THE PITCH PROJECT—
LARGE SCALE HIGH ELEVATION EROSION CONTROL[1]

by

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Abstract. The Homestake Pitch Project was a large scale mine-related land management and reclamation project located at high elevations in the Colorado Rockies. Extremely sensitive environmental and political factors required technical innovation, major environmental safeguards and perfection of high elevation reclamation techniques.

Introduction and Project Description

The Homestake Pitch Project was a large multi-disciplinary planning and design effort that typifies the mega-projects of the boom years of the 1980's in Colorado and throughout the West. Long recognized as an important uranium mining location, the project sits high in the Colorado Rockies near the Continental Divide. Located in Saguache County, the Pitch Project entailed expansion of an existing uranium mine, necessitating a greater degree of site disturbance than previous efforts, with eventual plans to construct an on-site mill and tailing impoundment to properly provide for long term disposal of various waste materials, most notably uranium mill tailing and all associated liquid fractions.

Located at the site of the old Pitch or Pinnacle Resources Mine, this valuable ore body had been mined for many decades (Vanderwilt 1947, Morse and Stanwood 1979, and Del Rio 1960). Narrow gauge railroads provided access to this historic mining district, where other minerals were also mined nearby (Holmes and Kennedy 1983). The high grade of uranium ore found here is of unusual quality verging on a black pitchblende appearance—thus the name "Pitch Project."

The overall mining and site development plan for the project is beyond description in this paper, but the entire approach was one of very sophisticated "state-of-the-art" design for safety, capacity, structural integrity, impoundment longevity, and protection of the surrounding natural environment.

[1]Presented at the 1991 National Meeting of the American Society for Surface Mining and Reclamation, Durango, Colorado, May 14–16, 1991.

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Project Team and Approach

The project team consisted of Homestake's own highly qualified technical staff (with an unusually large degree of direct, positive management participation) and a diverse team of engineers, surface and ground water hydrologists, geologists, health physicists, geotechnical specialists, geochemists, construction managers and environmental scientists representing such disciplines as wildlife biology, archeology limnology, and of course, ourselves as the primary consulting agronomist and landscape architect. Forestry, climatology, socioeconomics and other types of expertise were provided by numerous state and federal agencies. The authors, as the project landscape architect and reclamation specialist were responsible for preparing selected project specifications, supervising preparation of presentation graphics, and organizing numerous expert witnesses for lengthy and sometimes adversarial public hearings.

Major Project Elements

The key design element of the project was a large tailing impoundment with the crest elevation of the main structure at 9,365 feet above sea level, and many project elements at a much higher elevation. A complete limestone quarry was to be developed just to provide rock armoring material (rip-rap) for this embankment structure. While far from being the largest structure of its kind, one has to approach such a structure from below to appreciate the scale of such a large, sculptured earth-material element in the landscape. In this project there was no room for error.

Local Environment

Located on sloping topography in the montane zone, soils in the area are fine-textured and low in hydraulic conductivity. Existing vegetation in the project area is a mosaic of mixed conifer and aspen woodlands interspersed with sagebrush parks and grassy meadows. Numerous species of wildlife inhabit the area. Hunters, hikers and fisherman utilize the area in at least three seasons of the year. Downstream resources include numerous fisheries,

Proceedings America Society of Mining and Reclamation, 1991 pp 715-718
DOI: 10.21000/JASMR91020715
https://doi.org/10.21000/JASMR91010715

domestic and agricultural water users, and a picturesque railroad camp and ghost town of some historic significance.

An Integrated Approach to Erosion Control

Erosion control measures pertained primarily to specific phases of the project including pioneering and development of haul roads, development of materials stockpile areas, site development for the tailing pond, and a large engineered earthen embankment structure, temporary work areas, and ancillary structures such as spillways and drain systems, monitoring wells and outlying data-gathering points. The existing open-cut mine under development and a future mill site were not directly addressed in this plan.

This project was subjected to the most intense multi-agency environmental review procedures based upon the type of activity proposed, the longevity of the potential impacts, the multi-jurisdictional nature of the regulatory authorities, and a substantial amount of public environmental concern. Water management was a primary design factor and erosion control was a critical issue.

The entire erosion control plan was "designed in" rather than "added on". This approach not only assured successful erosion control, but provided the basis for a project designed to withstand the most severe potential erosion events—a combination of record snowmelt and cataclysmic floods in addition to improbable seismic loading from a simultaneous earthquake and rapid ground movement. No design effort was spared to ensure downstream safety, and erosion control measures, both macro-scale and micro-scale were planned for every project sub-phase. A multi-disciplinary effort was developed to ensure no downstream release of materials from the site. A rearrangement of suitable locally available earth-materials was chosen for structures due to the suitability of certain earth layers and the large amount of materials required. After detailed geologic and topographic surveys, project limits were defined and marked in the field. Contract specifications included clauses for protection of existing vegetation at the site. Disturbance was strictly specified to fall only within project limits. The U.S. Forest Service was assigned the primary on-site watchdog role, but other agencies were also assigned water quality monitoring and wildlife protection tasks as well. The Colorado State Engineer and the Colorado Division of Mined Land Reclamation jointly regulated the satisfactory achievement of erosion control objectives. The Colorado Department of Health was responsible for preventing any unlawful radiation release and correlating water quality information.

