used cannot extract the full thickness of the coal seam. As a result the rocks above and below the coal seam are not extracted and brought to the surface. This eliminates the possibility of contamination at the surface by this material. Since these strata remain in-place within the mine there is no more than the normal natural effect on the environment by these strata so the geochemical characteristics of the strata are irrelevant to the protection of the environment at the mine site. Also since the roof and floor rocks are not exposed during mining, Valley Camp has not generally been in a position to obtain current or on-going samples of these strata.

In order to better document the acid and or toxic forming potential of coal at the Belina Mines, the applicant agrees to collect a sample of coal which is shipped from the Valcam Loadout Facility biannually and have it analyzed for acid-toxic forming potential. A copy of the results of these analyses will be forwarded along with a cover letter to UDOGM within 30 days of receipt by the applicant. During October, 1992, a composite sample of coal was taken and analyzed, the results of which are reported in 1993 Appendix 623.100b. According to Division Guidelines (Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining, April, 1988) the coal is classified as "Good". Results from future sampling which are forwarded to UDOGM are to be inserted by the agency into 1993 Appendix 623.100b. Should it be determined that acid-toxic forming materials exist, the applicant agrees to investigate further the location of the material, and to comply with the appropriate State and Federal requirements.

TABLE 623.100a
GEOCHEMICAL RESULTS FROM SOIL SAMPLES (ppm)

Sample Loc.	Depth Interval (feet)	B	Ca	Cu	Fe	Mg	Mn	P	K	Na	Zn
TH-1	0-2	0.06	4500	0.25	66.5	15.81	14.5	20.6	114.0	0.42	1.7
	2-4	0.12	3450	0.10	68.3	15.33	12.6	31.4	95.0	0.51	2.4
	4-6	0.09	3870	0.30	59.2	14.26	10.5	4.5	81.0	0.72	1.9
	6-8	0.01	3600	0.05	77.5	17.26	6.7	16.2	110.0	0.85	2.3
TH-2	0-2	0.06	2700	0.20	51.5	21.4	4.9	16.5	110.0	0.30	1.0
	2-4	0.01	3870	0.27	45.6	15.7	8.6	26.4	86.0	0.51	1.9
	4-8	0.11	4390	0.30	44.9	17.3	9.3	25.4	79.0	0.54	2.0
	0-2.5	0.26	4600	0.02	56.5	14.8	9.2	12.9	112.0	0.69	1.8
	2.5-5	0.17	4200	0.09	54.2	14.4	6.8	15.6	95.0	0.52	2.0
	5-7.5	0.24	3770	0.10	63.5	13.8	4.9	8.7	86.0	0.65	1.8
	7.5-10	0.17	3920	0.15	74.1	13.6	8.3	16.2	69.0	0.78	7.1
	10-12.5	0.12	3700	0.28	58.9	13.1	9.5	11.4	72.0	0.43	7.5
	12.5-15	0.10	3490	0.03	66.9	10.5	11.6	10.5	105.0	0.47	2.2
	15-17.5	0.26	2960	0.05	71.4	13.6	9.5	14.5	120.0	0.38	1.3
	17.5-20	0.41	4130	0.10	75.2	15.2	8.5	21.6	119.0	0.50	1.5
	20-22.5	0.17	3590	0.24	61.5	13.7	6.8	15.5	88.0	0.52	1.2
	22.5-25	0.14	3150	0.25	59.5	14.4	8.5	11.5	79.0	0.65	2.1
	25-27.5	0.07	4025	0.42	45.5	14.5	11.2	30.7	96.0	0.45	1.7
	27.5-30	0.10	3960	0.46	43.8	15.2	10.9	29.2	91.0	0.50	1.8
BP-1	0-5	27	11500	18.0	-	-	-	-	-	250	-
	5-6.6	23	5600	16.0	-	-	-	-	-	360	-
	6.6-10	41	37300	16.0	-	-	-	-	-	150	-
	10-15	34	21700	8.0	-	-	-	-	-	100	-
	15-20	24	8900	6.0	-	-	-	-	-	90	-
	25-26	20	700	10.0	-	-	-	-	-	90	-
	16-27	43	1800	20.0	-	-	-	-	-	110	-

Sample Loc	Depth Interval (feet)	B	Ca	Cu	Fe	Mg	Mn	P	K	Na	Zn
	27-28	18	1000	14.0	-	-	-	-	-	35	-
	28-29	24	4400	21.0	-	-	-	-	-	110	-
	29-30	18	1900	22.0	-	-	-	-	-	140	-
	40-41.5	39	33700	12.0	-	-	-	-	-	120	-
BP-2	0-3	20	1500	14.0	-	-	-	-	-	30	-
	5-8	21	1300	14.0	-	-	-	-	-	60	-
	8-13	16	500	17.0	-	-	-	-	-	86	-
	13-18	15	700	7.0	-	-	-	-	-	37	-
	18-23	30	800	6.0	-	-	-	-	-	110	-
UT-1	10	0.8	5	0.5	15.1	1.7	9.4	17.4	123.0	1.2	1.1
UT-2	8	0.9	8	0.4	16.6	2.4	13.3	13.7	69.0	1.3	1.1
UT-3	6	0.8	2	0.8	59.3	0.4	7.5	8.7	68.0	0.9	0.7

* TH - i identifies test holes located at the Belina Mine.
BP - i identifies locations of roof and floor bore holes at the Belina Mine.
Ut - i identifies sampling sites located at the Valcam Loadout Facility

623.200. RECLAMATION.

Geologic information is presented within the permit application in sufficient detail to comply with the reclamation activities proposed herein as part of the permit.

623.300. SUBSIDENCE.

The Subsidence Control Plan under the Underground Coal Mine and Reclamation activities is presented in 1993 Appendix 724.600.

624. GEOLOGIC INFORMATION.

A discussion of the general geology of the Mine Permit Area is presented in 621. The geologic information provided in the following sections gives detailed stratigraphic descriptions and relates the geology to the movement of ground water. Information contained within this geologic section of the MRP is based upon general geologic expertise and reports prepared for the applicant by engineering and geologic consultants. Literature used in the preparation of this permit are included in the reference section of the permit.

624.100. GEOLOGIC DESCRIPTION.

All of the stratigraphic units exposed in the Mine Permit Area are part of the Mesaverde Group. The lowest geological unit in the Mine Permit Area is the Star Point Sandstone which is overlain by the Blackhawk Formation. It is within the Blackhawk Formation that local coal seams are found. A general geologic cross section showing the information discussed below is found in Stratigraphic Figure 622.200f. Additional maps and cross sections which may be useful to the reader are identified in Section 622. The plans for reclamation of the Mine Permit Area are presented in the "Reclamation Plan" volume of this permit submittal.

STAR POINT SANDSTONE FORMATION

The Star Point Sandstone, the lowest unit exposed in the Mine Permit Area, is a yellow-gray (salt and pepper) beach sandstone with massive beds and is medium-grained (Spieker, 1931). The Sandstone unit is exposed locally on the eastern edge, as well as to the east of the Mine Permit Area. The Star Point Sandstone is extremely tight and yields water in quantities of generally less than 5 to 10 gpm except where fractured. See page from the Star Point Sandstone is, however, an important part of the base flow to the stream in Eccles Canyon.

The Star Point Sandstone is thicker than normal in the Mine Permit Area and is over 1000 feet thick. The unit is a yellow-gray sandstone with beds that are mostly massive with occasional partings of shale or shaley sandstone. The amount of shale present is minor.

BLACKHAWK FORMATION

The Blackhawk Formation (which lies above the Star Point Sandstone unit) is the main unit in the Mine Permit Area and, in fact, is the main coal bearing unit in the region. The unit is approximately 1500 feet thick with the better coal seams being located within the lower 380 feet of the formation. The Blackhawk Formation is an interbedded formation of sandstone and shales. The sandstone beds are generally massive while the shale layers act bentonitic, tending to swell when wet and decomposing into a semi-impervious clay. The sands in this member of the Mesaverde Group are fine to medium grained and cemented by either calcite or silica with some iron discoloration. The sands are also more irregular than the sandstones typical of the Star Point Formation, tending to be local in extent and having locally high clay contents (Spieker, 1931; Doelling, 1972). The Aberdeen sandstone is a coarse-grained, light-colored sand with a thickness of 20 to 90 feet, which can be traced throughout the region (Spieker, 1931). The generally discontinuous nature of the Blackhawk sands is only locally important for groundwater since a well defined ground water aquifer capable of moving relatively large volumes of water does not exist.

Spieker (1931) has identified three types of shale in the Blackhawk Formation, all continental in origin. The three types are 1) a common clay shale which is soft and granular, 2) a carbonaceous shale and 3) a smoke-gray shale usually associated with the coal. As was the case with the sandstones, the shales are irregularly bedded (Spieker, 1931).

Stratigraphic Description

A drill log from drill hole 75-24-4 (shown on Figure 622.200g) is used to describe the lower part of the Blackhawk Formation, which is the most important portion of the formation with respect to coal mining operations in that it is within the lower zone where the mined coal is located. Drill hole 75-24-4 is located in the SE quarter of the SE corner of Section 24, T13S,R6W, SLBM as shown on Drill Hole Location Map 622.100a. This log provides a representative geologic stratigraphic section of the Mine Permit Area. The discussion that follows (related to the analysis of the log) starts at the bottom of the unit, and continues upward.

The lowest coal seam of the Blackhawk Formation in the vicinity of the Mine Permit Area is the Flat Canyon coal seam which lies approximately 50 feet above the Star Point Sandstone Formation. The Flat Canyon coal seam is not present over the entire Mine Permit Area, but in the area of drill hole 75-24-4 is found to be separated into two seams. The upper seam is one foot thick and is separated from the lower two foot thick seam by an eight foot shale layer. The 89 foot thick Aberdeen Sandstone layer lying above the Flat Canyon coal seam consists mostly of sandstone with some interbedded shales. It is described as a massive, irregularly bedded, gray to brownish quartzose sandstone and being medium to very fine grained. It is also known to have some local carbonaceous material present.

The Aberdeen Sandstone tends to grade upward from fine-grained at the base to medium and course-grained at the top and contains thin shaley intervals near the base. The conspicuously white upper few feet of the sandstone are significant because they generally lie immediately beneath the lowest minable coal seam. The chalky white appearance and the texture of this interval are similar to the uppermost part of the Star Point. The white color is imparted by the presence of the clay matrix which apparently formed diagenetically due to the action of acid waters from the overlying coal swamp, or as a result of subaerial weathering.

The Lower O'Connor coal seam overlies the Aberdeen Sandstone unit and at drill hole 75-24-4 is 22.5 feet thick. The Lower O'Connor ranges from 7 to 28.5 feet thick in the Mine Permit Area and contains a two-tenths of a foot thick fine grained sandstone bed within the coal seam. A thin clay seam lies above the top of the coal seam which in turn lies beneath 74 feet of medium to fine grained quartzose sandstone with minor interbedded shale. The quartzose sandstone unit has interbedded brown to reddish brown and gray to white lenses and is referred to as massive and irregularly bedded, while containing some local carbonaceous material. Lying above the 74 foot thick sandstone layer is a 1.5 foot seam of coal which in turn lies beneath 22 feet of sandstone. This upper 22 foot sandstone layer is similar to the 74 foot thick layer just discussed except that it contains more shale beds.

The next geologic unit encountered as we move upward is the Upper O'Connor coal seam. At this location, this coal seam is approximately 22 feet thick and is broken into three sections. The lower portion of the seam consists of six feet of coal followed by nearly four feet of light gray, fine grained, varved (layered) sandstone. Above this sandstone is 9.3 feet of coal followed by two feet of sandstone and then by one foot of coal. The next 406 feet of stratam between the last one foot of coal discussed and the surface, are made up of interbedded light to dark gray with some buff and tan colored shale, sandstone, and siltstone. The McKinnon coal seam is missing in the area of the geologic section, but would generally be located within this 406 foot section. In other areas the McKinnon seam is located approximately 350 feet above the Upper O'Connor

seam and is found to be up to 11 feet thick. Much of the McKinnon seam, however, is very thin and is not mined. Other thin coal seams are also locally present in this interval.

FAULTING

Three major north-south tending faults are found locally within or adjacent to the Mine Permit Area. The three faults are the Connelville Fault, the O'Connor Fault, and the Pleasant Valley Fault. As mining progressed within the Belina Mines, a series of smaller step faults not previously known to exist were found to be parallel to, and east of, the main Connelville Fault. Other faulting in the Mine Permit Area has also been encountered that was not previously mapped. The locations of local faults were discussed previously in Section 621 and are shown on General Geologic Map 621a in plan view. The geologic cross sections included within this submittal also include faults when encountered in the section. Information concerning the dip of local faults is sparse, however, information that is available seems to indicate that they are vertical or near vertical in most areas.

In addition to the three major north-south tending faults discussed above, there are some smaller easterly trending faults in the area, some of which have been intruded by dikes. The locations of these faults are also shown on General Geologic Map 621a. These dikes are classed as amprophyes. The major dike passing through the mining operations was found to have coked coal near the contact. This dike is located within the southern half of section 24 approximately three quarters of a mile south of the Belina Mines tunnel entrances. Some increase in metal content was also noted near the contact face including higher than normal pyrite contents in the coal.

GEOLOGIC EFFECTS UPON WATER MOVEMENT

The principle factor controlling the occurrence and availability of ground water in any area is lithology. Nearly all of the region surrounding the Mine Permit Area is underlain by rocks of continental and marine origin, consisting predominately of interbedded sandstones and shales (Price and Waddell, 1973). Although some of the sandstones in the region serve as water bearing strata, their ability to yield water for extended periods of time is largely controlled by the existence of the relatively impermeable interbedded shale layers, which prevent the downward movement of a significant amount of water. Because of this condition, specific areal extents, depths and thicknesses of aquifers are not easily defined. Price and Arnow (1974) state that the volume of recoverable water in the area is small, averaging less than 600 acre-feet per square mile in the upper 100 feet of saturated rock.

Surface water flow is affected by the geology to the extent that varying geologic structures control the infiltration of ground water. As stated, many of the sandstones and shales present within the Mine Permit Areas impede the infiltration of ground water. On the other hand, faults, fractures, and alluvial fill, where they exist, enhance infiltration thereby reducing net surface runoff. The dominant fault trends in the Mine Permit Area are in a north-south direction, however, smaller fault systems are noted locally to have an east-west orientation. It is suspected that faulting has only local hydrologic importance within the Blackhawk Formation because of the high clay content of surrounding materials which tends to seal the fractures and either restrict or stop water movement. Fracturing within the lower Star Point Sandstone

Formation, however, is not impacted greatly by clays, and therefore secondary permeability created by fracturing tends to increase local water yielding capabilities of this lower system.

