PSC- 3

Section 3.1.1.1 – Soils Handling Narrative

Removal of suitable plant growth material (SPGM) will be conducted in accordance with North Dakota Public Service Commission (NDPSC) approved soil surveys, and is expected to start in 2015 with stockpiling of SPGM and construction of sedimentation ponds and haulroads. SPGM will be segregated by landowner unless mixing agreements are in effect. When feasible, comingling SPGM invaded with noxious weeds pre-mining with non-invaded SPGM will be avoided. SPGM will be stockpiled off coal where possible, or coal areas that are not to be mined, or directly respread onto regraded areas whenever possible. Where off coal stockpile room is not available, SPGM may be stockpiled onto regraded areas.

Topsoil will be removed in all cases of disturbance, except for those situations allowed by NDAC 69-05.2-15-02(2)(b) and (4). Topsoil removal will occur in areas where disturbance is anticipated for the construction of haulroads, stockpiles, sedimentation ponds, support facilities, and in areas where mining is proposed. Topsoil will not be removed for the construction of a topsoil stockpile, except where required for scraper trail access or associated structures such as a sedimentation pond or diversion ditch. Subsoil will be removed where operations require the excavation of underlying overburden, or the placement of additional overburden material is expected. Topsoil and subsoil stock piles will be signed appropriately by a numbering system to identify the material for future respread. The location of topsoil and subsoil stockpiles, as well as sedimentation impoundments and support facilities can be seen on the Pit Layout And Facilities Map of Section 3.1.3.

The removal of SPGM is conducted in two lifts, utilizing tractor-scrapers, track bulldozers, and trucks loaded by hydraulic shovels or front-end loaders. Topsoil and subsoil removal monuments will be utilized. Monuments will be located on 200 foot centers, and will serve as a guideline for amounts of topsoil and/or subsoil to be salvaged. Staked lift depths are transferred from the Soil Survey and Prime Farmland Map of Section 2.5.6. Topsoil is removed to the depth indicated on the Soil Survey and Prime Farmland Map, or until all dark colored material is lifted, but in no case deeper than the combined topsoil/subsoil lift described on the lift depth stake. Subsoil is then removed to the total depth indicated on the lift stake. All subsoil will be salvaged, unless site-specific approval is granted to waive subsoil removal. SPGM will be segregated by ownership unless mixing agreements exist. After initial disturbance, details regarding specific lift areas and depths will be provided annually to the NDPSC in a soils handling plan. This plan describes amounts of soil available and volumes required to complete reclamation respread operations based on projected respread requirements.

Soil respread thicknesses are based on average amounts stripped, by landowner, by landuse. Average soil depth by section and landowner, based on the pre-mine soil survey, can be found in Section 2.5.4.1. This table can be used to help predict expected respread depths. However, actual respread depths will be calculated annually utilizing real topsoil and subsoil volumes salvaged and will be presented in the annual soils handling plan.

Subsoil and deep lift will be removed to maintain an adequate yearly surplus.. Typically, subsoil would make up the difference between the respread topsoil thickness and the amount

required to spread over a given quality regraded spoil. Soil respread thickness will be determined by overburden quality. None of the land has sufficient SPGM available to meet the projected respread requirements, as shown in Section 2.5.4.2. Therefore, as described in Section 2.5.4, deep lift sampling will identify all available suitable material so that an adequate amount can be salvaged. Additionally, special handling of non-sodic glacial till can be utilized to cover the sodic spoil. As described in Section 2.5.5, although prime farmlands will be disturbed by associated disturbance, there are none projected to be disturbed by mining (coal removal or spoil placement), so there are no prime soils that will be handled separately.

