

APPENDIX 3-G

(3.3.11 A)

ROAD RECLAMATION PLAN

8/23/85

AGREEMENT

This agreement made and entered into this 3rd day of August 1983, by and between Emery County, a body corporate and politic (County), and Co-Op Mining Company, a Utah general partnership (Co-Op),

WHEREAS, there is an existing road in Emery County known as Bear Creek Road, and

WHEREAS, Co-Op requires extensive use of said road, and

WHEREAS, due to said extensive use, said road should be relocated for the health, safety and welfare of the citizens of County as well as others who may have occasion to use said road,

NOW, THEREFORE, be it agreed as follows:

1. The parties hereto agree and acknowledge that the southern 0.65 miles of the road known as Bear Creek Road is a County road. Said County road runs from State Road 31 in a northerly direction for approximately 0.65 miles to a presently existing gate. Thereafter the road is a private road.
2. That Co-Op will relocate the Bear Creek Road according to the plans and specifications prepared by the Emery County Engineer and described on the document entitled Bear Canyon County Road Relocation dated October 12, 1982.
3. Co-Op will relocate the Road according to the plans and specifications referred to above at their expense. Co-Op will reimburse County for engineering costs incurred by County concerning the preparation of said plans and specifications and site inspections up to One Thousand (\$1,000.00) Dollars.
4. Co-Op will indemnify and defend County for any damage caused, or loss incurred to or claim made by any public or private individual, firm, group, association, partnership or corporation as a result of the construction conducted to relocate Bear Creek Road. Said indemnification will continue until such time as County approves the completed roadway and accepts the construction thereof.
5. Co-Op acknowledges and accepts the easements of North Emery Water Users and Huntington City which exist in, along and across the relocate Bear Creek Road. Said easements are in existence on the ground. Co-Op's acknowledgment thereof herein recognizes and preserves said easements.
6. Co-Op agrees to encase water lines of North Emery Water Users and Huntington City in nestable corrugated pipe pursuant to plans and specifications prepared by the Emery County Engineer.

7. Co-Op agrees to allow access to other property served by the relocated Bear Creek Road. Said access shall be allowed to the owner of the property, their successor in interest or any other individual, firm, group, association, partnership or corporation who requires access due to their association with the owner or because the owner has granted permission to the individual, firm, group, association, partnership or corporation to go upon his property. Co-Op will not withhold access due to the type of activity which the then owner or his agents, employees or invitees intend or in fact conduct.

8. Co-Op will provide a completion and performance bond to Emery County upon the execution hereof in the amount of Twenty-Five Thousand (\$25,000.00) Dollars which will remain in force and effect for twelve (12) months after the date said road is accepted by County as indicated in paragraph 4 above.

9. Co-Op will provide liability insurance in an amount not less than Five Hundred Thousand (\$500,000.00) Dollars to be in force during the construction of said road. Said policy will name County as an insured.

10. Co-Op agrees to complete said road in a timely manner not to exceed eighteen (18) months from the date of this agreement. County may make demand upon the bonding company under the bond provided pursuant to paragraph 8 above and secure completion of the relocation in the event construction is not completed within the agreed upon eighteen (18) months.

11. It is further understood that any additional improvements of the relocated Bear Creek Road will be at the expense of all primary users.

12. The Co-Op agrees to reclaim that portion of the old Bear Creek Road according to the specifications and requirements of the Bureau of Land Manager (BLM).

13. That the Co-Op agrees to provide Emery County with the necessary easement agreements with the Utah Department of Transportation.

14. Co-Op acknowledges and agrees to comply with standard number 6.3.8 "Protection Zone" of the Utah State Health Drinking Water Standards as it applies to supplies of drinking water in Bear Canyon.

15. County agrees to inspect the relocated Bear Creek Road within ten (10) days after notification by Co-Op of the completion thereof. County must within five (5) working days of said inspection accept the road or notify Co-Op of any deficiencies which must be then corrected by Co-Op within the time period outlined in paragraph 10 above. Should County fail to notify Co-Op of any deficiencies within five (5) working days, the road is deemed accepted by County and the twelve (12) month period indicated in paragraph 8 above begins to run from the sixth (6th) day after inspection.

IN WITNESS WHEREOF, this agreement is executed the day and year above first written, at Castle Dale, Utah, pursuant to a resolution of the Emery County Board of Commissioners at a regularly scheduled meeting of the Board.

EMERY COUNTY, a body politic and corporate,

ATTEST

Bruce D. Smith
County Clerk

By *Ree P. Ware*
Chairman of the Emery County
Board of Commissioners

IN WITNESS WHEREOF this agreement is executed at Huntington, Utah.

DATED this *3rd* day of *August*, 1983.

CO-OP MINING COMPANY, a Utah general partnership

By *B. W. Stoddard*
a General Partner

CO-OP MINING CO.
BOX 1245
HUNTINGTON, UTAH 84528

Aug. 8, 1983

S U B M I T T A L

TO:

DIVISION OF OIL GAS AND MINING
4241 STATE OFFICE BUILDING
SALT LAKE CITY, UTAH 84114

[Handwritten signature]
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Co-op Mining Co. submits the following plans for that portion of the haul road in the Bear Creek Canyon designated as a private road in the enclosed copy of the agreement between Emery County and Co-op Mining Co. The road coincides with the existing Bear Canyon road, which follows the original contour of the land, minimizing additional disturbance or adverse effects on the environment. There will be no cut or fill sections, and no material side-cast. If any new area is disturbed, any suitable topsoil will first be removed and stockpiled as described in the topsoil plan previously submitted. At the time of final reclamation, the road will be reclaimed as outlined in the previously submitted reclamation plan, unless it is determined to be necessary for post mining land use. Hydrology for the drainage controls has been calculated by Horrocks Engineers (See appendage A). Culverts will be galvanized corrugated type.

