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PLAN FOR DISPOSAL OF ROCK WASTE

SKYLINE MINE

I. INTRODUCTION

Coastal States Energy Company ("Coastal") proposes to develop a rock waste disposal site at a location southeast of Scofield, Utah. The facility is required for the disposal of rock wastes to be generated from the Skyline Mines during the mines' developmental and operational phases. Coastal believes that the proposed site is the best available for disposal of these wastes because of the pre-existing condition of the site, the potential for enhancing a previously degradated area, and the availability of adequate space for such disposal.

Coastal proposes to haul the rock wastes by truck from the Skyline Mine Site (portal area) and the unit train loadout facility to the waste disposal area. An operation plan has been developed as part of this application in order to establish proper techniques for disposal of the rock waste. A reclamation plan is also incorporated to provide satisfactory final reclamation. The disposal site has been designed to facilitate proper management and operation of the overall disposal process as well as successful reclamation and revegetation. No sanitary waste will be disposed of at the site.

The disposal site will require the use of approximately 2.16 acres of land located 3.6 air miles from the mine site (see Map 1). The right of access and use of the lands has been granted to Coastal by the Estate of George Telonis by lease agreement dated _____. The disposal area is accessed by an existing road which will be upgraded (see Maps 1 and 3). The proposed site preparation, including upgrading of the road is presented in the section entitled, "Development and Operations Plan."

The proposed site is part of a larger area previously disturbed by surface

and underground mining and never reclaimed. Coastal believes that a properly designed and operated facility will not further degradate the environmental state of the area but, rather, will by way of backfilling the abandoned strip pit, grading, seeding and other reclamation techniques greatly improve a significant portion of the previously disturbed area. Preliminary investigation of the sites' potential for reclamation has been prepared independently and is presented in Appendix 1.

II. DESCRIPTION OF SITE

The general location of the waste disposal site is shown on the USGS 7-1/2 minute Scofield quadrangle map (Map 1). The land to be affected by the disposal of waste is located in the SW¼ of the NW¼ of Section 4, Township 13 South, Range 7 East, Carbon County, Utah. The total affected acreage including the portion of the access road to be permitted is approximately 4.05 acres. The Estate of George Telonis owns the surface of the lands to be affected and the Western Reserve Coal Company owns the minerals in the subject lands and adjacent areas. The legal description of the area to be utilized by Coastal is:

A. Access Road:

?

B. Disposal Site:

The proposed disposal site is approximately 2.16 acres in size and located in a small canyon approximately one-half mile from Scofield, Utah (Map 1). The site is a part of a larger area disturbed by surface mining and never reclaimed (see Aerial Photograph, Map 2). The area to the north of the pit is underlaid by

abandoned mine workings in which the remaining coal pillars are burning and the products of combustion are being vented to the surface. The coal fires and resulting subsidence have produced cone-shaped depressions on the slope to the north of the surface mined area. The unreclaimed area and the coal fires have caused unsightly and hazardous conditions to exist in the area.

Reports have been prepared for Coastal (presented as Appendix 2) detailing the existing vegetation and soils of the area to be affected by the proposed disposal. Since the previous mining activity left the area in very poor condition, the existing baseline information is of little use in establishing reclamation goals for determining the success of reclamation efforts. Portions of the surface to be affected have been used for grazing although the pre-existing conditions (lack of reclamation and underground coal fires) has greatly reduced the area's potential for grazing or for any other use.

May? OK if ROW area is resolved

Investigations as to potential cultural resources within the area to be affected and adjacent areas have been conducted. Results of these investigations are presented as Appendix 3. Results of the cultural resource investigation were transmitted to the State of Utah Historical Preservation Office (SHPO) concurrently with a request for approval, which was granted on November 12, 1981 (Appendix 3).

May

No aquatic resource inventories have been prepared due to the intermittent flows of water in the study area. Water is present only for very brief periods during and immediately following precipitation events and/or during spring runoff.

Wayne - a problem?

The climate of the study area is similar to that described for the lower elevations of the Skyline permit area. No additional monitoring is proposed.

Adequate?

Two previously drilled exploratory holes in the general area of the proposed

disposal site provide the basis of the available geological information (see Appendix 4). Map 1 presents the location of the exploratory holes in relation to the area to be affected.

General Geology of the Proposed Rock Disposal Site

The coal-bearing Blackhawk Formation makes up the surface of the proposed rock disposal site. This formation consists of alternating, laterally discontinuous layers of sandstone, siltstone, shale, and coal. Only occasional sandstone ledges are exposed at the surface of the proposed site, with the remaining surface being covered with up to 20 feet of soil and weathered rock debris.

Two mineable coal seams occur beneath the site, including the Upper and Lower O'Connor Seams. The pertinent data for these coal beds is as follows:

Coal Bed	Thickness	Depth Below Surface
Upper O'Connor	8.0'	45'
Lower O'Connor	18.0'	130'

Four faults of undetermined displacement have been mapped near the proposed site. These faults are generally north-south trending and have acted as local barriers to mining in coal mines near the site.

Conversations with Mr. Frank Helsten of Scofield, Utah, on September 17, 1981, and May 17, 1982, revealed that the strip mining work was done from 1948 to 1950. Mr. Helsten was the shot hole driller and indicated that no abandoned underground workings were intercepted when drilling the seam lying 45 feet beneath the floor of the pit. Mining of the below-lying seam was planned but not accomplished due to economic conditions at the time.

does this imply that it is safe to assume that no workings

Due to the existence of coal fires, no hydrologic information is available for

the quality and quantity of the ground water of the area. Coastal believes that the proper sealing of the rock waste containment area, as outlined in the Development and Operations Plan, will prevent the communication of any accidental ignitions of the rock/coal waste into the adjacent coal seams, thereby eliminating degradation of the ground water resources beyond the effects of the existing underground coal fires.

No surface water information is presented herein due to the intermittent surface water flows in the disposal site area. Coastal proposes to redirect any surface runoff waters around the site (see Development and Operations Plan) into the original pre-strip mining drainage system in order to prevent contamination of the surface runoff by the disposal activities. Coastal will also contain in a catchment basin all runoff water from within the area to be affected. Therefore, no surface water will discharge from within the disposal site.

III. DEVELOPMENT AND OPERATIONS PLAN

Site Development

The development of the proposed rock disposal site will require upgrading the existing unpaved access road to the abandoned pit as well as the development work required to convert the abandoned strip pit into a disposal site.

A. Access Road

The access road to the proposed disposal site will follow the alignment of the existing unimproved access road shown on Map 3. Approximately 3,158 feet of the unimproved pre-existing road will be upgraded to comply with the standards set forth for Class II roads in UMC 817.160 to 817.164, inclusive. The gravelled

surface road will be approximately 16 feet wide, upon completion of the road. A temporary gravelled road will be developed using a bulldozer and grader. The temporary road will comply with all standards of UMC 817.160 to 818.167, including 817.162(c) as to temporary erosion control. A cross section of the upgraded road is presented in Figure 1. Following grading, sufficient locally derived gravel will be spread uniformly to provide a layer four inches thick.

B. Disposal Site

The preparation of the proposed disposal site will entail:

1. Emplacement of drainage controls to redirect surface waters around the site and into the original, pre-strip mining drainage system.
2. The emplacement of non-combustible fill material to form a barrier across the floor and along the walls of the abandoned strip pit where coal seams were exposed during prior mining activities.
3. The construction of a fence and gate to control access to the disposal site.

The present course of the drainage from the canyon to the east of the abandoned strip pit will be re-routed around the abandoned strip pit in order to redirect the flow into the original stream course and, therefore, around rather than into the proposed disposal site. An open channel and dip will be used to redirect the water flow (Maps 3 and 4). Calculations of 20-year 24-hour precipitation event flow and the design of the channel are presented in Appendix 5.

The compacted non-combustible fill will be emplaced along the floor and walls of the pit in order to isolate the coal seams in the highwall from the material to be disposed of in the pit. Approximately two feet of compacted material will be placed on the floor and three feet along the wall, where required. The material to isolate exposed coal seams along the walls will be built up and compacted in lifts during normal rock disposal operations after an initial 3-4 feet high barrier is constructed. Drainage onto the floor of the pit will be directed to a pre-existing sump at the east end of the abandoned strip pit (Map 4). Cross sections through the pit and sump are shown in Maps 5 and 6. A fence and gate will be installed in order to prevent access to the rock disposal site (Map 4).

Operations Plan

A. Access Road

During operations the access road will be maintained using a road grader and any other equipment which may be necessary to ensure compliance with the requirements of UMC 817.165. Drainage ditches and dips will be maintained to ensure proper functioning. Additional gravel will be selectively placed as required to ensure a minimum of four inches of road base gravel on the road.

B. Disposal Site

The underground development waste rock and excess fill material from the unit train loadout area will be emplaced and compacted in layers not exceeding two feet in thickness. A bulldozer will be used to level, grade and compact the material. As layers of compacted

material are added to the floor of the pit, the three-feet thick non-combustible barrier where required to isolate any exposed coal seams, will be added.

The compacted layers of fill will be sloped at an angle 2-3% to the east in order to direct any drainage from the pit floor into the sump at the east end of the pit. The sump will be pumped out if filled and the water will be hauled to the loadout sedimentation pond. The non-combustible barrier material will be derived from excess fill material at the unit train loadout site.

IV. RECLAMATION PLAN

Reclamation activities will be conducted on portions of the affected areas as those portions are filled to design capacity. The final contours of the rock disposal site are presented in Map 7. A revegetation plan has been prepared for Coastal by Stanley T. Welsh of Endangered Plant Studies, Inc., and is presented as Appendix 1.

Coastal proposes to perform the revegetation of the waste disposal area in successive stages with a stage representing the portions of the site that have been filled to design capacity. When a stage is completely full, that area will be graded and topsoil will be placed over the waste rock. As recommended, at least one foot of topsoil derived from aspen or sagebrush vegetative type areas will be placed on the fill area. The soil will be brought into the disposal site from other areas, e.g., unit train loadout or mine site stockpiles, since previous mining activity has rendered none available at the site. The soil will be spread in a manner to provide a roughened surface, so that seed and mulch can remain during germination and

initial growth of the seedlings. Raking the surface prior to planting seeds will provide the necessary roughened surface.

Revegetation will be accomplished following the ~~orderly placement~~ and scarification of the topsoil during spring, summer and/or autumn. Fertilizer will be applied at the rate of 150 pounds of available nitrogen per acre. The species to be planted and the rates per acre are as follows:

Grass species	Lbs./Acre
Kentucky Bluegrass (Poa pretenis)	1
Western Wheatgrass (agropyron smithii)	4
Western Wheatgrass (Bromus carinatus)	3

Forb species	Lbs./Acre
Blue penstemon Penstemon strictus	1
Blue flax (Linum Perenne)	1
Cicer milkvetch (Astragalus cicer)	1
Alfalfa (Medicago stiva)	1
Yellow sweetclover (Metilotus officinalis)	1
Yarrow (Archillea millefolium)	1

Shrub species	Lbs./Acre
Rubber rabbitbrush (Chrysothamnun nauseosus)	2
Big Sagebrush (Artemisia tridentata)	2

(Pounds per acre are in pure live seed)

The seeds will be sown by hand (broadcast) and a straw or fiber mulch will be placed atop the seeded surface. No fiber matting will be used since all slopes should be less than 1.5h:1v. Use of irrigation is not anticipated unless initial revegetation attempts are unsuccessful. Reclamation activities will continue until the new vegetation has established itself to a level equal to that on adjacent, undisturbed sagebrush and bunch grass covered lands. All ditches and retaining walls

need drainage control until veg. success is achieved?

will be reclaimed just following the final storage of rock waste. No reclamation is planned for the access roadway.

remains to be checked.

Coastal believes that the bonding level now covering the reclamation of the Skyline mining operations is of sufficient magnitude to cover Coastal's obligations for the reclamation of the site as well as all reclamation for the previously permitted areas. Coastal's contention is based upon the fact that actual disturbed acreage at the Skyline operations is less than that previously projected to be disturbed and bonded, especially the 15 acres included in the UDOT road from the unit train loadout to the Skyline mine site. Coastal's obligation is to cover all reclamation responsibilities in relation to the areas to be affected by the access road rock waste disposal site. Coastal's obligations, however, are not to include liabilities arising from the pre-existing conditions of the property, e.g., the effects of the coal fires upon the affected or adjacent lands, or the lack of the reclamation of the higwalls left by previous surface mining which may remain following completion of Coastal's rock waste disposal activities.

Fair enough but why not take care of this to demonstrate civic spirit?

APPENDIX 1

REVEGETATION PLAN -

WASTE ROCK DISPOSAL AREA, SKYLINE MINE

(T13S, R7E, SEC 4)

CARBON COUNTY, UTAH

Prepared for -
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23 November 1981

REVEGETATION PLAN

Introduction.- The proposed waste rock disposal site for the Skyline Mine of Coastal States Energy Company is situated in the southwest quarter of the northwest quarter of Section 4, T13S, R7E. The site is in a small canyon approximately one-half mile southeast of Scofield, Carbon County, Utah. The actual disposal site is approximately two acres in size, but is situated within a disturbance area of an abandoned strip mine and more ancient underground workings. The current vegetation in the abandoned workings and environs consists of cheatgrass and rubber rabbitbrush. The modified vegetative type is the result of the strip mining and underground mining. The underground mine is burning, and products of combustion are vented to the surface. Subsidence has occurred, producing cone-shaped depressions on the slope to the north of the strip-mine quarry. The area which has been affected is marked by the perimeter of cheatgrass. Evidence indicates that the strip-mine area previously supported a sagebrush community on the southwest slope, and a mixed aspen and white fir community on the north-facing slope. The total area to be reclaimed awaits final decisions on extent of the fill and dimensions of the access road leading into the canyon lateral which supports the disposal site. Total area involved will not exceed 12 acres.