Following stripping, soil will be directly respread unless it is impractical to do so, in which case it will be stockpiled for later respread. Stockpiles shall be selectively placed on a stable area within the permit in a manner that minimizes any loss or deterioration of such material. Proposed stockpile locations are shown on the Pit Layout and Facilities Map of Section 3.1.3, although field modifications may be made to these locations. Drainage from all soil stockpiles shall be directed to sediment ponds to alternate best management practices such as silt fences, straw bale dikes, or small sumps. Stockpiles will be seeded to control erosion, and/or mulched as necessary. Other protective measures as approved on an individual basis may be used where seeding or mulching is not practical. Unless approved by the NDPSC, stockpiled materials will not be moved prior to redistribution. An inventory of stockpiles will be performed annually to determine volume, owner, emplacement data, erosion, and respread depth.

Lands disturbed by mining will be submitted for grade approval. Submitted information will include the surveyed topography and soil respread depths. As discussed above, respread depths will follow those approved in an annual soils handling plan and will be based on actual soil volumes salvaged by landowner, by land use. Regraded spoils are staked on 100 foot centers to specify respread depths during respread operations. However, grade stakes may not be utilized where dozers are equipped with global positioning systems and/or other grade control systems.

Regraded land may be scarified, or otherwise treated, to eliminate slippage surfaces or to promote root penetration. Scarification will be evaluated on a case-by-case basis to determine its necessity. Typically, grades that exceed 12% will be scarified prior to placement of subsoil to ensure proper placement and stabilization of SPGM. Special attention will be given to transition areas where regraded land abuts to undisturbed land, ensuring a smooth transition from reclaimed to undisturbed lands.

Subsoil compaction has been identified on some reclaimed lands at other surface coal mines in North Dakota. CCMC is committed to ensuring compaction does not negatively impact the reclaimed lands' ability to meet revegetation standards regarding productivity and plans to take the following special precautions during the reclamation process to prevent additional and unnecessary topsoil and subsoil compaction. Vegetative production testing will be conducted, starting in the first three years after revegetation, to identify low producing areas that may indicate issues with compaction. Production is an appropriate parameter to test for, since it is the symptom of compaction that concerns owners of reclaimed land. Locations identified as an area of concern based on vegetative production may be tested for compaction or may be treated outright without testing. Current practices for treating compaction after the soil has been respread focus on either mechanical methods, such as deep ripping, or through the use of vegetation with large and/or deep

tap roots. The list of potential treatments may expand as research continues to identify alternatives and evaluate their success. The selection of treatment methods will vary depending on the situation.

Excessive moisture conditions can have an impact on soil compaction, especially under construction conditions as experienced during soil respread operations. Respread will generally be avoided during excessive moisture conditions to reduce the possibility of compaction. This will generally be feasible during most years, but in the case of an extremely wet cycle and above average precipitation, CCMC may need to conduct some respread operations under wet conditions.

CCMC's preferred method for subsoil respread operations will consist of trucks driving across overburden and dumping subsoil on top of the overburden, generally avoiding driving trucks on top of respread subsoil. Subsoil will then be respread to approved depths with a dozer in a fashion that reduces excess passes over any given area, reducing compaction in the process. It will also be necessary to respread some SPGM using tractor-scrapers. Additional care will be taken during topsoil respread operations, limiting the compaction of the subsoil layer by driving trucks on adjacent areas and allowing limited travel on the respread subsoil areas. Where this is unavoidable, the area will be ripped with a blade or a dozer or disked prior to topsoil respread. These areas include but are not limited to graded subsoil roads, pile bases, any undisturbed or respread subsoil that was temporarily used as a haulage route or had material piled on it, such as subsoil pile bases, subsoil roads and haulage routes across respread subsoil. After topsoil is respread, the surface will be worked to relieve possible compaction.

The methodology described above will likely be utilized in most scenarios. However, each grade approval area is unique in shape, design and field conditions. The grade approval process, as mentioned above, allows the opportunity to discuss each area before it is approved and respread with SPGM. At the time grade approval areas are inspected by Public Service Commission Reclamation Division, special consideration can be given and discussed to outline specific sequence, direction and pattern of SPGM redistribution. All factors for the area can be taken into consideration at that time, including but not limited to moisture conditions, compacted areas and special SPGM respread requirements to reduce potential compaction.

