# DETERMINATION OF COMPLETENESS AND TECHNICAL ADEQUACY

## U. S. STEEL MINING CO. RESPONSE

## GENEVA MINE

August 24, 1983

U. S. Steel Mining Co., Inc.
Western District
P. O. Box 807
East Carbon, Utah 84501

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UMC 771.23 **Permit Applications: General Requirements for Format and Contents**

The revised permit area is projected to recognize a 30 degree angle of draw from the limits of mining. The looping outline recognizes the changes in elevation and the depth of cover. The revised permit area includes some 3780 acres which includes the surface disturbed area of 50 acres.

UMC 783.11 **General Requirements and UMC 786.19 Criteria for Permit Approval or Denial**

The 211 Mining Plan covering Federal Coal Leases SL-046612 and SL-066145 dated May 17, 1977 and the updated Resource Recovery and Protection Plan are provided. The complete plans are provided in accord with Item 13.

Item 7 is addressed specifically as follows: The information regarding the Kenilworth seam was abstracted from Monograph Series No. 3 1972 "Central Utah Coalfields" page 403.

UMC 783.15 **Groundwater Information**

Drawing No. C3-1207 has been revised to show the Sunnyside Fault projection through the Geneva Mine block. Underground fault intercepts and pertinent seals (referenced in the MRP) are also clearly identified.

Groundwater that is intercepted at Geneva Mine is the result of deep percolation from surface precipitation (Hotchkiss, Israelsen, Riley, Oct. 1980, p. 10). It is presumed that recharge comes from melting snowpack in the higher elevations since rainstorms are generally of short duration which produce rapid runoff due to steep topography. The relatively high TDS levels of the mine discharges at 001 and 002 supports the assumption that water has traveled through the salt laden strata above the mine. No aquifers have been identified above the coal seam. The low annual precipitation in the area would not likely produce a regionally continuous groundwater table (Hotchkiss, Israelsen, Riley).

Prior to interception of the Sunnyside Fault the total mine discharge was through the borehole to the water tanks and overflow now designated as Discharge 001. The Operator has no record of the discharged volume prior to interception of the Sunnyside Fault. The prior volume is estimated to have averaged 0.20 cubic feet per second. The most recent discharges from the monitioring points show an average mine discharge of .464 cfs. We have not determined that there is a seasonal variation in the volume of water pumped from Geneva Mine. However, the large underground reservoirs of flooded mine workings and variations in pumping procedures caused by changes in the mine operation would probably mask any seasonal variation in the discharge should it exist. It does appear that the discharge from the mine is currently some 70% of the discharge when the mine is working.

The Sunnyside Fault extends across Geneva Mine and the adjacent abandoned Columbia Mine as shown on Map C3-1207. Geneva Mine has completed retreat mining upslope from the Sunnyside Fault in the 3rd East and is retreating upslope from the fault in the 2nd East. The water level in both slopes is above the Sunnyside Fault contacts. This water will flow through the fault contacts to strata below the Sunnyside Coal Seam if they have a potential to accept water. The Starpoint, Ferron and Emery Sandstone are below the Sunnyside Coal Seam.

The classification of the source of the recharge for Redden Springs as a perched aquifer that is annually recharged from melting winter and spring snow is based on the following:

1. There are no known aquifers above the Sunnyside coal beds.

2. It appears that the water percolating beneath the surface of the canyon encounters an imperm- eable layer of shale and is carried horizontally until it emerges in the sandstone shale contact below the streambed in Horse Canyon.

3. This is the only spring in Horse Canyon having this flow quantity and quality.

4. It is presumed that the areal extent of the recharge source is limited to the vicinity of Redden Springs and the drainage area upstream since there are no other springs in the area associated with this formation.

5. The Operator's conclusion that springs in the area are annually recharged by percolation of surface precipitation is supported by Hotchkiss, Israelsen and Riley, p. 10.

The flow of water is reasonably constant and does not vary with the seasons. The sampling and monitoring of the spring continues. The data subsequent to January 1981 is included with this submittal.

The walls, roof and working faces of the working areas of the mine are not producing measurable inflows of water.

Flow records for the Geneva Mine discharge are included on the updated water monitoring data sheets (refer to Appendix I).

UMC 783.16 Surface Water Information

On July 29, 1983, a field reconnaissance was conducted to locate the springs referenced in the ACR response. Two springs were located in Section 34 and are assumed to be the ones referenced, refer to Map E3-3332. This water source was identified in 1978 with one spring flowing at that time. The spring was sampled four times and monitoring data is included in this submittal. Monitoring was discontinued with the concurrence of the Division due to the low flow of less than five gallons per minute.

The Redden Spring area located in Section 3, T15S R14E was visited on July 29, 1983. The second spring was not located due to flow in the stream channel from recent precipitation events.

The Operator has identified several sources of water in the mine plan area. Based on the following, the Operator has concluded that the source of this water is surface flow in the stream channel.

1. All water sources are located within the immediate stream channel which consists of unconsolidated alluvial material.

2. The water source is closely associated with rock outcrops near the surface of the stream channel.

3. Flow rates appear to be seasonal, generally associated with normal creek flow.

4. Surface discharges into the dry creek bed are reabsorbed into the unconsolidated alluvials of the stream channel.

One water source as is described above was located in 1978 downstream from Redden Springs in Section 3. The Operator assumes that this is the "spring" referenced in the ACR. This water source is not considered to be a true spring by the Operator. Water quality and quantity would be dependent on the water quality and quantity in the stream and Redden Spring.

Refer to the Water Monitoring plan.

Mine water is discharged into Horse Canyon Creek at locations 001 and 002, shown on E3-3332. Updated water monitoring data is included in Appendix I of this submittal. Discharge quantities vary depending on underground usage requirements and location of active sections. Water quality data supports the Operator's claim that the groundwater source is deep percolation of surface precipitation through the salt laden overburden as follows:

1. TDS is usually 1800 to 1900 mg/l but ranges from 1700 to as high as 2700 mg/l.

2. pH is generally slightly basic and does not fluctuate significantly.

3. Alkalinity is relatively constant.

The Operator has not recorded any significant fluctuation in water quality of mine discharge since 1980. Iron and Manganese contents are consistantly low, and little oil or grease is discharged. The Operator does not expect to discharge water from the underground workings following mine closure.

Updated surface water monitoring data is included in Appendix I of this submittal. Flow rates appear to follow the normal seasonal variations. Correspondingly, the amounts of metals and suspended solids generally increases during the spring runoff period and when flow volumes are high. Little fluctuation in alkalinity, pH or TDS is noted. Surface drainage flows appear to be highest during the snowmelt months of April and May. Minimum flows are noted during late summer months. It should be noted that sample location B-1 is downstream from the mine discharge points and flow volumes would include the mine discharges.

UMC 783.19 Vegetation Information

The Operator has submitted a vegetation study under separate cover for inclusion in the MRP as Appendix G. Refer to this study for the information requested under this section.

UMC 783.22 Land Use Information

Refer to Appendix G of the Mining and Reclamation Plan (see 783.19 of this document).

UMC 783.25 Cross Sections and Maps

(f) The statement "The Operator has not identified or intercepted any underground or surface sources of water within the mine plan or adjacent areas" was made to support the absence of aquifers above the coal seams since no water that has been intercepted that can be identified as a aquifer source. We also have not identified an interception of surface water from streams above the coal mine. It is agreed that the statement taken out of context is confusing. The identified source of water is from the Sunnyside Fault which is not identified as an aquifer but as trapped water from within the fault zone. We have not identified a seasonal variation in the discharge of the water from the mine.

The Operator does not have any additional information on Redden Spring from which maps and cross sections could be developed.

(g) The located springs are shown on revised Map E3-3332 (which is included in this document.) Refer to comments under 783.16.

(i) Map H3-14 shows the location of the water and sewage systems including the supply lines.

(k) The Map F3-159 shows the drainage area to pond area No. 6. The map shows a continuous berm between the area that feeds Pond No. 6 and Horse Canyon Creek. The berm is continuous from Pond No. 6 to the stream crossing. Relative elevations shown on Map F3-159 indicate a depression upstream from the tressle crossing Horse Canyon. The depression received runoff from the portal area and filters it through straw bales prior to discharge into Horse Canyon Creek. The area further upstream is not part of the Geneva Mine hydrologic evaluation area since the disturbed area is associated with a public road providing access to Horse Canyon.

UMC 784.11 <u>Operation Plan: General Requirements</u>

The sediment that accumulates in the water treatment ponds as a result of runoff from precipitation events will be removed using a frontend loader when the sediment accumulates to 60 percent of the design sediment storage volume. The sediment that is removed will be place on the Road Junction Waste Dump or landfill. The sediment cleanout level will be designated by the top of the head of a roof bolt set in the pond.

UMC 784.13 <u>Reclamation Plan: General Requirements</u>

(b)(2) The Operator will include a cost estimate for the final disposition of sediment ponds in this submittal.

(b)(3) It is recognized that parts of the Geneva Mine disturbed areas have naturally revegetated to a level equal to or greater than the adjacent undisturbed areas. Various members of both the Enforcement and Technical Staffs have commented favorably on the volunteer vegetation. It is the Operators plan to use revegetated areas to the greatest extent possible at the time of reclamation provided these areas meet the success standards in the proposed vegetation plan for productivity, density and diversity based on evaluation at the time of reclamation. Any use of volunteer vegetation has not been included in the reclamation cost estimate.

In developing the cut/fill balances for surface reclamation, the Operator has provided for soil loss through direct placement on coarse materials. The Operator has evaluated the expected void area in the placed concrete, and developed an estimated conpaction rate of 1.8 loose cubic yards per compacted cubic yard. This assumption is reflected in the cut/fill balances and on Drawing No. E3-3340 and F3-170.

The volumes of broken concrete was provided in Appendix C of the MRP. A summary will be included in the cut/fill balance (see below).

The Operator has developed a cut/fill balance which is included in this submittal. Swell factors are assumed for moving fill material and compaction factors are assumed for placement and grading. The development of reclamation costs includes the use of compaction equipment on page C-14, 15.

A map will be provided to the Division showing the location of all remanent highwalls. These highwalls are similar in height and length to the cliffs in the surrounding areas (see Maps F3-170 and E3-3340). The highwalls are similar in composition and are visually compatible with the surrounding area.

(b)(4) This section is adequately addressed in accord with this regulation and the performance standards 817.21 - 817.25. The adequacy of soils to support revegetation will be discussed in the vegetation study.

Appendix D includes the operation and reclamation plan for the solid waste landfill and other minor technical revisions. These are site specific plans and should not be confused with the general plans for the mine which are presented in Section 784.13 of the MRP. The plan for the landfill recognizes the following:

1. Topsoil removal, storage, protection and redistribution.

    1.1 The plan states that the solid waste will be covered with two feet of soil that was excavated and saved during trench construction.

    1.2 The topsoil plan recognizes redistribution of available topsoil as described under Item 1 of the "Solid Waste Landfill Area" "Operation and Reclamation Plan".

The Operator's plan does not state that two feet of topsoil will be distributed in the landfill area or the total area.

Pictures of the Lila Fan site are included in Appendix V. From the pictures, it is clear that once the portals are sealed, there will be no access to the pad site for revegetation monitoring. As a good faith effort, the Operator has included seeding the pad area in the reclamation cost evaluation. Since the fan pad is located on a cliff face, it is the Operator's conclusion that the pad site is currently vegetated in a manner consistant with the surrounding area.

(b)(5) See comments under UMC 783.19 of the document.

(b)(7) Refuse samples are being evaluated by Ford Chemical Laboratory for the following parameters on a soluable basis: As, Ba, Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Se, B, CO3, Cl, F, Hg, NO3, SAR, Total Soluable Solids, Combustable Solids, Non-combustable Solids, % Sand, % Silt, % Clay, pH (initial reading), Acid-Base Saturation percent. Results will be forwarded when received by the Operator.

Non-coal waste and debris are disposed of in a solid waste landfill which is operated by Geneva Mine under a Department of Health permit. Hazardous and toxic wastes will be disposed of as described on page 784-25 of the MRP. The operation of the landfill is not expected to have any impact on surface or groundwater based on the following:

1. No springs or seeps have been identified in the area of the landfill.

2. No groundwater has been encountered during trench excavation.

3. The landfill is located some 150 feet away from Horse Canyon Creek (refer to Map F3-171).

4. No hazardous or toxic wastes will be disposed of in the landfill.

The mine development waste along the trackbed is not included in the permit area and as such is not a part of this plan. This area was abandoned prior to the SMCRA Act. The Operator has no plans to disturb this stable area.

UMC 784.14 Reclamation Plan: Protection of the Hydrologic Balance

(a) The design for enlarging Pond 3 to contain post reclamation precipitation runoff prior to revegetation is included with this submittal. Hydrologic design calculations are included in Appendix II.

(a)(2) The only water rights holder in the mine plan area other than United States Steel Corporation is Floyd Hawkins (refer to page 784-30 paragraph 2.1). This water right is limited to the portion of the Horse Canyon Creek between the SE 1/4 NE 1/4 Section 34 and the NW 1/4 SW 1/4 Section 34. This area has been undermined with no adverse surface impact. No additional mining is planned under the area of Horse Canyon Creek covered by this water right. Therefore, no future actions of Geneva Mine will impact this water right.

Horse Canyon Creek is an intermittant stream and therefore not a reliable source of surface water. The Operator proposes to leave a barrier 300 feet each side of Horse Canyon Creek to protect the creek from possible subsidence damage (refer to Map F3-169 revised in this document). Inside this barrier in the future, only development mining will be conducted. Additional measures to protect Horse Canyon Creek are described in paragraph C of this section.

(a)(4) See comments under UMC 817.50 and paragraph (d) of this section.

(b)(3) A water monitoring plan is included with this submittal.

(c) The Operator has not observed any adverse hydrologic consequence that has resulted from the Geneva Mine underground mining operation. The Operator does not project any future adverse hydrologic consequences that will result from future operations. It is concluded that the adverse hydrologic consequence of Geneva Mine operation if any, will be minor based on the following:

1. There are no known aquifers above the coal seam being mined at Geneva Mine.

2. The mine inflows are generally associated with faults.

3. The average discharge of some 0.4 cfs of water is not significant considering the mining of some 3000 acres.

4. The visual subsidence surveys conducted by the Operator have not identified evidence of subisdence damage in any steam channel.

5. The low annual precipitation will not likely produce a regionally continuous groundwater table (Hotchkiss, Israelsen and Riley).

6. Hotchkiss, Israelson, and Riley project an interception of .13 gpm per acre of future development. **Application of that projection** to 3250 mined acres at Geneva Mine would result in a discharge of 422.5 gpm. Geneva Mine discharges are generally consistant with that projection.

7. The Operator has not determined any seasonal variation in the volume of water discharged from Geneva Mine.

8. The streams leaving the area are either intermittant or ephemeral and thus do not provide a reliable source of water.

The worst case situation would be the interception of the Horse Canyon Creek through a subsidence crack to the surface. This has not occurred and is not projected to occur in the future. Future mining during the permit term will be under more than 500 feet of cover (reference F3-169). Based on the Operators experience, surface subsidence damage does not occur in areas with more than 500 feet of overburden.

In the unlikely event that a surface crack may develop and intercept Horse Canyon Creek, the Operator will evaluate the magnitude of the situation and prepare an engineering study of possible methods to restore creek flow (i.e. grouting, channel lining, culverts, pumping from underground, etc.) for review by appropriate regulatory authorities. When an appropriate method is established, the Operator would take remedial action immediately.

(d) It has been the Operators experience that the Sunnyside Fault is the major underground water source in the Geneva Mine area. Significant increases in water inflows were encountered when the 3 East and 2 East sections approached the fault. The Operator also extracted coal from the Lower Sunnyside Seam through the adjacent Columbia Mine and additional water inflows were also encountered as workings approached the Sunnyside Fault.

The 3 East slope was sealed in 1978. The seals are inspected regularly and to date no discharge has been noted. The 2 East area is still being dewatered for use as an active section. Columbia Mine was closed and abandoned in 1967 and to date there has been no water discharges noted from any portals. The Sunnyside Fault, fault intercepts, 3 East seals and Columbia Mine portal are shown on C3-1207. It is concluded that water inflows from the Sunnyside Fault will reach hydrostatic equilibrium probably at a lower elevation than the main entries on 3rd level (the location of the 3 East seals) in Geneva Mine. As such, portal seals at Geneva Mine are not expected to be under hydraulic head. The Operator is not familiar with site specific conditions at the Sunnyside or Book Cliffs Mines and cannot project them to Geneva Mine. The Sunnyside Mine is located some 10 miles north of Geneva Mine under the Grassy Trail-Whitmore Canyon drainage. It would not be appropriate to project experiences at Sunnyside Mine to Geneva Mine since they are located in different watershed areas. The Book Cliffs Mine is located up-dip from Geneva Mine in the same coal seam. Mining in the Book Cliffs Mine did not extend more than 1800 feet from the outcrop. Mining in Geneva Mine extends several thousand feet downdip from the outcrop. Therefore, experiences at Book Cliffs Mine could not be necessarily projected to Geneva Mine.

UMC 784.15 <u>Reclamation Plan: Postmining Land-Use</u>

The reclamation plan recognizes restoration of the affected areas to a condition that is consistant with the surrounding areas. The Operator is not aware of any locations within the mine plan or adjacent areas which is or has been dedicated wholly or partially to the production, protection or management of species of wildlife. The Operator intends to return the disturbed area to a production level at least equal to the surrounding area, but specific wildlife habitat uses or management related activities are not a part of this plan. Therefore, the Operator intends to return the disturbed areas to the premining land use of undeveloped land.

The reclamation plan and post-mining land use proposed by the Operator will not preclude use of the area by wildlife. Plant species for revegetation were chosen to provide forage and cover for wildlife (refer to Appendix G of the Mining and Reclamation Plan).

UMC 784.16 Relclamation Plan: Ponds, Impoundments and Embankments

(a)(1)(i) All sedimentation pond plans were prepared under the direction of Glenn H. Sides (No. 4169), Chief Engineer, U. S. Steel Mining Co., Inc., Western District.

(ii) Pond design drawings are included in the MRP. "As constructed" drawings are included in this submittal.

(iii) General hydrologic information is included in Section 783.16 of the MRP text. General geologic information is included in Section 783.14 of the MRP text. Specific hydrologic evaluation for each sedimentation pond is included in Appendix B of the MRP.

(iv) There are no plans for underground mining operations beneath the areas occupied by sedimentation ponds.

(v) All plans pertinant to sedimentation ponds have been submitted to the Division either in the MRP or in this submittal.

(a)(2) There are no ponds that meet or exceed the criteria of MSHA 30 CFR 77.216(a).

(a)(3)(i) See Item 784.16 (a)(1)(i).

(ii) See Item 784.16 (a)(1)(ii).

(iii) Accumulated water in sedimentation ponds is discharged after at least 24 hours under an approved NPDES permit. Sediment accumulation is removed when approximately 60 percent of the 3 year design accumulation is reached. This level is appropriately marked in each pond and is shown on Drawing No. E3-3441. Sediment which is removed from ponds is disposed of at either the waste dump or the landfill.

Sedimentation ponds are visually inspected at least quarterly. Maintenance that may be required is site specific and corrected immediately. Typical pond maintenance includes (but is not limited to) cleaning debris from the pond area and discharge structures.

(iv) Sediment ponds will be maintained during reclamation in accord with the time table on page 784-13 of the MRP. When a suitable stand of vegetation is established (based on the success standards as described in the vegetation study), the ponds will be removed as follows:

(1) The impoundment will be graded into the pond area to the configuration shown on Drawing No. F3-170.

(2) The regraded pond area will be revegetated in accord with the methods and recommendations contained in the vegetation study.

1. The proposed modifications to Pond 9 shown on E3-3373 were completed persuant to the design approval letter included on page B-17 of the MRP.

2. Complete "as constructed" pond drawings including cross sections, are included in this submittal.

UMC 784.19 Underground Development Waste

(a) During the last 5 years less than 50 cubic yards of waste has been added to the Road Junction Refuse Pile. Future additions would be expected to be similar in quantity and should not exceed 100 cubic yards per year as a maximum. Waste will be placed in layers less than 24 inches thick and compacted. The Operator does not have any plans to expand the refuse pile laterally. All future material will be added to the top of the pile. Refuse added to this pile over the remaining life of Geneva Mine should not increase the height of the pile more than four feet.

The Operator has conducted a stability analysis of the refuse pile which is included in Appendix IV of this document

UMC 784.22 Diversions

The Operator does not have a map showing the entire permit area on a scale which would adequately show the existing diversion. The diversion ditch shown on E3-3423 and A3-1427 is the only runoff diversion channel within the mine plan area. Hydrologic evaluation of the ditch, consistant with 817.43, is included in Appendix B. The Operator does not anticipate the need for any additional diversions for the life of the mine. Designs for three temporary diversions are included in Appendix II for channeling runoff away from newly graded areas during reclamation.

UMC 784.23 Operation Plan: Maps and Plans

Drawing No. E3-3334, under section (b)(12) on page 784-57, should read E3-3332.

UMC 785.19 Underground Coal Mining Activities on Areas or Adjacent to Areas Including Alluvial Valley Floors in the Arid or Semi-Arid Areas of Utah

The Operator has addressed the alluvial fan deposit as a potential aquifer on page 783-6 of the MRP text.

Mine water discharge volumes are included in this submittal. All information available to the Operator has been provided to the Division.

UMC 817.11 <u>Signs and Markers</u>

The Operator has installed signs with the following information:

Western District-Coal
United States Steel Corporation
East Carbon, Utah 84520
Phone No. 801-888-4431
Geneva Mine
MSHA No. 42-00-100
Utah Permit No. ACT/007/013
Refuse Pile No.'s 1211-UT-0018
1211-UT-0019

The permit area has been marked with roof bolts driven into the ground and flagged with colored flagging. The markers are spaced as necessary to adequately mark the permit area

UMC 817.22 <u>Topsoil: Removal</u>

Except at the solid waste landfill no future disturbances are included as a part of the MRP. Appendix D contains complete plans concerning topsoil removal at the landfill including topsoil sampling, storage, and subsoil handling. The topsoil plan for the landfill contained in Appendix D appears adequate. The general plan contained in 784.13 of the MRP is adequate for permitting when no additional future disturbances are projected in the general mine area. The vegetation study (Appendix G of the MRP) includes soil sample analyses of the Geneva Mine disturbed areas and adjacent undisturbed areas. The topsoil sample locations are shown on Map E3-3439. The subscript on the sample numbers indicate the type of sample as follows:

t = topsoil, undisturbed
s = subsoil
d = disturbed area - top layer

Any future disturbance not included in the MRP will require a technical revision. Site specific topsoil removal plans would be included in that technical revision. The soils information included in the vegetation study will be referenced in developing these plans.

The Operator will stake areas designated for topsoil removal to delineate the exact depth and area from which soils are to be removed.

The statement on page 784-24 that 12 inches of topsoil will be salvaged is in error. This statement should read that the A soil horizon or a minimum of 6 inches, whichever is greater, will be salvaged as topsoil. Reference Appendix G of the MRP for soil sample information.

The adequacy of available soils for use during reclamation has been discussed in the vegetation study. (Appendix G of the MRP)

UMC 817.23 Topsoil: Storage

1. The Operator has provided topsoil storage plans for operation of the landfill which appears to adequately address this section. There are no other areas at Geneva Mine where topsoil stripping is anticipated. Topsoil storage locations are shown on Map A3-1396 (Appendix D).

2. The anticipated volume of topsoil to be stored is included in Appendix D.

3. It is anticipated that the topsoil piles will be 4 to 5 feet deep.

4. The lateral dimensions of the pile will vary depending on the amount of topsoil actually stored.

5. The topsoil storage pile outslopes will not be steeper than 2h:1v.

6. Topsoil piles will be seeded with the following:

| | | Rate* |
|---|---|---|
| Agropyron smithi | Western Wheatgrass | 5 |
| Agropyron trachycaulum | Slender Wheatgrass | 5 |
| Hedysarum boreale | Northern Sweetclover Milkvetch | 5 |

*Pure live seed per acre
NOTE: Milkvetch may be susbstituted for Northern Sweetclover

Earth or straw bale berms will be placed around topsoil piles as necessary to protect the pile from surface drainage.

UMC 817.24 **Topsoil: Redistribution**

Surface slopes at the landfill are relatively flat and slippage surfaces couldnot develop. The final overburden surface will either be left rough following grading or ripped to a depth of 2 feet (as required) to promote revegetation and prevent any possible slippage surfaces developing under the topsoil layer.

Topsoil will be redistributed to a depth of 6 inches as the available topsoil volume permits.

(b)(2) Undue compaction of the topsoil following redistribution will be minimized by limiting travel of equipment and vehicles over the topsoil to the extent possible. Refer to the Revegetation Plan included in Appendix G of the MRP.

(b)(3) Topsoil will be protected from wind and water erosion following redistribution through mulching. Specific recommendations are included in the vegetation study (refer to Appendix G of the MRP).

Appendix C of the MRP provides typical equipment choices for use in earth moving operations during reclamation. Equipment used for topsoil redistribution would be similar.

A materials balance is included in Appendix III of this submittal.

UMC 817.25 **Topsoil: Nutrients and Amendments**

The revegetation plan in Appendix G of the MRP includes recommendations for the addition of soil amendments. The Operator will sample the soils to be planted following the completion of regrading. The samples will be analyzed for the same parameters listed on Table 7 of Appendix G. The results of these samples will be used to modify the recommendations for soil amendments (as necessary) contained in the revegetation plan.

UMC 817.42 **Hydrologic Balance: Water Quality Standards and Effluent Limitations**

Drawing No. E3-3423 shows all the disturbed areas in the yard area. The Operator does not have maps of the entire permit area at a suitable scale. Proposed sedimentation control structures for the small areas at Geneva Mine are included in Appendix D of the MRP.

UMC 817.46 Hydrologic Balance: Sedimendation Ponds

(a) See comments under UMC 784.14(a).

(g) Sedimentation Pond 9 was constructed persuant to the hydrologic evaluation approval letter included on page B-17 of Appendix B.

Ponds 3 and 4 are the only ponds which cannot contain the 10 year - 24 hour design storm. The size of these ponds cannot be increased due to 1) the lack of area available for raising impoundments since the yard is bounded by the railroad track access on one side and the natural highwall to Horse Canyon Creek on the other; and 2) the sewer line which passes beneath both ponds precludes increasing the ponds any deeper.

The Operator feels that the effluent limitations of UMC 817.42 can be met with the existing structures. This conclusion is based on the following:

1. Ponds 3 and 4 are built in series which provides primary and secondary settling prior to discharge.

2. Overflow channels have slight grades and in some areas have been riprapped to minimize additional sediment contribution from the channels.

3. All pond overflow is routed through a silt fence prior to discharge into Horse Canyon Creek.

4. The Operator is required under the NPDES permit to monitor all pond discharge. Pond discharge samples will be taken downstream from the silt fence and tested for the parameter required by the permit. Water quality reports will be reported as required by the NPDES permit.

(j) Refer to the "as constructed" drawings of sedimentation ponds for pertinant information.

(r) Certified "as constructed" drawings are included in this submittal.

(t) The Operator will inspect sedimentation ponds quarterly and submit a certified statement regarding their condition annually. A certified statement of pond conditions is included in this submittal and will be submitted at 3 month intervals hereafter.

(u) Drainage areas into sedimentation ponds during reclamation is shown on Drawing No. E3-3442 which is included in this submittal. Pond designs for enlarging ponds 1 and 3 during reclamation are included in this submittal.

The road that provides access to Horse Canyon is a public access road and is not a part of the reclamation plan. This road will provide access to all surface disturbed aras for site reconnaissance of runoff control structures. Any remedial construction of berms, sedimentation ponds or other runoff control structures which may be required will be addressed as soon as possible. Any area where excessive erosion is noted will be stabilized in a suitable manner.

(d) "As constructed" drawings show the 3 year silt accumulation level.

(e) See "as constructed" pond drawings.

(g) See "as constructed" pond drawings.

(h) The Operator will install stakes in each of the sedimentation ponds, the top of which will be set at 60 percent of the 3 year silt level.

(i) Overflow design calculations for a 25 year 24 hour storm have been included in Appendix II of this document.

The drainage area acreage for culvert 5 on page B-13 should be 73.0 which corresponds to a 79 cfs peak flow. this acreage includes the diversion ditch drainage which also passes through the culvert. Please note these changes on page B-13.

(l) Samples have been taken to determine the mechanical properties of the material used to construct the sedimentation pond impoundments. When the results of these samples are received, the Operator will furnish the Division a stability analysis of the impoundments to demonstrate that they are stable.

(m) See "as constructed" drawings for sedimentation ponds. The Operator will provide a stability evaluation for any impoundment which does not meet the requirement.

