SECTION 26

DRAINAGE CONTROL PLAN

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REV. NUMBER	REVISION DESCRIPTION	DATE APPROVED
1301	Ponds 201 and 202	

26 DRAINAGE CONTROL PLAN

26.1 Existing Drainage Control Structures

26.1.1 Primary Roads – Water and Sediment Control

Primary Roads will be designed and maintained in such a manner to minimize the contribution of additional suspended solids to surface runoff leaving the Permit Area. If the results from the hydraulic analysis indicate the potential for erosion to occur, rip-rap rock or other forms of protective lining will be installed. Primary Road drainage controls will be designed for a 10 year-6 hour storm event. The design and construction of Primary Roads will both be certified by a Professional Engineer. The construction will not commence until the designs are approved by the Regulatory Authority.

26.1.2 Ancillary Roads Control of Siltation

For existing and future Ancillary Roads, the runoff is usually drained into internal depression, or routed through existing nearby channels to impoundments or open mining pits. These roads are located so as to: 1) minimize construction efforts and disturbance, 2) keep road gradients minimal to deter erosion, and 3) minimize impact on existing drainage channels. Ancillary road drainage control structures will be designed for a 2 year-6 hour storm event. Measures will be taken to prevent contributions of additional suspended solids to stream flow or runoff outside the Permit Area, such as locating roads to prevent runoff from leaving the Permit Area, installing culverts, installing filter fences, or vegetating or otherwise stabilizing exposed surfaces such as sideslopes and roadcuts.

26.1.3 Surface Water Control

The Primary Roads are located with minimal impact upon existing drainage channels. At topographical lows or where roads intersect drainage channels, surface flows are routed through the road embankments with culverts.

All culverts are designed to safely pass the peak discharge from a 10 year-6 hour event for Primary Roads and 2 year-6 hour storm event for Ancillary Roads. Exhibit 23-1 shows the existing haulroad and access road culvert typical cross sections.

The utility routine for sizing culverts in SEDCAD+ was used to design the culverts. The design peak flows were determined with the SEDCAD+ computer program. All culvert watersheds were delineated, soil curve numbers determined and precipitation values for the event obtained from NOAA Atlas IV-New Mexico.

Hydrologic and channel information pertinent to the Primary Road culverts, and downdrains are located in Table 26-1 and Table 26-2. Hydrologic and channel information pertinent to the Ancillary Road culverts are located on Table 26-3. All culvert and downdrain locations and corresponding watershed are shown on Exhibit 26-1, Exhibit 26-2, Exhibit 26-3, Exhibit 26-4, Exhibit 26-5, Exhibit 26-6, and Exhibit 26-7. Reference Appendix 23.A and 23.B for additional culvert information.

26.1.4 Primary Road Static Stability

Primary Road embankment heights vary from 0 to 36 feet. The majority of the road embankment heights average less than 10 feet. Embankment height is defined as the difference in elevation from toe to grade.

Historically, Navajo Mine has not had problems with road embankments stability based upon the following reasons:

1. The mine's geologic setting is in an area with an abundance of clay and shaley material with the majority of road embankments being constructed of this material, The cohesive values of the two types of soils vary from 1,000 to 10,000 pounds per square foot,
2. The majority of the roads are on level ground, which requires minimum fill,
3. There is no evidence of the presence of shallow ground water where embankments are located, and
4. In the immediate natural hillsides and roads, there is no evidence of failures such as:
   a. creep
   b. landslides
   c. flows-wet & dry

Other embankments which consist of the same materials and construction methods as the existing roads have been tested for stability (See Appendix 23.E, "Slope Stability", for more information). As a worst case scenario, refer to page 11-Q-29 in Appendix 26.A, "Lowe Railroad Embankment #1 Stability Analysis" as all Primary Road embankment heights are less than the embankment height used in the stability analysis.

26.1.5 Railroad Drainage and Erosion Control

The railroad is designed and constructed to control contribution of additional sediment to the downstream flows leaving the Permit Area. Side ditches are provided in the cut section to collect the surface runoff from the cut slopes, track bed, service road and adjacent undisturbed areas. The grades of the side ditches/channels coincide with the railroad gradient, which in most cases are 1.0 percent or less. The watersheds for the side ditches are generally small. The flow velocity in the side ditches will seldom exceed the erosive velocity of the soil. The use of low gradient side ditches is a "best management practice" (BMP) in controlling the flow velocity and thereby minimizing the contribution of additional sediment to the downstream flows. At fill sections, relief ditches are utilized to route surface runoff to a natural drainage channel. The relief ditches are located along the toe of the railroad embankment. The grade of the relief ditches varies from moderate to steep depending on the topography. The flow velocity in the relief ditches will in some cases exceed the erosive velocity of the soil. In cases where the erosive velocity are exceeded and there is visible erosion, other types of BMP will be considered to control the sediment or erosion. The procedure and design criteria outlined below will be used to determine the type BMP that will be applied to control the sediment or erosion, if any is required.

- Field survey each concentrated flow or ditch created due to the construction of the railroad. From the field surveys and topographic maps determine the ditch slopes, sizes, flow lengths, soil types, approximate watersheds, and note any visible erosion.
- Using the data obtained above perform hydrological analysis for each ditch. Since the watersheds are small and numerous, several worse case hydrology analysis will be done at appropriate watershed size increments. The criteria below will be used for the worse case hydrology analysis.
  a) Minimum Design Storm Event – the 10 year – 6 hour storm
    - ◊ Storm Distribution Type – SCS Type II-65
    - ◊ Time of Concentration – Assumed to be equal to zero or instantaneous. This would be a conservative analysis giving higher peak discharges for design purposes.
    - ◊ Curve Number – Assumed to be equal to 89 for all watersheds. The recommended curve number for a graveled road on a Class C soil is 89. The assumption is conservative since the adjacent undisturbed areas that will be contributing surface runoff to the design structures have lower curve numbers.
    - ◊ The Sedcad+ computer software will be used to model the hydrology.
    - ◊ For worse case analysis use watershed increments of 0.5, 1.0, 2.0, 4.0, 6.0, and 8.0 acres. The watersheds greater than 8.0 acres will be modeled separately.
    - ◊ For watersheds greater than 8.0 acres the criteria above will also apply except for the curve number and time of concentration. The curve number will be determined using the procedure outlined in this Section. The time of concentration will be determined based on actual watershed configuration.
    - ◊ Perform the hydraulic analysis using the results from the hydrology analysis above. The Sedcad+ channel design utility will be utilized for the hydraulic analysis of the ditches/channels. The ditches/channels will be verified to safely pass the peak discharge from the 10 year – 6 hour storm event. The maximum flow velocity will be determined for each ditch/channel and compared to the erosive velocity of the soil.
- If the flow velocity is less than the erosive velocity, the existing ditch/channel configuration is sufficient in controlling the contribution of additional sediment to the downstream flow and no additional BMP is warranted.

- If the flow velocity in a ditch/channel exceeds the erosive velocity an appropriate type of BMP will be considered for controlling sediment and erosion.
- For watersheds ≤ 8.0 acres and the flow velocity > erosive velocity.
    - ◊ If there is no erosion visible a silt fence or straw bale barrier will be installed.
    - ◊ If erosion is visible a protective channel lining, i.e. rip-rap or straw bale check dams will be installed.
- For watersheds > 8.0 acres and the flow velocity > erosive velocity a protective channel lining, i.e. rip-rap will be placed.

Refer to Appendix 26.B for supporting design data. For locations of side ditches, relief ditches, drop structures, culverts, downdrain pipes, silt fences, straw bale barriers, straw bale check dams, and livestock crossings, see Exhibit 11-14A through 11-14G. For typical sections of ditches, drop structures, downdrain pipes, silt fences, straw bale barriers, straw bale check dams, and railroad cut/fill sections, see Exhibit 11-14H and 11-14J.

The railroad embankment slopes generally are hydrologically stable, very little rilling or erosion occurs on the slopes. Overland sheet flow is the primary type of flow that occurs on the embankment slopes. The stability is partly due to the infiltration of ballast material (1.5 inch crushed rock) into the embankment slopes. On large embankments with long slopes, berms/ditches and downdrain pipes are used to prevent concentrated flows from running down the slopes. Berms and ditches are located at the crest of railroad embankments to divert surface runoff to the downdrain pipes. The downdrain pipes extend from the crest of the embankment to the toe. Energy dissipater will be installed at the outlet of the downdrain pipes to prevent scouring. Overall a very minimal amount of sediment has been transported to the toe of the embankments during the period the rail system has been in service, approximately 25 years. Deposition occurs immediately adjacent to the toe of the embankment inside the ROW or Permit Area.

The railroad culverts were checked for capacity and adequacy for a peak discharge from a 10-yr, 6-hr event. Peak flows were determined with the SEDCAD+ computer program. Culvert watersheds were delineated, soil curve numbers were determined, and precipitation values for events were obtained from NOAA Atlas IV-New Mexico. The railroad culverts and pertinent information are shown in Table 26-2 and Table 26-4. Their locations and corresponding watersheds are shown in Exhibit 26-1, Exhibit 26-2, Exhibit 26-3, Exhibit 26-4, Exhibit 26-5, Exhibit 26-6, and Exhibit 26-7. Refer to Appendix 23.A and Appendix 26.B for hydrological analysis and SEDCAD+ runs.

All necessary field data obtained to evaluate the existing culverts were obtained from cross sectional surveys. The cross sectional survey determined the following culvert data:

1. Pipe size type and length
2. Pipe invert slope, and
3. Headwater depths of road embankments over pipe.

With the above information, the railroad culverts were checked for the design discharge using SEDCAD+. The field surveyed "Available Maximum Headwater Depth" was compared with calculated headwater to check pipe adequacy.

The majority of the railroad culverts are of single barrel arrangements except for the culverts CP-23 & 24. Culverts CP-23 & 24 consist of two 57 inch by 38 inch corrugated steel pipe-arches with 4 feet diameter CMP drop inlets and serve as emergency spillways for Barber Stockpile Pond #2. The spillway was checked using an equivalent round pipe for the arch pipe, the equivalent round pipe is a 48 inch diameter pipe. See SEDCAD+ run in Appendix 26.C and Exhibit 26-8 for more details.

Culvert numbers 8, 9, 13, and 14 are arranged in the field in series. Culvert CP-8 is immediately upstream of culvert CP-9, and culvert CP-14 is upstream of CP-13 (CP-8/9 are not in series with CP-14/13). Analysis of these culverts commenced with the downstream pipe. This way, the controlling headwater depth of the downstream pipe is the tailwater depth for the upstream pipe's outlet HW depth calculations. In both cases (CP-8/9 and CP-14/13) the upstream pipe outlet and downstream pipe inlet are submerged at peak design discharge.

The controlling headwater depths for CP-8/9 and CP-14/13 are inlet/inlet and outlet/inlet, respectively. See Figure 26-1 and Figure 26-2 for the drawings of pipes in a series.

All drainage and erosion control structures along the railroad will be maintained to ensure that no adverse condition that maybe harmful to the environment will arise. Structures will be inspected after each major storm event, any adverse conditions identified will be corrected.

26.1.5.1 Railroad Static Stability

The majority of the alignments are located on original ground with the exception of four embankments. The railroad has two major embankments with culverts: the Chinde Wash and the Up-Dip Barber Railroad embankments.

The Chinde Wash embankment (Big Fill) has a static safety factor of 1.5. See Permit NM-0003C, Chapter 34, Appendix 34-D for a copy of the report on this certification. Figures 5 and 6 of this report were done by two different consulting firms with several years time between each drawing. Figure 5 was drawn by Terratech in 1973 and referenced by Steffen, Robertson and Kristen (SRK) in their 1985 report. SRK drew Figure 6 for their report and the minor differences between figures 5 and 6 reflect only the different approach each author utilized. Both drawings and the analyses performed by the two consultants resulted in nearly identical factors of safety for the structure (see Appendix 34-D, page 34-D-15). A Seismic Stability Analysis for the Big-Fill was performed by SRK in 1987. The summary concluded based on a design horizontal acceleration of 0.08g, the safety factor of the fill, against failure under earthquake loading, generally exceeds 1.2. This is considered adequate for the stability of the fill. The findings report can be found in Permit NM-0003C, Chapter 29, Appendix 29-E.

The drop structure at the Chinde Wash embankment (Big Fill) will receive periodic maintenance following major precipitation events. Riprap, sized to pass a 10 year-6 hour flow, has been placed on filter fabric so as to prevent erosion. The riprap is comprised of an appropriate gradation of particle sizes. All remedial measures recommended by SRK were completed in 1985 (see Permit NM-0003C, Chapter, Appendix 34-D).

The Up-Dip Barber Railroad embankment has a minimum safety factor of 4.4. See Permit NM-0003C, Chapter 34, Appendix 34-F for the safety factor determination and the laboratory test results for the embankment.

Two additional embankments impound water along the railroad. These embankments are Lowe Embankments No. 1 and No. 2 and are located along the railroad just north of the Lowe Pit Coal Stockpile in Area 3. Both embankments contain small surface water runoff from the Lowe haulroad and spoil storage areas. A stability analysis was conducted in 1987 by Western Technologies Inc. Results on the largest of these embankments reported a static safety factor of 3.4. A copy of the analysis is found in Permit NM-0003C, Chapter 29, Appendix 29-C.

26.2 Ponds, Impoundments, Berms and Embankments

Ponds, impoundments, berms or embankments are used within the Permit Area to: 1) capture and/or treat surface water runoff from unreclaimed spoil, coal handling, shop, office or maintenance facilities, or other disturbed areas where runoff could leave the Permit Area, 2) prevent surface water runoff from undisturbed upstream areas from entering into active mine pits, and 3) reduce the amount of topdressing loss from topdressing stockpiles due to wind and surface water erosion. Upon disturbance/removal of sediment ponds due to mining advancement, the pit will provide drainage and sediment control during mining operations. The remaining sediment ponds will provide drainage and sediment control during regrade and reclamation. Other appropriate water and sediment control structures may be constructed as needed.

All temporary drainage control structures such as sedimentation ponds, impoundments, berms and embankments will be reclaimed according to the procedures outlined in Part 5 – Reclamation plan.

26.2.1 Sediment Ponds

The pond tables (see Table 26-5 for index listing of the pond tables) identify each sediment pond and specify the criteria used for the design of each pond. The pond tables also provide references for locating the supporting design data, design drawing, and the as-built drawing for each pond. The pond tables and the referenced data for each respective pond provide the information required for demonstrating that the ponds comply with CFR 30 Parts 816.46, 816.47 and 816.49. The hazard classification for each pond is also specified on the pond tables. The locations of the ponds are shown on Exhibit 26-9, Exhibit 26-10, Exhibit 26-11, and Exhibit 26-12.

The sediment ponds are designed to retain either the 10 year-24 hour or the 100 year-6 hour precipitation event. Riprap material is placed at the pond inlets and spillways if the hydraulic analysis indicates that a protective lining is required to minimize and control erosion. The spillways are designed to safely pass the peak discharge from the 25 year-6 hour precipitation event.

To ensure that the design capacity is maintained, the maximum permissible gauge reading for the water/sediment level will be provided. The volume above the maximum permissible water/sediment level is equal to the design volume and the volume below it, the excess volume. If the water or sediment level should exceed the maximum permissible gauge reading then the impoundment will be either pumped or cleaned out down to an acceptable level. This will insure that the design volume is maintained at all times. The maximum permissible gauge reading for water/sediment level to maintain the design volume will be provided for each impoundment, except for the sewer ponds, storage ponds for dust suppressant water, highwall impoundments, and North Cells. The permissible water/sediment level in the North Cells will be referenced from the top of overflow between Cell B and C. The maximum gauge reading for the permissible water/sediment level are on the pond tables, see Table 26-5 for index listing of the pond tables.

The watershed sizes and curve numbers change due to areas being mined and reclaimed. This results in changes in the volume of surface runoff that need to be retained by the impoundments. The hydrology and the maximum permissible gauge reading will be updated annually to account for these changes.

After a runoff event, 90 percent of the design capacity will be restored within 10 days, provided the pond is accessible. Weather and ground conditions may limit access to some ponds particularly those in the reclaimed areas. Accessing these ponds during muddy conditions with dewatering equipment will cause excessive damage to the adjacent reclaimed lands. In such a case, the dewatering will occur as soon as conditions improve.

Inspection and maintenance will be done on a periodic basis to ensure the ponds are kept in good condition and functional. Inspections will be performed on a quarterly basis; the fourth quarter inspection will be an annual inspection that will be submitted to the regulatory agency. The quarterly inspections will be kept on file at the mine site. Any maintenance items identified from the inspections will be promptly repaired or corrected.

Approval for additional sediment ponds will be obtained from the regulatory agency prior to construction. The detail engineering drawings and the supporting design data will be submitted for review and approval. After completion of construction an as-built drawing of the pond will be submitted for review. A registered professional engineer will certify both the design and the as-built drawings.

General Notes:

- All references unless otherwise noted are from the current approved PAP.
- 25 year – 6 hour Peak Discharge is the design flow for all spillway design.
- All ponds without spillways are designed to handle runoff volume with 1 ft. of freeboard except where noted.

26.2.2 Modification to Operations of Pond 5 and North Cells

The operations of Pond 5 and the North Cells were modified to reduce the frequent clean-out of Cell A (lined) and to increase the flow path in Cell A2. In order for Pond 5 to maintain sufficient capacity the stormwater and plant washdown water is being pumped to Cell A2. Cell A2 was divided into three additional cells to increase the flow path, which will allow coal fines to settle and to facilitate cleaning. The pump from Pond 5 has a maximum flow of 3.5 cfs so the outlet pipe from Cell A2 is sufficient to handle the flow into Cell A.

Cell A, Cell B and Cell C will collect the stormwater from the North Facility and equipment washdown water from the North Shop. Cell A has a liner; all the flows are diverted into this cell except for the runoff from the side slope into the other two cells. The overflow from Cell A to Cell B is equipped with a skimmer to retain any hydrocarbons within the lined cell. This will be the main hydrocarbon treatment for the North Facilities.

The water collected in Cells B and C will be periodically pumped to either the Lowe Loadout Pond or Barber Loadout Pond via the existing mainline to be used as dust suppressant water on the haulroads. If the water truck loadout ponds are full or for some reason cannot receive the water from Cell A2 then the water will be pumped to other sediment ponds having sufficient capacity. The permissible gauge reading or elevation will not be exceeded when pumping to other ponds.

This is a temporary solution for managing the effluent collected in Pond 5. The plant washdown system has been automated to comply with MSHA standards and the amount of effluent generated has increased significantly. For the long term solution an engineer study will be done to determine the best way to manage the plant washdown water.

The hydrology data and design exhibits have been revised to reflect the operational modification. The revised or updated hydrology data for Pond 5 and the North Cells are presented in Appendix 26.C. The embankment placed over the spillway between Cell A and Cell A2 is presented on Exhibit 26-13. The cells were surveyed after completion of recent clean-out. This survey data has been incorporated into the revised exhibit.

26.2.3 Ponds with a Single Closed Spillway

Five sediment ponds at Navajo Mine have been constructed, each with a single closed spillway. The ponds constructed as such are: Hosteen #3, Barber #2, and Block C Ponds 1, 2, and 3. All are located along the railroad embankment in Area 2. The ponds were designed to retain the runoff from the 10-year 24-hour storm event, and to discharge the 25-year 6-hour peak flow through the spillway. To facilitate the construction of several of the ponds the existing culverts beneath the railroad were converted to spillways.

The surface mine regulations at 30 CFR 816.49(a)(9) allow for the use of a single closed spillway only when it is combined with an emergency spillway. To demonstrate compliance with regulations, the ponds described above were re-evaluated as containment structures that rely primarily on storage capacity to control the runoff from the 100-year 6-hour storm event as specified in section 816.49(c)(2) of the regulations.

With the exception of the Block C Pond 3, each of the other ponds are capable of retaining the runoff from the 100-year 6-hour storm event without discharging at the spillway. The as-built pond capacities and the runoff volumes from the 100-year 6-hour storm are summarized in Table 26-6. The hydrologic analyses were revised by adjusting the curve numbers for the watersheds to account for reclaimed areas. This resulted in reductions of the runoff volumes. Refer to Appendix 26.C for the hydrologic analyses. The watershed areas are shown on Exhibit 26-10 and Exhibit 26-11. For Block B Pond 3-Stage Storage refer to Table 26-7.

These analyses support the conclusion to retain the single closed spillways in all five ponds. Four of the ponds (Hosteen #3, Barber #2, and Block C Ponds 1, and 2) will be maintained and operated to retain the 100-year 6-hour runoff volume. Block C Pond 3 will continue to be maintained and operated in compliance with the requirements for a 10-year 24-hour capacity sediment pond. If the spillway should become plugged during a storm event larger than the design storm, there is more than sufficient capacity to retain the runoff without overtopping and breaching the pond embankment.

26.2.4 Highwall Impoundments

Table 26-8 identifies the impoundments and classification, whereas, Exhibit 26-9, Exhibit 26-10, Exhibit 26-11 and Exhibit 26-12 provides locations. Highwall impoundments are constructed according to a typical design shown on the Highwall Impoundments Standard Design drawing (Appendix 26.D). Detailed design information also can be found in Appendix 26.D, Highwall Impoundment Design and As-Built Information. The standard design package for highwall impoundments serves as a pre-approved design for these structures, therefore structures constructed according to the typical design standard do not require approval prior to construction. As-built information for highwall structures are shown on the Highwall Impoundment As-Builts drawing in Appendix 26.D. Under normal circumstances, as-built information for highwall structures is submitted to OSM within sixty days following construction.

A brief description of each highwall impoundment at the Navajo Mine is included in Table 26-8. The locations are shown on Exhibit 26-9, Exhibit 26-10, Exhibit 26-11 and Exhibit 26-12. The impoundments are designed and built to prevent water from entering active mining pits. In no case will discharge from any of the impoundments leave the Permit Area as the pits would intercept the flows.

26.2.5 Berms

Berms are inspected regularly to ensure their stability and ability to perform as designed. When degradation of the berms is observed they will be reestablished using a blade or other appropriate equipment.

<u>26.2.5.1 Topdressing Stockpile Berms</u>

Exhibit 22-1 through Exhibit 22-3 provide the location of all current topdressing stockpiles as discussed in Section 22 – Support Facilities. In an effort to reduce topdressing loss resulting from wind and water erosion, berms and/or ditches are constructed around the perimeters of each topdressing stockpile or ponds are built. In addition, stockpiles that have a slope at angle of repose, a berm will be placed on the top to eliminate runoff erosion along the slopes.

Figure 25-1 provides a typical design and cross section of the berm surrounding the topdressing stockpiles. See Section 25 – Sediment Control Plan, for application of the typical design.

During periods when the topdressing stockpiles are active, breaches in the berms will be created to allow for equipment access. These berms will be reconstructed after the topdressing stockpiles become inactive.

26.2.5.2 Immediate Mining Area and Active Grading Area Berms

See Section 25 – Sediment Control Plan, Operation 2: "Immediate Mining Area and Active Grading Areas", for text discussion.

26.2.5.3 Coal Stockpile Berms

Berms are installed adjacent to the coal stockpiles to help divert the surface runoff into a sediment pond or other drainage control structures. The berms convey surface runoff either directly into a sediment pond or into a ditch or channel that leads to a sediment pond. They are examined after storm events, and kept in good condition to ensure that they function properly and as intended. A typical section of the berm is shown on Figure 22-1 and the design for the worst case scenario is in Appendix 23.B.

26.2.6 Embankments

Embankments are constructed in areas where the transportation facilities (haulroads, roads, railroad, etc) traverse across topographic lows. The embankments have culverts to prevent surface runoff from impounding on the upstream side, except for the section of railroad embankment just north of the Lowe Coal Stockpile. This section of railroad embankment impounds the surface runoff from two watersheds, which have been designated as Lowe Impoundment #1 and #2. The detail designs, plans and sections of these impoundments are shown on Exhibit 26-14 and Exhibit 26-15. Whereas, the location of the embankments and the culverts are shown on Exhibits 10-1 through 10-2 and Exhibits 10-4 through 10-7.

When segments of the transportation facilities are no longer needed they will be regraded and reclaimed in accordance with Section 22 – Support Facilities of the mine permit.

26.2.7 Hazard Classification

All impoundment's have been classified using the Soil Conservation Service (SCS) criteria for Class B and C dams (TR-60), and MSHA's criteria for impoundment's (30 CFR 77.216 (a) (1)). Tables 22-2 through 22-6, Table 26-5.1, Table 26-5.2, Table 26-5.3, Table 26-5.4, Table 26-5.5, Table 26-5.6, Table 26-5.7,

Table 26-5.8, Table 26-5.9, Table 26-5.10, Table 26-5.11, Table 26-5.12, Table 26-5.13, Table 26-5.14, Table 26-5.15, Table 26-5.16, Table 26-5.17, Table 26-5.18, Table 26-5.19, Table 26-5.20, Table 26-5.21, Table 26-5.22, Table 26-5.23, Table 26-5.24, Table 26-5.25, Table 26-5.26, Table 26-5.27, Table 26-5.28, Table 26-5.29 and Table 26.8 identify the impoundment's and classification, whereas Exhibit 26-9, Exhibit 26-10, Exhibit 26-11, and Exhibit 26-12 provide the locations.

All impoundments have been determined to be low hazard potential. In the event of a failure there is no potential hazard to homes, utilities, roads, or other structures downstream. Lowe Railroad Embankment #1 meets the MSHA impoundment criteria (embankment height higher than 20 feet and capacity greater than 20 acre-feet).

26.2.8 Miscellaneous Hydrologic Structures

Design proposals submitted to OSM will contain the appropriate engineering design analysis. Design analysis data (e.g. SEDCAD) for miscellaneous hydrologic structures is contained in Appendix 23.B.

26.3 Land Use/Condition, Hydrologic Groups and Curve Numbers

The NRCS has classified soil types into four hydrologic group ratings; A, B, C or D. To establish uniformity in the curve numbers used for reclaimed, undisturbed and cultivated (NAPI fields) lands. The curve numbers that will be used for the soils in the respective hydrologic groups and land types, are shown on Table 26-9. The land use/conditions and curve numbers were taken from SCS Engineering Division Technical Release 55, June 1986, "Urban Hydrology for Small Watersheds", Table 2-2d, page 2-8.

26.3.1 Reclaimed Areas

From the referenced table the type of land use/conditions for the reclaimed lands at Navajo Mine is between "Herbaceous" and "Desert Shrub", each with poor hydrologic condition. The curve numbers for the reclaimed lands were determined by interpolating between the curve numbers associated with the two land use/conditions. These curve numbers are conservative for the reclaimed lands. For the land use/condition "Herbaceous" and "Desert Shrub" the reference table does not take into account the mechanical treatments applied to the reclaimed lands such as, contouring, terracing, mulching, and small depressions. These land treatments are incorporated into the final reclamation to reduce the potential surface runoff and soil loss, but were not accounted for in establishing the curve numbers.

For the land use/conditions listed under "Arid and Semiarid Rangelands" the reference table does not five curve numbers for hydrologic soil group A, except for "Desert Shrub". A curve number of 63 is given for "Desert Shrub", hydrologic soil group A with poor hydrologic condition. A slightly higher curve number of 65 will be used for hydrologic soil group A in reclaimed lands.

The runoff curve number for the reclaimed lands in each mine area (Area 1, 2, 3, and 4) was estimated from the type and quantity of topdressing material to be salvaged from each area. Refer to Table 26-10 for the topdresssing soil types and quantities for each mine area. The hydrologic group classification or rating for each soil mapping unit was obtained from the NRCS soil surveys. The curve numbers associated with each hydrologic group rating was obtained from Table 26-9. The weighted curve number values were calculated using the volume of material from each mapping unit and its contribution to the total volume of topdressing available in each mine area. The weighted values for each mine area were summed to arrive at a mean curve number. Refer to Table 18-5 through 18-8 for the weighted runoff curve numbers for each mine area.

26.3.2 Undisturbed and Cultivated Areas

The land use/condition for undisturbed areas will be identical to the reclaimed lands (same curve numbers). The curve numbers for undisturbed areas will be determined on a case by case basis. The soil types and hydrologic group classification for all the soil types will be obtained from NRCS soil surveys. The curve number associated with the hydrologic group classification will be taken from Table 26-9. In large watersheds with several sub-watersheds, a mean curve number will be calculated for each sub-watershed.

The type of land use and condition selected for the NAPI cultivated fields from the referenced table is "Row crops, Straight row" with good hydrologic conditions. This is conservative since the crop residue cover was not taken into account.

26.3.3 Spoil Material

Spoil material at Navajo Mine typically exhibits hydrologic properties found in hydrologic grouping D. Therefore, a curve number of 89 will be used to model surface discharge for all watersheds composed of disturbed spoil material

26.4 Diversions

All planned permanent diversions will be designed in accordance with Navajo Mine's Reclamation Surface Stabilization Handbook (NTEC formerly known as BHP-Navajo Mine, 1992) (OSM approval date July 22, 1992). Designs and as-builts for diversion structures will be completed and submitted for OSM approval.

Should an existing diversion require additional maintenance (erosion control, improved vegetation establishment, etc.) the channel will be manipulated with either appropriate machinery or by the use of cattle impaction, whichever is deemed most effective by the operator. Machinery may be used to control erosion, and/or prepare for reclamation activities. Where appropriate and feasible, cattle will be used to impact inslopes. Cattle impaction will reduce erosion, incorporate mulch and seed into the soil and increase water infiltration by creating increased surface roughness.

26.4.1 Lowe/Dixon Diversion Channel Extension

Removed with Update 1307

26.4.2 North Fork Diversion Channel

The primary function of the North Fork Diversion Channel will be to prevent or minimize the inflow of surface water into the Dixon Pit Extension, enhancing the efficiency and safety of the mining operations. The upstream end of the diversion starts near the northern permit boundary where the North Fork enters the Permit Area. The diversion routes the North Fork drainage towards the south into a natural drainage, which is a tributary of the Middle Fork of the Cottonwood Arroyo. The location and alignment of the diversion are shown on Exhibit 26-16.

The total length of the diversion is approximately 6,340 feet. The portion to be constructed is approximately 3,980 feet in length and the portion in the natural drainage is approximately 2,360 feet in length. The constructed portion will have a grade of 0.263 percent and the portion in the natural drainage has an average grade of 0.988 percent. The alignment, profile and typical sections for the portion that will be constructed are presented on Exhibit 26-17 (Sheet 1 and Sheet 2). The constructed portion of the diversion passes through a ridge between Station 26+50 and 31+30. The side slopes through this reach were steepened to minimize excavation and surface disturbance.

The diversion is design to meet the criteria for a temporary diversion as outlined in CFR Part 816.43. A temporary diversion must safely pass the peak discharge from the 10 year–6 hour precipitation event. The hydrology for the North Fork of the Cottonwood was model in SEDCAD to simulate the 2, 5 and 10 year–6 hour storm events. The watershed subdivisions used in the model is presented in Exhibit 26-18. The results from the SEDCAD runs are presented in Appendix 26.E. The peak discharge from the 2, 5 and 10 year-6 hour precipitation events are 244, 472 and 647 cfs, respectively.

The channel design utility in SEDCAD was used to proportion the diversion channel. The diversion channel is designed to 1) remain stable during the peak flow from the 2 and 5 year-6 hour storm events and 2) safely pass the peak flow from the 10 year-6 hour storm event with a minimum freeboard of one foot. The entire length of the diversion is located in the badlands. The oil composition in the badlands is predominately shale and clays. The limiting velocity used in the design for stability is the erosive velocity of the soil, which is estimated to be 5.0 fps. The Manning’s roughness coefficient was estimated to be 0.031 in the portion to be constructed. The SEDCAD output for the channel design is presented in

Appendix 26.E. The flow depths and velocities from the SEDCAD channel design utility are summarized in the Table 26-11.

The flow velocities during the peak flows from the 2 and 5 year-6 hour storm events are all less than 5 fps, which indicates that the channel will remain stable with minimal amount of erosion. Some erosion can be expected occur from flows that are greater than the peak flow from the 5 year-6 hour storm. The maximum flow depth during the peak flow from 10 year-6 hour storm event is approximately 4 feet. The minimum design depth is 6 feet thus the channel will safely pass the peak flow form the 10 year-6 hour storm event with a minimum freeboard of 2 feet.

The portion of the diversion in the natural drainage was hydraulically evaluated using Manning's Equation. The flow depths and velocities were determined for the peak flows from the 2, 5 and 10 year-6 hour storm events at five cross sections. The Manning's roughness coefficient (n-value) for the natural drainage was estimated to be: 0.042 for the over bank flow, 0.035 for the channel banks, and 0.030 for the channel bottom. The n-value for the over bank flow is estimated to range from 0.032 to 0.047. In isolated short reaches the n-value is as low as 0.032 and as high as 0.047 but is predominately between 0.040 and 0.045. For this evaluation an n-value of 0.042 was used for the over bank flow. A composite n-value was calculated for each flow depth at each section. The cross section and stage flow data are presented in Appendix 26.E. The flow depths and velocities are summarized in Table 26-12.

The flow velocities during the peak flow from the 2 and 5 year-6 hour storm events are all less than 5 fps at each section except at Station 21+88. Station 21+88 is approximately 170 feet upstream from the point where the drainage enters the Middle Fork of the Cottonwood Arroyo. The channel in the vicinity of Station 21+88 is deeply incised. The channel bed has eroded downward to match the elevation of the channel bed in the Middle Fork. The higher flow velocities in this reach are due to the incised channel confining the flow. The average velocity during the peak flow from the 10 year-6 hour storm for this reach is 4.49 fps, but the velocity in the incised portion of the channel is probably in the range of 6 to 7 fps. Some erosion is expected to occur through this reach particularly in the lateral direction thus widening the channel. The extent of widening will depend on the magnitude of the flows that occur while the diversion is in service.

The typical configuration of the natural drainage is a swale with an incised channel. The dimension of the incised channel varies as shown in Table 26-13.

With the increased flows through the natural drainage some erosion is expected to occur. Additional down cutting of the channel bed is expected to occur particularly during storms that are greater than the 10 year-6 hour events. The major channels in the surrounding area have stabilized at grades between 0.7 and 0.9 percent. The reach of the diversion that is in the natural channel has an average grade of 1.0 percent. From field observations there is indications of bedrock outcropping at Station 0+50 and about midway at Station 10+10. These may develop into natural grade control structures. The rock outcrop at the upstream end does not appear to be as competent as the one downstream. In the worst-case scenario, maximum head cutting will occur if the channel stabilizes to a 0.7 percent grade. If this occurs the head cutting at Station 0+50 and 10+10 is expected to be approximately 3.0 and 4.0 feet, respectively. Assuming the outcropping rock is competent to withstand the flow velocities.

To minimize surface disturbance the channel in the natural drainage will be allowed to stabilize through natural processes. However if head cutting should exceed 5 feet in any reach, then corrective measures will be taken to prevent further head cutting upstream. The depth of head cutting will be measured from the current flow line. Riprapped drop structures will be considered as a mitigation measure. If the channel were not allowed to develop and stabilize through natural processes the alternative would be to construct a channel at a uniform grade on the current alignment. This will require m10/99; 6/01ore surface disturbance and excavation.

Riprapped downdrains will be installed to control erosion in locations where existing side drainages enter the diversion channel. The riprap rock is sized for the 10 year-6 hour peak flow. For the locations and details of the riprapped downdrains see Exhibit 26-17 (Sheet 1 and Sheet 2). The hydrology and design data for the downdrains are presented in Appendix 26.E.

The design criteria for the riprapped downdrains was revised, the flows to the downdrains are from ephemeral streams such flows are classified as miscellaneous flows. Temporary diversions for miscellaneous flows are designed to safely pass the peak flow from the 2 year-6 hour storm event (CFR 816.43(c)(3)). The revised design data for the riprapped downdrains are presented in Appendix 26.E (as-built data) of the PAP.

When the diversion is no longer needed it will be re-graded and reclaimed in accordance with the guidelines and procedures outlined in Section 35 – Hydrologic Reclamation Plan.

26.4.2.1 Drainage/Sediment Control for Excess Material Dump

During construction the excess excavation or waste was dumped along the west side of the diversion channel. To control drainage and sediment from the dump a berm will be constructed adjacent to the toe of west slope that will direct the drainage to the low points. At the natural low points or existing drainages there will be a break in the berm with a silt fence to release the drainage and retain the sediment. In some cases where the natural topography is favorable, a berm may not be required to direct the drainage to the low point where the silt fence will be placed. Refer to the typical section and profile on Figure 26-3 for location of berm and silt fences.

On the east side of the dump the slope for the most part is constructed flush with the cut slope of the channel. A short segment at the north end has a 15-foot bench at the crest of the cut. There is essentially no room to construct a berm or ditch to collect the runoff from the dump slope without moving the dump towards the west. In lieu of moving the dump to create room for placing drainage control structures an evaluation comparing the soil loss from the undisturbed surface with the dump slope was done to determine the potential degree of impact.

Slope/length measurements were taken on the east slope and on the undisturbed area adjacent to the west side of the dump. The data was used as input parameters in RUSLE Version 1.06 to determine the soil loss. The input parameters along the length of the dump were averaged based on similarity of conditions. The weighted average soil loss is based on the lengths of similar conditions along the dump and not on area. Refer to the Table 26-14, Table 26-15, Table 26-16, and Table 26-17 for the field measurements taken and the results from RUSLE Version 1.06. The estimated weighted average soil loss from the east dump slope is 2.0 ton/acre and from the undisturbed surface it is 1.9 ton/acre. The soil loss from the east dump slope is 5 percent more than the adjacent undisturbed surface. The additional sediment from the dump slope is very minimal, thus the potential impact to the downstream flow would be insignificant. Also the area in question (east dump slope) is very small compared to the total surface disturbance for the South Dixon Pit extension.

26.5 Discharges Into an Underground Mine

No underground mining is anticipated within the proposed Permit Area, and therefore, the potential for discharges to an underground mine do not exist.

References

BHP Navajo Coal Company (BNCC). 1992. Reclamation Surface Stabilization Handbook. Unpublished report, available for review at the Navajo Mine Environmental Quality Department

United States Department of Agriculture, Soil Conservation Service. 1980. Soil Survey of San Juan County, New Mexico, Eastern Part.

Table 26-1 Primary Culverts

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Appendix
CP-18	460.6	90.0	3.0	305	0	142.90	4.7	36.6	23.A
CP-20	42.2	24.0	2.5	262	2.6	27.18	12.0	27	23.A
CP-22	80.6	48.0	1.0	282	0	32.15	2.6	10	23.A
CP-31	23611.2	48.0	3.1	150	3.5	325.70	8.5	9.5	23.A
CP-32		48.0	3.1	150	3.5	325.70	8.5	9.5	23.A
CP-33		48.0	3.1	150	3.5	325.70	8.5	9.5	23.A
CP-34		48.0	3.1	150	3.5	325.70	8.5	9.5	23.A
CP-35A	662.4	24.0	2.4	147	0	18.22	2.9	4.3	23.A
CP-35B		24.0	2.4	147	0	18.22	2.9	4.3	23.A
CP-36	19.1	48.0	0.6	70	0	15.97	1.8	6.5	23.A
CP-37	21.3	24.0	1.5	160	0.9	12.29	2.3	5.5	23.A
CP-49	2.6	12.0	2.0	140	0	3.01	1.4	8	23.A
CP-50	72.2	30.0	2.1	140	0	49.00	5.9	7	23.A
CP-51	122.1	36.0	1.1	134	0	71.06	6.3	6.7	23.A
CP-52	510.6	42.0	0.7	137	0	112.00	8.4	8.6	23.A
CP-53		42.0	0.7	141	0	112.00	8.4	8.6	23.A
CP-53a				Removed culvert CP-53a, not install					
CP-54	18.5	18.0	1.1	178	0	13.47	5.0	12.5	23.A
CP-55	319.1	42.0	1.6	204	0	139.63	11.3	11.5	23.A
CP-55a				Removed culvert CP-55a, not install					
CP-56	195.1	48.0	1.7	170	0	109.90	12.3	16.5	23.A
CP-57	3.7	18.0	3.0	174	0	4.28	1.3	10.4	23.A

Table 26-1 (Continued)

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Appendix
CP-58	4.7	18.0	3.3	140	0	5.44	1.5	9.8	23.A
CP-59	4.5	18.0	3.4	142	0	5.24	1.5	9.6	23.A
CP-60	13.8	18.0	2.5	230	0	15.95	5.2	7	23.A
CP-61	53.9	30.0	2.9	140	0	39.23	4.4	6.5	23.A
CP-62	8.7	18.0	3.6	128	0	10.07	2.4	3.7	23.A
CP-63A	4.36	16.0	1.0	40	0	10.13	3.5	3	23.A
CP-63B		15.0	2.8	133	0	10.13	4.5	4.5	23.A
CP-66	RESERVED								
CP-67	CULVERT REMOVED								
CP-68	Plugged and made inactive, surface run off diverted into pit								
CP-69	7.1	72.0	1.1	83	0	5.05	1.0	7.00	23.A
CP-74	15.7	76.0	1.1	110	0	16.93	0.5	7.00	23.A
CP-77	46.5	36.0	1.0	231	0	14.22	1.8	6.00	23.A
CP-83	64.7	24.0	14.0	155	0	7.99	1.6	10.54	23.A
CP-84	5.5	15.6	0.9	48	0	3.90	1.5	2.50	23.A
CP-85	5.2	15.6	2.7	65	0	3.85	1.5	2.50	23.A
CP-91	17.8	18.0	1.0	70	0	10.95	1.8	2.80	23.A
CP-93	51.2	48.0	1.0	230	0	23.08	2.0	4.00	23.A
CP-103	29.2	30.0	1.0	124	0	22.75	2.9	4.00	23.A
CP-104	64.2	36.0	1.0	161	0	28.78	2.8	4.00	23.A
CP-106	1.8	10.0	6.5	75	0	1.16	1.0	1.60	23.A

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Information Appendix
CP-107	4.6	10.0	9.0	75	0	2.12	1.5	1.50	23.A
CP-109									
CP-119	31.9	18.0	2.2	95	0	4.15	1.2	3.83	23.A
CP-120	8.9	18.0	1.9	79	0	2.87	1.2	3.80	23.A
CP-122	13.0	24.0	1.0	54	0	2.26	0.8	6.00	23.B
CP-123	187.4	24.0	1.0	50	0	6.32	1.3	3.30	23.B
CP-124	372.0	24.0	1.0	50	0	7.74	1.5	3.30	23.B
CP-126	24.6	24.0	1.5	144	0	13.21	2.8	3.60	23.A
CP-128	58.6	24.0	1.5	116	0	14.23	3.3	8.00	23.A
CP-129	1.7	24.0	3.7	148	0	1.97	1.0	4.00	23.A
CP-130	0.9	24.0	5.2	142	0	1.04	0.7	15.40	23.A
CP-131	19.0	24.0	1.9	146	0	12.47	3.5	19.20	23.A
CP-132	12.0	24.0	2.6	132	0	7.51	1.6	12.40	23.A
CP-133	4.6	24.0	2.2	124	0	5.32	2.0	13.90	23.A
CP-134	137.0	42.0	1.7	132	0	81.00	5.4	13.50	23.A
CP-136	74.4	24.0	1.8	112	0	38.62	3.7	5.60	23.A
CP-137	25.8	24.0	1.9	226	0	17.23	4.2	29.30	23.A
CP-138	2.2	24.0	1.3	168	0	2.55	1.0	26.00	23.A
CP-139	16.5	24.0	2.2	154	0	16.52	3.7	3.90	23.A
CP-140	19.5	24	1.5	100	0	2.6	2.5	4.00	23.A

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Information Appendix
CP-141	6.0	24.0	2.0	122	0	6.95	1.6	8.30	23.A
CP-142	4.0	24.0	2.6	192	0	4.63	1.3	18.80	23.A
CP-143	4.2	24.0	4.6	226	0	4.86	1.3	3.50	23.A
CP-144	105.7	42.0	2.0	168	0	58.82	4.7	20.80	23.A
CP-145	23.0	24.0	1.5	188	0	15.46	3.4	12.90	23.A
CP-150	12.8	24.0	1.9	190	0	13.91	2.2	4.00	23.A
CP-151	Plugged and made inactive, surface run off diverted into pit								
CP-157	28.7	24.0	2.3	86	0	20.90	3.3	4.10	23.A
CP-158	38.9	24.0	2.0	94	0	28.33	5.7	6.10	23.A
CP-159	11.4	24.0	4.8	94	0	13.20	2.0	4.70	23.A
CP-160	23.7	24.0	0.9	90	0	16.66	2.9	4.90	23.A
CP-161	102.1	42.0	3.0	100	0	59.76	4.1	4.40	23.A
CP-162	40.2	24.0	2.1	86	0	28.88	5.8	8.00	23.A
CP-163	17,258.7	96.0	0.9	150	0	647.00	12.5	13.60	23.A
CP-164	45.5	30.0	1.5	94	0	27.11	3.1	4.50	23.A
CP-165	14.7	18.0	1.4	86	0	10.54	3.2	3.60	23.A
CP-166	13.0	24.0	2.0	100	0	15.05	2.4	5.00	23.A
CP-167	1.3	18.0	8.8	136	0	1.50	0.5	5.00	23.A
CP-168	0.7	12.0	9.7	110	0	0.81	0.5	2.50	23.A
CP-171	246.3	24.0	2.7	60	0	22.28	4.0	4	23.A
CP-173	6.8	24.0	3.5	74	0	8.21	1.5	4.3	23.A
CP-182	34.1	24	1.9	140	0	24.1	4.0	5	23.A
CP-183	6.5	24	2.0	130	0	6.61	1.4	3.85	23.A

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Information Appendix
CP-185	24.38	24	9.0	130	0	9.94	1.8	3.2	23.A
CP-186	108.5	24	2.9	206	0	13.02	2.0	5.3	23.A
CP-187	54.5	24	1.5	206	0	4.95	1.3	3.95	23.A
CP-189	90.6	30	5.2	330	0	65.69	10	23	23.A
CP-323	106.8	18	1.0	124	0	7.03	1.8	3	23.A
CP-324	41.7	24.0	0.6	110	0	10.41	2.1	3.25	23.A

Table 26-2 Downdrains

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Information Appendix
CP-86	23.9	15	10.99	14	0	5.02	1.6	2.25	23.A
CP-87	6.0	15.6	10.2	19	0.00	4.65	1.5	3.80	23.A
DD-01	19.5	30.0	34.0	36	0.00	2.04	0.6	4.00	23.A
DD-02	19.5	30.0	34.9	53	0.00	2.04	0.6	4.00	23.A
DD-03	19.5	30.0	37.6	53	0.00	2.04	0.6	4.00	23.A
DD-04	1.7	16.0	66.3	65	0.00	1.12	0.5	2.00	23.A
DD-05	10.4	42.0	28.6	29	0.00	3.22	0.8	4.00	23.A
DD-06	15.2	15.0	19.7	44	0.00	5.08	0.5	4.00	23.A
DD-07	56.2	15.0	20.4	325	0.00	5.18	2.2	2.25	23.A
DD-08	56.2	15.0	67.4	90	0.00	5.18	2.2	2.25	23.A
DD-09	56.2	15.0	66.3	87	0.00	5.18	2.2	2.25	23.A
DD-10	4.6	15.0	50.3	105	0.00	0.33	0.5	1.25	23.A
DD-11	4.6	15.0	12.1	408	0.00	0.33	0.5	1.25	23.A
DD-12	4.6	15.0	58.8	68	0.00	0.33	0.5	1.25	23.A
DD-13	15.0	15.0	27.9	206	0.00	0.97	0.6	1.25	23.A
DD-14	15.0	15.0	34.4	153	0.00	0.97	0.6	1.25	23.A
DD-15	15.0	15.0	32.4	154	0.00	0.97	0.6	1.25	23.A
DD-16	61.6	15.0	28.9	160	0.00	7.79	2.7	2.75	23.A
DD-17	61.6	15.0	29.4	126	0.00	7.79	2.7	2.75	23.A
DD-18	61.6	15.0	23.8	170	0.00	7.79	2.7	2.75	23.A
DD-19	4.3	15.0	36.0	55	0.00	5.00	1.5	5.00	23.A
DD-20	1.4	15.0	36.0	55	0.00	1.60	0.8	4.50	23.A

Table 26-2 (Continued)

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Information Appendix
DD-21	5.3	15.0	45.0	68	0.00	3.90	1.0	4.90	23.A
DD-22	0.2	15.0	50.0	250	0.00	0.22	0.3	1.50	23.A
DD-23	0.1	16.0	68.0	52	0.00	1.08	0.9	1.80	23.A
DD-24	0.1	10.0	50.0	45	0.00	0.54	1.0	1.40	23.A
DD-25	0.9	9.0	25.0	68	0.00	1.08	0.9	1.80	26.B
DD-27	0.4	12.0	65.0	25	0.00	0.54	0.4	1.00	26.B
DD-29	1.81	16.0	60.0	73	0.00	1.84	0.8	5.00	23.A
DD-30	6.3	4.0	50.0	334	0.00	1.09	1.6	5.11	23.A

Table 26-3 Ancillary Road Culverts

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Information Appendix
CP-64					REMOVED CULVERT				
CP-65					REMOVED CULVERT				
CP-75A	37.4	7.2	0.6	106	0	10.44	25	2.3	23.A
CP-75B		7.2	0.6	106	0	10.44	25	2.3	23.A
CP-76	4.1	24.0	1.3	89	0	3.18	1.0	3.00	23.A
CP-79	5.3	15	23.43	37	0	5.71	2	1.3	23.A
CP-80A	17.1	15.0	4.4	31	0	6.49	3.0	3.50	23.A
CP-80B		15.0	2.3	31	0	6.49	3.0	3.50	23.A
CP-81A	24.5	15.0	3.1	34	0	7.75	2.8	2.80	23.A
CP-81B		15.0	3.2	24	0	7.75	2.8	2.80	23.A
CP-88	3.9	14.5	1.8	39	0	1.60	1.0	2.70	23.A
CP-89	0.6	15.0	5.5	22	0	0.65	0.5	2.00	23.A
CP-90	1.21	15.0	9.16	24	0	1.3	0.62	1.5	23.A
CP-92	138.7	30.0	3.5	50	0	18.90	2.9	4.00	23.A
CP-94	1.7	12.0	0.9	31	0	2.22	1.5	2	23.A
CP-95	9.6	24.0	1.0	26	0	9.94	1.8	3.5	23.A
CP-96	2.3	18.0	0.5	144	0	1.8	0.2	2	23.A
CP-108	332.3	30.0	0.1	28	0	29.09	3.7	5.40	23.A
CP-110	0.4	117x79 arch	1.7	110	0	0.45	5.0	10.00	23.A
CP-125	4.2	16.0	1.3	28	0	1.12	0.6	1.80	23.A
CP-169	0.5	18.0	10.6	40	0	0.26	0.4	2.50	23.A
CP-170	1.0	18.0	6.4	48	0	0.52	0.4	4.8	23.A
CP-174	13.4	18	4.4	35	0	5.47	1.5	2.00	23.A
CP-175	14.4	16	1.5	40	0	5.88	1.7	2.20	23.A
CP-176	2.6	16	4.5	35	0	1.06	0.4	1.90	23.A
CP-177	58.6	30	3.0	40	0	16.58	2.0	3.50	23.A
CP-178	0.6	16	3.0	36	0	0.25	0.2	1.60	23.A
CP-179	0.7	16	4.0	40	0	0.29	0.2	1.90	23.A
CP-180	5.1	16	2.0	40	0	2.1	0.4	2.10	23.A
CP-181A	23	16	2.4	33	0	4.7	1.4	2.70	23.A
CP-181B		16	2.4	33	0	4.7	1.4	2.70	23.A

Table 26-3 (Continued)

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Information Appendix
CP-184	11.43	16.0	0.20	191	0	4.04	1.3	2.0	23.A
CP-189	0.6	16	3.1	40	0	0.31	2.3	3.5	23.A
CP-190	1.1	16	1.3	40	0	0.56	1.1	4.85	23.A
CP-202	2.9	18.0	3.8	30	0	1.18	0.6	3.5	23.A
CP-203	4.2	18.0	4.9	30	0	1.72	0.7	2.5	23.A
CP-204	3.5	18.0	2.6	61	0	1.43	0.6	6	23.A
CP-205	10.76	24.0	1.5	60	0	14.64	2.4	3.4	23.A
CP-206	12.67	24.0	2	60	0	17.24	2.7	3.5	23.A
CP-207	5.12	16.0	1.5	44	0	6.97	2.3	3.2	23.A
CP-300	8.9	24	8.2	110	0	4.59	1.0	3.2	23.A
CP-301	1.3	24.0	6.3	122	0	1.24	0.5	8.90	23.A
CP-302	8.4	18.0	5.6	80	0	8.31	1.3	3.50	23.A
CP-303	2.4	18.0	4.1	86	0	2.85	0.8	3.3	23.A
CP-304	2.3	18.0	5.0	80	0	2.23	0.7	2.8	23.A
CP-305A&B	14.6	18 (2)	6.3	120	0	8.23	1.5	2.6	23.A
CP-306	2.7	18	3.3	80	0	2.67	0.7	5.5	23.A
CP-307	20.6	18	5.4	80	0	11.5	1.3	6.8	23.A
CP-308A&B	22.2	18	2.7	80	0	12.01	1.8	2.3	23.A
CP-309	9.2	18	2.3	80	0	9.08	1.3	5	23.A
CP-320A&B	10.0	18 (2)	1.3	80	0	12.01	1.5	4.9	23.A
CP-321	28.4	24	1.4	100	0	33.95	2.0	7.1	23.A

Table 26-4 Railroad Culverts

Culvert locations can be found on Exhibits 26-1 through 26-6 and Exhibits 10-4 through 10-7

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Information Appendix
CP-01	92.1	48	2.5	76	2.7	40.02	2.8	13.7	23.A
CP-02	133.5	48	3.2	183	3.3	76.61	4.8	35.6	23.B
CP-03	87.6	48	2.6	100	2.1	44.35	3.5	18.6	23.A
CP-04	40.9	48	1.8	68	2	25.50	2.0	13.8	23.A
CP-05	27209.8	84	0.7	311	0	585.50	15.0	70.3	23.A
CP-06	195.1	60	2.1	218	1	68.54	3.8	36	23.A
CP-07[1]	103.9	42	1.1	158	0	23.58	0.8	2	26.C
CP-08[2]	76.2	30	0.4	81	0	21.70	1.0	2.5	26.C
CP-09[2]	76.2	30	4.3	48	0	21.70	2.6	6.5	26.C
CP-10[3]	55.8	24	4.2	120	0	13.00	2.2	2.7	26.C
CP-11	12.2	24	0.6	107	1	13.15	2.5	8.6	23.A
CP-12	26.5	24	2.2	101	1.2	18.52	2.9	6.3	23.A
CP-13	79.3	30	3.5	73	1.7	37.13	5.0	13.4	23.A
CP-14	79.3	30	3.7	129	4	37.13	5.0	8.5	23.A
CP-15	28.0	24	2.6	108	0.5	20.88	4.0	11.9	23.A
CP-16	196.4	60	1.1	153	0	15.18	2.7	42.5	23.A
CP-17	492.60	108	0.3	187	0	145.80	5.5	8.6	23.A
CP-19	72.3	30	0.6	203	0	49.45	9.6	23.4	23.A
CP-23[4]	122.7	58 x 36 Arch	1.5	146	3.8	41.59	1	10	26.C
CP-24[4]		58 x 36 Arch	1.5	146	3.8	41.59	1	10	26.C
CP-97[5]	89.1	24	0.93	140	0	10.99	1.87	7.2	26.C
CP-98	2.0	16	1	80	0	2.16	1.6	2.5	26.B
CP-99	2.0	16	1	80	0	2.16	1.6	2.5	26.B
CP-100	0.2	24	2	60	0	0.54	1.6	3	26.B
CP-101	2.0	12	1	40	0	2.16	1.6	3	26.B
CP-102	1.0	24	1	50	0	1.08	2.4	3	26.B

Notes: [1] Spillway for Block C Pond 3 [2] Spillway for Block C Pond 2 [3] Spillway for Block C Pond 1

[4] Spillway for Barber Stockpile Pond #2 [5] Spillway for Hosteen Stockpile Pond #3

Table 26-5 Pond Cross Reference

Pond Name	Pond Information
Area 3 Lowe Hole 3 Pond 2	Table 26-5.1 & Table 26.8
Area 3 Lowe Permanent Impoundment 1	Table 26-5.2
Area 2 Barber Stockpile Pond 2	Table 26-5.3
Area 2 Barber Stockpile Pond 3	Table 26-5.4
Area 2 South Barber Pond	Table 26-5.5
Area 3 Collyer Road Pond #4	Table 26-5.6
Area 1Emma's Pond	Table 26-5.7
Area 2 Hosteen Stockpile Pond 1	Table 26-5.8
Area 2 Hosteen Stockpile Pond 2	Table 26-5.9
Area 2 Hosteen Stockpile Pond 3	Table 26-5.10
Area 3 Lowe Railroad Impoundment #1	Table 26-5.11
Area 3 Lowe Railroad Impoundment #2	Table 26-5.12
Area 3 Lowe Stockpile Pond	Table 26-5.13
Area 1 North Pinto Pond	Table 26-5.14
Area 1 North Pond All Cells	Table 26-5.15
Area 1 North Pond 1 Cell A	Table 26-5.16
Area 1 North Pond 1 Cell A2	Table 26-5.17
Area 1 North Pond 1 Cell B	Table 26-5.18
Area 1 North Pond 1 Cell C	Table 26-5.19
Area 1 Pond 5	Table 26-5.20
Area 3 Northwest Dixon	Table 26-5.21
Area 3 South Dixon Pond 1	Table 26-5.22
Area 3 South Dixon Pond 2	Table 26-5.23
Area 3 South Dixon Pond 3	Table 26-5.24
Area 3 Southwest Dixon Pond	Table 26-5.25
Area 1 Vinnel Pond	Table 26-5.26
Area 2 Block C Pond 1	Table 26-5.27
Area 2 Block C Pond 2	Table 26-5.28
Area 2 Block C Pond 3	Table 26-5.29
Area 3 Lowe Hole 3 Pond 3	Table 26-5.30 & Table 26.8
Area 2 Mason Pond	Table 26-5.31
Area 2 Employee Coal Dump Pond	Table 26-5.32
Area 4 Pond 401	Table 26-5.33

Table 26-5 (Continued)

Pond Name	Pond Information
Area 4 North Pond 412	Table 26-5.34
Area 4 North Pond 3	Table 26-5.35
Area 4 North Pond 4	Table 26-5.36
Open	Table 26-5.37
Area 4 North Pond 411	Table 26-5.38
Area 4 North Pond 413	Table 26-5.39
Area 4 North Pond 402	Table 26-5.40
Open	Table 26-5.41
Area 4 North Pond 408	Table 26-5.42
Area 4 North Pond 409	Table 26-5.43
Area 4 North Pond 410	Table 26-5.44
Area 3 North Pond 301	Table 26-5.45
Area 3 North Pond 302	Table 26-5.46
Area 2 Block C Pond 4	Table 26-5.47
Area 3 Pond 309A	Table 26-5.48
Area 3 Pond 309B	Table 26-5.49
Area 4 North Pond 414	Table 26-5.50
Open	Table 26-5.51
Area 3 Pond 306	Table 26-5.52
Area 3 North Fork Pond	Table 26.8
Area 4 North Pond 406	Table 26.8
Area 4 North Pond 407	Table 26.8
Area 2 Pond 201	Table 26-5.53
Area 2 Pond 202	Table 26-5.54
Area 3 Pond 310	Table 26-5.55
Area 3 Pond 311	Table 26-5.56

Table 26-5.1 Area 3 Lowe Hole 3 Pond 2

Type of Pond	Impoundment
Location	Exhibit 26-24
Purpose	Minimizes inflow into Lowe Pit, thus enhancing the safety of the mining operations. Not classified as a sediment pond.
Design Information	Appendix 26.C, Exhibit 26-52
As-Built Information	Exhibit 26-55
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	628.7
As-Built Capacity (ac-ft)	9.82
Curve Number (SCS)	88
Design Storm Event	2 year-6 hour
Peak Discharge (cfs)	23.8
Runoff Volume (ac-ft)	7.7
Max. Permissible Gauge Reading for Water/Sediment (ft)	N/A
Depth at Upstream Toe (ft)	10
NRCS Hazard Classification	Low
Spillway Type	Emergency
25 yr - 6 hr Peak Discharge (cfs)	109.1 (spillway)
Foundation Soil Type	Spoils (shale and sandstone cobbles)
Comments	Pond minimizes the inflow of runoff into Lowe Pit during the more frequent low intensity storms. Overflow will be retained in the pit; off lease discharge is very unlikely.

Table 26-5.2 Area 3 Lowe Impoundment 1

Type of Pond	Impoundment
Location	Exhibit 26-12
Purpose	Minimize inflow into Lowe Pit, thus enhancing the safety of the mining operations. Not classified as a sediment pond.
Design Information	Appendix 26.C and Exhibit 11-127
As-Built Information	Pending
Intended Life Span	Will be removed in 2025
Watershed Area (ac)	1642 ac.
As-Built Capacity (ac-ft)	Pending As-built
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	25 year 6 hour for spillway
Peak Discharge (cfs)	241.9
Runoff Volume (ac-ft)	50.04
Max. Permissible Gauge Reading for Water/Sediment (ft)	N/A
Depth at Upstream Toe (ft)	7
NRCS Hazard Classification	Low Potential
Spillway Type	Emergency
25 yr - 6 hr Peak Discharge (cfs)	241.9
Foundation Soil Type	Clay
Comments	Spoil

Table 26-5.3 Area 2 Barber Stockpile Pond 2

Type of Pond	I
Location	Exhibit 26-10 and 26-11
Purpose	Contain surface runoff water runoff from the Barber Stockpile area.
Design Information	Appendix 26.C
As-Built Information	Exhibit 26-8
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	106.6
As-Built Capacity (ac-ft)	8.02
Curve Number (SCS)	81.9
Design Storm Event	100 year – 6 hour
Peak Discharge (cfs)	82.12
Runoff Volume (ac-ft)	5.72
Max. Permissible Gauge Reading for Water/Sediment (ft)	5.1, Elev.5280.0
Depth at Upstream Toe (ft)	4
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	Incised ponds with mild slopes.

Table 26-5.4 Area 2 Barber Stockpile Pond 3

Type of Pond	Detention
Location	Exhibit 26-10 and 26-11
Purpose	Contain surface runoff water runoff from the Barber Stockpile area.
Design Information	Appendix 26.C
As-Built Information	Exhibit 26-33
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	59.8
As-Built Capacity (ac-ft)	3.74
Curve Number (SCS)	76
Design Storm Event	10 year – 24 hour
Peak Discharge (cfs)	4.28
Runoff Volume (ac-ft)	1.13
Max. Permissible Gauge Reading for Water/Sediment (ft)	5.6, Elev. 5347.6
Depth at Upstream Toe (ft)	4
NRCS Hazard Classification	Low
Spillway Type	Trickle Tube & Emergency Spillway
25 yr - 6 hr Peak Discharge (cfs)	0.63 at spillway
Foundation Soil Type	Sandy Clay
Comments	Incised ponds with mild slopes.

Table 26-5.5 Area 2 South Barber Pond

Type of Pond	Sediment
Location	Exhibit 26-11
Purpose	Contain runoff from South Barber Ramp 5 reclaim area.
Design Information	Exhibit 26-39, Appendix 26.C
As-Built Information	Exhibit 26-40
Intended Life Span	2016
Watershed Area (ac)	157.4
As-Built Capacity (ac-ft)	6.17
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	70.0
Runoff Volume (ac-ft)	5.43
Max. Permissible Gauge Reading for Water/Sediment (ft)	2.2 (elev. 5384.2)
Depth at Upstream Toe (ft)	8.0
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Clay spoils
Comments	

Table 26-5.6 Area 3 Collyer Road Pond #4

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Surface water and Sediment control for South Dixon Pit.
Design Information	Appendix 26.C
As-Built Information	Exhibit 26-43
Intended Life Span	Will be removed in 2025
Watershed Area (ac)	142.1 – Worst case using AOC topo./ (45.8 Ac.– Current topo).
As-Built Capacity (ac-ft)	11.8
Curve Number (SCS)	86/(78 and 86)
Design Storm Event	100 year - 6 hour
Peak Discharge (cfs)	81.9/(40.1)
Runoff Volume (ac-ft)	10.0/(2.4)
Max. Permissible Gauge Reading for Water/Sediment (ft)	2.4, Elev. 5263.4/(7.0, Elev. 5268.0)
Depth at Upstream Toe (ft)	8.0
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay
Comments	Meets the applicable mass stability criteria of 30 CFR δ 816.49 based on evidence from NM-0003C Chapter 29.

Table 26-5.7 Area 1 Emma's Pond

Type of Pond	Sediment
Location	Exhibit 26-9
Purpose	Prevents undisturbed surface water runoff from entering the north industrial area.
Design Information	Appendix 26.F, Exhibit 11-31 & Exhibit 26-28
As-Built Information	Exhibit 26-27
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	91.5
As-Built Capacity (ac-ft)	9.66
Curve Number (SCS)	80
Design Storm Event	100 year-6 hour
Peak Discharge (cfs)	76.22
Runoff Volume (ac-ft)	3.34
Max. Permissible Gauge Reading for Water/Sediment (ft)	5.8, Elev. 5358.6
NRCS Hazard Classification	Low
Spillway Type	Emergency Spillway
25 yr - 6 hr Peak Discharge (cfs)	7.14 (discharge at spillway)
Foundation Soil Type	Sand with some clay.
Comments	Static factor of safety of 1.5 and seismic factor of safety of 1.2.

Table 26-5.8 Area 2 Hosteen Stockpile Pond 1

Type of Pond	Sediment
Location	Exhibit 26-10
Purpose	Contain surface water runoff from the Hosteen Stockpile area.
Design Information	Appendix 26.C.
As-Built Information	Exhibit 26-30
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	155.54
As-Built Capacity (ac-ft)	10.71
Curve Number (SCS)	79.1
Design Storm Event	10 year – 24 hour
Peak Discharge (cfs)	22.17
Runoff Volume (ac-ft)	4.01
Max. Permissible Gauge Reading for Water/Sediment (ft)	11.3, Elev. 5269.2
Depth at Upstream Toe (ft)	15
NRCS Hazard Classification	Low
Spillway Type	Emergency Spillway
25 yr - 6 hr Peak Discharge (cfs)	16.06 at spillway
Foundation Soil Type	Sandstone and shale
Comments	

Table 26-5.9 Area 2 Hosteen Stockpile Pond 2

Type of Pond	Sediment
Location	Exhibit 26-10
Purpose	Contain surface water runoff from the Hosteen Stockpile area.
Design Information	Appendix 26.C.
As-Built Information	Exhibit 26-31
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	122.8
As-Built Capacity (ac-ft)	12.98
Curve Number (SCS)	83
Design Storm Event	10 year – 24 hour
Peak Discharge (cfs)	26.55
Runoff Volume (ac-ft)	4.36
Max. Permissible Gauge Reading for Water/Sediment (ft)	7.7, Elev.5300.5
Depth at Upstream Toe (ft)	15
NRCS Hazard Classification	Low
Spillway Type	Trickle Tube & Emergency Spillway
25 yr - 6 hr Peak Discharge (cfs)	37.71
Foundation Soil Type	Spoils (sandstone and shale)
Comments	

Table 26-5.10 Area 2 Hosteen Stockpile Pond 3

Type of Pond	Sediment
Location	Exhibit 26-10
Purpose	Contain surface water runoff from the Hosteen Stockpile area.
Design Information	Appendix 26.C.
As-Built Information	Exhibit 26-32.
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	135.2
As-Built Capacity (ac-ft)	7.36
Curve Number (SCS)	80.9
Design Storm Event	100 year – 6 hour
Peak Discharge (cfs)	68.03
Runoff Volume (ac-ft)	6.76
Max. Permissible Gauge Reading for Water/Sediment (ft)	1.5, Elev. 5266.1
Depth at Upstream Toe (ft)	8
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Shale
Comments	

Table 26-5.11 Area 3 Lowe Railroad Impoundment #1

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	To contain sediment and runoff on lease.
Design Information	Appendix 26.G
As-Built Information	Exhibit 11-67
Intended Life Span	This pond will be reclaimed in 2015.
Watershed Area (ac)	105.73
As-Built Capacity (ac-ft)	19.2
Curve Number (SCS)	87.4 (Weighted Average, see design information for actual subwatershed Curve Numbers)
Design Storm Event	100 year – 6 hour
Peak Discharge (cfs)	89.73
Runoff Volume (ac-ft)	6.84
Max. Permissible Gauge Reading for Water/Sediment (ft)	13.5 Elev. 5303.5
Depth at Upstream Toe (ft)	13
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	The western boundary of this pond is the railroad embankment. The railroad embankment has the potential to hold 99.26 ac-ft of water.

Table 26-5.12 Area 3 Lowe Railroad Impoundment #2

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	To contain sediment and runoff on lease.
Design Information	Appendix 26.G
As-Built Information	Exhibit 11-67B
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	133.27
As-Built Capacity (ac-ft)	18.37
Curve Number (SCS)	81.7 (Weighted Average, see design information for actual subwatershed Curve Numbers)
Design Storm Event	10-yr., 24-hr.
Peak Discharge (cfs)	103.69
Runoff Volume (ac-ft)	6.65
Max. Permissible Gauge Reading for Water/Sediment (ft)	6.3 Elev. 5324.3
Depth at Upstream Toe (ft)	8
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay with Limestone
Comments	Large embankment with small drainage area and no culvert. Partially incised.

Table 26-5.13 Area 3 Lowe Stockpile Pond

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Contain runoff from the Lowe stockpile area.
Design Information	Appendix 26.C
As-Built Information	Exhibit 26-34
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	51.8
As-Built Capacity (ac-ft)	5.60
Curve Number (SCS)	89
Design Storm Event	10-yr., 24-hr.
Peak Discharge (cfs)	13.35
Runoff Volume (ac-ft)	2.99
Max. Permissible Gauge Reading for Water/Sediment (ft)	7.8, Elev. 5308.6
Depth at Upstream Toe (ft)	11
NRCS Hazard Classification	Low
Spillway Type	Emergency Spillway
25 yr - 6 hr Peak Discharge (cfs)	17.52
Foundation Soil Type	Badlands
Comments	Partially incised with maximum height of 6 ft. and slopes not excessively steep.

Table 26-5.14 Area 1 North Pinto Pond

Type of Pond	Sediment
Location	Exhibit 26-9
Purpose	Sediment control for Pinto Pit and prevents runoff from entering the North Area support facility.
Design Information	Appendix 26.H
As-Built Information	Exhibit 26-29.
Intended Life Span	Will be removed in 2025
Watershed Area (ac)	76.9
As-Built Capacity (ac-ft)	5.36
Curve Number (SCS)	80
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	42.4
Runoff Volume (ac-ft)	3.6
Max. Permissible Gauge Reading for Water/Sediment (ft)	3.1, Elev. 5373.3
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay
Comments	

Table 26-5.15 Area 1 North Pond Cell A, B & C (combined)

Type of Pond	Sediment
Location	Exhibit 26-9
Purpose	Retains surface runoff from the North Facility excluding the coal handling facilities.
Design Information	Appendix 26.C and Exhibit 22-13, Exhibit 22-14 and Exhibit 26-13.
As-Built Information	Exhibit 26-13
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	214.9
As-Built Capacity (ac-ft)	31.8
Curve Number (SCS)	See Appendix 26.C
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	138.4
Runoff Volume (ac-ft)	11.39
Max. Permissible Gauge Reading for Water/Sediment (ft)	Cells A, B and C function together. The max. permissible water level is at elevation 5330.3 in all cells.
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay.
Comments	Consists of 3 cells: A, B & C. A & B are lined.

Table 26-5.16 Area 1 North Pond 1 Cell A

Type of Pond	Sediment
Location	Exhibit 26-9
Purpose	Retains surface runoff from the North Facility excluding the coal handling facilities.
Design Information	Appendix 26.C, Exhibit 22-13, 22-14 & 26-13.
As-Built Information	Exhibit 26-13
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	See Table 26-5.15 North Pond 1 Cells A, B & C
As-Built Capacity (ac-ft)	4.8
Curve Number (SCS)	See Appendix 26.C
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	See Table 26-5.15 North Pond 1 Cells A, B & C
Runoff Volume (ac-ft)	See Table 26-5.15 North Pond 1 Cells A, B & C
Max. Permissible Gauge Reading for Water/Sediment (ft)	Elev. 5330.3
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay.
Comments	Lined, incised pond.

Table 26-5.17 Area 1 North Pond 1 Cell A2

Type of Pond	Sediment
Location	Exhibit 26-9
Purpose	In conjunction with Pond 5 retains surface runoff from the coal handling facilities and the coal plant washdown water. Cell A2 tied to N. Loadout, Barber Loadout, and Lowe Loadout for dust suppression needs and de-watering. Water collected in Pond 5 is pumped to Cell A2.
Design Information	Appendix 26.I, Appendix 26.C & Exhibit 26-13
As-Built Information	Exhibits 22-7 through 22-12 & 26-13
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	51.9
As-Built Capacity (ac-ft)	5.4
Curve Number (SCS)	See Appendix 26.C
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	16.3
Runoff Volume (ac-ft)	2.67
Max. Permissible Gauge Reading for Water/Sediment (ft)	Elev. 5328.8
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay.
Comments	Incised pond. Sump with pump/motor.

Table 26-5.18 Area 1 North Pond 1 Cell B

Type of Pond	Sediment
Location	Exhibit 26-9
Purpose	Retains surface runoff from the North Facility excluding the coal handling facilities.
Design Information	Appendix 26.C, Exhibit 22-13, 22-14 & 26-13.
As-Built Information	Exhibit 26-13.
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	See Table 26-5.15 North Pond 1 Cells A, B & C
As-Built Capacity (ac-ft)	14.3
Curve Number (SCS)	See Appendix 26.C
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	See Table 26-5.15 North Pond 1 All Cells A, B & C
Runoff Volume (ac-ft)	See Table 26-5.15 North Pond 1 All Cells A, B & C
Max. Permissible Gauge Reading for Water/Sediment (ft)	Elev. 5330.3
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay.
Comments	Incised Pond.

Table 26-5.19 North Pond 1 Cell C

Type of Pond	Sediment
Location	Exhibit 26-9
Purpose	Retains surface runoff from the North Facility excluding the coal handling facilities.
Design Information	Appendix 26.C, Exhibit 22-13, 22-14 & 26-13.
As-Built Information	Exhibit 26-13.
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	See Table 26-5.15 North Pond 1 Cells A, B & C
As-Built Capacity (ac-ft)	12.68
Curve Number (SCS)	See Appendix 26.C
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	See Table 26-5.15 North Pond 1 Cells A, B & C
Runoff Volume (ac-ft)	See Table 26-5.15 North Pond 1 Cells A, B & C
Max. Permissible Gauge Reading for Water/Sediment (ft)	Elev. 5330.3
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay.
Comments	Incised Pond.

Table 26-5.20 Area 1 Pond 5

Type of Pond	Sediment
Location	Exhibit 26-9
Purpose	In conjunction with Pond 1 Cell A2 retains the surface runoff from the coal handling facilities and the coal plant washdown water. Water collected in Pond 5 is pumped to Cell A2.
Design Information	Appendix 26.C & Exhibit 11-105A.
As-Built Information	Exhibits 22-7 through 22-12 & 11-105A
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	41.9
As-Built Capacity (ac-ft)	2.29
Curve Number (SCS)	See Appendix 26.C
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	36.53
Runoff Volume (ac-ft)	1.92
Max. Permissible Gauge Reading for Water/Sediment (ft)	Elev. 5329.6
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay
Comments	Incised, lined pond. Pond contains 25 HP pump that discharges at 1400 gpm.

Note: The excess runoff is pumped into Cell A.

Table 26-5.21 Area 3 Northwest Dixon

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Contain runoff from the outslope of the northwest portion of the Dixon boxcut spoils and adjacent off-lease area.
Design Information	Appendix 26.C.
As-Built Information	Exhibit 26-37.
Intended Life Span	Will be removed in 2025.
Watershed Area (ac)	62.2
As-Built Capacity (ac-ft)	5.9
Curve Number (SCS)	83
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	47.84
Runoff Volume (ac-ft)	4.42
Max. Permissible Gauge Reading for Water/Sediment (ft)	4.3, Elev. 5348.4
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay
Comments	Incised Pond.

Table 26-5.22 Area 3 South Dixon Pond 1

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Sediment Control for South Dixon (Block D).
Design Information	Appendix 26.J
As-Built Information	Exhibit 26-41
Intended Life Span	Will be removed in 2009.
Watershed Area (ac)	296.46
As-Built Capacity (ac-ft)	11.89
Curve Number (SCS)	80
Design Storm Event	10-yr., 24-hr.
Peak Discharge (cfs)	73.11
Runoff Volume (ac-ft)	6.63
Max. Permissible Gauge Reading for Water/Sediment (ft)	3.5, Elev. 5240.5
Depth at Upstream Toe (ft)	5
NRCS Hazard Classification	Low
Spillway Type	Emergency Spillway
25 yr - 6 hr Peak Discharge (cfs)	61.11 (at peak stage)
Foundation Soil Type	Sandy clay
Comments	Partially incised.

Table 26-5.23 Area 3 South Dixon Pond 2

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Sediment Control for South Dixon (Block D).
Design Information	Appendix 26.J, Exhibit 26-48 (modification)
As-Built Information	Exhibit 26-49
Intended Life Span	Will be removed in 2009.
Watershed Area (ac)	28.4
As-Built Capacity (ac-ft)	4.62
Curve Number (SCS)	80
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	23.15
Runoff Volume (ac-ft)	1.33
Max. Permissible Gauge Reading for Water/Sediment (ft)	7.1, Elev. 5248.6
Depth at Upstream Toe (ft)	7
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay.
Comments:	Partially incised with medium embankments providing freeboard.

Table 26-5.24 Area 3 South Dixon Pond 3

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Sediment Control for South Dixon (Block D).
Design Information	Appendix 26.J
As-Built Information	Exhibit 26-42
Intended Life Span	Will be removed in 2009.
Watershed Area (ac)	28.18
As-Built Capacity (ac-ft)	4.6
Curve Number (SCS)	80
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	22.60
Runoff Volume (ac-ft)	1.05
Max. Permissible Gauge Reading for Water/Sediment (ft)	3.0, Elev. 5246.25
Depth at Upstream Toe (ft)	6
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay.
Comments	Partially incised with medium embankments providing freeboard.

Table 26-5.25 Area 3 Southwest Dixon Pond

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Contain runoff from the outslope of the Southwest portion of the Dixon boxcut spoils and adjacent off-lease areas.
Design Information	Appendix 26.C, Pg. 105-114.
As-Built Information	Exhibit 26-38.
Intended Life Span	Will be removed in 2009.
Watershed Area (ac)	37.80
As-Built Capacity (ac-ft)	2.71
Curve Number (SCS)	80
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	33.33
Runoff Volume (ac-ft)	2.01
Max. Permissible Gauge Reading for Water/Sediment (ft)	4.8, Elev. 5371.1
Depth at Upstream Toe (ft)	6
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay
Comments	Partially incised with medium embankments providing freeboard.

Table 26-5.26 Area 1 Vinnel Pond

Type of Pond	Sediment
Location	Exhibit 26-9
Purpose	Contain runoff from the disturbed Vinnel area.
Design Information	Exhibit 26-35. Appendix 26.C.
As-Built Information	Exhibit 26-36
Intended Life Span	Will be removed in 2006.
Watershed Area (ac)	276.5
As-Built Capacity (ac-ft)	9.76
Curve Number (SCS)	76
Design Storm Event	10-yr., 24-hr.
Peak Discharge (cfs)	11.06
Runoff Volume (ac-ft)	4.78
Max. Permissible Gauge Reading for Water/Sediment (ft)	6.2, Elev. 5364.1
Depth at Upstream Toe (ft)	6
NRCS Hazard Classification	Low
Spillway Type	Emergency Spillway
25 yr - 6 hr Peak Discharge (cfs)	19.60
Foundation Soil Type	Clayey sand
Comments	Partially incised with medium embankments providing freeboard.

Table 26-5.27 Area 2 Block C Pond 1

Type of Pond	Sediment
Location	Exhibit 26-11
Purpose	Retain surface runoff from the outslope of the Western portion of the Block C mining area and adjacent railroad.
Design Information	Exhibit 26-57, Appendix 26.C.
As-Built Information	Exhibit 26-58
Intended Life Span	Will Be Removed In 2015.
Watershed Area (Ac)	49.48
As-Built Capacity (Ac-Ft)	5.1
Curve Number (Scs)	81
Design Storm Event	100 Year-6 Hour
Peak Discharge (Cfs)	38.54
Runoff Volume (Ac-Ft)	2.49
Max. Permissible Gauge Reading For Water/Sediment (Ft)	10.3, Elev. 5306.7
Depth At Upstream Toe (Ft)	N/A – Incised
Nrcs Hazard Classification	Low
Spillway Type	N/A
25 Yr - 6 Hr Peak Discharge (Cfs)	N/A
Foundation Soil Type	Clayey Sand
Comments	Incised

Table 26-5.28 Area 2 Block C Pond 2

Type of Pond	Sediment
Location	Exhibit 26-11
Purpose	Retain surface runoff from the outslope of the central portion of the Block C mining area and adjacent railroad.
Design Information	Exhibit 26-59, Appendix 26.C
As-Built Information	Exhibit 26-60
Intended Life Span	Will be removed in 2015.
Watershed Area (ac)	66.64
As-Built Capacity (ac-ft)	6.0
Curve Number (SCS)	85
Design Storm Event	100 year-6 hour
Peak Discharge (cfs)	62.1
Runoff Volume (ac-ft)	4.42
Max. Permissible Gauge Reading for Water/Sediment (ft)	4.5, Elev. 5303.1
Depth at Upstream Toe (ft)	11
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Clayey Sand
Comments	Partially incised with medium roadway embankment providing capacity and 1 ft. freeboard.

Table 26-5.29 Area 2 Block C Pond 3

Type of Pond	Sediment
Location	Exhibit 26-10, 26-11
Purpose	Retain surface runoff from the Block C mining area, adjacent railroad and Barber Coal Stockpile area.
Design Information	Exhibit 26-61, Appendix 26.C
As-Built Information	Exhibit 26-62
Intended Life Span	Will be removed in 2015.
Watershed Area (ac)	174.42
As-Built Capacity (ac-ft)	17.28
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year-6 hour
Peak Discharge (cfs)	94.7
Runoff Volume (ac-ft)	8.97
Max. Permissible Gauge Reading for Water/Sediment (ft)	4.1, Elev. 5268.6
Depth at Upstream Toe (ft)	9
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Clayey Sand
Comments	Medium roadway embankment providing capacity and 1 ft. freeboard.

Table 26-5.30 Area 3 Lowe Hole 3 Pond 3

Type of Pond	Impoundment
Location	Exhibit 26-12
Purpose	Minimize surface runoff into the pit.
Design Information	Exhibit 11-127, Exhibit 26-52, Exhibit 26-53, Appendix 26.C
As-Built Information	Exhibit 26-54
Intended Life Span	Will be removed in 2009.
Watershed Area (ac)	39.61
As-Built Capacity (ac-ft)	4.75
Curve Number (SCS)	79.67
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	32.45
Runoff Volume (ac-ft)	2.01
Max. Permissible Gauge Reading for Water/Sediment (ft)	N/A
Depth at Upstream Toe (ft)	0' Incised
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Spoils
Comments	Incised pond with mild slopes

Table 26-5.31 Area 2 Mason Pond

Type of Pond	Sediment
Location	Exhibit 26-11
Purpose	Retain surface runoff from a portion of regrade between Barber Ramps 5 and 6, and the adjacent Barber haulroad.
Design Information	Exhibit 26-26, Appendix 26.C
As-Built Information	Exhibit 26-81
Intended Life Span	Will be removed in 2015.
Watershed Area (ac)	133.2
As-Built Capacity (ac-ft)	10.09 design capacity, will be updated after construction.
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	96.4
Runoff Volume (ac-ft)	7.2
Max. Permissible Gauge Reading for Water/Sediment (ft)	4.4, Elev. 5383.9
Depth at Upstream Toe (ft)	9
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Clayey Sand
Comments	Partially incised with medium embankments providing freeboard.

Table 26-5.32 Area 2 Employee Coal Dump

Type of Pond	Sediment
Location	Exhibit 26-11
Purpose	Retain surface runoff from the Employee Coal Dump area
Design Information	Exhibit 26-56, Appendix 26.C
As-Built Information	Exhibit 26-56
Intended Life Span	2015
Watershed Area (ac)	6.73
As-Built Capacity (ac-ft)	3.33
Curve Number (SCS)	89
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	11.42
Runoff Volume (ac-ft)	0.55
Max. Permissible Gauge Reading for Water/Sediment (ft)	4.6, Elev. 5457.6
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay
Comments	

Table 26-5.33 Area 4 North Pond 401

Type of Pond	Sediment
Location	Exhibit 26-25
Purpose	Retains the runoff from box cut spoils
Design Information	Appendix 26.C and Exhibit 26-19
As-Built Information	Exhibit 11-01 As-built
Intended Life Span	Until Completion of Final Reclamation
Watershed Area (ac)	20.8
As-Built Capacity (ac-ft)	3.9 plus 1-foot freeboard (as-built)
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	1.4
Max. Permissible Gauge Reading for Water/Sediment (ft)	7.4 (as-built)
Depth at Upstream Toe (ft)	9
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 26-5.34 Area 4 North Pond 412

Type of Pond	Sediment
Location	Exhibit 26-25
Purpose	Retains the runoff from box cut spoils
Design Information	Appendix 26.C and Exhibit 26-45
As-Built Information	Exhibit 26-44 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	30.6
As-Built Capacity (ac-ft)	3.2 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year – 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	3.0
Max. Permissible Gauge Reading for Water/Sediment (ft)	1.7 (as-built)
Depth at Upstream Toe (ft)	9.8
NRCS Hazard Classification	Low
Spillway Type	Not required
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 26-5.35 Area 4 North Pond 3

Type of Pond	Sediment
Location	Exhibit 26-25
Purpose	Retains the runoff from box cut spoils
Design Information	Appendix 26.C and Exhibit 26-47
As-Built Information	Exhibit 26-46 As Built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	8.6
As-Built Capacity (ac-ft)	1.2 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	0.8
Max. Permissible Gauge Reading for Water/Sediment (ft)	2.4
Depth at Upstream Toe (ft)	7
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 26-5.36 Area 4 North Pond 4

Type of Pond	Sediment
Location	Exhibit 26-25
Purpose	Retains the runoff from box cut spoils
Design Information	Appendix 26.C and Exhibit 26-51
As-Built Information	Exhibit 26-50 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	46.3
As-Built Capacity (ac-ft)	5.6 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year – 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	4.5
Max. Permissible Gauge Reading for Water/Sediment (ft)	3.2
Depth at Upstream Toe (ft)	8.7
NRCS Hazard Classification	Low
Spillway Type	Not required
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

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Area 4 North Pond 405

Update 13-06.

Table 26-5.38 Area 4 North Pond 411

Type of Pond	Sediment
Location	Exhibit 26-25
Purpose	Retains the runoff from mining area
Design Information	Appendix 26.C and Exhibit 26-71
As-Built Information	Exhibit 26-70 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	12.5
As-Built Capacity (ac-ft)	1.7 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year – 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	1.2
Max. Permissible Gauge Reading for Water/Sediment (ft)	3.2
Depth at Upstream Toe (ft)	8.3
NRCS Hazard Classification	Low
Spillway Type	Not required
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 26-5.39 Area 4 North Pond 413

Type of Pond	Sediment
Location	Exhibit 26-25
Purpose	Retains the runoff from mining area
Design Information	Appendix 26.C and Exhibit 26-23
As-Built Information	Exhibit 11-6 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	6.8
As-Built Capacity (ac-ft)	2.6 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	0.6
Max. Permissible Gauge Reading for Water/Sediment (ft)	7.7
Depth at Upstream Toe (ft)	10
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

Table 26-5.40 Area 4 North Pond 402

Type of Pond	Sediment
Location	Exhibit 26-25
Purpose	Retains the runoff from box cut spoils
Design Information	Appendix 26.C and Exhibit 26-20
As-Built Information	Exhibit 11-04 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	96.8
As-Built Capacity (ac-ft)	7.9
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	6.8
Max. Permissible Gauge Reading for Water/Sediment (ft)	6.0
Depth at Upstream Toe (ft)	15.4
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

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Area 4 North Pond 404

Update 13-06.

Table 26-5.42 Area 4 North Pond 408

Type of Pond	Sediment
Location	EXHIBIT 26-25
Purpose	Retains the runoff from topsoil stockpile TS-401
Design Information	Appendix 26.C and Exhibit 26-67
As-Built Information	Exhibit 26-66 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	6.18
As-Built Capacity (ac-ft)	1.5
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	0.4
Max. Permissible Gauge Reading for Water/Sediment (ft)	4.5
Depth at Upstream Toe (ft)	5.2
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

Table 26-5.43 Area 4 North Pond 409

Type of Pond	Sediment
Location	Exhibit 26.25
Purpose	Retains the runoff from topsoil stockpile TS-402
Design Information	Appendix 26.C and Exhibit 26-69
As-Built Information	Exhibit 26-68 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	2.83
As-Built Capacity (ac-ft)	0.26
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	0.2
Max. Permissible Gauge Reading for Water/Sediment (ft)	1.6
Depth at Upstream Toe (ft)	3.5
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

Table 26-5.44 Area 4 North Pond 410

Type of Pond	Sediment
Location	Exhibit 26-25
Purpose	Retains the runoff from topsoil stockpile TS-402
Design Information	Appendix 26.C and Exhibit 26-69
As-Built Information	Exhibit 26-68 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	2.37
As-Built Capacity (ac-ft)	0.93
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	0.17
Max. Permissible Gauge Reading for Water/Sediment (ft)	2.7
Depth at Upstream Toe (ft)	3.0
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

Table 26-5.45 Area 3 Pond 301

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Retains the runoff from South Dixon pit area
Design Information	Appendix 26.C and Exhibit 26-72
As-Built Information	Exhibit 26-72
Intended Life Span	2016
Watershed Area (ac)	32.9
As-Built Capacity (ac-ft)	7.5 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	2.4
Max. Permissible Gauge Reading for Water/Sediment (ft)	5.1, Elev. 5297.2
Depth at Upstream Toe (ft)	8.0
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 26-5.46 Area 3 Pond 302

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Retains the runoff from South Dixon pit area
Design Information	Appendix 26.C and Exhibit 26-73
As-Built Information	Exhibit 26-73
Intended Life Span	2016
Watershed Area (ac)	53.62
As-Built Capacity (ac-ft)	7.4 plus 1 foot freeboard
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	4.02
Max. Permissible Gauge Reading for Water/Sediment (ft)	3.1, Elev. 5292.6
Depth at Upstream Toe (ft)	N/A (incised pond)
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 26-5.47 Area 2 Block C Pond 4

Type of Pond	Sediment
Location	Exhibit 26-10 & Exhibit 26-11
Purpose	Retain surface runoff from the Block C mining area, adjacent railroad and Barber Coal Stockpile area.
Design Information	Exhibit 26-80, Appendix 26.C.
As-Built Information	Exhibit 26-80 As-built
Intended Life Span	Will be removed in 2015.
Watershed Area (ac)	262.64
As-Built Capacity (ac-ft)	15.93
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year – 6 hour
Peak Discharge (cfs)	128.27
Runoff Volume (ac-ft)	13.19
Max. Permissible Gauge Reading for Water/Sediment (ft)	2.4, Elev. 5270.4
Depth at Upstream Toe (ft)	10.5
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 26-5.48 Area 3 Pond 309A

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Retains the runoff from explosive agents storage area (Gilmore Silos).
Design Information	Appendix 26.C and Exhibit 22-18
As-Built Information	Exhibit 22-18
Intended Life Span	2016
Watershed Area (ac)	2.8
As-Built Capacity (ac-ft)	0.47 plus 1-foot freeboard (based on design data will be updated after construction)
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	0.30
Max. Permissible Gauge Reading for Water/Sediment (ft)	1.45, Elev. 5267.95 (based on design data will be updated after construction)
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 26-5.49 Area 3 Pond 309B

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Retains the runoff from explosive agents storage area (Gilmore Silos).
Design Information	Appendix 26.C and Exhibit 22-18
As-Built Information	Exhibit 22-18
Intended Life Span	2016
Watershed Area (ac)	3.1
As-Built Capacity (ac-ft)	0.38 plus 1 foot freeboard (based on design data will be updated after construction)
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	0.33
Max. Permissible Gauge Reading for Water/Sediment (ft)	0.81, Elev. 5266.91 (based on design data will be update after construction)
Depth at Upstream Toe (ft)	N/A (incised pond)
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 26-5.50 Area 4 North Pond 414

Type of Pond	Sediment
Location	Exhibit 26-25
Purpose	Retains the runoff from Gilmore Pit
Design Information	Appendix 26.C and Exhibit 26-86
As-Built Information	Exhibit 26-86
Intended Life Span	2016
Watershed Area (ac)	476.8
As-Built Capacity (ac-ft)	34.5 plus 1-foot freeboard per design; will be updated after construction
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	30.3
Max. Permissible Gauge Reading for Water/Sediment (ft)	2.89, Elev. 5265.1; will be updated after construction per the as-built
Depth at Upstream Toe (ft)	4.9
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	Volume above upstream toe 19.33 ac-ft

Table 26-5.51 Removed with REV 1221

Type of Pond	Highwall
Location	
Purpose	
Design Information	
As-Built Information	
Intended Life Span	
Watershed Area (ac)	
As-Built Capacity (ac-ft)	
Curve Number (SCS)	
Design Storm Event	
Peak Discharge (cfs)	
Runoff Volume (ac-ft)	
Max. Permissible Gauge Reading for Water/Sediment (ft)	
Depth at Upstream Toe (ft)	
NRCS Hazard Classification	
Spillway Type	
25 yr - 6 hr Peak Discharge (cfs)	
Foundation Soil Type	
Comments	

Table 26-5.52 Area 3 Pond 306

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Retains the runoff from South Dixon pit area
Design Information	Appendix 26.C and Exhibit 26-85
As-Built Information	Exhibit 26-85
Intended Life Span	2016
Watershed Area (ac)	61.67
As-Built Capacity (ac-ft)	4.2 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 26.C
Runoff Volume (ac-ft)	3.6
Max. Permissible Gauge Reading for Water/Sediment (ft)	1.3, Elev. 5307.5
Depth at Upstream Toe (ft)	8.5
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 26-5.53 Area 2 Pond 201

Type of Pond	Sediment
Location	Exhibit 26-87
Purpose	Surface and sediment runoff control from upstream construction disturbance.
Design Information	Exhibit 26-11, Appendix 26.C & Exhibit 26-87.
As-Built Information	To develop after construction.
Intended Life Span	Life of mine.
Watershed Area (ac)	26.6
As-Built Capacity (ac-ft)	2.98 ac-ft plus 1-foot freeboard per design will be updated on the as-built after construction.
Curve Number (SCS)	Refer to Appendix 26.C
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	11.8
Runoff Volume (ac-ft)	1.95
Max. Permissible Gauge Reading for Water/Sediment (ft)	4.41 ft; Elev. 5,345.91 - to be updated per the as-built.
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay
Comments	The channels and inlets to the pond are designed to be stable for a 10 yr-6 hr storm event.

Table 26-5.54 Area 2 Pond 202

Type of Pond	Sediment
Location	Exhibit 26-88
Purpose	Surface and sediment runoff control from upstream construction disturbance.
Design Information	Appendix 26.C. Exhibit 22-20 & Exhibit 26-88.
As-Built Information	To develop after construction.
Intended Life Span	Life of mine.
Watershed Area (ac)	404.58
As-Built Capacity (ac-ft)	13.53 ac-ft plus 1-foot freeboard per design will be updated on the as-built after construction.
Curve Number (SCS)	See SEDCAD information in Appendix 26.C
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	157.94
Runoff Volume (ac-ft)	10.89
Max. Permissible Gauge Reading for Water/Sediment (ft)	3.10 ft; Elev. 5,348.10 – to be updated per the as-built.
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay
Comments	The channels and inlets to the pond are designed to be stable for a 10 yr-6 hr storm event.

Table 26-5.55 Area 3 Pond 310

Type of Pond	Sediment
Location	Exhibit 26-12
Purpose	Surface and sediment runoff control
Design Information	Appendix 26.C. Exhibit 26-93.
As-Built Information	To develop after construction.
Intended Life Span	Till final reclamation
Watershed Area (ac)	331.97
As-Built Capacity (ac-ft)	15.02 ac-ft plus 1-foot freeboard per design will be updated on the as-built after construction.
Curve Number (SCS)	See SEDCAD information in Appendix 26.C
Design Storm Event	100-yr., 6-hr.
Peak Discharge (cfs)	141.08
Runoff Volume (ac-ft)	13.38
Max. Permissible Gauge Reading for Water/Sediment (ft)	1.07 ft; Elev. 5321.07 - to be updated per the as-built.
Depth at Upstream Toe (ft)	N/A
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy clay
Comments	The channels and inlets to the pond are designed to be stable for a 10 yr-6 hr storm event.

Table 26-5.56 Area 3 Pond 311

Type of Pond	Sediment
Location	Exhibit 26-93
Purpose	Surface and sediment runoff control from upstream construction disturbance.
Design Information	Exhibit 26-12, Appendix 26.C. & and Exhibit 26-93.
As-Built Information	To be develop after construction.
Intended Life Span	Life of mine.
Watershed Area (ac)	259.8
As-Built Capacity (ac-ft)	8.30 ac-ft plus 1-foot freeboard per design, will be updated on the as-built after construction.
Curve Number (SCS)	See SEDCAD information in Appendix 26.C
Design Storm Event	10-yr., 24-hr.
Peak Discharge (cfs)	42.71
Runoff Volume (ac-ft)	6.90
Max. Permissible Gauge Reading for Water/Sediment (ft)	1.45 ft; Elev. 5,326.95 - to be updated per the as-built.
Depth at Upstream Toe (ft)	N/A (Incised Pond)
NRCS Hazard Classification	Low
Spillway Type	Emergency Spillway
25 yr - 6 hr Peak Discharge (cfs)	47.60
Foundation Soil Type	Sandy clay
Comments	The channels and inlets to the pond are designed to be stable for a 10 yr-6 hr storm event.

Table 26-6 Ponds With Single Closed Spillway As-built Capacity vs. Storm Runoff Volume

Pond	As-built Capacity (ac-ft)	100 yr-6 hr Runoff Volume (ac-ft)	Comments:
Block C Pond 1	5.10	2.49	Sufficient capacity to retain the 100 hr-6 hr runoff
Block C Pond 2	6.00	4.42	Sufficient capacity to retain the 100 hr-6 hr runoff
Barber #2	8.02	5.72	Sufficient capacity to retain the 100 hr-6 hr runoff
Hosteen #3	7.36	6.76	Sufficient capacity to retain the 100 hr-6 hr runoff

Table 26-7 Block B Pond 3 Stage Storage

Elevation (ft)	Area (ac)	Inc. Volume (ac-ft)	Cum. Volume (ac-ft)	Comments
5261.0	0.00	0.00	0.00	
5262.0	0.00	0.00	0.00	
5263.0	0.01	0.01	0.01	
5264.0	0.03	0.02	0.02	
5265.0	0.09	0.06	0.08	
5266.0	0.25	0.17	0.25	
5267.0	0.40	0.33	0.57	
5268.0	0.71	0.56	1.13	
5269.0	1.11	0.91	2.04	
5270.0	1.75	1.43	3.46	
5271.0	2.57	2.16	5.62	
5272.0	3.51	3.04	8.66	
5272.6	4.05	2.27	10.93	Spillway elevation
5273.0	4.40	1.69	12.62	
5273.8			16.41	Peak stage for 100 yr-6 hr runoff
5274.0	5.45	4.93	17.54	
5275.0	6.59	6.02	23.56	
5276.0	8.66	7.63	31.19	
5277.0	10.15	9.40	40.59	
5278.0	11.80	10.97	51.57	
5279.0	14.27	13.03	64.60	Pond basin crest elevation

Table 26-8 Highwall Impoundments and Impoundments Hazard Classification

IMPOUNDMENT ID.	LOCATION	CURRENT STATUS	WATERSHED AREA (ACRES)	CAPACITY (AC-FT)	DEPTH AT UPSTREAM TOE (FT)	HAZARD POTENTIAL	COMMENTS[1]:
Lowe Hole 3 Pond 2	Lowe	active	688.0	11.6	see comment	Low	Impoundment (incised), see Appendix 26.C, Exhibit 26-52 & 26-55
Lowe Hole 3 Pond 3	Lowe	active	41.8	4.6	12.0	Low	Impoundment, see Appendix 26.C and Exhibit 26-53
North Fork Pond	Dixon	active	198.7	19.5	12.3	Low	Impoundment
Area 4-North Pond 406	A4N	active	238.1	14.2	9.0	Low	Impoundment, see Appendix 26.C and Exhibit 26-64.
Area 4-North Pond 407	A4N	active	124.8	15.4	15.0	Low	Impoundment, see Appendix 26.C and Exhibit 26-65

[1]The standard design and as-built information for the highwall impoundments are in Appendix 26.D.

Table 26-9 Land Types and Curve Numbers

Land Use/Condition (1)	Curve Numbers for Hydrologic Groups (5)			
	A	B	C	D
Reclaimed Lands (2)	65	78	86	91
Undisturbed Lands (3)	65	78	86	91
NAPI Cultivated lands (4)	67	78	85	89

1. Land use/conditions and the associated curve numbers were taken from Ms. Pamela J. Schwab and Dr. Richard Warner (1987), "SEDCAD+ User's Manual", Civil Software Design, Table 5.3, pages 110-112.
2. From reference (1) the land use/condition for reclaimed lands is between "Herbaceous" and "Desert Shrub", each with poor hydrologic condition. The curve numbers were determined by interpolating between the curve numbers associated with the two land use/conditions.
3. The type of land use/condition for undisturbed areas will be identical to reclaimed lands (same curve numbers).
4. The type of land use/conditions selected from reference (1) is "Row crops, Straight row" with good hydrologic conditions.
5. The hydrologic group classification for the soil types will be obtained from the NRCS soil surveys.

Table 26-10 Topdressing Types and Quantities[1]

Soil Mapping Unit Symbol	Soil Mapping Units	Percent of Map Unit[3]	Soil volume (cubic yards) Area 1	Area 2	Area 2	Area 4 North	Total	Title of SCS Soil Survey[4]	Hydrologic Group
Ba	Badland	-	0	0	0	0	0		
Bb[2]	Bacobi and	39	37,061	20,523	201,579	342,305	601,468	1	C
	Monierco soils	61	57,967	32,101	315,290	535,401	940,759	2	D
Bc	Blancot	-	0	0	664,484	0	664,484	2	B
Bh	Blancot, very hard	-	0	0	307,680	0	307,680	2	B
Fa	Faro and Persayo Soils	-	8,024	83,158	0	161,922	253,104	2	D/D
Gr	Grieta	-	0	0	0	69,104	69,104	3	B
Jc	Jocity -Gilco	-	503,634	183,596	481,270	1,525,313	2,693,813	3	B/B
Jh	Jocity, very hard	-	0	0	103,722	46,339	150,061	3	B
Ma	Mack	-	0	0	1,433,038	176,992	1,610,030	5	C
Mn	Mayqueen	-	295,981	55,176	0	23,851	375,008	2	B
Ms	Mayqueen -Shiprock	-	421,971	341,951	614,672	333,565	1,712,159	2	B
Mv	Mayqueen -Shiprock, very hard	-	85,805	0	61,024	0	146,829	2	B
Na	Nakai	-	0	0	0	53,010	53,010	4	B
Nt	Natrargids	-	0	6,628	0	0	6,628	2	D
Nv	Natrargids, overblown	-	2,159	82,861	97,028	218,490	400,538	2	D
Ra	Razito	-	599,753	521,804	458,595	311,260	1,891,412	5	A
Rh	Razito. very hard	-	73,893	0	21,089	196,707	291,689	5	A

Table 26-10 (Continued)

Soil Mapping Unit Symbol	Soil Mapping Units	Percent of Map Unit[3]	Soil volume (cubic yards)					Title of SCS Soil Survey[4]	Hydrologic Group
Rl	Redlands Variant	-	19,683	33,505	945,193	331,678	1,330,059	5	B
Rv	Redlands Variant, very hard	-	0	0	105,452	61,901	167,353	5	B
Sc	Shiprock	-	192,636	540,865	868,130	160,006	1,761,637	2	B
Sh	Shiprock, very hard	-	22,430	21,812	67,523	143,239	255,004	2	B
Sl	Shiprock -Blancot	-	278,724	0	23,813	0	302,537	2	B/B
Sv	Shiprock Variant	-	0	0	416,510	70,420	486,930	2	B
Sz	Stumble	-	0	0	15,596	105,082	120,678	2	A
Ta	Trail	-	0	23,210	0	0	23,210	5	A
Th	Trail. very hard	-	0	16,144	0	4,538	20,682	5	A
TOTAL:			2,599,721	1,963,334	7,201,688	4,871,123	16,635,866		

[1]This information was generated from Part 2, Section 14 Soil, approved PAP for Navajo Mine.

[2]Undifferentiated groups and complex soil mapping units were delineated if the major components had contrasting hydrologic groups.

[3]Percentages of each major mapping unit component were derived from Part 2, Section 14.2 Soil Map Unit Descriptions, approved PAP for Navajo Mine.

[4]1 = Soil Survey Coconino County, Arizona; 2= Soil Survey San Juan County, New Mexico, Eastern Part; 3= Soil Survey Sandoval County, New Mexico; 4= Soil Survey San Juan County, Utah; 5= Soil Survey Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona.

Table 26-11 Flow Depths and Velocities for the Portion to be Constructed

	2 year-6 hour		5 year-6 hour		10 year-6 hour	
Channel Reach	Flow Depth (ft)	Average Velocity (fps)	Flow Depth (ft)	Average Velocity (fps)	Flow Depth (ft)	Average Velocity (fps)
Station 0+00 to 26+37	2.17	3.58	3.13	4.39	3.71	4.83
Station 26+37 to 26+88	2.21	3.69	3.21	4.56	3.83	5.02
Station 26+88 to 27+85	2.24	3.77	3.28	4.68	3.93	5.17
Station 27+85 to 29+30	2.26	3.81	3.32	4.74	3.98	5.25
Station 29+30 to 31+30	2.19	3.65	3.18	4.50	3.79	4.96
Station 31+30 to 39+80	2.17	3.58	3.13	4.39	3.71	4.83

Table 26-12 Flow Depths and Velocities for the Portion in the Existing Drainage

	2 year-6 hour		5 year-6 hour		10 year-6 hour	
Location	Flow Depth (ft)	Average Velocity (fps)	Flow Depth (ft)	Average Velocity (fps)	Flow Depth (ft)	Average Velocity (fps))
Station 6+02.75 (Section A-A’)	1.74	3.42	2.22	4.37	2.52	4.98
Station 10+61.75 (Section B-B’)	2.02	3.27	2.52	4.09	2.83	4.51
Station 13+85 (Section C-C’)	2.08	3.76	2.59	4.82	2.89	5.41
Station 17+80 (Section D-D’)	3.50	4.10	4.20	4.05	4.50	4.56
Station 21+88.34 (Section E-E’)	4.51	6.14	5.89	6.60	7.08	4.49

Table 26-13 Variation of Dimensions of Incised Channel

Location	Depth (ft)	Width (ft)
Station 0+00 to 14+00	0.5 to 1.0	1.0 to 2.0
Station 14+00 to 17+60	1.0 to 2.5	1.5 to 3.0
Station 17+60 to 23+60	2.5 to 7.0	2.5 to 5.0

Table 26-14 Excess Material Dump – Slope/Length Measurements

Location/Station	Slope Dist. (ft)	Elev. Diff. (ft)	Horiz. Dist. (ft)	Slope (%)	Rock Cover (%)
Sta. 4 to 11 (700 ft)	27	15.3	22.2	68.8%	
	25	13.4	21.1	63.5%	
Average	26	14.4	21.7	66.1%	75
Sta. 11 to 19 (800 ft)	45	13.7	42.9	32.0%	50
Sta. 19 to 24 (500 ft)	31	4.8	30.6	15.7%	50
Sta. 24 to 27 (300 ft)	70	19.0	67.4	28.2%	40
Sta. 31 to 39.8 (880 ft)	20	9.3	17.7	52.5%	
	20	9.6	17.5	54.7%	
Average	20	9.5	17.6	53.6%	75

Table 26-15 Undisturbed Surface – Slope/Length Measurements

	Slope Dist. (ft)	Elev. Diff. (ft)	Horiz. Dist. (ft)	Slope (%)	Rock Cover (%)
Sta. 4 to 16 (1200 ft)	48	9.8	47.0	20.9%	
	35	5.9	34.5	17.1%	
	26	3.7	25.7	14.4%	
	33	6.9	32.3	21.5%	
	37	9.0	35.9	25.1%	
	26	5.3	25.5	20.8%	
	17	7.2	15.4	46.8%	
	33	10.2	31.4	32.5%	
Average	32		31.0	24.9%	15
Sta. 16 to 23 & Sta. 31 to 39.8 (1580 ft)	47	5.3	46.7	11.3%	
	45	3.2	44.9	7.1%	
	36	2.8	35.9	7.8%	
Average	43		42.5	8.8%	40
Sta. 23 to 27 (400 ft)	67	3.8	66.9	5.7%	
	70	3.7	69.9	5.3%	
	60	2.9	59.9	4.8%	
	48	2.7	47.9	5.6%	
	17	0.9	17.0	5.3%	
Average	52		52.3	5.3%	50

*Measurements were taken on the undisturbed surface along the west side of the waste material dump.

