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State of Utah

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

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December 13, 1991

TO: Daron Haddock, Permit Supervisor

FROM: Randy Harden, Sr. Reclamation Engineer *RH*

RE: Request for information, Castle Gate Mine, AMAX Coal Company,
ACT/007/004, Folder #2, Carbon County, Utah

SUMMARY

The operator has requested a clarification of requirements for meeting Approximate Original Contour (AOC) as part of the reclamation plan. The following information attempts to more clearly define those requirements pertaining to AOC, backfilling and grading, previously disturbed areas and requirements for obtaining a variance from AOC requirements. The information provided in this review should not be considered as policy or requirements of the Division which are in lieu of the regulatory requirements.

ANALYSIS

REGULATORY REQUIREMENTS:

The following is a partial listing of those regulatory requirements and definitions which pertain to backfilling and grading, AOC requirements, and previously disturbed areas:

"Affected Area" means any land or water surface area which is used to facilitate, or is physically altered by, coal mining and reclamation operations. The affected area includes the disturbed area; any area upon which coal mining and reclamation operations are conducted; any adjacent lands the use of which is incidental to coal mining and reclamation operations; all areas covered by new or existing roads used to gain access to, or for hauling coal to or from coal mining and reclamation operations; any area covered by surface excavations, workings, impoundments, dams, ventilation shafts, entryways, refuse banks, dumps, stockpiles, overburden piles, spoil banks, culm banks, tailings, holes or depressions, repair areas, storage areas, shipping areas; any areas upon which are sited structures, facilities, or other property material on the surface resulting from, or incident to, coal mining and reclamation operations; and the area located above underground workings.

"Approximate Original Contour" means that surface configuration achieved by backfilling and grading of the mined areas so that the reclaimed area, including any terracing or access roads, closely resembles the general surface configuration of the land prior to mining and blends into and complements the drainage pattern of the surrounding terrain with all highwalls, spoil piles, and coal refuse piles having a design approved under the R614 Rules and prepared for abandonment. Permanent water impoundments may be permitted where the Division has determined that they comply with R614-301-413.100 through R614-301-413.334, R614-301-512.240, R614-301-514.300, R614-301-515.200, R614-301-533.100 through R614-301-533.600, R614-301-542.400, R614-301-733.220 through R614-301-733.224, R614-301-743, R614-302-270 through R614-302-271.400, R614-302-271.600, R614-302-271.800, and R614-302-271.900.

"Highwall" means the face of exposed overburden and/or coal in an open cut of a surface coal mining and reclamation activities or for entry to underground coal mining activities.

"Highwall Remnant" means that portion of highwall that remains after backfilling and grading of a REMINING permit area.

"Previously Mined Area" means land previously mined on which there were no coal mining and reclamation operations subject to the standards of the Federal Act.

"Reasonably Available Spoil" means spoil and suitable coal mine waste material generated by the remining activity or other spoil or suitable coal mine waste material located in the permit area that is accessible and available for use, and that when rehandled will not cause a hazard to public safety or significant damage to the environment.

"Steep Slope" means any slope of more than 20 degrees or such lesser slope as may be designated by the Division after consideration of soil, climate, and other characteristics of a region or Utah.

R614-301-512.260. **Variance From Approximate Original Contour.** The professional engineer will certify the design for the proposed variance from the approximate original contour, as described under R614-302-270, in conformance with professional standards established to assure the stability, drainage and configuration necessary for the intended use of the site.

R614-301-537. Regraded Slopes.

R614-301-537.100. Each application will contain a report of appropriate geotechnical analysis, where approval of the Division is required for alternative specifications or for steep cut slopes under R614-301-358, R614-301-512.250, R614-301-527.100, R614-301-527.230, R614-301-534.100, R614-301-534.200, R614-301-534.300, R614-301-542.600, R614-301-742.410, R614-301-742.420, R614-301-752.200, and R614-301-762.

R614-301-537.200. For the purposes of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES, regrading of settled and revegetated fills to achieve approximate original contour at the conclusion of mining operations will not be required if the following conditions are met.

R614-301-537.210. Settled and revegetated fills will be composed of spoil or nonacid- or nontoxic-forming underground development waste.

R614-301-537.220. The spoil or underground development waste will not be located so as to be detrimental to the environment, to the health and safety of the public, or to the approved postmining land use.