Please see enclosed map, profile, and cross-section for construction detail. (Plate 3-5)

CO-OP MINING COMPANY

Wendell Owen
WENDELL OWEN

RECLAMATION PLAN

MINE PORTAL ROAD

The following procedures are designed to revegetate and control erosion. They will satisfy the commitments made by Co-Op Mining Co. in their permit application and all applicable portions under CFR 784.13. The area in question will be along and adjacent to the main mine access. The reclamation will be of a permanent nature. (See Plate 3-1). The actual ground involved comprises approximately 3 acres of disturbance.

METHODOLOGY

The actual implementation of abandonment and ultimate reclamation can be broken down into four major categories and classification of types of work needed:

- (1). Earth moving: redistribution of top soil and redistribution of road cut material to approximate original contour of surface.
- (2). Clump planting of adjacent vegetation on recontoured surface.
- (3). Seeding and mulching to re-establish interim species and reduce erosion until climax vegetation can be established.
- (4). Perennial stream channel restoration and reconstruction of permanent drainage.

PHASE # 1 EARTH MOVING

The road system can be brought back to a reasonable configuration by implementation of a large backhoe unit. The actual method will involve the pulling of surface material from the road surface and berm and placing it against the opposing high wall. This material will then be covered with approximately 1 foot of top soil by pulling material from about 10 feet below the road cut up onto the road surface and spreading and compacting this material with the front bucket, at the same time pulling the leading edge of the high wall down to alleviate the degree and angle of the high wall. All work done both above and below the road will take into consideration existing vegetation and all effort will be made to minimize disturbance and utilize existing vegetation. When there is no alternative other than disturbance, an effort will be made to relocate earth and maintain existing vegetation in place, attempting to relocate the vegetation in the proximity of the road disturbance. (See attachment # 2).

PHASES # 2 AND 3 REVEGETATION

This procedure involves a two phase program: (1). To clump plant existing vegetation in small basins along the recontoured road, and, (2). To hydromulch the entire area to supplement revegetation and control run-off until stabilization is complete and to prepare a site which will be stable enough for a period of time to allow vegetation

to become established. The seed mix is composed of rapidly growing grasses and forbes species as well as woody species in order to stabilize and lessen the impact of surface run-off. Hydromulching to be carried out in conjunction with the earth work or Phase 1. By this methodology, the area should be fully stocked and provide the hydrological and aesthetic commitments as detailed in mine per application. Recommendations for the hydroseeding and mulching operation are as follows:

- (1). Early spring, apply the seed simultaneously with a soil tackifier. The rate and species application as indicated. Target completion by May 1.
- (2). Then apply a wood fiber mulch with tackifier at the approximate rate of 1,500 to 2,000 pounds per acre.
- (3). Incorporate approximately 100 lbs. of 16-16-8 fertilizer in the mulch application.

Stream Buffer Zones UMC 817.57

Co-Op has attempted to protect Bear Creek in all areas where existing structure and disturbance preclude the establishment of a buffer zone. This has been accomplished by earthen berms along roads adjacent to the stream, culverting in the area of the scale house, silt fences, and straw filters on all tributaries which pass disturbed runoff from haul roads. In addition, all disturbed area runoff other than haul roads pass through a sediment pond prior to discharge into Bear Creek. The buffer zone that does exist is properly posted and signed.

No additional disturbance is anticipated in the Bear Canyon drainage however, if in the future, expansion is required, Co-Op is committed in taking all necessary safeguards to ensure the integrity of Bear Creek and establishing an adequate buffer zone.

PHASE #4 DRAINAGE CHANNEL STABILIZATION AND RECONSTRUCTION

In conjunction with the recontouring, all drainage areas will re-establish to approximate original configuration. In order to minimize the loss of soil, all drainages will be lined with hygronomy blankets for approximately 10 feet above and below the areas of disturbance. In addition, where conditions warrant, rock rip rap will also be utilized to add yet another parameter of stability.

CONCLUSIONS AND RECOMMENDATIONS

The advantages of this recommended procedure are as follows:

1. By utilizing a backhoe, associated disturbance will be kept minimal.
2. The clump planting procedure accomplishes all of the below:
 - a. Immediate ground cover.
 - b. Aesthetically pleasing upon completion.
 - c. Maximize potential for native species to establish.
 - d. Inoculation of soil with indigenous mycorrhiza.
 - e. Modify and enhance the micro-environment surrounding each clump.
3. The hydroseeding, mulching, fertilization, and tackifying will virtually assure rapid establishment, thus minimizing wind and water erosion.
4. The channel liners are a proven method to eliminate erosion at the same time allowing for stabilization through revegetation.
5. A cost effective methodology to address a common problem associated with pre-law disturbance.

Class I Roads

The Bear Canyon Haul Road is approximately 1800' long from the gate to the scale house as shown on Plates 3-5 and 2-2. As shown on the map, this portion of the road has been included in the Permit Area. This Class I road is constructed 30' wide and is surfaced with 6" of 3/4" gravel, crowned in the middle as shown on the cross section. Drainage will be provided along the road by ditches with a minimum depth of 1.8 feet. Erosion protection, such as straw bales at 100' intervals or 6" median diameter rip rap on a bed of 1" gravel 6" thick, shall be provided in all areas where velocities are expected to exceed 5 ft. per sec.. Culverts are installed as shown on the drawings; In addition, the two proposed 30" CMP culverts are now in place as indicated on the map. Culvert inlets will be protected by rock-lining or concrete headwalls. In areas where culverts are placed, at least 30" of headwater depth is available to allow for a variance to allow the 18" culverts to pass the 10-year, 24-hour storm event. The culvert on the submitted drawing is to scale, and was installed with a trash rack to prevent plugging, a rock headwall at the inlet, and rip rap at the outlet to prevent erosion.

This road will be maintained in such a manner that the performance standards will be met throughout the life of

the entire transportation facility, including maintenance of the surface, shoulders, parking and side areas, and erosion control structures for safe and efficient utilization of the road.

Upon completion of the operation and reclamation of the mine site disturbed area, it is anticipated that this portion of the Bear Canyon Road will also be reclaimed. This will occur at approximately the same time as the final removal of the sedimentation pond and diversions on the mine site. The road surfacing material will be removed and either salvaged or disposed of within the pond site and buried. The reclamation will then be accomplished by ripping up the remaining base, spreading the material across the (roadway) disturbed area, and planting the area with the approved seed mix. During this time, all culverts shall be removed and either salvaged or disposed of in an approved landfill, and the natural drainage patterns shall be restored.