Table 26-16 Estimated Soil Loss – Excess Material Dump (RUSLE Version 1.06)

Filename	R	K	LS	C	P	A	Location/ Station	Length (ft)	% of Total Length	Weighted Soil Loss (tn/ac)
NFD1A	20	0.21	6.25	0.06	1.0	1.8	4 to 11	700.0	22.0%	0.40
NFD1B	20	0.21	3.40	0.20	1.0	2.8	11 to 19	800.0	25.2%	0.70
NFD1C	20	0.21	1.38	0.22	1.0	1.3	19 to 24	500.0	15.7%	0.20
NFD1D	20	0.21	3.88	0.24	1.0	4.0	24 to 27	300.0	9.4%	0.38
NFD1E	20	0.21	3.09	0.08	1.0	1.1	31 to 39.8	880.0	27.7%	0.30
									Weighted Average	2.0

Table 26-17 Estimated Soil Loss – Undisturbed Surface (RUSLE Version 1.06)

Filename	R	K	LS	C	P	A	Location/ Station	Length (ft)	% of Total Length	Weighted Soil Loss (tn/ac)
NFD2A	20	0.21	3.03	0.31	1.0	4.00	4 To 16	1200.0	37.7%	1.51
NFD2B	20	0.21	0.92	0.17	1.0	0.65	16 to 23	700.0	22.0%	0.14
NFD2C	20	0.21	0.60	0.13	1.0	0.33	23 to 27	400.0	12.6%	0.04
NFD2D	20	0.21	0.92	0.17	1.0	0.65	31 to 39.8	880.0	27.7%	0.18
									Weighted Average	1.9

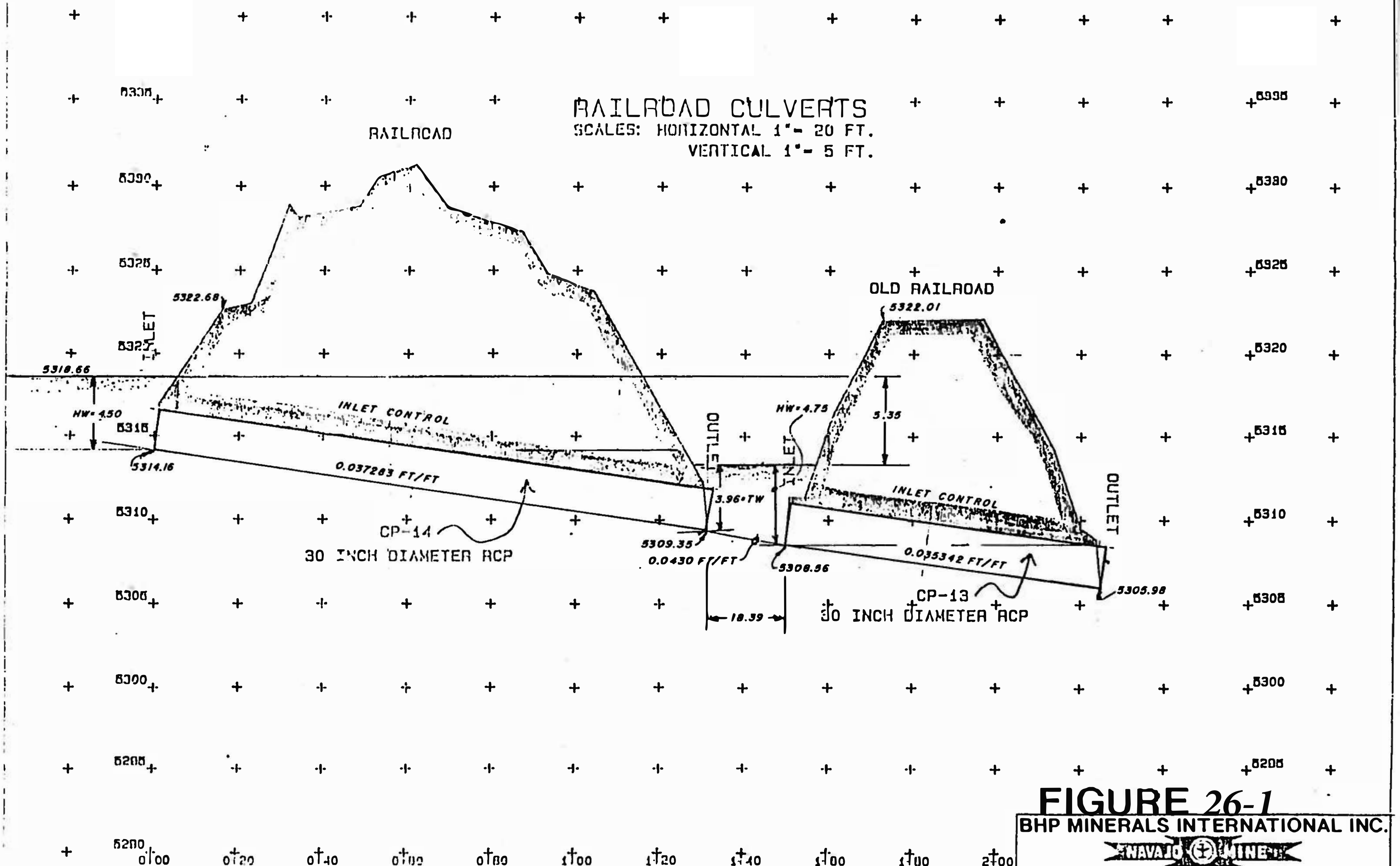


FIGURE 26-1

BHP MINERALS INTERNATIONAL INC.

NAVAJO MINE

P.O. BOX 155, FRUITLAND, NEW MEXICO, 87416

RAILROAD CULVERTS CP-14 AND CP-13 CROSS-SECTION

DRAWN BY PF	SCALE AS SHOWN	
APPROVED BY	DATE NOV. 10, 1992	FIG.
DRAWING NO.	LOCATION NO.	

REV. NO.	DATE	REVISIONS	APPROVALS DRAFT DE	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	10/92	Midterm Permit Review	PF	[illegible]	GAP	RCV

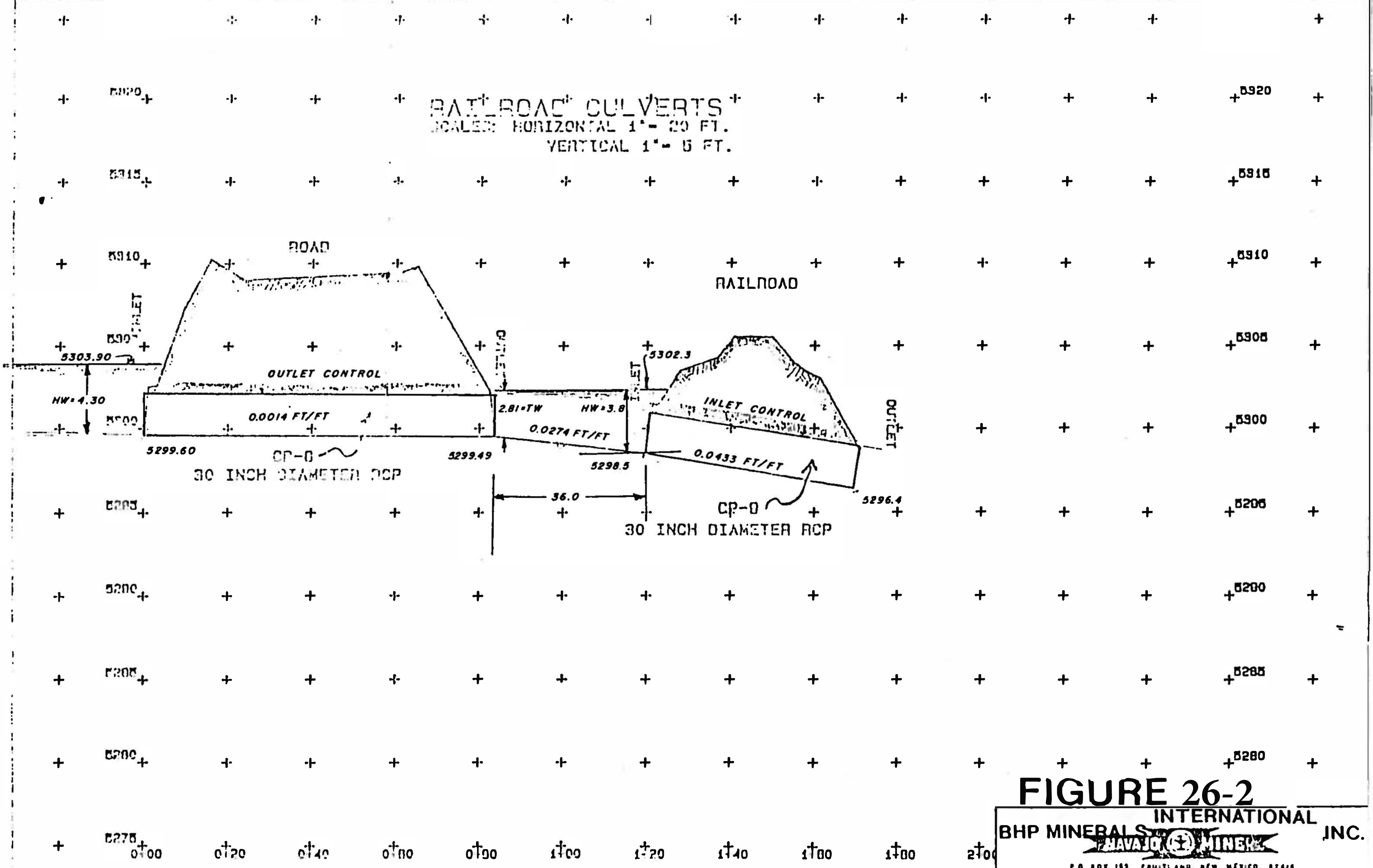


FIGURE 26-2

REV. NO.	DATE	REVISIONS	DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
			APPROVALS			
1	10/92	Midterm Permit Reviw	PF	[illegible]	GAP	RCV

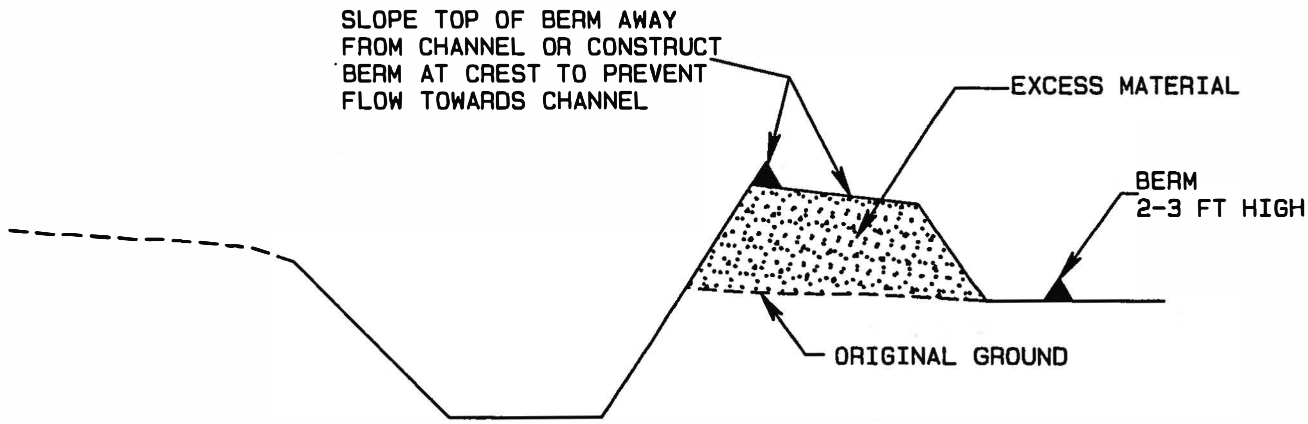
BHP MINERALS INTERNATIONAL INC.

NAVAJO MINE

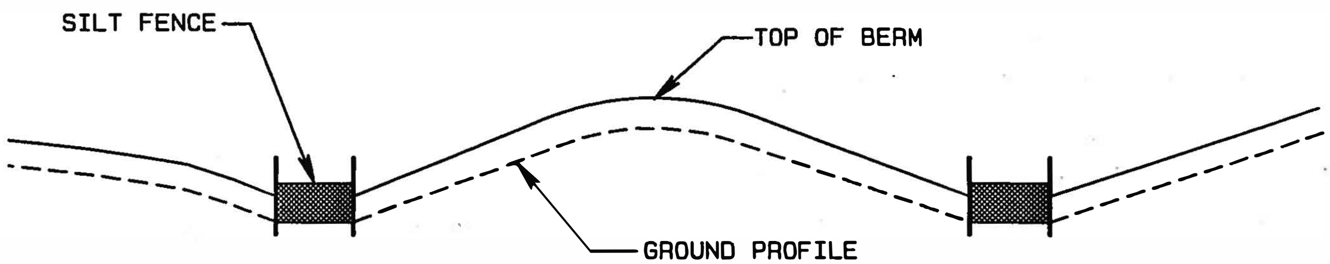
P.O. BOX 155, FRUITLAND, NEW MEXICO, 87416

RAILROAD CULVERTS CP-8 AND CP-9 CROSS-SECTION

DRAWN BY PF	SCALE AS SHOWN
APPROVED BY	DATE NOV. 10, 1992 — FIG.
DRAWING NO.	LOCATION NO.



TYPICAL SECTION
NTS



TYPICAL PROFILE
NTS

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PLN	E.G.	P.E.	RPLS
A	3-07-02	PJF	SUBMITTED TO OSM FOR REVIEW AND APPROVED.		NC	LR	

APPROVALS

FIGURE 26-3

BHP BILLITON NAVAJO COAL COMPANY

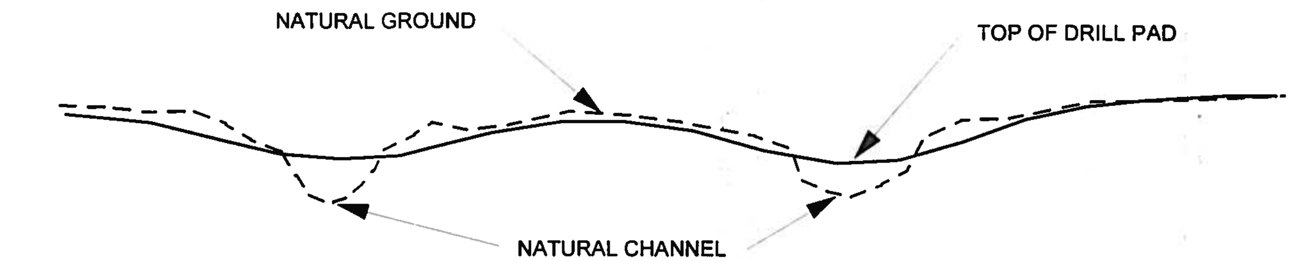
NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

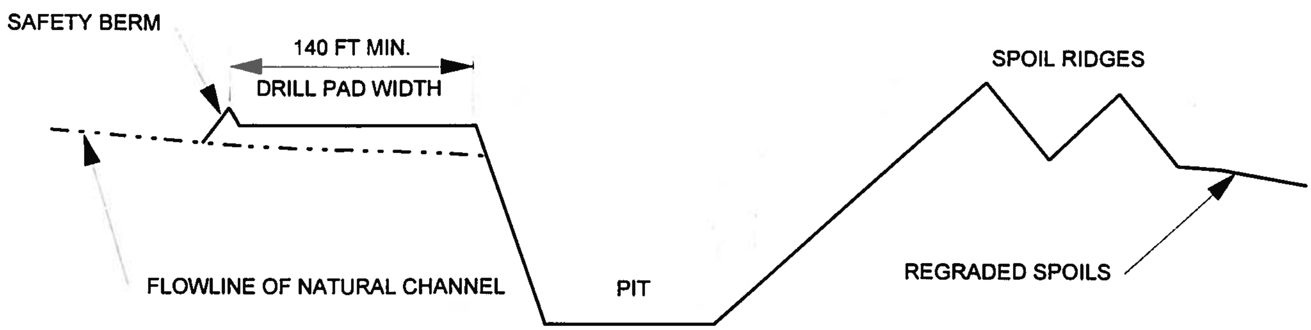
NORTH FORK DIVESION CHANNEL
DRAINAGE CONTROL FOR EXCESS MATERIAL DUMP

PREPARED BY LR	DRAWN BY PJF	SCALE 1" = NTS
APPROVED BY LR	DATE Mar. 7, 2002	

PATH: C:\DRAFTING-2001\DATA-92401\PAP EXHIBIT UPDATES\N_FORK_1-DIXON DIV-CHAN.pro



TYPICAL DRILL PAD SECTION
LONGITUDINAL DIRECTION
NTS



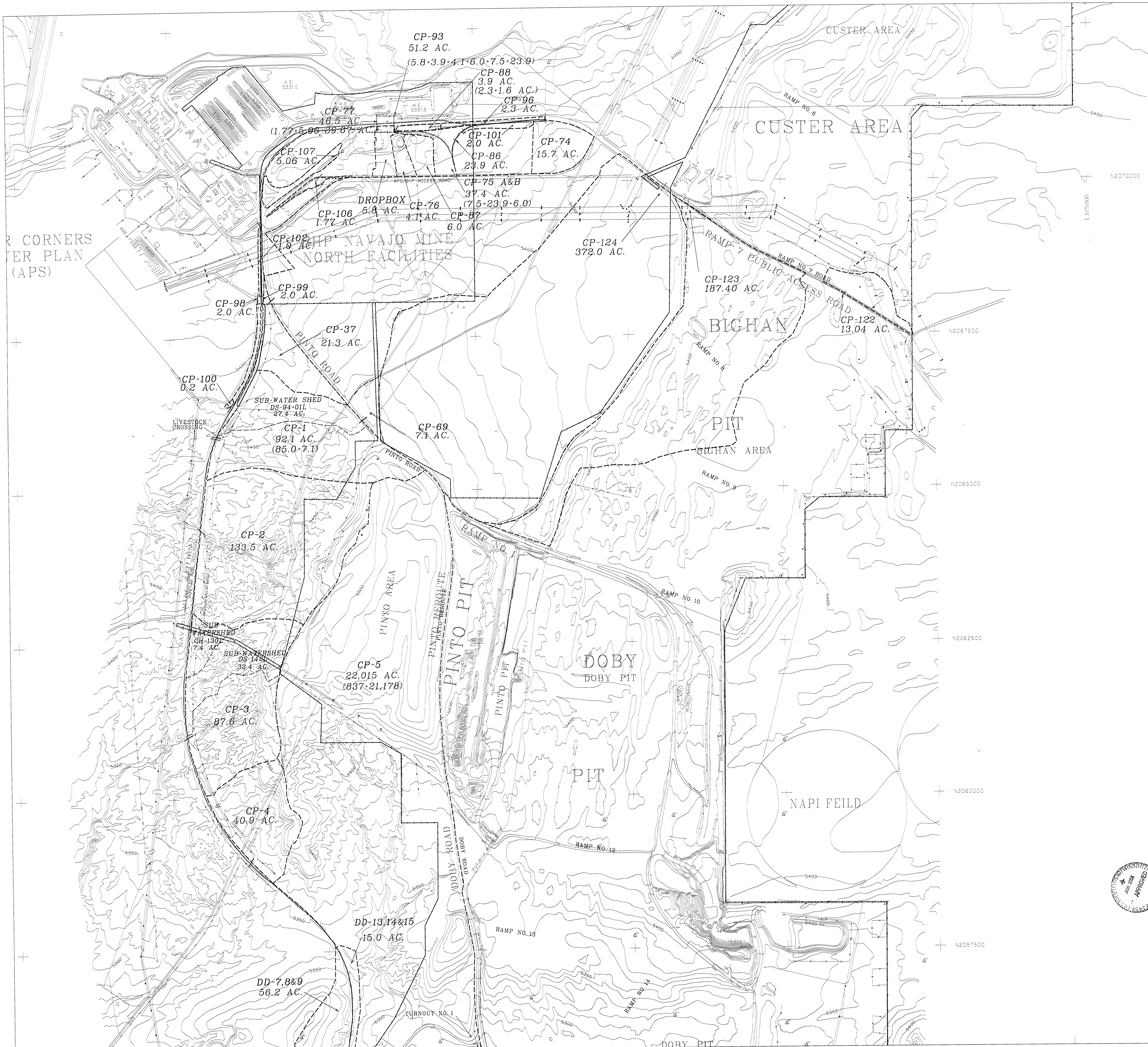
TYPICAL DRILL PAD SECTION
PERPENDICULAR TO HIGHWALL AND AT CHANNEL
NTS

BHP NAVAJO COAL COMPANY
NAVAJO MINE
SAFETY PAYS
P.O. BOX FRUITLAND, NM 87416
DRILL PAD
TYPICAL SECTIONS

PREPARED BY: LR	DRAWN BY: LR	SCALE: NTS
APPROVED BY:	DATE: 3-28-97	DWG.LOC.
DWG. NO.	REF. DWG.	

Figure 26-4

(3/97)



..\Misc data\V8-11-a12b_r304.dgn 03/19/2004 02:55:57 PM

LEGEND

PAVED ROAD
DIRT ROAD
HAUL ROAD
TRAIL
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOUR
HORIZ. & VERT. CONTROL
LEASE CORNER
PERMIT/LEASE BOUNDARY
CULVERT/DROPBOX STRUCTURE LOCATIONS AND WATERSHED AREAS

CONTOUR INTERVAL 10'

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

3-22-04

APPROVED JUN 2004

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
J	3-19-04	RY	REMOVED REFER TO CP-31 THRU CP-34 AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR		
I	4-28-03	PJF	REMOVED CP-78 AND SUBMITED TO OSM FOR REVIEW.	LR	MC	LR		
H	6-19-98	RY	Added CP-124 with Watershed		MC	LR		
G	5-27-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	PNS	LR		
F	11-10-97	PJF	ADDED CP-107, WATERSHED AREA AND REALIGNED CP-106.					
E	07-08-97	PJF	ADDED CP-106, AND WATERSHED AREA.					
D	1-14-97	PJF	ADDED SUB-WATERSHED FOR CH-130L, DS-142L, DS-94-01L ADDED CP-98, 99, 100, 101, 102					
C	9-28-96	PJF	ADDED CP-96, WITH UPDATED WATERSHED					
B	8-12-96	PJF	REMOVED CP-73A THRU E AND MODIFIED CP-70 WATERSHED.					
A	12-20-95	PJF	SUBMITTED TO OSM FOR APPROVAL.					

EXHIBIT 11.HNR/B 26-1

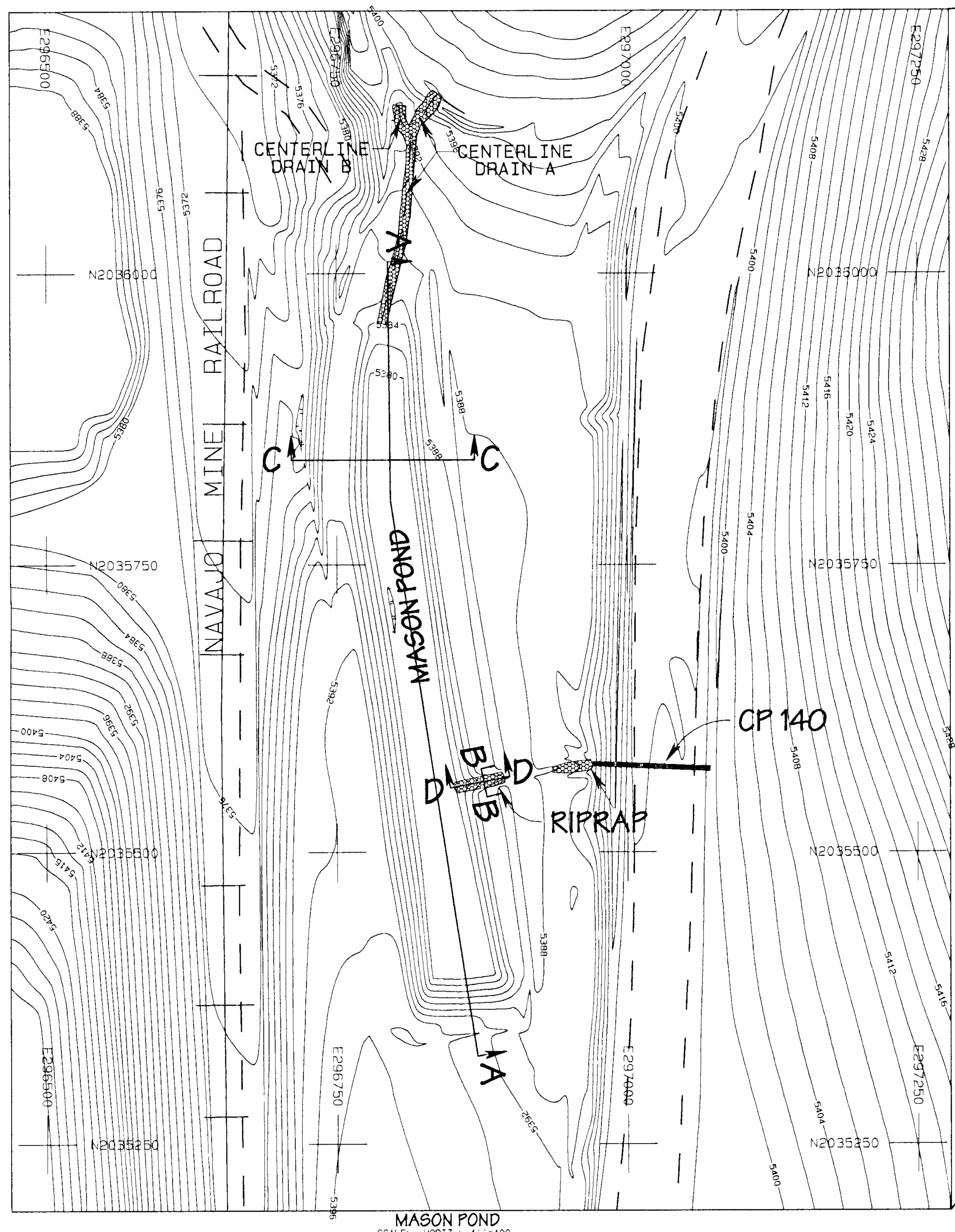
BHP NAVAJO COAL COMPANY

NAVAJO MINE

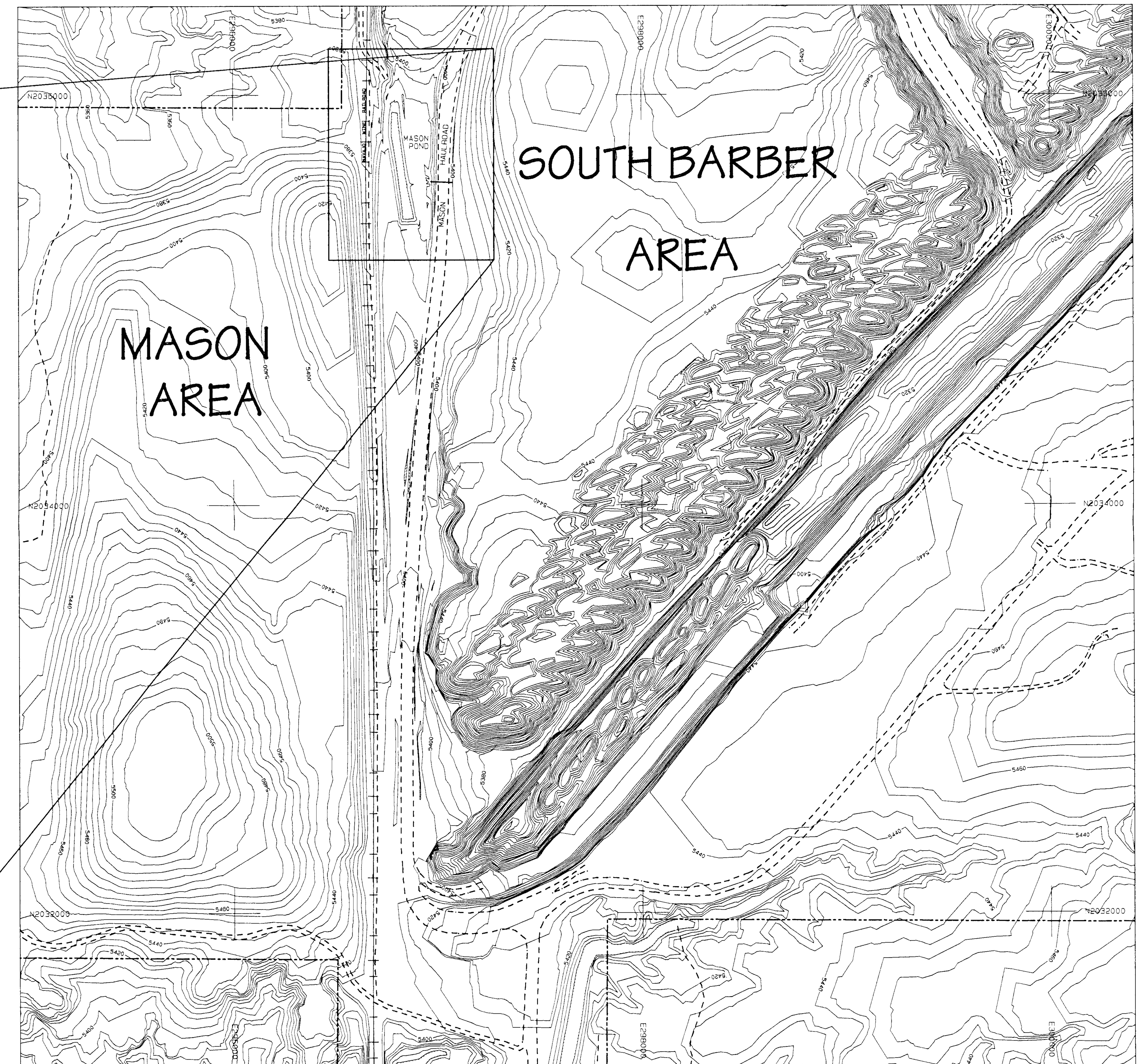
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

AREA-I
CULVERT/DROPBOX
STRUCTURE LOCATIONS
AND WATERSHED AREAS

PREPARED BY BTS/PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE DEC. 03, 1995	DWG. LOC. MF D-1
DWG. No.	REF. DWG.	



MASON POND
SCALE: HORIZ.: 1" =100'



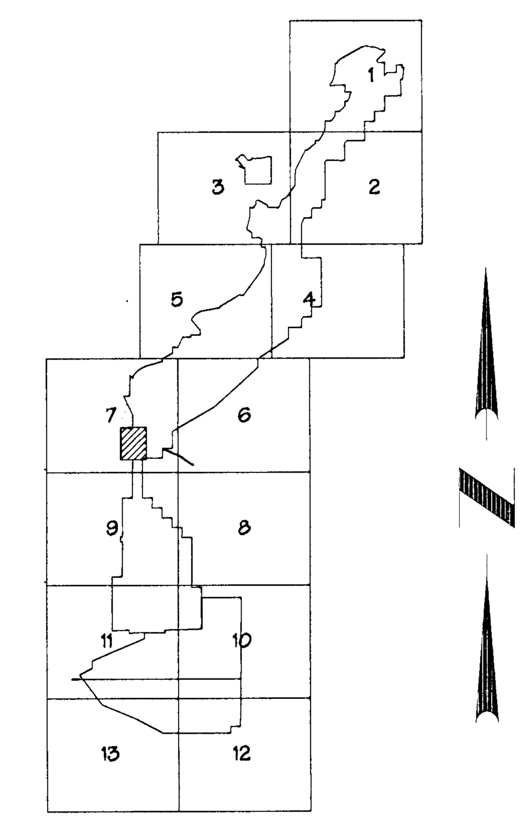
LOCATION MAP
SCALE: HORIZ.: 1" =400'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- LEASE LINE

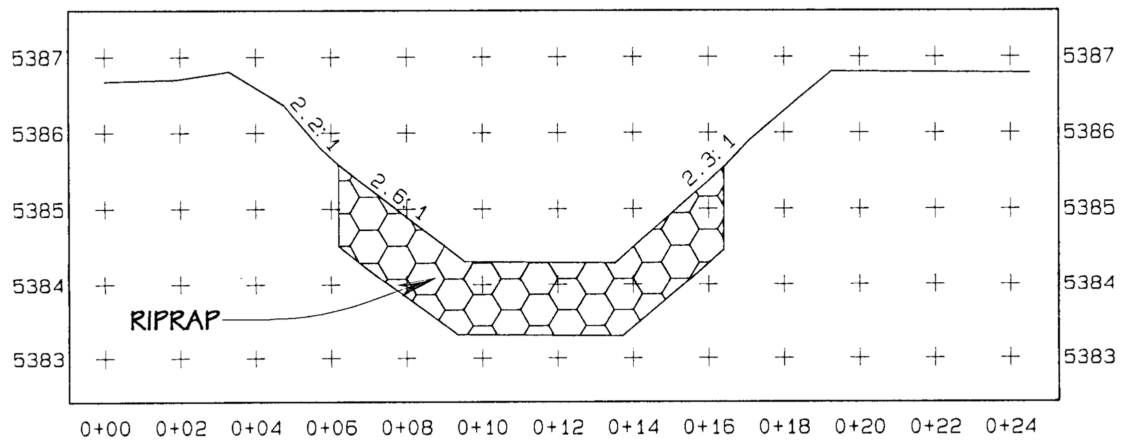
NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. Blueline Elevations can be found in Table 11-5.
3. Gauge post base elevation: 5379.54 (GPS).

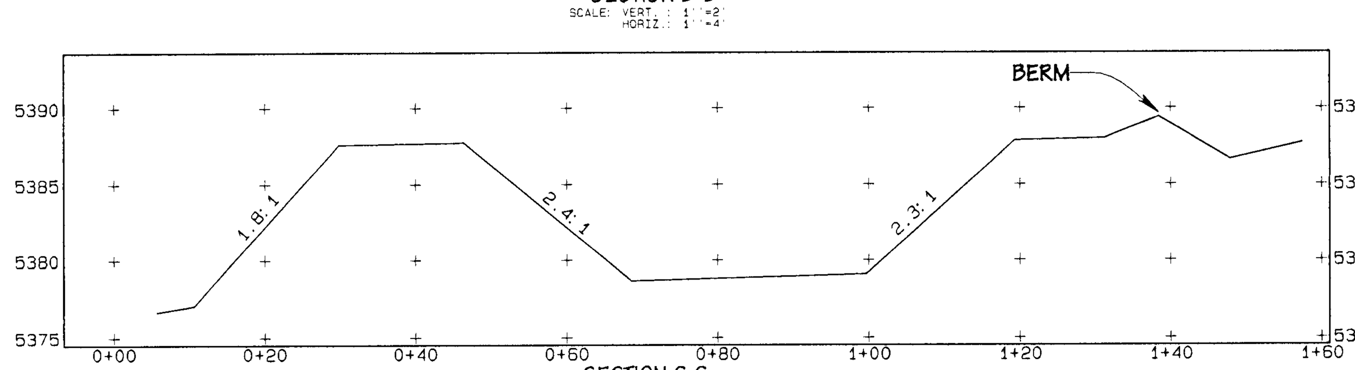


STAGE STORAGE DATA

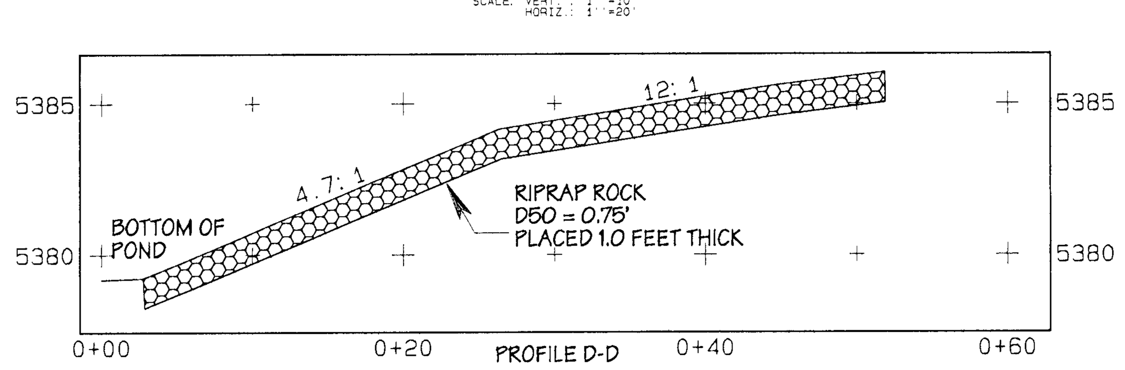
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5378	.01	0.00	0.00
5379	0.27	0.14	0.14
5380	0.48	0.38	0.52
5381	0.55	0.51	1.03
5382	0.61	0.58	1.61
5383	0.69	0.65	2.26
5384	0.76	0.72	2.99
5385	0.83	0.80	3.78
5386	0.91	0.87	4.65
5387	1.1	1.01	5.66



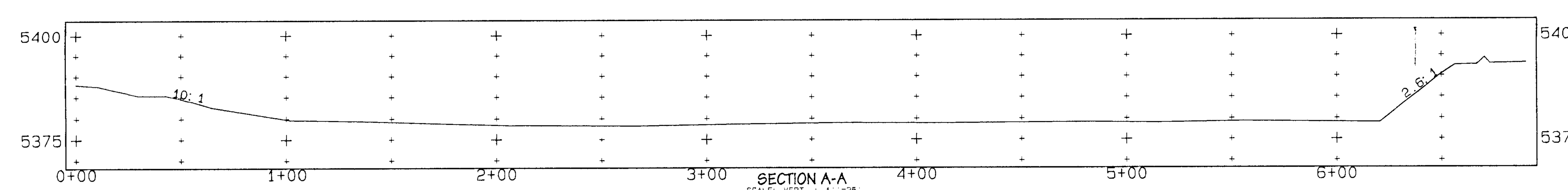
SECTION B-B



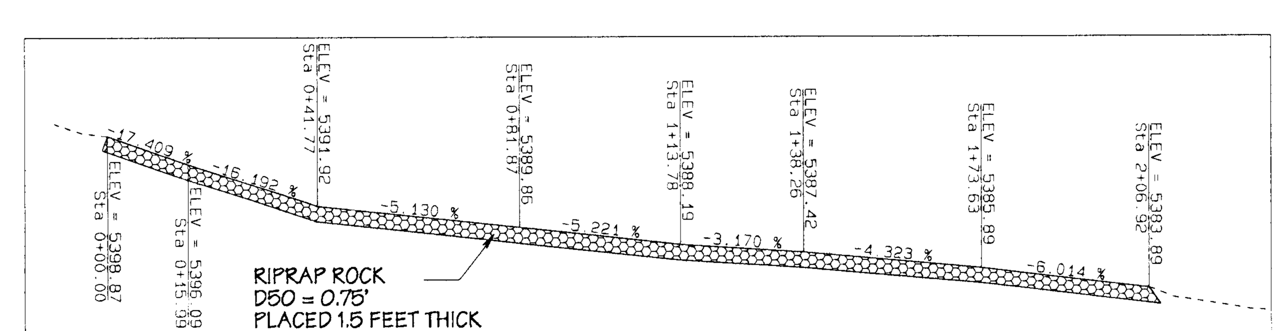
SECTION C-C



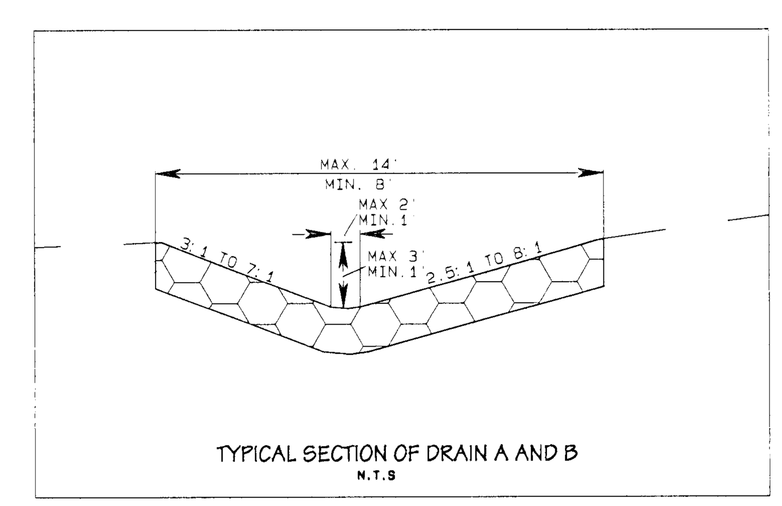
PROFILE D-D



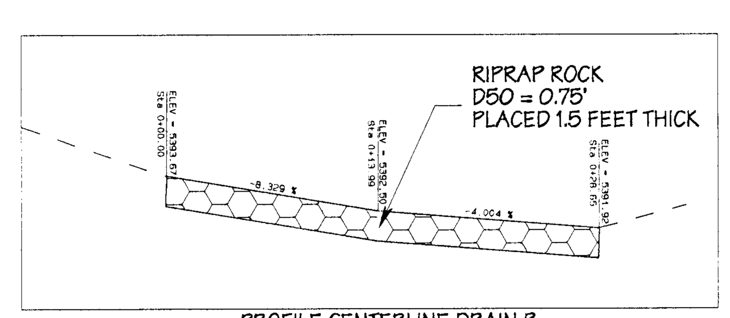
SECTION A-A



PROFILE CENTERLINE DRAIN A



TYPICAL SECTION OF DRAIN A AND B
N.T.S



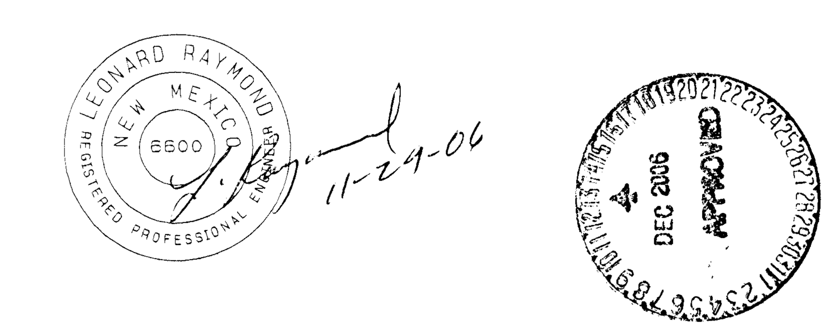
PROFILE CENTERLINE DRAIN B

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this impoundment has been constructed in accordance with the approved design plans and that this information shown is complete and accurate to the best of my knowledge, except as noted below.

1. The D50 riprap size placed in the inlet is less than the design due to decreases in the peak flow and the inlet slope.

4-17-00



REV NO	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	AY	04-17-00
2	ADDED DRAINAGE & RIP-RAPPED STRUCTURES ON NORTH SIDE OF POND (DRAIN A AND B).	RY	11-27-06
3			
4			
5			

PROJECT MANAGER: AY
ENGR. of RECORD: LR
REG. NO: 6600
SRVYR of RECORD:
REG. NO.

BHP-NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT:
DATE: APRIL 17, 2000
DESIGNED BY: AY
DRAWN BY: AY
CHECKED BY: LR
APPROVED BY: LR

PLAN, PROFILE AND SECTIONS

EXHIBIT 11-139A
MASON POND AS-BUILT

DRAWING
SHEET 1
OF 1

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	
A-12	1-10-2012	PJF	Removed CP-111, within the Chinde Temp.Diverision in Area-2 and submitted to OSM for Review.	Shawn Smith	KH	LR	
A-09	2-12-09	PJF	Re-label CP-172 to read CP-31, 32, 33, 34, since CP-172 will not be place, at Yazzie"Y", Chinde Channel and submitted to OSM for Review.	Shawn Smith	YB	RVV	
A-08	4-22-08	PJF	Removed CP-145, along the Hosteen-Yazzie Haulroad, and submitted to OSM for Review.	Shawn Smith	YB	RVV	
A-07	7-31-07	PJF	Removed CP-146, along the Hosteen-Yazzie Haulroad, CP-64, CP-65 at 8050 Tub Site, updated CP-63 A&B watershed and submitted to OSM for Review.	RVV	YB	RVV	
Q	4-11-06	PJF	UPDATED CULVERTS/WS BETWEEN CP-55 AND CP-61 AND SUBMITTED TO OSM FOR REVIEW.	LR	KJ	LR	
P	1-25-06	PJF	REMOVED CP-148, 149 AT THE END OF HOSTEEN-YAZZIE HAULROAD AND SUBMITTED TO OSM FOR REVIEW.	BH	KJ	LR	
O	8-11-05	PJF	Added the following along the Gorman Road; Cp-185, DS-16+04L, DD-29, with waterswhed areas, revised the watershed areas for the following; Cp-86, CP-64, CP-65 and submitted to OSM for Review.	LR	MC	LR	
N	4-08-05	PJF	Added CP-186, CP-187 along the Yazzie Spoilside Haulroad, CP-189, CP-190 along the 69 KV Access Road on the South side. Removed CP 121, Cp-30, Cp-29, DD-26 in Hosteen Pit and submitted to OSM for Review.	LR	MC	LR	
M	3-04-04	RY	Removed CP-31, 32, 33 & 34, added CP-172 with watershed area, updated watershed area for CP-111, CP-5 and submitted to OSM for review.	BH	MC	LR	
L	1-26-00	PJF	Added Culverts for Hosteen-Yazzie Haulroad and submitted to OSM for Review.	BH	MC	LR	
K	6-11-99	PJF	Added CP-126 with watershed and note for CP-7	BH	MC	LR	
J	11-12-98	PJF	Updated Watershed Area for CP-83 to 84.6 Ac.	BH	MC	LR	
H	8-31-98	PJF	DEFICIENCY UPDATE ON CP-111 AND RESUBMITTED TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR	
G	5-27-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	PNS	LR	
F	01-28-98	PJF	Added CP-121, DD-26 With Watershed Area Acreage. Along North Hosteen Road.	BH	PNS	LR	
E	11-12-97	PJF	ADDED CP-103, 104 AND WATERSHEDS	RH	PNS	LR	
D	6-22-97	PJF	ADDED CP-111 @ CHINDE X-ING (YAZZIE PIT)				
C	6-13-97	PJF	ADDED CP-108 LOCATION AND MOVED INSERT MAP TO NEW CREATED EXHIBIT 11-12C-1.				
B	01-11-97	PJF	ADDED DD-23 & 24 DOWN DRAINAGE.				
A	12-20-95	PJF	SUBMITTED TO OSM FOR APPROVAL.				

APPROVALS

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

Exhibit 26-2

bhpbilliton

BHP Navajo Coal Company

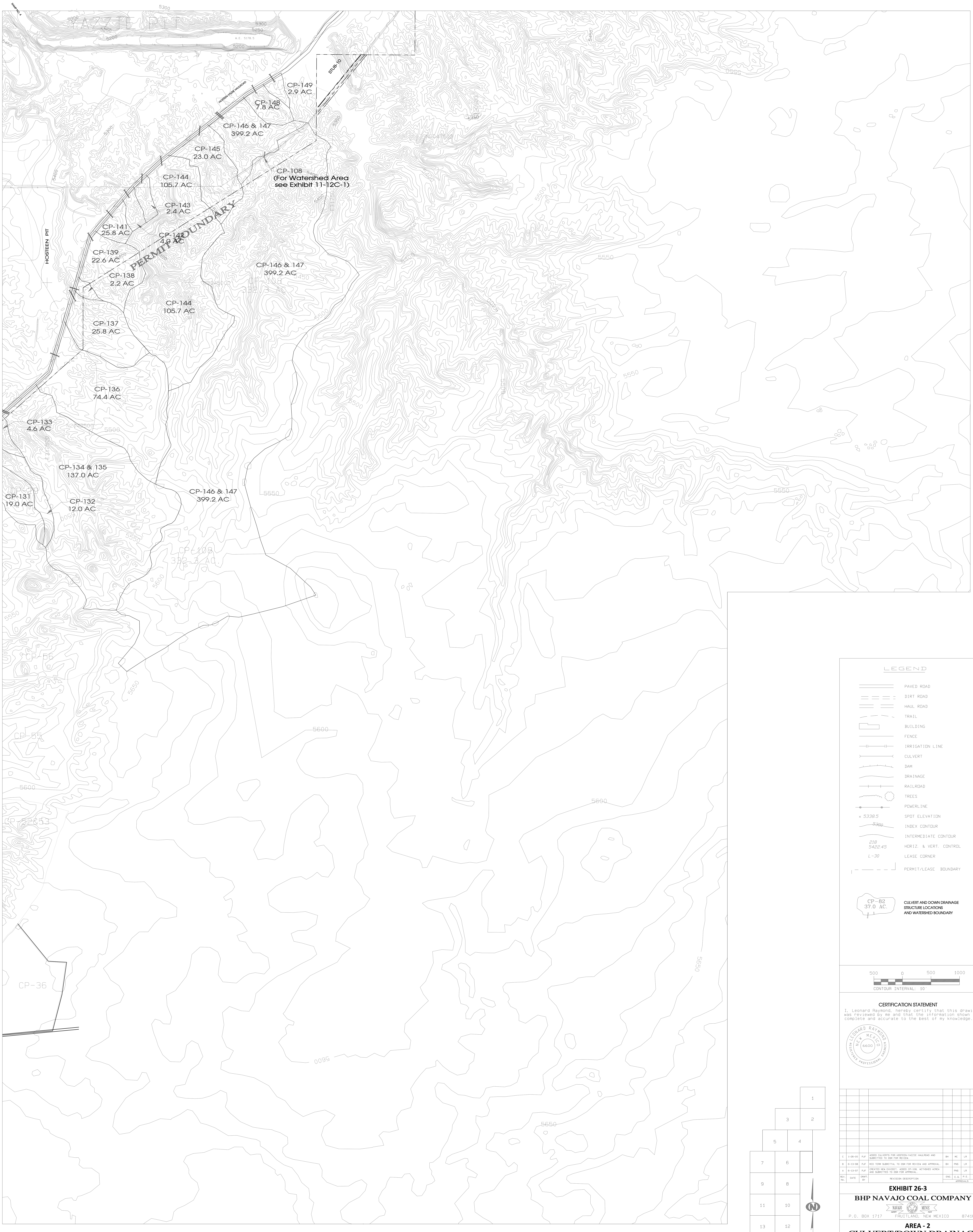
P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-4200
Fax: 505-568-3361

AREA–II CULVERT/DOWN DRAINAGE STRUCTURE LOCATIONS AND WATERSHED AREAS

PREPARED BY BTS/PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE DEC. 02, 1995	

MAP LOCATION: (See Lower Left Corner)



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.
C	1-26-00	PJF	ADDED CULVERTS FOR HOSTEEN-YAZZIE HAULROAD AND SUBMITTED TO OSM FOR REVIEW.	BH	MC	LR
B	6-13-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	PNS	LR
A	6-13-97	PJF	CREATED NEW EXHIBIT, ADDED CP-108, WITHSHED ACREA AND SUBMITTED TO OSM FOR APPROVAL.		PNS	LR

APPROVALS

EXHIBIT 26-3

BHP NAVAJO COAL COMPANY

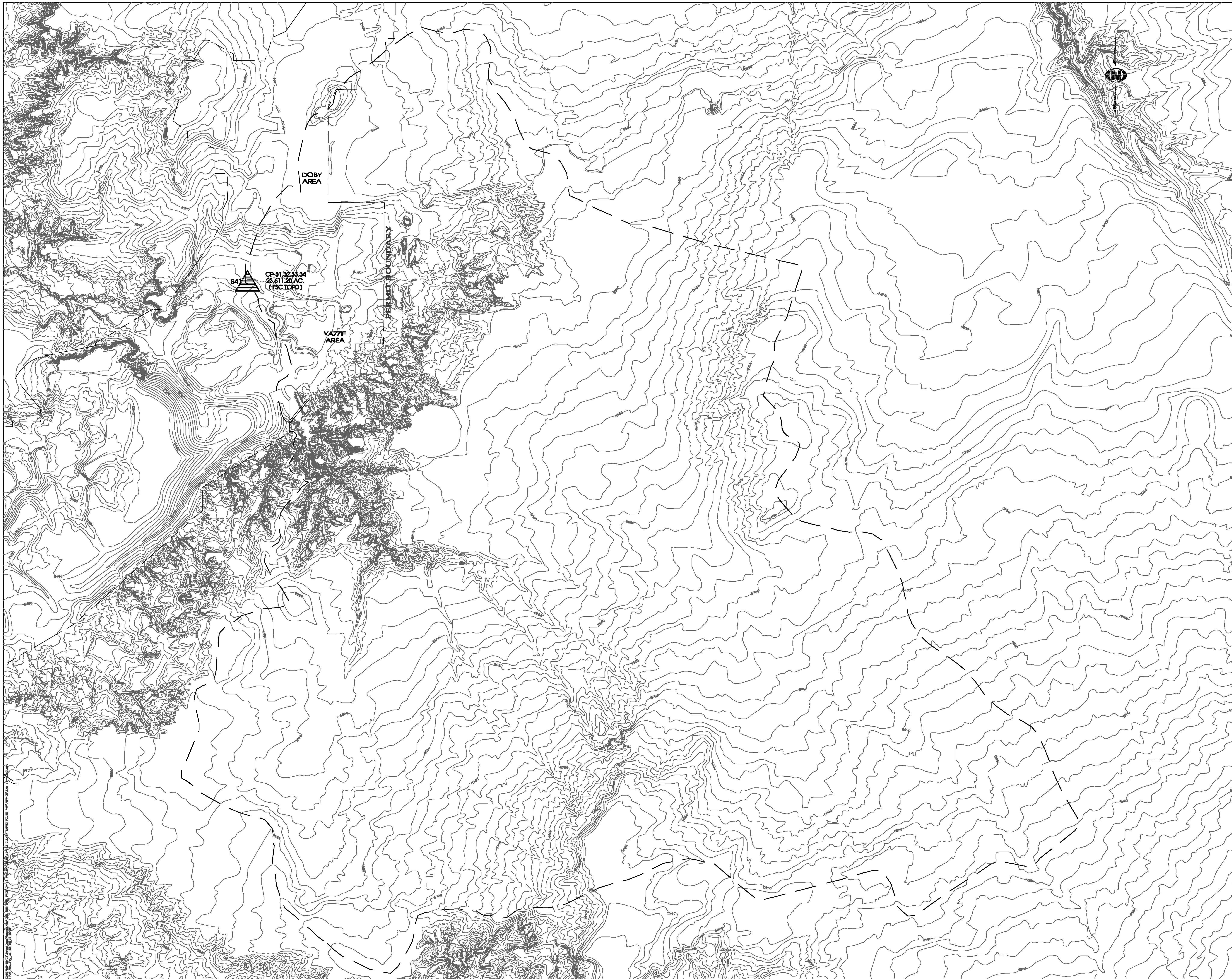
NAVAJO MINE
SAFETY PAYS

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

AREA - 2
CULVERT/DOWN DRAINAGE STRUCTURE LOCATIONS AND WATERSHED AREAS

PREPARED BY FJT/PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE JUNE 12, 1997	

G:\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBIT\11-012_CULVERTS\DGN EXH (CULV
Tue Sep 13 09:59:49 2005



LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 5422.45 — HORIZ. & VERT. CONTROL
- L-30 — LEASE CORNER
- PERMIT/LEASE BOUNDARY
- DROPBOX — DRAINAGE DROPBOX
- CP-37 — CULVERT LOCATION
- WATERSHED AND SUBWATERSHED BOUNDARY

NOTE :

1. REFER TO APPENDIX 11-V FOR HYDROLOGY DATA.
2. THE HYDROLOGY MODEL IS PRESENTED ON EXHIBIT 11-75.

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

RON C. VAN VALKENBURG
NEW MEXICO
9263
LICENSED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
A-09	2-12-09	PJF	Re-label CP-172 to read CP-31,32,33,34,since CP-172 will not be place, at Yazzie"Y", Chinde Channel and submitted to OSM for Review.	Shawn Smith	YB	RW		
D	3-04-04	RY	UPDATED WATERSHED FOR YAZZIE "Y" CULVERT AND SUBMITTED TO OSM FOR APROVAL.	LR	MC	LR		
D	3-04-04	RY	UPDATED WATERSHED FOR YAZZIE "Y" CULVERT AND SUBMITTED TO OSM FOR APROVAL.	LR	MC	LR		
C	8-31-98	PJF	DEFICIENCY UPDATE ON CP-111, REMOVED REFERENCE EXHIBIT No. AND RESUBMITTED TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR		
B	5-27-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL	BTS	PNS	LR		
A	11-05-95	PJF	SUBMITTED TO OSM FOR APPROVAL.					

APPROVALS

EXHIBIT 26-4

BHP NAVAJO COAL COMPANY

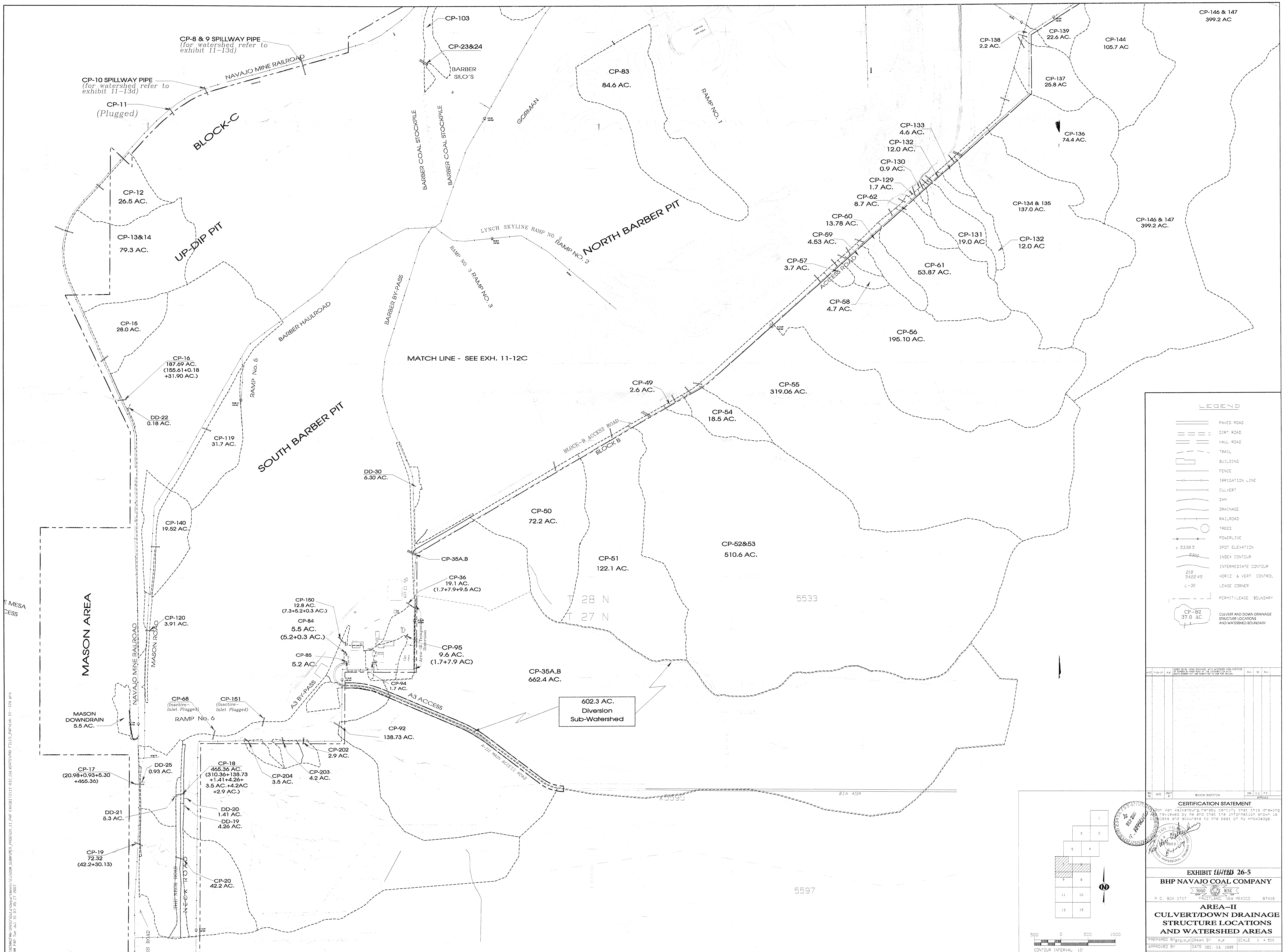
NAVAJO MINE

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

WATERSHED AREA
YAZZIE "Y" CULVERTS
(CP-172)

PREPARED BY BTS/PJF	DRAWN BY PJF	SCALE 1" = 2000'
APPROVED BY	DATE Dec. 20, 1995	

MAP LOCATION: (See Lower Left Corner)

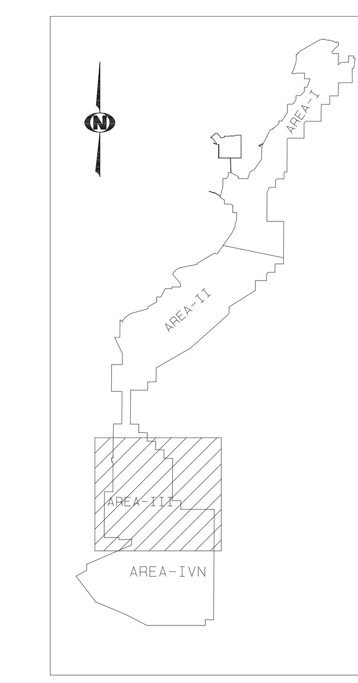


CP-103
CP-23&24
BARBER SILO'S
CP-8 & 9 SPILLWAY PIPE
(for watershed refer to exhibit 11-13d)
CP-10 SPILLWAY PIPE
(for watershed refer to exhibit 11-13d)
NAVAJO MINE RAILROAD
CP-11
(Plugged)
BLOCK-C
BARBER COAL STOCKPILE
BARBER COAL STOCKPILE
GORMAN
CP-83
84.6 AC.
RAMP NO. 1
CP-138
2.2 AC.
CP-139
22.6 AC.
CP-144
105.7 AC.
CP-146 & 147
399.2 AC
CP-137
25.8 AC.
CP-136
74.4 AC.
CP-133
4.6 AC.
CP-132
12.0 AC.
CP-130
0.9 AC.
CP-129
1.7 AC.
CP-62
8.7 AC.
CP-134 & 135
137.0 AC.
CP-146 & 147
399.2 AC.
CP-60
13.78 AC.
CP-59
4.53 AC.
CP-131
19.0 AC
CP-132
12.0 AC
CP-57
3.7 AC.
ACCESS ROAD
CP-61
53.87 AC.
CP-58
4.7 AC.
CP-56
195.10 AC.
CP-12
26.5 AC.
CP-13&14
79.3 AC.
UP-DIP PIT
LYNCH SKYLINE RAMP NO. 2
RAMP NO. 2
NORTH BARBER PIT
RAMP NO. 3
RAMP NO. 3
BARBER BY-PASS
BARBER HAULROAD
CP-15
28.0 AC.
MATCH LINE - SEE EXH. 11-12C
CP-16
187.69 AC.
(155.61+0.18
+31.90 AC.)
RAMP No. 5
CP-49
2.6 AC.
CP-55
319.06 AC.
CP-54
18.5 AC.
DD-22
0.18 AC.
CP-119
31.7 AC.
SOUTH BARBER PIT
BLOCK-B ACCESS ROAD
BLOCK B
DD-30
6.30 AC.
CP-140
19.52 AC.
CP-50
72.2 AC.
CP-35A,B
CP-51
122.1 AC.
CP-52&53
510.6 AC.
CP-36
19.1 AC.
(1.7+7.9+9.5 AC)
T 28 N
T 27 N
5533
MESA
ACCESS
MASON AREA
CP-150
12.8 AC.
(7.3+5.2+0.3 AC.)
CP-84
5.5 AC.
(5.2+0.3 AC.)
CP-120
3.91 AC.
NAVAJO MINE RAILROAD
MASON ROAD
CP-85
5.2 AC.
CP-95
9.6 AC.
(1.7+7.9 AC)
CP-35A,B
662.4 AC.
CP-94
1.7 AC.
A3 BY-PASS
A3 ACCESS
602.3 AC.
Diversion
Sub-Watershed
MASON DOWNDRAIN
5.5 AC.
CP-68
(Inactive-Inlet Plugged)
CP-151
(Inactive-Inlet Plugged)
RAMP No. 6
CP-92
138.73 AC.
CP-202
2.9 AC.
A-III MAIN ACCESS ROAD
DD-25
0.93 AC.
CP-18
465.36 AC.
(310.36+138.73
+1.41+4.26+
3.5 AC.+4.2AC
+2.9 AC.)
CP-204
3.5 AC.
CP-203
4.2 AC.
CP-17
(20.98+0.93+5.30
+465.36)
BIA 4104
DD-20
1.41 AC.
DD-21
5.3 AC.
DD-19
4.26 AC.
CP-19
72.32
(42.2+30.13)
CP-20
42.2 AC.
NECK ROAD
5597
ACCESS ROAD
LEGEND
PAVED ROAD
DIRT ROAD
HAUL ROAD
TRAIL
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOUR
HORIZ & VERT CONTROL
LEASE CORNER
PERMIT/LEASE BOUNDARY
CP-82
37.0 AC.
CULVERT AND DOWN DRAINAGE STRUCTURE LOCATIONS AND WATERSHED BOUNDARY
REV. No.
DATE
DRAFT BY
REVISION DESCRIPTION
ENG.
E.Q
P.E.
APPROVALS
CERTIFICATION STATEMENT
I, Ron Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.
SEP 2007
APPROVED
RON VAN VALKENBURG
NEW MEXICO
9263
LICENSED PROFESSIONAL ENGINEER
EXHIBIT 11-12D 26-5
BHP NAVAJO COAL COMPANY
NAVAJO MINE
SAFETY PAYS
P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416
AREA–II
CULVERT/DOWN DRAINAGE
STRUCTURE LOCATIONS
AND WATERSHED AREAS
PREPARED BY BTS/PJF
DRAWN BY PJF
SCALE 1" = 500'
APPROVED BY
DATE DEC. 03, 1995
MAP LOCATION: (See Lower Left Corner)
500 0 500 1000
CONTOUR INTERVAL 10'

LEGEND

PAVED ROAD
DIRT ROAD
HAUL ROAD
TRAIL
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOUR
HORIZ. & VERT. CONTROL
LEASE CORNER
PERMIT/LEASE BOUNDARY

CP-82
37.0 AC.
CULVERT AND DOWN DRAINAGE STRUCTURE LOCATIONS AND WATERSHED BOUNDARY



500 0 500 1000

CONTOUR INTERVAL: 10'

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.
13-A	4-15-13	RY	REMOVED CULVERTS CP-310 THRU 319 INCLUDING WATERSHED AND SUBMITTED TO OSM FOR APPROVAL.	LR	KH	LR
12-A	10-23-12	PJF/RY	ADDED CP-325, CP-326 WITH WATERSHED, UPDATED CP-320A&B, 321, 322 WATERSHED AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	LR	KH	LR
11-A	4-28-11	PJF	ADDED DIXON HAULROAD CP-323 CULVERT/WATERSHED DATA AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	SSmith	SO	RCV
0929	9-01-09	PJF	ADDED BURNHAM TEMPOPARY REROUTE ROAD AS-BUILT CULVERTS/WATERSHED DATA AND SUBMITTED FOR REVIEW	SSmith	YB	RCV

APPROVALS

Original Certified signed exhibits are maintained at the Mine Site and OSM

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.
09-B	7-12-09	PJF	ADDED IBR EASTSIDE OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.	KA/SSmith	YB	KAB
09-A	6-22-09	PJF	ADDED COTTONWOOD HAULROAD CROSSING WITH CP 188, W.S. AREAS NOTE AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	RVV
08-A	5-14-08	PJF	UPDATED CP-22, CP-91, CP-171, CP-184, DD-4, DD-5 WATERSHED AREAS, AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	RVV
07-A	7-25-07	PJF	ADDED CP-184, WITH WATERSHED, SOUTH DIXON PIT AREA AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV
P	11-15-06	PJF	REMOVED CP-115 EASTSIDE OF DIXON PIT AREA AND SUBMITTED TO OSM FOR REVIEW.	LR	KJ	LR
O	1-25-06	PJF	REMOVED CP-113, 114 EASTSIDE OF DIXON PIT AREA AND SUBMITTED TO OSM FOR REVIEW.	LR	KJ	LR
N	7-08-05	PJF	CHANGED APPENDIX REFERENCE	LR	MC	LR
M	12-14-04	PJF	ADDED CP-188 @ COTTONWOOD CROSSING. DATA, ALSO UPDATED AREAS FOR CP-152.	LR	MC	LR
L	12-29-03	RY	ADDED CP-171 THROUGH CP-181 WITH WATERSHED AND DATA, ALSO UPDATED AREAS FOR CP-152.	LR	MC	LR
K	11-08-02	RY	ADDED CP-169, CP-70 WITH WATERSHED AND DATA, ALSO REVISED DATA FOR CP-152.	LR	MC	LR
J	7-12-02	PJF	ADDED CP 152, 153, 154, 155, 156 WITH WATERSHED DATA. REMOVED CP-79, 80 A/B, 81 A/B, 89, 90 AND 110	LR	MC	LR
I	11-03-00	PJF	Removed CP_125, South Dixon Pit	LR	MC	LR
H	6-14-00	PJF	Removed Collyer Road, CP_112 and CP-118 Culverts.	LR	MC	LR
G	5-27-98	PJF	MID TERM SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	BH	PNS	LR
F	01-28-98	PJF	Updated CP-113 Watershed Bndy and Acreage. Removed DD-6, CP-21 and watershed areas. Updated watershed areas for DD-4, 5 and CP-22.	RH FTJ	PNS	LR
E	11-14-97	PJF	Added CP-113, 114, 115 and watershed areas, Modified CP-90 Watershed and Removed CP-82.	BH	PNS	FS
D	9-4-97	PJF	Added CP-112 and watershed @ south end of Lowe Pit Area, with OSM Approval, 8-97.			
C	6-22-97	PJF	Added CP-110 and watershed @ south end of Lowe Pit Area.			
B	4-07-97	PJF	UPDATED WATERSHED FOR CP-91 LOWE PIT AREA			
A	12-20-95	PJF	SUBMITTED TO OSM FOR APPROVAL.			

APPROVALS

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 26-6

bhpbilliton

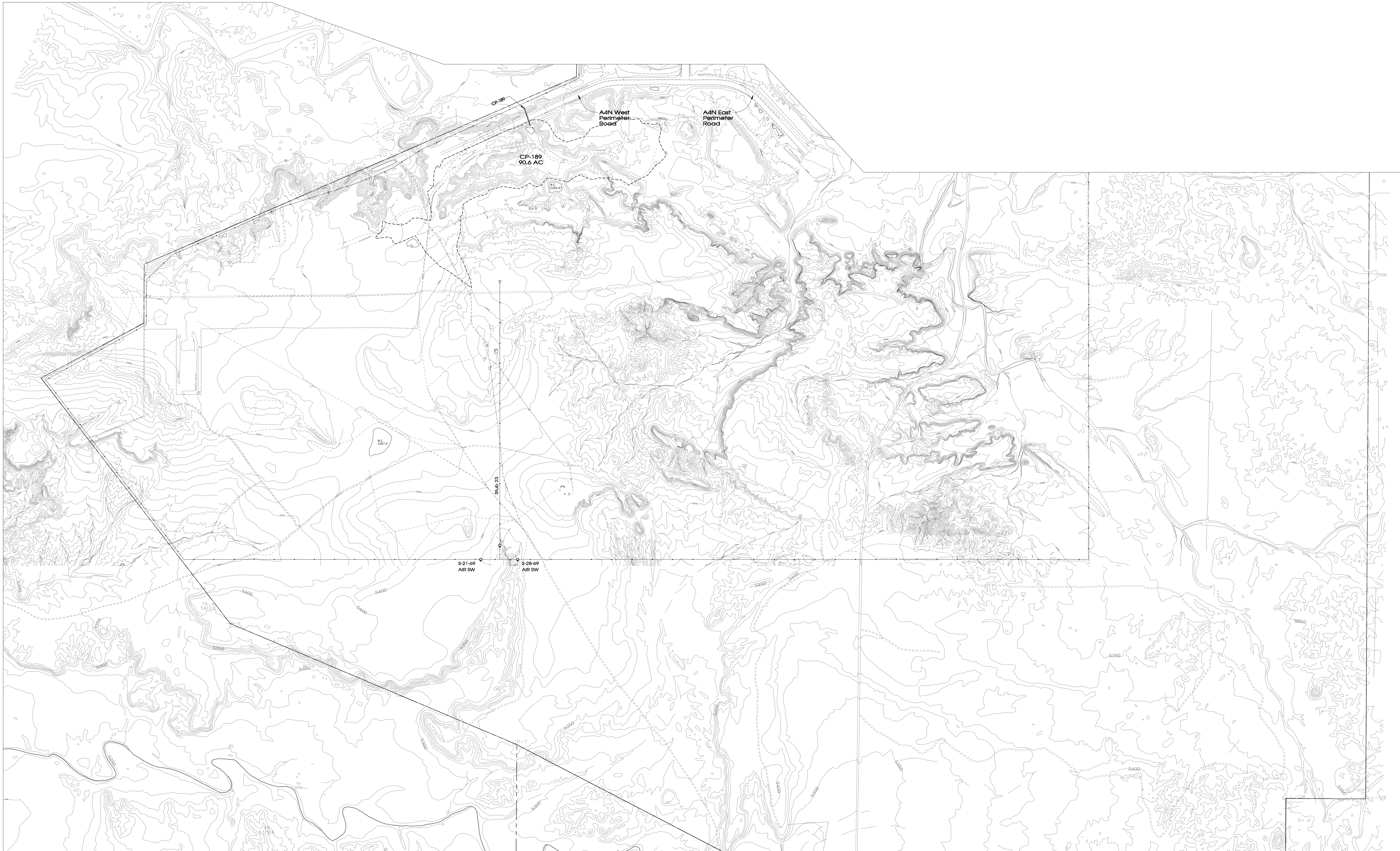
BHP Navajo Coal Company

P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

AREA 3_4 NORTH CULVERT/DOWN DRAINAGE STRUCTURE LOCATIONS AND WATERSHED AREAS

PREPARED BY BTS/PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE DEC. 02, 1995	

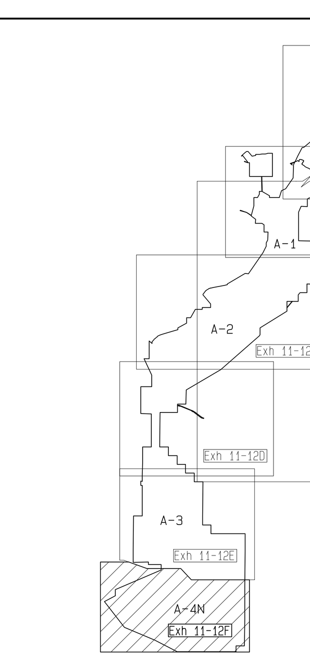
MAP LOCATION: (See Lower Left Corner)



NOTE:
1. ONLY ROADS ON THE PERMANENT PROGRAM LANDS WERE CLASSFIED. SEE EXHIBIT 1-4-1OF7 THRU 1-4-7OF7 FOR LANDS STATUS.

LEGEND

PAVED ROAD	× 5338.5 SPOT ELEVATION
DIRT ROAD	5300 INDEX CONTOUR
HAUL ROAD	INTERMEDIATE CONTOUR
TRAIL	218 5422.45 HORIZ. & VERT. CONTROL
BUILDING	L-30 LEASE CORNER
FENCE	PERMIT/LEASE BOUNDARY
IRRIGATION LINE	PRIMARY ROADS
CULVERT	ANCILLARY ROADS
DAM	PUBLIC ACCESS ROADS
DRAINAGE	DOWN DRAIN STRUCTURE
RAILROAD	CULVERT LOCATION
TREES	
POWERLINE	



REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
11-B	Aug-2011	PJF	Updated Area 4 North road label and submitted to OSM for Review and Approval.	LR	SO	LR		

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
11-A	FEB-2011	PJF	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	RCV	SO	RCV		
D	8-27-03	RY	ADDED SOUTH TIP OF CP-179	LR	MC	LR		
C	7-12-02	PJF	ADDED SOUTH TIP OF CP-156	LR	MC	LR		
B	5-27-98	PJF	MID TERM SUBMITTAL TO OSM FOR REIEW AND APPROVAL	BH	PNS	LR		
A	11-05-95	PJF	SUBMITTED TO OSM FOR APPROVAL					

APPROVALS

500 0 500 1000

CONTOUR INTERVAL: 10'

Revised by
Aero-Graphics, Inc.
2930 South West Temple
Salt Lake City, Utah 84115

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 26-7

bhpbilliton

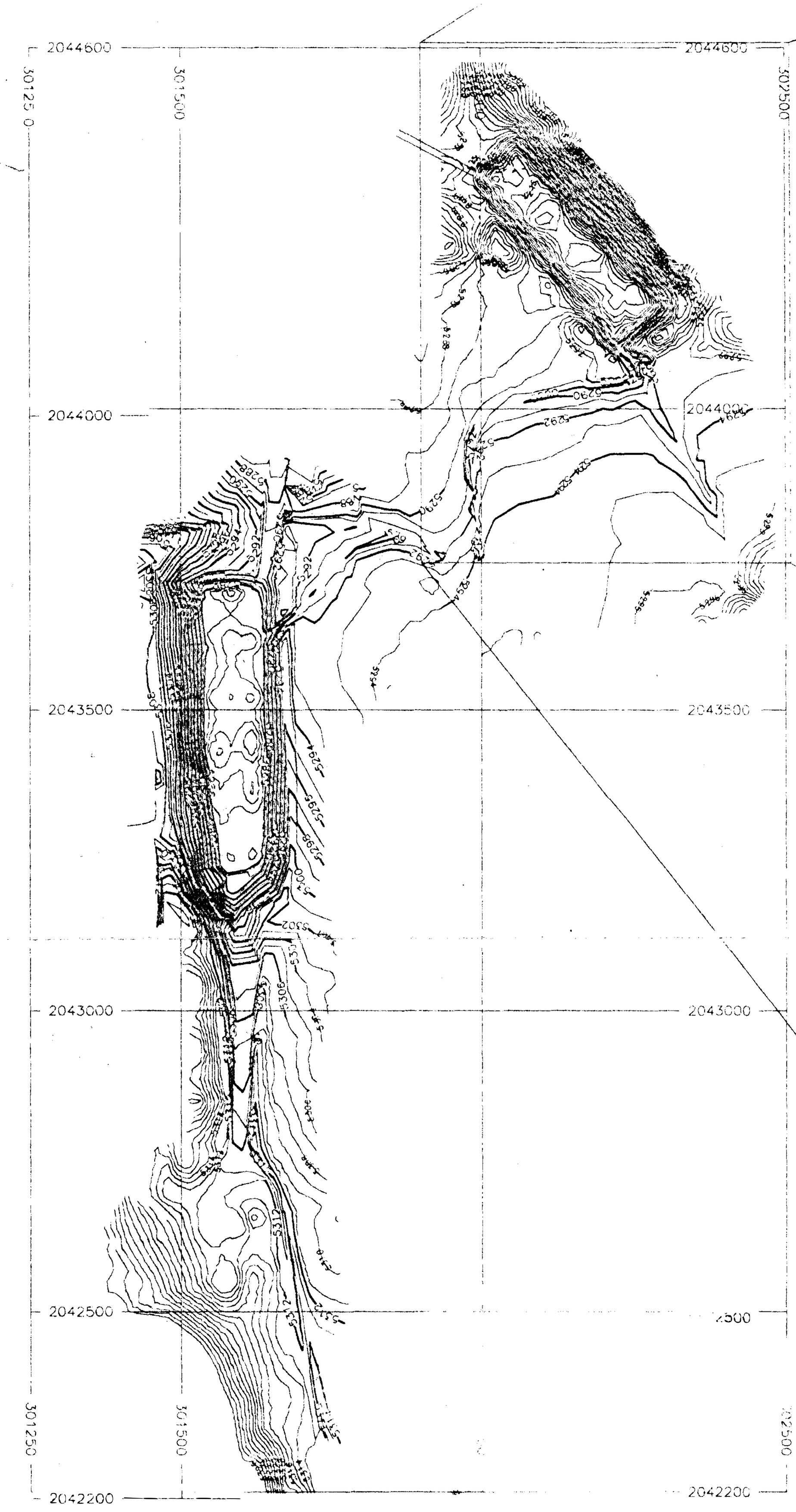
BHP Navajo Coal Company

P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

AREA 4 NORTH CULVERT/DOWN DRAINAGE STRUCTURE LOCATIONS AND WATERSHED AREAS

PREPARED BY BS/PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE Nov.5, 1995	

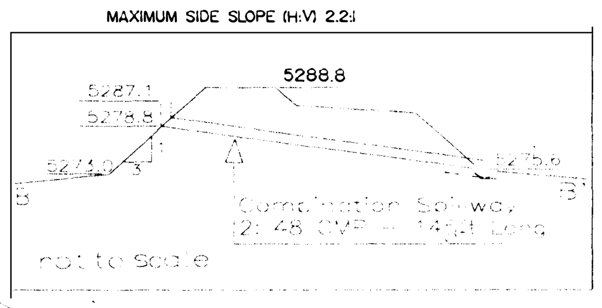
MAP LOCATION: (See Lower Left Corner)

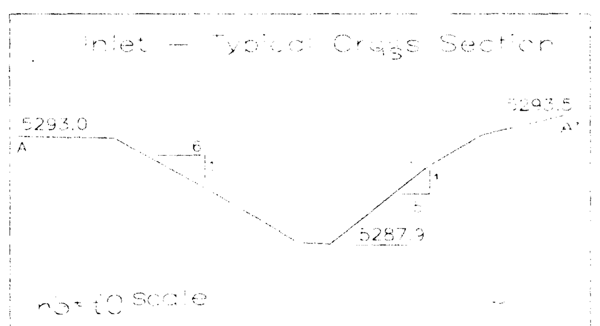


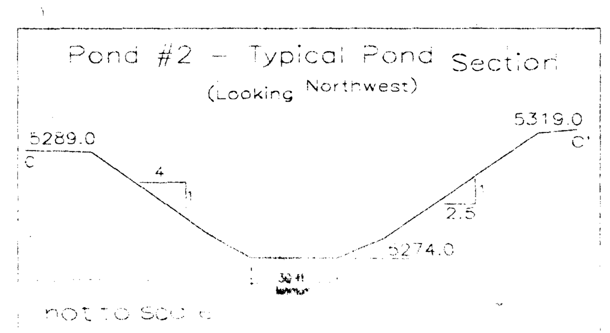
Design Summary	
Storm Event	25 YR-6 HR
Drainage Area	102.8 ac
Runoff Volume	4.15 ac.ft.
25 Yr. Sediment Volume	1.45 ac.ft.
Spillway Elevation	5287.1
Top of Dam	5288.8
Peak Stage	5287.7
Pond Volume @ Peak Stage	8.67 ac.ft.

5274.0	0.07	0.04
5275.0	0.16	0.15
5276.0	0.27	0.37
5277.0	0.41	0.71
5278.0	0.50	1.16
5279.0	0.56	1.69
5280.0	0.61	2.28
5281.0	0.67	2.92
5282.0	0.72	3.61
5283.0	0.78	4.36
5284.0	0.83	5.17
5285.0	0.89	6.03
5286.0	0.94	6.95
5287.1	1.01	8.02
5288.0	1.06	8.94
5288.8	1.14	9.82

TOP OF EMBANKMENT ELEVATION 5288.8
BOTTOM OF POND ELEVATION 5273.0
TOP WIDTH OF EMBANMENT 30 FT.
MAXIMUM SEDIMENT ELEVATION 5279.2
MAXIMUM SIDE SLOPE (H:V) 2.2:1







Legend

Area of Detail

Gauge Post

48" CMP Culvert

NOTE:

1. GAUGE POST BASE ELEVATION 5274.9.
2. FOR BLUELINE ELEVATION REFER TO TABLE 11-5D IN THE PAP.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowlege.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

2-3-99

I. RON VANVALKENBURG, HEREBY CERTIFY THAT THE INFORMATION DISPLAYED ON THIS EXHIBIT IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWNLEDGE.

RON C. VAN VALKENBURG NEW MEXICO REGISTERED PROFESSIONAL ENGINEER

APPROVED MAR 1999

REV. NO.	DATE	DRAFT. BY	DESCRIPTION	ENG.	E.C.	CHIEF ENG.
5	9-14-98	RY	Added Notes 1 and 2.			
4	7-25-94	PJF	UPDATED DESIGN SUMMARY AND STAGE-AREA DATA.			
3	8/24/93	JG	CHANGE EXHIBIT NO. TO 11-43			
2	6-11-93	PJF	ADDED CONTRUCTED APPROVED DRAINAGE SWAGE. DESIGN SUMMARY & CROSS-SECTIONS	JER		REV
1	03/29/91		AS-BUILT SUBMITTAL			

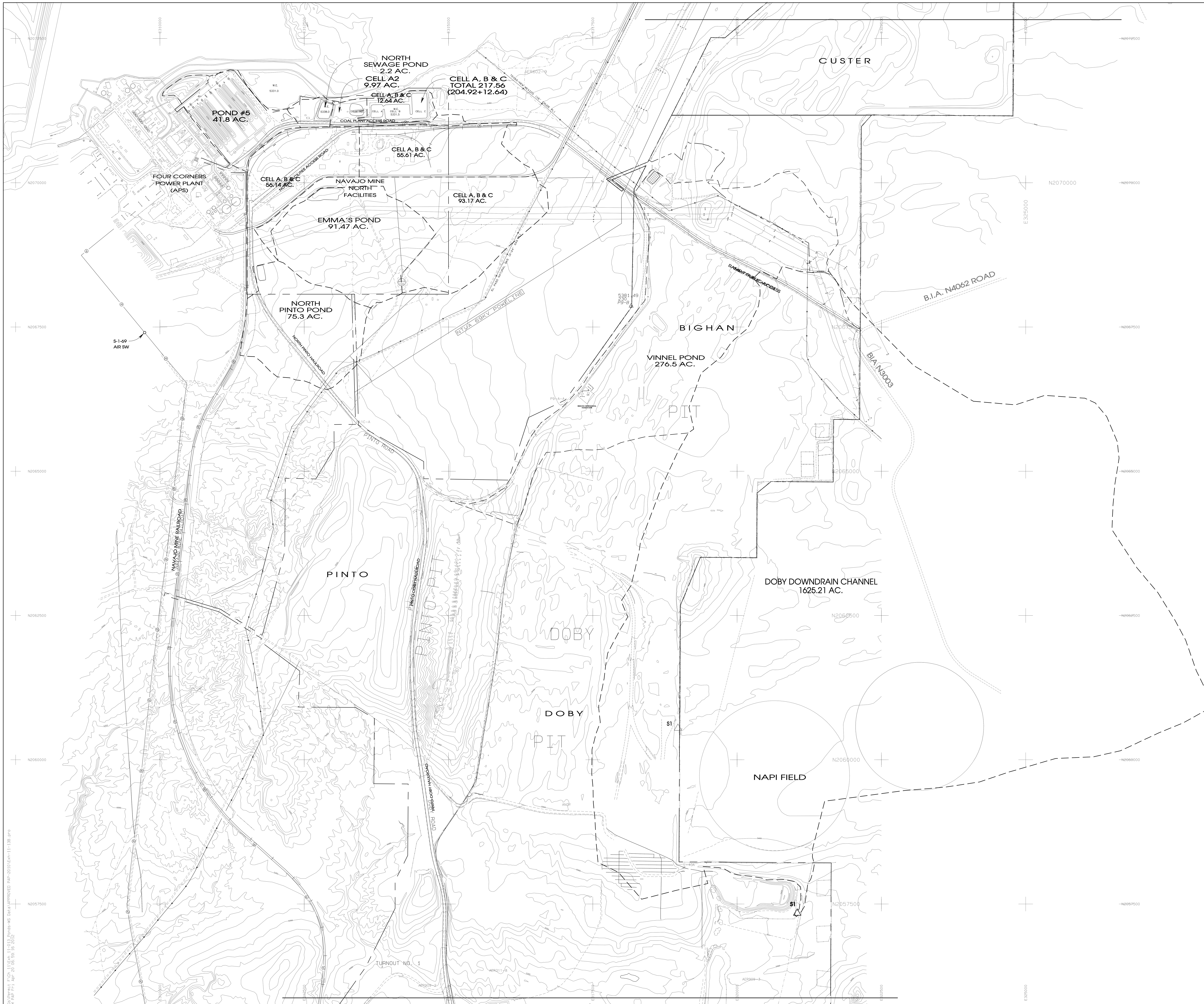
APPROVALS

EXHIBIT 26-8

BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO

AS-BUILT
Barber Coal Stockpile
Sedimentation Pond # 2

DRAWN BY JER | SCALE 1" = 200 ft C.I. 1.0 ft
APPROVED BY | DATE 06/11/93
DRAWING NO | LOCATION NO. MF-D2



LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 5422.45 HORIZ. & VERT. CONTROL
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY
- WATERSHED BOUNDARY
- PONDS

NOTES :

1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.

500 0 500 1000

CONTOUR INTERVAL: 10'
DATE OF PHOTOGRAPHY: May, 2010

Revised by
Aero - Graphics, Inc.
40 West Oakland Avenue
Salt Lake City, Uath 84115

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE'D BY	E.Q.	P.E.	APPROVED DATE
10-A	7-07-10	PJF	Updated North Cell's Watershed and submitted to OSM for review.	LR	YB	LR	
G	4-12-04	PJF	Revised Emma's Pond WS and Updated for PAP Renewal submittal to OSM for Review.	LR	MC	LR	
F	7-29-98	PJF	Mid Term submittal to OSM for Review and Approval.	BH	MC	LR	
E	6-22-98	PJF	REMOVED BIGHAM RAMP 8 POND AND MODIFIED VINNEL POND WATERSHED.	BH	MC	LR	
D	8-12-96	PJF	ADDED BIGHAM RAMP 8 POND WATERSHED AND MODIFIED VINNEL POND WATERSHED.				
C	3-20-96	PJF	ADDED TEXT TO NORTH CELL POND 1 (132.7 AC + 45.8 AC)				
B	12-20-95	PJF	REVISED DRAINAGE AREA.				
A	11-30-95	PJF	SUBMITTED TO OSM FOR APPROVAL.				
				APPROVALS			

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 26-9

bhpbilliton

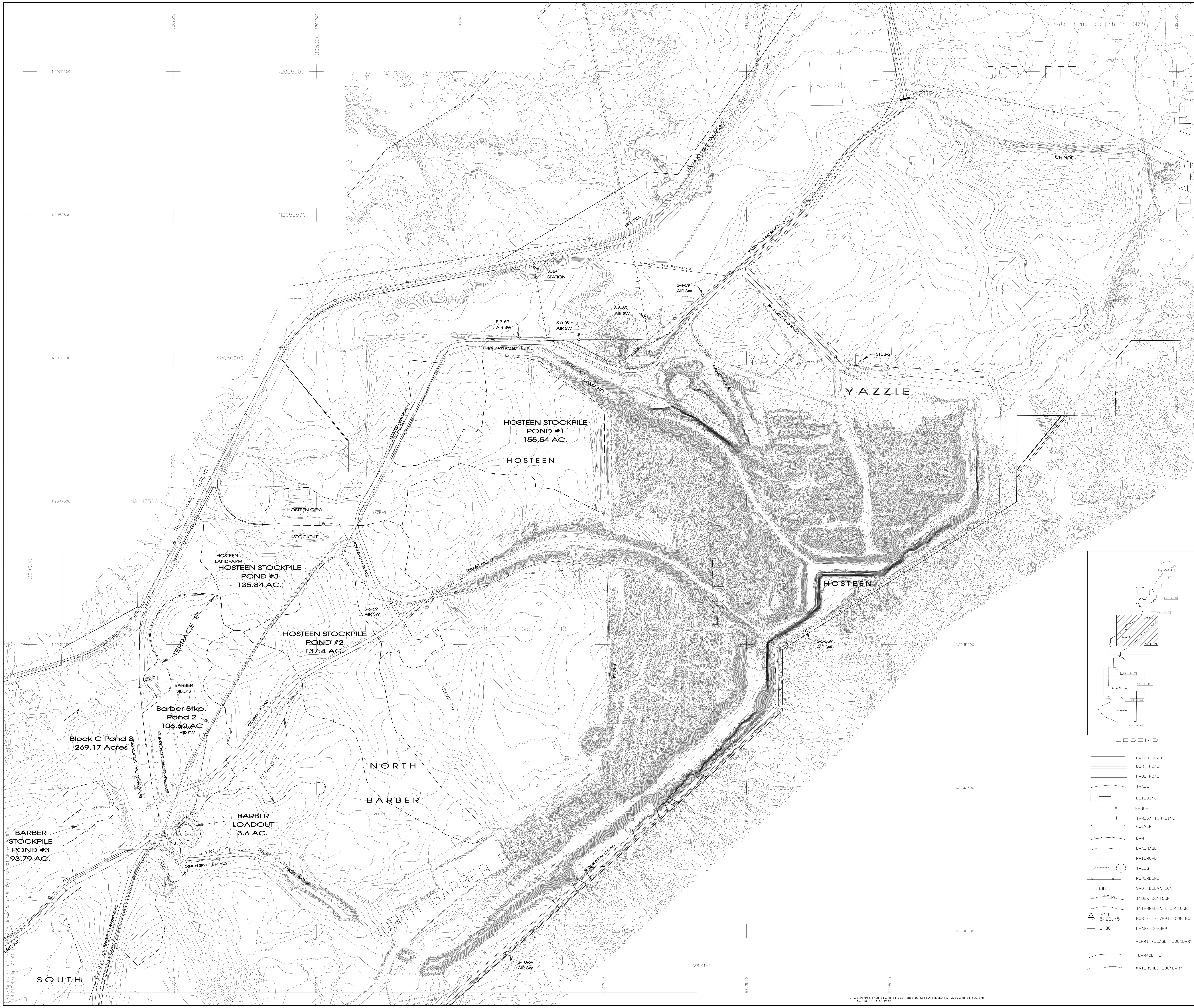
BHP Navajo Coal Company

P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

AREA- 1 IMPOUNDMENT AND POND LOCATIONS/ WATERSHED AREAS

PREPARED BY BS/PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE Nov. 5, 1995	

MAP LOCATION: (See Lower Left Corner)



NOTES :
1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.

500 0 500 1000
CONTOUR INTERVAL: 10'
DATE OF PHOTOGRAPHY: May, 2010

Revised by
Aero - Graphics, Inc.
40 West Oakland Avenue
Salt Lake City, Uath 84115

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE'D BY	E.Q.	P.E.
I	11-15-06	PJF	Updated Hosteen Stockpile Pond #3, removed Yazzie StocklPond #2, South Hosteen Stockpond Impoundment #1 and submitted to OSM for Review.	LR	KJ	LR
H	01-25-06	PJF	Removed Yazzie Stockpond Impoundmnet #1 and submitted to OSM for Review.	LR	KJ	LR
G	6-03-05	PJF	Revised watershed areas for the following; Block C Ponds 1,2,3, Barber Stockpile Ponds 2,3, Hosteen Stockpile Ponds 1,3 and submitted to OSM for Review.	LR	MC	LR
F	11-13-02	PJF	Removed South Hosteen Stockpond Impoundmnet #2, #3 and submitted to OSM for Review.	LR	MC	LR
E	8-5-02	PJF	Removed Stub 16 Impoundment #2, #3 and submitted to OSM for Review.	LR	MC	LR
D	1-08-02	PJF	Updated Block-C Pond-3, removed Barber Stockpile Pond No.1 and submitted to OSM for Review and Approval.	LR	MC	LR
C	6-1-99	PJF	Added Block-C Pond-3 and submitted to OSM for Review and Approval.	BH	MC	LR
B	7-29-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR
A	11-30-95	PJF	SUBMITTED TO OSM FOR APPROVAL.			

APPROVALS

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 26-10

bhpbilliton

BHP Navajo Coal Company

P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

AREA- 2
IMPOUNDMENT AND
POND LOCATIONS/
WATERSHED AREAS

PREPARED BY BS/PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE Nov. 26, 1995	

MAP LOCATION: (See Lower Left Corner)

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- LEASE/PERMIT BOUNDARY

0' 600' 1200' 1800'

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE'D BY	E.Q.	P.E.	APPROVED DATE
13-A	02-22-13	RRY	ADDED PONDS 201 AND 202 WS AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	RY	KH	LR	
12-A	11-19-12	PJF	Updated surface to current and EMCD watershed boundary	RY	KH	LR	
10-A	7-09-10	PJF	ADDED A3 FACILITIES SEWER POND-2 AND SUBMITTED TO OSM FOR REVIEW.	LR	YB	LR	
07-A	10-29-07	PJF	ADDED BLOCK C POND-4,W/WITH, UPDATED BLOCK C POND-3 WS AND SUBMITTED TO OSM FOR REVIEW.	S. SMITH	YB	DJR	
Q	3-27-06	PJF	ADDED SOUTH BARBER POND, WITH WATERSHED AND SUBMITTED TO OSM FOR REVIEW.	LR	KJ	LR	
P	6-03-05	PJF	REVISED WATERSHED FOR THE FOLLOWING; BLOCK C PONDS 1,2,3, BARBER STOCKPILE PONDS 2,3, HOSTEEN STOCKPILE PONDS 1,3 AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR	
O	1-13-03	PJF	CORRECTED WATERSHED ACREAGE TEXT FROM 295.05 TO 275.05 FOR BLOCK-C POND-3 AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR	
N	11-22-02	PJF	ADDED LOWEHOLE3_POND-2 W/WATERSHED, MODIFIED LOWEHOLE3_POND-3, BLOCK-C POND-3 WATERSHED AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR	
M	8-05-02	PJF	Removed Area-III Shop Pond, Stub 16 Impoundment #2, #3 and sumbitted to OSM for review.	LR	MC	LR	
L	6-11-02	PJF	Updated Block-C Pond 1 and Pond 3.Removed Barber Stockpile Pond 1 and submitted to OSM for Review ansd Approval.	LR	MC	LR	
K	11-02-00	RY	REMOVED AREA III COMPLEX POND AND WATERSHED AREA. AND MODIFIED WATERSHED AREA FOR EMPLOYEE COAL DUMP.	RY	MC	LR	
J	4-18-00	PJF	ADDED MASON POND W/WATERSHED	AAY	MC	LR	
I	11-12-99	PJF	Added Area-III Employee Coal Dump Watershed Area.	BH	BS	LR	
H	7-29-99	PJF	UPDATED WATERSHED AREA FOR LOWE HOLE3 POND-3	PJF	MC	LR	
G	6-14-99	PJF	Added Block-C Ponds 1, 2 and 3 with Watershed Bndy and submiited to OSM for Review and Approval.	BH	MC	LR	
F	7-29-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR	
E	01-28-98	PJF	UPDATED WATERSHED AREA FOR LOWE RAILRD EMBANKMENT #2	FTJ	PNS	LR	
D	5-22-97	PJF	UPDATED WATERSHED AREA FOR LOWE RAILRD EMBANKMENT #2	VAH			
C	3-20-96	PJF	REMOVED HIGHWALL IMPOUNDMENTS NO. 10A AND NO. 10.	LR			
B	12-20-95	PJF	REVISED DRAINAGE AREAS AND CHANGE BIA RD DESIGNATION FROM 4048 TO 4104.	PD			
A	11-30-95	PJF	SUBMITTED TO OSM FOR APPROVAL.				

APPROVALS

CERTIFICATION STATEMENT
I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 26-11

bhpbilliton

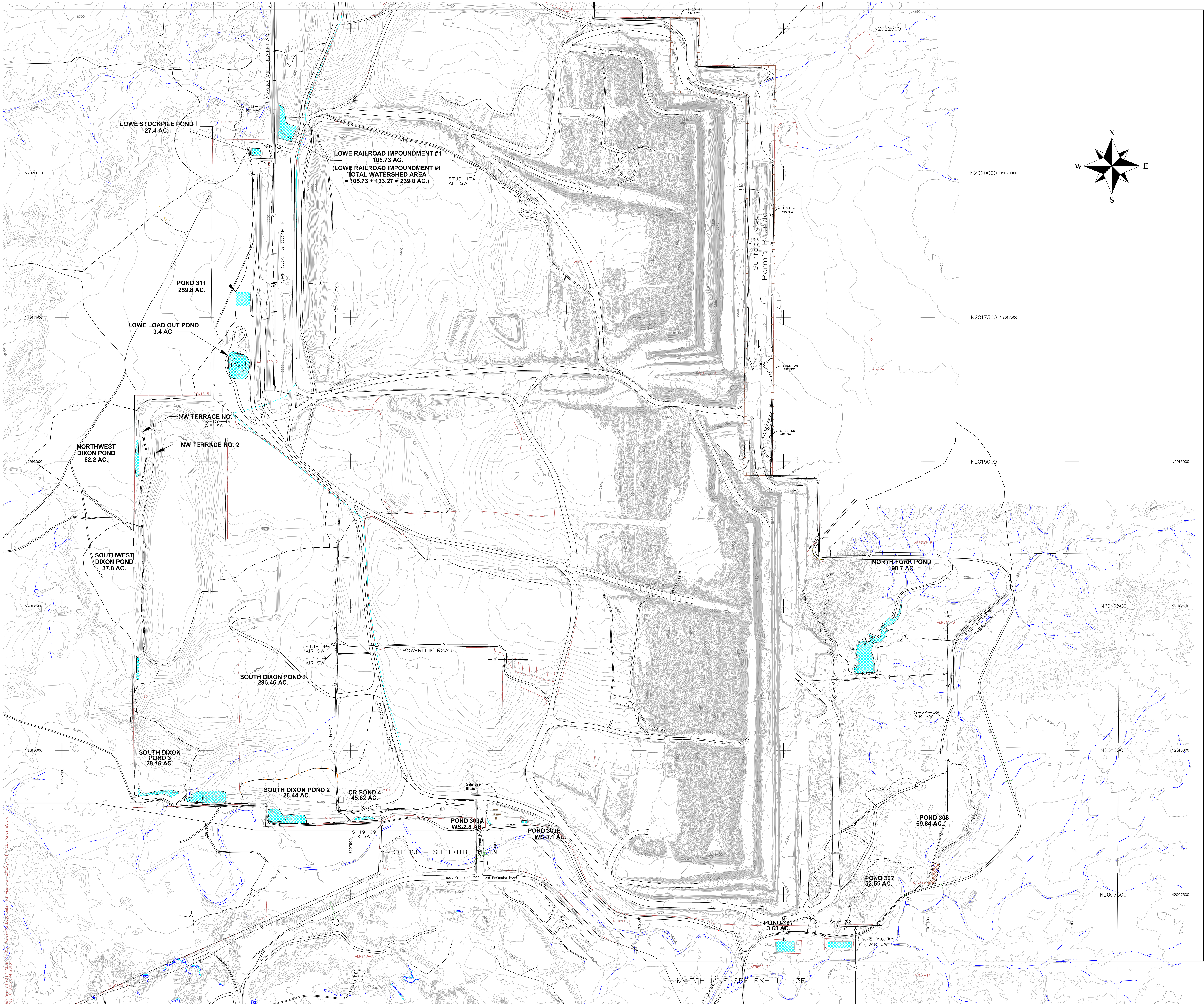
BHP Navajo Coal Company

P.O. Box 1717
Fruitland,New Mexico,87416

Phone: 505-598-4200
Fax: 505-568-3361

AREA II IMPOUNDMENT AND POND LOCATIONS/ WATERSHED AREAS

Prepared By: RRY	Drawn By: RRY	Scale: 1:600
Approved By: LR	Plot Date: 3/13/13	Layout: AREA II PONDS

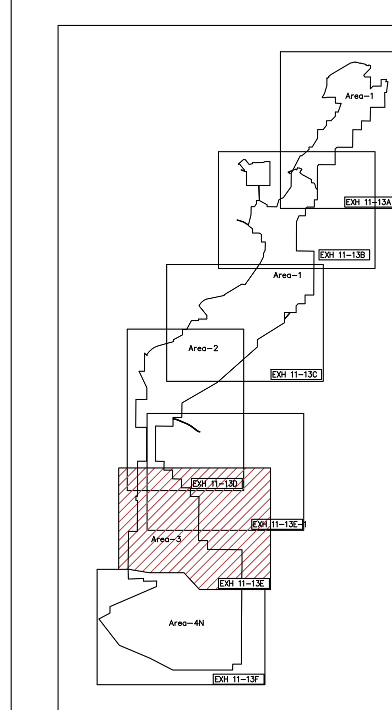


LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 5422.45 HORIZ. & VERT. CONTROL
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY
- WATERSHED BOUNDARY
- PONDS

NOTES :

1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.