Mining within the Blackhawk Formation has shown that faults may, but do not necessarily, provide conduits or a "plumbing system" for transporting groundwater. Investigations have shown that large volumes of water are not produced from faults unless a tension crack associated with a fault has provided an open channel that can drain adjacent sandstone and readily convey water into the mines. Wells drilled into the Blackhawk and Star Point Formations produce very little water (usually less than 5 gpm) unless a water conducting fracture(s) is encountered. Consequently, the culinary water supplies for both the Belina Mines and the adjacent Coastal States Energy Mines are obtained from wells drilled into faults in the Star Point Formation. Early culinary wells drilled for the Coastal States Energy Mines produce less than 10 gpm. Only when a well was drilled into the Connelville Fault zone was an adequate water supply developed. The culinary water supply well for the Belina Mines was drilled into the O'Connor Fault, from which it derives a moderate flow (maximum rate - 65gpm).

Another geologic phenomenon capable of altering water movement is caused by "rolling" of a formation. As formations develop waves or rolls through compression or vertical displacement, tension stresses result in the development of cracks which may collect and convey water within the formation. These cracks are generally local in nature and are not as extensive as the local faulting system. The combined effect of faulting and rolling in the formations containing coal seams may create secondary permeability zones which (when compared to most areas in the Blackhawk) would result in higher than anticipated ground water inflow into the Belina Mines.

Examples of these secondary permeabilities are given at the various locations within the mines which have experienced higher than anticipated inflows during mine advancement. Documented inflows over the period of mining are:

- An inflow of approximately three gallons per minute located at about 1,500 feet inside the mine in a northwest direction from the main mine portals.

- An inflow of approximately two gallons per minute located at about 1,500 feet inside the mine in a west-southwest direction from the main mine portals.

- An inflow of approximately ten gallons per minute was noted when a fault was encountered at about 2,600 feet inside the mine in a west-northwest direction from the main mine portals. At approximately 2,000 feet further south along this same fault, there was encountered again another inflow of approximately five gallons per minute. When the fault was encountered for the third time at a distance of approximately 1,500 feet farther south, no water inflow was reported.

- Water inflow was encountered in the area located approximately 2,500 feet south-southwest of the mine portal when a major roof fall occurred. The roof fall was located in a fault zone with a four foot displacement. No other local water was encountered.

Roof falls at other locations have been encountered without the production of water. It appears that water within the mines is generally related to either a zone of shallow overburden, or to a

roll in the rock which produces tension cracking. Normal faults generally do not produce water. Large flows occurring within the mines are generally associated with tension cracking, and usually reduce in flow volume over time as the adjacent sandstone is drained.

The abundance of shale in the Blackhawk also acts as an effective barrier to the downward movement of water within the formation, greatly reducing its overall vertical permeability and the amount of water which percolates through the formation to lower units. Water which reaches the Blackhawk percolates downward until it meets a shale layer, after which the water moves horizontally to the surface or another "drain" (i.e. sandstone finger, fault, etc.) within the formation. Investigations at springs and streams in the Mine Permit Area have confirmed that shale layers impede downward percolation of water through the Blackhawk, and that springs are generally located where shale layers outcrop. The fact that most springs are on fairly steep hillsides and not in channel bottoms where a regional aquifer would tend to discharge, provides additional evidence that the springs in the upper elevations of the Blackhawk Formation are draining perched aquifers. These springs tend to receive water from localized rather than regional sources.

A major east-west dike crosses the Mine Permit Area in the Boardinghouse Canyon area. At the location encountered within the Belina Mines, the dike was found to be approximately 230 feet thick. It is believed that this dike was formed subsequent to local faulting. The dike was essentially dry at the time it was encountered, and it is felt that the dike itself may be creating a partial barrier to the movement of ground water. This theory is based upon the fact that at the time the dike was encountered within the mine, essentially no water was noted on the north contact face. However, upon traversing the dike, a small amount of dripping was noted to occur from the south contact zone, indicating the presence of local water. After coming in contact with the dike, local ground water may be moving along the contact face in an east-west direction parallel to the dike.

In determining the magnitude of the effects of mining on areal hydrology, it is important to recognize the uses of the hydrologic resources. Within the Mine Permit Area, the principal use of the hydrologic resources is for the watering of livestock and wildlife. The area has numerous springs, seeps, and several streams. The disturbance of some of these sources may result in the need for livestock and wildlife to utilize another adjacent source. However, this has not appeared to be a problem for local livestock and wildlife because of the many local sources which exist within the area.

Additional hydrologic details related to both surface and ground water are given in Section 700.

624.200 thru 624.230. REQUIREMENTS WHEN STRATA ARE EXPOSED.

This section is not applicable to the applicant since mining activity within the Mine Permit Area will not include any type of open pit mining. Surface disturbances created by roads, work area, portals, etc. will be reclaimed according the reclamation plan.

624.300 thru 624.340. ANALYSIS OF CORES AND BORINGS.

DRILL LOGS

A limited number of drill logs are available for the Mine Permit Area. However, the nature of these data is such that presenting all available data in this report is impractical or impossible without extensive modifications in format. As an alternative, the information given by the logs not duplicated herein, is incorporated into the geologic sections described in Section 624.100. Drill hole logs and ground water information are presented on geologic cross sections 622.200f through 622.100m.

CHEMICAL ANALYSES

Chemical analyses of the coal seams that are or have been mined, as well as of the strata above and below the coal seams are summarized in Section 623.100.

GEOLOGIC PROPERTIES

As discussed above in 623.100 normal mining practice at Valley Camp leaves coal on both the roof and floor of the mine openings so that clay material above or below the coal seams is not exposed and does not directly affect the stability of the mine opening except in very limited and localized areas as discussed below.

Mining has been accomplished mostly by conventional room and pillar methods. The coal pillars are generally competent and the roof areas are stable where at least two feet of coal were left. Occasionally, roof falls have occurred in areas where less than two feet remained following mining. These roof falls have been more common in zones where the coal and shaley roof layers have been fractured by local faults. During mining, these zones are stabilized with roof bolts. Stabilization using roof bolts has been generally successful. Some areas have also been noted where a few inches of local clay have been found to exist above the coal seam.

Various reports prepared for the applicant by consultants have provided valuable information related to geology and related material properties. Pertinent information from these reports has been subtracted from them and is presented in the remaining information within this section. According to these reports, the material properties of the coal used as calculation factors for uniaxial strength, friction angle, and 52 degrees unit weight are 1431 psi, 52 degrees, and 85 pcf respectively. The factor used for the unit weight of the overburden is 150 pcf.

The pre-mining stress condition in the coal deposit was found to be as expected. The vertical stress is approximately equivalent to that of the overburden load, and lateral stresses are about one-third to one-half of the vertical stress, which is typical for gravity structures.

The direct measurement of stress in a coal seam has been one of the most difficult tasks of rock mechanics. For this reason, stress measurements from adjacent rock layers have sometimes been used in design. However, stresses in roof and floor rock are necessarily different from those in the coal seam because of the difference in properties, and the difference in the rate of stress relief through geologic time since deposition. Care must be taken therefore when using rock stress in the design of coal pillars.

A borehole deformation gage (BDG) was used to measure absolute stress in the coal mass. The BDG actually measures the change in the EX-size drill hole diameter as the stress around the drill hole is relieved by overcoring with a six-inch diameter coring bit. Measured deformations are used in the calculation of two dimensional stresses perpendicular to the drill hole axis. When three sets of these stresses are obtained from three drill holes having different orientations, both the magnitude and the three dimensional orientation of stress can be calculated.

Borehole deformation monitoring is referred to as an overcoring test. The equipment for an overcoring test consists of a drilling unit and a BDG unit. Auxiliary tools are also used to facilitate recovery of cores and insertion and positioning of the gage. The procedure has been standardized with slight variations in the intervals of strain reading during overcoring.

The first set of stress measurement consisted of overcoring of three holes drilled in three different orientations. The first of the three holes was drilled nearly perpendicular to the rib. In this drill hole, measurements were taken at every two to three feet of depth.

Preliminary analysis of the results from the three drill holes at the first site indicates that the pre-mining stresses are within the expected ranges for a sedimentary rock formation. There appears to be no tectonic influence in this area. Visual observations of the ground conditions in the Belina No. 1 Mine did not detect unusual stress conditions. The results of the test are shown in Table 624.340a.

Monitoring of short cockle gages indicated that there was virtually no separation of the immediate roof. The horizontal strain of the roof as indicated by HORST data confirms this. The roof-floor convergence measured with a tape extensometer shows a very slow and gradual closure. However, a sudden closure of 0.1 to 0.15 inches was indicated when active mining was done near the test area. Estimating that one-half of this closure was due to pillar deformation, the data implies that a 200 to 300 psi load was added to the pillars during active mining.

The gages indicated impending changes in the ground conditions for 10 to 20 days prior to a roof fall. Gages closer to the fall gave longer advance warning. Additional anomalies appear to be reflections of small roof falls near a fault.

The influence on Belina No. 2 Mine was also observed as part of the test. The results from the instrument monitoring in the test panel indicated that the roof sagging (flexure) is minimal. Visual observations of the mined-out area over a one-month period showed little change during that time. No roof or floor puncturing by the pillar was evident. These factors indicate the existence of a strong roof and floor. A strong roof or floor tends to dissipate the stresses rapidly thereby minimizing stress concentration. In addition, the overburden load in Belina No. 1 does not appear to cause a buildup of abutment pressures in the next panel area.

TABLE 624.340a
SUMMARY OF MINING TEST STRESS MEASUREMENT DATA

Site No.	DH Angle No.	Measured Depth Ft.	Deformation, in 10^{-6}			Two Dimensional Stress		
			Vertical U_1	45° Left U_2	45° Right U_3	T, psi	Q, psi	T, deg
1	1	1.0	14508	12320	6950	2251	1502	22
		5.0	8399	5320	7506	1331	1027	-21
		14.0	2232	3780	4170	664	467	5
		22.0	2790	4200	0	594	183	40
	2	20.5	2344	3920	723	541	234	45
	3	21.0	4743	1960	2780	664	389	-8
2	4	1.5	5792	4967	4242	908	759	14
		3.5	7647	7949	6341	1301	1137	35
		5.1	4218	5113	1818	783	455	38
		7.2	2854	4346	2830	641	474	-30
		13.4	3119	3931	2897	605	500	-36
3	5	5.1	10184	3365	7784	1517	852	-20
		6.7	6350	3310	6144	1041	714	-28

The factors discussed above indicate that conditions in the lower seam of the Belina No. 2 Mine will not be affected excessively by upper seam mining. The lower seam roof (floor of upper seam) appears to be sufficiently stable to achieve an evenly distributed load transfer. However, the pillars having the same dimensions as those in the upper seam would be less stable in the lower seam, due to increase in depth and to some amount of stress concentration.

The Belina No. 2 Mine has been partially developed below the West Mains of the Belina No. 1 Mine. The main entries in the Belina No. 2 Mine have been in a stable condition since the opening. As overburden increases, entries directly beneath the Belina No. 1 Mine show signs of deterioration, and narrow corner edges of pillars begin to spall. Within a fault zone, the roof may cave in more easily than in the upper seam. Without precautionary measures, cavings tend to be more extensive since the pillars deform more. Otherwise, the ground conditions in the lower seam should be similar to those in the upper seam mine.

If the pillars are left in a regular pattern, and if they have consistent dimensions, no extraordinary support system should be required for the lower seam. However, a method will need to be developed for pre-supporting the faulted/fractured zones.

625. ADDITIONAL GEOLOGIC INFORMATION.

To date, no additional geologic information is required under this regulation to protect the hydrologic balance, to minimize or prevent subsidence, or to meet the performance standards of R514-301 and R645-302.

626. REQUEST FOR VARIANCE FROM SECTIONS 624.200 AND 624.300.

No waiver of Section 625 is required or requested at this time.

627. OVERBURDEN THICKNESS AND LITHOLOGY.

The Blackhawk Formation, as discussed earlier in this geologic section is exposed over most of the Mine Permit Area. The Blackhawk is made up of interbedded sandstone and shale beds. This interbedded material is the lithology that makes up the overburden over the mined areas. The thickness of the overburden varies within the Mine Permit Area. In some areas the coal is exposed at the surface and in three drill holes the top of the Lower O'Connor coal seam is over 1100 feet deep. An isopach map of the overburden thickness is presented as 622.200e.

630. OPERATION PLAN.

No significant changes are anticipated in the operation of the mines. The overall plan is discussed in Section in 542. In effect, underground mining activities will be a continuation of previous operations. Surface activities will utilize existing buildings, facilities, utility corridors, coal storage, cleaning, and loading areas. Water and subsidence monitoring will continue utilizing the control points that have been presented within other sections of this permit.

631. CASING AND SEALING OF EXPLORATION HOLES AND BOREHOLES.

All exploration drill holes have been plugged using the procedures required by the U.S. Forest Service. The drill holes were filled with drill cuttings except in specific areas of the hole requiring concrete plugs. Concrete plugs are required, and were extended ten feet above and below any aquifer encountered, as well as being placed across all coal seams. In the vicinity of the surface, all drill holes were backfilled with at least a five foot concrete plug upon which a soil layer was added to conform to local soil conditions.

When plugged, the culinary water well being used by the applicant will be plugged with either 1) bentonite to within five feet of the surface whereafter a concrete plug will be placed, or 2) concrete to the full depth of the well. In either case, this work will be done as part of the site reclamation.

631.100. TEMPORARY CASING AND SEALING.

There has been no need for temporary casing or sealing since all existing abandoned drill holes have been plugged.

631.200. PERMANENT CASING AND SEALING.

Since there has been no temporary completion of drill holes there is no need for permanent casing or sealing in addition to that discussed in Section 631.

632. SUBSIDENCE MONITORING.

Information related to subsidence monitoring can be found within 1993 Appendix 724.600.

640 thru 642. PERFORMANCE STANDARDS.

All exploration holes and boreholes have been permanently cased and sealed according to 631 and as required by the U.S. Forest Service. All monuments and surface markers will also be reclaimed upon termination of all mining operations.

REFERENCES

Doelling, H.H. 1972. Wasatch Plateau Coal Fields. In Doelling, H.H. (ed.). Central Utah Coal Fields; Sevier-Sanpete, Wasatch Plateau, Book Cliffs and Emery. Utah Geological and Mineralogical Survey Monograph Surveys No. 3. Salt Lake City, Utah.