When topsoil and subsoil respread has been completed, compaction testing will be conducted using a cone penetrometer to determine if there is excess compaction in the topsoil and subsoil. Excess compaction will be defined by comparison with undisturbed soils of the same land use, by comparison to numerical limits that have been identified through research, or by a combination of the two. Tests will be conducted on 200 foot centers, which is a similar density to what is used for graded spoil sampling to determine soil respread thickness. Compaction testing will be conducted within a year after revegetation. Current practices for treating compaction after the soil has been respread focus on either mechanical methods, such as deep ripping, or through the use of vegetation with large and/or deep tap roots. The list of potential treatments may expand as research continues to identify alternatives and evaluate their success. The selection of treatment methods will vary depending on the situation.

In 2016, NDSU entered into a three-year sponsored research agreement between Coyote Creek, three other surface coal mines in the state and the industrial commission to study compaction on reclaimed land. Research findings will be used to refine details of the testing

methods to be used at Coyote Creek Mine, define what the threshold is for excessive compaction for each land use and determine what are the most effective treatment options. Since the reclamation schedule as shown in Section 3.1.1.3 doesn't project significant areas of respread to occur until 2020 and the three-year research project will conclude in 2018, allowing time to incorporate research findings into these plans is appropriate.

Soil compaction testing was delayed in 2020-2021 due to extremely dry conditions. Dry conditions result in inaccurate readings and unreliable results. Prior to 2021, CCMC relied on a hand penetrometer to gauge soil compaction. However, in 2021, CCMC purchased a CTS-1000 Soil Penetrometer to measure soil compaction. The CTS-1000 is a truck mounted penetrometer that gives accurate readings and records soil compaction throughout the soil profile. In 2022, CCMC began testing a majority of the reclaimed native grassland and reclaimed cropland/hayland tracts as well as undisturbed adjacent lands to compare compaction between the sites. The results indicated that the reclaimed lands had similar compaction as the undisturbed lands. Both undisturbed and reclaimed lands had compaction readings above the recommended 300 psi. In order to reduce compaction on reclaimed lands, CCMC plans to purchase and utilize a deep ripper.

Compaction testing will continue annually at CCMC as lands are reclaimed. The penetrometer will also be used as a tool to determine potential issues if areas appear to not be producing as expected.

There are fill sections of the haulroad that have been designated as subsoil stockpiles. Because they are part of the haulroad, subsoil in these areas will be compacted during construction. To alleviate this compaction, subsoil in the haulroad fills will be disked or ripped with a subsoil ripper prior to being loaded into a scraper for respread. Scrapers inherently fluff soils during loading when shaving thin layers of soil over a long cut, which will also help reduce compaction. In the respread, scrapers will lay the subsoil down in as thick of lifts as possible to minimize machine compaction. If subsoil is removed from a fill area to be respread elsewhere, normal handling by equipment is expected to relieve compaction, since the loading and respread process will fracture the soil. If subsoil in a road is at grade, it will be ripped prior to topsoil respread to relieve compaction.

For associated disturbance areas such as ponds, stockpiles, and roads, soil will be respread to approximately the same depth as prior to disturbance, based on an average soil respread depth over the entire landowner's property. Topsoil will be respread over unstripped subsoil. Subsoil and topsoil will be respread in areas where both were stripped. For subsoil roads, storage areas, etc., surfacing such as gravel and scoria, or any surface debris or spilled gray spoil will be cleaned off the surface prior to topsoil respread. These areas will also be ripped prior to respread to relieve potential compaction.