Access road shall not be included here.

Revegetation plan and schedule.- It is proposed that the revegetation of the waste rock disposal area be undertaken in successive stages. If it is possible to fill the strip mine cut from one end, bringing that end to contour with the previous slope angle, then topsoil

could be placed and planting completed as the cut was filled. Revegetation should be attempted as soon as possible following placement of topsoil over the waste rock. Revegetation can be successfully accomplished in spring, summer, or autumn. The actual timing will await the orderly completion of filling with waste rock and placement of topsoil. The life of the fill area is expected to last for the entire period of mine operation.

Since the profile of the fill slope will trend in a westerly direction, it is recommended that revegetation should involve mainly shrub, grass, and forb species. The species to be planted and the rate per acre is presented in the following table:

Grass species	lbs/acre
Bluebunch wheatgrass (Agropyron spicatum)	3
Kentucky bluegrass (Poa pratensis)	1
Western wheatgrass (Agropyron smithii)	4
Mountain brome (Bromus carinatus)	3
Forb species	**lbs/acre**
Blue penstemon (Penstemon strictus)	1/4
Blue flax (Linum perenne)	1/4
Cicer milkvetch (Astragalus cicer)	1/4
Alfalfa (Medicago sativa)	1
Yellow sweetclover (Melilotus officinalis)	1
Yarrow (Achillea millefolium)	1/4
Shrub species	**lbs/acre**
Rubber rabbitbrush (Chrysothamnus nauseosus)	2
Big sagebrush (Artemisia tridentata)	2

(pounds per acre are in pure live seed)

The surface of the topsoil overlay should be scarified by raking prior to planting of seed. The seeds should be sown by hand, since the area to be treated is small, and a straw or fiber mulch should be placed atop the seeded and scarified surface. Slopes are not anticipated to be as steep as 1.5h:1v, and fiber matting is not recommended. Supplemental

irrigation is not thought to be necessary either, but can be used during the drier portion of the first season following planting. This will assure the establishment, and prevent occupation of the newly contoured surface by cheatgrass.

Fertilizer should be applied at the rate of 150 lbs of available nitrogen per acre. This will assure sufficient nitrogen for successful establishment, and the leguminous forbs in the seed mix will continue to supply nitrogen following the establishment of grasses and non-leguminous forbs and shrubs.

The forb species proposed above are a mixture of native species (blue penstemon, yarrow, and blue flax) and acclimatized species (cicer milkvetck, alfalfa, and yellow sweetclover). The use of acclimatized species is to provide reasonable diversity of species that are expected to thrive in this region. Native forb seed is difficult to obtain in most years, and has been impossible to obtain in sufficient quantity to satisfy requirements. Many native forb species in the region adjacent to disturbance sites will move quickly onto the fill slopes, and it is expected that they will ultimately replace the species included in initial plantings.

It is recommended that at least one foot of topsoil derived from aspen or sagebrush vegetative types be placed on all fill areas. Adequate soil can be brought from stockpiles in other portions of the project area, since there is none available in the strip-mine storage site. The soil should be spread in such a manner as to provide a roughened surface. This will allow places where seed and mulch can remain during germination and initial growth of the seedlings.

APPENDIX 2

REPORT OF VEGETATION AND SOILS, PROPOSED WASTE ROCK DISPOSAL SITE, SKYLINE MINE

November 1981

Prepared for
COASTAL STATES ENERGY COMPANY
411 West 7200 South
Midvale, Utah 84047

Attn: Mr. Keith Welsh

Prepared by
Dr. Stanley L. Welsh and Dr. Joseph R. Murdock
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129 North 1000 East
Orem, Utah 84057

INTRODUCTION

The area proposed for a waste rock disposal site lies in a small canyon east of Scofield. Burning coal beds beneath the surface have caused slumping to occur throughout the area. The south-facing side of the canyon supports a cheatgrass (Bromus tectorum) community, apparently the only vegetation compatible with the increased soil temperatures and disturbance caused by subsidence. The north-facing side of the canyon has been previously disturbed by strip mining activities. A substantial coal seam has been exploited and large quantities of substrate have been removed from the hillside creating a high vertical cliff face. It is this area that is proposed for the disposal site, and waste rock will be dumped into the abandoned workings.

It is assumed that reclamation plans will be based on adjacent natural vegetation. If the purpose of revegetation efforts is only to return the area to its present disturbed condition, very little reclamation will be required. The area is presently in poor condition and use of this site for disposal will cause very little, if any, new disturbance. With this in mind studies have been initiated in adjacent sites to determine reclamation standards to be used at the completion of operations.

SOILS

When final reclamation of the area takes place, adequate topsoil may be brought from the mine site. If additional soil is required, soil belonging to the Brycan series, which is located in local drainage areas, could be used.

Soils were correlated with aspen, fir and sagebrush communities at the top of the vertical cliff. The major soil in the area has been correlated to the Croydon series. This is the soil which now supports both the aspen and fir communities. The small section of sagebrush community has been correlated to the Trag series. Correlation was done by the Soil Conservation Service. Soils were examined on-site to verify the correlation. The soils remained, in all cases, within the range of characteristics established for the series.

Croydon Series. The Croydon series consists of deep, well drained soils that formed in residuum and alluvium weathered from sandstone. These soils are on north-facing mountain slopes. Slopes range from 30 to 60 percent. The soils have slow runoff, permeability is moderately slow and the available water capacity is 7 to 8.5 inches. The taxonomic classification is fine-loamy, mixed Argic Cryoborolls. A typical pedon is as follows.

O1—0 to 1 inches. Leaves and other plant material.

A11—0 to 4 inches. Very dark grayish brown (10YR3/2) loam, very dark brown (10YR2/2) moist; weak thick platy structure that parts to moderate fine granular; soft, friable; slightly acidic; clear smooth boundary (3 to 16 inches thick).

A12—4 to 16 inches. Very dark grayish brown (10YR3/2) loam, very dark (10YR2/2) moist; moderate medium granular structure; soft, very friable; slightly acidic; abrupt broken boundary (0 to 13 inches thick).

A2—16 to 22 inches. Pale brown (10YR6/3) heavy loam, brown (10YR4/3) moist; weak coarse subangular blocky structure; slightly hard, very friable; 20 percent gravel; slightly acidic; clear wavy boundary (3 to 11 inches thick).

B21t—22 to 28 inches; pale olive (5Y6/3) sandy clay loam, light olive brown (2.5Y5/4) moist; moderate medium subangular blocky structure; very hard, firm; common thin and many moderately thick clay films on facis of peds; slightly acidic; clear smooth boundary (3 to 10 inches thick).

B22t—28 to 40 inches. Pale olive (5Y6/3) sandy clay loam, light olive brown (2.5Y5/4) moist; moderate coarse subangular blocky structure that parts to moderate fine subangular blocky; very hard, firm; continuous thin clay films on ped facis; slightly acidic; clear smooth boundary (6 to 31 inches thick).

C—40 to 48 inches. Pale olive (5Y6/3) sandy loam, light olive brown (2.5Y5/4) moist; weak medium subangular blocky structure; hard, friable; slightly acidic; abrupt smooth boundary (0 to 22 inches thick).

R—48 inches. Weathered sandstone bedrock.

Trag Series. The Trag series consists of deep, well-drained soils that formed in material weathered from sandstone. Trag soils are on mountains and sideslopes. Slopes range from 3 to 30 percent. The soils have medium to rapid runoff, permeability is moderate, and the available water capacity is 8.5 to 10.5 inches to a depth of 60 inches. Taxonomic classification is fine-loamy, mixed Typic Argiborolls. A typical pedon is as follows.

A1—0 to 9 inches. Dark grayish brown (10YR4/2) sandy loam, very dark brown (10YR2/2) moist; weak medium subangular blocks that part to moderate fine granular structure; soft, very friable; slightly acidic; clear wavy boundary (5 to 12 inches thick).

B1—9 to 16 inches; Brown (10YR5/3) light clay loam, dark brown (10YR3/3) moist; weak medium prisms that part to moderate medium

subangular blocky structure; hard, firm; thin patchy clay films; neutral; clear wavy boundary (6 to 11 inches thick).

B2t—16 to 35 inches. Brown (7/5YR5/4) clay loam, dark brown (7.5YR4/4) moist; moderate medium prisms that part to moderate medium subangular blocky structure; very hard, firm; thin nearly continuous clay films; neutral; clear smooth boundary (13 to 23 inches thick).

C—35 to 60 inches. Brown (7.5YR5/4) sandy clay loam, dark brown (7.5YR4.4) moist; weak medium subangular blocky structure; very hard, friable; neutral.

No Family detail ?

VEGETATION

On the slopes above the vertical cliff three community types, aspen, fir and sagebrush, exist in an area approximately two hundred yards long. Because of seasonal and time constraints only measurements for tree density were taken. Other needed measurements (cover, species composition, and productivity) should be taken in the spring of 1982 during the growing season.

Two parallel transects were randomly located to traverse all three community types and measurements were taken with the point-quarter method. Tree species encountered during the sampling procedures were Populus tremuloides, Prunus virginiana, and Abies concolor.

Measurements were taken at 23 points along the transects. Adequacy of sampling was checked statistically after returning to the lab using the following formula:

$$n(\min) = \frac{t^2 s^2}{d^2}$$

where t is a constant (for shrubland or tree communities 1.282), s is standard deviation, and d is one-tenth of the sample mean. Calculations

showed that 24 points needed to be sampled in order to characterize the community at the 80 percent confidence level. The mean distance between trees was 6.6 feet. Standard deviation was 2.56.

Density or the number of individuals per acre was calculated by dividing the square of the mean distance into 43,560 (the number of square feet in one acre). The data obtained from transect measurements indicated a total of 1,000 trees per acre in these communities. Populus tremuloides accounted for 83 percent of the total, or 830 trees/acre. Abies concolor accounted for 16 percent of the total, or 160 trees/acre. Prunus virginiana accounted for 1 percent of the total, or 10 trees/acre.

SUMMARY

Soils and vegetation of the proposed waste rock disposal area have been discussed. Existing condition of the area is poor, and characterizations have been obtained from adjacent areas. The soils information was correlated by the Soil Conservation Service at a level sufficient for this study. Vegetation information is preliminary and consists only of tree density measurements. A revegetation and reclamation plan will be included in a later submittal.

APPENDIX 3

ARCHEOLOGICAL - ENVIRONMENTAL RESEARCH CORPORATION

588 West 800 South Bountiful, Utah 84010
Tel: (801) 292-7061 or 292-9668

September 22, 1981

Subject: Cultural Resource Evaluations in the U. P. Canyon Locality of Carbon County, Utah

Project: Coastal States Energy Company - Utah Fuels Company Proposed Rock Dump Zone in U. P. Canyon

Project No.: CSEC-81-6

Permit: NA, Private Land

To: Mr. Keith Welch, Coastal States Energy Company, 411 West 7200 South, Midvale, Utah 84047

Info: Mr. James Dykman, State Historic Preservation Office, 300 Rio Grande, Salt Lake City, Utah 84101

GENERAL INFORMATION:

On September 17 and 21, 1981, AERC personnel conducted a cultural resource evaluation of portions of U. P. Canyon situated east of Scofield, Utah. The purpose of the survey was to determine the location, significance, and potential for adverse affect on cultural resources by the development of a refuse rock dump zone placed on private land within the canyon. Mr. Keith Welch of Coastal States Energy Company requested that an evaluation be conducted of the access route through the canyon and the immediate surfaces around the existing open-pit mine. The existing road to be upgraded extends from Scofield up the canyon and along the south slope where a new road will terminate above the open pit.

The project location is situated on private land in the $SW\frac{1}{4}$ of the $NW\frac{1}{4}$ of Section 4 and in the adjacent $E\frac{1}{2}$ of $NE\frac{1}{4}$ of Section 5, Township 13 South, Range 7 East.

Methodology:

On September 17, AERC personnel, working under the direction of Dennis G. Weder, conducted intensive surveys of the canyon floors and all the areas around the open-pit. The survey extended some 200 meters to the east and above the pit, including the drainage and slopes where the new road will cross the dry stream channel to terminate above the large pit. Team members walked a series of 20 meter wide transects across all surfaces where disturbance or surface modification will occur. Cultural features, when observed, were noted, photographed, and located on the appropriate topographic map.

A more detailed examination of the cultural features was conducted on September 21, under the direction

of F. R. Hauck, Principal Investigator for AERC. The purpose of this second phase of evaluation was to assess resource significance and to determine potential for adverse affect that the proposed dump project might have for the cultural resources situated within the canyon.

