Decommissioning and Reclamation Plan

FOR

Shootaring Canyon Uranium Processing Facility

Licence Number SUA-1371
Docket Number 40-8698

Prepared by

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1.0 INTRODUCTION & SUMMARY

The purpose of this reclamation program is to restore lands disturbed by project activities (except for the tailings impoundment) to a productive condition consistent with past and present uses of the area. This consists of restoring landscape contours to slopes similar to predisturbance conditions and, in some instances, replacing a sufficient thickness of topsoil to enable native vegetation to become reestablished.

It should be noted that several characteristics of the project area, and southern Utah in general, are considered nonconductive to the rapid establishment of native plant species on disturbed areas. The low average annual precipitation of 6 to 8 inches (15 - 20 cm); frequent droughts; extreme temperatures; high wind erosion; and a loose, undifferentiated soil profile with poor moisture-holding capacity and little organic content are a few of those characteristics.

Based on the types of disturbances anticipated, the environmental characteristics of the area, the present and proposed land uses, and the state-of-the-art knowledge on reclamation in arid environments, reclamation of the areas disturbed by the project will include:

a. Covering and stabilizing the tailings impoundment area;
b. Removing structures and regrading disturbed areas to blend with the surroundings;
c. Replacement of stockpiled topsoil in selected areas amenable to plant growth; and
d. Revegetating disturbed areas using native and introduced species.

This plan describes the designs, activities, schedule, and estimated costs of reclaiming Plateau Resources Limited's (PRL) Shootaring Canyon Uranium Mill Site and Tailings Impoundment, for bonding and surety coverage requirements. The actual final reclamation design and cost analyses will dependent on the quantity and depth of the tailings actually placed in the impoundment area and the surface area which they occupy. This document has been prepared with the intent of reclaiming the ultimate Stage I Area in accordance with pertinent federal regulations, guidelines and standards as well as other sound technical practices. Specifically, this plan has been prepared to comply with the requirements of 10 CFR 40, Appendix A

2.0 SIT: DESCRIPTION

The Shootaring Canyon Uranium Facility is located in Garfield County, southeastern Utah, approximately 50 miles south of Hanksville, Utah, 14 miles north of Bullfrog Basin Marina, and 2 miles west of Utah State Highway 276, See Figure 2.1. The Processing Facility is designed to produce 1,004,000 pounds of barreled U3O8 per year. The average ore grade is 0.15% U3O8. The ore is processed in an acid circuit at an average daily license rate of 1,000 tons per day. Tailings are contained by an engineered, NRC approved earthen and clay dam in a natural depression in the landscape. The existing tailings located above the cross valley berm have been placed on a clay lining system over the natural sandstone of the impoundment area. At this time facility is on standby and is currently seeking a production permit from the NRC.

The facilities that exist at the mill site and tailings impoundment are illustrated on Figure 2.2. Major site features consist of the mill facilities and associated support buildings, several ore stockpiles adjacent to the mill, and a tailings impoundment. Major facilities at the plant include the mill building itself, which contains the ore grinding and extraction processes, the counter-current decantation (CCD) tanks, laboratory and shop buildings, generator building, exterior reagent storage tanks, underground petroleum storage tanks, ore stockpiles, and outside materials storage areas, See Figure 2.3. The tailings impoundment consists of a main tailings dam and several smaller berms upgradiant of the main dam. During mill operations, ore was stockpiled at the ore pad just north of the mill after being weighed on the receiving scale. Ore was passed through the crushing and sampling section, the:: passed through the mill facility for processing. The resulting mill tailings were slurry pumped to the tailings impoundment area just west of the mill facility.

2.1 Land Ownership

The processing facility and its tailings disposal area are located on land purchased by PRL from the State of Utah on November 20, 1981. The patent for this property was obtained on March 1, 1982, from the State of Utah, which obtained the land from the U.S. Bureau of Land Management.

The United States reserved a right-of-way for ditches and canals constructed by authority of the United States in the purchased lands and also reserved oil and gas. The grant from the United States was made subject to then existing rights-of-way for the haulage road and telephone and sewer lines serving the facility. The State of Utah reserved coal and other mineral rights. PRL holds a lease from the State of Utah covering metalliferous minerals. A Garfield County road, constructed and maintained by PRL through an agreement with the county, provides access to the processing facility from State Highway 276, as shown on Figure 2.4. Beehive Telephone Company (an independently owned telecommunications company) that serves the processing facility, Tony M mine and Ticaboo, Utah, was granted a right-of-way for a buried telephone cable that runs, in part, in a generally north to south direction through the eastern portion of the site.

Prior to termination of the source material license, PRL will comply with the ownership requirements of Criterion 11 Appendix A to 10 CFR Part 40 for sites used for tailings disposal. Title and custody of the byproduct material (tailings), and the tailings disposal area, including any interests therein, will be transferred to the United States or the State of Utah, at the option of the state. As noted above, mineral rights are already owned by the United States (as to oil and gas) and the State of Utah (as to all other minerals). PRL reserves the right of first refusal provided in Section D of Criterion 11. PRL reserves the right to maintain, transfer, sell or otherwise dispose of its property adjacent to the tailings disposal area.

2.2 History of Operations

Plateau Resources Limited's (PRL) Shootaring Canyon Uranium Mill Facility and Impoundment Area was designed and constructed between 1978 and 1981. The facility operated for approximately three months in the summer of 1982, processing approximately 30,000 cubic yards of ore. The facility is currently seeking to reopen and operate pending NRC approvals.

Historically, the project area has been used for seasonal livestock grazing and as wildlife habitat. Human use of the project area for activities, such as camping, hiking, sightseeing, and hunting, has been minimal to date in part because of the availability of other areas in southeastern Utah for these activities.

Limited livestock grazing and wildlife habitat will probably continue to be the principal use of the affected area after termination and closure of the project. Agricultural use of the area, for either crop or hay production, is not anticipated due to the poor soil structure and scarcity of water. There are presently no urban or industrial developments in the project area other than the facilities originally related to the project and a boat repair/storage yard. No other developments are planned for the future.

Approximately18 acres (7.25 ha) were leveled for construction of the plant office, ore stockpile pads, plant buildings, and auxiliary structures. After topsoil removal and stockpiling, approximately 90% of the area was graded to develop a smooth, nearly level surface. Topsoil stockpiling and stabilization have been accomplished. The surface gradient for runoff is sloped toward the tailings impoundment area. Filling was required over the balance of the graded area. Typically, cuts ranged from zero to about 15 feet (4.57 m) in depth except in localized areas (such as the ore dump pocket and connection conveyor tunnel) where excavation was as deep as 45 feet. Maximum fill depth was approximately 40 feet at the southwest corner of the ore storage pad.

2.3 Referenced: Engineering Research & Studies of the Geology and Hydrology of the Mill Site and Tailings Impoundment Area and Corresponding Tailings Impoundment Dam Design

A complete investigation of the mill site and tailings impoundment dam were conducted prior to the design and construction of the facility. These investigations were performed by Woodward-Clyde Consultants in the evaluation and selection of the actual mill facility and tailings impoundment location. From their investigations of the demography, meteorology, hydrology of both the ground and surface water, the corresponding water uses and the geology, both regional and site geology, the designs of the facility were completed with the completion of the construction of the facility in 1981. Woodward-Clyde documented their findings and those findings are to be included in this plan. A complete listing of their findings, conclusions and designs may be reviewed in the following reference materials which will be made part of, and included in, this document.

References:

Attachment A.	EARTHWORK QUALITY CONTROL OVERVIEW AND AS-BUILT DRAWINGS CONSTRUCTION OF STAGE I, TAILINGS IMPOUNDMENT AND DAM. SHOOTARING CANYON URANIUM PROJECT. GARFIELD COUNTY, UTAH. JULY 1982.
Attachment B.	PRELIMINARY GEOTECHNICAL ENGINEERING REPORT. SHOOTARING CANYON URANIUM PROJECT. GARFIELD COUNTY, UTAH. APRIL 1978.
Attachment C.	STAGE I - TAILINGS IMPOUNDMENT AND DAM FINAL DESIGN REPORT. SHOOTARING CANYON URANIUM PROJECT. GARFIELD COUNTY, UTAH. MAY 1979.
Attachment D.	TAILINGS MANAGEMENT PLAN & GEOTECHNICAL ENGINEERING STUDIES. SHOOTARING CANYON URANIUM PROJECT. GARFIELD COUNTY, UTAH. SEPTEMBER 1978.
Attachment E.	PREOPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM, INTERIM RESULTS 1979 - 1980. SHOOTARING CANYON URANIUM PROJECT. GARFIELD COUNTY, UTAH. NOVEMBER 1980.

Another source for this information can be found in PRL Source Material License Renewal Application SUA 1371, Docket No. 4-8698, Dated March 11, 1996, which was submitted previously to the NRC.

Other References Referred to by Name Only:

1) 10 CFR 20
2) 10 CFR 40
3) 40 CFR 192
4) NUREG/CR-4620 ORNL/TM-10067 "Methodologies for Evaluation Long-Term Stabilization Designs of Uranium Mill Tailings Impoundments"
5) U.S. Nuclear Regulatory Commission, Regulatory Guide 3.11
6) U.S. Nuclear Regulatory Commission, Regulatory Guide 3.11.1
7) U.S. Nuclear Regulatory Commission, Regulatory Guide 3.64, (Task WM 503-4)
8) U.S. Nuclear Regulatory Commission, Final Staff Technical Position Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites.
9) U.S. Nuclear Regulatory Commission, Regulatory Guide 3.86 "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use of Termination of Licenses for Product, Source, of Special Nuclear Material"
10) NUREG 4118

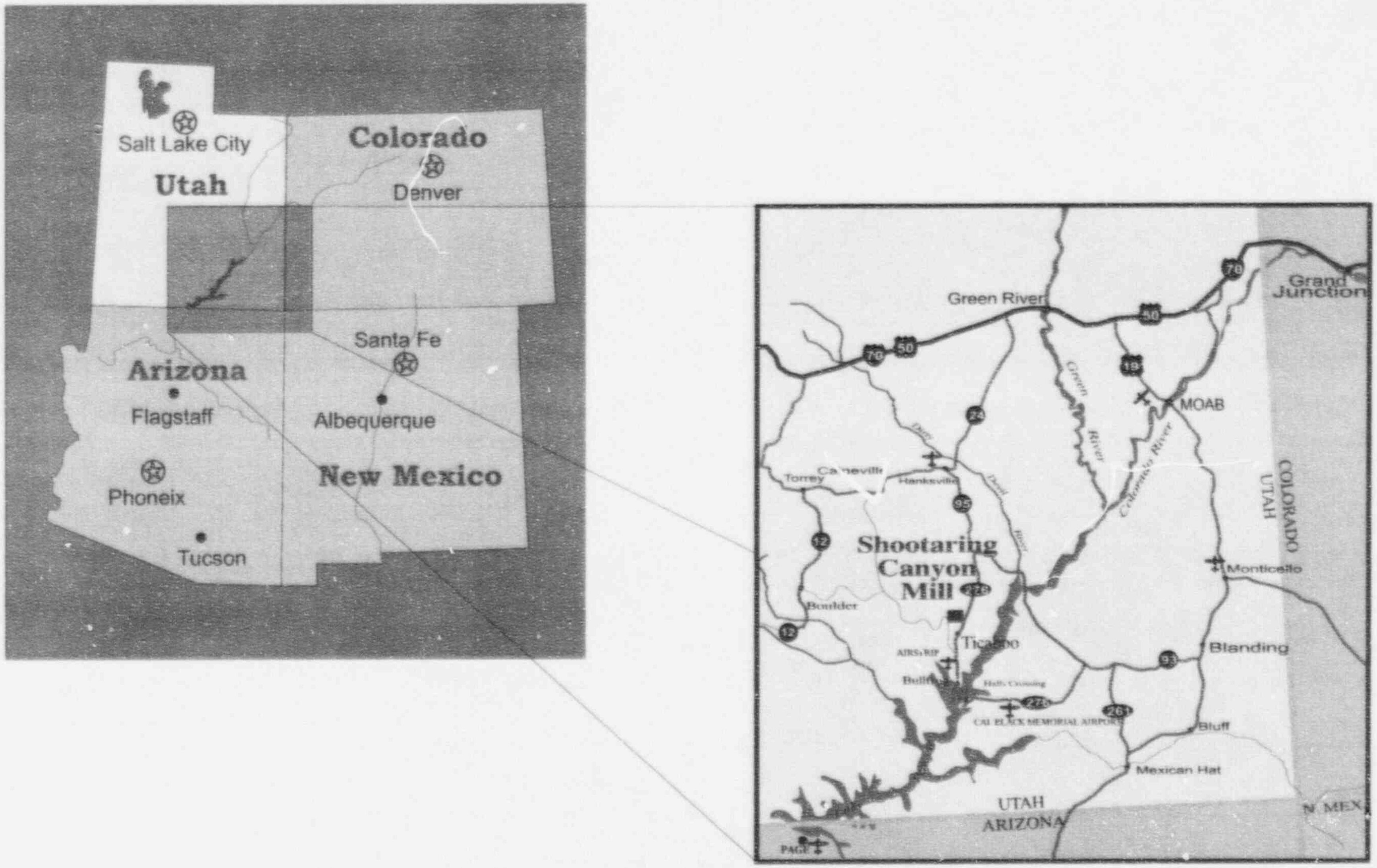


Figure 2.1 Location Map of the Shootaring Canyon Mill

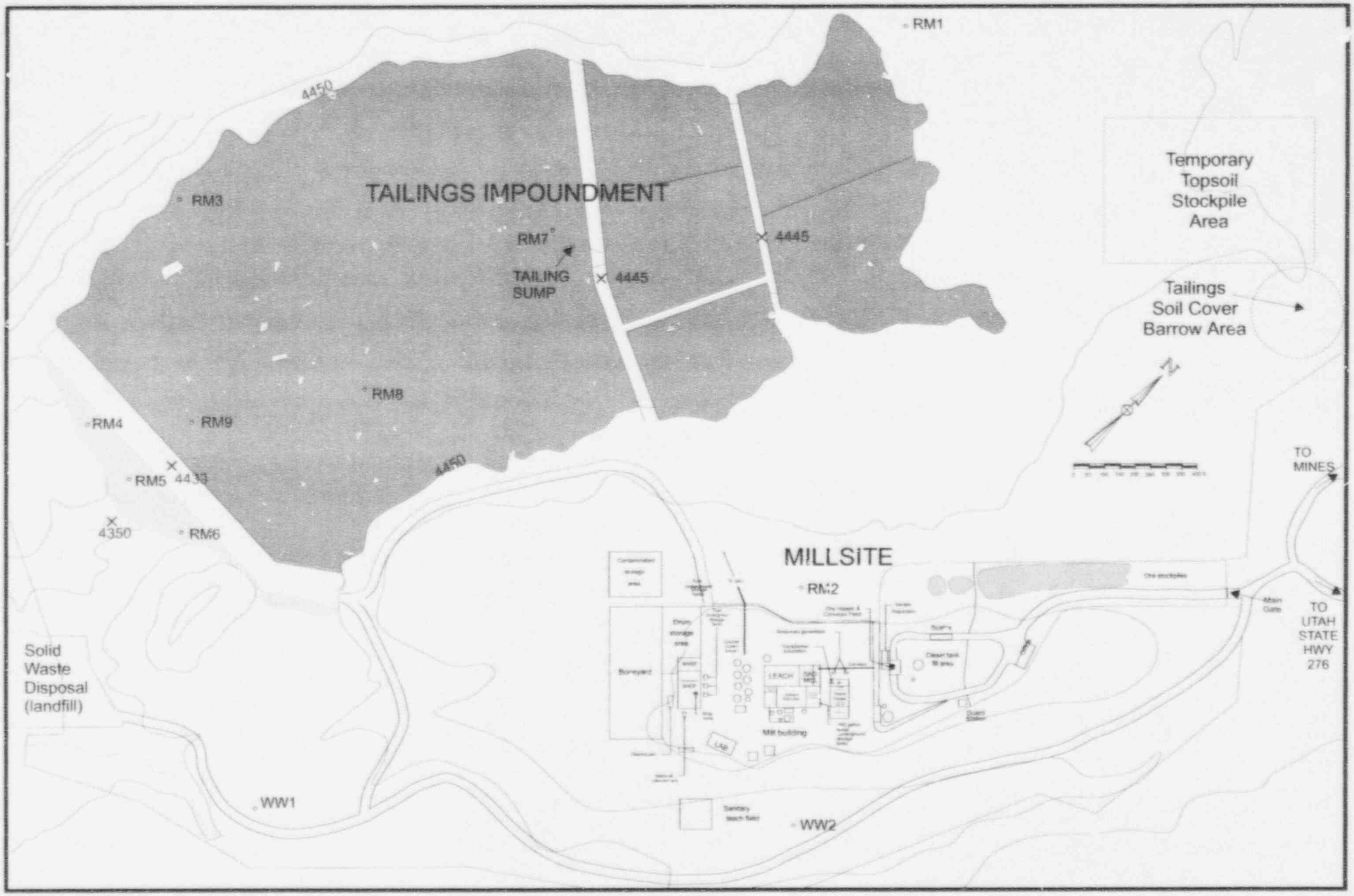


Figure 2.2 Location of Facilities at Shootaring Canyon Millsite.

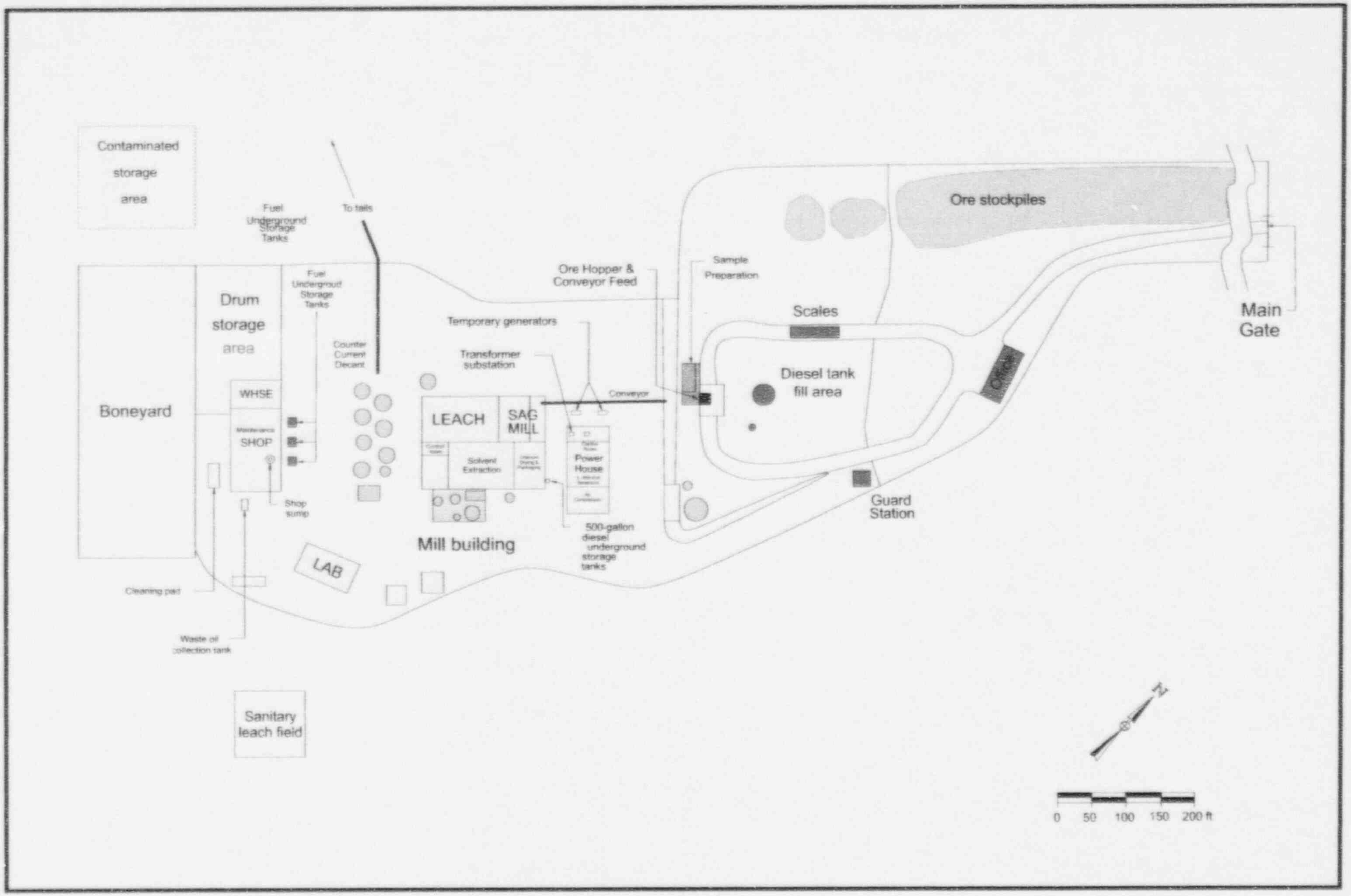


Figure 2.3 Mill Plant and Related Facilities.

3.0 OVERVIEW OF THE RECLAMATION PLAN.

It is the intent, in the reclamation of the facility, to remove all of the mill buildings and identify any contaminated soils that may exist at the mill site and place them into the tailings impoundment. Once the mill area has been demolished and any contaminated soils or materials identified and removed, the mill site will be recontoured to match the existing topography and may be seeded and released for unrestricted use per federal guidelines. See Section 9 on mill site decommissioning for a complete explanation, scheduling and cost analysis.

During the time of mill site demolition, the tailings ponds will be dewatered and stabilized in preparation for receiving the mill site wastes and the special designed radon attenuation cap. This cap will be a combination of clay, soils and rock placed in layers with engineered thicknesses and quality control practices to protect against the release of radon gas to the environment and to protect against the effects of erosion and the release of the tailings to the surroundings.

The desired end result of the design, construction, operation, and closure of the tailings disposal system has been planned with the objective of creating a facility that, after closure, will endure for up to one thousand (1000) years, or at a minimum of two hundred (200) years, without requiring either monitoring or maintenance while continuing to provide an environmentally safe and satisfactory performance. Reclamation of the site is planned which limits to the greatest extent possible the release of radon gases to less than 20 pCi/m^2-sec, without placing undo stress on the animal or plant life in the immediate location of the facility. As a minimum, annual site inspections shall be conducted by the government agency retaining ultimate custody of the site where tailings or wastes are stored to confirm the integrity of the stabilized tailings or waste systems and to determine the area, if any, needing maintenance and/or monitoring. Results of the government inspection shall be reported to the NRC within sixty days following each inspection. The Commission may require more frequent site inspections if, on the basis of a site-specific evaluation, such a need appears necessary due to the features of a particular tailings or waste disposal system.

Factors of long-term concern with respect to uranium tailings are the dispersal of tailings by erosion, the contamination of groundwater, and the release of radon to the atmosphere. These concerns are addressed in following sections.

3.1 Tailings Reclamation Performance Objectives

PRL's mill and tailings area are both within the restricted area to which access is controlled by a multistrand barbed wire fence or topographic features that form natural boundaries. The restricted area is posted with signs stating, "Any Area Within This Mill May Contain Radioactive Material," along with the radiation symbol. The site is remote. The nearest residence is in Ticaboo, Utah, approximately 2.5 miles south of the processing facility. The nearest recreation area, Bullfrog, is 14 miles south and the nearest town, Hanksville, is 56 miles north. The site is geographically isolated as shown in Figure 2.1. The site is in a

natural depression in the landscape as shown on the topographic map in Figure 2. The tailings will be isolated from groundwater by the placement of a double synthetic lining system under the tailings and 150 feet of sandstone between the double liner system and the groundwater.

Erosion, disturbance, and dispersion of tailings by natural forces over the long term will be minimized or prevented by the actions prescribed in the decommissioning and reclamation plan presented.

3.2 Nonproliferation Of Small Waste Disposal Sites

To avoid proliferation of small waste disposal sites and thereby reduce perpetual surveillance obligations, radioactive byproduct, contaminated equipment, and contaminated scrap form milling operations will be placed, with NRC approval, in the tailings impoundment for disposal. Precautions will be taken to place the materials in the tailings in such a way as to minimize any future subsidence of the area.

3.3 Site And Design Criteria

PRL's tailings disposal facility was designed to minimize the dispersal of tailings by wind and water, to minimize the upstream rainfall catchment area, to minimize the embankment and cover slopes, to minimize erosion of the cover, to locate the impoundment away from capable faults, and to promote deposition on top of the cover. Specific design criteria for the tailings impoundment and dam are detailed in Woodward-Clyde Consultants studies and designs. Refer to the list of reverence documents in Section 2. The design of the cover and reclamation is presented in this document. The design features of the impoundment and cover, will provide reasonable assurance of the longevity of the tailings disposal facility. See Section 6.

3.4 Control Of Radon Release And Gamma Exposure Rates

This plan covers the design of the radon barrier for the tailings impoundment consisting of one and one-half (1.5) feet of compacted clay covered by two (2) feet of soil, consisting of the locally sandy material, covered by a minimum of eight (8) inches of a rock cover. This radon barrier was designed to yield a radon emanation rate of 20 pCi/m^2/sec or less and gamma exposure levels that are equivalent to background gamma levels.

3.5 Pre-Operational And Operational Environmental Monitoring Program

The pre-operational environmental monitoring program and the data collected are presented in the Environmental Report, and in the Final Environmental Statement (NRC , 1979(b)). The operational and interim environmental monitoring programs are described in Section 5.5.6. of the Source Material License Renewal Application SUA 1371. Docket No. 40-8698, March 11, 1996.

3.6 Control Of Airborne Effluents

All airborne effluents from milling operations will be reduced to levels that are As Low As Reasonable Achievable (ALARA), which in turn controls exposures to populations around the site and site contamination to the maximum extent reasonably achievable.

Airborne effluent controls include:

NOTE: Sections below refer to the Source Material License Renewal Application SUA 1371. Docket No. 40-8698, March 11, 1996.

1. Sprinkling the potentially dry tailings beaches with tailings solutions and the controlled deposition of tailings slurry as described in Section 5.5.7..
2. Crust formation, sprinkling with water, and/or the application of chemical dust stabilizers in the ore pad areas as described in Section 5.5.7.
3. The use of the dust collection systems in the mill as described in Section 5.5.8. The operational characteristics of these systems are presented in Table 3.2-1, and the instrumentation and inspection in Section 3.2.2.
4. The use of the yellowcake dust control systems in the mill as described in Section 5.5.8. The operational characteristics of these systems are presented in Table 3.2-1, and the instrumentation and inspection in Section 3.2.2.

Daily inspections of the tailings retention system will be conducted and documented as specified in Table 5.5-7 interim program - Table 5.5-8, weekly inspections, of Source Material License Renewal Application SUA 1371. Docket No. 40-8698, March 11, 1996. The NRC regional office will be notified immediately of any failure of the tailings retention system which results in a release of tailings or waste into unrestricted areas and/or any unusual conditions, not contemplated in the design of the retention system, which if not corrected could indicate the potential for release of tailings to unrestricted areas.

3.7 Inspections

The design of the reclaimed tailings disposal area will result in a stable configuration that will not require ongoing maintenance to preserve isolation after decommissioning. However, to ensure the continued isolation of the tailings, annual site inspections, unless more frequent inspections are deemed necessary by the Commission, shall be conducted by the government agency retaining ultimate custody of the tailings disposal area to confirm the integrity of the stabilized tailings and to determine the need, if any, for maintenance and/or monitoring.

3.8 Hazardous Constituents

PRL does not reasonably expect any compound on the list of specific constituents presented in 10 CFR Part 40. Appendix A. Criterion 13 to be present in the groundwater under the PRL mill or tailings area as a result of site operations.

3.9 Financial Surety

At the present time surety arrangements have been established at the First Interstate Bank of Gillette, Wyoming with an account in the name of: Plateau NRC Surety which names the U.S. Nuclear Regulatory Commission as the beneficiary. The surety amount as of March 27, 1996 was $2,549,136.00. These funds are sufficient to carry out the decontamination and decommissioning of the facility and site, and for reclamation of the tailings disposal area as of this date. The amount of funds insured by the surety arrangement is based on cost estimates and the decommissioning plan approved by the Commission in November 1983 and 1988 which provide for (1) decontamination and decommissioning of mill buildings and the facility site to levels which would allow unrestricted use of these areas and (2) the reclamation of the tailings disposal area in accordance with the approved technical criteria. Plateau has committed to phased reclamation of the tailings accumulated throughout the operational life of the facility. The surety arrangement will provide funds that are sufficient to cover the costs of decommissioning and reclamation of the areas that are presently used for the mill and tailings disposal area.

The surety arrangement is reviewed annually by the licensee and adjusted with the approval of the Commission, when needed, to account for any increases or decreases resulting from inflation, changes in engineering plans, activities performed, or any other conditions affecting costs. Therefore, this reclamation plan and analysis will update the surety arrangements for the decommissioning and reclamation of the proposed Stage I Area utilization, See Sections 9, 10, & 11. This is in part to comply with the request for resumption of milling activity through the NRC permit application requirements

3.10 Interim Stabilization Plan

During the operation of the mill it will be anticipated that from time to time a short term shut down in operations may be required for various reasons. For most, if not all, of these occurrences the tailings ponds will be operated per the tailings management plan. For example, the ponds collection sump and under drain system will continue to collect the excess water from the tails. (See Section 7.2) A pump and spray system will distribute this water across the surface of the exposed tailings keeping them moist. This will limit or prevent wind blown erosion on the surface of the tailings preventing the release of particulate matter. The continued evaporation of this liquid along with little or no inflow from the mill will further consolidate and stabilize the tailings. If a major precipitation event should occur the impoundment design will contain this water. The mill area will continue to follow the operating and monitoring procedures set in place for the facility.

In the event that a longer shut down is required than currently planned, and before the economic life of the facility necessitates permanent decommissioning, a more stringent plan will be developed in accordance with the NRC's review, recommendations and approval. Such a plan may require that the tails be covered with a one foot layer of soil and/or a chemical binder to protect the tailings from wind erosion and the release of particulate matter.

At this time, once the mill is back on active status it will continue to operate until the designed life has expired or the economic viability of the mill requires decommissioning.

During the time of actual decommissioning of the mill and reclamation of the tailings impoundment, the exposed beaches will continue to be sprayed to prevent particulate release. Spraying will continue until tailings have been covered by the placement of the radon barrier materials.

3.11 Rodent and Plant Penetration into the Radon Barrier

At the completion of the reclamation phase there will be a minimum depth of one and one-half (1.6) feet of clay cover, followed by two (2) feet of soil cover and finally eight (8) inches of rock cover placed on top of the tailings in the impoundment area. The rock cover material will make the surface of the impoundment an unlikely habitat area for burrowing rodents, based on the size and depth of the rock cover.

The low average annual precipitation of 6 to 8 inches (15 - 20 cm); frequent droughts; extreme temperatures, and the fact the surface of the impoundment will be covered with cobble which will have poor moisture-holding capacity and little to no organic content the establishment of plant growth will be marginal at best. Therefore, there is no concern of roots penetrating the clay barrier and establishing a pathway for radon migration to the surface.

4.0 GEOLOGY AND SEISMOLOGY

A comprehensive summary for the Shootaring Canyon site of the geologic and seismologic setting and site and subsurface conditions was presented in previous reports and is generalized here. (Woodward Clyde Consultants, Environmental Report May, 1978).

4.1 Regional Geology

The project site is located within the Colorado Plateau physiographic province in southeastern Utah. Wide areas of nearly flat-lying rocks separated by abrupt monoclinal flexures form the broad uplifts and intervening basins common to this province. Igneous intrusions have formed several mountains, such as the Henry Mountains near the facility. However, most of the topographic relief in the Colorado Plateau is the result of erosion of deep canyons rather than upstanding mountain ranges (Thornbury, 1965).