R614-301-537.230. Stability of the spoil or underground development waste will be demonstrated through standard geotechnical analysis to be consistent with backfilling and grading requirements for material on the solid bench (1.3 static safety factor) or excess spoil requirements for material not placed on a solid bench (1.5 static safety factor).

R614-301-537.240. The surface of the spoil or underground development waste will be vegetated according to R614-301-356 and R614-301-357, and surface runoff will be controlled in accordance with R614-301-742.300.

R614-301-537.250. If it is determined by the Division that disturbance of the existing spoil or underground development waste would increase environmental harm or adversely affect the health and safety of the public, the Division may allow the existing spoil or underground development waste pile to remain in place. The Division may require stabilization of such spoil or underground development waste in accordance with the requirements of R614-301-537.210 through R614-301-537.240.

R614-301-542.300. For the purposes of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES, final surface configuration maps with cross sections (at intervals specified by the Division) that indicate:

R614-301-542.310. The anticipated final surface configuration to be achieved for the affected areas. The maps and cross sections will be prepared and certified as described under R614-301-512; and

R614-301-542.320. Location of each facility that will remain on the proposed permit area as a permanent feature, after the completion of coal mining and reclamation operations;

R614-301-553. **Backfilling and Grading.** Backfilling and grading design criteria must be described in the permit application. For the purposes of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES nothing in

R614-301-553 will prohibit the placement of material in road and portal pad embankments located on the downslope, so long as the material used and the embankment design comply with the applicable requirements of R614-301-500 and R614-301-700 and the material is moved and placed in a controlled manner.

- R614-301-553.100. Disturbed areas will be backfilled and graded to:
- R614-301-553.110. Achieve the approximate original contour, except as provided in R614-301-553.600 through R614-301-553.642;
- R614-301-553.120. Eliminate all highwalls, spoil piles, and depressions, except as provided in R614-301-552.100 (small depressions); R614-301-553.620 (previously mined highwalls); and in R614-301-553.650 (retention of highwalls);
- R614-301-553.130. Achieve a postmining slope that does not exceed either the angle of repose or such lesser slope as is necessary to achieve a minimum long-term static safety factor of 1.3 and to prevent slides;
- R614-301-553.140. Minimize erosion and water pollution both on and off the site; and
- R614-301-553.150. Support the approved postmining land use.
- R614-301-553.200. Spoil and Waste. Spoil and waste materials will be compacted where advisable to ensure stability or to prevent leaching or toxic materials.
- R614-301-553.210. Spoil, except as provided in R614-301-537.200, for the purposes of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES, and except excess spoil disposed of in accordance with R614-301-211, R614-301-212, R614-301-412.300, R614-301-512.210, R614-301-512.220, R614-301-514.100, R614-301-528.310, R614-301-535.100 through R614-301-535.130, R614-301-535.300 through R614-301-535.500, R614-301-536.300, R614-301-542.720, R614-301-553.240, R614-301-745.100, R614-301-745.300, R614-301-745.400, and will be returned to the mined-out surface area (UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES) or mined-out area (SURFACE COAL MINING AND RECLAMATION ACTIVITIES).
- R614-301-553.220. Spoil may be placed on the area outside the mined-out surface area (UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES) or mined-out area (SURFACE COAL MINING AND RECLAMATION ACTIVITIES) in nonsteep slope areas to restore the approximate original contour by blending the spoil into the surrounding terrain if the following requirements are met:
 - R614-301-553.221. All vegetative and organic material will be removed from the area;
 - R614-301-553.222. The topsoil on the area will be removed, segregated, stored, and redistributed in accordance with R614-301-232.100 through R614-301-232.600, R614-301-234, R614-301-242, and R614-301-243; and
 - R614-301-553.223. The spoil will be backfilled and graded on the area in accordance with R614-301-537.200, R614-301-552 through R614-301-553.230, R614-301-553.260 through R614-301-553.420, R614-301-553.600, and R614-301-553.900.
- R614-301-553.230. Preparation of final graded surfaces will be conducted so that the final-graded surfaces are configured in a manner that minimizes erosion and provides a surface for replacement of topsoil that will minimize slippage.
- R614-301-553.240. The final configuration of the fill (excess spoil) will be suitable for the approved postmining land use. Terraces may be constructed on the outslope of the fill if required for stability, control of erosion, to conserve soil moisture, or to facilitate the approved postmining land use. The grade of the outslope between terrace benches will not be steeper than 2h:1v (50 percent).
- R614-301-553.250. Refuse Piles.
- R614-301-553.251. The final configuration for the refuse pile will be suitable for the approved postmining land use. Terraces may be constructed on the outslope of the refuse pile if required for stability, control of erosion, conservation of soil moisture, or facilitation of the approved postmining land use. The grade of the outslope between terrace benches will not be steeper than 2h:1v (50 percent).
- R614-301-553.252. Following final grading of the refuse pile, the coal mine waste will be covered with a minimum of four feet of the best