Spieker, E.M. 1931. The Wasatch Plateau Coal Field, Utah, U.S. Geological Survey Bulletin No. 819. Washington D.C.

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U.S. Geological Survey. 1979. Development of Coal Resources in Central Utah, Final Environmental Statement. Salt Lake City, Utah.

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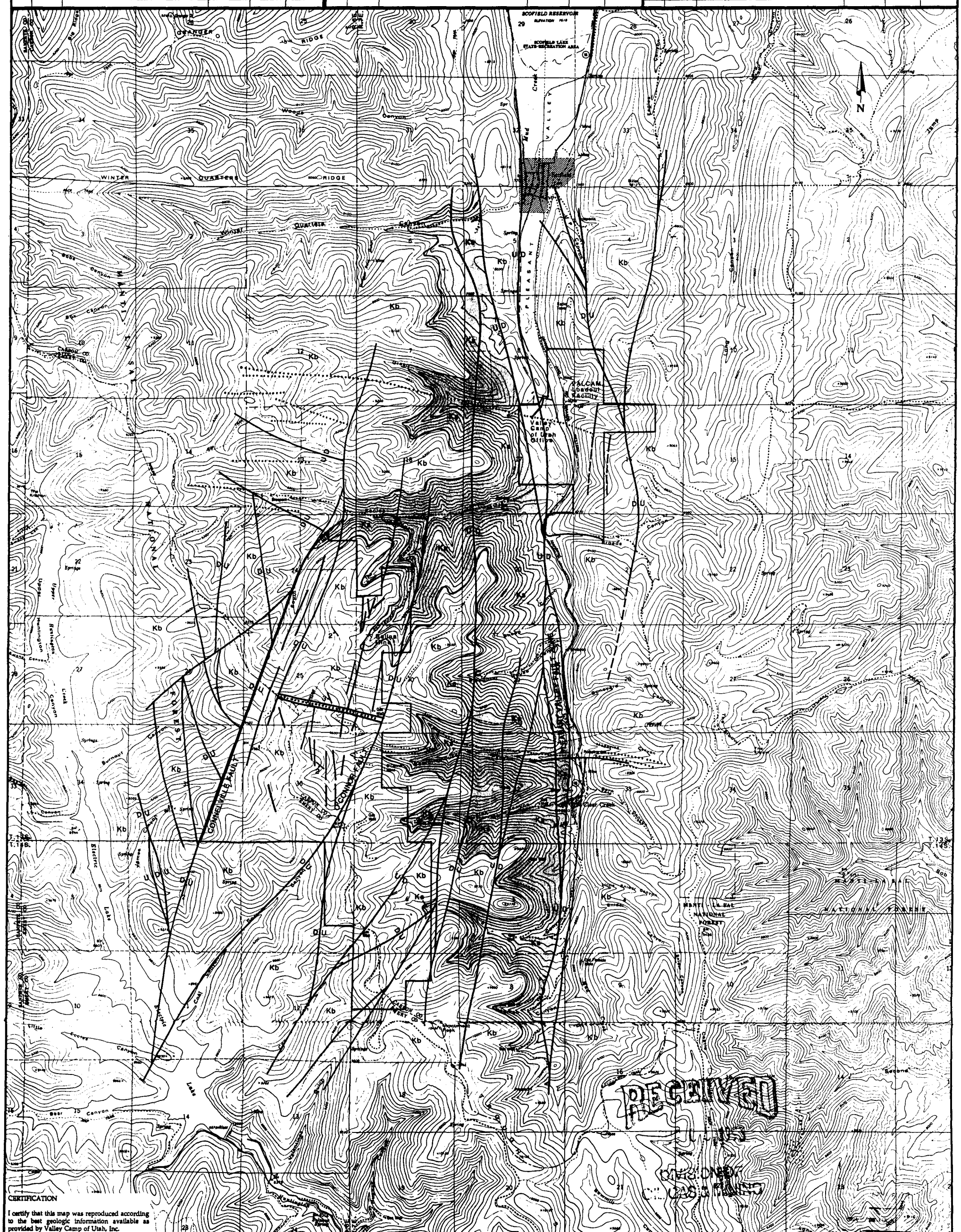

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LEGEND:

TERTIARY(?)

LAMPROPHYRE DIKE

CRETACEOUS

Kb — BLACKHAWK FORMATION

Ks — STARPOINT SANDSTONE

FAULT DASHED WHERE INFERRED
SHOWING RELATIVE MOVEMENT WHERE KNOWN

STRIKE AND DIP OF BEDS

THE TOWN OF SCOFIELD

REGISTERED PROFESSIONAL ENGINEER #7888 DAVID E. HANSEN 10/1/90 STATE OF UTAH

NOTE: INFORMATION PROVIDED IS EXTRAPOLATED FOR AREAS ON AND ADJACENT TO PERMIT AREAS. GEOLOGY NOT SHOWN FOR BORDER AREAS OF MAP.

VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE:

MAP R645-301-621a
GENERAL GEOLOGIC MAP

Drawn by: VALLEY CAMP	Date: -
Approval: DEH	Date: 9/90
Drawing No.	Rev. 1 3/93

HANSEN ALLEN & LUCE Salt Lake City Utah

SCALE: 1" = 2000'

SHEET 1 of 1

007.11.100.001

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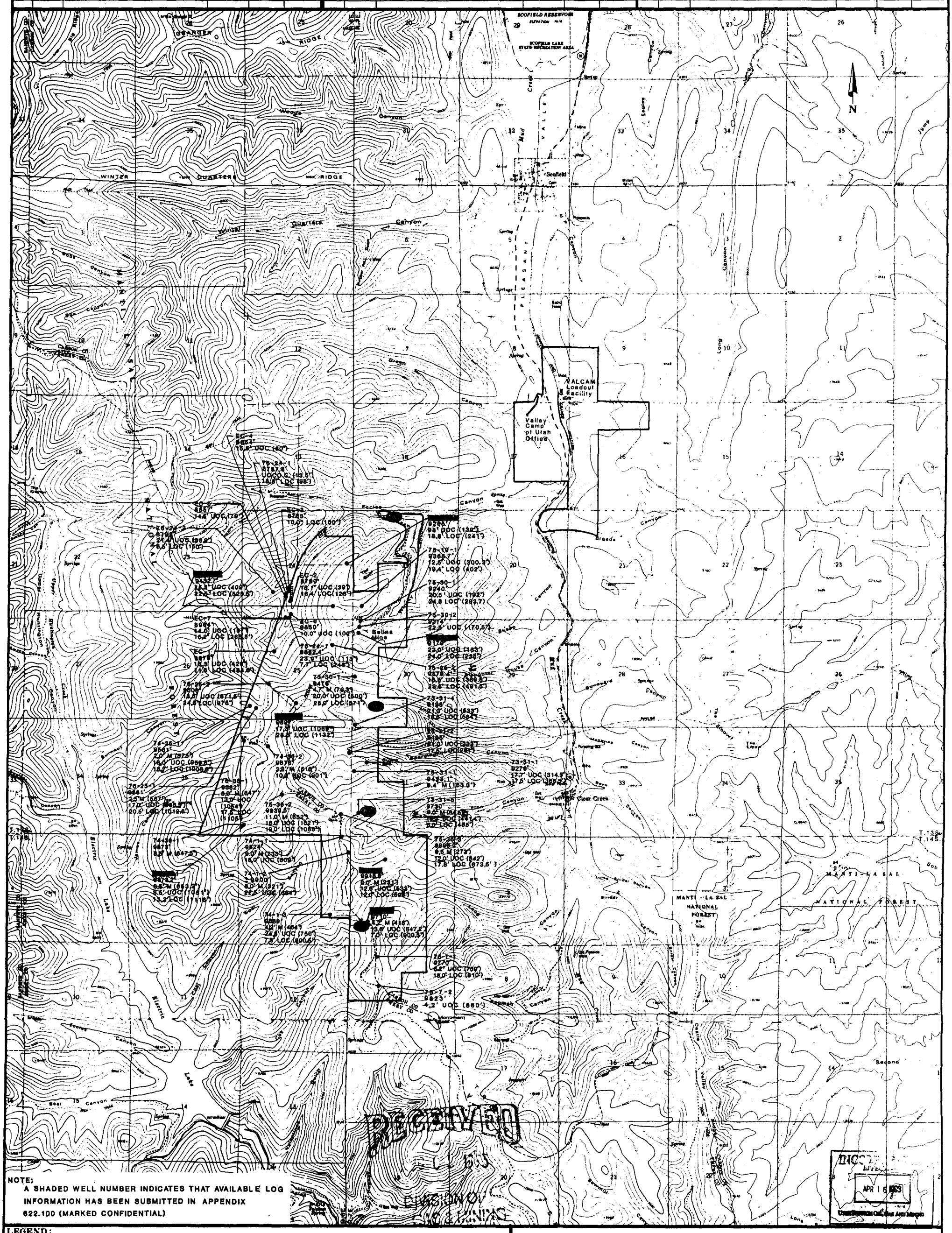
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS



NOTE:
A SHADED WELL NUMBER INDICATES THAT AVAILABLE LOG INFORMATION HAS BEEN SUBMITTED IN APPENDIX 622.100 (MARKED CONFIDENTIAL)

LEGEND:

74-6-1	WELL NUMBER. (SHADING INDICATES WELL LOG SUBMITTED)
9655'	GROUND ELEVATION
4.2' M (464')	4.2' THICK MCKINNON SEAM AT 464' DEPTH
24.5' UOC (750')	24.5' THICK UPPER O'CONNOR SEAM AT 756' DEPTH
7.8' LOC (800.5')	7.8' THICK LOWER O'CONNOR SEAM AT 800.5' DEPTH
M	MCKINNON COAL SEAM
UOC	UPPER O'CONNOR COAL SEAM
LOC	LOWER O'CONNOR COAL SEAM
UOC O.C.	UPPER O'CONNOR COAL OUTCROP

GAS WELL

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TITLE:
MAP R645-301-622.100a
DRILL HOLE AND GAS WELL LOCATIONS WITH COAL SEAM DATA

Drawn by: DCR	Date: 7/89
Approval: DEH	Date: 9/90
Drawing No.	Rev. 1 3/93

HANSEN ALLEN & LUCE Salt Lake City Utah

SCALE: 1" = 2,000'

SHEET 1 OF 1

007.11.100.002

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NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS

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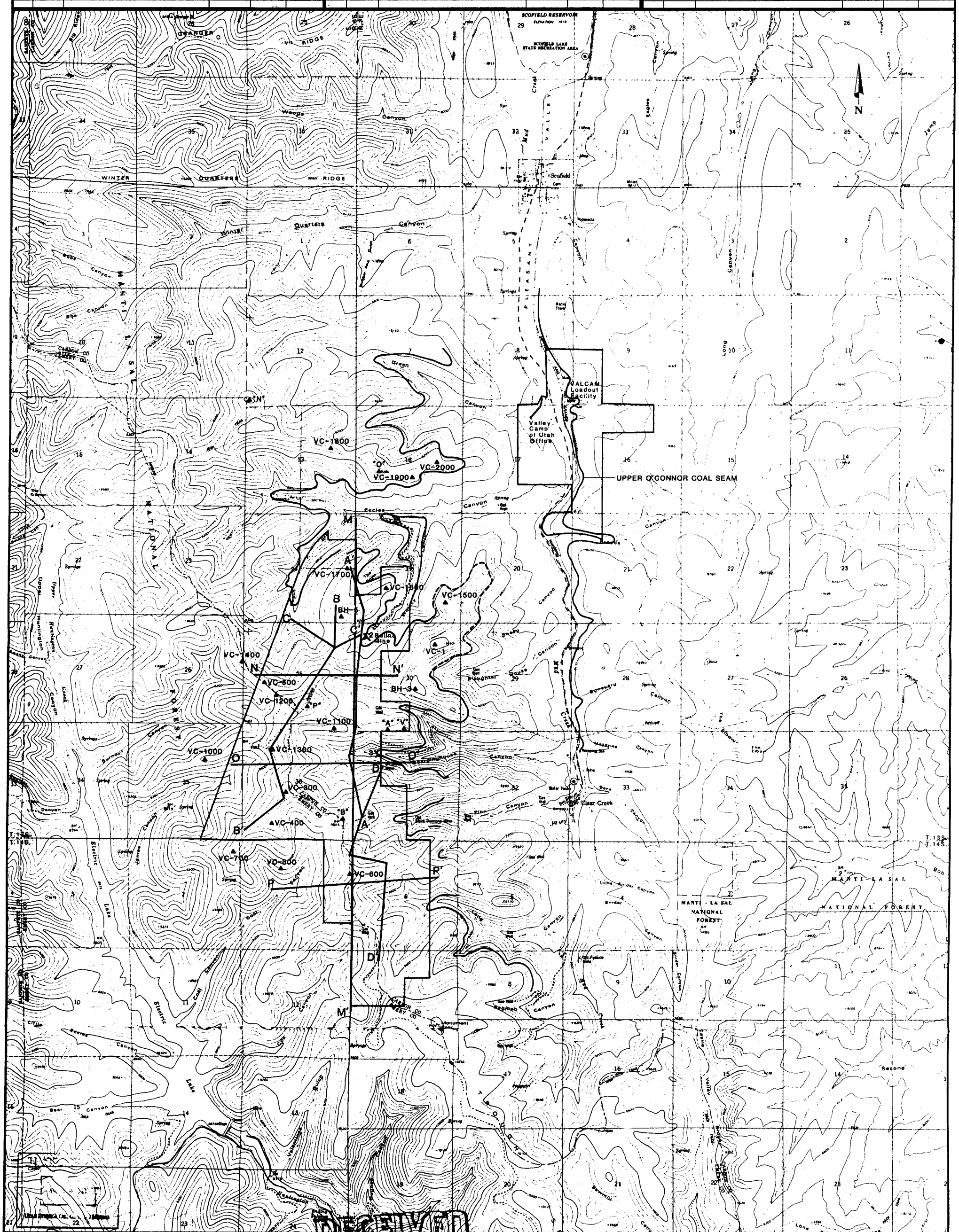
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS



LEGEND:

- A–A' STRATIGRAPHIC GEOLOGIC CROSS SECTION
- M–M' GEOLOGIC/HYDROLOGIC CROSS SECTION
- APPROXIMATE LOCATION OF O'CONNER COAL OUTCROP (UPPER AND/OR LOWER SEAMS) - DASHED WHERE INFERRED
- 2 STRIKE AND DIP OF COAL SEAM
- ▲VC-800 SUBSIDENCE MONITORING MONUMENT AND NUMBER