The Shootaring facility is located near the southern end of the Henry Mountains' structural basin. The basin contains sedimentary rocks ranging from Mesozoic to Cenozoic in age, and which are cut by the Tertiary intrusives forming the Henry Mountains, including Mt. Ellsworth See Figure 4.1. The basin is elliptical, with its longer axis 100 miles in length trending northerly and its shorter axis 50 miles in length trending easterly. The basin is bounded on the west by the Waterpocket Fold (monocline) and on the east by the Monument Upwarp. Elevations within the basin range from 4000 to 7000 feet. Major peaks rise 4000 to 5000 feet above the surrounding basin. Fault development in the area is associated with the intrusive igneous centers of the Henry Mountains. These faults commonly have a northeasterly or northwesterly strike and do not generally extend far from the intrusive bodies. Faults are not known to exist within the project

4.2 Site Geology

The processing facility site is located in an area characterized by buttes, mesas and canyons approximately five miles southwest of Mt. Ellsworth. See Figure 4.2. The mill is situated on a low mesa and a small, isolated catchment to the west contains the tailings impoundment. A tall butte separates the site from Shootaring Canyon. Drainage from the site is to the southwest into Shootaring Creek. Local relief ranges from 200 to 500 feet. Geologic structure is relatively simple in the immediate area, with the various sedimentary formations dipping gently (2 to 3 degrees) to the west. Sedimentary rocks exposed at the surface are predominantly sandstones of Upper Jurassic age. The high buttes and mesas west and north of the site are capped by the Salt Wash Member of the Morrison Formation. This fluvial sandstone unit contains the uranium deposits that are mined in the area. Exposed cliffs surrounding the buttes and mesas are comprised primarily of the thinly bedded reddish-brown siltstones and mudstones of the Summerville Formation, underlain by the generally massive fine grained reddish-brown Entrada Sandstone. The Entrada Sandstone is the bedrock underlying the mill and the tailings impoundment. In the vicinity of the site the Entrada is approximately 420 feet thick. Cementing agents are commonly calcite and ferric iron. Environment of deposition is believed to be primarily eolian. Subordinate amounts of shale are present locally, evidence of episodes of marginal marine conditions.

TYPICAL STRAT GRAPHIC SECTION

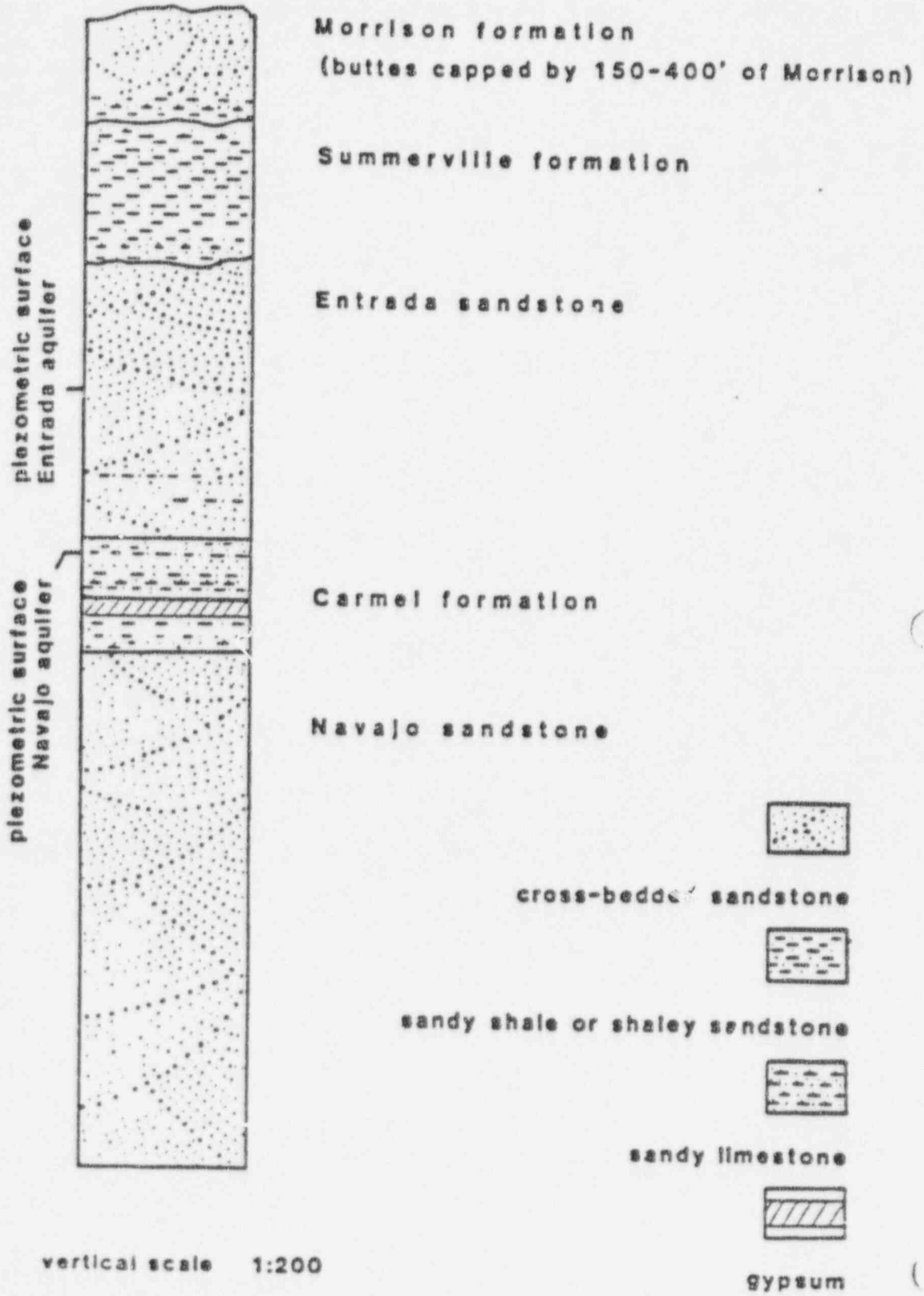
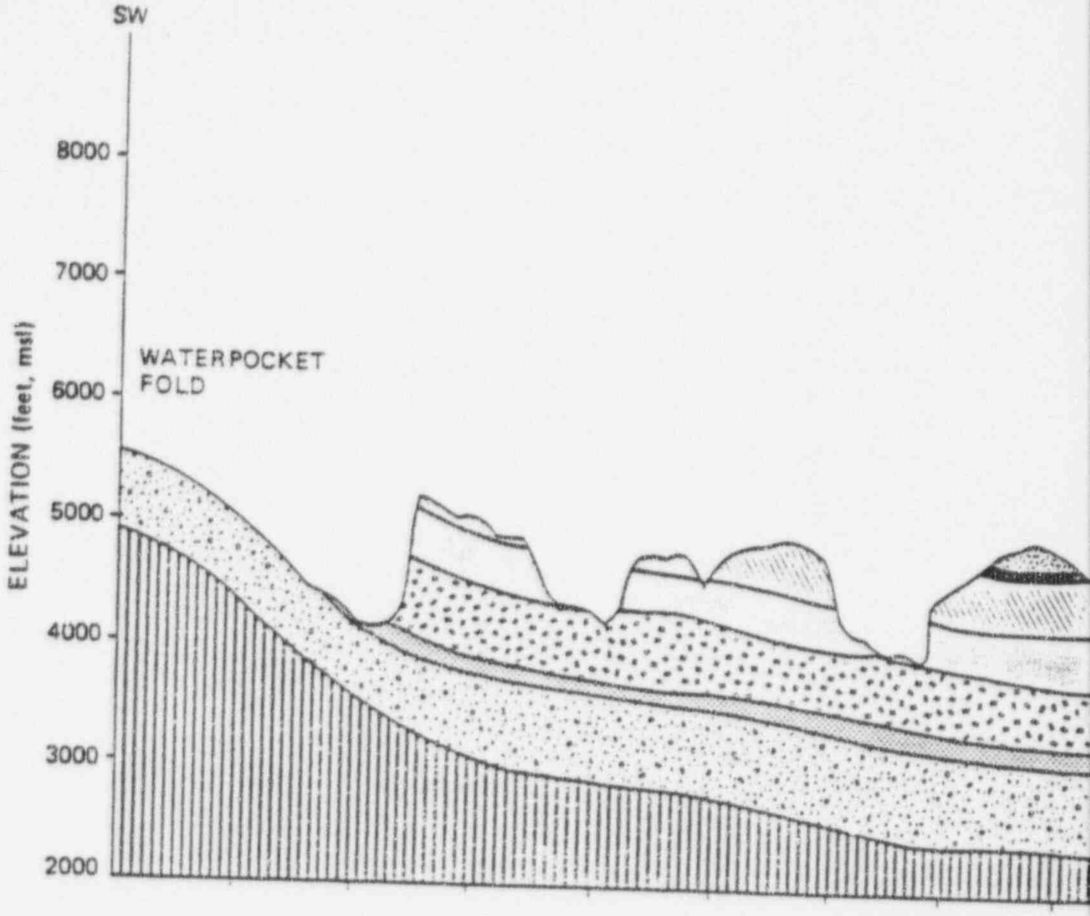


Figure 4.1



LEGEND

TERTIARY

Diorite Porphyry

Breccia zone

CRETACEOUS

Mancos Shale

Dakota Sandstone

JURASSIC

Morrison Formation

Summerville Formation

Entrada Sandstone

Carmel Formation

JURASSIC-TRIASSIC

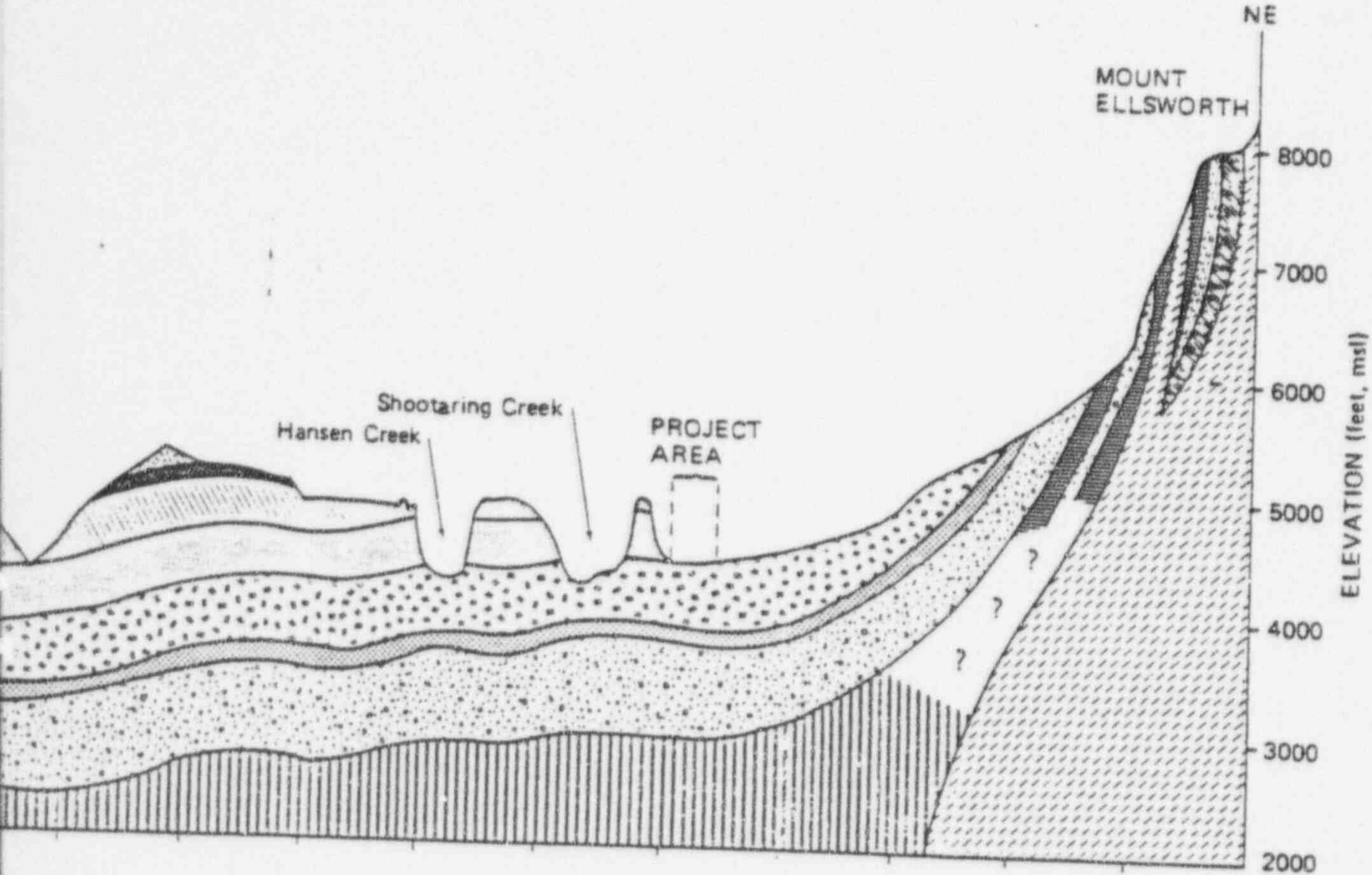
Navajo Sandstone

TRIASSIC

Kayenta Formation

Wingate Sandstone

Source: Developed from U.S. Geological Survey, 1952.



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Note: Vertical scale is 5.3 times larger than the horizontal scale.

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Figure 4.2. GENERALIZED GEOLOGICAL CROSS SECTION ACROSS THE HENRY MOUNTAINS BASIN

No major faulting has been observed in the Entrada Sandstone at the site. Limited sets of joints are widely spaced, steeply dipping and sealed with calcite and gypsum. Joint trends are northwesterly and northeasterly, coinciding with the regional structural pattern.

Beneath the Entrada lies the Carmel Formation, a heterogeneous unit approximately 160 feet thick composed of sandstone, siltstone, mudstone, limestone and gypsum. In the Shootaring Canyon area, the Carmel appears to include substantial layers of shale or mudstone. The Carmel is underlain by the Navajo Formation which is approximately 800 feet thick in the vicinity of the site. The base of the Navajo is approximately 1400 feet beneath the surface of the site. A typical stratigraphic section for the area surrounding the site is given in Figure 4.1.

4.3 Seismicity

Earthquake activity in the region that may affect the facility site can be evaluated by examining the historical seismicity of the region. Figure 4.3 shows epicenter locations for 112 earthquakes reported between 1853 and January 1976 with magnitudes of 3.5 and greater, or Modified Mercalli intensities of V and greater, within a 200-mile radius of the site. Table 4.1 defines intensity ratings on the Modified Mercalli scale (MM). This scale was used in assigning earthquake intensities in Utah prior to the mid-1940's. Table 4.2 describes an additional eight events with magnitude of 3.5 and greater reported within the 200 mile radius between July 1978 and December 1983. Figure 4.4 shows epicenter locations for 94 earthquakes reported between June 1983 to Jan. 1996 with magnitudes of 2.5 and greater within the 200 mile radius. Figure 4.5 shows epicenter locations for all earthquakes reported between 1853 and January 1996 with magnitudes greater than 0.

A persistent feature of the seismic history of the region is a broad band of activity trending NE-SW. This seismic belt coincides with the boundary between the Basin and Range and the Colorado Plateau physiographic provinces. The seismic activity associated with this belt is located more than 80 miles west of the facility. Seismicity in the nearest portion of the belt appears to be chiefly related to the Elsinore, Tushar and Sevier fault zones which bound the Sevier Valley. The interior of the Colorado Plateau historically exhibits a very low level of seismicity.

The largest recorded event depicted in Figure 4.3 had an epicenter about 110 miles northwest of the site and a maximum (MM) intensity of VIII to IX. Its magnitude was estimated at 6.7 (Cook and Smith, 1976). The event nearest the site had an epicenter about 20 miles southeast of the facility site. This earthquake, which occurred on August 22, 1986, had a magnitude of 4.0 on the Richter scale. The next nearest event occurred on September 20, 1963 and had an epicenter about 38 miles north of the facility with a magnitude of 4.5 on the Richter scale. Published curves relating ground motion intensity to distance from an earthquake's epicenter suggest that the maximum intensity that has occurred at the site is III-IV (MM) (Brazee, 1976). This level of intensity is not normally associated with structural damage (Richter, 1958). Based on the seismic history, the probability of a major damaging earthquake occurring at or near the site is remote. Algermissen and Perkins (1976) indicate a 90% probability exists that a horizontal acceleration of 4% of gravity would not be exceeded in 50 years. However, should such an acceleration level occur, only minor damage would be expected.

Table 4.1. MODIFIED MERCALLI INTENSITY SCALE OF 1931

Intensity	Summary of Observed Effects
I	Not felt by people, except under especially favorable circumstances.
II	Felt indoors by a few people.
III	Felt indoors by several people.
IV	Felt indoors by many people, outdoors by a few people. Awakens a few individuals.
V	Felt indoors by practically everyone, outdoors by most people. Awakens most sleepers.
VI	Felt by everyone, indoors and outdoors. Awakens all sleepers.
VII	Frightens everyone. General alarm. Difficult to stand.
VIII	General fright, alarm approaches panic. Persons driving cars are disturbed.
IX	Panic is general. Ground cracks conspicuously.
X	Panic is general. Extensive damage to well-constructed buildings.
XI	Panic is general. Broad fissures, earth slumps, and land slumps develop in soft, wet ground. Damage to buildings is severe.
XII	Panic is general. Damage is total and practically all buildings are destroyed.

Table 4.2 LISTING OF FELT EARTHQUAKES WITH MAGNITUDE OF 3.5 OR GREATER - JULY 1978 - DECEMBER 1983

Date/Time		Location	Magnitude
4/30/79	02:07:09.98	37N53.05 110W58.93 Southern Capitol Reef National Park	3.6
4/6/80	10:45:04.3	39N56.86 111W58.46 1 mile west of Elberta, Utah	3.5
5/24/80	10:03:36.47	39N56.21 111W57.59 near Elberta, Utah	4.4
2/1/81	02:21:47.67	37N33.82 113W15.83 near Kanarraville, Utah	3.6
4/5/81	05:40:39.69	37N35.49 11. W17.87 near Cedar City, Utah	4.6
5/14/81	05:11:04.34	39N28.86 111W04.72 Hiawatha, Utah	3.5
5/24/82	12:13:26.56	38N42.50 112W02.19 near Richfield, Utah	4.0
12/9/83	08:58:40.72	38N34.62 112W33.93 near Cove Fort, Utah	3.6

Source: Richins, Wm. D. et al. 1981 and 1984
Earthquake Data for Utah Region,
July 1978 to December 1980 and Jan. 1981 to Dec. 1983.
University of Utah, Department of Geology & Geophysics,
Salt Lake City, Utah

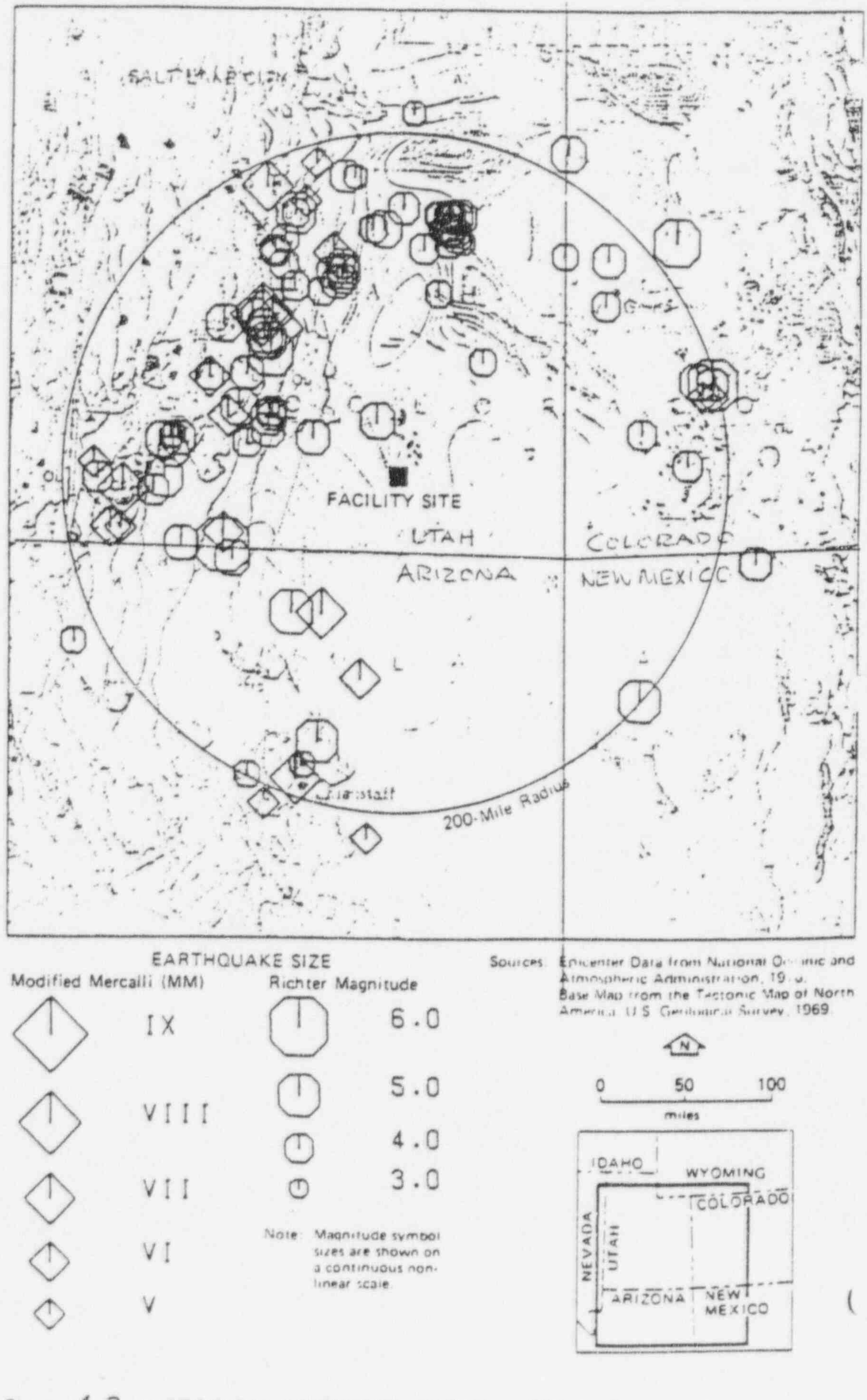
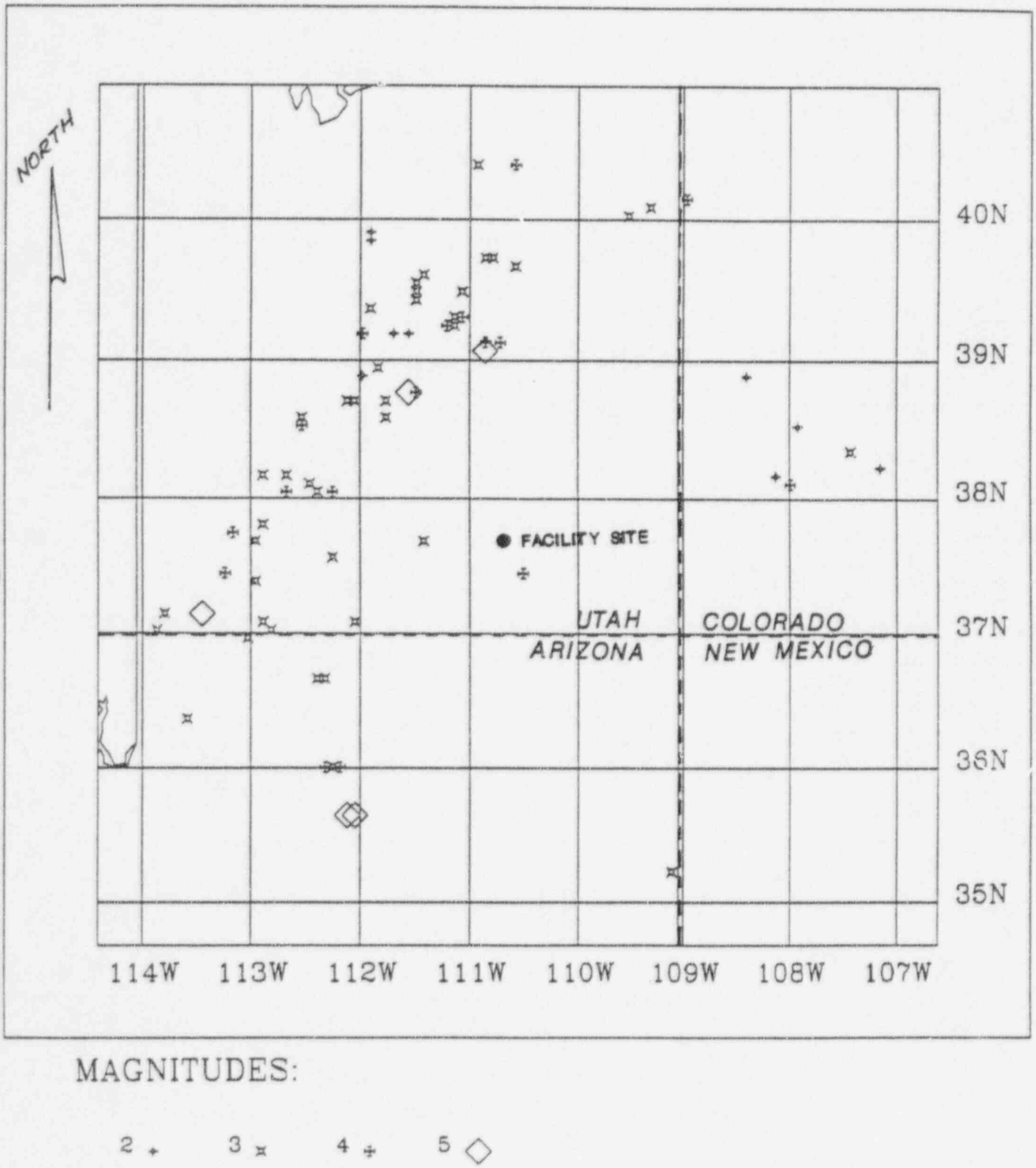


Figure 4.3 HISTORICAL SEISMICITY WITHIN A 200 MILE RADIUS OF THE PROPOSED FACILITY

HDF$:[HDF.PUBLIC.ENERGY]SR125324.DAT

First date: Jun 9, 1983   Last date: Jan 6, 1996

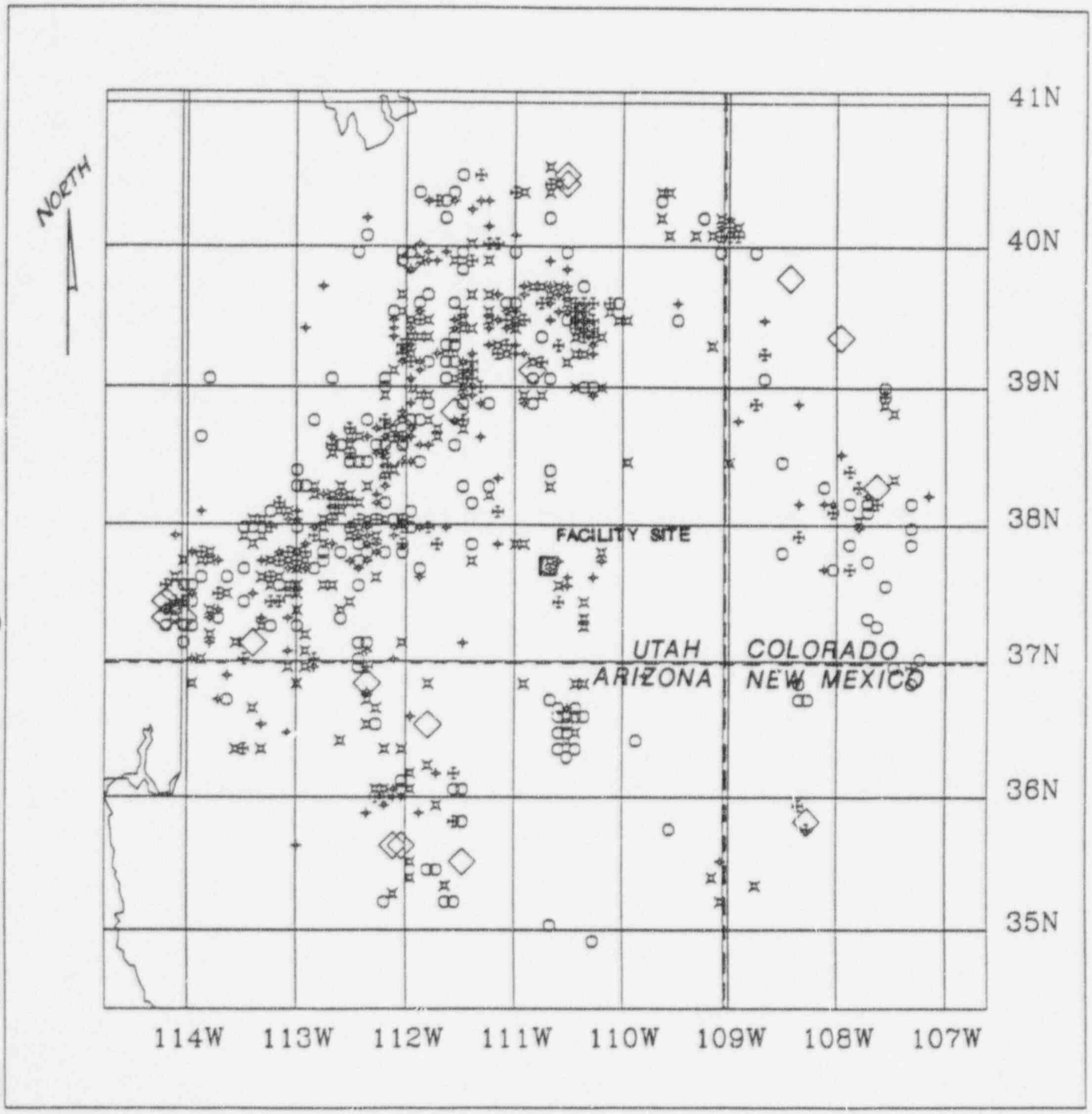


U. S. Geological Survey, National Earthquake Information Center
Data taken from the Earthquake Data Base System

Figure 4.4

HDF$:[HDF.PUBLIC.ENERGY]SR124731.DAT

First date: Dec 1, 1853 Last date: Jan 6, 1996



MAGNITUDES:

? ○ 1 □ 2 + 3 ¤ 4 ÷ 5 ◇

U. S. Geological Survey, National Earthquake Information Center
Data taken from the Earthquake Data Base System

Figure 4.5

5.0 SLOPE STABILITY

5.1 Dam Settlement Monitoring During Operations

During operation of the facility the engineered and NRC approved earthen clay impoundment dam will be regularly monitored to establish that the dam is performing as designed. This will entail placement of horizontal and vertical control points along the crest of the dam for the establishment of x, y and z coordinate analysis. If any changes were to occur, appropriate measures would be taken. At the completion of the final reclamation an as-built survey will be performed to establish the final contour of the impoundment area and dam. This data will be used as a base line for any future monitoring performed by the appropriate governmental agency taking possession of the facility.

5.2 Liquefaction of Tailings

There is no potential of liquefaction of the tailings placed in the natural depression and retained behind the engineered and NRC approved earthen clay impoundment dam. The tailings will be placed on top of a double liner system with an under drain system installed which will drain the excess water from the tailings and re-circulate it back to the mill facility during operations. At the time of reclamation, the under drain system will be further utilized in the dewatering and consolidation of the tailings held within the impoundment area. It should be noted that the top of the tailings placed behind the impoundment dam will be relatively flat, on the order of 0.5 % to 3 %. There will be no side slopes do to the fact that the tailings are placed within a natural depression and retained by the engineered and NRC approved earthen clay impoundment dam. Please refer to Figure 3 of the Reclamation Plan.