available, nontoxic and noncombustible material, in a manner that does not impede drainage from the underdrains. The Division may allow less than four feet of cover material based on physical and chemical analyses which show that the requirements of R614-301-244.200 and R614-301-353 through R614-301-357.

- R614-301-553.260. Disposal of coal processing waste and underground development waste in the mined-out surface area (UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES) or mined-out area (SURFACE COAL MINING AND RECLAMATION ACTIVITIES) will be in accordance with R614-301-210, R614-301-512.230, R614-301-513.400, R614-301-514.200, R614-301-515.200, R614-301-528.322, R614-301-528.320, R614-301-536 through R614-301-536.200, R614-301-536.500, R614-301-536.900, R614-301-542.730, R614-301-553.250, and R614-301-746.100 through R614-301-746.200, except that a long-term static safety factor of 1.3 will be achieved.
- R614-301-553.300. Exposed coal seams, acid- and toxic-forming materials, and combustible materials exposed, used, or produced during mining will be adequately covered with nontoxic and noncombustible materials, or treated, to control the impact on surface and ground water in accordance with R614-301-731.100 through R614-301-731.522 and R614-301-731.800, to prevent sustained combustion, and to minimize adverse effects on plant growth and the approved postmining land use.
- R614-301-553.400. Cut-and-fill terraces may be allowed by the Division where:
- R614-301-553.410. Needed to conserve soil moisture, ensure stability, and control erosion on final-graded slopes, if the terraces are compatible with the approved postmining land use; or
- R614-301-553.420. Specialized grading, foundation conditions, or roads are required for the approved postmining land use, in which case the final grading may include a terrace of adequate width to ensure the safety, stability, and erosion control necessary to implement the postmining land-use plan.
- R614-301-553.500. Previously Mined Areas.
- R614-301-553.510. Remining operations on previously mined areas that contain a preexisting highwall will comply with the requirements of R614-301-537.200, R614-301-552 through R614-301-553.230, R614-301-553.260 through R614-301-553.900, and R614-302-234, except as provided in R614-301-553.500.
- R614-301-553.520. The requirements of R614-301-553.110 and R614-301-553.120 requiring that elimination of highwalls will not apply to remining operations where the volume of all reasonably available spoil is demonstrated in writing to the Division to be insufficient to completely backfill the reaffected or enlarged highwall. The highwall will be eliminated to the maximum extent technically practical in accordance with the following criteria:
- R614-301-553.521. All spoil generated by the remining operation and any other reasonably available spoil will be used to backfill the area. Reasonably available spoil in the immediate vicinity of the remining operation will be included within the permit area;
- R614-301-553.522. The backfill will be graded to a slope which is compatible with the approved postmining land use and which provides adequate drainage and long-term stability;
- R614-301-553.523. Any highwall remnant will be stable and not pose a hazard to the public health and safety or to the environment. The operator will demonstrate, to the satisfaction of the Division, that the highwall remnant is stable; and
- R614-301-553.524. Spoil placed on the outslope during previous mining operations will not be disturbed if such disturbances will cause instability of the remaining spoil or otherwise increase the hazard to the public health and safety or to the environment.
- R614-301-553.600. Approximate Original Contour. Postmining slopes may vary from the approximate original contour when:
- R614-301-553.610. Approval is obtained from the Division in accordance with R614-302-270;
- R614-301-553.620. Approval is obtained from the Division for incomplete elimination of highwalls in previously mined areas in accordance with R614-301-553.500;