UMC 817.47 Hydrologic Balance: Discharge Structures

The Operator has used 1/4 x 3/4 inch riprap material in sedimentation pond spillway channels and on the down slope at the sewer treatment plant. All slopes are relatively flat grades where flow velocities are not significant. The size of riprap used was not established based on calculation, but rather based on the availability of "track ballast" at the mine site.

UMC 817.49 Hydrologic Balance: Permanent and Temporary Impoundments

(h) Certified "as constructed" drawings are included in this submittal.

(i) See Item 784.14(a) of this document.

UMC 817.48 Hydrologic Balance: Acid Forming and Toxic Forming Materials

A refuse sample has been taken and is being analyzed for soluable As, Ba, Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Se, B, CO3, Cl, F, Electro Conductivity, Hg, NO3, SAR, Soluable Solids, Combustible Solids, Non-Combustible Solids, % Sand-Silt-Clay, Acid-Base potential pH (initial reading), and saturation %. Results will be forwarded when received by the Operator.

UMC 817.50 Hydrologic Balance: Underground Mine Entry and Access Discharges

(a) All mine entries and accesses to underground workings, including fans and portals, and geologic strike and dip of the coal seam are clearly shown on Drawing No. F3-169.

(b) The Operator does not anticipate a gravity discharge due to the negative dip of the coal seam. See discussion under UMC 784.14(d) of this document.

UMC 817.54 Hydrologic Balance: Water Rights and Replacements

The disturbed areas at Geneva Mine are downstream from the water right discussed on page 784-30 of the MRP so there is no potential for contamination.

Refer to comments under 784.14(c).

UMC 817.57 Hydrologic Balance: Stream Buffer Zones

There are no perennial streams within the mine plan area. Horse Canyon Creek is an intermittant creek having no biological communities due to its periodic flow patterns. See page 783-46 of the MRP. This section does not apply.

UMC 817.71 Disposal of Underground Development Waste and Excess Spoil and Non-Acid and Non-Toxic Forming Coal Processing Waste

(a) Underground development waste placed at the disposal site originates as inseam rock bands, roof or floor rock in Geneva Mine. The Operator does not have any measurement of the swell factor as the solid rock is broken. The swell factor is estimated at 2.5.

Refer to comments under 784.19.

(l) Refer to comments under 784.13(b)(7) and 784.19.

UMC 817.89 Disposal of Non-Coal Waste

The Operator operates the landfill according to the requirements of the Department of Health. Appropriate distances are maintained between the landfill trenches and Horse Canyon Creek. The Operator has not identified any waterbearing strata during trench excavation. Refer to comments under 784.13(b)(7) of this document for additional information.

UMC 817.97 Protection of Fish, Wildlife, and Related Environmental Values

In the event that Geneva Mine returns to work the DWR film will be shown to employees.

The Operator will report to the appropriate regulatory authority the presence of any threatened or endangered species. The location of any new raptor nests will also be reported.

(d)(9) See comments under UMC 784.15 of this document.

UMC 817.99 Slides and Other Damage

In the event that a slide may occur which may have a potential adverse effect on public property, health, safety or the environment, the Operator will notify the Division immediately and together establish the appropriate remedial measures.

UMC 817.101 Backfilling and Grading: General Requirements

The Operator has included a plan for backfilling and grading under UMC 784.13(b)(3) in the MRP. Revised final configuration and cross section drawings are included in this submittal. The information currently provided appears to be adequate for permitting.

UMC 817.106 Regrading or Stabilizing of Rills and Gullies

Because of the varied nature of rills and gullies, they will be immediately addressed on a specific basis when and if they occur.

UMC 817.111-117 Revegetation

See comments under UMC 783.19 of this document and Appendix G of the MRP.

UMC 817.114 Revegetation: Mulching and Other Soil Stabilizing Practices

See comments under UMC 783.19 of this document.

UMC 817.122 Subsidence Control: Public Notice

The Operator will provide the Division a copy of any letters sent notifying surface owners of potential subsidence effects.

UMC 817.131 Cessation of Operations: Temporary

The Operator has provided the Division a notification of temporary cessationof operations. Similar actions will be taken as required in the future.

UMC 817.133 Postmining Land-Use

See comments under UMC 784.15.

# APPENDIX I

## WATER QUALITY INFORMATION

SURFACE WATER QUALITY DATA
GENEVA COAL MINE

| Sampling Date: | 2/81 | 3/81 | 4/81 | 5/81 |
|---|---|---|---|---|
| RF-1 | | | | |
| Flow (gpm) | NA | NA | NA | 10 |
| Acidity as CaCO3 mg/l | <0.1 | 14.0 | <0.01 | 4.00 |
| Alkalinity as CaCO3 mg/l | 520.00 | 444.00 | 386.00 | 400.00 |
| Dissolved Iron mg/l | 0.218 | 0.210 | 0.820 | 0.070 |
| Iron as Fe (Total) mg/l | 1.100 | 0.250 | 3,080 | 0.180 |
| Manganese as Mn (Tot) mg/l | 0.060 | 0.010 | 0.290 | 0.020 |
| Suspended Solids mg/l | 59.0 | 9.0 | 303 | 104 |
| Total Dissolved Solids mg/l | 1,000 | 1,800 | 950 | 900 |
| pH Units | 8.00 | 8.00 | 8.10 | 8.20 |

| Sampling Date: | 6/81 | 7/81 | 8/81 | 9/81 |
|---|---|---|---|---|
| RF-1 | | | | |
| Flow (gpm) | NA | 5 | 7 | 15 |
| Acidity as CaCO3 mg/l | <0.01 | 4.00 | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | 404.00 | 438.00 | 390.00 | 396.00 |
| Dissolved Iron mg/l | 0.030 | 0.010 | <0.001 | 0.024 |
| Iron as Fe (Total) mg/l | 0.050 | 0.020 | 0.070 | 0.065 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.010 | <0.001 | 0.013 |
| Suspended Solids mg/l | 15.0 | 8.0 | 2.0 | 7.0 |
| Total Dissolved Solids mg/l | 950 | 1,000 | 900 | 950 |
| pH Units | 8.20 | 7.70 | 8.60 | 8.30 |

| Sampling Date: | 10/81 | 11/81 | 12/81 | 3/82 |
|---|---|---|---|---|
| RF-1 | | | | |
| Flow (gpm) | 25 | 15 | 15 | 18 |
| Acidity as CaCO3 mg/l | 10.00 | <0.01 | <0.01 | 10.00 |
| Alkalinity as CaCO3 mg/l | 46.00 | 485.00 | 380.00 | 497.00 |
| Dissolved Iron mg/l | 0.030 | 0.033 | 0.026 | 1.900 |
| Iron as Fe (Total) mg/l | 0.140 | 0.065 | 0.095 | 9.400 |
| Manganese as Mn (Tot) mg/l | 0.020 | 0.020 | 0.013 | 0.018 |
| Suspended Solids mg/l | 6.2 | 5.0 | 2.0 | 130 |
| Total Dissolved Solids mg/l | 987 | 950 | 900 | 874 |
| pH Units | 8.00 | 8.20 | 8.10 | 7.60 |

| Sampling Date: | 4/82 | 5/82 | 6/82 | 7/82 |
|---|---|---|---|---|
| RF-1 | | | | |
| Flow (gpm) | 20 | 20 | 25 | 10 |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | 345.00 | 485.00 | 413.50 | 327.20 |
| Dissolved Iron mg/l | NA | NA | 0.030 | 0.030 |
| Iron as Fe (Total) mg/l | 0.200 | 1.100 | 0.100 | 0.040 |
| Manganese as Mn (Tot) mg/l | 0.020 | 0.035 | 0.008 | 0.005 |
| Suspended Solids mg/l | 15.0 | 59.0 | 13.0 | <1.0 |
| Total Dissolved Solids mg/l | 988 | 862 | 925 | 915 |
| pH Units | 8.10 | 8.20 | 8.40 | 8.50 |

# SURFACE WATER QUALITY DATA
## GENEVA COAL MINE

| Sampling Date: | 8/82 | 9/82 | 10/82 | 4/83 |
|---|---|---|---|---|
| RF-1 | | | | |
| Flow (gpm) | 25 | 20 | 20 | NA |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 | <0.01 | NA |
| Alkalinity as CaCO3 mg/l | 505.00 | 364.40 | 537.00 | NA |
| Dissolved Iron mg/l | 0.020 | 0.036 | 0.021 | NA |
| Iron as Fe (Total) mg/l | 0.025 | 0.052 | 0.030 | 26.500 |
| Manganese as Mn (Tot) mg/l | 0.008 | 0.008 | 0.010 | 0.360 |
| Suspended Solids mg/l | 4.0 | 9.0 | 8.0 | 1,648 |
| Total Dissolved Solids mg/l | 874 | 890 | 920 | 940 |
| pH Units | 8.30 | 8.40 | 8.50 | 8.10 |

| Sampling Date: | | | | |
|---|---|---|---|---|
| Flow (gpm) | | | | |
| Acidity as CaCO3 mg/l | | | | |
| Alkalinity as CaCO3 mg/l | | | | |
| Dissolved Iron mg/l | | | | |
| Iron as Fe (Total) mg/l | | | | |
| Manganese as Mn (Tot) mg/l | | | | |
| Suspended Solids mg/l | | | | |
| Total Dissolved Solids mg/l | | | | |
| pH Units | | | | |

| Sampling Date: | | | | |
|---|---|---|---|---|
| Flow (gpm) | | | | |
| Acidity as CaCO3 mg/l | | | | |
| Alkalinity as CaCO3 mg/l | | | | |
| Dissolved Iron mg/l | | | | |
| Iron as Fe (Total) mg/l | | | | |
| Manganese as Mn (Tot) mg/l | | | | |
| Suspended Solids mg/l | | | | |
| Total Dissolved Solids mg/l | | | | |
| pH Units | | | | |

| Sampling Date: | | | | |
|---|---|---|---|---|
| Flow (gpm) | | | | |
| Acidity as CaCO3 mg/l | | | | |
| Alkalinity as CaCO3 mg/l | | | | |
| Dissolved Iron mg/l | | | | |
| Iron as Fe (Total) mg/l | | | | |
| Manganese as Mn (Tot) mg/l | | | | |
| Suspended Solids mg/l | | | | |
| Total Dissolved Solids mg/l | | | | |
| pH Units | | | | |

# SURFACE WATER QUALITY DATA
# GENEVA COAL MINE

| Sampling Date: | 2/81 | 3/81 | 4/81 | 5/81 |
|---|---|---|---|---|
| B-1 | | | | |
| Flow (gpm) | NA | NA | NA | 375 |
| Acidity as CaCO3 mg/l | <0.1 | <0.1 | <0.01 | 6.00 |
| Alkalinity as CaCO3 mg/l | 424.00 | 372.00 | 346.00 | 330.00 |
| Dissolved Iron mg/l | 0.270 | 0.210 | 0.190 | 0.520 |
| Iron as Fe (Total) mg/l | 0.310 | 0.250 | 0.560 | 0.950 |
| Manganese as Mn (Tot) mg/l | 0.020 | 0.010 | 0.030 | 0.050 |
| Suspended Solids mg/l | 18.0 | 9.0 | 87.0 | 50.0 |
| Total Dissolved Solids mg/l | 1,900 | 1,800 | 2,050 | 1,700 |
| pH Units | 8.40 | 8.0 | 8.30 | 8.10 |

| Sampling Date: | 7/81 | 9/81 | 10/81 | 3/82 |
|---|---|---|---|---|
| B-1 | | | | |
| Flow (gpm) | 375 | 310 | 650 | 300 |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 | <0.01 | 4.50 |
| Alkalinity as CaCO3 mg/l | 356.00 | 298.00 | 1,095.00 | 293.60 |
| Dissolved Iron mg/l | 0.020 | 0.075 | 0.080 | 0.640 |
| Iron as Fe (Total) mg/l | 0.440 | 0.280 | 0.255 | 1.110 |
| Manganese as Mn (Tot) mg/l | 0.030 | 0.014 | 0.017 | 0.022 |
| Suspended Solids mg/l | 136 | 10.0 | 8.1 | 18.0 |
| Total Dissolved Solids mg/l | 1,850 | 2,000 | 1,850 | 362 |
| pH Units | 8.20 | 8.30 | 8.30 | 8.20 |

| Sampling Date: | 4/82 | 5/82 | 6/82 | 8/82 |
|---|---|---|---|---|
| B-1 | | | | |
| Flow (gpm) | 425 | 400 | 500 | 520 |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | 291.60 | 350.30 | 366.90 | 297.50 |
| Dissolved Iron mg/l | NA | NA | 0.760 | 0.810 |
| Iron as Fe (Total) mg/l | 1.600 | 0.060 | 1.720 | 1.920 |
| Manganese as Mn (Tot) mg/l | 0.060 | 0.015 | 0.070 | 0.090 |
| Suspended Solids mg/l | 105 | 3.0 | 98.0 | 114 |
| Total Dissolved Solids mg/l | 2,708 | 2,178 | 2,175 | 2,372 |
| pH Units | 7.80 | 8.10 | 7.90 | 8.10 |

| Sampling Date: | 9/82 | 10/82 | 4/83 |
|---|---|---|---|
| B-1 | | | |
| Flow (gpm) | 400 | 350 | NA |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 | NA |
| Alkalinity as CaCO3 mg/l | 304.00 | 399.20 | NA |
| Dissolved Iron mg/l | 0.820 | 0.920 | NA |
| Iron as Fe (Total) mg/l | 1.890 | 2.140 | 14.800 |
| Manganese as Mn (Tot) mg/l | 0.095 | 0.095 | 0.515 |
| Suspended Solids mg/l | 21.0 | 8.0 | 640 |
| Total Dissolved Solids mg/l | 2,120 | 1,900 | 1,688 |
| pH Units | 8.20 | 8.30 | 7.80 |

# SURFACE WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 3-81 | 4-81 | 5-81 | 6-81 |
|---|---|---|---|---|
| **HC1** | | | | |
| Flow (gpm) | NA | NA | 25 | NA |
| Acidity as CaCO3 mg/l | < 0.1 | < 0.01 | 10.00 | < 0.01 |
| Alkalinity as CaCO3 mg/l | 370.00 | 416.00 | 360.00 | 408.00 |
| Dissolved Iron mg/l | 0.030 | 0.010 | 0.140 | 0.010 |
| Iron as Fe (Total) mg/l | 0.060 | 0.230 | 0.270 | 0.120 |
| Manganese as Mn (Tot) mg/l | 0.030 | 0.020 | 0.040 | 0.050 |
| Suspended Solids mg/l | 1.0 | 23.0 | 12.0 | 44.0 |
| Total Dissolved Solids mg/l | 1,400 | 1,450 | 1,300 | 1,450 |
| pH Units | 7.70 | 8.10 | 8.00 | 8.10 |

| Sampling Date: | 7-81 | 8-81 | 10-81 | 11-81 |
|---|---|---|---|---|
| **HC1** | | | | |
| Flow (gpm) | 40 | 3 | 35 | 25 |
| Acidity as CaCO3 mg/l | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Alkalinity as CaCO3 mg/l | 420.00 | 416.00 | 985.00 | 452.00 |
| Dissolved Iron mg/l | 0.070 | 0.090 | 0.130 | 0.019 |
| Iron as Fe (Total) mg/l | 0.080 | 0.140 | 0.265 | 0.155 |
| Manganese as Mn (Tot) mg/l | 0.050 | 0.120 | 0.130 | 0.030 |
| Suspended Solids mg/l | 11.0 | 5.0 | 6.6 | 16.0 |
| Total Dissolved Solids mg/l | 1,400 | 1,400 | 1,500 | 1,500 |
| pH Units | 8.20 | 8.30 | 8.20 | 8.10 |

| Sampling Date: | 12-81 | 4-82 | 5-82 | 6-82 |
|---|---|---|---|---|
| **HC1** | | | | |
| Flow (gpm) | 17 | 12 | 60 | 65 |
| Acidity as CaCO3 mg/l | < 0.01 | < 0.01 | 4.00 | 2.00 |
| Alkalinity as CaCO3 mg/l | 360.00 | 252.00 | 517.50 | 412.00 |
| Dissolved Iron mg/l | 0.013 | NA | NA | 0.040 |
| Iron as Fe (Total) mg/l | 0.150 | 0.030 | 2.250 | 0.070 |
| Manganese as Mn (Tot) mg/l | 0.025 | 0.010 | 0.100 | 0.010 |
| Suspended Solids mg/l | 11.0 | 4.0 | 106 | 9.0 |
| Total Dissolved Solids mg/l | 1,325 | 1,566 | 1,372 | 1,375 |
| pH Units | 8.10 | 7.80 | 7.90 | 8.00 |

| Sampling Date: | 7-82 | 8-82 | 10-82 | 4-83 |
|---|---|---|---|---|
| **HC1** | | | | |
| Flow (gpm) | 45 | 40 | 10 | NA |
| Acidity as CaCO3 mg/l | < 0.01 | < 0.01 | 6.00 | NA |
| Alkalinity as CaCO3 mg/l | 339.50 | 523.00 | 211.00 | NA |
| Dissolved Iron mg/l | 0.040 | 0.040 | 0.038 | NA |
| Iron as Fe (Total) mg/l | 0.040 | 0.044 | 0.040 | 49.300 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.055 | 0.042 | 1.450 |
| Suspended Solids mg/l | 2.0 | 2.0 | 14.0 | 2,152 |
| Total Dissolved Solids mg/l | 1,425 | 1,502 | 1,500 | 1,188 |
| pH Units | 8.00 | 8.10 | 7.80 | 8.10 |

## SURFACE WATER QUALITY

## MINE DISCHARGES

| | 001<br>4-6-81 | 002<br>4-6-81 |
|---|---|---|
| Aluminum, Al mg/l | 0.016 | 0.025 |
| Ammonia, NH3 mg/l | 0.10 | 0.45 |
| Antimony, Sb mg/l | <0.001 | <.001 |
| Arsenic, As mg/l | 0.002 | 0.005 |
| Barium, Ba mg/l | 0.035 | 0.045 |
| Bicarbonate, HNO3 mg/l | | |
| Boron, B mg/l | 0.020 | 0.033 |
| Cadmium, Cd mg/l | <0.001 | <0.001 |
| Beryllium, Be mg/l | <0.01 | <0.01 |
| Bromide, Br mg/l | <0.001 | <0.001 |
| Cobalt, Co, mg/l | <0.001 | <0.004 |
| Chromium, Cr mg/l | <0.001 | <0.001 |
| Conductivity, umhos/cm | | |
| Copper, Cu mg/l | 0.003 | 0.006 |
| Flouride, F mg/l | 0.35 | 0.41 |
| Hardness, CaCO3 mg/l | | |
| Iron, Fe (total) mg/l | 0.120 | 0.170 |
| Lead, Pb mg/l | 0.003 | <0.001 |
| Magnesium, Mg mg/l | 112.80 | 96.00 |
| Manganese, Mn mg/l | 0.012 | 0.016 |
| Mercury, Hg mg/l | <0.0002 | <0.0002 |
| Molybdenum, Mo mg/l | 0.003 | 0.009 |
| Nickel, Ni mg/l | 0.094 | 0.095 |
| Nitrate, NO3-N mg/l | 0.66 | 0.62 |
| Nitrite, NO2-N mg/l | <0.01 | 0.08 |
| Phosphate, PO4 mg/l | 0.070 | 0.060 |
| Potassium, K mg/l | | |
| Selenium, Se mg/l | <0.001 | <0.001 |
| Sodium, Na mg/l | | |
| Sulfate, SO4 mg/l | 990 | 960 |
| Sulfide, S mg/l | 0.67 | 0.92 |
| Suspended Solids mg/l | 20.0 | 28.0 |
| Total Combustable Solids mg/l | | |
| Total Dissolved Solids mg/l | | |
| Zinc, Zn mg/l | 0.006 | 0.019 |
| pH Units | | |

# SURFACE WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 3/11/81 | 3/27/81 | 4/6/81 | 4/22/81 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | NA | NA | 1.60 | 1.60 |
| Acidity as CaCO3 mg/l | <0.1 | <0.1 | NA | <0.1 |
| Alkalinity as CaCO3 mg/l | 376.00 | 378.00 | NA | 386.00 |
| Dissolved Iron mg/l | 0.220 | 0.040 | NA | 0.020 |
| Iron as Fe (Total) mg/l | 0.240 | 0.140 | 0.120 | 0.080 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.010 | 0.012 | 0.020 |
| Oil and Grease mg/l | 1.60 | NA | 0.80 | NA |
| Suspended Solids mg/l | 8.0 | 8.0 | 20.0 | 25.0 |
| Total Dissolved Solids mg/l | 1,770 | 1,750 | NA | 2,100 |
| pH Units | 7.70 | 7.80 | 7.30 | 8.10 |

| Sampling Date: | 5/13/81 | 6/11/81 | 6/24/81 | 7/8/81 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 1.60 | 1.60 | 0.197 | 0.197 |
| Acidity as CaCO3 mg/l | | <0.01 | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | | 370.00 | 366.00 | 366.00 |
| Dissolved Iron mg/l | | 0.010 | 0.180 | 0.050 |
| Iron as Fe (Total) mg/l | | 0.080 | 0.210 | 0.080 |
| Manganese as Mn (Tot) mg/l | | 0.010 | 0.010 | <0.001 |
| Oil and Grease mg/l | | 1.00 | NA | <0.01 |
| Suspended Solids mg/l | | 1.0 | 29.0 | 9.0 |
| Total Dissolved Solids mg/l | | 1,700 | 1,900 | 1,850 |
| pH Units | | 8.10 | 8.10 | 8.20 |

| Sampling Date: | 7/22/81 | 8/12/81 | 8/26/81 | 9/9/81 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 0.197 | 0.197 | 0.197 | 0.197 |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 | 3.46 | 3.60 |
| Alkalinity as CaCO3 mg/l | 372.00 | 370.00 | 388.00 | 340.00 |
| Dissolved Iron mg/l | 0.185 | 0.038 | 0.150 | 0.024 |
| Iron as Fe (Total) mg/l | 0.240 | 0.050 | 0.260 | 0.110 |
| Manganese as Mn (Tot) mg/l | 0.012 | 0.010 | 0.018 | 0.015 |
| Oil and Grease mg/l | NA | 1.60 | NA | 1.40 |
| Suspended Solids mg/l | 5.0 | 4.0 | 12.5 | 10.0 |
| Total Dissolved Solids mg/l | 1,822 | 1,800 | 1,850 | 1,975 |
| pH Units | 8.20 | 8.30 | 7.90 | 7.60 |

| Sampling Date: | 9/9/81 | 10/14/81 | 10/28/81 | 11/10/81 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 0.197 | 0.271 | 0.271 | 0.271 |
| Acidity as CaCO3 mg/l | <0.01 | 2.40 | 6.00 | <0.01 |
| Alkalinity as CaCO3 mg/l | 368.00 | 363.00 | 362.00 | 439.00 |
| Dissolved Iron mg/l | 0.040 | 0.040 | 0.085 | NA |
| Iron as Fe (Total) mg/l | 0.068 | 0,115 | 0.112 | 0.112 |
| Manganese as Mn (Tot) mg/l | 0.015 | 0.015 | 0.018 | 0.050 |
| Oil and Grease mg/l | NA | 2.50 | NA | 0.20 |
| Suspended Solids mg/l | 13.0 | 4.0 | 11.0 | 15.0 |
| Total Dissolved Solids mg/l | 1,985 | 2,000 | 1,900 | 1,800 |
| pH Units | 8.10 | 7.95 | 7.90 | 8.10 |

# SURFACE WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 11/15/81 | 12/9/81 | 12/23/81 | 1/13/82 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 0.271 | 0.271 | 0.271 | 0.127 |
| Acidity as CaCO3 mg/l | | | | |
| Alkalinity as CaCO3 mg/l | | | | |
| Dissolved Iron mg/l | | | | |
| Iron as Fe (Total) mg/l | | | | |
| Manganese as Mn (Tot) mg/l | | | | |
| Oil and Grease mg/l | | | | |
| Suspended Solids mg/l | | | | |
| Total Dissolved Solids mg/l | | | | |
| pH Units | | | | |

| Sampling Date: | 1/27/82 | 2/9/82 | 2/22/82 | 3/9/82 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 0.127 | 0.319 | 0.319 | 0.325 |
| Acidity as CaCO3 mg/l | | <0.01 | NA | 6.00 |
| Alkalinity as CaCO3 mg/l | | 238.00 | NA | 472.00 |
| Dissolved Iron mg/l | | 0.110 | NA | 0.380 |
| Iron as Fe (Total) mg/l | | 0.125 | 0.240 | 0.420 |
| Manganese as Mn (Tot) mg/l | | 0.044 | NA | 0.062 |
| Oil and Grease mg/l | | <1.0 | NA | 1.60 |
| Suspended Solids mg/l | | 5.0 | 26.0 | 2.0 |
| Total Dissolved Solids mg/l | | 2,000 | 2,150 | 2,456 |
| pH Units | | 7.70 | 7.70 | 7.80 |

| Sampling Date: | 3/23/82 | 4/13/82 | 4/27/82 | 5/13/82 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 0.325 | 0.119 | 0.119 | 0.162 |
| Acidity as CaCO3 mg/l | NA | <0.01 | NA | 10.0 |
| Alkalinity as CaCO3 mg/l | NA | 323.50 | NA | 381.20 |
| Dissolved Iron mg/l | NA | 0.180 | NA | 0.250 |
| Iron as Fe (Total) mg/l | 0.260 | 0.195 | 0.286 | 0.250 |
| Manganese as Mn (Tot) mg/l | NA | 0.020 | NA | 0.040 |
| Oil and Grease mg/l | NA | 1.4 | NA | <0.1 |
| Suspended Solids mg/l | 1.0 | 13.0 | 4.0 | 5.0 |
| Total Dissolved Solids mg/l | 2,308 | 2,654 | 2,632 | 2,566 |
| pH Units | 7.80 | 7.90 | 7.90 | 7.80 |

| Sampling Date: | 5/24/82 | 6/8/82 | 6/23/82 | 7/13/82 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 0.162 | 0.184 | 0.184 | 0.183 |
| Acidity as CaCO3 mg/l | NA | <0.01 | NA | 1.00 |
| Alkalinity as CaCO3 mg/l | NA | 401.10 | NA | 313.40 |
| Dissolved Iron mg/l | NA | 0.200 | NA | 0.250 |
| Iron as Fe (Total) mg/l | 0.150 | 0.210 | 0.230 | 0.250 |
| Manganese as Mn (Tot) mg/l | NA | 0.015 | NA | 0.035 |
| Oil and Grease mg/l | NA | 0.2 | NA | 1.2 |
| Suspended Solids mg/l | 2.0 | 9.0 | 6.0 | 5.0 |
| Total Dissolved Solids mg/l | 2,268 | 1,875 | 2,150 | 2,035 |
| pH Units | 8.00 | 7.90 | 7.80 | 7.80 |

## SURFACE WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 7/28/82 | 8/11/82 | 8/26/82 | 9/15/82 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 0.263 | 0.208 | 0.208 | 0.234 |
| Acidity as CaCO3 mg/l | NA | 1.00 | NA | 9.00 |
| Alkalinity as CaCO3 mg/l | NA | 398.70 | NA | 348.50 |
| Dissolved Iron mg/l | NA | 0.050 | NA | 0.285 |
| Iron as Fe (Total) mg/l | 0.290 | 0.116 | 0.180 | 0.335 |
| Manganese as Mn (Tot) mg/l | NA | 0.055 | NA | 0.015 |
| Oil and Grease mg/l | NA | <0.1 | NA | 0.4 |
| Suspended Solids mg/l | 1.0 | 7.0 | 38.0 | 1.0 |
| Total Dissolved Solids mg/l | 1,970 | 1,890 | 1,820 | 2,610 |
| pH Units | 8.00 | 8.00 | 7.90 | 7.60 |

| Sampling Date: | 9/28/82 | 10/12/82 | 10/26/82 | 11/10/82 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 0.263 | 0.208 | 0.208 | 0.234 |
| Acidity as CaCO3 mg/l | NA | 1.00 | NA | 9.00 |
| Alkalinity as CaCO3 mg/l | NA | 398.70 | NA | 348.50 |
| Dissolved Iron mg/l | NA | 0.050 | NA | 0.285 |
| Iron as Fe (Total) mg/l | 0.290 | 0.116 | 0.180 | 0.335 |
| Manganese as Mn (Tot) mg/l | NA | 0.055 | NA | 0.015 |
| Oil and Grease mg/l | NA | <0.1 | NA | 0.4 |
| Suspended Solids mg/l | 1.0 | 7.0 | 38.0 | 1.0 |
| Total Dissolved Solids mg/l | 1,970 | 1,890 | 1,8250 | 2,610 |
| pH Units | 8.00 | 8.00 | 7.90 | 7.60 |

| Sampling Date: | 11/24/82 | 12/8/82 | 12/22/82 | 1/12/83 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 0.234 | 0.263 | 0.263 | 0.272 |
| Acidity as CaCO3 mg/l | NA | <0.01 | NA | <0.01 |
| Alkalinity as CaCO3 mg/l | NA | 319.80 | NA | 439.00 |
| Dissolved Iron mg/l | NA | 0.420 | NA | 0.340 |
| Iron as Fe (Total) mg/l | 0.370 | 0.430 | 0.210 | 0.340 |
| Manganese as Mn (Tot) mg/l | NA | 0.025 | NA | 0.030 |
| Oil and Grease mg/l | NA | 0.6 | NA | 1.2 |
| **Suspended Solids mg/l** | **6.0** | **17.0** | **5.0** | **4.0** |
| Total Dissolved Solids mg/l | 1,920 | 1,815 | 1,840 | 1,890 |
| pH Units | 8.00 | 8.10 | 7.90 | 8.10 |

| Sampling Date: | 1/26/83 | 2/9/83 | 2/22/83 | 3/9/83 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | 0.272 | NA | NA | NA |
| Acidity as CaCO3 mg/l | NA | 6.00 | NA | 3.0 |
| Alkalinity as CaCO3 mg/l | NA | 328.20 | NA | 344.70 |
| Dissolved Iron mg/l | NA | 0.380 | NA | 0.320 |
| Iron as Fe (Total) mg/l | 0.550 | 0.430 | 0.190 | 0.320 |
| Manganese as Mn (Tot) mg/l | NA | 0.020 | NA | 0.030 |
| Oil and Grease mg/l | NA | 0.6 | NA | <0.2 |
| Suspended Solids mg/l | 17.0 | 26.0 | <0.1 | 5.0 |
| Total Dissolved Solids mg/l | 1,850 | 1,800 | 1,775 | 1,810 |
| pH Units | 7.80 | 7.80 | 7.80 | 7.50 |