The Erosion Control Plan

As stated earlier, the entire erosion control plan was designed to work together as a comprehensive whole. This is in contrast to so many projects where "band-aid" solutions are sought after the fact to remedy excessive off-site sedimentation, slope failures, massive landslides and similar undesired effects. Clearing and grubbing included stringent stockpiling of topsoil as this is a critical resource at this elevation in the Colorado Rockies. This sounds so simple, but all too often, on other projects in the West, this resource has been lost, buried or otherwise wasted away. In all but standing rock cuts, sideslopes were designed to provide a surface capable of being revegetated with the materials and capabilities at hand.

Topsoil was specified for replacement at a 12-inch depth on finished slopes. Finished rock slopes were specified to use the pre-split method to minimize blasting over-break and provide a stable and attractive finished appearance. Numerous large permanent drainage systems were designed to accommodate, and in some instances completely contain concentrated overland flow. Materials for erosion and sediment control included massive amounts of large rock pieces, rip-rap, gravel and sand, baled straw barriers, jute matting, secondary hand-excavated diversion ditches, sediment traps, temporary cover (spray mulch, straw or other technical materials such as tackifiers, plastic sheeting and staples, as needed). Filter cloth blanket was specified for selected critical areas. Filter cloth was specified as "TYPAR" manufactured by DuPont or "MIRAFI" as manufactured by the Celanese Corporation. Standard erosion control practices were specified for all applications. All fabrics were to have a one foot overlap along seams. Rock placement was in zoned structures to meet geotechnical specifications.

Revegetation

The primary means of both near term and long term erosion control on and around the primary structure was prompt revegetation of all disturbed areas. Permanent revegetation would also address requirements under the Colorado Mined Land Reclamation Act to restore mined lands to beneficial use. Detailed revegetation planning addressed concerns related to critical area stabilization, ecological sensitivity, land use goals, and aesthetic considerations. Because of the diversity of disturbances and micro-site conditions, detailed revegetation plans were developed on an area-by-area basis (Table 1). Each area was evaluated in terms of elevation, slope, aspect, and soil characteristics. Previous vegetation type and long term land use goals were also considered. An extensive revegetation research program consisting of plot plantings was completed at the project area. These plots were undertaken with the help of an ecologist at a nearby college and a number of his students. These studies proved invaluable in selecting adapted species for the project area and developing successful cultural techniques, especially for woody plantings on steep slopes.

The range in elevation over the project area necessitated two distinct seed mixtures, the "revised mountain mix" for lower elevations (Table 2) and the "alpine mix" for higher elevations (Table 3). Each mixture contained both native and naturalized species, and seeding rates were calculated for both drilled and broadcast seedings to provide a specified number of seeds per square foot for each species. All disturbed areas would be seeded with one of these two mixtures. Seeding rates, methods of application, erosion control measures, and hand plantings of woody species were additionally specified for each area as appropriate for the site-specific conditions. It had been realized early on that because of the wide topographic variation across the project area, and the harsh climatic conditions, a single generic revegetation plan could not adequately address all of the disturbed area variables.

Once detailed revegetation planning was completed, it became a rather daunting task to translate the plans into a contract document for bidding and construction. Because of the number of (then) innovative techniques involved, as well as the detail of the revegetation plans themselves, it quickly became apparent that available "off-the-shelf" specifications commonly used by the construction industry were not appropriate for this project. Therefore, revegetation and erosion control specifications were developed from a clean sheet of paper (Dravo 1980). As with the revegetation planning, the specifications were very detailed and subject to intense public scrutiny as well as professional peer review. A significant consideration in this regard was the fact that successful implementation of the revegetation plan would be a legal commitment made to the state, which would require surety in the form of a reclamation performance bond. The detailed specifications were viewed as an effective means of minimizing risk for the mining company. Under Colorado law, the bond amount would be based on actual estimated reclamation costs to reclaim (re-contour, topsoil, stabilize and revegetate) the project under a worst-case scenario for disturbance.