RESULTS:

Surface survey in U. P. Canyon established the location and cultural significance of two separate sites. The historic Union Pacific Mine (AERC 627R/1) was found to be situated within the canyon, comprising a number of distinct cultural loci. This site has been given the permanent site number 42Cb333. Cultural loci for the mine site include railroad beds, ore car rail beds, railroad car scale pits and associated weigh booths (2), portals (2), tower bases (2), a series of loading trestle bases, collapsed tunnels, slag and refuse piles, trash middens, and various collapsed structures. The large pit situated above the main fork of U. P. Canyon is also part of the historic site complex. It was evidently an open-pit coal mine where the thick coal seam, situated near the earth's surface, was strip mined, probably during the 1910 to 1930 period.

Basic infomation on the mine has been provided by Doelling, who relates the following:

> "The Scofield mine, better known as the Union Pacific Mine, was one of the more successful mines of Pleasant Valley area. It was intermittently active from 1884 to 1936 in coal to 30 feet thick. A lower mine operated on the thick U. P. bed and an upper mine probably on the Castlegate 'A.' Total production is estimated just short of two million tons."

(See H. H. Doelling, 1972 Central Utah Coal Fields. Utah Geological and Mineralogical Survey, Monograph Series No. 3, Salt Lake City, page 223.)

The second site discovered during the survey consists of a large prehistoric extended campsite (AERC 627R/2) situated at the mouth of U. P. Canyon and immediately south and west of the U. P. Canyon creek. Artifacts and cultural materials on the locus indicate that the site had Archaic period and Numa occupations. The site has multiple hearth zones and contains detritus, including fragments of grinding stones. The site is relatively shallow, ranging from ten to 25 centimeters in depth. This significant cultural resource has been given the permanent designation of 42Cb334.

Site reports and a copy of this report will be forwarded to the Utah State Division of History for filing.

CONCLUSION AND RECOMMENDATIONS:

The National Register of Historic Places has been consulted and no registered sites will be affected by this project. The Scofield Cemetery, which lies about 250 meters north of the prehistoric site, is on the Utah Register of Historic Sites. The cemetery is sufficiently distant from the refuse rock-haul road and will not be adversely affected by the proposed development in U. P. Canyon.

The historic Scofield Mine site (42Cb333) is presently bisected by a dirt road which connects the ridge roads to the east and southeast above the canyon. The majority of cultural loci on this site appears to be sufficiently dispersed and outside the new road corridor and, therefore, will be preserved from direct adverse affect during road construction. Indirect impact of these features, e. g., vandalism, can be controlled by restricting access into the canyon. Two cultural features on this site will be affected by the road development and refuse dumping. These features involve the earlier railroad coal car scale-pit location, which is situated immediately adjacent on the east

side of the existing road. This locus consists of a ground level, concrete-reinforced, rectangular pit with railroad ties situated in the two ends of the pit at ground level. A loosely laid stone wall and fragments of the weigh booth are visible opposite the pit against the slope of the hill. AERC recommends that this feature be avoided during road construction. If avoidance is not practical, then the pit and adjacent wall and booth locations could possibly be buried under the new road. Burial of the locus would be preferable to removal. However, if the site cannot be buried or avoided, then careful photographic coverage and measurements of the locus should be conducted prior to its removal.

The second feature of the historic Scofield Mine which will be affected by the refuse dumping will be the large open-pit mine which is situated above the junction in the canyon. This locus is not considered culturally significant for it contains no structures or occupational debris. The pit measures about 100 to 120 meters in length by 40 to 60 meters in width, and is about 20 to 30 meters deep on the downhill side. Subsurface fires burning in the remnant coal seams are venting into the pit. These noxious fumes curtail human activity within the locality.

Should all traffic into the dump zone and into U. P. Canyon be confined to the existing road, the prehistoric site (42Cb334) will not be affected by the development as it is across the creek from the road. Should the access into the mouth of the canyon be routed to the south in order to avoid traffic on the Scofield City streets, then such a route will have direct adverse affect upon this significant resource site. If rerouting the road across the site becomes necessary, salvage excavation of the disturbance corridor should be conducted to insure preservation of important site materials and scientific data on the site.

← probable stip

With avoidance of the weigh pit on historic site 42Cb333 and avoidance of the prehistoric site (42Cb334), AERC considers the proposed development and operational phases of the dumping project to have no adverse affect for the significant cultural resources situated in the locality and recommends clearance for development. Such clearance should be based upon the recommendations made above and adherence to the following stipulations:

1. All vehicular traffic, personnel movement, and construction be confined to the locations examined and to access roads leading into these locations.

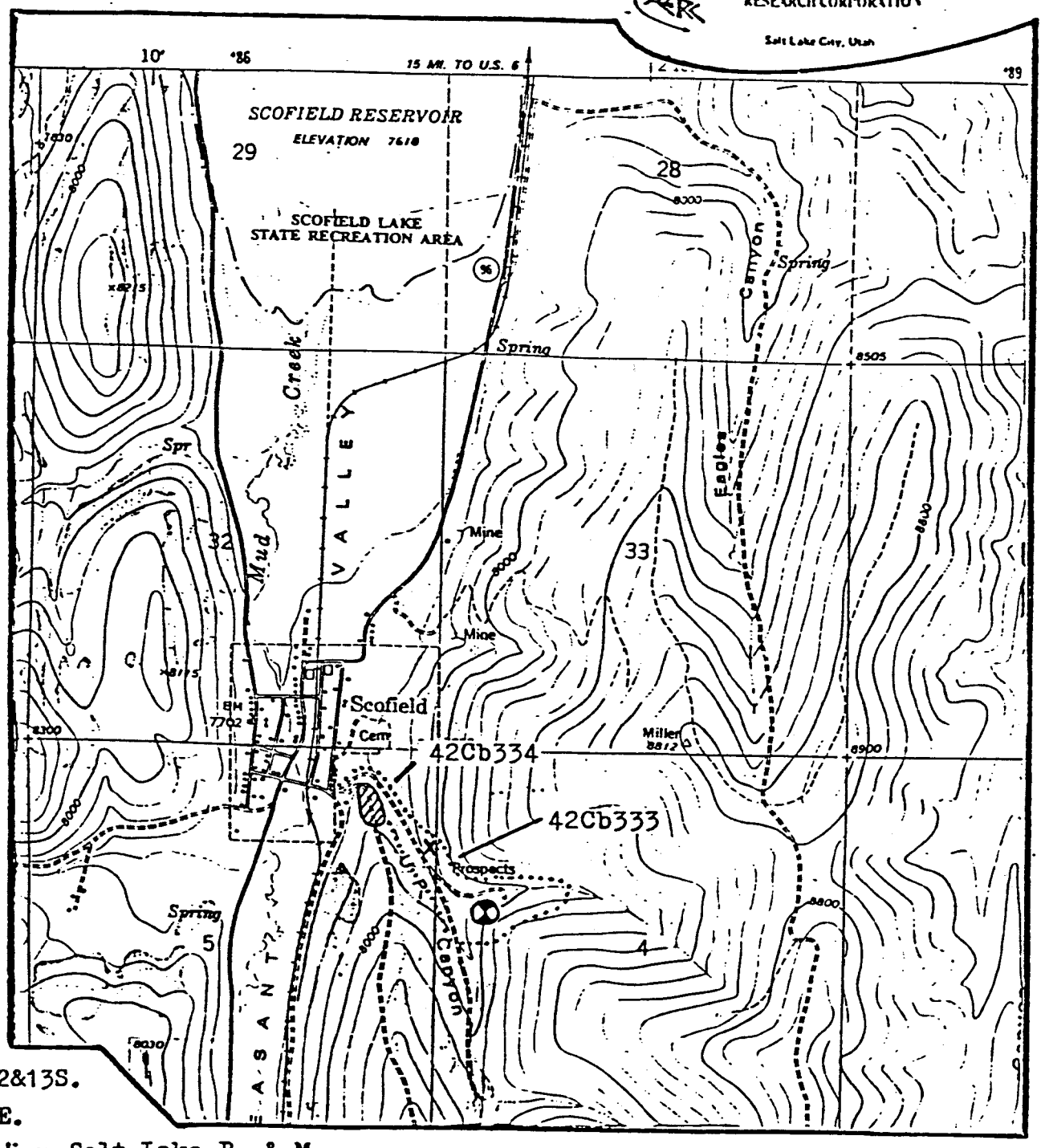
2. All personnel refrain from collecting individual artifacts or from disturbing any cultural resources in the area.

3. A qualified archeologist be consulted should cultural remains from subsurface deposits be exposed during construction work or if the need arises to relocate or otherwise alter the construction area.

F. R. Hauck

F. R. Hauck, Ph.D.
President

ARCHEOLOGICAL-ENVIRONMENTAL RESEARCH CORPORATION
Salt Lake City, Utah



T. 12&13S.
R. 7E.
Meridian: Salt Lake B. & M.

Quad: Scofield, Utah 7.5 Minute USGS

Project: CSEC-81-6
Series: Central Utah
Date: 9-22-81

CULTURAL RESOURCES IN THE U. P. CANYON LOCALITY OF CARBON COUNTY, UTAH

Legend:
- Survey zone
- Prehistoric site
- Dump zone
- Weigh scale locus

0 .5 1 mi
.5 0 .5 1Km
Scale

Coastal States
Energy Company

411 West 7200 South
Midvale, Utah 84047
(801) 566-7111

Subsidiary of
The Coastal
Corporation

November 4, 1981

Mr. Melvin T. Smith
Director and State Historic Preservation Officer
Utah State Historical Society
350 Rio Grande
Salt Lake City, Utah 84101

Dear Mr. Smith:

Coastal States Energy Company is in the process of constructing an underground coal mine in Eccles Canyon near Scofield, Utah. Clearances from your office have previously been sought and obtained for those facilities located in Eccles Canyon proper.

Negotiations with various state and federal agencies have now made it necessary to propose a waste rock disposal site located outside of the area cleared by your office. This proposed site, located in Union Pacific Canyon near Scofield has been surveyed by our archaeological consultant, AERC. For your convenience, a copy of Dr. Hauck's report is attached.

It is our request that you review this report, along with other data which you may have, and, if justifiable, that you provide this office with the necessary clearance documentation.

Your continuing cooperation is appreciated.

Sincerely,

Keith W. Welch

Keith W. Welch
Environmental Coordinator

KWW:jb

Attachment

SCOTT M. MATHESON
GOVERNOR

STATE OF UTAH
DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT

Division of
State History
(UTAH STATE HISTORICAL SOCIETY)

MELVIN T. SMITH, DIRECTOR
300 RIO GRANDE
SALT LAKE CITY, UTAH 84101
TELEPHONE 801/533-5755

November 12, 1981

Division of Oil Gas, & Mining
1588 West North Temple
Salt Lake City, Utah 84116

Re: Eccles Canyon Coal Mine, Waste Rock Disposal Site, Eccles Canyon, Near Scofield, Utah

To Whom It May Concern:

The staff of the Utah State Historic Preservation Officer received a letter from Coastal States Energy dated November 4, 1981, attaching a report of an archeological survey that took place for Coastal States Energy in relation to the development of a waste rock disposal site outside the present survey areas. The site itself is located in the Union Pacific Canyon near Scofield and was surveyed by AERC.

Our staff has reviewed the archeological document and concurs with the recommendations and the determinations of eligibility contained within the document. Therefore, our office would recommend to the Division of Oil, Gas, and Mining that if stipulations are followed the company may consider the development of this waste rock disposal site located outside the main mine plan area as adequately protecting cultural resources.

If you have any questions or concerns, please contact this office at 533-7039.

Sincerely,

Melvin T. Smith

Melvin T. Smith
Director and
State Historic Preservation Officer

JLD:lo C588/1238c

APPENDIX 4

Sanders Associates, Inc.