Prime Farmlands

Prime farmlands have been identified using the Mercer County Soil Survey and information contained in North Dakota Important Farmlands (SCS updated). Also, the State Office of the Natural Resource Conservation Service was consulted to determine the extent of prime farmlands. Prime farmlands are located on the Soil Survey and Prime Farmland Map of Section

2.5.6. Each landowner will receive the same acreage of prime farmland following reclamation as existed prior to mining. A request for a negative determination is made for those prime soils located in native grassland, and for prime soils located in other areas historically not cropped, such as prairie trails, roads, farmsteads, and shelterbelts. Prime farmlands have been blocked out of these areas on the soil survey maps. Prime farmlands in the permit area will only be disturbed by associated disturbance, so prime soils will not be handled separately. Refer to Section 2.5.5 for more information on prime soils.

Current regulations require the permittee to demonstrate, through "available agricultural school studies or other scientific data....the proposed method of reclamation will achieve, within a reasonable time, equivalent or higher levels of productivity after mining as existed before mining." A tremendous amount of research has been conducted on reclamation of mined lands in North Dakota. Most of this has been by the NDSU Land Reclamation Research Center and the Northern Great Plains Research Center, Agricultural Research Service. A thorough discussion of this research, as it applies to reclamation techniques to be used here, follows this paragraph. This discussion demonstrates the technological capability of proposed methods to restore productivity.

Narrative Predicting Potential for Reestablishment of Vegetation

NDAC 69-05.2-09-15(6) requires the applicant submit a plan containing available agricultural school studies, or other scientific data, that affirmatively demonstrate the proposed method of reclamation will achieve equivalent or higher levels of yield as existed before mining. Although this requirement is stated specifically for prime farmlands, the following narrative demonstrates the technological capability to reclaim other agricultural land as well.

The North American Coal Corporation (NACCO) and its subsidiaries, including Coyote Creek Mine, have kept abreast of research activities conducted on mined lands. Mined land reclamation research has been a primary tool in developing reclamation plans for disturbed lands. Through the reclamation practices developed from research and the experience gained from reclaiming mined lands for over 20 years, NACCO has developed the technological capability to reclaim mined land.

Most mined land reclamation research has been associated with plant establishment and production on rangeland and cropland. Research has shown that the application of proper techniques will result in successful revegetation of mined lands to equal or greater than original productivity levels.

Research associated with plant production has shown that yields comparable to those of unmined lands resulted when SPGM was spread over graded spoil material. Plant production (grain and forage) increased as total thickness of replaced SPGM increased up to 30 inches (Barker et al., 1979). Greater thicknesses did not result in significant increases in yields. An average depth of SPGM for the permit area is greater than 30 inches. For prime farmlands located in the permit area, and any non-prime agricultural land to be reclaimed, there are currently plans to lift a minimum of 60 inches of topsoil and subsoil where disturbance is planned and soil removal is required, if there are no limiting factors. Based on the above research findings, this will be sufficient to achieve maximum yields.

In an unpublished report entitled "Project No: NDSU-1", the researchers (Barker et al., 1979) found that spring wheat yields on a plot disturbed to simulate reclamation procedures resulted in yields not significantly different than those on an undisturbed plot. Yields for these plots were 11.56 and 11.93 bushels/acre for the reclaimed and undisturbed plots, respectively.

Power, Ries, and Sandoval (1978) found that returning the original soil material to the surface regraded spoils is a "practical means of restoring agricultural productivity." Their research established that high sodium spoils must be covered with about 70 centimeters of soil material to achieve maximum production, and that topsoil must be segregated and spread separately from subsoil. These practices are currently being conducted by NACCO.

Establishment of grasses is greatly aided with the replacement of SPGM. Power, Ries, and Sandoval (1978) found that with varying levels of topsoil (from 0-30 centimeters), maximum plant density for a crested wheatgrass and a native grass mix stand was achieved with as little as 5 cm of replaced topsoil.

The reclamation research quoted in the following annotated bibliography provides further data supporting NACCO's technological capability to reclaim mined lands. Note that comments are made after some excerpts, stating how the results of these scientific studies relate directly to reclamation methods used by NACCO.