- R614-301-553.650. For the purposes of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES, approval is obtained from the Division for retention of highwalls in accordance with R614-301-553.100, and:
- R614-301-553.651. The "retained" highwall is not significantly greater in height or length than the dimensions of existing cliffs and the surrounding area;
- R614-301-553.652. The residual highwall is similar in structural composition to the preexisting cliffs in the surrounding area and is compatible with the visual attributes of the area; and
- R614-301-553.653. The residual highwall is compatible with the geomorphic processes of the area.
- R614-301-553.900. For the purposes of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES, regrading of settled and revegetated fills at the conclusion of coal mining and reclamation operations will not be required if the conditions of R614-301-537.200 are met;
- R614-302-234. Backfilling and Grading.
- R614-302-234.100. Coal mining and reclamation operations on steep slopes will be conducted so as to meet the requirements of R614-301-537.200, R614-301-552 through R614-301-553.230, R614-301-553.260 through R614-301-553.900, except where mining is conducted on flat or gently rolling terrain with an occasional steep slope through which the mining proceeds and leaves a plain or predominantly flat area or where operations are conducted in accordance with R614-302-227.
- R614-302-234.200. The following materials will not be placed on the downslope except as provided for UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES under R614-301-553:
- R614-302-234.210. Spoil;
- R614-302-234.220. Waste materials of any type;
- R614-302-234.230. Debris, including that from clearing and grubbing; and
- R614-302-234.240. Abandoned or disabled equipment.
- R614-302-234.300. Land above the highwall will not be disturbed unless the Division finds that this disturbance will facilitate compliance with the environmental protection standards of R614-301 and R614-302 and the disturbance is limited to that necessary to facilitate compliance.
- R614-302-234.400. Woody materials will not be buried in the backfilled area unless the Division determines that the proposed method for placing woody material within the backfill will not deteriorate the stable condition of the backfilled area.
- R614-302-270. Variances from Approximate Original Contour Restoration Requirements.
- R614-302-271. The Division may issue approval ~~or, if applicable, a permit for nonmountaintop removal mining~~ which includes a variance from the requirements of R614-301-537.200, R614-301-552 through R614-301-553.230, R614-301-553.260 through R614-301-553.420, R614-301-553.600 through R614-301-553.900, and R614-302-234 to restore the disturbed areas to their approximate original contour. The permit may contain such a variance only if the Division finds, in writing, that the applicant has demonstrated, on the basis of a complete application, that the following requirements are satisfied:
- R614-302-271.100. The alternative postmining land use requirements of R614-301-413.300 are met;
- R614-302-271.200. All applicable requirements of the State Program, other than the requirements to restore disturbed areas to their appropriate original contour are met;
- R614-302-271.300. After consultation with the appropriate land use agencies, if any, the potential use is shown to constitute an equal or better economic or public use;

- R614-302-271.400. Federal, Utah and local government agencies with an interest in the proposed land use have had an adequate period of time in which to review and comment on the proposed use;
- R614-302-271.500. After reclamation, the lands to be affected by the variance within the permit area will be suitable for an industrial, commercial, residential or public postmining land use (including recreational facilities);
- R614-302-271.600. The surface landowner of the lands within the permit area has knowingly requested, in writing, as part of the permit application, that a variance be granted so as to render the land, after reclamation, suitable for an industrial, commercial, residential or public use (including recreational facilities). The request will be made separately from any surface owner consent given for the operations under R614-301-114 and will show an understanding that the variance could not be granted without the owner's request;
- R614-302-271.700. The watershed of lands within the proposed permit and adjacent areas will be improved by the coal mining and reclamation operations when compared with the condition of the watershed before mining or with its condition if the approximate original contour were to be restored. The watershed will be deemed improved only if:
- R614-302-271.710. The amount of total suspended solids or other pollutants discharged to ground or surface water from the permit area will be reduced, so as to improve the public or private uses or the ecology of such water, or flood hazards within the watershed containing the permit area will be reduced by reduction of the peak flow discharge from precipitation events or thaws; and
- R614-302-271.720. The total volume of flow from the proposed permit area, during every season of the year, will not vary in a way that adversely affects the ecology of any surface water or any existing or planned use of surface or ground water;
- R614-302-271.800. Engineering. The proposed design plan for the variance will be prepared and certified as described under R614-301-512.260. The proposed design plan will also meet the following requirements:
- R614-302-271.810. Unless the highwall is determined to be retained under R614-301-553.650, the highwall will be completely backfilled with spoil material, in a manner which results in a static factor of safety at least 1.3, using standard geotechnical analysis; and
- R614-302-271.820. Only the amount of spoil as is necessary to achieve the postmining land use, ensure the stability of spoil retained on the bench, and meet all other requirements of the Act and R614 Rules will be placed on the mine bench. All spoil not retained on the bench will be placed in accordance with R614-301-211, R614-301-212, R614-301-412.300, R614-301-512.210, R614-301-512.220, R614-301-514.100, R614-301-528.310, R614-301-535.100 through R614-301-535.130, R614-301-535.300 through R614-301-535.500, R614-301-536.300, R614-301-542.720, R614-301-553.240, R614-301-745.100, R614-301-745.300, and R614-301-745.400; and
- R614-302-271.900. After Division approval, the watershed of the permit and adjacent areas is shown to be improved.
- R614-302-272. If a variance is granted under R614-302-270:
- R614-302-272.100. The requirements of R614-302-270 will be included as a specific condition of the permit; and
- R614-302-272.200. The permit will be specifically marked as containing a variance from approximate original contour.
- R614-302-273. A permit incorporating a variance under R614-302-270 will be reviewed by the Division at least every 30 months following the issuance of the permit to evaluate the progress and development of the coal mining and reclamation operations to establish that the operator is proceeding in accordance with the terms of the variance.
- R614-302-274. If the permittee demonstrates to the Division that the coal mining and reclamation operation has been, and continues to be, conducted in compliance with the terms and conditions of the permit, the requirements of the Act, the R614 Rules, and the State Program, the review specified in R614-302-273 need not be held.
- R614-302-275. The terms and conditions of a permit incorporating a variance under R614-302-270 may be modified at any time by the Division, if it determines that more stringent measures are necessary to ensure that the operations involved are conducted in compliance with the requirements of the State Program.