500 0 500 1000

CONTOUR INTERVAL: 10'
DATE OF PHOTOGRAPHY: MAY, 2010

Revised by
Aero - Graphics, Inc.
40 West Oakland Avenue
Salt Lake City, Uath 84115

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE'D BY	E.Q.	P.E.	APPROVED DATE
13-A	06-27-13	RRY	ADDED POND 311 WATERSHED AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	LR	TR	LR	
12-A	10-23-12	PJF/RY	ADDED PONDS 309A, 309B, 306, UPDATED POND 302, 301 WATERSHED, REMOVED HW POND 303, LOWE-DIXON DIVERSION POND AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	LR	KH	LR	
11-B	3-15-11	PJF	REMOVED SOUTH DIXON POND 7, LOWE-DIXON DIVERSION NORTH POND-A AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	RCV	SO	RCV	
11-A	FEB-2011	PJF	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL. (NOT APPROVED AS OF 3/15/2011)	RCV	SO	RCV	
10-D	7-21-10	PJF	ADDED HIGHWALL POND 303 WITH WATERSHED AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV	
10-C	3-04-10	PJF	PREPARED SOUTH DIXON PONDS 301, 302 WATERSHED AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV	
10-B	02-10-10	PJF	UPDATED SOUTH DIXON POND 7 WATERSHED, REMOVED SOUTH DIXON POND 8 AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV	
10-A	01-08-10	PJF	UPDATED LOWE-DIXON DIV POND-A WITH AS-BUILT DATA, REMOVED NORTH LOWE HIGHWALL POND, LOWE-DIXON DIV NORTH POND AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV	
09-C	12-17-09	PJF	PREPARED AS-BUILT FOR CR POND-4, UPDATED WATERSHED, AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	RCV	
09-B	7-12-09	PJF	Original Certified signed exhibits are maintained at the Mine Site and OSM ADDED IBR EASTSIDE OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	KAB	
09-A	02-02-09	PJF	REVISED POND 7 TEXT TO READ POND 8 IN THE WATERSHED DATA AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	RVV	
08-D	11-20-08	PJF	ADDED SOUTH DIXON POND 7 AND POND-8 WATERSHED AREA AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	RVV	
08-C	11-20-08	PJF	REVISED SOUTH DIXON POND 3 AND POND-1 WATERSHED AREA AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	RVV	
08-B	5-14-08	PJF	MODIFIED SOUTH DIXON POND-1, LOWE RAILROAD IMPONDMENT #1, #2,SOUTH DIXON POND-7 WATERSHED AREAS, REMOVED LOWE-DIXON DIVERSION SOUTH POND AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	RVV	
08-A	1-23-08	PJF	UPDATED EXHIBIT, REMOVED NORTH FORK HIGHWALL IMPOUNDMENT, MODIFIED SOUTH DIXON POND-7 WATERSHED, ADDED NORTH FORK POND WITH WATERSHED AREA AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV	
			NOTE: FOR REVISIONS FROM 1995 TO 2006,PLEASE TURN ON LAYER REV-95>2006, IT WILL APPEAR ON THE RIGHT SIDE.				
				APPROVALS			

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 26-12

bhpbilliton

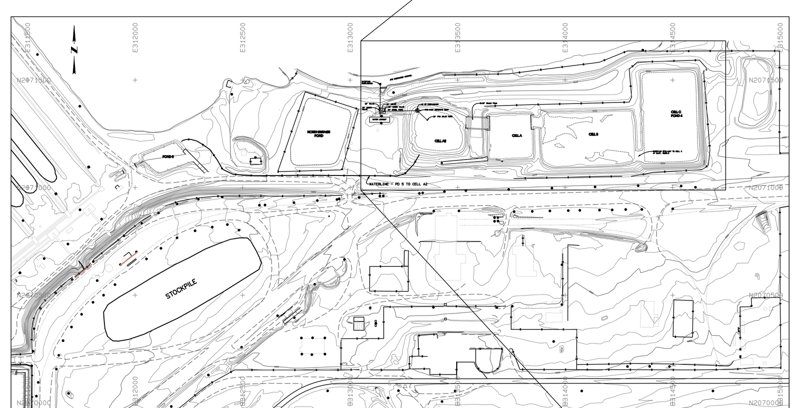
BHP Navajo Coal Company

P.O. Box 1717
Fruitland,New Mexico,87416
Phone: 505-598-4200
Fax: 505-568-3361

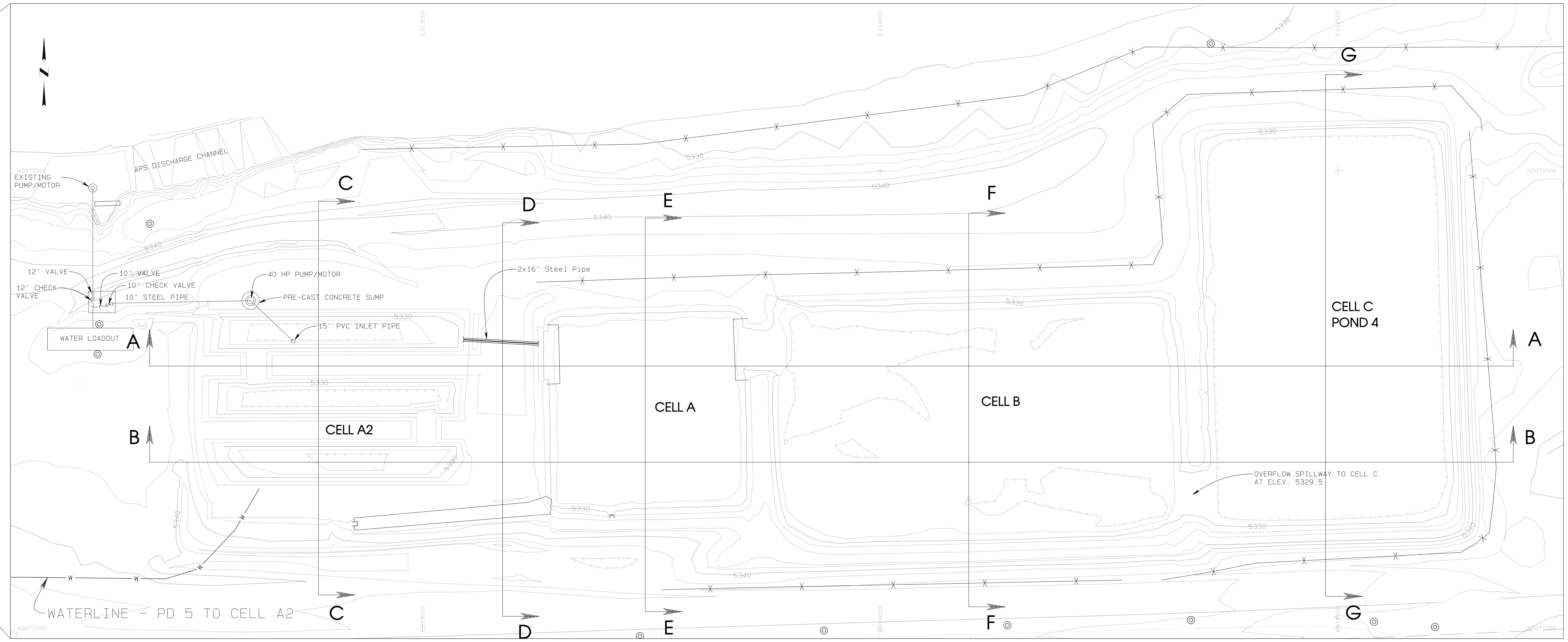
AREA-III IMPOUNDMENT AND POND LOCATIONS/ WATERSHED AREAS

PREPARED BY RRY	DRAWN BY RRY	SCALE 1" = 500'
APPROVED BY LR	DATE JUNE 27, 2013	(Plot Area: 35"x47")

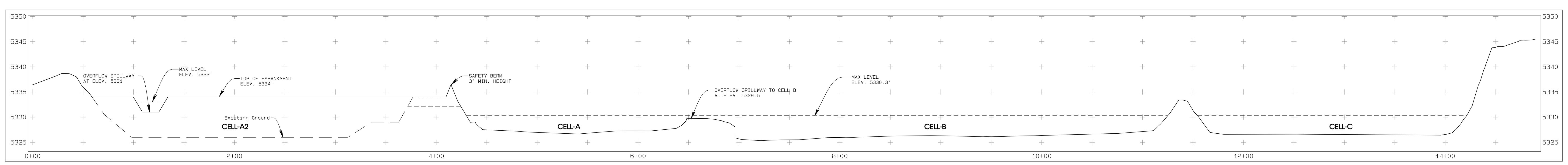
MAP LOCATION: (See Lower Left Corner)



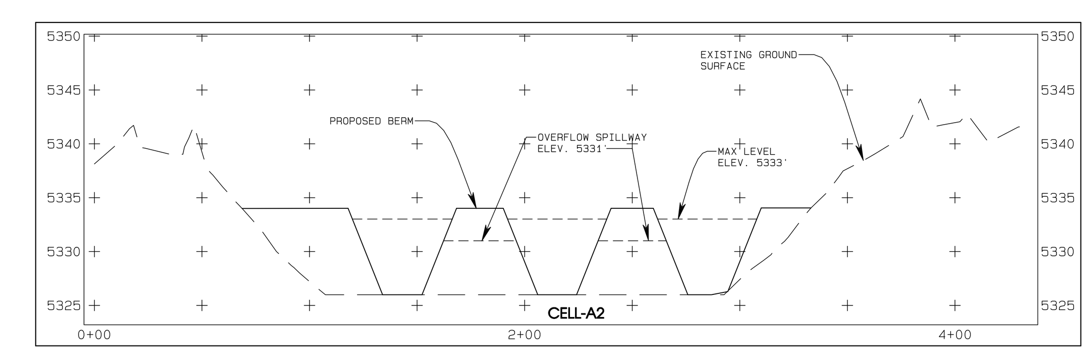
PLAN - NORTH FACILITY
1" = 500'



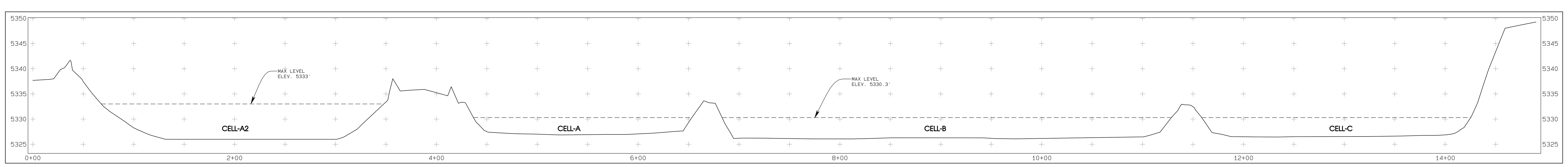
PLAN - NORTH CELLS
1" = 50'



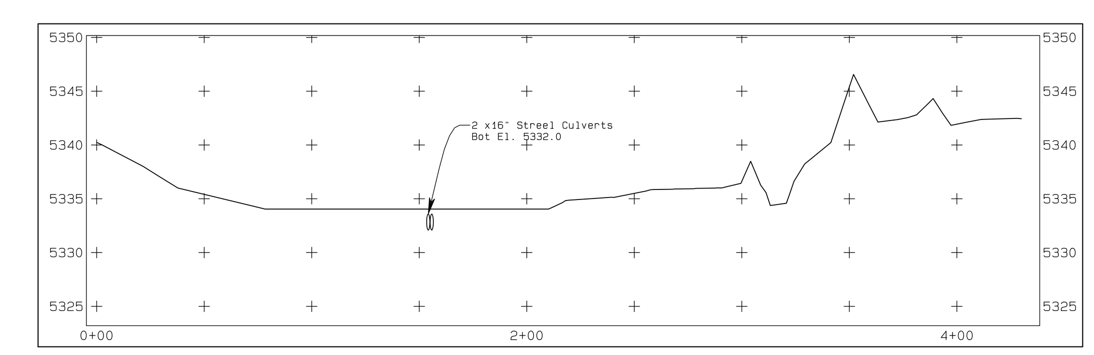
SECTION A



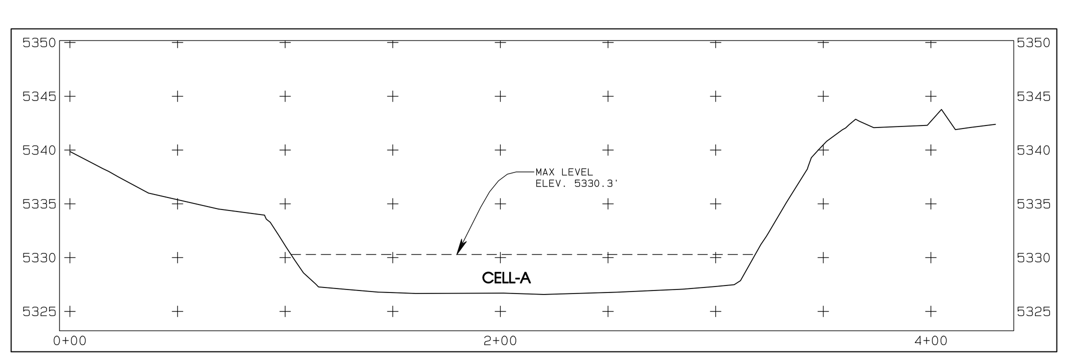
SECTION C



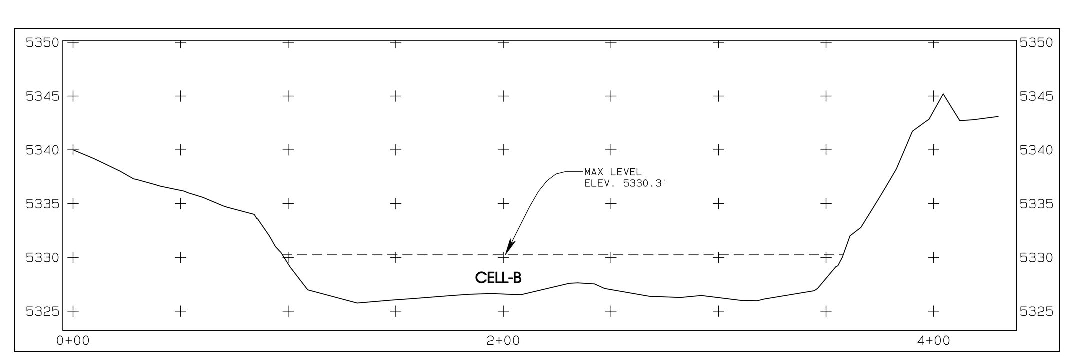
SECTION B



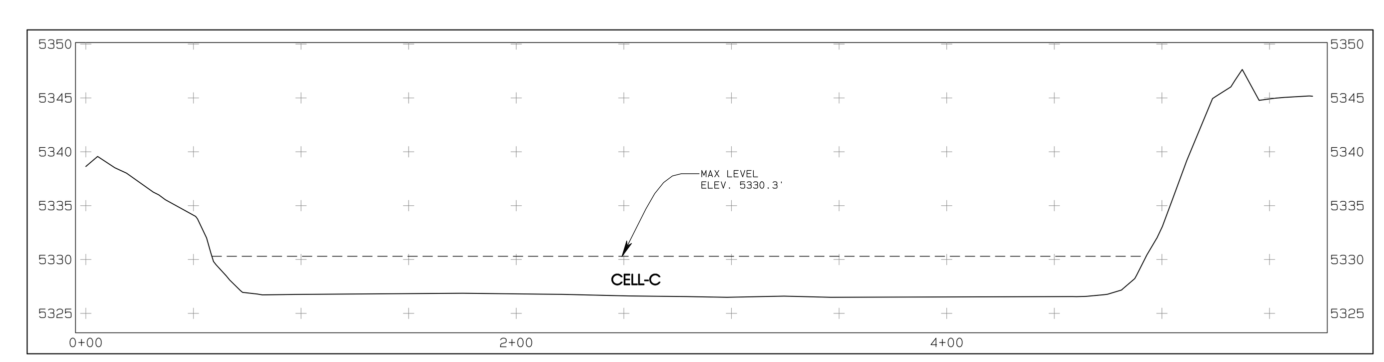
SECTION D



SECTION E



SECTION F



SECTION G

SECTION SCALE:
HORIZ. - 1" = 50'
VERT. - 1" = 10'

CELL A
STAGE STORAGE

ELEV.	AREA (AC)	INC. VOL. (AC-FT)	ACCUM. VOL. (AC-FT)
5327.0	0.26	0.00	0.00
5328.0	0.91	0.59	0.59
5329.0	0.99	0.95	1.53
5329.6	1.02	0.60	2.14
5330.0	1.07	0.42	2.55
5331.0	1.13	1.10	3.65
5332.0	1.18	1.15	4.80

CELL B
STAGE STORAGE

ELEV.	AREA (AC)	INC. VOL. (AC-FT)	ACCUM. VOL. (AC-FT)
5325.0	0.00	0.00	0.00
5326.0	0.54	0.27	0.27
5327.0	2.13	1.33	1.61
5328.0	2.38	2.25	3.86
5329.0	2.50	2.44	6.30
5329.5	2.56	1.26	7.56
5330.0	2.63	1.30	8.86
5331.0	2.72	2.68	11.54
5332.0	2.80	2.76	14.30

CELL C
STAGE STORAGE

ELEV.	AREA (AC)	INC. VOL. (AC-FT)	ACCUM. VOL. (AC-FT)
5327.0	2.07	0.00	0.00
5328.0	2.37	2.22	2.22
5329.0	2.51	2.44	4.66
5329.5	2.58	1.27	5.93
5330.0	2.80	1.35	7.28
5331.0	2.64	2.72	10.00
5332.0	2.72	2.68	12.68

CELL A, B & C COMBINE
STAGE STORAGE

ELEV.	AREA (AC)	INC. VOL. (AC-FT)	ACCUM. VOL. (AC-FT)
5325.0	0.01	0.00	0.00
5326.0	0.54	0.27	0.27
5327.0	4.46	1.33	1.61
5328.0	5.66	5.06	6.67
5329.0	5.99	5.82	12.49
5329.5	6.16	3.14	15.63
5330.0	6.50	3.06	18.69
5331.0	6.49	6.49	25.18
5332.0	6.71	6.60	31.78

HIGH WATER LEVEL ELEVATION 5332.0
MAX. PERMISSIBLE SEDIMENT/WATER LEVEL - ELEV. 5330.30

CELL A2
STAGE STORAGE

ELEV.	AREA (AC)	INC. VOL. (AC-FT)	ACCUM. VOL. (AC-FT)
5326.0	0.19	0.00	0.00
5327.0	0.30	0.24	0.24
5328.0	0.39	0.35	0.59
5329.0	0.49	0.44	1.03
5330.0	0.59	0.54	1.57
5331.0	0.71	0.65	2.21
5332.0	0.81	0.76	2.98
5333.0	0.92	0.87	3.85
5334.0	1.03	0.98	4.82

HIGH WATER LEVEL ELEVATION 5333.0

NOTES:
1. THE HYDROLOGY DATA IS PRESENTED IN APPENDIX 11-AA.
2. THE LOCATION AND WATERSHED AREAS ARE PRESENTED ON EXHIBIT 11-13B.

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

RON C. VAN VALKENBURG
NEW MEXICO
9263
LICENSED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
B-10	7-27-10	PJF	RE-DESIGN CELL A2 AND SUBMITTED TO OSM FOR REVIEW.	RCV	YB	RCV		
A-10	7-07-10	PJF	BLOCKED THE OVERFLOW TO CELL A2 AND UPDATED AFTER CLEAN OUT	LR	YB	LR		
B	7-22-96	PJF	ADDED DEWATERING PUMP AND ASSOCIATED PIPING IN CELL A2.					
A	11-28-95	DJR	SUBMITTED TO OSM FOR APPROVAL					

APPROVALS

EXHIBIT 26-13

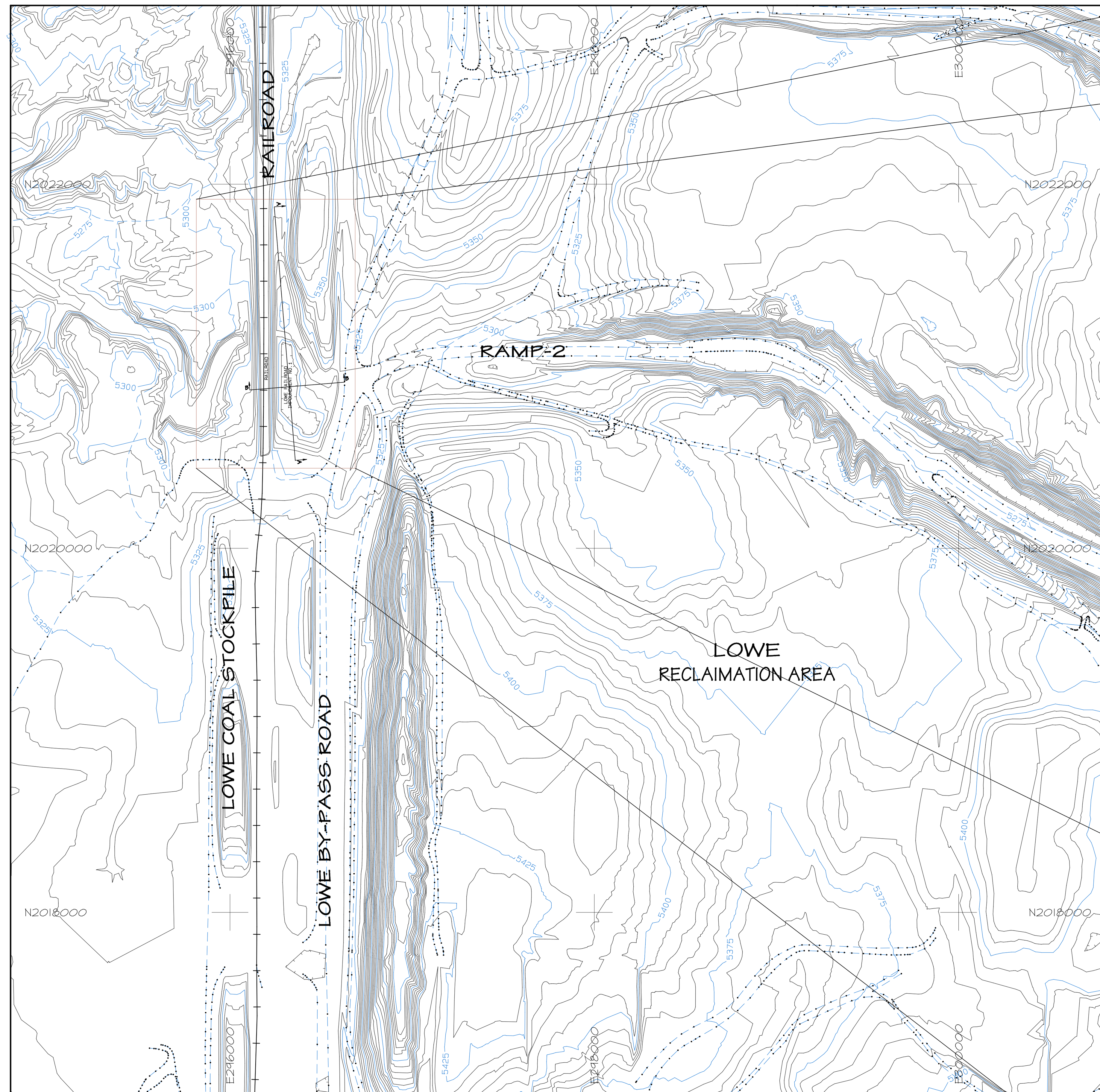
BHP NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS

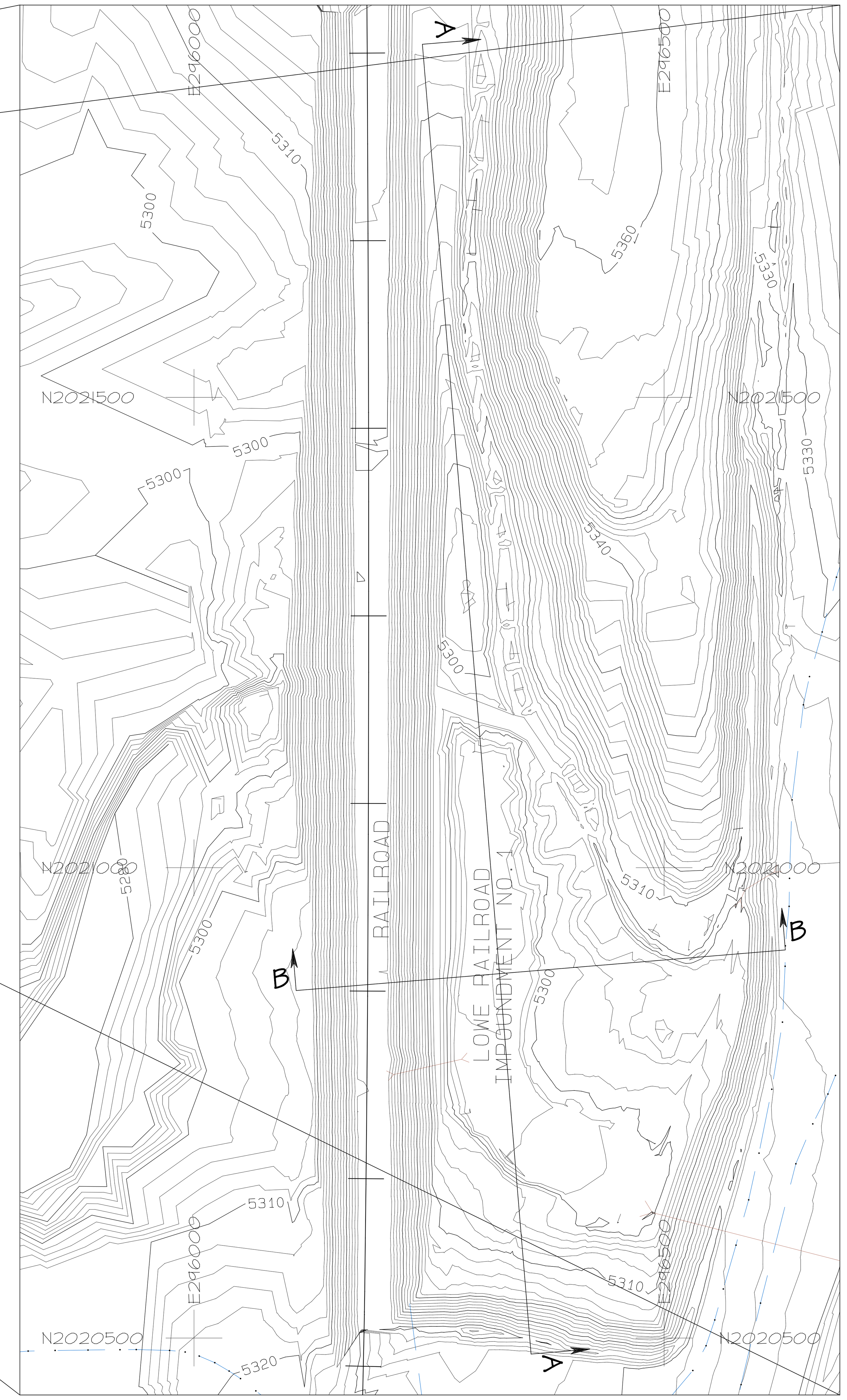
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

NORTH CELLS MODIFICATION

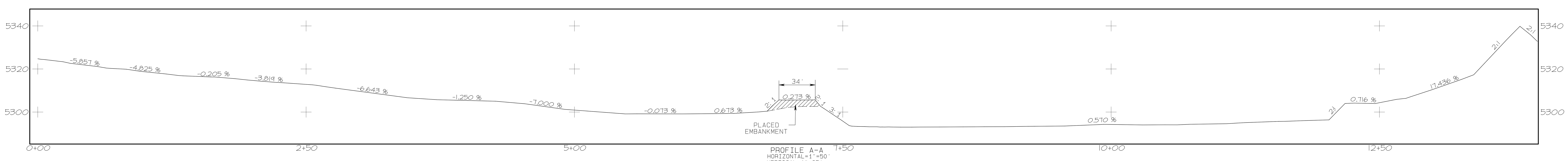
PREPARED BY DJR	DRAWN BY DJR
APPROVED BY LR	DATE 11-28-95
SCALE AS NOTED	REF DWG EXH 11-106



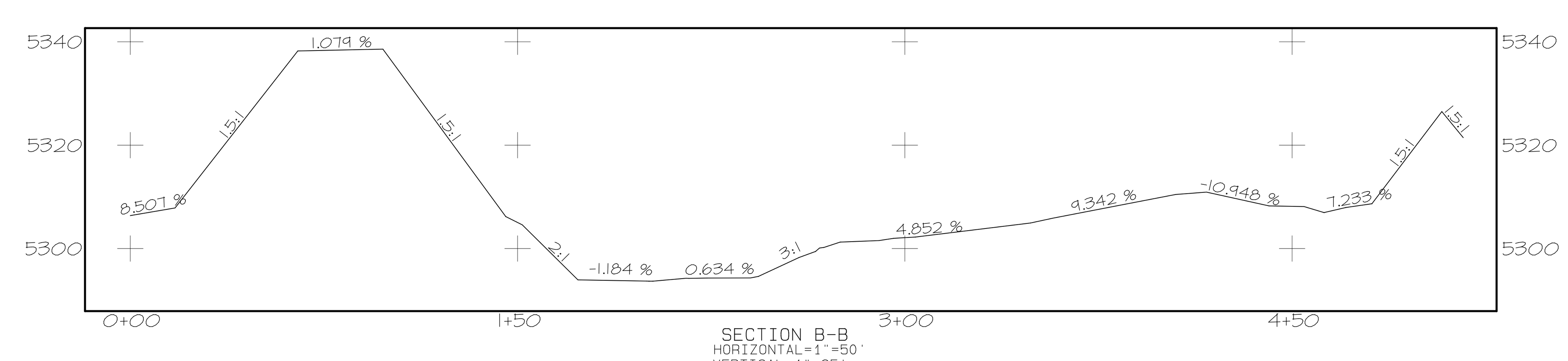
LOCATION MAP
1"=2000'



PLAN
1"=100'



PROFILE A-A
HORIZONTAL=1"=50'
VERTICAL=1"=25'



SECTION B-B
HORIZONTAL=1"=50'
VERTICAL=1"=25'

LEGEND

ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE CORNER
PERMIT/LEASE BOUNDARY

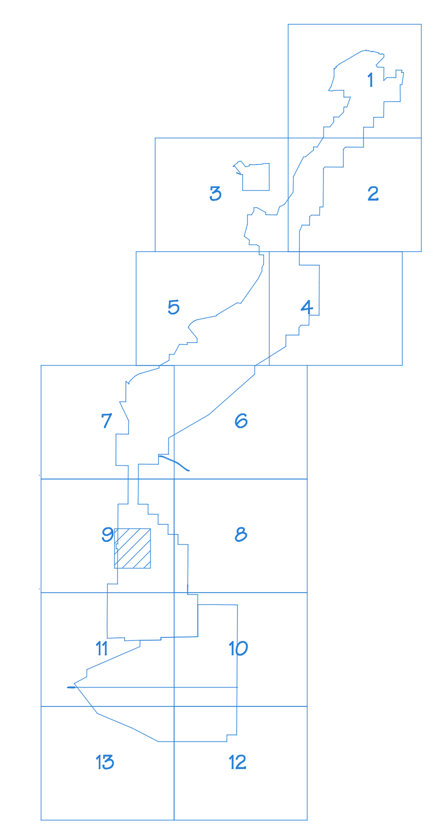
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5293	0.00	0.00	0.00
5294	0.33	0.17	0.17
5295	0.55	0.44	0.60
5296	0.68	0.61	1.22
5297	0.86	0.77	1.96
5298	1.06	0.96	2.95
5299	1.28	1.17	4.12
5300	1.51	1.39	5.52
5301	1.75	1.63	7.15
5302	1.99	1.87	9.01
5303	2.23	2.11	11.22
5304	2.49	2.36	13.48
5305	2.89	2.69	16.16
5306	3.19	3.04	19.20 (1)
5307	3.51	3.35	22.76
5308	3.77	3.64	26.19
5310	4.27	8.04	34.23
5312	4.69	8.96	43.19
5314	5.05	9.74	52.93
5316	5.43	10.48	63.41
5318	5.80	11.22	74.62
5320	6.16	11.94	86.57
5322	6.55	12.69	99.26 (2)

(1) PEAK STAGE FOR DESIGN STORM EVENT (100 YR – 6 HR).
(2) MAXIMUM IMPOUNDMENT CAPACITY.

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13E.
3. For impoundment information refer to Table 11-5Q.



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

Ron C. VAN VALKENBURG
NEW MEXICO
9263
LICENSED PROFESSIONAL ENGINEER

EXHIBIT 26-14
LOWE RAILROAD IMPOUNDMENT NO. 1
AS–BUILT

PLAN, PROFILE AND SECTION

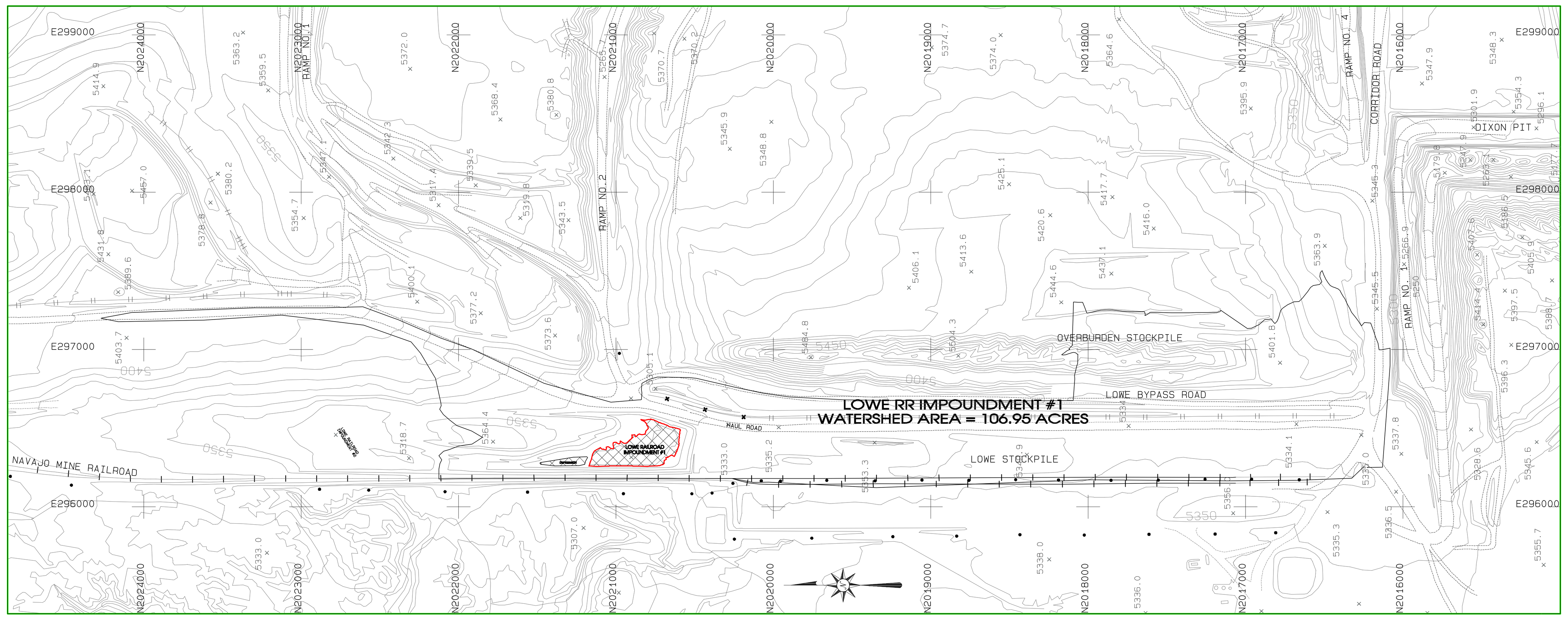
ACCOUNT:
DATE: 6-18-08
DESIGNED BY: SS
DRAWN BY: RV
CHECKED BY: RCV
APPROVED BY: RCV

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

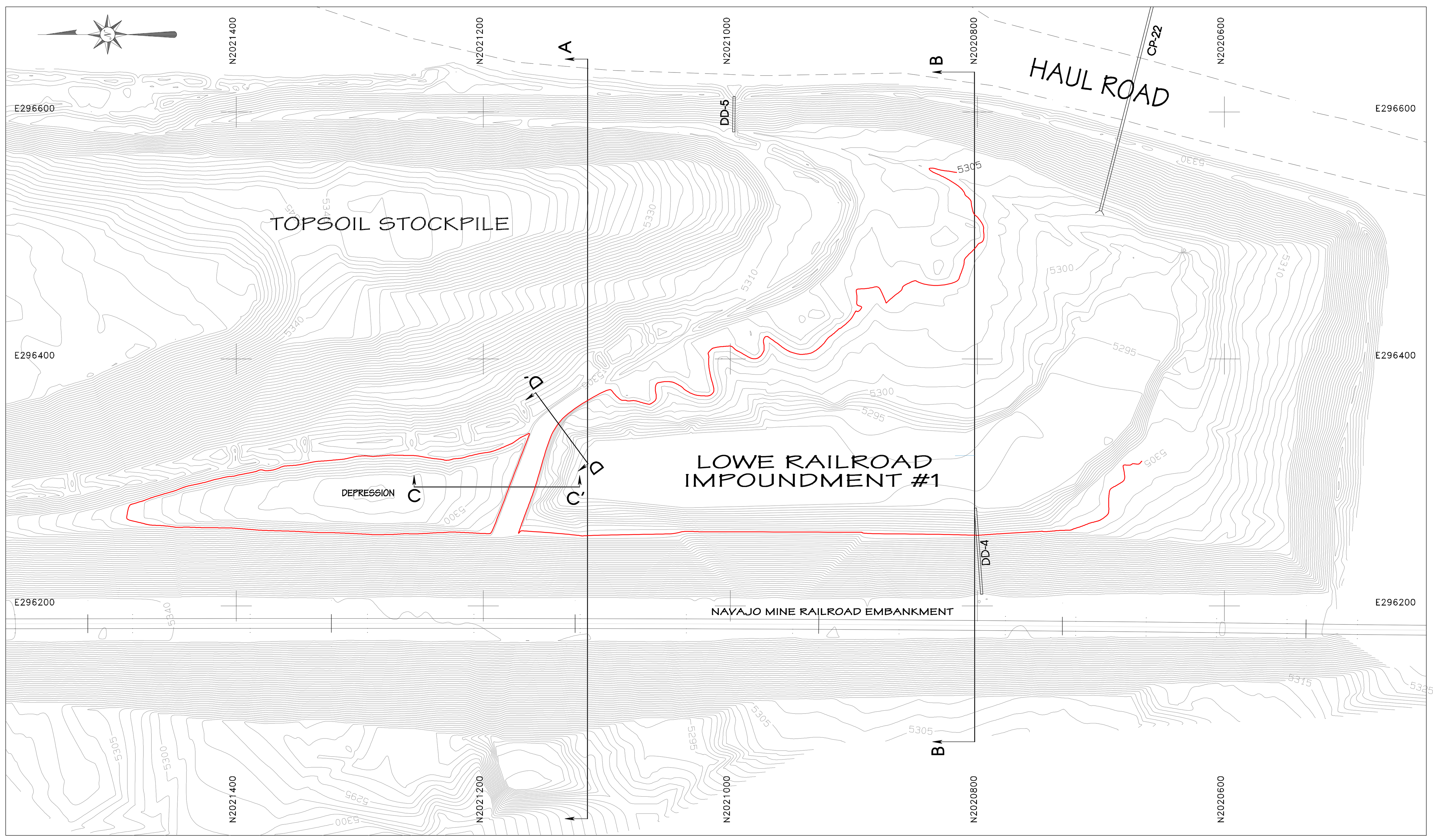
PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

REV NO.	DESCRIPTION	REV BY	DATE
1	UPDATED TO CURRENT SUBMITTED TO OOM FOR REVIEW	RV	7-9-08
2			
3			
4			
5			

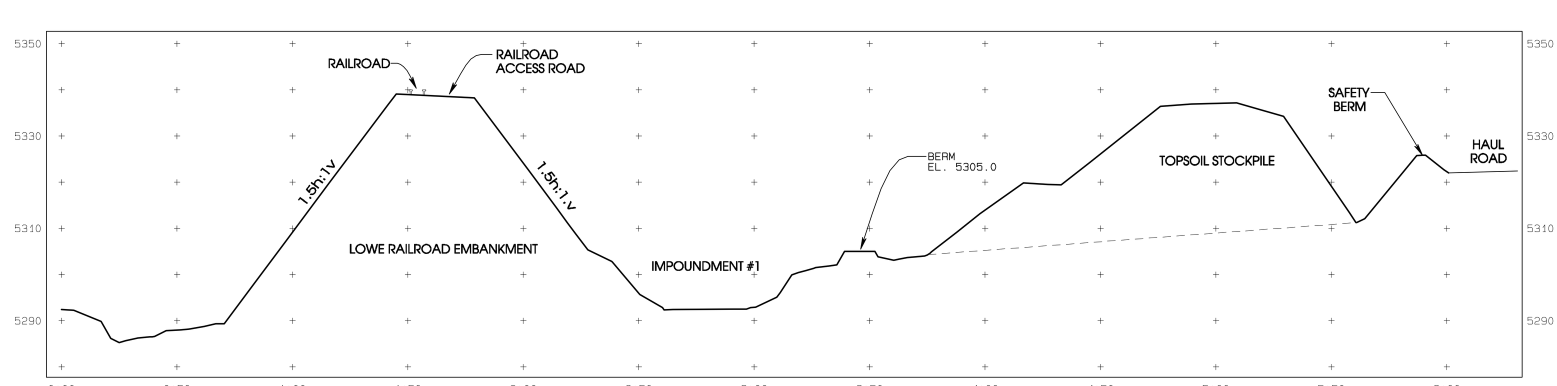
DRAWING
SHEET 1 OF 1



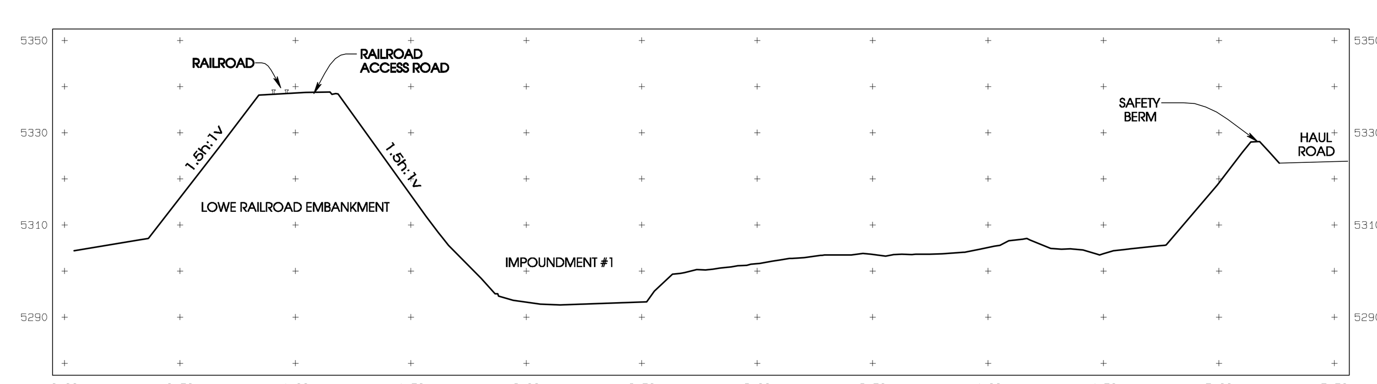
LOCATION MAP
SCALE 1" = 500'



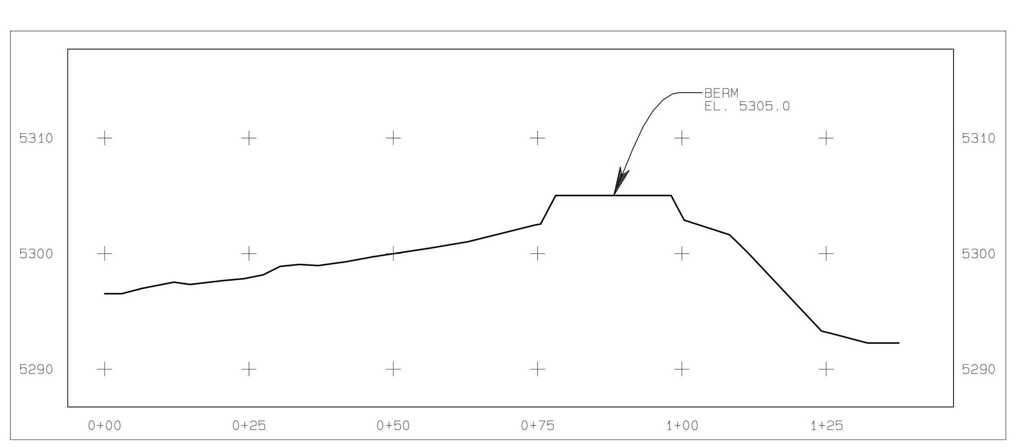
LOWE RAILROAD IMPOUNDMENT #1
SCALE 1" = 50'



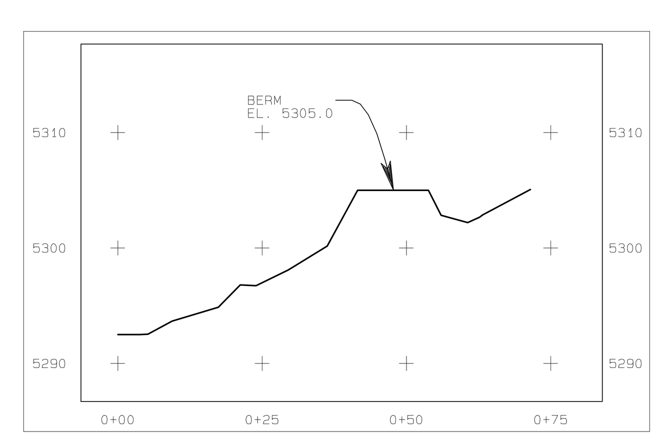
LOWE RAILROAD
IMPOUNDMENT #1
CROSS SECTION A-A'



LOWE RAILROAD
IMPOUNDMENT #1
CROSS SECTION B-B'



LOWE RAILROAD
IMPOUNDMENT #1
CROSS SECTION C-C'



LOWE RAILROAD
IMPOUNDMENT #1
CROSS SECTION D-D'

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- PERMIT/LEASE BNDY

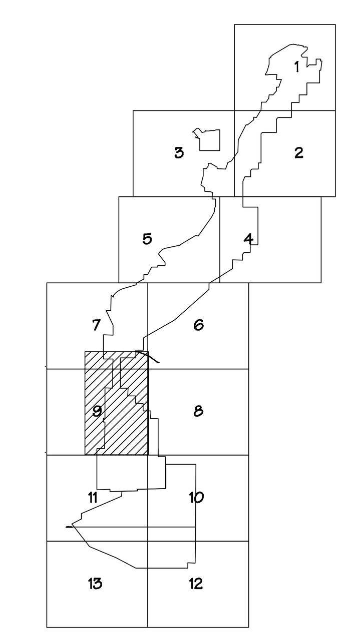
NOTES

1. For hydrology and design information refer to Appendix 11-Q in the approved PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5293	0.38	0.00	0.00
5294	0.67	0.53	0.53
5295	0.80	0.74	1.27
5296	0.91	0.86	2.13
5297	1.00	0.96	3.09
5298	1.10	1.06	4.15
5299	1.21	1.16	5.31
5300	1.34	1.28	6.59
5301	1.53	1.45	8.04
5302	1.71	1.62	9.66
5303	1.91	1.81	11.47 (2)
5304	2.13	2.02	13.49
5305	2.31	2.22	15.71
5306	3.18 (1)	4.57 (1)	20.28 (1)
5307	3.50	3.37	23.65
5308	3.77	3.66	27.31
5310	8.30	8.08	35.39
5312	9.19	9.08	44.47
5314	9.91	9.80	54.27
5316	10.65	10.54	64.81
5318	11.38	11.28	76.09
5320	12.10	12.01	88.10
5322	12.86	12.76	100.86 (3)

(1) AREA AND VOLUME FROM ELEV. 5296 TO 5305 FROM ADJACENT DEPRESSION INCLUDED.
(2) PEAK STAGE FOR DESIGN STORM EVENT (100 YR - 6 HR) + 5 ACRE-FEET.
(3) MAXIMUM IMPOUNDMENT CAPACITY.



REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	
08-A	02-11-08	PJF	MODIFIED LOWE RAILROAD IMPOUNDMENT #1 AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL	S. SMITH	Y. BENALLY	RCVV	

APPROVALS

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

RON C. VAN VALKENBURG
NEW MEXICO
9263
LICENSED PROFESSIONAL ENGINEER

EXHIBIT 26-14

BHP NAVAJO COAL COMPANY

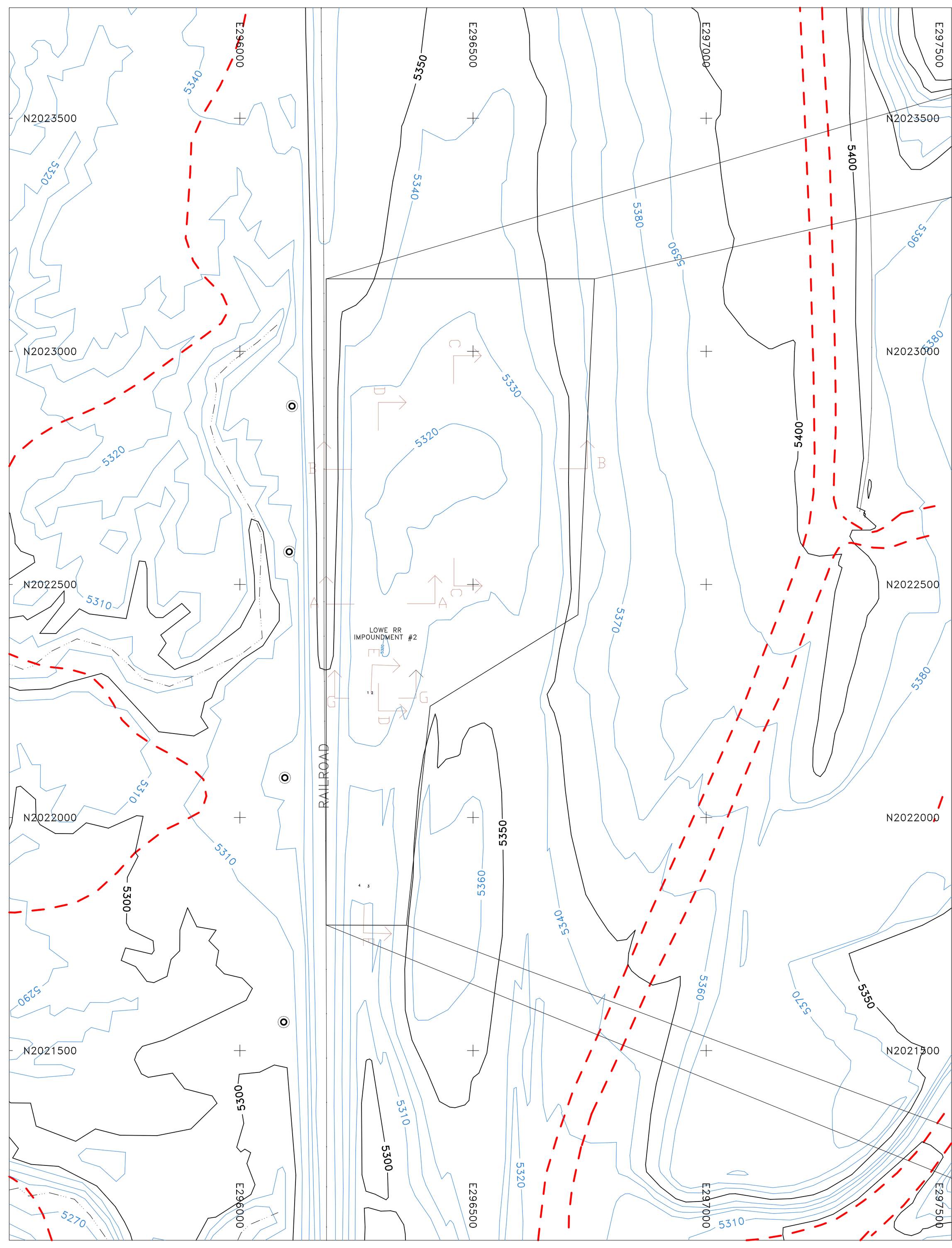
NAVAJO MINE
SAFETY PAYS
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

AREA 3

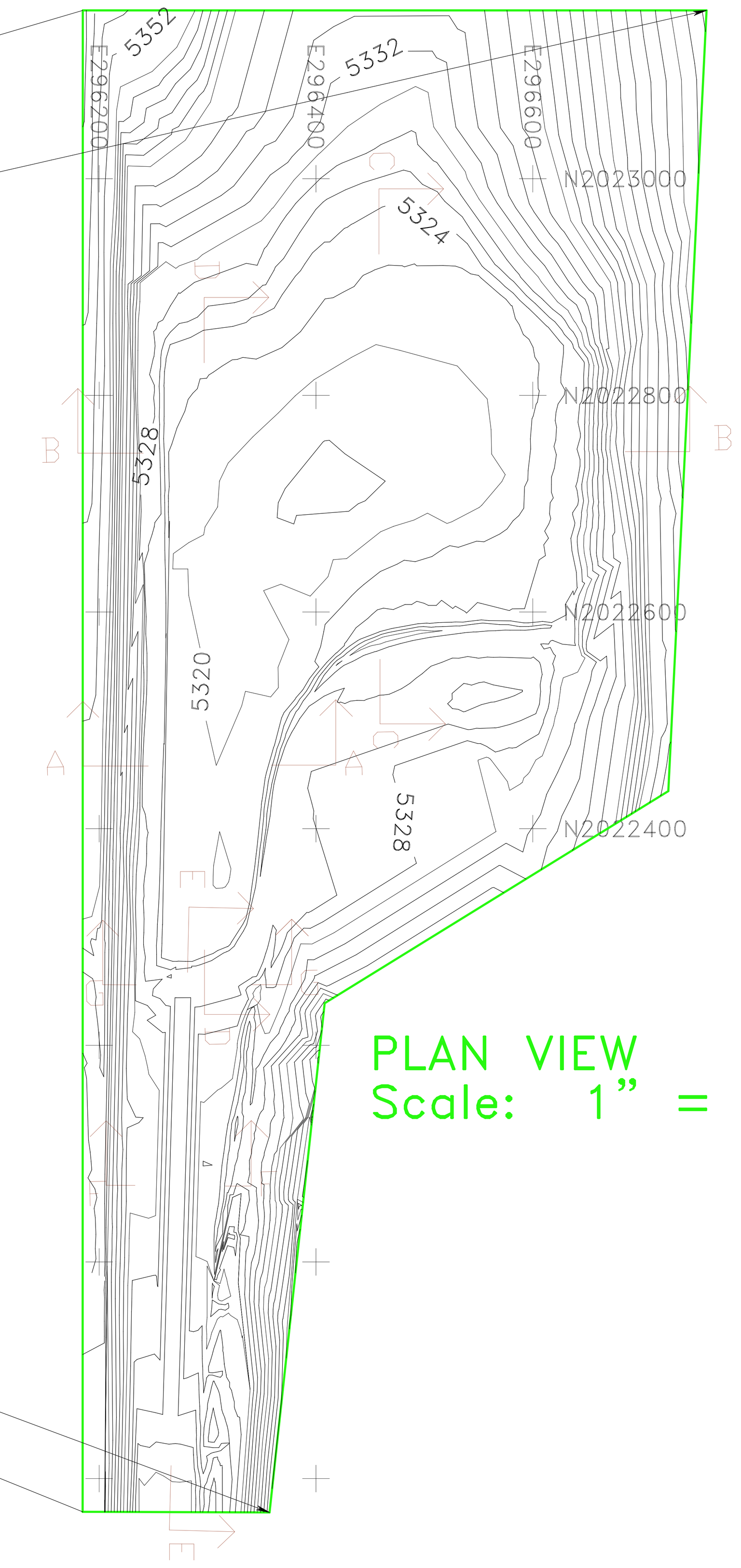
LOWE RAILROAD IMPOUNDMENT #1 MODIFIED POND DESIGN

PREPARED BY Shawn Smith	DRAWN BY PJFoster	SCALE AS NOTED
APPROVED BY RV	DATE 01/24/2008	REF DWG EXH. 11-67

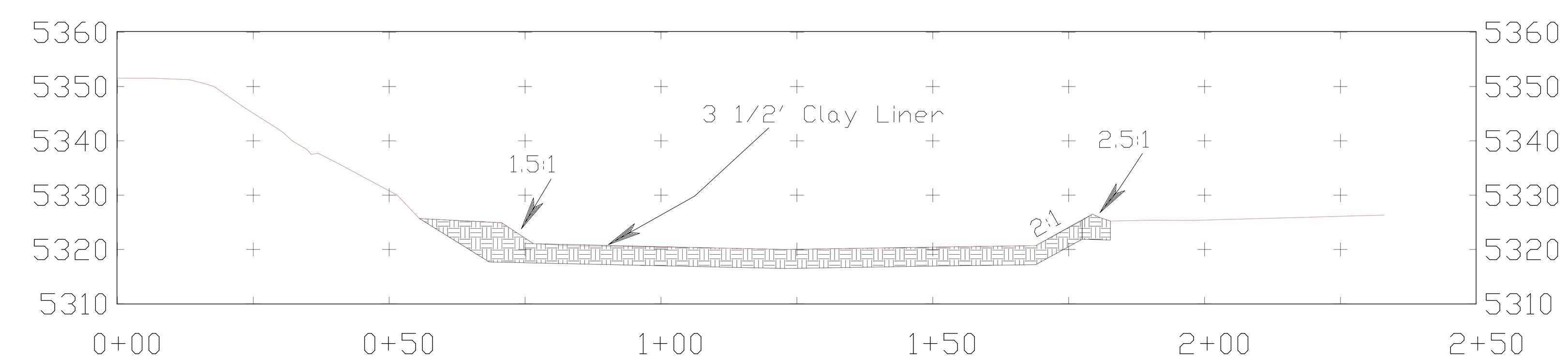
G:\Gis\Permit F\Ch 11\Exh 11-067_Lowe-Railroad Imp 1-2\Design Data\11-67C.prn
PJFoster\ Thu Mar 24 15:29:21 2011



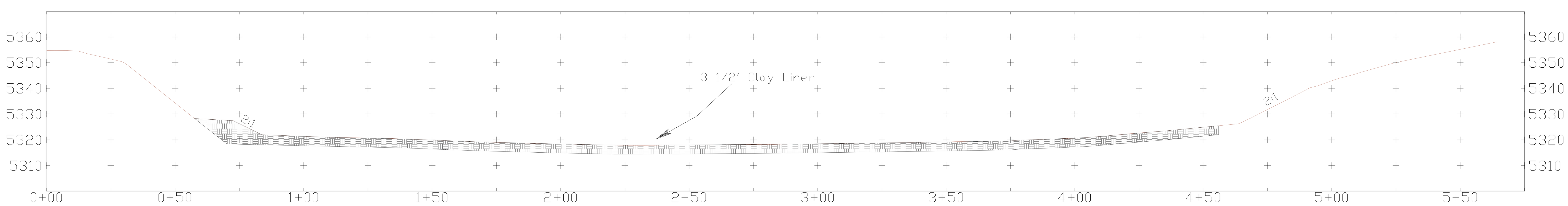
LOCATION MAP
Scale: 1" = 200'



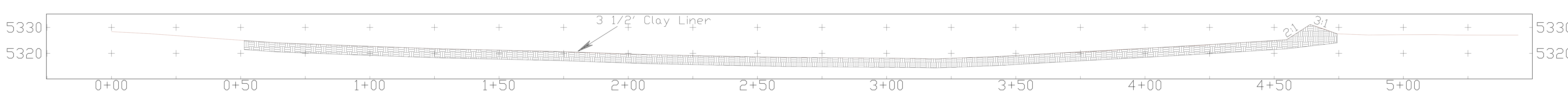
PLAN VIEW
Scale: 1" = 100'



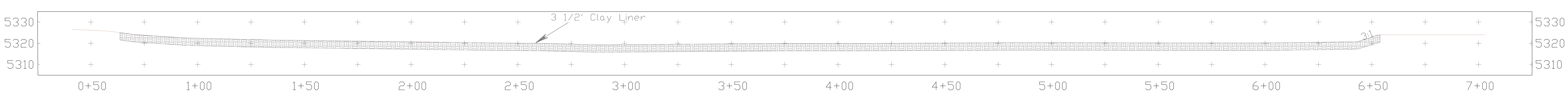
Section A



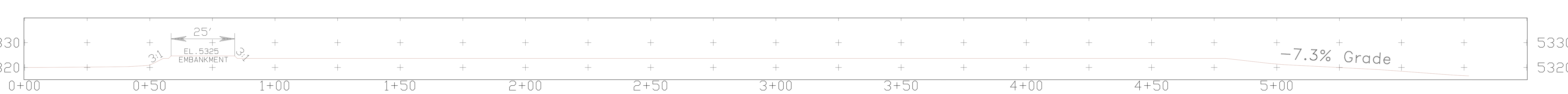
Section B



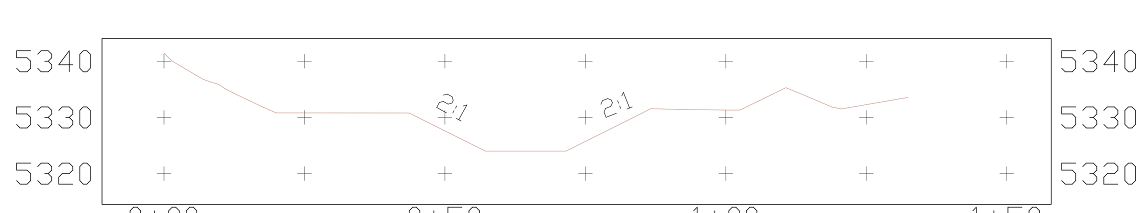
Section C



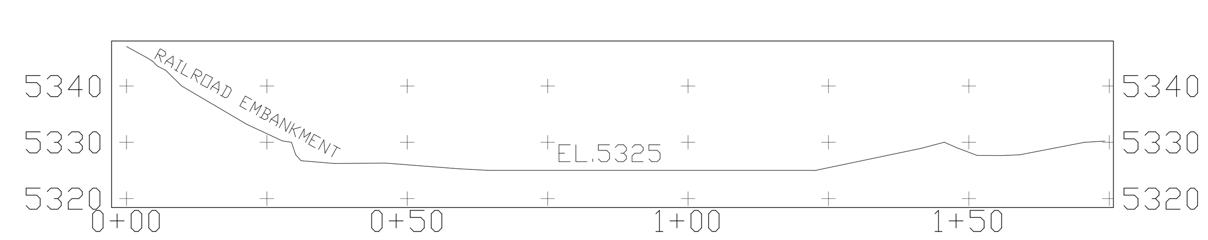
Section D



Section E



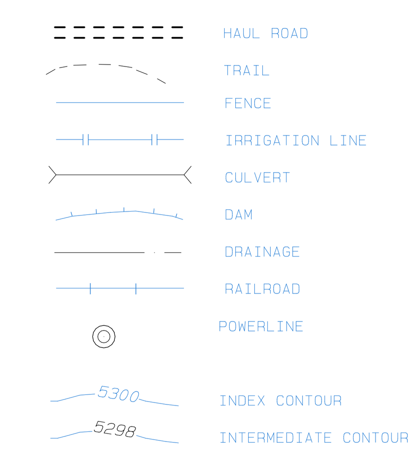
Section F



Section G

CROSS SECTIONS
Horiz. Scale: 1" = 20'
Vert. Scale: 1" = 20'

LEGEND

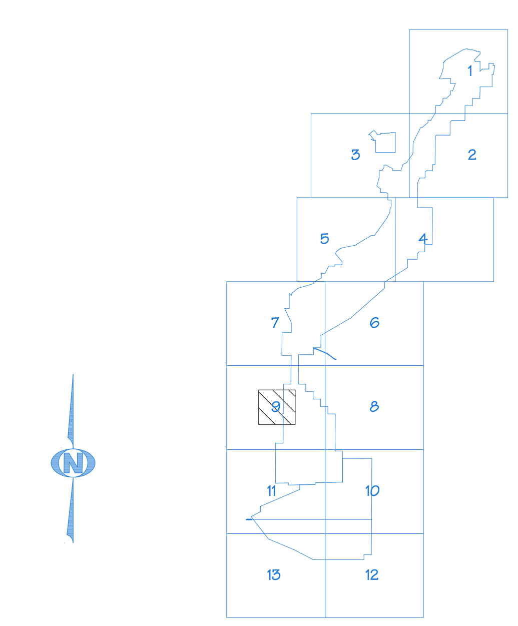


NOTES

1. For hydrology information refer to Appendix 11-Q in the approved PAP.
2. For watershed information refer to Exhibit 11-13E in the approved PAP.
3. TOPOGRAPHY BASED ON SURVEY DATED JANUARY 26, 1998.
4. THIS IMPOUNDMENT IS DESIGNED TO CONTAIN 100 YR-6 HR STORM EVENT THEREFORE NO SPILLWAY REQ'D.

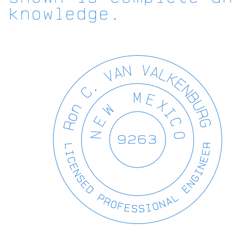
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5318	0.095	0.000	0.000
5319	0.423	0.261	0.261
5320	1.143	0.789	1.049
5321	2.112	1.639	2.689
5322	2.625	2.386	5.075
5323	3.000	2.833	7.908
5324	3.358	3.202	11.110
5325	3.650	3.504	14.614



CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.



REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
08A	02/08/08	SHAWN SMITH	REVISED SPILLWAY OF POND, RE-PROFILE CROSS SECTION E, ADDED CROSS SECTION G, UPDATED TO CURRENT TOPO AND ADDED NOTES 3 AND 4. SUBMITTED TO OSM FOR APPROVAL					
B	01/26/98	FTJ	CHANGED EXH. 11-67B TO 11-67A.					
A	05/27/97	VAH	SUBMITTED TO OSM FOR APPROVAL					

APPROVALS

EXHIBIT 26-15

NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS

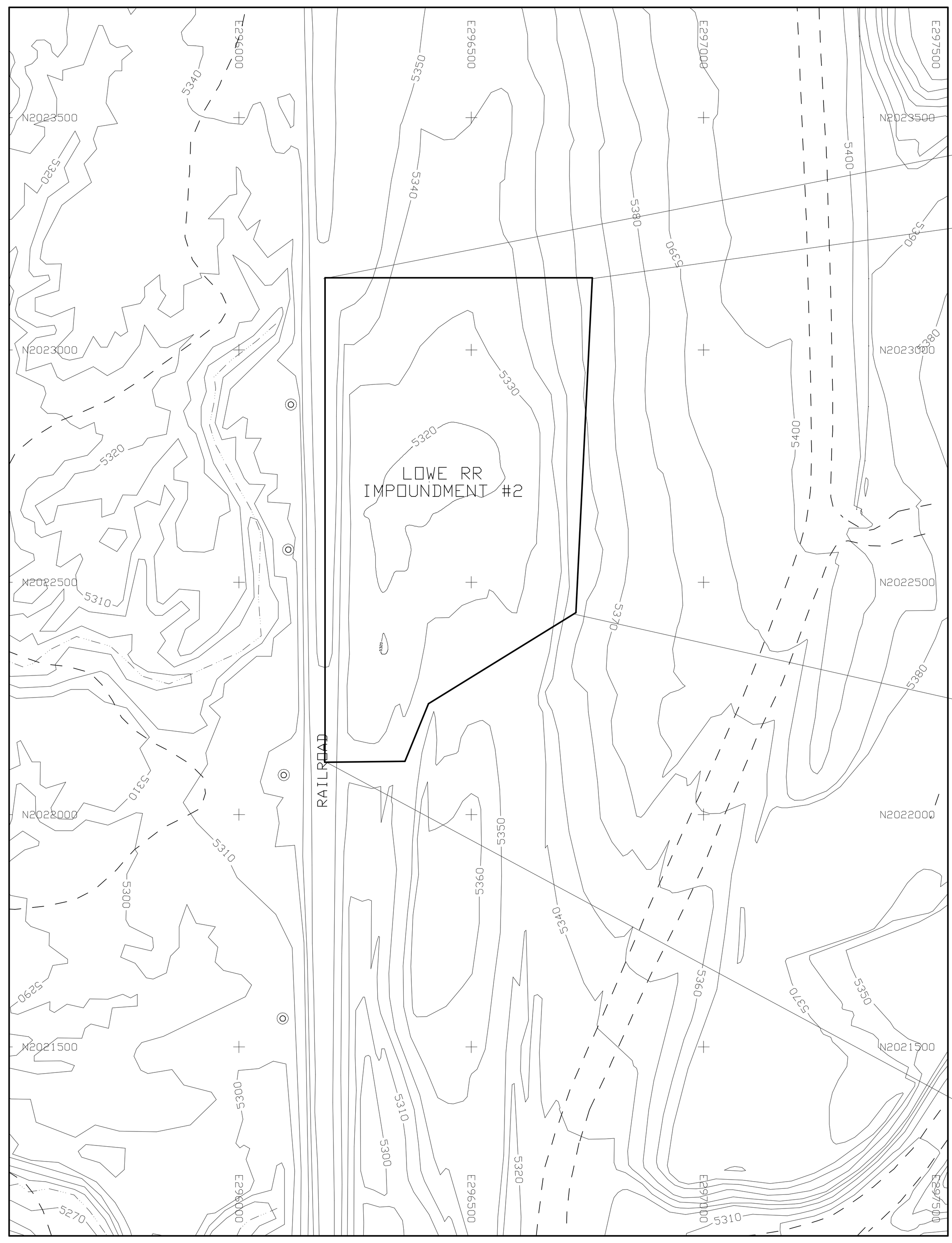
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

AREA 3

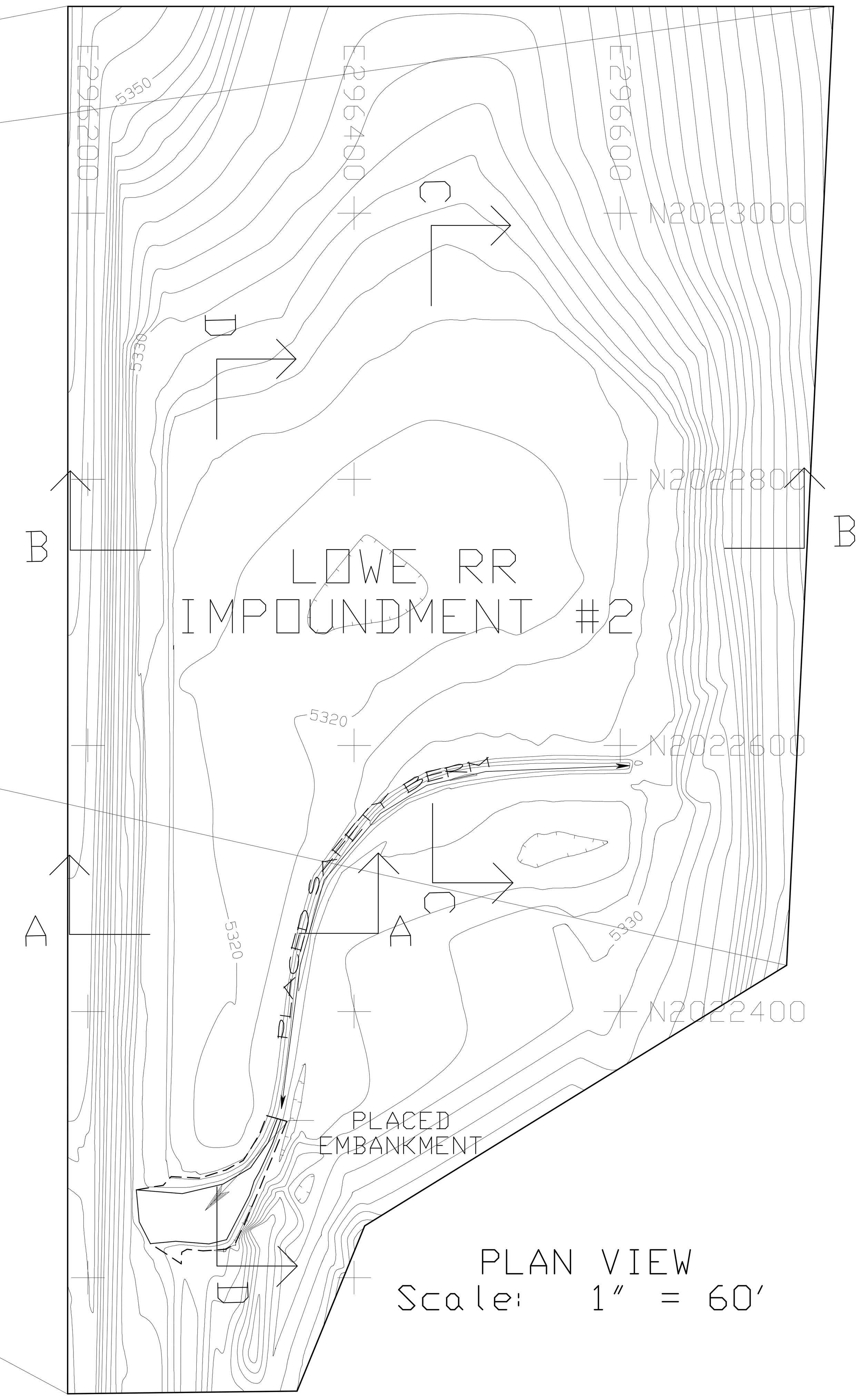
LOWE RAILROAD IMPOUNDMENT #2

PREPARED BY VAH	DRAWN BY VAH	SCALE AS NOTED
APPROVED BY LR	DATE 05/27/97	REF DWG EX. 11-67

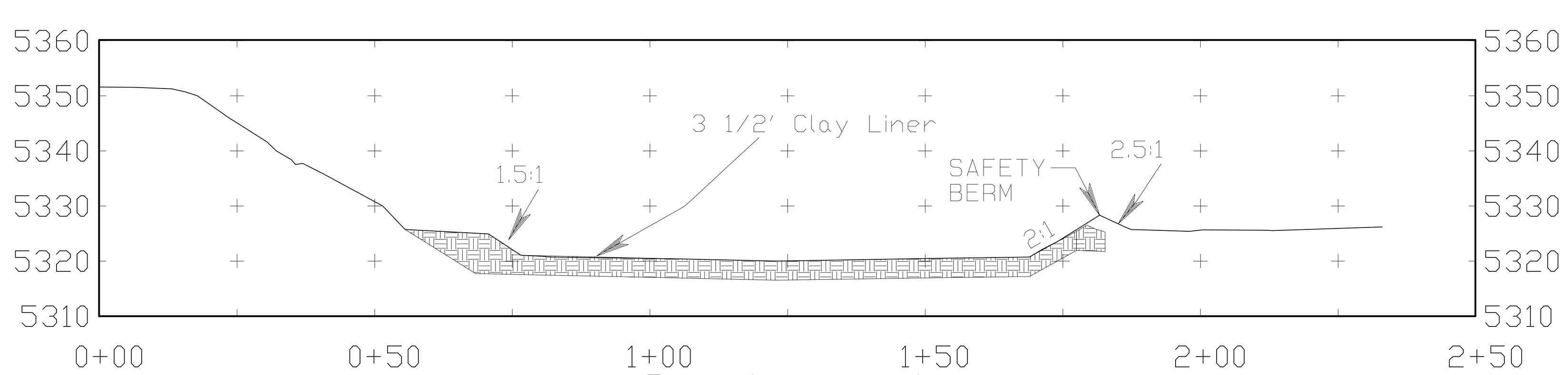
DWG LOC J: \OSM_SUBM\PER_PROG\CH_11\11-67\EXHIBITS\11-67A.PRO



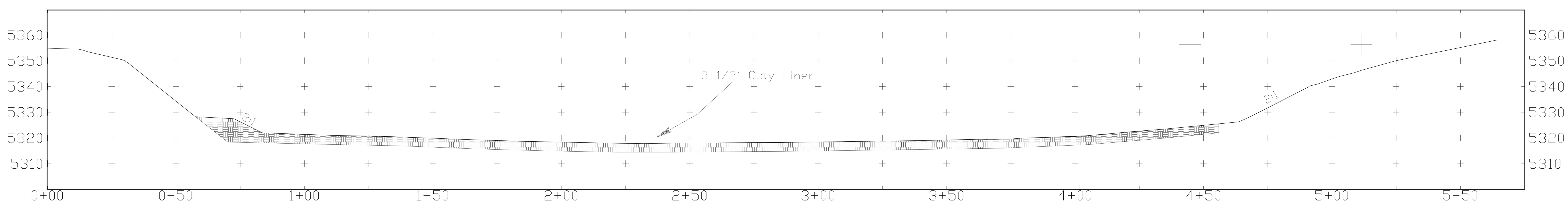
LOCATION MAP
Scale: 1" = 200'



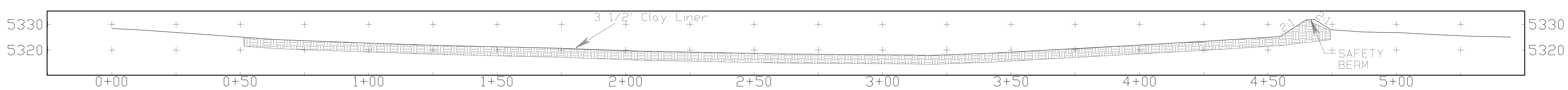
PLAN VIEW
Scale: 1" = 60'



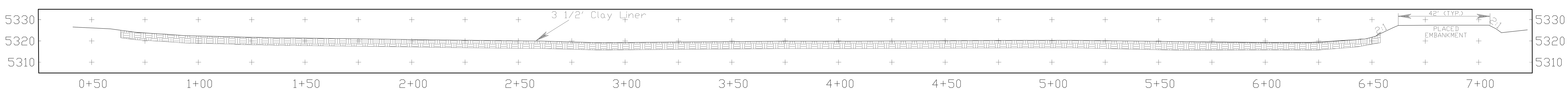
Section A



Section B



Section C



Section D

CROSS SECTIONS
Horiz. Scale: 1" = 20'
Vert. Scale: 1" = 20'

LEGEND

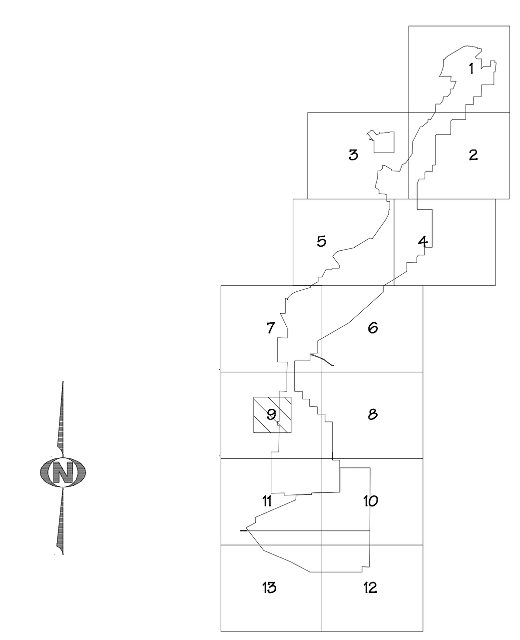
- HAUL ROAD
- TRAIL
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- POWERLINE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR

NOTES

1. For hydrology information refer to Appendix 11-AA in the approved PAP.
2. For watershed information refer to Exhibit 11-13E in the approved PAP.
3. For impoundment and blueline elevation information refer to Table 11-5R.
4. Gauge Post base elevation 5318.0 (GPS)

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5318	0.092	0.000	0.000
5319	0.405	0.248	0.248
5320	1.299	0.852	1.100
5321	2.092	1.695	2.796
5322	2.598	2.345	5.141
5323	2.977	2.788	7.929
5324	3.338	3.155	11.083
5325	3.651	3.488	14.571
5326	3.958	3.797	18.368



CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
08A	06/2/08	RY	UPDATED AS-BUILT TO CURRENT	SS	YB	RCV	BH	RF
A	05/27/97	VAH	SUBMITTED TO OSM FOR REVIEW					

APPROVALS

EXHIBIT 26-15

NAVAJO COAL COMPANY

NAVAJO SAFETY PAYS MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

AREA 3

LOWE RAILROAD IMPOUNDMENT #2
AS - BUILT

PREPARED BY FTJ	DRAWN BY FTJ	SCALE AS NOTED
APPROVED BY RCV	DATE Thu Mar 24 2011	REF DWG EXH. 11-67A
DWG LOC G:\Gs\Permit F\Ch 11\Exh 11-067_Lowe-Railroad Imp 1-2\As		

LEGEND

ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
5338.5 SPOT ELEVATION
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
218 5420.45 LEASE CORNER
L-30
PERMIT/LEASE BOUNDARY

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE'D BY	E.Q.	P.E.	APPR'D DATE
B	6-01-01	PJF	SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	LR	MC	LR	
A	2-9-01	PJF	SUBMITTED TO OSM FOR REVIEW AND APPROVAL. (DRAFT)	LR	MC	LR	

EXHIBIT 26-16

BHP NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS

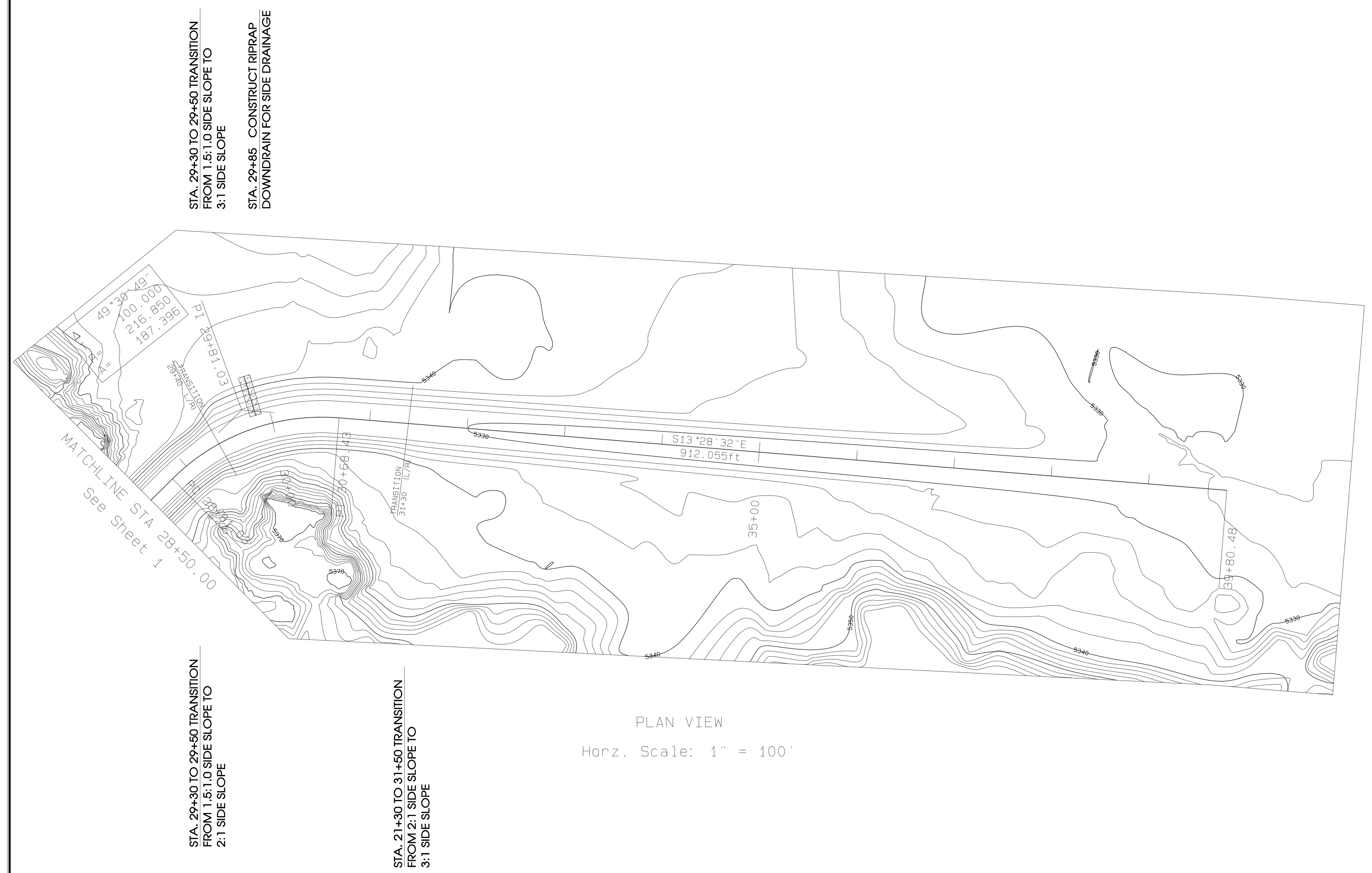
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

NORTH FORK DIVERSION CHANNEL LOCATION AND PIT LAYOUT MAP

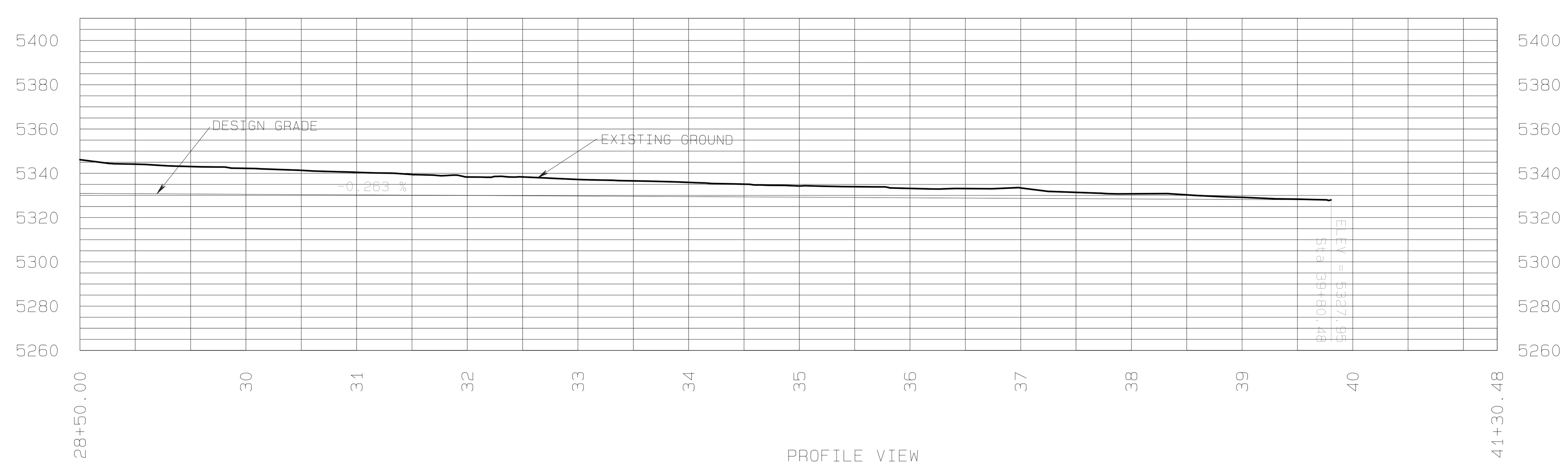
PREPARED BY PJF	DRAWN BY PJFOSTER	SCALE : 1" = 500'
APPROVED BY LR	DATE 11-10-00	

PATH: G:\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBIT\11-142-N FORK DIV CHAN\NORTH FORK DIV

Path: G:\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBIT\11-142-N FORK DIV CHAN\NORTH FORK DIV\Exhibits\EXH 11_142.pro
PJFoster \ Tue Aug 16 11:16:24 2005



PLAN VIEW
Horz. Scale: 1" = 100'



PROFILE VIEW
Vert. Scale: 1" = 50'

NOTE :

1. FOR SUPPORTING DESIGN DATA REFER TO APPENDIX 11-QQ IN THE PAP.

2. THE PLACEMENT OF THE EXCESS CUT MATERIAL OR WASTE IS NOT SHOWN IN THE PLAN VIEW. IT WILL BE PLACED ALONG THE WEST BANK OF THE DIVERSION CHANNEL. DURING THE REMOVAL AND RECLAMATION OF THE DIVERSION THE EXCESS CUT MATERIAL WILL BE USED TO BACKFILL THE DIVERSION. REFER TO THE TYPICAL SECTIONS FOR PLACEMENT OF THE EXCESS CUT MATERIAL.

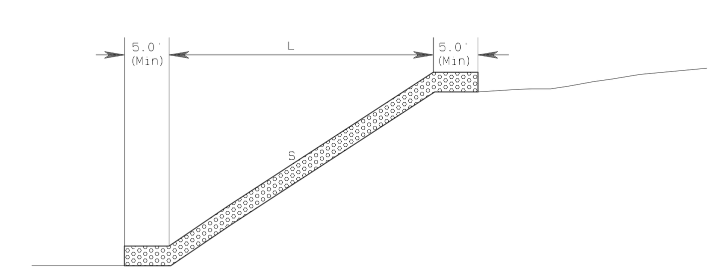
RIPRAPPED DOWNDRAIN SCHEDULE

LOCATION	L (ft)	S (%)	W (ft)	H (ft)	T (ft)	D_{50} ROCK SIZE (IN)
1+55	55	15.0	4.0	1.5	1.0	9
3+50	50	15.0	6.0	1.5	1.0	9
3+80	40	20.0	4.0	1.5	1.0	9
7+30	60	15.0	5.0	1.5	1.0	9
9+82	85	20.0	4.0	1.5	1.0	9
20+80	40	15.0	5.0	1.5	1.0	9
25+95	55	15.0	2.0	1.5	1.0	9
29+85	75	15.0	5.0	1.5	1.0	9

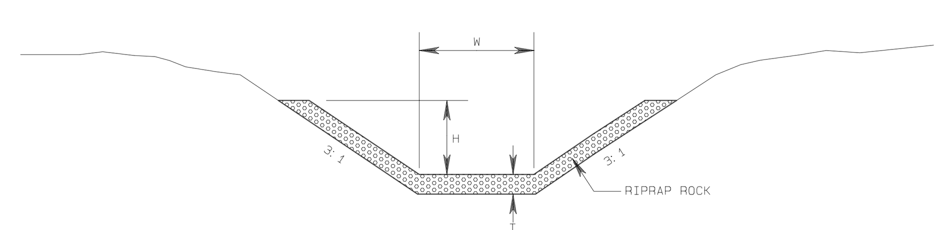
CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

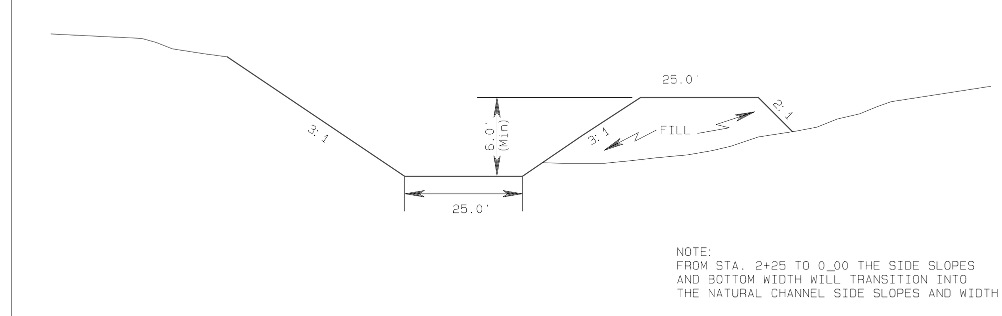
LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER



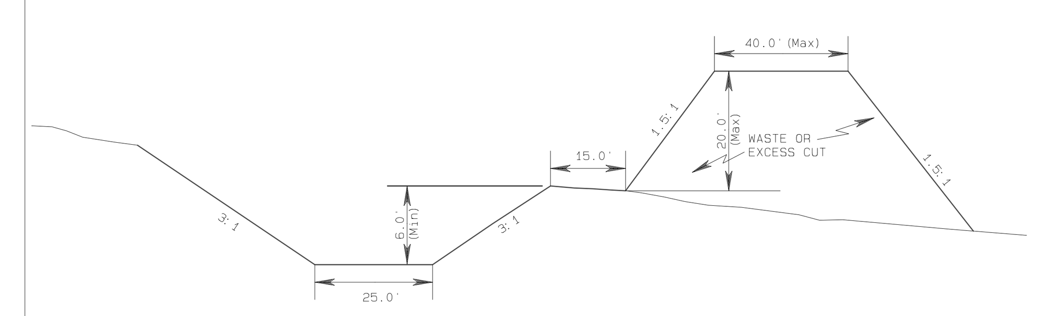
TYPICAL PROFILE
RIPRAPPED DOWNDRAIN
N.T.S.



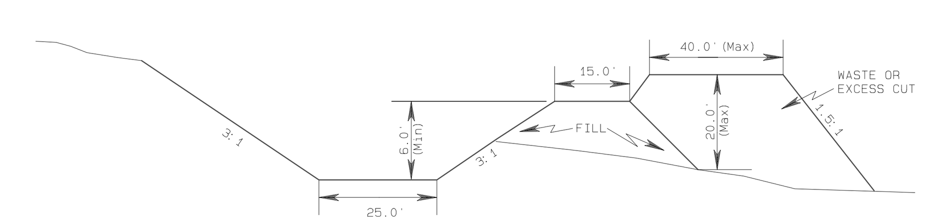
TYPICAL SECTION
RIPRAPPED DOWNDRAIN
N.T.S.