Power, J. F., Ries, R. E., and Sandoval, F. M. 1978.
Reclamation of coal-mined land in the northern great plains. Journal of Soil and Water Conservation. 33(2):69-74.

a. Page 73: "As little as two inches of topsoil over sodic spoils can increase the infiltration rate several fold, reduce runoff, and vastly improve plant survival and growth." (Much more than two inches of SPGM is planned for replacement over all spoils (sodic and non-sodic) in the permit area.)

Colorado School of Mines. Preliminary Phase I Report:
Topsoil depth requirements for surface mined areas. Prepared for the U. S. Bureau of Mines.

a. Page 72, Reclaimed Site: "Above-ground biomass averaged 241.4 g/m^2 (2153 lbs./acre) and ranged from 94.6 to 639.1 g/m^2 (844 to 5700 lbs./acre). Proportion of cover for plants, litter, and bare ground was 40%, 33%, and 27%, respectively. Depth of topsoil averaged 28 cm (11 inches)."

b. Page 73, Undisturbed Site: "Blue grama, bluegrass, western wheatgrass, and forbs (generally sunflower and mustard) were found in the plots and above-ground biomass averaged 64.6 g/m^2 (576 lbs./acre). Fifty-four percent of the surface was covered by plants, 42% was covered with plant litter, and 4% was bare."
(Note that in these studies, reclaimed areas had greater yields than undisturbed acres for rangeland - 2,153 lbs./acre versus 476 lbs./acre).

c. Page 97: "Significant differences in pH were not found between spoils and topsoil of the reclaimed site and soils from the undisturbed site."

d. Page 97: "The surface soils at both sites were non-saline. Differences in the texture of spoil and topsoil may have prevented the upward capillary movement of salts."

Power, J. F., Ries, R. E., and Sandoval, F. M. 1976.
Use of soil materials on spoils effects of thickness and quality. North Dakota Farm Research. 34(1):23-24.

a. Page 24: "If these trends continue in future years, these results mean that for the crops being studied and for the type of spoil used, about 30 inches of soil material is needed for maximum yield, regardless of quality of the soil material. However, maximum yield appears to increase as better soil material is used."
(In general, more than 30 inches of SPGM will be returned over regarded spoils.)

Barker, R. et al. 1979. 1979 Reclamation Research
Supplement to "North Dakota Progress Report on Research on Reclamation of Strip-Mined Lands Update 1977." Agricultural Research, USDA SEA. Mandan, North Dakota.

a. Page 8: "Regardless of thickness of the returned soil, the SAR's immediately above the spoil have increased due to upward sodium movement, while the SAR's of the subsoil immediately below the topsoil have decreased somewhat. The results indicate that with three feet, and as much as seven feet, of replaced soil, the highest concentration of sodium salts developed between the 2nd and 3rd foot depth."
(There is currently great dispute concerning possible directions of sodium migration. Regardless, the thickness of returned SPGM should be sufficient to reduce any chance of upward sodium migration to levels near the surface.)

b. Page 11: "Results to date show prairie hay can provide natural seed of several species, but before using prairie hay, information on the number and kind of seed contained is needed."
(Recent work by Ries et al. indicates that great strides have taken place in the use of native prairie hay. If possible, native hay will be used as mulch. An effort will be made to determine the cutting date, range site, and range condition. For further information, see Ries, R. E., L. Hofmann, and W. C. Whitman. 1980. Potential control and value of seeds in prairie hay for revegetation. Reclamation Review. 3:149-160.)

c. Page 13: "In conclusion, it is encouraging that this first season's results indicate that there are a large number of cultivars (dryland alfalfa) that may be established under rather adverse conditions, including both mine spoils and rangeland."
(Alfalfa is currently planned for some seed mixes, possibly as an amendment to others.)

d. Page 15: "A study to evaluate the effect of different intensities of livestock grazing on the vegetation and the soil-spoil complex of a reclaimed area was initiated near Center in 1976."
(These production figures are comparable to those obtained in other grazing experiments on non-mined land at Mandan.)