AOC REQUIREMENTS:

In order to receive a variance from AOC requirements, the operator must specifically request such a variance. In accordance with R614-301-512.260. Variance From Approximate Original Contour. The professional engineer will certify the design for the proposed variance from the approximate original contour, as described under R614-302-270, in conformance with professional standards established to assure the stability, drainage and configuration necessary for the intended use of the site.

To summarize the above requirements for requesting a variance from AOC requirements the following criteria must be met:

1. The AOC variance must be shown to be compatible with the approved post mining land use.
2. The designs for reclamation which include a variance from AOC requirements must meet all other applicable performance standards under the regulations.
3. The AOC variance request must demonstrate that **the watershed will be improved** by the coal mining and reclamation operations **when compared** with the condition of the watershed before mining or with its **condition if the approximate original contour were to be restored.**
4. Specific landowner consent regarding a variance from AOC requirements must be provided in the plan.
5. The variance must be approved by all other applicable federal and state agencies and must undergo public notification and comment.
6. Highwall retention must meet additional requirements as described under section R614-301-553.600.
7. The review required at a minimum of every 30 months as mentioned in R614-302-273 will be accomplished jointly with the mine plan mid-term and permit renewal periods.

BACKFILLING AND GRADING REQUIREMENTS:

In general, backfilling and grading requirements to meet AOC requirements will include the elimination of all cut slopes, roads, and pad areas. Elimination of these areas should be accomplished by backfilling and grading previously existing benches and highwalls

to achieve the most moderate slope possible which does not exceed the angle of repose, maintain long term stability, and eliminate the highwalls and benches to the maximum extent technically practical.

Road cuts and fills, ridge lines and other sudden breaks in slope from relatively flat to steep or moderate slopes should be rounded or softened to lend in with the surrounding contours. Cut slopes from roads, pads, and highwalls should be backfilled only on the cut portions of those structures and not on the fill portions which could reduce the long term stability of these areas. In general, cut slopes should not be reduce by cutting or grading above the cut slope areas, This practice would, in most cases, require that previously undisturbed areas be affected, and would increase the disturbed areas above these slopes.

More importantly, backfilling and grading designs for reclamation should be accomplished in a manner that will restore surface drainage and runoff to pre-mining conditions. Regardless of whether or not an AOC variance is approved, drainage and sediment control must be established to meet effluent requirements, and provide long term stability of drainage areas and channels. It is believed that once a thorough and complete hydrologic design is accomplished for the sites, that backfilling and grading requirements will be limited by the location and the gradient of these reclaimed channels.

In those areas where insufficient material is available to completely reduce or eliminate these structures, the operator may request a variance from AOC requirements. Demonstration that the areas which will not meet AOC requirements must be provided in the reclamation design to show that the plans meet all other applicable regulatory requirements except for those which are specifically allowed for under a variance from AOC requirements.