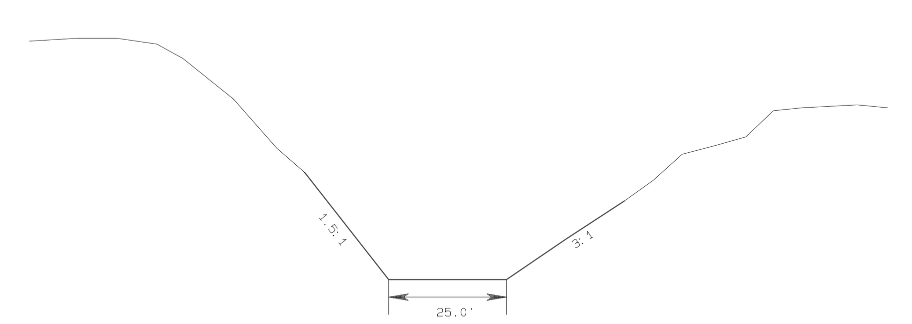
TYPICAL SECTION
N.T.S.
STA. 0+00 TO 3+00



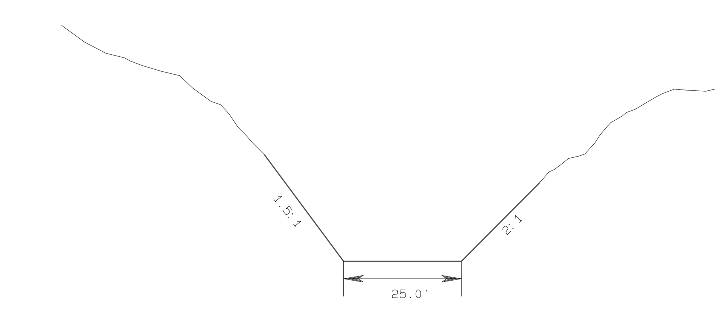
TYPICAL SECTION
N.T.S.
STA. 3+00 TO 3+80
STA. 5+35 TO 19+30



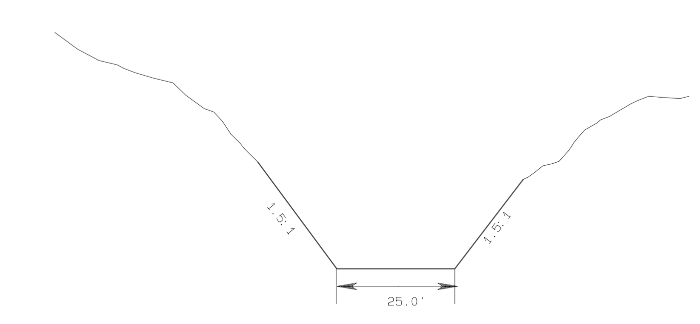
TYPICAL SECTION
N.T.S.
STA. 3+80 TO 5+35
STA. 19+30 TO 26+37



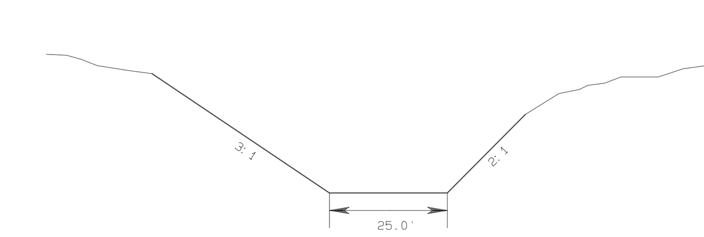
TYPICAL SECTION
N.T.S.
STA. 26+57 TO 26+88



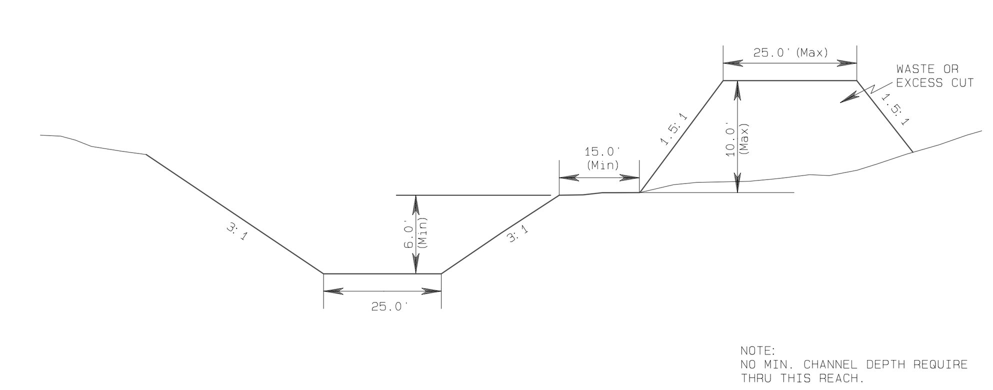
TYPICAL SECTION
N.T.S.
STA. 27+08 TO 27+85



TYPICAL SECTION
N.T.S.
STA. 28+05 TO 29+30



TYPICAL SECTION
N.T.S.
STA. 29+50 TO 31+30



TYPICAL SECTION
N.T.S.
STA. 31+50 TO 39+80

PROJECT MANAGER: Cory Nelson	REV No.	DESCRIPTION	REV BY	DATE
ENGR. of RECORD: Leonard Raymond	1	SUBMITTED TO OSM FOR REVIEW AND APPROVAL. (DRAFT)	PJF	2-09-01
REG. NO: 6600	2	SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	PJF	6-01-01
SRVYR of RECORD: W. Benally	3			
REG. NO: 11952	4			
	5			

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

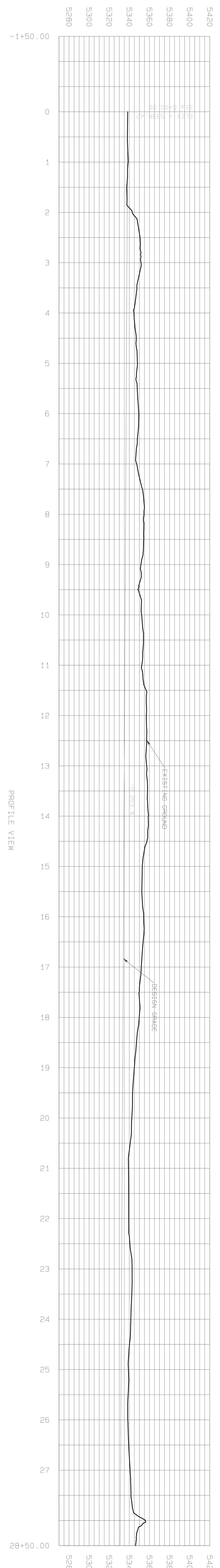
ACCOUNT: N1675
DATE: Nov. 10, 2000
DESIGNED BY: PJFOSTER
DRAWN BY: PJFOSTER
CHECKED BY: LRAYMOND
APPROVED BY: LRAYMOND

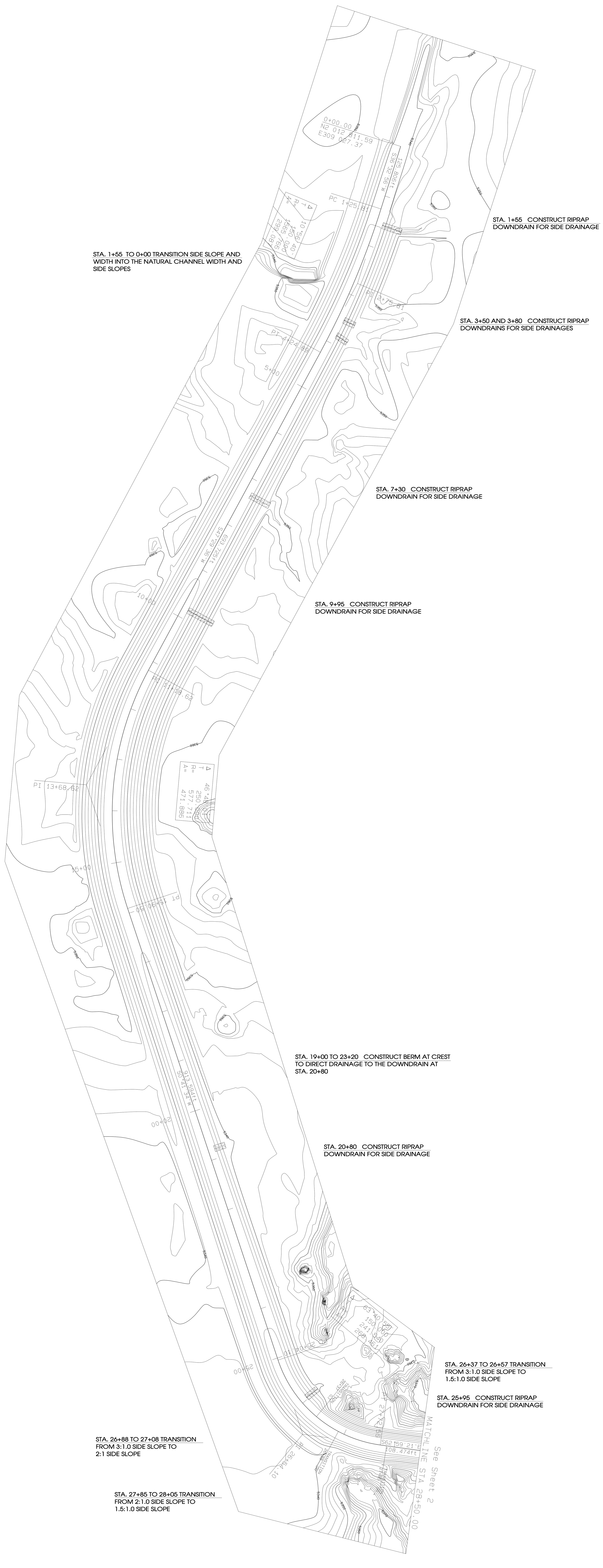
PLAN, PROFILE AND SECTIONS

EXHIBIT 26-17
NORTH FORK
DIVERSION CHANNEL

DRAWING P/P-2
SHEET OF 2

Path: G:\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBIT\11-142-N FORK DIV CHAN\NORTH FORK DIV\Exhibits\EXH_11-142B_142C.pro
PJFoster\Tue Aug 16 10:57:02 2005





NOTE:

1. FOR SUPPORTING DESIGN DATA REFER TO APPENDIX 11-QQ IN THE PAP
2. FOR TYPICAL CHANNEL SECTIONS REFER TO EXHIBIT 11-142C.
3. THE PLACEMENT OF THE EXCESS CUT MATERIAL OR WASTE IS NOT SHOWN IN THE PLAN VIEW. IT WILL BE PLACED ALONG THE WEST BANK OF THE DIVERSION CHANNEL. DURING THE REMOVAL AND RECLAMATION OF THE DIVERSION THE EXCESS CUT MATERIAL WILL BE USED TO BACKFILL THE DIVERSION. REFER TO THE TYPICAL SECTIONS ON EXHIBIT 11-142C FOR PLACEMENT OF THE EXCESS CUT MATERIAL.
4. THE RIPRAPPED DOWNDRAIN SCHEDULE IS ON EXHIBIT 11-142C.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

SHEET 2 OF 1 DRAWING P/P-1	**EXHIBIT 26-17** NORTH FORK DIVERSION CHANNEL	***PLAN, PROFILE AND SECTIONS***	ACCOUNT: N167S DATE: Nov. 10, 2000 DESIGNED BY: PJFOSTER DRAWN BY: PJFOSTER CHECKED BY: LRAYMOND APPROVED BY: LRAYMOND	**BHP NAVAJO COAL CO.** NAVAJO MINE PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

PROJECT MANAGER: Cory Nelson
ENGR. of RECORD: Leonard Raymond
REG. NO: 6600
SRVYR of RECORD: W. Benally
REG. NO: 11952

REV No.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR REVIEW AND APPROVAL. (DRAFT)	PJF	2-09-01
2	SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	PJF	6-01-01
3			
4			
5			

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PJFoster\Tue Aug 16 10:56:17 2005

NOTES

1. For hydrology and design information refer to Appendix 11-GG in the approved PAP.

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- SPOT ELEVATION (x5338.5)
- INDEX CONTOUR (5300)
- INTERMEDIATE CONTOUR (5298)
- LEASE CORNER (218 / 5422.45 / L-30)
- LEASE/PERMIT BOUNDARY

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND — NEW MEXICO — 6600 — REGISTERED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE'D BY	E.Q.	P.E.	APPR'D DATE
B	6-01-01	PJF	SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	LR	MC	LR	
A	2-09-01	PJF	SUBMITTED TO OSM FOR REVIEW AND APPROVAL. (DRAFT)	LR	MC	LR	

EXHIBIT 26-18

BHP NAVAJO COAL COMPANY

NAVAJO MINE — SAFETY PAYS

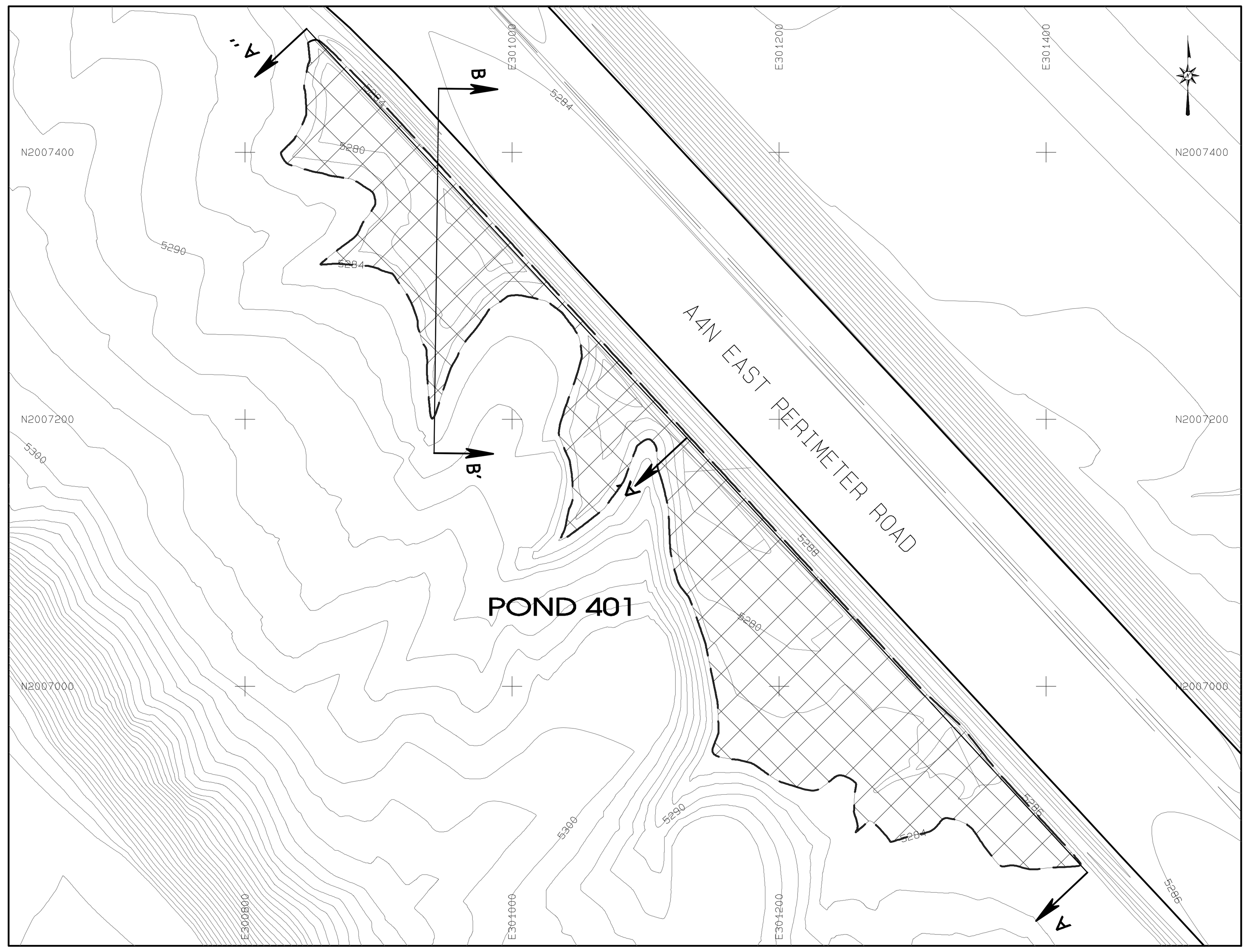
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

NORTH FORK DIVERSION CHANNEL

SEDCAD WATERSHED SUBDIVISIONS

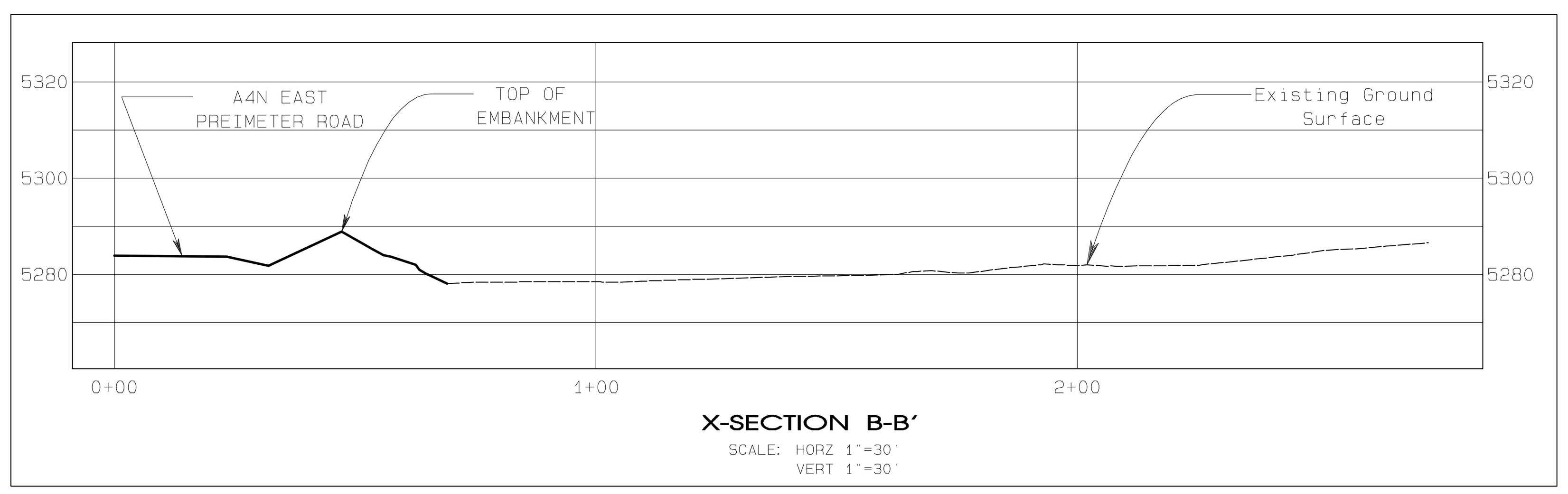
PREPARED BY PJF	DRAWN BY PJF	SCALE 1"= 2000'
APPROVED BY LR	DATE 11/08/00	

PATH: G: \Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBIT\11-142-N FORK DIV CHAN\NORTH FORK



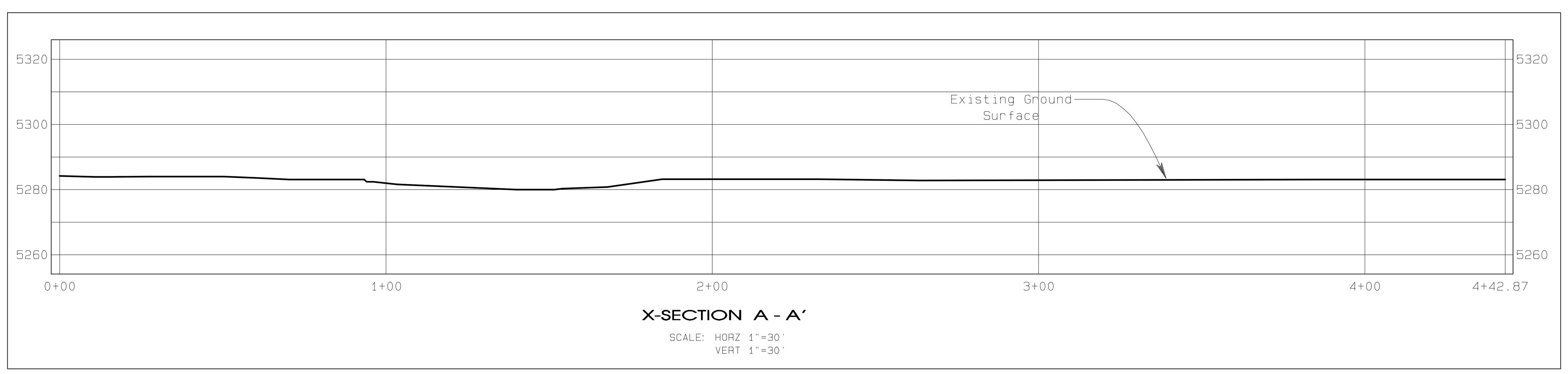
PLAN VIEW

CONTOUR INT: 2 FT
SCALE: 1"=80'



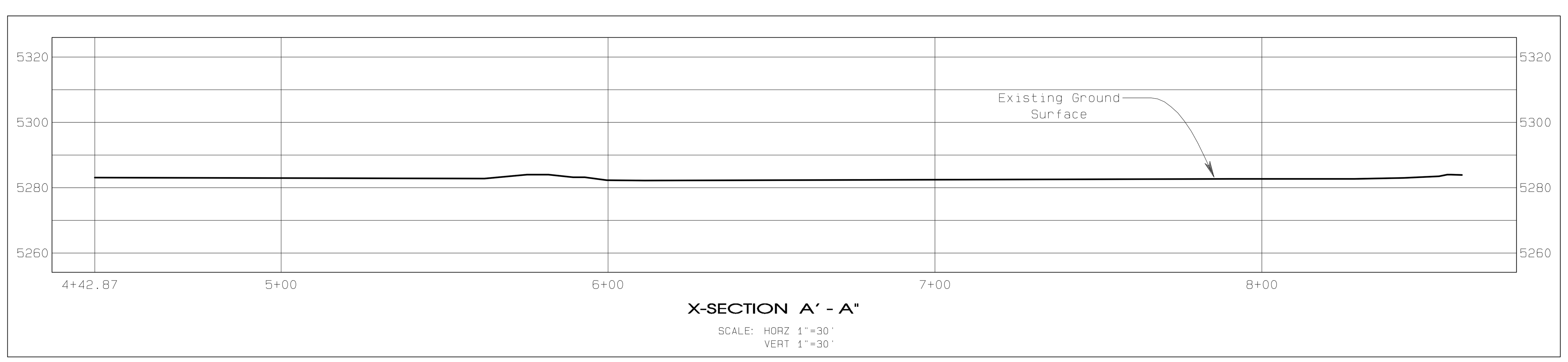
X-SECTION B-B'

SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION A - A'

SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION A' - A"

SCALE: HORZ 1"=30'
VERT 1"=30'

LEGEND

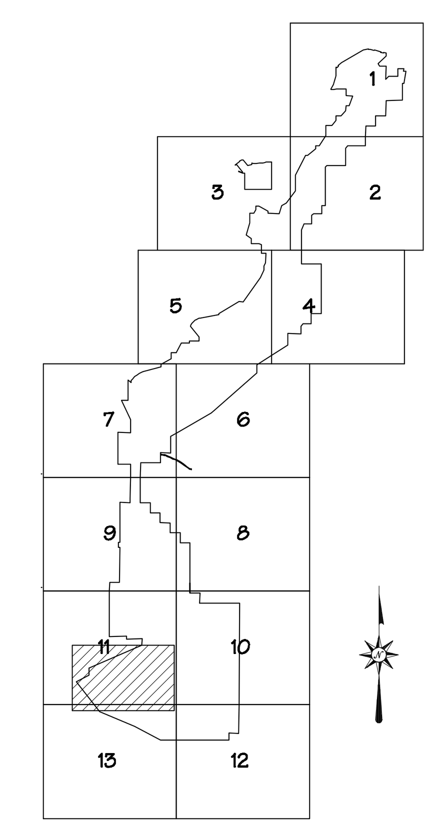
- ROAD
- BUILDING
- FENCE
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5274	0.046	0.00	0.00
5276	0.199	0.20	0.20
5278	0.471	0.70	0.90
5280	0.949	1.40	2.30
5282	1.237	2.20	4.50



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

REVISION	DATE
09-A UPDATED A4N DEVELOPMENT AND SUBMITTED TO OSM FOR REVIEW	8/28/09
11-A AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	FEB-2011

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO: NM 9263
SRVYR of RECORD:
REG. NO:

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

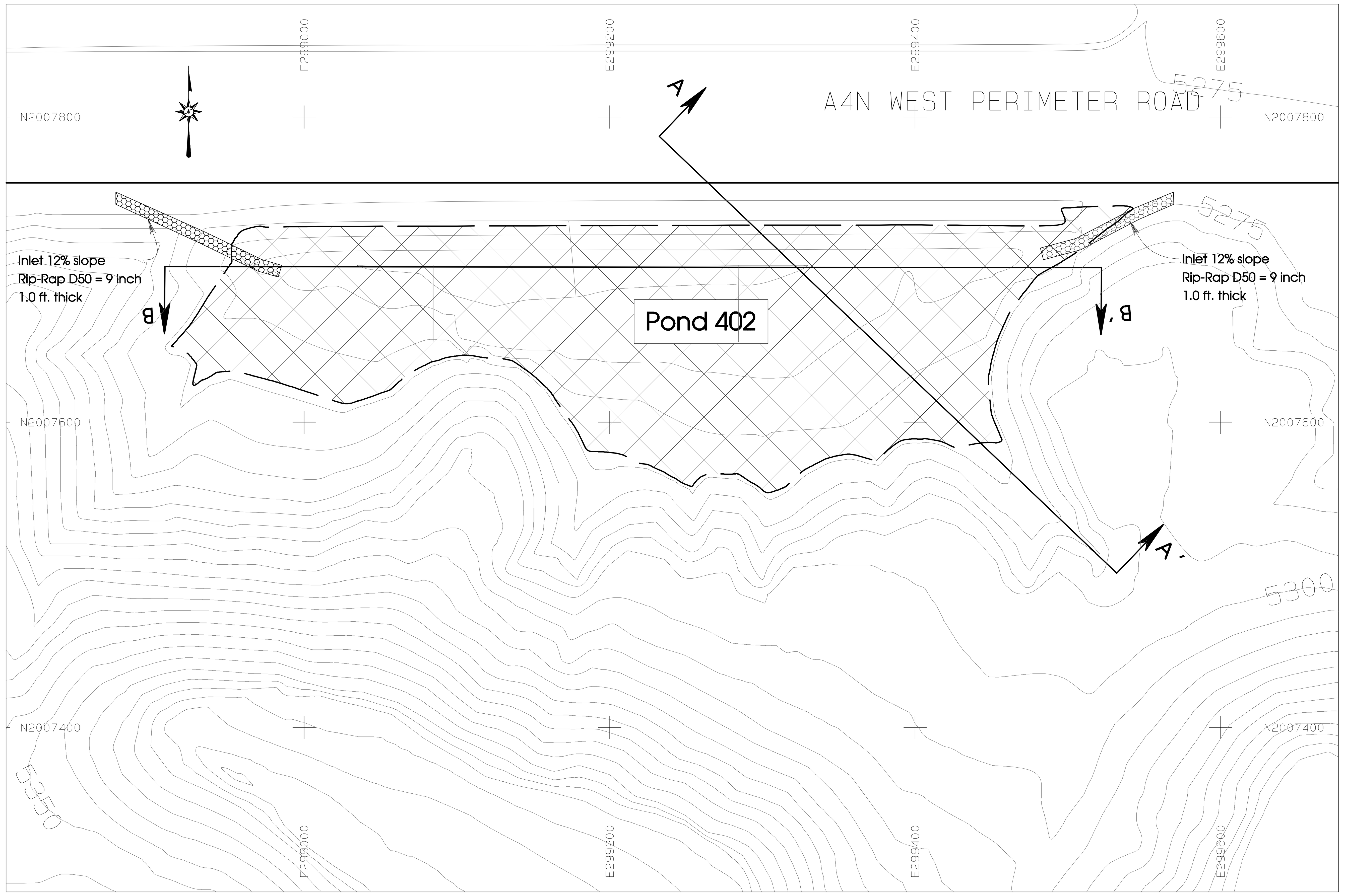
PROJECT: A4N
DATE: AUG.8,2009
DESIGNED BY: RCV
DRAWN BY: PJFOSTER
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 26-19
AREA 4 NORTH POND 401 Design

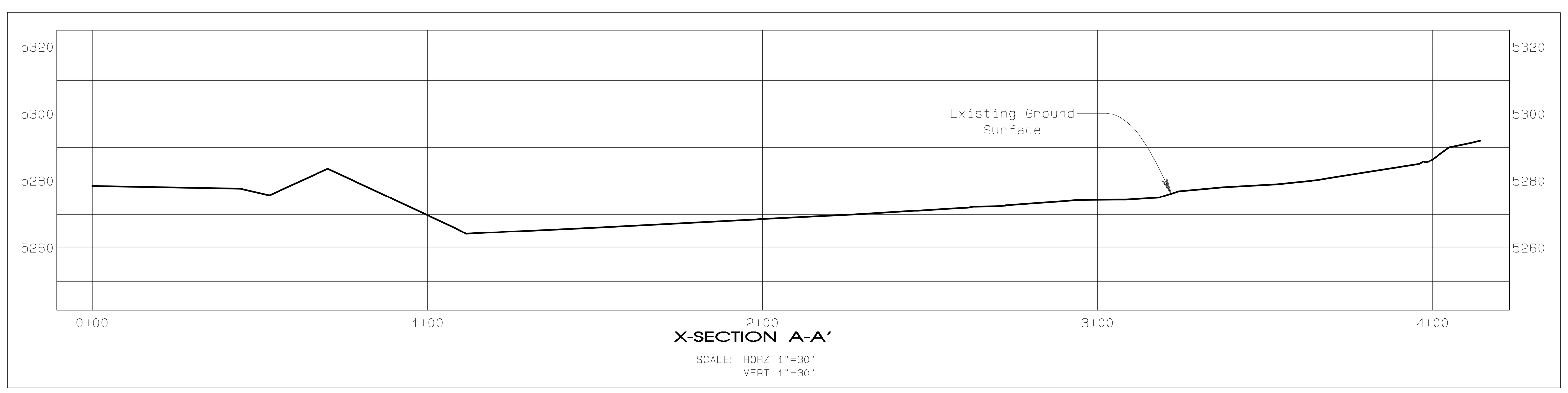
DRAWING
SHEET OF 0

G:\Gs\Permit F\Ch 11\Exh 11-001_A4N_PD 401\OSM Subm-12011\Exh 11-01D_A4N_Pond 401_Design.pro
Tue Feb 15 09:43:49 2011



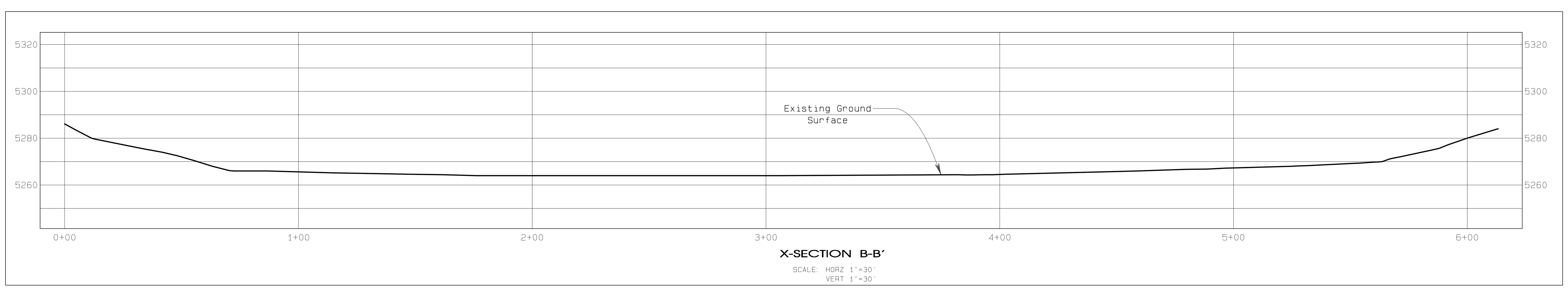
PLAN VIEW

SCALE: 1"=80'



X-SECTION A-A'

SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION B-B'

SCALE: HORZ 1"=30'
VERT 1"=30'

LEGEND

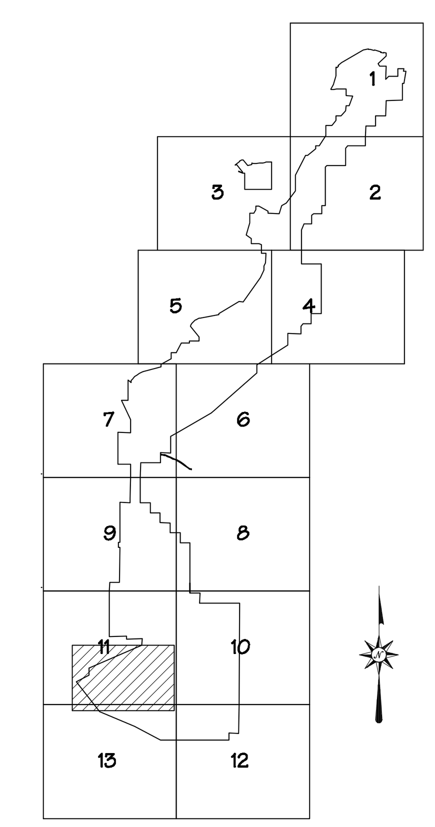
ROAD
BUILDING
FENCE
CULVERT
DRAINAGE
POWERLINE
INDEX CONTOUR (5300)
INTERMEDIATE CONTOUR (5298)
PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5260	0.09	0.00	0.00
5262	0.31	0.40	0.40
5264	0.49	0.80	1.20
5266	0.66	1.10	2.30
5268	0.84	1.50	3.80
5270	1.06	1.90	5.70
5272	1.31	2.40	8.10
5274	1.54	2.90	11.00
5276	1.75	3.30	14.30



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

RON C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

REVISION	DATE
09-A UPDATED A4N DEVELOPMENT AND SUBMITTED TO OSM FOR REVIEW	8/26/09
11-A AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	FEB-2011

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO: NM 9263
SRVYR of RECORD:
REG. NO:

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

PROJECT: A4N
DATE: AUG.8,2009
DESIGNED BY: RCV
DRAWN BY: PJFOSTER
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 26-20
AREA 4 NORTH
POND 402
Design

DRAWING
SHEET
OF 0

G:\Gs\Permit F\Ch 11\Exh 11-002-03_A4N PDS 402-403\OSM SuBM-12011\Exh 11-02D_03D_Pond -402_403_Design.pro
Tue Feb 15 09:53:33 2011

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Area 4 North Pond 404

Update 13-06.

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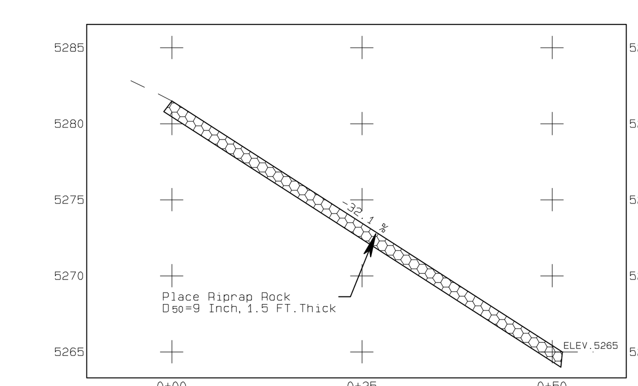
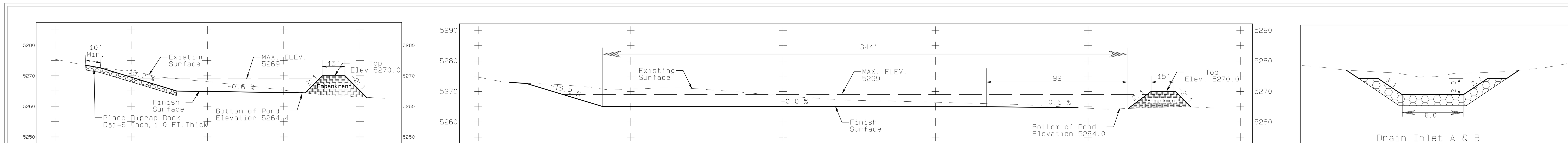
Area 4 North Pond 405

Update 13-06.

PLAN VIEW
1"=100'



PROFILE INLET B
HORIZ. - 1"=20'
VERT. - 1"=10'

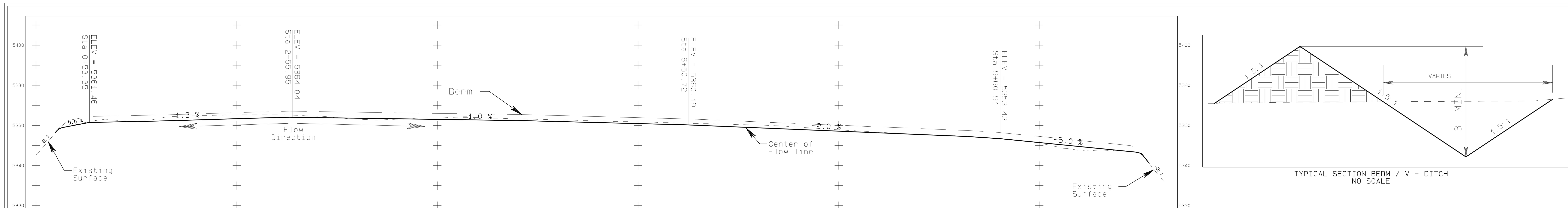


CROSS SECTION A - A
HORIZ. - 1"=40'
VERT. - 1"=20'

PROFILE B - B
HORIZ. - 1"=40'
VERT. - 1"=20'

TYPICAL CROSS SECTION
NO SCALE

PROFILE AND CROSS SECTIONS
OF AREA 4 NORTH POND 413



PROFILE CENTER OF BERM
HORIZ. - 1"=60'
VERT. - 1"=30'

TYPICAL SECTION BERM / V - DITCH
NO SCALE

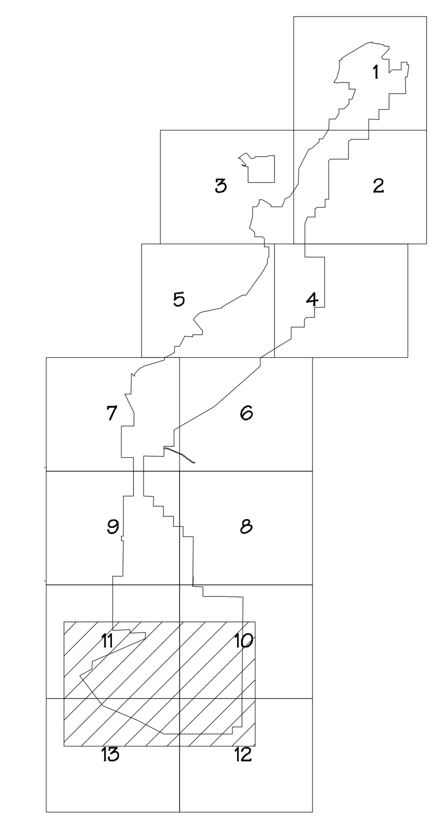
PROFILE AND CROSS SECTION OF BERM

LEGEND

ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
×5338.5 SPOT ELEVATION
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
218 5422.45
L-30 LEASE CORNER
PERMIT/LEASE BOUNDARY
DRAIN FLOW PATH

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
1. Refer to Exhibit 11-13F for watershed information and location of ponds.



SCALE AS NOTED

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5264	0.01	0.0	0.00
5265	0.42	0.22	0.22
5266	0.47	0.44	0.66
5268	0.55	0.51	1.68
5270	0.67	0.61	2.90

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

Ron C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

REVISION	DATE
1 SUBMITTED TO OSM FOR APPROVAL	01/15/10
11-A AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	FEB-2011

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO. 9263
SRVYR of RECORD:
REG. NO.

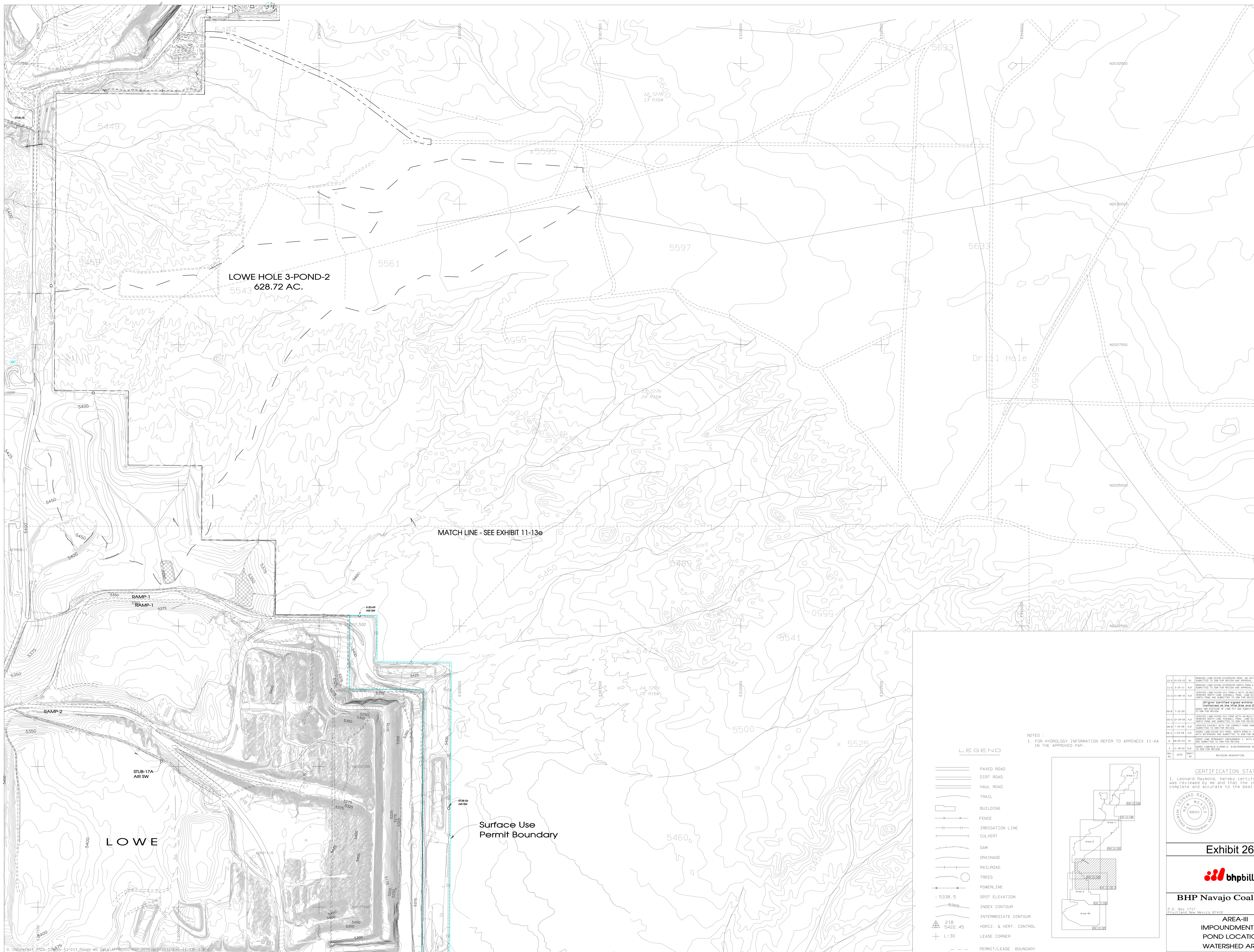
bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717,FRUITLAND,NEW MEXICO,87416 PHONE 505-598-3209/FAX 505-598-3361

ACCOUNT:
DATE: 01-26-10
DESIGNED BY: RCV
DRAWN BY: RY
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTIONS

EXHIBIT 26-23
AREA 4 NORTH
POND 413
Design

DRAWING
SHEET 1 OF 1



NOTES :
1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE'D BY	E.Q.	P.E.	APPROVED DATE
12-A	10-23-12	RY	REMOVED LOWE-DIXON DIVERSION POND, WS DATA AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	LR	KH	LR	
11-A	3-15-11	PJF	REMOVED LOWE-DIXON DIVERSION NORTH POND-A AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	RCV	SO	RCV	
10-A	01-08-10	PJF	UPDATED LOWE-DIXON DIV POND-A WITH AS-BUILT DATA, REMOVED NORTH LOWE HIGHWALL POND, LOWE-DIXON DIV NORTH POND AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV	
09-B	7-12-09		Original Certified signed exhibits are maintained at the Mine Site and OSM ADDED IBR EASTSIDE OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	KAB	
09-A	12-18-09	PJF	UPDATED LOWE-DIXON DIV POND WITH AS-BUILT DATA, REMOVED NORTH LOWE HIGHWALL POND, LOWE-DIXON DIV NORTH POND AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV	
08-B	7-15-08	PJF	UPDATED EXHIBIT WITH THE CORRECT POND NAMES AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV	
08-A	1-23-08	PJF	ADDED LOWE-DIXON DIV POND, NORTH POND-A, NLH POND WITH WATERSHED AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV	
B	08-20-03	RY	ADDED LOWE PERMANENT IMPOUNDMENT 1, WITH WATERSHED AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR	
A	11-18-02	PJF	ADDED LOWEHOLE-3_POND-2, W/WATERSHEDAND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR	

APPROVALS

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

Exhibit 26-24

BHP Navajo Coal Company

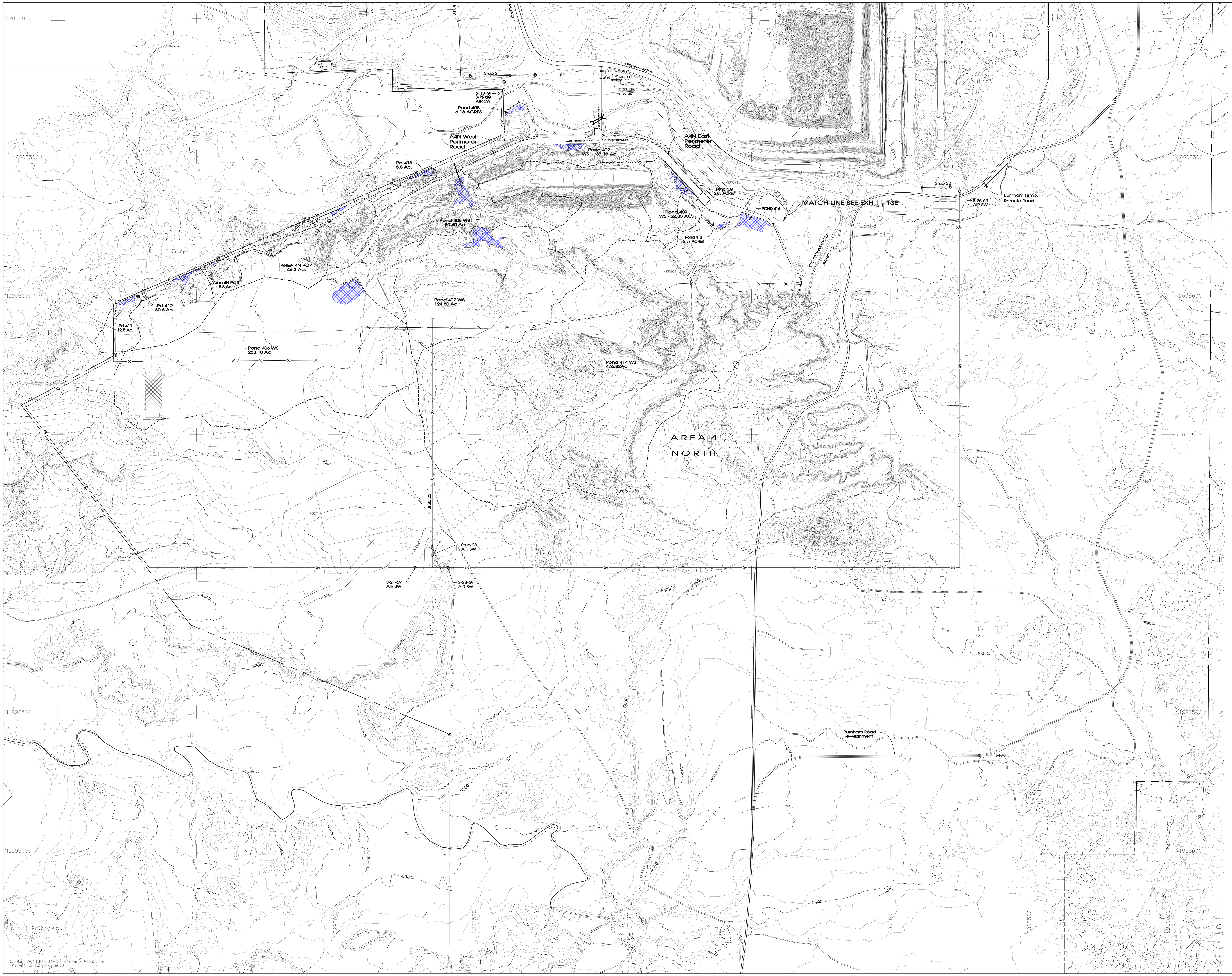
P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-4200
Fax: 505-568-3361

AREA-III IMPOUNDMENT AND POND LOCATIONS/ WATERSHED AREAS

PREPARED BY PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE Nov. 15, 2002	

MAP LOCATION: (See Lower Left Corner)



LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 5422.45 HORIZ. & VERT. CONTROL
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY
- WATERSHED BOUNDARY
- A4N PONDS

NOTES :
1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.

500 0 500 1000

CONTOUR INTERVAL: 10'
DATE OF PHOTOGRAPHY: MAY, 2010

Revised by
Aero - Graphics, Inc.
40 West Oakland Avenue
Salt Lake City, Uath 84115

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE'D BY	E.Q.	P.E.
13-A	4-12-2013	RY	Removed Pond 415 and Updated pond 414 watershed and submitted to OSM for Review and Approval.	LR	KH	LR
12-A	10-23-2012	PJF/RY	Updated Pond 401, 402, 405 watershed and added pond 414, 415 watershed and submitted to OSM for Review and Approval.	LR	KH	LR
11-B	Aug-2011	PJF	Updated Area 4 North road label and submitted to OSM for Review and Approval.	LR	SO	LR
11-A	FEB-2011	PJF	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	RCV	SO	RCV
10-B	10-29-10	PJF	REVISED WATERSHED FOR POND AS-BUILT IN A4N AND SUBMITTED TO OSM FOR REVIEW (NOT SUBMITTED)	RCV	YB	RCV
10-A	1-28-10	PJF	ADDED PROPOSED AREA 4 NORTH PONDS 411, 412, 413 AND REVISED WATERSHEDS FOR AREA 4N PONDS 3, 4 AND SUBMITTED TO OSM FOR REVIEW.	RCV	YB	RCV
09-B	12-07-09	PJF	ADDED AS-BUILT AREA 4 NORTH PONDS 408, 409, 410 WITH WATERSHED AND SUBMITTED TO OSM FOR REVIEW.	RCV	YB	RCV
09-A	8-28-09	PJF	ADDED PROPOSED AREA 4 NORTH REVISION AND SUBMITTED TO OSM FOR REVIEW.	RCV	YB	RCV
C	11-17-04	PJF	ADDED A4N DATA AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR
B	7-29-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR
A	11-05-95	PJF	SUBMITTED TO OSM FOR APPROVAL			
				APPROVALS		

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 26-25

bhpbilliton

BHP Navajo Coal Company

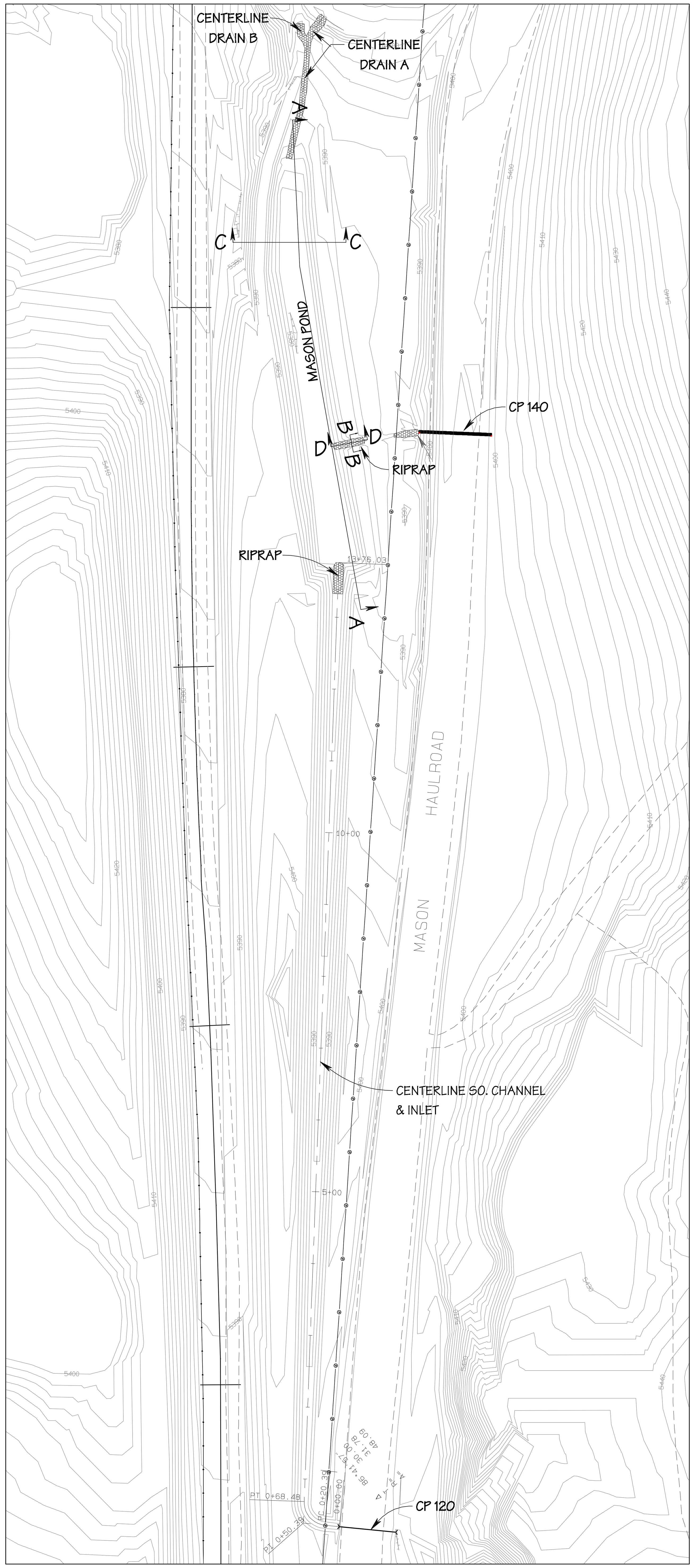
P.O. Box 1717
Fruitland, New Mexico, 87416

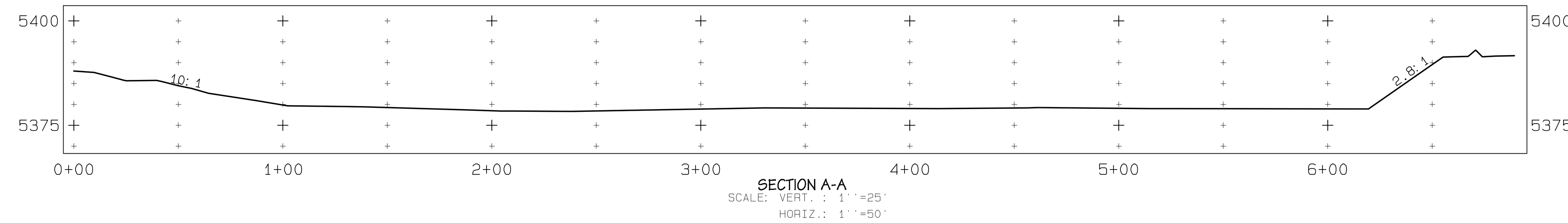
Phone: 505-598-4200
Fax: 505-598-3361

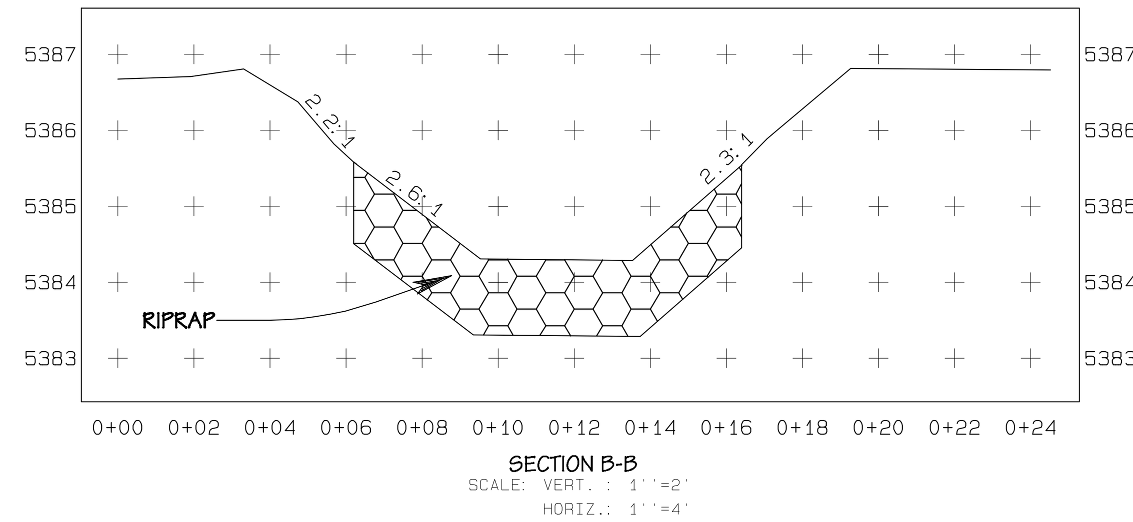
AREA 4N IMPOUNDMENT AND POND LOCATIONS/ WATERSHED AREAS

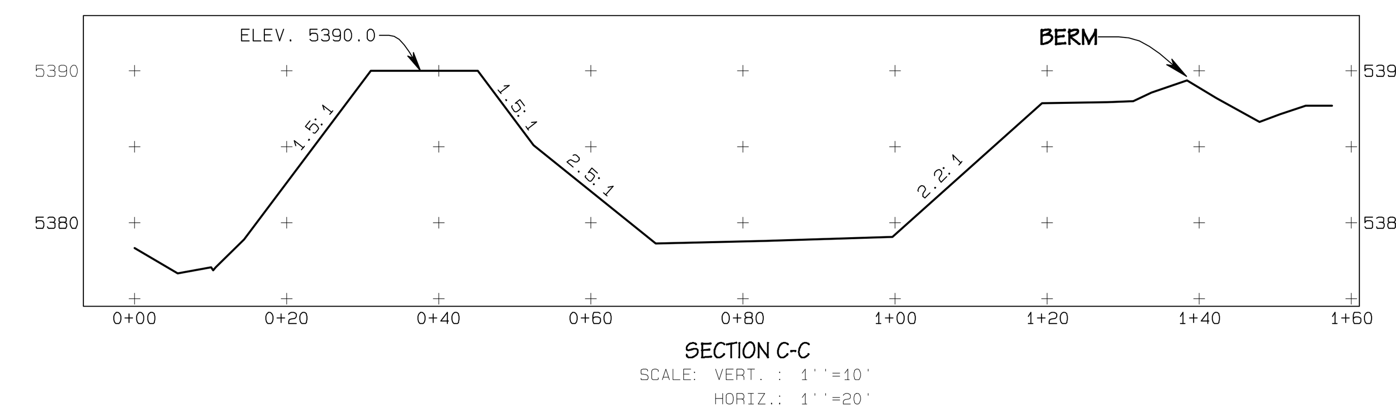
PREPARED BY RY/LR	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE Nov. 12, 2004	

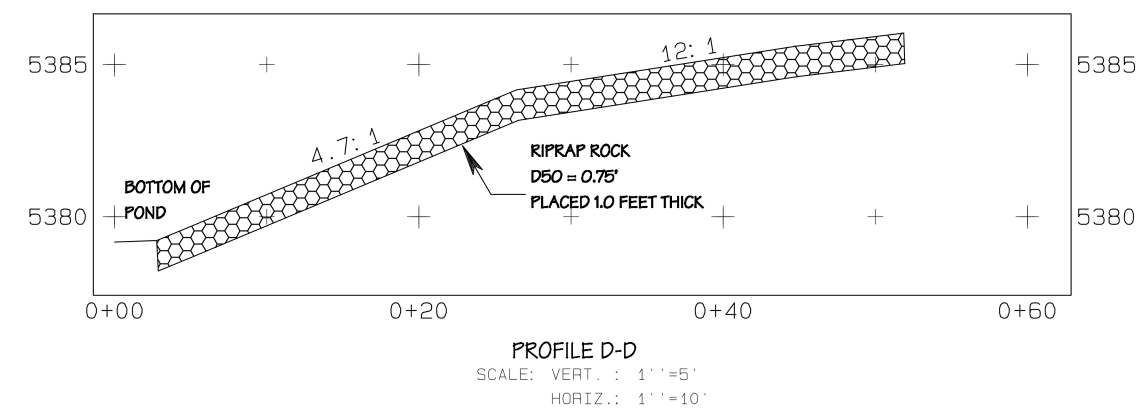
MAP LOCATION (See Lower Left Corner)

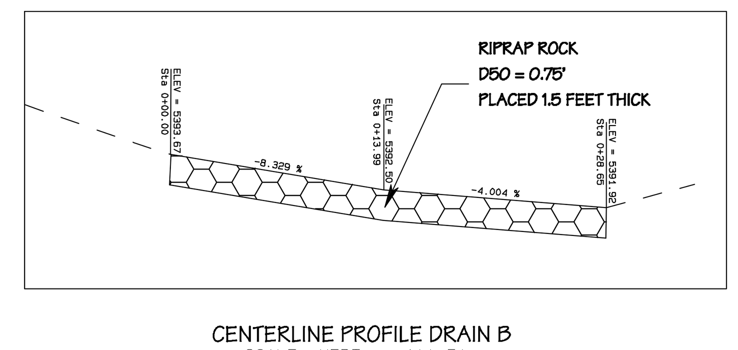


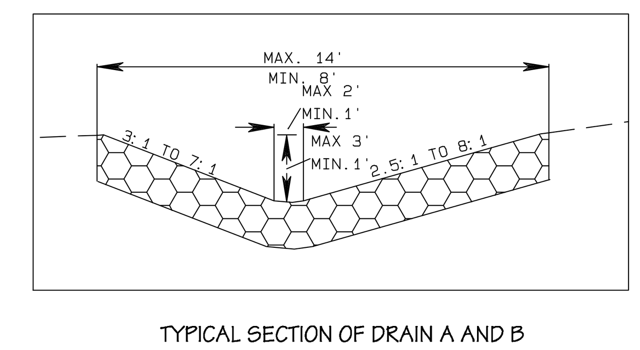


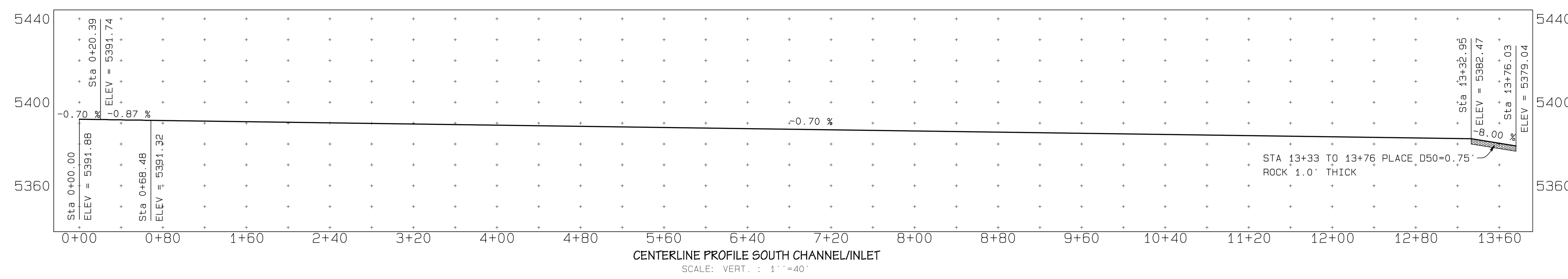


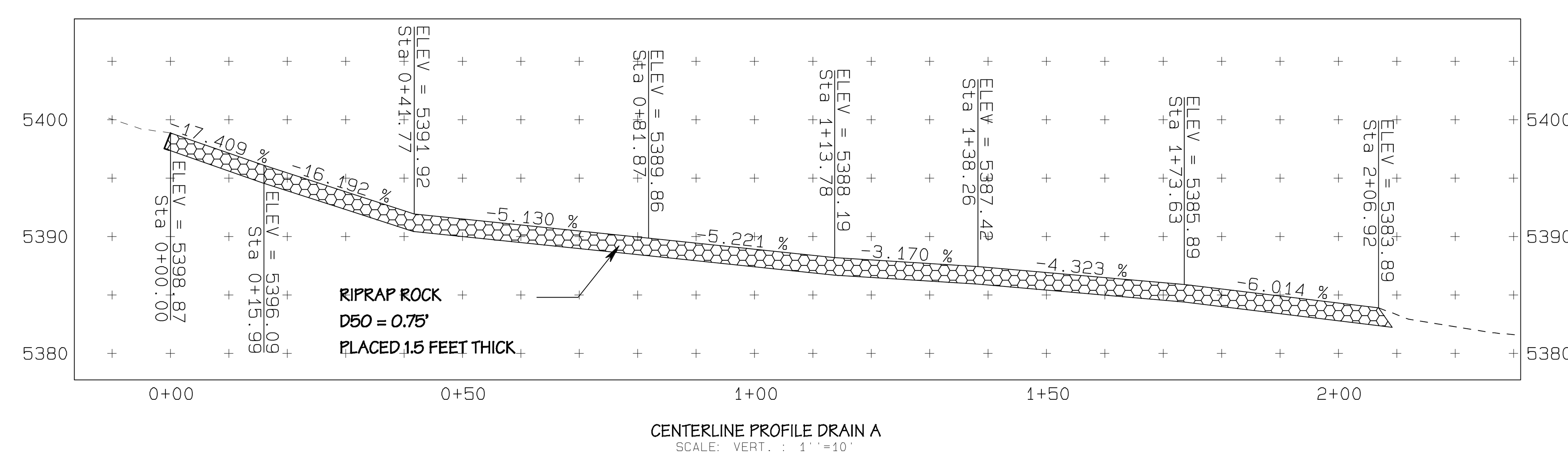


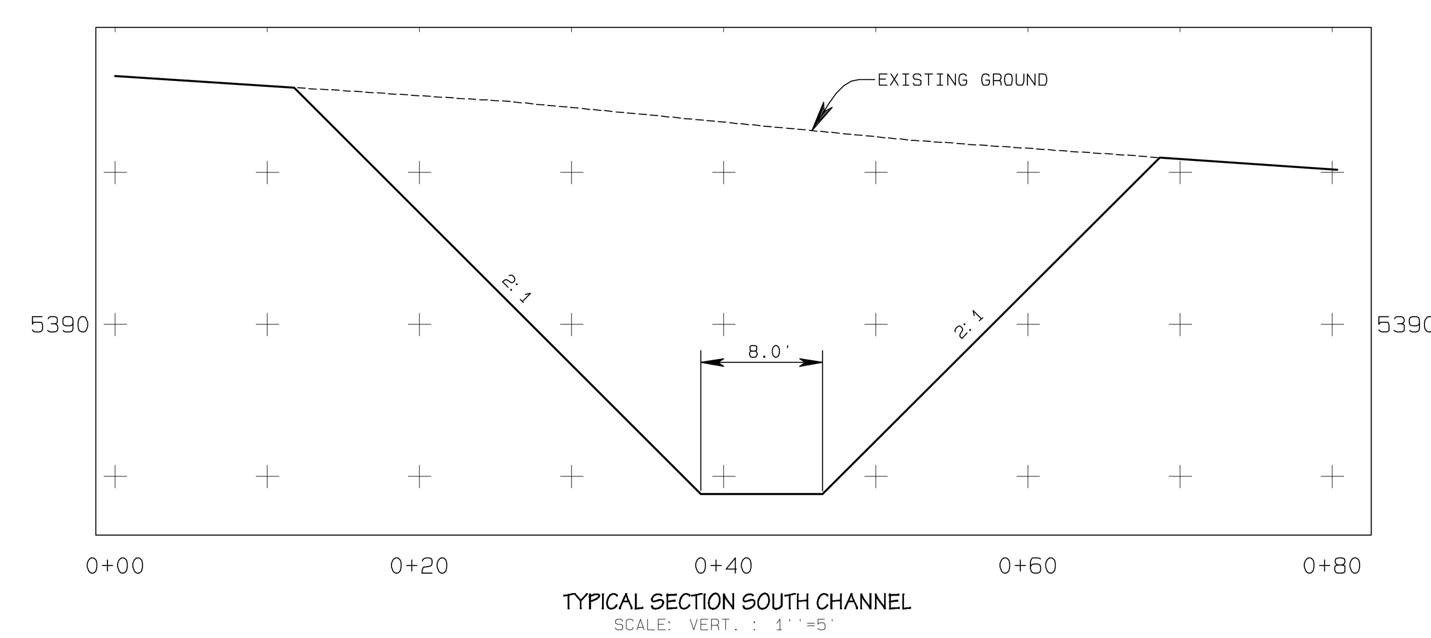


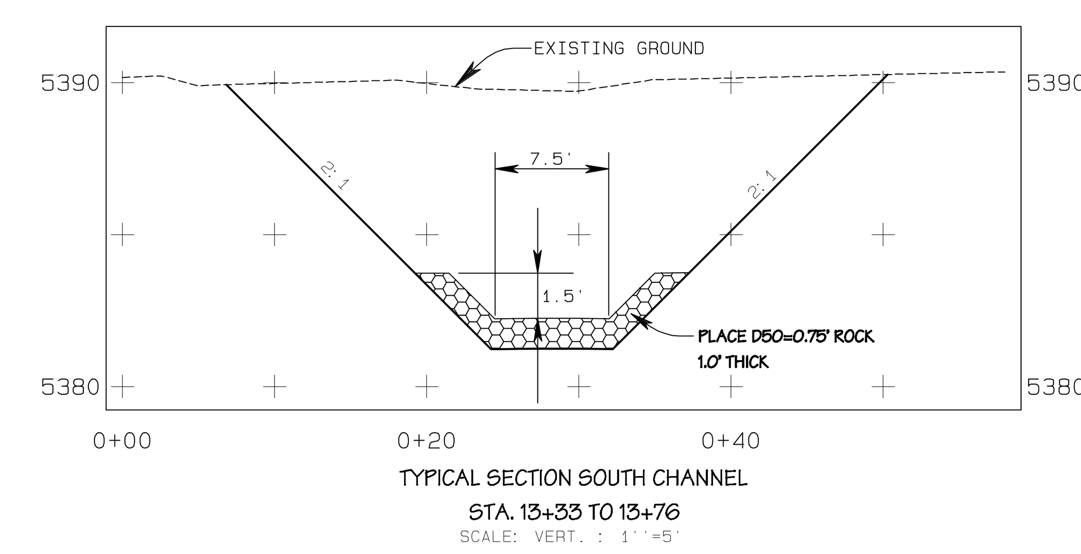










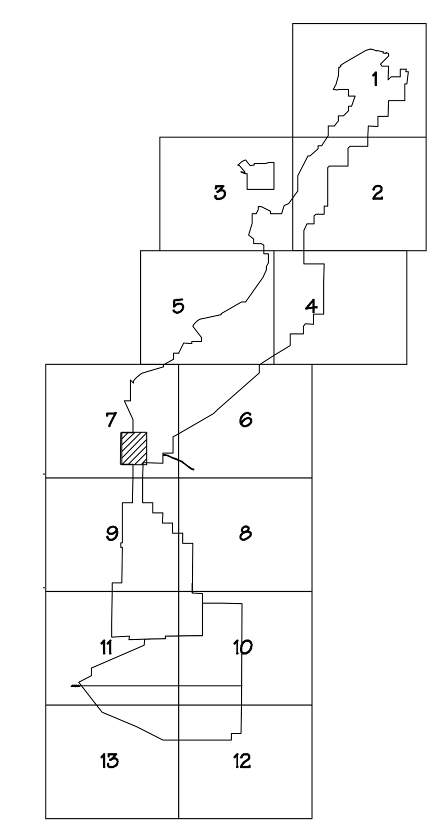


LEGEND

ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE LINE

NOTES:

1. FOR HYDROLOGY AND DESIGN INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.
2. THE POND LOCATION AND WATERSHED AREA ARE PRESENTED ON EXHIBIT 11-13D.



ELEV.	AREA (AC)	INC. VOLUME	CUM. VOLUME (AC-FT)
5379.0	0.28	0.00	0.00
5380.0	0.48	0.38	0.38
5381.0	0.55	0.52	0.89
5382.0	0.62	0.59	1.48
5383.0	0.72	0.67	2.15
5384.0	0.83	0.77	2.92
5385.0	0.96	0.89	3.82
5386.0	1.10	1.03	4.84
5387.0	1.37	1.23	6.08
5388.0	1.90	1.64	7.71
5389.0	2.85	2.38	10.09
5390.0	3.35	3.10	13.19

CERTIFICATION STATEMENT

I, LEONARD RAYMOND, HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

REVISION	DATE
Modified Mason Pond and submitted to OSM for Review.	Jan. 18, 2011

PROJECT MANAGER: Ferguson Gorman
ENGR. of RECORD: Leonard Raymond
REG. NO: NM-6600
SRVYR of RECORD: Wilson Begay
REG. NO: NM-18628

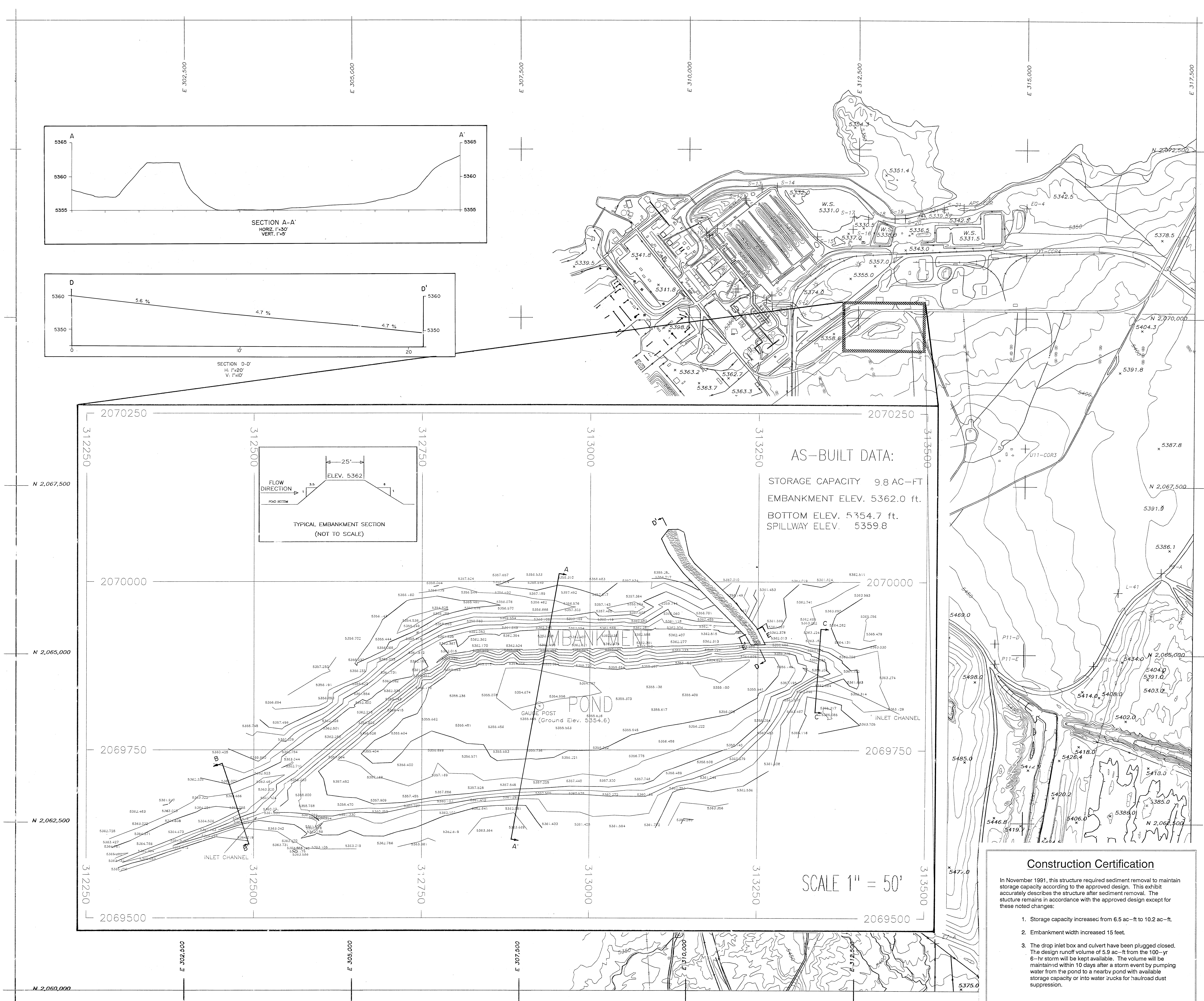
bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 / PHONE 505-598-4200/FAX 505-598-3361

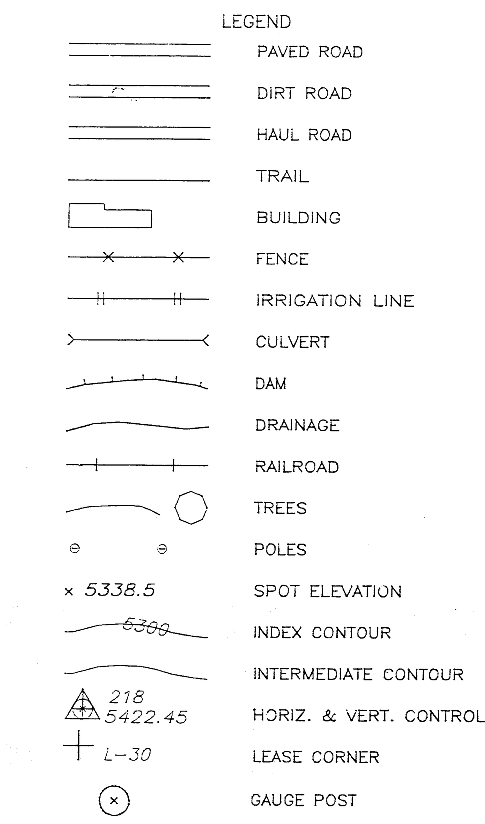
PROJECT:
DATE:
DESIGNED BY: Leonard Raymond
DRAWN BY: P. Foster
CHECKED BY: L. Raymond
APPROVED BY: L. Raymond

PLAN, PROFILE, AND SECTIONS

EXHIBIT 26-26
MASON POND MODIFICATION DESIGN

DRAWING
SHEET 1 OF 1

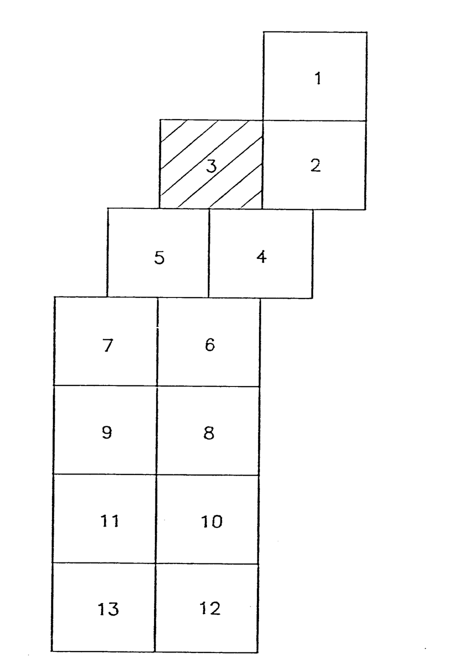




Emma's pond

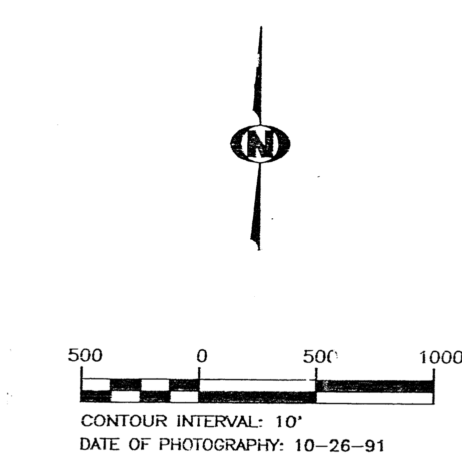
Elevation	Contour Area (Ac)	Increm. Volume (Ac–ft)	Cumulative Volume (Ac–ft)	Reserve Volume (Ac–ft)
5354.7	0.00	0.00	0.00	10.24
5355.0	0.16	0.02	0.02	10.22
5356.0	1.33	0.75	0.77	9.47
5357.0	2.00	1.67	2.43	7.81
5358.0	2.50	2.25	4.68	5.56
5359.0	2.79	2.65	7.33	2.91
5360.0	3.03	2.91	10.24	–0.00

CAPACITY @ 5359.8 - 9.66 Ac-Ft



NOTES :

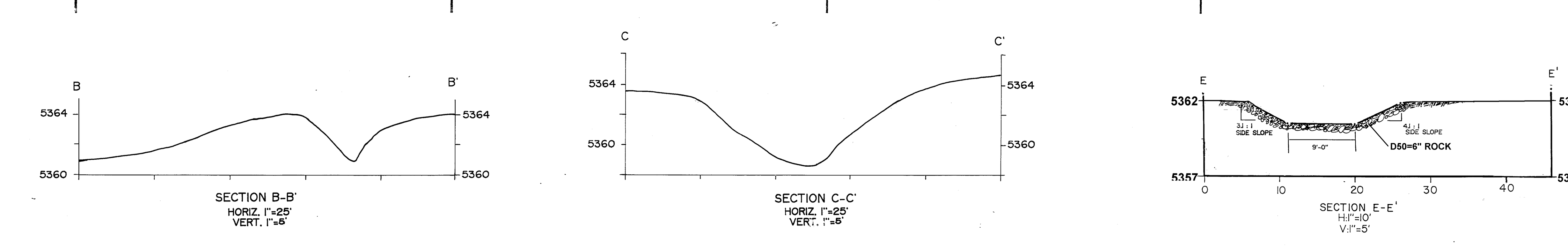
1. REFER TO APPENDIX 11-D FOR HYDROLOGY DATA
2. WATERSHED AREA IS PRESENTED ON EXHIBIT 11-13B



Construction Certification

In November 1991, this structure required sediment removal to maintain storage capacity according to the approved design. This exhibit accurately describes the structure after sediment removal. The stucture remains in accordance with the approved design except for these noted changes:

1. Storage capacity increased from 6.5 ac–ft to 10.2 ac–ft.
2. Embankment width increased 15 feet.
3. The drop inlet box and culvert have been plugged closed. The design runoff volume of 5.9 ac–ft from the 100–yr 6–hr storm will be kept available. The volume will be maintained within 10 days after a storm event by pumping water from the pond to a nearby pond with available storage capacity or into water trucks for haulroad dust suppression.



Prepared by
IntraSearch
Denver, Colorado

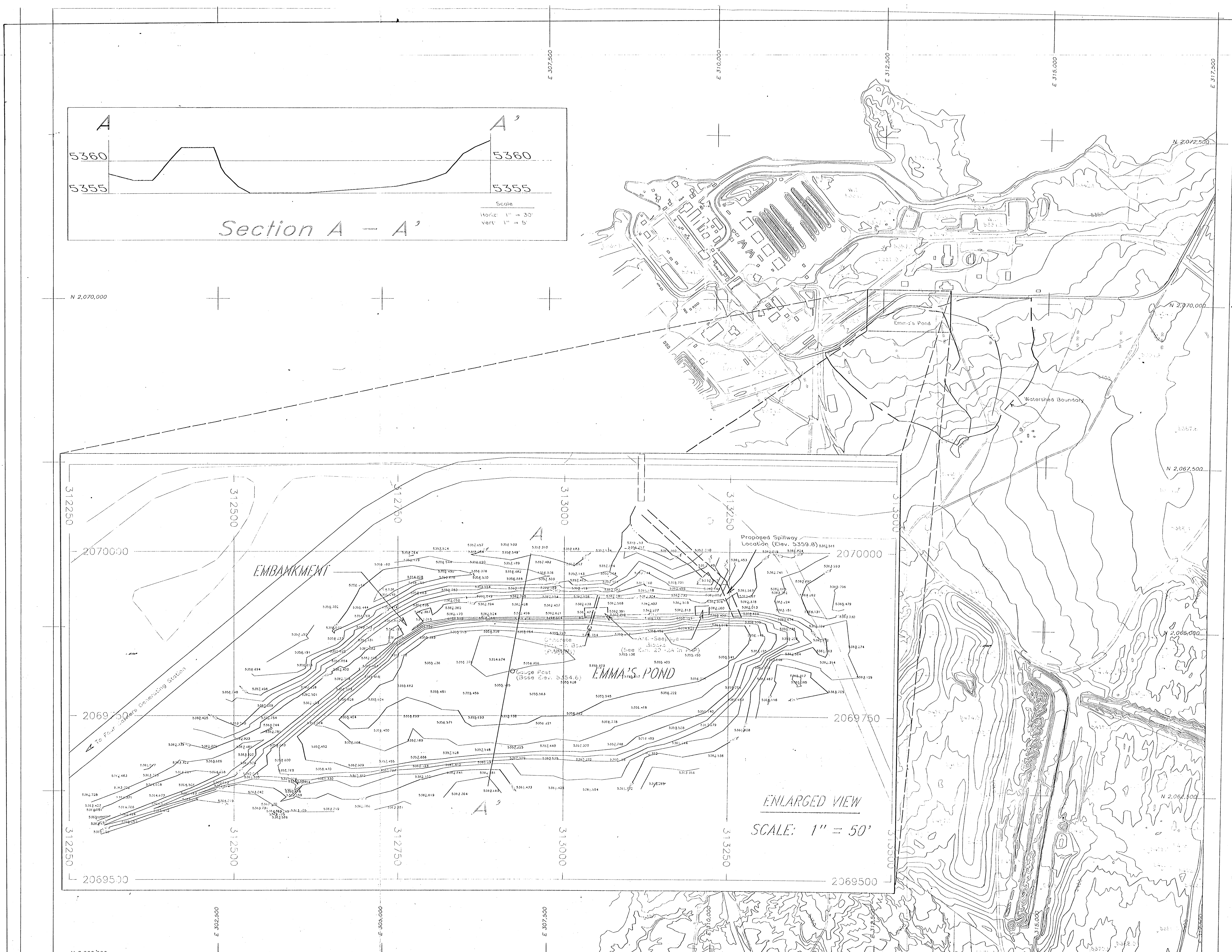
REV. NO.	DATE	REVISIONS	DRAFT BY:	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	8/24/93	CHANGE EXH. NO. TO 11-33 AND CO. NAME	JG			
2	7-31-94	ADDED AS BUILT OVERFLOW LOCATION AND SECTIONS D-D' AND E-E'	PJF	SPT		
3	4-14-04	UPDATED EXHIBIT AND SUBMITTED TO OSM FOR REVIEW	PJF	LR		

BHP MINERALS INTERNATIONAL
NAVAJO MINE
FRUITLAND, NEW MEXICO

EMMA'S POND "AS-BUILT"

EXHIBIT 26-27

DRAWN BY SYP	SCALE 1" = 500'
APPROVED BY SAP	DATE 01/23/92
DRAWING NO	LOCATION NO MF-D2



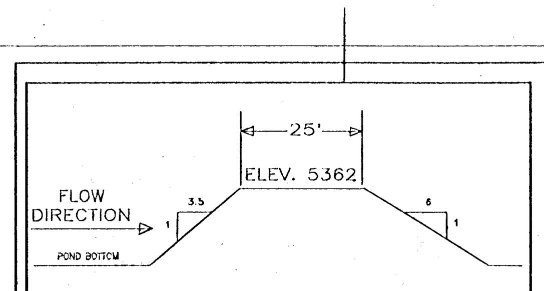
LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POLES
- SPOT ELEVATION
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- HORIZ. & VERT. CONTROL
- LEASE CORNER
- GAUGE POST
- Watershed boundary

500 0 500 1000

CONTOUR INTERVAL: 10'
DATE OF PHOTOGRAPHY: 10-26-91

Prepared by
IntraSearch
Denver, Colorado
EXHIBIT 26-28



TYPICAL EMBANKMENT SECTION
(NOT TO SCALE)

DESIGN DATA: EMMA'S POND

STORAGE CAPACITY 9.8 AC–FT.	WATERSHED AREA 114 ACRES
EMBANKMENT ELEV. 5362.0 ft.	CURVE NUMBER 80
BOTTOM ELEV. 5354.7 ft.	RUNOFF VOLUME 5.9 AC–FT
	100–YR 6–HR EVENT (2.1 IN.)

Emma's pond

Elevation	Contour Area (Ac)	Increm. Volume (Ac–ft)	Cumulative Volume (Ac–ft)	Reserve Volume (Ac–ft)
5354.7	0.00	0.00	0.00	9.76
5355.0	0.19	0.02	0.02	9.74
5356.0	1.33	0.76	0.78	8.98
5357.0	2.01	1.67	2.45	7.31
5358.0	2.54	2.28	4.73	5.03
5359.0	2.83	2.69	7.41	2.35
5359.8	3.01	2.35	9.76	0.00

RON C. VAN VALKENBURG NEW MEXICO REGISTERED PROFESSIONAL ENGINEER 9-21-93

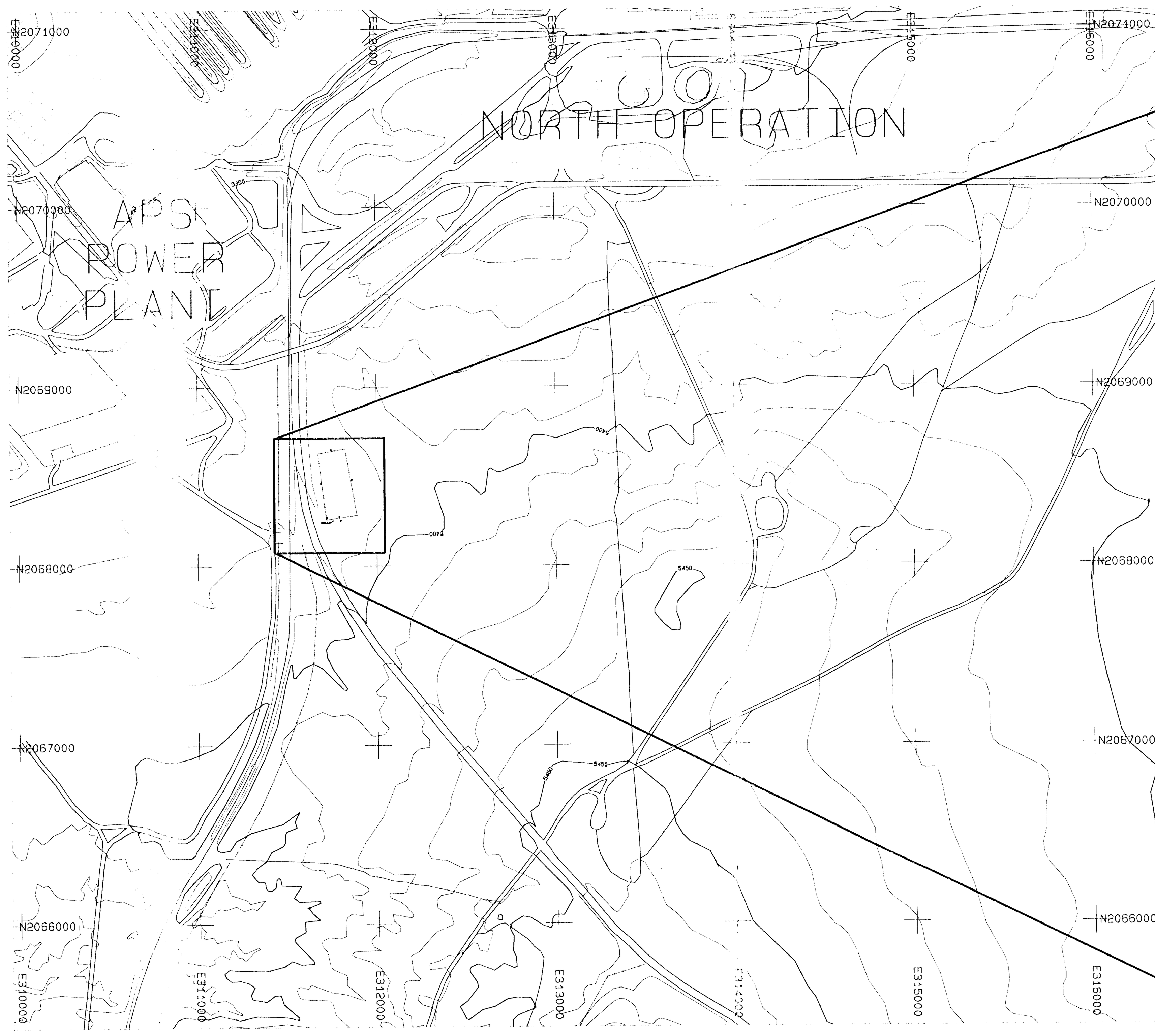
Emma's pond has been designed using current, prudent engineering practices and in accordance with 30 CFR 816.49.

REV. NO.	DATE	REVISIONS	DRAFT BY:	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	9-16-93	CHANGE EXHIBIT NO.	PJF			RCV

BHP MINERALS INT'L INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO

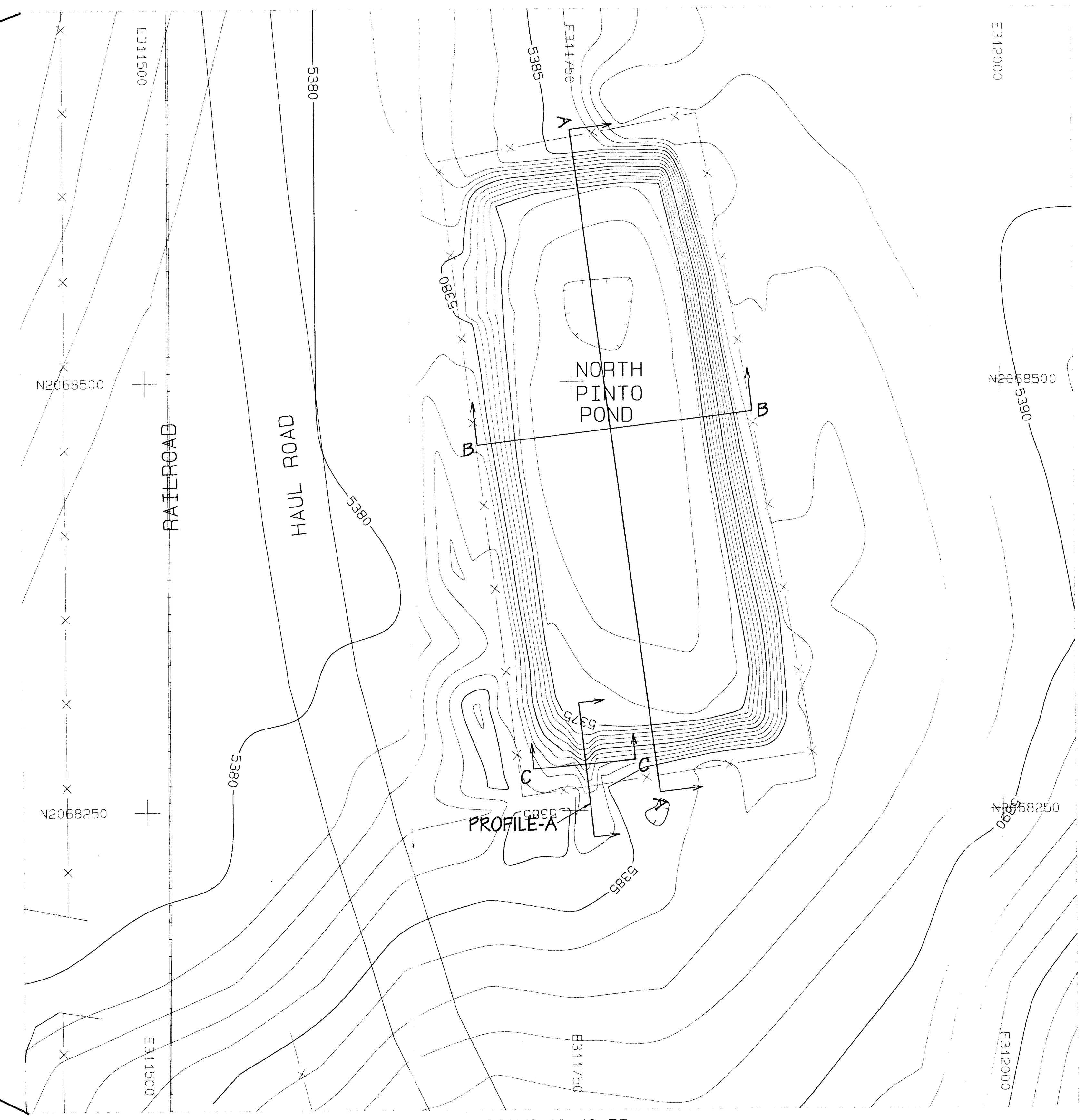
EMMA'S POND HYDROLOGY and POND DESIGN

DRAWN BY SYP/RCV	SCALE 1" = 500'
APPROVED BY	DATE 03/12/92
DRAWING NO	LOCATION NO



LOCATION MAP

SCALE 1"=400 FT.



SCALE 1"=40 FT.

LEGEND

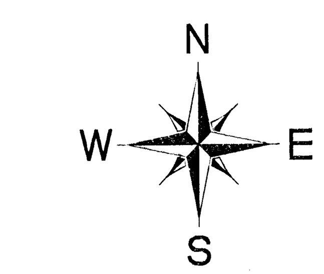
ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
x5338.5 SPOT ELEVATION
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
218 5422.45
L-30 LEASE CORNER

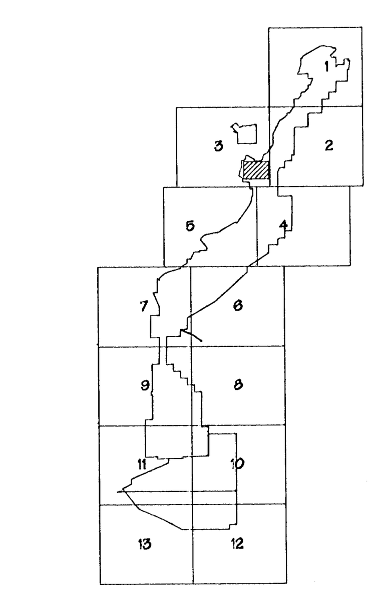
STAGE STORAGE DATA

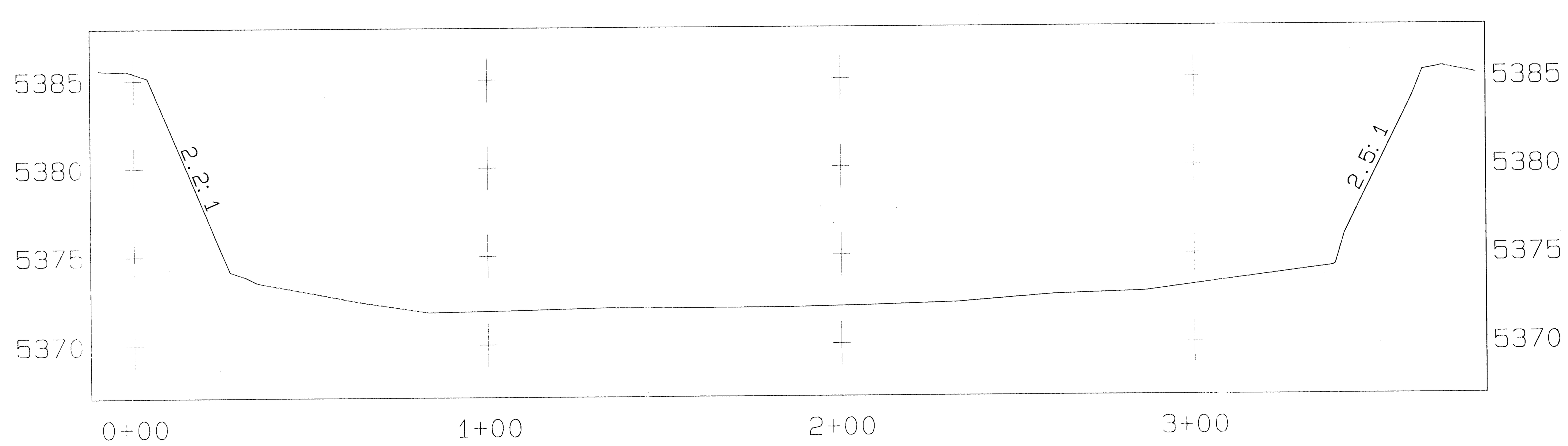
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5372	0.32	0.00	0.00
5373	0.43	0.23	0.23
5374	0.68	0.56	0.78
5375	0.78	0.74	1.52
5376	0.83	0.81	2.34
5377	0.88	0.86	3.20
5378	0.93	0.91	4.11
5379	0.98	0.96	5.07
5380	1.03	1.01	6.08

NOTES

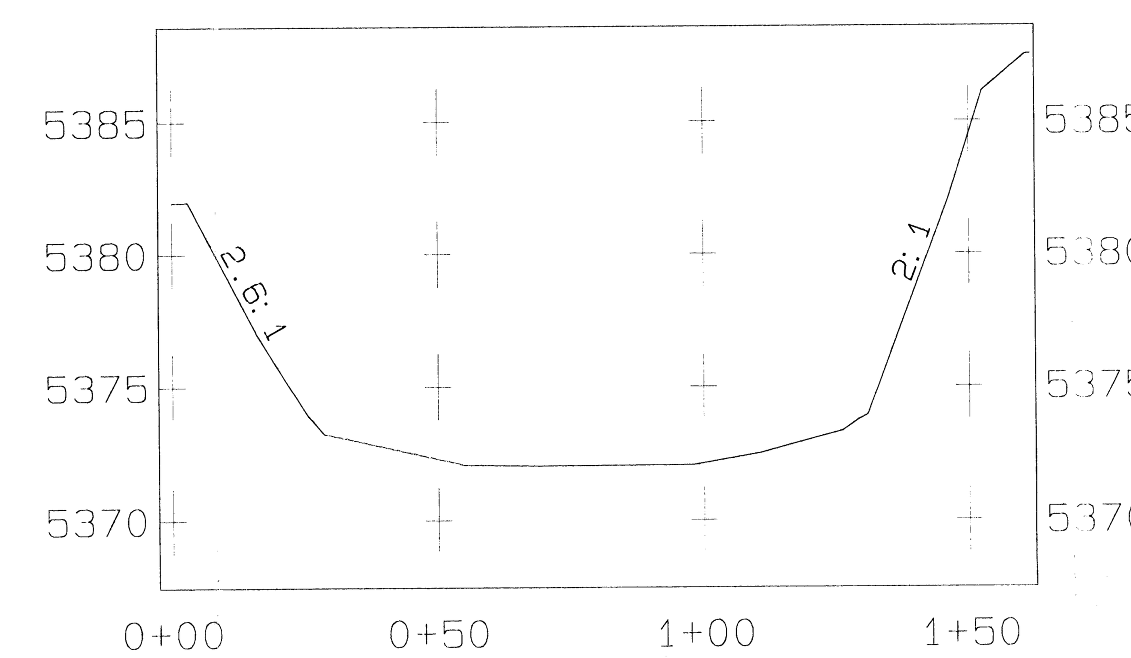
1. For hydrology and design information refer to Appendix 11-G in the approved PAP.
2. Blueline Elevations can be found in Table 11-5T.
3. Gauge Post base Elevation: 5372.18 (GPS).



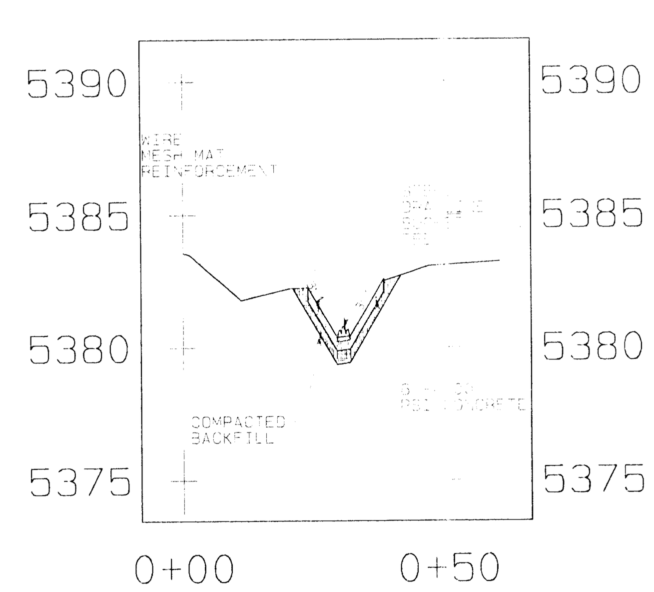




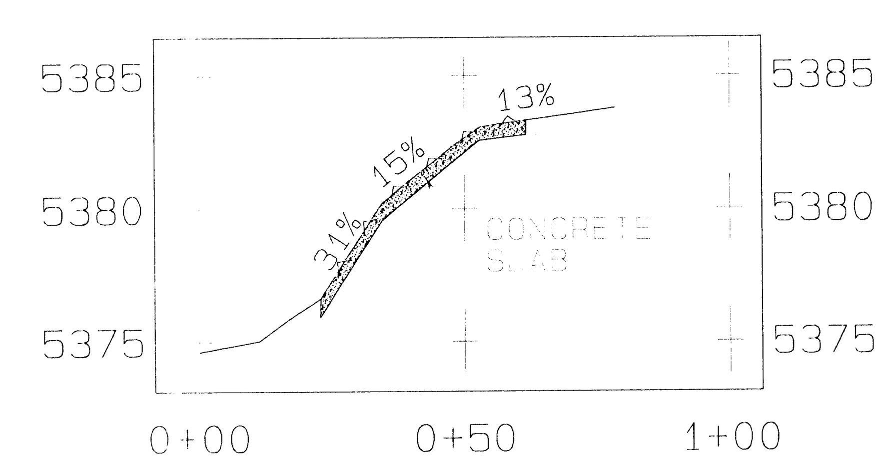
SECTION A-A



SECTION B-B



SECTION C-C



PROFILE -A

SECTIONS AND PROFILE SCALE - HORIZONTAL 1"=20 FT.
VERTICAL 1"=4 FT.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

2-3-99

MAR 1999 APPROVED

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
	1-27-99	PJF	CORRECTED SECTION LABELS.					
1	05/10/98	RY	RE-SURVEYED AND RE-ASBUILT					

APPROVALS

EXHIBIT 26-29

NAVAJO COAL COMPANY

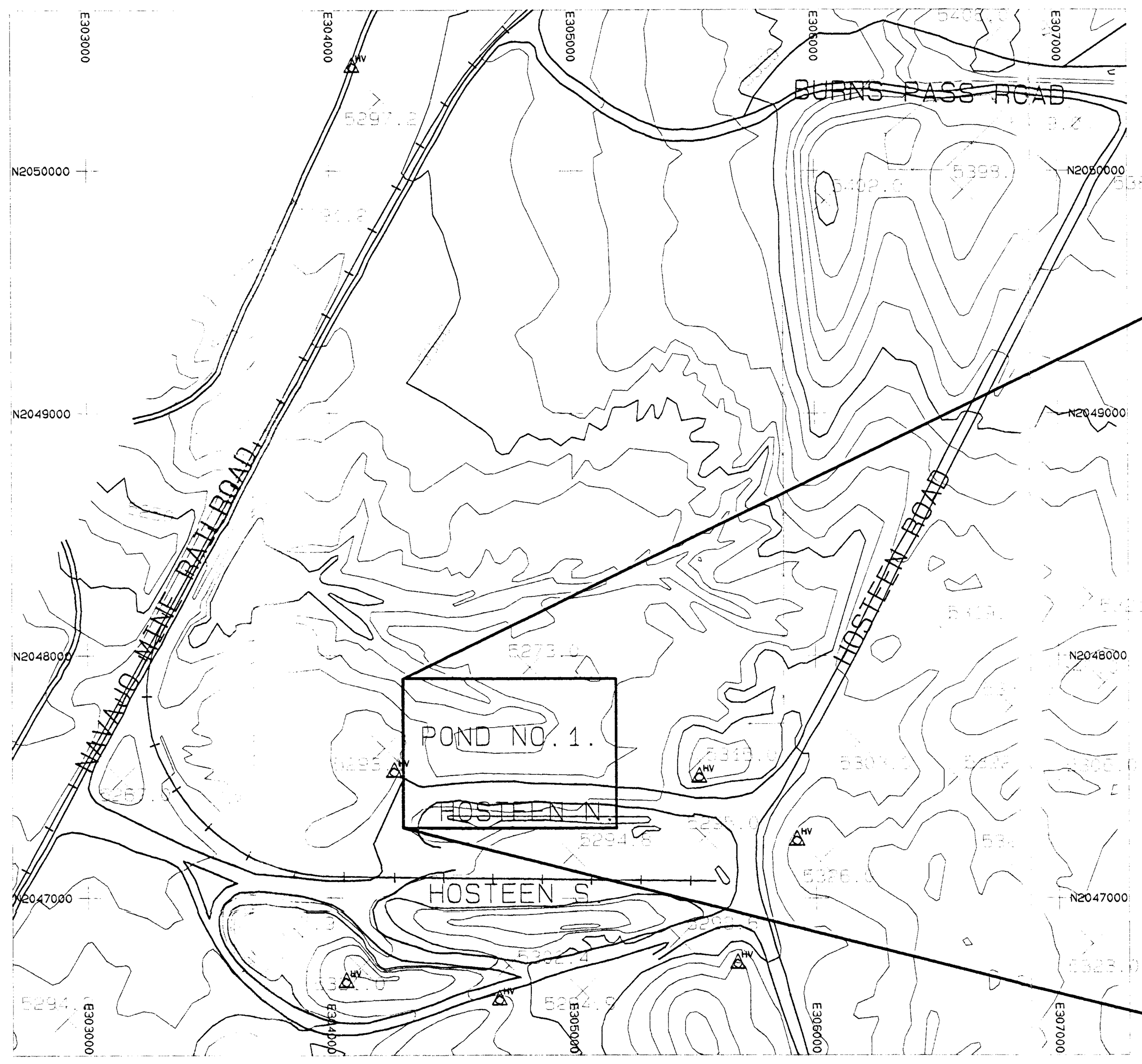
NAVAJO MINE
SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

NORTH PINTO POND
AS-BUILT

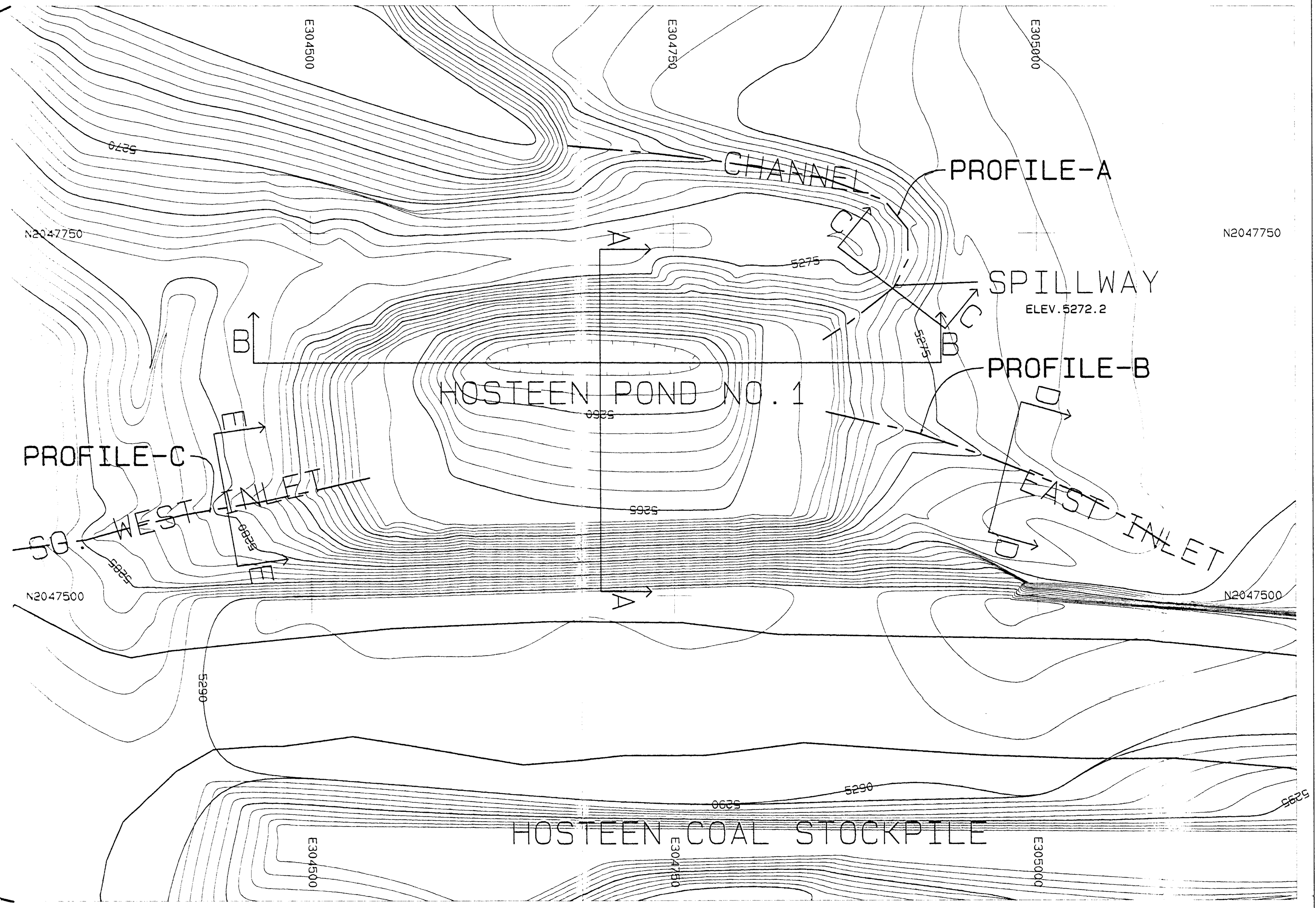
PREPARED BY RY	DRAWN BY RY	SCALE AS NOTED
APPROVED BY LR	DATE 05/05/98	REF DWG

DWG LOC J:\OSM_SUBM\PER_PROG\CH_11\1998 pond Asbuilts\Exhibits\NPINTOPD



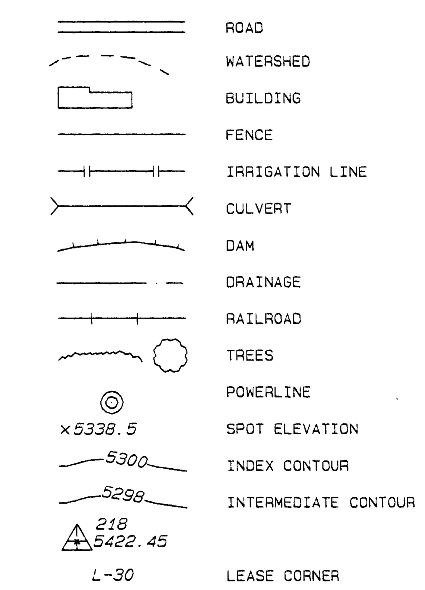
LOCATION MAP

SCALE: 1"=400 FT.



SCALE: 1"=50 FT.