Kay, B. L. 1978. Mulch and chemical stabilizers for land reclamation in dry regions. In Reclamation of Drastically Disturbed Lands. American Society of Agronomy. Madison, Wisconsin. pp. 467-483.

a. Page 468: "The mulch effect of straw can be expected to increase plant establishment."
(Mulch is planned for use in the reclamation process.)

b. Page 469: "Straw to be crimped is commonly used at 4.5 metric tons/ha..."
(This is roughly equivalent to two tons/acre, the amount to be applied and crimped on steeper reclaimed slopes.)

Jensen, I. B. and Schafer, W. M. 1979. Effect of surface manipulation on percolation, infiltration, and ground water quality. In Proceedings Canadian Land Reclamation Association, Fourth Annual Meeting. July, 1979. pp. 121-137.

a. Page 192: "Topsoiling management is unequivocally a major reclamation tool in the control of surface runoff by increasing infiltration. Without exception, during a runoff event topsoiled watersheds underwent less runoff than similar nontopsoiled watersheds.
(All reclaimed areas will be topsoiled.)

b. "Page 132: "Preliminary vegetation establishment and development data also show that vegetation stand development is more uniform and productive gouged and chiseled areas."
(Current plans call for deep chisel plowing after respreading topsoil.)

c. Page 134: "Preliminary results show that surface manipulation treatments do significantly influence the hydrologic balance of spoils. All surface manipulation treatments collect and retain more precipitation on the treated area as compared to nontreated areas."
(Surface manipulation treatments will include deep chisel plowing, disking, harrowing, and rock picking.)

Pole, M. W., Bauer, A., Zimmerman, L., and Melsted, S. W. 1979. Effects of topsoil thickness placed on spoil banks on wheat and corn yields in North Dakota. In Proceedings Canadian Land Reclamation Association, Fourth Annual Meeting. July, 1979. pp. 139-157.

a. Page 144: "Positive responses to "topsoil" thicknesses were measured for corn silage, wheat straw, and wheat grain on topsoil placed on moderately sodic, respread spoil materials at the Knife River Mine in North Dakota."
(These same treatments will be used at the Coyote Creek Mine, which is located adjacent to the Knife River Mine, now referred to as the Beulah Mine.)

b. Page 145: "In general, the 30 cm "topsoil" thickness resulted in corn and wheat yields nearly as high as those measured on the 61 cm thickness."
(Generally, topsoil and subsoil replacement will be greater than 61 cm.)

c. Page 145: "There is no evidence of upward sodium migration or other increased salinity problems in the "topsoil" materials at the Knife River Mine research site. The SAR of the spoil materials at the site in general are in the range of 10 to 20. They are lower than those measured where topsoil deterioration by sodium migration has been reported (Sandoval and Gould, 1978)."

Hofmann, L. and Ries, R. E. 1980. Comparison of vegetative composition, cover, and production on reclaimed and non-mined grazed lands. In Adequate Reclamation of Mined Lands. A Symposium. Soil Conservation Society of America. Billings, Montana. pp. 27-1 to 27-10.

a. Page 27-1: "Dry matter yields harvested from moderately, lightly, and ungrazed reclaimed pastures were equal to or better than yields from two adjacent non-mined range sites."

b. Page 27-1: "However, live vegetation plus litter was equal or better on reclaimed sites than on native sites, and cover was sufficient to prevent soil loss on both reclaimed pastures and native range as predicted by the Universal Soil Loss Equation."