10 WEST CENTER STREET • KAYSVILLE, UTAH 84037 • (801) 376-9762 531-8131

DRILL HOLE REPORT

SURVEYING DATA

DRILL HOLE NUMBER S-4

NORTH CO-ORDINATE 26,928.23

EAST CO-ORDINATE 2,041.42

ELEVATION 8107

DATE SURVEYED 11-1-76

FIELD BOOK NR-13

PAGE

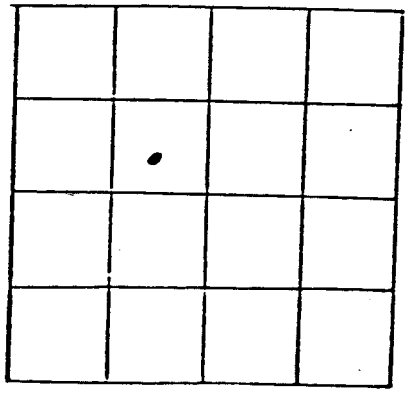
TRAVERSE POINT LOCATED FROM I-17

SURVEY CREW MEMBERS Moore
Robins
Russell

CLIENT

PROJECT NUMBER

STANDARD SECTION

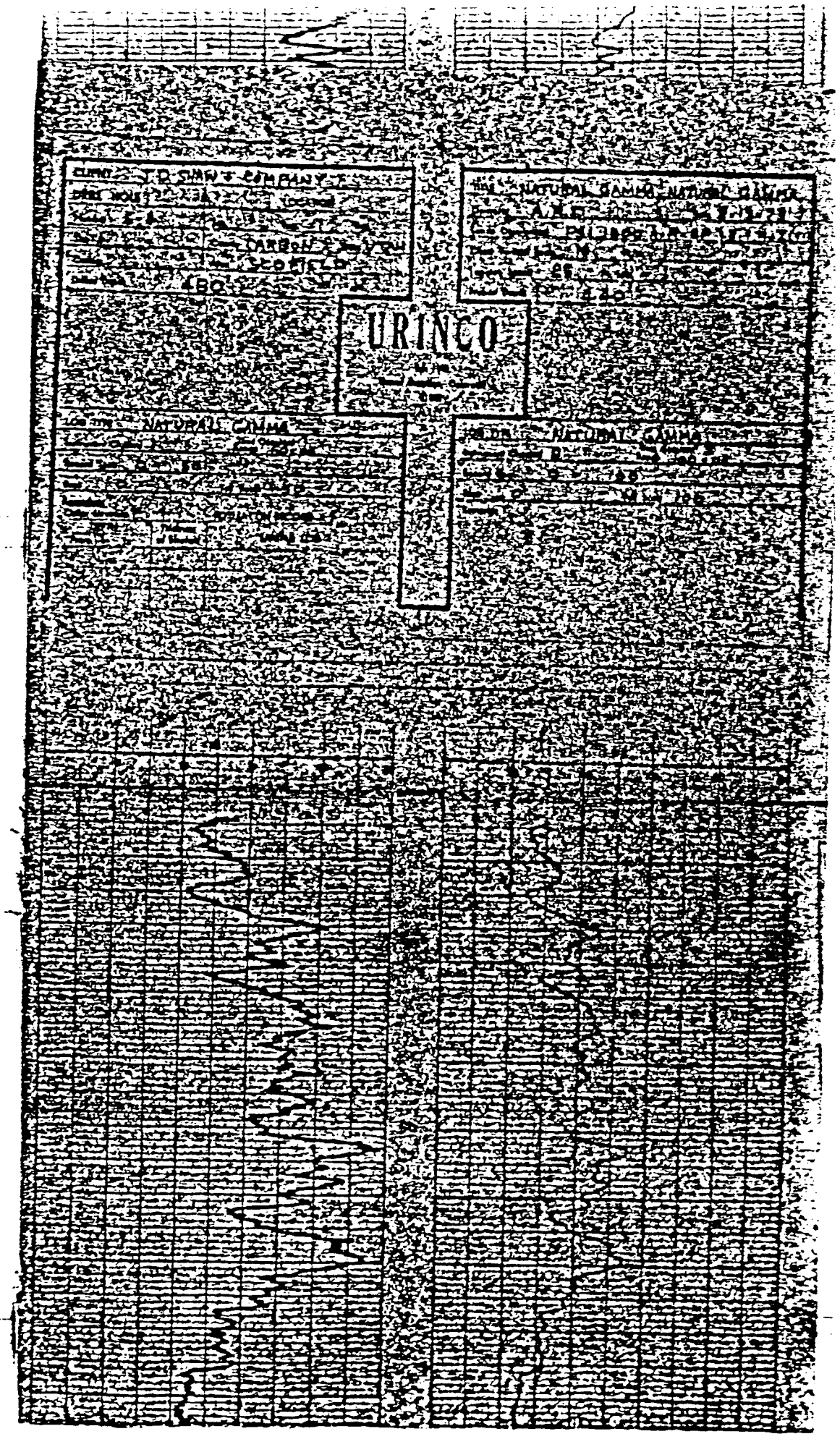


LOCATION •

TOWNSHIP 13S RANGE 7E SECTION 4

GEOLOGIST REQUESTING WORK

URINGO


URINCO

DRILL HOLE DATA SHEET

NUMBER: 76-23 STATE: Utah COUNTY: Carbon SEC. 4 T. 12S, R. 7E

CLIENT: Itel Resources PROJECT/AREA: 3016/Colombine

CONTRACTOR: XL DRILLER: Doug

PLUGGING RECORD:

CASING/DEPTH: MEDIUM: H_2O/Mud

ELEVATION: est. 8122 TOTAL DEPTH DRILLED: 267

CO-ORDINATES N. est. 24214 E. est. 1344
(offset of G-1)

CORED INTERVALS:

	DEPTH from	to	DEPTH from	to
Continuous Core				

LOGGING RECORD:

TYPE	DEPTH from	to
No/Log		

LITHOLOGY PENETRATED:

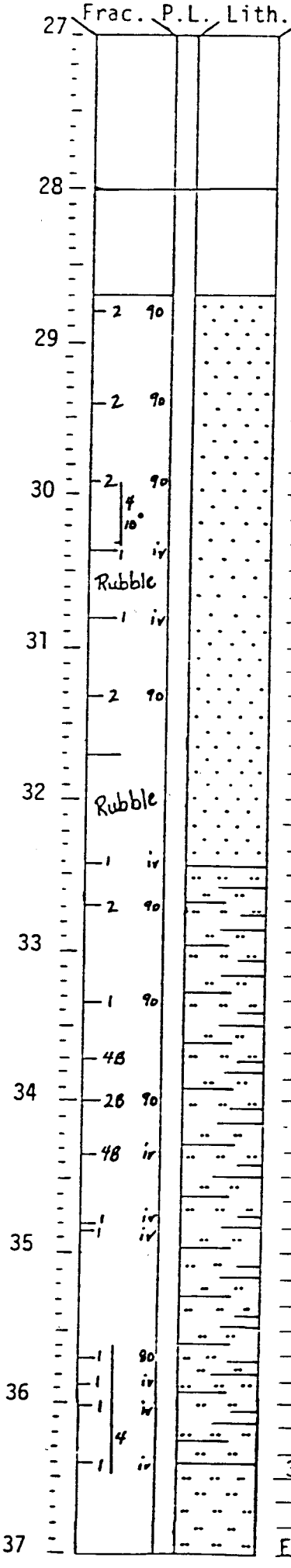
TYPE	DEPTH from	to
Kinney Seam	239.2	246.6
Coal	249.2	251.7

COMPLETION DATE: 11-20-76

CORE DATA SHEET

1. Hole Number 76-23
2. Sec. 4 T. 12S R. 7E
3. Project Number 3016
4. County Carbon
5. State Utah
6. T. D.
7. Elevation est. 8122
8. Co-ordinate N. est. 24214
   offset of G-1 E. est. 1344
9. Date Cored 11-13-76
10. Core Run No. # 1
11. Logged by M. Weller
12. Date Shipped
13. Shipped by
14. Shipped via
15. Core Diameter NX
16. Company Itel Resources
    Address Two Embarcadero
    San Francisco, Calif.

Sum. of Core Rec.	Sum of 4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
I	II	III	I/III x 100	II/III x 100
8.3'		9'		



Begin run 28'

Begin Core 28.7

28.7-32.4

Sandstone, red - orange brn fg, SH WS

32.4-36.4

Shale, brown-gy-orange

&

Siltstone, lt gy, lt gy-brown

36.4-37

Siltstone, lt gy-white

End Run 37

CORE DATA SHEET

Hole Number 76-23

Sec. _____ T. _____ R. _____

Project Number 3016

County Carbon

State Utah

T. D. _____

Elevation _____

Co-ordinate N. _____

E. _____

Date Cored 11-13-76

Core Run No. # 2

Logged by _____

Date Shipped _____

Shipped by _____

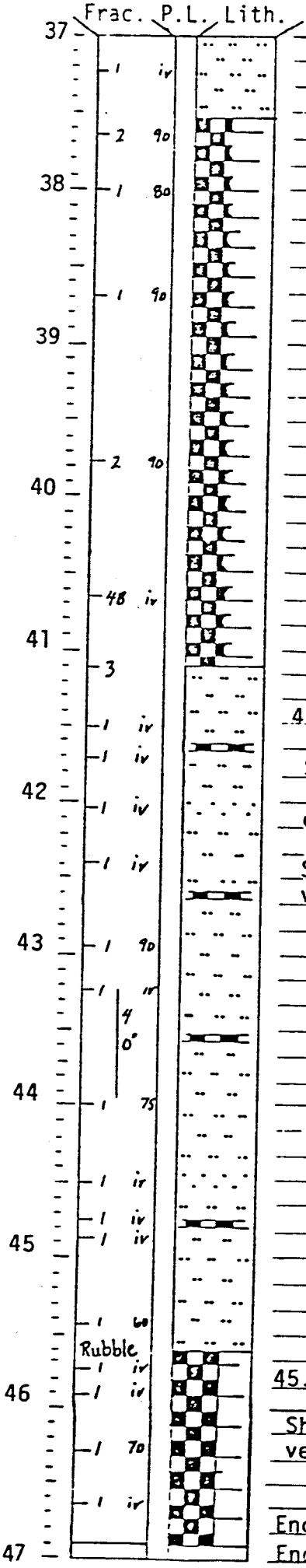
Shipped via _____

Core Diameter _____

Company _____

Address _____

Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Rec. (%)	RQD (%)
I	II	III		II/III x 100
9.9'		10'	99%	



37-37.55
Siltstone, org brown-red brown

37.55-41.1
Shale, dk gy-gy
carbonaceous

41.1-45.6
Siltstone, lt org brown-rd brn
carbonaceous streaks
Some thin Sandstone
vfg, lt gy

45.6-47
Shale, dk gy-gy
very carbonaceous

End Core 46.9
End Run 47

CORE DATA SHEET

. Hole Number 76-23

2. Sec. _____ T. _____ R. _____

3. Project Number 3016

4. County _____

5. State _____

6. T. D. _____

7. Elevation _____

8. Co-ordinate N. _____

E. _____

9. Date Cored 11-13-76

0. Core Run No. # 3

. Logged by _____

2. Date Shipped _____

3. Shipped by _____

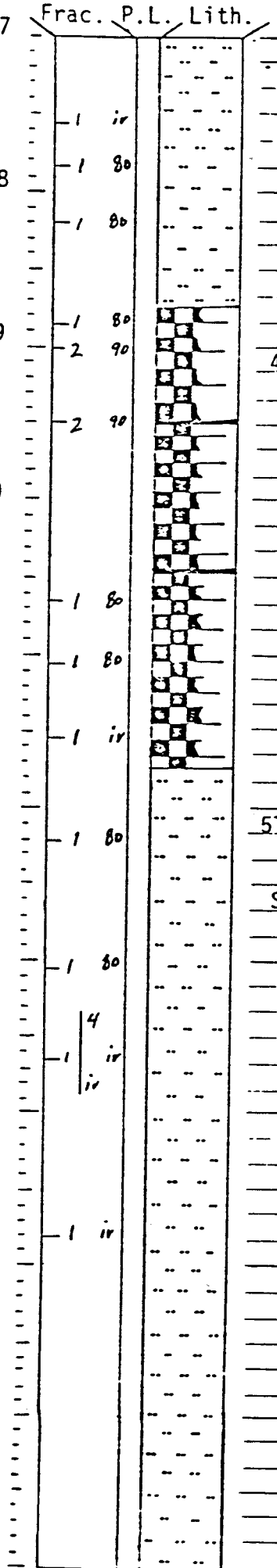
4. Shipped via _____

5. Core Diameter _____

6. Company _____

Address _____

Sum. of Unit	Sum of Core Rec.	Sum of Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III×100	II/III×100



47-48.75

Siltstone, beige-yellow brn

48.75-51.75

Shale, dk gy-gy

carbonaceous

thin Coal streaklets

51.75-57.3

Siltstone, yellow brn-lt gy

Hole Number 76-23

Sec. _____ T. _____ R. _____

Project Number 3016

County _____

State _____

T. D. _____

Elevation _____

Co-ordinate N. _____

E. _____

Date Cored 11-13-76

Core Run No. # 4

Logged by _____

Date Shipped _____

Shipped by _____

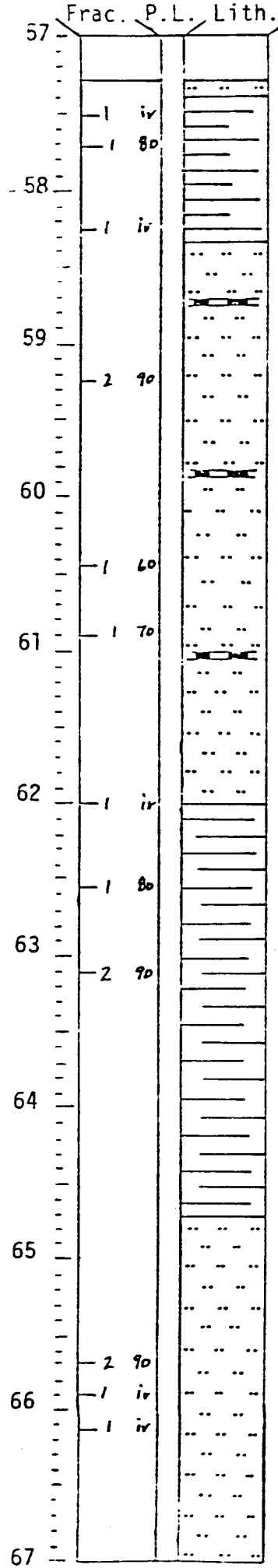
Shipped via _____

Core Diameter _____

Company _____

Address _____

Sum of Core Recovered	Sum of Individual Pieces	Length of Run	Core Recovery (%)	RQD (%)
I	II	III	I/III×100	II/III×100



Start Run 57.3

57.3-57.4 Siltstone red-org-brn

57.4-58.35 Shale, dk gy-gy

58.35-62

Siltstone, yellow brn-red orange brown- lt gy

a few carbonaceous streaks

62-64.7

Shale dk gy-dk green gy

64.7-67.15

Siltstone, green orange brown-orange brown-grey

End Run, Core 67.15

CORE DATA SHEET

1. Hole Number 76-23
2. Sec. ____ T. ____ R. ____
3. Project Number 3016
4. County ____
5. State ____
6. T. D. ____
7. Elevation ____
8. Co-ordinate N. ____
   E. ____
9. Date Cored 11-13-76
10. Core Run No. # 5
11. Logged by ____
12. Date Shipped ____
13. Shipped by ____
14. Shipped via ____
15. Core Diameter ____
    Company ____
    Address ____

Sum of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
I	II	III	I/III x 100	II/III x 100
9.65'		10'	96.5%	

Frac. P.L. Lith.