5.3 Seismic Stability Analysis

Inberg Miller has completed a seismic stability analysis for the Shootaring Canyon Dam based on information supplied by PRL contained in the following documents:

- "Tailings Management Plan and Geotechnical Engineering Studies - Shootering Canyon Uranium Project", by Woodward-Clyde Consultants dated September, 1978
- "Stage I - Tailings Impoundment and Dam - Final Design Report, Shootering Canyon Uranium Project", by Woodward-Clyde Consultants dated May 1979.
- "Stage I Tailings Impoundment and Dam Field Density Test in Zone 2 Material - Shootering Canyon Uranium Project", by Woodward-Clyde Consultants dated November 13, 1980

- "Earthwork Quality Control Overview and As-Built-Drawings - Construction of Stage I Tailings Impoundment and Dam - Shootering Canyon Uranium Project", by Woodward-Clyde Consultants dated July 28, 1982.

Inberg Miller developed an understanding of the dam geometry, geologic conditions, and engineering properties of soils which comprise the dam according to the above documents as basis for modeling the dam for analysis. Inberg Miller also reviewed "Seismic Hazard Analysis of Title II Reclamation Plans", by Lawrence Livermore National Laboratory dated June 26, 1994.

5.3.1 Inberg Miller Analysis Report

SLOPE CONDITIONS AND PARAMETERS

We understand the Stage I of the Shootering Canyon Dam was completed in 1982. The dam is an earthen structure designed to impound uranium mill tailings. It has a crest elevation of 4433 feet and a maximum height of approximately 85 feet. The design maximum surface elevation of impounded tailings is 4420 feet. Tailings are assumed to be saturated.

In general, the dam is comprised of 3 zones as shown on Figure 5, Section C -C from July 28, 1982 Earthwork Quality Control Overview and As-Built Drawings - Construction of Stage I Tailings Impoundment and Dam - Shootering Canyon Uranium Project. Zone 1 is the core of the dam, extending from the base to the crest, which is "silty sandy clayey" soil. Zone 1 is key-in to the rock foundation at the base. Zone 3 adjoins the core on the upstream and downstream sides, also extending from the base to the crest, which is "fine sand". Zone 2 forms the upstream and downstream face of the dam outside of Zone 3, and is described as "boulders, cobbles, gravels, and sand". We also understand an additional 2.25-foot thick layer of 18" rip-rap will extend from the downstream toe up the face a height of 15 feet. Soil descriptions for each soil zone were as defined by Woodward-Clyde Consultants in their above referenced reports. A copy of Section C-C that we referred to for modeling the slope is contained in Exhibit A.

Based on information provided by Plateau Resources Limited (PRL), we understand that the tailings will be contained by a liner and collection system. The liner system will consist of a double-layer 60 mil HDPE liner with leak detection, and will extend up the upstream face of the dam to the crest. Accordingly, our slope stability analysis assumes there is no phreatic surface through the dam.

The soil properties of the different units which are part of the dam system were taken from Table C-1 for operating conditions and seismic conditions in the May 1979 Stage I - Tailings Impoundment and Dam Final Design Report. Based on the Nov. 13, 1980, letter regarding Stage I Tailings Impoundment and Dam Field Density in Zone 2 Material by Woodward-Clyde Consultants, the unit weight of Zone 2 soil was increased from 125.0 to 131.0 pcf. A copy of Table C-1 and the Nov. 13, 1980 letter is contained in Exhibit B. The soil properties we used are summarized below:

Soil Number	Description	Unit Wt. (pcf)	Cohesion (psf)	Friction Angle (ϕ)
1	Zone 1 - Silty Sandy Clayey Soil	125	1500	0
2	Zone 2 - Boulders, cobbles, gravels, sand	131	0	40
3	Zone 3 - Fine sand	125	0	32
4	Rock Foundation	140	1000	45
5	Tailings	100	0	10

PRL requested that we use a horizontal seismic coefficient of 0.19 g based on "Seismic Hazard Analysis of Title II Reclamation Plans", by Lawrence Livermore National Laboratory. A copy of the report section, to which PRL referred us, is contained in Exhibit C.

ANALYSIS RESULTS

We performed a slope stability analysis using the computer program PCSTABL version 5M, and the parameters which were described above. Stability analyses were performed in accordance with Bishop and Janbu methods which are available as options on PCSTABL. Per PRL's request, we analyzed the downstream slope assuming a full tailings pool (surface elevation 4420 feet). No other configurations were requested or analyzed.

The lowest safety factor (1.14) was determined using the Janbu method for the downstream face of the dam. The critical failure surface determined with PCSTABL is characterized as an "infinite slope failure" which is planar and parallel to the slope face, and typical of failure surfaces in granular soil. The safety factor calculated with PCSTABL compares favorably with manual calculations for an "infinite slope" using a soil friction angle of 40 degrees and a horizontal seismic coefficient of 0.19 g. Input and plot files for the PCSTABL critical failure surface are included in Exhibit D.

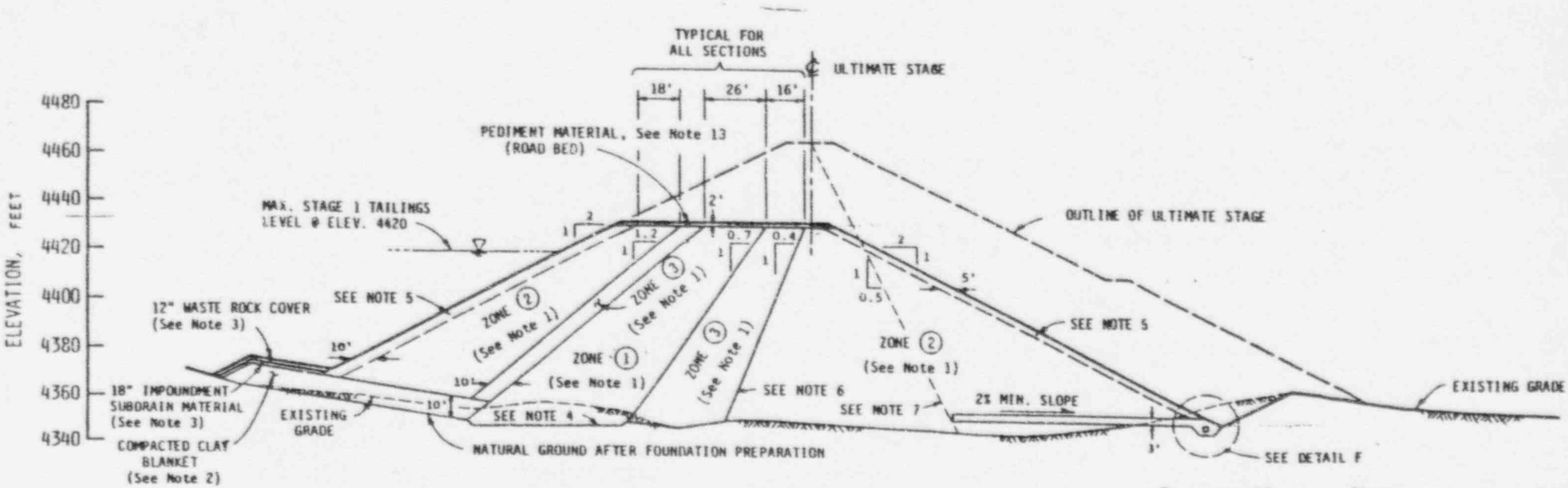
INBERG-MILLER ENGINEERS

Glen M. Bobnick, P.E.
Geotechnical Engineer

Exhibit A - Existing Conditions
Exhibit B - Soil Properties
Exhibit C - Seismic Hazard Analysis
Exhibit D - Stability Analysis Results

EXHIBIT A - EXISTING CONDITIONS

Figure 5, Section C -C from July 28, 1982 Earthwork Quality Control Overview and As-Built Drawings - Construction of Stage I Tailings Impoundment and Dam - Shootering Canyon Uranium Project


TYPICAL FOR ALL SECTIONS
ULTIMATE STAGE
18'
26'
16'
PEDIMENT MATERIAL, See Note 13 (ROAD BED)
MAX. STAGE 1 TAILINGS LEVEL @ ELEV. 4420
OUTLINE OF ULTIMATE STAGE
ELEVATION, FEET
4480
4460
4440
4420
4400
4380
4360
4340
12" WASTE ROCK COVER (See Note 3)
SEE NOTE 5
ZONE 2 (See Note 1)
ZONE 3 (See Note 1)
ZONE 1 (See Note 1)
ZONE 3 (See Note 1)
ZONE 2 (See Note 1)
SEE NOTE 5
SEE NOTE 6
SEE NOTE 7
SEE NOTE 4
2% MIN. SLOPE
EXISTING GRADE
18" IMPOUNDMENT SUBDRAIN MATERIAL (See Note 3)
EXISTING GRADE
COMPACTED CLAY BLANKET (See Note 2)
NATURAL GROUND AFTER FOUNDATION PREPARATION
SEE DETAIL F
0
40
80 ft.

SECTION C-C

EXHIBIT B - SOIL PROPERTIES

Table C-1 from May 1979 Stage I - Tailings Impoundment and Dam Final Design Report, and November 13, 1980 letter regarding State I Tailings Impoundment and Dam Field Density Test in Zone 2 Material

TABLE C-1

SOIL PROPERTIES USED IN STABILITY ANALYSES

Material	Soil Number (Figure D-3)	Unit Weight (pcf)	Effective Strength Parameters C'(psf)	Effective Strength Parameters Ø'(°)	Total Strength Parameter C(psf)	Total Strength Parameter Ø(°)
Zone 1*	1	125	0	26(1)	900(2) 2200(4) 1500(5)	13(2) 0(4) 0(5)
Zone 2(3)	2	125	0	40	-	-
Zone 3(3)	3	125	0	32	-	-
Clay Blanket*	1	125	0	26(1)	900(2) 2200(4) 1500(5)	13(2) 0(4) 0(5)
Tailings(3)	5	100	0	10	-	-
Rock Foundation(3)	4	140	1000	45	-	-

(1) Parameters for operating conditions - static condition

(2) Parameters for end of construction - static condition

(3) Effective strength parameters for these materials apply to all conditions

(4) Parameters for end of construction - seismic condition

(5) Parameters for operating conditions - seismic condition

* Estimates strength values to be confirmed and presented with additional stability analyses in supplemental report to be submitted by June 5, 1979.

Three Embarcadero Center, Suite 700
San Francisco, California 94111
415-956-7070

Woodward-Clyde Consultants

November 13, 1980

Project: 60255N

Plateau Resources Limited
772 Horizon Drive
Grand Junction, Colorado 81501

Attention: Mr. U.K. Gupta

Gentlemen:

STAGE 1 TAILINGS IMPOUNDMENT AND DAM
FIELD DENSITY TEST IN ZONE 2 MATERIAL
SHOOTERING CANYON URANIUM PROJECT
Garfield County, Utah

As required in Amendment No. 1 to the Source Material License SUA 1371, and as discussed during the NRC site inspection on November 5, 1980, a field density test is required in the Zone 2 material for every 50,000 cubic yards of Zone 2 material placed. Because of the wide range of grain sizes, the conventional testing being used for Zone 1 and 3 is not applicable. The first test was completed on November 6, 1980, and the results show that the Zone 2 material is being compacted to a dry density of 131 pcf. This value is well above the estimated 125 pcf used in the stability analysis for the dam (WCC Report, May, 1979), hence stability being achieved is well in excess of the minimium requirements.

Attached is a copy of the test procedures for the field density test discussed above. These procedures will also apply to the remaining density tests to be performed in the Zone 2 material. The total time required to complete the field portion of the test is about 1-1/2 hours provided all of the necessary equipment and labor is present at the onset of the test.

If you have any questions concerning the contents of this letter, please contact Mr. Bernard Gordon or the undersigned.

Sincerely yours,

Don A. Poulter
Staff Engineer

sme

Enclosure

cc: w/Enclosure
Bill Luhrs (PRL)
PRL Field File
(c/o S. Ankrum)
R. Duncan (Garco)
D. Rose (Garco)
D. Staton (MSME)
M Brown (MSME)

ZONE 2 FILL DENSITY TESTS PROCEDURES

SHOOTERING CANYON URANIUM PROJECT

Garfield County, Utah

---

1) Select a representative area approximately six to seven feet square. The area should be approximately level or require only minimal grading.

2) Excavate a pit approximately 6ft. x 6ft. x 3ft. The corners and bottom may be rounded. As the material is excavated, carefully load it into a clean, empty truck making sure that no material is wasted or lost.

3) Trim the loose material off the sides and bottom of the pit by hand. Place this material into the truck making sure that no material is wasted or lost.

4) After all of the material has been loaded into the truck, weigh the loaded truck on calibrated scales (±10 lbs. is desired); dump the material and weigh the truck empty. If the scales are not on site, the material should be covered with a tarp to minimize moisture evaporation during travel.

5) After weighing, collect a sample (approx. 2-1/2 lbs.) of the finer material (minus 2 inch) and determine its moisture content. The sample should be representative and not contain material reduced in moisture from evaporation.

6) Line the excavated pit with a flexible sheet of plastic, approximately 10 mils thick. The linear should be loosely fitted so that it may conform to the sides of the pit as it is fill[illegible]th water. The plastic should overlap the t[illegible]o or three feet.

7) Using a calibrated meter or calibrated container, carefully fill the pit with a measured volume of water. Once the water level reaches the top of the pit, stop the test and record the volume of water placed in the pit. If the top of the pit is not level, measure the unfilled portion and determine its volume. (For this reason, it is best to excavate a square or rectangular pit).

SHOOTERING CANYON URANIUM PROJECT

(Continued)

8) After the test is completed and all of the data are recorded, empty the pit by pumping out the water, and discharge it into an area that will not adversely affect the construction or performance of the dam.

9) Backfill test pit to original grade with material recompacted to same density.

10) Calculate the density of compacted Zone 2 material, using the attached form. A copy of the completed test form should be sent to WCC.

FIELD DENSITY TEST

ZONE 2 MATERIAL

SHOOTERING CANYON URANIUM PROJECT

Garfield County, Utah

Test No: Date:

Tested by:

Supervisor(s) Present:

Weight of Truck plus Material:

Weight of Empty Truck:

Weight of Excavated Material:

Wet Weight of Moisture Sample:

Dry Weight of Moisture Sample:

Moisture Content:

Gallons of Water:

Volume of Water:

Volume of Unfilled Portion of Pit:

Total Volume of Pit:

Dry Density:

Calculations:

EXHIBIT C - SEISMIC HAZARD ANALYSIS

Referenced section from June 26, 1994 " smic Hazard Analysis of Title II Reclamation Plans", by Lawrence Livermore National Laboratory

larger M~5.8 event, we use the median estimate to account for its much lower probability of occurring. This leads to an estimate for PGA of 0.19g.

Fault 2

Fault 2 trends northwest hence it is favorably oriented with the stress field. The fault is approximately 10 km long. If the entire fault ruptured in a single event this could lead to a M~6.25 earthquake. If we assume only one-half of the fault ruptures, this leads to a M~5.9 earthquake. The fault is approximately 13 km from the site. The 1-sigma estimate for PGA at the site from a M~5.9 earthquake located on what we have labeled fault 2 is 0.28g. Because of its lower probability of occurrence, we use the median estimate for M_u~6.25 which is 0.19g. The median estimate for a M~5.9 event is 0.16g.

Fault 3

This fault is almost due east of the site. The fault is listed as a possible Quaternary fault by Hecker (1993) and could have some seismicity associated with it. The fault trends northeast and hence not in the most likely direction for earthquakes. Thus it is not a likely candidate for earthquakes. However, it is included in the analysis for completeness. The fault has a length of approximately 23 km and lies approximately 35 km from the site. If we assume the entire fault ruptured, this would give rise to a 6.7 earthquake. This is larger than might be expected, at least based on the historical record. However, as we pointed out in the methodology section, it is not clear that the historical record gives a good indication of the largest event that could occur because we expect that the largest possible event would be a characteristic earthquake governed by its own characteristic return interval. If we use a distance of 35 km and M = 6.7 in the Joyner - Boore model, we get 1-sigma estimate of 0.14g.

Random Earthquake Analysis

Based on the geology and pattern of seismicity around the Plateau Resources site, we selected a source zone which seemed reasonable to use to develop our recurrence model. As described in the methodology section we applied Stepp's method to try and determine the completeness of the earthquake catalog. There is no data in the catalog before 1963 for the selected zone. Stepp's method indicated that the catalog was reasonably complete for events of about magnitude 3 for the last 10 to fifteen years. The smaller events did not appear to be complete. Fig. 7.17 shows the data for the last 30 years. Also shown is the truncated exponential model that we use with M_u = 5.75. The model appears to fit the data reasonably well. The simple Richter form of the model normalized to a per year basis is

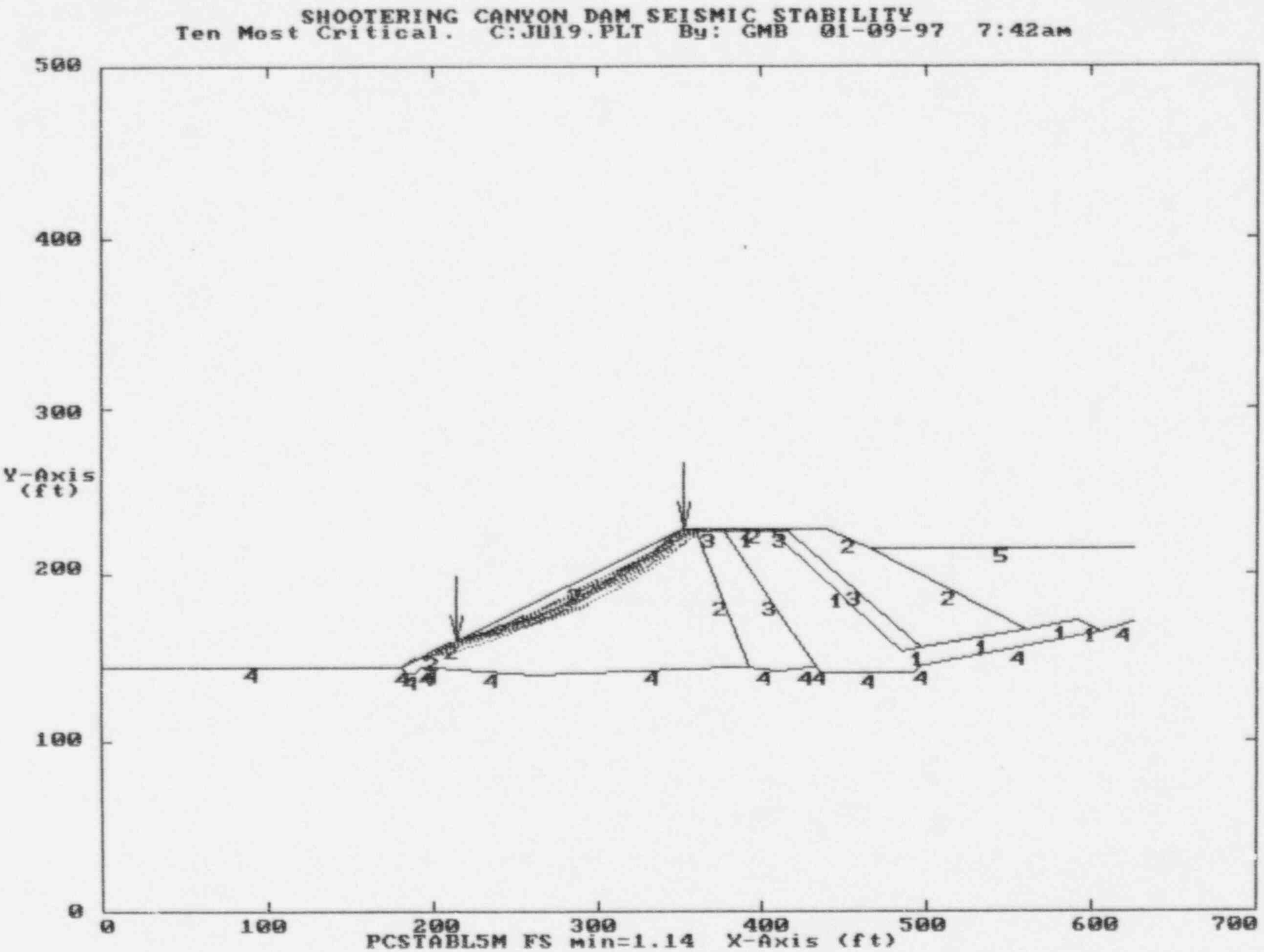
$$\log N = 2.43 - 0.92M$$

We used this recurrence model to develop the seismic hazard for the region around the Plateau Resources site as outlined in our methodology section. Fig. 7.18 gives the hazard curves for values of M_u = 5.5, 5.75, 6.25, and 7. We see from the hazard curves that at a PE level of 10^{-4} the PGA varies between 0.17g to 0.24g. As there are no major faults in the vicinity of the site our preferred choice for M_u is 5.75. * This leads to 0.19g estimate for the ground motion at the site from the random earthquake at a PE level of 10^{-4}. At a PE level of $5x10^{-4}$ the PGA varies between 0.08g to 0.12g depending upon the choice of M_u with a value of 0.09g at M_u = 5.75.

7.8.5 Conclusions

There appear to be no faults through the site that could cause problems. Our deterministic analysis lead to an estimate for PGA of 0.16g to 0.3g. The random earthquake analysis gives a lower estimate of 0.17 g to 0.24 g. There is a possibility of a larger earthquake in the vicinity of the site, which is included in the analysis for random earthquakes, however the likelihood is sufficiently low that in our opinion the M~5.5 earthquake meets our criteria.

EXHIBIT D - STABILITY ANALYSIS RESULTS
Input and Plot Files for the PCSTABL Critical Failure SurfacE


SHOOTERING CANYON DAM SEISMIC STABILITY
Ten Most Critical. C:JU19.PLT By: GMB 01-09-97 7:42am
Y-Axis (ft)
PCSTABL5M FS min=1.14 X-Axis (ft)

```
PROFIL        C:JU19.IN  PCSTABL Version 5M
SHOOTERING CANYON DAM SEISMIC STABILITY
33 7
0. 145. 181. 145. 4
181. 145. 211. 160. 2
211. 160. 214. 160. 2
214. 160. 353. 228. 2
353. 228. 440. 228. 2
440. 228. 466. 216. 2
466. 216. 626. 216. 5
466. 216. 562. 167. 2
562. 167. 593. 173. 1
593. 173. 607. 165. 1
607. 165. 626. 171. 4
360. 226. 377. 226. 3
377. 226. 406. 226. 1
406. 226. 416. 226. 3
416. 226. 498. 156. 3
498. 156. 562. 167. 1
406. 226. 485. 154. 1
485. 154. 498. 156. 1
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412. 142. 433. 144. 4
433. 144. 437. 141. 4
437. 141. 492. 141. 4
492. 141. 495. 145. 4
495. 145. 607. 165. 4
607. 165. 626. 171. 4
SOIL
5
125. 125. 1500. 0. 0. 0. 0
131. 131. 0. 40. 0. 0. 0
125. 125. 0. 32. 0. 0. 0
140. 140. 1000. 45. 0. 0. 0
```

```
100. 100. 0. 10. 0. 0. 0
EQUAKE
0.19 0. 0.
CIRCLE-Janbu circular, search.
0
20 20
175. 225. 350. 400. 10. 25. 0. 0.
```

6.0. EROSION PROTECTION OF THE TAILINGS IMPOUNDMENT

6.1 Tailings Dispersal By Erosion

To control water erosion, it has been planned to establish sheet flow over the impoundment area and dam which will prevent any erosion from precipitation falling on the impoundment and the surrounding areas. The tailings impoundment will be graded as to establish two drainage patterns. At the location of the existing cross valley berm, a ridge line will be established to split the runoff. The area north of the cross valley berm will sheet flow across the tailings cap to a man made channel cut in the natural topography to the northwest. The area south of the cross valley berm will sheet flow toward the impoundment dam and sheet flow across the entire width of the impoundment dam. The precipitation which flows from the mill facility will be directed to and flow over the impoundment area. Each runoff area shall be designed to handle the Probable Maximum Flood (PMF) for each collection area. It should be noted that a buffer, or transition zone of riprap will be constructed around the perimeter of the impoundment, See Reclamation Plan Map Figure 3. The riprap protection, will be of sufficient size and gradation to withstand the erosive forces, protecting the integrity of the impoundment cap and dam surface.

The surface of the tailings area will receive a desert paving, or as it will be referred to as a rock cover, to protect the radon barrier and the tailings from wind dispersal and water erosion. This layer will be engineered to the required size, gradation and thickness requirements for the Probable Maximum Precipitation (PMP) and PMF. At the location of intersection or joint where the radon barrier meets the native ground, the transition rock will extend onto the native ground for protection. At ridge lines or gradient changes on the tailings cap, a larger size transition rock will be placed to protect the transition zones.

All water entering or falling on the tailings impoundment will not be retained or pooled. In the original design concept for the tailings cap, the impoundment dam would have two spillways with flow lines constructed at three feet higher than the tailings cap. This concept was to limit the erosive forces of the water with pooling effects, and to maintain the clay's moisture content at near optimum, enhancing the cap's effectiveness as a barrier to the movement of radon gas emanating from the tailings. This Reclamation Plan is a design which sheds the water off the tailings cap so that no pooling can take place. In essence no recharge of the tailings can take place from the precipitation. The tailing impoundment area has been split into two different drainage areas, the first being that area north of the existing cross valley berm which would drain through a man made cut in the natural topography to the northwest, and the second being the area south of the existing cross valley berm which would sheet flow across the entire width of the impoundment dam, See Figure 3. In order to accomplish this at the time of final reclamation, a cut will be required in the natural topography to the northwest sized to handle the flows generated from the PMF. It should be noted that this cut will be made in the native sandstone bedrock with material removed placed in the outlet of the cut as an energy dissipation system. Draining the area south of the cross valley berm will require that the entire width of the impoundment dam be breached and laid

back across the tailings cap as soil cover. The dimensions of this breach will be approximately eight feet in depth, and eighty feet in width. The excavated breach material will be used as the soil cover on the radon barrier, with the riprap layer from the down slope of the dam face used on the transition on the top of the dam. This approximate eight foot breach is the depth required to protect from runoff water overtopping the dam during a high precipitation event during operations. It should be noted that construction of the breach will reduce the cost of the material required to be placed as soil cover because there will be no processing or hauling from borrow required.

6.2 Below-Grade Disposal

PRL's tailings impoundment is in a natural depression enclosed on the downstream end by an engineered, NRC approved dam. Such a tailings area minimizes the dispersion of tailings by wind and water erosion. The tailings disposal basin is effectively surrounded by natural cliffs and hills. It is anticipated, because of this fact, that net deposition of windborne soils is expected to occur over the impoundment area, rather than loss of coverings over the tailings due to wind erosion. Accordingly, natural deposition will be exploited to enhance the security of the projected tailings impoundment.

6.3 Rock Cover Protection Calculations

RE: Design of the erosion cap on the tailings impoundment of the Shootaring Canyon Uranium Mill, located in Garfield County, Utah.

Note: The tailings pond is divided into two separate drainage areas, the first being the area north of the existing cross valley berm which will drain to the northwest through a man made cut in the natural topography, and the second being the area south of the existing cross valley berm with sheet flow across the entire width of the impoundment dam. This drainage configuration will eliminate any free standing water left on the tailings area after a precipitation event. Because of the natural topography of the site and the fact that over time a net deposition of soil will occur, it was decided to not establish drainage ditches on the sides to capture runoff prior to its reaching the tailings cap, because any ditch established would be filled in over time by soil deposition and rendered useless. Instead, a transition riprap will be designed and placed at the contact point of the tailings cap and the natural ground which will disperse the energy and spread the flow out to ensure a sheet flow onto the tailings cap. See Tables 6.2 and 6.2, pages 6-30 and 6-31 for rock quality score and sample test results.

A. Design of Drainage Area above the Existing Cross Valley Berm.

This drainage area is generally to the north of the existing cross valley berm. The intent is to capture all the precipitation and pass it through a man made cut in the natural topography to the northwest. For all equations, figures and tables referenced in the design calculation in this section can be found in the NUREG/CR-4620 ORNL/TM-10067, Dated June 1986, Methodologies for Evaluation Long - Term Stabilization Designs of uranium Mill Tailings Impoundments.

Area of Drainage: 143 Acres
Runoff Coefficient 0.95 From table 4.4

Using Equation (4.45) the Time of Concentration can be determined. It should be noted that because of the two extremes in slope, a combined Time of Concentration must be determined. The first, or A', is the area which lies above the tailings area. This area will drain to the tailings cap and then sheet flow across the cap to the rock cut. The second, or A'', is the tailings cap. It will take the combined time to reach the rock cut.

Time of Concentration A' = (11.9*L^3 / H)^ 0.385
=(11.9*0.47^3 / 162)^ 0.385
= 0..15 HRS
= 9.26 Minutes

Where L = 2500/5280 = 0.47 miles
H = 4620-4458 = 122 FT

Time of Concentration A'' = (11.9*L^3 / H)^ 0.385
=(11.9*0.24^3 / 7)^ 0.385
= 0..24 HRS
= 13.94 Minutes

Where L = 1250/5280 = 0.24 miles
H = 4458-4451 = 7 FT

Therefore the combined Time of Concentration is A' + A'' = 9.26 + 13.94 = 23.2 min.

Using Table (2.1) in Section (2.1.1) The % PMP is found by interpolation using the Time of Concentration above.

%PMP = 84.2%

Using Equation (2.1) the Rainfall Depth is Calculated:

Rain Depth = (%PMP) X (PMP)
=(84.2%)X(8.5)
= 7.16 inches

Where the PMP is found in fig. 2.1 PMP = 8.5 inches

Using Equation (2.2) the Rain Intensity "i" is calculated:

Rain Intensity = (Rain Depth) X (60 / Time of Concentration)
= 7.16*(60/23.2)

= 18.5 inches / Hour

Using the Rational Method

$Q = CiA$
$Q = 0.95 \times 18.5 \times 143$
$Q = 2{,}516$ CFS

This water must flow through the rock cut channel.

Using Equation (4.40) a depth of flow can be found by trial and error on various configurations of channels.

Q = (1.486/n)*Area of Flow*(Area of Flow / Wetted Perimeter)^(2/3)*Slope^0.5

Note: Using Equation (4.41) the value of n can be determined by the size of riprap used in the channel

n = 0.395 (d50) ^ (1/6)

For this Rock Cut or Channel use the following criteria:

Q = 2,520 CFS
S = 1%
Side Slope of 1.5:1
Bottom Width of 30 Feet
Size of Riprap is 18" Diameter therefore n = 0.0423

By trial and error the depth of flow is found to be 6.4 Feet.

V = Q/A
V = 10 FT/Sec

From Fig (4.11) it is determined graphically that a minimum stone size of 15" must be used, therefore 18" riprap is OK. The velocity of the water will enable the channel to be self cleaning. This riprap will be placed upon the bedrock in the rock channel.

Quantity of Riprap and bedding required for the protection of the rock cut:

Note: Use a depth of 1.5 times the size required, therefore 2.25 FT. Use a 6" depth of 4" (-) bedding under the riprap. The bedding will be well-graded down to a minimum of 3/16".

18" Dia Riprap	= (2.25 FT)*(2*SQRT(8^2+(1.5*8)^2)+30*240 LF*1.2/27 = 1,412 CY
4" (-) Bedding	= 1412 CY * (0.5/2.25)Ratio = 314 CY

Please refer to Figures 6.1 and 6.2 at the end of this section for details of the rock cut and protection.

Design of Cap Protection on upper area:

Using Equation (4.43) and the rain fall intensity determined above, the unit width flow may be determined.

$$q = CiAw = 0.95*18.5*0.0861 = 1.51 \text{ CFS / ft width}$$

Where i = 18.5 inches / hour
Aw = 3,750*1/43560 = 0.0861
C = 0.95

Using EQ (4.46) the depth of flow is determined as:

$$y = [(Qn)/(1.486*s\hat{}0/5)]\hat{}(3/5) = [(1.51*0.0314)/(1.486*(.0075)\hat{}0.5]\hat{}(3/5) = 0.55 \text{ FT}$$

Where n = 0.0395*(d50)^(1/6). Therefore using a d50 = 3" , n = 0.0314
s = slope on the cap = 0.5 to 0.75 %

The velocity can then be determined as;

$$V = Q/A = 1.51 / (0.55*1) = 2.75 \text{ FT / Sec}$$

which is less then the values in Table 4.7 Therefore O.K. use d50 = 3".