# SURFACE WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 3/23/83 | 4/14/83 | 4/28/83 | 5/17/83 |
|---|---|---|---|---|
| 001 | | | | |
| Average Flow (Mgpd) | NA | 0.075 | 0.075 | 0.048 |
| Acidity as CaCO3 mg/l | NA | <0.01 | NA | <0.01 |
| Alkalinity as CaCO3 mg/l | NA | 324.00 | NA | 338.00 |
| Dissolved Iron mg/l | NA | 0.310 | NA | 0.190 |
| Iron as Fe (Total) mg/l | 0.200 | 0.370 | 0.290 | 0.190 |
| Manganese as Mn (Tot) mg/l | NA | 0.025 | NA | 0.018 |
| Oil and Grease mg/l | NA | <0.2 | NA | <0.1 |
| Suspended Solids mg/l | 13.0 | 3.0 | 15.0 | 11.0 |
| Total Dissolved Solids mg/l | 1,810 | 2,160 | 2,172 | 2,124 |
| pH Units | 7.30 | 7.10 | 7.80 | 8.20 |

| Sampling Date: | 5/26/83 | 6/8/83 | 6/29/83 |
|---|---|---|---|
| 001 | | | |
| Average Flow (Mgpd) | 0.048 | | |
| Acidity as CaCO3 mg/l | NA | <0.01 | NA |
| Alkalinity as CaCO3 mg/l | NA | 320.00 | NA |
| Dissolved Iron mg/l | NA | 0.030 | NA |
| Iron as Fe (Total) mg/l | 0.240 | 0.170 | 0.100 |
| Manganese as Mn (Tot) mg/l | NA | 0.027 | NA |
| Oil and Grease mg/l | NA | <0.2 | NA |
| Suspended Solids mg/l | 30.0 | 29.0 | 11.0 |
| Total Dissolved Solids mg/l | 2,016 | 1,988 | 1,710 |
| pH Units | 8.00 | 7.90 | 7.80 |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| **Manganese as Mn (Tot) mg/l** |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

# SURFACE WATER QUALITY - GENEVA COAL MINE

| Sampling Date: | 2/12/81 | 2/27/81 | 3/11/81 | 3/27/81 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | NA | NA | NA | NA |
| Acidity as CaCO3 mg/l | <0.1 | 12.0 | 8.0 | 10.0 |
| Alkalinity as CaCO3 mg/l | 462.00 | 430.00 | 432.00 | 390.00 |
| Dissolved Iron mg/l | NA | 0.270 | 0.620 | 0.310 |
| Iron as Fe (Total) mg/l | 0.660 | 0.270 | 0.650 | 0.340 |
| Manganese as Mn (Tot) mg/l | NA | 0.025 | 0.030 | 0.020 |
| Oil and Grease mg/l | 5.60 | NA | 1.20 | NA |
| Suspended Solids mg/l | 3.0 | 6.0 | 7.0 | 6.0 |
| Total Dissolved Solids mg/l | 1,750 | 1,950 | 1,750 | 1,700 |
| pH Units | 8.40 | 7.50 | 7.60 | 7.30 |

| Sampling Date: | 4/6/81 | 4/22/81 | 5/13/81 | 6/11/81 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.319 | 0.319 | 0.319 | 0.319 |
| Acidity as CaCO3 mg/l | NA | 10.00 | 35.00 | |
| Alkalinity as CaCO3 mg/l | NA | 368.00 | 470.00 | |
| Dissolved Iron mg/l | NA | 0.020 | 0.050 | |
| Iron as Fe (Total) mg/l | 0.170 | 0.310 | 0.160 | |
| Manganese as Mn (Tot) mg/l | 0.016 | 0.250 | 0.020 | |
| Oil and Grease mg/l | 0.80 | NA | 2.10 | |
| Suspended Solids mg/l | 28.0 | 18.0 | 9.0 | |
| Total Dissolved Solids mg/l | NA | 1,900 | 1,800 | |
| pH Units | 7.40 | 7.60 | 7.80 | |

| Sampling Date: | 6/24/81 | 7/8/81 | 7/22/81 | 8/12/81 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.319 | 0.225 | 0.225 | 0.225 |
| Acidity as CaCO3 mg/l | 6.80 | 8.00 | 5.70 | 20.00 |
| Alkalinity as CaCO3 mg/l | 404.00 | 404.00 | 364.00 | 382.00 |
| Dissolved Iron mg/l | 0.330 | 0.110 | 0.350 | 0.090 |
| Iron as Fe (Total) mg/l | 0.350 | 0.140 | 0.398 | 0.150 |
| Manganese as Mn (Tot) mg/l | 0.080 | <0.001 | 0.085 | 0.010 |
| Oil and Grease mg/l | NA | <0.01 | NA | 0.80 |
| Suspended Solids mg/l | 19.0 | 9.0 | 4.0 | 5.0 |
| Total Dissolved Solids mg/l | 1,800 | 1,800 | 1,810 | 1,700 |
| pH Units | 7.80 | 7.80 | 7.70 | 7.90 |

| Sampling Date: | 8/26/81 | 9/9/81 | 9/23/81 | 10/14/81 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.225 | 0.225 | 0.225 | 0.213 |
| Acidity as CaCO3 mg/l | | | | 10.00 |
| Alkalinity as CaCO3 mg/l | | | | 451.00 |
| Dissolved Iron mg/l | | | | 0.095 |
| Iron as Fe (Total) mg/l | | | | 0.150 |
| Manganese as Mn (Tot) mg/l | | | | 0.010 |
| Oil and Grease mg/l | | | | 0.20 |
| Suspended Solids mg/l | | | | 2.0 |
| Total Dissolved Solids mg/l | | | | 1,800 |
| pH Units | | | | 7.80 |

# SURFACE WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 10/28/81 | 11/10/81 | 11/25/81 | 12/9/81 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.213 | 0.213 | 0.213 | 0.213 |
| Acidity as CaCO3 mg/l | | | | |
| Alkalinity as CaCO3 mg/l | | | | |
| Dissolved Iron mg/l | | | | |
| Iron as Fe (Total) mg/l | | | | |
| Manganese as Mn (Tot) mg/l | | | | |
| Oil and Grease mg/l | | | | |
| Suspended Solids mg/l | | | | |
| Total Dissolved Solids mg/l | | | | |
| pH Units | | | | |

| Sampling Date: | 12/13/81 | 1/13/82 | 1/27/82 | 2/9/82 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.213 | 0.000 | 0.000 | 0.000 |
| Acidity as CaCO3 mg/l | | | | |
| Alkalinity as CaCO3 mg/l | | | | |
| Dissolved Iron mg/l | | | | |
| Iron as Fe (Total) mg/l | | | | |
| Manganese as Mn (Tot) mg/l | | | | |
| Oil and Grease mg/l | | | | |
| Suspended Solids mg/l | | | | |
| Total Dissolved Solids mg/l | | | | |
| pH Units | | | | |

| Sampling Date: | 2/22/82 | 3/9/82 | 3/23/82 | 4/13/82 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.000 | 0.122 | 0.122 | 0.197 |
| Acidity as CaCO3 mg/l | | | NA | <0.01 |
| Alkalinity as CaCO3 mg/l | | | NA | 335.80 |
| Dissolved Iron mg/l | | | NA | 0.570 |
| Iron as Fe (Total) mg/l | | | 0.630 | 0.588 |
| Manganese as Mn (Tot) mg/l | | | NA | 0.050 |
| Oil and Grease mg/l | | | NA | 1.6 |
| Suspended Solids mg/l | | | 1.0 | 12.0 |
| Total Dissolved Solids mg/l | | | 2,516 | 2,404 |
| pH Units | | | 7.40 | 7.60 |

| Sampling Date: | 4/27/82 | 5/17/82 | 5/24/82 | 6/8/82 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.197 | 0.185 | 0.185 | 0.819 |
| Acidity as CaCO3 mg/l | NA | 12.00 | NA | 24.00 |
| Alkalinity as CaCO3 mg/l | NA | 442.10 | NA | 410.20 |
| Dissolved Iron mg/l | NA | 0.300 | NA | 0.350 |
| Iron as Fe (Total) mg/l | 0.665 | 0.300 | 0.250 | 0.350 |
| Manganese as Mn (Tot) mg/l | NA | 0.035 | NA | 0.045 |
| Oil and Grease mg/l | NA | <0.1 | NA | 0.6 |
| Suspended Solids mg/l | 6.0 | 6.0 | 3.0 | 9.0 |
| Total Dissolved Solids mg/l | 2,772 | 2,150 | 2,192 | 2,275 |
| pH Units | 7.60 | 7.70 | 7.70 | 7.50 |

# SURFACE WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 6/23/82 | 7/13/82 | 7/29/82 | 8/11/82 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.819 | 0.360 | 0.360 | 0.253 |
| Acidity as CaCO3 mg/l | NA | | NA | 10.00 |
| Alkalinity as CaCO3 mg/l | NA | | NA | 311.80 |
| Dissolved Iron mg/l | NA | | NA | 0.320 |
| Iron as Fe (Total) mg/l | 0.160 | | 1.100 | 0.350 |
| Manganese as Mn (Tot) mg/l | NA | | NA | 0.030 |
| Oil and Grease mg/l | NA | | NA | 0.2 |
| Suspended Solids mg/l | 5.0 | | 14.0 | 5.0 |
| Total Dissolved Solids mg/l | 2,200 | | 2,344 | 2,450 |
| pH Units | 7.40 | | 7.60 | 7.80 |

| **Sampling Date:** | **8/27/82** | **9/15/82** | **9/28/82** | **10/12/82** |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.253 | 0.185 | 0.185 | 0.164 |
| Acidity as CaCO3 mg/l | NA | 5.00 | NA | 8.00 |
| Alkalinity as CaCO3 mg/l | NA | 346.10 | NA | 485.10 |
| Dissolved Iron mg/l | NA | 0.290 | NA | 0.065 |
| Iron as Fe (Total) mg/l | 1.320 | 0.330 | 0.230 | 0.380 |
| Manganese as Mn (Tot) mg/l | NA | 0.036 | NA | 0.041 |
| Oil and Grease mg/l | NA | <0.1 | NA | <0.1 |
| Suspended Solids mg/l | 18.0 | 25.0 | 1.0 | 6.0 |
| Total Dissolved Solids mg/l | 1,900 | 2,190 | 1,820 | 1,800 |
| pH Units | 7.80 | 7.80 | 7.80 | 7.60 |

| Sampling Date: | 10/26/82 | 11/10/82 | 11/24/82 | 12/8/82 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.164 | 0.180 | 1.180 | 0.153 |
| Acidity as CaCO3 mg/l | NA | <0.01 | NA | 3.00 |
| Alkalinity as CaCO3 mg/l | NA | 339.60 | NA | 320.20 |
| Dissolved Iron mg/l | NA | 0.065 | NA | 0.520 |
| Iron as Fe (Total) mg/l | 0.240 | 0.120 | 0.570 | 0.535 |
| Manganese as Mn (Tot) mg/l | NA | 0.020 | NA | 0.025 |
| Oil and Grease mg/l | NA | 0.8 | NA | 1.0 |
| Suspended Solids mg/l | 5.0 | 2.0 | 3.0 | 11.0 |
| Total Dissolved Solids mg/l | 1,910 | 1,900 | 2,500 | 2,505 |
| pH Units | 7.70 | 8.10 | 7.40 | 7.50 |

| Sampling Date: | 12/22/82 | 1/13/83 | 1/27/83 | 2/9/83 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.153 | 0.993 | 0.993 | 0.150 |
| Acidity as CaCO3 mg/l | NA | 9.00 | NA | 11.00 |
| Alkalinity as CaCO3 mg/l | NA | 422.50 | NA | 329.00 |
| Dissolved Iron mg/l | NA | 0.500 | NA | NA |
| Iron as Fe (Total) mg/l | 0.380 | 0.530 | 0.300 | 0.310 |
| Manganese as Mn (Tot) mg/l | NA | 0.025 | NA | 0.015 |
| Oil and Grease mg/l | NA | <0.1 | NA | <0.1 |
| Suspended Solids mg/l | 8.0 | 9.0 | 27.0 | 27.0 |
| Total Dissolved Solids mg/l | 2,510 | 1,785 | 2,500 | 1,775 |
| pH Units | 7.70 | 7.50 | 7.60 | 7.60 |

# SURFACE WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 2/22/83 | 3/9/83 | 3/23/83 | 4/13/83 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.150 | 0.132 | 0.132 | 0.304 |
| Acidity as CaCO3 mg/l | NA | 7.00 | NA | <0.01 |
| Alkalinity as CaCO3 mg/l | NA | 351.30 | NA | 394.00 |
| Dissolved Iron mg/l | NA | 0.270 | NA | 0.380 |
| Iron as Fe (Total) mg/l | 0.250 | 0.270 | 0.285 | 0.380 |
| Manganese as Mn (Tot) mg/l | NA | 0.015 | NA | 0.015 |
| Oil and Grease mg/l | NA | <0.2 | NA | <0.2 |
| Suspended Solids mg/l | 1.0 | 3.0 | 13.0 | <0.1 |
| Total Dissolved Solids mg/l | 1,845 | 1,725 | 1,750 | 1,710 |
| pH Units | 7.60 | 7.40 | 7.20 | 7.80 |

| Sampling Date: | 4/27/83 | 5/10/83 | 5/25/83 | 6/8/83 |
|---|---|---|---|---|
| 002 | | | | |
| Average Flow (Mgpd) | 0.304 | 0.253 | 0.253 | |
| Acidity as CaCO3 mg/l | NA | <0.01 | NA | <0.01 |
| Alkalinity as CaCO3 mg/l | NA | 428.00 | NA | 374.00 |
| Dissolved Iron mg/l | NA | 0.300 | NA | 0.030 |
| Iron as Fe (Total) mg/l | 0.410 | 0.445 | 0.370 | 0.220 |
| Manganese as Mn (Tot) mg/l | NA | 0.017 | NA | 0.015 |
| Oil and Grease mg/l | NA | <0.2 | NA | 1.2 |
| Suspended Solids mg/l | 14.0 | 11.0 | 27.0 | 12.0 |
| Total Dissolved Solids mg/l | 1,988 | 1,822 | 1,978 | 1,902 |
| pH Units | 7.60 | 7.80 | 7.80 | 7.70 |

| Sampling Date: | 6/29/83 |
|---|---|
| 002 | |
| Average Flow (Mgpd) | |
| Acidity as CaCO3 mg/l | NA |
| Alkalinity as CaCO3 mg/l | NA |
| Dissolved Iron mg/l | NA |
| Iron as Fe (Total) mg/l | 0.180 |
| Manganese as Mn (Tot) mg/l | NA |
| Oil and Grease mg/l | NA |
| Suspended Solids mg/l | 13.0 |
| Total Dissolved Solids mg/l | 1,724 |
| pH Units | 7.60 |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Oil and Grease mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

# SURFACE WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 2/1281 | 3/11/82 | 4/6/81 | 5/13/81 |
|---|---|---|---|---|
| 003 | | | | |
| BOD 5 day mg/l | 4.8 | 0.19 | 0.04 | NA |
| Free Chlorine (Avail) as Cl2 | 0.20 | 0.19 | 0.04 | NA |
| MPN Fecal Coliform MPN/100 ml | <2.0 | 790 | <2.0 | <2.0 |
| MPN Total Coliform MPN/100 ml | 8.0 | 1,300 | NA | 460 |
| Oil and Grease mg/l | 2.01 | 3.80 | <0.01 | 1.20 |
| Suspended Solids mg/l | 26.0 | 4.0 | 30.0 | 16.0 |
| Total Chlorine mg/l | NA | NA | NA | <0.01 |
| pH Units | 7.80 | 7.50 | 7.50 | 7.50 |

| Sampling Date: | 6/11/81 | 7/8/81 | 8/12/81 | 9/9/81 |
|---|---|---|---|---|
| 003 | | | | |
| BOD 5 day mg/l | 16.8 | 12.0 | 4.5 | 11.0 |
| Free Chlorine (Avail) as Cl2 | NA | NA | NA | NA |
| MPN Fecal Coliform MPN/100 ml | <2.0 | 23.0 | 23.0 | <2.0 |
| MPN Total Coliform MPN/100 ml | 130 | 700 | 3,300 | 110 |
| Oil and Grease mg/l | <0.01 | 1.20 | 5.40 | <0.01 |
| Suspended Solids mg/l | 32.0 | 30.0 | 2.0 | 9.0 |
| Total Chlorine mg/l | 0.04 | 0.01 | 0.08 | 0.06 |
| pH Units | 7.20 | 7.30 | 7.50 | 7.70 |

| Sampling Date: | 10/15/81 | 11/10/81 | 11/12/81 | 12/9/81 |
|---|---|---|---|---|
| 003 | | | | |
| BOD 5 day mg/l | 2.6 | 4.4 | NA | 2.0 |
| MPN Fecal Coliform MPN/100 ml | <2.0 | NA | <2.0 | <2.0 |
| MPN Total Coliform MPN/100 ml | 8.0 | NA | <2.0 | <2.0 |
| Oil and Grease mg/l | 2.70 | 0.80 | NA | 4.00 |
| Suspended Solids mg/l | 4.0 | 2.0 | NA | 4.2 |
| Total Chlorine mg/l | 1.58 | 3.17 | NA | 2.14 |
| pH Units | 7.68 | 7.50 | NA | 7.70 |

| Sampling Date: | 1/13/82 | 2/9/82 | 3/9/82 | 4/14/82 |
|---|---|---|---|---|
| 003 | | | | |
| BOD 5 day mg/l | 6.6 | 6.5 | 7.0 | 1.8 |
| MPN Fecal Coliform MPN/100 ml | 3,300 | 2.0 | 5.0p | <2.0 |
| MPN Total Coliform MPN/100 ml | 13,000 | 79.0 | 130 | 1,700 |
| Oil and Grease mg/l | 2.20 | <1.0 | 1.20 | 1.6 |
| Suspended Solids mg/l | 12.0 | 15.0 | 3.2 | 4.0 |
| Total Chlorine mg/l | 3.11 | 2.46 | 3.78 | 0.06 |
| pH Units | 7.40 | 7.40 | 7.70 | 7.70 |

## SURFACE WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 5/17/82 | 6/8/82 | 7/13/82 | 8/11/82 |
|---|---|---|---|---|
| 003 | | | | |
| BOD 5 Day mg/l | 3.7 | 3.5 | 12.6 | 9.5 |
| MPN Fecal Coliform MPN/100 ml | <2.0 | <2.0 | 5.0 | <2.0 |
| MPN Total Coliform MPN/100 ml | 79.0 | 1,300 | 13,000 | 4,900 |
| Oil and Grease mg/l | 4.0 | 1.8 | 13.0 | 0.6 |
| Suspended Solids mg/l | 16.0 | 22.0 | 18.0 | 8.5 |
| Total Chlorine mg/l | <0.01 | <0.01 | <0.01 | <0.01 |
| pH Units | 7.90 | 7.80 | 7.50 | 7.90 |

| Sampling Date: | 9/15/82 | 10/12/82 | 11/19/82 | 12/8/82 |
|---|---|---|---|---|
| 003 | | | | |
| BOD 5 Day mg/l | 7.0 | 5.0 | 2.0 | 2.1 |
| MPN Fecal Coliform MPN/100 ml | <2.0 | <2.0 | <2.0 | <2.0 |
| MPN Total Coliform MPN/100 ml | <2.0 | 21.0 | <2.0 | 11.0 |
| Oil and Grease mg/l | 0.4 | 0.8 | 0.6 | 0.6 |
| Suspended Solids mg/l | 16.0 | 18.0 | 8.0 | 15.0 |
| Total Chlorine mg/l | <0.01 | 5.48 | 0.63 | 0.83 |
| pH Units | 7.30 | 7.60 | NA | 7.60 |

| Sampling Date: | 1/12/83 | 2/9/83 | 3/9/83 | 4/13/83 |
|---|---|---|---|---|
| 003 | | | | |
| BOD 5 day mg/l | 4.4 | 5.2 | 5.0 | 2.8 |
| MPN Fecal Coliform MPN/100 ml | <2 | <2 | <2 | <2 |
| MPN Total Coliform MPN/100 ml | <2.0 | 79.0 | <2.0 | 33.0 |
| Oil and Grease mg/l | <0.2 | 0.2 | <0.2 | <0.2 |
| Suspended Solids mg/l | 24.0 | 13.0 | 12.0 | 4.0 |
| Total Chlorine mg/l | 0.84 | 0.07 | 4.22 | 0.34 |
| pH Units | 7.80 | 7.50 | 7.50 | 7.60 |

| Sampling Date: | 5/10/83 | 6/8/83 |
|---|---|---|
| 003 | | |
| BOD 5 day mg/l | 3.2 | 3.90 |
| MPN Fecal Coliform MPN/100 ml | <2 | 2 |
| MPN Total Coliform MPN/100 ml | <2.0 | 22.0 |
| Oil and Grease mg/l | <0.2 | 0.6 |
| Suspended Solids mg/l | 12.0 | 14.0 |
| Total Chlorine mg/l | 0.09 | <0.02 |
| pH Units | 7.90 | 7.80 |

SURFACE WATER QUALITY DAT/
GENEVA COAL MINE

| Sampling Date: | 2/81 | 3/81 | 4/81 | 5/81 |
|---|---|---|---|---|
| B-1 | | | | |
| Flow (gpm) | NA | NA | NA | 375 |
| Acidity as CaCO3 mg/l | <0.1 | <0.1 | <0.01 | 6.00 |
| Alkalinity as CaCO3 mg/l | 424.00 | 372.00 | 346.00 | 330.00 |
| Dissolved Iron mg/l | 0.270 | 0.210 | 0.190 | 0.520 |
| Iron as Fe (Total) mg/l | 0.310 | 0.250 | 0.560 | 0.950 |
| Manganese as Mn (Tot) mg/l | 0.020 | 0.010 | 0.030 | 0.050 |
| Suspended Solids mg/l | 18.0 | 9.0 | 87.0 | 50.0 |
| Total Dissolved Solids mg/l | 1,900 | 1,800 | 2,050 | 1,700 |
| pH Units | 8.40 | 8.0 | 8.30 | 8.10 |

| Sampling Date: | 7/81 | 9/81 | 10/81 | 3/82 |
|---|---|---|---|---|
| B-1 | | | | |
| Flow (gpm) | 375 | 310 | 650 | 300 |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 | <0.01 | 4.50 |
| Alkalinity as CaCO3 mg/l | 356.00 | 298.00 | 1,095.00 | 293.60 |
| Dissolved Iron mg/l | 0.020 | 0.075 | 0.080 | 0.640 |
| Iron as Fe (Total) mg/l | 0.440 | 0.280 | 0.255 | 1.110 |
| Manganese as Mn (Tot) mg/l | 0.030 | 0.014 | 0.017 | 0.022 |
| Suspended Solids mg/l | 136 | 10.0 | 8.1 | 18.0 |
| Total Dissolved Solids mg/l | 1,850 | 2,000 | 1,850 | 362 |
| pH Units | 8.20 | 8.30 | 8.30 | 8.20 |

| Sampling Date: | 4/82 | 5/82 | 6/82 | 8/82 |
|---|---|---|---|---|
| B-1 | | | | |
| Flow (gpm) | 425 | 400 | 500 | 520 |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | 291.60 | 350.30 | 366.90 | 297.50 |
| Dissolved Iron mg/l | NA | NA | 0.760 | 0.810 |
| Iron as Fe (Total) mg/l | 1.600 | 0.060 | 1.720 | 1.920 |
| Manganese as Mn (Tot) mg/l | 0.060 | 0.015 | 0.070 | 0.090 |
| Suspended Solids mg/l | 105 | 3.0 | 98.0 | 114 |
| Total Dissolved Solids mg/l | 2,708 | 2,178 | 2,175 | 2,372 |
| pH Units | 7.80 | 8.10 | 7.90 | 8.10 |

| Sampling Date: | 9/82 | 10/82 | 4/83 |
|---|---|---|---|
| B-1 | | | |
| Flow (gpm) | 400 | 350 | NA |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 | NA |
| Alkalinity as CaCO3 mg/l | 304.00 | 399.20 | NA |
| Dissolved Iron mg/l | 0.820 | 0.920 | NA |
| Iron as Fe (Total) mg/l | 1.890 | 2.140 | 14.800 |
| Manganese as Mn (Tot) mg/l | 0.095 | 0.095 | 0.515 |
| Suspended Solids mg/l | 21.0 | 8.0 | 640 |
| Total Dissolved Solids mg/l | 2,120 | 1,900 | 1,688 |
| pH Units | 8.20 | 8.30 | 7.80 |

GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 2-81 | 3-81 | 4-81 | 5-81 |
|---|---|---|---|---|
| RS2 | | | | |
| Flow (gpm) | NA | NA | NA | 20 |
| Acidity as CaCO3 mg/l | < 0.1 | < 0.1 | 2.50 | 4.00 |
| Alkalinity as CaCO3 mg/l | 500.00 | 434.00 | 418.00 | 450.00 |
| Dissolved Iron mg/l | 0.032 | 0.060 | NA | 0.390 |
| Iron as Fe (Total) mg/l | 0.040 | 0.190 | 0.160 | 0.440 |
| Manganese as Mn (Tot) mg/l | < 0.001 | 0.050 | 0.010 | 0.050 |
| Suspended Solids mg/l | NA | NA | NA | 9.0 |
| Total Dissolved Solids mg/l | 900 | 900 | 1,000 | 900 |
| pH Units | 8.10 | 7.80 | 8.00 | 8.20 |

| Sampling Date: | 6-81 | 7-81 | 8-81 | 9-81 |
|---|---|---|---|---|
| RS2 | | | | |
| Flow (gpm) | NA | 34 | 24 | 25 |
| Acidity as CaCO3 mg/l | < 0.01 | 4.00 | 4.00 | < 0.01 |
| Alkalinity as CaCO3 mg/l | 424.00 | 424.00 | 416.00 | 430.00 |
| Dissolved Iron mg/l | 0.010 | <0.001 | <0.001 | 0.018 |
| Iron as Fe (Total) mg/l | 0.400 | 0.010 | 0.070 | 0.420 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.010 | 0.010 | 0.009 |
| Suspended Solids mg/l | 113 | 14.0 | 5.0 | 8.0 |
| Total Dissolved Solids mg/l | 900 | 950 | 900 | 950 |
| pH Units | 8.10 | 7.80 | 8.10 | 8.10 |

| Sampling Date: | 10-81 | 11-81 | 12-81 | 4-82 |
|---|---|---|---|---|
| RS2 | | | | |
| Flow (gpm) | 30 | 30 | 24 | 20 |
| Acidity as CaCO3 mg/l | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Alkalinity as CaCO3 mg/l | 79.00 | 486.00 | 388.00 | 494.00 |
| Dissolved Iron mg/l | 0.020 | NA | 0.015 | NA |
| Iron as Fe (Total) mg/l | 0.450 | 0.465 | 0.460 | <0.001 |
| Manganese as Mn (Tot) mg/l | 0.015 | 0.025 | 0.017 | 0.010 |
| Suspended Solids mg/l | 6.1 | NA | 2.0 | 7.0 |
| Total Dissolved Solids mg/l | 950 | 900 | 900 | 1,050 |
| pH Units | 8.30 | 8.10 | 8.30 | 7.80 |

| Sampling Date: | 5-82 | 6-82 | 7-82 | 8-82 |
|---|---|---|---|---|
| RS2 | | | | |
| Flow (gpm) | 30 | 30 | 25 | 30 |
| Acidity as CaCO3 mg/l | 6.00 | 18.00 | 5.00 | <0.01 |
| Alkalinity as CaCO3 mg/l | 520.20 | 411.00 | 500.00 | 536.00 |
| Dissolved Iron mg/l | NA | 0.010 | 0.030 | 0.060 |
| Iron as Fe (Total) mg/l | 0.060 | 0.010 | 0.030 | 0.150 |
| Manganese as Mn (Tot) mg/l | 0.005 | 0.002 | 0.005 | 0.015 |
| Suspended Solids mg/l | 7.0 | 11.0 | <1.0 | 5.0 |
| Total Dissolved Solids mg/l | 886 | 900 | 950 | 862 |
| pH Units | 7.80 | 7.60 | 7.60 | 8.20 |