Class II Roads

The mine area and portal access road is approximately 2,112' long. A cross-section and profile of this road is shown on Plate 3-5. Culvert locations and ditches are also shown on this drawing, as well as on Plate 3-1. This road is primarily used for access to the mine portals and

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other facilities. The road was originally constructed for access to the old Bear Mine, and has since been widened and fitted with proper drainage controls to protect the environment. The road is designed, used and maintained to meet the requirements of UMC - 817.156, and to control or minimize erosion and siltation, air and water pollution, and damage to public or private property.

The road is located along the canyon floor above the stream, and along the stable slope leading to the portals. The overall grade of the road does not exceed 1:V:10h (10%) and the maximum pitch grade does not exceed 1V:6.5h (15%). The horizontal alignment is consistent with the existing topography and with the volume, speed, and weight of anticipated traffic.

As mentioned earlier, the initial road was constructed under pre-law conditions, using the cut/fill side-cast method. A stability analyses was performed on the road by Dames & Moore in 1981 (Appendix 3-F). Their conclusion was that the Bear Canyon Portal Access Road has a stability factor of safety of a minimum of 1.43, and ranges upward to 2.15.

There are 3 other Class II roads within the Permit Area. Following is a description of each of these:

Ditches and culverts have been added to the roads to control run-off and safely pass the run-off from a 10-year, 24-hour precipitation event. (See Plates 3-1 and 3-5). Ditches shall be maintained at a minimum depth of 1.8 feet, and at least 30" of headwater depth will be maintained at the inlet of the 18" culverts. Culverts are fitted with trash racks to prevent plugging, and buried and compacted a minimum of 30" to prevent crushing. In areas where velocities of run-off exceed 5 fps, erosion protection such as straw bales at 100' intervals or 6" median diameter rip rap on a bed of 2" gravel/sand 6" thick shall be maintained. Culvert spacing conforms with the requirements of UMC 817.153 (c)(z) for Class II Roads. (i) Rock or concrete headwalls shall be provided at the inlet to all culverts, and rip rap or other erosion protection shall be provided at the outlet.

The roads are surfaces with 4" of -3/4 gravel, and is maintained in such a manner that the approved design standards are met throughout the life of the facility. Damage to the roads from use or weather events shall be promptly repaired.

These roads shall be removed upon completion of the mining operation. The timing and procedure of removal and reclamation is discussed in detail under the Backfilling and Grading Plan in Sec. 3.6.4.

Class III Roads

The only Class III Road on the permit area is a jeep trail that was constructed pre-law, probably as a cattle trail. This road is shown on Plate 2-2, Surface Facilities Map. The road is blocked off and is not used; therefore, no maintenance or reclamation plan is proposed for this trail.

All roads shall be maintained in such a manner to prevent damage to fish, wildlife, and related environmental values. This is accomplished by:

1. Maintaining hydrologic controls, such as ditches, culverts, diversions and sedimentation ponds to assure that disturbed drainage is conveyed away from undisturbed drainages and either held or cleaned before releases.
2. Watering of roads as necessary to reduce fugitive dust.
3. Protection of wildlife within the permit area and reporting of sightings of threatened and endangered species.
4. Contemporaneous reclamation.

5. Advocating good-housekeeping practices to reduce the possibility of contamination of surface waters in the area.

6. Co-op is committed that all support facilities will be restored to prevent damage to fish, wildlife, and related environmental values and the possibility of additional contributions of suspended solids to streamflow or runoff outside the permit area will be minimal.

There is one additional class 3 road giving access to sediment "Pond A". The road is in actuality the disturbed drainage ditch to sediment "Pond A", and is used infrequently to clean sediment from "Pond A".

APPENDIX 3-H

(APPENDIX 3-5-8A)

SURVEY RENEWABLE RESOURCE LANDS
AND POTENTIAL OF SUBSIDENCE IMPACTS

8/23/85

SURVEY OF RENEWABLE RESOURCE LANDS
CO-OP BEAR CANYON PERMIT AREA AND
POTENTIAL IMPACTS OF SUBSIDENCE

On June 13, 1984, an area survey was conducted of the entire Bear Canyon Mine Permit Area as well as all surrounding areas which could feasibly be impacted by subsidence. The results of that survey are as follows:

- (1) Hydrologic Balance: There are no seeps and/or springs above the area of the coal beds. No surface water was observed other than Bear Creek which lies beyond the potential area of subsidence.
- (2) Timber: There is no marketable timber within the area and the terrain is so steep as to preclude the establishment and/or harvest of such.
- (3) Vegetation (Ref. grazing): The bulk of the area is high priority wildlife habitat. Potential impacts were evaluated in cooperation with UDWR Personnel. The results of that evaluation are discussed under Impacts.

The terrain is inhospitable to domestic grazing and is not utilized as such under present or future land use practices.

- (4) Fish and Wildlife: The absence of water precludes the presence of fish. The entire area of influence is utilized by a wide variety of wildlife.
- (5) Paleo-Archeo: There are no known sites within the area as documented by ground Paleo-Arch survey, Appendix 5-1.

- (6) Man-Made Structure: There are no man-made structures within the area of influence other than a small unauthorized jeep trail on the northern rim of the permit area.
- (7) Minerals, Oil & Gas: There are no oil and/or gas wells within the area and no known mineral reserves.

Potential Impacts

No negative impacts to renewable resources are anticipated other than potential impacts to wildlife.

Mr. Larry Dalton, Resource Analyst Utah Division of Wildlife Resources and the State's foremost authority on potential impacts of subsidence on wildlife, inspected the site on June 18, 1984. The results of that investigation in part are as follows:

Considering the absence of spring, water sources, the negative potential impacts of subsidence within the Bear Canyon Permit Area could easily be offset by potential positive aspects.