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STATE OF UTAH PROFESSIONAL ENGINEER #7888 DAVID E. HANSEN 10/11/90

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SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE: MAP R645-301-622.200a GEOLOGIC CROSS SECTIONS, COAL OUTCROP & FOREST SERVICE SUBSIDENCE MONITORING LOCATION MAP

Drawn by: DCR	Date: 7/89
Approval: DEH	Date: 9/90
Drawing No.	Rev. 1 3/93

HANSEN ALLEN & LUCE, Salt Lake City, Utah

SCALE: 1" = 2000'

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007.11.100.003

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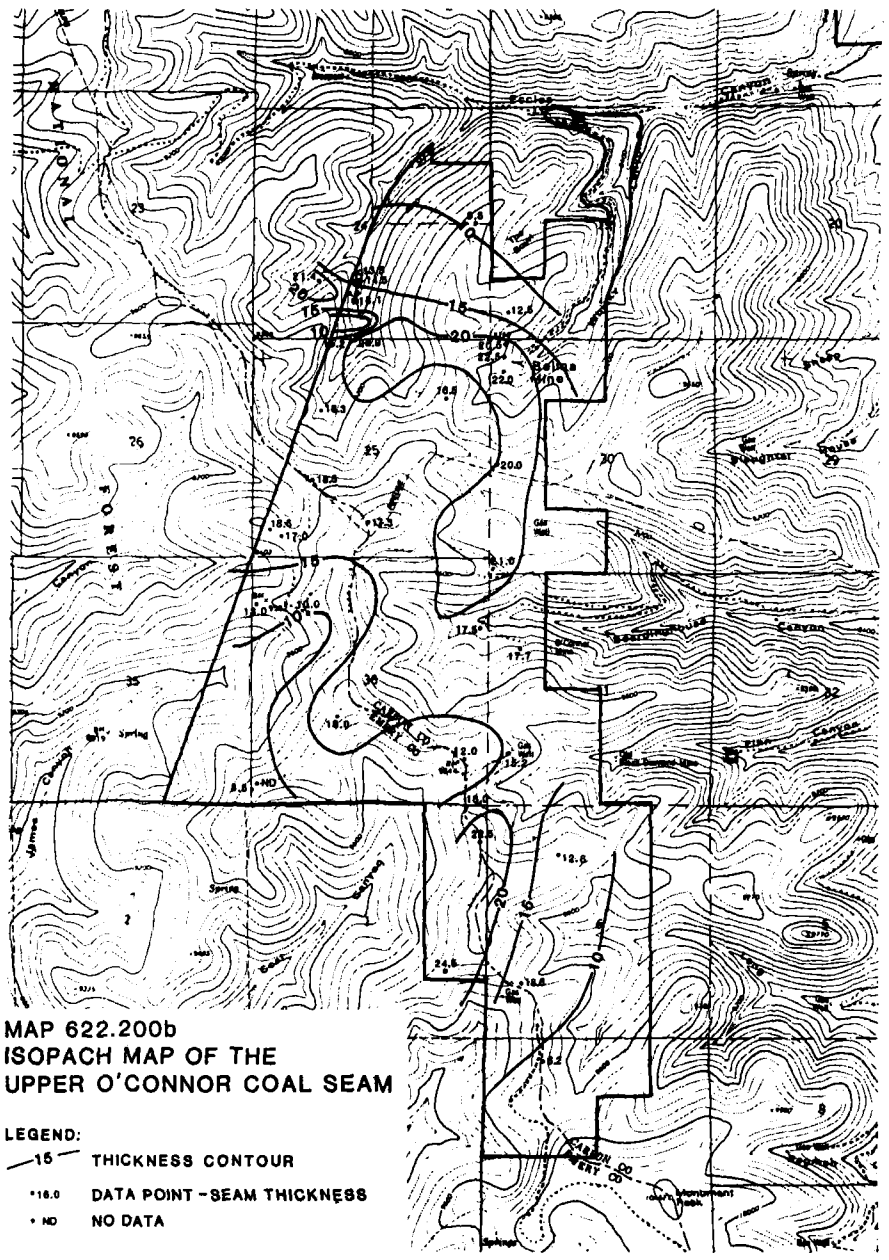
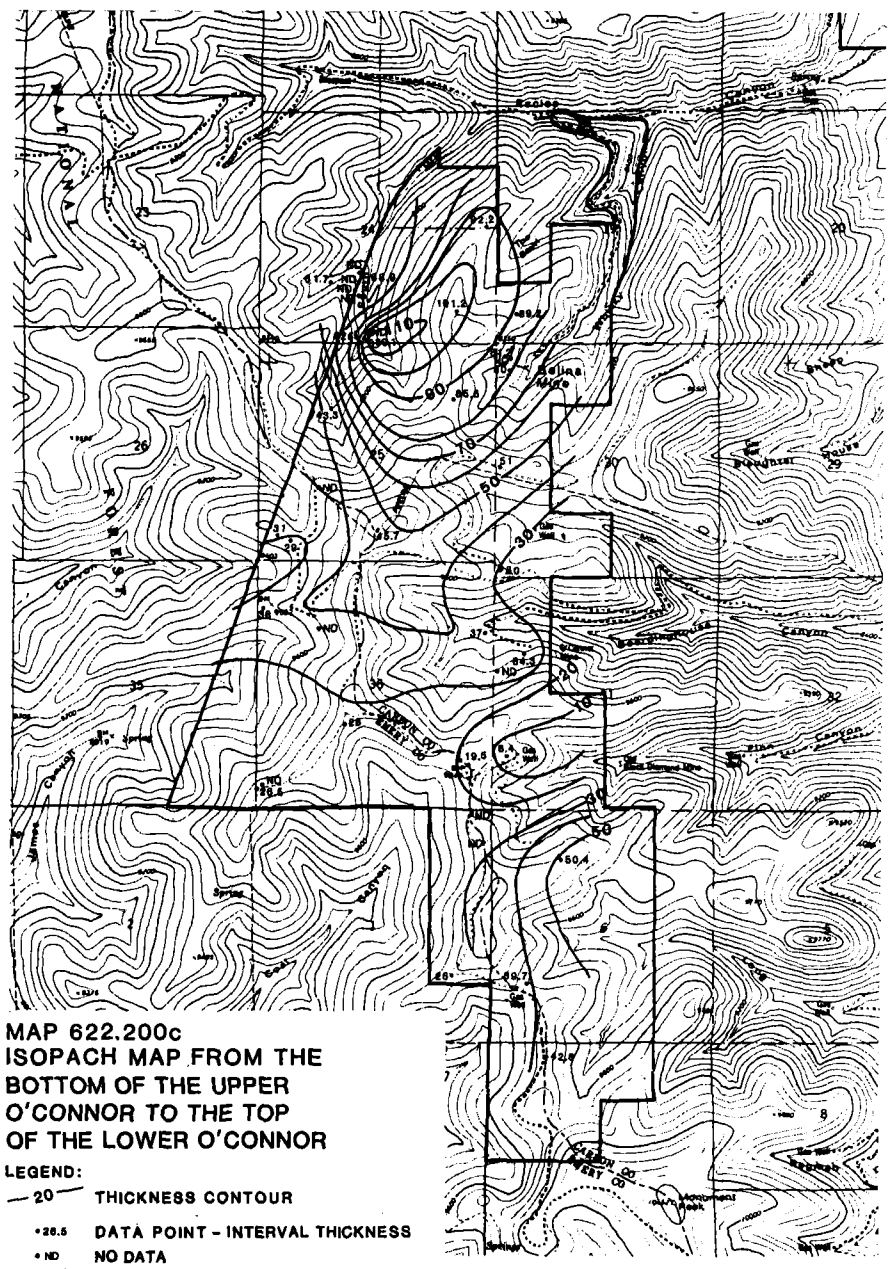
NO.	DATE	DESCRIPTION	REF. NO.	DATE	INITIALS



MAP 622.200b
ISOPACH MAP OF THE
UPPER O'CONNOR COAL SEAM

LEGEND:

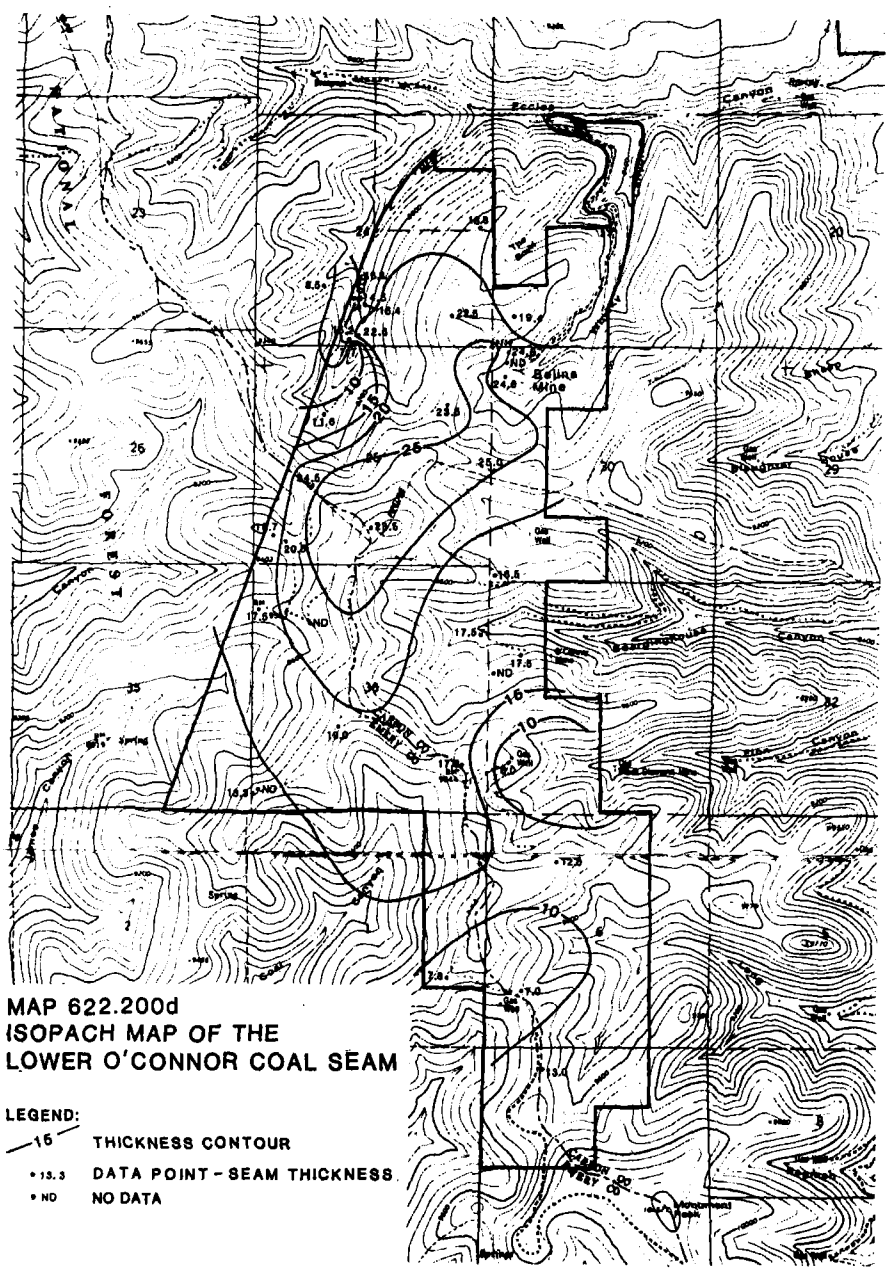
- 15 THICKNESS CONTOUR
- •16.0 DATA POINT - SEAM THICKNESS
- • ND NO DATA



MAP 622.200c
ISOPACH MAP FROM THE
BOTTOM OF THE UPPER
O'CONNOR TO THE TOP
OF THE LOWER O'CONNOR

LEGEND:

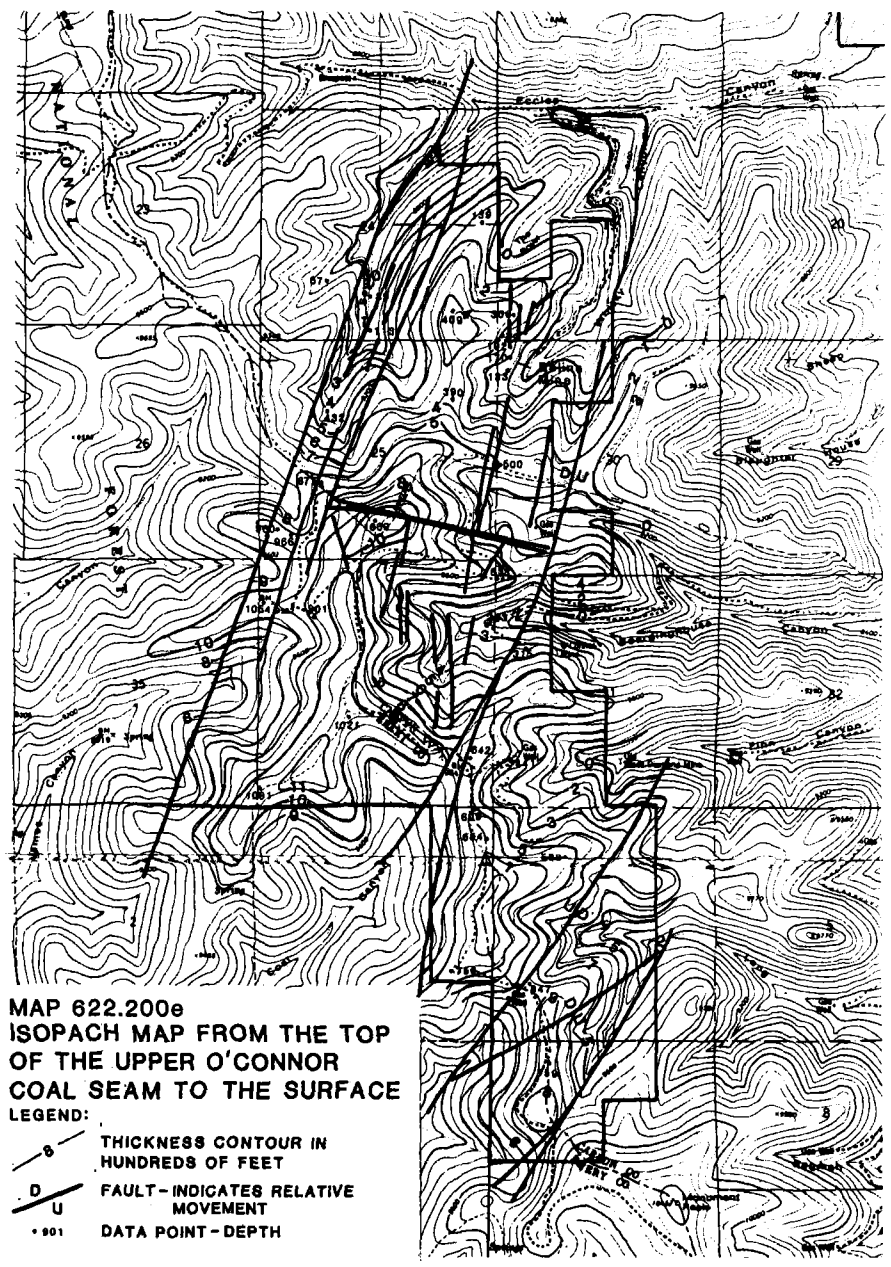
- 20 THICKNESS CONTOUR
- •26.5 DATA POINT - INTERVAL THICKNESS
- • ND NO DATA



MAP 622.200d
ISOPACH MAP OF THE
LOWER O'CONNOR COAL SEAM

LEGEND:

- 15 THICKNESS CONTOUR
- •15.3 DATA POINT - SEAM THICKNESS
- • ND NO DATA



MAP 622.200e
ISOPACH MAP FROM THE TOP
OF THE UPPER O'CONNOR
COAL SEAM TO THE SURFACE

LEGEND:

- 8 THICKNESS CONTOUR IN HUNDREDS OF FEET
- D U FAULT - INDICATES RELATIVE MOVEMENT
- •901 DATA POINT - DEPTH

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TITLE:
MAPS R645-301-622.200b
THROUGH R645-301-622.200e
ISOPACH MAPS

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Drawing No.	Rev. 1 3/93

Salt Lake City Utah

SCALE: 1"=2000'

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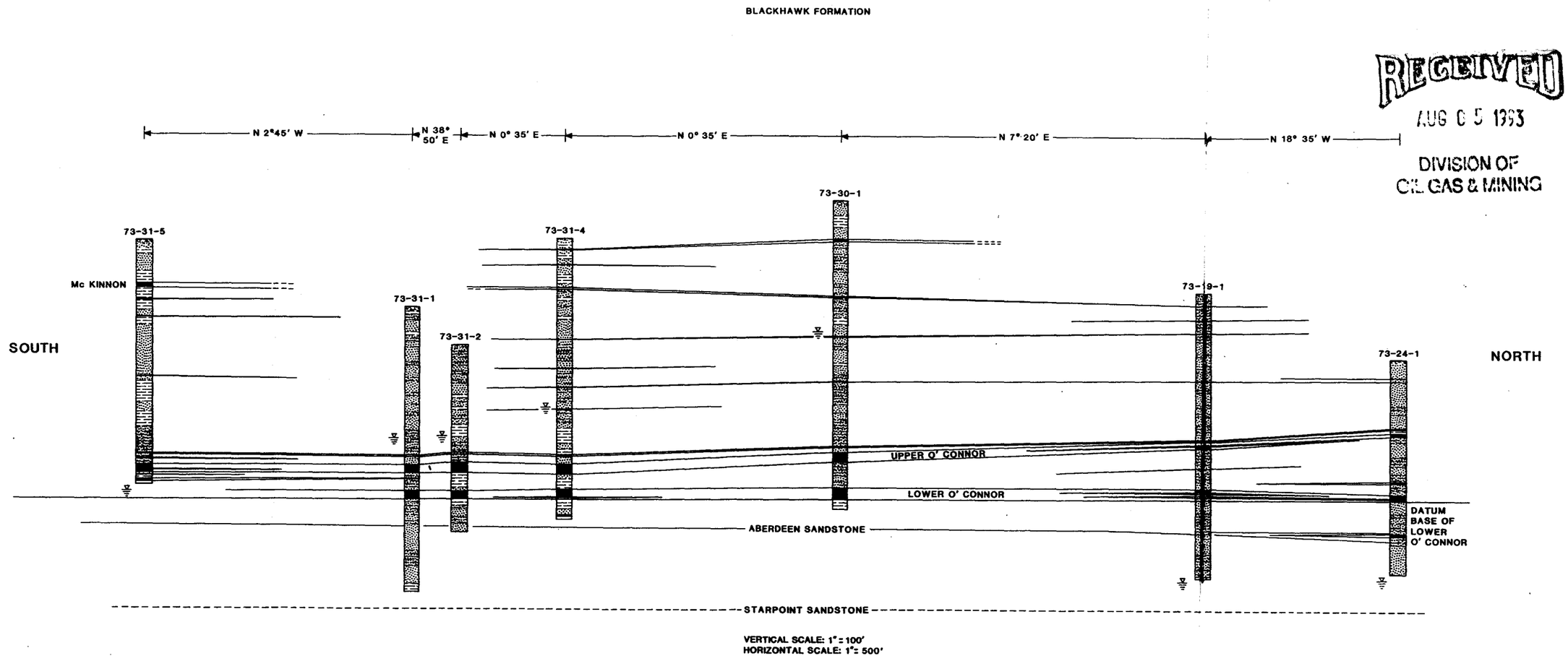

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LEGEND:

- GRAVEL AND ALLUVIUM
- SANDSTONE
- SHALE
- COAL
- 73-30-1 WELL NUMBER
- N 7° 20' E BEARING
- APPROXIMATE WATER TABLE LEVEL

NOTE: LOCATION OF CROSS SECTION SHOWN ON MAP 622.200a

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TITLE: FIGURE R645-301-622.200f STRATIGRAPHIC GEOLOGIC CROSS SECTION A-A'

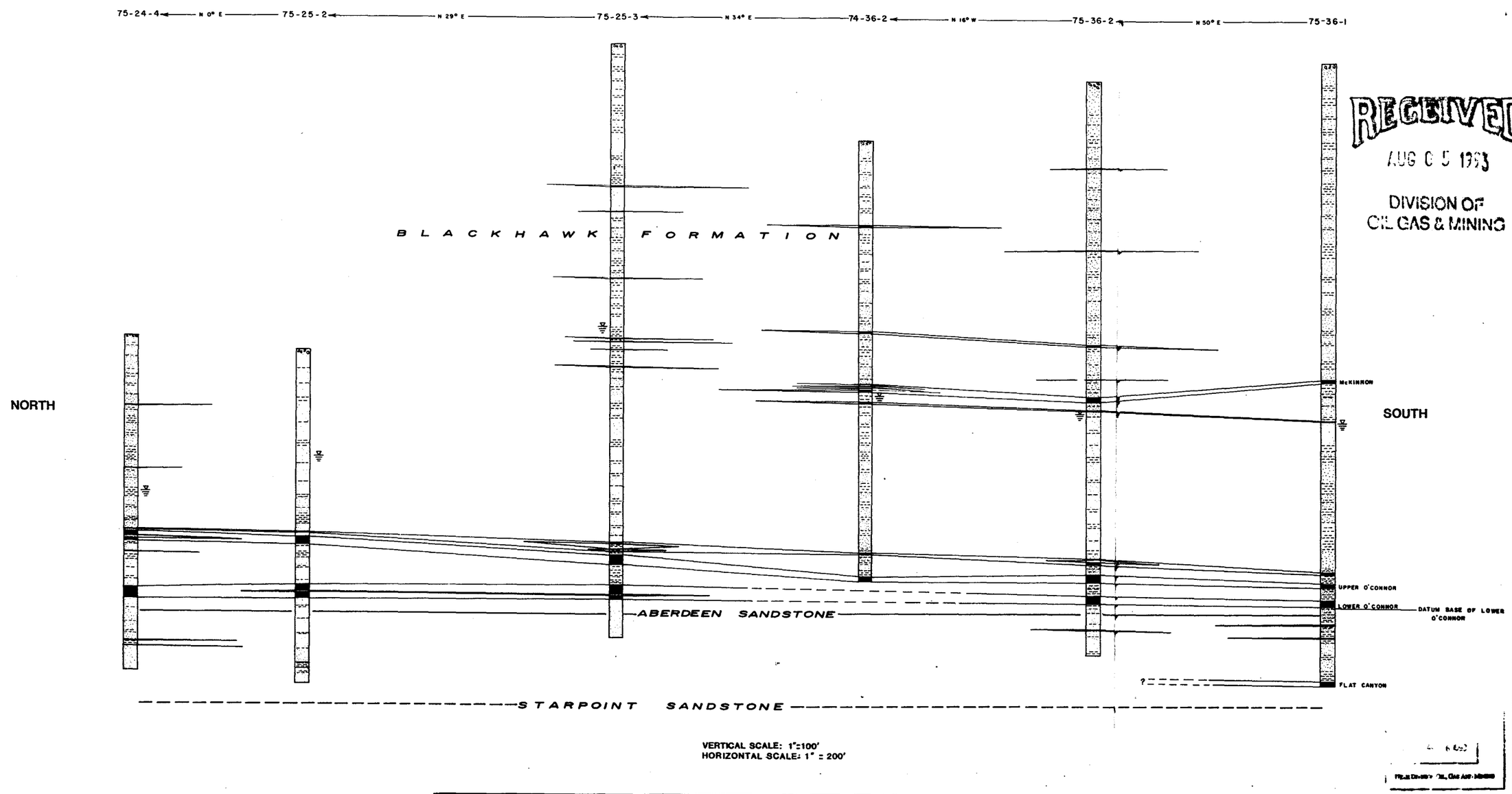
Drawn by: VALLEY CAMP	Date: -
Approval: DEH	Date: 9/90
Drawing No.	Rev. 1 3/93

HARTCROW NOTEK & ASSOCIATES Salt Lake City Utah

SCALE: AS SHOWN

SHEET 1 OF 1

007.11.100.006



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LEGEND:

- GRAVEL AND ALLUVIUM
- SANDSTONE
- SHALE
- COAL
- 75-36-1 WELL NUMBER
- ← N 50° E BEARING
- APPROXIMATE WATER TABLE LEVEL

NOTE: LOCATION OF CROSS SECTION SHOWN ON MAP 622.200a

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TITLE: FIGURE R645-301-622.200g STRATIGRAPHIC GEOLOGIC CROSS SECTION B-B'

Drawn by: KCF(VALLEY CAMP)	Date: 9/9/83		
Approval: DEH	Date: 9/90		
Drawing No. VALLEY CAMP NO. D5-0087	Rev. 1 3/93		

Salt Lake City Utah

SCALE: AS SHOWN

SHEET 1 OF 1

007:11.100.006

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VALLEY CAMP ACT/007/001 REVISION			INCORPORATED INTO MRP BY DOGM		
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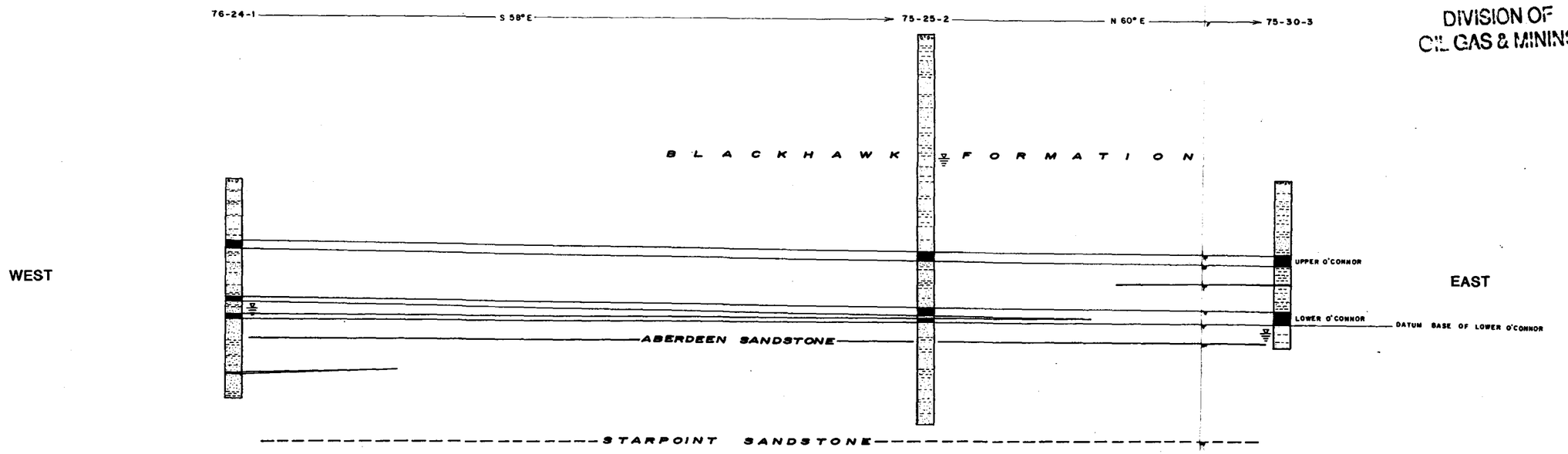

VERTICAL SCALE: 1" = 100'
HORIZONTAL SCALE: 1" = 200'

LEGEND:

- GRAVEL AND ALLUVIUM
- SANDSTONE
- SHALE
- COAL
- 75-30-3 WELL NUMBER
- ← N 60° E BEARING
- APPROXIMATE WATER TABLE LEVEL

NOTE: LOCATION OF CROSS SECTION SHOWN ON MAP 622.200a

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VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE:

FIGURE R645-301-622.200h
STRATIGRAPHIC GEOLOGIC
CROSS SECTION C-C'

Drawn by: KCF (VALLEY CAMP)	Date: 9/9/83		
Approval: DEH	Date: 9/90		
Drawing No. D5-0088	Rev. 1 3/93		
Salt Lake City Utah		SCALE: AS SHOWN	SHEET 1 OF 1