LEGEND

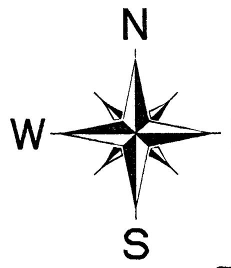


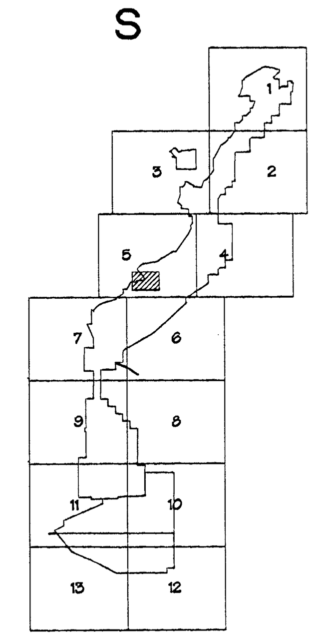
STAGE STORAGE DATA

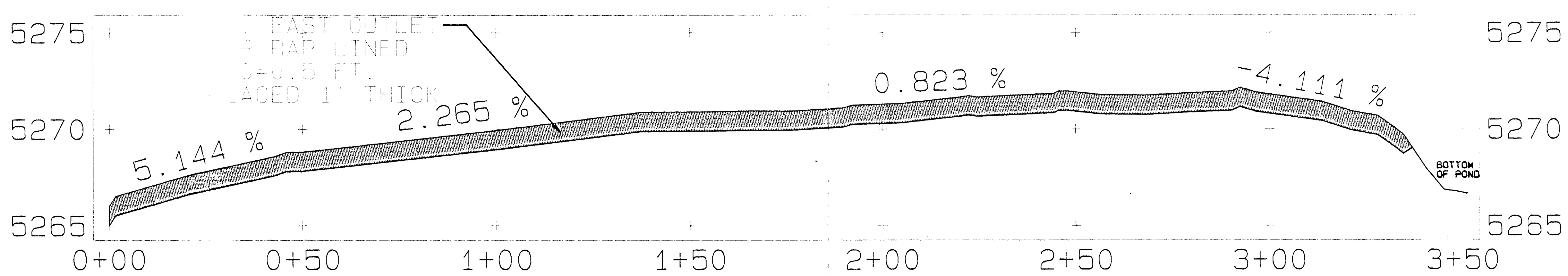
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5258	0.08	0.00	0.00
5259	0.15	0.11	0.11
5260	0.22	0.18	0.30
5261	0.29	0.26	0.55
5262	0.38	0.34	0.89
5263	0.47	0.42	1.32
5264	0.56	0.52	1.83
5265	0.66	0.61	2.45
5266	0.91	0.79	3.24
5267	1.06	0.99	4.23
5268	1.12	1.10	5.33
5269	1.19	1.16	6.49
5270	1.26	1.23	7.72
5271	1.34	1.32	9.03
5272	1.42	1.39	10.42

NOTES

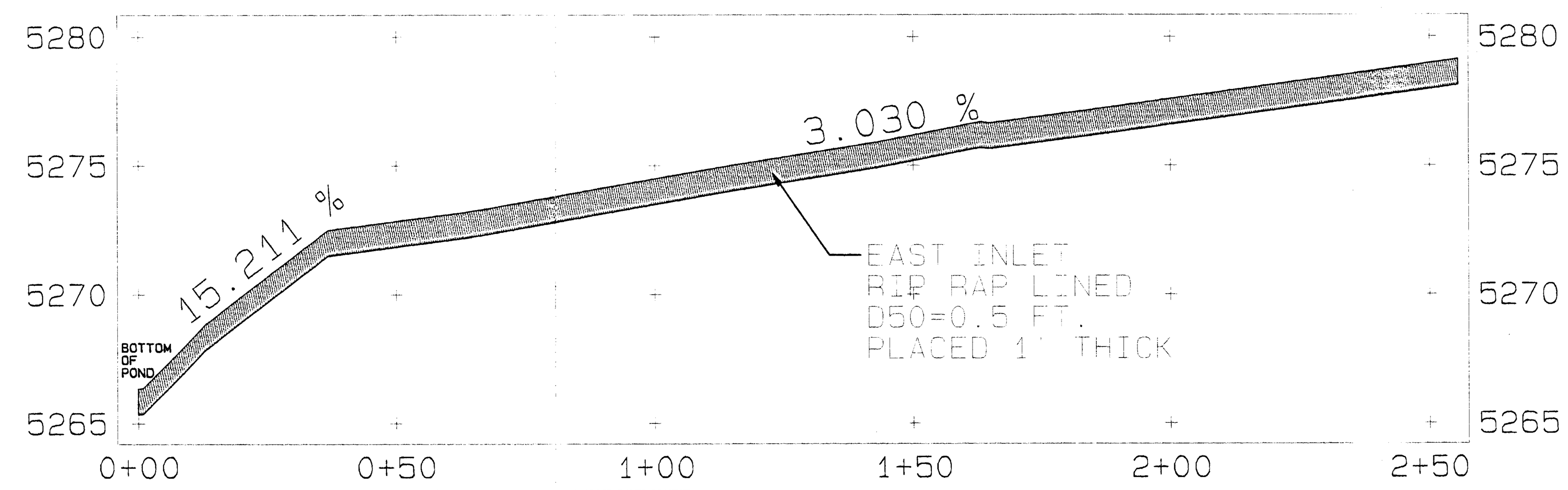
1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. Blueline Elevations can be found in Table 11-5K.
3. Gauge Post Base Elevation: 5257.8 FT. (GPS)



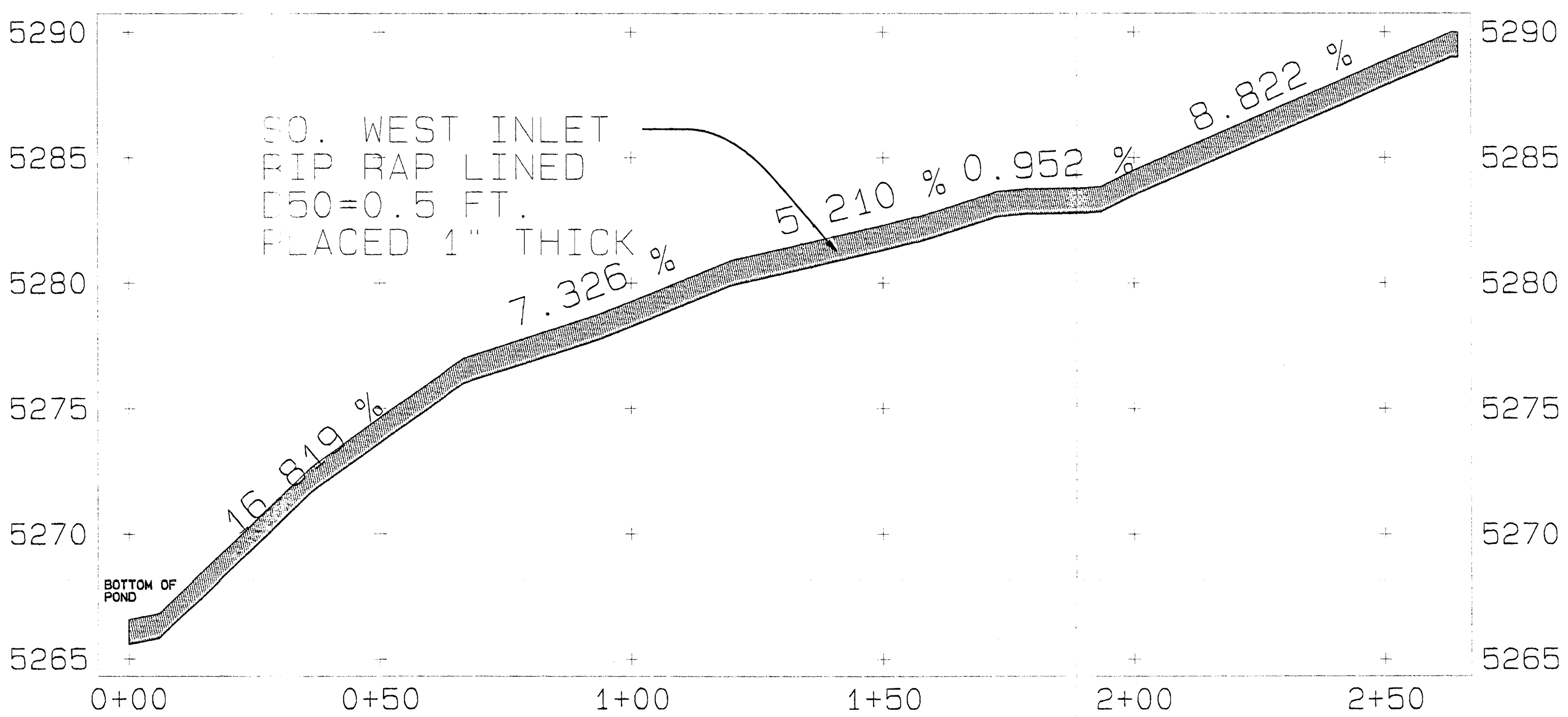




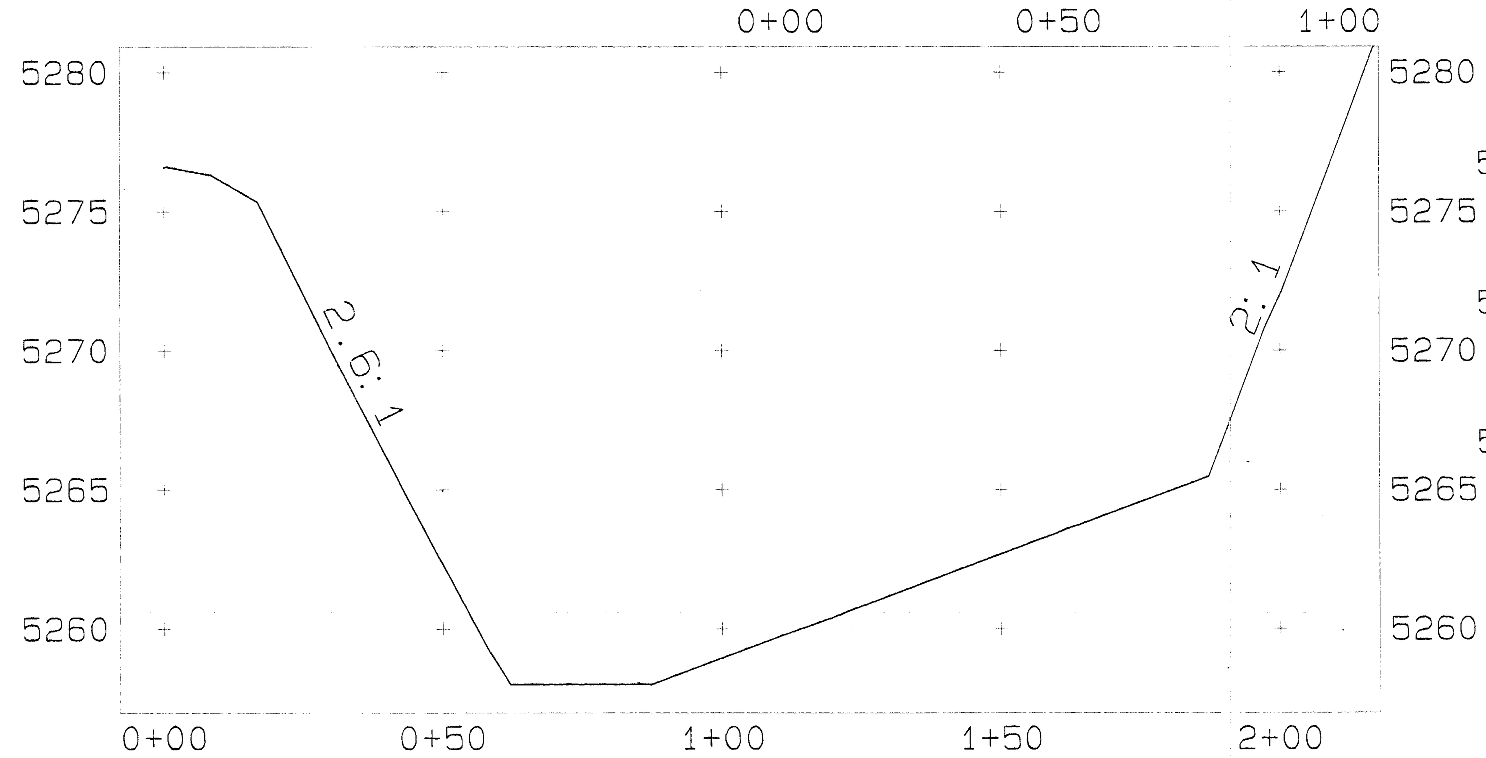
PROFILE A



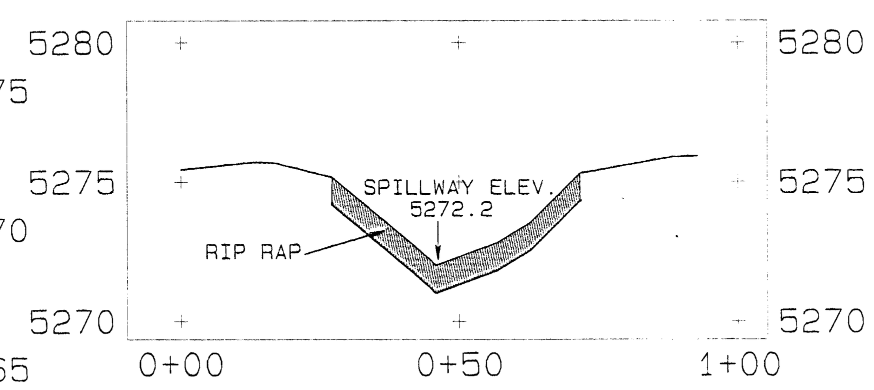
PROFILE B



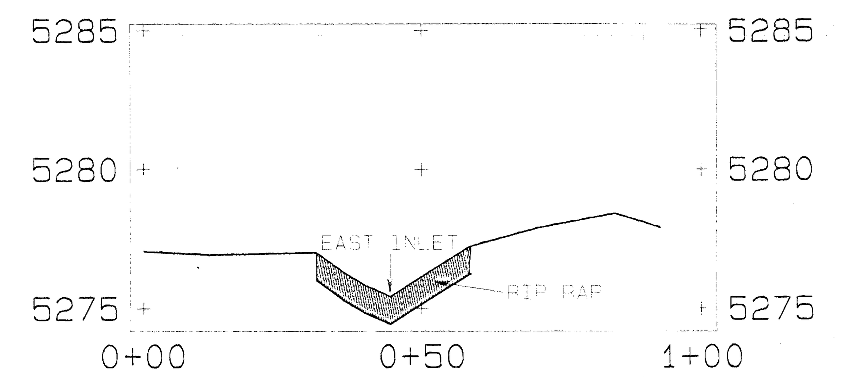
PROFILE C



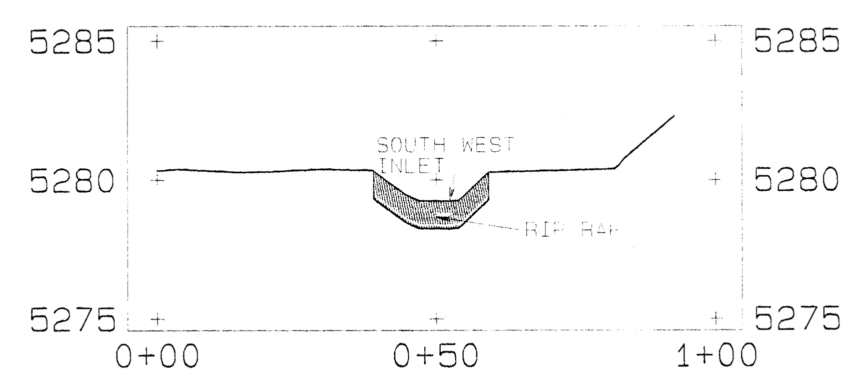
SECTION A-A



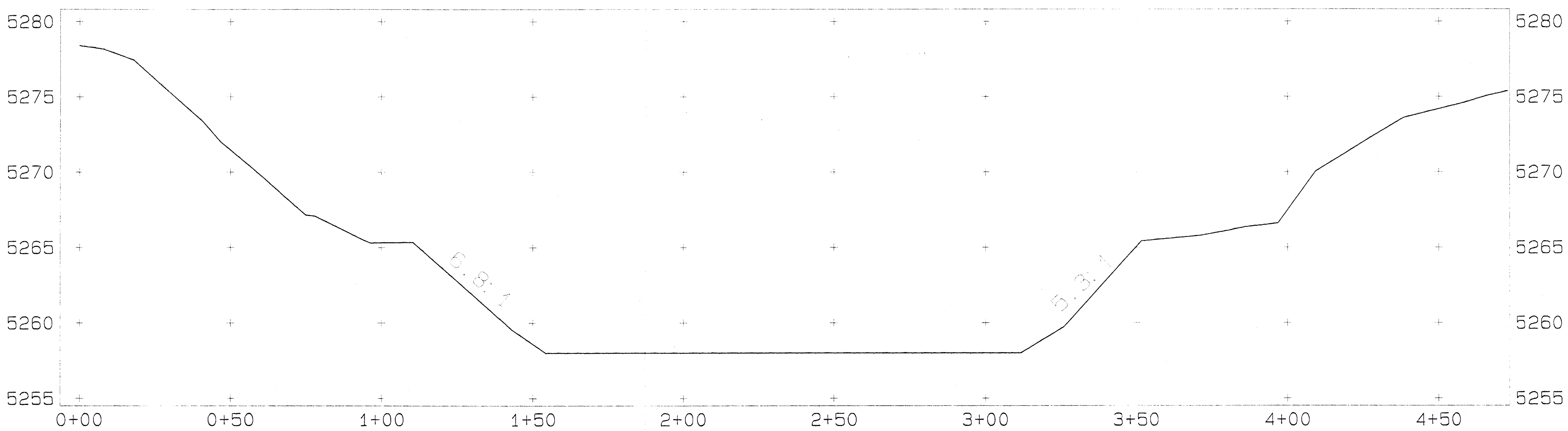
SECTION C-C



SECTION D-D



SECTION E-E



SECTION B-B

SECTIONS AND PROFILE SCALE-HORIZONTAL: 1"=20 FT.
VERTICAL: 1"=4 FT.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

2-3-99

MAR 1999 APPROVED

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
2	1-27-99	PJF	CORRECTED SECTION LABELS.					
1	05/15/98	RY	RE-SURVEYED AND RE- ASBUILT					

APPROVALS

EXHIBIT 26-30

NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS

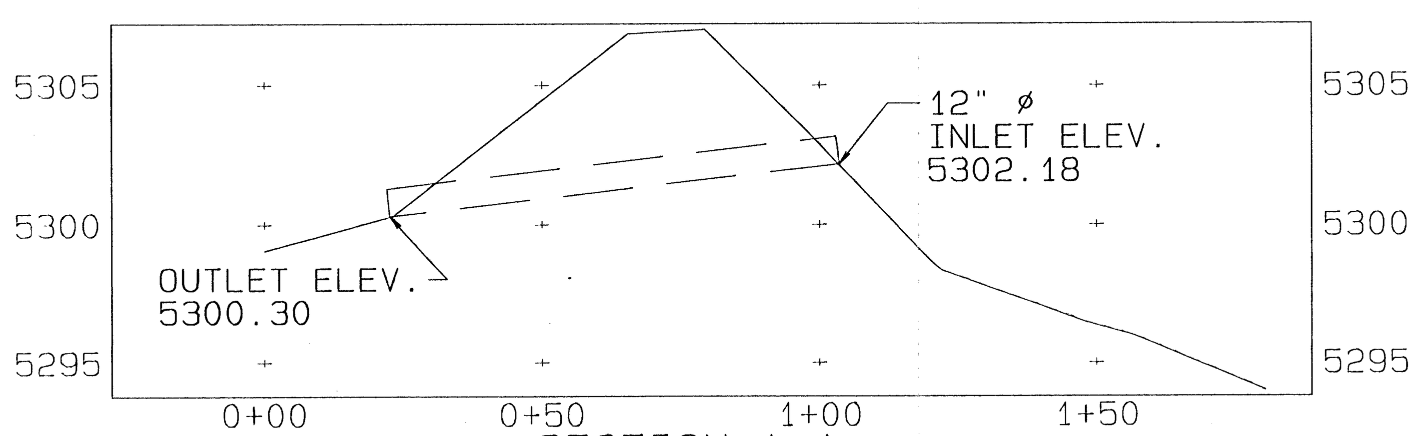
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

HOSTEEN POND #1
AS-BUILT

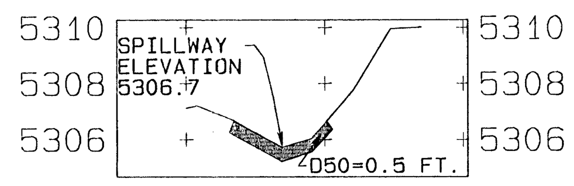
PREPARED BY RY	DRAWN BY RY	SCALE AS NOTED
APPROVED BY LR	DATE 05/15/98	REF DWG
DWG LOC J: \OSM_SUBM\PER_PROG\CH_11\1998 pond Asbuilts\		

LOCATION MAP
SCALE: 1"=400 FT.

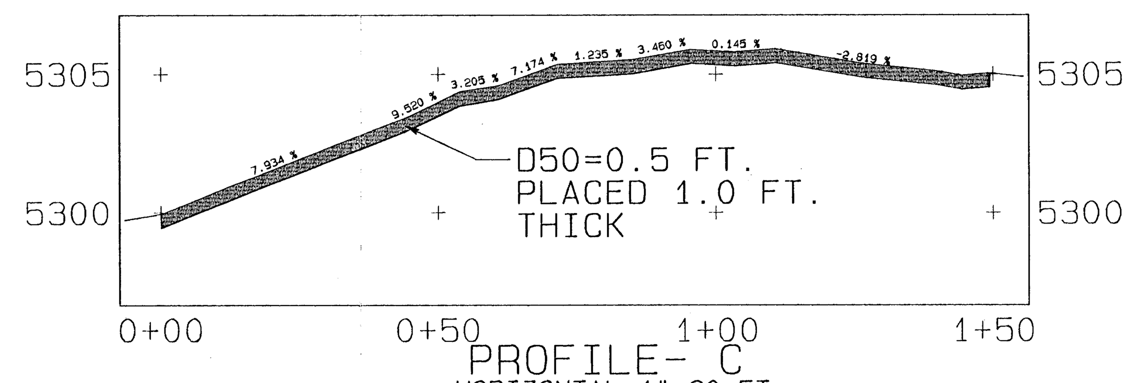
SCALE: 1"=100 FT



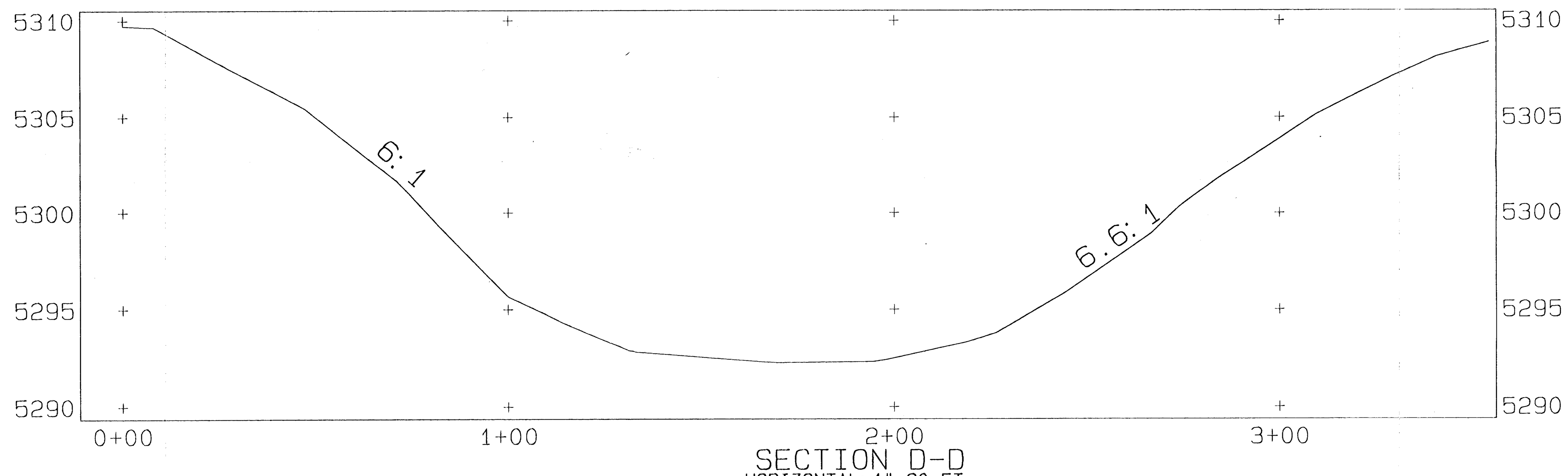
SECTION A-A
HORIZONTAL: 1"=20 FT.
VERTICAL: 1"=4 FT.



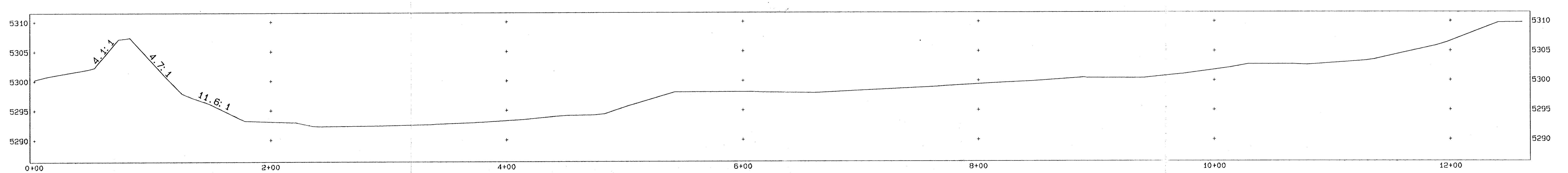
SECTION B-B
HORIZONTAL: 1"=20 FT.
VERTICAL: 1"=4 FT.



PROFILE- C
HORIZONTAL: 1"=20 FT.
VERTICAL: 1"=4 FT.



SECTION D-D
HORIZONTAL: 1"=20 FT.
VERTICAL: 1"=4 FT.



SECTION E-E
HORIZONTAL: 1"=20 FT.
VERTICAL: 1"=4 FT.

LEGEND

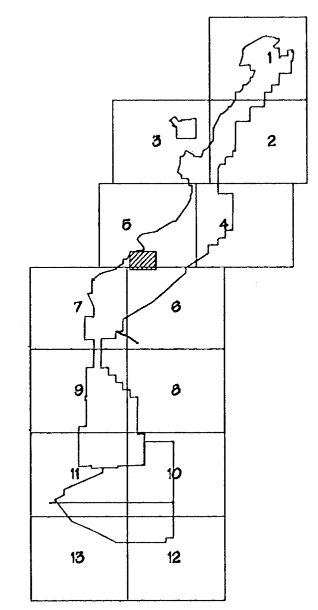
- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- x5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5293	0.23	0.00	0.00
5294	0.52	0.38	0.38
5295	0.73	0.63	1.00
5296	0.94	0.84	1.85
5297	1.12	1.04	2.88
5298	1.31	1.22	4.11
5299	1.63	1.48	5.59
5300	2.00	1.83	7.41
5301	2.44	2.24	9.65
5302	2.92	2.70	12.35

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. Blueline Elevations can be found in Table 11-5L.
3. Gauge Post base Elevation: 5292.75 (GPS).



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

2-3-99

MAR 1999 APPROVED

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
2	1-27-99	PJF	CORRECTED SECTION LABELS.					
1	05/04/98	RY	RE SURVEYED AND RE ASBUILT					

APPROVALS

EXHIBIT 26-31

NAVAJO COAL COMPANY

NAVAJO MINE — SAFETY PAYS

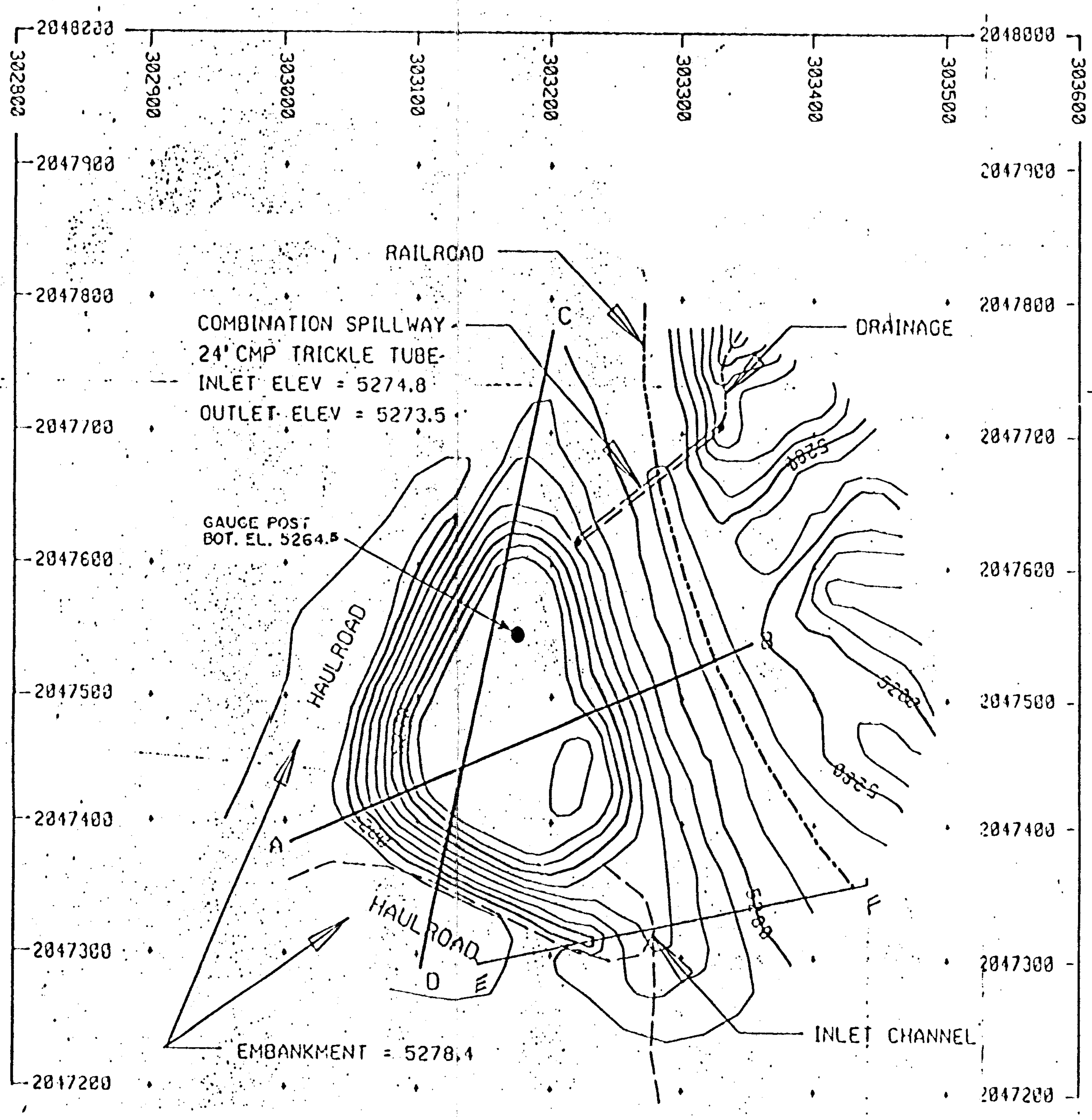
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

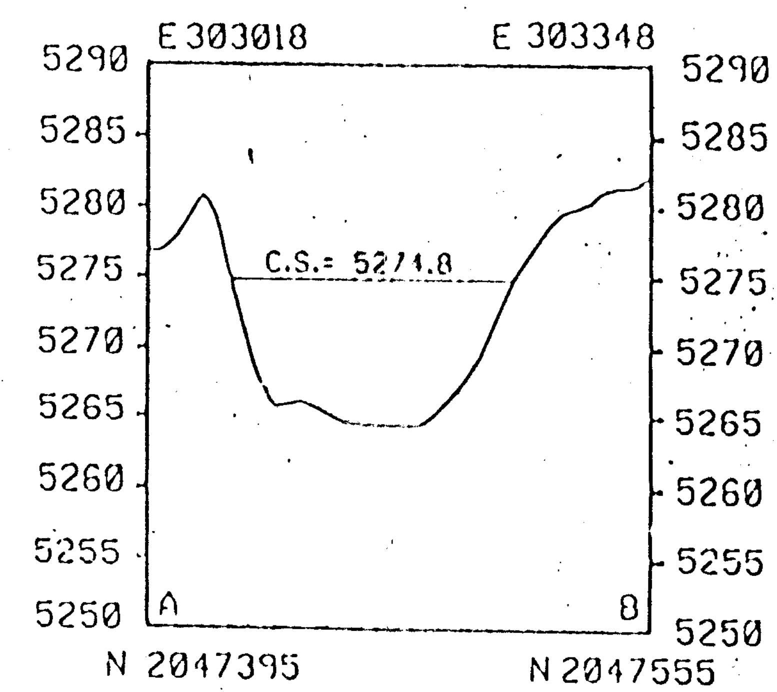
HOSTEEN POND 2

AS-BUILT

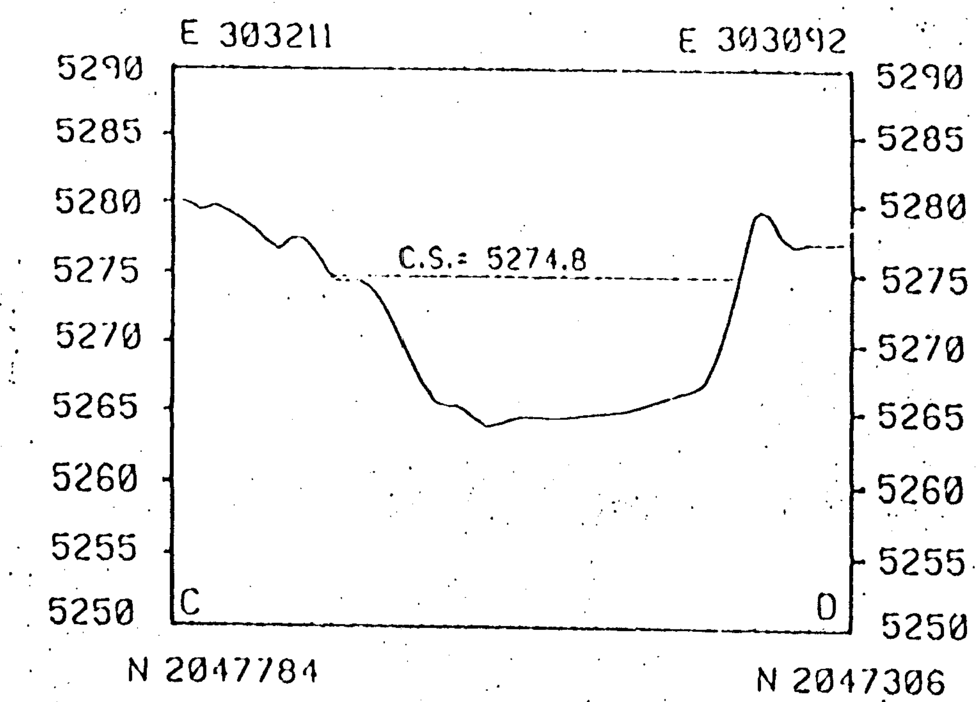
PREPARED BY RY	DRAWN BY RY	SCALE AS NOTED
APPROVED BY LR	DATE 05/04/98	REF DWG

DWG LOC J:\OSM_SUBM\PER_PROG\CH_11\1998 pond Asbuilts\Exhibits\HOSTPND2





SECTION A-B VERTICAL EXAGGERATION OF 10.00



SECTION C-D VERTICAL EXAGGERATION OF 10.00

LEGEND

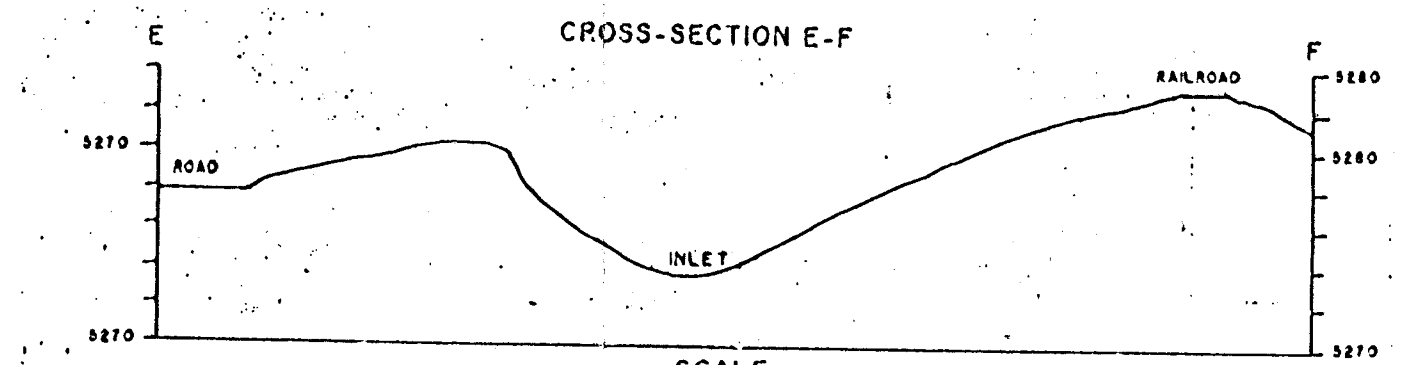
- COMBINATION SPILLWAY
- INLET & OUTLET CHANNELS
- RAILROAD

NOTE: HAULROAD AND RAILROAD SERVE AS POND EMBANKMENTS

FOR BLUELINE ELEVATION REFER TO TABLE 11-5M.

STAGE AREA DATA		
ELEVATION	AREA (AC)	VOL. (AC-FT)
5263.0	0.00	0.00
5264.0	0.03	0.02
5266.0	0.51	0.56
5270.0	0.73	3.04
5272.0	0.84	4.61
5273.0	0.94	5.30
5274.0	1.04	6.49
5274.8	1.14	7.38
5275.0	1.17	7.60

CROSS-SECTION E-F



SCALE
HOR 1"=50'
VERT 1"=10'

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowlege.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

2-3-99

MAR 1999 APPROVED

EXHIBIT 26-32

REGISTERED PROFESSIONAL ENGINEER 15998 OKLAHOMA

9-20-93

P.E. Stamp

BHP MINERALS INTERNATIONAL

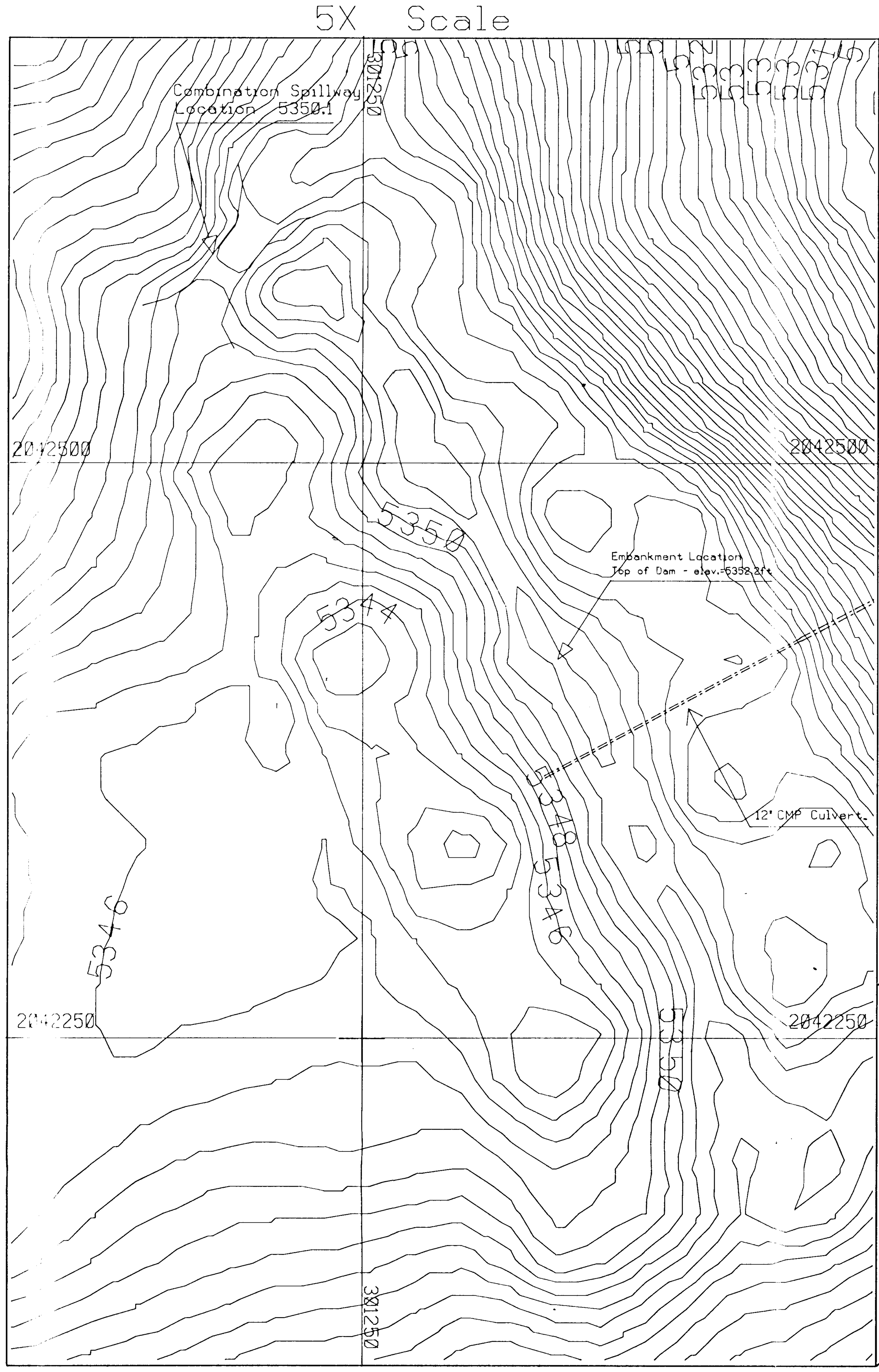
NAVAJO MINE

FRUITLAND, NEW MEXICO USA

HOSTEEN POND 3 AS - BUILT

DRAWN BY: JRC	SCALE: 1" = 100'	CONTOUR INT.: 2'
APPROVED BY:	DATE: 10/12/90	
DRAWING NO. EXHIBIT 29-4E	LOCATION NO. MF-D2	

REV. NO.	DATE	REVISIONS	APPROVALS Proj. Engineer	Professional Engineer	Chief Engineer
1	[illegible]	AS-BUILT CERTIFICATION	JRC	SCF	[illegible]
2	91498	ADDED NOTE			

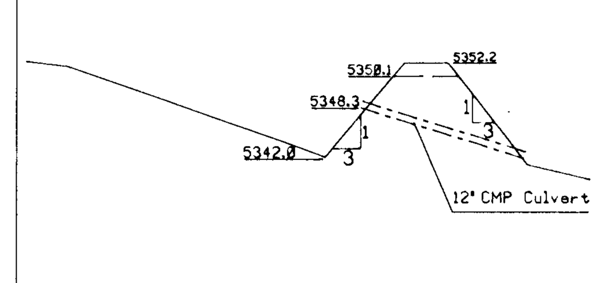


Stage-Area Data

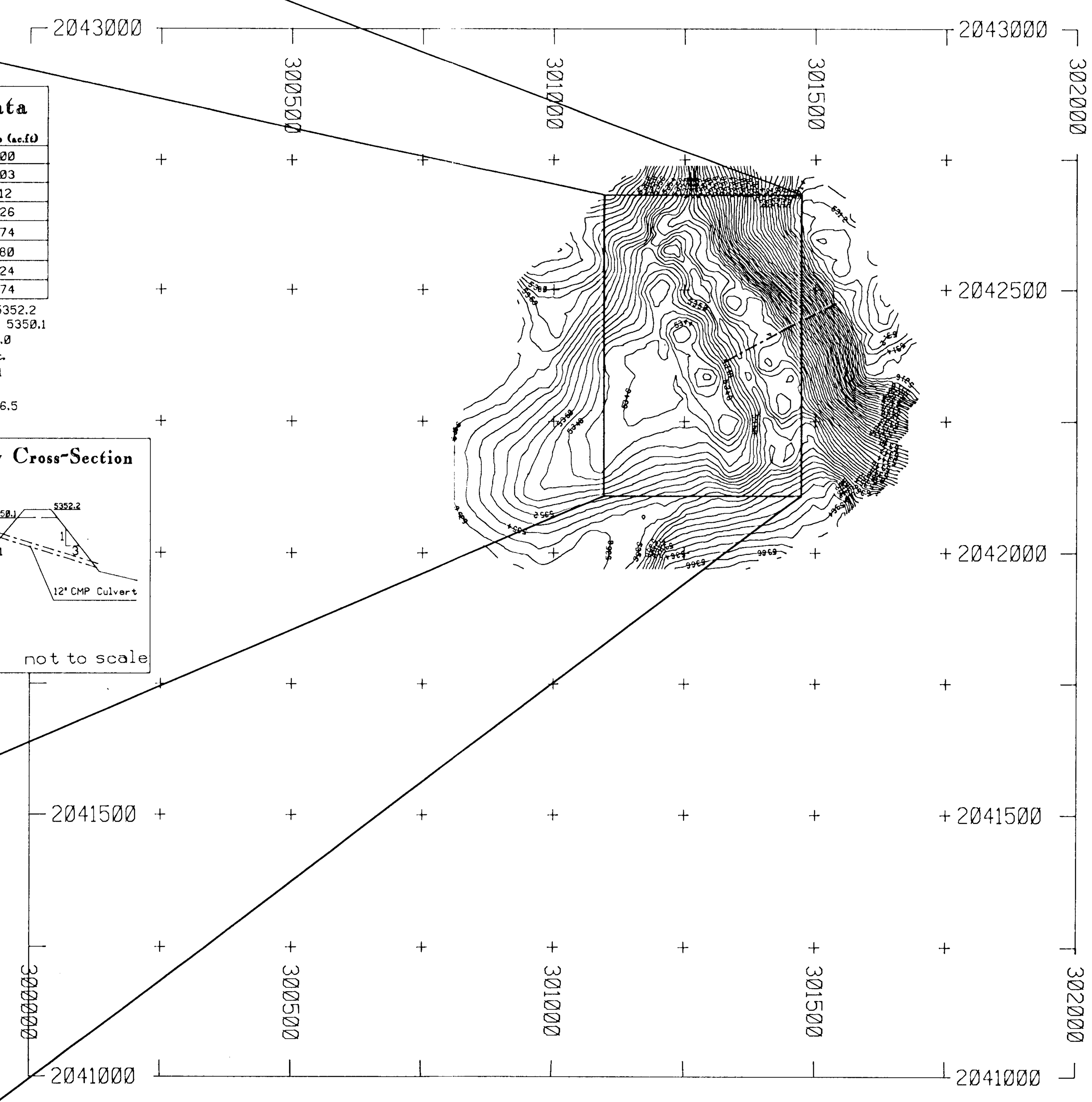
Elevation	Area(acre)	Volume (ac.ft)
5342.0	0.00	0.00
5343.0	0.05	0.03
5344.0	0.13	0.12
5345.0	0.14	0.26
5346.0	0.82	0.74
5347.0	1.29	1.80
5348.0	1.59	3.24
5348.3	1.74	3.74

Top of Embankment Elevation 5352.2
Combination Spillway Elevation 5350.1
Bottom of Pond Elevation 5342.0
Top Width of Embankment 12.0 ft.
Down-Stream Side Slope (H:V) 3:1
Up-Stream Side Slope (H:V) 3:1
Maximum Sediment Elevation 5346.5

Combination Spillway Cross-Section



not to scale



Legend

Area of Detail

Culvert

N

RON C. VAN VALKENBURG NEW MEXICO REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 26-33

BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO USA

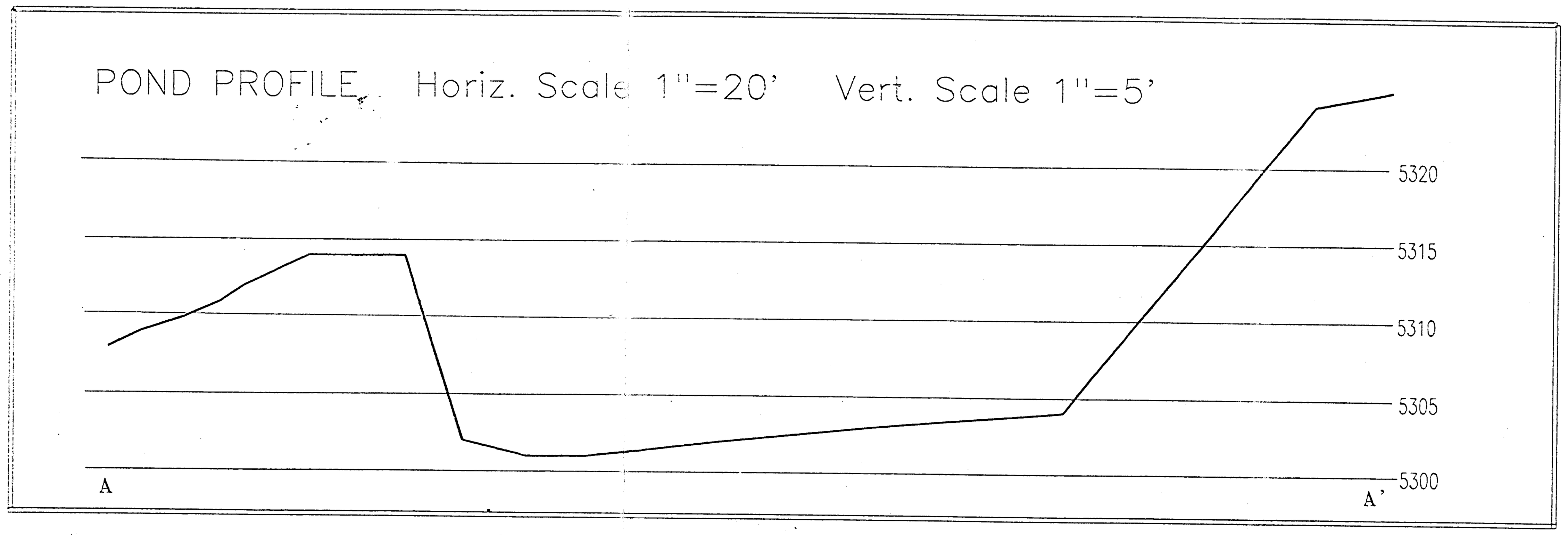
AS-BUILT
Barber Coal Stockpile Detention Pond #3

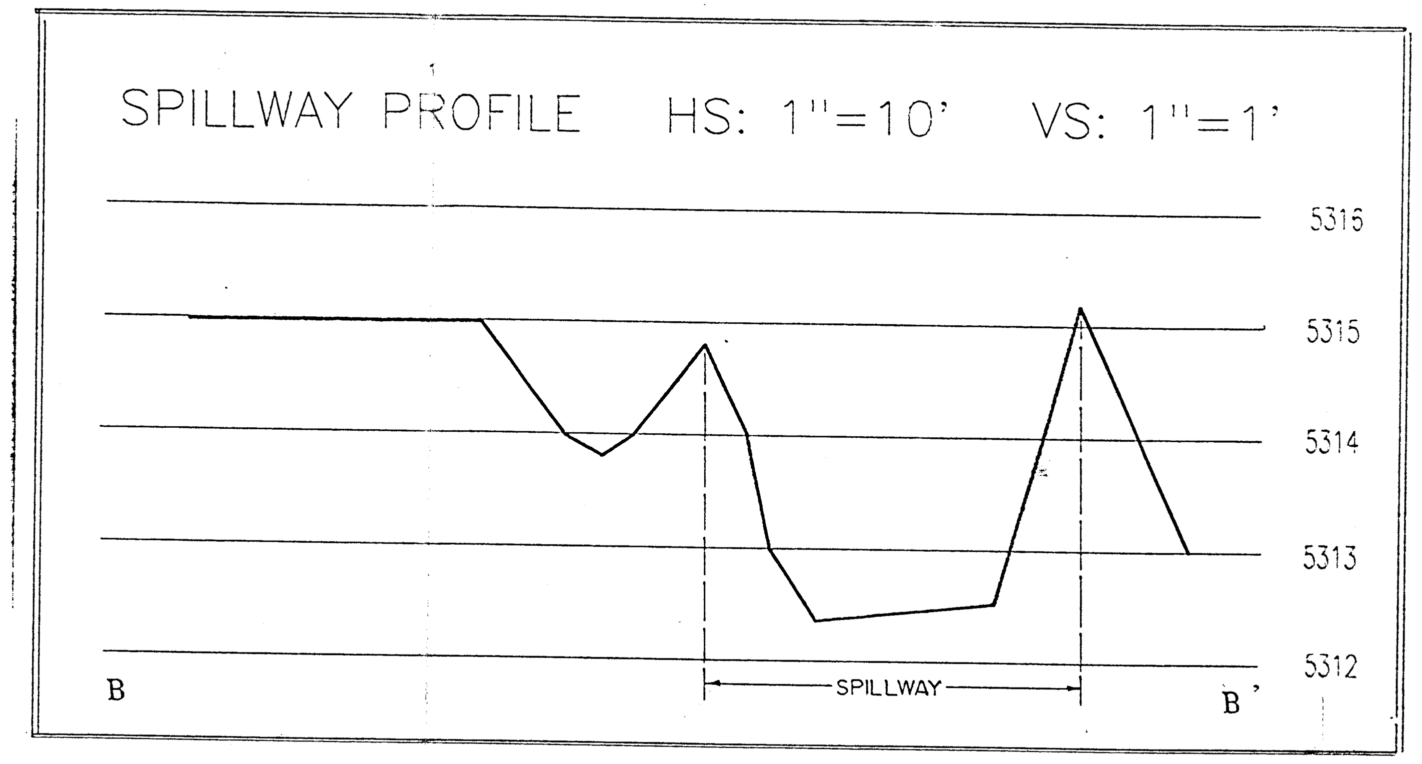
DRAWN BY: ACCA	SCALE: 1"=200'	CONTOUR INT.: 1'
APPROVED BY:	DATE: 02/14/91	
DRAWING NO.	LOCATION NO.	

REV. NO.	DATE	REVISIONS	Proj. Engineer	Professional Engineer	Chief Engineer
	02/14/91	As-Built Submittal		RCV	
1	8/24/93	CHANGE EXHIBIT NO. TO 11-44 JG.			

P.E. Stamp

/usr2/ctran/barbpd.dgn Jun. 17, 1993 10:19:07





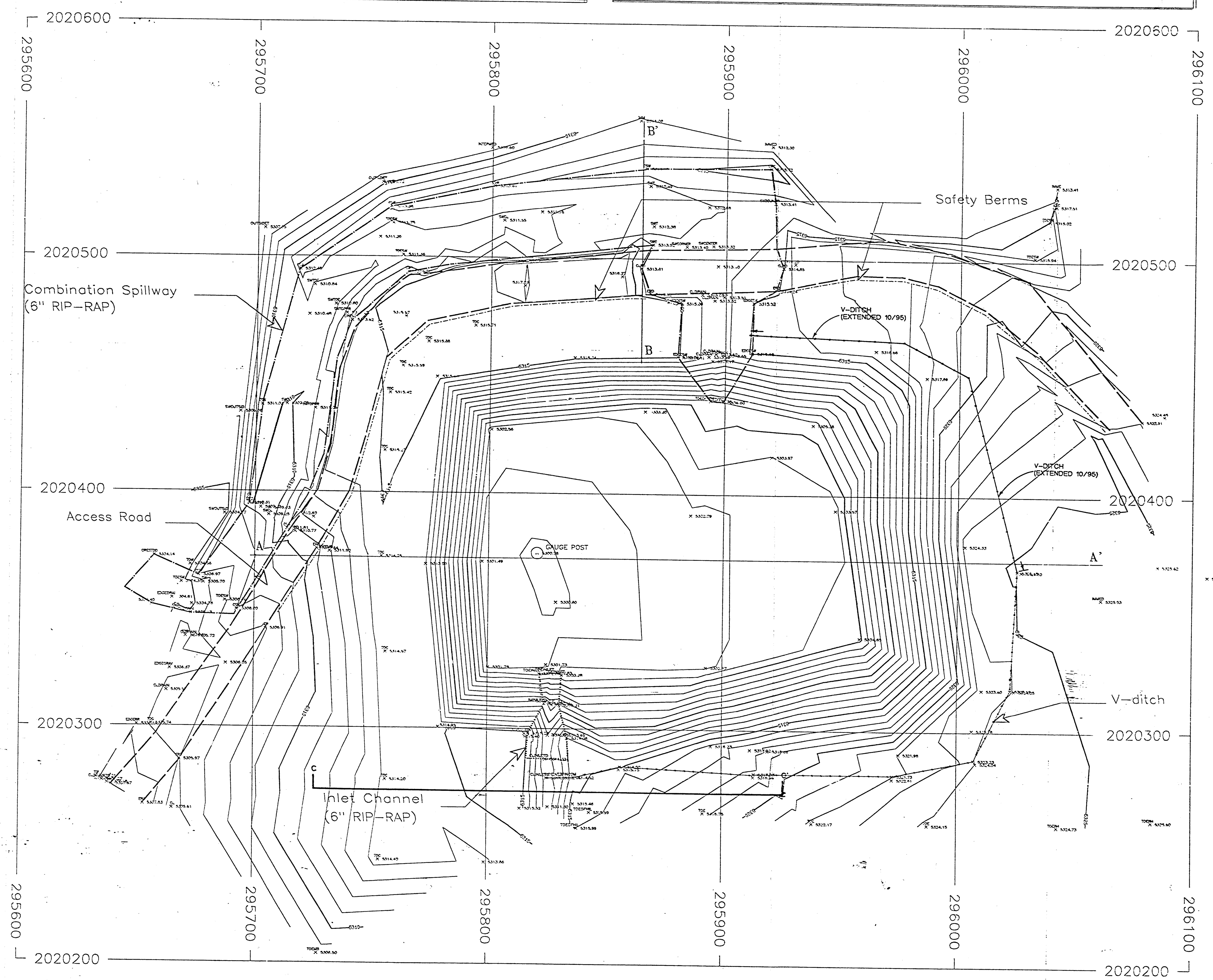
LEGEND
- ACCESS DIRT ROAD
- COMBINATION SPILLWAY
- V-DITCH
- SAFETY BERMS
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- GAUGE POST
- INLET CHANNEL

NOTES:

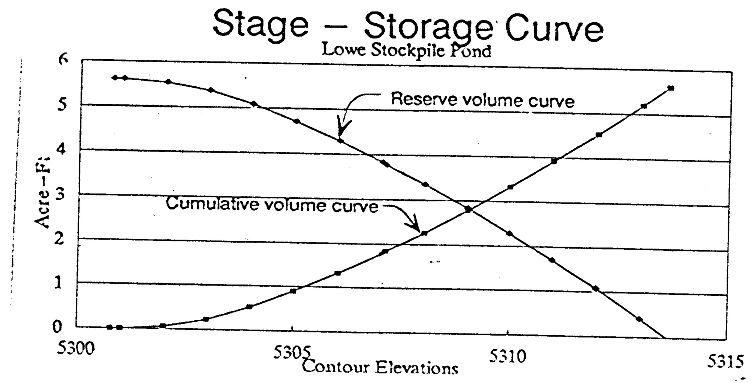
1. GAUGE POST BASE ELEVATION 5300.8
2. FOR BLUELINE ELEVATION REFER TO TO TABLE 11-5S IN THE PAP.

Lowe Stockpile Pond

Elevation	Contour Area (Ac)	Increm. Volume (Ac-ft)	Cumulative Volume (Ac-ft)	Reserve Volume (Ac-ft)
5300.8	0.00	0.00	0.00	5.60
5301.0	0.01	0.00	0.00	5.60
5302.0	0.11	0.06	0.06	5.54
5303.0	0.23	0.17	0.23	5.37
5304.0	0.35	0.29	0.52	5.08
5305.0	0.40	0.38	0.90	4.71
5306.0	0.44	0.42	1.32	4.29
5307.0	0.47	0.46	1.77	3.83
5308.0	0.50	0.49	2.26	3.35
5309.0	0.53	0.52	2.77	2.83
5310.0	0.57	0.55	3.32	2.28
5311.0	0.60	0.59	3.91	1.70
5312.0	0.64	0.62	4.53	1.08
5313.0	0.68	0.66	5.19	0.42
5313.6	0.70	0.42	5.60	−0.00



Stage – Storage Curve



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowlege.

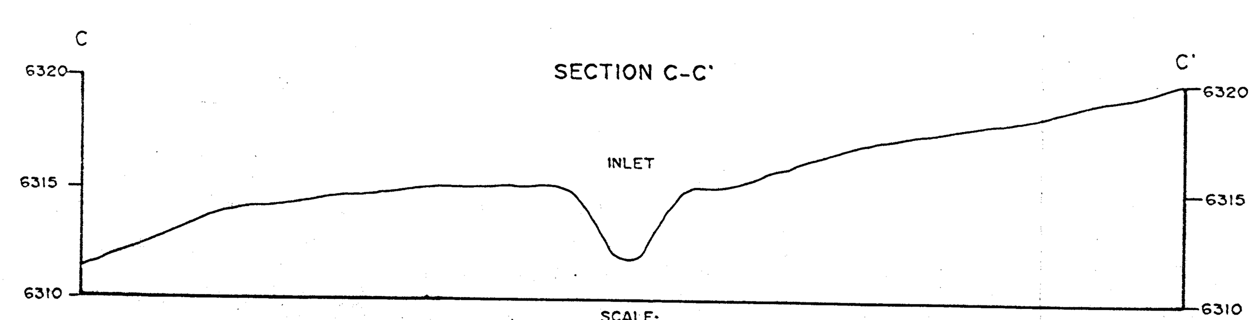
LEONARD RAYMOND NEW MEXICO 5600 REGISTERED PROFESSIONAL ENGINEER

2-3-99

MAR 1999 APPROVED

20 0 20 40

CONTOUR INTERVAL: 1'



REV. NO.	DATE	REVISIONS	DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR./PE
1	6-17-93	ADDED X-SECTION C-C'	PJF			
2	8/20/93	CHANGE EXHIBIT NO. TO 11-45	JG			
3	11-21-95	ADDED V-DITCH EXTENSION.				
4	9-14-98	ADDED NOTES 1 AND 2.	RY			

EXHIBIT 26-34

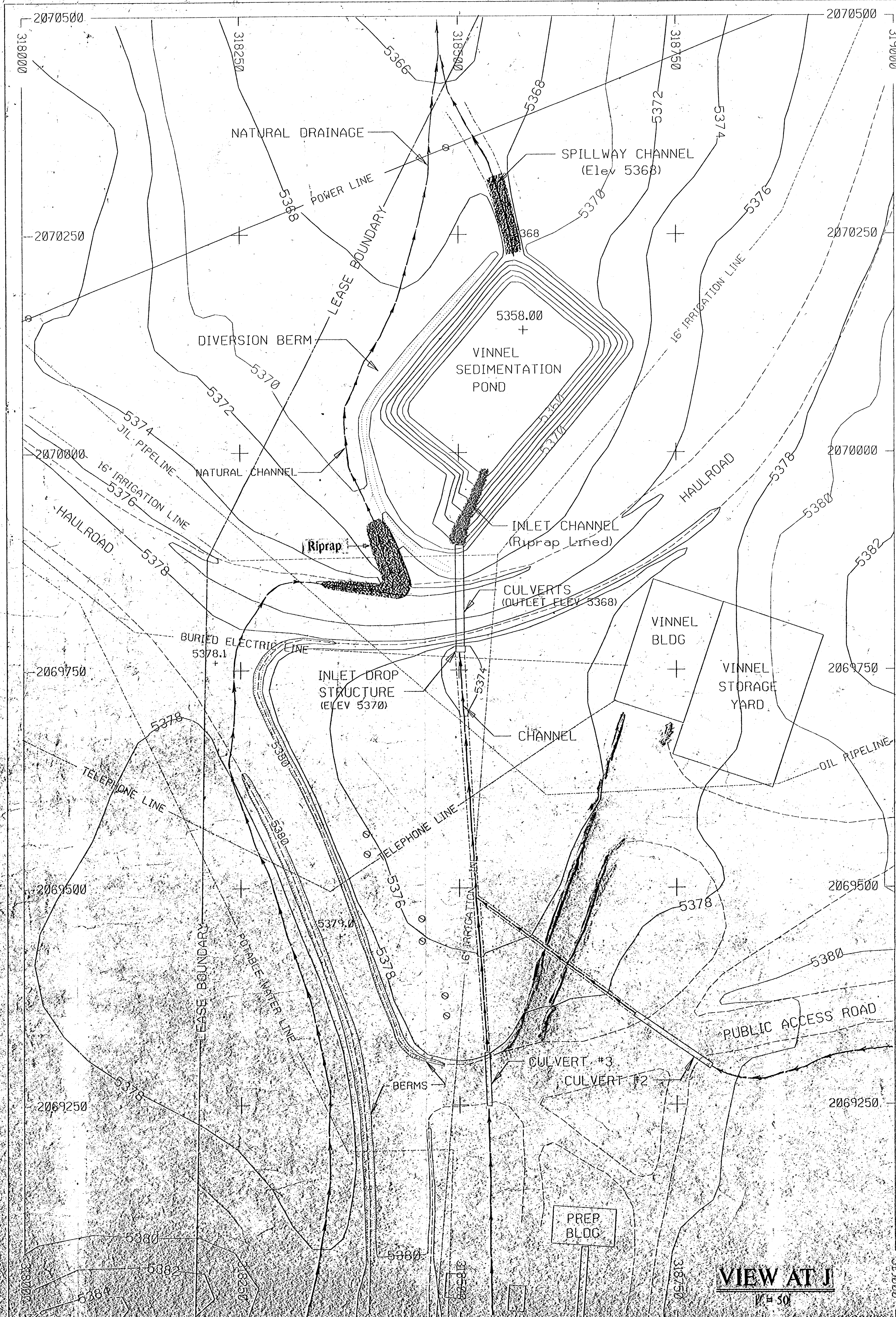
BHP MINERALS INTERNATIONAL INC.

NAVAJO MINE

FRUITLAND, NEW MEXICO

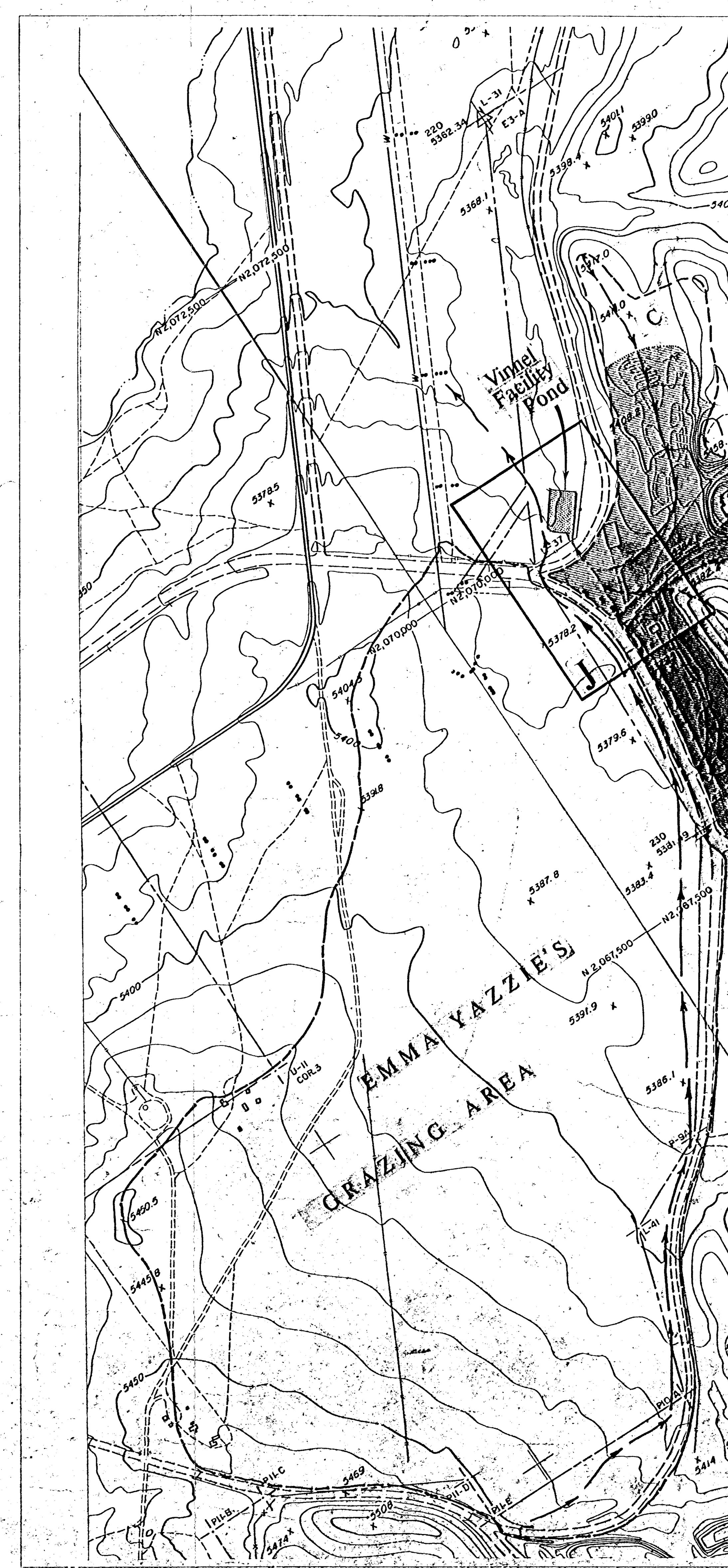
LOWE STOCKPILE POND
AS-BUILT

DRAWN BY SYP	SCALE 1"=20'
APPROVED BY BAP	DATE 04/20/92
DRAWING NO EXHIBIT 29-9B	LOCATION NO MF-D2a



VIEW AT J

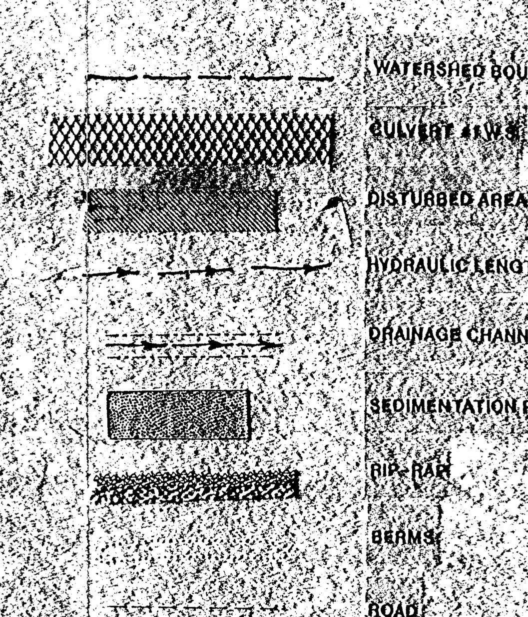
1" = 50'



WATERSHED DETAILS

SCALE 1" = 500

LEGEND



BHP MINERALS INTERNATIONAL

NAVAJO MINE

FRUITLAND, NEW MEXICO, USA

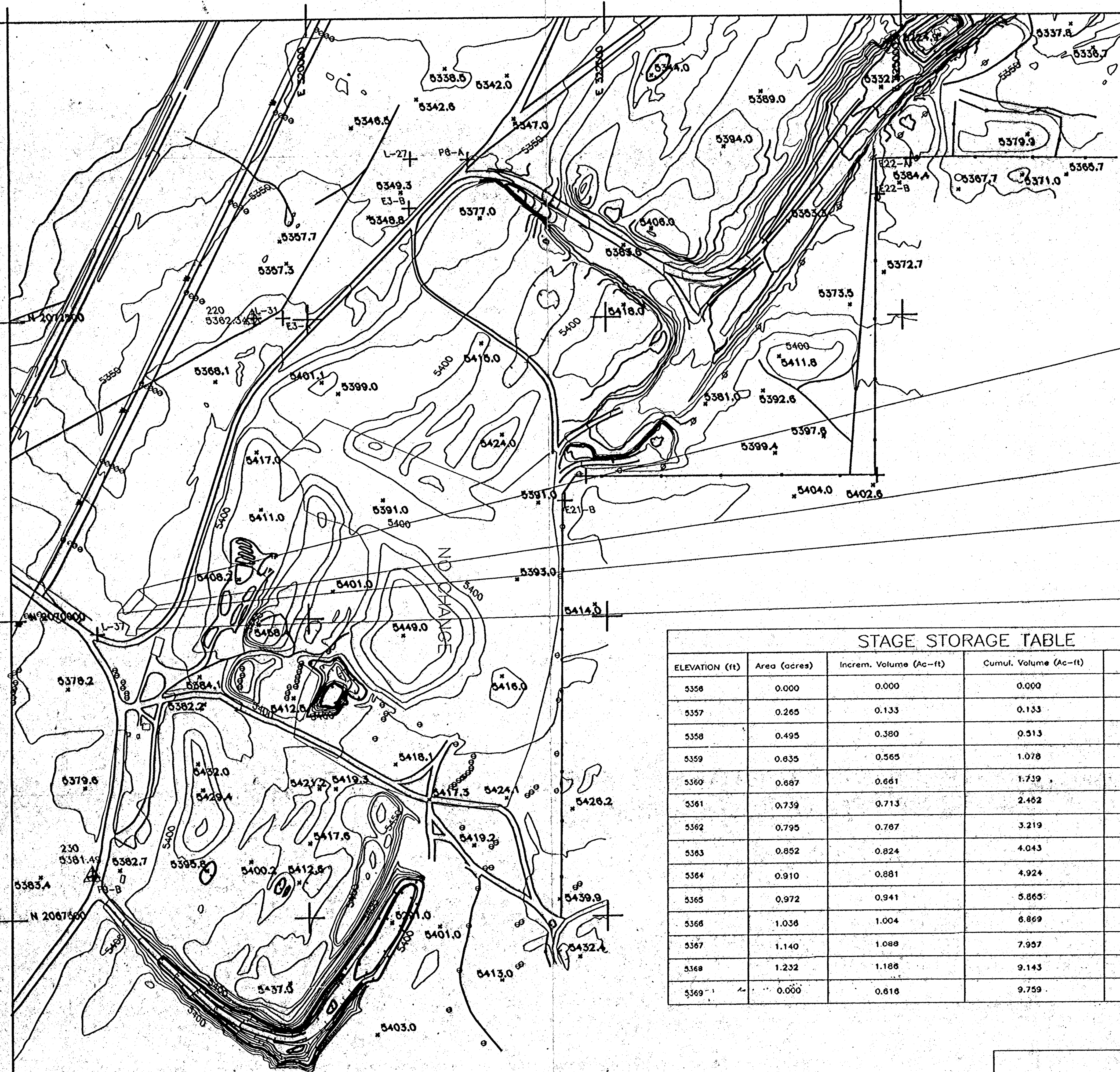
VINNEL HYDROLOGY PLAN

EXHIBIT 26-35

DRAWN BY: JRC	SCALE: 1" = 50'	CONTOUR INT: 2'
APPROVED BY: JRC	DATE: 1/9/90	
DRAWING NO.	LOCATION NO.	

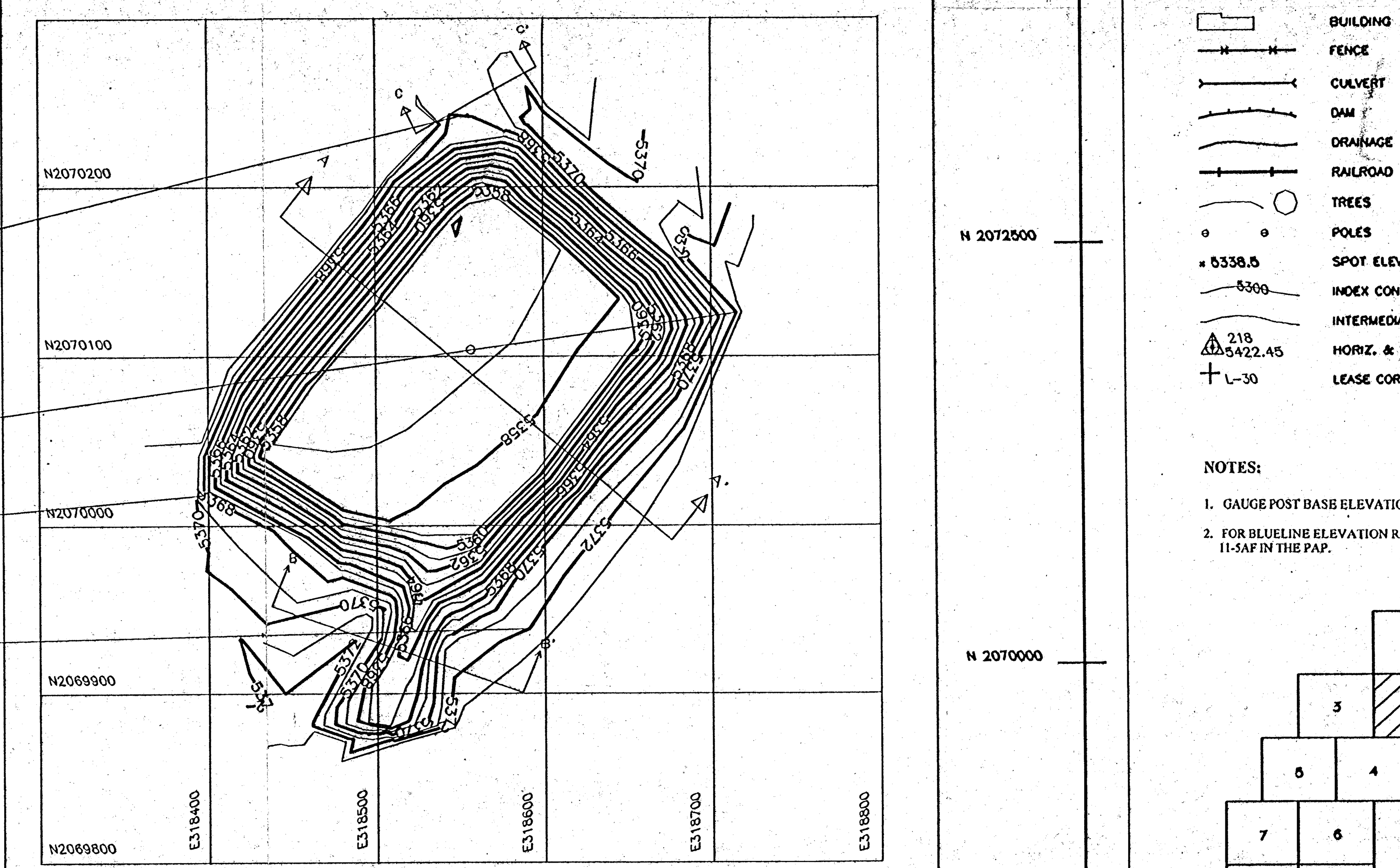
REV. NO.	DATE	REVISIONS	Proj. Engineer	Professional Engineer	Chief Engineer
1	3/1/91	POND RELOCATION & DIVERSION STRUCTURES ADDED			
2	7/3/91	RIPRAP ADDED			
3	9/3/92	RENUMBERED FROM EXH. 29-18 TO EXH. 29-19			
4	8/23/93	CHANGE EXHIBIT # TO 11-46 AND CO. NAME	JG		

P.E. Stamp



STAGE STORAGE TABLE

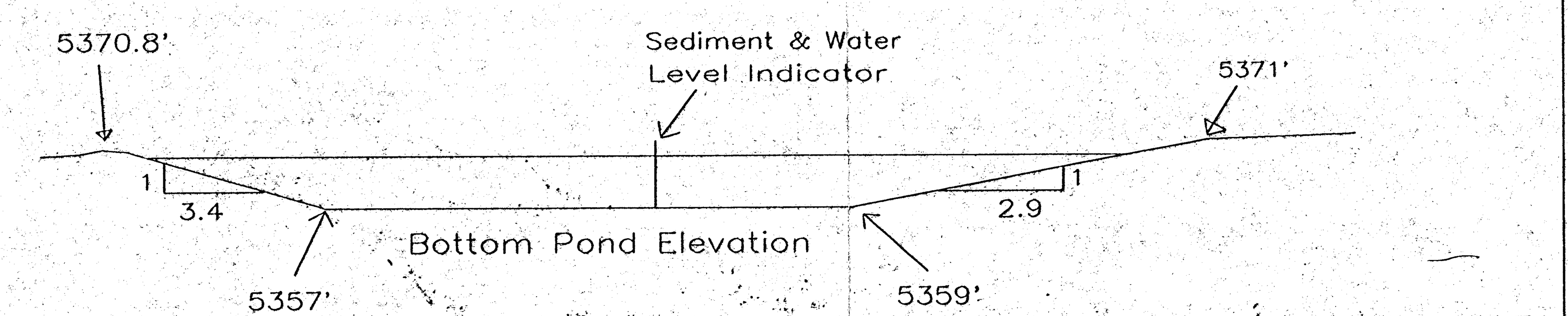
ELEVATION (ft)	Area (acres)	Increm. Volume (Ac-ft)	Cumul. Volume (Ac-ft)	Reserve Volume (Ac-ft)
5356	0.000	0.000	0.000	9.759
5357	0.265	0.133	0.133	9.626
5358	0.495	0.380	0.513	9.246
5359	0.635	0.565	1.078	8.681
5360	0.687	0.661	1.739	8.020
5361	0.739	0.713	2.452	7.307
5362	0.795	0.767	3.219	6.540
5363	0.852	0.824	4.043	5.716
5364	0.910	0.881	4.924	4.835
5365	0.972	0.941	5.865	3.894
5366	1.036	1.004	6.869	2.890
5367	1.140	1.088	7.957	1.802
5368	1.232	1.186	9.143	0.616
5369	0.000	0.616	9.759	0.000



Vinnel Pond

scale: 1" = 50'

Cross Section A–A'

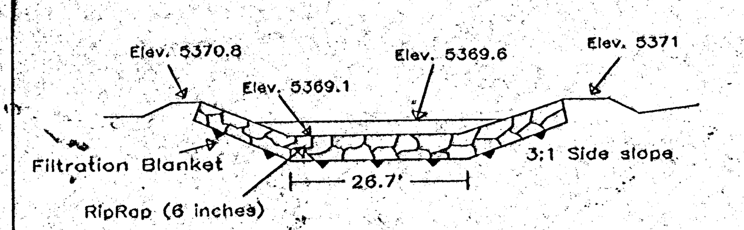


Scale: 1" = 25'

ITEM	ELEV. – DIM.
ELEV. OF TOP OF DAM	5370.8
ELEV. OF POND BOTTOM	5356
COMBINATION SPILLWAY ELEV.	5369.1

Emergency Spillway

Typical Cross section C-C'

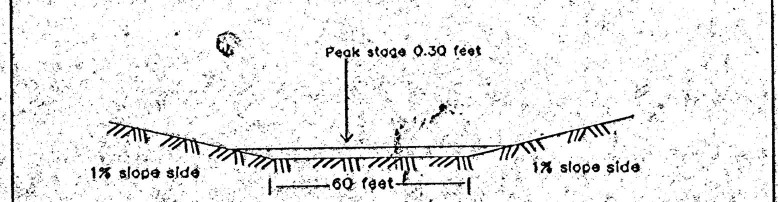


Peak Stage: 25 years–6 hours event = 5369.6

No Scale

CHANNEL BETWEEN HAULROAD and RAMP 7

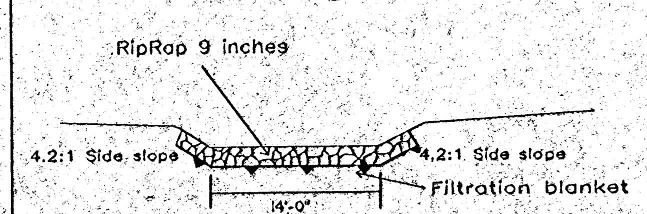
Typical cross section



No scale

Vinnel Pond Inlet

Cross Section B-B'



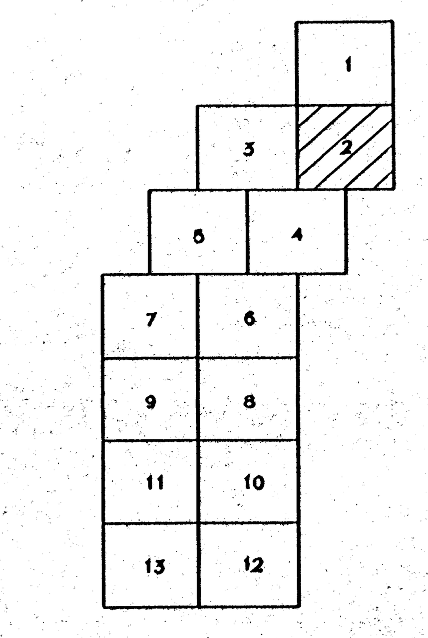
No scale

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POLES
- SPOT ELEVATION
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- HORIZ. & VERT. CONTROL
- LEASE CORNER

NOTES:

1. GAUGE POST BASE ELEVATION 5357.8 GPS.
2. FOR BLUELINE ELEVATION REFER TO TABLE II-5AF IN THE PAP.



CONTOUR INTERVAL: 10'
DATE OF PHOTOGRAPHY: 10-26-91

Revised by
DATAMAP
DIGITAL SERVICES, INC.
Revision photography May 30, 1993

Construction Certification and Inspection Report

Vinnel Pond construction have been in accordance with the approved design except for these noted minor changes:

1. Pond length, width, top and bottom elevations, spillway width and Elevation varied slightly from the design plan, however the as-built volume is greater than the designed volume and does not affect the safety operation of the pond.
2. The inlet channel width was increased to 60 feet with a flatter slope to accommodate the flow rates and field limitations.

I, Steve Robert Flammang, hereby certify this as-built information concerning the Vinnel Pond as being complete and accurate to the best of my knowledge.

MAR 1999
APPROVED

As-Built

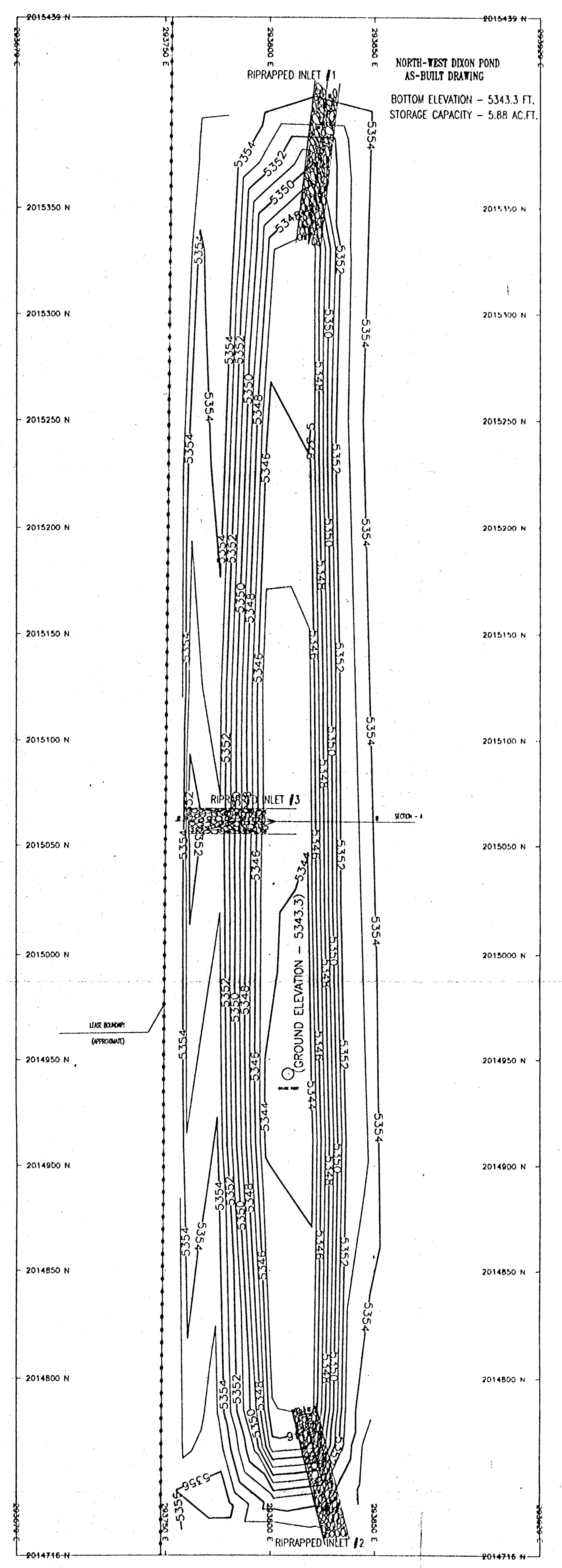
LEONARD RAYMOND
NEW MEXICO
6600

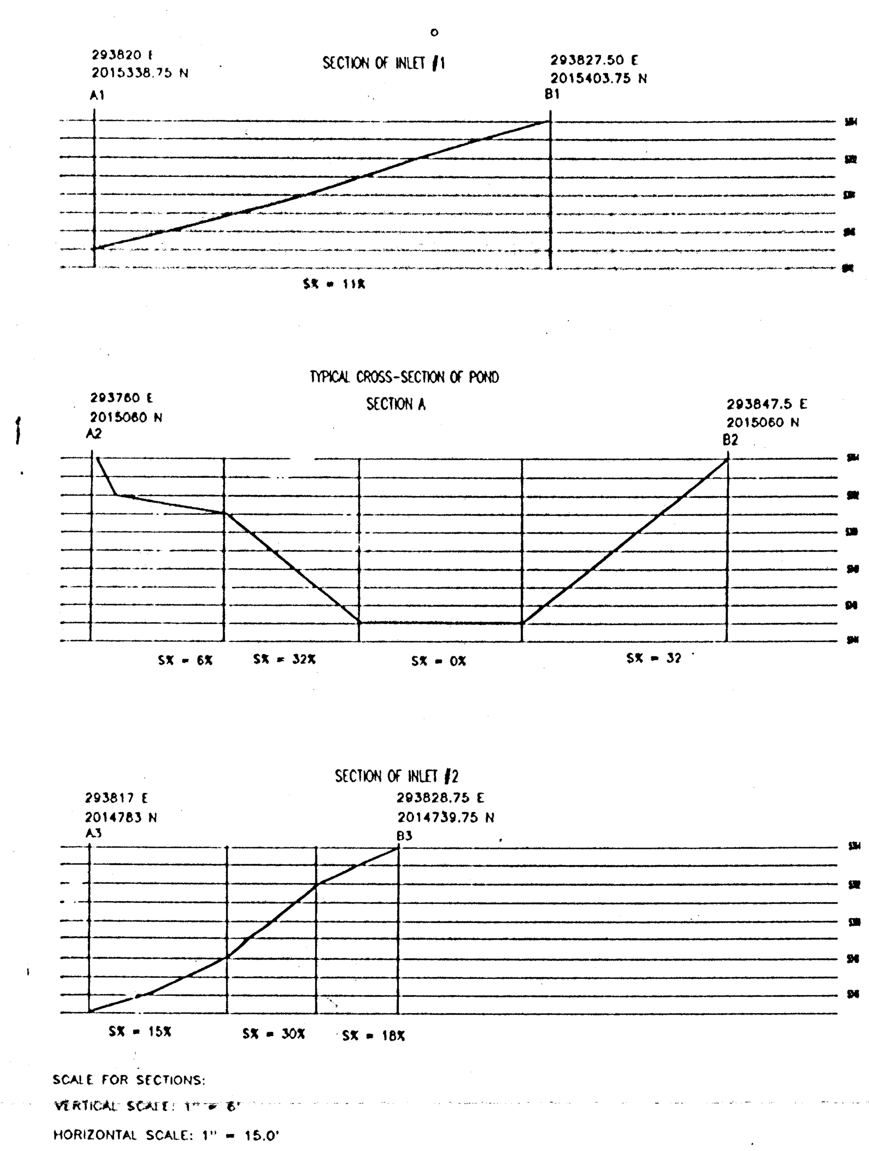
9-25-98

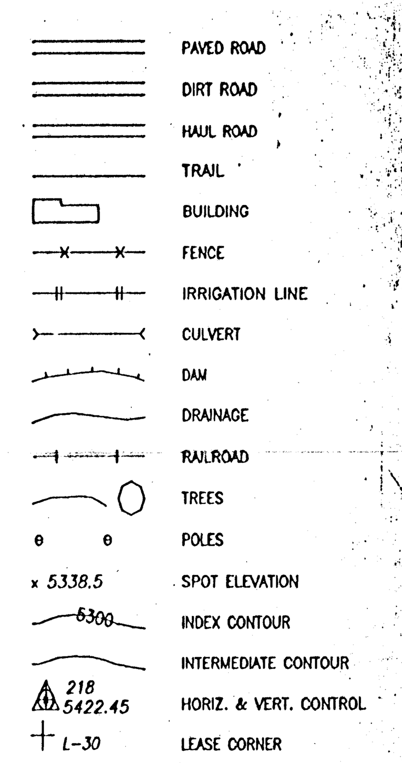
BHP Minerals International
NAVAJO MINE
FRUITLAND, NEW MEXICO

Vinnel Pond
EXHIBIT 26-36

DRAWN BY SJP	SCALE 1" = 500'		
APPROVED BY	DATE May 1994		
DRAWING NO		LOCATION NO	







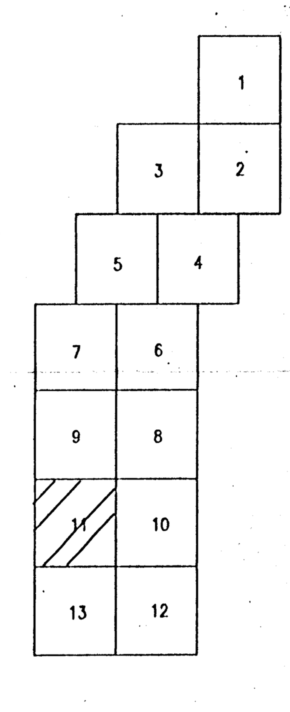
ELEVATION	CONTOUR AREA (AC.)	INCREM. VOLUME (AC-FT)	CUMULATIVE VOLUME (AC-FT)	RESERVE VOLUME (AC-FT)
5343.3	0.00	0.00	0.00	5.88
5344.0	0.06	0.02	0.02	5.86
5345.0	0.24	0.14	0.16	5.72
5346.0	0.35	0.30	0.45	5.43
5347.0	0.40	0.38	0.83	5.05
5348.0	0.48	0.44	1.27	4.61
5349.0	0.57	0.53	1.79	4.09
5350.0	0.60	0.59	2.38	3.50
5351.0	0.84	0.72	3.10	2.78
5352.0	0.89	0.87	3.96	1.92
5353.0	0.94	0.92	4.88	1.00
5354.0	1.06	1.00	5.88	0.00

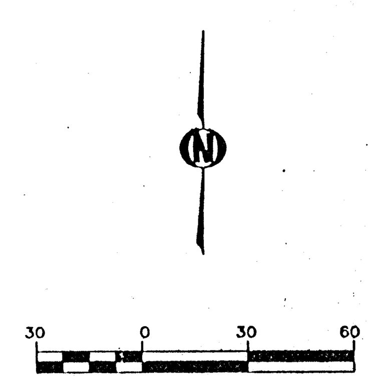
NOTES

ADJUSTMENT FOR SURVEY CONTROLS

1. Original as built base on level loop for North West Dixon Pond, which is 0.58 Feet below the GPS control data.
2. Base Elevation of gauge post is based on GPS survey. Gauge post base Elevation is 5344.62 ft.

8. Blueline Elevations can be found in Table 11-5AA





CONTOUR INTERVAL: 1'

APPROVED MAR 1999

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowlege.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

2-3-99

REV. NO.	DATE	DRAFT. BY	DESCRIPTION	ENG.	E.O.	CHIEF ENG.
4	1-28-99	PJF	REMOVED NOTE, DESIGN INFOR, REVISED TITLE AND ADDED CERTIFICATION STATEMENT.			
3	5-26-98	RY	ADDED SURVEY BASE			
2	11-29-95		REVISED DESIGNED DATA.	DR		
1	8/24/93	JG	CHANGE EXHIBIT NO. TO 11-47			

APPROVALS

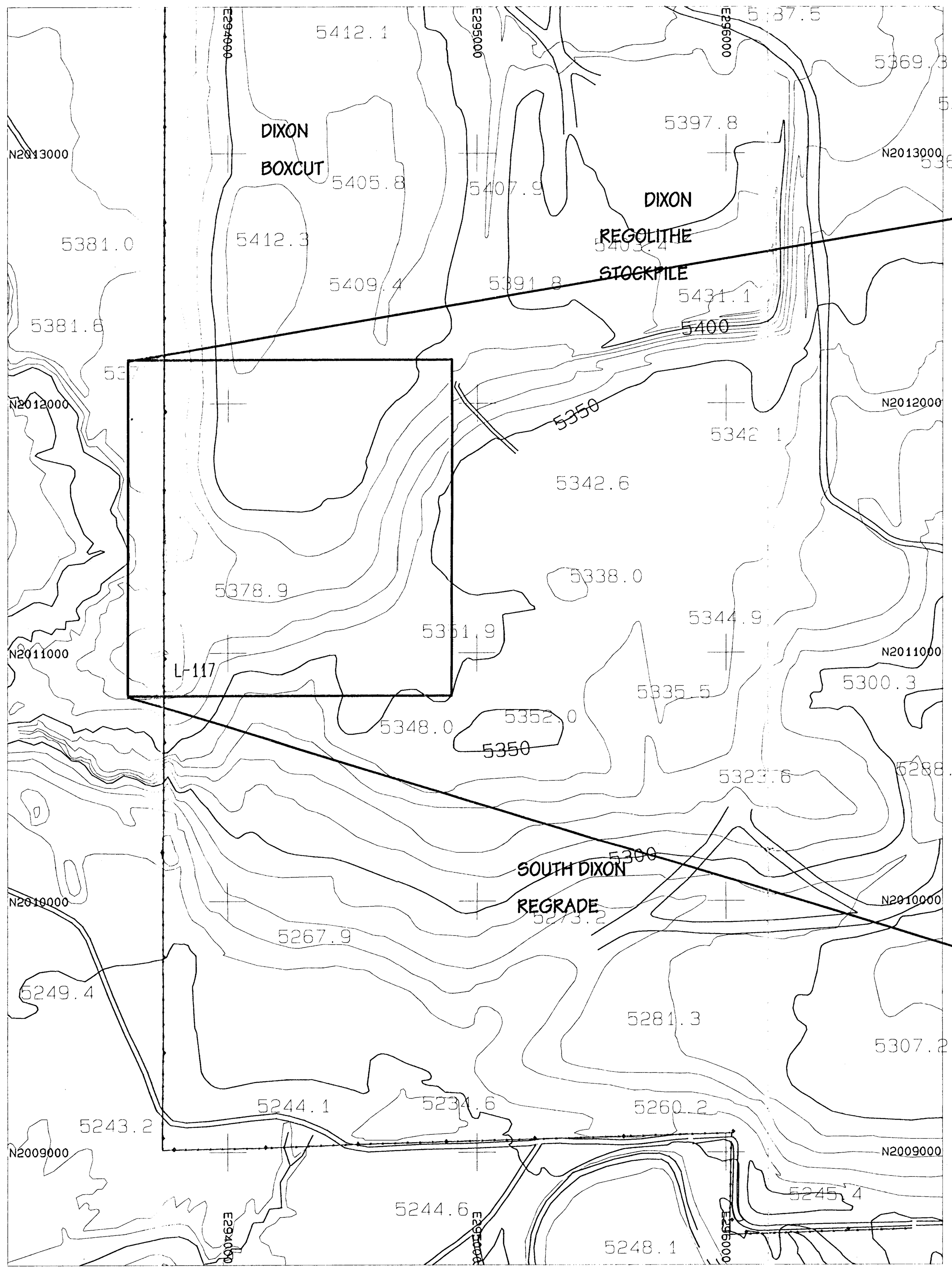
BHP MINERALS INTERNATIONAL INC.

NAVAJO MINE
SAFETY PAYS
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

EXHIBIT 26-37

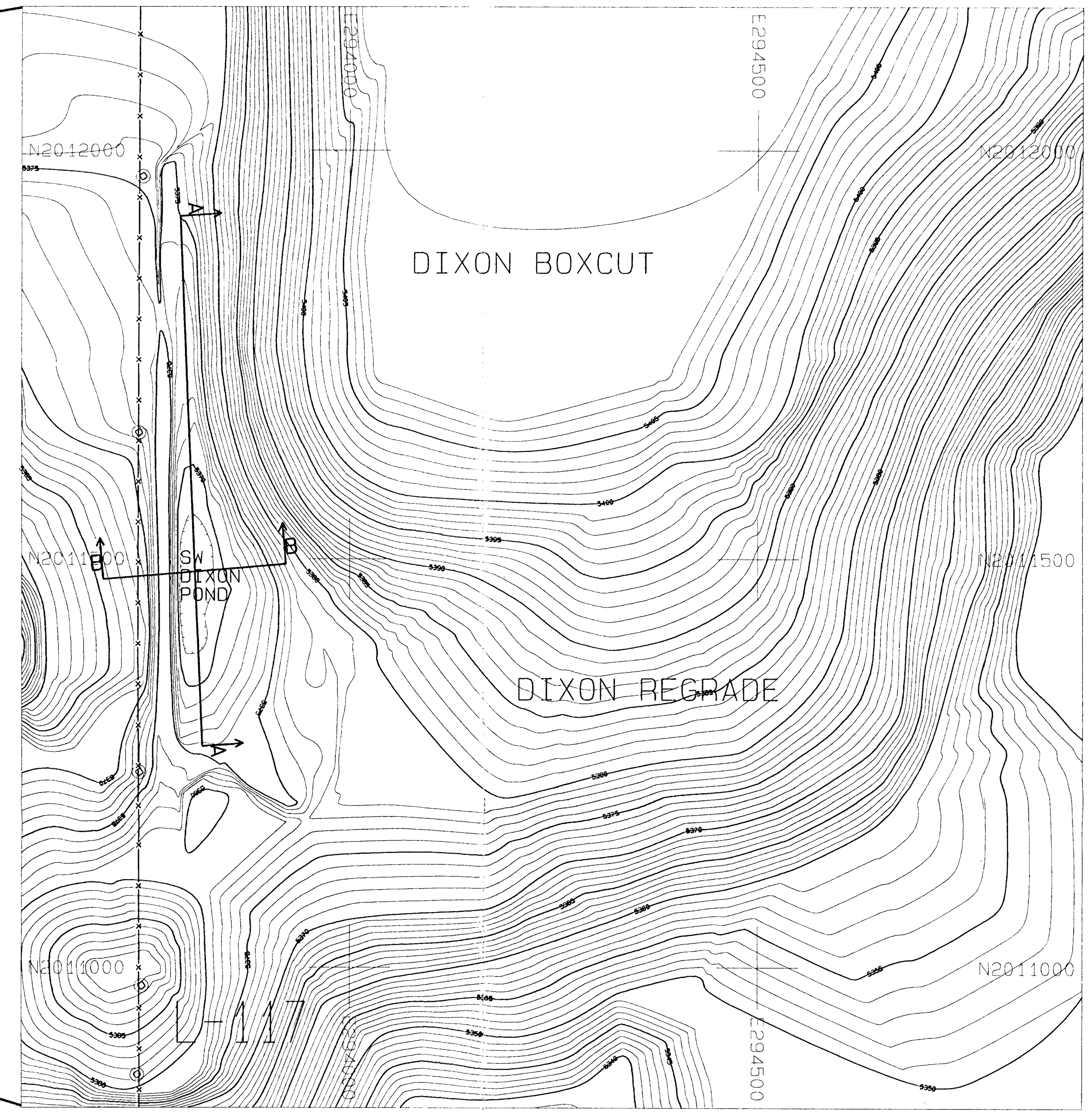
NORTHWEST DIXON POND AS-BUILT

PREPARED BY A.K. ESSIAM | DRAWN BY PJFOSTER | SCALE: 1" = 30'
APPROVED BY GAP | DATE MAY 27, 1993 | DRAWING LOCATION MF-024
DRAWING NO.



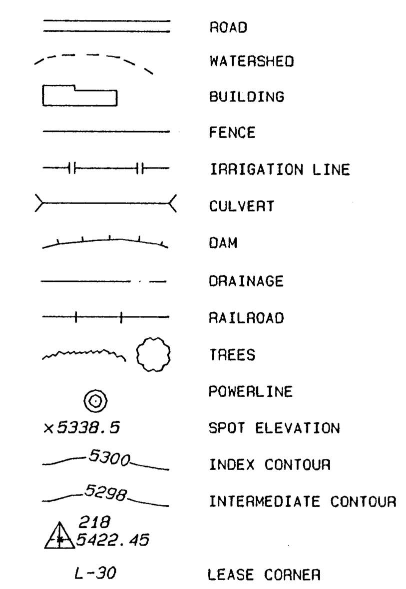
LOCATION MAP

SCALE: 1"=300 FT.



SCALE: 1"=100 FT.

LEGEND

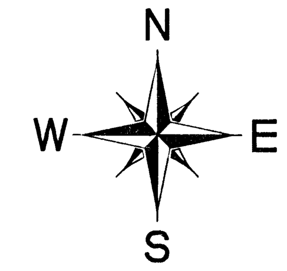


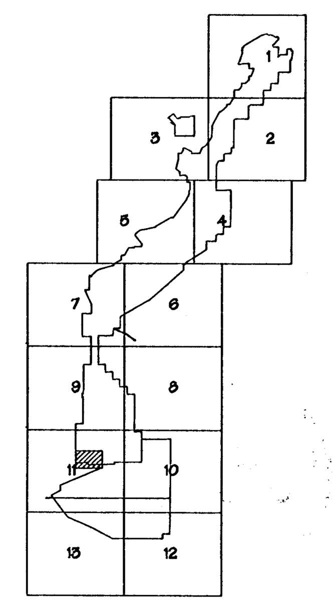
STAGE STORAGE DATA

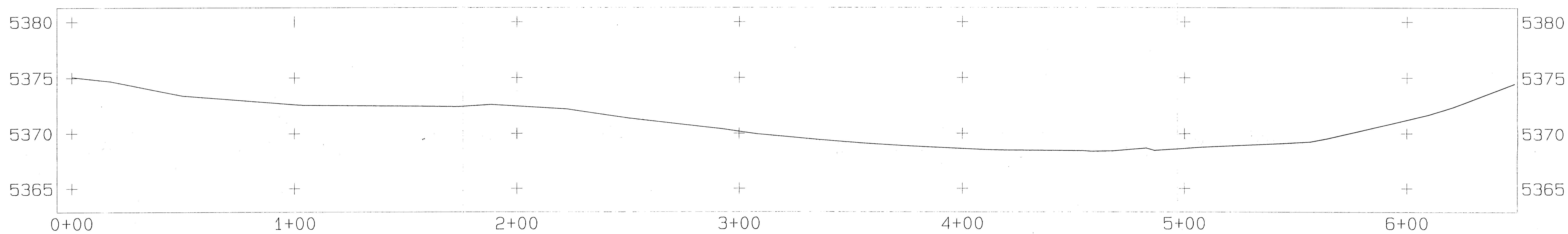
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5368	0.04	0.00	0.00
5369	0.13	0.08	0.08
5370	0.26	0.20	0.28
5371	0.44	0.35	0.63
5372	0.58	0.51	1.14
5373	0.77	0.68	1.82
5374	0.99	0.89	2.71

NOTES

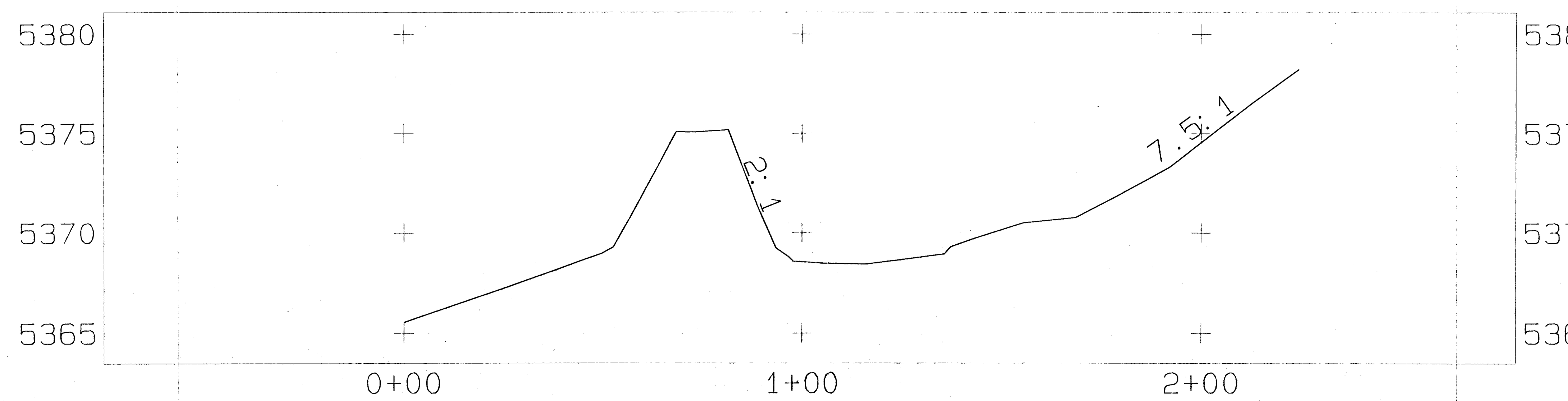
1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. Gauge Post Base Elevation: 5367.53 FT. (GPS)
3. **Blueline Elevations can be found in Table 11-5.**







SECTION A-A

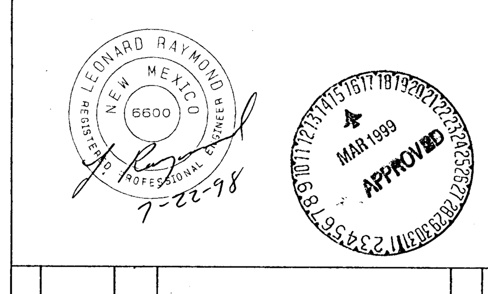


SECTION B-B

SECTIONS SCALE-HORIZONTAL: 1"=20 FT.
VERITCAL: 1"=4 FT.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.



REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
1	05/15/98	RY	RE-SURVEYED AND RE-ASBUILT					

APPROVALS

EXHIBIT 26-38

NAVAJO COAL COMPANY

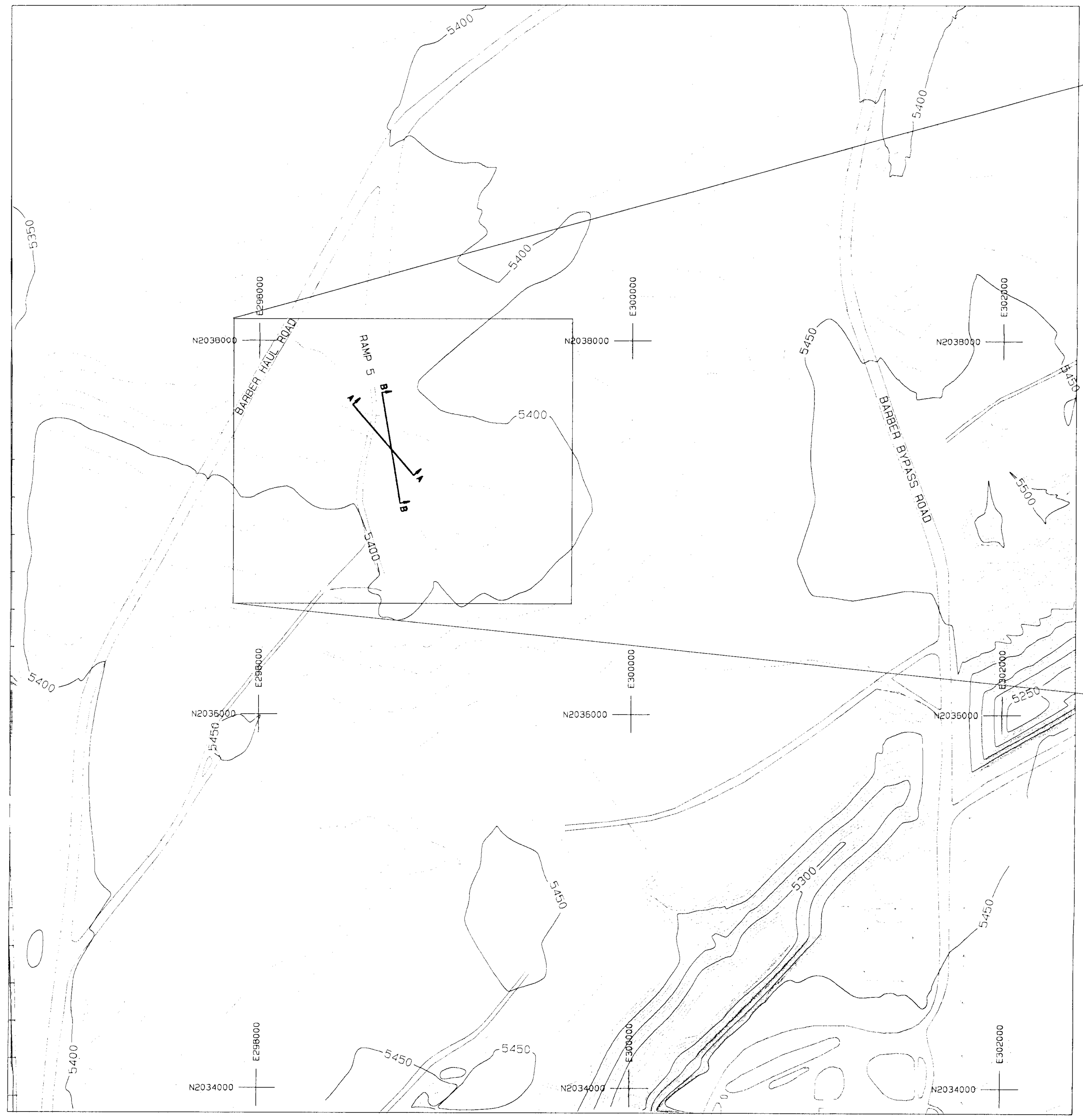
NAVAJO MINE
SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

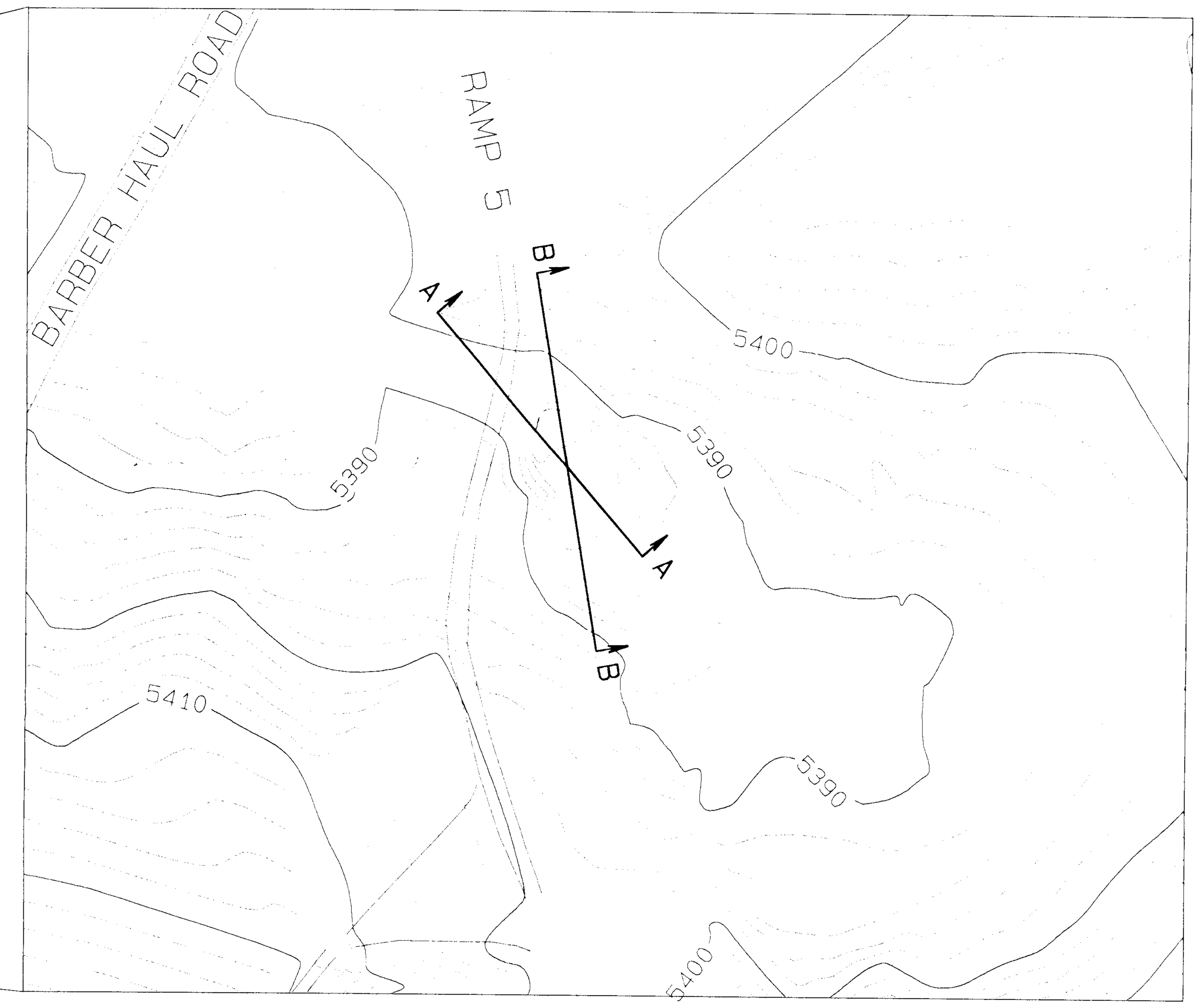
ASBUILT
SOUTH WEST DIXON POND

PREPARED BY RY	DRAWN BY RY	SCALE AS NOTED
APPROVED BY LR	DATE 05/15/98	REF DWG

DWG LOC J: \OSM_SUBM\PER_PROG\CH_11\1998PO~1\EXHIBITS\S



Scale: 1" = 500'



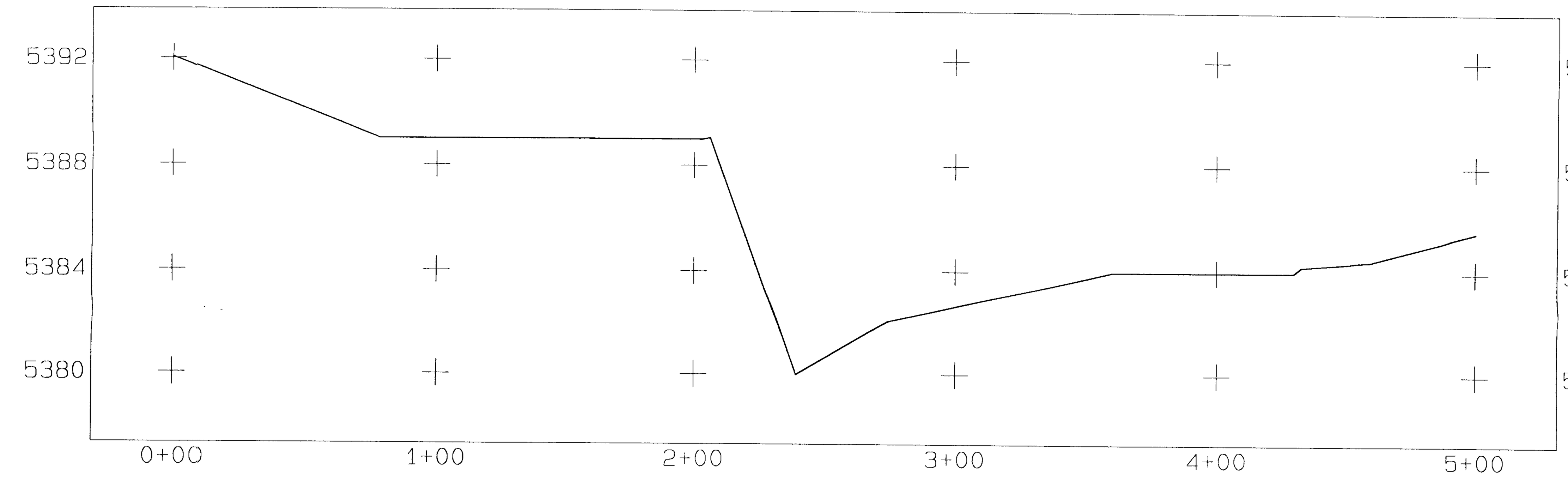
Scale: 1" = 200'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 CONTROL
- L-30 LEASE CORNER

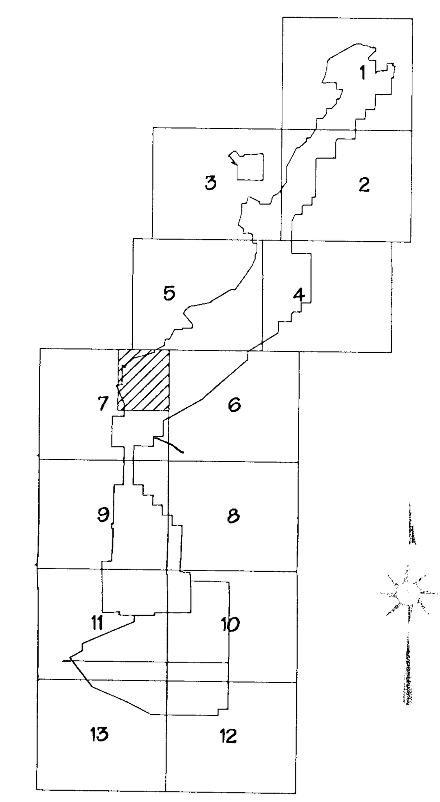
NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. See Exhibit 11-050 for South Barber Pond design, respectively.
3. For watershed area, see Exhibit 11-13D.
4. See Table 11-5F for impoundment data.



SECTION A - A

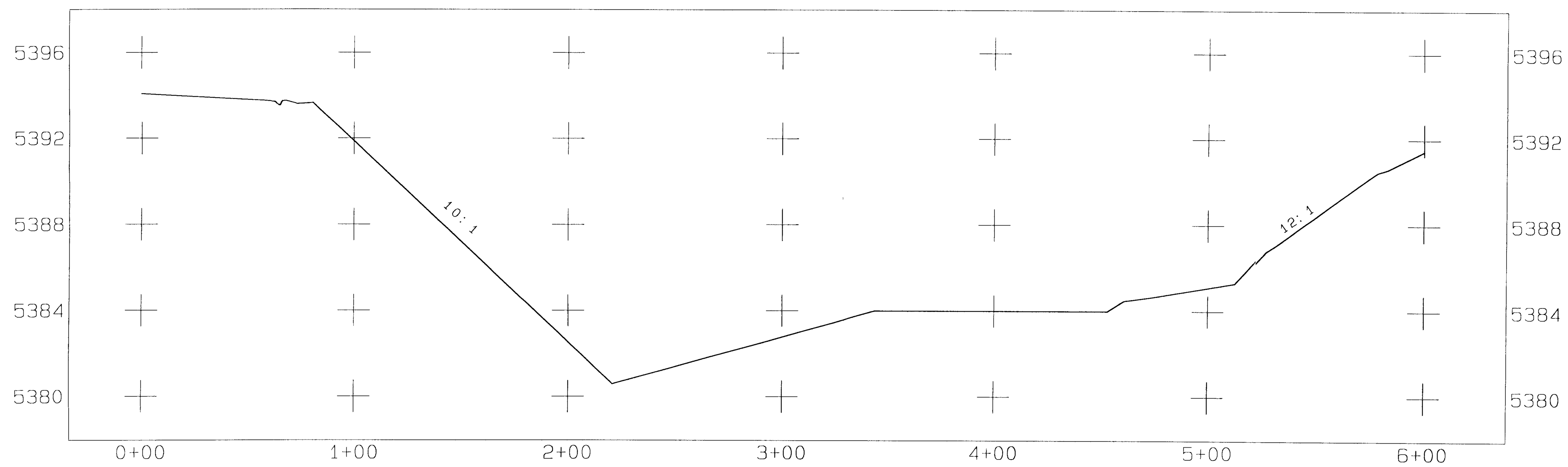
Scale Horizontal 1" = 40'
Vertical 1" = 4'



SCALE AS NOTED

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5380	0.00	0.00	0.00
5381	0.05	0.02	0.02
5382	0.13	0.09	0.11
5383	0.25	0.19	0.31
5384	0.66	0.45	0.76
5385	0.94	0.80	1.56
5386	1.17	1.05	2.61
5387	1.45	1.31	3.92
5388	2.02	1.73	5.65
5389	2.72	2.37	8.02



SECTION B - B

Scale Horizontal 1" = 40'
Vertical 1" = 4'

APPROVED

1-30-00

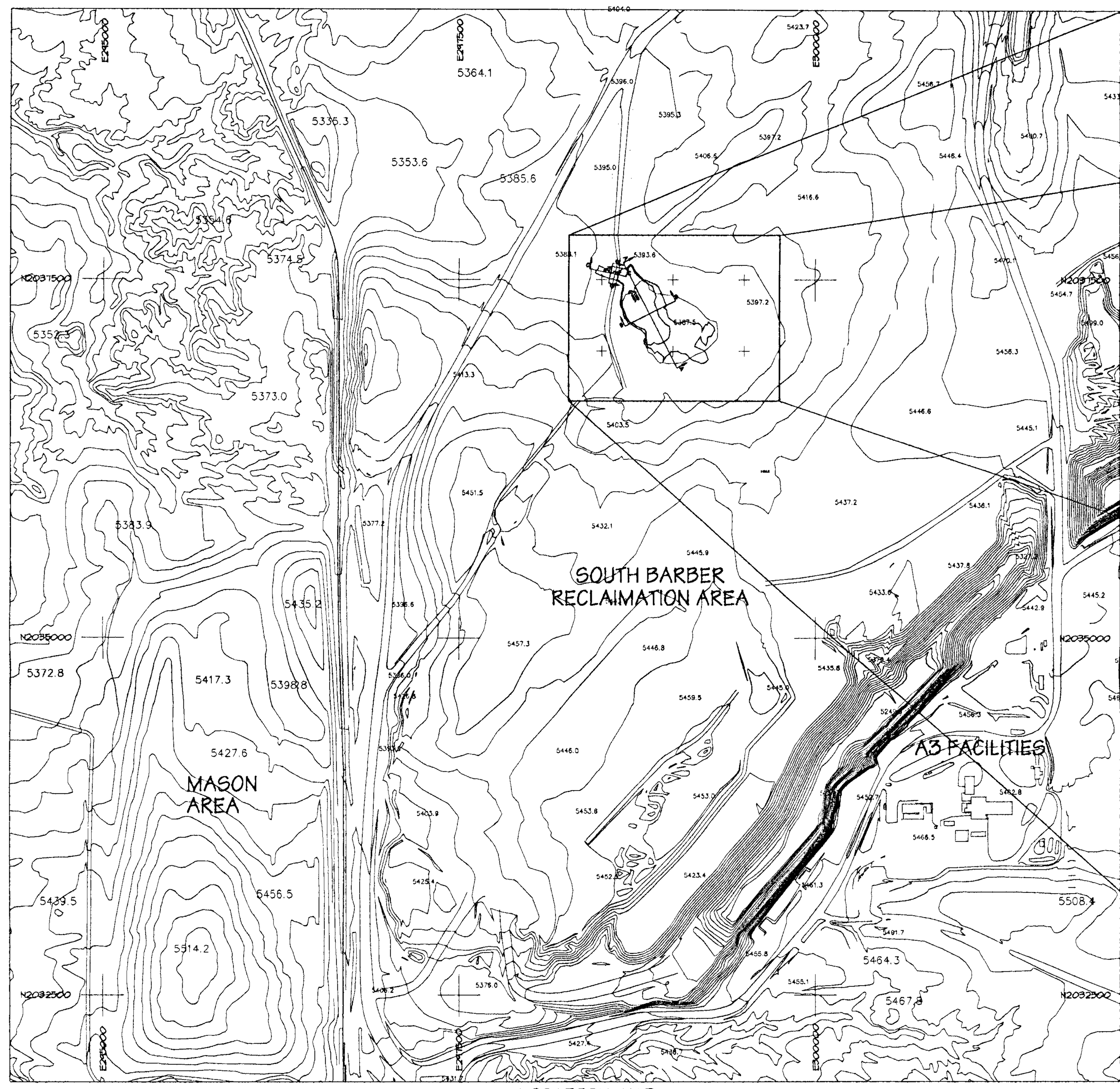
CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

1-31-06

EXHIBIT 26-39 SOUTH BARBER POND DESIGN	PLAN, PROFILE AND SECTION
ACCOUNT: DATE: JAN. 30, 200 DESIGNED BY: WJ NAPOLEON DRAWN BY: WJ NAPOLEON CHECKED BY: LEONARD RAYMOND APPROVED BY: LEONARD RAYMOND	BHP NAVAJO COAL CO. NAVAJO MINE PO BOX 1717, FRUITLAND, NEW MEXICO, 87416
PROJECT MANAGER: BEN HOSKIE ENGR. of RECORD: LEONARD RAYMOND REG. NO. 6600 SRVYR of RECORD: REG. NO:	REV NO. 1 — DESCRIPTION: SUBMITTED TO OSM FOR APPROVAL — DATE: 01-30-06



LOCATION MAP
Scale: 1" = 800'

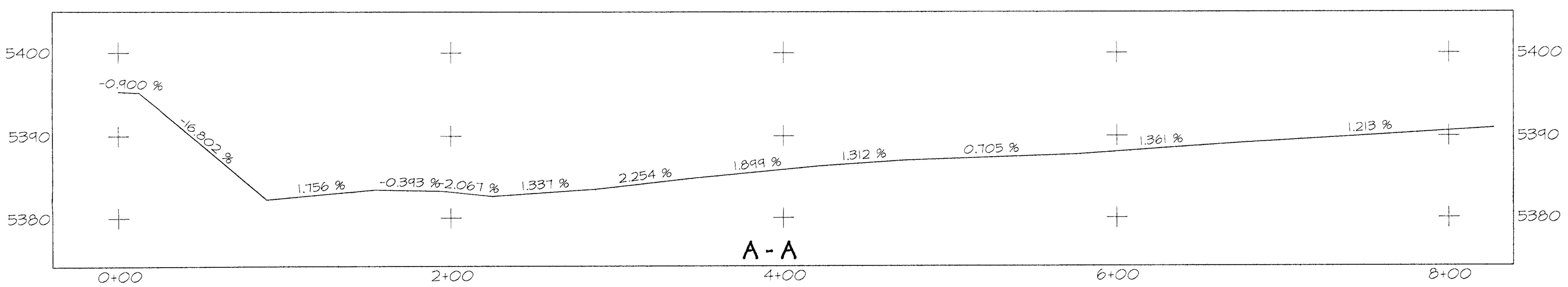
PLAN
Scale: 1" = 100'

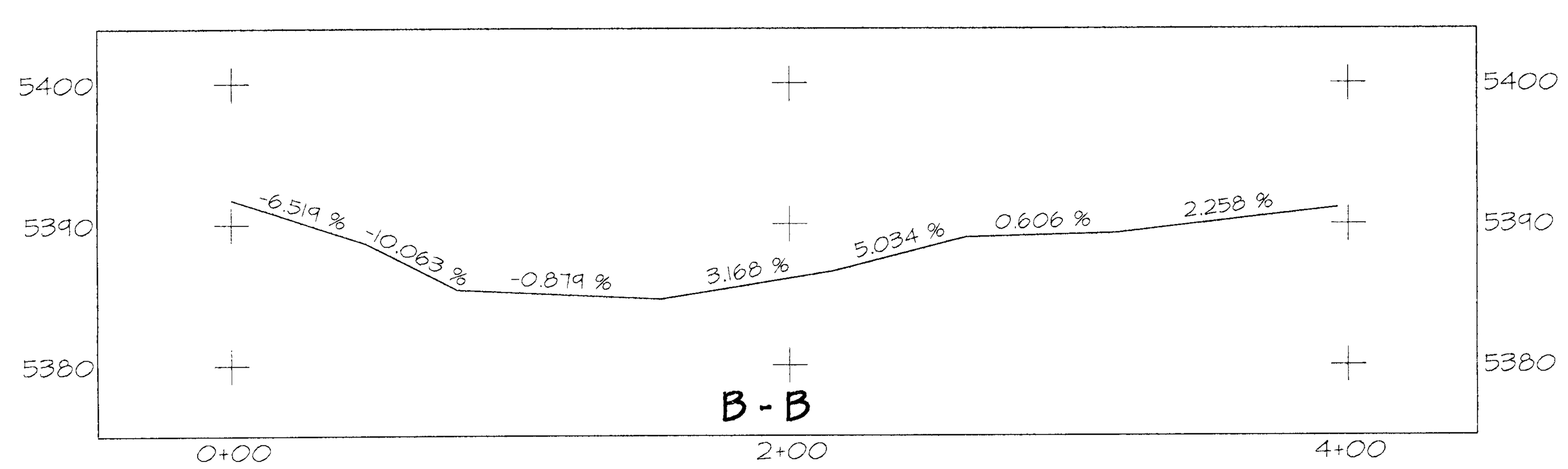
LEGEND

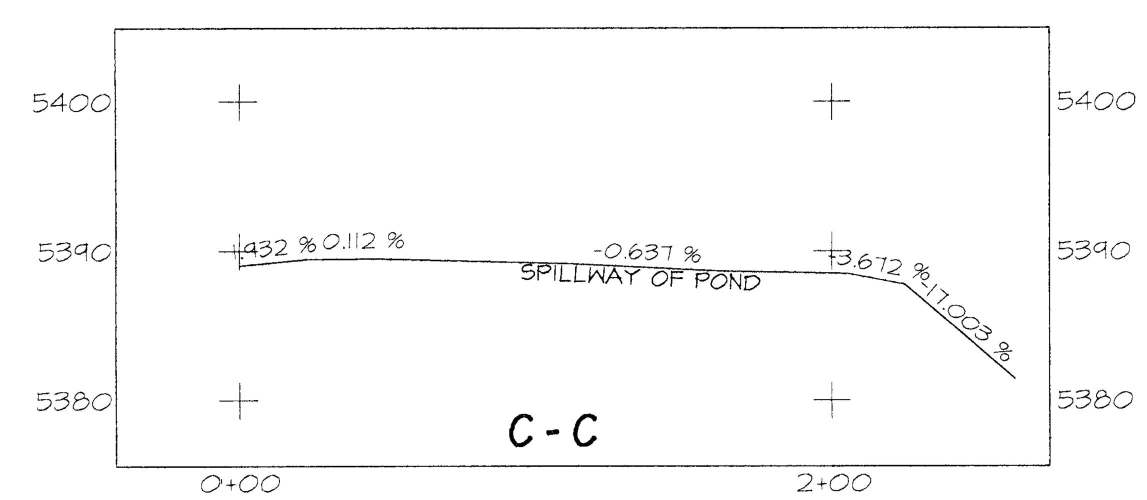
ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
x5338.5 SPOT ELEVATION
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
218 5422.45 L-30 LEASE CORNER
PERMIT/LEASE BOUNDARY

NOTES

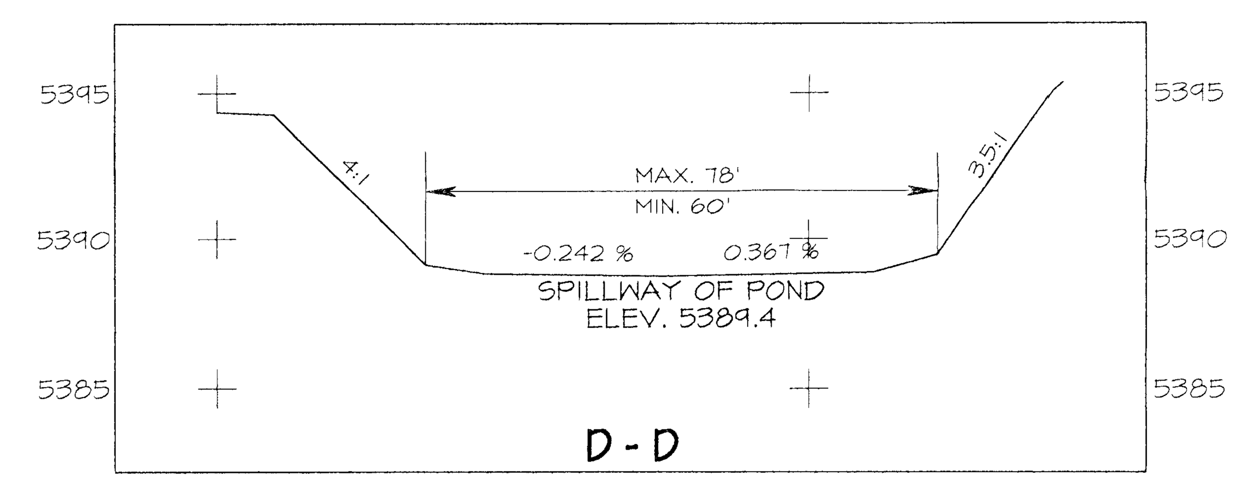
1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. For watershed area, see Exhibit 11-13C.
3. See Table 11-5F for impoundment data.







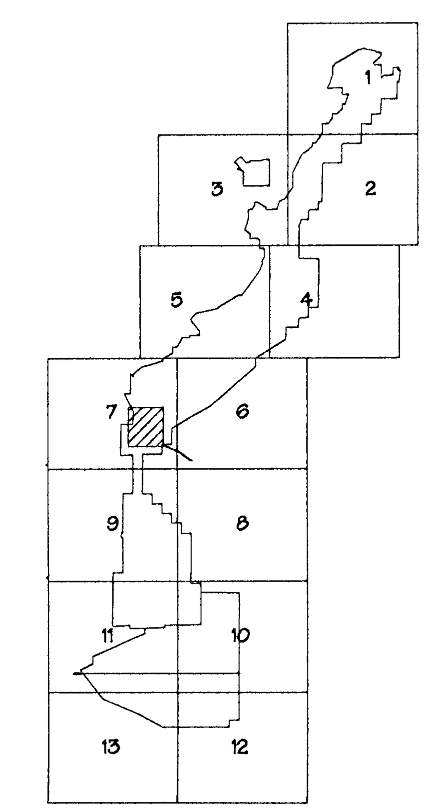
TYPICAL SECTIONS
HORIZONTAL=1"=50'
VERTICAL=1"=10'



TYPICAL SECTION
HORIZONTAL=1"=25'
VERTICAL=1"=5'

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5381.4	0.01	0.00	0.00
5382	0.09	0.03	0.03
5384	0.43	0.52	0.54
5386	1.09	1.52	2.07
5388	2.06	3.15	5.22
5388.4	2.35	0.95	6.17
5389.4	4.82	3.58	9.75



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this pond has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

6-16-06

APPROVED JUL 2008

6-15-06

REV NO.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR REVIEW	RY	6-15-06
2			
3			
4			
5			

PROJECT MANAGER: DR
ENGR. of RECORD: LR
REG. NO. 6600
SRVYR of RECORD:
REG. NO.

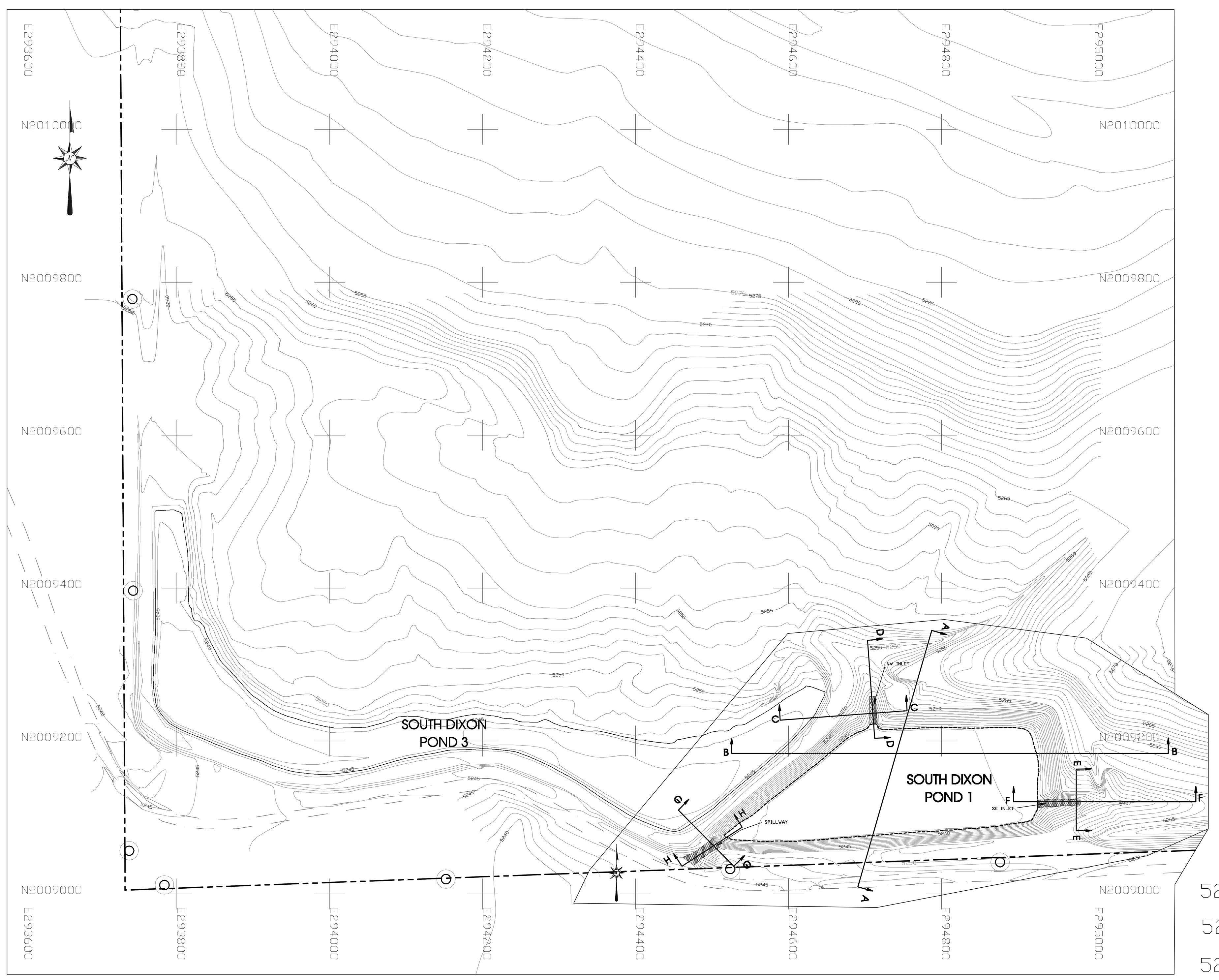
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT:
DATE: 6-15-06
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: LR
APPROVED BY: LR

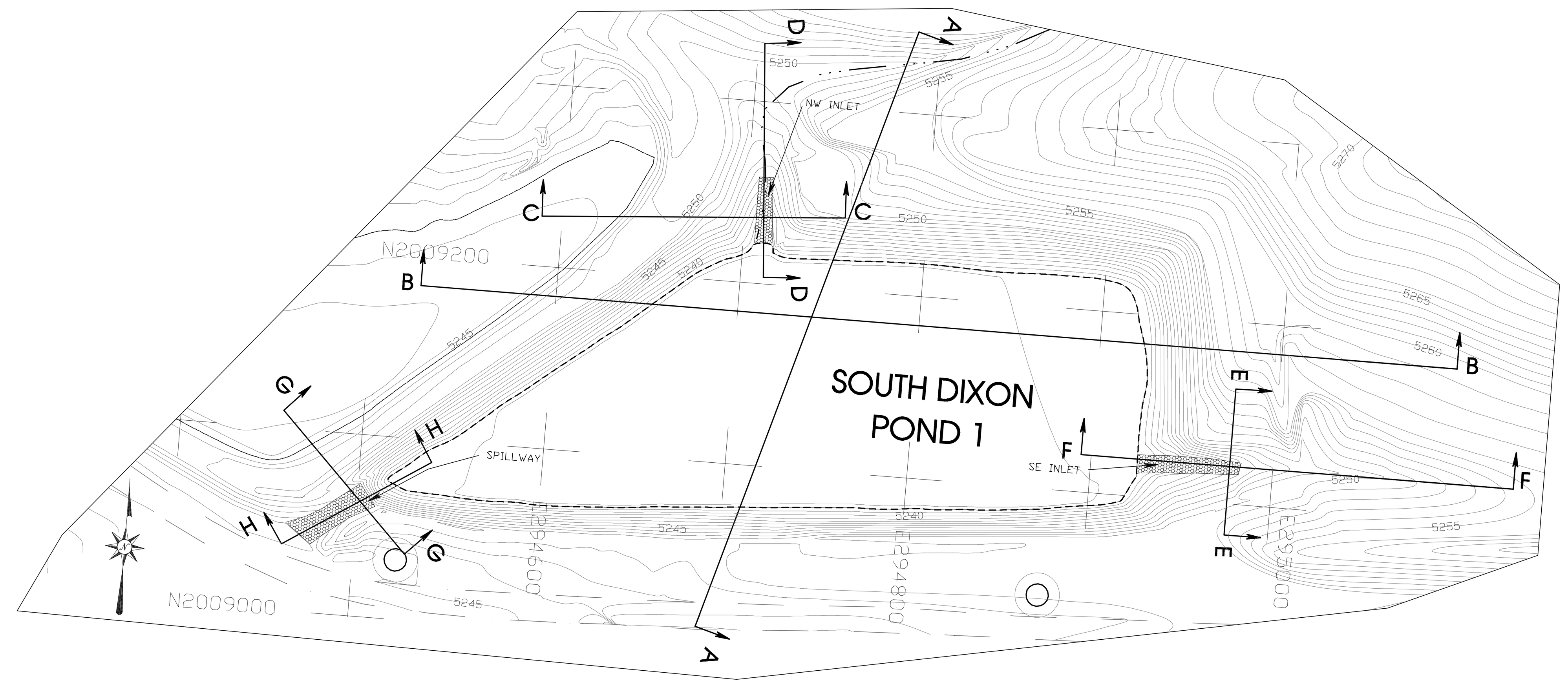
PLAN, PROFILE AND SECTIONS

EXHIBIT 26-40
SOUTH BARBER POND
AS-BUILT

DRAWING
SHEET 1 OF 1



South Dixon Pond-1
Location Map
Scale: 1" = 100'



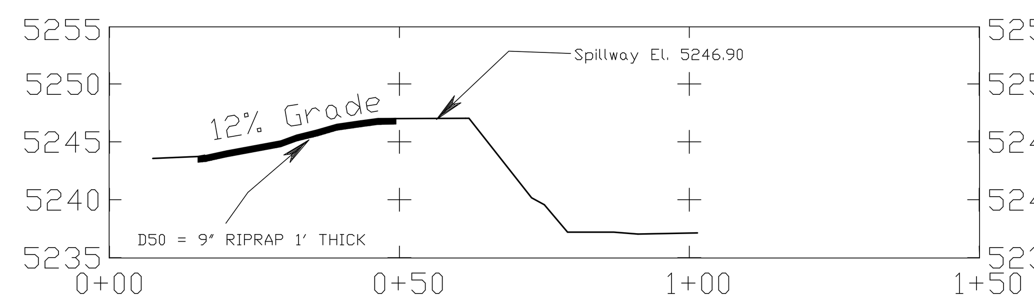
South Dixon Pond-1
Plan View
Scale: 1" = 50'

LEGEND

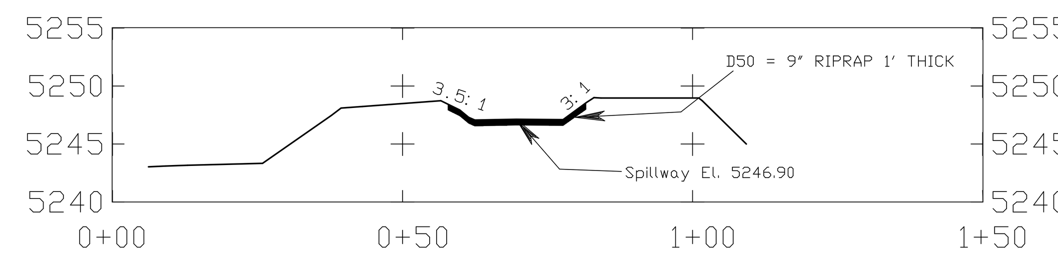
- DIRT ROAD
- POWERLINE
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- LEASE BOUNDARY

NOTES:

1. For watershed information refer to Exhibit 11-13E in the approved PAP.
2. For hydrology information refer to Appendix 11-AA in the approved PAP.
3. For design information refer to Exhibit 11-51A in the approved PAP.
4. Maximum Water or Sediment Level = 5240.50



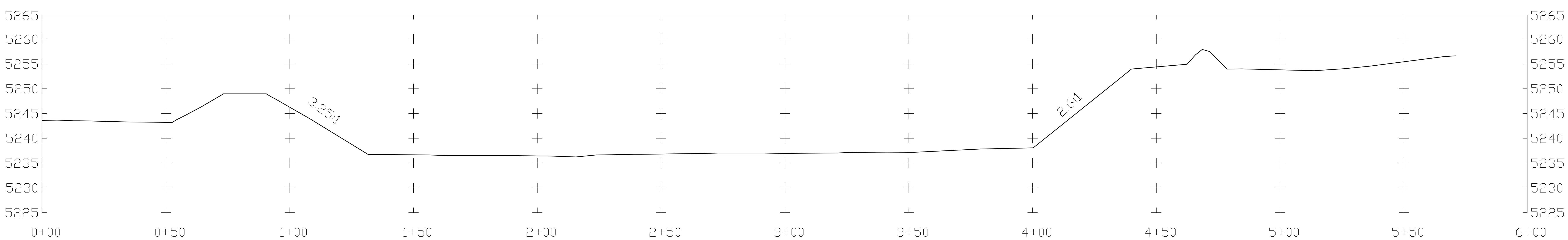
Section H-H



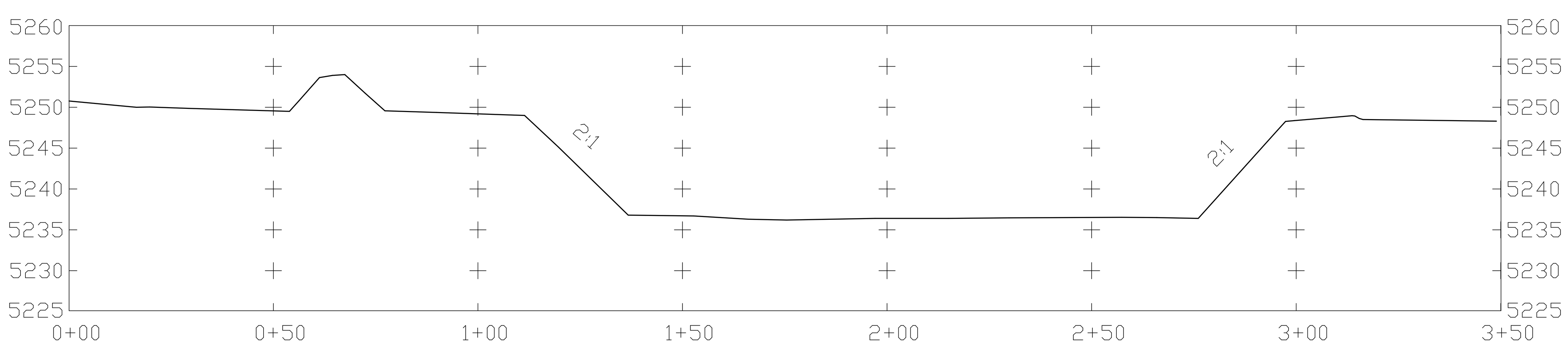
Section G-G

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5237	0.777	0.000	0.000
5238	1.006	0.898	0.898
5239	1.058	1.040	1.938
5240	1.107	1.091	3.029
5241	1.157	1.140	4.170
5242	1.207	1.191	5.360
5243	1.258	1.242	6.602
5244	1.311	1.294	7.896
5245	1.368	1.349	9.246
5246	1.430	1.409	10.655
5247	1.495	1.473	12.128
5248	1.555	1.536	13.664
5249	1.602	1.590	15.254

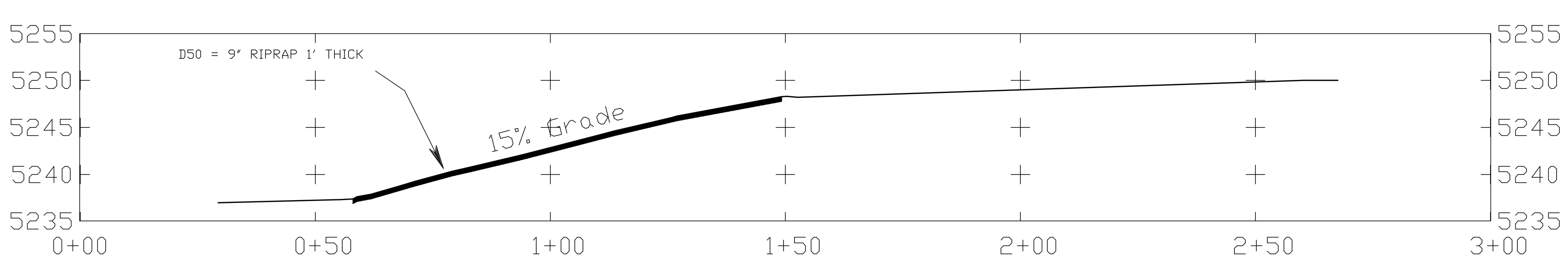


Section B-B

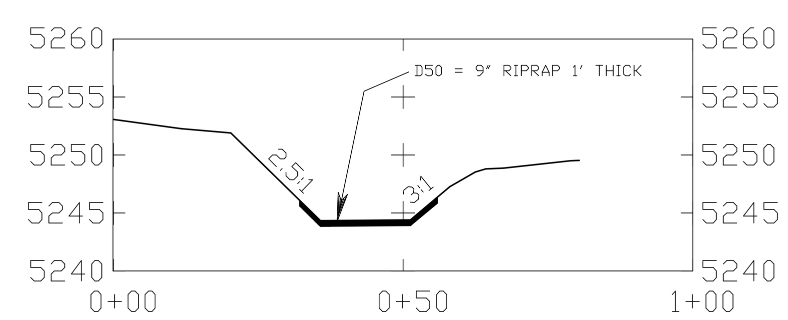


Section A-A

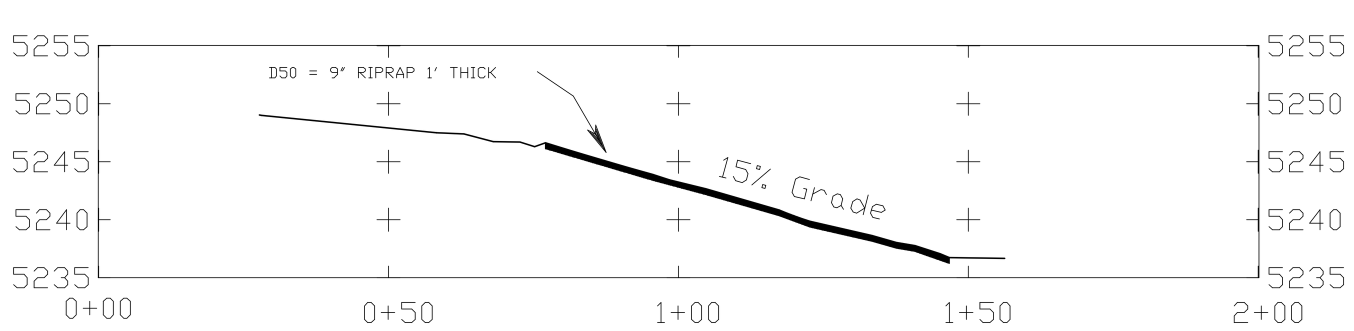
SOUTH DIXON POND-1
Cross Sections A-A thru H-H
Scales:
Horizontal: 1" = 20'
Vertical: 1" = 10'



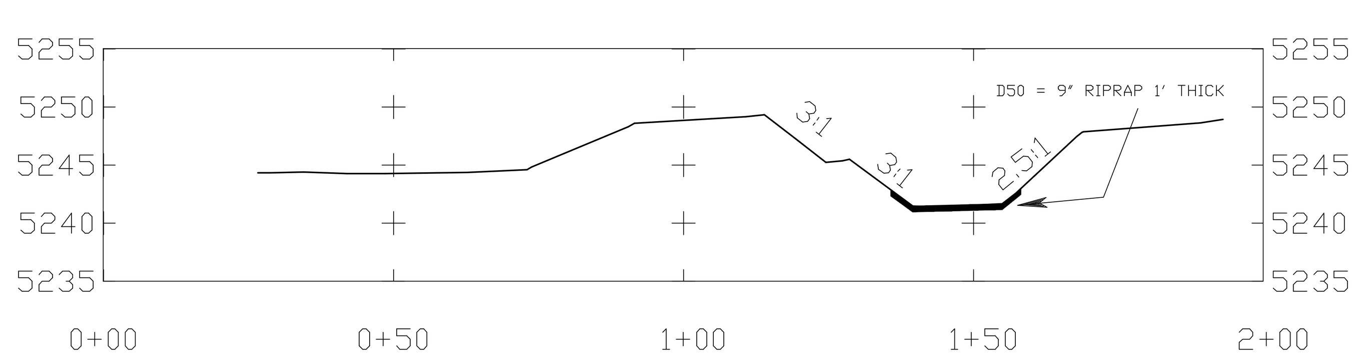
Section F-F



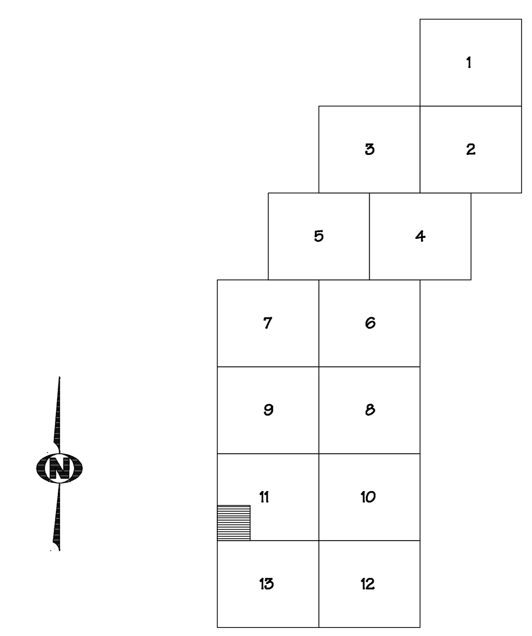
Section E-E



Section D-D

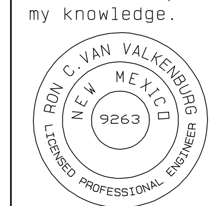


Section C-C



CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.



REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.		
09-A	2-03-09	PJF	UPDATED EXHIBIT AND RESUBMITTED TO OSM FOR REVIEW.	S. SMITH	YB	RVV		
08-A	11-20-08	PJF	UPDATED NOTES, LOCATION MAP TOPO, ADDED TEXT IN SECTION H-H, G-G AND SUBMITTED TO OSM FOR REVIEW.	S. SMITH	YB	RVV		
A	03/21/97	VAH	SUBMITTED TO OSM FOR APPROVAL					

APPROVALS

Exhibit 26-41

NAVAJO COAL COMPANY

NAVAJO SAFETY MINE PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

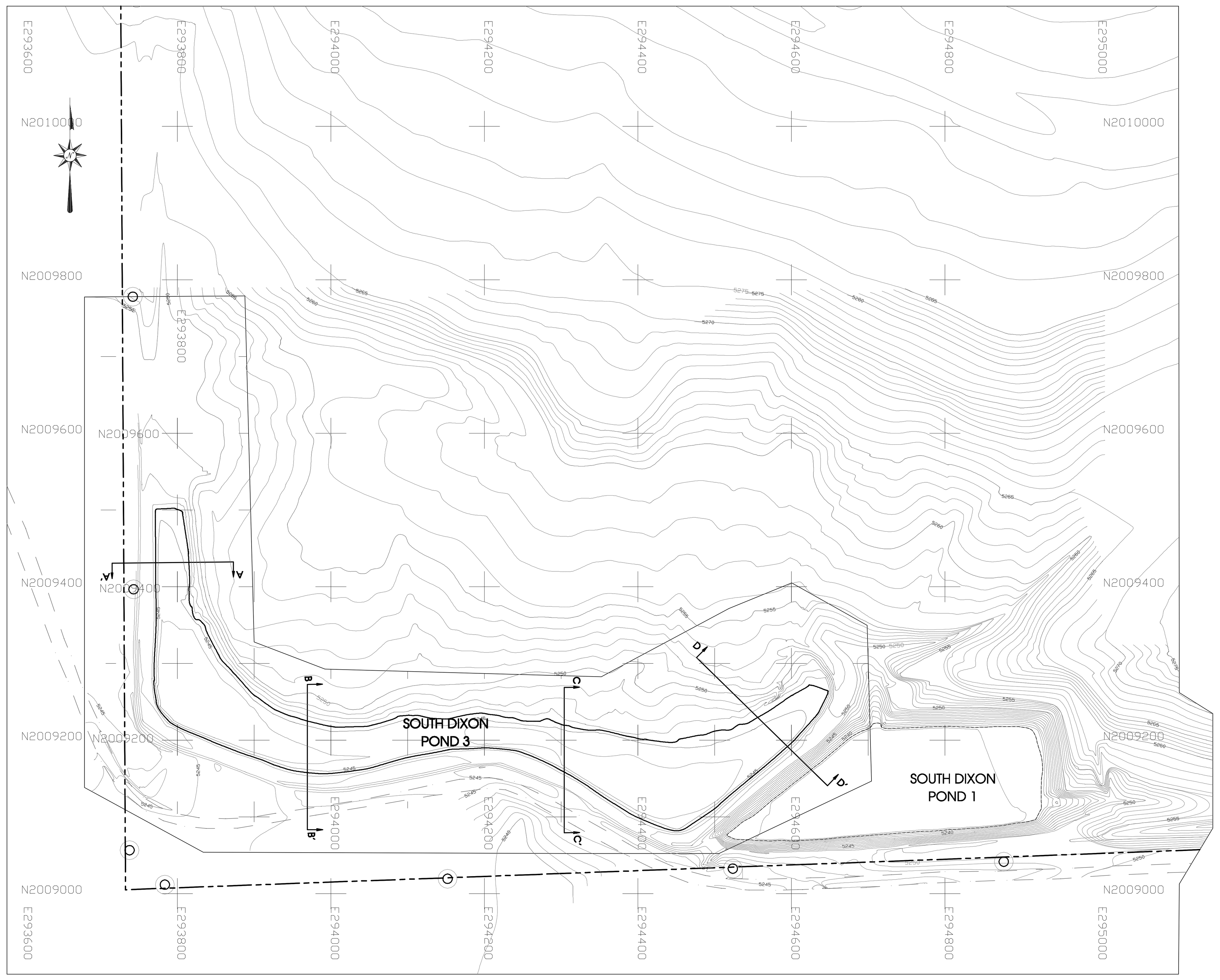
AREA 3

"AS BUILT"

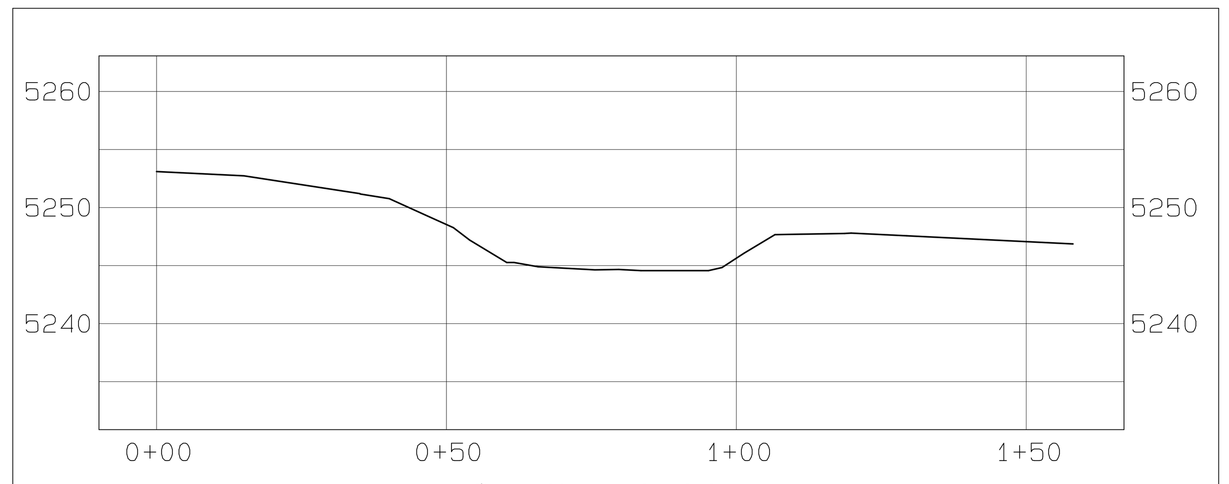
South Dixon Pond #1

PREPARED BY VAH	DRAWN BY VAH	SCALE AS NOTED
APPROVED BY LR	DATE 03/21/97	REF DWG

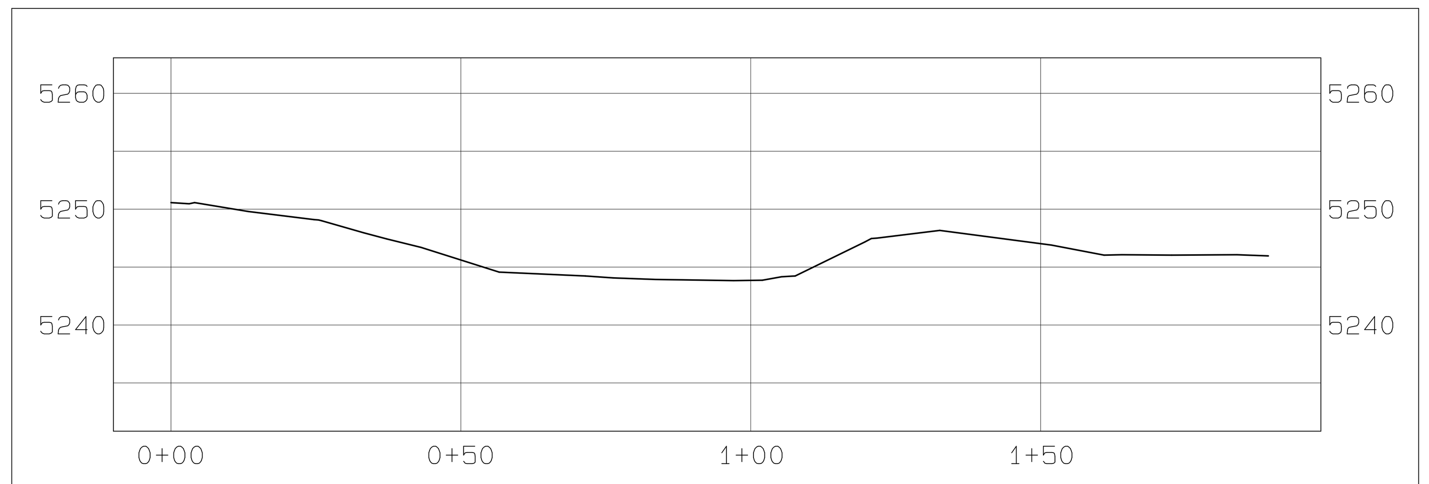
G:\Gs\Permit F\Ch 11\Exh 11-051_S Dixon Pd 1\As-Built Data\Exh 11-51C_D-SDX PD1-3.pro



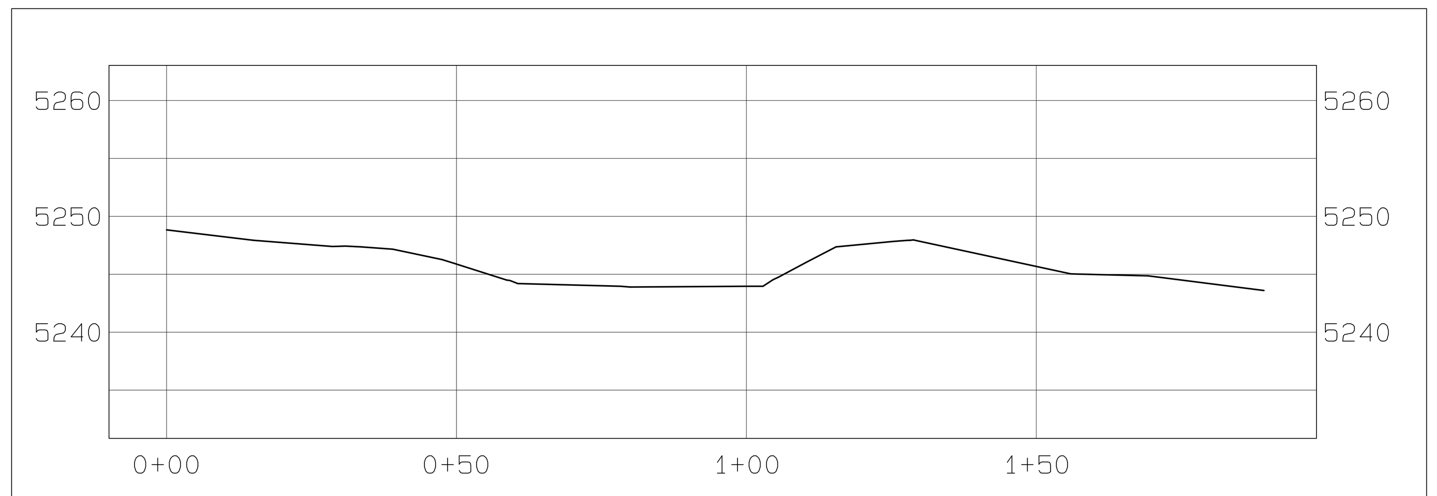
South Dixon Pond-3
Location Map
Scale: 1" = 100'



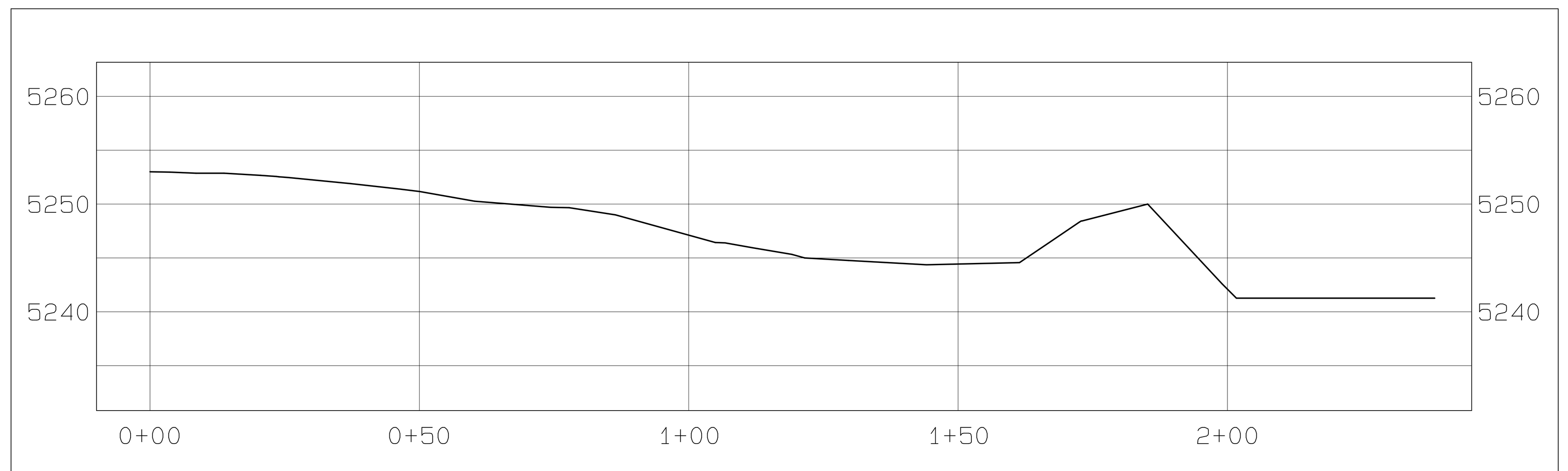
Section A-A'



Section B-B'

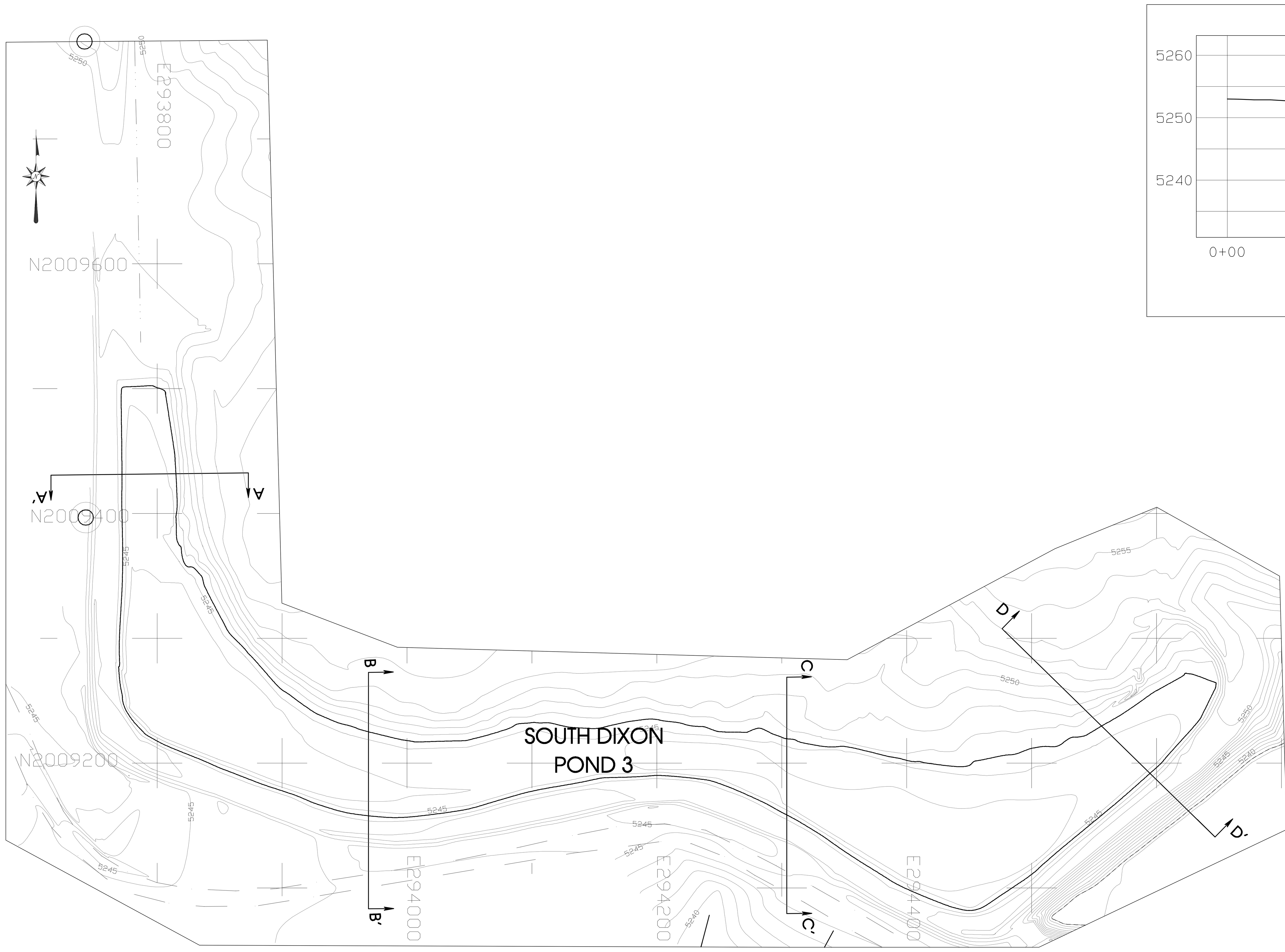


Section C-C'



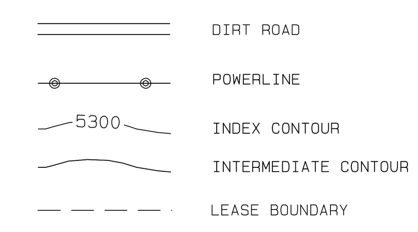
Section D-D'

SOUTH DIXON POND-3
Cross Sections A-A ' thru D-D '
Scales
Horizontal: 1" = 20'
Vertical: 1" = 10'



South Dixon Pond-3
Plan View
Scale: 1" = 50'
Contour Interval = 1'-0"

LEGEND

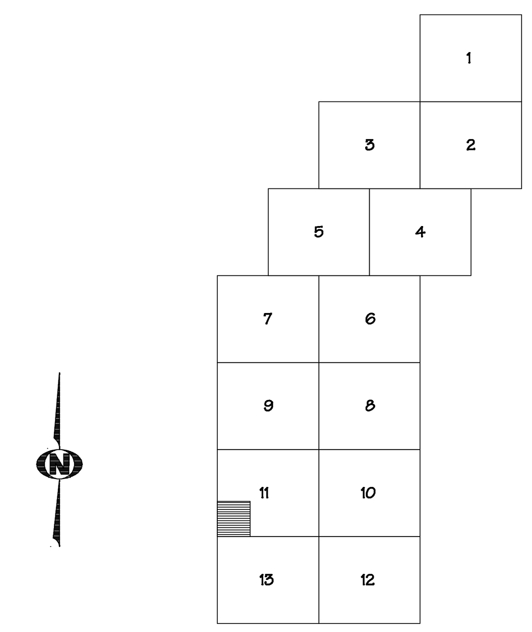


NOTES:

1. For watershed information refer to Exhibit 11-13 E in the approved PAP.
2. For hydrology information refer to Appendix 11-AA in the approved PAP.
3. For design information refer to Exhibit 11-51B in the approved PAP.
4. This pond contains the 100Yr-6Hr storm, therefore no spillway is needed.
5. Maximum Water or Sediment Level = 5246.25

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5243.5	0.1	0.0	0.0
5244.0	0.7	0.2	0.2
5245.0	1.4	1.0	1.2
5246.0	1.7	1.5	2.8
5247.0	1.9	1.8	4.6



CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

RON C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.
09-A	2-03-09	PJF	UPDATED EXHIBIT AND RESUBMITTED TO OSM FOR REVIEW.	S. SMITH	YB	RVV
08-A	11-20-08	PJF	AS-BUILT SOUTH DIXON POND-3 AND UPDATED NOTES, STAGE STORAGE DATA AND SUBMITTED TO OSM FOR REVIEW.	S. SMITH	YB	RVV
A	03/21/97	VAH	SUBMITTED TO OSM FOR APPROVAL			

APPROVALS

Exhibit 26-42

NAVAJO COAL COMPANY

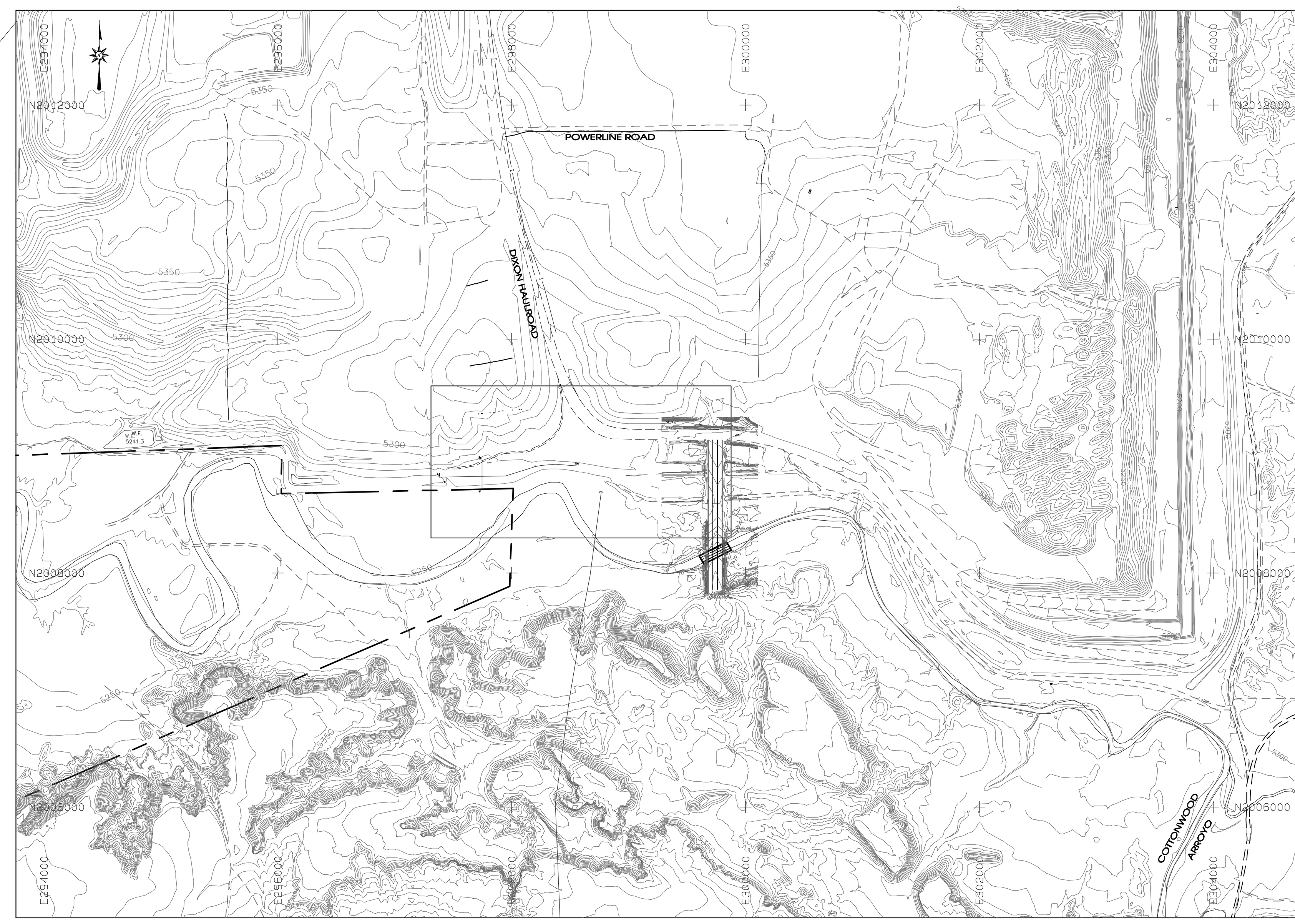
NAVAJO MINE
SAFETY PAYS
BHP NAVAJO COAL COMPANY
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

AREA 3

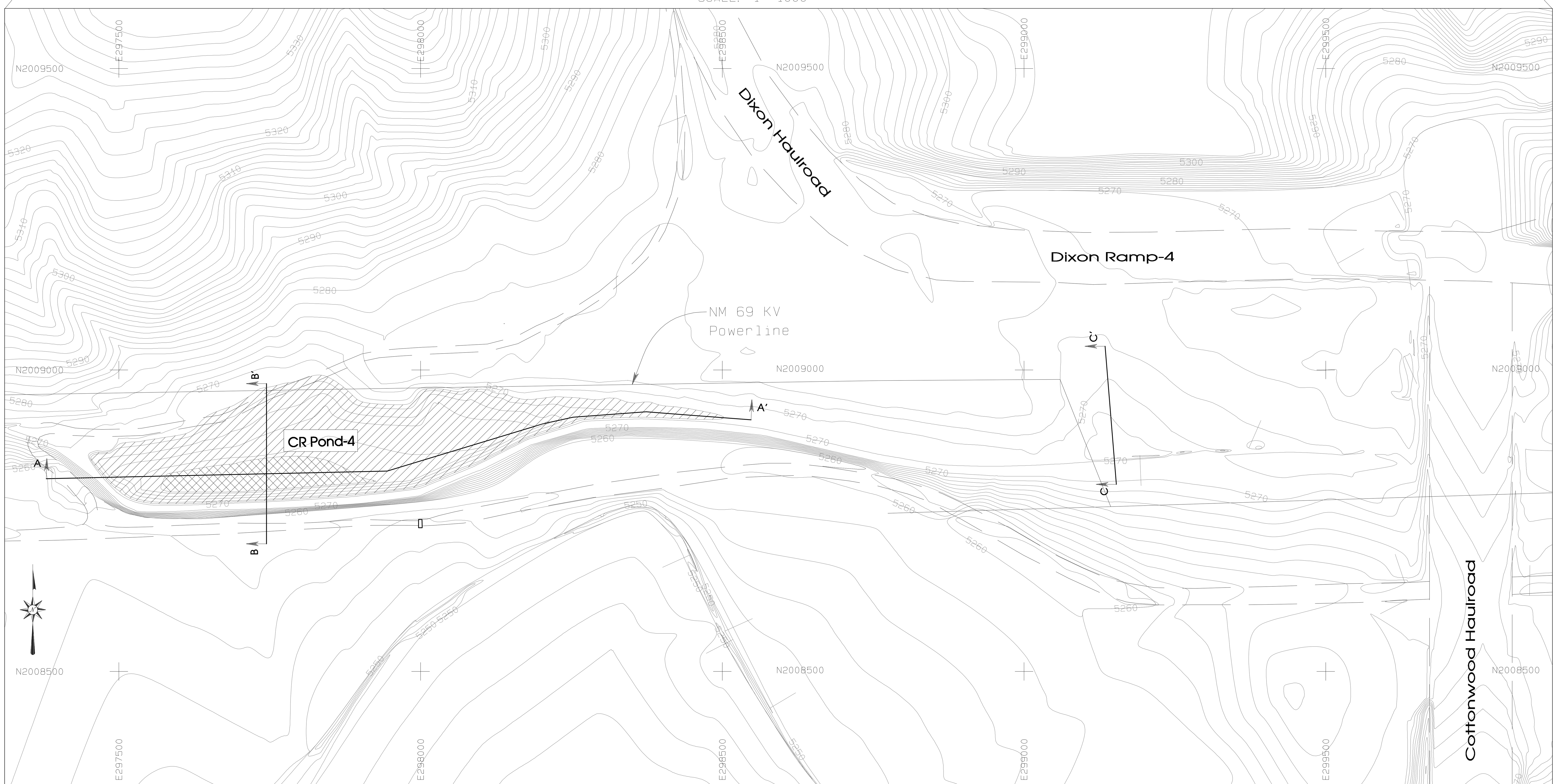
South Dixon Pond #3
"AS BUILT" - 2008

PREPARED BY VAH	DRAWN BY VAH	SCALE AS NOTED
APPROVED BY LR	DATE 03/21/97	REF DWG

G:\Gs\Permit F\Ch 11\Exh 11-051_S Dixon Pd 1\As-Built Data\Exh 11-51C_D-SDX PD1-3.pro



PLAN VIEW
SCALE: 1"=1000'



PLAN VIEW
SCALE: 1"=100'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- x5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 LEASE CORNER
- L-30
- PERMIT/LEASE BOUNDARY

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. Refer to Table 11-5 for additional data.

1 2 3 4 5 6 7 8 9 10 11 12 13

SCALE AS NOTED

SHEET INDEX
EXHIBIT 11-109_CR POND-4_AS-BUILT-1 OF 2
PLAN VIEW
EXHIBIT 11-109_CR POND-4_AS-BUILT-2 OF 2
X-SECTIONS

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this embankment has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge except as noted below:
1. Approximatley 1,000 feet of the embankment extension was removed at the East end to construct the Cottonwood Crossing Haulroad. This reduced the watershed area for CR Pond-4.The hydrology for the pond was revised accordingly. See Appendix 11-AA for supporting data.

RON C. VAN VALKENBURG
NEW MEXICO
9263
LICENSED PROFESSIONAL ENGINEER

REVISION	DATE
1 PREPARED AS-BUILT FOR CR POND-4 AND SUBMITTED TO OSM FOR REVIEW	DEC.17,2009

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO: NM 9263
SRVYR of RECORD:
REG. NO:

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

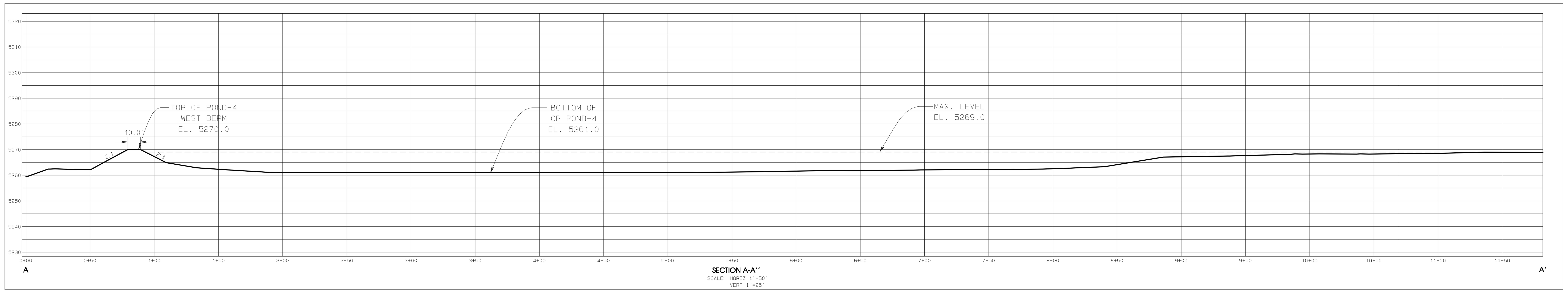
PROJECT: AREA-3 CR POND-4 AS-BUILT
DATE: DEC.14,2009
PREPARED BY: PJFOSTER
DRAWN BY: PJFOSTER
CHECKED BY: RON C. VAN VALKENBURG
APPROVED BY: RON C. VAN VALKENBURG

PLAN VIEW

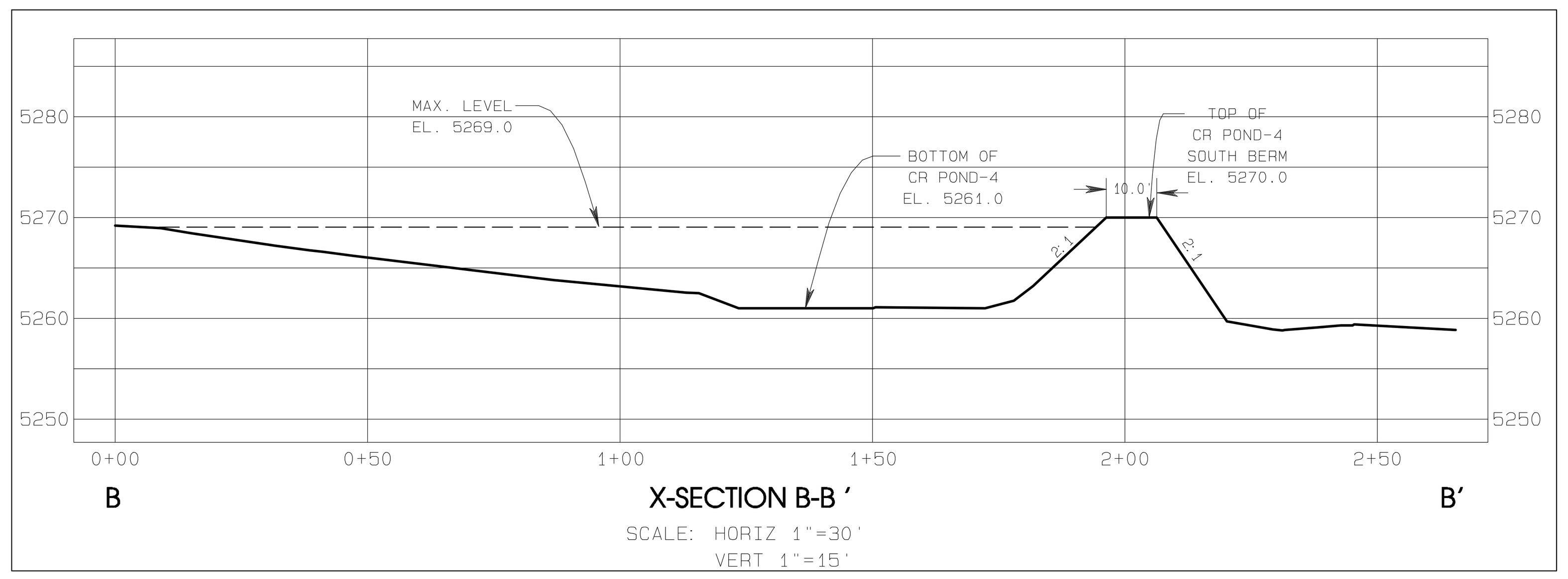
EXHIBIT 26-43
CR POND-4
AS-BUILT

DRAWING
PLAN1
SHEET 1
OF 2

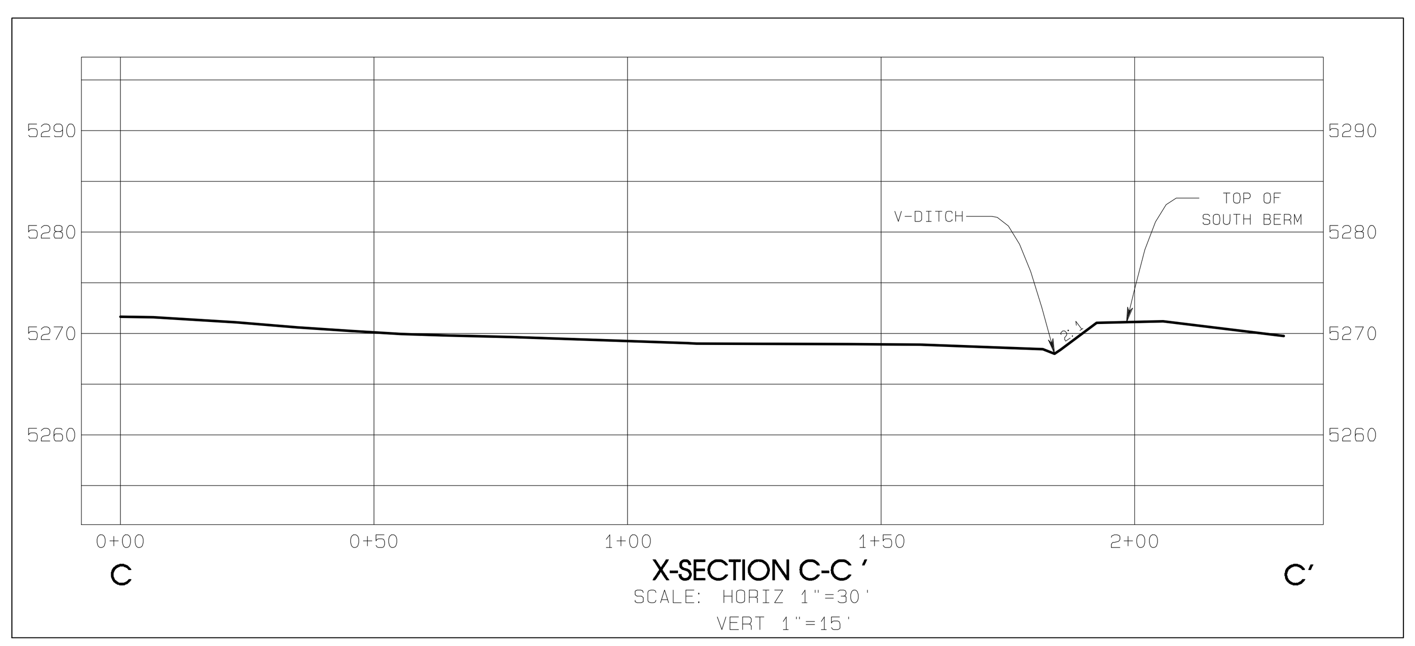
G:\Gs\Permit F\Ch 11\Exh 11-109_S Dixon CR Pd 4\As-Built\Exh 11-109_CR-Pond-4 As-Built.pro
Mon Mar 07 09:05:32 2011



SECTION A-A''
SCALE: HORIZ 1"=50'
VERT 1"=25'



X-SECTION B-B '
SCALE: HORIZ 1"=30'
VERT 1"=15'



X-SECTION C-C '
SCALE: HORIZ 1"=30'
VERT 1"=15'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- x5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

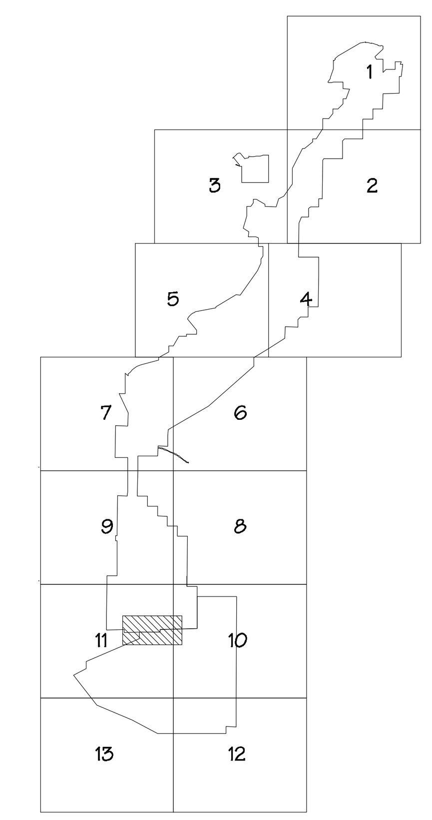
NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. Refer to Table 11-5 for additional data.

CR POND-4
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5261	0.319	0.0	0.0
5262	0.660	0.5	0.5
5263	1.036	0.8	1.3
5264	1.296	1.2	2.5
5265	1.524	1.4	3.9
5266	1.730	1.6	5.5
5267	1.938	1.8	7.4
5268	2.179	2.1	9.4
5269	2.646	2.4	11.8

Pond Crest Elevation-5270.0
As-Built Volume at Crest (Ac-Ft)-11.84



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this embankment has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge except as noted below:
1. Approximatley 1,000 feet of the embankment extension was removed at the East end to construct the Cottonwood Crossing Haulroad. This reduced the watershed area for CR Pond-4.The hydrology for the pond was revised accordingly. See Appendix 11-AA for supporting data.

REVISION	DATE
1 PREPARED AS-BUILT FOR CR POND-4 AND SUBMITTED TO OSM FOR REVIEW	DEC.17,2009

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO: NM 9263
SRVYR of RECORD:
REG. NO:

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717,FRUITLAND,NEW MEXICO,87416 PHONE 505-598-3209/FAX 505-598-3361

PROJECT: AREA-3 CR POND-4 AS-BUILT
DATE: DEC.14,2009
PREPARED BY: PJFOSTER
DRAWN BY: PJFOSTER
CHECKED BY: RON C. VAN VALKENBURG
APPROVED BY: RON C. VAN VALKENBURG

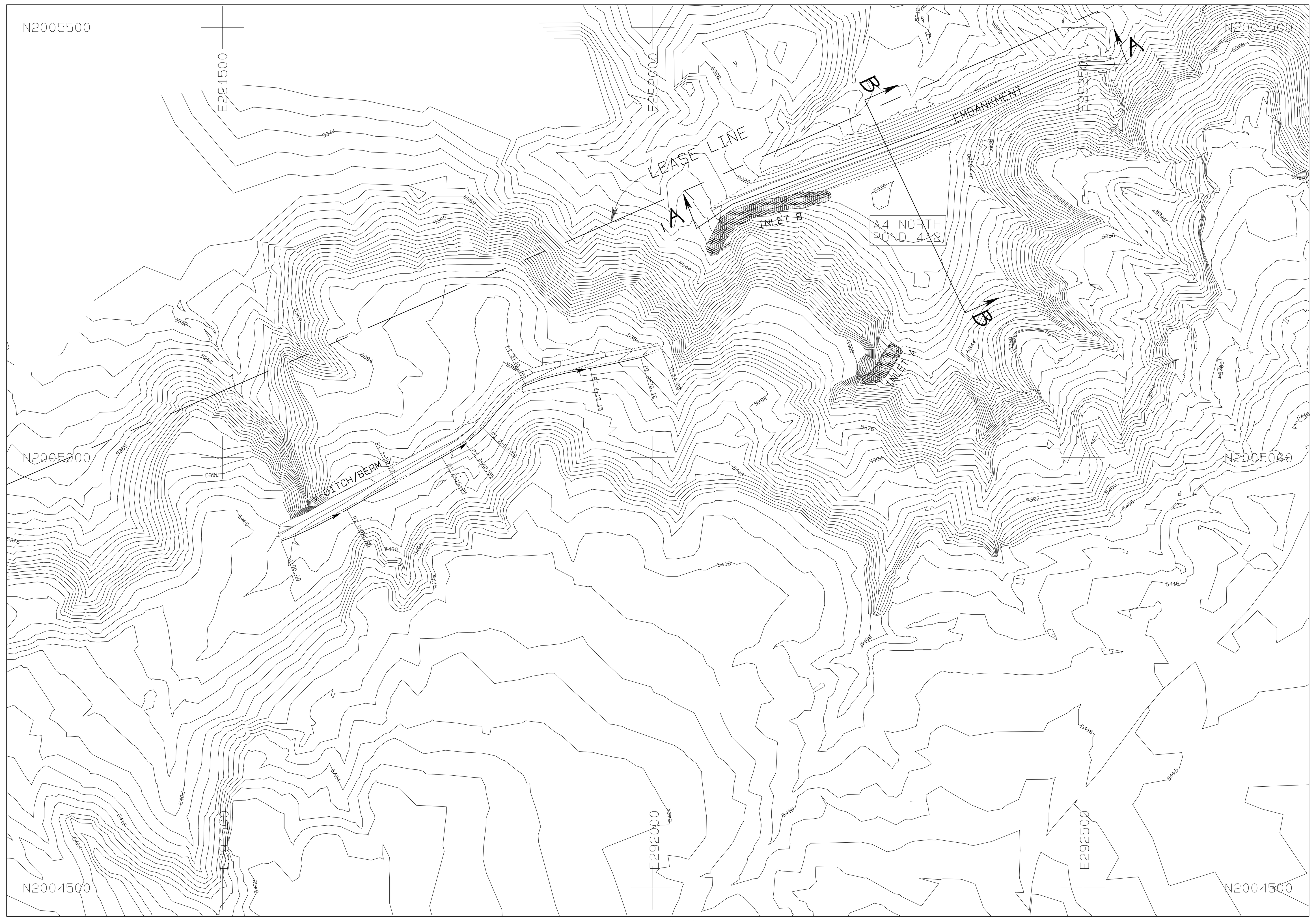
X-SECTIONS

EXHIBIT 26-43
CR POND-4 AS-BUILT

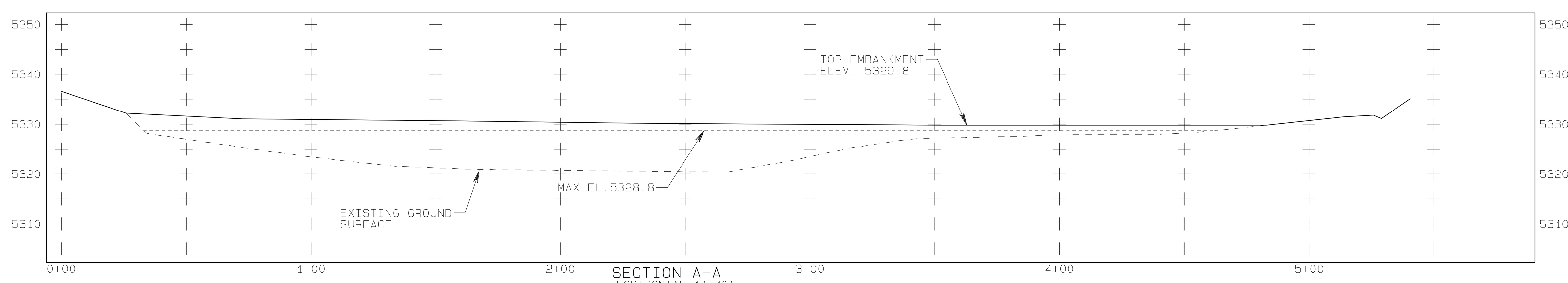
DRAWING
PLAN2

SHEET 2
OF 2

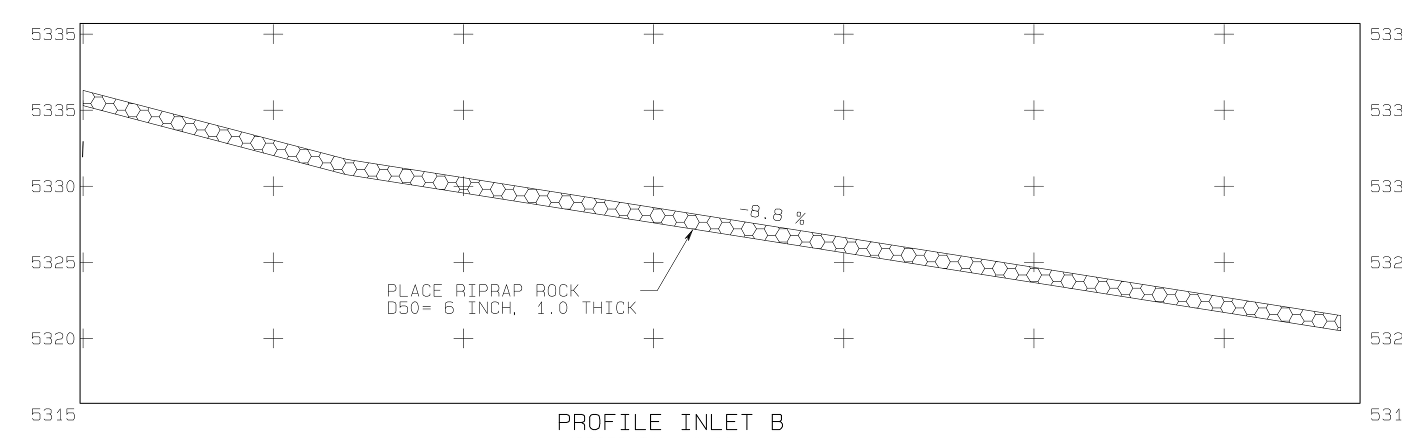
G:\Gs\Permit F\Ch 11\Exh 11-109_S Dixon CR Pd 4\As-Built\Exh 11-109_CR-Pond-4 As-Built.pro
Mon Mar 07 09:05:33 2011



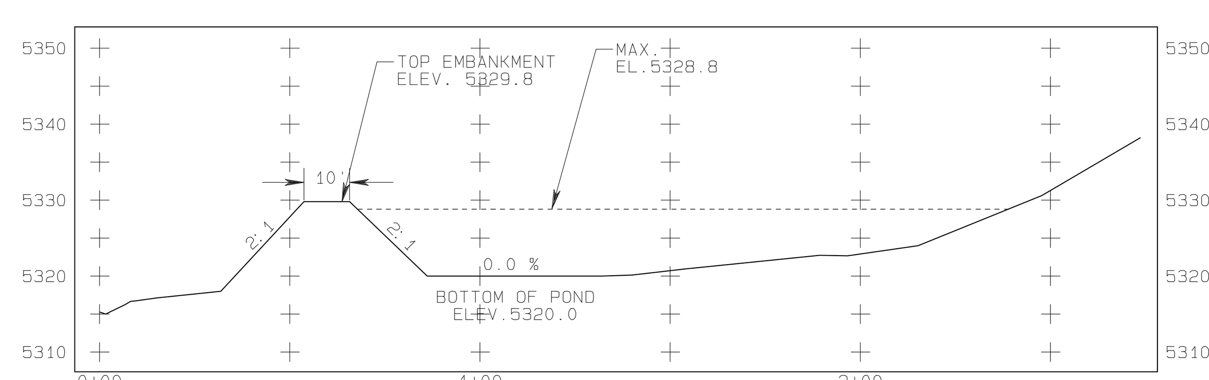
PLAN
Scale: 1" = 100'



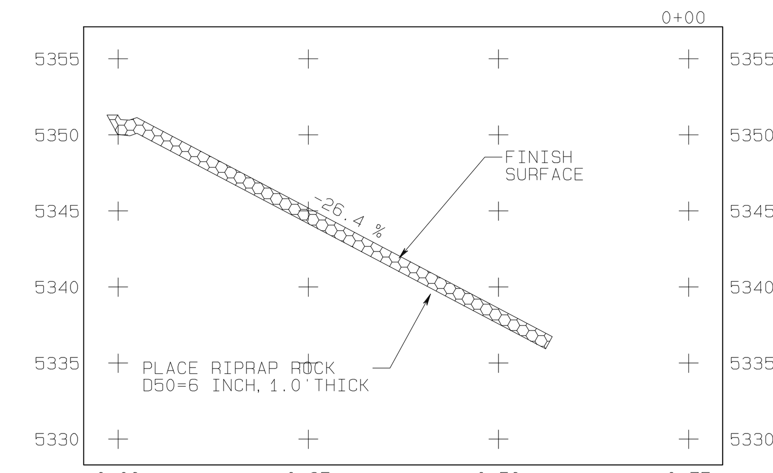
SECTION A-A
HORIZONTAL=1"=40'
VERTICAL=1"=20'



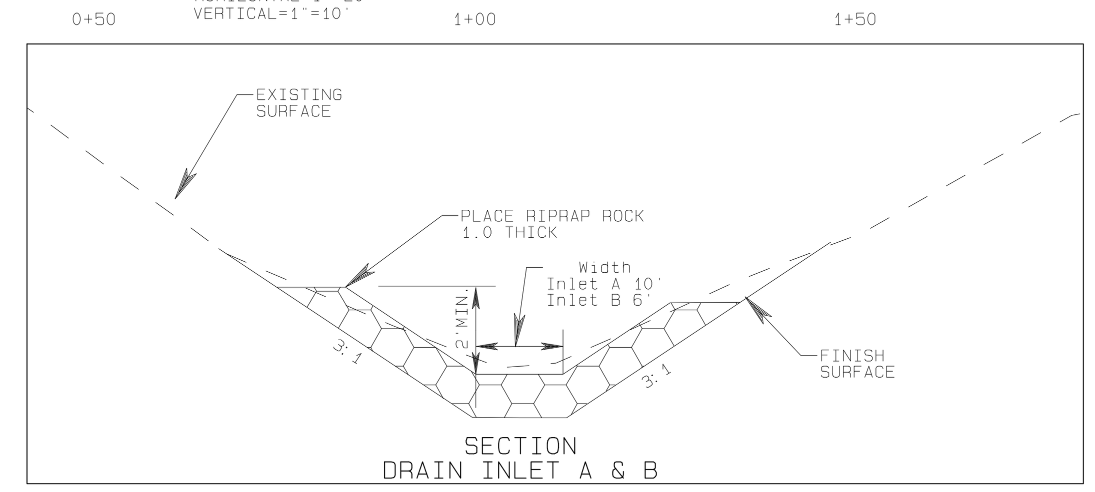
PROFILE INLET B
HORIZONTAL=1"=20'
VERTICAL=1"=10'



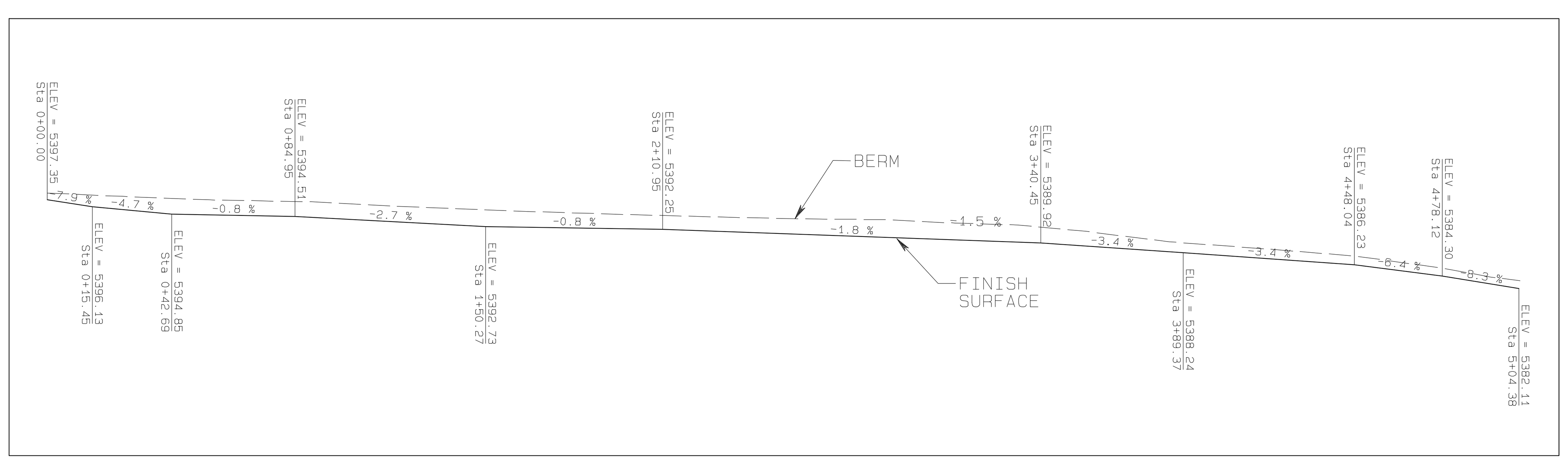
SECTION B-B
HORIZONTAL=1"=40'
VERTICAL=1"=20'



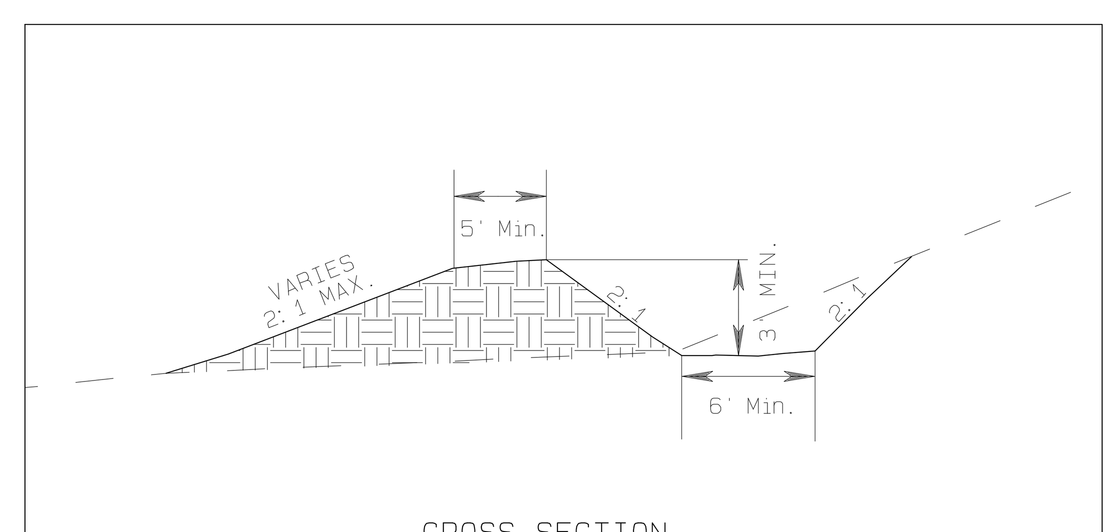
PROFILE INLET A
HORIZONTAL=1"=20'
VERTICAL=1"=10'



SECTION
DRAIN INLET A & B



PROFILE OF V-DITCH/BERM
HORIZONTAL=1"=40'
VERTICAL=1"=20'



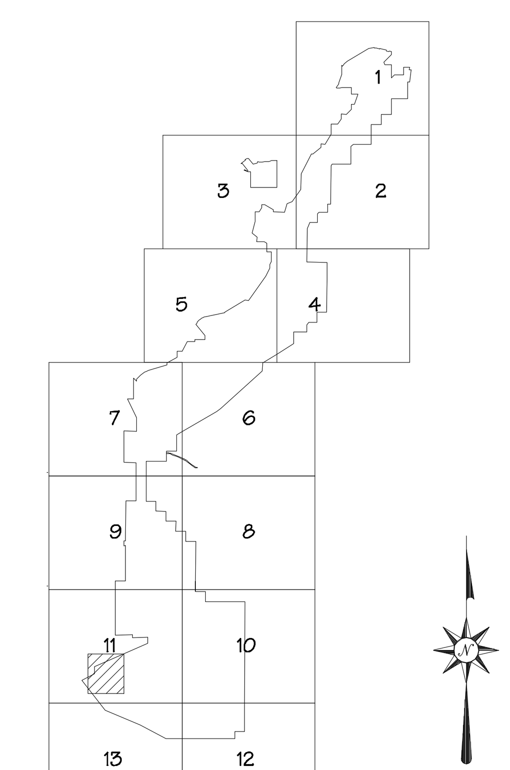
CROSS SECTION
V-DITCH / BERM

LEGEND

- ROAD
- WATERSHED
- BUILDING
- DRAIN DITCH
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13F.



SCALE AS NOTED

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5320	1.01	0.0	0.0
5321	1.17	0.1	0.09
5322	0.23	0.2	0.29
5323	0.29	0.3	0.55
5324	0.35	0.3	0.87
5325	0.41	0.4	1.24
5326	0.46	0.4	1.68
5327	0.52	0.5	2.17
5328	0.59	0.6	2.72
5329	0.67	0.6	3.36
5330	0.75	0.7	4.07

Pond Crest Elevation 5329.8
As-Built Volume @ Crest (Ac-Ft) 3.9
Design Max. Water Elevation 5328.8
Capacity @ Max. Water Elevation 3.2

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this structure has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge except as noted below:

1. Minor elevation differences for pond contour resulted in smaller capacity. The smaller as-built capacity will contain the design 100-yr 6-hr storm event.