On the negative side: Loss of riparian area and/or water sources is of greatest concern, followed by loss of vegetation from methane gas leaking to the surface from an underground works. Considering the lack of riparian area or water sources above the coal seam, this concern is not warranted. Secondly, Co-Op has never encountered methane gas underground so there is little concern relative to potential vegetation loss, and last, the loss of nests due to escarpment failure.

On the positive side: The tension fractures resulting from subsidence along the steep side hills are frequently utilized by big game as movement corridors. The fractures and rubble provide escape cover for a variety of wildlife species as well

as additional habitat for burrowing and denning animals. While there is concern over the potential loss of nests as a result of escarpment failure, there is also a potential for additional nesting sites to be created through this gravitational shearing of escarpment surfaces.

SUBSIDENCE CONTROL AND MONITORING PLAN

8/23/85

Structures

No manmade structures occur anywhere above the Bear Canyon Permit Area.

Renewable Resources

The renewable resources that exist above the mine area are of a hydrologic and vegetative nature. (See appendix 3.5.8 renewable resource land).

The vegetation resource above the mining area consists of some rangeland for grazing of stock and wildlife and limited potential for timbering. Again, past mining in the area has indicated no surface effects upon this resource. If subsidence should occur, the effects would be minimal, possible resulting in some fractures or slight depressions. The effect upon the vegetation resource would also be minimal, since subsidence (should it occur) is not likely to destroy vegetation, but merely displace it. It is not expected that subsidence will have any negative effect upon the plant communities or even become evident on the surface. Should this happen, mitigation measures may include: filling of fractures, regrading of broken areas, replanting degraded areas, intensified monitoring.

The hydrologic resources above the mining area consists primarily of a potential recharge zone for groundwater resources (springs) located in the strata below the mining. While it is unlikely that mining

activities will have any effect upon the springs, there is some potential for mining to have an effect upon the upper recharge zones. The potential effect of mining on the hydrologic regime, as well as any proposed mitigation measures are discussed in detail in Chapter 7 of the PAP.

Mining Methods

Mining at the Bear Creek Mine is conducted by the room and pillar method. This method may result in 75% - 80% extraction within the pillar panels, with an overall extraction of approximately 50% for the entire reserve. Longwall mining is not currently a proposed mining method for this mine.

A 200' barrier is proposed to be left between the mining and the coal outcrop, and a 100' barrier will be left between mining and property boundaries.

It is not proposed to leave any other coal permanently in place for protection of resources above the mine, since the resources that could potentially be affected by subsidence are not localized, but exist above the entire area. It is therefore proposed that subsidence protection measures will be employed only at the outcrops (and property boundaries), and that the company be prepared to implement mitigation measures as proposed if such resources are negatively impacted.

Subsidence

Subsidence can normally be expected to occur over areas where second mining has taken place (pillaring). Based on the geologic interruptions within a mine, subsidence becomes very difficult to predict, due to the variable nature of the mining panels. However, the attached Figure will give an estimate of the maximum subsidence that may be expected in mines studied in the Western U.S. Maximum subsidence for an average panel in the Bear Canyon Mine has been estimated from Figure 1, using the following criteria:

Panel Width - 600'

Average Depth - 800'