007.11.100.007

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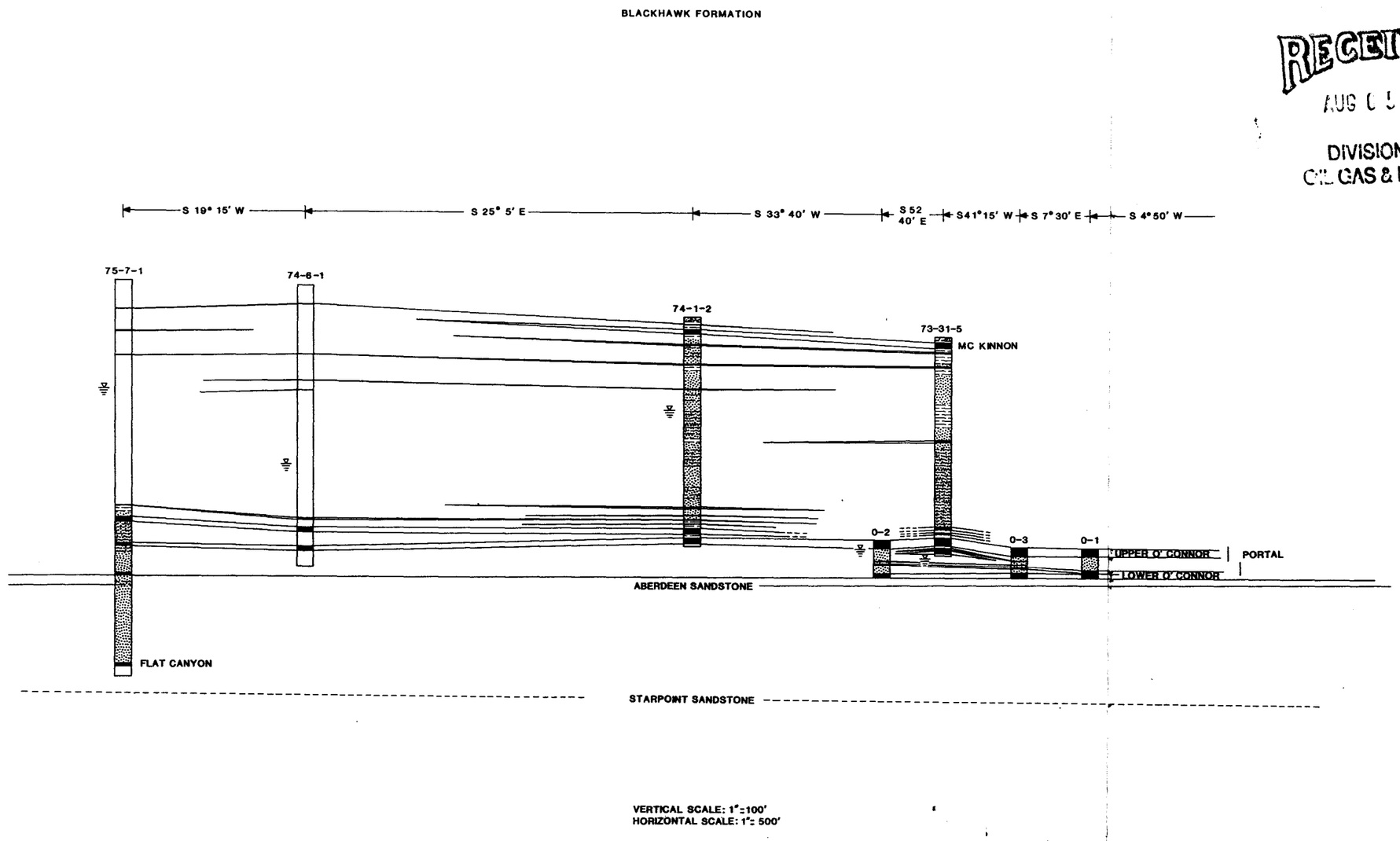

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DIVISION OF
OIL GAS & MINING

LEGEND:

- GRAVEL AND ALLUVIUM
- SANDSTONE
- SHALE
- COAL
- 0-1 WELL NUMBER
- ← S 4° 50' W BEARING
- APPROXIMATE WATER TABLE LEVEL

NOTE: LOCATION OF CROSS SECTION SHOWN ON MAP 622.200a

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VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE: FIGURE R645-301-622.200i STRATIGRAPHIC GEOLOGIC CROSS SECTION D-D'

Drawn by: VALLEY CAMP	Date: –
Approval: DEH	Date: 9/90
Drawing No.	Rev. 1 3/93

Salt Lake City Utah

SCALE: AS SHOWN

SHEET 1 OF 1

007.11.100.008

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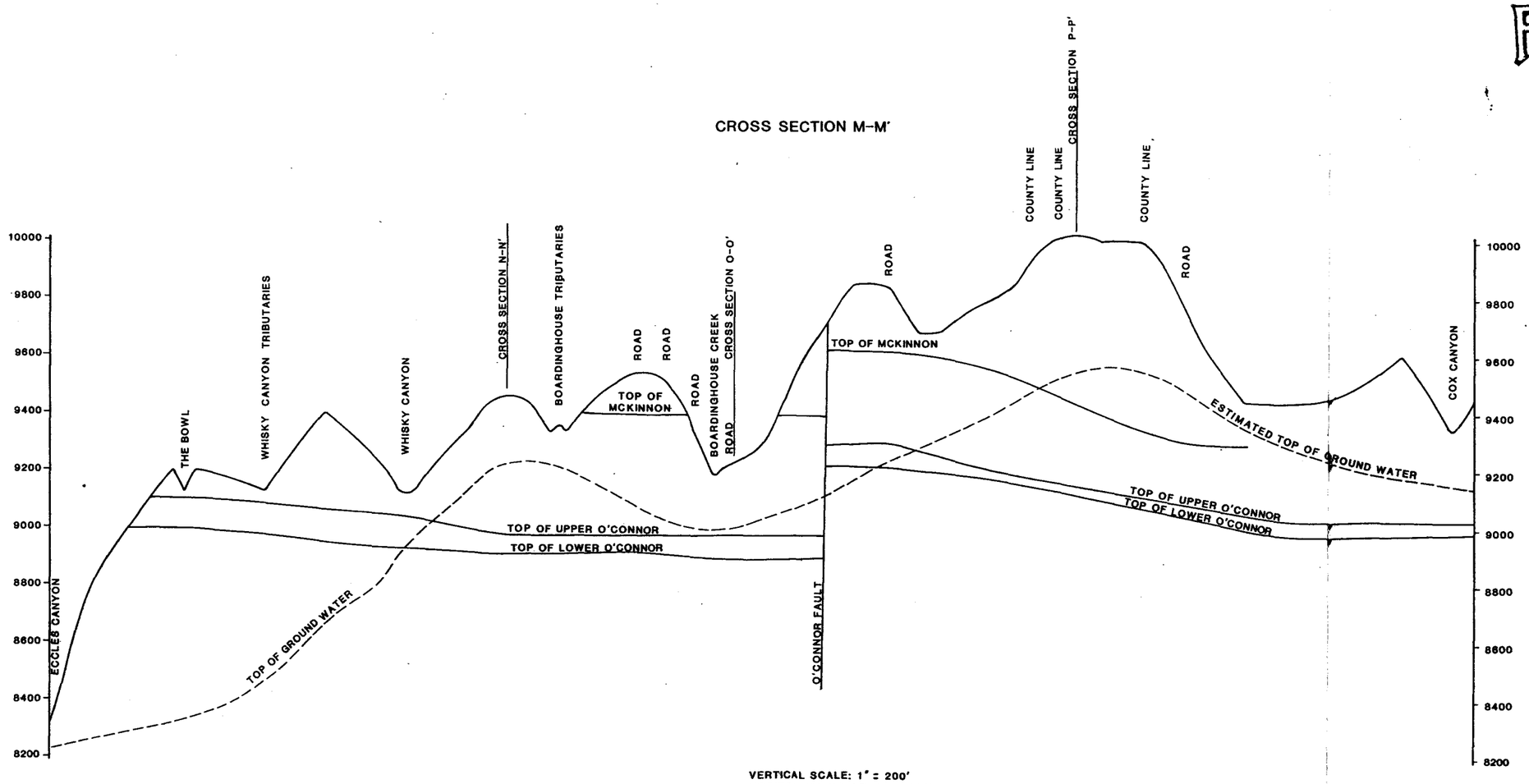
CROSS SECTION M-M'



VERTICAL SCALE: 1" = 200'
HORIZONTAL SCALE: 1" =1000'

622.200

NOTE: LOCATION OF CROSS SECTION SHOWN ON MAP 622.200a

CERTIFICATION

I certify that this figure was reproduced according to the best geologic information available as provided by Valley Camp of Utah, Inc.

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VALLEY CAMP OF UTAH, INC.

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TITLE: FIGURE R645-301-622.200j GEOLOGIC/HYDROLOGIC CROSS-SECTION M-M'

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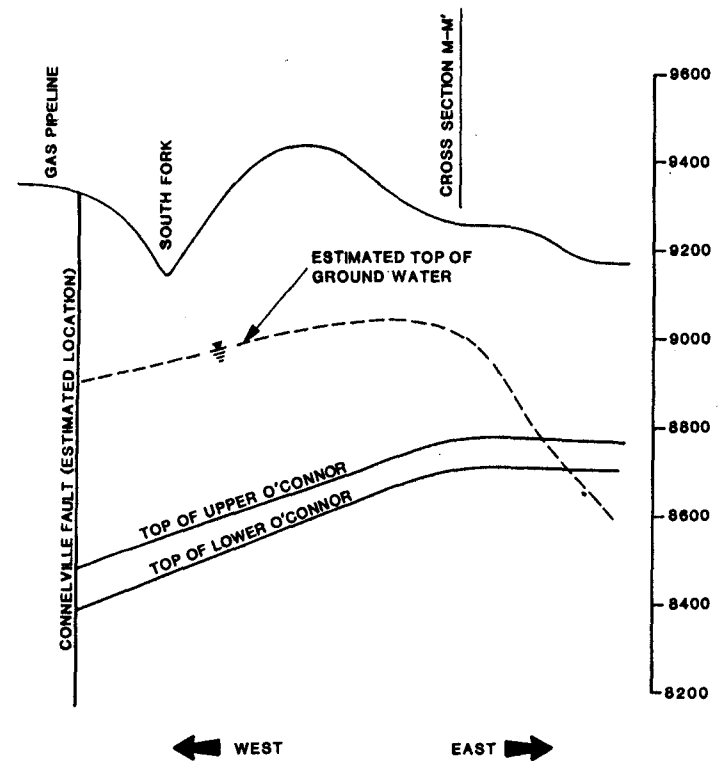

FIGURE 622.200k
GEOLOGIC/HYDROLOGIC
CROSS SECTION N-N'

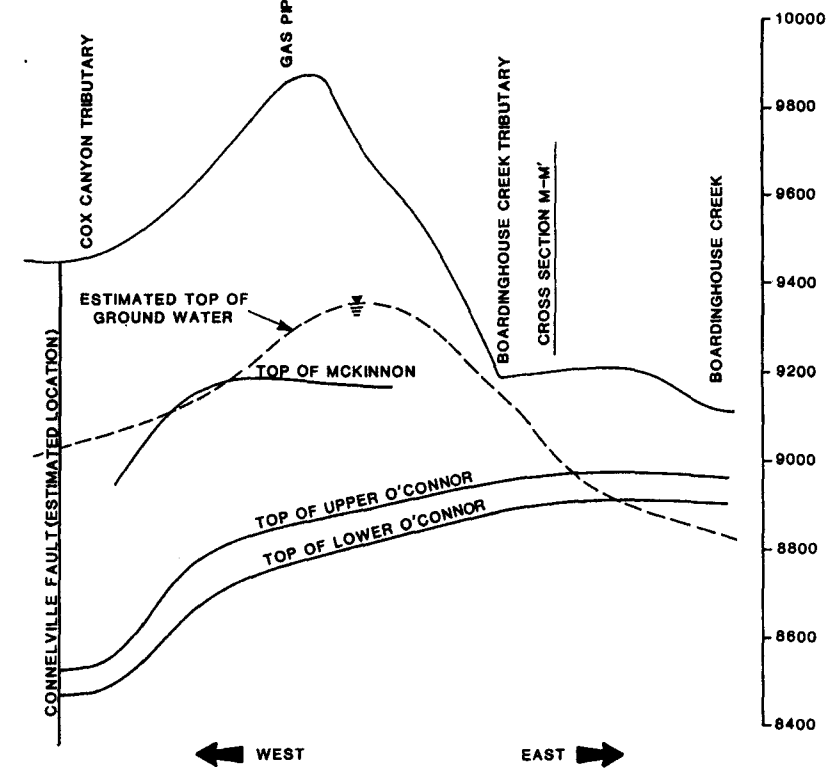

FIGURE 622.200l
GEOLOGIC/HYDROLOGIC
CROSS SECTION O-O'

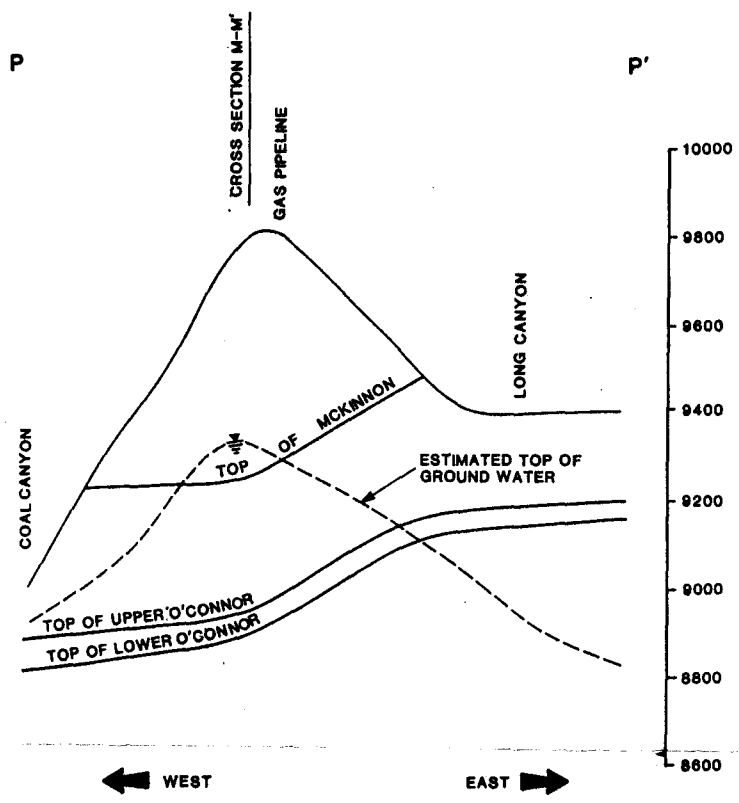

FIGURE 622.200m
GEOLOGIC/HYDROLOGIC
CROSS SECTION P-P'

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NOTE: LOCATION OF CROSS SECTIONS SHOWN ON MAP 622.200a

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VALLEY CAMP OF UTAH, INC.