Ron C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

REV NO.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	RY	11-19-04
2	SUBMITTED TO OSM FOR APPROVAL	RY	01-26-10
3	Prepared As-Built for A4N Pond 412 and submitted to OSM for Review(NOT SUBMITTED)	PF	07-29-10
1-4	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	PF	01-26-11

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR. of RECORD:
REG. NO:

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT:
DATE: 01-26-10
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: RCV
APPROVED BY: RCV

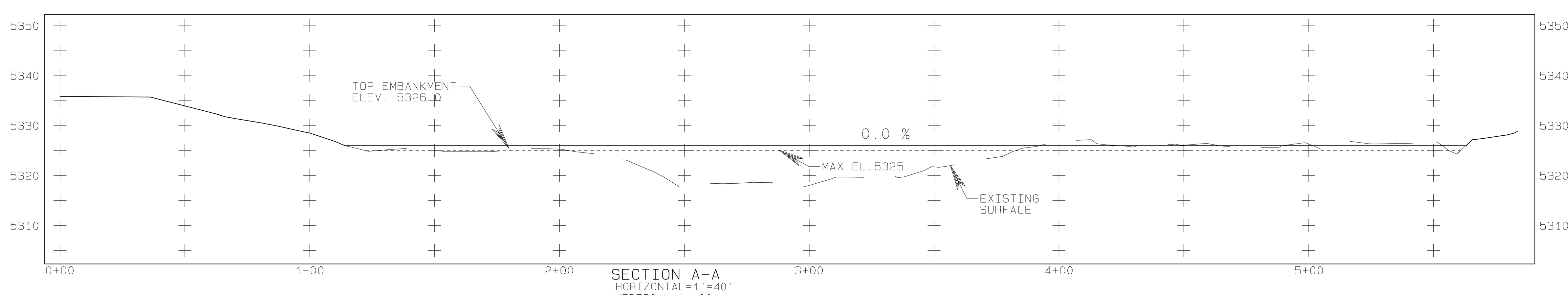
PLAN, PROFILE AND SECTION

EXHIBIT 26-44
AREA 4 NORTH POND 412
AS-BUILT

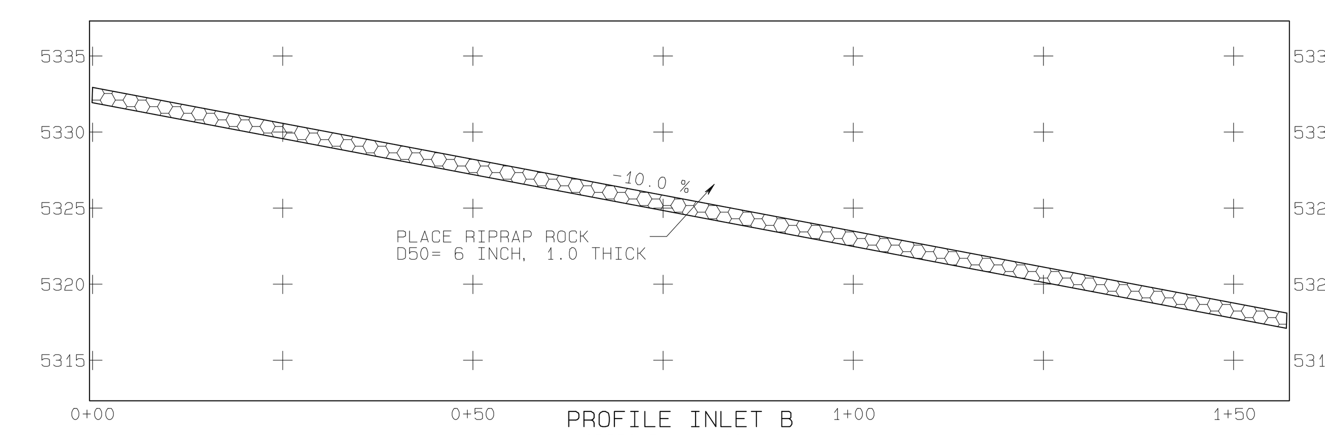
DRAWING
SHEET 1 OF 1

Path: G:\Os\Permit F\Ch 11\Exh 11-111_A4N Pd 412\OSM Subm-12011\Exh 11-111_A4N Pond 412 As-Built.pro

PLAN
Scale: 1" = 100'



SECTION A-A
HORIZONTAL=1"=40'
VERTICAL=1"=20'



PROFILE INLET B
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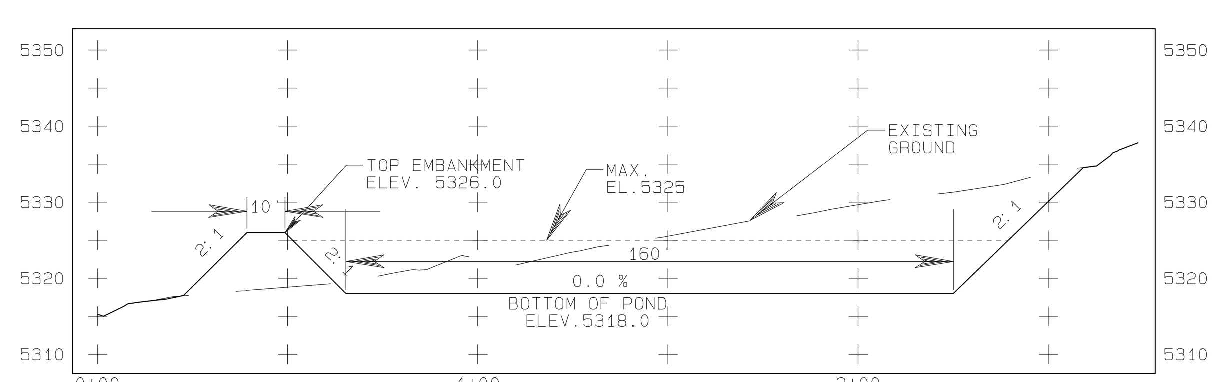
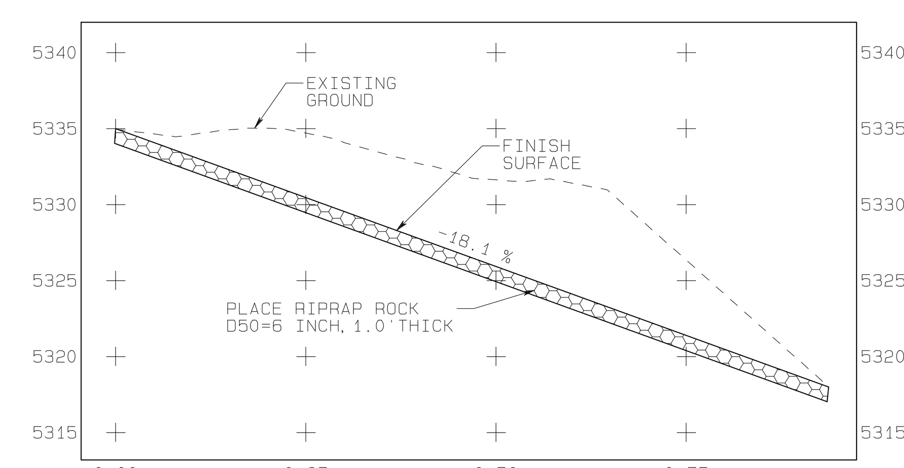
VERTICAL=1"=10'



SECTION B-B
HORIZONTAL=1"=40'
VERTICAL=1"=20'



PROFILE INLET A
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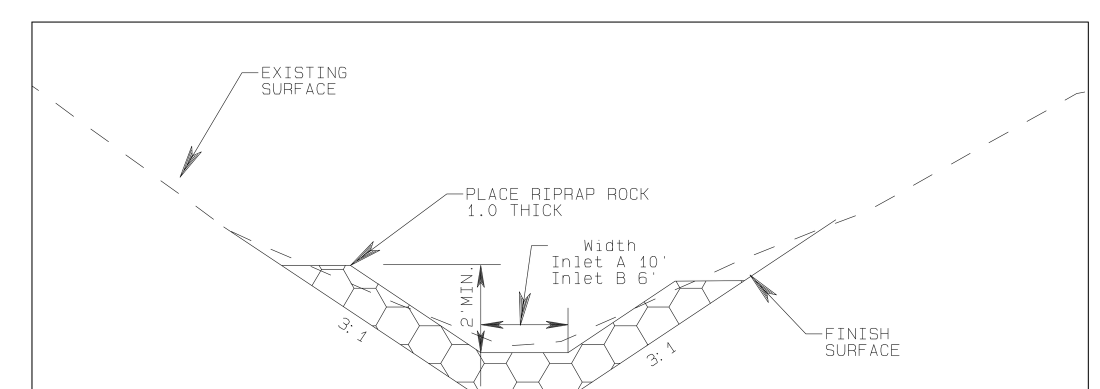
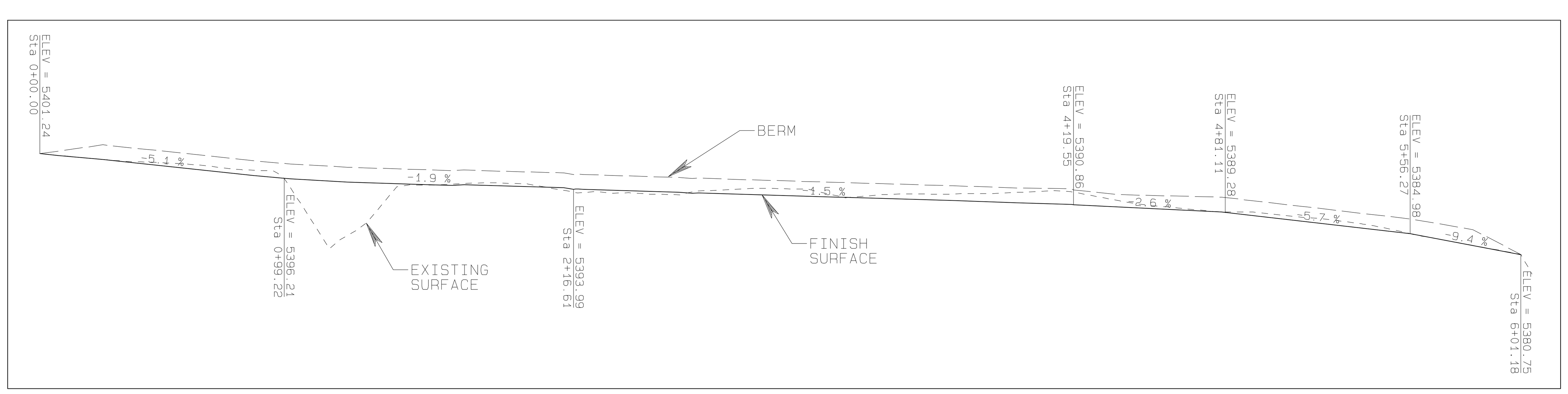
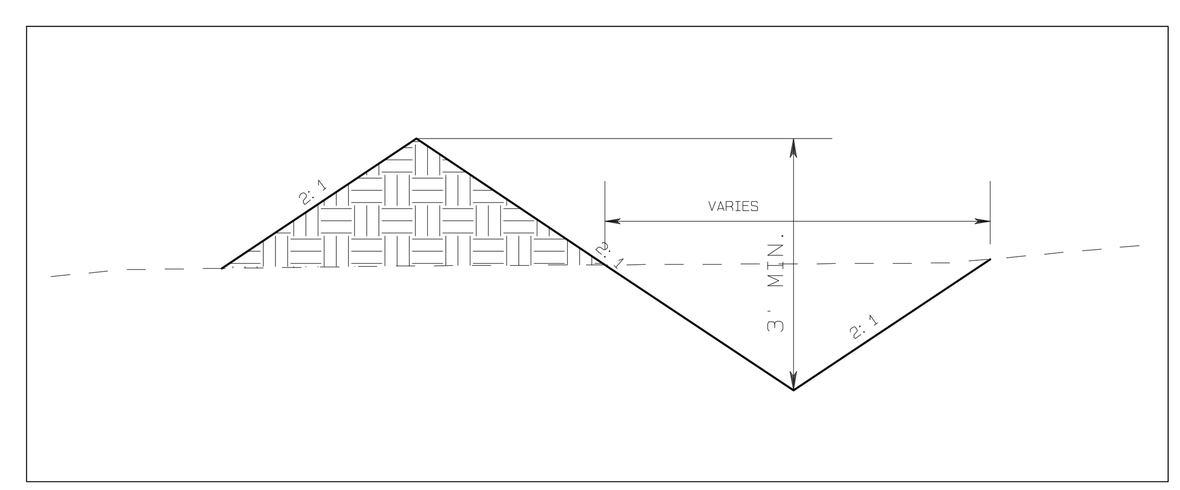
VERTICAL=1"=10'



TYPICAL SECTION
DRAIN INLET A & B



PROFILE OF DIVERSION BERM
HORIZONTAL=1"=40'
VERTICAL=1"=20'



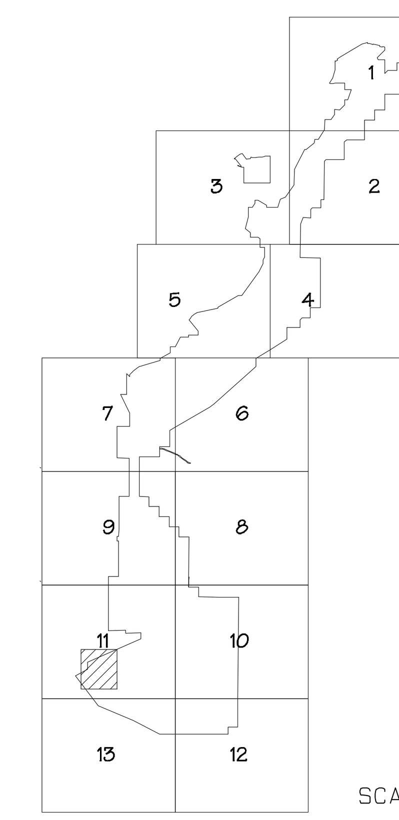
TYPICAL SECTION
V-DITCH / BERM

LEGEND

- ROAD
- WATERSHED
- BUILDING
- DRAIN DITCH
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13F.



SCALE AS NOTED

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5318	0.42	0.0	0.0
5320	0.48	0.9	0.9
5322	0.56	1.0	1.9
5324	0.64	1.2	3.1
5326	0.77	1.4	4.5

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

Ron C. VAN VALKENBURG
NEW MEXICO
9263
LICENSED PROFESSIONAL ENGINEER

EXHIBIT 26-45
AREA 4 NORTH POND 412
DESIGN

PLAN, PROFILE AND SECTION

ACCOUNT:
DATE: 01-26-10
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: RCV
APPROVED BY: RCV

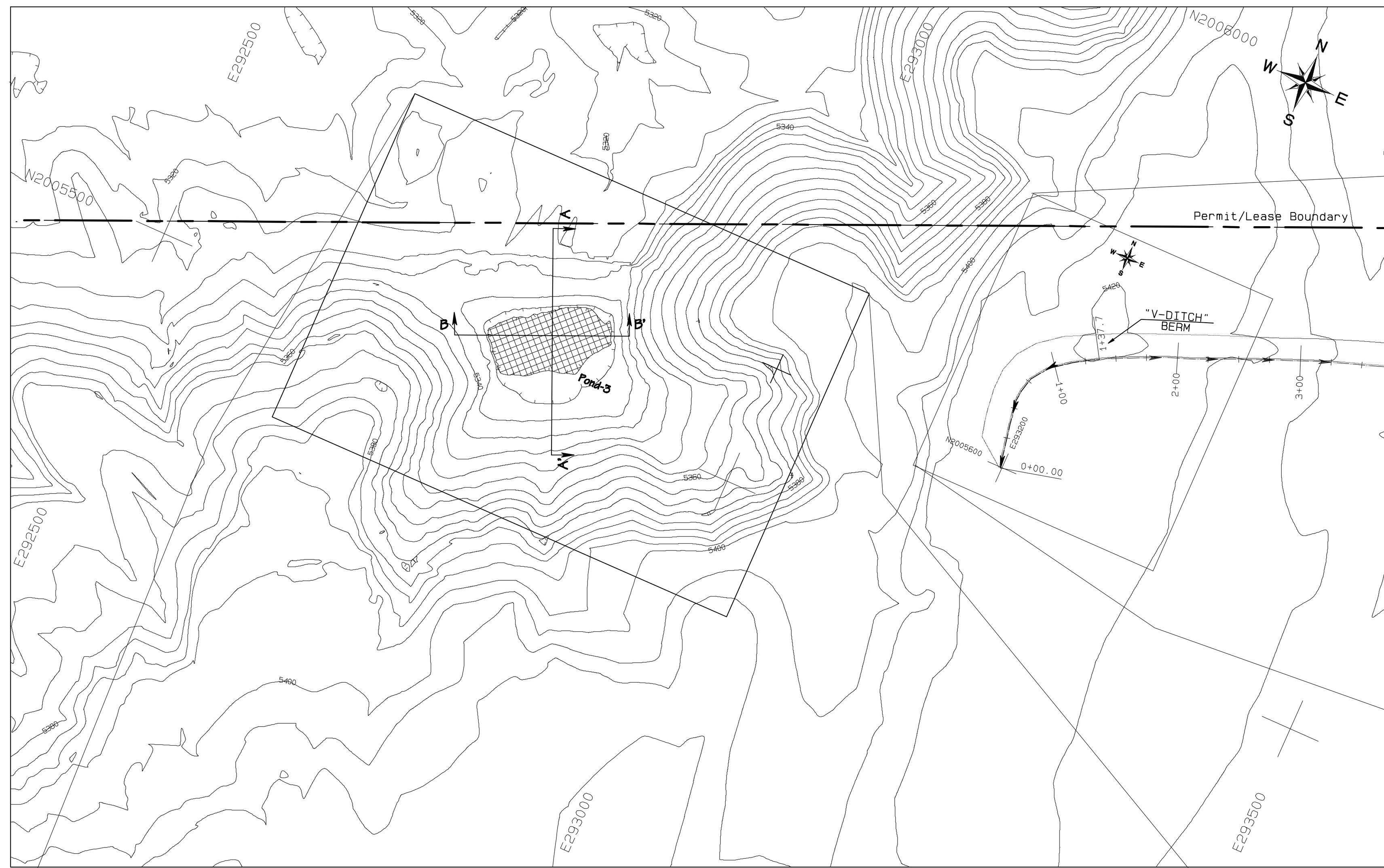
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

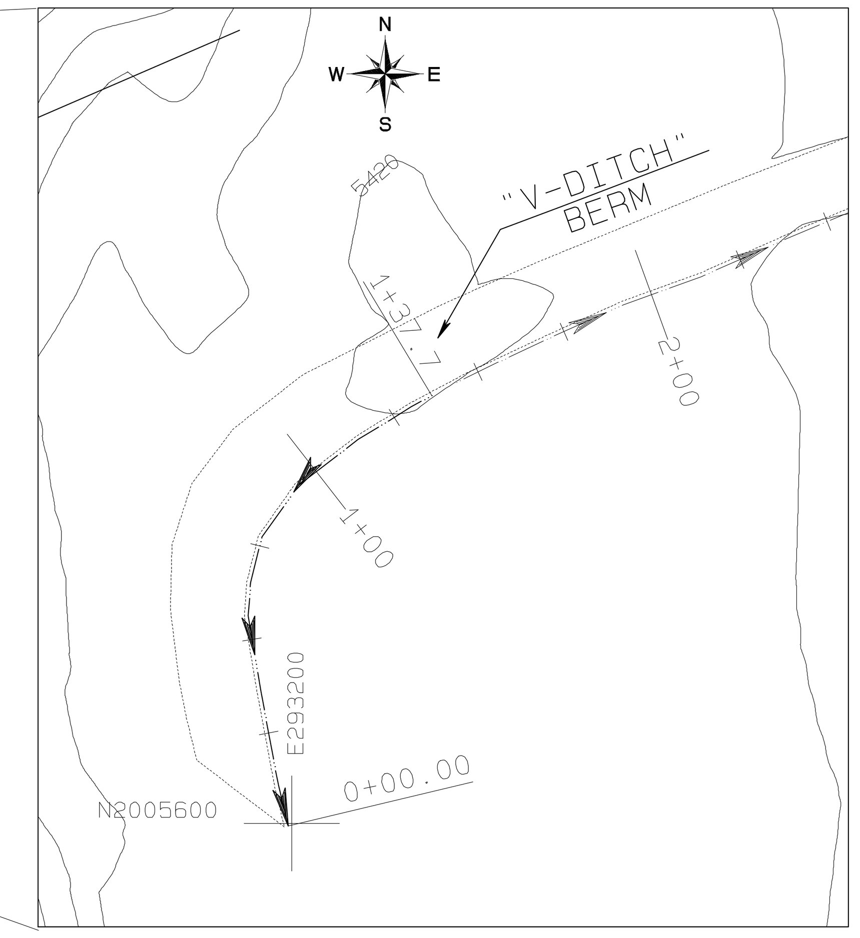
REV No.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	RY	11-19-04
2	SUBMITTED TO OSM FOR APPROVAL	RY	01-26-10
11-A	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	PJF	FEB-2011

DRAWING
SHEET 1 OF 1

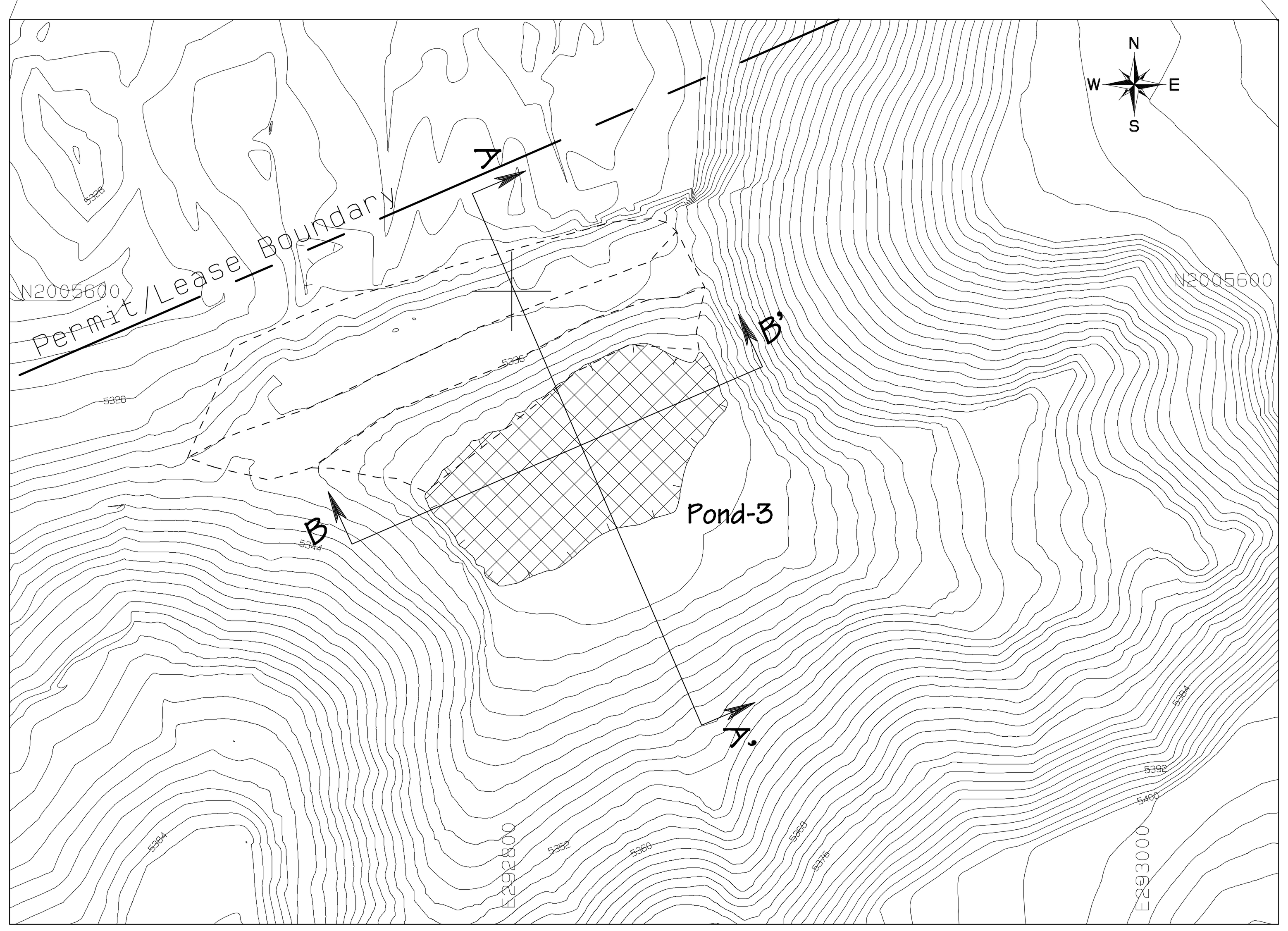
Path: G:\Da\Permit F\Ch 11\Exh 11-111_A4N Pd 412\OSM Subm-12011\Exh 11-111D_A4N Pond 412_Design.pro



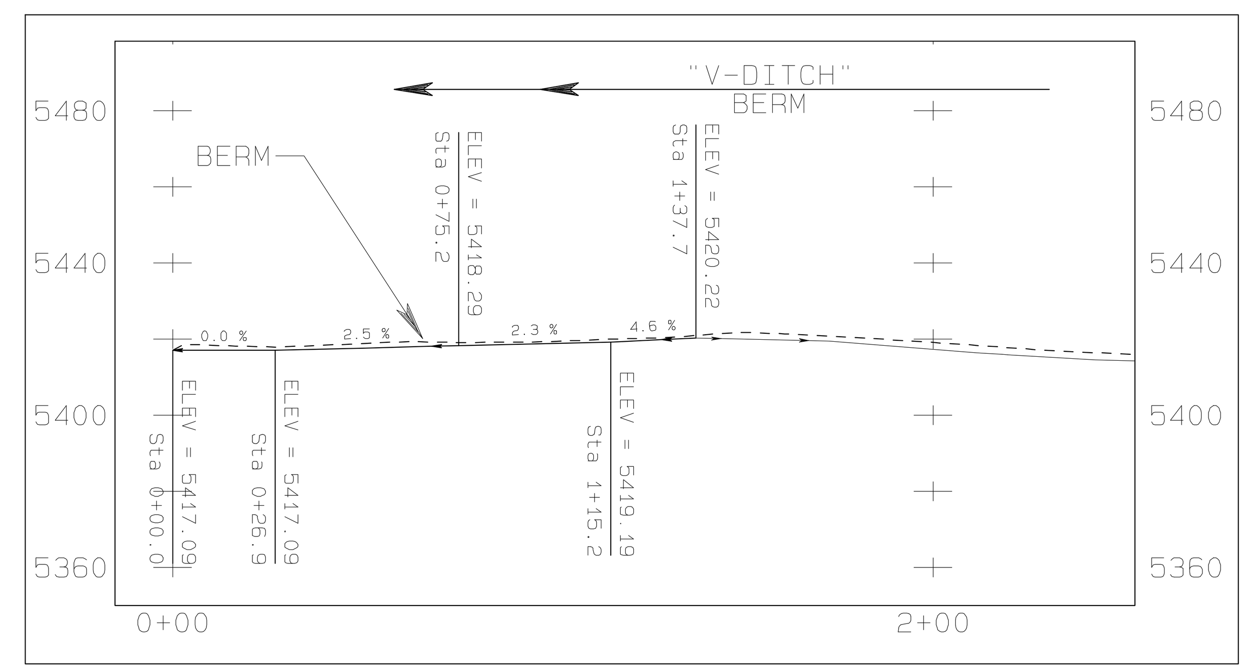
LOCATION MAP
Scale: 1" = 100'



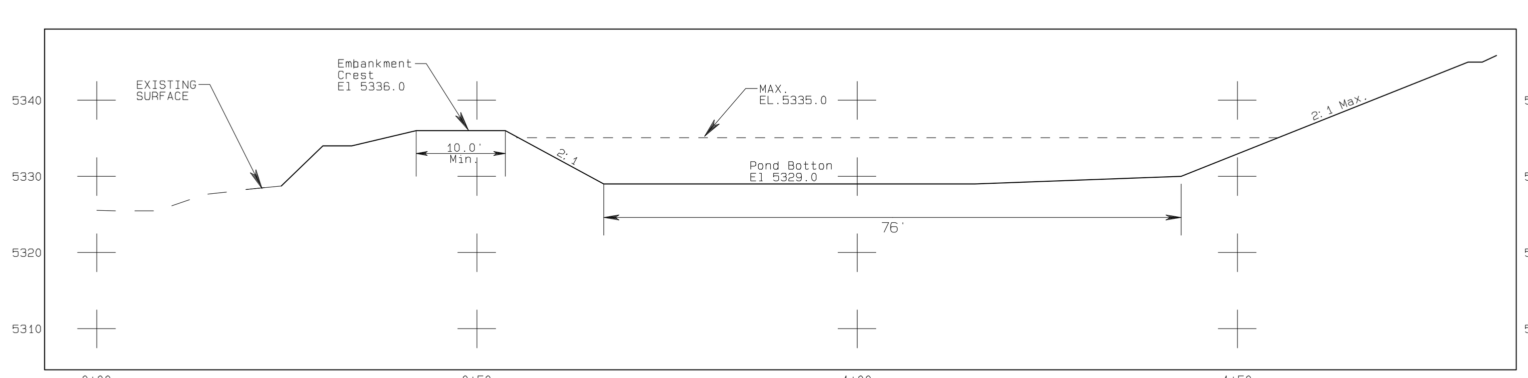
PLAN
Scale: 1" = 40'



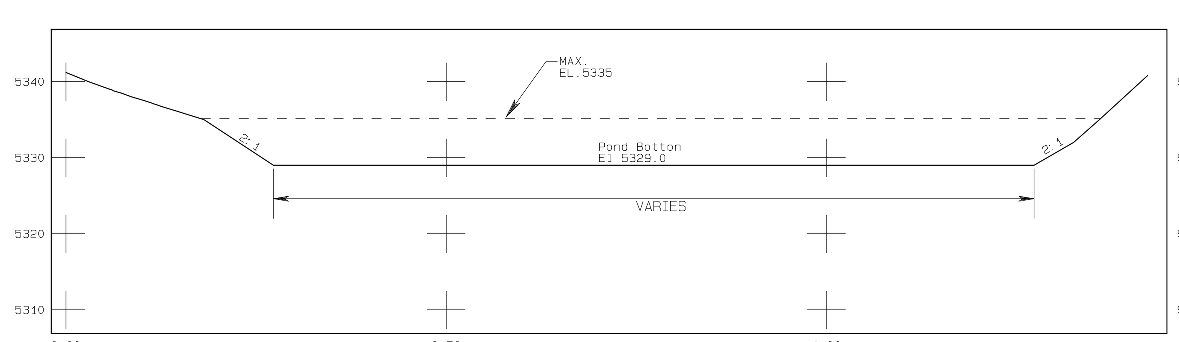
PLAN
Scale: 1" = 40'



V-Ditch Berm
SCALE=1"=40'



SECTION A-A'



SECTION B-B'
SECTIONS A AND B
SCALE=1"=20'

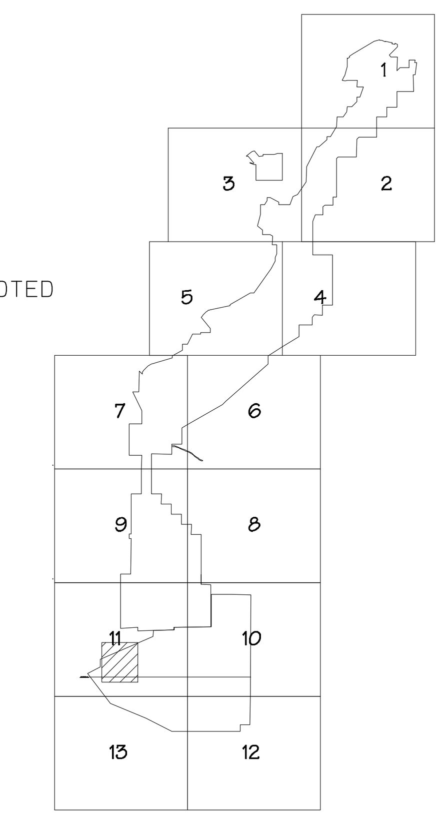
LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- x5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY
- DRAIN FLOW

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13F.

SCALE AS NOTED



STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5329	0.09	0.0	0.0
5330	0.157	0.12	0.12
5331	0.186	0.12	0.30
5332	0.208	0.20	0.49
5333	0.229	0.22	0.71
5334	0.249	0.24	0.95
5335	0.270	0.26	1.21
5336	0.294	0.28	1.49

Pond Crest Elevation 5336.0
As-Built Volume at Crest (Ac-Ft) 1.5
Design Max. Water Elevation 5335.0

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this structure has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge. except as noted below:

1. Only minor elevation differences for pond bottom and embankment crest.

REV NO.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	RY	11-19-04
2	SUBMITTED TO OSM FOR APPROVAL, ADD DIVERSION BERM	RY	01-26-10
3	PREPARED AS-BUILT AND SUBMITTED TO OSM FOR REVIEW	PJF	6-21-10
4			
5			

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

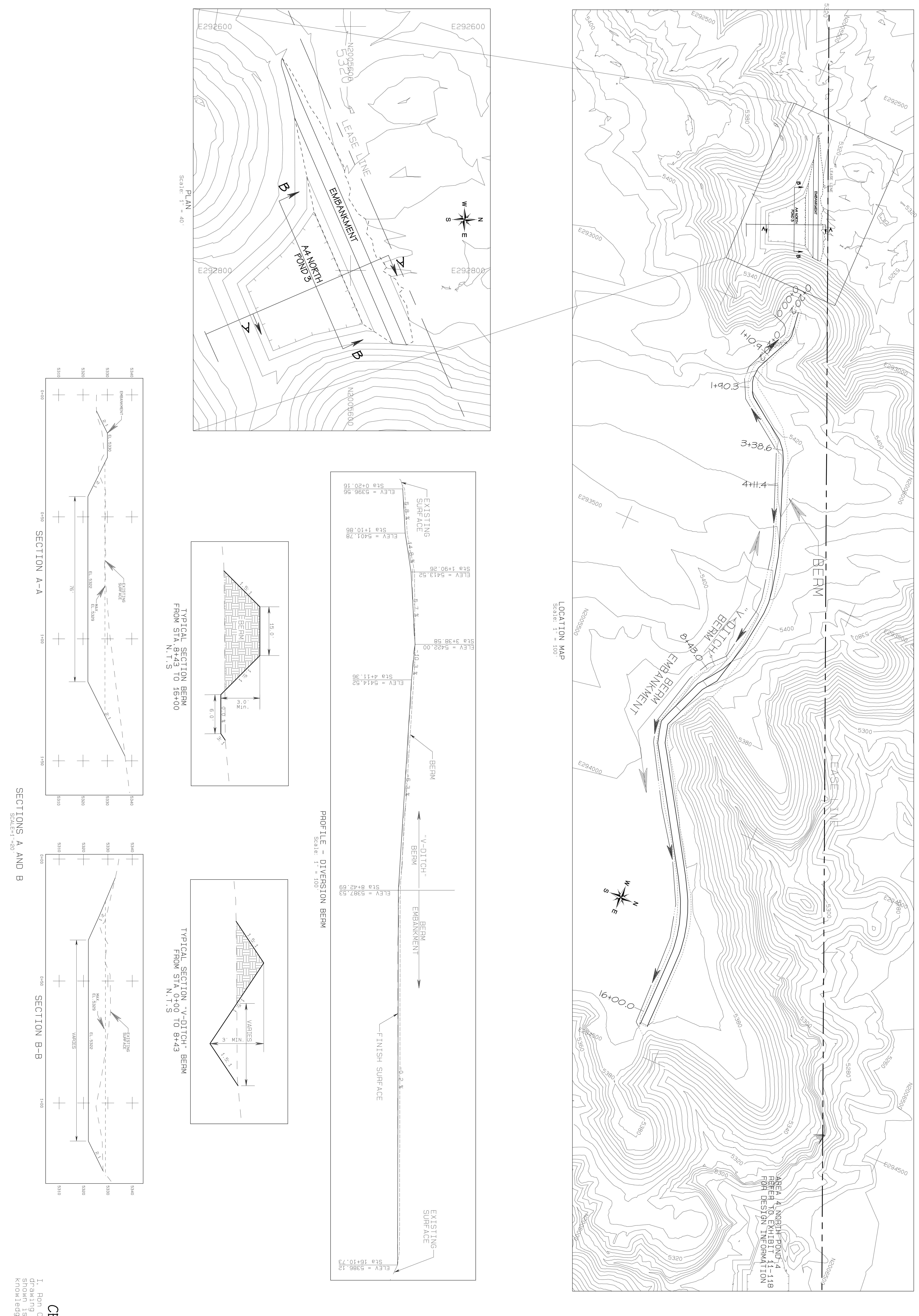
ACCOUNT:
DATE: 01-26-10
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 26-46
AREA 4 NORTH POND 3 AS-BUILT

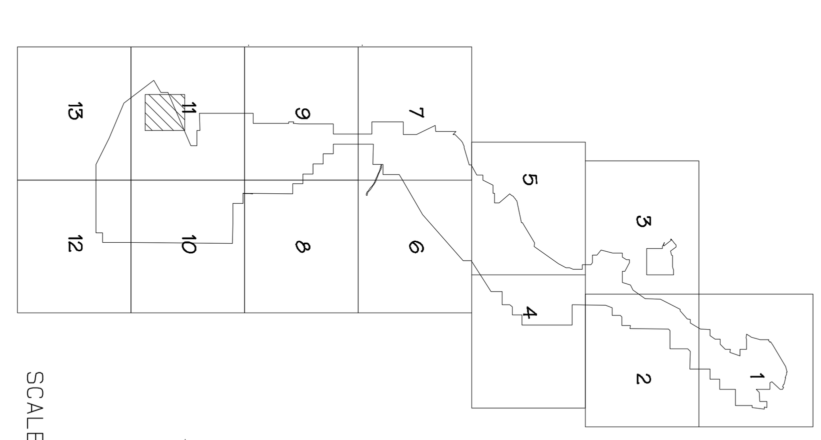
DRAWING
SHEET 1
OF 1

Path: G:\Da\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBITS\11-115-A4N POND-3\A4N PERMIT EXH\Exh 11-115_A4N Pond 3_As-Built.prs



STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5322	0.13	0.0	0.0
5324	0.16	0.3	0.3
5326	0.20	0.4	0.7
5328	0.24	0.4	1.1
5330	0.29	0.5	1.6



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEGEND

ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE CORNER
PERMIT/LEASE BOUNDARY
DRAIN FLOW

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13F.

EXHIBIT 26-47
AREA 4 NORTH POND 3
DESIGN

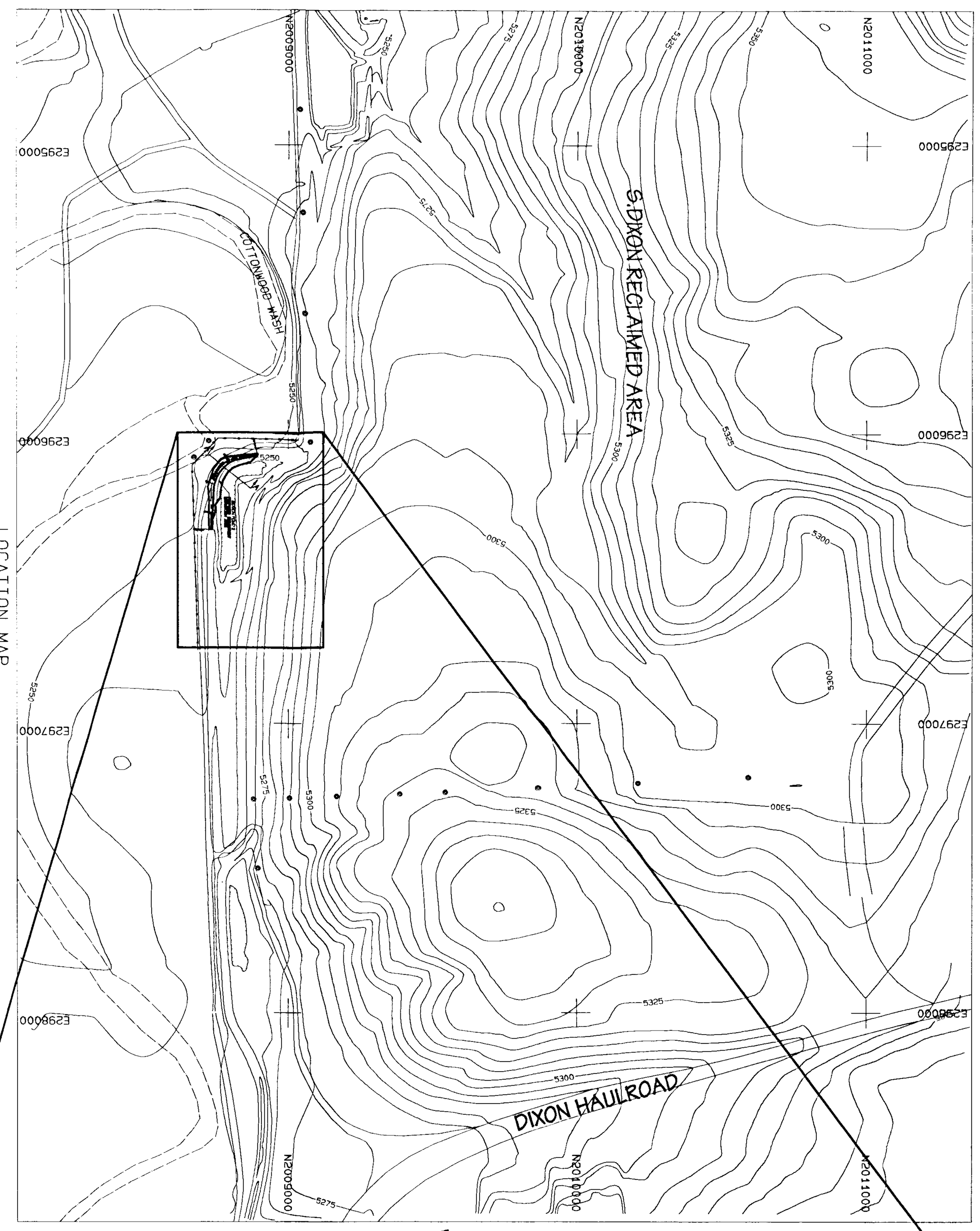
PLAN, PROFILE AND SECTION

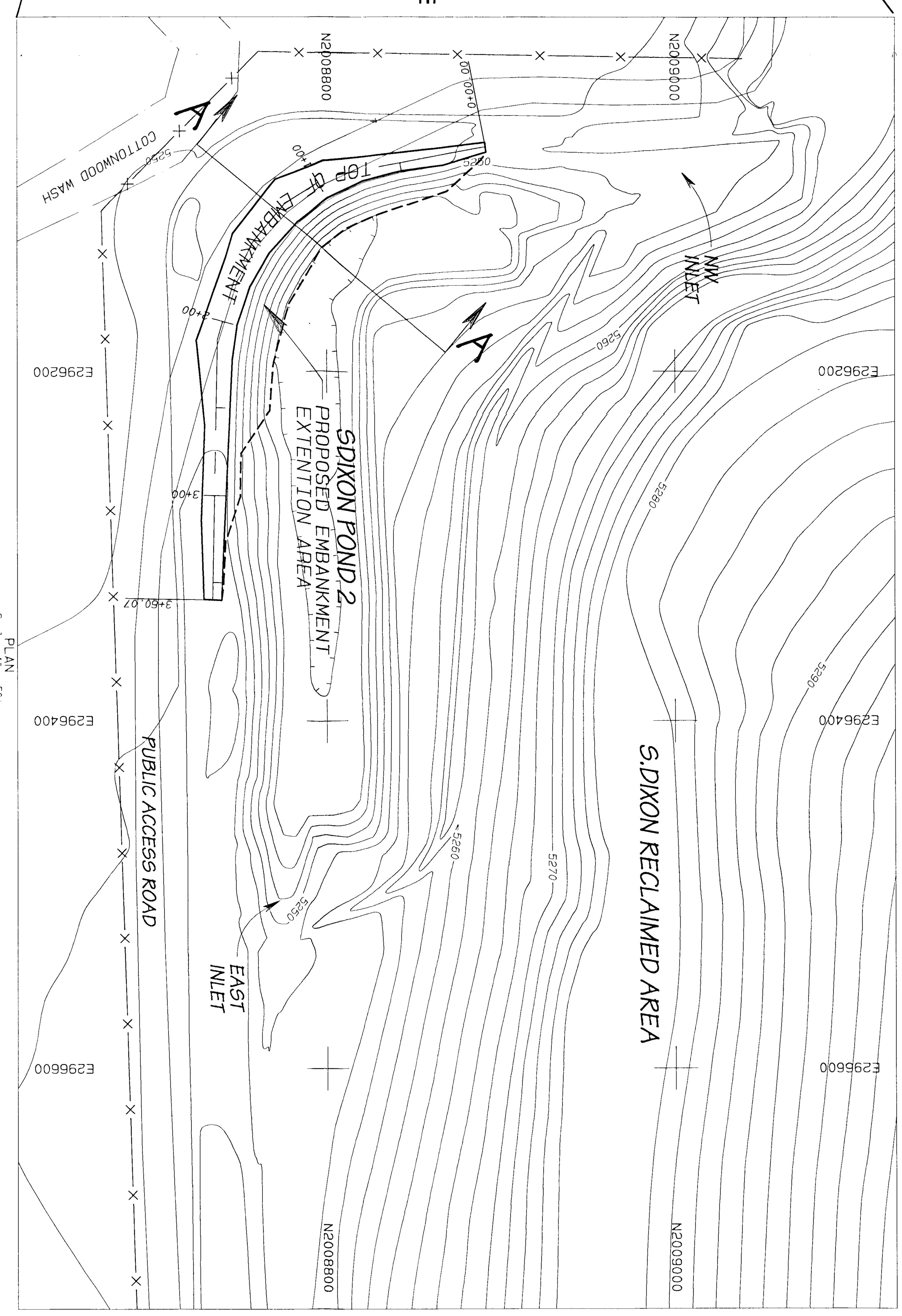
ACCOUNT:
DATE: 01-26-10
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: RCV
APPROVED BY: RCV

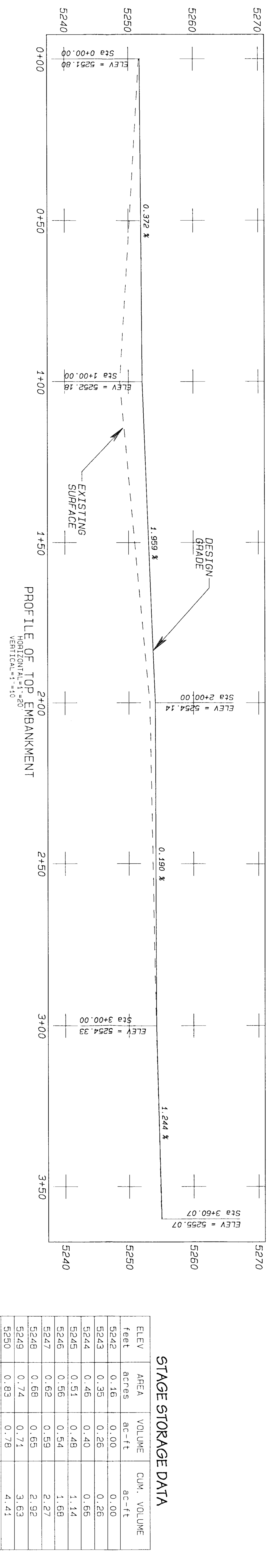
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

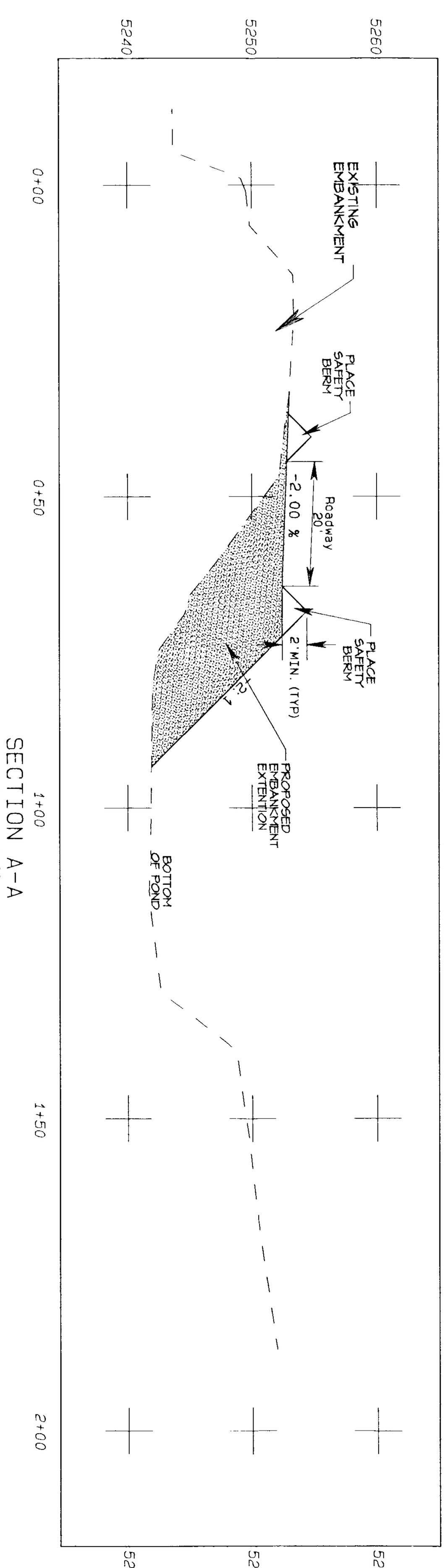
PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

REV No.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	RY	11-19-04
2	SUBMITTED TO OSM FOR APPROVAL. ADD DIVERSION BERM	RY	01-26-10
11-A	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	PJF	FEB-2011









STAGE STORAGE DATA

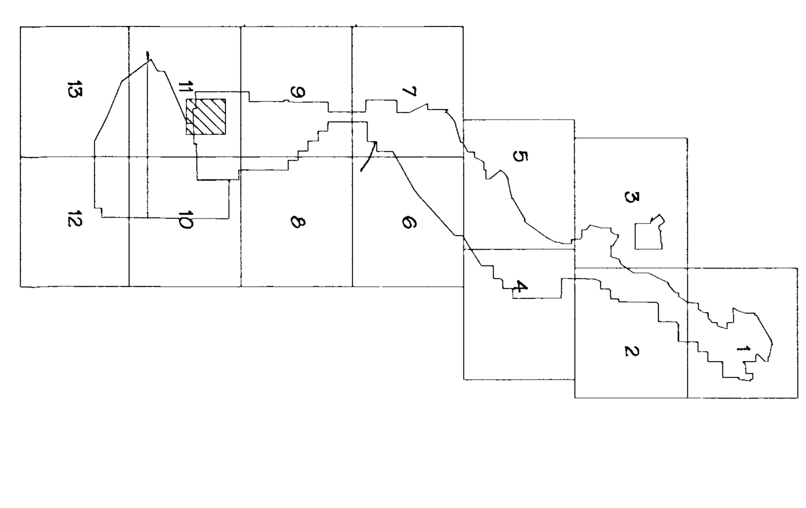
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5242	0.16	0.00	0.00
5243	0.35	0.26	0.26
5244	0.46	0.40	0.66
5245	0.51	0.48	1.14
5246	0.56	0.54	1.68
5247	0.62	0.59	2.27
5248	0.68	0.65	2.92
5249	0.74	0.71	3.63
5250	0.83	0.78	4.41
5250.6	0.91	0.55	4.95
5251.6	1.06	0.98	5.94

LEGEND

ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE CORNER
PERMIT/LEASE BOUNDARY

NOTES

1. For hydrology and design information refer to Appendix 11-T in the approved PAP.



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

11-18-05

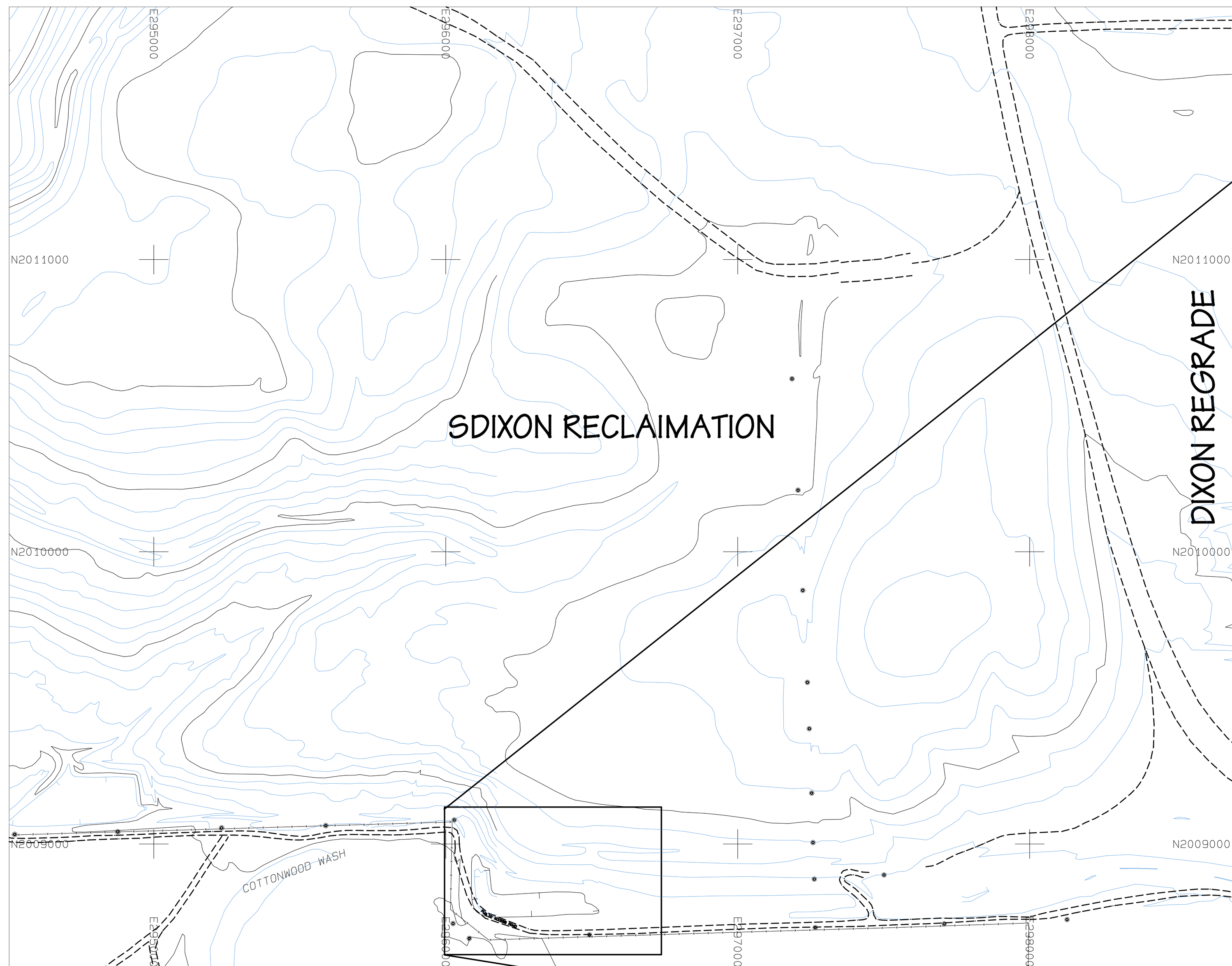
11-18-05

SHEET 1 OF 1 DRAWING	EXHIBIT 26-48 SOUTH DIXON POND-2 MODIFICATION DESIGN	PLAN, PROFILE AND SECTION	ACCOUNT: DATE: 11-18-05 DESIGNED BY: RY DRAWN BY: RY CHECKED BY: LR APPROVED BY: LR	BHP NAVAJO COAL CO. NAVAJO MINE PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

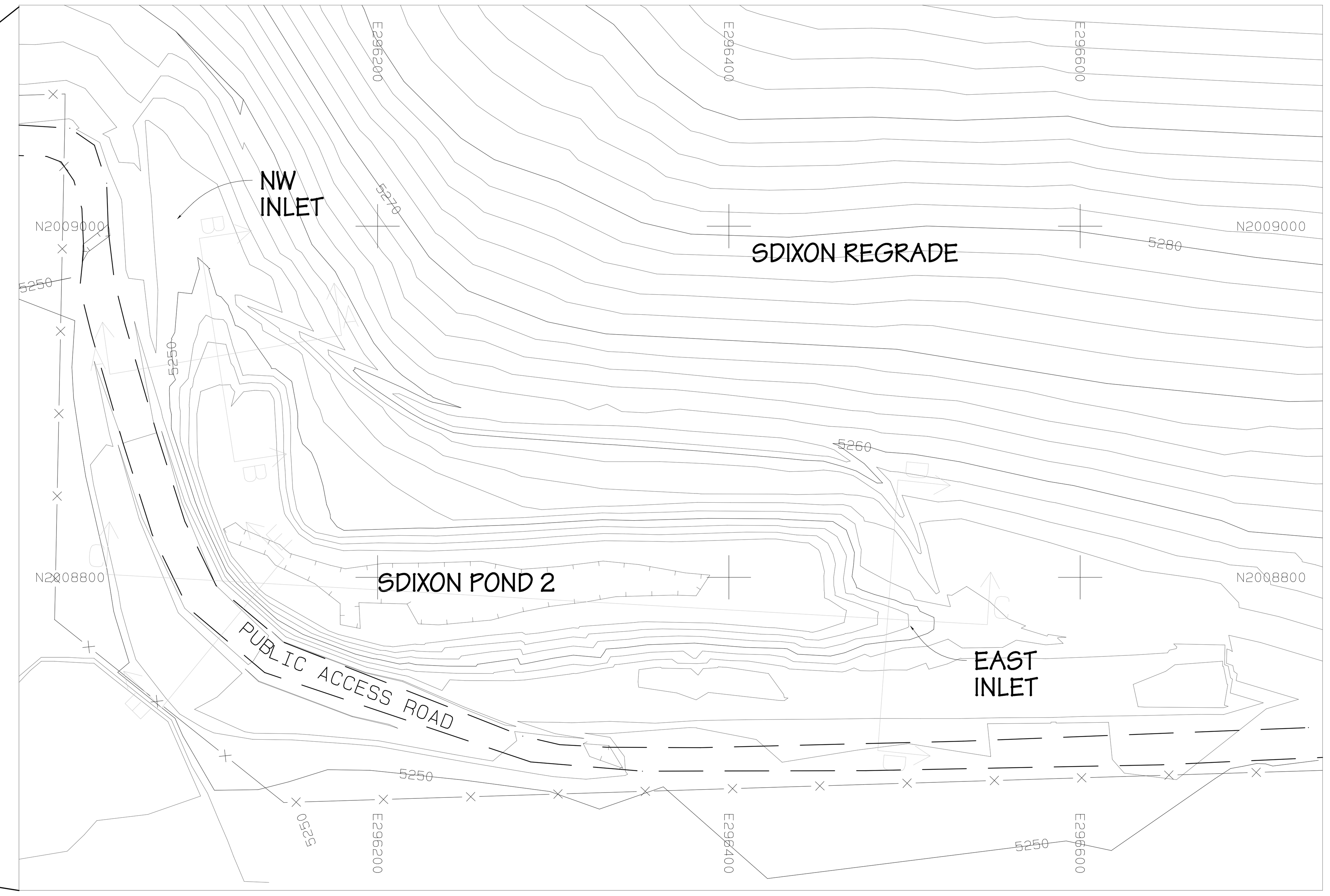
PROJECT MANAGER:	BH
ENGR. of RECORD:	LR
REG. NO:	5500
SRVYR of RECORD:	
REG. NO:	

REV No.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	RY	11-18-05
2			
3			
4			
5			

Path: G:\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBITS\11-117_A8_So-Dixon Pd-2 (NE)\SDixon Pond2 Modification_design.pro



LOCATION MAP
SCALE: 1"=100 FT.



SCALE: 1"=40 FT.

LEGEND

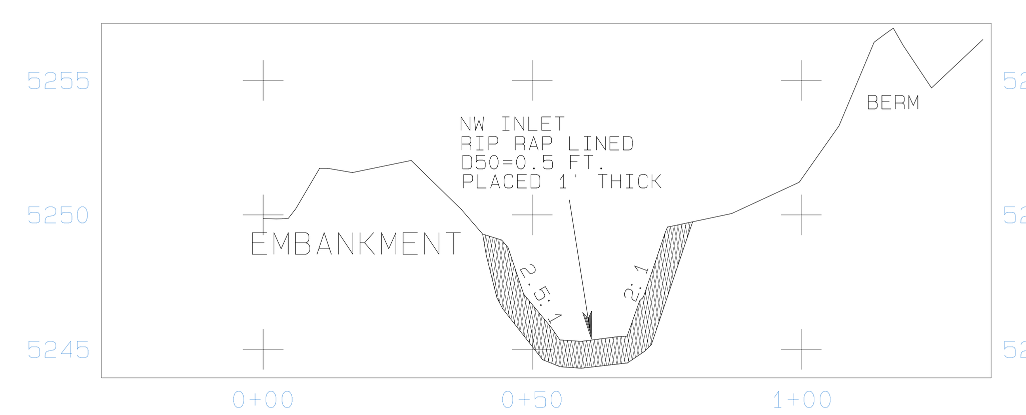
- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER

STAGE STORAGE DATA

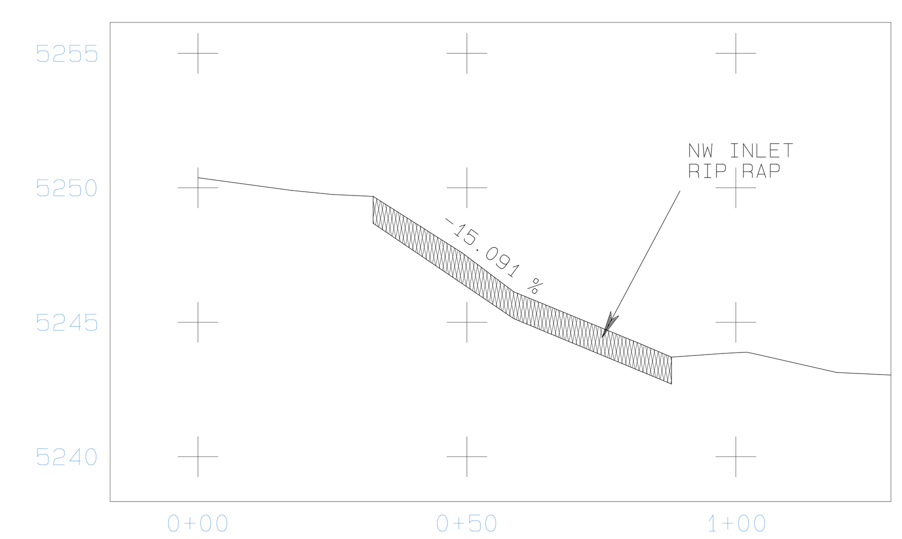
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5242	0.13	0.00	0.00
5243	0.34	0.24	0.24
5244	0.45	0.40	0.63
5245	0.50	0.48	1.11
5246	0.55	0.52	1.64
5247	0.60	0.58	2.21
5248	0.66	0.63	2.85
5249	0.72	0.68	3.53
5250	0.80	0.76	4.29
5251	0.93	0.87	5.15
5251.4	0.98	0.33	5.49

NOTES

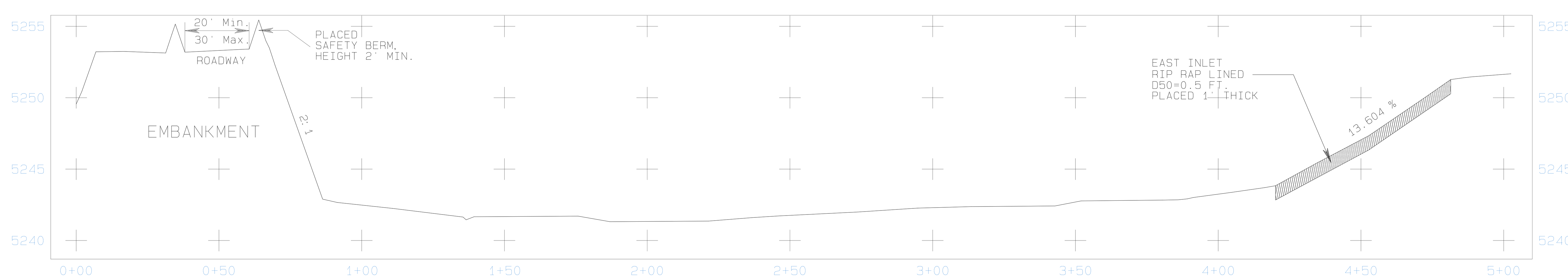
1. For hydrology and design information refer to Appendix 11-T in the approved PAP.
2. For watershed area, see Exhibit 11-13E
3. See Table 11-5AC in the PAP for impoundment data.



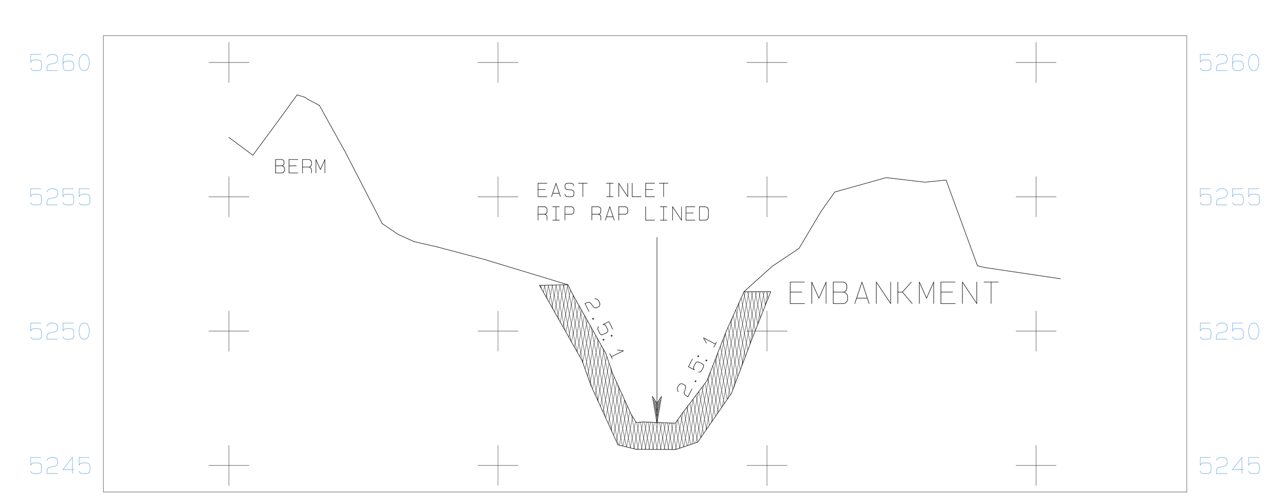
SECTION A-A



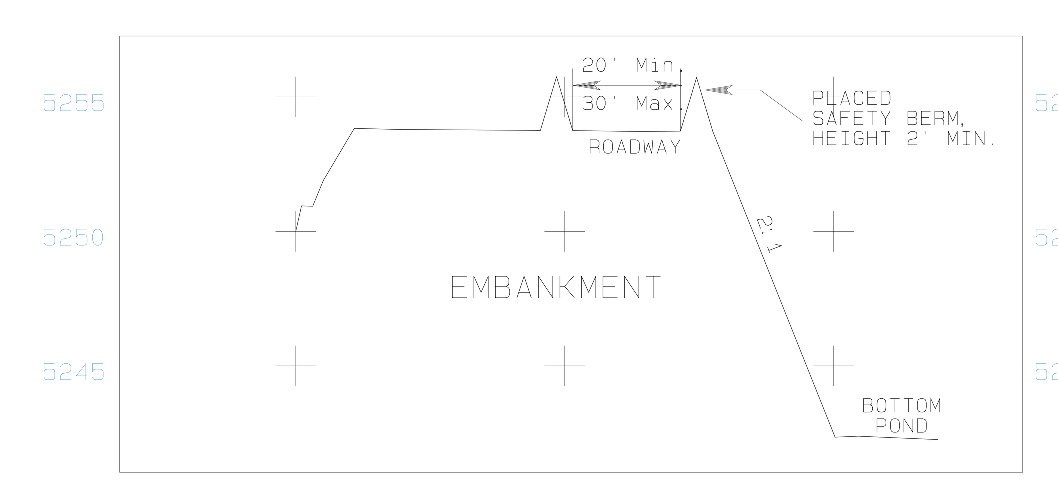
SECTION B-B



SECTION C-C

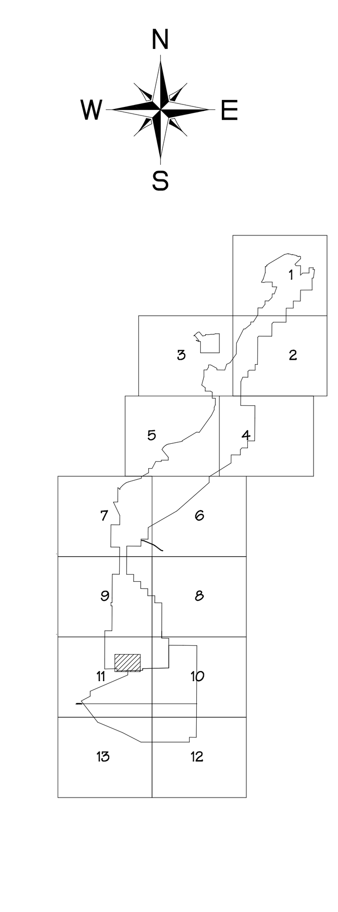


SECTION D-D



SECTION E-E

SECTIONS SCALE-HORIZONTAL: 1"=20 FT.
VERTICAL: 1"=4 FT.



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this pond has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
3	6-16-06	RY	As-built pond modification, updated exhibit to current topo and submitted to OSM for review.	LR	KJ	LR		
2	4-29-04	PJF	UPDATED EXHIBIT AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR		
1	05/20/98	RY	RE-SURVEYED AND RE-ASBUILT					

APPROVALS

EXHIBIT 26-49

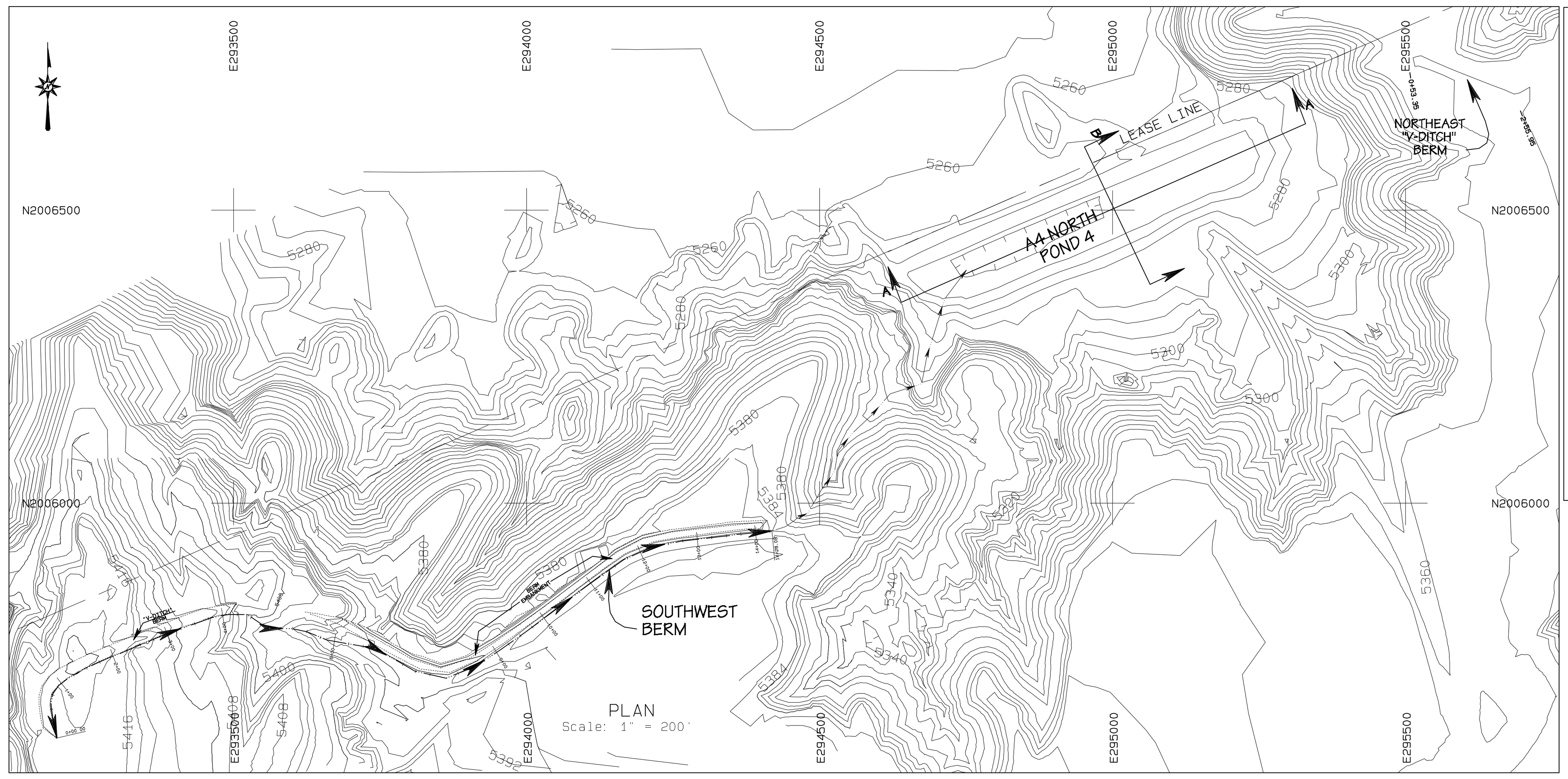
NAVAJO COAL COMPANY

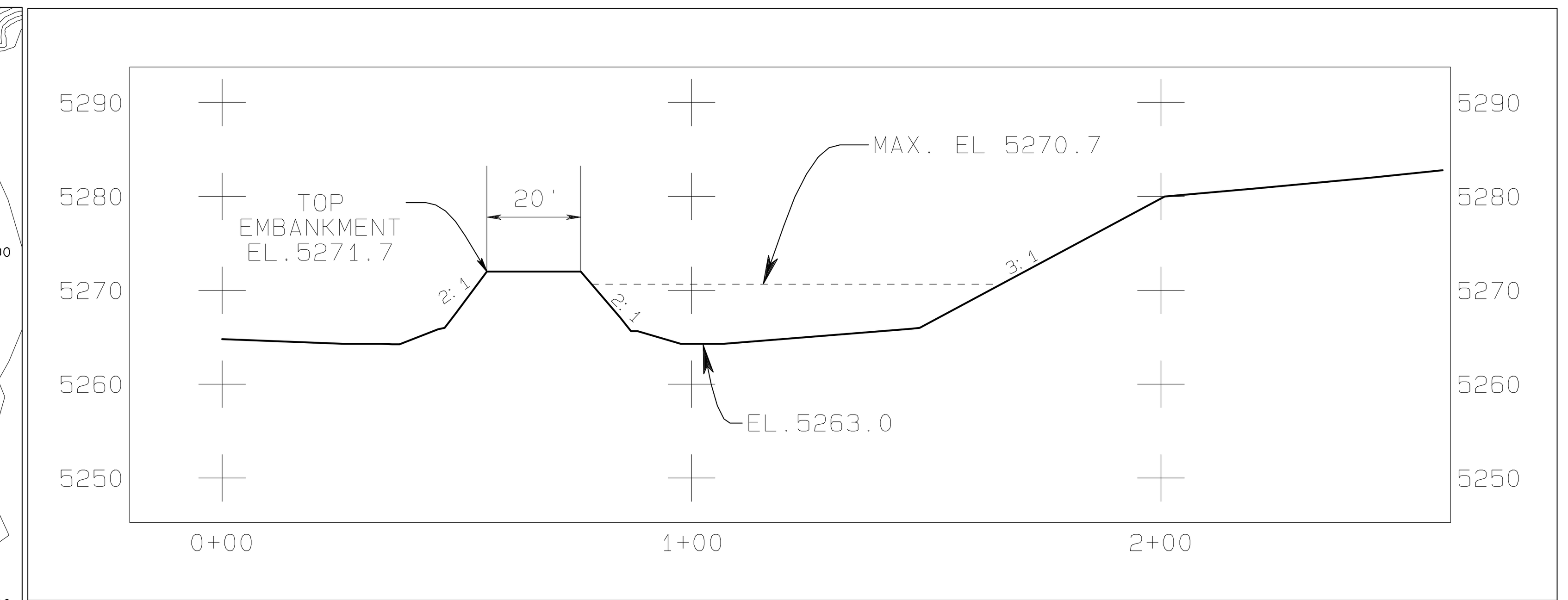
NAVAJO MINE
SAFETY PAYS
P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

ASBUILT
SOUTH DIXON POND 2

PREPARED BY RY	DRAWN BY RY	SCALE AS NOTED
APPROVED BY LR	DATE 05/20/98	REF DWG

\\ENCNMCFMN-SRV02\Data\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBITS\11-117_AB_So-Dixon Pd-2 (NE)\SDix Pond2 Mod





POND-4 AS-BUILT
SECTION B - B
HORIZONTAL=1"=30'
VERTICAL=1"=15'

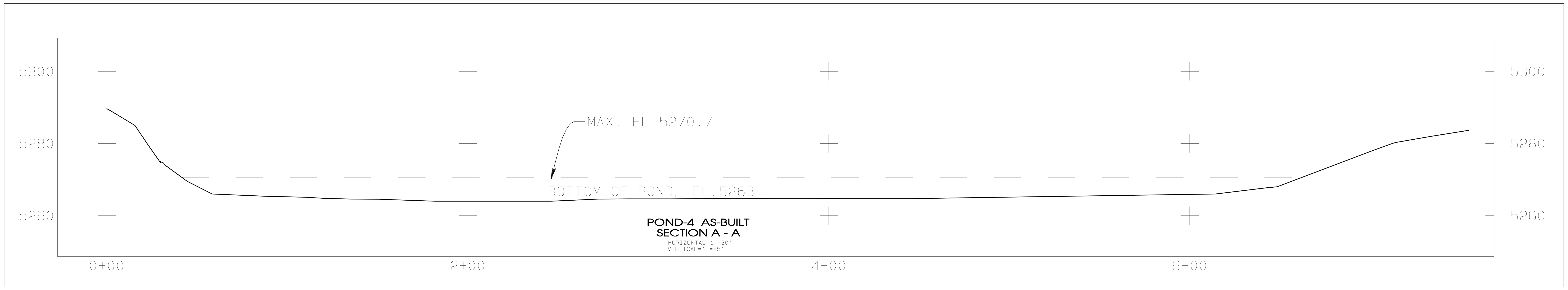
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5263	0.00	0.00	0.00
5264	1.116	0.1	0.06
5266	0.777	0.9	0.89
5268	0.966	1.7	2.64
5270	1.133	2.1	4.74
5272	1.307	2.4	7.18

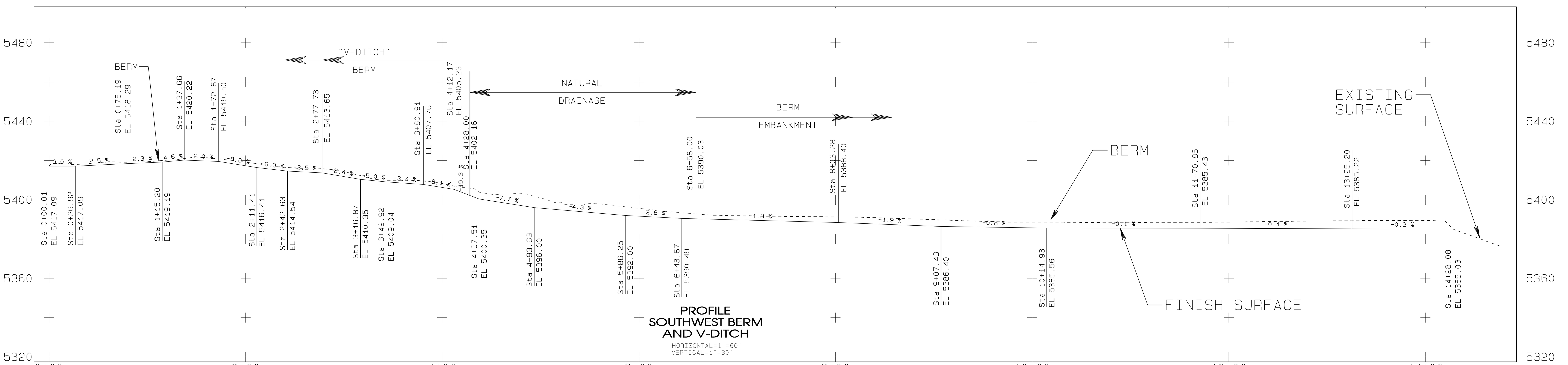
Design High Water at Crest — El. 5271.7
Design Capcity at High Water El. — 6.8 Ac-Ft

LEGEND

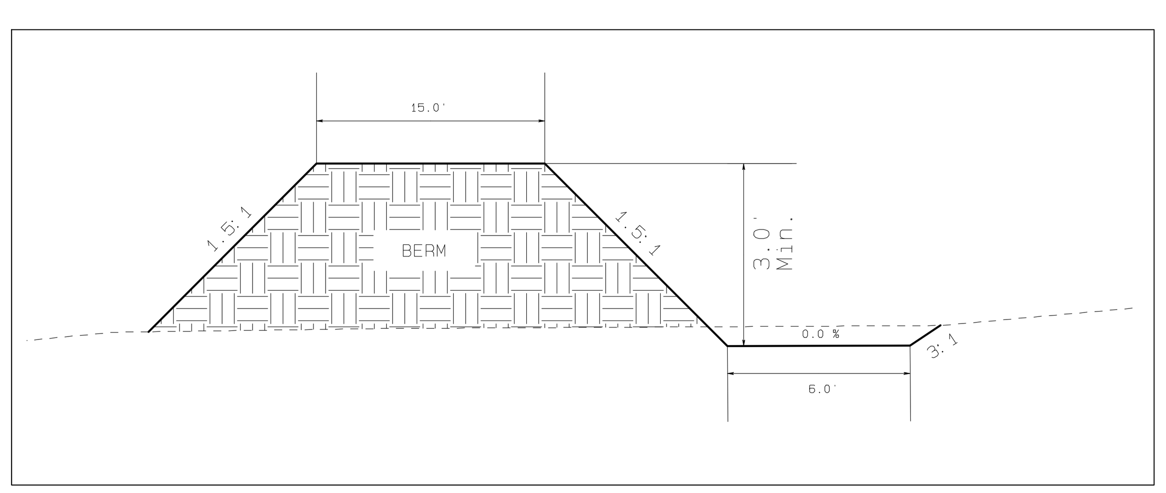
ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
×5338.5 SPOT ELEVATION
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
218 5422.45 L-30 LEASE CORNER
PERMIT/LEASE BOUNDARY



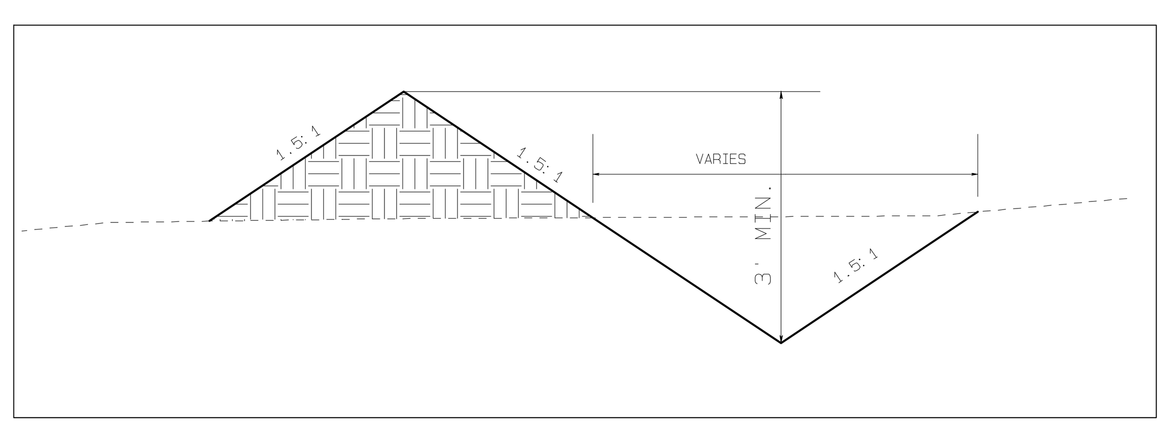
POND-4 AS-BUILT
SECTION A - A
HORIZONTAL=1"=30'
VERTICAL=1"=15'



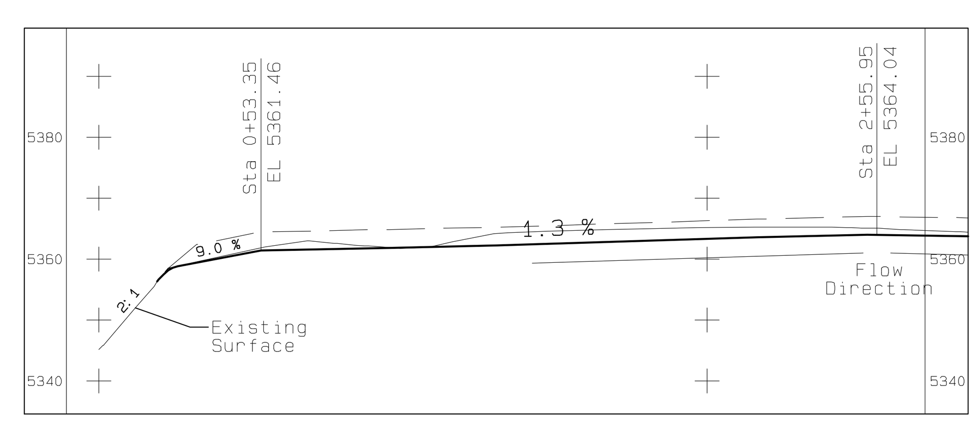
PROFILE
SOUTHWEST BERM
AND V-DITCH
HORIZONTAL=1"=60'
VERTICAL=1"=30'



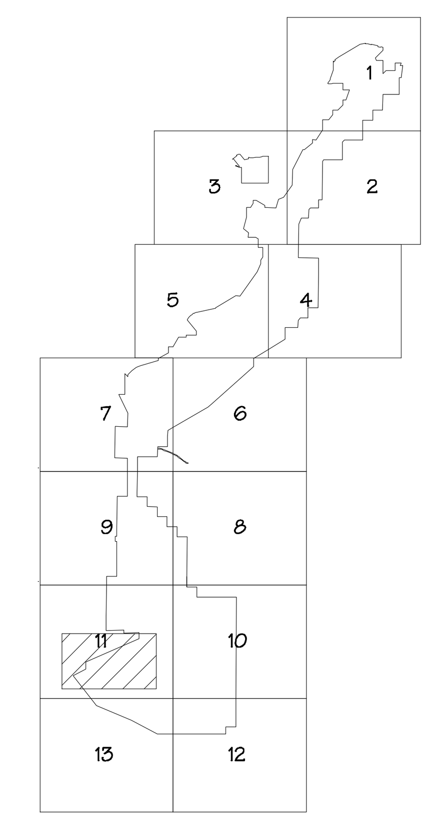
TYPICAL SECTION BERM
FROM STA. 6+58 TO14+28 SOUTHWEST BERM
N.T.S.



TYPICAL SECTION "V-DITCH" BERM
FROM STA. 0+00 TO12+17 SOUTHWEST BERM
AND STA. 0+53.0 TO 2+56.0 NORTHEAST BERM
N.T.S.



PROFILE FOR NORTHEAST BERM
STA. 0+53.0 TO 2+56.0 FROM EXH 11-06
HORIZONTAL=1"=50'
VERTICAL=1"=25'



SCALE AS NOTED

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13F.

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this structure has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge, except as noted below:

I. Only minor elevation and dimension differences for pond bottom and embankment crest.

RON C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

REV NO.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	RY	3-24-10
2	PREPARED AS-BUILT FOR POND-4 BERM DITCH AND SUBMITTED TO OSM FOR REVIEW (NOT SUBMITTED)	PJF	6-21-10
11-A	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	pjf	1-26-2011

PROJECT MANAGER: FERGUSON GORMAN
ENGR. of RECORD: RON VAN VALKENBURG
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

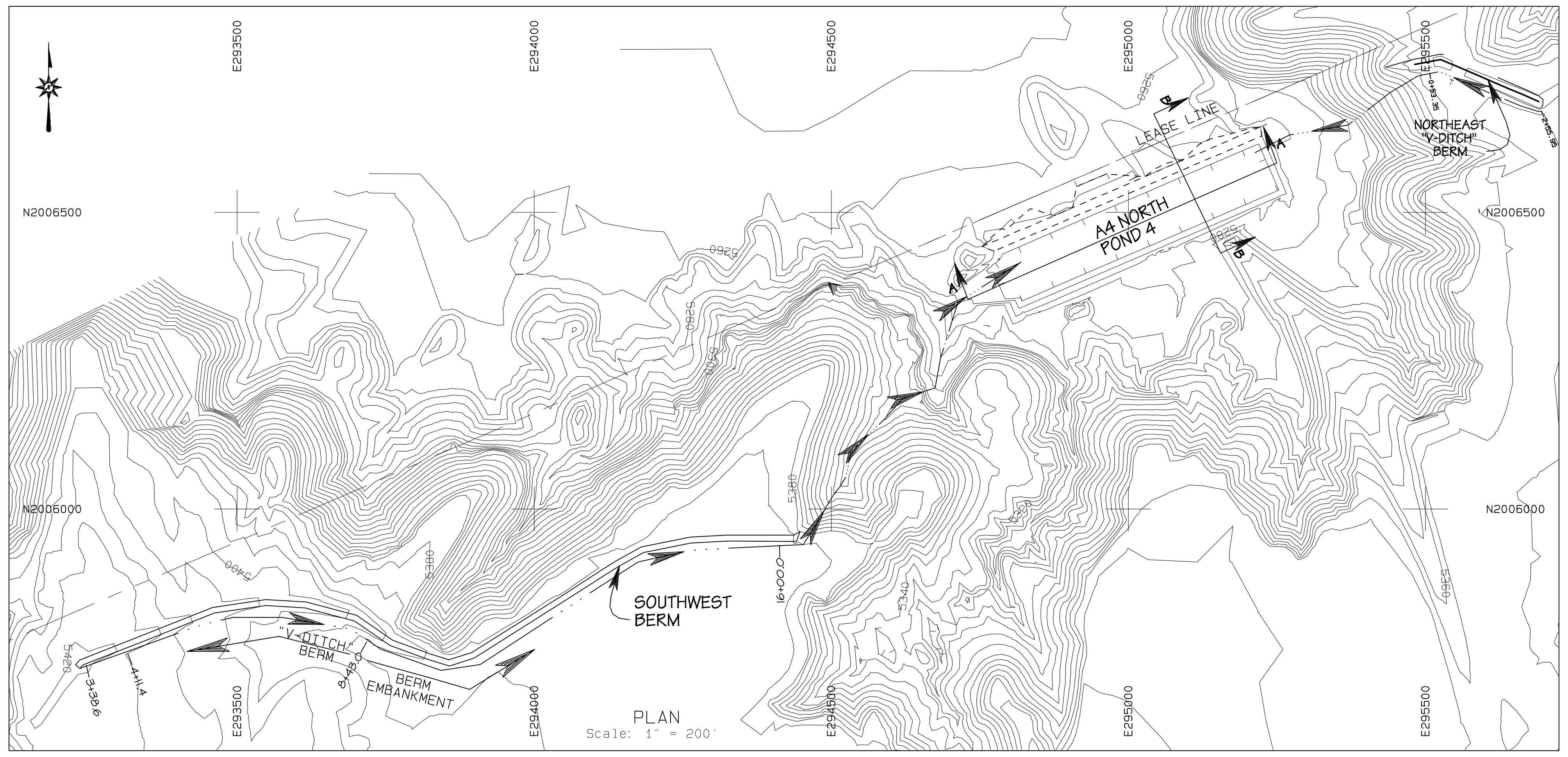
ACCOUNT:
DATE: 11-16-04
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: RCVV
APPROVED BY: RCVV

PLAN, PROFILE AND SECTION

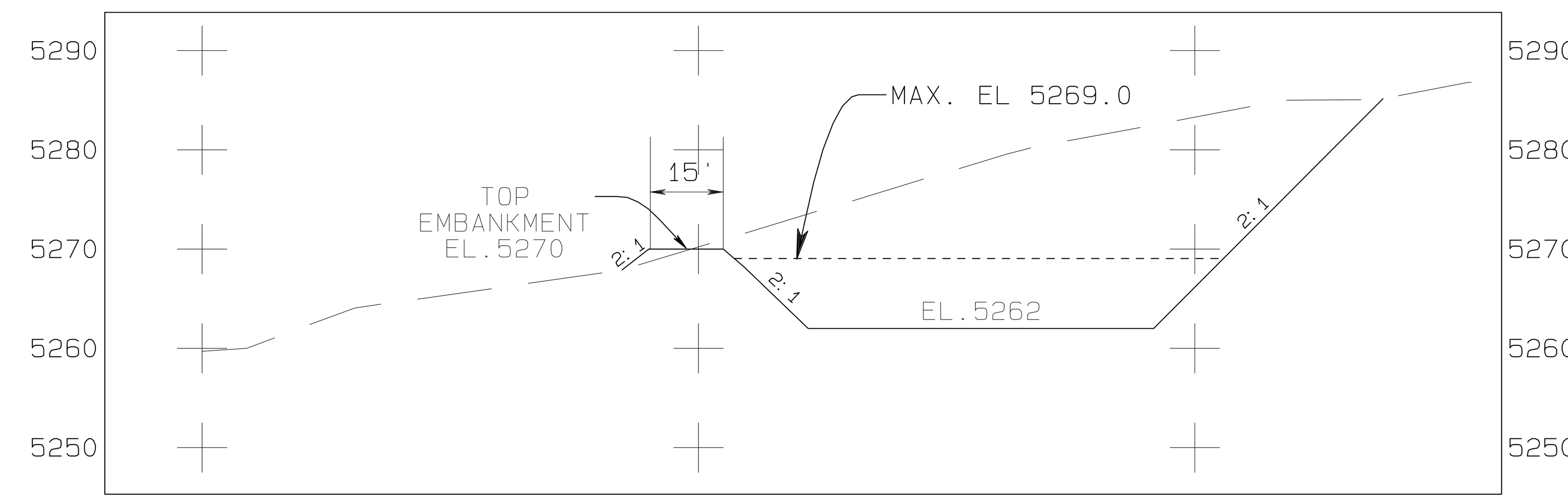
EXHIBIT 26-50
AREA 4 NORTH POND 4
AS-BUILT

DRAWING
SHEET 1 OF 1

Path: S:\Da\Permit F\Ch 11\Exh 11-11B_A4N Pd 4\OSM Subm-12011\Exh 11-11B_A4N Pd 4_As-Built-A.pro



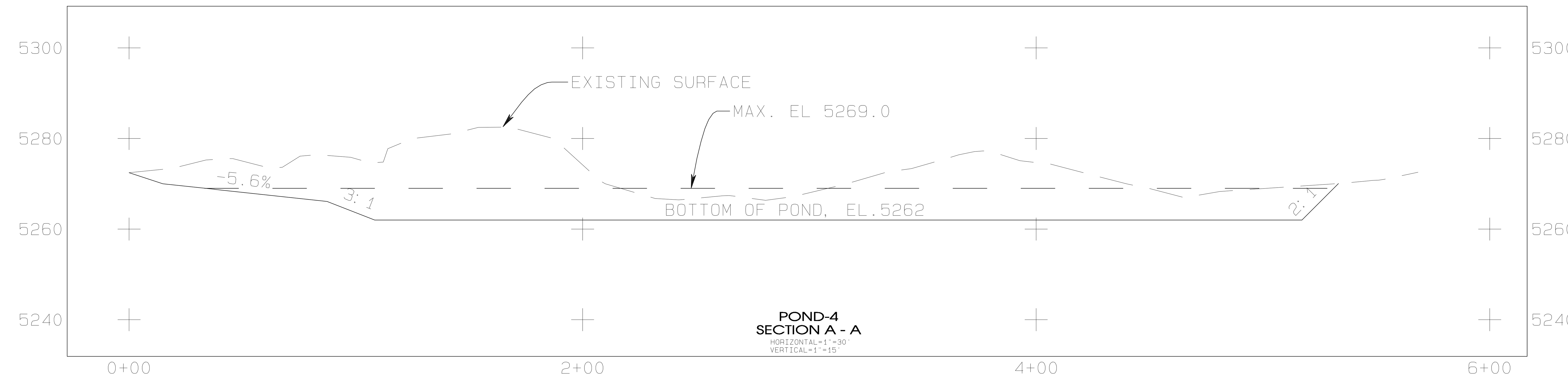
PLAN
Scale: 1" = 200'



POND-4
SECTION B - B
HORIZONTAL=1"=30'
VERTICAL=1"=15'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY



POND-4
SECTION A - A
HORIZONTAL=1"=30'
VERTICAL=1"=15'

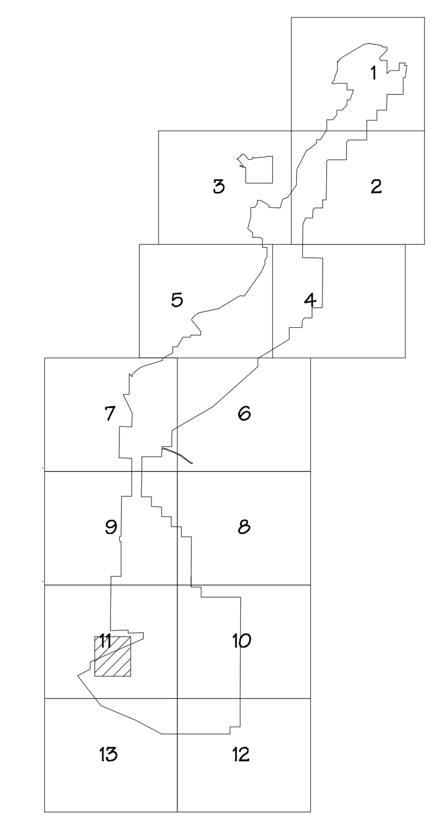
STAGE STORAGE DATA

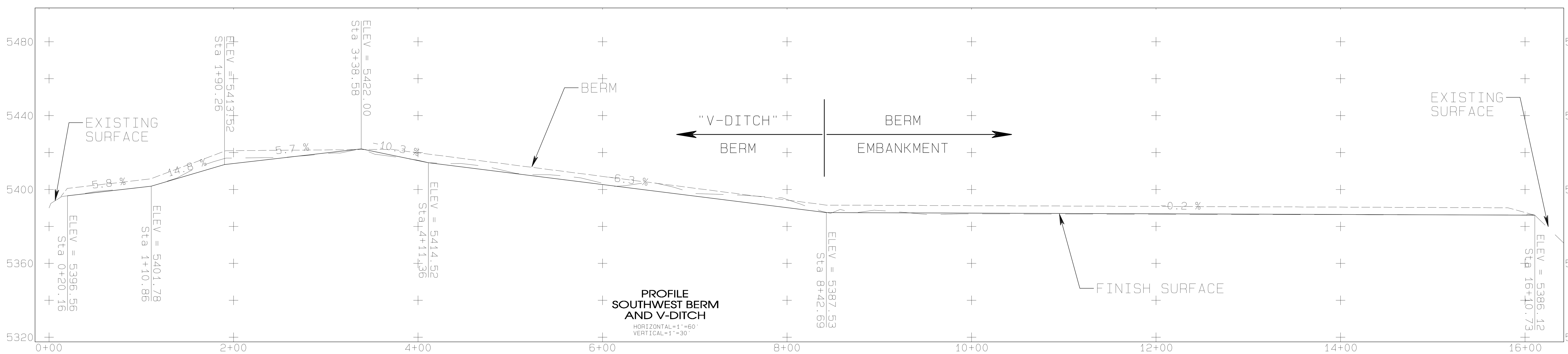
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5262	0.65	0.00	0.00
5264	0.79	1.44	1.44
5266	0.95	1.74	3.18
5268	1.15	2.10	5.28
5270	1.40	2.56	7.84

Design High Water El. 5269.0
Design Capcity at High Water El. 6.6 Ac-Ft

NOTES

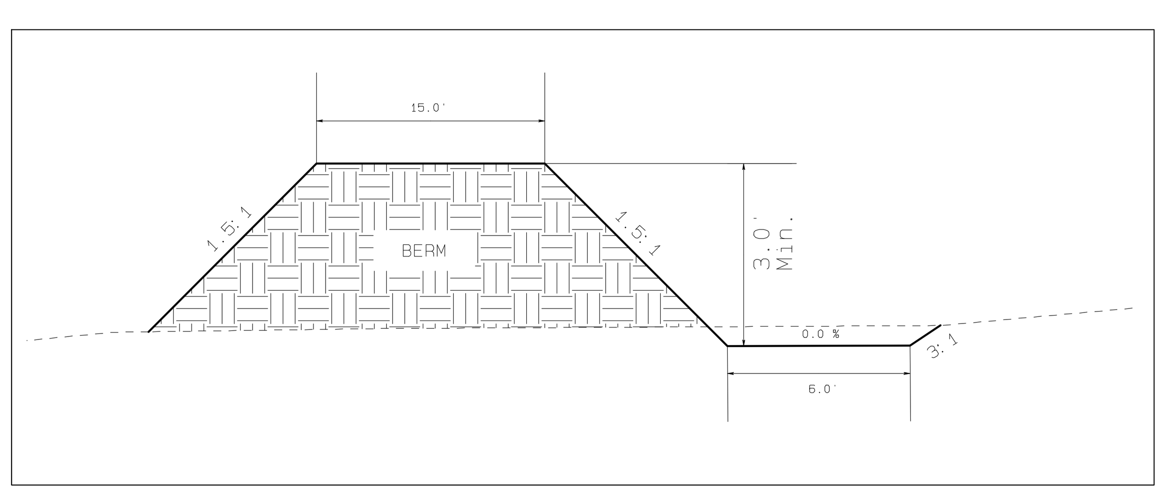
1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13F.



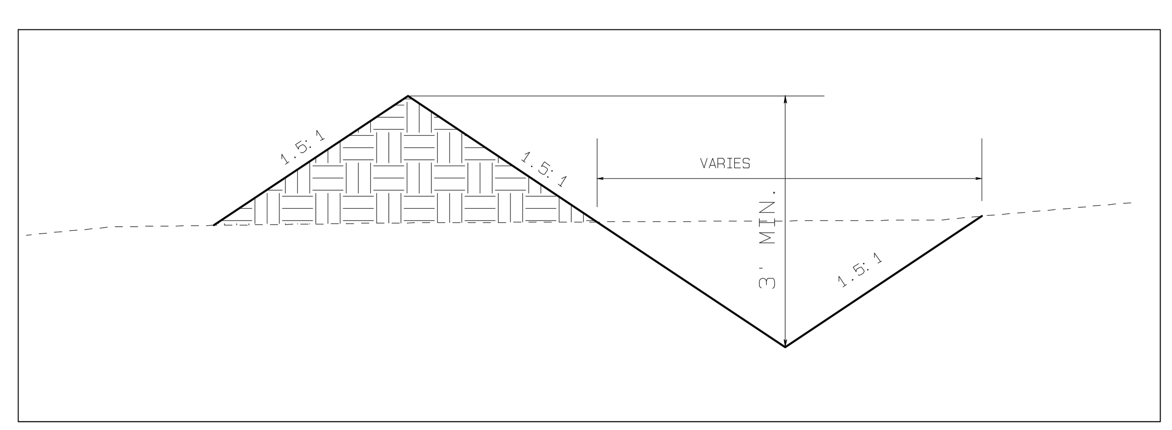


PROFILE
SOUTHWEST BERM
AND V-DITCH
HORIZONTAL=1"=60'
VERTICAL=1"=30'

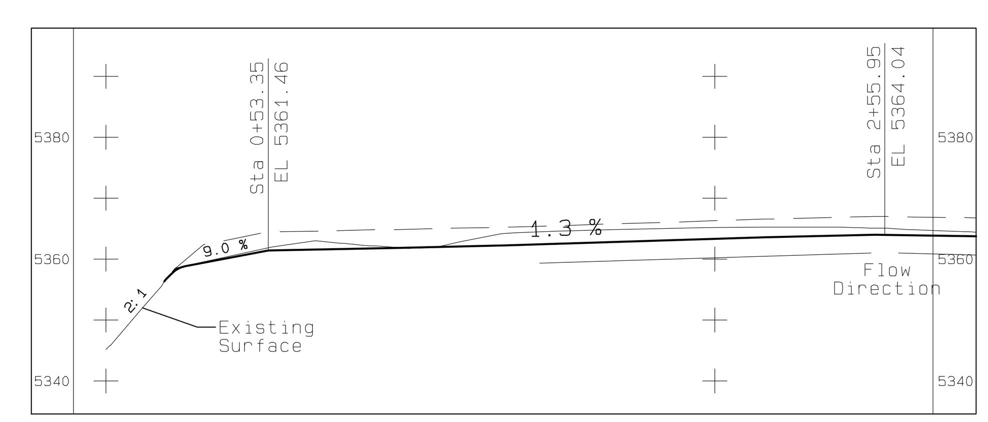
SCALE AS NOTED



TYPICAL SECTION BERM
FROM STA. 8+43 TO 16+00 SOUTHWEST BERM
N.T.S.



TYPICAL SECTION "V-DITCH" BERM
FROM STA. 0+00 TO8+43 SOUTHWEST BERM
AND STA. 0+53.0 TO 2+56.0 NORTHEAST BERM
N.T.S.



PROFILE FOR NORTHEAST BERM
STA. 0+53.0 TO 2+56.0 FROM EXH 11-06
HORIZONTAL=1"=50'
VERTICAL=1"=25'

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

RON C. VAN VALKENBURG
NEW MEXICO
9263
LICENSED PROFESSIONAL ENGINEER

REV NO.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	RY	3-24-10
11-A	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	PJF	FEB-2011

PROJECT MANAGER: FERGUSON GORMAN
ENGR. of RECORD: RON VAN VALKENBURG
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT:
DATE: 11-16-04
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: RCVV
APPROVED BY: RCVV

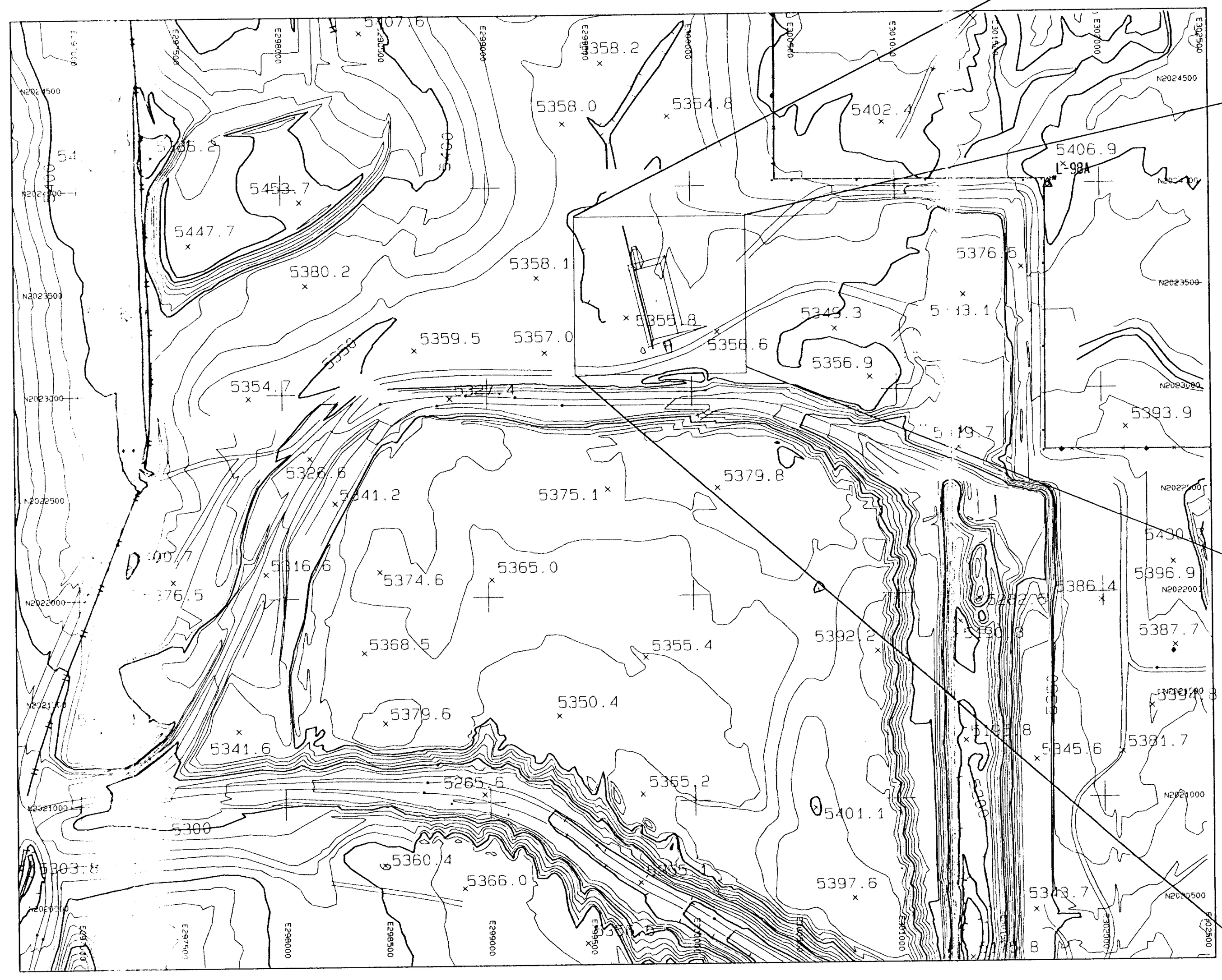
PLAN, PROFILE AND SECTION

EXHIBIT 26-51
AREA 4 NORTH POND 4
DESIGN

DRAWING

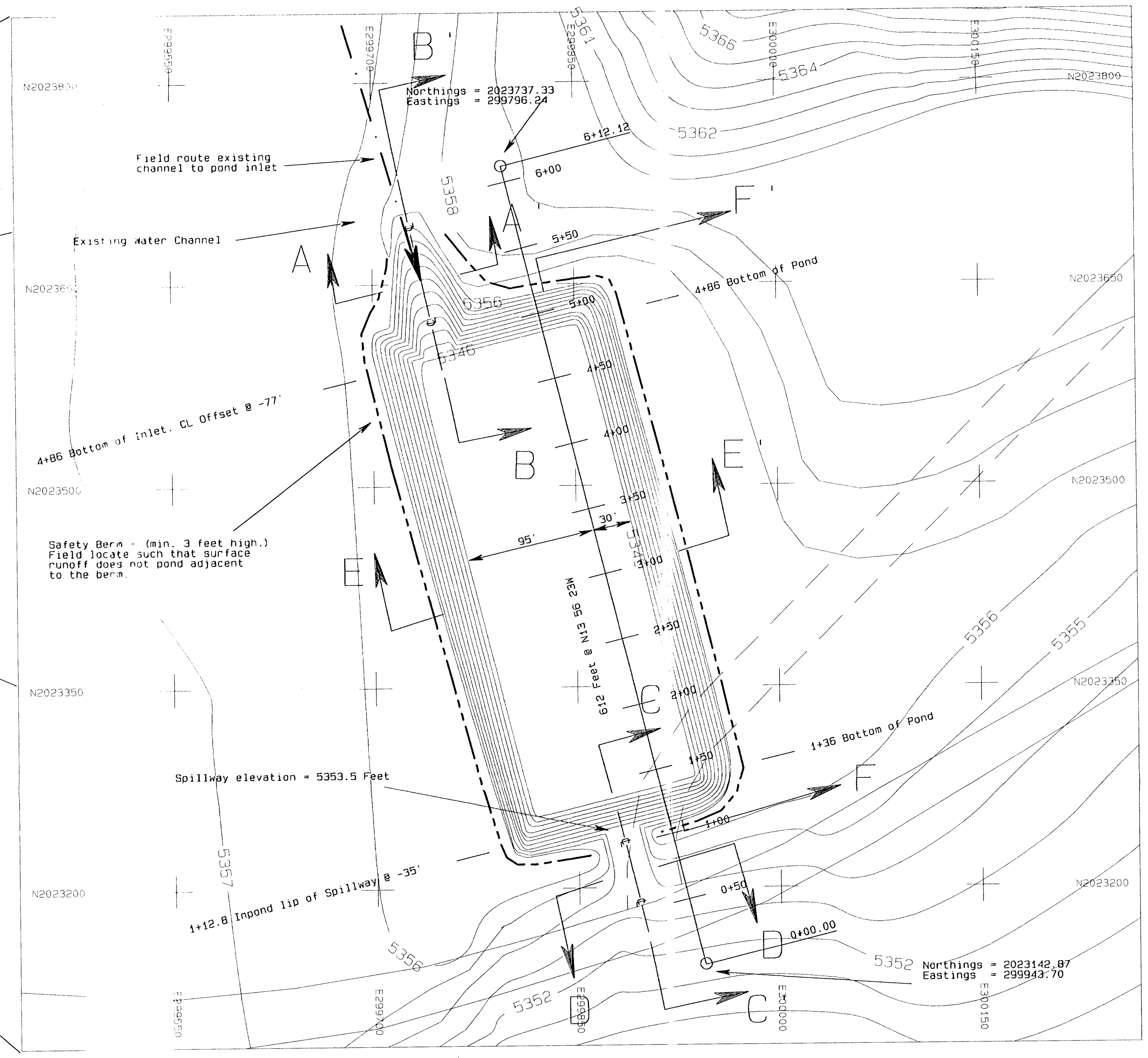
SHEET 1
OF 1

Path: G:\Gs\Permit F\Ch 11\Exh 11-11B_A4N Pd 4\OSM Subm-12011\Exh 11-11BD_A4N Pond 4_Design.pro



LOCATION MAP

SCALE: 1" = 500'



SCALE: 1" = 50'

LEGEND

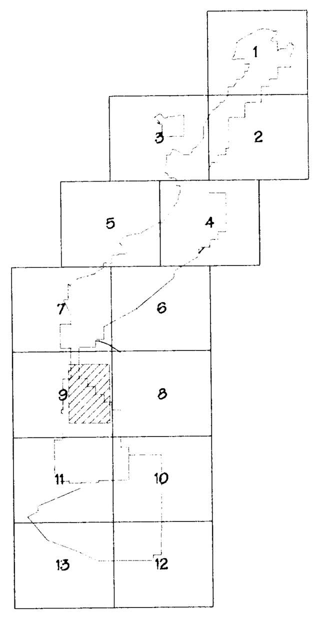
- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- x5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT BOUNDARY

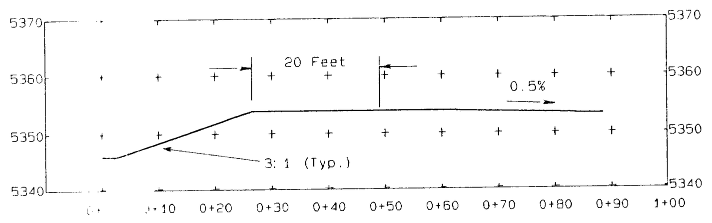
NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.