NA = NOT AVAILABLE

# GROUNDWATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 9-82 | 10-82 | 4-83 | |
|---|---|---|---|---|
| RS2 | | | | |
| Flow (gpm) | 25 | 30 | 20 | |
| Acidity as CaCO3 mg/l | < 0.01 | 5.00 | NA | |
| Alkalinity as CaCO3 mg/l | 318.30 | 552 | NA | |
| Dissolved Iron mg/l | 0.045 | 0.040 | NA | |
| Iron as Fe (Total) mg/l | 0.056 | 0.049 | 0.180 | |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.012 | 0.003 | |
| Suspended Solids mg/l | 11.0 | 8.0 | 61.0 | |
| Total Dissolved Solids mg/l | 946 | 910 | 966 | |
| pH Units | 8.10 | 7.80 | 7.90 | |

| Sampling Date: | 1-81 | 2-81 | 3-81 | 4-81 |
|---|---|---|---|---|
| 2WB | | | | |
| Flow (gpm) | 3 | 3 | 3 | 3 |
| Acidity as CaCO3 mg/l | <0.1 | <0.1 | 2.0 | 3.60 |
| Alkalinity as CaCO3 mg/l | 184.00 | 168.00 | 162.00 | 150.00 |
| Dissolved Iron mg/l | 0.420 | 0.050 | 0.040 | 0.030 |
| Iron as Fe (Total) mg/l | 0.640 | 0.060 | 0.060 | 0.070 |
| Manganese as Mn (Tot) mg/l | 0.030 | 0.020 | 0.020 | 0.020 |
| Suspended Solids mg/l | 59.0 | 10.0 | 8.0 | 8.0 |
| Total Dissolved Solids mg/l | 2,200 | 2,200 | 2,100 | 2,200 |
| pH Units | 7.40 | 8.00 | 7.70 | 8.10 |

| Sampling Date: | 5-81 | 6-81 | 7-81 | 8-81 |
|---|---|---|---|---|
| 2WB | | | | |
| Flow (gpm) | 3 | 3 | 5 | 7 |
| Acidity as CaCO3 mg/l | 5.70 | <0.01 | 10.80 | <0.01 |
| Alkalinity as CaCO3 mg/l | 124.00 | 140.00 | 350.00 | 210.00 |
| Dissolved Iron mg/l | 0.140 | 0.033 | 0.150 | 0.146 |
| Iron as Fe (Total) mg/l | 0.360 | 0.075 | 0.380 | 0.410 |
| Manganese as Mn (Tot) mg/l | 0.030 | 0.025 | 0.027 | 0.020 |
| Suspended Solids mg/l | 19.0 | 13.0 | 15.0 | 1.0 |
| Total Dissolved Solids mg/l | 2,300 | 2,400 | 2,050 | 2,200 |
| pH Units | 8.00 | 8.10 | 7.60 | 7.90 |

| Sampling Date: | 9-81 | 10-81 | 11-81 | 12-81 |
|---|---|---|---|---|
| 2WB | | | | |
| Flow (gpm) | 3 | 3 | 3 | 3 |
| Acidity as CaCO3 mg/l | 2.00 | <0.01 | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | 265.00 | 198.10 | 203.30 | 228.20 |
| Dissolved Iron mg/l | 0.136 | 0.150 | 0.150 | 0.150 |
| Iron as Fe (Total) mg/l | 0.390 | 0.380 | 0.380 | 0.400 |
| Manganese as Mn (Tot) mg/l | 0.022 | 0.025 | 0.025 | 0.027 |
| Suspended Solids mg/l | 24.0 | 17.0 | 13.0 | 7.0 |
| Total Dissolved Solids mg/l | 2,200 | 2,175 | 2,200 | 2,175 |
| pH Units | 8.10 | 7.90 | 8.10 | 8.20 |

NA = NOT AVAILABLE

# GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 1-82 | 2-92 | 3-82 | 4-82 |
|---|---|---|---|---|
| 2WB | | | | |
| Flow (gpm) | 3 | 3 | 5 | 3 |
| Acidity as CaCO3 mg/l | 12.00 | 12.00 | < 0.01 | 2.00 |
| Alkalinity as CaCO3 mg/l | 204.40 | 249.20 | 205.20 | 232.70 |
| Dissolved Iron mg/l | 0.350 | 0.020 | NA | NA |
| Iron as Fe (Total) mg/l | 0.365 | 0.050 | 0.100 | 0.100 |
| Manganese as Mn (Tot) mg/l | 0.030 | 0.020 | 0.020 | 0.020 |
| Suspended Solids mg/l | 23.0 | 40.0 | 10.0 | 7.0 |
| Total Dissolved Solids mg/l | 2,375 | 2,200 | 3,516 | 2,232 |
| pH Units | 7.50 | 8.00 | 7.70 | 7.80 |

| Sampling Date: | 5-82 | 6-82 | 7-82 | 8-82 |
|---|---|---|---|---|
| 2WB | | | | |
| Flow (gpm) | 3 | 3 | 3 | 4 |
| Acidity as CaCO3 mg/l | <0.01 | 1.50 | 4.00 | 7.00 |
| Alkalinity as CaCO3 mg/l | 209.60 | 219.20 | 211.70 | 195.50 |
| Dissolved Iron mg/l | 0.030 | 0.113 | 0.090 | 0.090 |
| Iron as Fe (Total) mg/l | 0.200 | 0.180 | 0.090 | 0.095 |
| Manganese as Mn (Tot) mg/l | 0.003 | 0.015 | 0.015 | 0.012 |
| Suspended Solids mg/l | 1.0 | 17.0 | 3.0 | 1.0 |
| Total Dissolved Solids mg/l | 3,928 | 2,400 | 3,490 | 2,325 |
| pH Units | 8.10 | 7.70 | 7.80 | 8.00 |

| Sampling Date: | 9-82 | 10-82 |
|---|---|---|
| 2WB | | |
| Flow (gpm) | 7 | 3 |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | 193.70 | 183.40 |
| Dissolved Iron mg/l | 0.090 | 0.130 |
| Iron as Fe (Total) mg/l | 0.100 | 0.140 |
| Manganese as Mn (Tot) mg/l | 0.020 | 0.015 |
| Suspended Solids mg/l | 4.0 | 8.0 |
| Total Dissolved Solids mg/l | 2,410 | 2,300 |
| pH Units | 8.20 | 8.00 |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

NA = NOT AVAILABLE

# GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 1/81 | 2/81 | 3/81 | 4/81 |
|---|---|---|---|---|
| 1E2 | | | | |
| Flow (gpm) | 1 | 1 | 1 | 1 |
| Acidity as CaCO3 mg/l | <0.1 | <0.1 | 4.0 | 10.80 |
| Alkalinity as CaCO3 mg/l | 330.00 | 294.00 | 296.00 | 290.00 |
| Dissolved Iron mg/l | 0.030 | 0.010 | 0.020 | 0.030 |
| Iron as Fe (Total) mg/l | 0.050 | 0.020 | 0.040 | 0.080 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.010 | 0.010 | 0.020 |
| Suspended Solids mg/l | 13.0 | 11.0 | 9.0 | 6.0 |
| Total Dissolved Solids mg/l | 1,900 | 1,810 | 1,800 | 1,875 |
| pH Units | 7.60 | 8.10 | 7.70 | 8.10 |

| Sampling Date: | 5/81 | 8/81 | 7/81. | 8/81 |
|---|---|---|---|---|
| 1E2 | | | | |
| Flow (gpm) | 1 | 1 | 1 | 1 |
| Acidity as CaCO3 mg/l | 7.60 | <0.01 | 1.80 | <0.01 |
| Alkalinity as CaCO3 mg/l | 270.00 | 322.00 | 310.00 | 298.00 |
| Dissolved Iron mg/l | 0.010 | 0.035 | 0.009 | 0.010 |
| Iron as Fe (Total) mg/l | 0.150 | 0.095 | 0.136 | 0.150 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.021 | 0.011 | 0.019 |
| Suspended Solids mg/l | 5.0 | 10.0 | 1.0 | 4.0 |
| Total Dissolved Solids mg/l | 1,800 | 2,000 | 1,950 | 2,000 |
| pH Units | 8.00 | 8.00 | 8.20 | 7.90 |

| Sampling Date: | 9/81 | 10/81 | 11/81 | 12/81 |
|---|---|---|---|---|
| 1E2; 1E-B | | | | |
| Flow (gpm) | 1 | 1 | 1 | 1 |
| Acidity as CaCO3 mg/l | 2.00 | <0.01 | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | 439.00 | 312.00 | 287.10 | 317.80 |
| Dissolved Iron mg/l | 0.020 | 0.022 | 0.014 | 0.011 |
| Iron as Fe (Total) mg/l | 0.156 | 0.160 | 0.185 | 0.155 |
| Manganese as Mn (Tot) mg/l | 0.020 | 0.015 | 0.014 | 0.009 |
| Suspended Solids mg/l | 14.0 | 10.0 | 13.0 | 1.0 |
| Total Dissolved Solids mg/l | 1,900 | 1,900 | 1,950 | 1,875 |
| pH Units | 8.50 | 8.00 | 8.10 | 8.20 |

| Sampling Date: | 1/82 | 2/82 | 3/82 | 4/82 |
|---|---|---|---|---|
| 1E2; 1E-B | | | | |
| Flow (gpm) | 1 | 1 | 1 | 1 |
| Acidity as CaCO3 mg/l | <0.01 | 2.00 | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | 297.70 | 311.10 | 317.90 | 325.00 |
| Dissolved Iron mg/l | 0.030 | 0.020 | NA | NA |
| Iron as Fe (Total) mg/l | 0.060 | 0.190 | 0.020 | 0.040 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.010 | 0.010 | 0.010 |
| Suspended Solids mg/l | 20.0 | 11.0 | 11.0 | 6.0 |
| Total Dissolved Solids mg/l | 1,975 | 1,950 | 2,714 | 1,430 |
| pH Units | 7.80 | 8.00 | 7.90 | 8.00 |

# GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 5/82 | 6/82 | 7/82 | 8/82 |
|---|---|---|---|---|
| 1EB | | | | |
| Flow (gpm) | 1 | 1 | 1 | Sump |
| Acidity as CaCO3 mg/l | <0.01 | 1.00 | <0.01 | 14.00 |
| Alkalinity as CaCO3 mg/l | 315.00 | 335.50 | 317.30 | 356.70 |
| Dissolved Iron mg/l | 0.002 | 0.011 | 0.020 | 0.019 |
| Iron as Fe (Total) mg/l | <0.001 | 0.020 | 0.020 | 0.022 |
| Manganese as Mn (Tot) mg/l | <0.001 | 0.005 | 0.008 | 0.006 |
| Suspended Solids mg/l | 1.0 | 5.0 | 4.0 | 12.0 |
| Total Dissolved Solids mg/l | 2,622 | 2,000 | 2,626 | 2,825 |
| pH Units | 8.00 | 7.90 | 8.00 | 7.50 |

| Sampling Date: | 9/82 | 10/82 |
|---|---|---|
| 1EB | | |
| Flow (gpm) | Sump | Sump |
| Acidity as CaCO3 mg/l | 10.00 | 5.00 |
| Alkalinity as CaCO3 mg/l | 405.20 | 218.00 |
| Dissolved Iron mg/l | 1.240 | 10.550 |
| Iron as Fe (Total) mg/l | 1.400 | 13.200 |
| Manganese as Mn (Tot) mg/l | 0.105 | 0.115 |
| Suspended Solids mg/l | 5.0 | 17.0 |
| Total Dissolved Solids mg/l | 2,715 | 2,720 |
| pH Units | 7.60 | 7.80 |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

# GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 1/81 | 2/81 | 3/81 | 4/81 |
|---|---|---|---|---|
| **2E-B** | | | | |
| Flow (gpm) | Sump | Sump | Sump | Sump |
| Acidity as CaCO3 mg/l | 14.0 | 30.0 | 16.0 | 18.00 |
| Alkalinity as CaCO3 mg/l | 482.00 | 416.00 | 422.00 | 408.00 |
| Dissolved Iron mg/l | 1.810 | 0.550 | 1.650 | 1.350 |
| Iron as Fe (Total) mg/l | 1.830 | 1.770 | 1.820 | 1.470 |
| Manganese as Mn (Tot) mg/l | 0.060 | 0.070 | 0.060 | 0.050 |
| Suspended Solids mg/l | 6.0 | 7.0 | 10.0 | 8.0 |
| Total Dissolved Solids mg/l | 1,850 | 1,830 | 1,750 | 1,750 |
| pH Units | 7.20 | 7.40 | 7.10 | 7.70 |

| Sampling Date: | 5/81 | 6/81 | 7/81 | 8/81 |
|---|---|---|---|---|
| **2E-B** | | | | |
| Flow (gpm) | Sump | Sump | Sump | Sump |
| Acidity as CaCO3 mg/l | 24.70 | 5.10 | 14.40 | 5.19 |
| Alkalinity as CaCO3 mg/l | 398.00 | 428.00 | 420.00 | 398.00 |
| Dissolved Iron mg/l | 1.250 | 0.996 | 1.310 | 1.440 |
| Iron as Fe (Total) mg/l | 1.470 | 1.510 | 1.542 | 1.825 |
| Manganese as Mn (Tot) mg/l | 0.050 | 0.048 | 0.066 | 0.060 |
| Suspended Solids mg/l | 5.0 | 20.0 | 8.0 | 4.0 |
| Total Dissolved Solids mg/l | 1,700 | 1,800 | 1,750 | 1,800 |
| pH Units | 7.40 | 7.50 | 7.60 | 7.40 |

| Sampling Date: | 9/81 | 10/81 | 11/81 | 12/81 |
|---|---|---|---|---|
| **2E-B** | | | | |
| Flow (gpm) | Sump | Sump | Sump | Sump |
| Acidity as CaCO3 mg/l | 12.0 | 12.0 | 12.0 | 16.00 |
| Alkalinity as CaCO3 mg/l | 252.00 | 448.00 | 499.00 | 343.00 |
| Dissolved Iron mg/l | 0.810 | 1.100 | 0.965 | 1.130 |
| Iron as Fe (Total) mg/l | 1.520 | 1.588 | 1.550 | 1.520 |
| Manganese as Mn (Tot) mg/l | 0.065 | 0.055 | 0.076 | 0.046 |
| Suspended Solids mg/l | 17.0 | 10.0 | 9.0 | 57.0 |
| Total Dissolved Solids mg/l | 1,750 | 1,750 | 1,750 | 1,700 |
| pH Units | 7.90 | 7.80 | 7.50 | 7.60 |

| Sampling Date: | 1/82 | 2/82 | 3/82 | 4/82 |
|---|---|---|---|---|
| **2E-B** | | | | |
| Flow (gpm) | Sump | Sump | Sump | Sump |
| Acidity as CaCO3 mg/l | 18.00 | 18.00 | <0.01 | 24.00 |
| Alkalinity as CaCO3 mg/l | 317.80 | 550.00 | 479.00 | 332.70 |
| Dissolved Iron mg/l | 3.380 | 0.020 | NA | NA |
| Iron as Fe (Total) mg/l | 3.380 | 0.300 | 2.250 | 2.500 |
| Manganese as Mn (Tot) mg/l | 0.080 | 0.040 | 0.060 | 0.060 |
| Suspended Solids mg/l | 8.0 | 12.0 | 14.0 | 5.0 |
| Total Dissolved Solids mg/l | 1,825 | 1,850 | 2,162 | 1,690 |
| pH Units | 7.50 | 7.50 | 7.50 | 7.50 |

# GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 5/82 | 6/82 | 7/82 | 8/82 |
|---|---|---|---|---|
| 2E-B | | | | |
| Flow (gpm) | Sump | Sump | Sump | Sump |
| Acidity as CaCO3 mg/l | 24.00 | 10.00 | 7.00 | 16.00 |
| Alkalinity as CaCO3 mg/l | 369.20 | 382.30 | 442.00 | 435.00 |
| Dissolved Iron mg/l | 2.100 | 1.450 | 1.900 | 1.800 |
| Iron as Fe (Total) mg/l | 2.100 | 2.100 | 1.930 | 1.870 |
| Manganese as Mn (Tot) mg/l | 0.050 | 0.050 | 0.045 | 0.050 |
| Suspended Solids mg/l | 6.0 | 3.0 | 2.0 | 15.0 |
| Total Dissolved Solids mg/l | 2,022 | 1,850 | 2,086 | 1,775 |
| pH Units | 7.60 | 7.40 | 7.60 | 7.50 |

| Sampling Date: | 9/82 | 10/82 |
|---|---|---|
| 2E-B | | |
| Flow (gpm) | Sump | Sump |
| Acidity as CaCO3 mg/l | 11.00 | 11.00 |
| Alkalinity as CaCO3 mg/l | 589.20 | 44.00 |
| Dissolved Iron mg/l | 1.220 | 1.540 |
| Iron as Fe (Total) mg/l | 1.230 | 1.680 |
| Manganese as Mn (Tot) mg/l | 0.045 | 0.045 |
| Suspended Solids mg/l | 5.0 | 10.0 |
| Total Dissolved Solids mg/l | 1,800 | 1,710 |
| pH Units | 7.80 | 7.70 |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

# GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 1/81 | 2/81 | 3/81 | 4/81 |
|---|---|---|---|---|
| 2LN-K | | | | |
| Flow (gpm) | | | | |
| Acidity as CaCO3 mg/l | 38.0 | 4.0 | 48.0 | 37.80 |
| Alkalinity as CaCO3 mg/l | 622.00 | 544.00 | 580.00 | 584.00 |
| Dissolved Iron mg/l | 0.060 | 0.030 | 0.040 | 0.040 |
| Iron as Fe (Total) mg/l | 0.120 | 0.090 | 0.080 | 0.090 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.010 | 0.020 | 0.010 |
| Suspended Solids mg/l | 5.0 | 10.0 | 15.0 | 10.0 |
| Total Dissolved Solids mg/l | 2,200 | 2,100 | 2,100 | 2,150 |
| pH Units | 7.00 | 7.60 | 7.00 | 7.40 |

| Sampling Date: | 5/81 | 6/81 | 7/81 | 8/81 |
|---|---|---|---|---|
| 2LN-K | | | | |
| Flow (gpm) | | | 3 | 3 |
| Acidity as CaCO3 mg/l | 57.00 | 40.80 | 43.20 | 50.17 |
| Alkalinity as CaCO3 mg/l | 582.00 | 620.00 | 650.00 | 618.00 |
| Dissolved Iron mg/l | 0.090 | 0.050 | 0.110 | 0.130 |
| Iron as Fe (Total) mg/l | 0.140 | 0.110 | 0.160 | 0.188 |
| Manganese as Mn (Tot) mg/l | 0.030 | 0.009 | 0.031 | 0.027 |
| Suspended Solids mg/l | 16.0 | 6.0 | 8.0 | 7.0 |
| Total Dissolved Solids mg/l | 2,100 | 2,300 | 2,400 | 2,450 |
| pH Units | 7.30 | 7.20 | 7.40 | 7.20 |

| Sampling Date: | 9/81 | 10/81 | 11/81 | 12/81 |
|---|---|---|---|---|
| 2LN-K | | | | |
| Flow (gpm) | 3 | 3 | 3 | 3 |
| Acidity as CaCO3 mg/l | 32.00 | 48.00 | 28.00 | 38.00 |
| Alkalinity as CaCO3 mg/l | 526.00 | 620.00 | 752.00 | 140.00 |
| Dissolved Iron mg/l | 0.133 | 0.095 | 0.095 | 0.110 |
| Iron as Fe (Total) mg/l | 0.200 | 0.150 | 0.166 | 0.165 |
| Manganese as Mn (Tot) mg/l | 0.020 | 0.027 | 0.014 | 0.031 |
| Suspended Solids mg/l | 12.0 | 11.00 | 9.0 | 8.0 |
| Total Dissolved Solids mg/l | 2,350 | 2,275 | 2,300 | 2,250 |
| pH Units | 7.50 | 7.30 | 7.30 | 7.30 |

| Sampling Date: | 1/82 | 2/82 | 3/82 | 4/82 |
|---|---|---|---|---|
| 2LN-K | | | | |
| Flow (gpm) | 3 | 3 | 3 | 3 |
| Acidity as CaCO3 mg/l | 38.00 | 46.00 | 14.00 | 58.00 |
| Alkalinity as CaCO3 mg/l | 319.40 | 330.90 | 830.00 | 341.20 |
| Dissolved Iron mg/l | 1.290 | 0.300 | NA | NA |
| Iron as Fe (Total) mg/l | 1.320 | 0.355 | 0.300 | 0.140 |
| Manganese as Mn (Tot) mg/l | 0.040 | 0.020 | 0.030 | 0.025 |
| Suspended Solids mg/l | 11.0 | 8.0 | 22.0 | 3.0 |
| Total Dissolved Solids mg/l | 2,350 | 2,400 | 3,640 | 2,428 |
| pH Units | 7.20 | 7.20 | 7.20 | 7.20 |

# GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 5/82 | 6/82 | 7/82 | 8/82 |
|---|---|---|---|---|
| 2LN-K | | | | |
| Flow (gpm) | 3 | 3 | 3 | 3 |
| Acidity as CaCO3 mg/l | 66.00 | 30.00 | 36.00 | 76.00 |
| Alkalinity as CaCO3 mg/l | 1,210.00 | 552.00 | 408,00 | 799.00 |
| Dissolved Iron mg/l | 0.020 | 0.040 | 0.090 | 0.110 |
| Iron as Fe (Total) mg/l | 0.050 | 0.100 | 0.090 | 0.120 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.015 | 0.015 | 0.016 |
| Suspended Solids mg/l | 1.0 | 11.0 | 30.0 | 16.0 |
| Total Dissolved Solids mg/l | 3,586 | 2,600 | 3,542 | 2,225 |
| pH Units | 7.00 | 7.10 | 7.20 | 7.10 |

| Sampling Date: | 9/82 | 10/82 |
|---|---|---|
| 2LN-K | | |
| Flow (gpm) | 1 | 1 |
| Acidity as CaCO3 mg/l | 27.00 | 35.00 |
| Alkalinity as CaCO3 mg/l | 789.20 | 844.00 |
| Dissolved Iron mg/l | 0.080 | 0.133 |
| Iron as Fe (Total) mg/l | 0.110 | 0.140 |
| Manganese as Mn (Tot) mg/l | 0.015 | 0.015 |
| Suspended Solids mg/l | 1.0 | 29.0 |
| Total Dissolved Solids mg/l | 2,710 | 2,620 |
| pH Units | 7.10 | 7.30 |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 1/81 | 2/81 | 3/81 | 4/81 |
|---|---|---|---|---|
| Main Slope | | | | |
| Flow (gpm) | Sump | Sump | Sump | Sump |
| Acidity as CaCO3 mg/l | 8.0 | 10.0 | 18.0 | 16.20 |
| Alkalinity as CaCO3 mg/l | 442.00 | 404.00 | 398.00 | 376.00 |
| Dissolved Iron mg/l | 1.930 | 2.150 | 2.120 | 1.850 |
| Iron as Fe (Total) mg/l | 1.930 | 2.150 | 2.130 | 1.960 |
| Manganese as Mn (Tot) mg/l | 0.110 | 0.100 | 0.100 | 0.090 |
| Suspended Solids mg/l | 14.0 | 9.0 | 16.0 | 10.0 |
| Total Dissolved Solids mg/l | 2,200 | 2,050 | 2,000 | 2,000 |
| pH Units | 7.20 | 7.60 | 7.20 | 7.60 |

| Sampling Date: | 5/81 | 6/81 | 7/81 | 8/81 |
|---|---|---|---|---|
| Main Slope | | | | |
| Flow (gpm) | Sump | Sump | Sump | Sump |
| Acidity as CaCO3 mg/l | 3.80 | 8.50 | 7.20 | 6.92 |
| Alkalinity as CaCO3 mg/l | 270.00 | 406.00 | 390.00 | 360.00 |
| Dissolved Iron mg/l | 1.100 | 1.600 | 1.170 | 1.350 |
| Iron as Fe (Total) mg/l | 1.580 | 2.200 | 1.650 | 1.770 |
| Manganese as Mn (Tot) mg/l | 0.020 | 0.085 | 0.025 | 0.035 |
| Suspended Solids mg/l | 44.0 | 4.0 | 10.0 | 6.0 |
| Total Dissolved Solids mg/l | 1,700 | 2,150 | 2,100 | 2,200 |
| pH Units | 8.10 | 7.60 | 7.80 | 7.60 |

| Sampling Date: | 9/81 | 10/81 | 11/81 | 12/81 |
|---|---|---|---|---|
| Main Slope | | | | |
| Flow (gpm) | Sump | Sump | Sump | Sump |
| Acidity as CaCO3 mg/l | 10.00 | 18.00 | 14.00 | 12.00 |
| Alkalinity as CaCO3 mg/l | 214.00 | 407.00 | 287.00 | 377.00 |
| Dissolved Iron mg/l | 0.470 | 1.060 | 1.160 | 1.130 |
| Iron as Fe (Total) mg/l | 1.410 | 1.850 | 1.650 | 1.665 |
| Manganese as Mn (Tot) mg/l | 0.039 | 0.031 | 0.025 | 0.019 |
| Suspended Solids mg/l | 35.0 | 12.0 | 14.0 | 15.0 |
| Total Dissolved Solids mg/l | 2,150 | 2,125 | 2,100 | 2,050 |
| pH Units | 8.00 | 7.50 | 8.05 | 7.70 |

| Sampling Date: | 1/82 | 2/82 | 3/82 | 4/82 |
|---|---|---|---|---|
| Main Slope | | | | |
| Flow (gpm) | Sump | Sump | Sump | Sump |
| Acidity as CaCO3 mg/l | 20.00 | 20.00 | 2.00 | 18.00 |
| Alkalinity as CaCO3 mg/l | 332.30 | 320.70 | 500.00 | 318.10 |
| Dissolved Iron mg/l | 0.020 | 1.900 | NA | NA |
| Iron as Fe (Total) mg/l | 2.380 | 1.950 | 1.750 | 1.690 |
| Manganese as Mn (Tot) mg/l | 0.100 | 0.100 | 0.100 | 0.090 |
| Suspended Solids mg/l | 10.0 | 18.0 | 12.0 | 8.0 |
| Total Dissolved Solids mg/l | 2,175 | 2,200 | 2,770 | 2,640 |
| pH Units | 7.40 | 7.50 | 7.50 | 7.50 |

GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 5/82 | 6/82 | 7/82 | 8/82 |
|---|---|---|---|---|
| Main Slope | | | | |
| Flow (gpm) | Sump | Sump | Sump | Sump |
| Acidity as CaCO3 mg/l | 20.00 | 10.00 | <0.01 | 15.00 |
| Alkalinity as CaCO3 mg/l | 351.30 | 3,567.00 | 230.10 | 241.20 |
| Dissolved Iron mg/l | 2.000 | 0.985 | 0.310 | 0.260 |
| Iron as Fe (Total) mg/l | 2.200 | 2.250 | 0.340 | 0.450 |
| Manganese as Mn (Tot) mg/l | 0.070 | 0.095 | 0.030 | 0.035 |
| Suspended Solids mg/l | 18.0 | 34.0 | 6.0 | 7.0 |
| Total Dissolved Solids mg/l | 2,584 | 2,225 | 2,016 | 2,020 |
| pH Units | 7.50 | 7.40 | 8.10 | 7.60 |

| Sampling Date: | 9/82 | 10/82 |
|---|---|---|
| Main Slope | | |
| Flow (gpm) | Sump | Sump |
| Acidity as CaCO3 mg/l | <0.01 | 9.00 |
| Alkalinity as CaCO3 mg/l | 185.10 | 287.30 |
| Dissolved Iron mg/l | 1.650 | 1.550 |
| Iron as Fe (Total) mg/l | 1.800 | 1.870 |
| Manganese as Mn (Tot) mg/l | 0.045 | 0.095 |
| Suspended Solids mg/l | 5.0 | 20.0 |
| Total Dissolved Solids mg/l | 1,795 | 2,090 |
| pH Units | 8.20 | 7.60 |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 1/81 | 2/81 | 3/81 | 4/81 |
|---|---|---|---|---|
| 12 N-M | | | | |
| Flow (gpm) | | | | |
| Acidity as CaCO3 mg/l | <0.1 | <0.1 | 4.0 | 7.20 |
| Alkalinity as CaCO3 mg/l | 384.00 | 348.00 | 336.00 | 328.00 |
| Dissolved Iron mg/l | 0.020 | 0.020 | 0.010 | 0.030 |
| Iron as Fe (Total) mg/l | 0.030 | 0.020 | 0.020 | 0.060 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.010 | 0.010 | 0.020 |
| Suspended Solids mg/l | 5.0 | 4.0 | 5.0 | 7.0 |
| Total Dissolved Solids mg/l | 1,650 | 1,600 | 1,575 | 1,875 |
| pH Units | 7.50 | 8.20 | 7.80 | 8.00 |

| Sampling Date: | 5/81 | 6/81 | 7/81 | 8/81 |
|---|---|---|---|---|
| 12 N-M | | | | |
| Flow (gpm) | | | 20 | 20 |
| Acidity as CaCO3 mg/l | 5.70 | <0.01 | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | 318.00 | 342.00 | 350.00 | 326.00 |
| Dissolved Iron mg/l | 0.030 | 0.035 | 0.027 | 0.038 |
| Iron as Fe (Total) mg/l | 0.080 | 0.077 | 0.095 | 0.099 |
| Manganese as Mn (Tot) mg/l | 0.010 | 0.019 | 0.011 | 0.015 |
| Suspended Solids mg/l | 8.0 | 9.0 | 4.0 | 3.0 |
| Total Dissolved Solids mg/l | 1,700 | 1,800 | 1,750 | 1,750 |
| pH Units | 8.10 | 8.10 | 8.40 | 7.90 |

| Sampling Date: | 9/81 | 10/81 | 11/81 | 12/81 |
|---|---|---|---|---|
| 12N-M | | | | |
| Flow (gpm) | 20 | 20 | 20 | 24 |
| Acidity as CaCO3 mg/l | 6.00 | 12.00 | 8.00 | 16.00 |
| Alkalinity as CaCO3 mg/l | 212.60 | 218.80 | 217.20 | 241.90 |
| Dissolved Iron mg/l | 0.040 | 0.045 | 0.040 | 0.035 |
| Iron as Fe (Total) mg/l | 0.080 | 0.089 | 0.075 | 0.088 |
| Manganese as Mn (Tot) mg/l | 0.012 | 0.011 | 0.014 | 0.012 |
| Suspended Solids mg/l | 41.0 | 25.0 | 22.0 | 16.0 |
| Total Dissolved Solids mg/l | 2,450 | 2,350 | 2,350 | 2,200 |
| pH Units | 7.90 | 7.60 | 7.80 | 8.00 |

| Sampling Date: | 1/82 | 2/82 | 3/82 | 4/82 |
|---|---|---|---|---|
| 12N-M | | | | |
| Flow (gpm) | 24 | 20 | 20 | 20 |
| Acidity as CaCO3 mg/l | 12.00 | 8.00 | <0.01 | 12.00 |
| Alkalinity as CaCO3 mg/l | 269.80 | 290.70 | 295.20 | 250.40 |
| Dissolved Iron mg/l | 0.550 | 0.430 | NA | NA |
| Iron as Fe (Total) mg/l | 0.680 | 0.450 | 0.610 | 0.790 |
| Manganese as Mn (Tot) mg/l | 0.110 | 0.090 | 0.160 | 0.120 |
| Suspended Solids mg/l | 12.0 | 20.0 | 21.0 | 18.0 |
| Total Dissolved Solids mg/l | 2,125 | 2,000 | 3,096 | 2,186 |
| pH Units | 7.70 | 8.00 | 7.70 | 7.80 |

# GROUND WATER QUALITY DATA - GENEVA COAL MINE

| Sampling Date: | 5/82 | 6/82 | 7/82 | 8/82 |
|---|---|---|---|---|
| 12N-M | | | | |
| Flow (gpm) | 20 | 20 | 20 | 20 |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 | <0.01 | 3.00 |
| Alkalinity as CaCO3 mg/l | 204.40 | 294.90 | 292.20 | 288.10 |
| Dissolved Iron mg/l | 0.350 | 0.155 | 0.280 | 0.250 |
| Iron as Fe (Total) mg/l | 0.350 | 0.350 | 0.280 | 0.260 |
| Manganese as Mn (Tot) mg/l | 0.060 | 0.050 | 0.060 | 0.061 |
| Suspended Solids mg/l | 1.0 | 11.0 | 6.0 | 6.0 |
| Total Dissolved Solids mg/l | 2,398 | 2,050 | 2,756 | 2,050 |
| pH Units | 8.00 | 7.90 | 8.00 | 8.10 |

| Sampling Date: | 9/82 | 10/82 |
|---|---|---|
| 12N-M | | |
| Flow (gpm) | 20 | 20 |
| Acidity as CaCO3 mg/l | <0.01 | <0.01 |
| Alkalinity as CaCO3 mg/l | 300.30 | 290.00 |
| Dissolved Iron mg/l | 0.180 | 0.185 |
| Iron as Fe (Total) mg/l | 0.200 | 0.220 |
| Manganese as Mn (Tot) mg/l | 0.045 | 0.045 |
| Suspended Solids mg/l | 43.0 | 24.0 |
| Total Dissolved Solids mg/l | 2,090 | 2,005 |
| pH Units | 8.20 | 8.00 |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

| Sampling Date: |
|---|
| Flow (gpm) |
| Acidity as CaCO3 mg/l |
| Alkalinity as CaCO3 mg/l |
| Dissolved Iron mg/l |
| Iron as Fe (Total) mg/l |
| Manganese as Mn (Tot) mg/l |
| Suspended Solids mg/l |
| Total Dissolved Solids mg/l |
| pH Units |

# GROUND WATER QUALITY MONITORING
# GENEVA COAL MINE

CA-1

| Sample Date: | 9/13/78 | 9/26/79 | 8/8/80 | 9/24/80 |
|---|---|---|---|---|
| Aluminum, Al mg/l | 0.47 | <0.001 | <0.010 | NA |
| Ammonia, NH3 mg/l | NA | NA | 0.15 | NA |
| Arsenic, As mg/l | <0.001 | <0.001 | <0.001 | NA |
| Antimony as Sb mg/l | <0.001 | <0.001 | 0.100 | NA |
| **Barium, Ba mg/l** | **0.010** | **0.020** | **0.010** | **NA** |
| Beryllium as Be mg/l | 0.018 | 0.001 | <0.001 | NA |
| Bicarbonate, HNO3 mg/l | NA | NA | 329.40 | NA |
| Boron, B mg/l | 0.230 | 0.140 | 0.060 | NA |
| Cadmium, Cd mg/l | <0.001 | <0.001 | <0.001 | NA |
| Calcium,Ca mg/l | 92.8 | 280.00 | 116.80 | NA |
| Carbonate, CO3 mg/l | <0.01 | <0.01 | <0.01 | NA |
| Chloride, Cl mg/l | 26.0 | 18.0 | 22.0 | NA |
| Chromium, Cr mg/l | <0.001 | <0.001 | <0.001 | NA |
| Cobalt as Co mg/l | 0.025 | 0.045 | 0.026 | NA |
| Copper, Cu mg/l | 0.007 | 0.003 | 0.010 | NA |
| Flouride, F mg/l | 0.29 | 0.25 | 0.25 | NA |
| Flow gpm | NA | 3 | 4 | 4 |
| Germanium as Ge mg/l | <0.001 | <0.001 | <0.001 | NA |
| Hardness, CaCO3 mg/l | NA | NA | 696 | NA |
| Iron, Fe (total) mg/l | 0.114 | 20.000 | 21.800 | 16.200 |
| Lead, Pb mg/l | 0.004 | <0.001 | <0.001 | NA |
| Magnesium, Mg mg/l | 54.72 | 2.40 | 96.96 | NA |
| Manganese, Mn mg/l | 0.077 | 0.088 | 0.050 | 0.100 |
| Mercury, Hg mg/l | <0.0005 | <0.0002 | <0.0002 | NA |
| Molybdenum, Mo mg/l | 0.09 | <0.001 | <0.001 | NA |
| Nickel, Ni mg/l | <0.001 | 0.046 | 0.023 | NA |
| Nitrate, NO3-N mg/l | 0.11 | <0.01 | 0.04 | NA |
| Nitrite, NO2-N mg/l | <0.01 | <0.01 | 0.01 | NA |
| Phosphate, PO4 mg/l | 0.014 | 0.040 | 0.002 | NA |
| Potassium, K mg/l | NA | NA | 4.70 | NA |
| Selenium, Se mg/l | <0.001 | 0.002 | <0.001 | NA |
| Silver as As mg/l | <0.001 | <0.001 | <0.001 | NA |
| Sodium, Na mg/l | 159.4 | 137.00 | 135.00 | NA |
| Sulfate, SO4 mg/l | 690.0 | 680 | 658 | NA |
| Sulfide, S mg/l | NA | NA | <0.01 | NA |
| Suspended Solids mg/l | 6.0 | 1.0 | 58.0 | 36.0 |
| Total Dissolved Solids mg/l | 1,250 | 1,200 | 1,199 | 1,200 |
| Total Kjeldahl Nitrogen mg/l | <0.01 | 0.20 | 0.30 | NA |
| Vanadium as V mg/l | 0.17 | <0.001 | <0.001 | NA |
| Zinc, Zn mg/l | 0.015 | 0.194 | 0.010 | NA |
| pH Units | NA | NA | NA | 7.10 |

NA - Not Available

# GROUND WATER QUALITY MONITORING
# GENEVA COAL MINE

RS-1

| Sample Date: | 9/18/78 | 9/26/68 | 8/8/80 | 9/24/8 |
|---|---|---|---|---|
| Aluminum, Al mg/l | 0.06 | | | |
| Ammonia, NH3 mg/l | NA | | | |
| Arsenic, As mg/l | <0.001 | | | |
| Antimony as Sb mg/l | <0.001 | | | |
| **Barium, Ba mg/l** | **0.030** | | | |
| Beryllium as Be mg/l | 0.014 | | | |
| Bicarbonate, HNO3 mg/l | NA | | | |
| Boron, B mg/l | 0.080 | | | |
| Cadmium, Cd mg/l | <0.001 | | | |
| Calcium,Ca mg/l | 49.6 | | | |
| Carbonate, CO3 mg/l | <0.01 | | | |
| Chloride, Cl mg/l | 18.0 | | | |
| Chromium, Cr mg/l | <0.001 | | | |
| Cobalt as Co mg/l | 0.011 | | | |
| Copper, Cu mg/l | 0.002 | | | |
| Flouride, F mg/l | 0.21 | | | |
| Flow gpm | NA | No Flow | No Flow | No Flow |
| Germanium as Ge mg/l | <0.001 | | | |
| Hardness, CaCO3 mg/l | NA | | | |
| Iron, Fe (total) mg/l | 0.105 | | | |
| Lead, Pb mg/l | <0.001 | | | |
| Magnesium, Mg mg/l | 66.24 | | | |
| Manganese, Mn mg/l | 0.013 | | | |
| Mercury, Hg mg/l | <0.0002 | | | |
| Molybdenum, Mo mg/l | 0.015 | | | |
| Nickel, Ni mg/l | <0.001 | | | |
| Nitrate, NO3-N mg/l | 0.34 | | | |
| Nitrite, NO2-N mg/l | <0.01 | | | |
| Phosphate, PO4 mg/l | 0.012 | | | |
| Potassium, K mg/l | NA | | | |
| Selenium, Se mg/l | <0.001 | | | |
| Silver as As mg/l | <0.001 | | | |
| Sodium, Na mg/l | 133.9 | | | |
| Sulfate, SO4 mg/l | 296.0 | | | |
| Sulfide, S mg/l | NA | | | |
| Suspended Solids mg/l | 8.0 | | | |
| Total Dissolved Solids mg/l | 976 | | | |
| Total Kjeldahl Nitrogen mg/l | <0.01 | | | |
| Vanadium as V mg/l | 0.019 | | | |
| Zinc, Zn mg/l | 0.019 | | | |
| pH Units | NA | | | |

NA - Not Available

# GROUND WATER QUALITY MONITORING
# GENEVA COAL MINE

RS-2

| Sample Date: | 9/13/78 | 9/16/79 | 8/8/80 | 9/24/80 |
|---|---|---|---|---|
| Aluminum, Al mg/l | 0.31 | 0.010 | 0.310 | NA |
| Ammonia, NH3 mg/l | NA | NA | <0.01 | NA |
| Arsenic, As mg/l | <0.001 | <0.001 | <0.001 | NA |
| Antimony as Sb mg/l | <0.001 | <0.001 | 0.060 | NA |
| Barium, Ba mg/l | 0.210 | 0.050 | 0.030 | NA |
| Beryllium as Be mg/l | 0.020 | <0.001 | <0.001 | NA |
| Bicarbonate, HNO3 mg/l | NA | NA | 534.36 | NA |
| Boron, B mg/l | 0.315 | 0.190 | 0.090 | NA |
| Cadmium, Cd mg/l | <0.001 | <0.001 | <0.001 | NA |
| Calcium,Ca mg/l | 49.6 | 168.00 | 52.00 | NA |
| Carbonate, CO3 mg/l | <0.01 | <0.01 | 1.20 | NA |
| Chloride, Cl mg/l | 22.0 | 22.0 | 30.0 | NA |
| Chromium, Cr mg/l | <0.001 | <0.001 | <0.001 | NA |
| Cobalt as Co mg/l | 0.005 | 0.004 | <0.001 | NA |
| Copper, Cu mg/l | 0.004 | 0.006 | 0.020 | NA |
| Flouride, F mg/l | 0.24 | 0.19 | 0.18 | NA |
| Flow gpm | NA | 9 | 30 | 30 |
| Germanium as Ge mg/l | <0.001 | <0.002 | <0.001 | NA |
| Hardness, CaCO3 mg/l | NA | NA | 460 | NA |
| Iron, Fe (total) mg/l | 0.018 | <0.001 | 0.310 | 0.080 |
| Lead, Pb mg/l | 0.003 | <0.001 | <0.001 | NA |
| Magnesium, Mg mg/l | 72.0 | 16.80 | 79.20 | NA |
| Manganese, Mn mg/l | 0.016 | 0.012 | 0.010 | 0.010 |
| Mercury, Hg mg/l | <0.0002 | <0.0002 | <0.0002 | NA |
| Molybdenum, Mo mg/l | 0.16 | <0.001 | <0.001 | NA |
| Nickel, Ni mg/l | <0.001 | 0.001 | <0.001 | NA |
| Nitrate, NO3-N mg/l | 0.04 | 0.45 | <0.01 | NA |
| Nitrite, NO2-N mg/l | <0.01 | <0.01 | <0.01 | NA |
| Phosphate, PO4 mg/l | 0.055 | 0.060 | 0.010 | NA |
| Potassium, K mg/l | NA | NA | 1.57 | NA |
| Selenium, Se mg/l | <0.001 | 0.004 | <0.001 | NA |
| Silver as As mg/l | <0.001 | 0.001 | <0.001 | NA |
| Sodium, Na mg/l | 140.9 | 170.00 | 171.00 | NA |
| Sulfate, SO4 mg/l | 300.0 | 350 | 320 | NA |
| Sulfide, S mg/l | NA | NA | <0.01 | NA |
| Suspended Solids mg/l | 9.0 | 1.0 | 10.0 | 14.0 |
| Total Dissolved Solids mg/l | 920 | 900 | 925 | 1,000 |
| Total Kjeldahl Nitrogen mg/l | <0.01 | 0.10 | 0.22 | NA |
| Vanadium as V mg/l | 0.25 | <0.001 | <0.001 | NA |
| Zinc, Zn mg/l | 0.018 | 0.017 | 0.020 | NA |
| pH Units | NA | NA | NA | 7.70 |

NA - Not Available

# APPENDIX II

## HYDROLOGIC CALCULATIONS

## Geneva Mine - Sedimentation Pond Discharge Structures

Sedimendation pond discharge structures are designed to pass the runoff from a 25 year 24 hour storm. The intensity of the storm in the Geneva Mine area is 2.18 inches (isopluval map attached). Runoff evaluations are based on the methods described on page B-1 of Appendix B.

Ponds equipped with decant structures (ref. A3-1428, p. B-12) all have an open 6 inch PVC overflow pipe. Discharge through the overflow pipe is calculated using the wier formula $Q=3.33 (L-0.2H)H^{1.5}$ , where: L = length of wier in feet = $0.5\pi$ ; H = head in feet; Q = outflow quantity in cfs.

It should be noted that capacities of all sedimentation ponds are based on the volume of water contained when the water level reaches the elevation of a discharge structure. Pond 2 capacity, however, is based on a maximum water level of 6218.4 ft., which corresponds to 1.0 feet of freeboard.

### POND 1 (ref. pp. B-5, B-12, Dwg. E3-3441

From references:

| | |
|---|---|
| CN = 86 | Crest elev. = 6181.5 ft |
| S = 1.63 | Overflow elev. = 6179.1 ft |
| Acres = 2.957 | Spillway elev. = 6180.5 ft |
| Soil = 33 cf | Pond capacity = 8615 cf |

Calculations:

$$Q = \frac{(2.18-0.2(1.63))^2}{2.18+0.8(1.63)} = 0.987 \text{ in}$$

$$\text{Runoff Volume} = \frac{(0.987 \text{ in})(2.957 \text{ ac})(43560 \text{ ft}^2/\text{ac})}{12 \text{ in/ft}} = 10590\text{cf}$$

Maximum design volume = 10590 + 33 = 10623 cf
10623 cf > 8615 cf - pond will overflow

Average flow into pond = 10590 cf/24 hr = 0.123 cfs

Head required on overflow = 0.083 ft
$0.124 = 3.33\ (1.57-0.2(0.083)).083^{1.5}$

Maximum water level = 6179.1 + 0.083 = 6179.2 ft (spillway will not flow)

Pond freeboard = 6181.5 - 6179.2 = 2.3 ft

### POND 2 (ref. pp. b-5, B-12, Dwg. E3-3441)

From references:

CN = 78
S = 2.82
Acres = 1.025
Soil = 22 cf

Crest elev. = 6219.4 ft
Overflow elev. = no decant structure
Spillway elev. - 6218.8
Capacity = 12889 cf

Calculations:

$$Q = \frac{(2.18-0.2(2.82))}{2.18+0.8(2.82)} = 0.589 \text{ in}$$

$$\text{Runoff volumne} = \frac{(0.589 \text{ in})(1.025 \text{ ac})(43560 \text{ ft /ac})}{12 \text{ in/ft}} = 2190\text{cf}$$

Maximum design volume = 2190 + 22 = 2212 cf
2212 cf < 12289 cf

Pond will contain a 25 year 24 hour storm

PONDS 3 and 4 (ref. pp. B-7, B-12, Dwg E3-3441)

From references:

CN = 79
S = 2.66
Acres = 12.594
Soil = 384 cf
Combined capacity = 16,256 cf

Crest elev. #4 = 6249.0 ft
Overflow elev. #4 = 6247.7 ft
Spillway elev. #4 = 6248.2 ft.
Crest elev. #3 = 6241.0 ft
Spillway elev. #3 - 6240.5 ft

Calculations:

$$Q = \frac{(2.18 - 0.2(2.66))^2}{2.18 + 0.8(2.66)} = 0.630 \text{ in.}$$

$$\text{Runoff volume} = \frac{(0.630 \text{ in})(12.594 \text{ ac})(43560 \text{ ft}^2\text{/ac})}{12 \text{ in/ft}} = 28821\text{cf}$$

Maximum design volume = 28,821 + 384 = 29,205 cf
29,205 cf > 16,256 cf - ponds will overflow

Average flow into pond = 28821 cf/24 hr = 0.334 cfs

Head required on overflow = 0.162 ft.
$0.334 = 3.33\ (1.57-0.2(0.162))0.162^{1.5}$

Maximum #4 water level = 6247.7 + 0.162 = 6247.9 ft (spillway will not flow)

Maximum #3 water level = 6239.9 + 0.162 = 6240.06 ft (spillway will not flow)

Pond 4 freeboard = 6249.0 - 6247.9 = 1.10 ft

Pond 3 freeboard = 6241.0 - 6240.06 = <u>0.94 ft</u>

POND 5 (ref. pp. B-8, B-12, Dwg. E3-3441)

From references:

| | |
|---|---|
| CN = 82 | Crest elev. = 6279.0 ft |
| S = 2.20 | Overflow elev. = 6277.4 ft |
| Acres = 1.322 | Spillway elev. = 6278.1 ft |
| Soil = 50 cf | Capacity = 2738 cf |

Calculations:

$$Q = \frac{(2.18 - 0.2(2.20))}{2.18 + 0.8(2.20)} = 0.768 \text{ in}$$

$$\text{Runoff volume} = \frac{(0.768 \text{ in})(1.322 \text{ ac})(43560 \text{ ft}^2/\text{ac})}{12 \text{ in/ft}} = 3688\text{cf}$$

Maximum design volume = 3688 + 50 = 3738 cf
3738 cf > 2738 cf - pond will overflow

Average flow into pond = 3688 cf/24 hr = 0.043 cfs

Head required on overflow = 0.041 ft

$$0.043 = 3.33\ (1.57 - 0.2(0.041))\ 0.041^{1.5}$$

Maximum water level = 6277.4 + 0.041 = 6277.4 ft (spillway will not flow)

Pond freeboard = 6279.0 - 6277.4 = 1.6 ft

POND 6 (ref. pp. B-9, B-12, Dwg. E3-3441)

From references:

| | |
|---|---|
| CN = 82 | Crest elev. = 6285.0 ft |
| S = 2.20 | Overflow elev. = 6284.0 ft |
| Acres = 1.775 | Spillway elev. = 6284.0 ft |
| Soil = 77 cf | Capacity = 8540 cf |

Calculations:

$$Q = \frac{(2.18-0.2(2.20))^2}{2.18+0.8(2.20)} = 0.768 \text{ in}$$

$$\text{Runoff volume} = \frac{(0.768 \text{ in})(1.775 \text{ ac})(43560 \text{ ft}^2/\text{ac})}{12 \text{ in/ft}} = 4951\text{cf}$$

Maximum design volume = 4951 + 77 = 5028 cf
5028 cf < 8540 cf

Pond will contain a 25 year 24 hour storm

POND 7 (ref. pp. B-10, B-12, Dwg. E3-3441)

From references:

| | |
|---|---|
| CN = 32 | Crest elev. = incised pond |
| S = 2.20 | Overflow elev. = no decant structure |
| Acres = 0.941 | Spillway elev. = 6295.1 ft |
| Soil = 157 cf | Capacity = 4993 cf |

Calculations:

$$Q = \frac{(2.18 - 0.2(2.20))^2}{2.18 + 0.8(2.20)} = 0.768 \text{ in}$$

$$\text{Runoff volume} = \frac{(0.768 \text{ in})(0.941 \text{ ac})(43560 \text{ ft}^2/\text{ac})}{12 \text{ in/ft}} = 2625\text{cf}$$

Maximum design volume = 2625 + 157 = 2782 cf
2782 cf < 4993 cf

Pond will contain a 25 year 24 hour storm

POND 8 (ref. pp. B-11, B-12, Dwg. E3-3441)

From references:

| | |
|---|---|
| CN = 79 | Crest elev. - 6267.5 ft |
| S = 2.66 | Overflow elev. = 6266.4 ft |
| Acres = 1.519 | Spillway elev. = 6267.0 ft |
| Soil = 70 cf | Capacity = 2624 cf |

Calculations:

$$Q = \frac{(2.18 - 0.2(2.66))^2}{2.18 + 0.8(2.66)} = 0.630 \text{ in}$$

$$\text{Runoff volume} = \frac{(0.630 \text{ in})(1.519 \text{ ac})(43560 \text{ ft}^2/\text{ac})}{12 \text{ in/ft}} = 3476\text{cf}$$

Maximum design volume = 3476 + 70 = 3546 cf
3546 cf > 2624 cf - pond will overflow

Average flow into pond = 3476 cf/24 hr = 0.040 cfs

Head required on overflow = 0.039 ft
$0.040 = 3.33\ (1.57 - 0.2(0.039))\ 0.039^{1.5}$

Maximum water level = 6266.4 + 0.039 = 6266.4 ft (spillway will not flow)

Pond freeboard = 6267.5 - 6266.4 = 1.1 ft

POND 9 (ref. pp. B-20, B-12, Dwg. E3-3441)

From references:

| | |
|---|---|
| CN = 53  S = 8.87 | Crest elev. - 6231.5 ft |
| CN = 45  S = 12.20 | Overflow elev. = 6230.3 ft |
| CN = 73  S = 3.70 | Spillway elev. = 6231.2 ft |
| Acres = 72.9 | Capacity = 3974 cf |
| Soil = 709 cf | |

Calculations:

| Area | % Total Area | S | Weighted Q |
|---|---|---|---|
| 1B | 0.010 | 8.87 | - |
| 1G | 0.025 | 12.20 | - |
| 1Y | 0.004 | 3.70 | 0.002 |
| 2B | 0.129 | 8.87 | 0.002 |
| 2G | 0.099 | 12.20 | 0.001 |
| 2Y | 0.014 | 3.70 | 0.006 |
| 3B | 0.577 | 8.87 | 0.010 |
| 3G | 0.123 | 12.20 | 0.001 |
| 3Y | 0.019 | 3.70 | 0.008 |
| | 1.000 | | 0.030 in |

Runoff volume = $\frac{(0.030 \text{ in})(72.9 \text{ ac})(43560 \text{ ft}^2/\text{ac})}{12 \text{ in/ft}}$ = 7939cf

Maximum design volume = 7939 + 709 = 8648 cf
8648 cf > 3974 cf - pond will overflow

Average flow into pond = 8648 cf/24 hr = 0.100 ft

Head required on overflow = 0.072 ft
$0.100 = 3.33\ (1.57 - 0.2(0.072))\ 0.072^{1.5}$

Maximum water level = 6230.3 + 0.072 = 6230.4 ft (spillway will not flow)

Pond freeboard = 6231.5 - 6230.4 = 1.1 ft

RECLAMATION PLAN: SEDIMENTATION PONDS

Prior to regrading the Geneva Mine surface area to the reclaimed contour, the Operator proposes to enlarge Ponds 1 and 3 as shown drawing numbers E3-3440 and E3-3442. Pond 9 will be maintained in its current condition, but the drainage area will be reduced by installing a diversion ditch and removing the straw bales referenced to on page B-18.

Hydrologic curve numbers referred to in this evaluation correspond to those developed on page B-3 of Appendix B. During reclamation, track ballast, building roofs and blacktop will all be removed and the surface graded. Curve numbers assumed for these graded areas are CN=82 for soil group B and CN=89 for soil group D (ref. Roads, p. B-32). All other curve numbers developed on page B-3 are appropriate for this evaluation.

Some additional undisturbed areas are included in the drainage areas of Ponds 1 and 3. Curve numbers are developed as follows (references correspond to those on page B-3):

| Drainage Area | Acres | Cover (2) Density | Cover Type (2) | Soil (3) Group | Curve No. |
|---|---|---|---|---|---|
| Pond 1 | 1.992 | 0 | Juniper/Grass | B | 82(5) |
| Pond 1 | 8.200 | 30% | Juniper/Grass | D | 85(5) |
| | 10.192 | | | | |

| Total drainage into Pond 1: | | |
|---|---|---|
| | Pond 1 (p. B-5) | 2.957 A |
| | Pond 2 (p. B-6) | 1.025 A |
| | Pond 7 (p. B-10) | 0.941 A |
| | Undisturbed | 10.192 A |
| | | 15.115 A |

| Total drainage into Pond 3: | | |
|---|---|---|
| | Pond 3/4 (p. B-7) | 12.594 A |
| | Pond 5 (p. B-8) | 1.322 A |
| | Pond 6 (p. B-9) | 1.775 A |
| | Pond 8 (p. B-11) | 1.519 A |
| | Undisturbed | 3.310 A |
| | | 20.520 A |

Curve numbers have not been developed for the additional undisturbed area in Pond 3 since the regraded surface is so large by comparison.

Runoff calculations are based on the method described on page B-1 and are evaluated for a 10 year - 24 hour and a 25 year - 24 hour precipitation event.

Soil loss calculations are based on the method referenced on page B-2.