SCOFIELD ROUTE, HELPER, UTAH 84526

TITLE:
FIGURES R645-301-622.200k
TO R645-301-622.2000m
GEOLOGIC/HYDROLOGIC
CROSS SECTIONS N-N', O-O' & P-P'

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HANSEN ALLEN & LUCE Salt Lake City Utah

SCALE: 1" = 1000' H, 1" = 200' V

SHEET 1 OF 1

007.11.100.010

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R645-301-700. HYDROLOGY.

710 thru 713. INTRODUCTION.

All materials and data requiring certification have been certified in accordance with the requirements of 712 as appropriate. Individual certification statements can be found on the appropriate drawings, at the head of the hydrologic section, and at the beginning of each appendix where required.

Valley Camp of Utah Inc. has five sedimentation ponds located within the permit area. Ponds 001A through 004A are of the dirt embankment fill type and Filter Pond 005A is a concrete pond. All sedimentation ponds are not subject to MSHA or CFR 30 and will be inspected quarterly by a qualified individual assigned by the coal company for appearance of structural weakness and other hazardous conditions. All sediment ponds will be inspected annually by a certified professional engineer and an annual summary of such inspection will be provided to the UDOGM and a copy will be retained at the mine office.

Other specifics related to the general requirements of these sections are given in the sections referenced therein.

720. ENVIRONMENTAL DESCRIPTION.

721. GENERAL REQUIREMENTS.

GENERAL SURFACE HYDROLOGY

For purposes of discussion within this hydrology section, the Mine Permit Area has been separated into two distinct areas. The larger of the two areas (referred to in both the geology and hydrology sections as the Belina Permit Area) lies to the west of Pleasant Valley and Mud Creek and contains the majority of the total Mine Permit Area. The second and smaller area is associated with the Valcam Loadout Facility and General Office Area (referred to as the Valcam Permit Area) and is located along Mud Creek. These two areas are shown on Ground and Surface Water Sampling Location Map 722.100a.

The total Mine Permit Area is situated in the headwaters of the Price and San Rafael river basins, with the Carbon-Emery county line marking the watershed divide. The Belina portion of the Mine Permit Area crosses over a total of seven small watersheds. Four of the seven are east facing drainages with the remaining three being west facing drainages. East facing drainages include Eccles Canyon, Boardinghouse Canyon, Finn Canyon, and Long Canyon. West facing drainages include Burnout Canyon, James Canyon and Coal Canyon. The Valcam portion of the Mine Permit Area crosses over a total of four small watersheds. Green Canyon is an east facing drainage and the remaining three (Broads Canyon and two unnamed watersheds) are west facing drainages. Local perennial streams which may potentially be impacted by mining include Upper Huntington Creek, Eccles Creek and Mud Creek. According to previous efforts including the original Technical Assessment completed by OSM and Environmental Impact Statement, Boardinghouse Creek and Whisky Creek are not perennial. At times, much if not all of the flow which is recorded in Whisky Creek originates from within the mine through Filter Pond 005A.

Approximately three quarters of the surface water runoff from the total Mine Permit Area drains to the east through Eccles Creek and other smaller tributaries of Pleasant Valley and Mud Creek. These waters pass through Scofield Reservoir before entering the Price River. The remaining area not tributary to Scofield Reservoir drains to the south and west towards the San Rafael River via Upper Huntington Creek and Electric Lake.

Snowmelt is the primary source of water for the perennial streams in the two major drainage basins with summer precipitation usually producing little runoff (U.S. Geological Survey, 1979). Intermittent streams are also abundant in the Price and San Rafael river basins, existing primarily at lower elevations where evapotranspiration significantly exceeds precipitation.

VEGETATIVE COVER

The majority of the total Mine Permit Area is covered with the conifer-aspen vegetative type, with a small portion of the land being covered with sagebrush and meadow communities (Bentley et al., 1978). Because of the depth of soil, moderate inherent soil fertility (Rapin, 1977), and high precipitation, the area is abundant in species.

Aspen Communities occur primarily along the ridges and down the drier slopes to the canyon bottoms. Spruce-fir types are present on north facing slopes where evaporation is low due to the low angle of incidence of the sun's rays and on the west facing slopes where the water supply is more abundant due to the westerly dip of the strata. Sagebrush communities fringe and intermix with the aspen type.

Productivity and percent cover over the area appear to be generally high. This vegetative cover benefits the local hydrologic system, according to Storey et al. (1964) by:

1. Building up and maintaining the organic matter content of the soil, thus developing a more open soil structure which increases infiltration and the moisture storage capacity of the soil as well as protects the surface from the erosive forces of runoff and rainfall impact.

2. Keeping the water spread out over the land, thereby slowing runoff and allowing more time for adsorption, resulting in increased infiltration and decreased overland flow (with its attendant erosion and gully formation): and

3. Shading the ground and minimizing wind movement, reducing snowmelt rates and promoting infiltration.

WATER QUALITY

In general, the chemical quality of water in the headwaters of the Price and San Rafael river basins is excellent. However, this quality rapidly deteriorates downstream as the streams cross shale formations (particularly the Mancos Shale) and receive irrigation return flows from lands situated on Mancos derived soils (Price and Waddell, 1973). Within the Price River Basin, for example, Mundorff (1972) reports that the Price River and its tributaries generally have a dissolved solids content of less than 400 milligrams per liter and are of the calcium bicarbonate type within the upper regions of the Price River drainage. This is consistent with data collected

by the applicant which is discussed in detail in Section 724. Water originating on or traversing Mancos shales within lower reaches of the Price river are of a lower quality and are of the calcium-magnesium-sodium-sulfate type. Typical TDS concentrations within these lower reaches in the area of Wellington are approximately 1700 mg/l. Downstream stations such as at Woodside (located approximately 22 miles upstream from the confluence of the Price River with the Green River) have weighted average TDS concentrations generally between 2000 and 4000 mg/l and consist mostly of sodium sulfate type waters. Data from this location confirms a pattern of rapid downstream water quality degradation.

Sediment yield from the upper portions of the two major basins is probably negligible (Mundorff, 1972). According to the U.S. Soil Conservation Service (1975), erosion rates in the Price and San Rafael river basins vary from 0.1 to 3.0 acre feet per square mile per year. The bulk of the sediment yielded each year at the mouths of major rivers comes from limited areas covered with highly erodible shales (Mundorff, 1972) and not in the upper elevations characteristic of the total Mine Permit Area.

722. CROSS SECTIONS AND MAPS.

Cross sections and maps as required are provided in sections 722.100 through 722.500.

722.100. LOCATION AND EXTENT OF SUBSURFACE WATER.

REGIONAL GROUND WATER HYDROLOGIC SYSTEM

The principle factor controlling the occurrence and availability of ground water in any area is geology. As noted by Price and Waddell (1973), nearly all of the region surrounding the total Mine Permit Area is underlain by rocks of continental and marine origin, consisting predominately of interbedded sandstones and shales. Although some of the sandstones in the region serve as the principal water bearing strata, their ability to yield water for extended periods of time is largely controlled by the existence of relatively impermeable interbedded shale layers, which prevent the downward movement of a significant amount of water.

According the U.S. Geological Survey (1979), ground water in the region exists under water table, artesian, and perched conditions. Water table conditions exist primarily in shallow alluvial deposits along larger perennial streams and in relatively flat lying sedimentary rocks. Artesian conditions exist at greater depths where a confining layer overlies a more permeable member. However, pressures are generally not sufficient to produce flowing wells. Perched or impeded conditions exist where the confining layer lies beneath the water bearing strata.

Because of the high annual precipitation, the Book Cliffs and the adjacent Wasatch Plateau (where the Mine Permit Area is located), act as recharge areas for regional ground water systems (Price and Arnow, 1974). However, only a small portion of the annual precipitation, probably much less than five percent, recharges the ground water supply (Price and Arnow, 1974; U.S. Geological Survey, 1979). Although the depth of water infiltrating through the surface to saturated beds is small (due to the presence of the relatively impermeable shale layers near the surface over much of the area), the total recharge volume from the region is significant because of the areal extent of the zone of recharge.

Price and Arnow (1974) indicate that properly constructed wells in the Price and San Rafael river basins would have only limited yields (normally less than 50 gallons per minute). Wells immediately adjacent to the Mine Permit Area could normally be expected to yield less than 10 gallons per minute. Increased yields could be expected from wells penetrating highly fractured sandstones.

Rocks in the mountainous areas near the Mine Permit Area generally have low specific yields (0.2 to 0.7 percent) and low hydraulic conductivities (Price and Waddell, 1973). The volume of recoverable water in the area is small, averaging less than 600 acre-feet per square mile in the upper 100 feet of saturated rock (Price and Arnow, 1974).

The quality of ground water in the Price and San Rafael river basins deteriorates with the distance downstream much the same as surface water. Dissolved solids contents in ground water often range from less than 250 mg/l near the Mine Permit Area to 3,000 mg/l near the confluence of the rivers with the Green River (Price and Waddell, 1973). This increase in dissolved solids concentration is the result of increased contact of water and rock as travel distance increases. Saline shales contribute the major portion of the dissolved constituents found at lower elevations.

A 1986 report by the USGS (Water-Supply Paper 2246) identifies the Blackhawk Formation and Starpoint Sandstone as the exposed strata in the Valcam Loadout Facility area, with the Starpoint Sandstone exposed west of the Pleasant Valley fault and the Blackhawk Formation exposed east of the Pleasant Valley fault. The general significance of these layers as water bearing strata is discussed in Section 624.

The USGS report (1986) states that during periods of low flow, water in Mud Creek is derived principally from seepage from the Star Point Sandstone and Blackhawk Formation. This report also states that seepage from the Star Point Sandstone along the Pleasant Valley fault contributes significantly to the flow of Mud Creek near Boardinghouse Canyon, upstream from the Valcam Loadout Facility. This information indicates that seepage from this fault is a local source of shallow groundwater in the area. The only specific information about shallow water bearing strata in the vicinity of the Valcam Loadout Facility came from the well log of a well drilled in 1987 by the LDS Church (Water Right No. 2475). This well log is found in 1993 Appendix 725.100 and indicates the well intercepted a water bearing layer 11 to 29 feet deep yielding approximately 2 gpm in the 10 inch diameter well.

Information about groundwater levels in the Valcam Loadout Area was obtained from well logs which are included in 1993 Appendix 725.100 and are discussed in Section 722.400. The static groundwater levels measured in three wells at the time they were drilled were compared with water levels in Mud Creek. The relationship between the groundwater water and surface water levels leads us to believe that the creek and shallow groundwater are inter-connected, with groundwater flowing toward the creek at a gradient of about 3% to 10%. Elevations of the ground surface at the well locations were obtained from available contour maps. Table 722.100 identifies the well and ground surface information used to calculate the flow gradients.

TABLE 722.100.
VALCAM SHALLOW WATER TABLE SUMMARY

WR #	WELL OWNER	ELEVATION AT GROUND SURFACE	DEPTH TO WATER (ft)	GROUND WATER ELEV. (ft)	ELEV. OF ADJACENT MUD CREEK (ft)	DISTANCE TO MUD CREEK (ft)	AVE. GRADIENT (ft/ft)
E722	Valley Camp	7910	75	7,835	7810	250	0.10
91 200	Alpine School District	7960	100	7,860	7835	1000	0.03
E2475	LDS Church	7920	18	7,902	7850	550	0.09

The calculated flow gradients are slightly flatter than or about equal to the slope of the ground surface between the wells and Mud Creek. This relationship between the flow pattern and the topography is typical of a shallow unconfined aquifer. The direction of flow in an shallow unconfined aquifer is usually consistent with the general slope of the surface topography.

SEEPS AND SPRINGS

As an index of ground water hydrologic conditions in the Mine Permit Area, an inventory was made of existing seeps and springs on, and adjacent to the Mine Permit Area during both the low and high flow seasons of 1978 and 1979, and again in the fall of 1990. Water quality and flow data collected at selected seep and spring locations between the respective surveys is presented within Section 724.100. All seep and spring surveys were completed by traversing the area by foot. Each seep and spring location was noted on topographic mapping and discharge and quality data was collected. Based on these data, selected sampling locations were chosen to represent flow, quality, and geographic variations throughout the Mine Permit Area. Current sampling locations for the representative seeps and springs are shown on Ground and Surface Water Sampling Location Map 722.100a. A complete water quality history for each seep and spring identified is presented in 1993 Appendix 722.100a, and a more in depth discussion of water quality is presented in section 724. For additional details related to the complete seep and spring inventory taken in the late 1970's, the reader is referred to the 1980 Vaughn Hansen Associates report entitled "Hydrologic Inventory and Baseline Study of the Valley Camp Lease Area and Adjacent Areas, Carbon and Emery Counties, Utah". Because of its voluminous nature, and because additional copies of large mapping associated with the report are no longer available, the 1980 Vaughn Hansen Associates report is not included within the appendices of this MRP. However, a copy of the report is on file with the Utah Division of Oil, Gas & Mining for review by interested parties. Additional data is also available in the 1984 study completed by Cedar Creek Associates entitled "Seep and Spring Inventory and Proposed Seep and Spring Monitoring Program". A copy of this seep and spring inventory is included within 1993 Appendix 722.100b.

MAP 722.100a. Ground and Surface Water Sampling locations with Seasonal Water Quality

At the request of UDOGM, an update to these seep and spring inventories was conducted by Hansen, Allen & Luce, Inc. in the month of August, 1990. The results of this effort are

summarized on Map 722.100b. The map has been prepared to show field water quality data as collected at each spring site during both the original and 1990 seep and spring inventories. Field data shown includes (where available) spring number, date, flow, air and water temperature, conductivity and pH. It is interesting to note that flow at some of the springs has increased between the seep and spring inventories in spite of current drought conditions. It is also interesting to note that some new springs were also found during the 1990 inventory. These new springs can be identified on Map 722.100b by locating from the data summary those springs for which only 1990 data is available. Analyses of the data include both mapping and numerical techniques.

A survey of the seeps and springs in the Valcam Loadout Facility area will be completed at the same time the seep and spring survey is updated for the Belina Mine Area. This survey is scheduled to be completed during the summer prior to permit renewal (i.e. the summer of 1994 and every 5 years thereafter).