It should be noted that this is a conservative size but the material will be readily available from the borrow areas. No bedding will be required under this rock cap because the soil cover material is composed of a well-graded sandy gravely material. No fines will be lost into the rock cap.

The rock cap will cover the tailings radon barrier above the existing cross valley berm. The surface area of this barrier is twenty-five and one-half (25.5) acres. Install an eight (8) inch depth d50 = 3" for the protective cover.

Quantity of (d50 = 3") = 25.5*43560*(8/12)*1.2 / 27 = 33,000 CY

Another factor to be considered in protecting the cap is to protect the places where the precipitation is flowing onto the cap in a concentrated fashion. In other words a transition rock should be designed and placed along the contact of the cap and the undisturbed soil. This transition rock will be a minimum of twenty feet wide and extend onto the undisturbed ground a distance of ten feet. This transition zone will dissipate the energy of the concentrated water and enable it to fan out and sheet flow onto the tailings cap.

Some sample locations have been analyzed to check the required rock size used in the transition zones. The sample locations are illustrated on Figure 6.6 at the end of this section.

Location "A":

Area of Drainage	26 Acres
Runoff Coefficient	0.95

Equation (4.45) Time of Concentration:

Time of Concentration = (11.9*L^3 / H)^0.385
= (11.9*(1400/5280)^3 / (4550-4458))^0.385
= 0.098 HRS
= 5.9 Minutes

From Table 2.1, the % PMP is found by interpolation:

% PMP = 48 %

Equation (2.1) Rainfall Depth:

Rain Depth = % PMP * PMP
= 48% * 8.5
= 4.1 inches

Equation (2.2) Rain Intensity:

Rain Intensity "i" = Rain Depth * (60 / Time of Concentration)
= 4.1 * (60 / 5.9)
= 41.7 inches / Hour

Equation (4.43) Unit width flow:

q = C i Aw
= 0.95 * 41.7 * (1400*1/43560)
= 1.27 CFS / FT

Equation (4.46) Depth of Flow:

y = [(Q*n) / (1.486 * s^0.5)]^(3/5)
= [(1.27*(0.0395*(9/12)^(1/6)) / (1.486 * 0.2^0.5)]^(3/5)
= 0.2062 FT

The velocity can then be found as:

v = Q / A
= 1.27 / (0.2062 * 1)
= 6.16 FT / Sec

Check Fig 4.11 to graphically check required rock size.

From the graph a 6" rock would be marginal, therefor the assumption of the 9" riprap is O.K.

For this test area, the transition rock must be 9" riprap. The depth of the rock will be eighteen (18) inches, and shall be placed on 6" of a 4" (-) bedding.

Location "B":

Area of Drainage 29 Acres
Runoff Coefficient 0.95

Equation (4.45) Time of Concentration:

Time of Concentration = (11.9*L^3 / H)^0.385
= (11.9*(1650/5280)^3 / (4582-4458))^0.385
= 0.1058 HRS
= 6.35 Minutes

From Table 2.1, the % PMP is found by interpolation:

% PMP = 50 %

Equation (2.1) Rainfall Depth:

Rain Depth = % PMP * PMP
= 50% * 8.5
= 4.25 inches

Equation (2.2) Rain Intensity:

Rain Intensity "i" = Rain Depth * (60 / Time of Concentration)
= 4.25 * (60 / 6.35)
= 40.2 inches / Hour

Equation (4.42) Flow which enters the cap in a channelized form:

Q = C i A
= 0.95 * 40.2 *29
= 1107 CFS

This flow enters as a channel to the tailings cap, therefore, a large diameter rock must be used to absorb the energy. For selection of the rock a minimum width must be chosen through which the water will enter the cap. For design purposes assume a minimum width of thirty feet.

Equation (4.40)
Q = 1.486/n * A * R^2/3 * s^1/2

From above equation the depth can be found by trial and error.
n = 0.0395(d50)^1/6 Try 18" Rock; n = 0.0423
s = slope entering = 0.025 ft / ft
width = 30 FT with 2:1 side slope minimum

Depth of flow is; 3 feet.

The velocity can be found by V = Q / A

V = 1110 / 3*(3*2*2+30+30)/2
= 10.3 FT / Sec

Check Fig 4.11 to graphically check required rock size.

From the graph 18" riprap would be O.K. up to 11 FT/Sec, therefor the assumption of the 18" riprap is O.K. Once the water flows onto the cap it immediately slows down and the depth increases. This increase in depth will be O.K. because as the water flows onto the cap, the width of flow also increases. For design and costing for the bond requirements, extend this 18" riprap out onto the cap for a distance of 100 feet, then install 12" riprap until the width across the channel reaches 80 feet. At that point install 6" riprap until you are out of the finger. See Figure 6.3 at the end of this section for a detail.

The 18" and 12" riprap will be required to be placed on a 6" depth of 4"(-) bedding material. The 6" riprap will not require special bedding and placed to a one (1) foot depth. The depth of the 18" riprap will be twenty-seven (27) inches, and the 12" riprap will be eighteen (18) inches deep.

Location "C":

Area of Drainage	34 Acres
Runoff Coefficient	0.95

Equation (4.45) Time of Concentration:

Time of Concentration = (11.9*L^3 / H)^0.385
= (11.9*(2400/5280)^3 / (4620-4458))^0.385
= 0.147 HRS
= 8.8 Minutes

From Table 2.1, the % PMP is found by interpolation:

% PMP = 58 %

Equation (2.1) Rainfall Depth:

Rain Depth = % PMP * PMP
= 58% * 8.5
= 4.9 inches

Equation (2.2) Rain Intensity:

Rain Intensity "i" = Rain Depth * (60 / Time of Concentration)
= 4.9 * (60 / 8.8)
= 33.4 inches / Hour

Equation (4.43) Unit width flow:

q = C i Aw
= 0.95 * 33.4 * (2400*1/43560)
= 1.75 CFS / FT

Equation (4.46) Depth of Flow:

y = [(Q*n) / (1.486 * s^0.5)]^(3/5)
= [(1.75*(0.0395*(9/12)^(1/6)) / (1.486 * 0.25^0.5)]^(3/5)
= 0.234 FT

The velocity can then be found as:

$$v = Q / A$$
$$= 1.75 / (0.234 * 1)$$
$$= 7.5 \text{ FT / Sec}$$

Check Fig 4.11 to graphically check required rock size.

From the graph the assumption of the 9" riprap is O.K.

For this test area, the transition rock must be 9" riprap. The depth of the riprap will be eighteen (18) inches, and shall be placed on 6" depth of a 4" (-) bedding.

Location "D":

Area of Drainage	1.7 Acres
Runoff Coefficient	0.95

Equation (4.45) Time of Concentration:

$$\text{Time of Concentration} = (11.9*L^3 / H)^{0.385}$$
$$= (11.9*(500/5280)^3 / (4820-4455))^{0.385}$$
$$= 0.018 \text{ HRS}$$
$$= 1.06 \text{ Minutes, therefore use default of 2.5 minutes}$$

From Table 2.1, the % PMP is found by interpolation:

$$\% \text{ PMP} = 27.5 \%$$

Equation (2.1) Rainfall Depth:

$$\text{Rain Depth} = \% \text{ PMP} * \text{PMP}$$
$$= 27.5\% * 8.5$$
$$= 2.34 \text{ inches}$$

Equation (2.2) Rain Intensity:

$$\text{Rain Intensity "i"} = \text{Rain Depth} * (60 / \text{Time of Concentration})$$
$$= 2.34 * (60 / 2.5)$$
$$= 56.1 \text{ inches / Hour}$$

Equation (4.43) Unit width flow:

$$q = C\ i\ Aw$$
$$= 0.95 * 56.1 * (500*1/43560)$$
$$= 0.61\ CFS / FT$$

Equation (4.46) Depth of Flow:

$$y = [\ (Q*n) / (1.486 * s^{0.5})\ ]^{(3/5)}$$
$$= [\ (0.61*(0.0395*(6/12)^{(1/6)}\ ) / (1.486 * 0.33^{0.5}\ )\ ]^{(3/5)}$$
$$= 0.11\ FT$$

The velocity can then be found as:

$$v = Q / A$$
$$= 0.61 / (0.11 * 1)$$
$$= 5.6\ FT / Sec$$

Check Fig 4.11 to graphically check required rock size.

From the graph the assumption of the 6" rock is O.K.

For this test area, the transition rock must be 6" riprap. The depth of the rock will be twelve (12) inches, and shall be placed on 6" depth of a 4" (-) bedding.

Using this same method around the perimeter of the tailings cap, the transition rock can be sized. It should be noted that the minimum width for the transition rock will be twenty feet on the east and north sides of the tailings impoundment. The minimum width for the area on the west side under the bluff will be fifty feet which will act as a buffer zone. The soil cover under this fifty foot buffer will be increased to a total depth of six feet which will protect the clay cover in the event that a large diameter rock should fall from the bluff and impact onto the cap. In the event that a rock would come off of the bluff the initial impact would be on the slope above the tailings cap and then the boulder may roll or slide onto the cap. At the time of reclamation the existing boulders on the slope above the tailings cap may be selectively placed along the edge of the transition rock to further protect the cap.

B. Design of Drainage Area Below the Existing Cross Valley Berm.

This drainage area is generally to the south of the existing cross valley berm. The intent is to capture all the precipitation and sheet flow it over the entire width of the impoundment dam.

Area of Drainage:	78 Acres
Runoff Coefficient	0.95 From table 4.4

Using Equation (4.45) the Time of Concentration can be determined. It should be noted that because of the two extremes in slope, a combined Time of Concentration must be determined. The first, or A', is the area which lies above the tailings area. This area will drain to the tailings cap and then sheet flow across the cap. The second, or A'', is the tailings cap. It will take the combined time to reach the crest of the dam.

Time of Concentration A' = (11.9*L^3 / H)^ 0.385
=(11.9*0.104^3 / 392)^ 0.385
= 0.019 HRS
= 1.2 Minutes

Where L = 550/5280 = 0.104 miles
H = 4850-4458 = 392 FT

Time of Concentration A'' = (11.9*L^3 / H)^ 0.385
=(11.9*0.34^3 / 33)^ 0.385
= 0.19 HRS
= 11.7 Minutes

Where L = 1800/5280 = 0.34 miles
H = 4458-4425 = 33 FT

Therefore the combined Time of Concentration is A' + A'' = 1.2 + 11.7 = 12.9 min.

Using Table 2.1 in Section 2.1.1 The % PMP is found by interpolation using the Time of Concentration above.

%PMP = 69%

Using Equation (2.1) the Rainfall Depth is Calculated:

Rain Depth = (%PMP) X (PMP)
=(69 %)X(8.5)
= 5.9 inches

Where the PMP is found in fig. 2.1 PMP = 8.5 inches

Using Equation (2.2) the Rain Intensity "i" is calculated:

Rain Intensity = (Rain Depth) X (60 / Time of Concentration)
= 5.9*(60/12.9)
= 27.5 inches / Hour

Using the Rational Method

$$Q = CiA$$
$$Q = 0.95 \times 27.5 \times 78$$
$$Q = 2038 \text{ CFS}$$

This flow will be across the entire width of the dam. For a quick check, the width on top of the dam is 1,000 LF + -. Therefore 2,038 / 1,000 = 2.04 CFS / LF . Check using unit width approach.

q=CiAw
q=(0.95)*27.5*((550+1800)*1/43560)
q=1.41 CFS / FT width across the cap

For a conservative approach use the 2.04 CFS / LF

Depth of flow is found from Equation (4.46)

y=(Qn/(1.486*S^0.5))^(3/5)
y=(2.04*(.0395*(3/12)^(1/6))/(1.486*(0.024)^0.5))^(3/5)
y=0.464FT

Therefore the velocity is calculated to be

V=Q/A
V=2.04 / (0.464*1)
V=4.4 FT / Sec

Which is less than those found in tables 4.7, 4.8 & 4.9. Therefore OK.

For the rock cover on the area below the existing cross valley berm, use an eight (8) inch layer of d50 = 3". This is larger than required, but the material is readily available at the site. The area of the tailings cap is forty-two and one-half (42.5) acres.

Quantity of d50 = 3" riprap = 42.5*43560*(8/12)*1.2 / 27
= 55,000 CY

It should be noted that the dam will have to be breached in order to allow the sheet flow across the crest of the dam. This will require lowering the dam height by thirteen feet. The downstream face of the dam has a protective cover of d50 = 12", see Attachment "A", Figure 5, Note 5. This riprap will be utilized and placed onto the top of the new dam height which will protect the transition area and further reduce the velocity at the top of the dam crest.

C. Toe Protection of Impoundment Dam

The dam face is at a 2:1 slope and as such a check must be run to determine the adequacy of the d50 = 12" protection.

With a q = 2.04 CFS / LF :

Depth of flow is found from Equation (4.46)

y=(Qn/(1.486*S^0.5))^(3/5)
y=(2.04*(.0395*(3/12)^(1/6))/(1.486*(0.50)^0.5))^(3/5)
y=0.2142FT

Therefore the velocity is calculated to be
V=Q/A
V=2.04 / (0.2142*1)
V= 9.52 FT / Sec

For added protection, place 18" diameter riprap at the toe of the impoundment dam, and up the sides at the contact point of the dam and the undisturbed bank to a depth of 2.25 feet. (See Figure 3 for area to be protected.) This toe protection will extend up the face of the dam for a total height of fifteen feet, and extend downstream for forty feet. The riprap on the native ground will be placed on a 6" depth of 4" (-) bedding. The width of the 18" riprap placed up the contact area of the dam face and the native ground will be twenty feet. Loose material over the native ground area will be excavated to bedrock and a trench 36" wide and 24" deep will be cut in bedrock and filled with 18" riprap. See Figure 6.7 for typical cross section and Figure 6.8 for depth to bedrock down the existing natural drainage.

Quantity of 18" Riprap and Bedding:

Toe:	18" Dia. Riprap	(34+40)*150*2.25*1.2 / 27	= 1,050 CY
	Bedding	1,050 * 0.5/2.25	= 240 CY
Slope:	18" Dia. Riprap	20*700*2.25*1.2 / 27	= 1,400 CY
	Bedding	1,400 * 0.5/2.25	= 310 CY

6.4 EROSION PROTECTION - ROCK MATERIALS AND PLACEMENT

A. RESPONSIBILITIES

Construction work under this specification to be performed by earthwork or rock placement contract or by PRL's forces.

Quality control testing/inspection by PRL and contract soil testing service.

B. PERFORMANCE STANDARDS

1. All rock used for erosion protection shall be obtained in the designated borrow areas adjacent to the site as shown on Figure 2, of Attachment "A"..

2. The rock shall be processed to produce those sizes and gradations as calculated in the erosion protection section of the specifications.

3. The quality of rock shall be not less than a weighted score of 80 for all applications of erosion protection. Rock that has received an initial score of < 80 but > 50 may be used if it is oversized by at least (80-rating)% or (d_{50} x (1+(80-rating))). Rock with a rating less than 50% may not be used for applications covered by this specification.

4. The rock used for covers on the impoundment and riprap used in the transition protection shall be sized as follows:

large relatively flat tailings top	d_{50} = 3 inches
transition from upper to lower tailings area	d_{50} [illegible] inches
rock cut to the northwest	Riprap = 18 inches
Area in nor[illegible]t Finger	Riprap = 18 inches
	Riprap = 12 inches
transition from native ground to tailings cap	Riprap = 6 inches
	Riprap = 9 inches
toe protection below impoundment dam	Riprap = 18 inches

5. Rock covers and riprap shall be 90% - 125% of the following thickness:

large relatively flat tailings top	0.66 feet
transition from upper to lower tailings area	1.0 feet
rock cut to the northwest	2.25 feet
Area in northeast Finger	2.25 feet
	1.5 feet
transition from native ground to tailings cap	1.0 feet
	1.5 feet
toe protection below impoundment dam	2.25 feet

The riprap used in the rock cut, transition protection and toe protection shall be placed on 6 inch layer of 4"(-) uniformly graded bedding material. This bedding material will be processed from the same borrow areas producing the rock cover material. This 4"(-) bedding material [illegible] also be used to fill any voids in the riprap as needed.

6. Rock covers and riprap shall be placed by dumping and spreading with heavy equipment to:
   a) maintain the acceptable gradation ranges listed above and avoid segregation of sizes
   b) create a uniform cover surface free of visible high or low spots so that irregularities in the rock surface do not exceed +/- 1.0 feet vertical difference from the design gradient surface over 100 feet.

7. The excavation and/or shaping of the rock cut, transition protection and toe protection will be to the required dimensions as calculated in the erosion protection section of the specifications. The bedding material and riprap coarse will be placed to the design thicknesses and heights.

C. TESTING AND INSPECTION

1. Daily visual inspection of rock delivered and placed during construction activity shall be performed by PRL.

2. Visual inspection of rock cover surfaces shall be performed to evaluate thickness of rock placed and the surface uniformity. If the visual inspection by PRL results in uncertainty or dispute about the thickness of or the adequacy of uniformity at any location, the location shall be surveyed by rod and level, or other method of at least equal accuracy, to determine if allowable limits of surface irregularity are exceeded along 100 foot horizontal and slope gradient lines. This requirement does not negate or substitute for rock thickness testing requirements, which may be performed by the use of a tape measure, as the cover advances. As a guideline, this should be performed at a regular basis to ensure that placement is to the specified thickness. This may require thickness testing every hour, or as every load is hauled in and placed.

3. The contract soil testing service or PRL shall perform the following tests:

   a. Rock quality testing (sulfate soundness, specific gravity, and absorption): One test on the first 500 cy produced, one test per 10,000 cy produced thereafter, and one test on the last 500 cy produced for each gradation.

   b. Rock and bedding size and gradation: One test per 5,000 cy produced at the borrow area and one test for every 5,000 cy placed in the project site.

   c. Rock and bedding layer thickness: One measurement per 1,000 cy of placement.

D. DOCUMENTATION AND REPORTING

1. PRL shall maintain a daily construction activity log, recording the thicknesses, quantities and locations of rock and bedding placed and significant events or conditions that affect the placement and properties of the materials.

2. Contract soil testing service and PRL shall report all tests, in writing, on a weekly basis and shall report all failing tests immediately to PRL.

E. NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the PRL representative who will direct the contractor or field personnel to stop work or take specific corrective action. The appropriate technical consultant will be contacted as needed to identify the importance of the nonconformance and the necessary corrective action to be taken if required.

2. The designated corrective action will be implemented before additional related work is permitted. PRL will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by PRL for any nonconformance that, in PRL's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F. RECORDS

1. A daily project journal will be maintained by PRL's representative. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. PRL will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

6.5 EXCAVATION AND SHAPING OF ROCK CUT AND TRANSITION PROTECTION

A. RESPONSIBILITIES

Construction work under this specification to be performed by earthwork or rock placement contract or by PRL's forces.

Quality control testing/inspection by PRL and contract soil testing service.

B. PERFORMANCE STANDARDS

1. The rock cut, transition protection, and toe protection will be constructed to the lines, grades and dimensions as determined. The control points needed for the establishment of the construction staking of the work will be provided by PRL or their representative. Actual construction staking may be performed by PRL for their own forces if they elect or by a qualified firm for contract construction.

2. The material obtained from the rock cut excavation may be utilized as soil cover on the radon barrier, if it meets specifications, or may be used in the construction of energy dissipation structures below the outfall. Excess material from the rock cut may be disposed of in approved locations.

3. All embankments shall be placed in a maximum of eight (8) inch lifts and compacted to 95 % of standard maximum dry density at plus or minus 2 % optimum moisture content. Material placed in embankments will not exceed four (4) inches in its greatest dimension.

4. No fill materials shall be placed under adverse weather conditions, including freezing temperatures, or during or immediately after heavy precipitation events. PRL shall determine when these adverse conditions exist.

5. Excavation of the rock cut will not be performed by means of blasting without the written permission of PRL. It must be demonstrated that any blasting performed will not jeopardize the stability of or the performance of the tailings impoundment dam. All liabilities for the impoundment dam will be born by the contractor performing the excavation work or PRL.

6. Please refer to the technical specification entitled, "EROSION PROTECTION OF THE TAILINGS IMPOUNDMENT" for the bedding material and riprap coarse sizing and placement requirements.

7. All survey books used in the staking and checking of the ditches will be turned over to PRL for review as requested and at termination of the project given to PRL for their permanent records.

C. TESTING AND INSPECTION

1. Daily visual inspection of the construction activity shall be performed by PRL. Verification of lines, grades and dimensions will be performed by use of survey equipment appropriate for verification needs.

2. The contract soil testing service or PRL shall perform the following tests:

   a. Soil gradation and classification: One per 2,000 cy of embankment material placed.

   b. In-place density test: For the embankment placement, at least one per 1,000 cy per ASTM D-1556. ASTM Method D-2922 may be used if the results of this method are within 2% of the results of method D-1556 based on not less than 10 comparative tests.

D. DOCUMENTATION AND REPORTING

1. PRL shall maintain a daily construction activity log, recording the quantities and locations of ditch excavation and embankment and significant events or conditions that affect the placement and properties of the materials.

2. Contract soil testing service and PRL shall report all tests, in writing, on a weekly basis and shall report all failing tests immediately to PRL.

E. NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the PRL representative who will direct the contractor or field personnel to stop work or take specific corrective action. The appropriate technical consultant will be contacted as needed to identify the importance of the nonconformance and the necessary corrective action to be taken if required.

2. The designated corrective action will be implemented before additional related work is permitted. PRL will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by PRL for any nonconformance that, in PRL's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F. RECORDS

1. A daily project journal will be maintained by PRL's representative. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. PRL will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

6.6 REGRADING AND SHAPING OF DISTURBED BORROW AREAS

A. RESPONSIBILITIES

Construction work under this specification to be performed by earthwork or rock placement contract or by PRL's forces.

Quality control testing/inspection by PRL and contract soil testing service.

B. PERFORMANCE STANDARDS

1. All borrow areas shall be graded after all other construction activities have been completed and before revegetation activities of the affected area begins.

2. All slopes in the borrow areas will be regraded to a 4:1 horizontal to vertical after all materials required from such borrow area is obtained. The oversize, reject or excess processed material will be placed or scattered along any working face prior to the flattening of the slopes. The entire disturbed site will be regraded to maintain the directions and gradients of ground surfaces that existed prior to the borrow areas development, if possible.

3. After grading is complete, topsoil removed (if any) will be replaced in preparation of seeding.

4. Site seeding will follow topsoiling and conform to the latest technologies for establishment of plant growths in arid regions. Fertilizer ratios, tonnage of mulch used and seed certification slips as to type, species, and germination will be given to and retained by PRL for permanent record requirements.

5. No seeding will be allowed while the ground is frozen or during times of freezing temperatures.

C. TESTING AND INSPECTION

1. Daily visual inspection of the regrading and seeding activities shall be performed by PRL.

D. DOCUMENTATION AND REPORTING

1. PRL shall maintain a daily construction activity log, recording the regrading, topsoiling and seeding activities. At the time of final regrading of all disturbed areas, tailings and mill site decommissioning an aerial photography survey will be performed of the entire site. The resulting topographic map will be submitted as a documentation of the adequacy of final lines and grades.

E. NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the PRL representative who will direct the contractor or field personnel to stop work or take specific corrective action. The appropriate technical consultant will be contacted as needed to identify the importance of the nonconformance and the necessary corrective action to be taken if required.

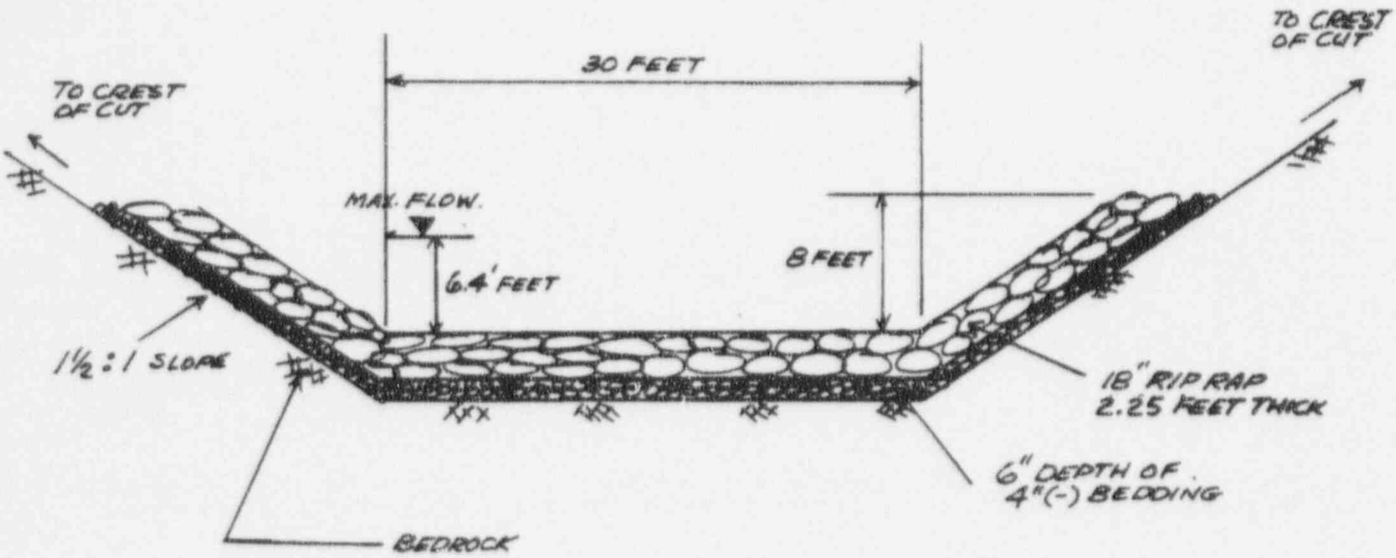
2. The designated corrective action will be implemented before additional related work is permitted. PRL will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by PRL for any nonconformance that, in PRL's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F. RECORDS

1. A daily project journal will be maintained by PRL's representative. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. PRL will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.



NOT TO SCALE

Figure 6.1 Section (C-C') Typical cross section of rock cut
(See Figure 3, Reclamation Plan Map)

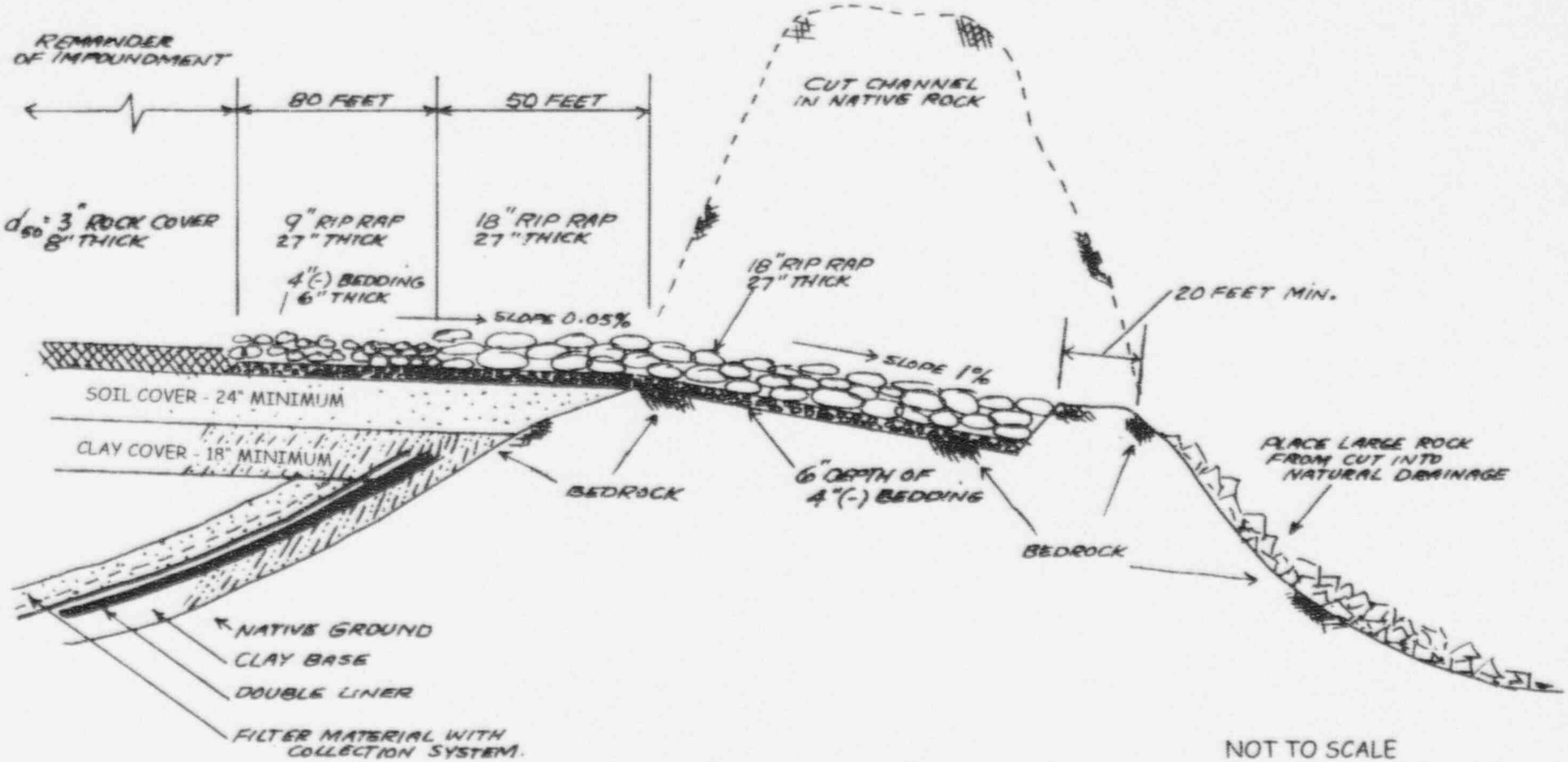


Figure 6.2 Section (D-D') Typical longitudinal profile of rock cut - not to scale (See Figure 3, Reclamation Plan Map)

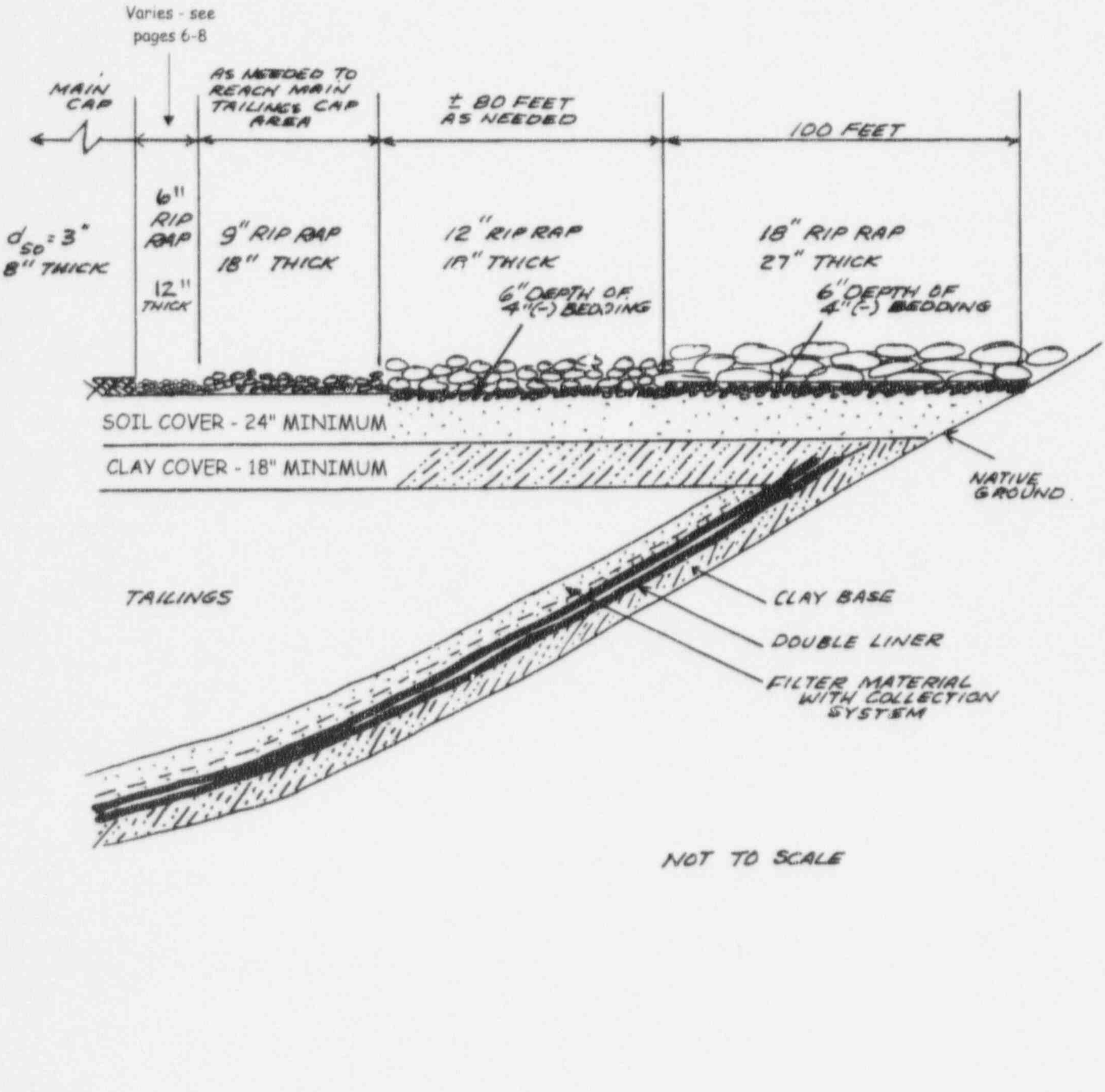


Figure 6.3 Section (E-E') Longitudinal section of the cap in the drainage area in the NE corner of the impoundment. (See Figure 3, Reclamation Plan Map and Figure 2 for run off area.)