Sedimentation pond adequacy combines the runoff from the 10 year - 24 hour precipitation event with the anticipated sediment accumulation over a three year period. This required storage capacity is then compared to the proposed pond capacity.

Overflow adequacy evaluates the 25 year - 24 hour storm discharge through overflow structures. The head requirement on the overflow pipe is calculated using the wier formula discussed in "Sediment Pond Discharge Structures" in this appendix.

Pond 1 (Reference Appendix B)

RUNOFF CALCULATION:

| Curve No. | Acres | % of Total | Weighted CN | Runoff Calc. |
|---|---|---|---|---|
| 56 | 0.034 | 0.002 | 0.11 | CN = 85 |
| 61 | 0.106 | 0.007 | 0.43 | S = 1.76 |
| 65 | 0.009 | 0.001 | 0.07 | 10-24Q=0.689" |
| 82 | 3.621 | 0.240 | 19.68 | 25-24Q=0.931" |
| 85 | 9.182 | 0.607 | 51.60 | |
| 89 | 1.809 | 0.120 | 10.68 | |
| 93 | 0.354 | 0.023 | 2.14 | |
| | 15.115 | 1.000 | 84.71 | |

SOIL LOSS CALCULATION:

| Length | % Grade | Acres | R | K | LS | C | A | T/YR |
|---|---|---|---|---|---|---|---|---|
| 10 | 3.0 | 15.115 | 20 | 0.43 | 0.14 | 0.45 | 0.54 | 8.19 |

SEDIMENTATION POND ADEQUACY:

Runoff requirement = (0.689)(15.115)(43560)/12 = 37791 cf

Sediment requirement = (8.19)(3)(2000)/85 = 578 cf

| | | |
|---|---|---|
| Total Storage Requirement | = | 38369 cf |
| Total Pond Capacity | = | 40726 cf |

OVERFLOW ADEQUACY:

Runoff requirement = (0.932)(15.115)(43560)/12 = 51099 cf

Pond will overflow

Average flow into pond = 51099 cf/24 hr = 0.591 cfs

Head required on overflow = 0.239 ft

Maximum water level = 6180.0 + 0.239 = 6180.2 ft

Pond freeboard = 6181.5 - 6180.2 = 1.3 ft

(Spillway will not overflow)

Pond 3 (Reference Appendix B)

RUNOFF CALCULATION:

Most all of the drainage area into pond 3 will be from regraded surfaces having a curve number of 82 (p. B-3, B-32, 33). The small undisturbed area uphill, which would have a smaller curve number because of vegetal cover, is considered negligable. The total drainage area equals 20.520 acres.

CN = 82
S = 2.20
10-24 Q = 0.551"
25-24 Q = 0.768"

SOIL LOSS CALCULATION:

| Length | % Grade | Acres | R | K | LS | C | A | T/YR |
|---|---|---|---|---|---|---|---|---|
| 10 | 3.0 | 20.520 | 20 | 0.43 | 0.14 | 0.45 | 0.54 | 11.12 |

SEDIMENTATION POND ADEQUACY:

Runoff requirement = (0.551)(20.520)(43560)/12 = 41042 cf

Sediment requirement = (11.12)(3)(2000)/85 = 785 cf

Total Storage Requirement = 41828 cf
Total Pond Capacity = 53730 cf

OVERFLOW ADEQUACY:

Runoff requirement = (0.768)(20.520)(43560)/12 = 57206 cf

Pond will overflow

Average flow into pond = 57206 cf/24 hr = 0.662 cfs

Head required on overflow = 0.258 ft

Maximum water level = 6244.5 + 0.258 = 6244.8 ft.

Pond freeboard = 6246.0 - 6244.8 = 1.2 ft

(Spillway will not flow)

Pond 9

Reduced drainage area: Hydrologic evaluation in Appendix B is adequate for permitting.

Reclamation Plan - Diversion Ditch Adequacy

Three additional diversion ditches will be cut to channel runoff from the undisturbed hillside away from newly graded areas during reclamation. The diversion ditch referenced in Appendix B of the MRP will be maintained during reclamation and will hereafter be designated as Ditch No. 1. The three ditches proposed herein will be referred to as Ditches 2, 3 and 4 as shown on E3-3442.

Each ditch will be constructed at the contact between the disturbed area and the undisturbed hillside. As such, all runoff into the ditch will be from undisturbed areas, but the ditch itself will be constructed on currently disturbed land (reference Drawing A3-1436).

Ditches will be constructed as follows:

1. Grade and compact the disturbed area according to the methods described in the MRP to the reclaimed contour shown on Drawing No. A3-1436.

2. Excavate the ditch in the compacted soil using spoil material to build a berm on the downstream side.

3. Compact the berm and channelway as necessary to ensure proper drainage.

4. Maintain a minimum of two feet of depth between the bottom of the channel and both the undisturbed contact and the top of the berm.

5. Line the channel with riprap or other currently acceptable stabilizing material to minimize erosion potential.

Each ditch will be built with the same cross section (reference Drawing A3-1436) but the length, and slope will be site specific. **Each ditch will be two feet deep and maintain 0.3 feet of freeboard.** As such, the following values will be the same for each diversion:

$$\text{Area} = (1.7)^2 + 1.7(1.0) = 4.59 \text{ sq ft}$$

$$\text{Wetted Perimeter} = 1 + 2\sqrt{2(1.7)^2} = 5.81 \text{ ft}$$

$$\text{Hydraulic Radius} = 4.59/5.81 = 0.790 \text{ ft}$$

Each ditch is located on the south facing hillside. The following information pertinant to runoff evaluation will be the same for each ditch:

Steep slopes in drainage area (reference Dwg.E3-3442)
Hydrologic soil group C (reference Dwg. F3-172)
37% Juniper/grass cover (reference pg.15 of vegetation study)
Curve number of 78 (reference pg. B-32,33)

10 year-24 hour storm intensity of 1.85 inches (reference pg. B-49)

DITCH NO. 1

No changes to Ditch No. 1 are proposed. Reference pages B-15, 16 of Appendix B.

DITCH NO. 2

Ditch slope = 0.036 ft/ft (ref. Dwg.E3-3442)
Drainage area = 10.3 acres (ref. Dwg. E3-3442)
Peak flow = less than 6.2 cfs (ref. pg. B-43)
Ditch capacity $= \frac{1.486}{0.035} (4.59)(0.790)^{2/3} (0.036)^{1/2} = 31.6$cfs (ref. pp. B-15, 47)

DITCH NO. 3

Ditch slope = 0.160 ft/ft (ref. Dwg. E3-3442)
Drainage area = 7.8 acres (ref. Dwg. E3-3442)
Peak flow = less than 5 cfs (ref. p. B-43)
Ditch capacity $= \frac{1.486}{0.035} (4.59)(0.790)^{2/3} (0.160)^{1/2} = 66.6$cfs (ref. pp. B-15, 47)

DITCH NO. 4

Ditch slope = 0.063 ft/ft (ref. Dwg. E3-3442)
Drainage area = 10.7 acres (ref. Dwg. E3-3442)
Peak flow = less than 6.4 cfs (ref. p. B-43)
Ditch capacity $= \frac{1.486}{0.035} (4.59)(0.790)^{2/3} (0.063)^{1/2} = 41.8$cfs

All diversion ditches will be reclaimed concurrently with sedimentation ponds 1, 3 and 9 when the disturbed area has been successfully revegetated (refer to Appendix G of MRP).

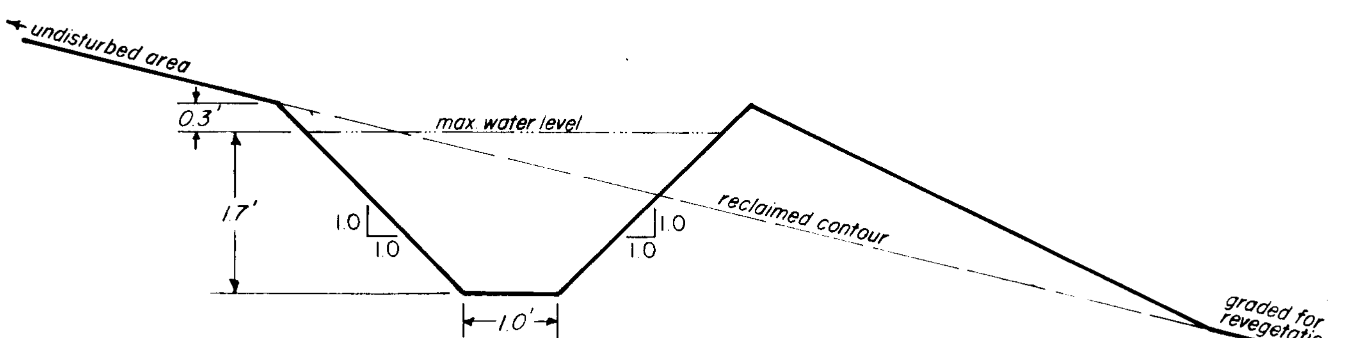
Regrading of diversion ditches will consist of smoothing and compacting the berm into the channelway. Since the disturbed area was graded to final reclaimed contour prior to ditch excavation (ref. item 1 under ditch construction), cuts and fills when regrading the ditches will balance to the reclaimed contour shown on A3-1436.

U. S. STEEL (USS) MINING CO. **A3-1436**

ENGINEERING DEPARTMENT
WESTERN DISTRICT COAL

# GENEVA MINE

# TYPICAL DIVERSION DITCH CROSS SECTION




| DITCH NO. | SLOPE (ft/ft) | CAPACITY (cfs) |
|---|---|---|
| 2 | 0.036 | 31.6 |
| 3 | 0.160 | 66.6 |
| 4 | 0.063 | 41.8 |

Registered Professional Engineer
GLENN H. SIDES
No. 4169
State of Utah

THIS DRAWING WAS PREPARED UNDER MY SUPERVISION

Glenn H Sides 4169
Registered Professional Engineer- Utah

AUG 26 1983
Date

DRAWN: B.A.F. 8-23-83 CHECKED: ___ APPROVED FOR SAFETY: ___ APPROVED G.H.S. 8-23-83

REF. DWGS. E3-3442

## RECLAMATION PLAN - CULVERT ADEQUACY

The road which spans the Geneva Mine site provides public access to Horse Canyon and is not a part of the reclamation plan. Since the road will be left intact when the mine site is reclaimed, the Operator proposes to leave the three culverts which pass beneath the access road. These culverts are designated as culverts 1, 3, and 5 on Drawing No. A3-1426 (p. B-14). Drainage areas during and after reclamation are shown on E3-3442.

Hydrologic evaluation based on the 100 year - 24 hour precipitation event is as follows (reference numbers correspond to those on page B-13):

100 year - 24 hour storm intensity: 2.74 inches
("Estimated Return Periods for Short Duration Precipitation", Station: Price)

| Culvert No. (1) | Drainage Area(E3-3442) | Curve No. | Peak Flow(6) | Culvert Capacity |
|---|---|---|---|---|
| 1 | 28.0 | 73 | 18 | 79 |
| 3 | 57.3 | 71 | 30 | 7250 |
| 5 | 73.0 | 85 | 120 | 7800 |

The drainage area for Culvert 1 includes Diversion Ditch 4. The drainage area for Culvert 3 includes Diversion Ditches 2 and 3. The drainage area for Culvert 5 includes Diversion Ditch 1.

## SEDIMENTATION POND CERTIFICATION

Nine sedimentation ponds have been constructed at Geneva Mine. The ponds were constructed as shown on the "as constructed" drawings included in U. S. Steel Mining Co.'s response to the Determination of Completeness and Technical Adequacy. All sedimentation ponds are visually inspected quarterly. The ponds have the following capacity and maximum water depth:

| Pond | Capacity | Maximum Depth |
|---|---|---|
| 1 | 8,615 cf | 1.9 ft |
| 2 | 12,889 cf | 3.0 ft |
| 3 | 8,514 cf | 2.6 ft |
| 4 | 7,742 cf | 2.0 ft |
| 5 | 2,738 cf | 2.7 ft |
| 6 | 8,540 cf | 3.2 ft |
| 7 | 4,993 cf | 3.7 ft |
| 8 | 2,624 cf | 2.6 ft |
| 9 | 3,974 cf | 1.6 ft |

Any rills, gullies or other damage to the impoundment which affect stability will be corrected immediately.

Glenn H. Sides

Glenn H. Sides — 4169 Registration Number

# GENEVA MINE
## WATER MONITORING

The Operator currently monitors eleven discharge points under an approved NPDES permit. Future water monitoring will be consistant with the requirements of the current approved permit.

Approved discharge locations:

001 - Mine Water Discharge at Water Tank
002 - Mine Water Discharge Near Tressle
003 - Sewer Plant Discharge
004 - Sedimentation Pond No. 1
005 - Sedimentation Pond No. 7
006 - Sedimentation Pond No. 2
007 - Sedimentation Pond Nos. 3 and 4
008 - Sedimentation Pond No. 9
009 - Sedimentation Pond No. 5
010 - Sedimentation Pond No. 6
011 - Sedimentation Pond No. 8

Monitoring parameters required under the present NPDES permit:

003 - BOD - 5 Day
pH
Total Suspended Solids
Oil and Grease
Total Residual Chlorine
Fecal Coliform
Total Coliform

All Others - pH
Total Suspended Solids
Oil and Grease
Total Iron
Total Dissolved Solids
Flow

Monitoring frequency required under the present NPDES permit:

003 - Monthly
All Others - Bi-monthly

Samples are handled and preserved in accord with EPA guidelines.

The Division will continue to be notified of any noncompliance with the approved permit effluent limitations within five days.

Water monitoring reports will be submitted to the Division quarterly.

# APPENDIX III

## RECLAMATION CALCULATIONS AND ESTIMATED COSTS

# RECLAMATION CALCULATIONS

U. S. Steel Mining Co., Inc. re-evaluated the proposed final contours for Geneva Mine. The final contours shown on Map F3-170 of the MRP have been changed to eliminate highwalls to the maximum extent possible. Revised Map F3-170 (included in this document) shows the revised final contours for Geneva Mine. The reclamation cost calculations have been completely revised and are included in this appendix.

Table 1 presents a cut and fill balance for the regrading of Geneva Mine. All volumes of earth excavation and embankment are presented on an "in place" basis.

## SWELL FACTORS

### Reinforced Concrete

The swell factor for handling rough quarry stone is 1.75(4). This corresponds to 5.7% solid and 43% voids. Reinforced concrete will break in larger blockier pieces than stone. 40% voids were assumed which corresponds to a swell factor of 2.5.

$$\frac{1}{0.4} = 2.5$$

### Brick

The swell factor for rock is 1.6 - 1.7(3). Brick will break in generally smaller pieces than rock. Therefore, a swell factor of 1.5 was used.

### Earth Excavation

The swell factor for a mixture of 75% earth and 25% rock is 1.25(3). Therefore 1.3 was used.

### Earth Cover Over Concrete

Percent Voids in Crushed Material(5)

| | Coarse-Subsoil | Fine-Subsoil |
|---|---|---|
| Rammed | 46 | 43 |
| Compacted | 49 | 45 |

Rammed

Average percent voids = 46 + 43/2 = 44.5
Average percent solids = 100 - 44.5 = 0.555
Swell Factor = 1/.555 = 1.80

Compacted

Average percent voids = 49 + 45/2 = 47
Average percent solids = 100 - 47 = 53
Swell factor = 1/0.53 = 1.89

Use 1.82 as a ratio for placing soil over concrete rubble. The required soil volume was calculated by assuming a 2.0 ft minimum cover - expanded by 1.82 over all concrete disposal areas. This factor assumes that all voids in the concrete disposal area will be filled with soil to a depth of 4 feet.

The swell factors used in calculating the reclamation costs are conservative and should result in higher estimated costs.

| | |
|---|---|
| Subject: Estimated Reclamation<br>Geneva Mine | Calculation Notes<br>By: R. Crebs<br>Date: 9-29-1980<br>Revised: 8-24-83<br>By: V. R. Watts |

## DEMOLITION AND DISPOSAL

| | | |
|---|---|---|
| 1. | Brick Buildings and Structures | |
| 1.1 | Volume | 603,071.2 cf |
| 1.2 | Unit cost (2) | $0.12/cf |
| 1.3 | Demolition cost | $72,368.54 |
| 2. | Concrete Buildings and Structures | |
| 2.1 | Volume | 739,719.9 cf |
| 2.2 | Unit cost (2) | $0.16/cf |
| 2.3 | Demolition cost | $118,335.18 |
| 3. | Steel Buildings and Structures | |
| 3.1 | Volume | 501,537.1 cf |
| 3.2 | Unit cost inc. disposal (2) | $0.12/cf |
| 3.3 | Demolition cost | $60,184.45 |
| 4. | Mine Fans | |
| 4.1 | Dismantling labor | 48 hours |
| 4.2 | Labor cost (2) | $13.50/hour |
| 4.3 | Dismantling labor cost | $648.00 |
| 4.4 | Crane rental w/operator (1) | $996.45/day |
| 4.5 | Crane rental time | 1 day |
| 4.6 | Crane cost | $996.45 |
| 4.7 | Tractor-trailer rental w/operator (2) | $208.00/day |
| 4.8 | Tractor-trailer operating cost (2) | $7.19/hour |
| 4.9 | Operating hours | 8 hours |

| | | |
|---|---|---|
| 4.10 | Tractor-trailer rental time | 1 day |
| 4.11 | Tractor-trailer rental cost | $208.00 |
| 4.12 | Tractor-trailer operating cost | $57.52 |
| 4.13 | Total cost per fan | $1,909.97 |
| 4.14 | Total cost for 3 fans | $5,729.91 |

5. Substation

| | | |
|---|---|---|
| 5.1 | Dismantling labor | 128 hours |
| 5.2 | Labor cost (electrician)(2) | $16.05/hour |
| 5.3 | Dismantling cost | $2,054.40 |
| 5.4 | Crane rental w/operator (2) | $996.45/day |
| 5.5 | Crane rental time | 5.3 days |
| 5.6 | Crane cost | $5,314.40 |
| 5.7 | Tractor-trailer rental w/operator (2) | $208.00/day |
| 5.8 | Tractor-trailer operating cost (2) | $7.19/hour |
| 5.9 | Tractor-trailer operating time | 8 hours |
| 5.10 | Tractor-trailer rental time | 1 day |
| 5.11 | Tractor-trailer rental cost | $208.00 |
| 5.12 | Tractor-trailer operating cost | $57.52 |
| 5.13 | Total cost to remove substation | $7,634.32 |

6. Railroad Tracks

| | | |
|---|---|---|
| 6.1 | Length of track | 13,070 ft |
| 6.2 | Removal cost (track, ties, ballast including equipment and operators)(2) | $8.90/ft |
| 6.3 | Removal cost | $116,323 |

Total Demolition and Disposal $380,575

TIPPLE - Backfilling and Grading

Earth Excavation prior to Demolition

1560 bcy of dirt must be excavated before demolition of the tipple

1560 bcy x 1.3 (swell factor) = 2028 Lcy

Use Cat 225 excavator - 1.62 cy capacity (54" bucket width) the bucket fill factor for the ground around the tipple is 0.90.
Average bucket payload = (heaped bucket capacity) x (bucket fill factor)
= 1.62 x 0.90
= 1.46 cy

The cycle time Cat 225 (average operator) see pg. 88 Cat Performance Book

| Load Bucket | | Swing Loaded | | Dump Bucket | | Swing Empty | | |
|---|---|---|---|---|---|---|---|---|
| 6.0 | + | 5.0 | + | 2.0 | + | 4.0 | = | 17.0 sec |

cy /60 min hr = $\frac{60 \text{ min/hr}}{17 \text{ sec/60 sec/hr}}$ x 1.46 cy = 309.18 cy/hr

Actual cy /hr = 309.18 cy x .833 job efficiency factor (50 min/hr)
= 257.54 cy/hr

Total Time for Excavation - $\frac{2028 \text{ LCY}}{257.54 \text{ LCY/hr}}$ = 7.9 hrs

Total Cost for 7.9 hrs excavation using Cat 225 Excavator at $63.13/hr

Tipple 7.9 hrs x $63.13/hr = $499

Move Demolished Concrete From Tipple to Main Yard Disposal Area

Total hauling distance from tipple to disposal area = 3200 ft

Use Cat 769C Off-Highway Truck

Operating weight = 67,730 lb GVW - 137,730 lbs
Capacity - 35 T
- 30.8 cy (2:1) heaped (SAE)

Capacity of concrete
Concrete weighs 144 lbs/cf x 27 $\frac{\text{cf}}{\text{cy}}$ = $\frac{388 \text{ lbs/cy}}{2000 \text{ lbs/ton}}$

= 1.944 tons/cy

Allowable capacity of truck = $\frac{30.8\ yd}{2.5}$ (swell factor for concrete)

= 12.32 cy of solid concrete

12.32 cy of solid concrete weighs

12.32 cy x 1.944 tons/yd = 23.95 tons - 35 ton capacity of truck

= 47,900 lbs

Gross weight = weight of truck + weight of payload
= 67,730 lbs + 47,900 lbs = 115,630 lbs

Total resistance = grade + rolling
= 3% + 2% (from Cat Performance Handbook pg. 47)
= 5%

with respective total resistance, and haul distance one way
load haul time = 2.05 min (pg. 223 Cat)
empty haul time = 1.30 min (pg. 224 Cat)

Figure load time using 980 c Cat rubber tire loader
- use V-edge rock bucket, bucket capacity 5.25 cy
- dump clearance at full tilt and 45 deg discharge 9' 10'
- loading height of truck 10'6", thus a small loading ramp will be required

Cycle time - load
30.8 cy hauled 40'

| | | |
|---|---|---|
| - loaded haul time | .09 | |
| - empty haul time | .08 | efficiency factor |
| - basic | .40 | |
| | .57 | x $\frac{1}{.833}$ = .687 |

Bucket fill factor = 0.60
5.25 cy x 0.60 = 3.15 cy
cycles/hr = $\frac{60\ min}{.687}$ = 87.336

cy/hr = 87.336 x 3.15 cy = 275.20

hr/truck $\frac{30.8\ cy}{275.20\ cy/hr}$ = .112 hrs x 60 min/hr = 6.72 min

Total cycle time to load - haul - return tipple
(using two trucks)

| Manuver to Load | Waiting Time to be Loaded | Load Time | Haul Load | Manuver & Dump | Return | |
|---|---|---|---|---|---|---|
| 1.00 + | 1.37 + | 6.72m + | 2.05 + | 1.00 + | 1.30 | =13.44 min cycle |

13.44 min to cycle 30.8 LCY of tipple concrete

There is 3780 LCY concrete in tipple to be moved to the main yard disposal area.

Total time to move tipple

3780 LCY x 13.44 min = 825 min = 13.7 hrs

Job efficiency factor = 0.833 (50 min/hr)

Total time = 16.4 hrs

Total Cost of Reclamation of Tipple

Equipment used

(1) 980 C Wheel Loader @ $81.66/hr
(2) 769 C Off-Highway Truck @ $88.12/hr/truck
(2) D-8K (77V1) Bulldozer @ $83.75/hr/bulldozer
1 - at tipple piling concrete
1 - at office-warehouse disposal area

Total Reclamation Time = 16.4 hrs

| | |
|---|---|
| (1) 980 C 16.4 hrs x $81.66/hr | $1,339 |
| (2) 769 C 16.4 hrs x $88.12/hr x 2 | 2,890 |
| (2) D-8K(77V1) 16.4 hrs x $83.75/hr x 2 doz | 2,747 |
| Total Cost | $6,976 |

Grading at Tipple

| | | |
|---|---|---|
| Volume of material to be cut | | 2045 BCY |
| Swell factor (3) | | 1.3 |
| Volume of material | | 2659 LCY |
| Volume of material from demolition excavation | | 2028 LCY |
| Total volume to be graded | | 4687 LCY |
| Average dozing distance | | 150 ft |
| Estimated production Cat D8S | | 675 LCY |
| Job Factors (3) | | |
| Efficiency | 0.83 | |
| Operator | 0.75 | |
| Net production | | 420 LCY/hr |
| Time required | | 11.1 hrs |

| | |
|---|---|
| Cost of Caterpillar D8S with sheeps foot roller (1) | $93.04 |
| Total Grading Cost | $1,033 |
| Total Backfilling and Grading Cost at Tiple | $8,508 |

## SEWAGE DISPOSAL PLANT

### Demolition

| Buildings and Structures | Volume | Unit Cost | Cost |
|---|---|---|---|
| Concrete | 13,684.22 | $.16 | $2,189.48 |
| Brick | 1,440.00 | .12 | 172.80 |
| | | | $2,362.28 |

Haul concrete and brick to office-warehouse disposal area
= 3200 ft. one way

From tipple reclamation, 13.44 min cycle to haul 30.8 LCY of concrete

Volume of concrete to be disposed = 169 LCY

$$\frac{200\ \text{LCY}}{30.8\ \text{LCY/truck} \times 2\ \text{trucks}} \times 13.44\ \text{min} = 44\ \text{min} = 0.7\ \text{hrs}$$

Total Cost

Equipment used

(1) 980 C wheel Loader @$81.66/hr
(2) 769 C Off-Highway Truck @$88.12/hr/truck
(2) D-8K(77V1) Bulldozer @$83.75/hr/bulldozer
1 - at sewage plant
1 - at office-warehouse disposal area

Total Time = 0.7 hrs

| | |
|---|---|
| (1) 980 C - 0.7 hrs x $81.66 | $ 57 |
| (2) 769 C - 0.7 hrs x 2 x $88.12 | 123 |
| (2) D-8K - 0.7 hrs x 2 x $83.75 | 117 |
| | $297 |

### Excavation Prior to Demolition

| | |
|---|---|
| Volume of material to be excavated | 157 BCY |
| Swell Factor (3) | 1.3 |
| Volume of material to be excavated | 204 LCY |
| Production (from calculations for tipple) | 257.54 LCY/hr |
| Time required for excavation | 0.8 hrs |
| Cost/hr for Cat 225 excavator | $63.13 |
| Total Cost | $51.00 |

Grading

| | | |
|---|---|---|
| Volume of material to be graded | | 309 BCY |
| Swell factor (3) | | 1.3 |
| Volume to be graded | | 402 LCY |
| Average dozing distance | | 75 ft |
| Estimated production | | 950 LCY/hr |
| Job Factors (3) | | |
| Efficiency | 0.83 | |
| Operator | 0.75 | |
| Net production | | 591 LCY/hr |
| Time required | | 1.6 hrs |
| Cost/hr for Cat D8-K bulldozer with sheeps foot roller (1) | | $93.04 |
| Total Cost | | $149.00 |
| Total Cost for Sewage Disposal Plant | | $2,859.00 |

400,000 GALLON WATER TANK

400,000 gal. capacity / 7.48 gal/cf = 53,485.94 cf of steel
The demolish cost for steel if \$.12/cf, thus
53,475.94 x \$.12/cy = \$6,417.11

Concrete base 35' dia. 1' thick @ \$.16/cf demolition
(17.5) x II x 1' = 962.11 cf x .16 = \$153.94
Redwood tank base (6.0) x II x 1' = 113.097 cf x .16 =\$18.10

Haul concrete base down to highwall disposal area - 1.2 miles or 6400 ft

962.11 cf
113.10 cf
1075.21 cf 27 = 39.82 cy solid x 2.5 (swell factor) =99.56LCY

Total cycle time

| Manuver to laod | Load time | Haul load | Manuver & dump | Return | |
|---|---|---|---|---|---|
| 1.00 + | 6.72 + | 4.41 + | 1.00 + | 3.45 | = 16.58 min |

Total time $\frac{99.56 \text{ cy}}{30.8 \text{ LCY/truck}}$ x 16.58 min = 53.59 min + 60 min travel
= 113.59 min or 1.89 hrs

Total cost to move

(1) 980 C wheel loader @\$81.66/hr x 1.89 hrs = \$154.34
(1) 769 C Off-highway truck @\$88.12/hr x 1.89 hrs = \$166.55
(1) D-8K (77V1)bulldozer @\$83.75/hr x 1.89 hrs = \$158.29
Total Cost \$479.18

Move Borrow Material

66.7 cy from borrow area, avg. haul 6040 ft one way
66.7 cy x 1.75 (swell factor) = 116.73 LCY, use 769 off-highway truck

Cycle time

| Maneuver to load | Load time | Haul load | Maneuver & dump | Return | |
|---|---|---|---|---|---|
| 1.00 + | 6.72 + | 4.60 + | 1.00 + | 2.80 | = 16.12 min |

$\frac{116.73 \text{ LCY}}{30.8 \text{ LCY/truck}}$ x 16.12 min = 61.09 min
= 1.02 hrs

Cost 980 C \$81.66/hr x 1.02 = \$83.15
769 C \$88.12/hr x 1.02 = 89.73
\$172.87

Total Cost \$7,069.00

ROAD JUNCTION REFUSE PILE - PROVIDE 8 INCH SOIL COVER

Soil cover required for 1.96 ac 8" thick
Volume required = 2100 cy
One way haul distance = 5.3 mi