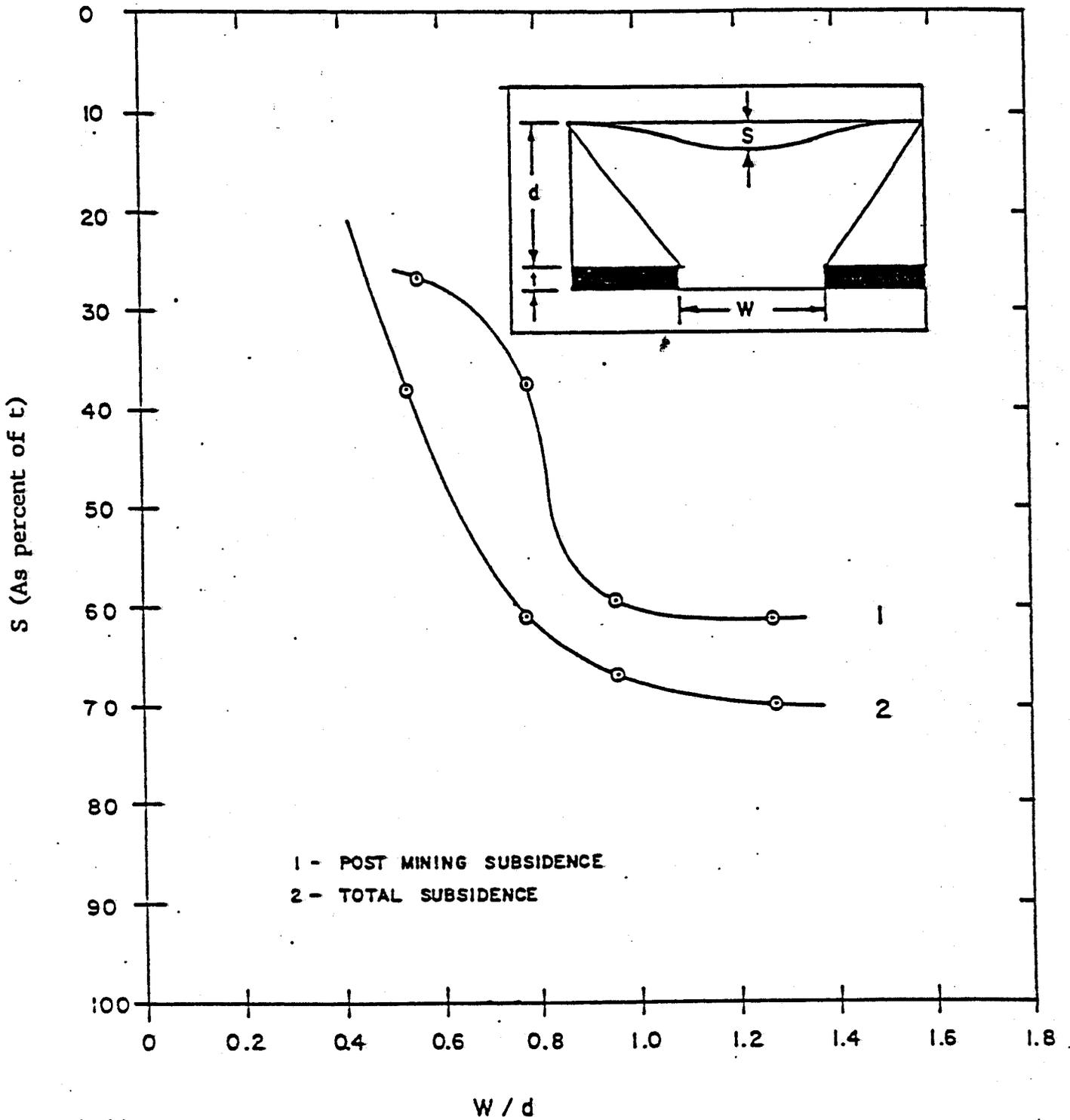
Width/Depth Ratio - 0.75

Seam Thickness - 9.0'

Based on this criteria and the graph, subsidence could reach a maximum of 5.40' directly over a pillared panel. However, since past pillaring has been performed in this general area as much as 40 years ago, and there are no obvious surface expressions of resulting subsidence, it is expected that this figure will be substantially less, if even measurable.

If both the upper and lower seams are extracted, maximum subsidence has been estimated from Figure 3-6 for the lower seam as follows:

Figure 1



Maximum subsidence, as a percentage of seam thickness, versus width/depth ratio for room and pillar mining at Somerset, Colorado (after Dunrud, 1980).

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Panel Width - 600'

Average Depth - 860'

Width/Depth Ratio - 0.70

Seam Thickness - 5.0'

Based on the graph, subsidence for the lower seam could reach 3.20' directly over a pillared panel, and 8.60' if both seams are pillared. Again, past experience in this area shows no indication that subsidence would be this drastic.

Plate 3-3 shows the potential subsidence at different points over the mining area if both seams were pulled and maximum subsidence should occur. The potential subsidence is based on the 600' panels as above, using 10' for the Blind Canyon Seam and 5' for the Hiawatha Seam, calculated at varying depths from 200' to 1600'. The maximum area of influence is also shown on the map. This area is based on a 20° angle of draw, which has been found to be more realistic for the western coal seams. (See Stipulation No.8, Gordon Creek No. 2 Mine Permit).

Monitoring

Since subsidence may occur over any underground extraction, it is proposed to set up and maintain a monitoring network as described below.

It is proposed to install two permanent subsidence monitoring points, one at each end of the property, to allow for an on-going evaluation of subsidence or other mining-related surface impacts. The stations shall be monitored at nominal 6-month intervals, for changes in elevation, tilt or rotation. In addition, a field investigation shall be made at least once per year, and any obvious subsidence or mine related surface effects will be noted and located on a map. A copy of the results of the subsidence survey and map will be available for inspection at the office, and a summary of the survey results will be sent to the Division within 60 days following the final survey for the year.

It is proposed to use the SMS, or the Subsidence Monitoring System, described in detail in the following pages. This system is available commercially, and if approved by the Division, the program will be implemented in the Spring/Summer of 1986. The monitoring program will continue until the completion of reclamation has occurred. Location of monitoring stations are shown on Plate 3-3.

During the operation, all owners of property within the area that could be impacted by subsidence shall be notified by mail six months prior to mining beneath their property and be informed of:

1. Specific areas mining will take place
2. Dates of underground operations that could cause subsidence in the area.

3. Measures to be taken to prevent and or control adverse surface effects.

Co-Op Mining Co. further commits to the following course of action should subsidence cause any material damage or a reduction in value of structures or land.

1. Restore, rehabilitate, or remove and replace, to the extent technologically and economically feasible, each materially damaged structure, feature or value promptly after the material damage from subsidence is suffered, to the condition it would be in if no subsidence had occurred and restore, to the extent technologically and economically feasible, those surface lands that were reduced in reasonably foreseeable use as a result of such subsidence to a condition capable of supporting before subsidence; or

2. Purchase the damaged structure or feature (except structures or features owned by the person who conducted the underground coal mining activities) for its pre-subsidence fair market value. The person conducting the underground coal mining operation shall promptly, after the material damage or reduction in value or reasonably foreseeable use from subsidence occurs, to the extent technologically and economically feasible, restore the purchased structure or the structure owned by the person conducting the underground mining operations, restore those surface lands that were materially damaged or reduced in value or reasonable foreseeable use by such subsidence,

to a condition capable and appropriate of supporting the structure, and any other foreseeable uses such surface lands were capable of supporting before mining. Nothing in the paragraph shall be deemed to grant or authorize an exercise of the power of condemnation or the right of eminent domain by any person engaged in underground coal mining activities; or

3. Compensate the owner of any surface structure in the full amount of the diminution in value resulting from subsidence, by purchase prior to mining of a noncancellable premium prepaid insurance policy or other means approved by the Division as assuring before mining begins that payments will occur; indemnify every person owning an interest in the surface for all damages suffered as a result of the subsidence; and, to the extent technologically and economically feasible, fully restore the land to a condition capable of maintaining reasonably foreseeable uses which it could support before subsidence.

SUBSIDENCE MONITORING SYSTEM

Introduction: The Subsidence Monitoring System (SMS) is a complete subsidence and surface effects monitoring system for underground coal mines. The system consists of a monitoring tower and graduated base plate, which, when properly installed, allows for easy measurement of elevation changes, as well as magnitude and direction of tilt and rotation of the station. The SMS stations can be purchased separately and owner-installed, or they can be purchased with installation included. Precise surveying is required for initial set-up, as with all monitoring stations.

Purpose: The SMS is designed to assist underground coal operators to comply with the requirements of the subsidence monitoring and protection portion of the Surface Mining Regulations administered under the Office of Surface Mining (and related State Agencies) and the 43 CFR 3246 regulations under the Bureau of Land Management.