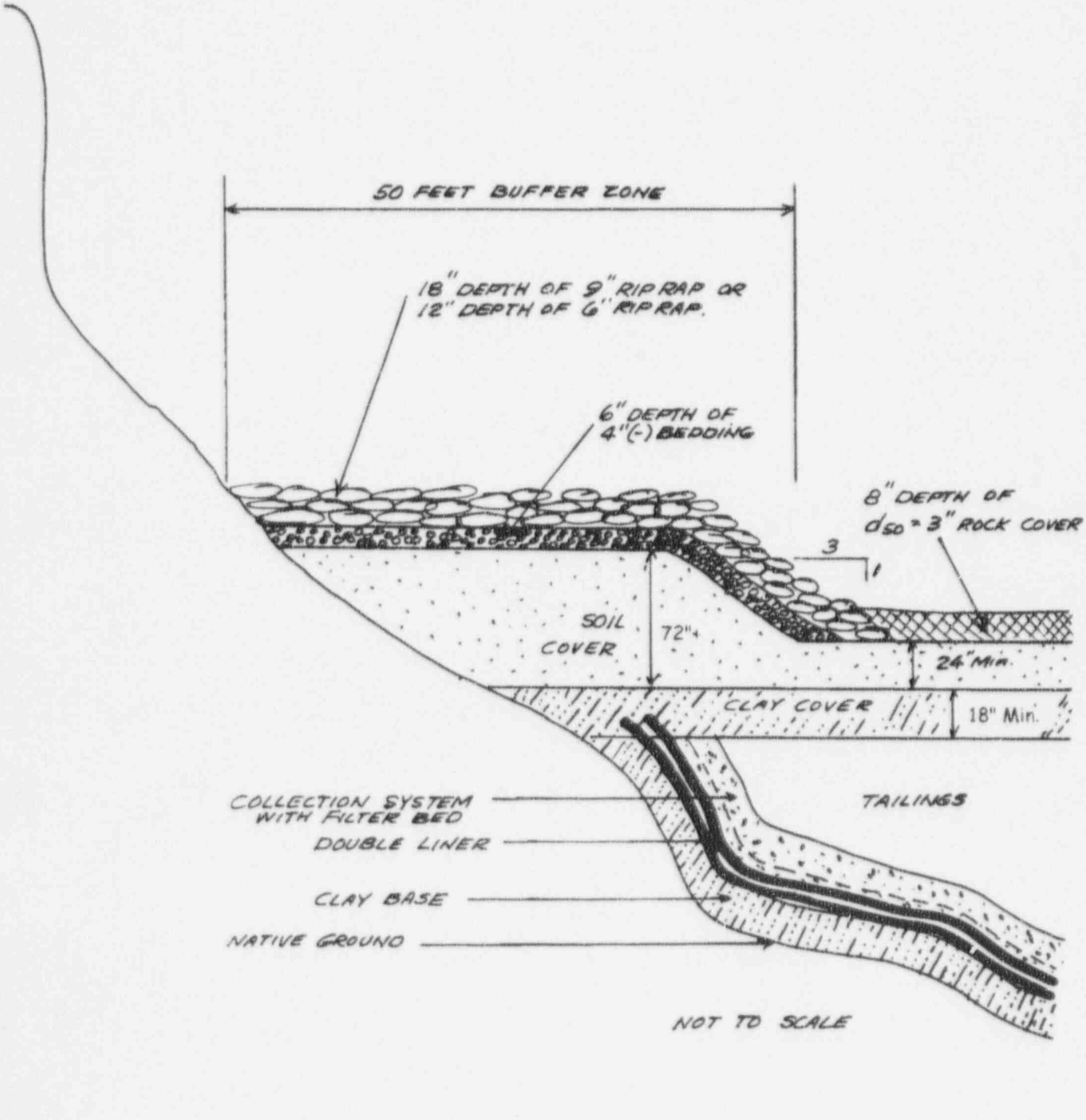


Figure 6.4 Section (F-F') Typical section of buffer zone on west side of impoundment.

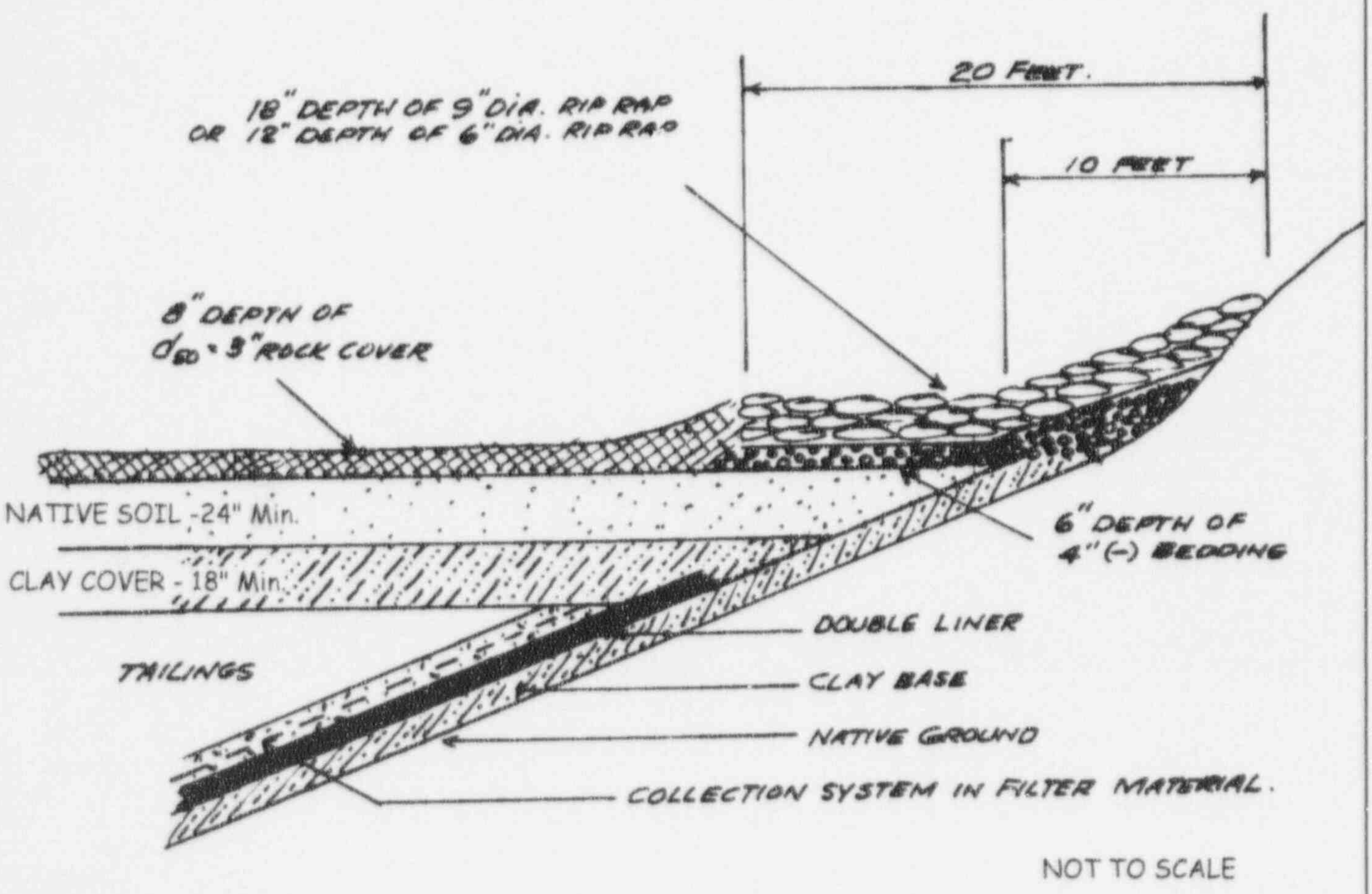
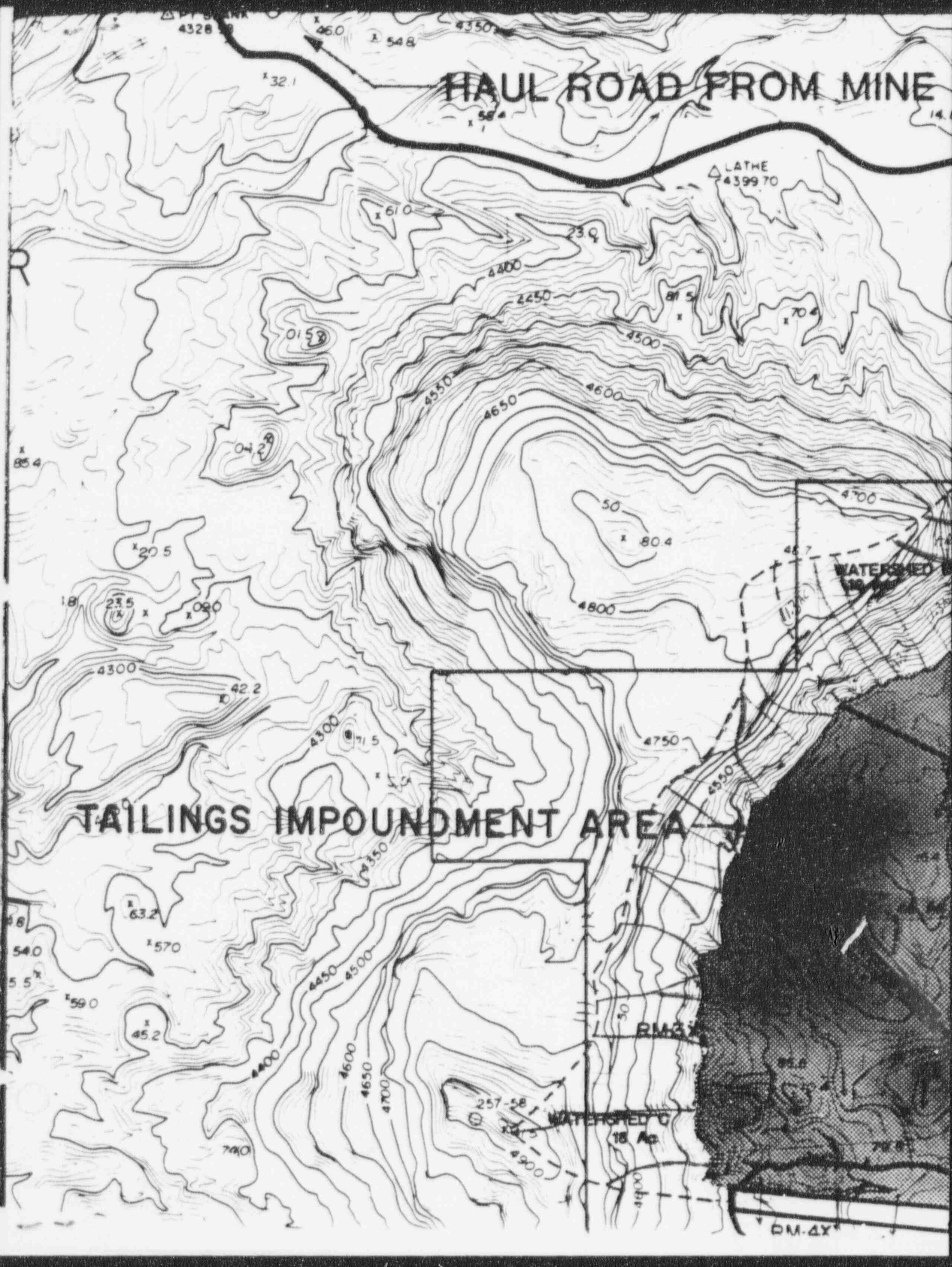
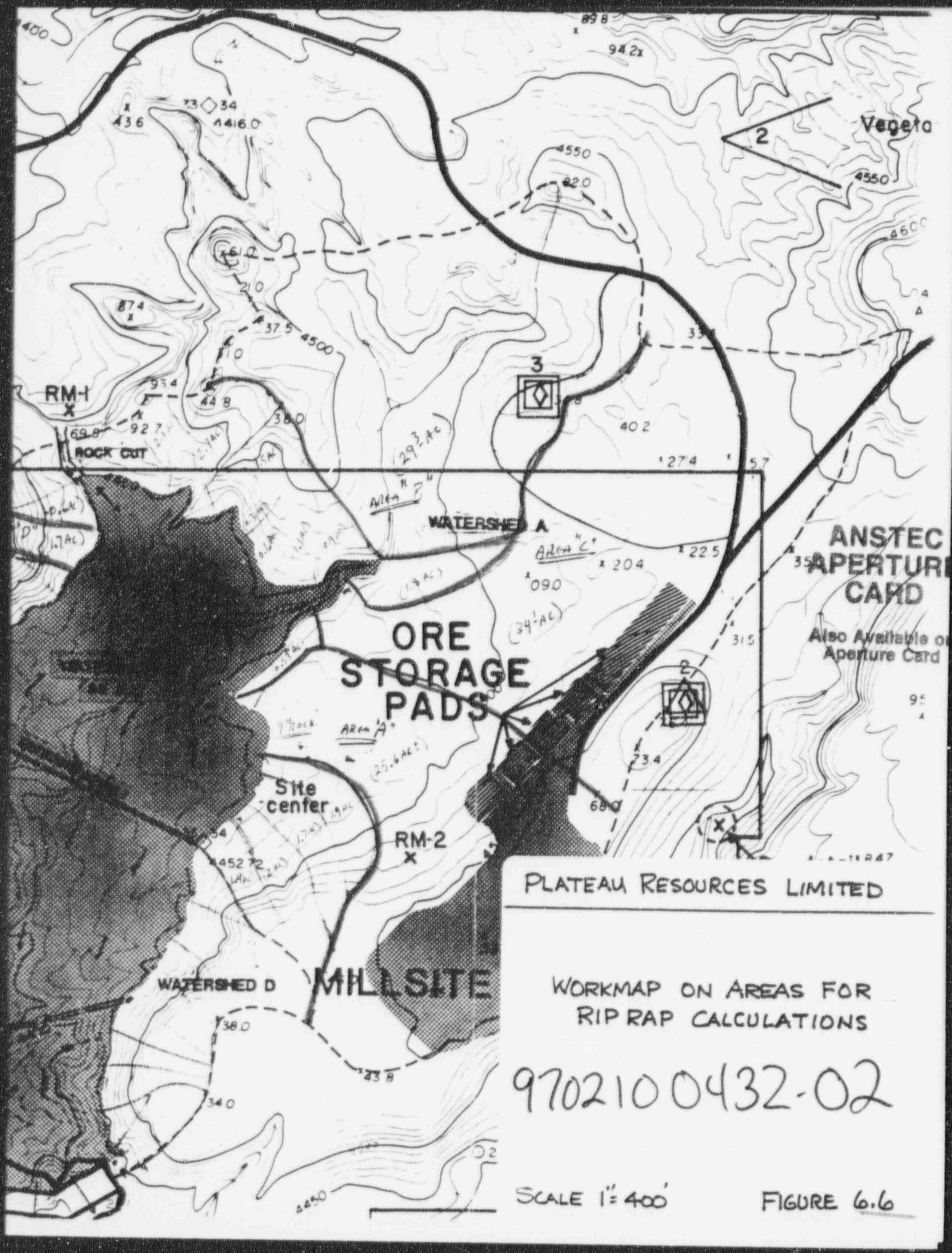


Figure 6.5 Section (G-G') Typical section of rip rap transition zone on east and north sides of the impoundment. (See Figure 3, Reclamation Plan Map)


HAUL ROAD FROM MINE
LATHE
4399.70
4400
4450
4500
4550
4600
4650
4700
4750
4800
TAILINGS IMPOUNDMENT AREA
4300
4350
WATERSHED C
18 Ac.
4900



PLATEAU RESOURCES LIMITED

WORKMAP ON AREAS FOR RIP RAP CALCULATIONS

9702100432-02

SCALE 1" = 400'

FIGURE 6.6

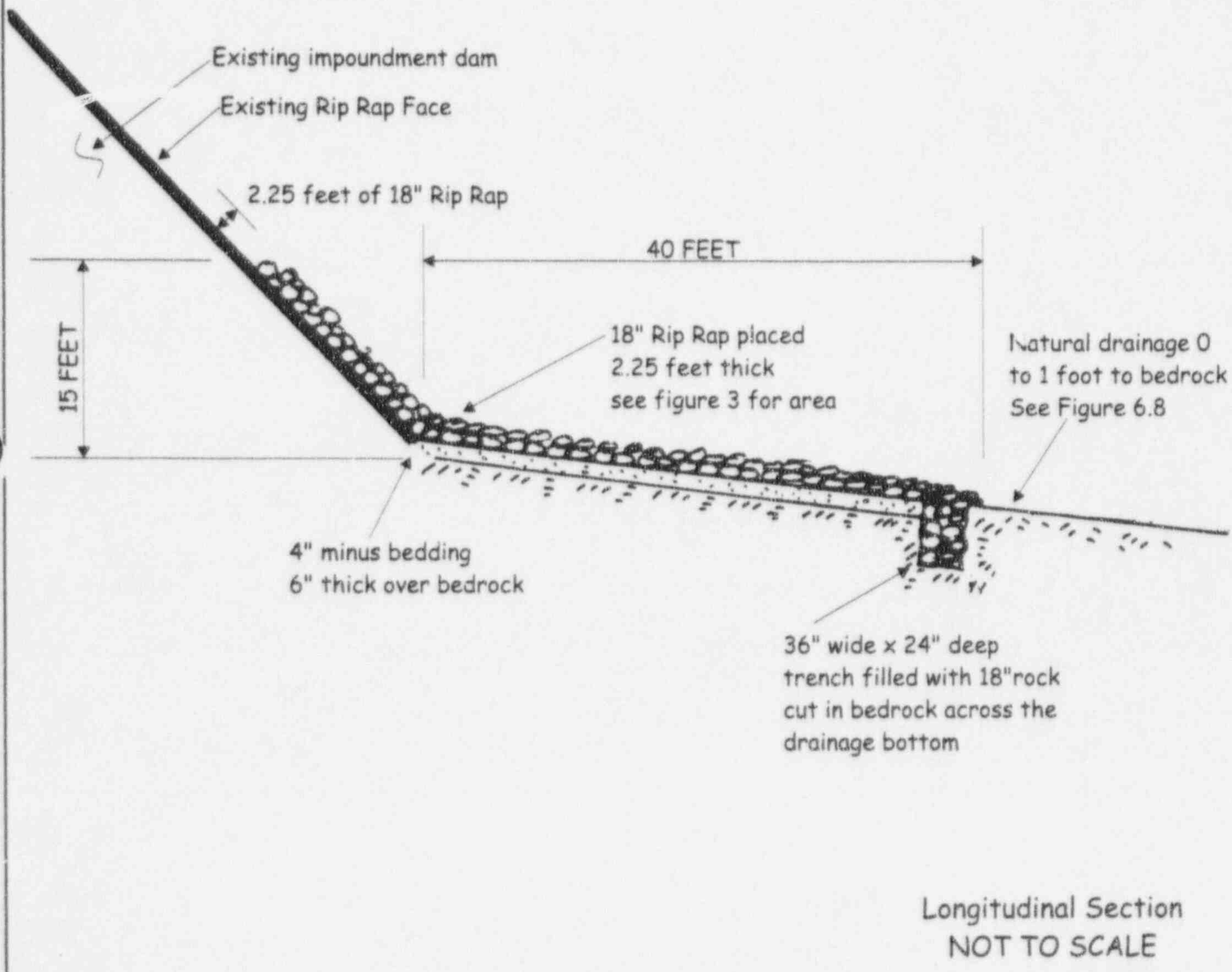
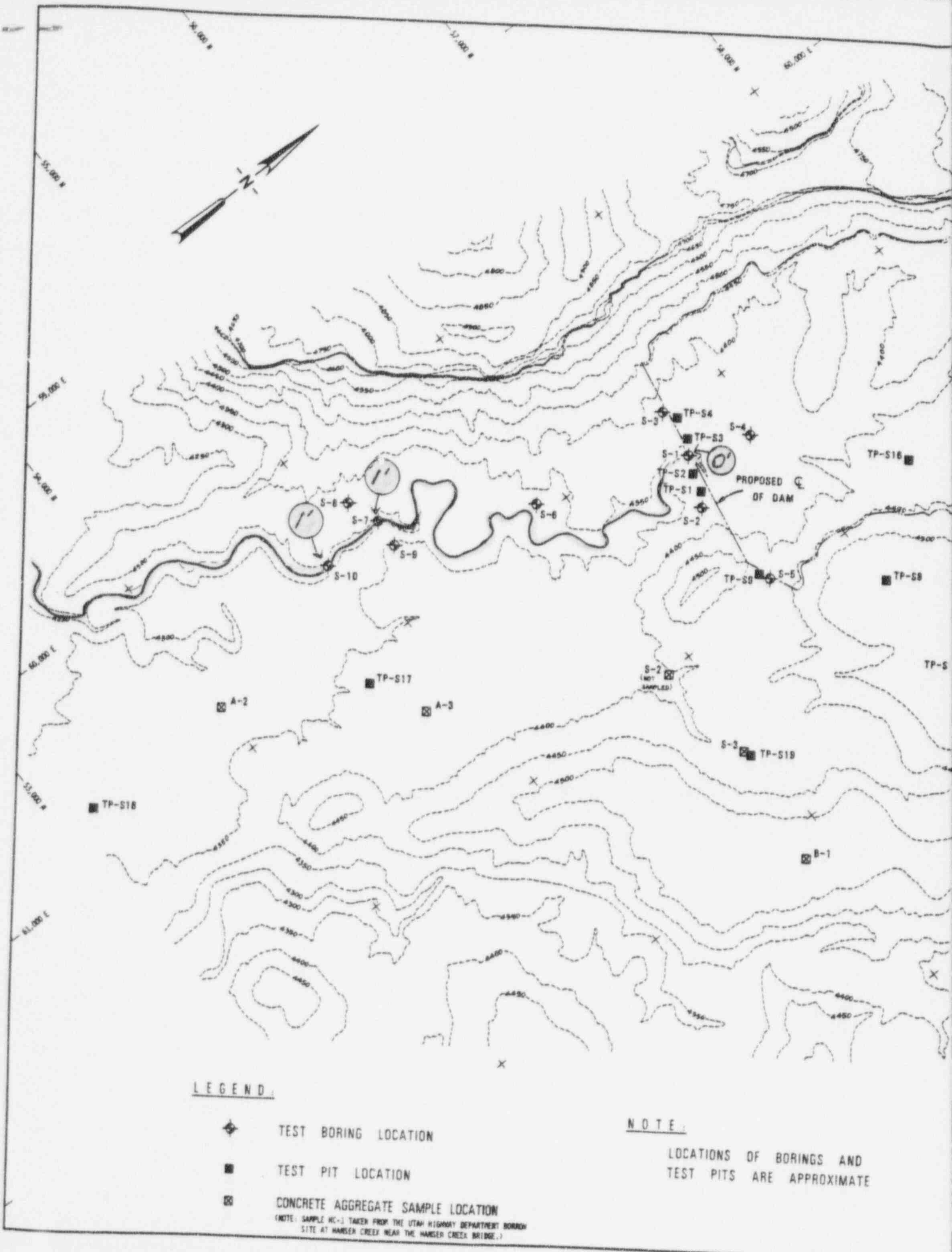
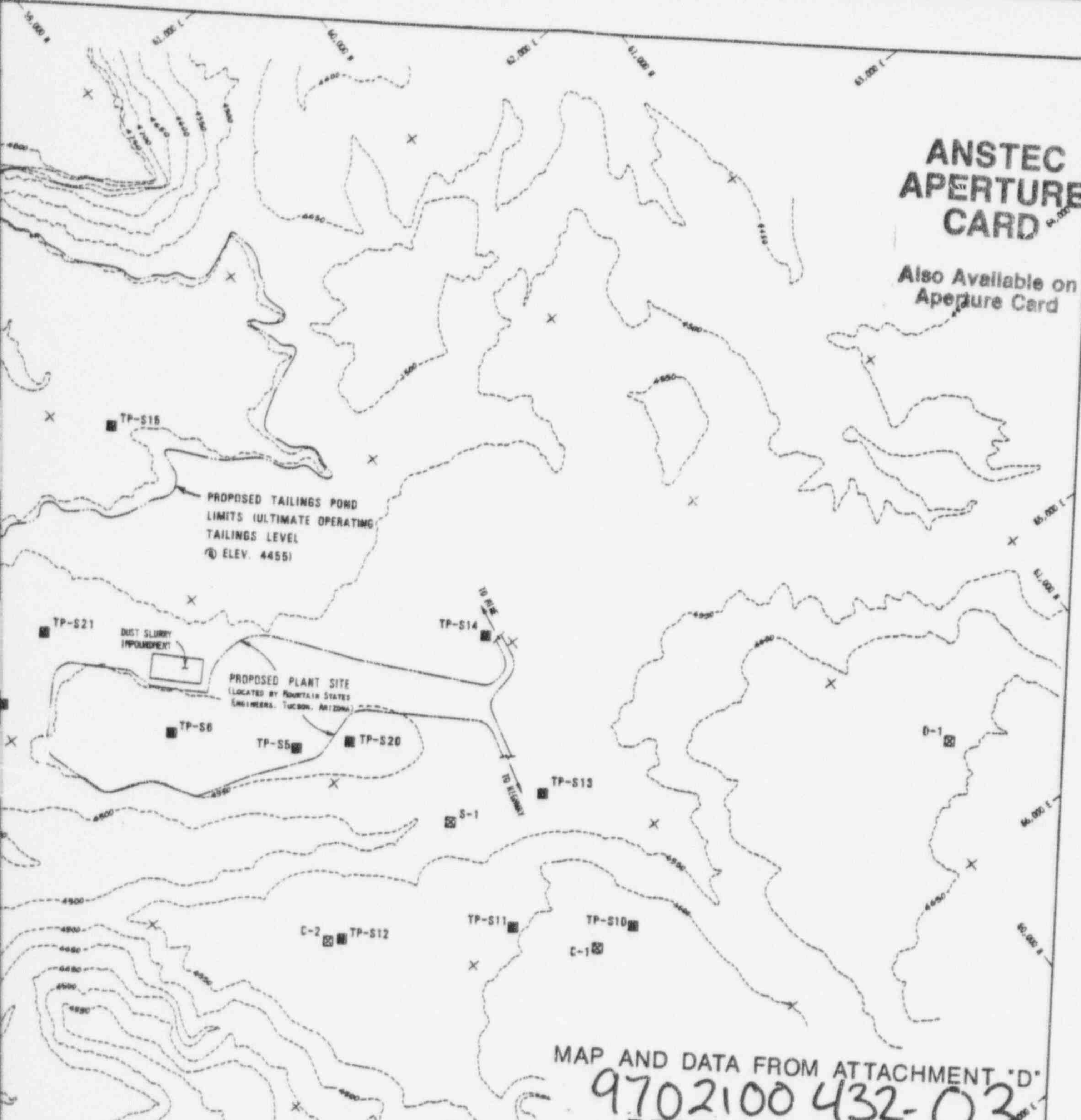


Figure 6.7 Toe Protection of the Impoundment Dam


PROPOSED ℄ OF DAM
TP-S4
TP-S3
TP-S2
TP-S1
TP-S16
TP-S8
TP-S9
TP-S17
TP-S18
TP-S19
S-1
S-2
S-3
S-4
S-5
S-6
S-7
S-8
S-9
S-10
A-2
A-3
B-1
LEGEND:
TEST BORING LOCATION
TEST PIT LOCATION
CONCRETE AGGREGATE SAMPLE LOCATION
NOTE:
LOCATIONS OF BORINGS AND TEST PITS ARE APPROXIMATE



MAP AND DATA FROM ATTACHMENT "D"

9702100432-03

DEPTH TO BEDROCK IN AND DOWN DRAINAGE FROM IMPOUNDMENT DAM

REFERENCE:

Topography from AIR PHOTO SURVEYS AND GLOBAL ENGINEERING, INC. Grand Junction, Colorado

FIELD EXPLORATION & SITE PLAN

PLATEAU RESOURCES LIMITED

SHOOTERING CANYON URANIUM PROJECT

Garfield County, Utah

Project No. 60255 F

WOODWARD-CLYDE CONSULTANTS

~~Figure 4~~

Figure 6.8

TABLE 6.1

SHOOTARING CANYON
Rock Quality Score
Sampl M, from Rock Borrow Source A, (See Figure 6 for area)

Lab Test	Result	Score[1]	Weight[2]	Score x Weight	Max. Score
Sp. Gr.	2.492	4.8	7.5	36	75
Absorp, %	2.15	2.7	3.5	9.5	35
Sod. Sulf., %	2.17(3)	8.6	7	60.2	70
L.A. Abr., %	4.4	8.3	4.5	37.6	45
Totals				143.3	225

Rating 143.3/225 = 0.64 or 64%
Suitable for use in occasionally saturated areas. If oversized by (80-65) or 16%

1 Interpolated number
2 Rock Source is 50% sandstone and 50% igneous. Weighting factor is the average of sandstone and igneous weighting factor.
3 Average of + 3/8" rock products.

TABLE 6.2

ROCK DURABILITY TEST RESULTS

U.S. Energy Corp.
Shootaring Canyon, Utah
IME Job No. 7664-RM
January 2, 1997

Test	Sample M	Sample Gp
Los Angeles Abrasion - % Loss[1]	4.4	7.7
Apparent Bulk Specific Gravity	2.633	2.645
Bulk Specific Gravity	2.492	2.468
SSD Bulk Specific Gravity	2.545	2.535
Absorption (%)	2.15	2.72
$NaSO_4$ Soundness[2] % Loss 2½" to 2"	1.12	2.53
$NaSO_4$ Soundness[2] % Loss 2" to 1½"	2.11	6.38
$NaSO_4$ Soundness[2] % Loss 1½" to 1"	0.94	14.96
$NaSO_4$ Soundness[2] % Loss 1" to ¾"	2.26	5.08
$NaSO_4$ Soundness[2] % Loss ¾" to ½"	4.40	9.98
$NaSO_4$ Soundness[2] % Loss ½" to 3/8"	2.72	19.98
$NaSO_4$ Soundness[2] % Loss 3/8" to #4	4.28	23.77

Notes:

1. Modified for 100 revolutions.
2. Actual percent loss - not weighted for "original gradation". As requested, $NaSO_4$ Soundness samples were crushed to generate sufficient material of practical test size.