Cycle time calculation

| | |
|---|---|
| Bucket capacity Cat 980 (3) | 5.25 cy |
| Basic cycle | 0.5 min |
| Truck capacity | 20 cy |
| Cycles to load truck | 4 |
| Cycle time to load each truck | 2.0 min |
| Avg. speed for travel | 30 mph |
| One way travel distance | 5.3 mi |
| Two way travel time | 10.6 min |
| Total cycle time per truck | 12.6 min |
| Cycles/hr | 4.8 |
| Use 3 trucks | |
| Cycles/hr for 3 trucks | 14.3 |
| Production | 286 cy/hr |
| Job efficiency (3) | .83 |
| Material efficiency (3) | .85 |
| Production | 202 cy/hr |
| Use the following additional equip. | |
| D-8 to strip topsoil | |
| D-8 to spread topsoil at refuse pile | |
| Time required | 10.4 hr |

Equipment Costs:

| Description | Qty. | Unit Cost (1) | Cost |
|---|---|---|---|
| Cat 980 Wheel Loader | 1 | 81.66 | $ 81.66 |
| Cat D-8 Bulldozer | 2 | 83.75 | 167.50 |
| 20 cy Trucks | 3 | 47.62 | 142.86 |
| Total hourly cost | | | $392.02 |
| Total Cost | | | $4,077 |

## SOUTH FAN AND STANDBY AREA - BACKFILLING AND GRADING

### Excavation Prior to Demolition

| | |
|---|---|
| Volume of material to be excavated | 190 BCY |
| Swell factor (3) | 1.3 |
| Volume of material | 247 LCY |
| Use Cat 225 Excavator | |
| Estimated production (refer to tipple calculations) | 257.5 LCY/hr |
| Time required for excavation | 1.0 hr |
| Estimated cost/hr (1) | $63.13 |
| | |
| Total Cost | $63.00 |

### Haul Borrow Material

| | |
|---|---|
| Volume of borrow required | 737 BCY |
| Swell factor (3) | 1.3 |
| Volume of borrow | 958 LCY |
| One way haul distance | 6300 ft |

Cycle time (Cat 769 C Truck)

| | |
|---|---|
| Manuever to load | 1.00 min |
| Load | 6.72 min |
| Manuever & dump | 1.00 min |
| Haul | 4.6 min |
| Return | 2.30 min |
| | 15.6 min |

| | |
|---|---|
| Truck capacity (3) | 30.8 LCY |
| Production use two trucks | 237 LCY/hr |
| Time required | 4.0 hrs |
| Job efficiency (3) | 0.83 |
| Net time required | 4.8 hrs |

Labor and Equipment Costs/hr

| | Qty. | Unit Cost (1) | Hourly Cost |
|---|---|---|---|
| Cat 769 Truck | 2 | 88.12 | 176 |
| Cat 980 Wheel Loader | 1 | 81.66 | 82 |
| Cat D8-K Bulldozer | 1 | 83.75 | 84 |
| Total | | | $342 |

| | |
|---|---|
| Total Cost to Move Borrow Material | $1,642.00 |

### Grading

| | |
|---|---|
| Volume of material to be excavated | 2067 BCY |
| Swell factor (3) | 1.3 |
| Volume of material | 2687 LCY |
| Volume of material excavated prior to demolition | 247 LCY |
| Volume of borrow material | 958 LCY |
| Total volume to be graded | 3,892 LCY |
| Average dozing distance | 75 ft |

| | | | |
|---|---|---|---|
| Estimated production | | | 975 LCY/hr |
| Job factors (3) | | | |
| | Efficiency | 0.83 | |
| | Operator | 0.75 | |
| Net production | | | 607 LCY/hr |
| Time required to grade | | | 6.4 hrs |
| Cost for Cat D8-K with sheeps foot roller (1) | | | $93.04/hr |
| Cost for Grading | | | $597.00 |
| Total Cost for South Fan Area | | | $2,302.00 |

## NORTH FAN AREA - BACKFILLING AND GRADING

### Excavation Prior to Demolition

| | |
|---|---|
| Volume of material to be excavated | 65 BCY |
| Swell factor (3) | 1.3 |
| Volume of material | 85 LCY |
| Use Cat 225 Excavator | |
| Estimated production (see tipple cal.) | 257.5 LCY/hr |
| Time required to excavate | 0.3 hrs |
| Cost/hr (1) | $63.13 |
| Cost | $21.00 |

### Haul Borrow Material

| | | |
|---|---|---|
| Volume of borrow required | | 378 BCY |
| Swell factor (3) | | 1.3 |
| Volume to be moved | | 491 LCY |
| One way haul distance | | 7300 ft |
| Cycle time | | |
| Manuever to load | 1.00 | |
| Manuever & dump | 1.00 | |
| Load | 6.72 | |
| Haul | 5.50 | |
| Return | 2.50 | |
| | 16.72 | |
| Cycles/hr | | 3.6 |
| Job efficiency (3) | | 0.83 |
| Truck capacity | | 30.8 LCY |
| Production use two trucks | | 184 LCY/hr |
| Time required | | 2.7 hrs |
| Equipment cost/hr (refer to South Fan calculations)(1) | | $342/hr |
| Cost | | $923.00 |

### Grading

| | | |
|---|---|---|
| Volume of material excavated prior to demolition | | 85 LCY |
| Volume of borrow material | | 378 LCY |
| Total volume to be graded | | 463 LCY |
| Average dozing distance | | 75 ft |
| Estimated production | | 975 LCY/hr |
| Job factors (3) | | |
| Efficiency | 0.83 | |
| Operator | 0.75 | |
| Net production | | 607 LCY/hr |
| Time required | | 0.8 hr |
| Cost/hr for Cat D8-K bulldozer with sheeps foot roller (1) | | $93.04 |
| Cost | | $74.00 |

| | |
|---|---|
| Total Cost | $1,018.00 |

SEDIMENTATION POND REMOVAL

| Pond | Capacity | Notes |
|---|---|---|
| 1 | 8,615 cf | To be enlarged |
| 2 | 12,889 cf | |
| 3 | 8,514 cf | To be enlarged |
| 4 | 7,742 cf | include in pond 3 |
| 5 | 2,738 cf | |
| 6 | 8,540 cf | |
| 7 | 4,993 cf | |
| 8 | 2,624 cf | |
| 9 | 3,974 cf | |

Total Volume 31,784 cf does not inc. 1,3,4 & 9

| | | |
|---|---|---|
| Estimate of material to be graded | | 1177 BCY |
| Swell factor | | 1.3 |
| Estimate of material to be graded | | 1530 LCY |
| Cycle time | | 2.0 min |
| Cycles/hr | | 30 |
| Job efficiency (3) | 0.83 | |
| Bucket fill (3) | 0.50 | |
| Net cycles/hr | | 12 |
| Bucket capacity | | 5.25 cy |
| Production | | 63 cy/hr |
| Time required | | 24.3 hrs |
| Cost of Cat 980 wheel loader (1) | | $81.66 |
| Cost to Remove Ponds | | $1,984.00 |

Enlarge Ponds 1 and 3

Pond 1

| | | |
|---|---|---|
| Volume of material to be moved | | 1650 BCY |
| Swell factor (3) | | 1.3 |
| Volume of material | | 2145/cy |
| Basic cycle - Cat 980 wheel loader | | 0.50 min |
| Add for bank | | .04 |
| Add for tramming | | .20 |
| Total cycle time | | 0.74 min |
| Cycles/hr | | 81.1 |
| Job efficiency (3) | 0.83 | |
| Bucket fill (3) | 0.75 | |
| Cycles/hr - adjusted | | 50.5 |
| Bucket capacity (3) | | 5.25 cy |
| Production | | 2651 cy/hr |
| Time required | | 6.2 hr |
| Cost/hr Cat 980 wheel loader (1) | | 81.66 |
| Cost | | $508.00 |

Pond 3

| | |
|---|---|
| Volume of fill material (compacted) | 1600 cy |
| Swell factor (3) | 1.3 |
| Volume of fill (loose) | 2080 LCY |
| Basic cycle - Cat 980 wheel loader | 0.50 min |
| Add for bank material | .10 min |
| Total cycle time | 0.6 min |
| Cycles/hr | 100 |
| Bucket capacity (3) | 5.25 |
| Production | 5251 cy/hr |
| Job efficiency (3) 0.83 | |
| Net production | 4361 cy/hr |
| Time required | 3.7 hrs |

Equipment and Labor Costs:

| Description | Qty. | Unit Cost (1) | Cost |
|---|---|---|---|
| Cat 980 wheel loader | 1 | 81.66 | $ 81.66 |
| Hand held compactor | 3 | 8.18 | 24.54 |
| Laborers | 8 | 14.75 | $118.00 |
| Total | | | $224.20 |
| Cost | | | $830.00 |
| Total Cost | | | $3,322.00 |

REVEGETATION COST

SCARIFY COST

Tipple

Scarify and reseed area - 1.89 " area = 75600 sf = 1.74 acres

Use Cat 120G Motor grader @$60.63/hr w/scarifier width 10'
Avg. speed of 120 G 3.9 MPH = 20,592 ft/hr x 10' scarifier width
= 105,920 sf/hr

$\frac{75600 \text{ sf}}{205.920 \text{ sf/hr}}$ = 367 hrs + .5 hr travel time = .867 hr

Cost - 0.876 hr x 60.63/hr = $53.11

Sewer Disposal Plant

Scarify and reseed area - 2.09 " = 83,600 sf = 1.92 acres
From above data $\frac{83,600 \text{ sf}}{205,920 \text{ sf/hr}}$ = .406 hr + .5 hr travel time =.906hrs

Cost - .906 hrs x $60.63/hr = $54.93

Main Yard Area Including South Fan

Scarify and reseed area - 16.39 " = 655,600 sq = 15.05 acres
From above data $\frac{655,600 \text{ sf}}{205,920 \text{ sf/hr}}$ = 3.18 hrs +.5 hrs = 3.68 hrs

Cost - 3.68 hr x $60.63/hr = $223.35

400,000 Gallon Water Tank

75 " = 30,000 sf = .689 acres
Use Cat 120 G motor grader w/scarifer (11 teeth) @$60.63/hr
Avg. speed of 120 G = 3.9 MPH = 20,592 ft/hr x 10' scarifier
= 205,920 sf/hr

$\frac{30,000 \text{ sf}}{205,920 \text{ sf/hr}}$ = .15 hr + 1 hr travel time = 1.15 hrs

Cost - 1.15 hrs x $60.63 = $69.72

Total Scarifing Cost $404.11

Reseeding Cost

Total acres to be reseeded - 50.0 acres

Use 14 lb/acre seed mix @$8.00/lb plus $363/acre for Range Drilling (including labor, fert., etc.)

Total cost/acre = 14 lb/acre x $8.00/lb + $363.00/acre = $475/acre

Total cost - 50.0 acres x $475/acre = $23,750.00

Total Cost $24,154.00

## MAIN YARD AREA

### Earth Excavation Prior to Demolition

| | |
|---|---|
| Volume of material to be excavated prior to demolition | 3602 BCY |
| Swell factor (3) | 1.3 |
| Volume of excavated material | 4683 LCY |
| Production (Cat 225 Excavator - see tipple calculations) | 257.54 LCY/hr |
| Time required | 18.2 hrs |
| Cost/hr | $63.13 |
| Total Cost | $1149 |
| Total Cost of Earth Excavation | $1732.00 |

### Backfilling and Grading - Reservoir Area

| | | |
|---|---|---|
| Volume of excavation | | 1760 BCY |
| Swell factor (3) | | (1.3) |
| Volume of material to be graded | | 2288 LCY |
| Average dozing distance | | 300 ft |
| Estimated production Cat D8S (3) | | 300 LCY/hr |
| Job factors | | |
| Efficiency | 0.83 | |
| Operator | 0.75 | |
| Material | 0.80 | |
| Net production | | 149 LCY/hr |
| Time required | | 15.3 hrs |

### Backfilling and Grading - Highwall Near Transfer House

| | | |
|---|---|---|
| Volume of excavation | | 11,195 BCY |
| Swell factor (3) | | 1.3 |
| Volume of material to be graded | | 14,554 |
| Average dozing distance | | 200 ft |
| Production - Cat D8S (3) | | 625 LCY/hr |
| Job factors | | |
| Efficiency | 0.83 | |
| Operator | 0.75 | |
| Material | 0.80 | |
| Net production | | 311 LCY/hr |
| Time required | | 46.7 hrs |

### Backfilling and Grading - Highwall Near Garage

| | | |
|---|---|---|
| Volume of excavation | | 13,555 BCY |
| Swell factor (3) | | 1.3 |
| Volume of material to be graded | | 17,622 LCY |
| Average dozing distance | | 400 ft |
| Estimated production - Cat D8S (3) | | 225 LCY/hr |
| Job factors | | |
| Efficiency | 0.83 | |

| | | |
|---|---|---|
| Operator | 0.75 | |
| Material | 0.80 | |
| Net production | | 112 LCY/hr |
| Time required | | 157.3 hrs |

Backfilling and Grading - Track

| | | |
|---|---|---|
| Volume of excavation | | 2195 BCY |
| Swell factor (3) | | 1.3 |
| Volume of material to be graded | | 2854 LCY |
| Average dozing distance | | 400 ft |
| Estimated production - Cat D8S (3) | | 225 LCY/hr |
| Job factors | | |
| Efficiency | 0.83 | |
| Operator | 0.75 | |
| Material | 0.80 | |
| Net production | | 112 LCY/hr |
| Time required | | 25.5 hrs |

Backfilling and Grading - Cost Development

| | |
|---|---|
| Reservoir | 15.3 hrs |
| Transfer house | 46.7 hrs |
| Garage | 157.3 hrs |
| Track | 25.5 hrs |
| Total time | 244.8 hrs |
| Cost/hr for Cat D8S with sheeps foot roller (1) | $93.04 |
| Total Cost | $22,776 |

## BLACK TOP

0.74 ¤" 29,600 sq ft

Use D-8K w/hydraulic rear ripper @ \$93.04/hr
Ave speed 1 MPH (including slippage and stalls)
Full time ripping (no pushing or dozing assignments)
Every 500 ft. required 1/4 min to raise, pivot, turn, and lower again

Thus: $\frac{500 \text{ ft}}{88 \text{ ft/min}}$ = 5.68 min + .25 (turn time) = 5.93 min

Operator works 50 min/hr. $\frac{50}{5.93}$ = 8.43 passes/hr

Volume ripped = $\frac{500 \times 3 \times 2}{27}$ = 111 $yd^3$ per pass

Production - 111 $yd^3$ x 8.43 pass/hr = 935.73 yds/hr.

Fig. 2 ft ripped, 29,600 sq ft. x 2 ft = $\frac{59,200 \text{ cu ft.}}{27}$ = 2192.59 cu yds

Total Time $\frac{2192.59 \text{ cu yds}}{953.75 \text{ yd/hr}}$ = 2.30 hrs.

Cost - 2.30 hrs. x \$93.04/hr = <u>\$213.89</u>

Push blacktop to disposal area, assume blacktop 1' thick ave doze 320'

29,600 sq ft x 1 ft = $\frac{29,600 \text{ cu ft}}{27}$ = 1096.29 $yd^3$ x 1.4 (swell factor)
= 1534.81 LCY

Production D-8K with 320' doze 132.30 LCY/hr

- $\frac{1534.81 \text{ LCY}}{132.30 \text{ LCY/hr}}$ = 11.60 hrs.

Cost - 11.60 hrs x 83.75/hr = <u>\$971.58</u>

## COST
## MATERIAL MOVED TO DISPOSAL AREA

| | Building | Loose Cubic Yards Concrete | Brick | Haul Distance (ft) | Total Time (min) | Equipment (1)-Cat 980C @ 81.66/hr (2)-Cat 769C @ 88.12/hr (3)-D-8K @ 83.75/hr | Cost |
|---|---|---|---|---|---|---|---|
| 1. | South Fan | 162 | - | 1560' | 53.5 | (1) - 1<br>(1) - 2<br>(1) - 3 | $ 226.06 |
| 2. | North Fan | 283.89 | - | 1600' | 93.83 | 1-(1), 1-(2), 1-(3) | 396.47 |
| 3. | Transfer | 262.50 | - | 80' | 38.00 | 1-(3) | 53.04 |
| | House & conveyor gallery | 980.0 | | 1600' | 323.9 | 1-(1) 1-(2) 1-(3) | 1368.63 |
| 4. | Rock Tunnel Portal | All concrete is to be placed inside tunnel | | | | | |
| '. | 300,000 gal concrete reservoir | 1480.63 | - | 320' | 671.49 | 1- (3) | 937.28 |
| . | Garage | 56.33 | 109.14 | 80' | 23.95 | 1 - (3) | 33.43 |
| 7. | Office Bldg. | 96.97 | 130.23 | 80' | 32.88 | 1 - (3) | 45.90 |
| . | Wash House | 51.94 | 505.98 | 80' | 80.75 | 1 - (3) | 112.71 |
| 9. | Materials Bldg. | 1488.11 | 311.85 | 320' | 816.31 | 1 - (3) | 1139.43 |
| 10. | Machine Shop | 1017.88 | 294.26 | 460' | 850.11 | 1 - (3) | 1186.61 |
| 1. | Oil house | 145.67 | 27.52 | 460' | 112.21 | 1 - (3) | 156.63 |
| 12. | Sand house | 62.19 | 33.72 | 460' | 62.13 | 1 - (3) | 86.72 |
| '3. | Iginitron & sub-station | 399.49 | 127.43 | 80' | 76.27 | 1 - (3) | 106.46 |
| 14. | Heating Pl. | 152.96 | 136.94 | 80' | 41.96 | 1 - (3) | 58.57 |
| '5. | Heat Plant | Stack - assume stack will be spread while other material is dozed into place | | | | | |
| 6. | Car shop | 153.52 | - | 460' | 99.46 | 1 - (3) | 138.82 |
| 17. | Car shop Clean. slab | 45.86 | - | 460' | 29.71 | 1 - (3) | 41.47 |
| 8. | Fire hose house | 24.3 | - Disposed of during grading | | | | |
| 9. | Roof bolt shed | 69.56 | - | 460' | 45.06 | 1 - (3) | 62.90 |
| 20. | Compressor Bldg. | 23.83 | - | 320' | 10.81 | 1 - (3) | 15.09 |
| 4. | Steel Stg. rack | 45.08 | - | 320' | 20.45 | 1 - (3) | 28.55 |
| 5. | Piping Tunnel | 211.9 | - Disposed of in place | | | | |
| | | | | | | Total | $6194.77 |

PORTAL SEALS

South Fan

Outside area 159.41 sf
The fan entry will be sealed with accordance to Dwg. A8-1367
Total amount of blocks required for 159.41 sf entry

1 block 8" x 8" x 16" or .667' x .667' x 1.333'
the face area is .667' x 1.333' = 0.889 sf

$\frac{159.41 \text{ sf}}{0.889 \text{ sf/blk}}$ = 179.31 blocks, deliver 200 blocks to area

Cost of blocks is $2.00/block including delivery and cement
Thus 200 blocks x $2.00/block = $400.00

Labor to install stopping - 2 men 2 days at $13.50/hr/man
2 men x 2 day x 8 hr/day x $13.50/hr/man = $432.00

Install 50 timber to secure entry after demolition of concrete
50 timber at $5.00/timber delivered = $250.00

Same 2 men take one day to set timber
2 men x 8 hrs x 13.50/hr/man = $216.00

Use 1 cy LHD to place concrete and earth fill in entry

Cycle time

| | | | |
|---|---|---|---|
| Load haul time | .15 | | |
| Empty haul time | .10 | efficiency factor | |
| Basic | .40 | | |
| | .65 | x $\frac{1}{.833}$ | = .78 |

Bucket fill factor

1 cy bucket x .75 = 0.75 cy
cycles/hr = $\frac{60}{.78}$ = 76.92
cy/hr = 76.92 x .75 - 57.69

Total cy = 160.91 LCY - concrete
+229.29 LCY - earth fill
390.20 LCY

Total time = 390.20 LCY = 6.76 hrs + 1 hr travel time =7.76hrs

| Item | Time | Rate | Cost |
| --- | --- | --- | --- |
| 1 yd LHD | 7.76 | 35.56 | $ 275.95 |
| 1 Operator | 7.76 | 14.25 | 110.58 |
| Operating Cost | 7.76 | 15.16 | 117.64 |
| D-8K Dozer | 4.00 | 124.55 | 498.20 |
| 1 Operator | 4.00 | 14.25 | 57.00 |
| Operating Cost | 4.00 | 17.81 | 71.24 |
| | | | $1130.61 |

Total cost to seal portal after demolition

| | |
| --- | --- |
| Machinery | $1130.61 |
| Blocks and Timber | 650.00 |
| Labor for Blocks & Timber | 648.00 |

$2428.61 for 159.41 sf area or $15.23/sf/ft of entry

| | | | | | |
| --- | --- | --- | --- | --- | --- |
| South Fan | 159.41 sf/ft | x | $15.23 | = | $ 2,428.61 |
| North Fan | 162.00 sf/ft | x | 15.23 | = | 2,467.26 |
| Rock Tunnel | 158.66 sf/ft | x | 15.23 | = | 2,416.39 |
| Main Intake (south) | 210.00 sf/ft | x | 15.23 | = | 3,198.30 |
| Manway (south) | 125.00 sf/ft | x | 15.23 | = | 1,903.75 |
| Carlson Portal | 150.00 sf/ft | x | 15.23 | = | 2,284.50 |
| Carlson Portal | 150.00 sf/ft | x | 15.23 | = | 2,284.50 |
| Woodard Portal | 162.00 sf/ft | x | 15.23 | = | 2,467.26 |
| Woodard Portal | 162.00 sf/ft | x | 15.23 | = | 2,467.26 |
| | Total Cost | | | | $21,917.83 |

Total Cost to Seal All Portals $21,917.83

1. Lila Fan Reclamation

1.1 Fan dismantling

| | | |
|---|---|---|
| 1.1.1 | Labor requirement | $48/hr |
| 1.1.2 | Labor unit cost | $13.50/hr |
| 1.1.3 | Dismantling cost | $648.00 |

1.2 Building Demolition

| | | |
|---|---|---|
| 1.2.1 | Concrete volume (inc. swell) | 368 cy |
| 1.2.2 | Concrete demolition unit cost (1) | $0.16/cy |
| 1.2.3 | Concrete demolition cost | $58.88 |
| 1.2.4 | Block and steel volume (inc. swell) | 370 cy |
| 1.2.5 | Block and steel demolition unit cost (1) | $0.12/cy |
| 1.2.6 | Block and steel demolition cost | $44.40 |
| 1.2.7 | Demolition cost | $103.28 |

1.3 Disposal

| | | |
|---|---|---|
| 1.3.1 | Disposal volume | 738 cy |
| 1.3.2 | Disposal rate | 7.20 min/cy |
| 1.3.3 | Scoop tractor operating time | 89 hours |
| 1.3.4 | Scoop tractor operating unit cost (1) | $5.30/hr |
| 1.3.5 | Scoop tractor operating cost | $471.70 |
| 1.3.6 | Labor requirement | 192 hours |
| 1.3.7 | Labor unit cost | $13.50/hr |
| 1.3.8 | Labor cost | $2592.00 |
| 1.3.9 | Disposal cost | $3063.70 |

| | | |
|---|---|---|
| 1.4 | Seal Portal | |
| 1.4.1 | Fan entry area | 158 sf |
| 1.4.2 | Block unit cost (inc. cement & del.) | $2.00 ea |
| 1.4.3 | Block area (8"x8"x16") | 0.889 block/sf |
| 1.4.4 | Block required (A3-1371) each stopping | 200 blocks |
| 1.4.5 | Block walls required | 7 |
| 1.4.6 | Block cost | $2800.00 |
| 1.4.7 | Rockdust required | 123 tons |
| 1.4.8 | Rockdust unit cost (delivered) | $17.92/ton |
| 1.4.9 | Rockdust cost | $2204.16 |
| 1.4.10 | Labor required | 224 hours |
| 1.4.11 | Labor unit cost | $13.50/hr |
| 1.4.12 | Labor cost | $3024.00 |
| 1.4.13 | Portal sealing cost | $8028.16 |
| 1.5 | Revegetation | |
| 1.5.1 | Area to revegetate | 0.1 acre |
| 1.5.2 | Seed unit cost | $8.00/lb |
| 1.5.3 | Seeding rate | 14 lb PLS/ac |
| 1.5.4 | Seed cost | $11.20 |
| 1.5.5 | Labor required | 2 hrs |
| 1.5.6 | Labor unit cost | $13.50/hr |
| 1.5.7 | Labor cost | $27.00 |
| 1.5.8 | Revegetation cost | $38.20 |
| Lila Fan Reclamation Total Cost | | $11,881.34 |

## REMOVE PONDS 1, 3 AND 9

### Pond 1

| | | |
|---|---|---|
| Volume of material to be moved | | 2500 BCY |
| Swell factor (3) | | 1.3 |
| Volume of material to be moved | | 3250 LCY |
| Avg. dozing distance | | 80 ft |
| Production | | 1100 cy/hr |
| Job efficiency (3) | 0.83 | |
| Operator (3) | 0.80 | |
| Net production | | 730 cy/hr |
| Time required | | 3.4 hrs |
| Cost for D8 bulldozer (1) | | $83.75/hr |
| Grading cost | | $285 |

### Reseeding

| | |
|---|---|
| Area to be reseeded | 0.7 acres |
| Cost/acre | $475 |
| Reseeding cost | $333 |

Total Cost to Remove Pond 1 — $618.00

### Pond 3

Grade embankment into pond

| | | |
|---|---|---|
| Volume to be graded | | 1600 BCY |
| Swell factor (3) | | 1.3 |
| Volume to be graded | | 2080 LCY |
| Dozing distance | | 80 ft |
| Production | | 1100 LCY/hr |
| Job efficiency (3) | 0.83 | |
| Operator (3) | 0.80 | |
| Net production | | 730 LCY/hr |
| Time required | | 2.2 hrs |
| Cost for D-8 (1) | | $83.75/hr |
| Total cost for grading | | $184.00 |

### Reseeding

| | |
|---|---|
| Acres to be seeded | 0.94 acre |
| Cost/acre | 475 |
| Seeding cost | $447.00 |

Total Cost to Remove Pond 3 — $631.00

Pond 9

| | |
|---|---|
| Estimate of material volume | 150 BCY |
| Swell factor (3) | 1.3 |
| Estimate of volume to be graded | 195 LCY |
| Cycle time | 2.0 min |
| Estimated production (refer to sedimentation pond removal) | 63 LCY/hr |
| Time required | 3.1 hr |
| Cost of Cat 980 wheel loader (1) | $81.66 |
| Cost to Remove Pond 9 | $253.00 |
| Total Cost to Remove Ponds 1, 3 and 9 | $1,502.00 |

## TOTAL RECLAMATION COST SUMMARY

| | | |
|---|---|---|
| 1. | Demolition and Disposal of Buildings | $380,575 |
| 2. | Tipple Area-Backfilling and Grading | 8,508 |
| 3. | Demolition and Grading of Sewage Disposal Plant | 2,859 |
| 4. | South Fan and Standby Area-Backfilling and Grading | 2,302 |
| 5. | North Fan Area-Backfilling and Grading | 1,018 |
| 6. | Soil Cover for Refuse Pile | 4,077 |
| 7. | 400,000 Gallon Water Tank-Reclamation | 7,069 |
| 8. | Main Yard Area | |
| | 8.1 Earth Excavation Prior to Demolition | 1,149 |
| | 8.2 Backfilling and Grading | 22,776 |
| | 8.3 Black Top Removal | 972 |
| | 8.4 Concrete Disposal | 6,195 |
| | 8.5 Total Main Yard Area | 31,092 |
| 9. | Portal Seals | 21,918 |
| 10. | Remove Sedimentation Ponds and Enlarge Ponds 1 and 3 | 3,322 |
| 11. | Revegetation Cost - Reseed Twice | 47,904 |
| 12. | Lila Fan Reclamation | 11,881 |
| 13. | Remove Ponds 1, 3, 9 | 1,502 |
| TOTAL | | $524,027 |