This station offers complete "subsidence" or "surface effects" data for undermined areas, by facilitating the measurement of elevation change, degree and direction of tilt, as well as rotation. Most subsidence stations are nothing more than a survey point and provide only data on elevation changes, completely ignoring the other common surface effects of underground mining - ground tilt and rotation. By determining all applicable surface effects, and correlating such effects with known mining conditions, the operator has a much better chance of predicting potential surface effects of the operation, and supporting those predictions as required.

The question of subsidence has long been a "gray area", not only in the industry, but particularly in the regulations. Laws require prediction (and generally monitoring) of mine subsidence; however, until recently, no definite guidelines or criteria have been pushed by

the agencies. This is changing with the advent of the "Permanent Program Approvals" required by the surface mining agencies, and the gradual "maturing" of the agencies themselves. The SMS is designed to allow an operator to get into and remain in compliance with the regulations, and when properly implemented, this system is guaranteed to comply with the requirements of the law and provide adequate data to allow reasonable prediction of surface effects from underground mining.

The SMS stations are initially somewhat more costly and complicated than conventional subsidence monitoring "points", however, not only will they provide more complete and reliable data, they will also result in cost savings as the monitoring program continues. The following is a partial list of the positive attributes of this system:

- (1) Permanent installation.
- (2) Elevations can be shot directly from long distance, reducing manpower and field costs.
- (3) Station monitoring (other than elevation) requires only a plumb-bob and 60' of string, reducing time and effort from packing survey instruments over the mountainous terrain.
- (4) Station monitoring can be done in conjunction with required field inspections and/or aerial flagging visits.
- (5) The system works extremely well with an aerial monitoring program, reducing survey time and costs.
- (6) Provide measurement of elevation, as well

as magnitude and direction of ground tilt and/or rotation.

- (7) Meets or exceeds agency guidelines.
- (8) Assures continued compliance, even if requirements are more strictly enforced or made more stringent.

The SMS is proposed to the industry for two main reasons:

1. To provide for complete and reliable data on the actual surface effects of underground mining.
2. To provide data that will enable companies and agencies to better predict possible surface effects of underground mining under various cover and extractions conditions.

With reliable data, it is conceivable that this program could ultimately result in the ability to predict that no surface effects will occur under certain mining conditions, possibly eliminating the need for further monitoring in the future. Thus, the ultimate goal of the SMS may very well become the elimination of its need under certain circumstances.

Principle: The SMS is designed to serve as a permanent subsidence monitoring point. It can either be used in conjunction with a conventional elevation survey, or with elevations determined from an aerial survey. In addition to providing an elevation base, this station readily displays direction and magnitude of tilt and/or rotation. The following procedure should be followed each time the station is checked:

- (1) An elevation should be determined at the center of the base plate
This can be accomplished by:

- (a) A conventional level survey from a known, undisturbed benchmark.
 - (b) Shooting the station from a distant, known benchmark and calculating the new elevation by use of the vertical angle;
 - (c) Performing an aerial survey to determine new elevations; Note that the SMS lends itself very well to (a) & (b) above, both of which require a minimum of manpower and time.
- (2) An inspection of the surface around and between stations should be made, and any possible subsidence effects should be noted.
- (3) A plumb-bob should than be hung from the hook inside the station cap, and allowed to swing freely about 1/8" above the base plate. If the point of the bob hangs directly over the center of the base plate, no tilt has occurred. If the plumb-bob point rests outside of the base plate center, the direction of tilt can be closely estimated from the compass on the base plate, and the degree of tilt can be read directly off the concentric rings on the plate. Record the results and;
- (4) Remove the plumb-bob. Next, tie one end of the 50' - 60' string onto the south reference point and stretch the line through the station legs, tying it off on the north reference point. (The line should be free and taut between the points.) Now observe the location of the line in relation to the north-south line on the base plate. If the lines coincide, no rotation has occurred. If the line does not match the base plate north-south line, the degree and direction of rotation can be readily determined from the compass on the plate. It should be noted that the direction of rotation will be opposite to that shown on the compass. (Example: If the line matches the N 15 E bearing line on the plate, the degree of rotation is 15 , and the direction of

actual rotation is N 15° W.)

- (5) Record all results and proceed to the next station.

A great deal of time and effort can be saved by locating several (or all) of the SMS stations in view of a single benchmark or reference station. In this manner, vertical angles can be shot to all visible stations from a minimum number of set-ups. The stations are made to allow for direct readings over a long distance, eliminating the need for a rodman to go to each station. This allows for completion of the elevation survey in a single step, eliminating the need to pack a transit or level to each of the stations. The only apparatus required for the rotation and tilt determinations is the plumb-bob and 60' of string.

The SMS system is even further simplified when used in conjunction with an aerial survey. Once initial elevations are determined, all that is required is a visit to each station to install (or check) the aerial flagging - of course, the tilt and rotation should be monitored at this time, with elevations to be determined during the aerial survey. In this situation, no transits or levels are needed at all, beyond the initial installation.

SUBSIDENCE MONITORING SYSTEM
SPECIFICATION SHEET

- 1 - 6' aluminum tower, graduated in 0.1' intervals, painted red and white with black numerals. Note: Tower is 8' long, allowing for 2' in ground.

- 1 - 6.28" diameter, aluminum baseplate, inscribed in 15° compass increments and $\frac{1}{2}^\circ$ tilt indicator.