Location of Sample M and Sample GP is shown on Figure 2.

7.0. WATER RESOURCE PROTECTION

7.1 Groundwater Protection

The tailings management plan for the Shootaring Canyon uranium project has been developed to prevent contamination of groundwater underlying the tailings disposal area. A lining system consisting of a double liner with leak detection over a 12" minimum clay base will be placed over the natural sandstone of the impoundment area to limit or prevent the rate of seepage from the tailings impoundment into the foundation rock. To reduce the amount of tailings liquids available for seepage from the impoundment, tailings will be distributed around the basin in such a manner as to continuously provide a large wetted area exposed for evaporation. Also, tailings liquid collected in the drainage system of the impoundment will be recycled to the process circuit. This water will also be used to wet the exposed tailings during operations, preventing wind erosion and dispersion of the tailings. At the time of reclamation, the tailings area will be dewatered of the drainable water, further limiting the amount of water which may seep from the tailings impoundment.

At the project site, net evaporation from exposed water surfaces will average approximately 70 inches (177.8 cm) per year, which is equivalent to approximately 3.6 gallons (13.63 l) per minute per acre of exposed surface. At an ore processing rate of 1,000 tons (907 mt) per day, and assuming a tailings slurry containing 49 percent solids by weight, approximately 175 gallons (662.4 l) per minute of tailings liquid will be delivered to the impoundment. Saturated, dense, settled tailings would be expected to have a moisture content of approximately 35 percent. Based on this assumption, approximately 85 gallons (321.7 l) per minute will be recycled to the mill and approximately 90 gallons (321.7 l) per minute of the tailings liquid will be retained in the settled tailings which will be subject to evaporation assuming a sixty-five (65) acre area.

Since the tailings management plan provides a means for disposing of all excess tailings liquids during the project operation, no significant amount of free tailings liquid will remain in the impoundment at project termination to seep into the groundwater. Also, after the project is terminated, normal evaporation from the tailings cap or radon barrier will dispose of the incident precipitation, including runoff. A limited potential therefore exists for groundwater contamination from this project, and the requirements for surveillance of the groundwaters of the area will be minimal. The monitoring wells located near the impoundment perimeter for monitoring seepage from the basin during project operation will be maintained and be available for subsequent groundwater monitoring.

7.2 Seepage

Woodward-Clyde Consultants calculated that over the predicted 20 year life-span of the tailings disposal system, approximately 413 acre feet of seepage would seep through the "original existing clay" liner. Assuming a water table 150 feet below the clay liner, an average porosity of the underlying sandstone of 25 percent, the calculated voids would be 2600 acre feet. Therefore, the total seepage would not be sufficient to saturate the underlying rock.

The Entrada sandstone underlying the disposal system has a high calcite (calcium carbonate) content and a permeability of 5 x 10-5 cm/sec, as computed from field test data. This high calcite content will effectively neutralize any acid (pH 1-2) tailings solution that may contact the calcite. The acidic tailings are not anticipated to penetrate more than 10 feet of the underlying sandstone. Neutralization raises the pH, which in turn precipitates the radionuclides and heavy metal present in the tailings liquids. For a more complete discussion on the geology and chemical properties of the underlying material, refer to Woodward-Clyde Consultants studies in the Preliminary and Final geotechnical studies of the area, See Attachments "B & C". In addition to the above analysis, the areas below and above the existing cross valley berm will be lined with a HDPE double liner with leak detection which will reduce the volume of seep water to near zero.

10 CFR 40 Appendix A requires the use of a liner under the tailings that "is designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil, ground water, or surface water at any time during the active life (including the closure period) of the impoundment. The installation of the double liner system as described for new portions and existing portions of the tailings impoundment would preclude any seepage from those areas. In addition the water used in the process comes form the Navajo Formation which lies at a depth of 600 feet below the surface in the tailings disposal area. The Carmel Formation separates the Entrada and Navajo Formations, providing an additional barrier to mixing.

The double liner with leak detection system design is the Best Available Technology (BAT) and comparable to similar facilities in the industry. The design allows for verifying on a continuous basis that the ground water protection levels are not being exceeded. The use of Geosynthetic HDPE offers superior performance by maintaining the highest standards of durability and the low permeability provides assurance that the groundwater and leachate will not penetrate the liner.

The area above the existing cross valley berm has been lined with a clay blanket of not less than two feet in thickness. The clay blanket has been overlain with sandy material covered with gravel which is designed to collect slimes. Within the sand layer and adjacent to the clay liner are drainage pipes which drain to a collection sump. The collection sump, located downstream of the cross valley berm, is equipped with a pump. The liquid in the sump is pumped to surface evaporation ponds or recycled back to the mill. The mill circuits have been designed to maximize the use of the return liquid, to reduce the mill water through-put requirements, and to dewater the tailings slurry as discharged into the tailings impoundment. The sump will remain active until final reclamation is initiated for that particular portion of the impoundment. The underdrain will then be connected to the underdrain system of the cells developed below the cross valley berm.

During milling activities, seepage from the ore storage pad will be minimal. The limited rain water runoff from the ore stockpiles and ore storage pad is diverted to the drainage for the tailings area.

7.3 New Synthetic Liner Above Cross Valley Berm

A new leakage detection in a typical double lined system will be installed in the existing clay lined cells on a prepared surface material that has previously been placed on the areas above the cross valley berm. The existing cover material in the cells will be leveled to grade and prepared for an acceptable base per specification of the liner fabricator. A new collection system will be installed over the double liner consisting of PVC drainage piping placed within a filter bed. This collection system will drain to a new sump in which the liquid will be pumped to a surface evaporation pond built during operations, used for dust abatement or recycled back to the mill.

7.4 New Synthetic Liner Below Cross Valley Berm

The area below the cross valley berm may be divided into a number of cells which will have a double liner system with leak detection placed over a 12" compacted clay base. A collection system will be installed over the double liner consisting of PVC drainage piping placed within a filter bed. All the collection piping will attach together into one continuous drain field which will collect tailing water into a sump. The liquid will be pumped to a surface evaporation pond built during operations, used for dust abatement or recycled back into the mill. The sump will be used until the reclamation phase of covering the impoundment as been completed..

7.5 Monitoring Threshold Values

The NRC has selected the following threshold values: Arsenic = 0.022 mg/L, Chloride = 40 mg/L, Selenium = 0.022 mg/L, and pH = 6.8 standard units. Uranium is compared to the 10 CFR 20, Appendix B effluent concentration of 3E-7 mCi/mL. The up-gradient well RM-1 is located immediately north of the tailings impoundment. The compliance wells are RM -4, RM-5, and RM-6 as shown on Figure 2.2 and Figure 4.

8.0. RADON ATTENUATION AND TAILINGS COVER THICKNESS

The cap to be placed over the tailings impoundment for final reclamation will be designed and constructed with the goal of limiting radon gas and gamma radiation emissions from the tailings. The waste disposal area shall be closed in accordance with a design which shall provide reasonable assurance of control of radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years, and (ii) limit releases of radon-222 from uranium byproduct materials to the atmosphere so as not to exceed an average release rate of 20 pCi/M^2 /Sec. Direct gamma exposure from the tailings or wastes should be reduced to background levels.

The design requirements in this criterion for longevity and control of radon releases shall apply to any portion of a licensed and/or disposal site unless such portion contains a concentration of radium in land averaged over areas of 100 square meters, which, as a result of byproduct material does not exceed the background level by more than (i) 5pCi/ m of radium-226 averaged over the first 15 cm below the surface, and (ii) 15 pCi/g of radium-226 averaged over 15-cm-thick layers more than 15 cm below the surface.

8.1 DETERMINATION OF COVER THICKNESSES

8.1.1 Background Information of the Clay Cover Materials

Woodward-Clyde Consultants performed tests on the clay material to be used for the radon attenuation cover. These tests may be found in Attachment "C", pages B-1 through B-12. The preferred clay borrow sources for this project will be clay borrow area "G", with alternate sources of clay found in borrow area "H", "I" and "J". See Attachment "A", Figure 2, for location and quantity information of the clay borrow sources. Two tests from the clay borrow area "G" are as follows:

Test	#1	#2	Average
Max Dry Density (PCF)	97.4	104.0	100.7
Optimum Moisture Content %	25.6	21.5	23.6
Liquid Limit	61.4	45.7	
Plastic Limit	24.5	13.8	
% Passing 200	80	60	

From the above information and using the average maximum dry density and the calculated long term average moisture content of the clay, which is less then the optimum moisture, the "RADON" program was run to determine layer thickness requirements. It should be noted that the default parameters were used on the tailings material and the soil cover material.

For the tailings material an average ore grade of 0.15 % to 0.29 % were run to check the differences in the clay cover thickness requirements at two differing radium activity levels, and using a differing moisture content of the soil cover material to see what effect this had.

8.1.2 Dewatering and Settlement Concerns Prior to Placement of the Radon Barrier

Placement of the radon barrier will not take place until the tailings have been sufficiently dewatered to allow the tailings to stabilize and support the various pieces of construction equipment. There will be a large volume of pore water within the tailings, especially the slimes, however, a substantial volume of the moisture is drainable under the influence of gravity. This water will drain through the collection and/or underdrain piping network installed within the tailings impoundment area prior to placement of the tailings. (Please refer to Attachment "A", Figure 4) This water will be pumped back onto the tails to prevent dusting or will be pumped to an evaporation pond within the tailings impoundment area constructed during operations. Water used on the tailings to control dusting will not be of sufficient quantity to cause recharge to the saturated zone within the tailings.

In the dewatering process there will be a corresponding settlement taking place within the tailings material which will be monitored by the use of periodic surface elevation surveys. At least 120 days prior to the time of final decommissioning of the mill, and tailings impoundment reclamation, a calculation will be run on the tailings area to determine the expected settlement of the tailings. This settlement will be largely dependent on the depth of the tailings placed. Placement of the radon barrier will not commence until 90% of the settlement due to primary consolidation has occurred as determined by calculation and surveys of the actual tailings placed in the impoundment..

8.1.3 Description and Function of the Cover Materials

It should be noted that the cover over the tailings material will consist of three distinct layers, the first being a clay material or clay cover, which will be optimized in the computer run, followed by a soil cover, and finally a rock cover to protect against erosion. The NRC has advised that in running of the computer program, "RADON", the rock cover layer can not be included in the analysis.

The primary function of the clay cover is to control the release of radon gas from the tailings material to the environment, and to prevent the penetration of precipitation into the underlying tailings material with essentially no recharge of the tailings taking place. The clay cover will be placed at 95% of standard maximum density at plus or minus 2% of optimum moisture content. Density and moisture tests will be required for every 2,000 CY of material placed. The clay material will have to be prepared to bring the required moisture content up to optimum prior to and during placement activities. The clay shall be placed in lifts which do not exceed eight inches prior to compaction. Care should be taken to ensure that the clay does not dry out between lifts, or if placement is during adverse weather conditions, no placement will be made on excessively wet or frozen lifts. The clay material is easy to work with and can be placed and compacted as specified with standard construction equipment. The physical properties of the clay makes it ideal for the intended use, and the reliability and stability of the material meets the design criteria. Note: This clay material was identified and used in the construction of the impoundment dam. There is sufficient material located in the borrows. See Figure 6, and Attachment "A" Figure 2, for location of borrow areas and quantities.

The primary function of the soil cover is to protect the clay cover from the effects of the environment which will minimize the potential of the clay material to dry out and develop cracks which would reduce its efficiency in controlling the radon release. In addition this layer will prevent freeze thaw action from ever reaching the clay cover material. It should be noted that the frost penetration at the location of the tailings impoundment is on the order of 1 to 18 inches per the Building Inspection department of Garfield County. This in part is do to the relatively mild winter temperatures at the site location. To ensure that the frost line does not reach the clay cover, the minimum soil cover depth will be two feet, with the additional depth of the rock cover placed on top. The soil cover shall be placed at 95% of standard maximum density at plus or minus 2% optimum moisture content. The soil cover shall be placed in lifts which do not exceed eight inches prior to compaction. Care should be taken to ensure that the soil cover material does not dry out between lifts, or if placement is during adverse weather conditions, no placement will be made on excessively wet or frozen lifts. The material is readily available on site and will meet stability and durability requirements. See Figure 6 and Attachment "A" Figure 2, for location of borrow areas and quantities.

The rock cover will be designed to protect against the erosional effects of wind and water. This rock blanket will ensure the protection of the radon attenuation cap and the tailings. The design of this rock cover may be found in Section 6. There will be no prescribed compaction on the rock cover material due to the nature of the material. It is also applicable to mention that the natural topography of the immediate surroundings of the tailings impoundment will result in a net deposition or placement of materials onto the impoundment area by natural means, further increasing the depth of the cover on the tails and protection against erosion and radon release to the environment. Furthermore, because the slope on the reclaimed tails is relatively flat, there will be the benefit of any precipitation which falls on the tailings impoundment to help maintain the moisture content of the clay layer below the soil cover and rock cover.

The long-term average dry weight percent moisture of the clay material Wc, can be determined:

$$
\begin{aligned}
Wc &= 100 * p_w * (0.026 + 0.005*Z + 0.0158\ Y) / p_c \\
&= 100*1*0.326 / 1.61 \\
&= 20.20\ \%
\end{aligned}
$$

Therefore use 20% in radon calculation program, where Z = % Clay = 60% ave., Y = % organics = 0 %, p_w & p_c = the density of water & cover material, respectively. It should be noted that in this calculation we have not taken credit for any organics present which would increase the long-term average dry weight percent moisture of the clay material.

8.1.4 Radon Program Input Data

The table below gives the input information and corresponding results for the various computer runs.

TABLE OF ENTERED DATA INTO THE RADON PROGRAM

CONSTANTS	RUN #1	RUN #2	RUN #3	RUN #4	RUN #5
Radon Decay Constant	.0000021	.0000021	.0000021	.0000021	.0000021
Radon Water / air Partition Coefficient	.26	.26	.26	.26	.26
Specific Gravity of Cover & Tailings	2.65	2.65	2.65	2.65	2.65
GENERAL INPUT PARAMETERS					
Layers of Cover and Tailings	3	3	3	3	3
Desired Radon Flux Limit	20	20	20	20	20
No. of the Layer to be Optimized	2	2	2	2	2
Default Surface Radon Concentration	0	0	0	0	0
Surface Flux Precision	.0001	.0001	.0001	.0001	.0001
LAYER INPUT PARAMETERS					
Layer 1 Tailings Placed in Impoundment					
Thickness	500	500	500	500	500
Default Porosity	.4	.4	.4	.4	.4
Calculated Mass Density	1.59	1.59	1.59	1.59	1.59
Ore Grade Percentage	.15	.15	.24	.23	.29
Calculated Radium Activity	421.8	421.8	674.88	646.76	815.48
Default Layer Emanation Coef. .35	.35	.35	.35	.35	.35
Calculated Source Term Conc.	1.232D-03	1.232D-03	1.972D-03	1.890D-03	2.383D-03
Weight % Moisture	6	6	6	6	6
Moisture Saturation Fraction	.238	.238	.238	.238	.238
Calculated Diffusion Coef.	3.131D-02	3.131D-02	3.131D-02	3.131D-02	3.131D-02
Layer 2 Clay Cover From Borrow					
Thickness	61	61	61	61	61
Calculated Porosity	.392	.392	.392	.392	.392
Measured Mass Density	1.61	1.61	1.61	1.61	1.61
Measured Radium Activity	1	5	5	5	1
Default Layer Emanation Coef. .35	.35	.35	.35	.35	.35
Calculated Source Term Conc.	3.015D-06	1.508D-05	1.508D-05	1.508D-05	3.015D-06
Weight % Moisture	20	20	20	20	20
Moisture Saturation Fraction	.820	.820	.820	.820	.820
Calculated Diffusion Coef.	9.849D-04	9.849D-04	9.849D-04	9.849D-04	9.849D-04
Layer 3 Soil Cover From Borrow					
Thickness	61	61	61	61	61
Default Porosity	.4	.4	.4	.4	.4
Calculated Mass Density	1.59	1.59	1.59	1.59	1.59
Measured Radium Activity	1	5	5	5	1
Default Layer Emanation Coef. .35	.35	.35	.35	.35	.35
Calculated Source Term Conc.	2.922D-05	1.461D-05	1.461D-05	1.461D-05	2.922D-06
Weight % Moisture	5	5	5	2	5
Moisture Saturation Fraction	.199	.199	.199	.079	.199
Calculated Diffusion Coef.	3.585D-02	3.585D-02	3.585D-02	5.359D-02	3.585D-02

Results of Radon Diffusion Calculations:

Layer						
1	Thickness (cm)	500	500	500	500	500
2	Thickness (cm)	31.61	35.34	45.28	45.54	45.96
	(Thickness (FT)	**1.04**	**1.16**	**1.49**	**1.49**	**1.48)**
3	Thickness (cm)	61	61	61	61	61

From these results it can be seen that for ease of construction, and to meet the requirement of the radon attenuation cap, a one and one-half (1.5) feet thick layer of clay material will be required to be placed over the tailings, followed by a two (2) feet thick layer of soil cover. This design will meet and exceed the requirements set out in 10 CFR Part 40, Appendix A, Criteria 6. This also allows the mill to have some flexibility in the ore grade run through the facility. Just prior to the actual construction of the radon cap, a check of this design will be run to verify the accuracy in effectively performing as required based on the latest technologies in radon cap designs.

From Regulatory Guide 3.64 (Task WM 503-4), Calculation of Radon Flux Attenuation By Earthen Uranium Mill Tailings Covers, June 1989, Section 1.14 , page 3.64-10 it states that "the radium activity in the cover soils may be neglected (Rc = 0) for cover design purposes provided the cover soils are obtained from background materials that are not associated with ore formations or other radium-enriched materials." We have taken a conservative approach in placing a value of 1 and 5 pCi g^-1 in our radon flux calculations. There was relatively little change in the No. 2 (clay material) layer thickness requirement between the two values. From Attachment "E", pages 5-12 through 5-15, it is found that the preoperational surface Ra-226 concentrations in and around the borrow sites where on the order of 0.2 - 0.6 pCi/g, which corresponds to the tests run in November of 1996. See Attachment E, Section E-3 for copies of the test results. It should be noted that at the time of actual design and construction of the radon cap, radium activity measurements of the cover materials obtained from the clay and soil borrow areas will be performed.

8.2 TAILINGS IMPOUNDMENT RADON BARRIER PLACEMENT

A. RESPONSIBILITIES

Construction work under this specification to be performed by earthwork contract or by PRL's forces.

Quality control testing/inspection by PRL and contract soil testing service.

B. PERFORMANCE STANDARDS

1. Before placement of the initial fill lift after any rain event that results in puddling of water, or after any fill placement activity interruption in excess of three days, the impoundment surface will be scarified prior to subsequent placement of any material. This does not apply to the rock cover material.

2. The clay cover material shall consist of natural silty sandy clayey soil obtained from the designated clay borrow areas as shown on Figure 6 and Attachment "A" Figure 2. This material shall be placed in a manner that produces a reasonably well-graded and homogeneous impervious soil with an average of 60% passing the No. 200 sieve. The material shall be placed in a maximum of eight (8) inch lifts and compacted to 95% of standard maximum dry density at plus or minus 2% of optimum moisture content. The final minimum depth of the clay cover material will be one and one-half (1.5) feet.

3. The soil cover material shall consist of the natural sand and gravel soils found in the borrow areas adjacent to the tailings impoundment. (Refer to Figure 6, and Attachment "A." Figure 2.) This material will be processed to produce a four (4) inch minus material. The material shall be placed in a maximum of eight (8) inch lifts and compacted to 95% of maximum dry density at plus or minus 2% of optimum moisture content. The final minimum depth of the soil cover material will be two (2) feet.

4. Cover materials (radon barrier) will be placed as soon as possible after the tailings have achieved the 90% of primary-consolidation settlement.

5. All fill materials used to construct the impoundment radon barrier shall be borrowed from approved borrow locations as shown on Figure 6 and Attachment "A" Figure 2, or from other locations approved by PRL or its engineer.

6. No fill material shall be placed under adverse weather conditions, including freezing temperatures, or during or immediately after heavy precipitation events. PRL shall determine when these adverse conditions exist.

7. No fill material shall be used in the radon barrier that has contaminated material (concentration of byproduct-derived Ra-226 in excess of 5.0 pCi/g). All fill material will be obtained from background materials that are not associated with ore formations or other radium-enriched materials.

C. TESTING AND INSPECTION

1. Daily visual inspection of the radon barrier construction activity shall be performed by PRL. This will include the quantities, thicknesses and locations of fill placed. These inspections will be performed and documented at such a frequency as to maintain that the placement of the radon barrier materials meet the specifications.

2. The contract soil testing service or PRL shall perform the following tests:
   a. Soil gradation and classification: One per 2,000 cy of clay and soil cover material placed.

   b. Standard Proctor Density (ASTM D-698): At least one per 7500 cy of clay and soil cover material placed.

   c. In-place density test: For the clay and soil cover placement, at least one per 2,000 cy per ASTM D-1556. ASTM Method D-2922 may be used if the results of this method are within 2% of the results of method D-1556 based on not less than 10 comparative tests.

D. DOCUMENTATION AND REPORTING

1. PRL shall maintain a daily construction activity log, recording the quantities, thickness and locations of fill placed and significant events or conditions that affect the placement and properties of the soil cover.

2. Contract soil testing service and PRL shall report all tests, in writing, on a weekly basis and shall report all failing tests immediately to PRL.

E. NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the PRL representative who will direct the contractor or field personnel to stop work or take specific corrective action. The appropriate technical consultant will be contacted as needed to identify the importance of the nonconformance and the necessary corrective action to be taken if required.

2. The designated corrective action will be implemented before additional related work is permitted. PRL will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by PRL for any nonconformance that, in PRL's judgment, may jeopardize subsequent work that depends for its quality upon the nonconforming work.

F. RECORDS

1. A daily project journal will be maintained by PRL's representative. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. PRL will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

8.3 SETTLEMENT MONITORING

A. RESPONSIBILITIES

Work under this specification to be performed by PRL.

Quality control testing/inspection by PRL.

B. PERFORMANCE STANDARDS

1. Settlement monitoring points shall be established on the surface of the tailings on 300 foot by 300 foot grid system.

2. The monitoring points shall be constructed with materials and dimensions shown on Figure 8.1. Other materials may be substituted if they have equivalent properties, as approved by PRL.

3. The steel base plate of each monitoring point shall be placed between two and four feet below the tailings surface. The plates may be installed once the tailings surface has reached its ultimate operational elevation.

4. The initial construction of each monitoring point shall include:
   a. welding of a 2"coupling to the 12" x 12" x 1/8" steel plate
   b. connection of one or more 2" riser pipe sections with appropriate couplings
   c. installation of a protective PVC guard pipe over the riser pipe
   d. placement of the monitor point at its designated location and elevation
   e. backfill of the monitor point, with the bottom of the PVC guard pipe raised to not more than 18 inches above the steel plate

5. Immediately following installation of each monitor point, it shall be surveyed to determine the x, y and z coordinates to a precision of 0.1, 0.1 and 0.01 feet, respectively, and an accuracy of 0.05 feet or better. At least three control points shall be used for these and subsequent surveys. The control points shall be permanently located and protected at positions on the ground surface that will be unaffected by construction on the impoundment surfaces.

6. Subsequent readings shall be made to determine the elevation of each point. The initial subsequent reading shall be made within two weeks of installation, and successive readings after that shall be made biweekly to monthly until future settlements can be shown to no longer have the potential to adversely affect the cover, as determined by engineering analysis of settlement data performed by the responsible engineer.

7. The engineering analysis of settlement data shall consist of the recording and plotting of the changes in elevation vs. time for each settlement point and the plotting,

comparison, and projection of cumulative elevation changes (settlements) of all settlement monitoring points.

8. Once the 90% of expected settlement due to primary consolidation has been determined by PRL or their engineer, the monitor points will be destroyed prior to installation of the radon barrier material. This will seal off any means of radon release through the riser stems.

C. TESTING AND INSPECTION

1. PRL or their representative shall inspect each monitor point after it is assembled and when it is installed prior to backfilling of the monitoring point.

2. Each point shall be visually inspected at least weekly during construction activity to determine if any point has been damaged or displaced by construction activity.

D. DOCUMENTATION AND REPORTING

1. The initial x, y and z coordinates of each monitor point shall be surveyed and recorded. Subsequent changes in elevation shall be monitored and recorded.

2. Settlements shall be evaluated by PRL or its engineer and shall be reported at least annually to the NRC until 90% of expected settlements due to primary consolidation have been demonstrated by the data and approved by PRL and the NRC.

E. NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the PRL representative who will direct the contractor or field personnel to stop work or take specific corrective action. The appropriate technical consultant will be contacted as needed to identify the importance of the nonconformance and the necessary corrective action to be taken if required.

2. The designated corrective action will be implemented before additional related work is permitted. PRL will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by PRL for any nonconformance that, in PRL's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F. RECORDS

1. A daily project journal will be maintained by PRL's representative. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. PRL will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

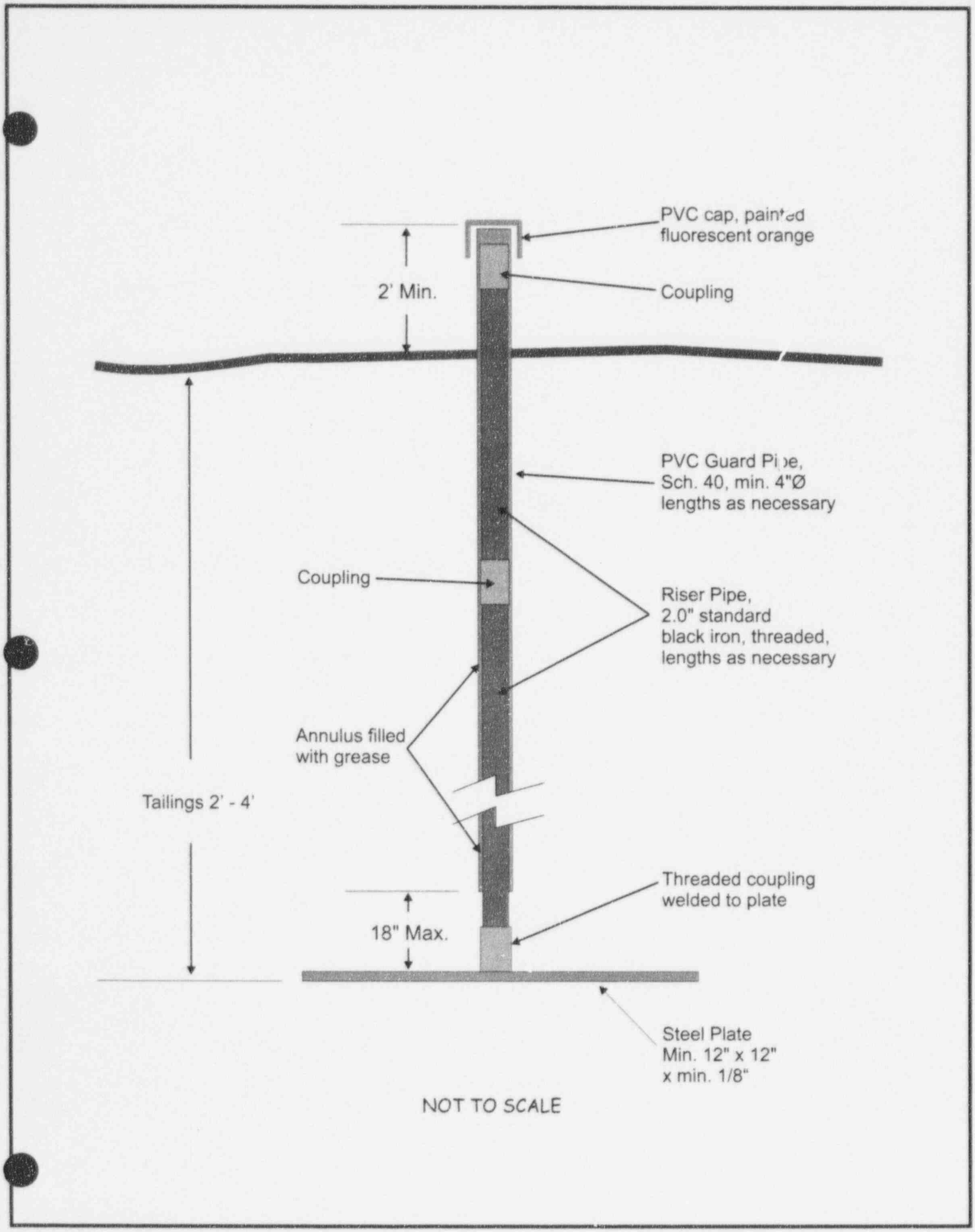


Figure 8.1 Settlement Monitoring Point

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RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

SHOOTARING CANYON URANIUM MILL 12/12/96 RUN 1

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	3	
DESIRED RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	2	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.0001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 TAILINGS IN IMPOUNDMENT

THICKNESS	500	cm
DEFAULT POROSITY	.4	
CALCULATED MASS DENSITY	1.59	g cm^-3
ORE GRADE PERCENTAGE	.15	%
CALCULATED RADIUM ACTIVITY	421.8	pCi g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	1.232D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.238	
CALCULATED DIFFUSION COEFFICIENT	3.131D-02	cm^2 s^-1

LAYER 2 CLAY COVER

THICKNESS	61	cm
CALCULATED POROSITY	0.392	
MEASURED MASS DENSITY	1.61	g cm^-3
MEASURED RADIUM ACTIVITY	1	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	3.015D-06	pCi cm^-3 s^-1
WEIGHT % MOISTURE	20	%
MOISTURE SATURATION FRACTION	.820	
CALCULATED DIFFUSION COEFFICIENT	9.849D-04	cm^2 s^-1

LAYER 3 SOIL COVER

THICKNESS	61	cm
DEFAULT POROSITY	.4	
CALCULATED MASS DENSITY	1.59	g cm^-3
MEASURED RADIUM ACTIVITY	1	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	2.922D-06	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.199	
CALCULATED DIFFUSION COEFFICIENT	3.585D-02	cm^2 s^-1

BARE SOURCE FLUX FROM LAYER 1: 5.917D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	4.965D+01	5.288D+05
2	3.161D+01	2.148D+01	3.991D+03
3	6.100D+01	2.000D+01	0.000D+00

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ARE CALCULATED FOR MULTIPLE LAYERS

SHOOTARING CANYON URANIUM MILL 12/12/96 RUN 2

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	3	
DESIRED RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	2	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.0001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 TAILINGS IN IMPOUNDMENT

THICKNESS	500	cm
DEFAULT POROSITY	.4	
CALCULATED MASS DENSITY	1.59	g cm^-3
ORE GRADE PERCENTAGE	.15	%
CALCULATED RADIUM ACTIVITY	421.8	pCi g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	1.232D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.238	
CALCULATED DIFFUSION COEFFICIENT	3.131D-02	cm^2 s^-1

LAYER 2 CLAY COVER

THICKNESS	61	cm
CALCULATED POROSITY	0.392	
MEASURED MASS DENSITY	1.61	g cm^-3
MEASURED RADIUM ACTIVITY	5	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	1.508D-05	pCi cm^-3 s^-1
WEIGHT % MOISTURE	20	%
MOISTURE SATURATION FRACTION	.820	
CALCULATED DIFFUSION COEFFICIENT	9.849D-04	cm^2 s^-1

LAYER 3 SOIL COVER

THICKNESS	61	cm
DEFAULT POROSITY	.4	
CALCULATED MASS DENSITY	1.59	g cm^-3
MEASURED RADIUM ACTIVITY	5	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	1.461D-05	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.199	
CALCULATED DIFFUSION COEFFICIENT	3.585D-02	cm^2 s^-1

BARE SOURCE FLUX FROM LAYER 1: 5.917D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	4.765D+01	5.307D+05
2	3.534D+01	1.852D+01	3.706D+03
3	6.100D+01	2.000D+01	0.000D+00

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ARE CALCULATED FOR MULTIPLE LAYERS