Bonding costs can be significant for mining projects, and again the detailed revegetation and erosion control specifications were invaluable for accurately documenting estimated costs for the state, even before the project went to bid. Costs were calculated on a per acre basis for each distinct area, and ranged from a low of about $2,500 per acre to nearly $10,000 per acre. Tight specifications allowed for tabulation of cost adjustments year-by-year as seed and material prices would rather vigorously fluctuate based upon supply and demand. The mining industry and its consultants continue to develop new and better ways for reclaiming mining disturbances. Materials and technology, however, are only as good as the means to implement. In our experience there have been problems at many projects because good reclamation plans were not translated into clear, understandable and enforceable contract documents. Many environmental contractors, however competent, will tend to have their own ways of doing things, often irrespective of commitments made in reclamation plans and permit documents. Even components as fundamental as seed mixtures can be "field engineered" by contractors or suppliers. Sometimes a subcontractor with good intentions will try to use up materials left over from other projects. This can be disastrous for high elevation sites.Specifications are the critical link between the theoretical "paper" reclamation plan and the real world of the state reclamation inspector. Proper specifications are not only an important adjunct to cost determination, but they are also the effective instrument of quality control on any erosion control project. Without good specifications that comprehensively reflect the concerns of the reclamation planning team, successful reclamation of difficult high elevation sites can be little more than a haphazard occurrence.

Table 1. Project revegetation considerations by area.

Site	Characteristics	Mix	Apply	Woody plantings	Mulch
Borrow area	Moderate slopes	Mtn	Drill	Pine on slopes	Straw
Linestone quarry	Rocky and steep	Alp	Hydro	Pine on benches	Hydro
Road sideslopes	Steeply sloping	Mtn	Hydro	—	Hydro
Disposal area A	Moderate slopes	Mtn	Hydro	—	Hydro
Clay borrow area	Moderate slopes	Mtn	Drill	Pine and spruce	Straw
Sand borrow area	Gentle slopes	Mtn	Drill	—	Straw
Cut tree decks	Gentle slopes	Mtn	Drill	—	Straw
Staging areas	Moderate slopes	Mtn	Drill	—	Straw
Tree waste areas	Moderate slopes	Mtn	Drill	—	Straw
Disposal area B	Gentle slopes	Mtn	Drill	—	Straw
Other areas	Variable slopes	Alp	Hydro	—	Hydro

Postscript

It should be mentioned in closing that due to changing market conditions, coupled with operational changes at the open-cut at the mine, much of this project was eventually shelved, and will not likely be resumed in the near future.

Table 2. Revised mountain mix "Mtn"

Variety	Common name	Scientific name	Amount (%)
Manchar	Smooth brome	*Bromopsis inermis*	5.9
Bromar	Mountain brome	*Ceratochloa marginata*	5.9
Climax	Timothy	*Phleum pratense*	5.9
Troy	Kentucky bluegrass	*Poa pratensis*	2.9
Sherman	Big bluegrass	*Poa ampla*	2.9
	Western wheatgrass	*Agropyron smithii*	23.5
Durar	Hard fescue	*Festuca ovina* var. *duriuscula*	5.9
	Winter rye	*Secale cereale*	11.8
	Perennial rye	*Lolium perenne*	5.9
	Slender wheatgrass	*Agropyron trachycaulum*	11.8
Lutana	Cicer milkvetch	*Astragalus cicer*	5.9
	Orchardgrass	*Dactylis glomerata*	5.9
	Alsike clover	*Trifolium hybridum*	2.9
Rubens	Canada bluegrass	*Poa compressa*	2.9

Table 3. Alpine mix "Alp"

Variety	Common name	Scientific name	Amount (%)
	Winter rye	*Secale cereale*	23.1
Manchar	Smooth brome	*Bromopsis inermis*	17.0
	Dutch white clover	*Trifolium repens*	11.1
Pennlawn	Creeping red fescue	*Festuca rubra*	8.2
Lutana	Cicer milkvetch	*Astragalus cicer*	8.2
Durar	Hard fescue	*Festuca ovina* var. *duriuscula*	7.1
Climax	Timothy	*Phleum pratense*	5.2
Potomac	Orchardgrass	*Dactylis glomerata*	4.8
	Meadow foxtail	*Alopecurus pratensis*	4.8
Garrison	Creeping foxtail	*Alopecurus arundinaceus*	4.8
Troy	Kentucky bluegrass	*Poa pratensis*	2.8
	Redtop	*Agrostis alba*	2.8

Literature Cited

Del Rio, S. M. 1960. *Mineral resources of Colorado, first sequel.* State of Colorado, Mineral Resources Board, Denver, Colorado.

Dravo Engineers & Constructors. 1980. *Specifications for Homestake Mining Company Hale Gulch tailings dam, Pitch Project, Saguache County, Colorado.* Homestake Mining Company, Golden, Colorado.

Holmes, Richard and Marianna B. Kennedy. 1983. *Mines and minerals of the great American rift (Colorado–New Mexico).* Van Nostrand Reinhold Company, New York, New York.

Morse, Jerome G. and R. M. Stanwood. 1979. *Energy resources in Colorado: coal, oil shale and uranium.* Westview Press, Boulder, Colorado.

Vanderwilt, John W. 1947. *Mineral resources of Colorado.* State of Colorado, Mineral Resources Board, Denver, Colorado.