- 1 - North Reference Point

- 1 - South Reference Point

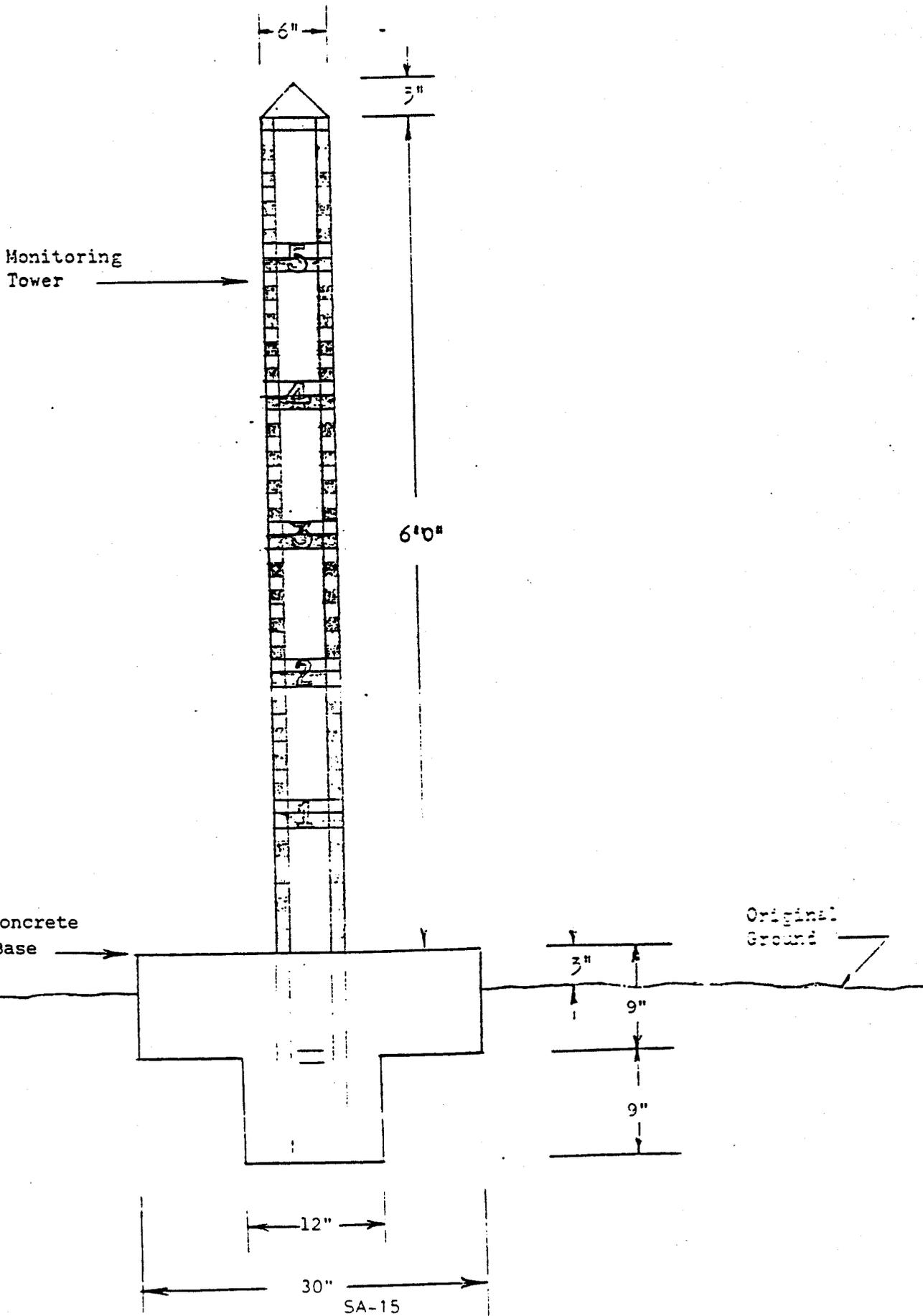
- 1 - Plumb-bob Hook

- 1 - 2" X 4" Brass Name Plate

- 6 ft.³ Concrete for Installation (Provided only with installation package).