67
68
69
70
71
72
73
74
75
76
77

2 90
1 60
1 80
48 90
4
1 in
15

67.15-69.1

Siltstone, lt gy

69.1-75

Shale, dk gy-gy-lt gy

carbonaceous

some Siltstone

75-76.8

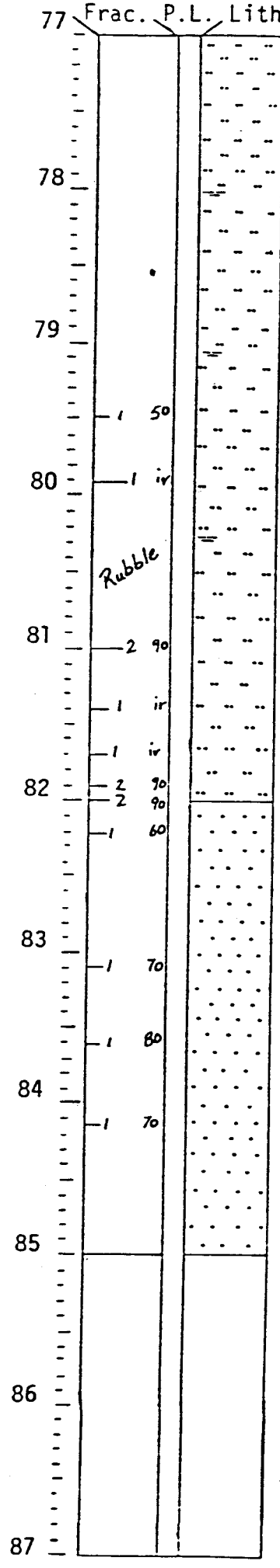
Siltstone, org brn-beige

End Run, Core 76.8

CORE DATA SHEET

1. Hole Number 76-23
2. Sec. _____ T. _____ R. _____
3. Project Number 3016
4. County _____
5. State _____
6. T. D. _____
7. Elevation _____
8. Co-ordinate N. _____
   E. _____
9. Date Cored 11-13-76
10. Core Run No. _____
11. Logged by _____
12. Date Shipped _____
13. Shipped by _____
14. Shipped via _____
15. Core Diameter _____
16. Company _____
    Address _____

Sum. of Last Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
I	II	III	I/III x 100	II/III x 100
8'		10'	80%	



77-82

Siltstone, beige-yellow brown-lt orange brown

some Clay

82-85

Sandstone, red orange brown

fg, SA WS

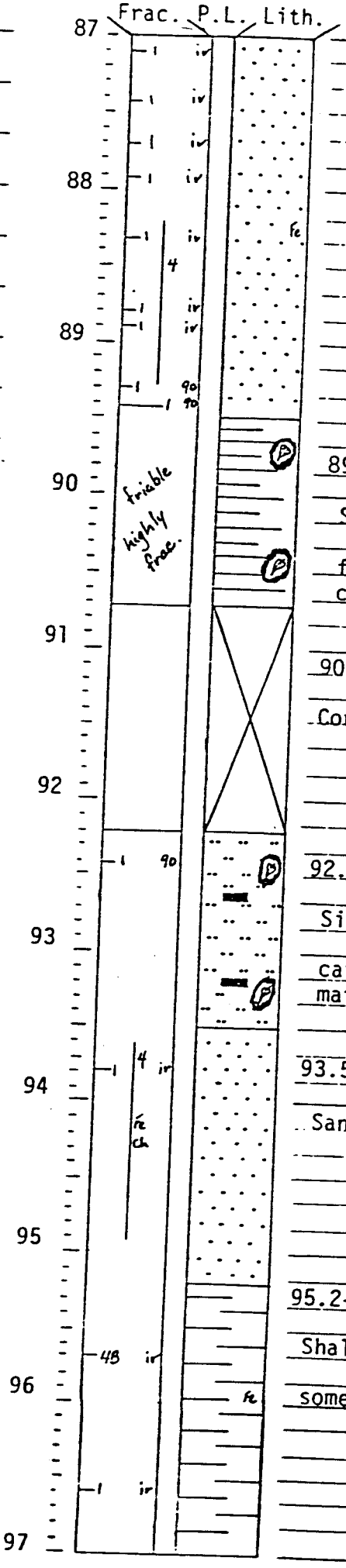
weathered

End Core 85

End Run 87

CORE DATA SHEET

1. Hole Number 76-23
2. Sec. _____ T. _____ R. _____
3. Project Number 3016
4. County _____
5. State _____
6. T. D. _____
7. Elevation _____
8. Co-ordinate N. _____
   E. _____
9. Date Cored 11-17-76
10. Core Run No. • # 7
11. Logged by M.Weller A.Markos
12. Date Shipped _____
13. Shipped by _____
14. Shipped via _____
15. Core Diameter _____
16. Company _____
    Address _____



87-89.5

Sandstone, rust, vfg, R WS

iron staining

89.5-90.75

Shale, gy-dk gy

friable

carbonaceous plant fragments

90.75-92.2

Core missing

92.2-93.5

Siltstone, gy

carbonaceous plant fragments & mat.

93.5-95.2

Sandstone, vf, rust, WS

95.2-

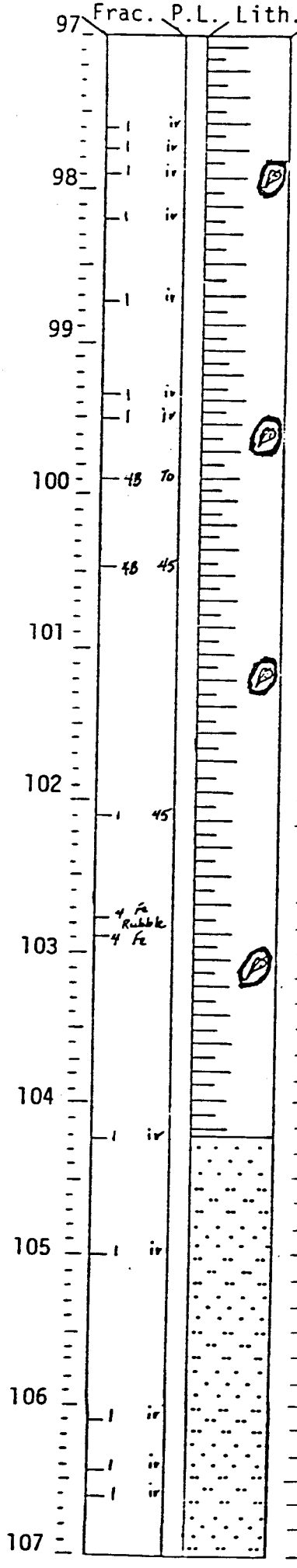
Shale, gy, green gy

some iron stain

Unit	Sum of Core Rec. I	Sum of +4" Pieces II	Length of Run III	Core Recovery (%) I/III x 100	RQD (%) II/III x 100
	8.55		10%	85.5%	

1. Hole Number 76-23
2. Sec. _____ T. _____ R. _____
3. Project Number 3016
4. County _____
5. State _____
6. T. D. _____
7. Elevation _____
8. Co-ordinate N. _____
   E. _____
9. Date Cored 11-17-76
10. Core Run No. # 8
11. Logged by M.Weller & A.Markos
12. Date Shipped _____
13. Shipped by _____
14. Shipped via _____
15. Core Diameter _____
16. Company _____
    Address _____

Unit	Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III x 100	II/III x 100
	10'		10'	100%	



97-104.2

Shale, gy-lt gy

carbonaceous plant fragments

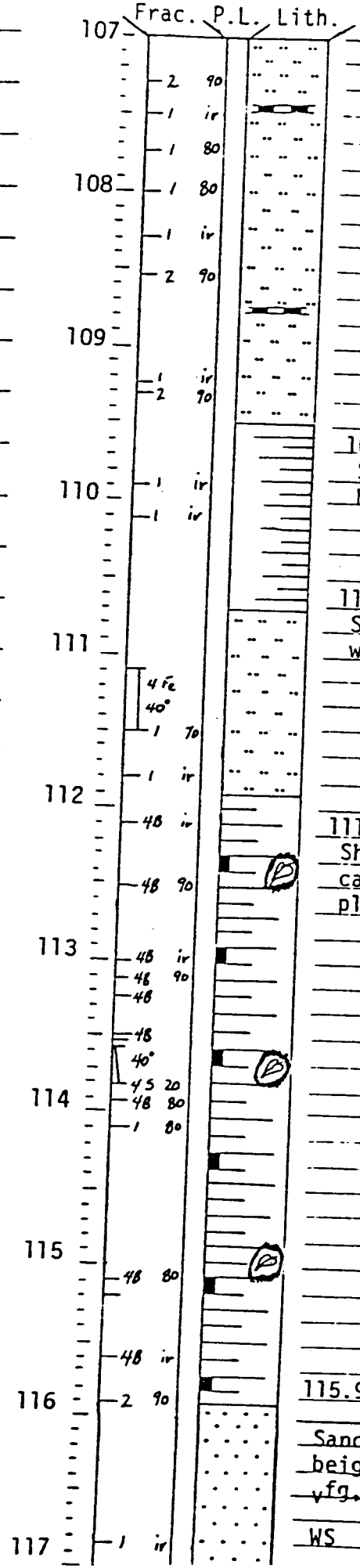
104.2-107

interbedded
Sandstone, vfg, orange brown-lt gy, R WS
&
Siltstone, lt gy-green grey

CORE DATA SHEET

1. Hole Number 76-23
2. Sec. ____ T. ____ R. ____
3. Project Number 3016
4. County ____
5. State ____
6. T. D. ____
7. Elevation ____
8. Co-ordinate N. ____
   E. ____
9. Date Cored 11-17-76
10. Core Run No. # 9
11. Logged by A.Markos & M.Weller
12. Date Shipped ____
13. Shipped by ____
14. Shipped via ____
15. Core Diameter ____
16. Company ____
    Address ____

Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
I	II	III	I/III x100	II/III x100



107-109.5
Siltstone
greenish grey
red, orange brown
carbonaceous streaks

109.5-110.7
Shale, greenish-grey
beige

110.7-111.9
Siltstone, lt orange brown,
with some greenish grey-lt gy

111.9-115.9
Shale, grey-dk gy
carbonaceous material,
plant fragments

115.9-117.0
Sandstone, lt orange brown
beige
vfg. A-SA
WS

Hole Number 76-23

Sec. ______ T. ______ R. ______

Project Number 3016

County ______

State ______

T. D. ______

Elevation ______

Co-ordinate N. ______

E. ______

Date Cored 11-17-76

Core Run No. # 10

Logged by ______

Date Shipped ______

Shipped by ______

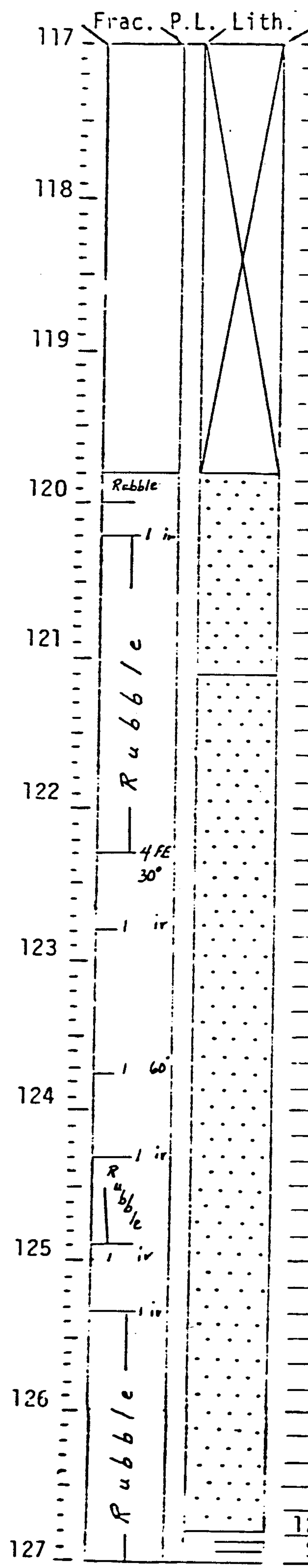
Shipped via ______

Core Diameter ______

Company ______

Address ______

Unit	Sum of Core Rec.	Sum of >4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III x100	II/III x100