MAP 722.100b. Seep and Spring Survey Update

After reviewing the data from the seep and spring inventories it was decided to plot by color all springs which were noted to have an increase in flow versus those which were noted to have a decreased in flow over the period between 1979 and 1990. This was done to investigate whether there was any pattern to the changes in flow which could be attributable to the mining effort. All springs which showing an increase in flow were plotted with a blue marker, those showing a decrease in flow were plotted in red. No correlation to flow variation as a function of horizontal distribution could be identified from the map over the entire Mine Permit Area. A check in the variation of spring flow in the vertical plane was also completed by plotting spring elevations on an X-Y scatter plot. The scatter plot likewise showed no variation between drier and wetter springs as a function of elevation.

A numerical analysis was also made of spring flows for which 1979 and 1990 fall data exist. By limiting the analysis to these springs only, a relative comparison of overall changes in flow was possible. The comparison of fall 1979 to fall 1990 spring flows reveal that there has been an overall decline in spring flow of approximately 33 percent. This drop in flow corresponds relatively closely with the drop in precipitation which has been noted within the Central Utah area over the last few years (See Table 724.411). It must be stated however that these declines are not consistent nor general over the entire area. If the data is broken down into total 1979 (spring and fall) data versus fall 1990 data it is found that there was a 74 percent decrease in flows over the last 10 years. This data is misleading however because of the natural decrease in flows which occurs between the spring and fall seasons. A further breakdown of data utilizing only fall 1979 and fall 1990 data shows that there has in actuality been an overall increase in flows of 245 percent. In the fall of 1979 the total spring flow measured (which was found to be dry in the fall of 1990) was 8.83 gpm. New springs found in the fall of 1990 had a combined flow of 21.6 gpm, hence the 245 percent overall increase or gain in flow. In summary, it appears that changes in spring flows and their locations is occurring over the Mine Permit Area with an overall spring flow decrease of approximately 33 percent. Data shown in Table 724.411 shows precipitation decreases of 38, 46, 36, and 33 percent for the State, Nephi, Coastal States, and Cyprus Plateau stations respectively for the period of record. All of these stations show a decrease in precipitation of roughly the same magnitude as the decrease in spring flows which have been measured within the Valley Camp permit area.

As a result of the 1978 and 1979 seep and spring survey completed by Vaughn Hansen Associates, it was determined that there were in excess of 74 seeps and springs located within the Mine Permit Area, as well as 35 located in areas adjacent to the permit boundary. According to the Vaughn Hansen Associates report (1980) there was an average of one water source encountered for every 37 acres, not including perennial streams. Observations and measurements in the area also indicated that the majority of the seeps and springs continued to flow throughout the low flow period of the year. Travel distance between water supplies is therefore relatively short for the wildlife and livestock which utilize the area. The impact that a decrease in water supply resulting from a drought, mining impacts or other causes would therefore be relatively mild since other sources of water are located within the close proximity.

The 1990 seep and spring survey indicates that there were a total of 124 seeps and springs identified in the general permit area. Eighty one (65%) of these springs were flowing, 43 (35%) were dry as compared to 86% flowing and 14% dry in the fall of 1979. Again the decrease in flowing wells is believed attributable to local climatic trends because no patterns have been identified to date which correlate any of the decreases to mining activities.

Several observations should be made regarding the occurrence of seeps and springs in the Mine Permit Area. First, many springs issue near the base of a sandstone lens (where contact is made with a shale member), often a considerable distance (from a few feet to tens of feet) above the adjacent streambed. This indicates that the shale layers in the Blackhawk Formation act a impeding lenses, carrying at least a portion of the water which percolates through the soil mantle back to the surface where it is eventually discharged into an adjacent stream. Thus, because of the presence of a large amount of shale in the Mine Permit Area, ground water recharge is likely slow.

A second observation deals with the origin of the water issuing from the seeps and springs. Note that a number of springs are located at relatively high elevations. This, together with the fact that the sandstone lenses in the Blackhawk Formation are very discontinuous, implies that much, if not all, of the water found in a given spring originates in the small surface depression of basin immediately adjacent to the spring. It is therefore believed that the springs are supplied by a bedrock member which is extremely local in extent, as opposed to a larger, more regional system. The same conditions presumably apply to springs at lower elevations.

A third observation to be made concerning location is that very few seeps and springs appear to be fault related. This phenomenon has also been noted elsewhere along the Wasatch Plateau. As noted by the U.S. Geological Survey (1979), the shale layers of the Blackhawk Formation are bentonitic, tending to swell when wet and decompose into impervious clay. Apparently, fractures in the Blackhawk Formation seal readily because of the ability of the shale layers to swell and decompose, providing a barrier to water movement.

As a final observation, travertine deposits are often associated with springs in the area. Although this may suggest a deeper seated water source than a localized sandstone, Hem (1970) indicates that this may also result from the high calcium bicarbonate content of the water. This explanation is felt to be reasonable, thereby supporting the hypotheses that faults in the Blackhawk Formation are not ready conveyors of water.

Additional information related water quality of local seeps and springs will be given in section 724.100.

A map estimating localized ground water contours was prepared in September of 1980 based upon data available from both the applicant and from Coastal States Energy reports. Subsequent to that time only limited ground water data has been made available for a contour map update due to 1) the abandonment of local ground water wells which were utilized in the 1980 approximation, and 2) the lack of access to any remaining wells. Map 722.100c was updated in 1993 for areas where information was available. Data were obtained for five monitoring wells in the Coastal States Energy mine area adjacent to the permit area. The available information indicates a small general decline in groundwater levels in this area. Ground water contours for the Valcam Loadout area were added based on the static water levels recorded on well logs for area wells and the elevation of Mud Creek. The elevation of Mud Creek was estimated using contour maps. The elevation 7800' groundwater contour line was estimated using the elevation of Mud Creek and assuming flow gradients approximately the same as surface topography. Note that the contours generally slope to both the east and west with the local ridgeline (and also county line) forming the divide.

Although there are no recent data available from monitoring wells in the Belina Mine permit area, mining impacts on groundwater can be inferred from annual spring flow data. The spring flow data and a discussion of the flow variations are found in the annual Spring Depletion Report completed by HA&L dated December 1, 1992. This report states that most of the variations in spring flows appear to be due to natural flow factors and below average precipitation for the area. The only spring which shows evidence of significant mining impact is located along the northwestern mine permit boundary in the South Fork of Eccles Creek. It is possible that groundwater levels in this area are being impacted by mining on the west side of the fault. With this exception, it is believed that current hydrologic conditions are similar to those found in 1980, and therefore ground water contours should be similar to those identified in the 1980 analysis. The preparation of a map showing seasonal variations in ground water contours is not possible due to a lack of seasonal data.

MAP 722.100c. Ground Water Contours

722.200. LOCATION OF WATER BODIES.

Local surface water bodies located in the vicinity of the Mine Permit Area include three reservoirs and perennial stream channels. As can be seen on Ground and Surface Water Sampling Location Map 722.100a, the largest water body in the general area is Scofield Reservoir which is located approximately three miles north of the Valcam Loadout Facility. Electric Lake, a reservoir built in conjunction with the power generating facility in Huntington Canyon, and Cleveland Reservoir both lie to the south and west of the Belina Mines. Both reservoirs lie in a south, southwest direction from the Belina Mines with Electric Lake being the closest water body at a distance of approximately 4.5 miles from the mine portals, and with Cleveland Reservoir at a radial distance of approximately 6 miles. Electric Lake lies approximately one mile south and west from the far western permit boundary of the Belina Permit Area. All three reservoirs are well known recreation spots and are heavily fished during the summer months. Other local water bodies include perennial streams briefly discussed in section 721, as well as some small unnamed beaver ponds.

Irrigation diversions, stock ponds or reservoir uses within the area adjacent to the Mine Permit Area are located on Map 724.100a. A listing of water right owners for each of these diverters is provided within 1993 Appendix 722.100c.

722.300. LOCATIONS OF MONITORING STATIONS.

Elevations and locations of monitoring stations used to gather baseline data on water quality and quantity are shown in two locations. Information related to the original seep and spring inventory completed in 1978 and 1979 as discussed in section 722.100 is shown in the original report completed by Vaughn Hansen Associates (1980) and is not reproduced herein due to its voluminous and dated nature. The reader is referred to the original report as referenced for additional details should they be desired. Current surface and ground water sampling locations are shown on Map 722.100a. The locations of the seeps and springs located on the map were identified in the field through visual triangulation and altimeter readings. A brief description of each sampling location along with an explanation as to why it is currently being sampled is given in Table 722.300.

TABLE 722.300a
CURRENT WATER QUALITY MONITORING STATIONS

STATION	LOCATION	VALUE OF STATION
VC-1	Mud Creek below Valcam Loadout Facility	This station is located not only below the Valcam Loadout Facility, but also below all disturbed mine areas including Coastal States Coal operation. A comparison of data between this station and VC-2 will give an indicator as to impacts of the loadout facility.
VC-2	Mud Creek above Valcam Loadout Facility	This station is located above the Valcam Loadout Facility and is used as a baseline to compare with downstream station VC-1. If UDOGM desired, the data collected could also be compared with VC-5 and VC-10 to determine possible impacts due to other local mining operations.
VC-4	Whisky Canyon Creek above Belina Mines	This station is located above all mining activities and as such can be used as an indicator of downstream mining impacts due to the Belina mines through a comparison of data collected from station VC-5.
VC-5	Whisky Canyon Creek below Belina Mines	This station is located at the mouth of Whisky Creek and picks up water quality variations due to mining activities in the Belina area as well as impacts from the coal haul road which accesses the mine.

STATION	LOCATION	VALUE OF STATION
VC-10	South Fork Eccles Creek above Whisky Creek	This station is located above the point on Eccles Creek where Belina mining impacts could be realized. Data collected and reviewed against Station VC-5 indicates the general comparison of quality between the two streams, and the possible impact to downstream quality through mixing.
VC-11	Boardinghouse Creek	This station serves as an indicator of water quality in neighboring canyons as well as an indicator of the potential impacts to water quality caused by mining. Mining impacts identified at this location would be through the subsurface migration of water from mine tunnels to the surface stream.
VC-12	Finn Canyon Creek above Clear Creek	This station serves as an indicator of water quality in neighboring canyons as well as an indicator of the potential impacts to water quality caused by mining. Mining impacts identified at this location would be through the subsurface migration of water from mine tunnels to the surface stream.
S7-11	Section 7 T14S R7E	This station is identified so as to allow the collection of data related to the migration of subsurface water from the mine area to adjacent areas. It also serves as an indicator of climatic changes and the impact of weather and subsidence on spring flow.
S24-12	Section 24 T13S R6E	This station is identified so as to allow the collection of data related to the migration of subsurface water from the mine area to adjacent areas. It also serves as an indicator of variation noted resulting from climatic changes, and as a gauge of possible, impacts of subsidence on ground water movement.
S25-13	Section 25 T13S R6E	This station is identified as an indicator of the impacts of weather on spring flow. It may also be useful in identifying any potential impacts due to subsidence in areas with heavy geologic cover.
S31-13	Section 31 T13S R7E	This station is identified so as to allow the collection of data related to the migration of subsurface water from the mine area to adjacent areas. It also serves as an indicator of impacts on flow caused by weather changes and adjacent potential subsidence areas.

STATION	LOCATION	VALUE OF STATION
S36-7	Section 36 T13S R6E	This station is identified to serve as an indicator of changes in flow resulting from climatic changes, and local subsidence.
S36-17	Section 36 T13S R6E	This station is identified to serve as an indicator of changes in flow resulting from climatic changes, and local subsidence.
S36-19	Section 36 T13S R6E	This station is identified so as to allow the collection of data related to the migration of subsurface water from the mine area to adjacent areas, as an indicator of changes in flow due to climatic fluctuations, and to note impacts caused by local and regional subsidence.
S36-23	Section 36 T13S R6E	This station is identified so as to allow the collection of data related to the migration of subsurface water from the mine area to adjacent areas, as an indicator of changes in flow due to climatic fluctuations, and to note impacts caused by local and regional subsidence.

The current number and location of water monitoring stations has changed throughout the years as the needs of the coal mine and the regulatory agency have changed. A brief description of water quality monitoring stations which have been dropped, along with a clarifier as to why they were dropped is given in Table 722.300b.

TABLE 722.300b
STATIONS DROPPED FROM MONITORING PROGRAM

STATION	YEARS MONITORED	REASON NOT CURRENTLY SAMPLED
CS-1	11/78 - 04/81	Station monitored by Coastal States Energy.
CS-7	11/78 - 09/79	Station monitored by Coastal States Energy.
S-1	09/83 - 06/84	Located within channel bottom and is impacted by stream flow.
S25-1	08/83 - 12/83	Inaccessible through much of year
S25-2	09/83 - 06/84	Inaccessible through much of year
S25-6	09/83 - 06/84	Inaccessible through much of year

STATION	YEARS MONITORED	REASON NOT CURRENTLY SAMPLED
CS-1	11/78 - 04/81	Station monitored by Coastal States Energy.
S32-3	10/83 - 06/84	Springs owned and operated by Scofield City and are inaccessible to sampling because of the removal of sampling overflow pipes.
UPL-3	07/74 - 08/79	Maintained by Utah Power and Light.
UPL-10	06/78 - 08/79	Maintained by Utah Power and Light.
VC-001*	09/77 - 10/83	Number changed to UPDES No. 005A located at Filter Pond 005A discharge.
VC-002	09/77 - 05/78	Pumping halted out of mine workings. No longer discharging.
VC-3	12/75 - 06/77	Mine water no longer discharging.
VC-3A	08/75 - 06/78	Mine water no longer discharging.
VC-6	06/76 - 07/87	Station monitored by Coastal States Energy.
VC-7	01/76 - 11/76	Impacts noted at this station are better detected at Station VC-11.
VC-8	01/76 - 06/77	Impacts noted at this station are better detected at Station VC-12.
VC-9	01/76 - 04/81	Station monitored by Coastal States Energy.
VC-13	02/80 - 06/84	Station outside probable area of impact for this permit period.
VC-14	04/80 - 06/84	Total mining impacts of the Belina mines is better recorded at station VC-5.
W19-1	12/79 - 06/84	This well now provides culinary water to the bath house. Opening the well to collect a water level sample could create a health threat to those who now depend upon the supply.

* Now UPDES Discharge Station 005A.

722.400. LOCATION AND DEPTH OF WATER WELLS.

Three wells have been drilled by the applicant in the permit area, two at the Valcam Loadout Facility and one on the south side of Whisky Creek near the Belina mine. The first well was drilled in 1974 near the bottom of the undisturbed area bypass ditch UDD-1 in the Valcam