SHOOTARING CANYON URANIUM MILL 12/12/96 RUN 3

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	3	
DESIRED RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	2	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.0001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 TAILINGS IN IMPOUNDMENT

THICKNESS	500	cm
DEFAULT POROSITY	.4	
CALCULATED MASS DENSITY	1.59	g cm^-3
ORE GRADE PERCENTAGE	.24	%
CALCULATED RADIUM ACTIVITY	674.88	pCi g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	1.972D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.238	
CALCULATED DIFFUSION COEFFICIENT	3.131D-02	cm^2 s^-1

LAYER 2 CLAY COVER

THICKNESS	61	cm
CALCULATED POROSITY	0.392	
MEASURED MASS DENSITY	1.61	g cm^-3
MEASURED RADIUM ACTIVITY	5	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	1.508D-05	pCi cm^-3 s^-1
WEIGHT % MOISTURE	20	%
MOISTURE SATURATION FRACTION	.820	
CALCULATED DIFFUSION COEFFICIENT	9.849D-04	cm^2 s^-1

LAYER 3 SOIL COVER

THICKNESS	61	cm
DEFAULT POROSITY	.4	
CALCULATED MASS DENSITY	1.59	g cm^-3
MEASURED RADIUM ACTIVITY	5	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	1.461D-05	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.199	
CALCULATED DIFFUSION COEFFICIENT	3.585D-02	cm^2 s^-1

BARE SOURCE FLUX FROM LAYER 1: 9.468D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	7.360D+01	8.518D+05
2	4.527D+01	1.852D+01	3.706D+03
3	6.100D+01	2.000D+01	0.000D+00

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RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

SHOOTARING CANYON URANIUM MILL 12/12/96 RUN 4

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	3	
DESIRED RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	2	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.0001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 TAILINGS IN IMPOUNDMENT

THICKNESS	500	cm
DEFAULT POROSITY	.4	
CALCULATED MASS DENSITY	1.59	g cm^-3
ORE GRADE PERCENTAGE	.23	%
CALCULATED RADIUM ACTIVITY	646.76	pCi g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	1.890D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.238	
CALCULATED DIFFUSION COEFFICIENT	3.131D-02	cm^2 s^-1

LAYER 2 CLAY COVER

THICKNESS	61	cm
CALCULATED POROSITY	0.392	
MEASURED MASS DENSITY	1.61	g cm^-3
MEASURED RADIUM ACTIVITY	5	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	1.508D-05	pCi cm^-3 s^-1
WEIGHT % MOISTURE	20	%
MOISTURE SATURATION FRACTION	.820	
CALCULATED DIFFUSION COEFFICIENT	9.849D-04	cm^2 s^-1

LAYER 3 SOIL COVER

THICKNESS	61	cm
DEFAULT POROSITY	.4	
CALCULATED MASS DENSITY	1.59	g cm^-3
MEASURED RADIUM ACTIVITY	5	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	1.461D-05	pCi cm^-3 s^-1
WEIGHT % MOISTURE	2	%
MOISTURE SATURATION FRACTION	.079	
CALCULATED DIFFUSION COEFFICIENT	5.359D-02	cm^2 s^-1

BARE SOURCE FLUX FROM LAYER 1: 9.073D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	7.050D+01	8.163D+05
2	4.554D+01	1.782D+01	2.219D+03
3	6.100D+01	2.000D+01	0.000D+00

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ARE CALCULATED FOR MULTIPLE LAYERS

SHOOTARING CANYON URANIUM MILL 12/12/96 RUN 5

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	3	
DESIRED RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	2	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.0001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 TAILINGS IN IMPOUNDMENT

THICKNESS	500	cm
DEFAULT POROSITY	.4	
CALCULATED MASS DENSITY	1.59	g cm^-3
ORE GRADE PERCENTAGE	.29	%
CALCULATED RADIUM ACTIVITY	815.4799999999999	
pCi g^-1		
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	2.383D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.238	
CALCULATED DIFFUSION COEFFICIENT	3.131D-02	cm^2 s^-1

LAYER 2 CLAY COVER

THICKNESS	50	cm
CALCULATED POROSITY	0.392	
MEASURED MASS DENSITY	1.61	g cm^-3
MEASURED RADIUM ACTIVITY	1	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	3.015D-06	pCi cm^-3 s^-1
WEIGHT % MOISTURE	20	%
MOISTURE SATURATION FRACTION	.820	
CALCULATED DIFFUSION COEFFICIENT	9.849D-04	cm^2 s^-1

LAYER 3 SOIL COVER

THICKNESS	61	cm
DEFAULT POROSITY	.4	
CALCULATED MASS DENSITY	1.59	g cm^-3
MEASURED RADIUM ACTIVITY	1	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	2.922D-06	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.199	
CALCULATED DIFFUSION COEFFICIENT	3.585D-02	cm^2 s^-1

BARE SOURCE FLUX FROM LAYER 1: 1.144D+03 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	8.989D+01	1.028D+06
2	4.524D+01	2.148D+01	3.991D+03
3	6.100D+01	2.000D+01	0.000D+00

9.0. MILL DECOMMISSIONING & SITE CLEAN UP

SHOOTARING CANYON URANIUM FACILITY

9.1.0 General Information

Plateau Resources Limited, (PRL), is the holder of NRC Source Material License SUA - 1371 issued pursuant to Title 10, CFR, Part 40 and in accordance with PRL Application for a Source Materials License.

9.1.1 Name, Address and License Number

Name:	Plateau Resources Limited
Address:	877 North 8th West Riverton, Wyoming 82501
Contact Name:	Kenneth J. Webber Environmental Coordinator
License Number:	SUA-1371 Docket No. 40-8698

Facility Location and Address

Name:	Plateau Resources Limited
Address:	Box 2111 Ticaboo Lake Powell, UT 84355-2111

9.1.2 General Description of the Facility

The Shootaring Canyon Uranium Facility is located in Garfield County, southeastern Utah, approximately 50 miles south of Hanksville, Utah, 14 miles north of Bullfrog Basin Marina and 2 miles west of Utah State Highway 276. The Processing Facility is designed to produce 1,004,000 pounds of barreled U3O8 per year. The average ore grade is 0.15% U3O8. The ore is processed in an acid circuit at an average daily license rate of 1000 tons per day. The tailings are retained behind an earthen, clay dam in an engineered lined natural depression in the landscape.

The facility consists of the following:

Main Office Building	Truck Scales	Maintenance Shop
Ore Storage Area	Bucking Room	Warehouse
Grizzly - Dump Pocket	Acid Tank	Environmental Lab
Fuel Oil Tank	Potable Water Tank	Analytical Lab-Stacks
Raw Water Tank	Wet Scrubber - Stack	Reagent Storage
Conveyor - Tunnel	Seal Water Tank	Generator Buildings- Stacks
Pump House	De-Mister Stack	
Grinding Leach Area	Solvent Extraction Area	
Counter Current Decantation Area		
Precipitation - Drying - Packaging Area - Stack		

9.2.0 DESCRIPTION OF MILL SITE DECOMMISSIONING ACTIVITIES

NOTE: PRL will, at least 120 days before decommissioning of the facility begins, provide a detailed decommissioning plan (characterization of radiological contamination, cleanup and verification procedures, and quality assurance/control program) to the NRC.
NRC Regulatory Guide 3.65 for general guidance, and 10 CFR 40.42 g(4).

9.2.1 Overview of Decommissioning Activities

PRL will test for surface contamination of all on site equipment to ensure that the levels are at or below criteria set forth in U.S. Nuclear Regulatory Commission's Regulatory Guide 1.86, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use of Termination of Licenses for Product, Source, of Special Nuclear Material." Should any equipment fail to meet these above mentioned criteria the equipment will be decontaminated or placed in the tailings impoundment adjacent to the site. During dismantling and decommissioning operations, PRL shall maintain health physics controls to limit exposure of personnel to levels of radioactivity below those specified in 10 CFR part 20 regulations. PRL shall also maintain survey data and other records as required to ensure that all material released for unrestricted use meets the requirements of Regulatory Guide 1.86. All records related to the dismantling and decommissioning shall be maintained by the company in accordance with NRC regulations (specifically 10 CFR 20.401) and the State of Utah Department of Environmental Quality regulations. The following is an overview of the major Decommissioning objectives and activities:

1. Train working staff in principles and practices of radiological health.
2. Evaluate exposure potential of work activities in affected and unaffected areas.
3. Implement Radiation Work Permits.
4. Monitor potential airborne uranium particulate concentration in work locations.
5. Establish personnel exposure assessment program, i.e., TLD, bioassay.
6. Assess personnel exposure and record keeping weekly.
7. Survey individual workers for alpha contamination before leaving the premises daily.
8. Implement maximum health physics controls for individuals working in restricted areas, i.e., respirators and protective equipment.
9. Evaluate safety hazards for specific job tasks during decommissioning activities.
10. Implement safety controls and equipment and establish safe working practices.
11. Review safety procedures and changes in working conditions periodically.
12. Implement QA/QC policies.
13. Identify materials and equipment which are unreleasable.
14. Consolidate and/or prepare any such material for disposal into the tailings impoundment.
15. Remove contaminated soils.
16. Prepare all manifests and documentation for transportation of materials approved for release.

17. Demonstrate that all radiological conditions at the Processing Facility satisfy NRC Regulations for release of unrestricted use as per Regulatory Guide 1.86, NUREG 4118 and 40 CFR 192, Subpart B.
18. Survey area based on standard format and protocol.
19. Collect verification samples.
20. Prepare records.
21. Prepare Final Site Survey and Decommissioning Report.
22. Regrade and seed site as required.

9.2.2 Specific Decommissioning Objectives and Procedures

9.2.2.1 Maintain Programs to Protect Workers Health and Safety

Objective - Maintain health and safety practices to ensure protection of the work force, environment and public. Monitor radiological, chemical and industrial hazards to ensure compliance with applicable health safety and environmental standards.

Activities and Tasks - PRL's overriding consideration during decommissioning is the protection of workers, public health and safety, and protection of the environment. To ensure that this objective is accomplished, PRL will prepare a Decommissioning Plan and establish a specific safety and monitoring procedure at least 120 days before Decommissioning begins.

9.2.2.2 Characterize and Delineate Radiological Contamination in the Facility

Objective - Characterize and delineate equipment and areas which have been shown to have or are likely to have radiological contamination in excess of NRC Regulatory Guide 1.86 "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use o Termination of Licenses for Product, Source or Special Nuclear Material" criteria for release of facilities and equipment for unrestricted use.

Activities and Tasks - Radiological contamination will be delineated through actual survey of plant equipment, buildings and operational areas. Survey information, in conjunction with knowledge of the Processing Facility, shall allow the designation of "affected areas" and "unaffected areas" and "affected equipment" and "unaffected equipment" within the plant. Affected areas and equipment are those that have potential for radioactive contamination or known radiological contamination. Unaffected areas and equipment are all other areas and equipment which may be released for unrestricted use. The Decommissioning Plan will summarize available survey and process information and accomplish the objective of preliminary characterization and delineation of contamination at the Shootaring Canyon Uranium Facility.

Monitoring and testing of equipment and material in affected and unaffected areas will be ongoing during decommissioning.

9.2.2.3 Disassemble and Dispose of Affected Equipment and Structural Materials

Objective - All materials and plant equipment unreleasable for unrestricted use shall be removed from the site and placed in the tailings impoundment for disposal.

Equipment released for unrestricted use with potential market value shall be retained by PRL for their use. All contaminated equipment shall be transferred to the tailings impoundment for disposal.

9.2.2.4 Building Disassembly and Related Activities

Objective - Survey all buildings and foundations for radioactive contamination levels prior to release for unrestricted use. Core holes may be drilled through the concrete floors and sumps of the buildings. The cored concrete shall be tested for process contamination (i.e. retained uranium and radium - 226) and the soil beneath the concrete should be tested in fifteen (15) centimeter intervals over a total depth of seventy - five (75) centimeters for natural uranium and radium - 226 to determine if it has been contaminated. The buildings interiors should be monitored for radon and ambient gamma radiation to determine if it is in compliance with 40 CFR 192 Subpart B and NUREG CR-4118. If the buildings, slabs and soils beneath the slabs are not process contaminated, the buildings shall be released for unrestricted use, provided it meets the specific requirements of 40 CFR 192 Subpart B and NUREG CR-4118. If the buildings, slabs and/or underlying soils are found to be contaminated, or if the buildings are unreleasable due to high ambient gamma radiation or radon level, the buildings shall be demolished, the slabs removed, and the underlying soils removed (if contaminated) and all contaminated materials shall be placed in the tailings impoundment. At the actual time of demolishing certain releasable concrete slabs may be elected to be covered with a placement of four (4) feet of clean native soil from borrow in lieu of removal and disposal in the impoundment area.

Activities and Tasks - Initially, the internal surfaces of the buildings siding and support structures shall be visually assessed to determine areas within the plant which may have become stained or otherwise affected by contact with process solutions. They shall then be tested for fixed and or removable surface contamination.

The buildings themselves may be characterized and delineated. Portions of the buildings may be designated affected and unaffected. The appropriate radiological survey techniques and protocol shall be used to further survey building materials, prior to release for unrestricted use. The buildings may be disassembled by PRL personnel or contract personnel under the supervision of PRL management. Uncontaminated building siding, support structures, steel and other materials may be retained by Plateau Resources Limited.

All contaminated equipment and material in the Facility will be placed in the tailings impoundment for disposal. All mobile equipment and tools used on site will be monitored prior to leaving the site to detect any residual radiological contamination. Equipment and tools found to exceed the limits in Regulatory Guide 1.86 "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use of Termination of Licenses for Product, Source or Special Nuclear Material" shall be decontaminated. If decontamination is not possible, they shall be placed in the tailings impoundment.

9.2.2.5 Process or Laboratory Chemicals

Objective - The transfer and or removal of all reagents and laboratory chemicals remaining on site will be in conformance with all applicable federal and state regulations pertaining to the

transport and disposal of hazardous material, where applicable. Reagents and chemicals will be tested for byproduct contamination before transfer.

Activities and Tasks - Laboratory chemicals which did not come in contact with the uranium recovery process, and are not contaminated with radionuclides, will be transferred off site.

9.2.2.6 Disposal of Wash Water

Objective - Dispose of any decontamination wash solutions in a manner consistent with the protection of the public health and environment.

Activities and Tasks - Plateau will dispose of decontamination wash solutions by pumping the fluid to the tailings impoundment for disposal. The facility slabs are constructed to allow drainage of liquids to a sump. All cleaning water will drain to these sumps.

9.2.2.7 Identification and Disposal of Radioactive Waste

Objective - Identify and dispose of waste materials contaminated with levels of radionuclides. These materials may include the actual building siding, supports, foundations or the equipment contained there in, along with any soils in and around the buildings.

Activities and Tasks - For the purpose of the dollar estimate for this decommissioning plan for bonding purposes Plateau will place all buildings, piping and miscellaneous items into the tailings impoundment. It will be assumed that the entire mill site area, including the ore stockpile area may have to be stripped to a six (6) inch depth. Sufficient native site soil will then be spread to help establish plant growth over the area.

9.2.2.8 Survey & Identification of Radiologically Contaminated Soils & Concrete

Objective - Identify and remove contaminated soils and concrete from the Facility site. Survey the entire operations area to document decontamination. Regrade the surface, seed and document all decommissioning activities in a final Verification Report to the UDEQ and NRC.

Activities and Tasks - All concrete removed from affected areas will be placed in the tailings impoundment. Soil beneath the concrete will be sampled at fifteen (15) centimeter intervals to a depth of seventy-five (75) centimeters and tested for radium - 226 and natural uranium, sampled on a 10 meter by 10 meter grid with five (5) samples collected and combined into one soil sample. If contaminated soils exist beneath the concrete, the soil will be removed and placed in the tailings impoundment. The entire operations area will be surveyed using a Ludlum Model 12S Micro-R-Meter, or equal, and sampled on a 10 meter by 10 meter grid. Particular attention should be given to areas underlying former plant sumps and areas showing any unusual visual alterations to the subsurface. The concrete foundations and soils may be covered with four (4) feet on native soils if they are determined to be releasable. Determination will be made at time of final reclamation.

Soils samples shall be analyzed for U-nat and Ra-226 to ensure identification of process contaminated soils. Tailings material will be also sampled for Thorium 230 to determine if Thorium 230 is a constituent that has to be sampled for in the reclamation process. Process contaminated soils should be placed in the tailings impoundment. When the Facility area has been thoroughly surveyed and all contaminated concrete, soils and / or misc. items have been removed, the final radiological survey of the operations area shall be performed. The final radiological survey shall be performed over the entire area within the respective restricted area boundaries. A verification report will be prepared and submitted.

9.2.2.9 Mill Site Reclamation

Objective - Return the site to an erosional stable condition for unrestricted use.

Activities and Tasks - After the mill site and ore stockpile location have been cleared of all byproduct contamination as determined by verification surveys, recontouring will begin to blend the site with the natural topography. Native site soils will be added where practical to help establish natural vegetation. Fertilization and mulch may be added as needed.

The desired species of plant growth over the mill site and disturbed areas will be determined at the time of actual reclamation to take advantage of the latest information on the establishment of plant growths in arid regions.

9.3 Decommissioning Schedule

Decommissioning activities shall be performed continuously once began and may extend over a two year period. Please see the Section 9.6 which illustrates major activities and estimated time frames for completion. Radiation safety and monitoring programs shall continue throughout the decommissioning process.

9.4 Decommissioning Safety

All individuals, employees and contractor personnel shall be trained in the principles of basic radiation protection. This training shall be documented. A site specific safety program will be developed for the decommissioning of the mill site, prior to beginning decommissioning. This safety program shall be adhered to, ensuring that radiological exposures to personnel and releases to the environment are maintained As Low As Reasonably Achievable (ALARA).

The principles and practices of ensuring that occupational radiation exposures are "ALARA" will be of primary focus during the decommissioning of the Facility. During the dismantlement of the buildings, equipment removal, and soil removal, this principal shall be implemented. The following is an example of what may be in the ALARA practices:
Prior to commencing dismantlement activities, all the building structures and contents shall be washed with a high pressure washer to eliminate loose residual contaminants and thereby

reduce potential airborne contamination. General radiological monitoring of equipment and materials will proceed on a piece by piece basis as these materials become available during disassembly. These radiological determinations will be used to qualify materials whic' hall require disposal or may be released accordingly under the release limits contained in the applicable sections of Regulatory Guide 1.86. Special equipment and piping that is known to contain copious amounts of residual contamination shall be flooded with water and drained or pumped to the tailing impoundment prior to disassembly and handling. This will reduce the potential of dispersing uranium airborne particulate matter. The disassembly and handling of equipment in the facility will proceed under the conditions described in a radiation work permit, with health physics controls being implemented. The wash water will be collected and pumped to the tailings impoundment.

Contaminated / unreleasable equipment and materials will be transferred to the tailings impoundment if fixed alpha or gamma contamination exceeds levels for unrestricted use specified in Regulatory Guide 1.86 or removed alpha contamination exceeding levels for release for unrestricted use in Regulatory Guide 1.86 is found. Visual inspection as well as radiological surface contamination surveys shall be performed on all equipment and materials in accordance with the protocol established for materials designated affected versus unaffected. Additionally, health physics controls and personnel monitoring requirements shall be implemented as necessary during this project to ensure that radioactive contaminant levels are within regulatory limits and all risks of radioactive exposure to workers and the general public are As Low As Reasonably Achievable.

9.5 Planned Final Radiation Survey

The form and content of the final site survey will provide information in sufficient detail as to allow termination by the NRC of the License SUA - 1371, and release the site to the DOE or the State of Utah. The site shall be reclaimed to a condition satisfactory to the governing regulations and or agencies. The final status report shall contain a comprehensive discussion of all activities and results associated with the decommissioning effort. The final status survey report shall be submitted within three months of the completion of decommissioning and reclamation activities at the site. Items to be discussed are enumerated in Section 9, Survey Documentation and Reports of the Regulatory Guide 4118 "Manual for Conducting Radiological Surveys in Support of License Termination". The release or disposal of all materials shall be made prior to executing the final site survey as follows:

1. Byproduct waste and materials shall be disposed of in the tailings impoundment pursuant to conditions as set forth in the License SUA-1371.

2. Building materials and equipment shall be monitored for release for unrestricted use. Contaminated materials and equipment shall be placed in the tailings impoundment for disposal and compacted as tightly as possible to reduce voids in the tails which may otherwise allow subsequent settlement.

A final site survey to verify that the soils and property are not contaminated and shall meet the release criteria for unrestricted use shall be made. The entire property boundary should be sectioned into a 10 meter by 10 meter grid system and a gamma measurement taken at each intersection location of the grid.

9.6 Cost Estimate for Mill Site Decommissioning

As presented, the decommissioning and reclamation activities are expected to take approximately two years to complete. PRL prepared a cost estimate which includes the following assumptions:

1. The on-site work force will consist of the following estimated labor components:
   1 - Radiation Safety Officer
   1 - Environmental Manager / Engineer
   1 - Lab Technician
   1 - Demolition Superintendent
   5 - Equipment Operators
   1 - Equipment Mechanic Oiler
   1 - Electrician
   4 - Laborers
   1 - Welder
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Personnel may be increased or decreased depending on the project activity or other specialist required for certain high risk areas.

2. All demolition and reclamation work and associated monitoring and supervision will be performed by Plateau Resources personnel or outside contractors under the supervision of PRL.

3. Support Equipment may include the following equipment required for variable lengths of time.
   1 - 25 Ton Crane
   1 - 70,000 Pound Crawler Excavator with Attachments
   1 - Crawler Dozer (Cat D - 8 size or equal)
   1 - Front End Loader with Attachments
   1 - Welding Truck
   2 - Dump Trucks or Tractors with Belly Dumps and/or End Dumps
   3 - Pickups
   1 - Water Truck
   1 - Paddle Wheel Scraper
   1 - Portable Control Office Trailer and or Job Trailer
   1 - LS Misc. Sanitation Facilities, Hand tools, Pressure Washers, Pumps, or other items required for the project.

9.6.1 Estimated Decommissioning and Reclamation Costs Breakdown

The equipment hourly costs come from "RENTAL RATE BLUE BOOK for Construction Equipment" by Dataquest or from other current construction rates.

A.1 <u>Mill Feed Conveyor - Demo</u>: 2wks $23,370

Remove and place into the tailings impoundment. Requires disassembly of support towers, rollers, bridging and foundations. For costing it is estimated to take two weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative
25 Ton Crane w/ Operator	85	40	3,400	
Crawler Excavator w/ Operator	90	30	2,700	
Front End Loader w/ Operator	65	70	4,550	
Welder & Truck	45	40	1,800	
Dump Truck w/ Driver	50	70	3,500	
Crawler Dozer w/ Operator	130	30	3,900	
2 EA Labors	12	160	1,920	
Misc. Hand Tools	20	80	1,600	
		TOTAL =	**$ 23,370**	**$ 23,370**

A.2 <u>Truck Scale Demo</u>: 1/2 wk $6,730

Remove and place into the tailings impoundment. Requires disassembly scale building, bridging and foundations. For costing it is estimated to take half a week to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative:
Crawler Excavator w/ Operator	90	20	1,800	
Front End Loader w/ Operator	65	20	1,300	
Welder & Truck	45	10	450	
Dump Truck w/ Driver	50	20	1,000	
Crawler Dozer w/ Operator	130	10	1,300	
2 EA Labors	12	40	480	
Misc. Hand Tools	20	20	400	
		TOTAL =	**$6,730**	**$30,100**

A.3 Truck Dump Pocket and Building Demo: 3 wks $37,180

Remove and place into the tailings impoundment. Requires disassembly of building, foundations and demo and backfilling of dump pocket. For costing it is estimated to take three weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative:
Crawler Excavator w/ Operator	90	80	7,200	
Front End Loader w/ Operator	65	100	6,500	
Welder & Truck	45	40	1,800	
Dump Truck w/ Driver	50	120	6,000	
Crawler Dozer w/ Operator	130	80	10,400	
2 EA Labors	12	240	2,880	
Misc. Hand Tools	20	120	2,400	
		TOTAL =	**$37,180**	**$ 67,280**

A.4 Reagent & Storage Tanks Demo: 3 wks $45,720

Remove and dispose of any fluids in tanks per state and federal laws. Remove and crush tanks and foundations for placement into the tailings impoundment. For costing it is estimated to take three weeks to complete with the following crew:

Crew	Cost / Hour	Hours	Extension	Cumulative:
Crawler Excavator w/ Operator	90	80	7,200	
Front End Loader w/ Operator	65	100	6,500	
Welder & Truck	45	100	4,500	
Dump Truck w/ Driver	50	120	6,000	
Crawler Dozer w/ Operator	130	80	10,400	
Bulk Fluid Truck	55	80	4,400	
3 EA Labors	12	360	4,320	
Misc. Hand Tools	20	120	2,400	
		TOTAL =	**$45,720**	**$113,000**

A.5 CCD Circuit Demo: 3 1/2 wks $60,960

Remove and crush tanks and foundations for placement into the tailings impoundment. For costing it is estimated to take three and a half weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative:
25 Ton Crane w/ Operator	85	100	8,500	
Crawler Excavator w/ Operator	90	100	9,000	
Front End Loader w/ Operator	65	120	7,800	
Welder & Truck	45	100	4,500	
2 EA Dump Truck w/ Driver	50	240	12,000	
Crawler Dozer w/ Operator	130	100	13,000	
2 EA Labors	12	280	3,360	
Misc. Hand Tools	20	140	2,800	
		TOTAL =	**$60,960**	**$173,960**

A.6 Mill Building Demo: 12 wks $234,040

Remove building structure, equipment and foundations for placement into the tailings impoundment. For costing it is estimated to take twelve weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative:
25 Ton Crane w/ Operator	85	400	34,000	
Crawler Excavator w/ Operator	90	400	36,000	
Front End Loader	65	400	26,000	
Welder & Truck	45	440	19,800	
2 EA Dump Truck w/ Driver	50	880	44,000	
Crawler Dozer w/ Operator	130	320	41,600	
4 EA Labors	12	1920	23,040	
Misc. Hand Tools	20	480	9,600	
		TOTAL =	**$234,040**	**$408,000**

A.7 Environmental Lab Building Demo: 1 wk $16,910

Remove building structure, equipment and foundations for placement into the tailings impoundment. For costing it is estimated to take one week to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative:
25 Ton Crane w/ Operator	85	20	1,700	
Crawler Excavator w/ Operator	90	30	2,700	
Front End Loader w/ Operator	65	40	2,600	
Welder & Truck	45	10	450	
2 EA Dump Truck w/ Driver	50	60	3,000	
Crawler Dozer w/ Operator	130	30	3,900	
2 EA Labors	12	80	960	
Misc. Hand Tools	20	80	1,600	
		TOTAL =	**$16,910**	**$424,910**

A.8 Metallurgical Lab Building Demo: 3 wks $50,780

Remove building structure, equipment and foundations for placement into the tailings impoundment. For costing it is estimated to take three weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative:
25 Ton Crane w/ Operator	85	80	6,800	
Crawler Excavator w/ Operator	90	100	9,000	
Front End Loader w/ Operator	65	100	6,500	
Welder & Truck	45	40	1,800	
2 EA Dump Truck w/ Driver	50	220	11,000	
Crawler Dozer w/ Operator	130	80	10,400	
2 EA Labors	12	240	2,880	
Misc. Hand Tools	20	120	2,400	
		TOTAL =	**$50,780**	**$475,690**

A.9 Office Building Demo: 3 wks $50,780

Remove building structure, equipment and foundations for placement into the tailings impoundment. For costing it is estimated to take three weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative
25 Ton Crane w/ Operator	85	80	6,800	
Crawler Excavator w/ Operator	90	100	9,000	
Front End Loader w/ Operator	65	100	6,500	
Welder & Truck	45	40	1,800	
2 EA Dump Truck w/ Driver	50	220	11,000	
Crawler Dozer w/ Operator	130	80	10,400	
2 EA Labors	12	240	2,880	
Misc. Hand Tools	20	120	2,400	
	TOTAL =		**$50,780**	**$526,470**

A.10 Power Plant Building Demo: 8 wks $124,760

Remove building structure, equipment and foundations for placement into the tailings impoundment. For costing it is estimated to take eight weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative
25 Ton Crane w/ Operator	85	240	20,400	
Crawler Excavator w/ Operator	90	240	21,600	
Front End Loader w/ Operator	65	200	13,000	
Welder & Truck	45	160	7,200	
2 EA Dump Truck w/ Driver	50	400	20,000	
Crawler Dozer w/ Operator	130	160	20,800	
4 EA Labors	12	1280	15,360	
Misc. Hand Tools	20	320	6,400	
		TOTAL =	**$124,760**	**$651,230**

A.11 Maint. & Warehouse Building Demo: 4 wks $70,080

Remove building structure, equipment and foundations for placement into the tailings impoundment. For costing it is estimated to take four weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative
25 Ton Crane w/ Operator	85	120	10,200	
Crawler Excavator w/ Operator	90	120	10,800	
Front End Loader w/ Operator	65	160	10,400	
Welder & Truck	45	120	5,400	
2 EA Dump Truck w/ Driver	50	240	12,000	
Crawler Dozer w/ Operator	130	80	10,400	
4 EA Labors	12	640	7,680	
Misc. Hand Tools	20	160	3,200	
		TOTAL =	**$70,080**	**$721,310**

A.12 Remove Contaminated Soils From Around Building and Ore Pad: 3 wks $63,880

Remove approximately 6" of soil from the entire site for placement into the tailings impoundment. For costing it is estimated to take three weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative
Scraper w/ Operator	135	120	16,200	
Motor Grader w/ Operator	75	120	9,000	
Crawler Excavator w/ Operator	90	80	7,200	
Front End Loader w/ Operator	65	80	5,200	
2 EA Dump Truck w/ Driver	50	160	8,000	
Crawler Dozer w/ Operator	130	100	13,000	
2 EA Labors	12	240	2,880	
Misc. Hand Tools	20	120	2,400	
		TOTAL =	**$63,880**	**$85,190**

A.13 Water Tanks & Pump Station Demo: 3 wks $38,180

Remove water tanks, pump house and foundations for placement into the tailings impoundment. For costing it is estimated to take three weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative
Crawler Excavator w/ Operator	90	100	9,000	
Front End Loader w/ Operator	65	100	6,500	
2 EA Dump Truck w/ Driver	50	140	7,000	
Crawler Dozer w/ Operator	130	80	10,400	
2 EA Labors	12	240	2,880	
Misc. Hand Tools	20	120	2,400	
		TOTAL =	**$38,180**	**$823,370**

A.14 Recontouring, Shaping and Seeding Mill Site and Borrow: 3 wks $62,060

Grade site to match the surrounding area. Place soils and seeding where required for establishment of plant growth. For costing it is estimated to take three weeks to complete with the following crew:

Crew:	Cost / Hour	Hours	Extension	Cumulative
Scraper w/ Operator	135	80	10,800	
Crawler Excavator w/ Operator	90	80	7,200	
Front End Loader w/ Operator	65	80	5,200	
2 EA Dump Truck w/ Driver	50	160	8,000	
Crawler Dozer w/ Operator	130	100	13,000	
Farm Tractor & Acc. w/ Operator	12	80	960	
2 EA Labors	25	160	4,000	
Seed, Fertilizer & Mulch Cost 35 Acres - $300 / Acre			10,500	
Misc. Hand Tools	20	120	2,400	
		TOTAL =	**$62,060**	**$885,430**

A.15 Management, Reporting, Testing & Monitoring: 52 wks $586,400

The following is the cost to have on staff or on site the following people and or equipment & facilities during decommissioning activities. The time required is matched to the above mill site decommissioning items, which is fifty-two weeks or one year. The personnel below will be performing the daily paper work, reporting, management of decommissioning activities, environmental and radiological surveys and testing, quality control testing, monitoring and any other safeguards and requirements to establish a site which will meet the unrestricted use parameters. The average radon flux will be determined on the disposal cell based on 100 canister readings. Note the time allowed in this matches the time to perform the work in the decommissioning of the mill facility. These people will also be used in the reclamation of the tailings impoundment and the additional time and expense for them will be accounted for in that section. The cost to perform independent testing and monitoring is also given below, along with an estimate on preparing a detailed decommissioning plan and completion report.