117.0-119.8

missing

119.8-121.1

Sandstone, vfg, R, WS, beige

121.1-126.8

Sandstone, rust-beige
fg, R-SR, iron stain

126.8-127.0

Shale, greenish grey

CORE DATA SHEET

Hole Number 76-23

Sec. _____ T. _____ R. _____

Project Number 3016

County _____

State _____

T. D. _____

Elevation _____

Co-ordinate N. _____

E. _____

Date Cored 11-18-76

Core Run No. # 11

Logged by M.Weller & A.Markos

Date Shipped _____

Shipped by _____

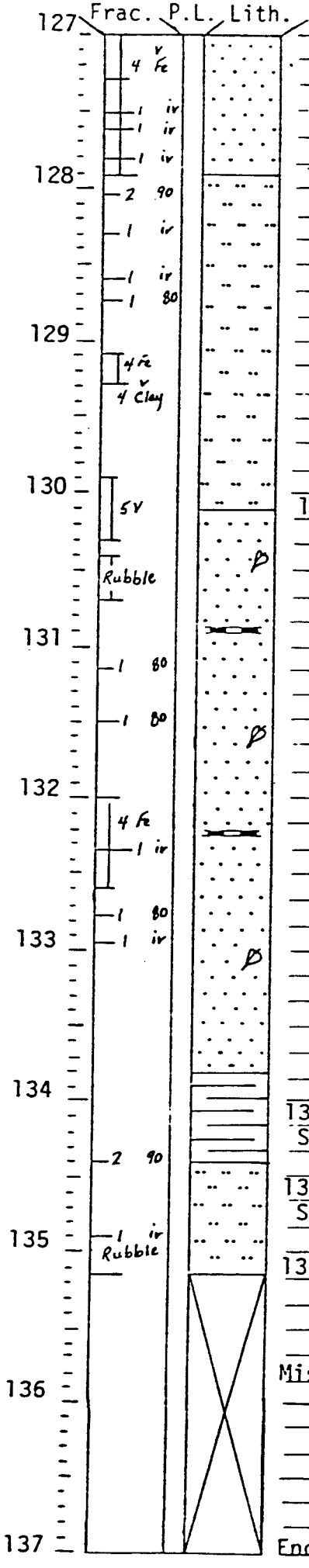
Shipped via _____

Core Diameter _____

Company _____

Address _____

Unit	Sum. of Core Rec. I	Sum of +4" Pieces II	Length of Run III	Core Recovery (%) I/III x100	RQD (%) II/III x100
11	8.2'		10'	82%	



127.0-127.9
Sandstone, vfg, SR, WS, orange-brown-beige

127.9-130.1
Siltstone
lt greenish grey

130.1-133.8
Sandstone, rust-lt orange-brown to lt greenish gy
vfg, SR, WS, carbonaceous streaks, plant fragments

133.8-134.4
Shale, dk gy-gy brown

134.4-135.15
Siltstone, yellow-brown-beige

135.15 End of Core

Missing Core

End Run 137

Hole Number 76-23

Sec. _____ T. _____ R. _____

Project Number 3016

County _____

State _____

T. D. _____

Elevation _____

Co-ordinate N. _____

E. _____

Date Cored 11-18-76

Core Run No. # 12

Logged by A.Markos & M.Weller

Date Shipped _____

Shipped by _____

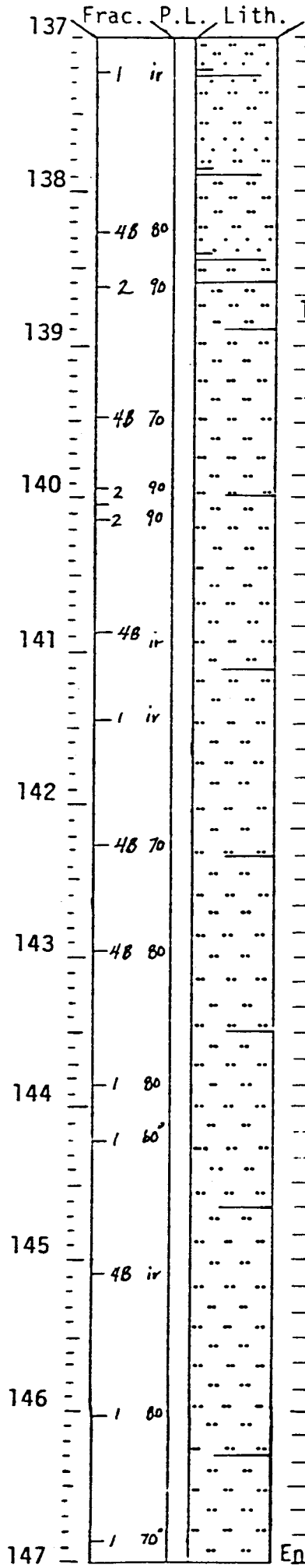
Shipped via _____

Core Diameter _____

Company _____

Address _____

Unit	Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III×100	II/III×100
12	10		10	100%	



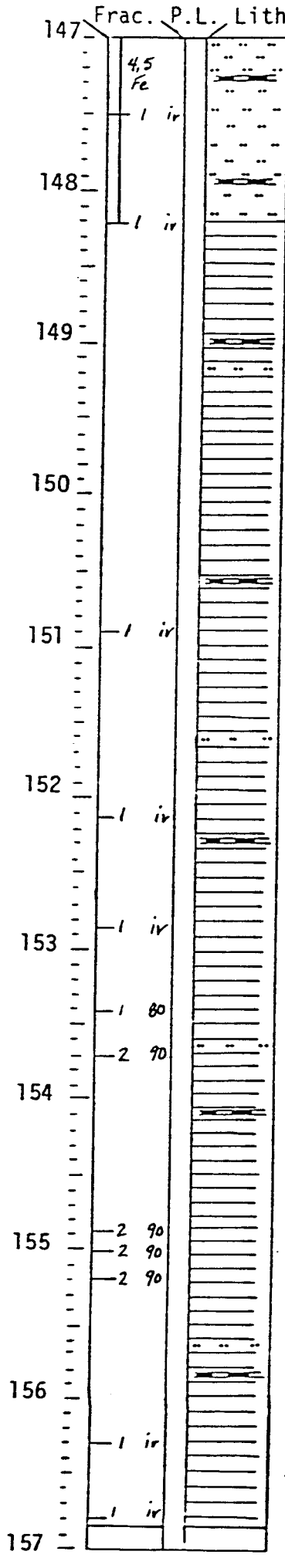
137.0-138.6
Siltstone
thinly interbedded
with Shale & Sandstone vfg
lt-dk gy

138.6-147.0
Siltstone
lt gy-dk gy
very hard
some thin brown
Shale interbedded

End Run & Core 147

- Hole Number 76-23
- Sec. _____ T. _____ R. _____
- Project Number 3016
- County _____
- State _____
- T. D. _____
- Elevation _____
- Co-ordinate N. _____
  E. _____
- Date Cored 11-18-76
- Core Run No. # 13
- Logged by M.Weller & A.Markos
- Date Shipped _____
- Shipped by _____
- Shipped via _____
- Core Diameter _____
- Company _____
  Address _____

Sum. of Unit Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
I	II	III	I/III x 100	II/III x 100



147.0-148.2
Siltstone, lt gy-gy
carbonaceous streaks

148.2-156.55

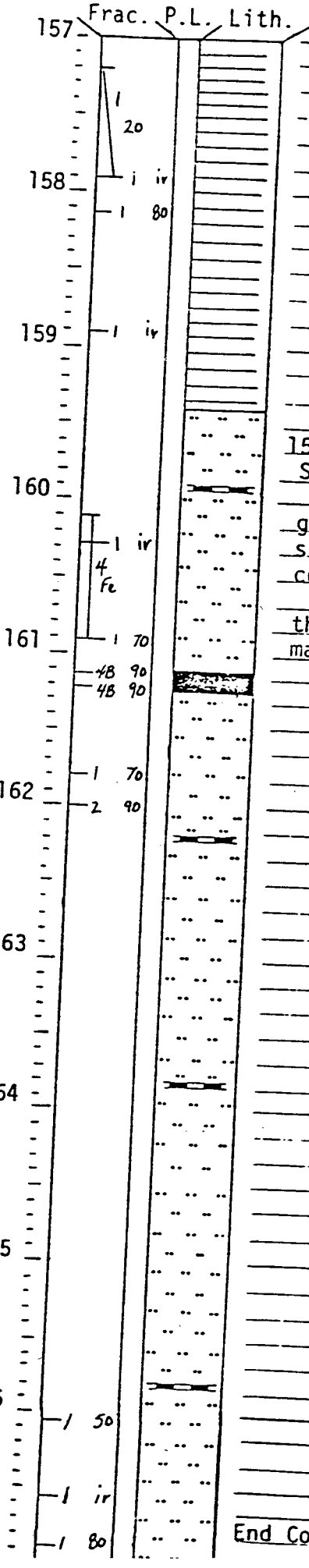
Shale, dk gy
carbonaceous streaks
some lt gy thin
minor Siltstone

End Core 156.85
End Run 157

CORE DATA SHEET

1. Hole Number 76-23
2. Sec. ____ T. ____ R. ____
3. Project Number 3016
4. County ____
5. State ____
6. T. D. ____
7. Elevation ____
8. Co-ordinate N. ____
   E. ____
9. Date Cored 11-18-76
10. Core Run No. # 14
11. Logged by M.Weller & A.Markos
12. Date Shipped ____
13. Shipped by ____
14. Shipped via ____
15. Core Diameter ____
16. Company ____
    Address ____

Sect.	Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III x 100	II/III x 100



157.0-159.4
Shale, dk gy

159.4-167.0
Siltstone

grey-dk gy, carbonaceous streaks

convolute bedding

thin layer bituminous material 161.1-161.3

End Core & Run 167.0

CORE DATA SHEET

1. Hole Number 76-23
2. Sec. 4 T. 12S R. 7E
3. Project Number 3016
4. County
5. State
6. T. D.
7. Elevation
8. Co-ordinate N.
   E.
9. Date Cored 4-19-76
10. Core Run No. # 15
11. Logged by M.Weller & A.Markos
12. Date Shipped
13. Shipped by
14. Shipped via
15. Core Diameter
16. Company
    Address

Unit	Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III x 100	II/III x 100

Frac. P.L. Lith.

167 — 1 90
168 — 1 70; 1 85; 1 90; 1 80
169 — 1 80; 1 90; 1 80
170 — 1 80
171 — 1 80; 1 70
172 — 2 ir; 1 80
173 — 1 ir
174 —
175 —
176 — 48 ir; 4Cl; 1 45
177 —

167.0-177.0

Siltstone, lt gy-gy

some rust stain

171.4-172.5

Bituminous layer
175.7-175.9

Hole Number 76-23

Sec. _____ T. _____ R. _____

Project Number 3016

County _____

State _____

T. D. _____

Elevation _____

Co-ordinate N. _____

E. _____

Date Cored 11-19-76

Core Run No. M.Weller & A.Markos

Logged by _____

Date Shipped _____

Shipped by _____

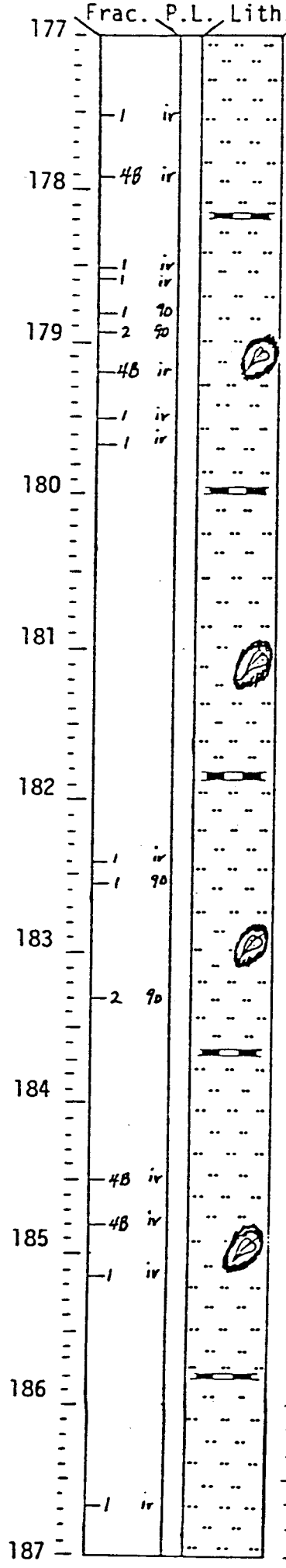
Shipped via _____

Core Diameter _____

Company _____

Address _____

Unit	Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III x100	II/III x100
	10'		10'	100%	