SPOILS:

To clarify the question of the immediate vicinity of spoils available with regard to Castle Gate, immediate vicinity shall mean spoil which is within the operator's disturbed area boundaries. These disturbed area boundaries shall include the cut and fill slopes which adjoin and are an integral part of the pads, roads or other structures used in conjunction with mining operations. Spoils which will not be considered as within the immediate vicinity are those areas which have been previously disturbed by mining and have not been re-affected by SMCRA regulated mining activities within the permit area.

SETTLED AND REVEGETATED SPOIL MATERIALS:

The moving and regrading of settled and revegetated fills is addressed under section R614-301-537.200. The regrading of settled and revegetated fills to achieve approximate

original contour at the conclusion of mining operations will not be required if: the settled and revegetated fills will be composed of spoil or nonacid- or nontoxic-forming underground development waste; the spoil or underground development waste will not be located so as to be detrimental to the environment, to the health and safety of the public, or to the approved postmining land use; the stability of the spoil or underground development waste will be demonstrated through standard geotechnical analysis to be consistent with backfilling and grading requirements for material on the solid bench (1.3 static safety factor) or excess spoil requirements for material not placed on a solid bench (1.5 static safety factor); and, the surface of the spoil or underground development waste will be vegetated, and surface runoff will be controlled. If it is determined by the Division that disturbance of the existing spoil or underground development waste would increase environmental harm or adversely affect the health and safety of the public, the Division may allow the existing spoil or underground development waste pile to remain in place.

The grading or moving of settled or revegetated fills should not occur unless these materials need to be moved to ensure stability or allow for proper drainage. Additionally, regrading of these areas should not be in a manner which would disturb previously undisturbed areas or previously mined areas which have not been affected by current mining operations unless necessary to ensure stability or drainage restoration. The operator should make reasonable efforts to minimize such additional disturbances when conducting reclamation construction.

GEOTECHNICAL ANALYSIS:

A standard geotechnical analysis for the cut and fill slopes which are apparent throughout the permit area can consist of stability analysis based on average engineering properties of compacted soils as provided by the **Bureau of Reclamation**, typical soil and rock properties as described by **Hoek and Bray**, or, other available published references indicating normal or typical ranges for soil or rock types which may be applied those materials which need to be analyzed for stability.

A field survey of the cut slopes, fills, and highwalls should be conducted to gather site specific information related to those areas which require analysis. The field survey should include photographic documentation of these area to indicate their current condition and visual appearance. Characteristics of these areas gathered during the field survey should include but not be limited to: soil and rock types; height, length and slope; presence of water or other conditions which may affect stability; and, evidence of any previous failures associated with the structures. Based on this field information, stability analysis of these areas can consist of charts and tables used for evaluating the stability and the factor of safety for these slopes.

Tables, charts, and in some cases, computer analysis of these slopes based on the field information will need to be presented in the plan to demonstrate stability. These charts and tables have been developed in the above reference publications, by **Huang**, and others to simplify and expedite the evaluation of stability analysis. These simplified methods of analysis are considered adequate by the Division in cases where the slopes and highwalls do not or potentially would not result in potential harm to the general public safety or the environment. If the retention of the slopes were in critical areas, a more detailed design and analysis would be required.

In addition to the field survey, an estimate as to the age of the cut or fill slopes should be presented in the analysis. Based on the age of these structures, the operator may be able to further support the stability of these slopes and long-term stability.

If this preliminary analysis yields factors of safety within or in excess of those required by the regulations, no additional geotechnical analysis will be required. In the event that these structures do not meet the safety factors required by the regulations using typical or average properties of the soils and rocks, a more detailed analysis may be required. It is not anticipated by the Division that any of the slopes within the permit area will require detailed, in-situ analysis in order to demonstrate adequate factors of safety for the design of the slopes. In the event that the field and preliminary analysis of the slopes is found to be inadequate, the operator may need to consult the Division regarding additional sampling, analysis and design criteria prior to approval of these structures.

References:

Bureau of Reclamation, 1987, *Design of Small Dams*, 3rd Edition, United States Government Printing Office, Washington, DC.

Hoek, Everet and Bray, John, 1981, *Rock Slope Engineering*, 3rd Edition, The Institute of Mining and Metallurgy, London.

Huang, Yang H., 1983, *Stability Analysis of Earth Slopes*, Van Nostrand Reinhold Company, Inc., New York, NY.

cc: B. Richards