Crew:	Cost / Month	Months	Extension	Cumulative
Radiation Safety Officer	5,300	12	63,600	
Environmental Engineer	5,300	12	63,600	
Lab Technician for Testing	4,200	12	50,400	
Construction Superintendent	4,500	12	54,000	
Office & Lab Trailer	500	12	6,000	
Shower & Sanitation Trailer	400	12	4,800	
Utility Cost (Phone, Elec. , ect.)	800	12	9,600	
Housing for Crew (10 rooms)	5,000	12	60,000	
Misc. Office Supplies	500	12	6,000	
Mechanics 2 EA	3,000	24	72,000	
Oiler	2,200	12	26,400	
Environmental, Radiological & Other Required or Needed Quality Control & Testing Equipment Allowance	10,000	12	120,000	
Preparing a Detailed Decommissioning Plan and Completion Report	1	LS	10,000	
Outside Analytical, testing and Calibration Costs	1	LS	40,000	
		TOTAL =	**$586,400**	**$1,471,830**

A.16 Mobilization & Demobilization: 2 wks $59,000

Move equipment to the site and then move off site. For costing assume equipment may have to come in from a total of 500 miles away. Therefore see the following cost estimate:

12 Pieces of Equipment @ 500 Miles X 2 Ways X $4.50 /Mile	=	$54,000	
Misc. Mobilization Items -- 1 LS @ $5,000.00	=	$ 5,000	
	TOTAL =	**$59,000**	**$1,530,830**

Summary of the above items for Decommissioning of the Facility:

DESCRIPTION:		COST	TIME
A.1	Feed Conveyor Demo:	$ 23,370	2 WKS
A.2	Truck Scale Demo:	$ 6,730	1/2 Wk
A.3	Truck Dump Pocket & Building Demo:	$ 37,180	3 WKS
A.4	Reagent & Storage Tanks Demo:	$ 45,720	3 WKS
A.5	CCD Circuit Demo:	$ 60,960	3.5 WK
A.6	Mill Building Demo:	$234,040	12 WKS
A.7	Environmental Lab Building Demo:	$ 16,910	1 WK
A.8	Metallurgical Lab Building Demo:	$ 50,780	3 WKS
A.9	Office Building Demo:	$ 50,780	3 WKS
A.10	Power Plant Building Demo:	$124,760	8 WKS
A.11	Maint. & Warehouse Building Demo:	$ 70,080	4 WKS
A.12	Remove Contaminated Soils from Buildings &Ore Pads:	$ 63,880	3 WKS
A.13	Water Tanks & Pump Station Demo:	$ 38,180	3 WKS
A.14	Recontouring, Shaping and Seeding Mill Site & Borrow:	$ 62,060	3 WKS
A.15	Management, Reporting and Monitoring:	$586,400	52 WKS
A.16	Mobilization & Demobilization:	$ 59,000	2 WKS

Total Cost for Decommissioning & Site Cleanup of Mill Area: = $1,530,830 52 WKS

10.0. COST ANALYSIS FOR RECLAMATION OF TAILINGS

Cost breakdown of the areas of work:

10.1 B.1 C.1 Dewatering Tailings:

The infrastructure for the dewatering will already be in place at the time the reclamation phase begins. The existing under drain system with the corresponding sump or sumps will be utilized to pump the tailings liquid onto the surface of the tailings for evaporation and dusting. The existing piping and sprayers used during operations will be utilized and moved as needed to best accelerate the evaporation process . The cost associated with this item will be the cost of the electricity to run the pumps and the man power to verify that the system is working as needed. Note: For terminology, the area above the existing cross valley berm can also be referred to as the upper area and the area below the existing cross valley berm like wise can be referred to as the lower area.

CREW:	1EA Labor (1/4 Time)	@	$ 3 / HR
	1 LS Generator & Pumping	@	$ 5 / HR
	Total per hour =		$ 8 / HR

Cost to dewater the upper tailings area:

B.1: $8/HR * 24 HR/Day * 365 Day/YR * (4/12) of a YR = $ 23,360

Cost to dewater the lower tailings area:

C.1: $8/HR * 24 HR/Day * 365 Day/YR * (8/12) of a YR = $ 46,720

10.2 B.2 C.2 Grading Tailings for Radon Cap

The surface of the tailings will require grading after the dewatering and consolidation of the tailings in preparation of receiving the radon barrier.

CREW:	2 EA	Dozer	@	$260 / HR
	2 EA	Labor	@	$ 24 / HR
	1 EA	Mechanic	@	$ 20 / HR
	1 EA	Water Truck	@	$ 40 / HR
	1 LS	Misc.	@	$ 10 / HR
		Total per hour =		$ 354 / HR

Estimate that grading will be done at a rate of four (4) acres per day.

B.2 Upper Area: 25.5 AC / 4 AC/DAY * 8 HR / Day * $354 / HR = $ 18,054

C.2 Lower Area: 42.6 AC / 4 AC/DAY * 8 HR / Day * $354 / HR = $ 30,160

10.3 B.3 C.3 Place 1.5 Feet Clay Cover Material:

Load, haul, place and compact to the required density and moisture content above the tailings.

Upper Tailings Area	25.5 Ac x 43,560 x 1.5 FT x 1.25 / 27	=	77,500 CY
Lower Tailings Area	42.63 Ac x 43,560 x 1.5 FT x 1.25 / 27	=	129,000 CY

B.3 Upper Tailings Area	77,500 CY	x	$ 6.96 / CY	=	$ 539,400
C.3 Lower Tailings Area	129,000 CY	x	$ 6.96 / CY	=	$ 897,840
			TOTAL COST	=	**$1,437,240**

CREW:	1 EA	Excavator	@	$ 90 / Hr / EA
	2 EA	Dozer	@	$130 / HR / EA
	1 EA	Loader	@	$ 65 / HR / EA
	2 EA	Compactor	@	$ 60 / HR / EA
	1 EA	Blade	@	$ 75 / HR / EA
	4 EA	Water Truck	@	$ 40 / HR / EA
	11 EA	Haul Truck	@	$ 60 / HR / EA
	1 EA	Disc & Tractor	@	$ 75 / HR / EA
	2 EA	Mechanics	@	$ 40 / HR / EA
	2 EA	Oilers	@	$ 20 / HR / EA
	2 EA	Labors	@	$ 12 / HR / EA
	1 LS	Misc Exp.	@	$ 20 / HR
		Total per hour =		$1,669 / HR

Expect 2 rounds/HR/Truck = 7EA x 20CY/Load x 2 Loads/HR x 8 HR/Day
= 2,240 CY/Day

Therefore:	(8HR x $1,669 / HR) / 2,240 CY =	$ 5.96 / CY
Plus Royalty payment:		$ 1.00 / CY
	Total Cost =	$ 6.96 / CY

Time to do each area:

Upper area = 77,500 cy / 2,240 (cy/day) = 35 working days or 1.6 months
Lower area = 129,000 cy / 2,240 (cy/day) = 58 working days or 2.7 months

Note: In the above calculation it was figured to use 11 haul trucks, 4 on the bluff and 7 on the tailings site.

10.4 B.4 C.4 Place 2 Feet Soil Cover Material:

Load, haul, place and compact to the required density and moisture content above the Clay.

Upper Tailings Area	25.5 Ac x 43560 x 2 FT x 1.25 / 27	=	103,000 CY
Lower Tailings Area	42.63 Ac 43560 x 2 FT x 1.25 / 27	=	172,000 CY
B.4 Upper Tailings Area	103,000 CY x \$4.07 / CY	=	\$ 419,210
C.4 Lower Tailings Area	172,000 CY x \$4.07 / CY	=	\$ 700,040
	TOTAL COST	=	**\$1,119,250**

CREW:	1 EA	Excavator	@	\$ 90 / Hr / EA
	1 EA	Dozer	@	\$130 / HR / EA
	1 EA	Loader	@	\$ 65 / HR / EA
	2 EA	Compactor	@	\$ 60 / HR / EA
	1 EA	Blade	@	\$ 75 / HR / EA
	4 EA	Water Truck	@	\$ 40 / HR / EA
	6 EA	Haul Truck	@	\$ 60 / HR / EA
	1 EA	Mechanics	@	\$ 40 / HR / EA
	1 EA	Oilers	@	\$ 20 / HR / EA
	2 EA	Labors	@	\$ 12 / HR / EA
	1 LS	Misc Exp.	@	\$ 20 / HR
		Total per hour =		\$1,104 / HR

Expect 3 rounds/HR/Truck = 6EA x 20CY/Load x 3 Loads/HR x 8 HR/Day
= 2880 CY/Day

Therefore:	(8HR x \$1,104/HR) / 2880 CY =	\$3.07 / CY
Plus Royalty payment:		\$ 1.00 / CY
	Total Cost =	\$ 4.07 / CY

Time to do each area:

Upper area = 103,000 CY / 2,880 (cy/day) = 36 working days or 1.7 months
Lower area = 172,000 CY / 2,880 (cy/day) = 60 working days or 2.7 months

10.5 B.6 C.5 Place Rock Cover Materials:

Process, load, haul and place to the required thickness above the soil cover and on slopes.

Upper Tailings Area d50 = 3"	25.5 Ac x 0.66 FT x 1.15 / 27	=	32,000 CY
Lower Tailings Area d50 = 3"	42.63 Ac x 0.66 FT x 1.15 / 27	=	54,000 CY
Transition protection 6" Riprap	2200 LF x 20 FT x 1.0 x 1.15 / 27	=	1,900 CY
	1500 LF x 50 FT x 1.0 x 1.15 / 27	=	3,200 CY
6" Riprap in Northeast Finger	200 x 100 x 1.0 x 1.15 / 27	=	850 CY
Transition protection 9" Riprap	1200 LF x 20 FT x 1.5 x 1.15 / 27	=	1,600 CY
	1100 LF x 50 FT x 1.5 x 1.15 / 27	=	3,700 CY
9" Riprap in Northwest Finger	80 x 150 x 1.5 x 1.15 / 27	=	800 CY
12" Riprap in Northwest Finger	80 x 80 x 1.5 x 1.15 / 27	=	430 CY
18" Riprap in Northwest Finger	20,870 SF x 2.25 x 1.15 / 27	=	2,000 CY
18" Riprap in Northeast Finger	5,740 SF x 2.25 x 1.15 / 27	=	550 CY
18" Riprap on Toe of Dam	25,040 SF x 2.25 x 1.15 / 27	=	2,400 CY
4" minus Bedding Mat'l	300,520 SF x 0.5 x 1.15 / 27	=	6,400 CY

Upper Tailings Area	32,000 CY	x	$ 5.66 / CY	=	$ 181,120
Lower Tailings Area	54,000 CY	x	$ 5.66 / CY	=	$ 305,640
6" through 18"Riprap	17,300 CY	x	$ 5.66 / CY	=	$ 98,644
Bedding Mat'l	6,400 CY	x	$ 5.66 / CY	=	$ 36,224
			TOTAL COST	=	**$ 621,638**

B.6 $181,120 + ($98,654 + $36,224) / 2 = $248,559
C.5 $305,640 + ($98,654 + $36,224) / 2 = $373,079

CREW:	2 EA	Excavator	@	$ 90 / Hr / EA
	1 EA	Dozer	@	$130 / HR / EA
	2 EA	Loader	@	$ 65 / HR / EA
	1 EA	Screen	@	$100 / HR / EA
	1 EA	Blade	@	$ 75 / HR / EA
	1 EA	Water Truck	@	$ 40 / HR / EA
	6 EA	Haul Truck	@	$ 60 / HR / EA
	1 EA	Mechanics	@	$ 40 / HR / EA
	1 EA	Oilers	@	$ 20 / HR / EA
	2 EA	Labors	@	$ 12 / HR / EA
	1 LS	Misc Exp.	@	$ 20 / HR
		Tctal per hour =		$ 1,119 / HR

Expect 2 rounds/HR/Truck = 6EA x 20CY/Load x 2 Loads/HR x 8 HR/Day
= 1920 CY/Day

Therefore: (8HR x $1,119/HR) / 1920 CY = $ 4.66 / CY
Plus Royalty payment: $ 1.00 / CY
Total Cost = $ 5.66 / CY

Time to do each rock cover area:

Upper area	= 32,000 CY / 1,920 (cy/day) =	17 working days or	1 months
Lower area	= 54,000 CY / 1,920 (cy/day) =	28 working days or	1.3 months
Riprap & Bedding	= 23,830 CY / 1,920 (cy/day) =	13 working days or	0.6 months

10.6 B.5 Excavate Rock Cut:

Excavate drainage channel for drainage of area above the cross valley berm:

B.5 Upper Tailings Area	14,000 CY	x	$5.05 / CY	=	$ 70,700
			TOTAL COST	**=**	**$ 70,700**

CREW:	1 EA	Excavator	@	$ 90 / Hr / EA
	1 EA	Dozer	@	$130 / HR / EA
	1 EA	Loader	@	$ 65 / HR / EA
	2 EA	Haul Truck	@	$ 60 / HR / EA
	1 EA	Mechanics	@	$ 40 / HR / EA
	1 EA	Oilers	@	$ 20 / HR / EA
	1 EA	Powder man	@	$ 75 / HR / EA
	1 LS	Misc Exp.	@	$ 50 / HR
		Total per hour =		$590 / HR

Expect 3 Weeks to do this work = 14,000 CY / (3WK x 40 HR/WK) = 117 CY / HR

Therefore:	$590/HR / 117 CY/ HR	=	$ 5.05 / CY
Plus Royalty payment:			$ 0.00 / CY
		Total Cost =	$ 5.05 / CY

10.7 B.7 C.6 Management, Reporting, Testing & Monitoring:

The following is the cost to have on staff or on site the following people and or equipment & facilities during reclamation activities. The time required is matched to the above tailings site recla[illegible]on items, which is fifty-two weeks or one year. The personnel below will be perfo[illegible] the daily paper work, reporting, management of reclamation activities, envi[illegible]al and radiological surveys and testing, quality control testing, monitoring and any o[illegible]eguards and requirements to establish a site which is stable and requires no further monitory or care. Note these people are also used in the decommissioning of the mill site and the additional time and expense for them will be accounted for in that section. The cost to perform independent testing and monitoring is also given below, along with an estimate on preparing a detailed completion report.

Crew	Cost / Month	Months	Extension
Radiation Safety Officer	5,300	12	63,600
Environmental Engineer	5,300	12	63,600
Lab Technician for Testing	4,200	12	50,400
Construction Superintendent	4,500	12	54,000
Office & Lab Trailer	500	12	6,000
Shower & Sanitation Trailer	400	12	4,800
Utility Cost (Phone, Elec., etc.)	800	12	9,600
Housing for Crew (10 rooms)	5,000	12	60,000
Misc Office Supplies	500	12	6,000
Environmental, Radiological & Other Required or Needed Quality Control & Testing Equipment Allowance	10,000	12	120,000
Completion Report	1	LS	5,000
Radon Flux Testing			15,000
Outside Analytical, testing and Calibration Costs	1	LS	20,000
		TOTAL	$ 478,000

B.7 Upper area 1/3 x $ 478,000 = $ 162,520

C.6 Lower area 2/3 x $ 478,000 = $ 315,480

Summary of the above items for Tailings Reclamation:

DESCRIPTION:			COST
10.1	DEWATER TAILINGS:		
	B.1 ABOVE CROSS VALLEY BERM:	$	23,360
	C.1 BELOW CROSS VALLEY BERM:	$	46,720
10.2	GRADE TAILINGS FOR RADON BARRIER:		
	B.2 ABOVE CROSS VALLEY BERM:	$	18,054
	C.2 BELOW CROSS VALLEY BERM:	$	30,160
10.3	PLACE 1.5 FEET CLAY COVER MATERIAL:		
	B.3 ABOVE CROSS VALLEY BERM:	$	539,400
	C.3 BELOW CROSS VALLEY BERM:	$	897,840
10.4	PLACE 2 FEET SOIL COVER MATERIAL:		
	B.4 ABOVE CROSS VALLEY BERM:	$	419,210
	C.4 BELOW CROSS VALLEY BERM:	$	700,040
10.5	PLACE ROCK COVER MATERIALS:		
	B.6 ABOVE CROSS VALLEY BERM:	$	248,559
	C.5 BELOW CROSS VALLEY BERM:	$	373,079
10.6	B.5 EXCAVATE ROCK CUT:	$	70,700
10.7	MANAGEMENT, REPORTING, TESTING & MONITORING:		
	B.7 ABOVE CROSS VALLEY BERM	$	162,520
	C.6 BELOW CROSS VALLEY BERM	$	315,480
	SUB TOTAL TAILINGS RECLAMATION:	$	3,845,122

SUMMARY OF TOTAL COST FOR BONDING REQUIREMENTS

Events for Reclamation and Decommissioning of Shootaring Canyon Mill Facility		Cost
A. Section 9: Decommission and Site Clean Up of Mill Facility		
A.1	Mill Feed Conveyor Demo	$ 23,370
A.2	Truck Scale Demo	6,730
A.3	Truck Dump Pocket & Building Demo	37,180
A.4	Reagent & Storage Tanks Demo	45,720
A.5	CCD Circuit Demo	60,960
A.6	Mill Building Demo	234,040
A.7	Environmental Lab Building Demo	16,910
A.8	Metallurgical Lab Building Demo	50,780
A.9	Office Building Demo	50,780
A.10	Power Plan Building Demo	124,760
A.11	Maintenance & Warehouse Building Demo	70,080
A.12	Remove contaminated Soils from Around Building & Ore Pad	63,880
A.13	Water Tanks & Pump Station Demo	38,180
A.14	Recontouring, Shaping and Seeding Mill Site and Borrow	62,060
A.15	Management, Reporting, Testing & Monitoring	586,400
A.16	Mobilization & Demobilization	59,000
	Total Cost for Decommission & Site Cleanup of Mill Area =	**$1,545,830**
B. Section 10: Reclamation of Tailings Above Cross Valley Berm		
B.1	Dewater Tailings	$ 23,360
B.2	Grade Tailings for Radon Cap	18,054
B.3	Place 1.5 Feet Clay Cover Material	539,400
B.4	Place 2 Feet Soil Cover Material	419,210
B.5	Excavate Rock Cut	70,700
B.6	Place Rock Cover Materials	248,559
B.7	Management, Reporting, Testing & Monitoring	162,520
	Total Cost for Upper Tailings Area =	**$1,481,803**
C. Section 10: Reclamation of Tailings Below Cross Valley Berm		
C.1	Dewater Tailings	$ 46,720
C.2	Grade Tailings for Radon Cap	30,160
C.3	Place 1.5 Feet Clay Cover Material	897,840
C.4	Place 2 Feet Soil Cover Material	700,040
C.5	Place Rock Cover Materials	373,079
C.6	Management, Reporting, Testing & Monitoring	315,480
	Total Cost for Lower Tailings Area =	**$2,363,319**
	SUBTOTAL OF WORK =	**5,390,952**
	15% CONTINGENCY =	**808,643**
	LONG TERM MAINTENANCE COST =	**584,564**
TOTAL COST OF MILL DECOMMISSIONING, SITE CLEANUP AND TAILINGS RECLAMATION WORK IS EQUAL TO		**$6,784,159**

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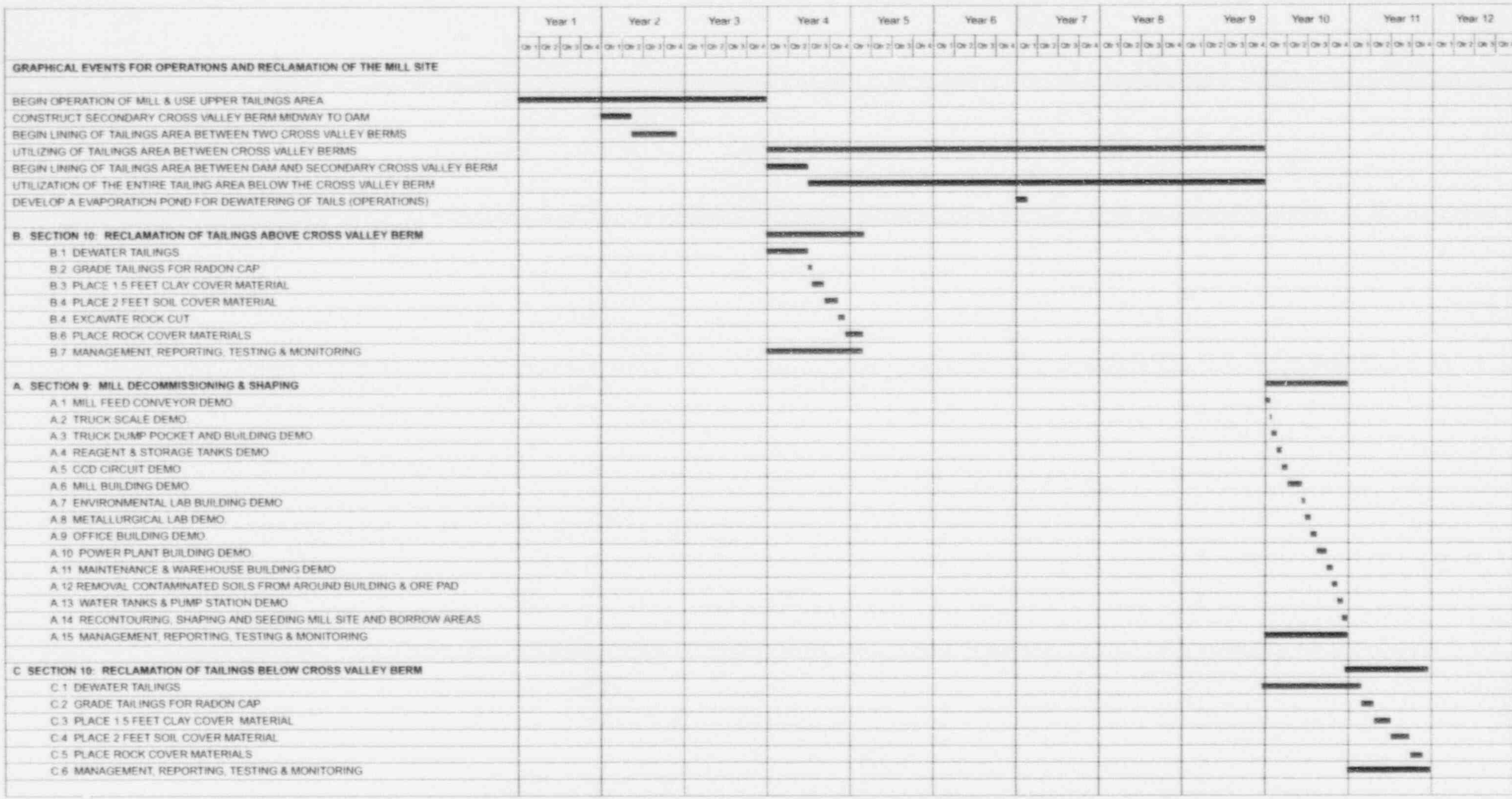
December 18, 1996

Schedule of Operation and Reclamation Activity at the Shootaring Canyon Millsite

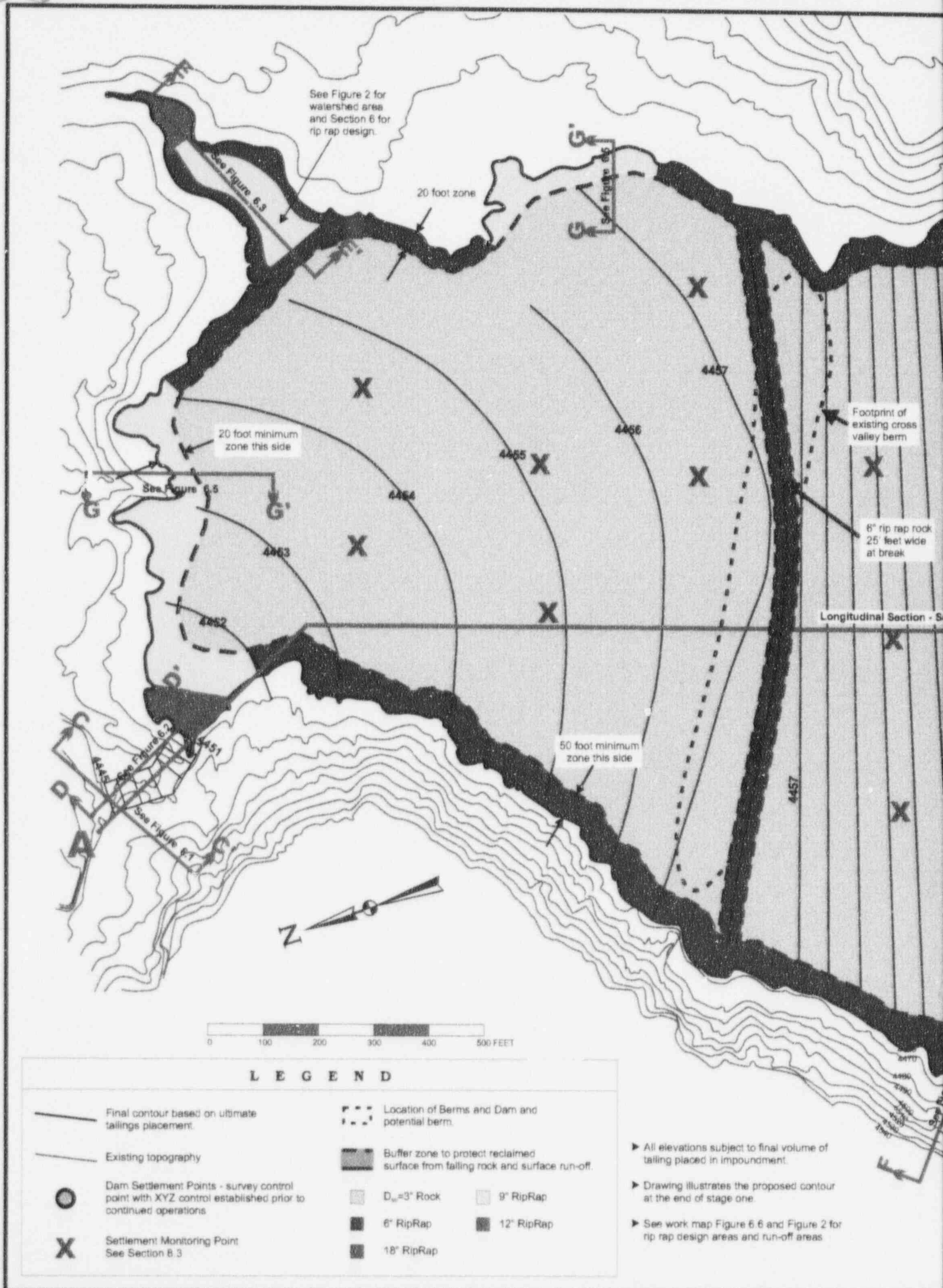


Critical

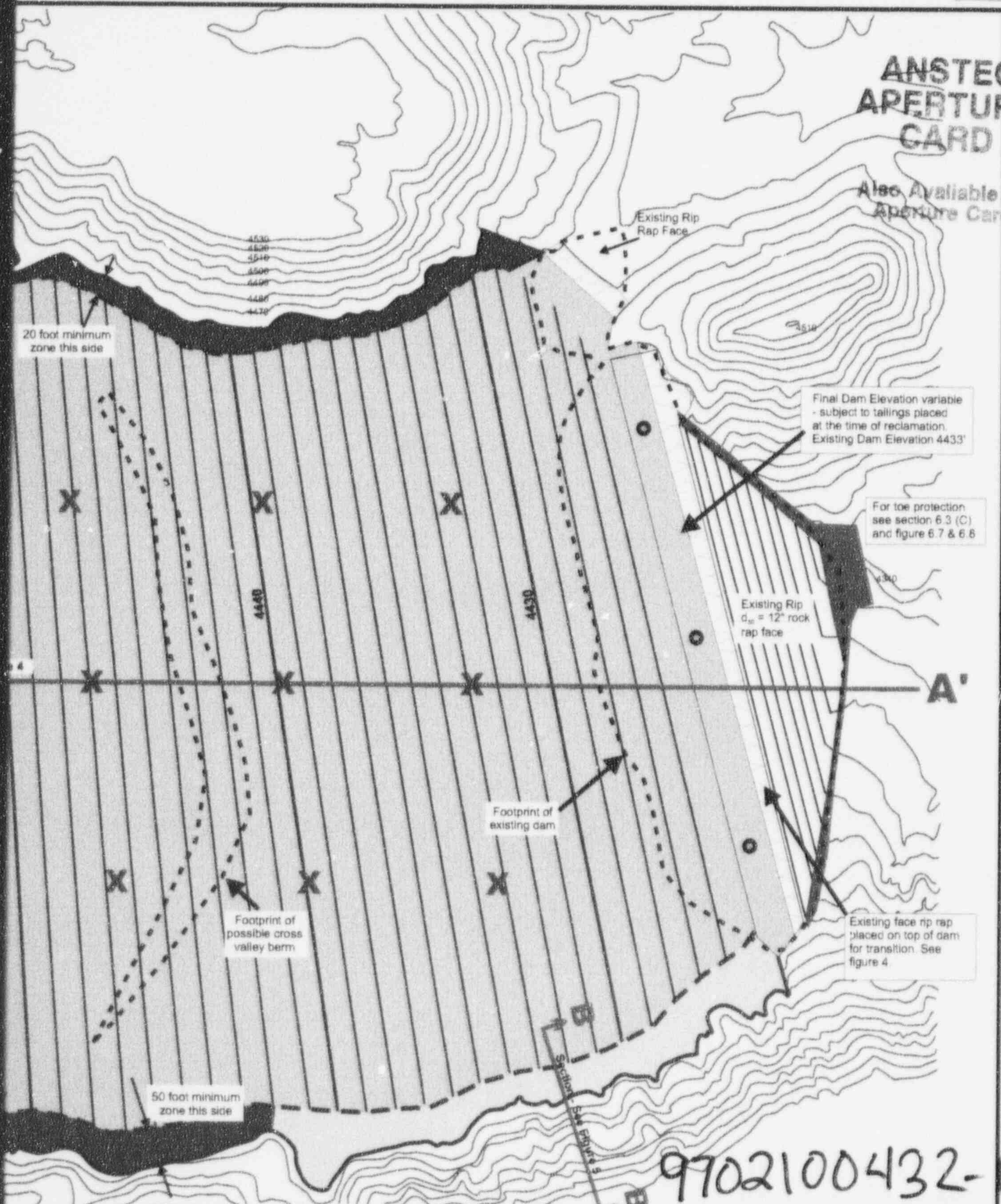
Noncritical

Plateau Resources Limited
Operation and
Reclamation Schedule
Date: 12-18-96

Figure 1



See Figure 2 for watershed area and Section 6 for rip rap design.
See Figure 6.3
20 foot zone
See Figure 6.5
20 foot minimum zone this side
See Figure 6.5
4457
4456
4455
4464
4463
4462
4451
Footprint of existing cross valley berm
6" rip rap rock 25' feet wide at break
Longitudinal Section - S
50 foot minimum zone this side
See Figure 6.2
See Figure 6.1
Z
0 100 200 300 400 500 FEET
LEGEND
Final contour based on ultimate tailings placement.
Existing topography
Dam Settlement Points - survey control point with XYZ control established prior to continued operations
Settlement Monitoring Point See Section 8.3
Location of Berms and Dam and potential berm.
Buffer zone to protect reclaimed surface from falling rock and surface run-off.
D=3" Rock
9" RipRap
6" RipRap
12" RipRap
18" RipRap
All elevations subject to final volume of tailing placed in impoundment.
Drawing illustrates the proposed contour at the end of stage one.
See work map Figure 6.6 and Figure 2 for rip rap design areas and run-off areas.



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No.	Date	Revisions	By
1	9-9-96	Final Topography and Ditches	KJW
2	12-18-96	Final Topography, Rip Rap and Cover	KJW

Approved:

DATE: 9-6-96

Plateau Resources Limited

Shootaring Canyon Tailings Area

Reclamation Plan

Final Topography

Figure 3