# Table 1
## Cut and Fill Balance

| Buildings and Structures | Expanded Concrete | Voids at Site | Excess Concrete | Expanded Brick | Excavation | | Embankment | | Total Volumes | | Differences | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Demolition | Highwall | Misc Voids | Grading | Excavation | Embankment | Borrow | Waste |
| South Fan and Standby | 400 | 238 | 162 | | 190 | 2067 | 503 | 2490 | 2256 | 2993 | (1) 737 | |
| North Fan | 471 | 187 | 284 | | 65 | | 442 | | | | (2) 378 | |
| Tipple | 9130 | 5350 | 3780 | | 1560 | 2045 | | (5) 3565 | 3605 | 3565 | | (3) 40 |
| Sewer Plant | 435 | 266 | 169 | 31 | 157 | 268 | 157 | 306 | 157 | 464 | (4) 41 | |
| Sub-Total | 10436 | | (6) 4395 | (6) 31 | | | | | | | | |
| Main Yard | | | 4395 | 31 | | | (7) 6055 | 18745 | | | | |
| Reservoir | 1480.6 | 0 | 1480.6 | 0 | 0 | 1760 | | 800 | | | | |
| Rock Tunnel Portal | 75.9 | 148.1 | -72.2 | 0 | 0 | | | 350 | | | | |
| Transfer House | 262.5 | 0 | 262.5 | 0 | 0 | 11195 | | 4740 | | | | |
| Garage | 56.3 | 76.1 | -19.8 | 109.1 | 10 | 13555 | | 1980 | | | | |
| Office Building | 97.0 | 211.0 | -103.1 | 130.2 | 0 | | | | | | | |
| Wash House | 51.9 | 382.9 | -330.9 | 506.0 | 0 | | | | | | | |
| Materials Building | 1488.1 | 9.3 | 1478.8 | 311.9 | 2601 | | | | | | | |
| Machine Shop | 1017.9 | 97.9 | 925.9 | 294.3 | 71 | | | 2970 | | | | |
| Oil House | 145.7 | 5.3 | 140.4 | 27.5 | 24 | | | | | | | |
| Sand House | 62.2 | 0 | 62.2 | 33.7 | 21 | | 21 | | | | | |
| Ignitron & Substa. | 399.5 | 0 | 399.5 | 127.4 | 0 | | | | | | | |
| Heating Plant | 153.0 | 431.9 | -278.4 | 136.9 | 35 | | | | | | | |
| Heat. Plant Stack | 69.1 | 0 | 69.1 | 0 | 0 | | | | | | | |
| Car Shop | 199.4 | 16.6 | 182.8 | 0 | 34 | | | | | | | |
| Fire Hose Houses | 24.3 | 0 | 24.3 | 17.0 | 33 | | 33 | | | | | |
| Roof Bolt Shed | 7.0 | 0 | 7.0 | 0 | 0 | | | | | | | |
| Comp. Building | 23.8 | 0 | 23.8 | 0 | 0 | | | | | | | |
| Oil Tank Bldg. | 2.4 | 0 | 2.4 | 0 | 0 | | | | | | | |
| Steel Storage Rack | 45.1 | 0 | 45.1 | 0 | 28 | | 28 | | | | | |
| Piping Tunnel | 211.9 | 1516.8 | -1304.9 | 0 | 745 | | | | | | | |
| Conv. Gallery | 980.0 | 0 | 980.0 | 0 | 0 | 2195 | | | | | | |
| Track Grading | | | | | | | | | | | | |
| Total | | | 8366.6 | 1724.5 | 3602 | 28705 | 6137 | 29585 | 42400 | 35720 | | (8) 6680 |

Notes

(1) from borrow area

(2) from borrow area

(3) Minimal volume - waste on site

(4) Obtain from site grading

(5) Includes expansion for concrete cover

(6) To Main yard

(7) Expanded fill to cover concrete

(8) Waste excess fill by providing additional soil cover over concrete

All volumes are in cubic yards

REFERENCES:

(1) Rental Rate Blue Book, 1980

(2) Building Construction Cost Data, 1980, 38th Edition

(3) Caterpillar Performance Handbook

(4) Trautwines Engineer's Pocket Book

(5) Denver Equipment Handbook

# APPENDIX IV

## STABILITY ANALYSIS OF ROAD JUNCTION REFUSE PILE

## STABILITY ANALYSIS ROAD JUNCTION REFUSE PILE

Underground development waste from Geneva Mine is disposed of at the Road Junction Refuse Pile. The refuse pile is limited in areal extent (approximately 300 ft. long by 300 ft. wide) and is generally less than 20 feet in height above the ground surface. U. S. Steel Mining Co. conducted a stability analysis on the side slopes of the pile as follows:

### GENERAL

The Rotational Equilibrium Analysis of Multilayered Embankment (REAME) program, developed by the University of Kentucky, was used to perform the safety factor calculations. A circular failure surface is assumed under a rotating mass. The mass is divided into slices and the sum of moments tending to cause and resist failure are determined. The safety factor is the ratio of these two sums. REAME can calculate the safety factor using either the normal method or the simplified Bishop method. All calculations were completed using the simplified Bishop method.

No springs or seeps have been observed on the side slopes of the refuse pile or in the adjacent areas. Therefore, the ground water table was assumed to be below any failure surface.

The following angles of internal friction were located in reference materials:

| | Friction Angle | Density |
|---|---|---|
| *Common earth, moist | 25 - 45 degrees | |
| *Gravel, sand and clay | 20 - 35 degrees | |
| +Sand, dry | 35 degrees | 90-110 |
| +Earth, common loam | 35 degrees | 73 |
| +Gravel, run of bank | 38 degrees | 90-100 |
| +Shale, crushed | 39 degrees | 90 |

*Caterpillar Performance Handbook
+BF Goodrich Engineering Handbook

To be conservative, the natural ground (soil 1) was assumed to have the following material properties:

| | |
|---|---|
| Friction Angle | 30 degrees |
| Density | 90 lbs/cf |
| Cohesion | 0.0 lbs/sf |

Samples of coarse refuse have been sampled at Somerset Mine and the Wellington Coal Cleaning Plant (refer to Technical Revision No. 1). The results of these samples are reproduced below:

| | Somerset Mine | Hole 1 Wellington | Hole 2 Wellington |
|---|---|---|---|
| Friction Angle | 35.5 deg. | 34.7 deg. | 32.8 deg. |
| Density lb/cf | 84.8 deg. | 93.7 deg. | 84 deg. |
| Cohesion lb/sf | 0.0 deg. | 144 deg. | 288 deg. |

The following properties were assumed for the stability calculations:

| | |
|---|---|
| Friction Angle | 35 degrees |
| Density | 85 lbs/cf |
| Cohesion | 144 lbs/sf |

RESULTS

Case 1

Case 1 is the west slope of section A-A' shown on Drawing C3-1208. An enlarged cross-section is attached which shows the potential failure surface where the minimum safety factor was calculated. The following table lists some of the failure surfaces evaluated and their associated safety factors:

| Coordinates of Center Hor. | Vert. | Radius of Failure Surface | No. Failure Surfaces at Center | Minimum Safety Factor |
|---|---|---|---|---|
| 64.667 | 28.000 | 21.690 | 11 | 1.890 |
| 72.000 | 32.000 | 26.090 | 11 | 2.126 |
| 54.083 | 29.750 | 23.563 | 7 | 2.260 |
| 61.417* | 33.750 | 27.778 | 11 | 1.799 |
| | | 28.525 | - | 1.809 |
| | | 26.286 | - | 1.831 |
| 68.750 | 37.750 | 31.146 | 11 | 1.928 |
| 58.167 | 39.500 | 33.869 | 11 | 1.799 |
| 65.500 | 43.500 | 36.286 | 11 | 1.852 |
| 51.667 | 51.000 | 44.195 | 11 | 2.134 |
| 59.000 | 55.000 | 48.453 | 11 | 1.830 |

*Minimum Safety Factor

Case 2

Case 2 is the west slope of section B-B' shown on Drawing C3-1208. An enlarged cross-section is attached which shows the potential failure surface where the minimum safety factor was calculated. The following table lists some of the failure surfaces evaluated and their associated safety factors:

| Coordinates of Center Hor. | Vert. | Radius of Failure Surface | No. of Failure Surfaces at Center | Minimum Safety Factor |
|---|---|---|---|---|
| 42.000 | 34.667 | 16.789 | 11 | 1.884 |
| 49.000 | 39.333 | 21.813 | 11 | 1.946 |
| 44.333* | 46.333 | 28.458 | 11 | 1.768 |
| | | 26.484 | | 2.005 |
| | | 29.446 | | 1.777 |
| 51.333 | 51.000 | 33.356 | 11 | 1.888 |
| 39.667 | 53.333 | 35.245 | 11 | 1.809 |
| 46.667 | 58.000 | 39.784 | 11 | 1.790 |
| 35.000 | 60.333 | 43.019 | 11 | 1.955 |
| 42.000 | 65.000 | 47.417 | 11 | 1.782 |

*Minimum

Case 3

Case 3 is the east slope of section A-A' shown on Drawing C3-1208. An enlarged cross section is attached which shows the potential failure surface where the minimum safety factor was calkculated. The following table lists some of the failure surfaces evaluated and their associated safety factors:

| Coordinates of Center Hor. | Vert. | Radius of Failure Surface | No. of Failure Surfaces at Center | Minimum Safety Factor |
|---|---|---|---|---|
| 73.333 | 36.667 | 22.513 | 11 | 4.529 |
| 80.000 | 40.000 | 24.164 | 11 | 4.225 |
| 69.833 | 43.667 | 30.418 | 11 | 4.334 |
| 76.500 | 47.000 | 32.004 | 11 | 4.122 |
| 66.333 | 50.667 | 37.553 | 11 | 4.286 |
| 73.000* | 54.000 | 39.504 | 11 | 4.095 |

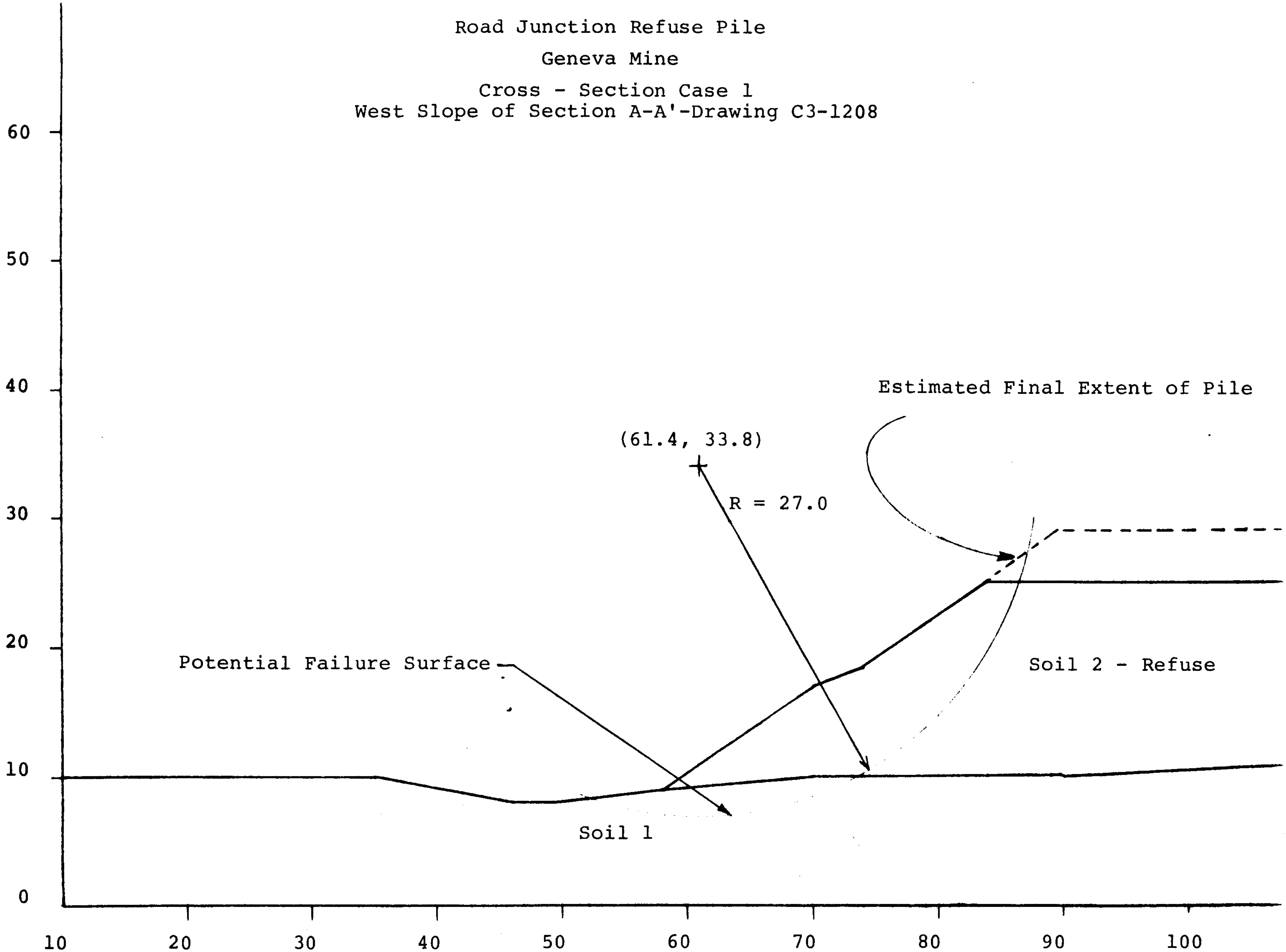
*Minimum

All of the above calculations are based on the dimensions of the final refuse pile shown on the cross sections. The minimum safety factors for the existing pile are shown below:

| Case | Coordinates of Center Hor. | Vert. | Radius of Failure Surface | Minimum Safety Factor |
|---|---|---|---|---|
| 1 | 61.417 | 33.750 | 27.032 | 1.837 |
| 2 | 44.333 | 46.333 | 28.485 | 1.789 |
| 3 | 73.000 | 54.000 | 39.504 | 4.095 |

## Conclusion

The three slopes evaluated have minimum safety factors in excess of 1.5.

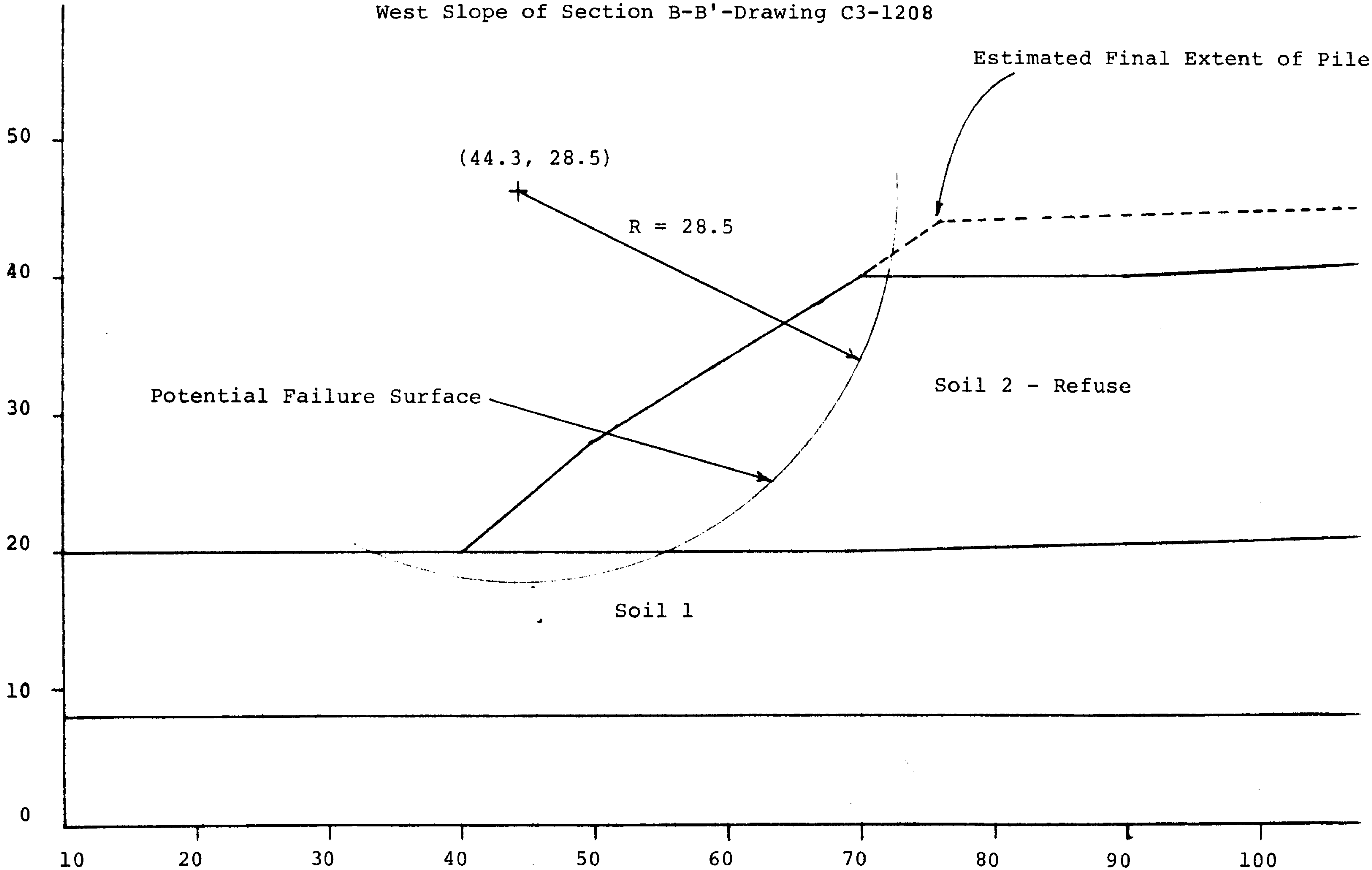


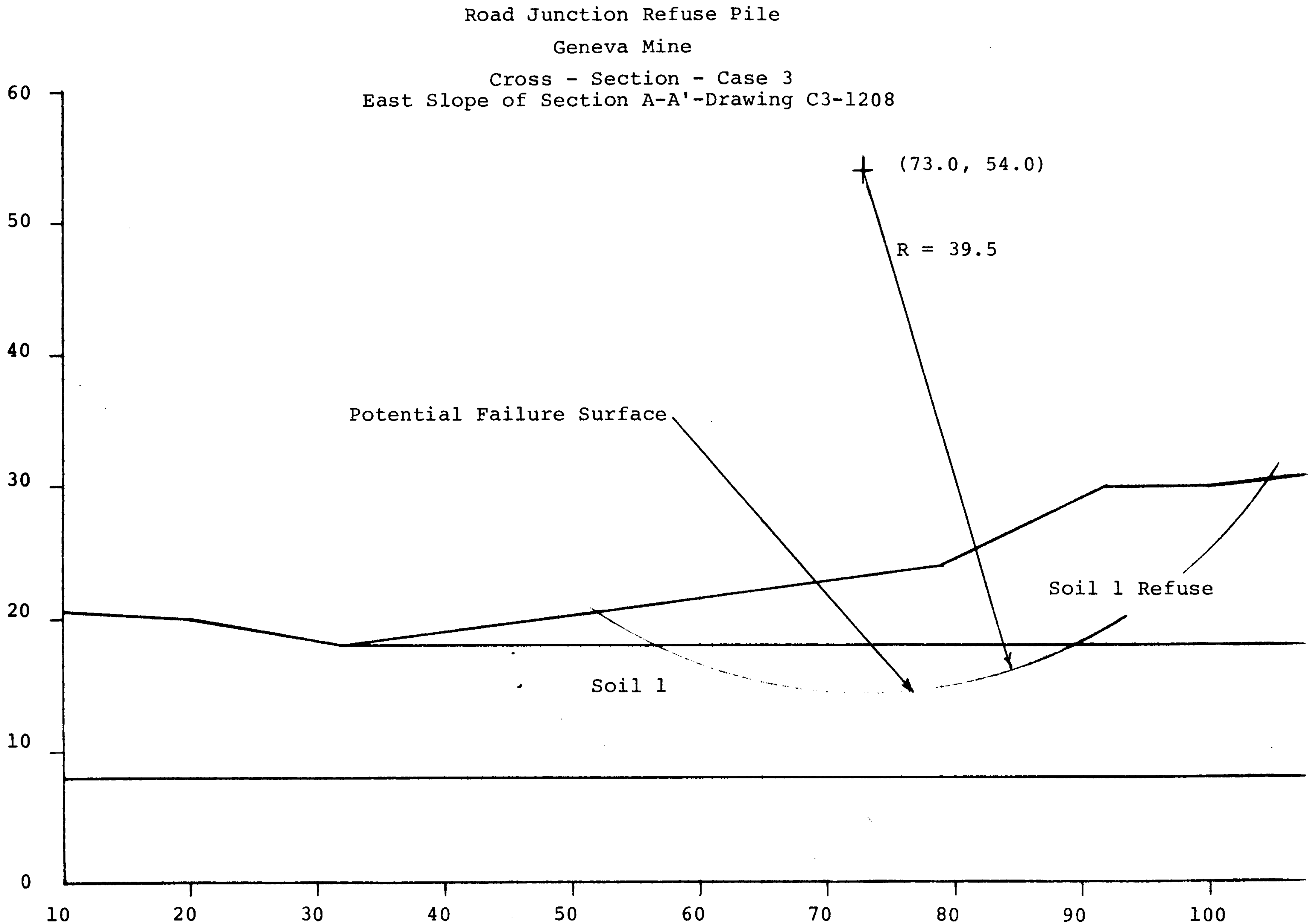
Road Junction Refuse Pile
Geneva Mine
Cross - Section Case 1
West Slope of Section A-A'-Drawing C3-1208
Estimated Final Extent of Pile
(61.4, 33.8)
R = 27.0
Potential Failure Surface
Soil 2 - Refuse
Soil 1
0
10
20
30
40
50
60
10
20
30
40
50
60
70
80
90
100

Road Junction Refuse Pile

Geneva Mine

Cross - Section Case 2
West Slope of Section B-B'-Drawing C3-1208




Road Junction Refuse Pile
Geneva Mine
Cross - Section - Case 3
East Slope of Section A-A'-Drawing C3-1208
(73.0, 54.0)
R = 39.5
Potential Failure Surface
Soil 1 Refuse
Soil 1
60
50
40
30
20
10
0
10
20
30
40
50
60
70
80
90
100

## APPENDIX V

Miscellaneous Exhibits

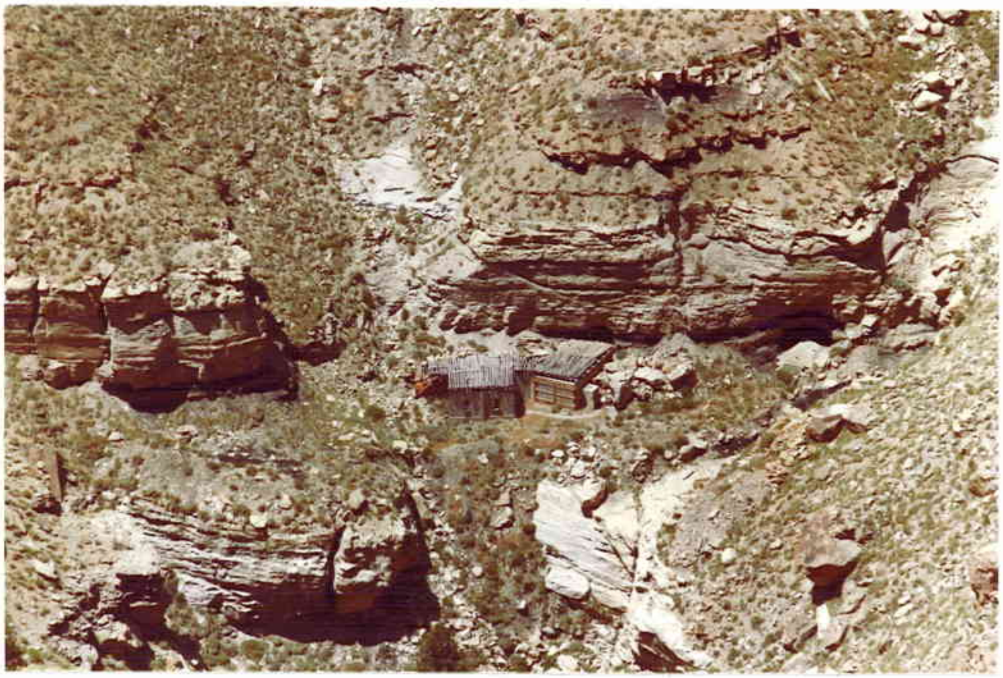
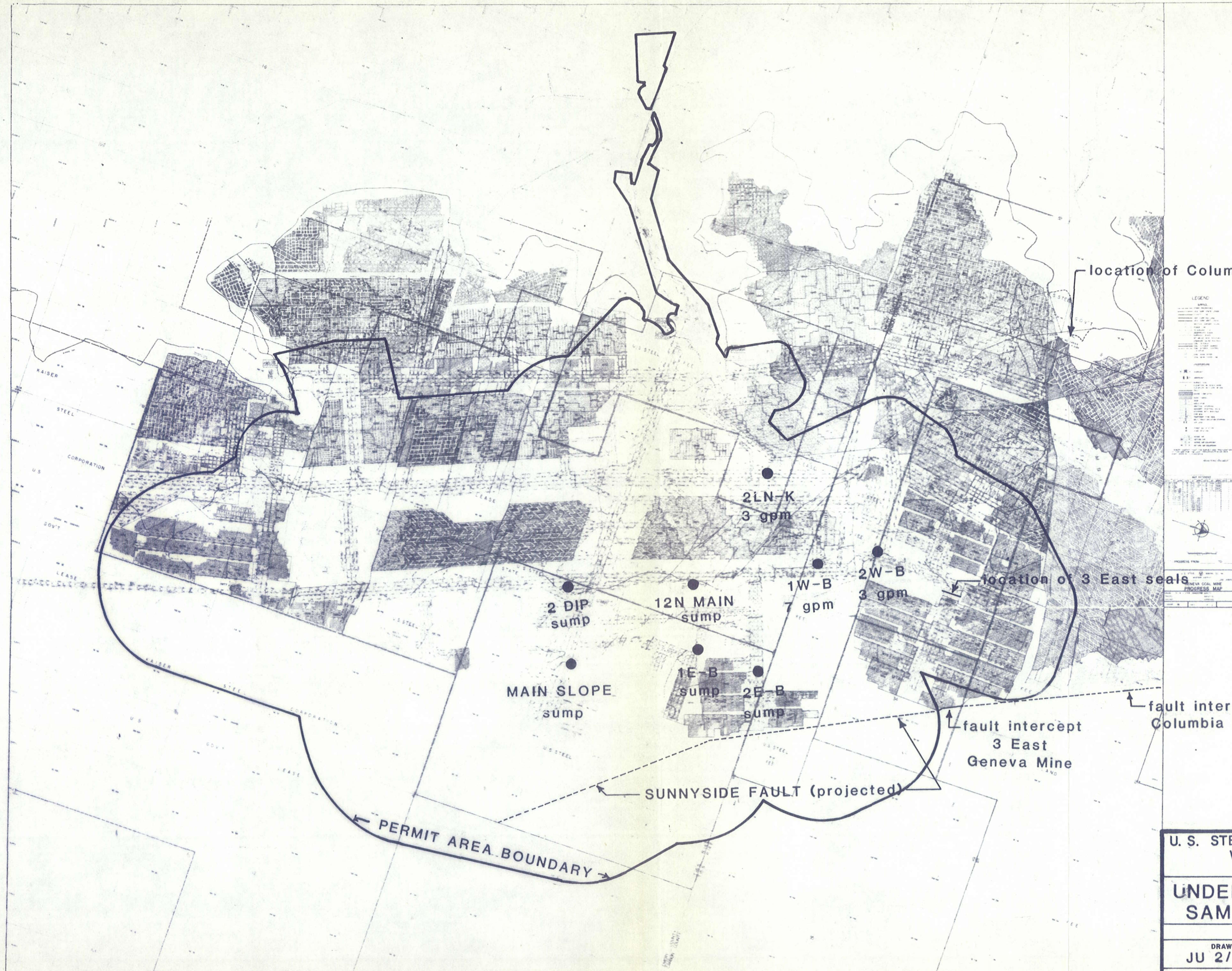


EXHIBIT 1: Lila Fan Pad showing existing structures and local vegetation.

EXHIBIT 2: Lila Canyon showing fan pad located on a rock out-crop and inaccessibility for revegetation monitoring.




NOTE: 1E-2, which flowed about 1 gpm, now is collected at 1E-B

Registered Professional Engineer
GLENN
H. SIDES
No. 4169
State of Utah

THIS DRAWING WAS PREPARED UNDER MY SUPERVISION

AUG 26 1983
Date

Glenn H. Sides
4169
Registered Professional Engineer- Utah

U. S. STEEL MINING COMPANY, INC.
WESTERN DISTRICT
GENEVA MINE

UNDERGROUND WATER SAMPLE LOCATIONS

| DRAWN: | APPROVED: |
| --- | --- |
| JU 2/2/81 | GHS 2/2/81 |
| SCALE: 1":2000' | C3-1207 |

783-9

Revised: BAF 5/16/83 8/8/83