These brief statements, along with a bibliography of cited research, provide information which demonstrates NACCO's technological capabilities to reclaim mined lands. Operational reclamation completed on mine sites and research conducted in the Northern Great Plains region show that mined lands can be reclaimed to equal or greater than original production levels. The reader is suggested to consult published research for a more thorough treatment of the subject. Space limitations preclude the inclusion of copies of articles and reports. In addition, the reader is strongly urged to consult with noted authorities on mined land reclamation and agricultural production, if there are questions concerning the technological capability of NACCO and subsidiary companies to reclaim mined land. Such authorities can be found at the USDA (ARS-SEA) Northern Great Plains Research Center (Mandan, North Dakota), North Dakota State University (Fargo, North Dakota), local and state cooperative Extension Service offices, and USDA Soil Conservation District and state offices.

Past reclamation performance has demonstrated the capability of NACCO to reclaim mined lands. A significant amount of reclaimed land has been released from bond.

Reclamation procedures required by the current statutes and regulations are being successfully executed. The most significant requirements include the removal and segregation of two lifts of

SPGM, the conservation measures associated with soil stockpile maintenance, the backfilling and regrading requirements, and the protection of air, soil, and water resources.

Operators are required to remove and segregate SPGM in two lifts, based on a NDPSC approved soil survey completed by a certified professional soil classifier, in accordance with NDAC 69-05.2-15. Materials best suited for top dressing are removed in the first lift. These materials must meet standards as specified in NDAC 69-05.2-08-10(1)(a). Second lift materials pertain to SPGM with characteristics specified in NDAC 69-05.2-08-10(1)(b). All SPGM are inventoried (before mining) to a minimum depth of five feet. If soil materials suitable for top dressing (first lift) are found below the five foot depth, such materials will be mapped to the depth at which they occur.

First and second lift materials (not redistributed on graded areas directly) are stored separately in stockpiles to await replacement after mining is completed. SPGM that is stockpiled is selectively placed and protected from wind and water erosion, as related to time, the nature of the SPGM, and the stockpile's placement.

Backfilling and grading of mined areas are required to achieve an approved post-mining land use, as specified by NDCC 38-14.1, and to achieve a gentle topography consistent with the adjacent unmined landscape, in order to develop a post-mining landscape that will provide for maximum moisture retention, drainage that will complement the surrounding terrain, maximum stability, and minimum soil losses from runoff and erosion.

Protection of air, soil, and water resources is accomplished using conservation practices such as planting cover crops, mulching (vegetation or amendment), no-till planting, etc., which will protect stockpiled materials and disturbed areas from erosional degradation, and air and water resources from sediment contamination.

Pre-mining characterization is an important step to help understand potential problems associated with reclamation. Characterization includes the chemical and physical nature of soil and overburden materials, vegetation and land use analysis, and the groundwater parameters.

A large number of overburden samples are taken to provide chemical and physical characterization data that can be used to identify reclamation problems. Piezometer tubes are installed to monitor groundwater movement, quantity and quality, and to help evaluate groundwater problems that may result from the mining operation. These data provide valuable input in designing sedimentation ponds, diversion ditches, erosion control structures, etc. Vegetation is monitored in order to identify trends and predict problems.

NACCO is concerned about properly reclaiming mined lands. Company personnel from all aspects of the operation are encouraged to support reclamation.

A reclamation training program has been developed for mine personnel. Individuals are required to attend classroom instruction which includes such subject matter as: (1) laws, regulations, and permits concerning the operation of a mine, water use and discharge, reclamation, air quality, etc.; (2) reclamation procedures that may relate to the chemical and physical nature of the soil and overburden; (3) conservation measures for preservation of air and water quality, including erosion

control; and (4) the importance of doing the best job possible, contributing ideas, and notifying the proper people of possible pollution problems. The course is provided to all new hires. All employees are given updating instruction on an annual basis.

Research associated with mined land reclamation has had and will continue to have NACCO support. A significant amount of capital, in the form of equipment and time, has been donated to construct plots and to install equipment for the various research groups.

Through these efforts, NACCO has developed the technological capabilities to reclaim mined land.

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