177-187

Siltstone, lt gy, gy

convolute bedding

carbonaceous plant fragments
streaks

Hole Number 76-23

Sec. _____ T. _____ R. _____

Project Number 3016

County _____

State _____

T. D. _____

Elevation _____

Co-ordinate N. _____

E. _____

Date Cored _____

Core Run No. # 17

Logged by M.Weller & A.Markos

Date Shipped _____

Shipped by _____

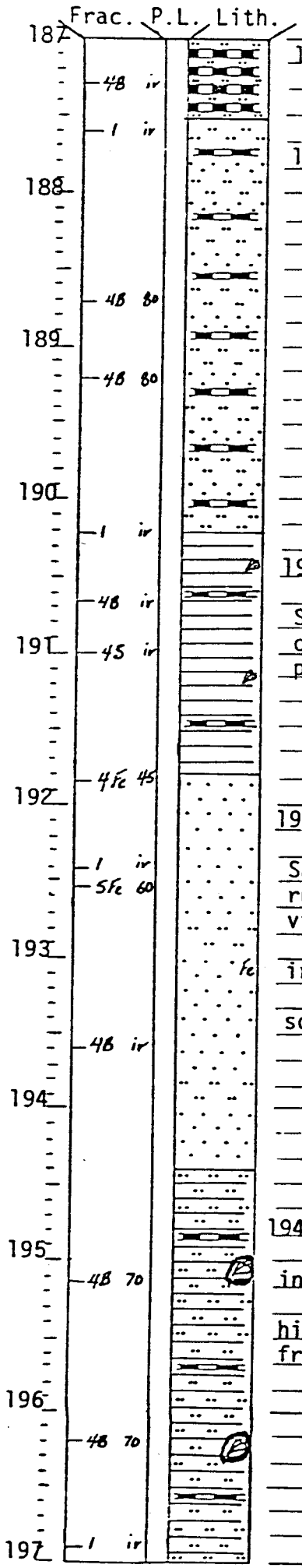
Shipped via _____

Core Diameter _____

Company _____

Address _____

Unit	Sum. of Core Rec.	Sum of 4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III×100	II/III×100



187-187.5
thin Siltstone & Shale, dk gy carbonaceous

187.5-190.2
interbedded Sandstone & Siltstone
Sandstone, vf lt gy A WS
abundant carbonaceous streaks

190.2-191.8
Shale, dk gy
carbonaceous streaks
plant fragments

191.8-194.4
Sandstone, lt orange brown - rust
vfg, A, WS
iron stain
some Siltstone

194.4-197
interbedded Siltstone & Shale
highly carbonaceous plant fragments & streaks

1. Hole Number 76-23
2. Sec. ____ T. ____ R. ____
3. Project Number 3016
4. County ____
5. State ____
6. T. D. ____
7. Elevation ____
8. Co-ordinate N. ____
   E. ____
9. Date Cored 11-20-76
10. Core Run No. # 18
11. Logged by Andy Markos
12. Date Shipped ____
13. Shipped by ____
14. Shipped via ____
15. Core Diameter ____
16. Company ____
    Address ____

Sum. of Unit I Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
I	II	III	I/III x 100	II/III x 100

Frac. P.L. Lith.

197 — 1 80

197.0-199.3
Siltstone, grey
carbonaceous plant fragments

198 — 1 iv

199 — 1 80

199.3-200.9
Siltstone & Sandstone
interbedded, orange-brown
rust, iron stain
Sandstone, vfg, SA-A WS

200 — 1 iv

201 — 1 iv
48 90
48 90
48 90
1 60
48
1 iv

200.9-201.8
Shale, gy-dk gy
carbonaceous - bituminous
layers abundant

202 — 40
45
1 iv
1 iv

201.8-202.7
Siltstone, greenish-grey
minor carb. plant fragments

203 — 1 90
1 iv

202.7-206.7
Shale, grey-dk grey
friable carbonaceous
plant fragments

204 — 1 iv
1 45
1 90

205

206

End of Core 206.7

207

End of Run 207

CORE DATA SHEET

1. Hole Number 76-23
2. Sec. _____ T. _____ R. _____
3. Project Number 3016
4. County _____
5. State _____
6. T. D. _____
7. Elevation _____
8. Co-ordinate N. _____
   E. _____
9. Date Cored 11-20-76
0. Core Run No. 19
1. Logged by Andy Markos
2. Date Shipped _____
3. Shipped by _____
4. Shipped via _____
5. Core Diameter _____
6. Company _____
   Address _____

Unit	Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III x100	II/III x100

Frac. P.L. Lith.

207 — 1 90, 1 45, 1 ir, 1 ir

208 — 1 80, 1 ir, 1 90, 1 70

209 — 2 90, 1 ir

210 — 1 ir, 1 ir

211 — 5 70

4Fe 20

212 — 1 90

1 ir

213 — 4Fe 30, 1 ir

214 — 2 90

215

216

1 ir

217

207.0-211.1
Shale, gy-dk gy, friable carbonaceous

211.1-217.0
Siltstone massive-no bedding iron stains along verticle fracture rust-lt orange brown gradating to lt gy

End Run & Core 217

Hole Number 76-23

Sec. _____ T. _____ R. _____

Project Number 3016

County _____

State _____

T. D. _____

Elevation _____

Co-ordinate N. _____

E. _____

Date Cored 11-20-76

Core Run No. 20

Logged by Andy Markos

Date Shipped _____

Shipped by _____

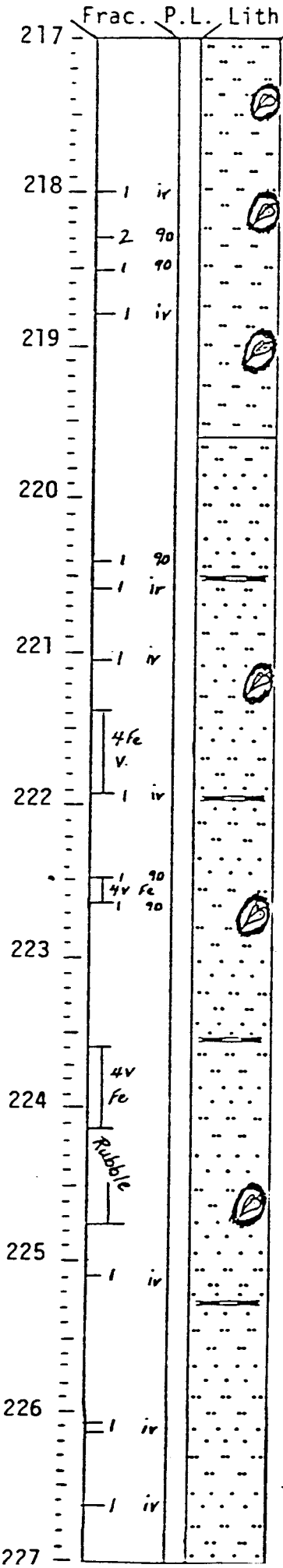
Shipped via _____

Core Diameter _____

Company _____

Address _____

Unit	Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III x 100	II/III x 100



217.0-219.6
Siltstone, gy-dk gy
carbonaceous plant fragment
abundant

219.6-227.0
Siltstone & Sandstone
interbedded
convolute bedding
lt gy - gy
streaks carbonaceous material
plant fragments

iron staining along verticle
fractures

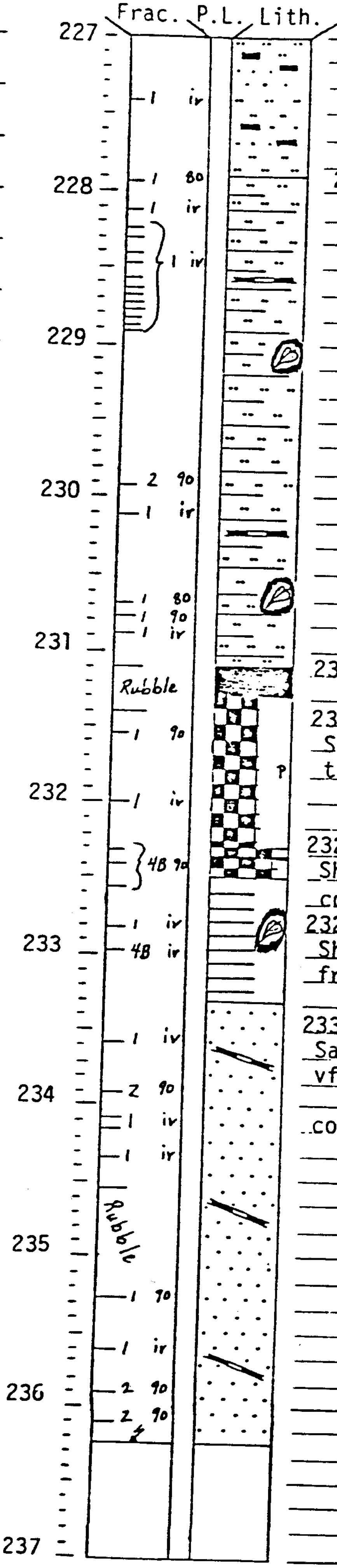
CORE DATA SHEET

1. Hole Number 76-23
2. Sec. ____ T. ____ R. ____
3. Project Number 3016
4. County
5. State
6. T. D.
7. Elevation
8. Co-ordinate N.

   E.
9. Date Cored 11-20-76
10. Core Run No. 21
11. Logged by Andy Markos
12. Date Shipped
13. Shipped by
14. Shipped via
15. Core Diameter
16. Company

   Address

Unit	Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III×100	II/III×100



227.0-227.9 Siltstone & Sandstone, interbedded lt gy convolute carbonaceous

227.9-231.1 Siltstone - Shale thinly interbedded, gy-dk gy carbonaceous plant fragments & streaks

231.1-231.3 Coal

231.3-232.3 Shale, gy, carbonaceous trace pyrite

232.3-232.5 Shale, dk gy, highly carbonaceous coal streaks

232.5-233.3 Shale, grey, carbonaceous plant fragments

233.3-236.25 Sandstone, lt orange brown vfg, rust iron stain

convolute carbonaceous streaks

Hole Number 76-23

Sec. _____ T. _____ R. _____

Project Number 3016

County _____

State _____

T. D. _____

Elevation _____

Co-ordinate N. _____

E. _____

Date Cored 11-20-76

Core Run No. 22

Logged by Andy Markos

Date Shipped _____

Shipped by _____

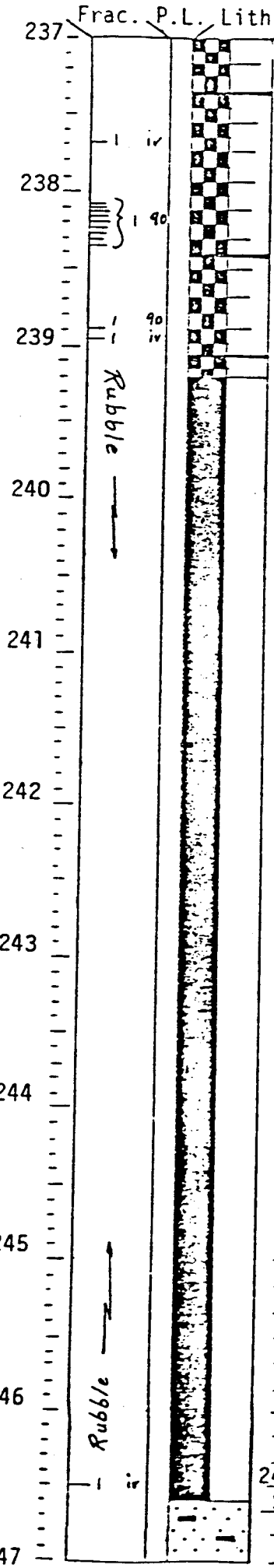
Shipped via _____

Core Diameter _____

Company _____

Address _____

Run	Sum of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
I	II	III			II/III x 100



237.0-239.2
Shale, grey-dark grey
friable
carbonaceous
Coal streaks

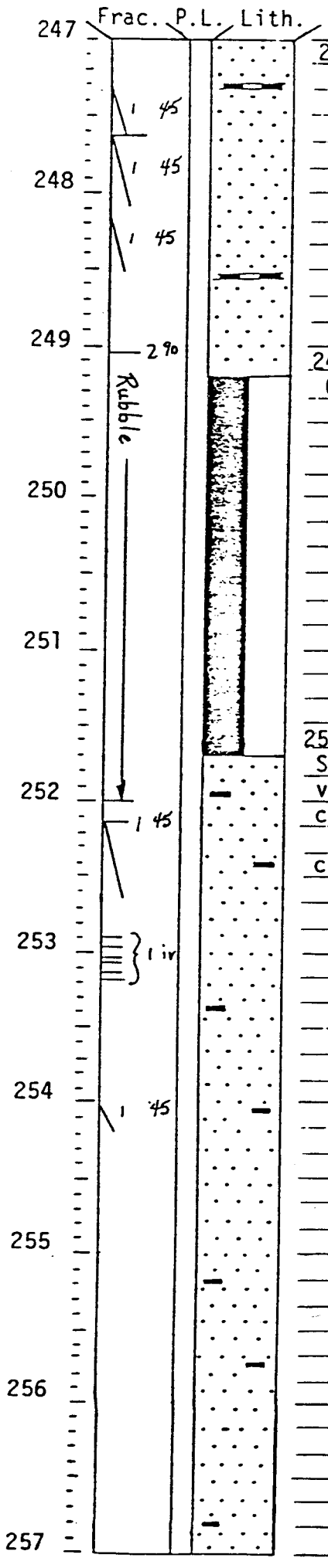
239.2-246.6
Coal
Extremely poor recovery

2 feet rubble recovered

246.6-247.0
Sandstone, vfg, dk brown
carbonaceous

1. Hole Number 76-23
2. Sec. _____ T. _____ R. _____
3. Project Number 3016
4. County _____
5. State _____
6. T. D. _____
7. Elevation _____
8. Co-ordinate N. _____
   E. _____
9. Date Cored 11-20-76
10. Core Run No. 23
11. Logged by Andy Markos
12. Date Shipped _____
13. Shipped by _____
14. Shipped via _____
15. Core Diameter _____
16. Company _____
    Address _____

Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
I	II	III	I/III×100	II/III×100



247.0-249.2
Sandstone, vfg, WS, lt brown
carbonaceous streaks
convolute bedding

249.2-251.7
Coal - poor recovery

251.7-257.0
Sandstone, lt brown-lt grey
vfg, SR-R WS
carbonaceous material

clean beach sand

CORE DATA SHEET

1. Hole Number 76-23
2. Sec. ____ T. ____ R. ____
3. Project Number 3016
4. County ____
5. State ____
6. T. D. ____
7. Elevation ____
8. Co-ordinate N. ____
   E. ____
9. Date Cored 11-20-76
10. Core Run No. 24
11. Logged by ____
12. Date Shipped ____
13. Shipped by ____
14. Shipped via ____
15. Core Diameter ____
16. Company ____
    Address ____

Unit	Sum. of Core Rec.	Sum of +4" Pieces	Length of Run	Core Recovery (%)	RQD (%)
	I	II	III	I/III×100	II/III×100

Frac. P.L. Lith.