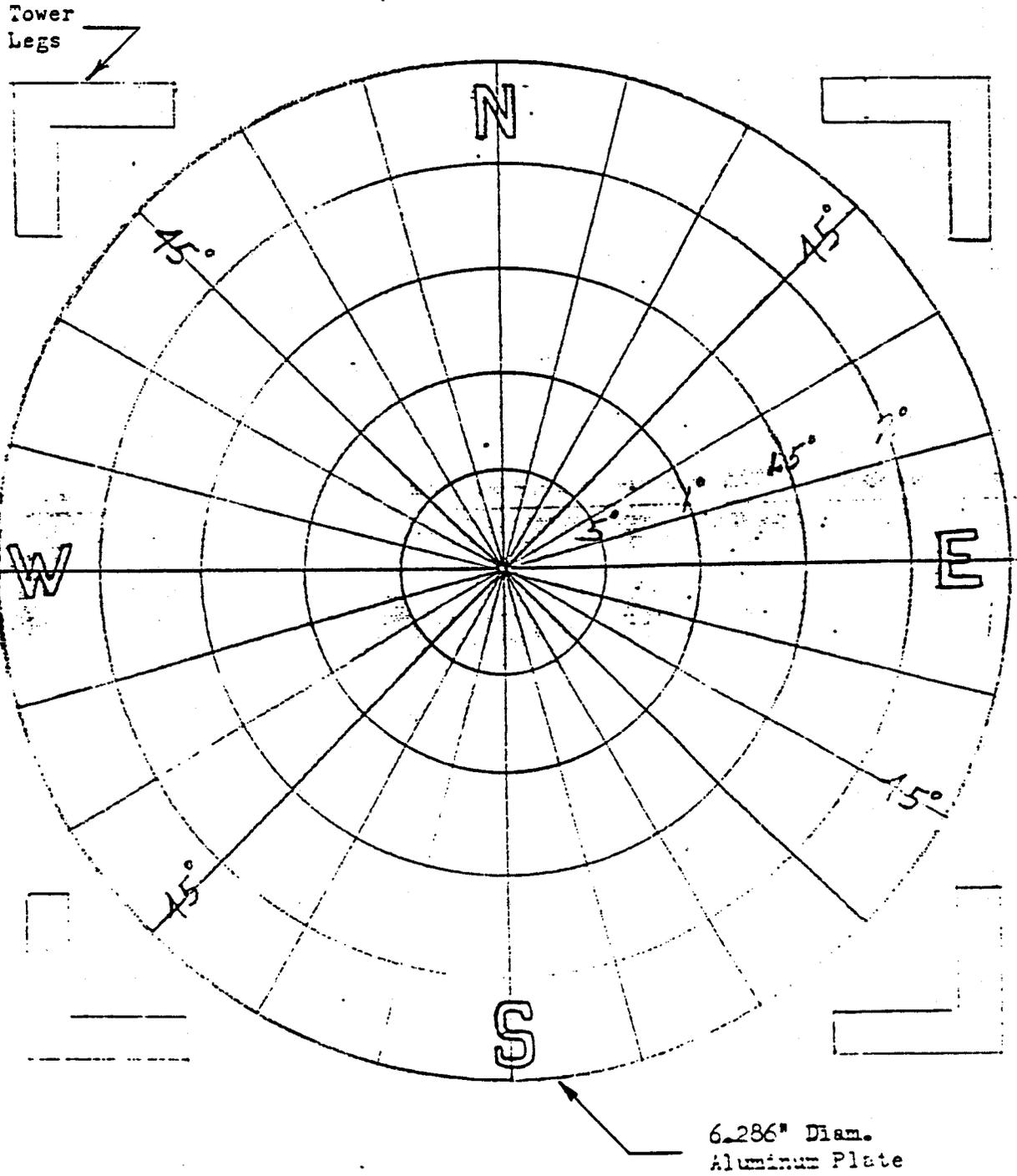
SMS MONITORING STATION

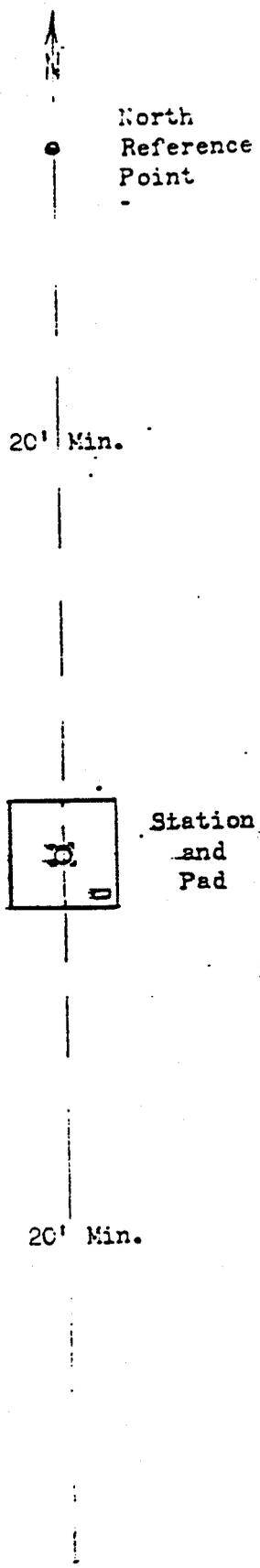
Scale: 1"=1'



SMS BASE PLATE

(Actual Size)





North
Reference
Point

20' Min.

Station
and
Pad

20' Min.

South
Reference
Point

SA-17

SMS STATION LAYOUT
(Plan View)

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APPENDIX 3-1

BLIND CANYON INTAKE PORTAL

BLIND CANYON INTAKE PORTAL

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In order to facilitate adequate ventilation across the working face as mining advances from the existing intake portal provide an alternative escape way, Co-Op Mining requests approvals of the Blind Canyon Portal as shown on Plate 3-4.

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This portal can be implemented from within the mine by utilization of standard mining methodology and implementation of a continuous miner. The intake adit will simply be extended to an exposed coal outcrop in the head of Blind Canyon. The outcrop presently has a 4 foot overhang. The overhang is made up of an overlying sandstone seam of approximately 12 feet. The coal being of a more erosive nature than the sandstone is incised into the slope. The toe of the coal outcrop is composed of broken ledge rock and lies on approximately a 70% slope. The nature and location of the outcrop precludes surface access by any means other than foot. Due to this, it is suitable for an escapeway in the event of a catastrophic closure of the existing portal area and is strongly supported by Co-Op's safety personnel as well as M.S.H.A.

The portal will be supported by 4" steel "I" beams placed on 5' centers for a distance of 25' into the sope. The roof will be bolted and shielded as needed with a combination of $\frac{1}{4}$ " plate and chain link to minimize sluffing of rock. The entry will be reinforced and covered with chain link and posted with a "No Trespassing" sign. There will be an escapeway door installed which will only allow

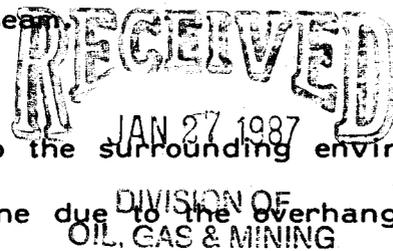
access from within the mine. The chain link will prevent access of people as well as large animals which could theoretically utilize the portal for denning. (See attached illustration).

Surface disturbance will be minimal due to the nature of a continuous mining machine pulling the material into the mine. Any coal debris which may crumble and fall down the slope will be retrieved by hand to whatever degree is reasonable. It is important to note that due to the exposed nature of the coal seam, there is eroded coal presently on the slope.

It is anticipated that the reclamation can be accomplished from within the mine by removing all metal support structures and by utilizing a D-2 Class Crawler dozer to push large panels of coal into the portal for a minimum distance of 40', then install a seal as pictured in Chapter 3 Sec. 3.6.3.1. The natural appearance of the canyon will be re-established with only the sealing of the portal due to the total lack of vegetation on an exposed seam.

Minimal adverse impacts are anticipated to the surrounding environment. Surface water will not enter the mine due to the overhanging ledge and dip of the coal seam at this point. Also, this is a dry area of the mine, so no mine water is anticipated to be discharged from the portal. If water were to be encountered, Co-Op would take whatever action was necessary to contain this water within the mine.

There are no raptor nests present within a half mile of the portal



as noted on Co-Op's most recent raptor survey.

Due to the intake nature of this portal and distance from the fan, no increase in noise should be anticipated after construction is completed. Work will be accomplished during the winter months so as not to create disturbance during elk calving period or deer fawning periods. Vegetation and forage loss is not anticipated due to the absence of vegetation on an exposed coal seam.

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BLIND CANYON
PROPOSED PORTAL
Scale: 1"=5' 12/10/85

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