257
258
259
260
261
262
263
264
265
266
267

1 ir
1 ir
1 iv
1 iv
1 ir
1 45
1 ir

257.0-267.0
Sandstone, vfg,fg
lt gy-gy
WS, SR, SA
carbonaceous streaks
salt & pepper
sugary

APPENDIX 5

1. DRAINAGE BASIN CHARACTERISTICS

AREA: 260 AC BY PLANIMETRY OF USGS 7½' SCOFIELD
HORIZONTAL L: 4200 FEET
HEIGHT: 995 FEET
SLOPE: 0.24
$\measuredangle$: 13.33°

2. DISCHARGE (BY RATIONAL METHOD)

$Q = C \cdot i \cdot A$, WHERE
C ≡ COEF.
i ≡ DURATION
A ≡ AREA

ASSUME C = 0.1 FOR TRACK SERIES SOILS

GET i FROM CHART, KNOWING T_c & 20 yr 24 HR CHART

NOW $T_c = \dfrac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{S}}$

$D = \sqrt{H^2+L^2}$

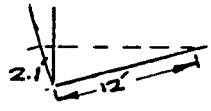
$D = [(995)^2+(4200)^2]^{1/2} = 4316.25$

$T_c = \dfrac{1.8(1.1-0.1)\sqrt{4316.25}}{\sqrt[3]{24}} = 40.997 \Rightarrow 41$

FROM CHART, $i \cong 29.9$ CFS $\Rightarrow$ 30 CFS

3. OPEN CHANNEL FLOW FROM

$Q = AV$



V FROM CHART KNOWING R AND S (HYD RADIUS & SLOPE)

NOW $R = A/WP$

$A = \frac{1}{2}(2.1 \times 12) = 12.6\ ft^2$

$WP = 2.1 + 12 = 14.1\ ft$

$\therefore R = 0.894$

CONT'D P. 2/2

3. CONT'D

FROM CHART FOR SOLVING MANNING'S EQUATION

W/ $R = 0.89$ & $S = 0.03$,

$V = 13.5$ FPS

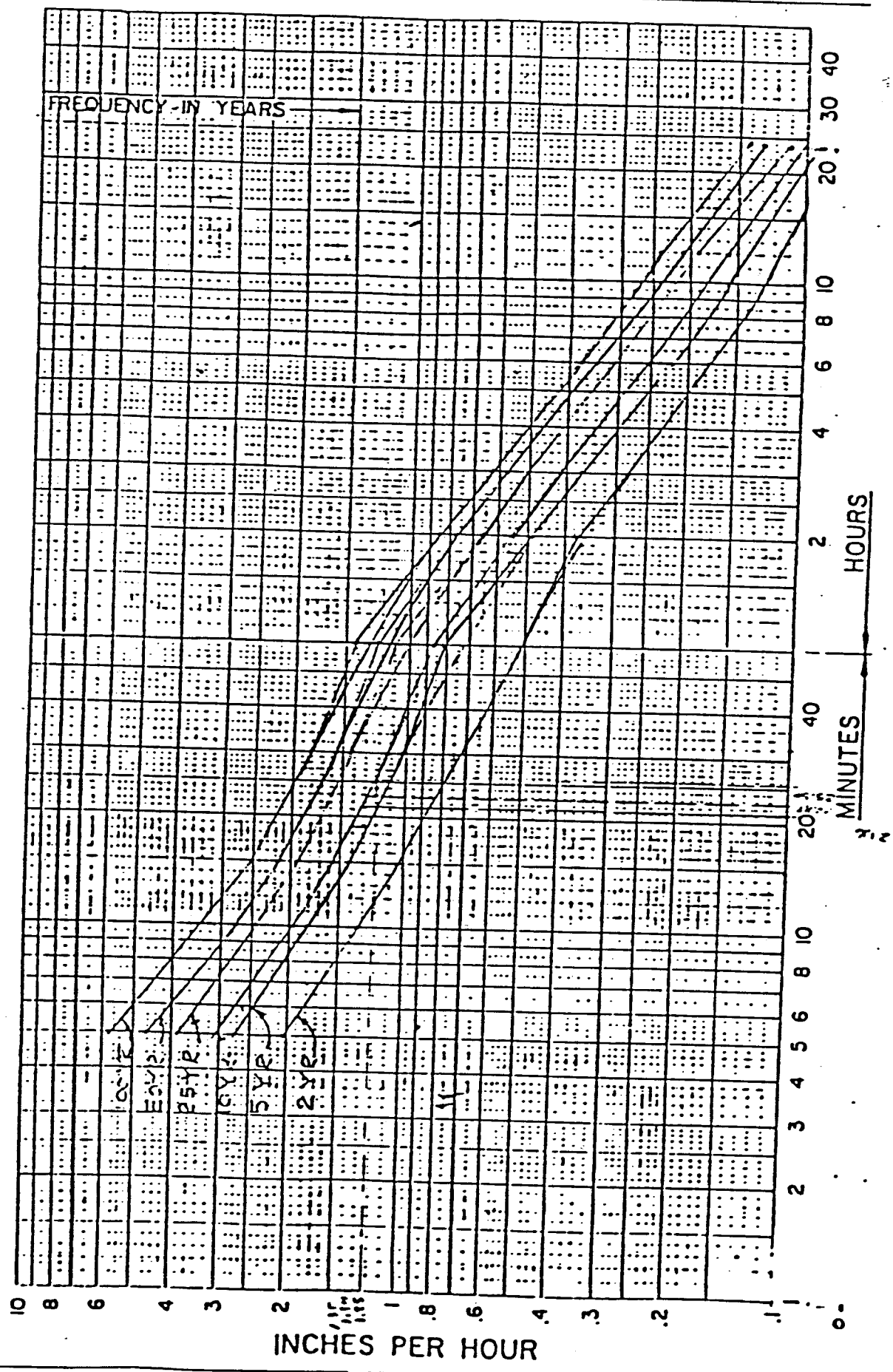
NOW $Q = AV$

$= 12.6\ ft^2 \times 13.5\ ft/s = 170\ ft^3/s$

OR 5.6 TIMES GREATER THAN REQUIRED.

11-9/79

RAINFALL INTENSITY DURATION CURVES



SHEET NO.

CHEZY EQUATION

A basic hydraulic formula developed by Chezy for determining the flow of water particularly in open channels is written as follows:

$$Q = AV \qquad V = c\sqrt{RS} \qquad \text{and} \qquad Q = Ac\sqrt{RS} \quad \ldots\ldots\ldots\ldots (2)$$

in which:

Q = discharge, cfs
A = cross-sectional area of flow in sq ft, at right angles to the direction of flow
V = mean velocity of flow, fps
c = a coefficient of roughness whose value depends upon the character of surface over which water is flowing
R = hydraulic radius in ft = $\frac{A}{WP}$
WP = wetted perimeter or length, in ft, of wetted contact between a stream of water and its containing channel measured at right angles to the direction of flow
S = slope, or grade in ft per ft

This fundamental formula is the basis of most capacity formulas.

MANNING'S EQUATION

Manning's formula, published in 1890, gives the value of c in the Chezy formula as:

$$c = \frac{1.486}{n} R^{1/6} \quad \ldots\ldots\ldots\ldots (3)$$

the complete Manning formula being:

$$V = \frac{1.486}{n} R^{2/3} S^{1/2} \quad \ldots\ldots\ldots\ldots (4)$$

and combining with the Chezy Equation:

$$Q = A\frac{1.486}{n} R^{2/3} S^{1/2} \quad \ldots\ldots\ldots\ldots (5)$$

in which:

A = cross-sectional area of flow in sq ft
S = slope in ft per ft
R = hydraulic radius in ft
n = coefficient of roughness (see Tables 4-6, 4-5)

In many computations, it is convenient to group the properties peculiar to the cross section in one term called conveyance (K) or:

$$K = \frac{1.486}{n} AR^{2/3} \quad \ldots\ldots\ldots\ldots (6)$$

then

$$Q = KS^{1/2} \quad \ldots\ldots\ldots\ldots (7)$$

Uniform flow of "clean" water in a straight, unobstructed channel would be a simple problem but is rarely attained. Manning's formula gives reliable results if the channel cross section, roughness, and slope are fairly constant over a sufficient distance to establish uniform flow.

Table 4-5 Coefficient of Roughness n for Channels

Type of Lining	n (Manning)
Ordinary earth, smoothly graded	.02
Sod, depth of flow over 6 in.	.04
Sod, depth of flow under 6 in.	.06
Type A riprap, rough	.04
Concrete paved gutter	.016

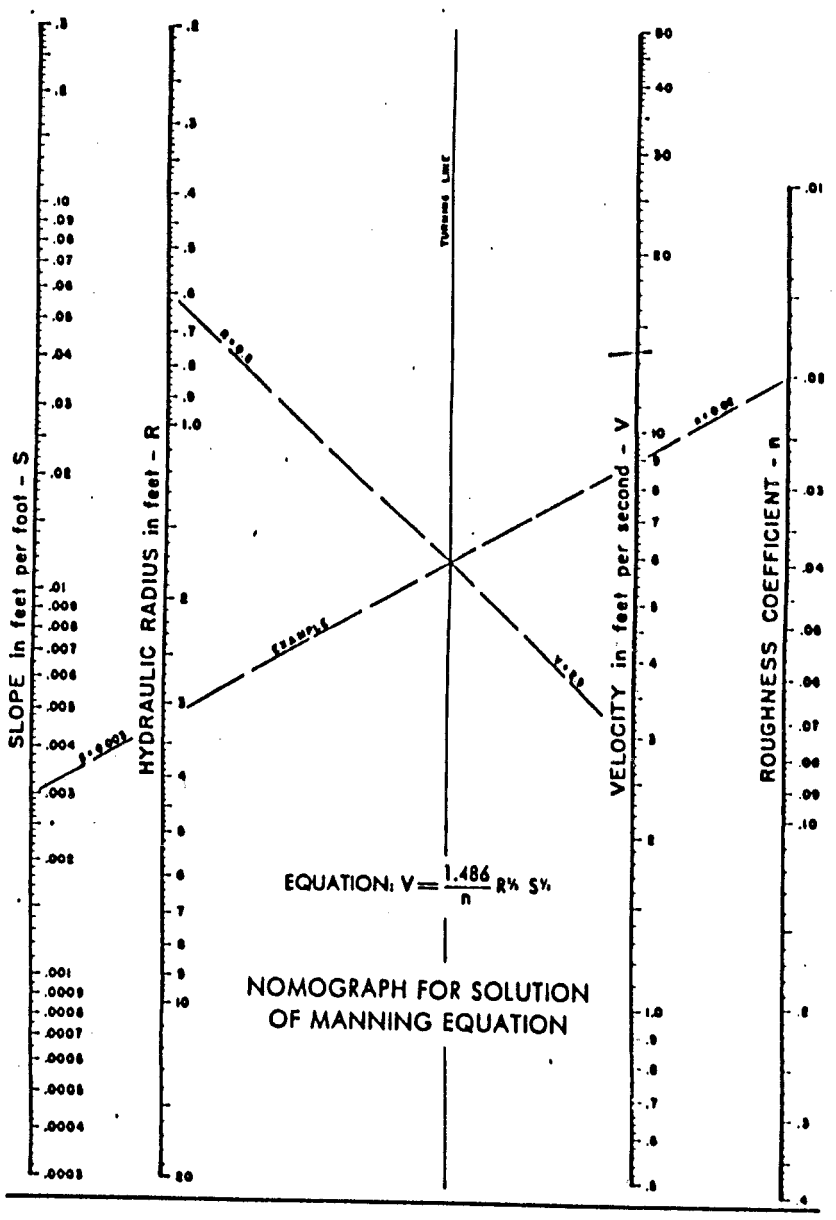


Fig. 4-8. Nomograph for solution of Manning's equation, (4)