STAGE STORAGE DATA

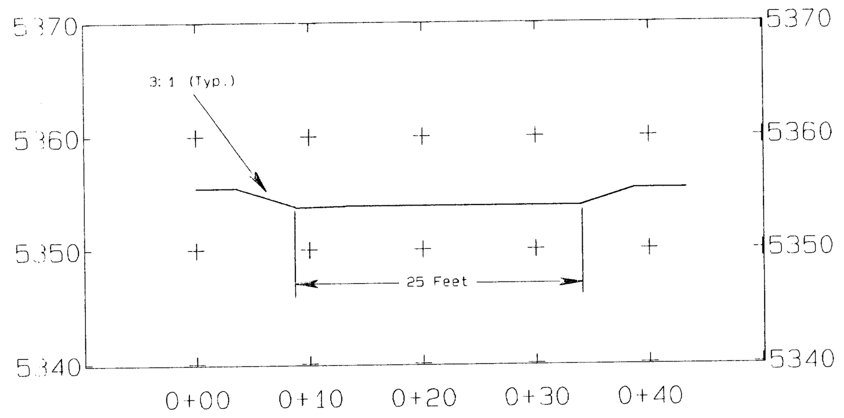
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5346	1.00	0.00	0.00
5347	1.07	1.03	1.03
5348	1.14	1.1	2.14
5349	1.20	1.17	3.31
5350	1.28	1.28	4.6
5351	1.35	1.3	5.9
5352	1.43	1.4	7.3
5353	1.50	1.42	8.72
5354	1.58	1.53	10.26
5355	1.66	1.63	11.9
5356	.	.	.





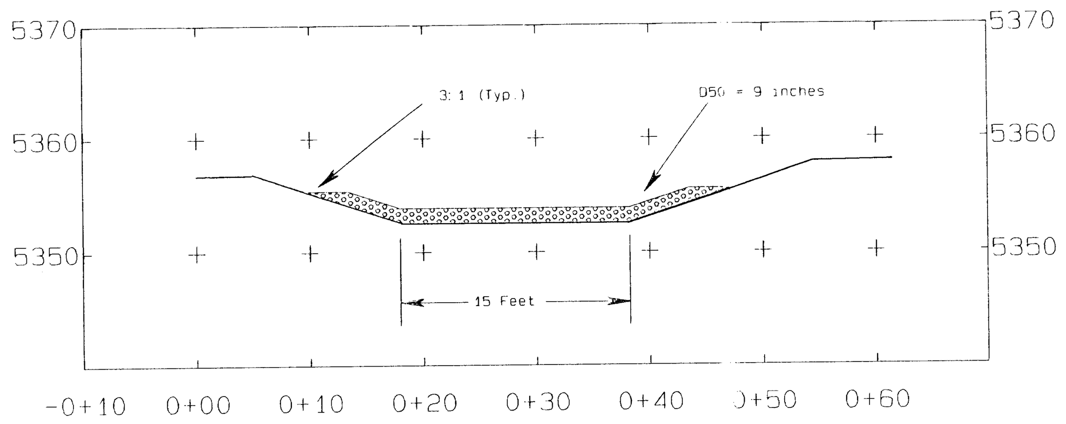
SECTION CC'

SCALE: 1" = 20'



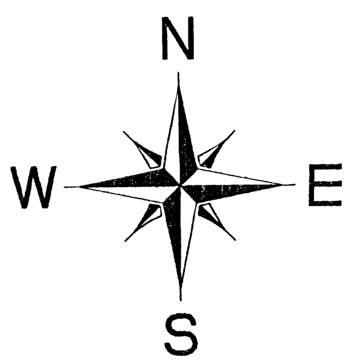
SECTION DD'

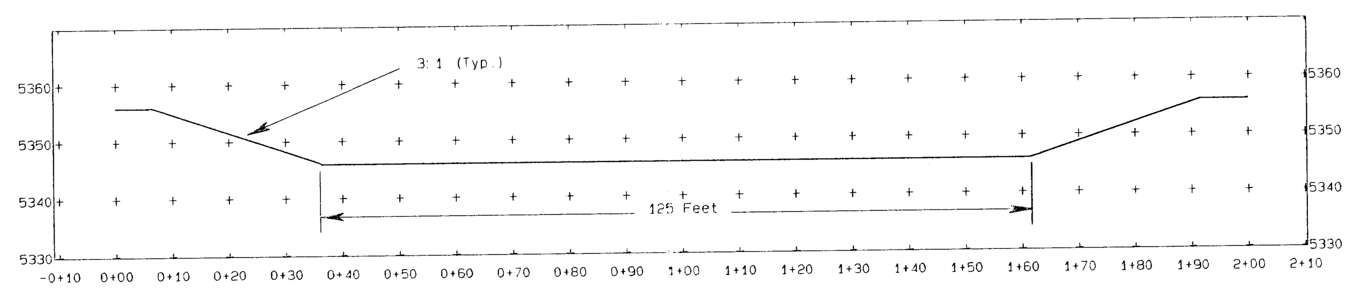
SCALE: 1" = 20'



SECTION AA'

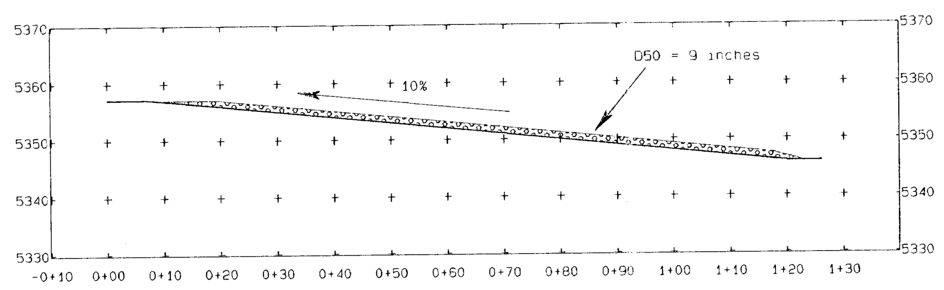
SCALE: 1" = 20'





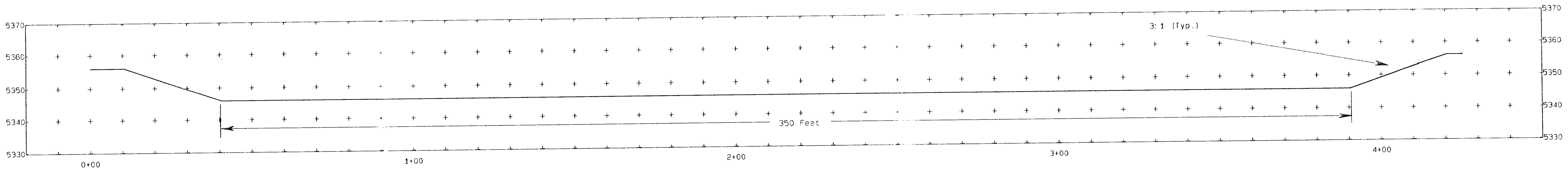
SECTION EE'

SCALE: 1" = 20'



SECTION BB'

SCALE: 1" = 20'



SECTION FF'

SCALE: 1" = 20'

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

10-2-97

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG	E.Q.	P.E.	P.S.	CHIEF ENG.
	09/04/97	RH	SUBMITTED TO OSM FOR APPROVAL					

APPROVED DEC 1997

EXHIBIT 26-52

NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS
BHP NAVAJO COAL COMPANY

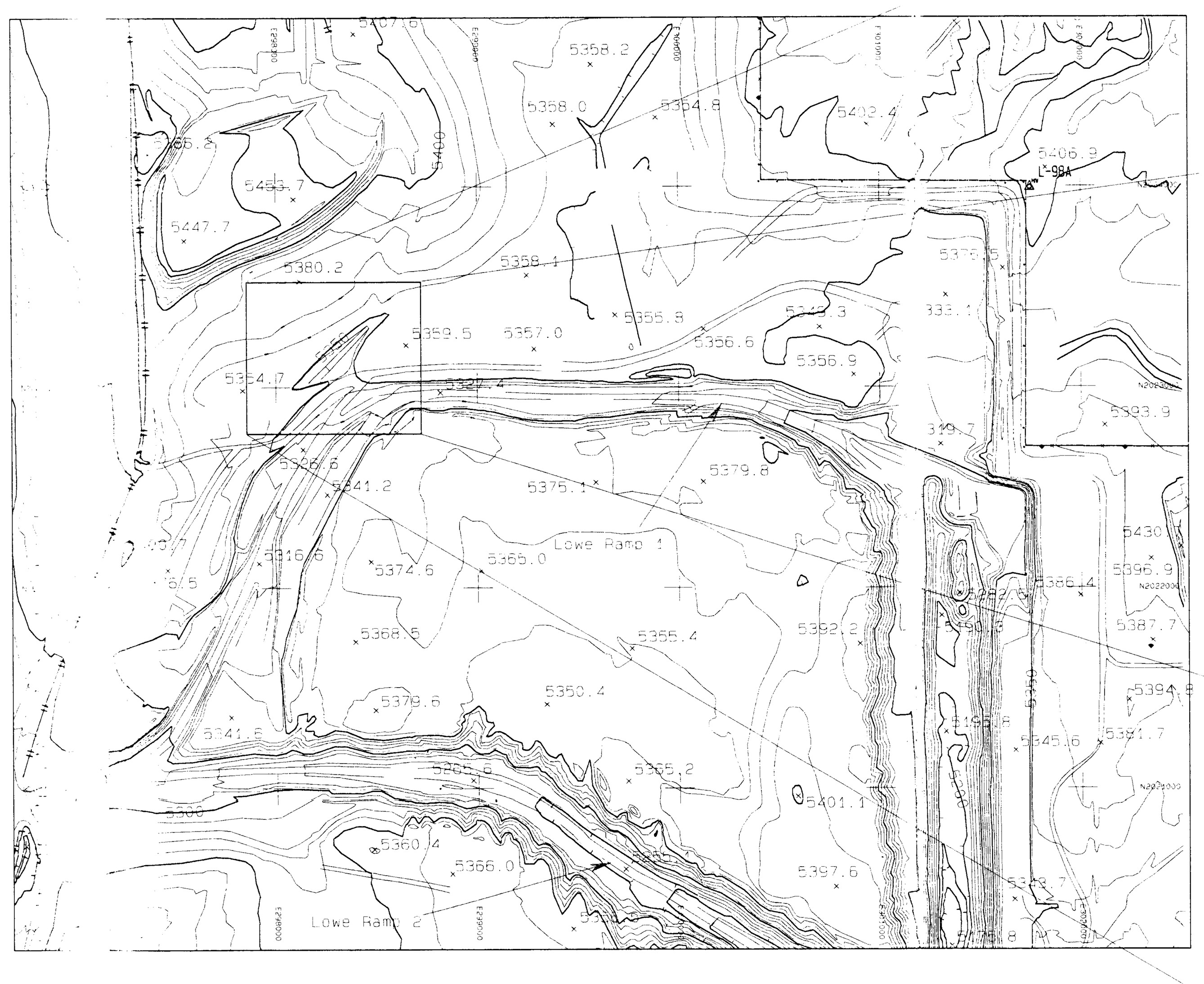
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

AREA 3

"DESIGN"

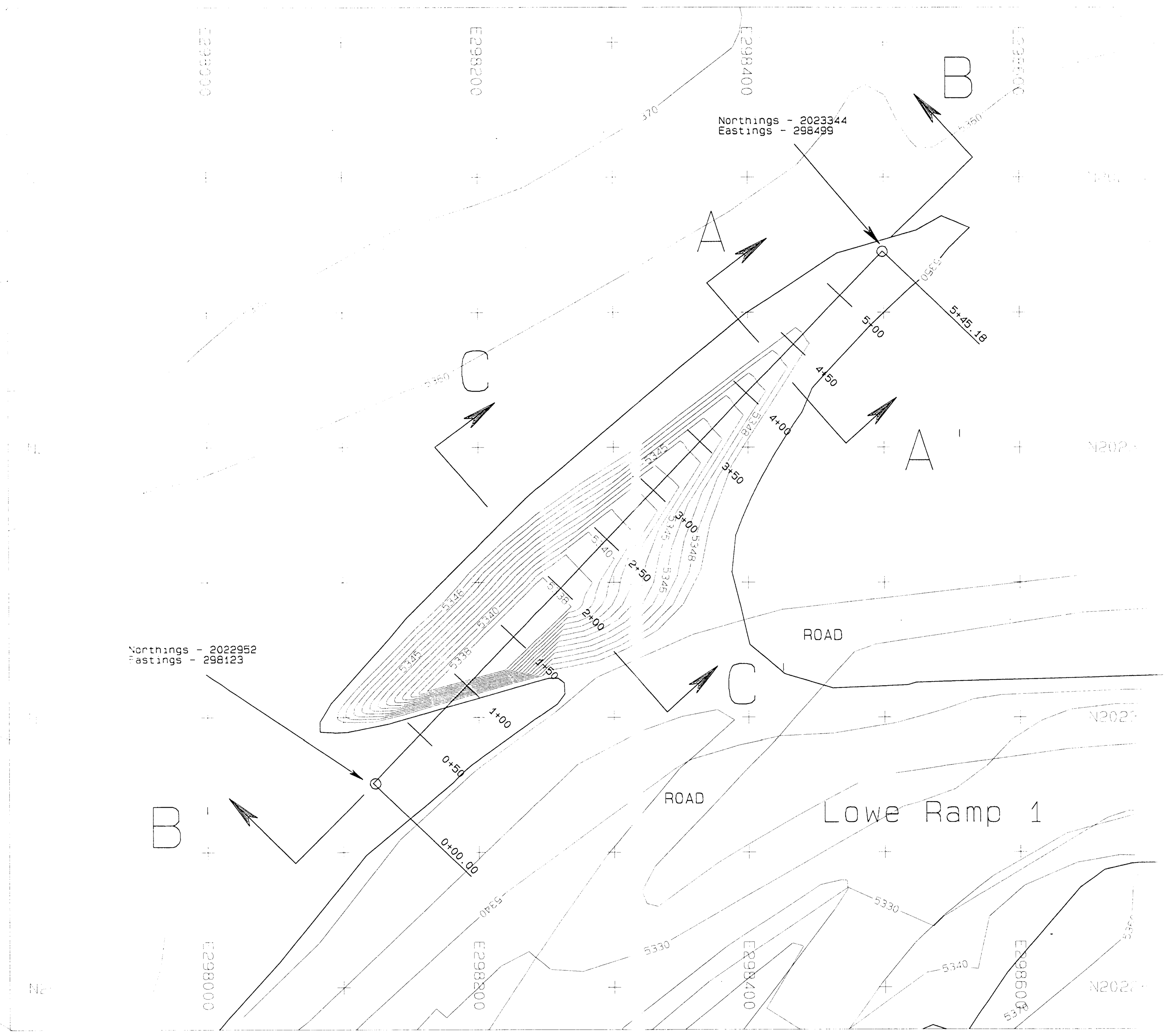
LOWE HOLE 3 POND 2

PREPARED BY RH	DRAWN BY RH	SCALE AS NOTED
APPROVED BY LR	DATE 09/04/97	REF DWG
DWG LOC G:\USER\KFHARRN\RUSSWORK\LOWE_PON\LOWE_PON.PR		

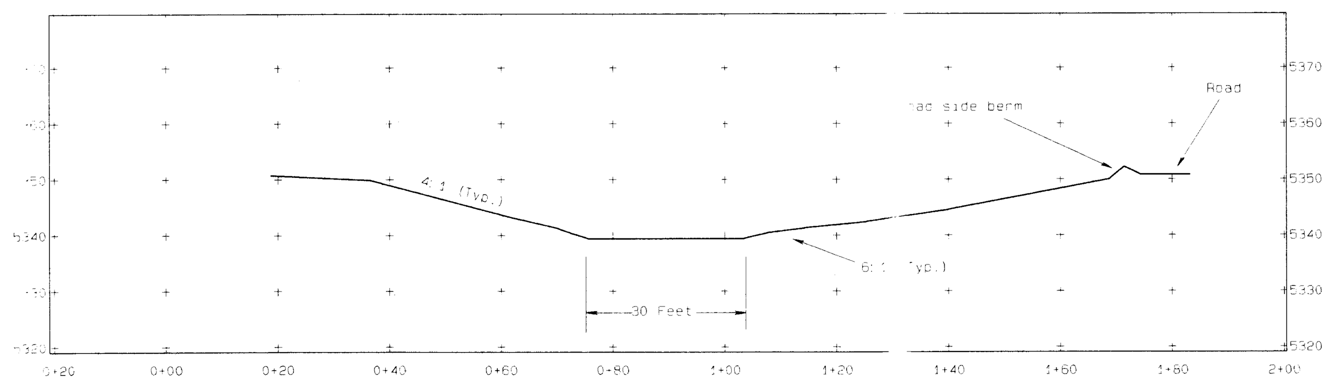


LOCATION MAP

SCALE: 1" = 500'

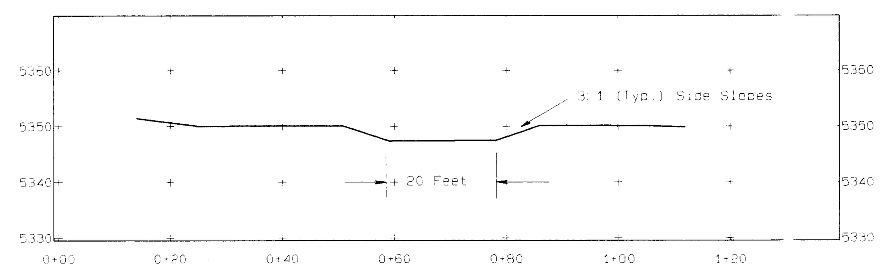


SCALE: 1" = 50'



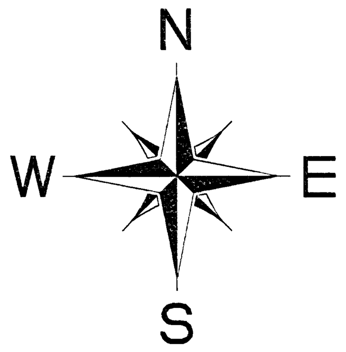
SECTION CC'

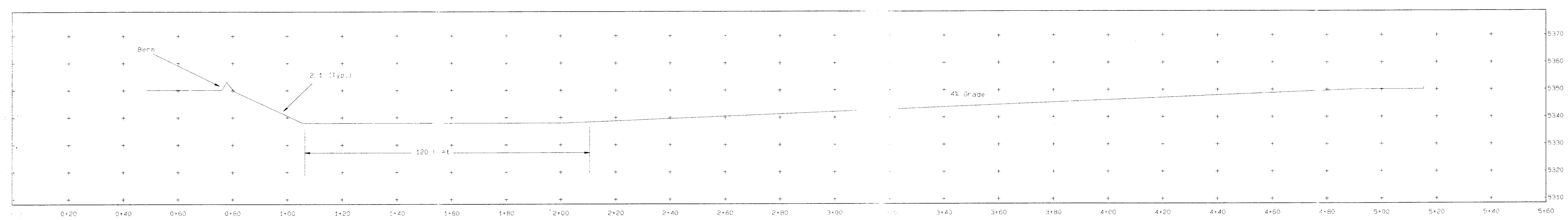
SCALE: 1" = 20'



SECTION AA'

SCALE: 1" = 20'





SECTION BB'

SCALE: 1" = 20'

LEGEND

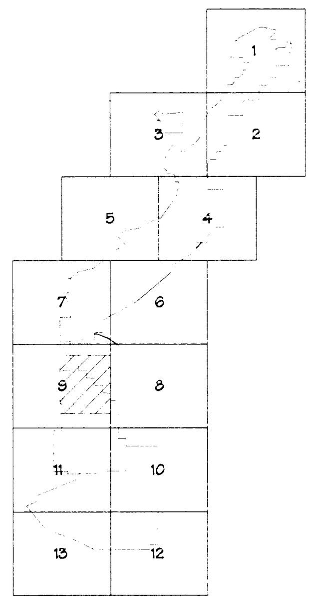
- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- x5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT BOUNDARY

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5338	0.08	0.00	0.00
5339	0.11	0.09	0.09
5340	0.15	0.13	0.22
5341	0.19	0.17	0.39
5342	0.24	0.22	0.61
5343	0.29	0.26	0.87
5344	0.35	0.32	1.19
5345	0.42	0.39	1.58
5346	0.49	0.45	2.03
5347	0.56	0.53	2.56
5348	0.64	0.6	3.16
5349	0.73	0.68	3.84
5350	0.82	0.77	4.61



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

L. Raymond 10-2-97

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.	P.S.	CHIEF ENG.
A	09/04/97	RH	SUBMITTED TO OSM FOR APPROVAL					

APPROVED DEC 1997

EXHIBIT 26-53

NAVAJO COAL COMPANY

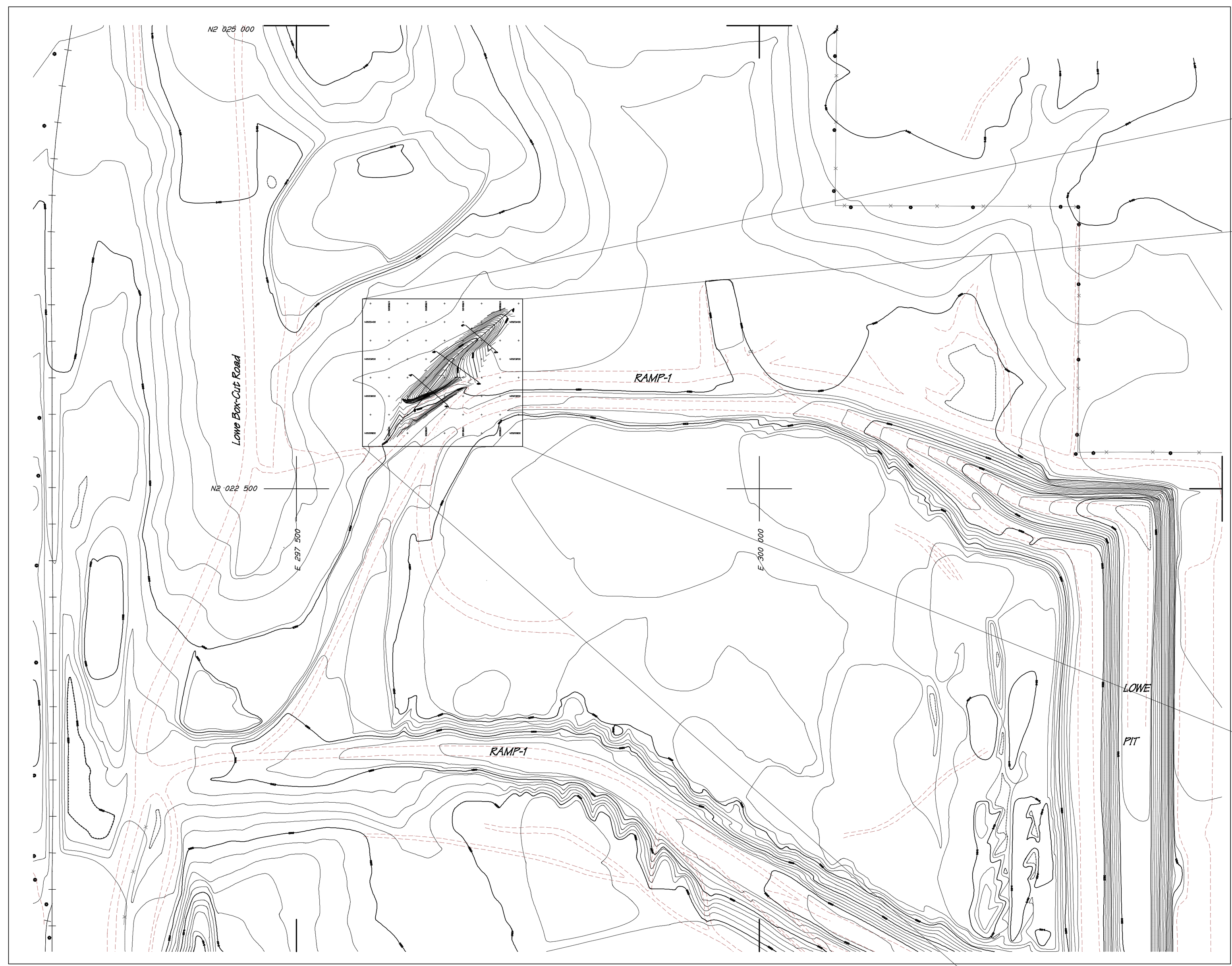
NAVAJO MINE
SAFETY PAYS
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

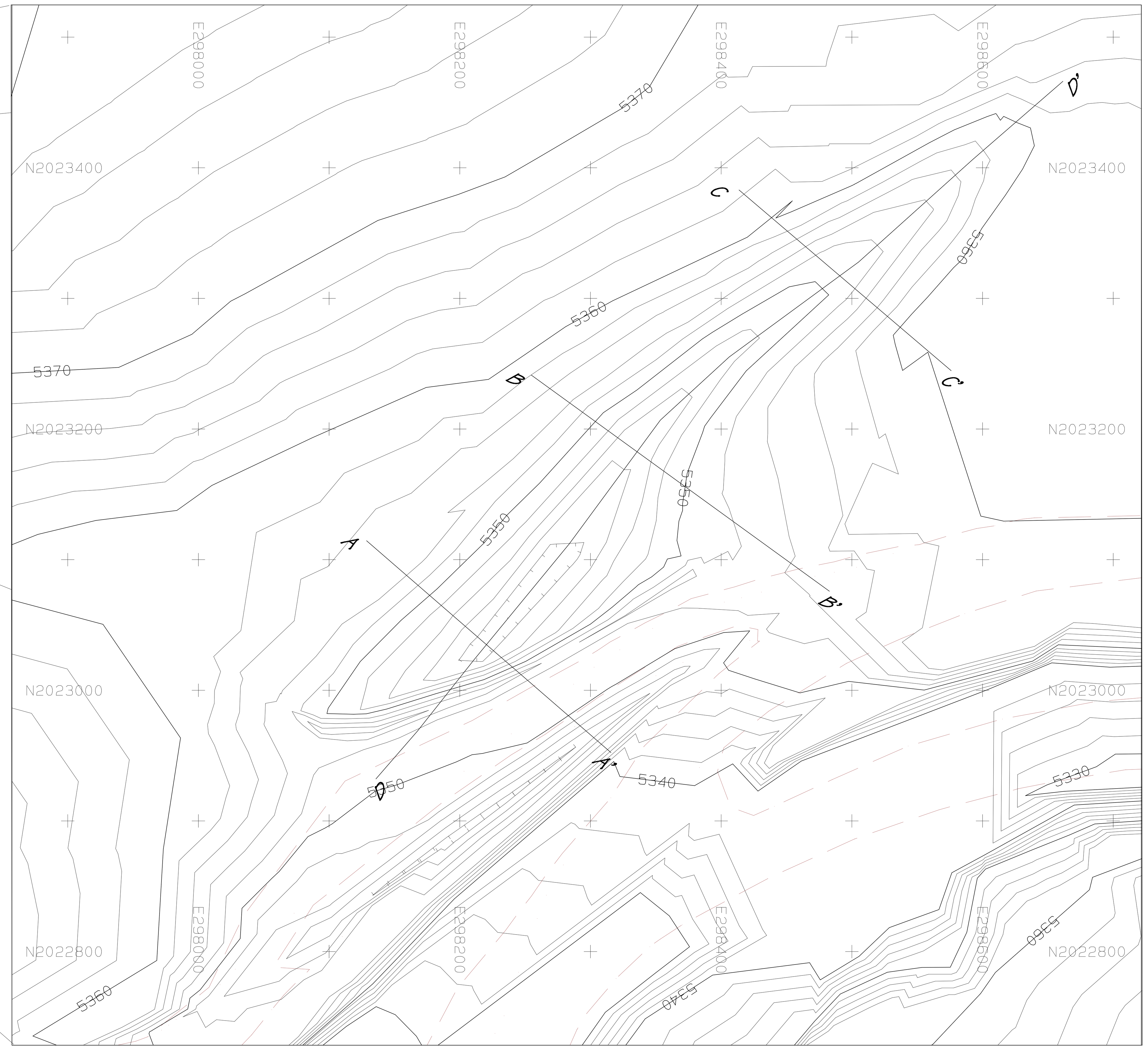
AREA 3

"DESIGN"

LOWE HOLE 3 POND 3

PREPARED BY RH	DRAWN BY RH	SCALE AS NOTED
APPROVED BY LR	DATE 09/04/97	REF DWG
DWG LOC C:\RUSSWORK\LOWE_PON\LOWEPD3.PRO		





LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER

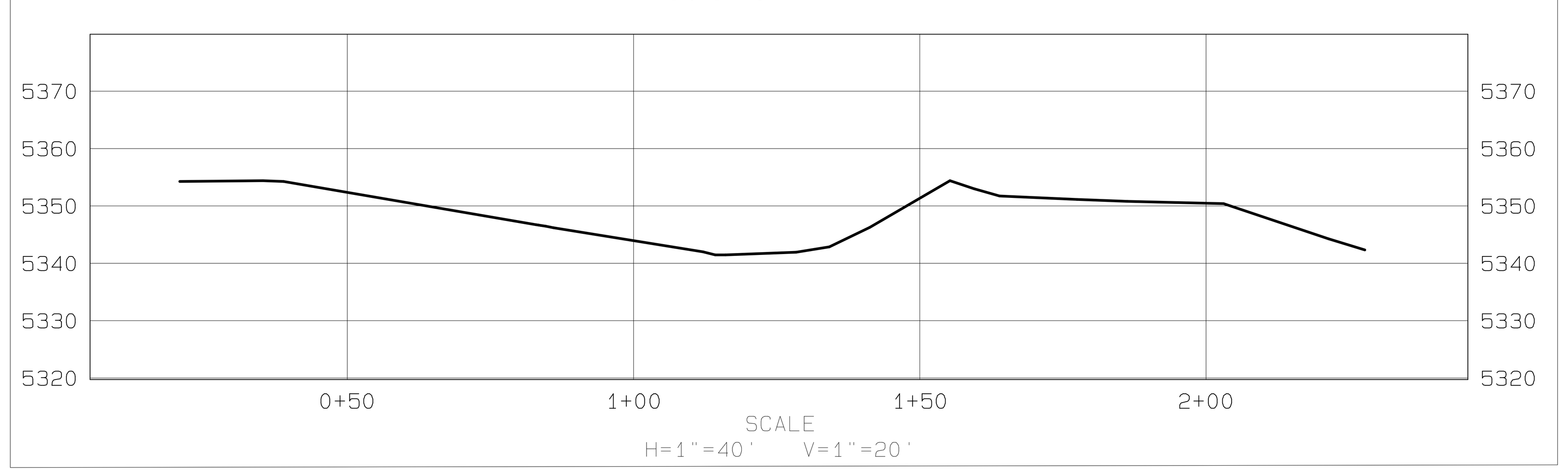
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5342	0.052	0.00	0.00
5343	0.107	0.080	0.080
4344	0.171	0.140	0.220
5345	0.244	0.209	0.429
5346	0.326	0.287	0.715
5347	0.420	0.376	1.091
5348	0.523	0.475	1.566
5349	0.642	0.587	2.153
5350	0.778	0.715	2.869
5351	0.928	0.860	3.728
5352	1.103	1.023	4.752

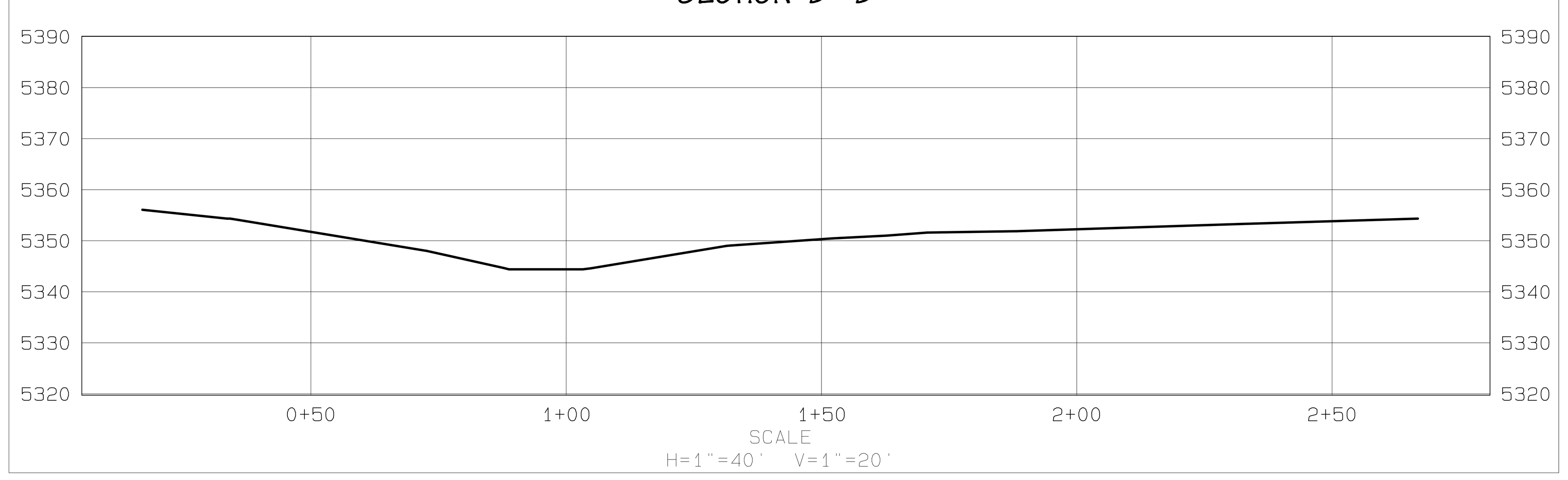
NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. For Watershed area see exhbits 11-13d and 11-13e.
3. For "Blueline" elevation refers to Table 11-5AJ, Lowe Hole 3 Pond 3

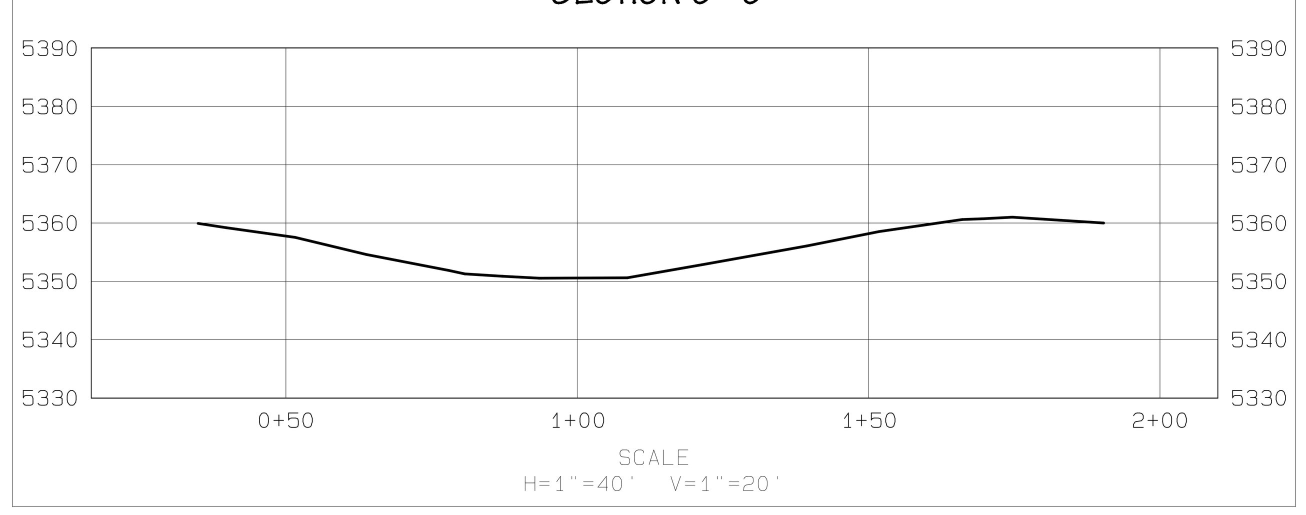
SECTION A - A'



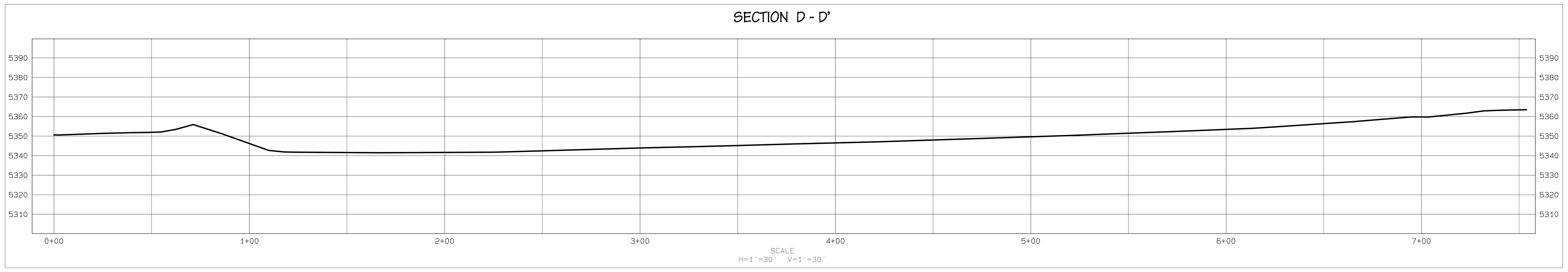
SECTION B - B'

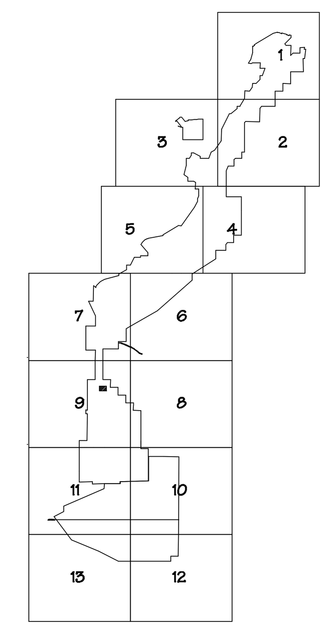


SECTION C - C'



SECTION D - D'





CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this impoundment has been constructed in accordance with the approved design plans and that this information shown is complete and accurate to the best of my knowledge.

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.L.S.	DATE APR'D
A	07/27/99	PJF	Submitted to OSM for Review.	KBB	MC	LR		

APPROVALS

EXHIBIT 26-54

NAVAJO COAL COMPANY

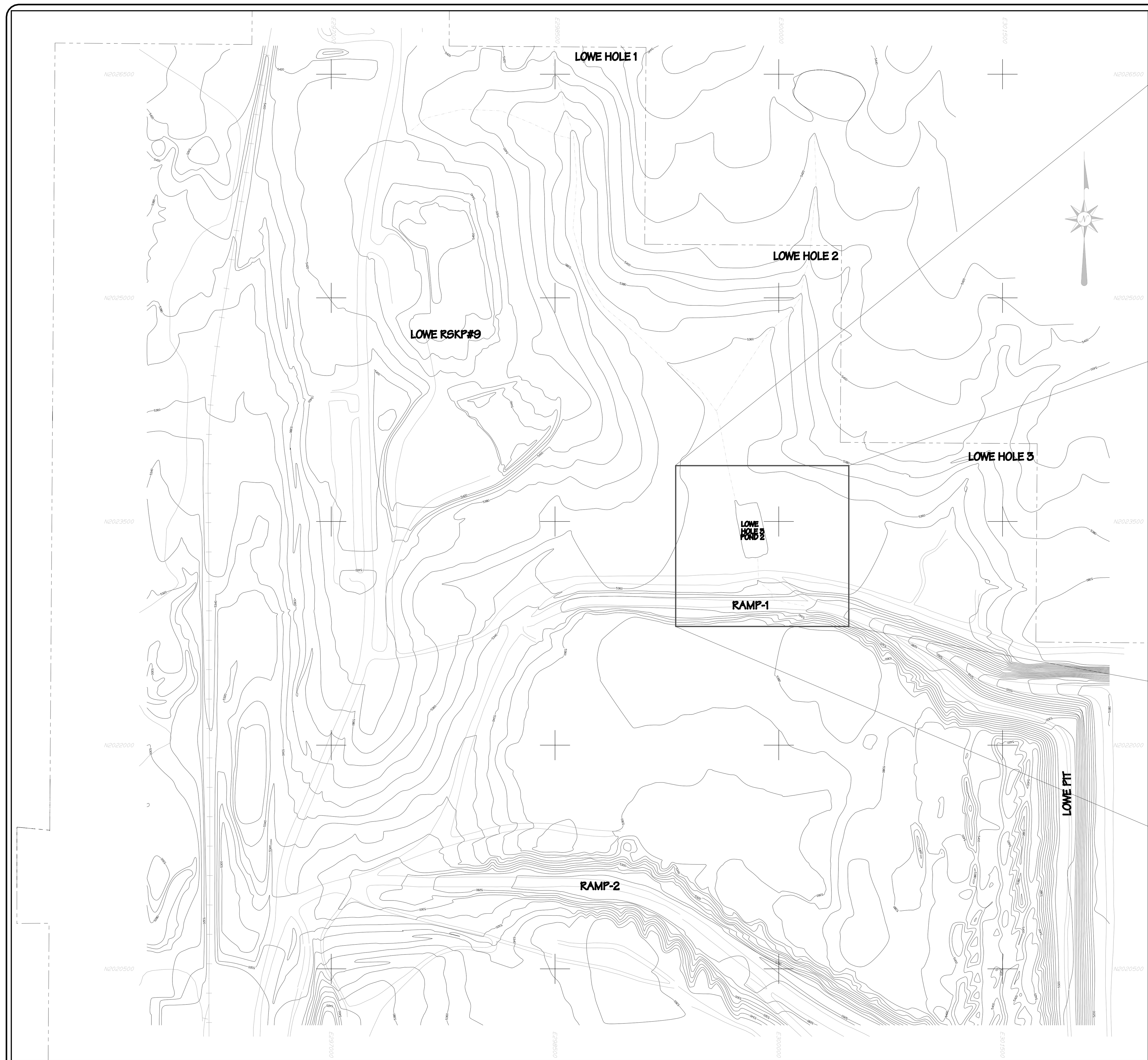
NAVAJO MINE
SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

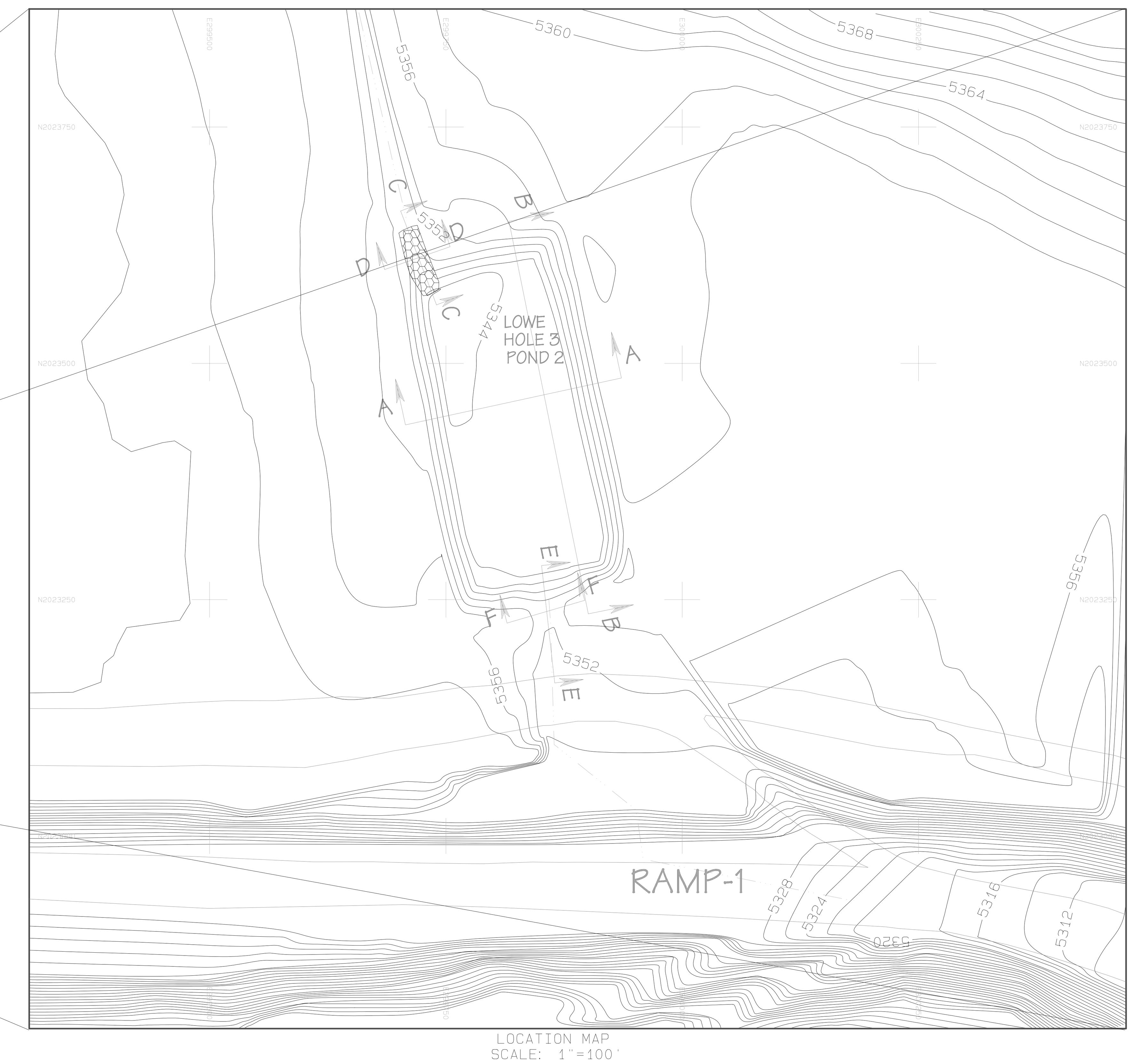
LOWE HOLE 3 POND 3
AS-BUILT

PREPARED BY PJF	DRAWN BY PJFOSTER	SCALE = AS NOTED
APPROVED BY LR	DATE 07/19/99	

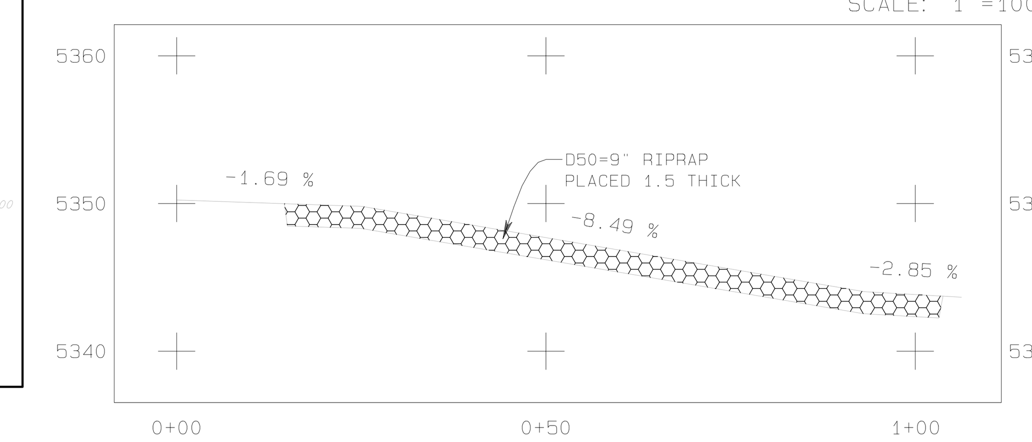
PATH: G:\Gs\Permit F\Ch 11\Exh 11-127_Lowe Hole 3 Pd 2\Exhibit 2010\exhi



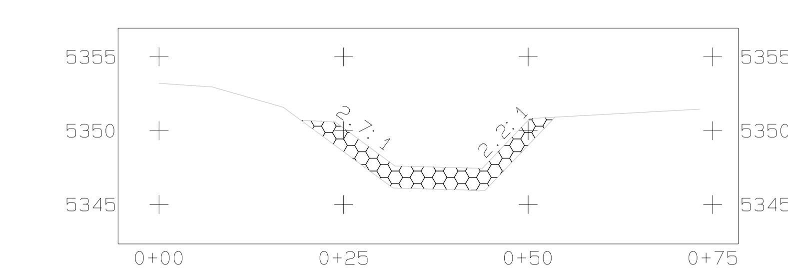
PLAN VIEW
SCALE: 1"=500'



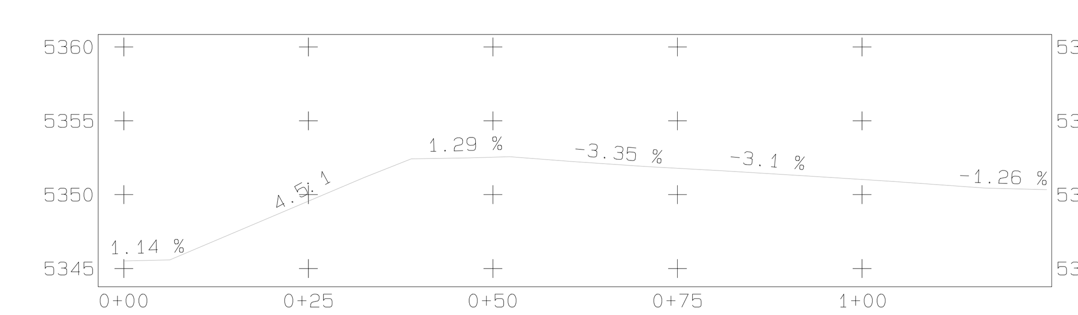
LOCATION MAP
SCALE: 1"=100'



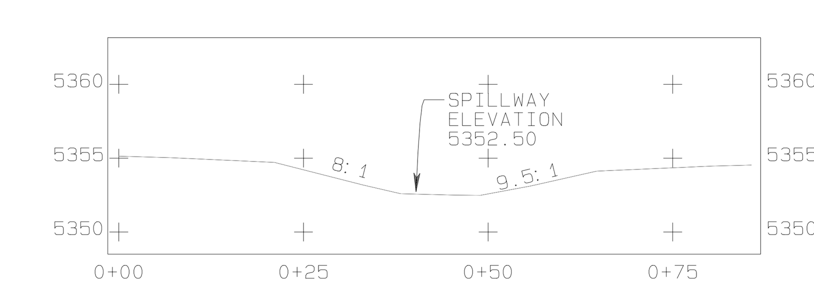
SECTION C-C



SECTION D-D

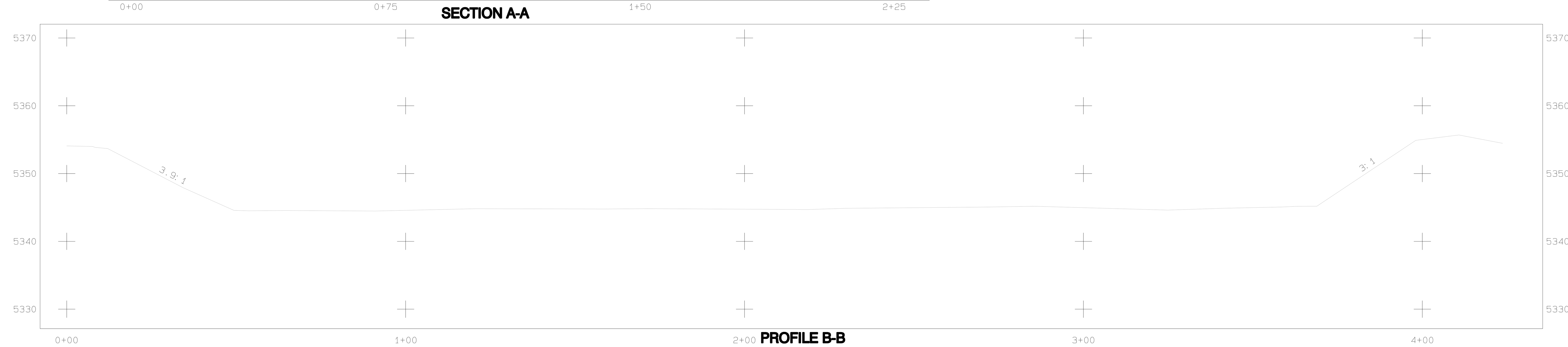


SECTION E-E



SECTION F-F

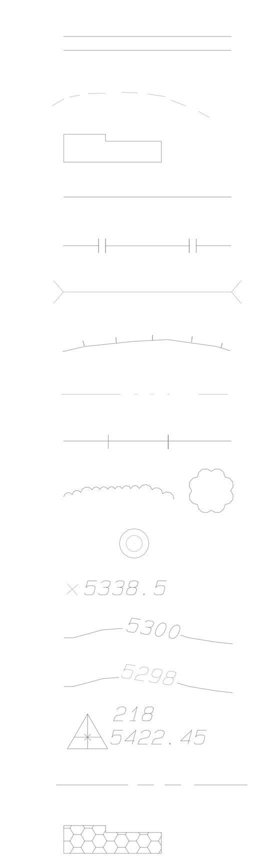
SECTION A-A



PROFILE B-B

SECTIONS AND PROFILE
HORIZONTAL: 1"=20'
VERTICAL: 1"=10'

LEGEND



ROAD
TRAIL
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
x5338.5 SPOT ELEVATION
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
218 5422.45 CONTROL
PERMIT BOUNDARY
SEDIMENT CONTROL STRUCTURE

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5343.5	0.04	0.00	0.00
5344	0.17	0.05	0.05
5345	0.65	0.41	0.46
5346	1.03	0.84	1.30
5347	1.11	1.07	2.37
5348	1.18	1.15	3.52
5349	1.26	1.22	4.74
5350	1.34	1.30	6.04
5351	1.46	1.40	7.44
5352	1.63	1.54	8.99
5352.5	1.72	0.83	9.82

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this Pond has been constructed in accordance with approved design plans and that the information shown is complete and accurate to the best of my knowledge, except as noted below.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

1. Due to a sink hole that developed in the pond, the spillway was reconstructed at a lower elevation. The As-built was revised accordingly. The reconstructed spillway will safely pass the required storm event (25 YR - 6 HR).

REVISION		DATE
1	AS-BUILT	09/05/00
2	Updated Spillway and Inpond Volume	04/28/03
3		
4		
5		

PROJECT MANAGER: Corey Nelson
ENGR. of RECORD: Leonard Raymond
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
PO BOX 155, FRUITLAND, NEW MEXICO, 87416

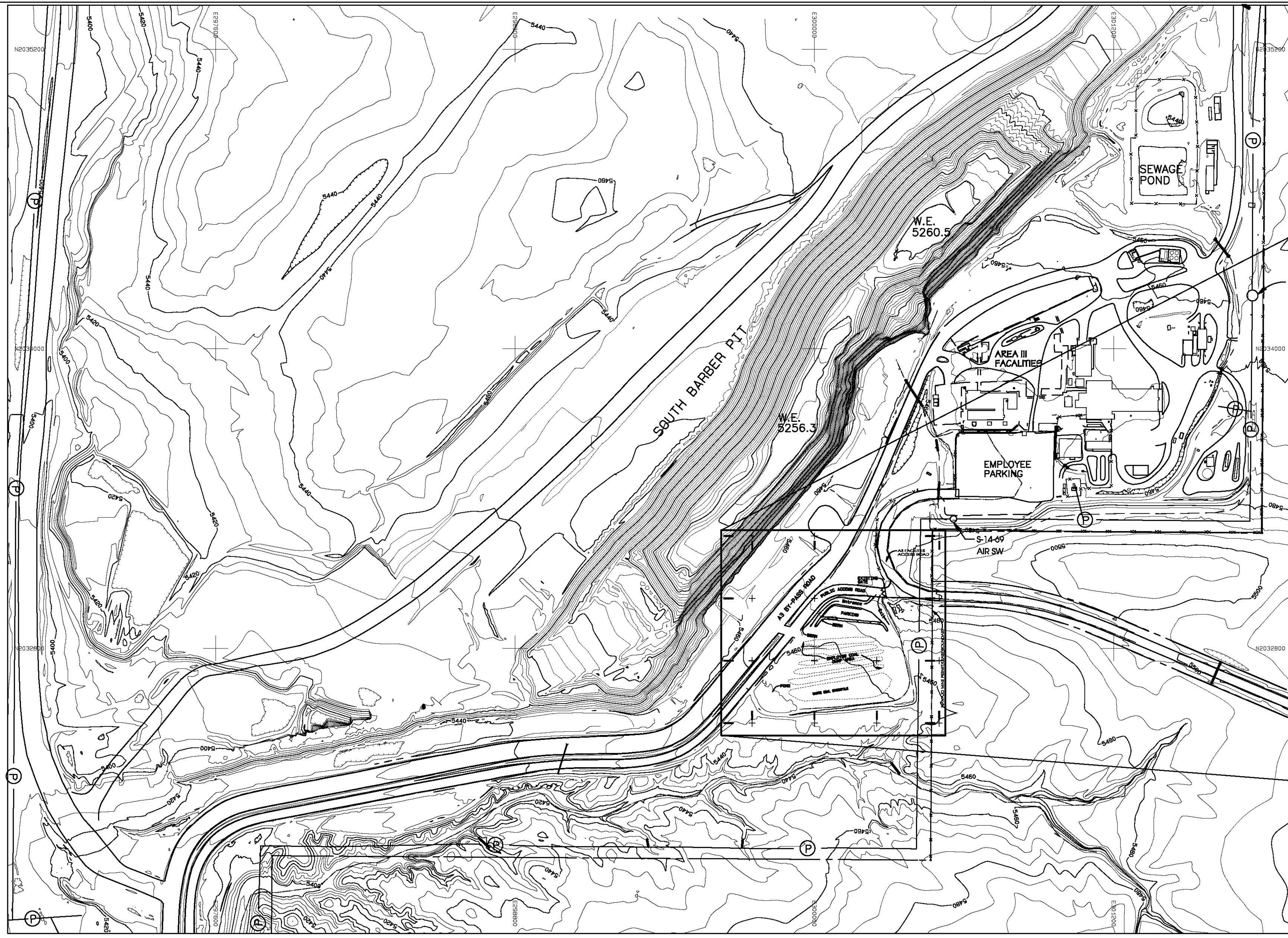
ACCOUNT:
DATE: September 15, 2000
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: LR
APPROVED BY: LR

PLAN, PROFILE & SECTION

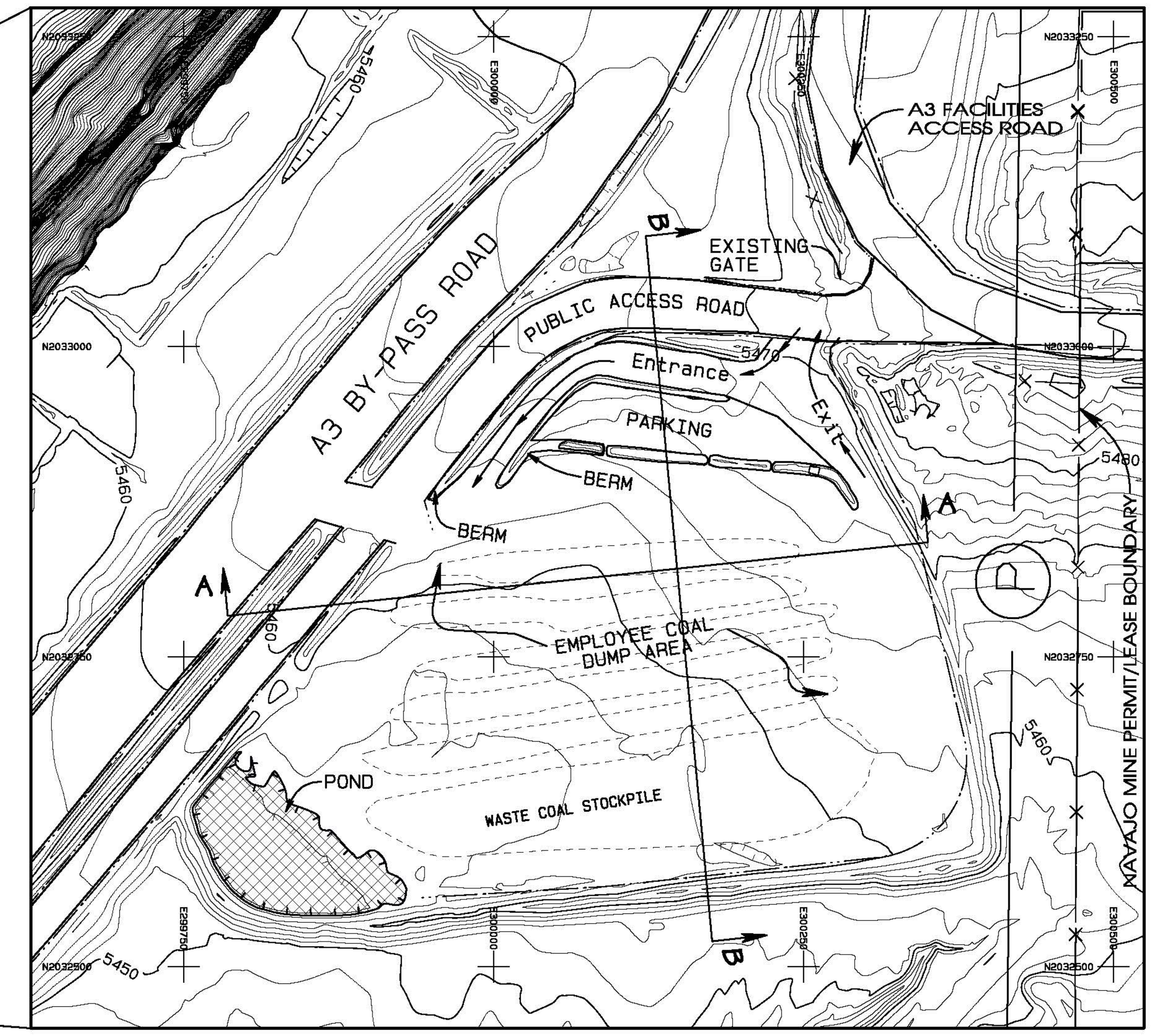
EXHIBIT 26-55
LOWE HOLE 3, POND 2
AS-BUILT

DRAWING
SHEET 1 OF 1

Project Desc: Path: ...POND-2\exhibits\Lwe hole3_pnd-2_As_Built.pro Plot time: Mon Aug 08 10:17:21 2005



LOCATION MAP
SCALE 1"=300'



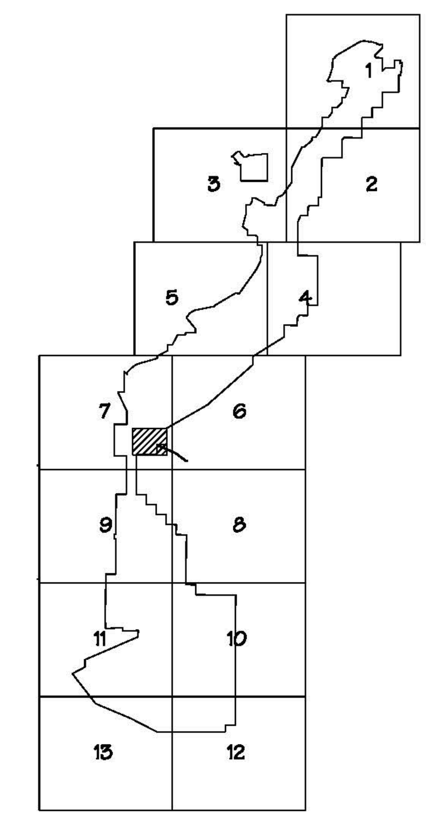
SCALE 1"=100'

LEGEND

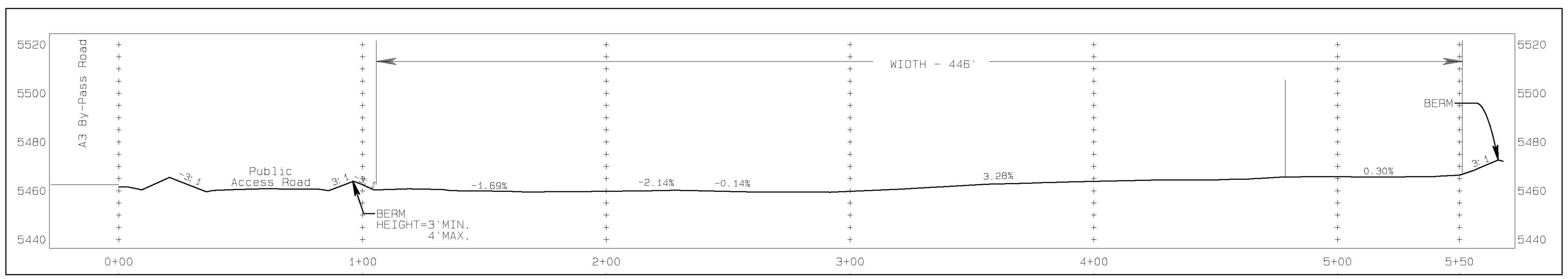
- ROAD
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 CONTROL
- LEASE
- LOCATION
- WATERSHED

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. See Table 11-5AL for impoundment data .



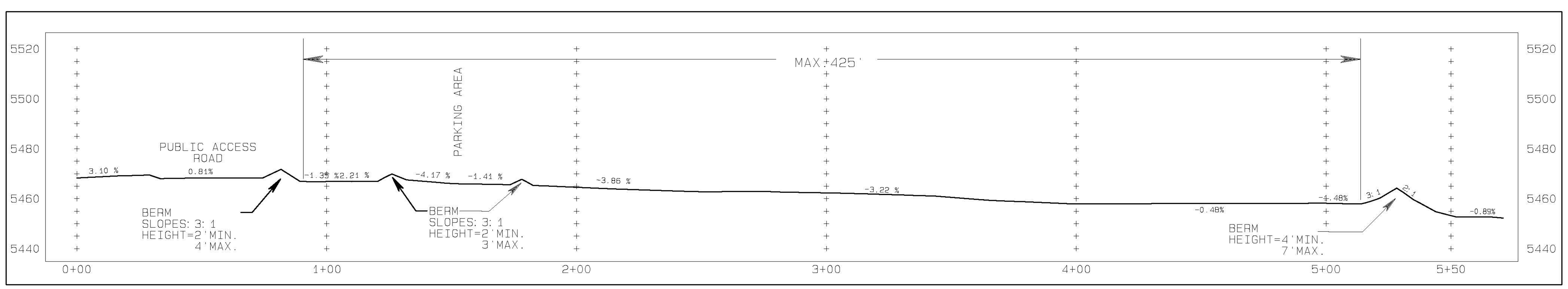
SCALE AS NOTED



CROSS SECTION A-A'
SCALE
H: 1"=30' V: 1"=30'

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5453	0.06	0.00	0.00
5454	0.19	0.12	0.12
5455	0.28	0.23	0.35
5456	0.83	0.55	0.90
5457	1.22	1.02	1.93
5458	1.59	1.41	3.33



PROFILE B-B'
SCALE
H: 1"=30' V: 1"=30'

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this structures has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge, except as noted below.

REVISION		Rev By	DATE
1	AS-BUILT	PJF	11/01/00
12-A	Updated surface to current and stage storage table.	RY	11/19/12

PROJECT: EMCD, POND AS-BUILT
DATE: November 19, 2012
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: LR
APPROVED BY: LR

PROJECT MANAGER: James L Shackelford
ENGR. of RECORD: LEONARD RAYMOND
REG. NO: NM-6600
SRVYR of RECORD:
REG. NO:

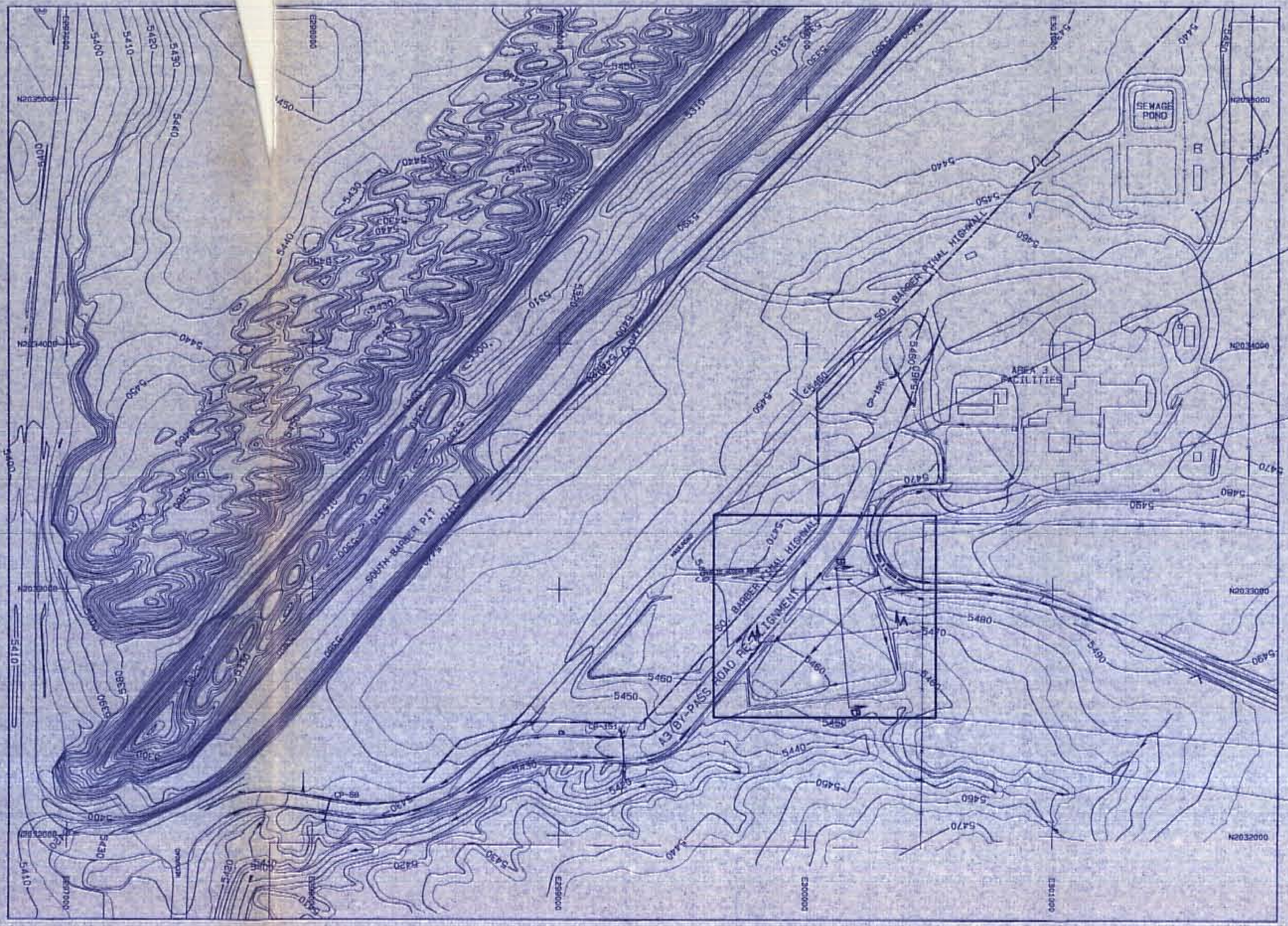
bhpbilliton
BHP NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 / PHONE 505-598-4200/FAX 505-598-3361

PLAN, PROFILE AND SECTION

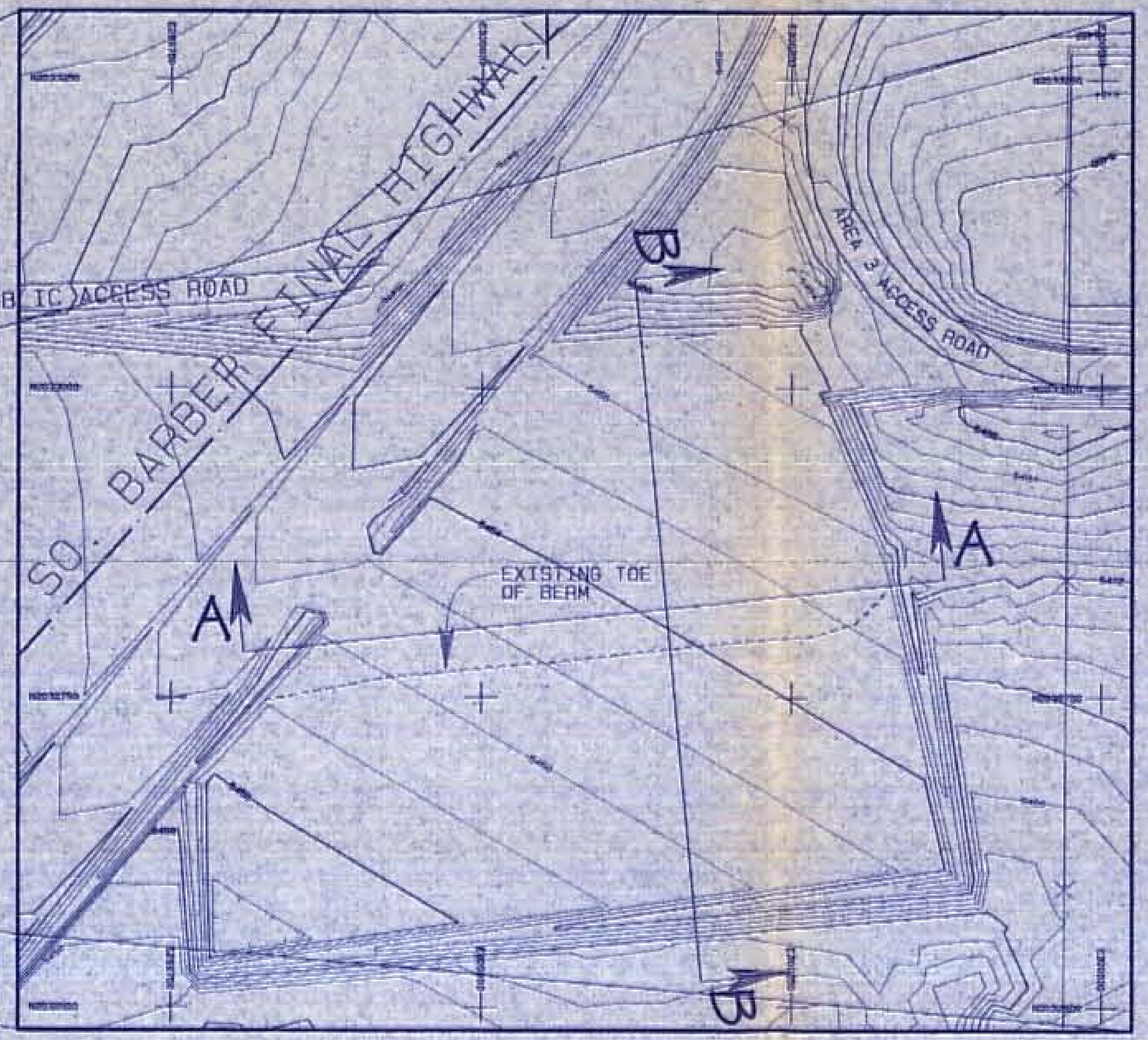
Exhibit 26-56

EMPLOYEE'S COAL DUMP
AS-BUILT

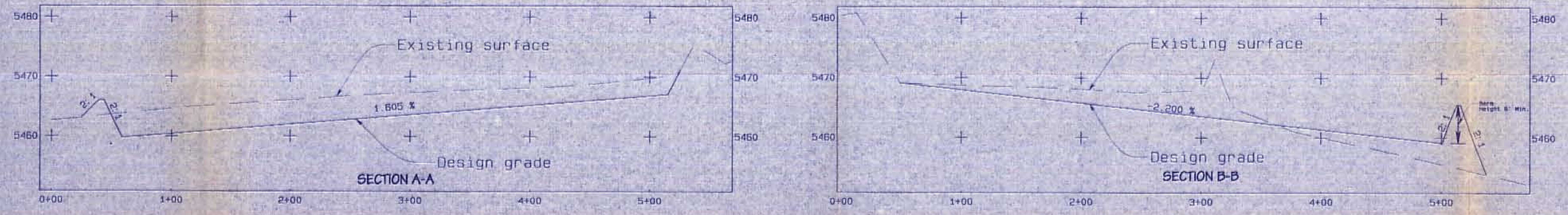
DRAWING
SHEET 1 OF 1



LOCATION AND DRAINAGE PLAN
SCALE 1"=300'



PLAN VIEW
SCALE 1"=100'



SECTIONS
HORZ. 1"=50'
VERT. 1"=10'

LEGEND

- ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- x5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 CONTROL
- LEASE
- LOCATION
- WATERSHED

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. See Table 11-5AL for impounment data.
3. For Area III By-Pass Road realignment see Exhibit 11-90A.

SCALE AS NOTED

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5454	0.05	0.00	0.00
5456	0.34	0.40	0.40
5458	0.83	1.17	1.57
5460	1.47	2.31	3.89

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing has been reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 9800

L Raymond 4-13-00

REVISION	DATE
1. SUBMITTED TO OSM FOR APPROVAL	04/12/00
2.	
3.	
4.	
5.	

PROJECT MANAGER: COREY NELSON
ENGR. of RECORD: LEONARD RAYMOND
REG. NO. 9800
SRVYR of RECORD:
REG. NO.

BHP-NAVAJO COAL CO.
PO BOX 155, FRUITLAND, NEW MEXICO, 87416

ACCOUNT:
DATE: April 12, 2000
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: LR
APPROVED BY: LR

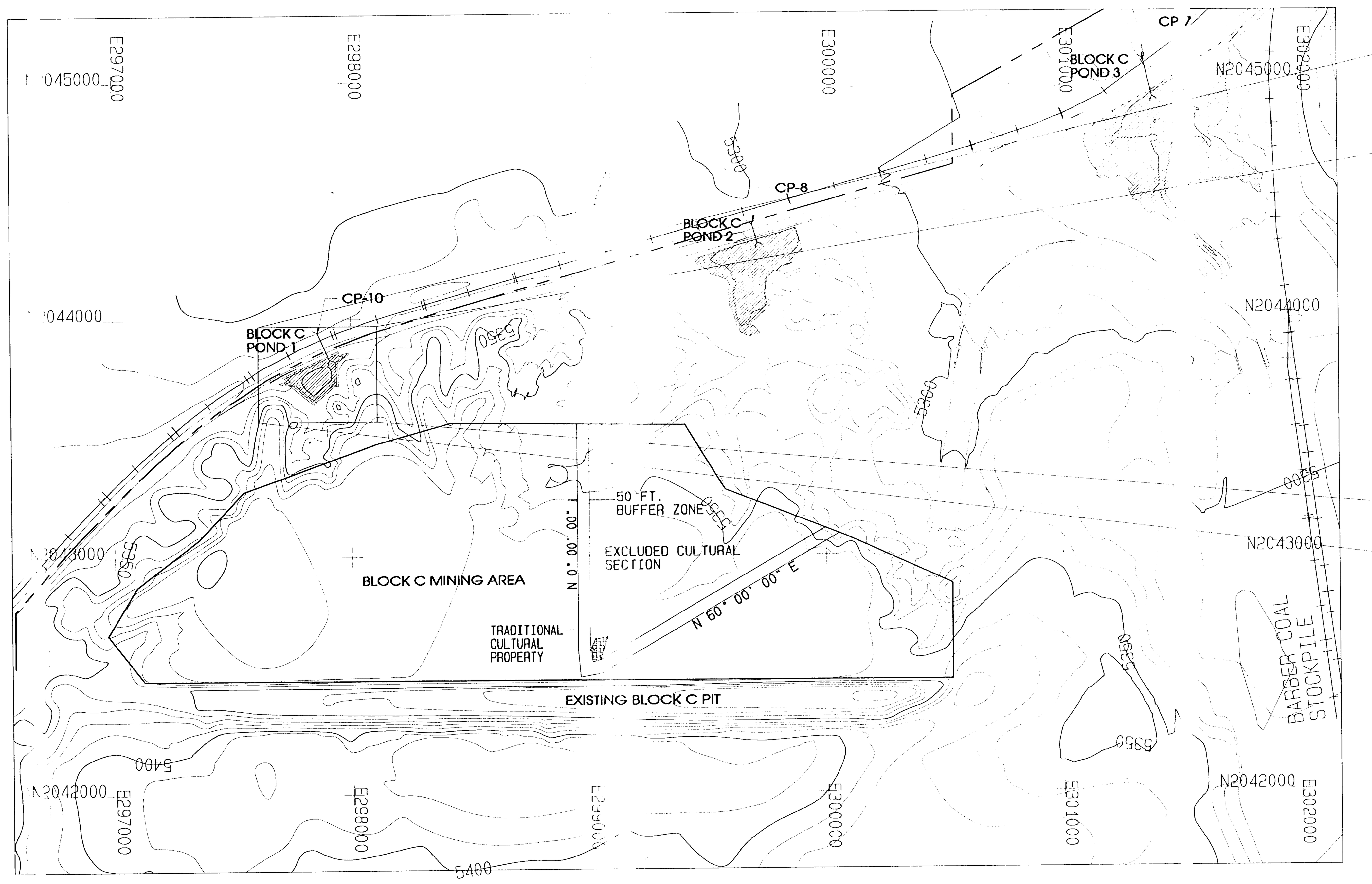
PLAN, PROFILE AND SECTION

EXHIBIT 26-56

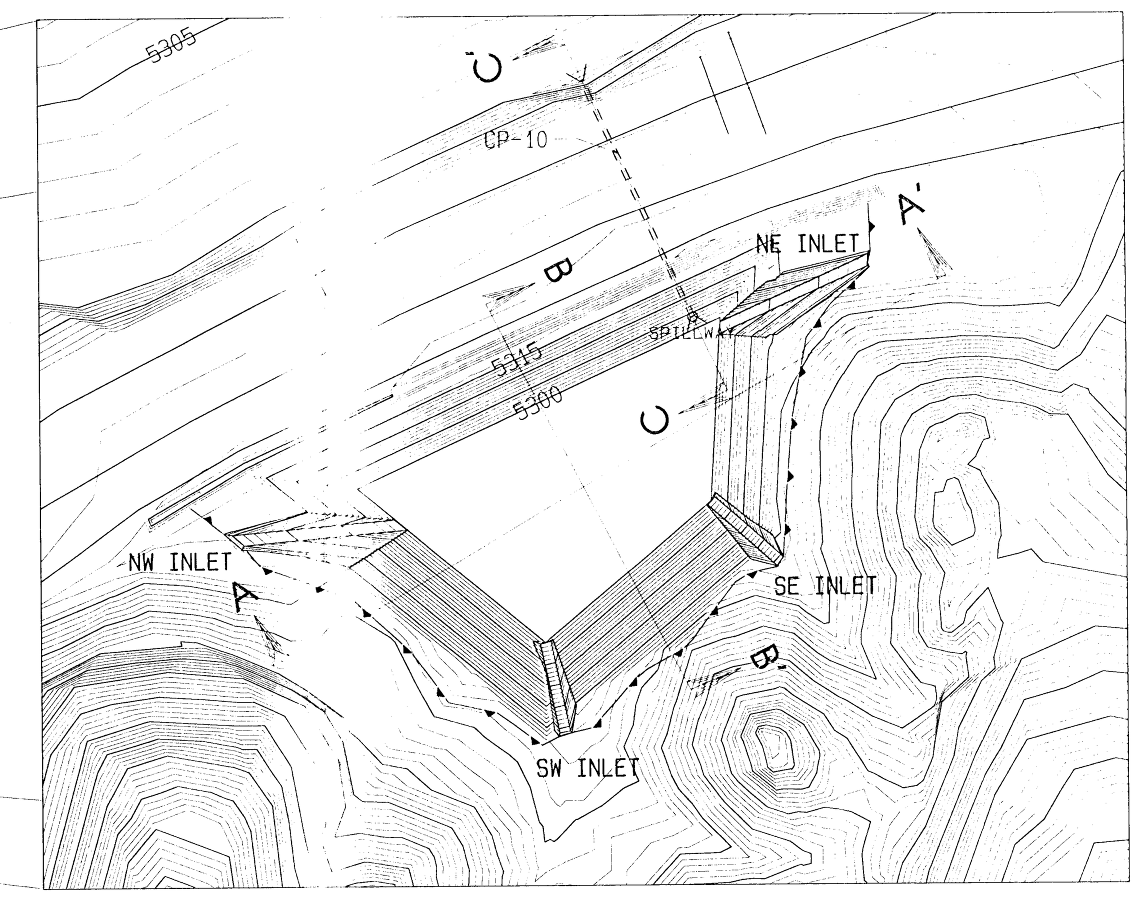
EMPLOYEE COAL DUMP MODIFICATION DESIGN

DRAWING
SHEET 1 OF 1

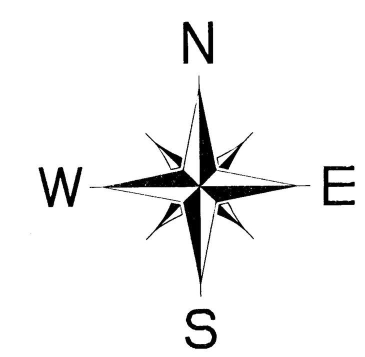
PERMIT COPY
NM-0003E



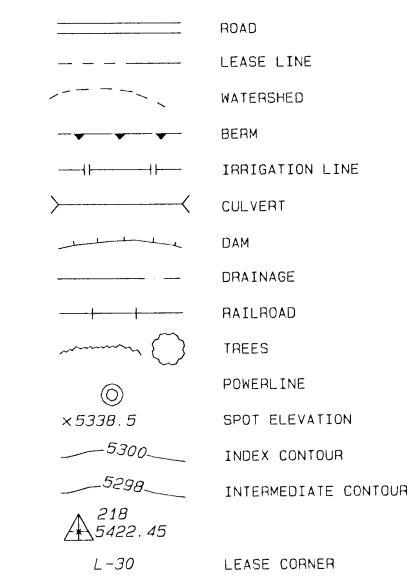
BLOCK C LOCATION MAP
SCALE: 1" = 300'



BLOCK C POND 1
SCALE: 1" = 50'



LEGEND

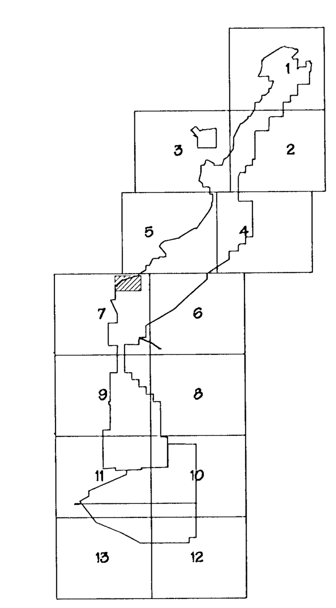


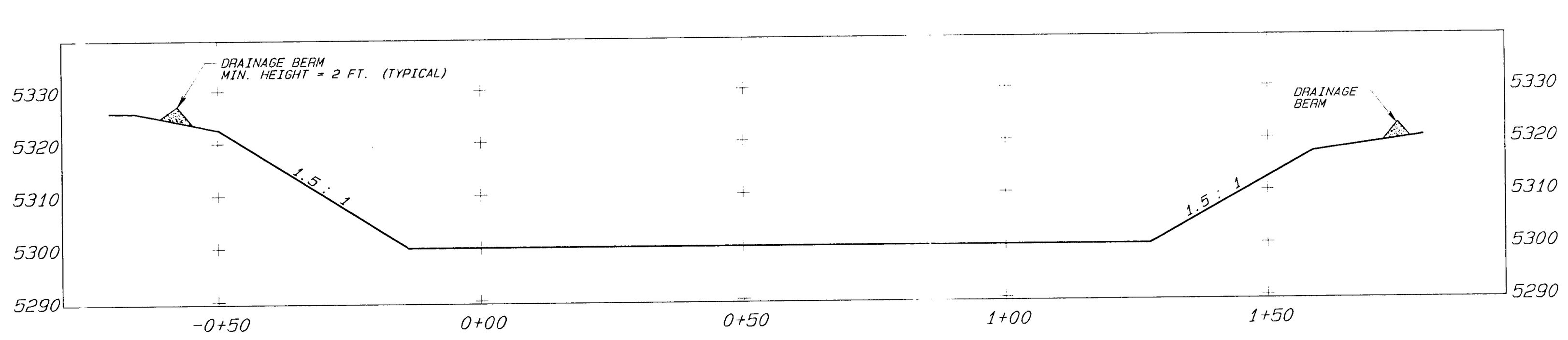
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5300	0.29	0.00	0.00
5301	0.30	0.30	0.30
5302	0.32	0.32	0.61
5303	0.34	0.33	0.95
5304	0.36	0.35	1.30
5305	0.38	0.37	1.67
5306	0.40	0.39	2.10
5307	0.42	0.42	2.48
5308	0.45	0.44	2.92
5309	0.47	0.46	3.38
5310	0.49	0.48	3.87
5311	0.52	0.51	4.38
5312	0.54	0.53	4.91
5313	0.57	0.56	5.47
5314	0.59	0.58	6.05
5315	0.62	0.61	6.67

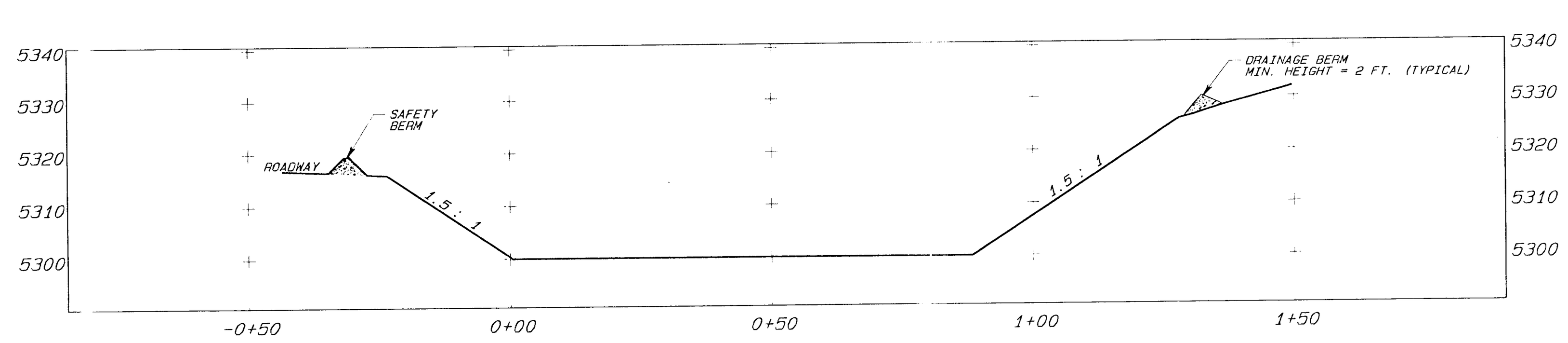
NOTES

1. For hydrology and design information refer to Appendix 11- AA in the approved PAP.
2. Construct berms to drain into inlet entrances. Field locate as required.
3. Refer to Table 11-5AG for "blueline" elevation.
4. Refer to Exhibit 11-13D for watershed information.

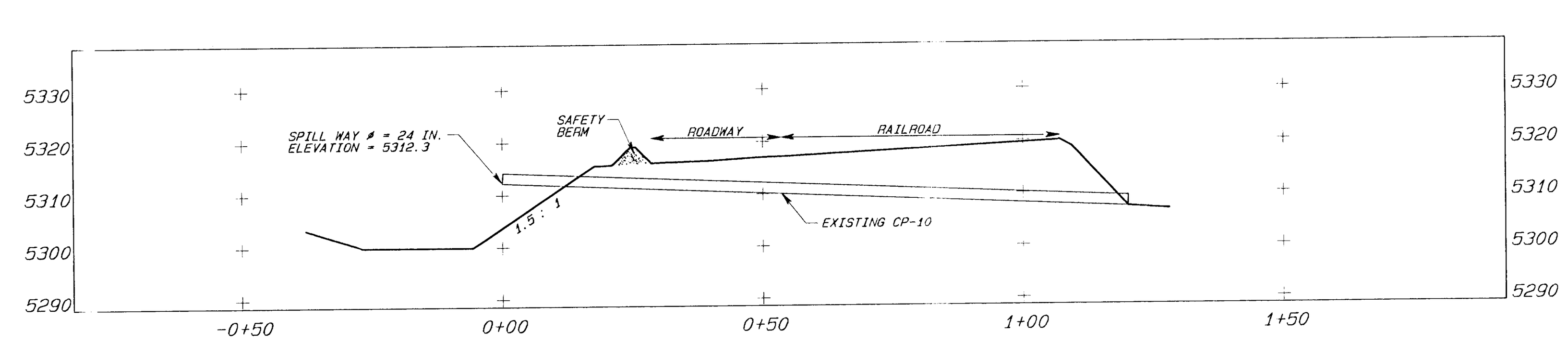




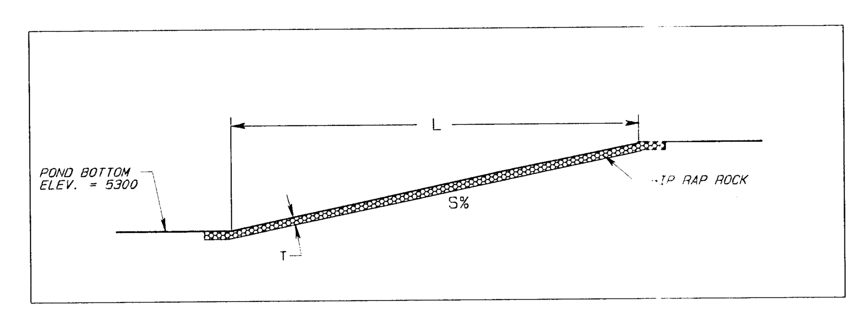
SECTION A-A'
SCALE: 1" = 20'



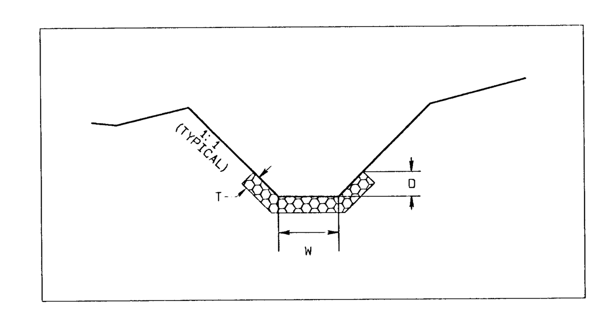
SECTION B-B'
SCALE: 1" = 20'



SECTION C-C'
SCALE: 1" = 20'



TYPICAL INLET PROFILE
NTS



TYPICAL INLET CROSS SECTION
NTS

INLET SCHEDULE

INLET	L ft	S %	W ft	D ft	T ft	RIP RAP ROCK d50 in
NW	75.0	20.0	5.0	1.0	1.50	12.0
NE	75.0	20.0	5.0	1.0	1.13	9.0
SW	42.0	25.0	5.0	1.0	1.50	12.0
SE	40.0	25.0	5.0	1.0	1.13	9.0

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing has been reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

1-29-99

REV. NO.	DATE SUBMITTED	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	DATE APPROVED BY OSM
A	01/29/99	BH	SUBMITTED TO OSM FOR APPROVAL					

APPROVED MAY 1999

EXHIBIT 26-57

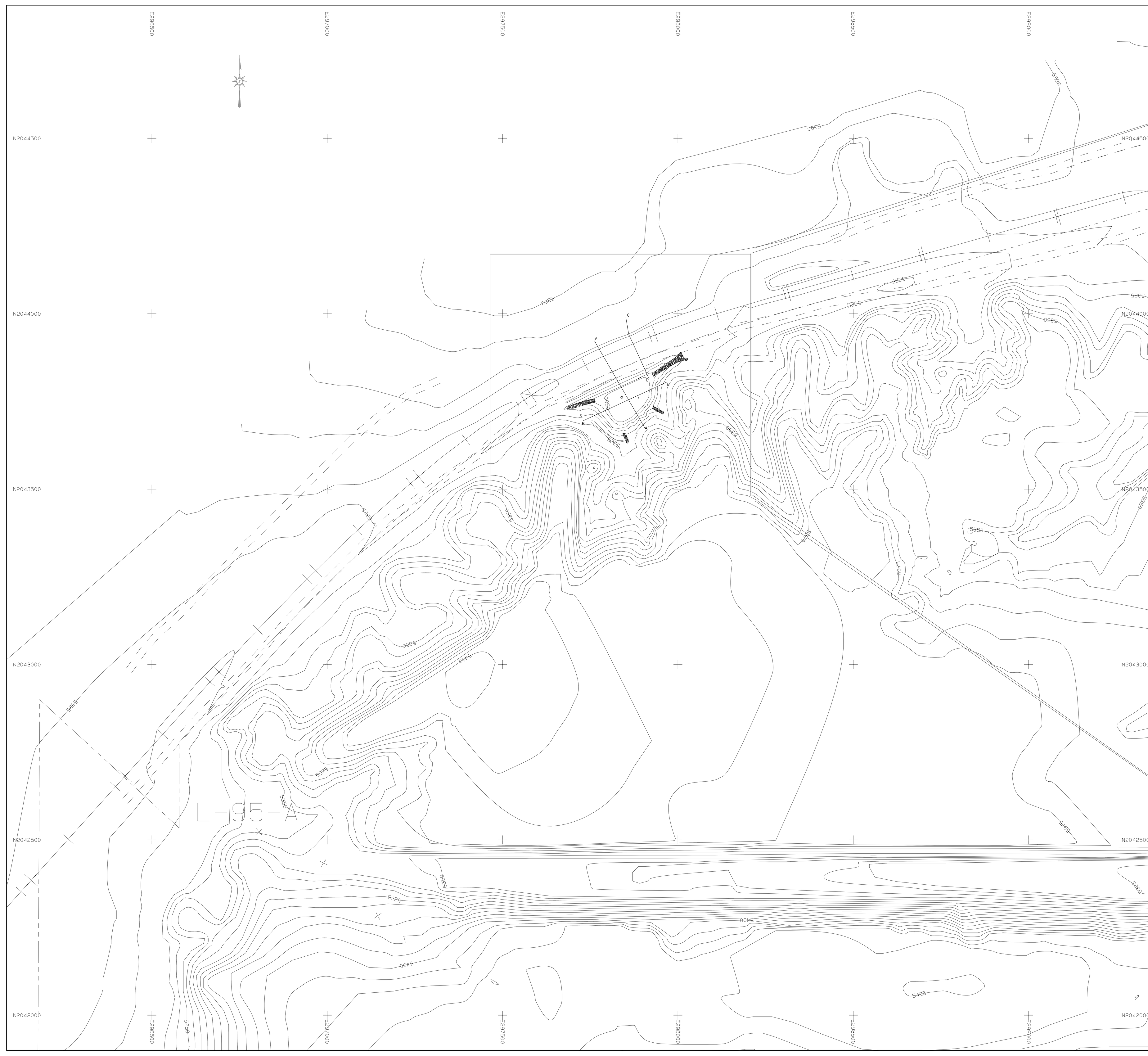
NAVAJO COAL COMPANY

NAVAJO MINE — SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

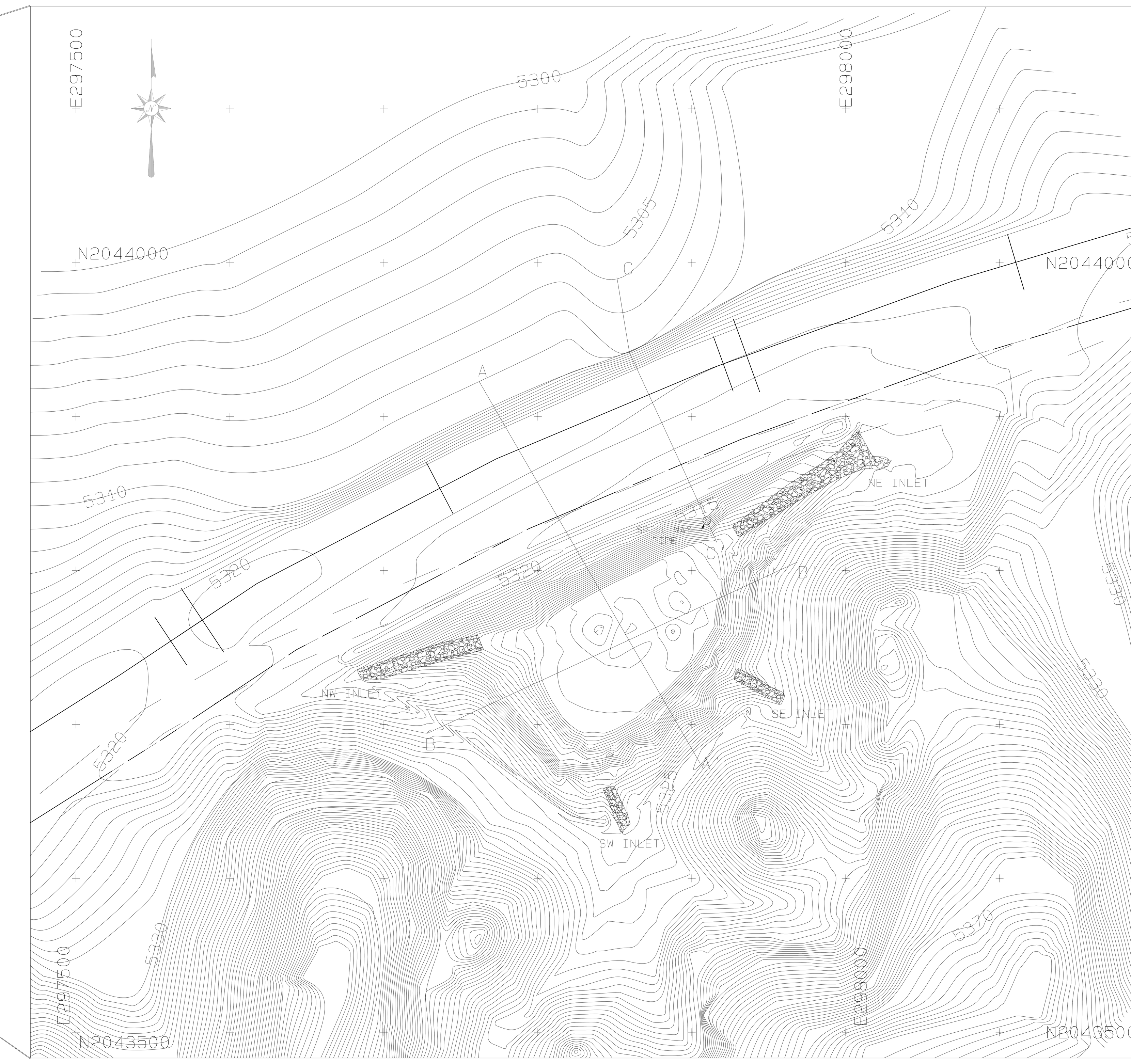
BLOCK C POND 1
DESIGN

PREPARED BY BH	DRAWN BY BH	SCALE AS NOTED
APPROVED BY LR	DATE 01/29/99	REF DWG
DWG LOC J:\OSM_SUBM\PER_PROG\CH_11\11-133, 134, &135\bcdesign.pro		



BLOCK-C POND-1 LOCATION MAP

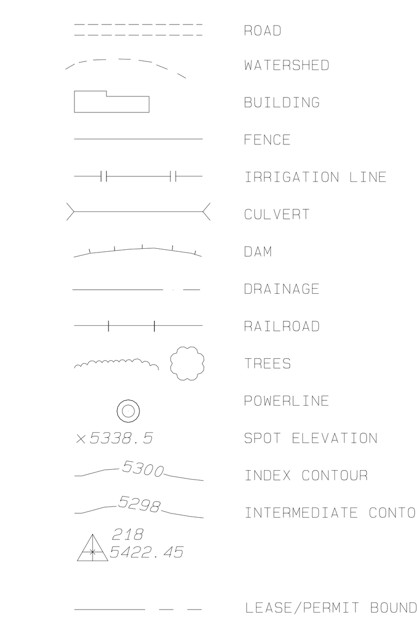
SCALE: 1"=200'



BLOCK-C POND 3

SCALE: 1"=50'

LEGEND

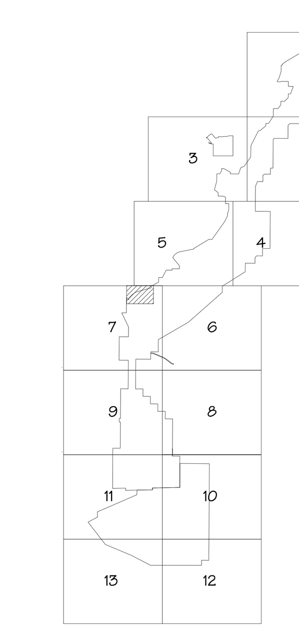


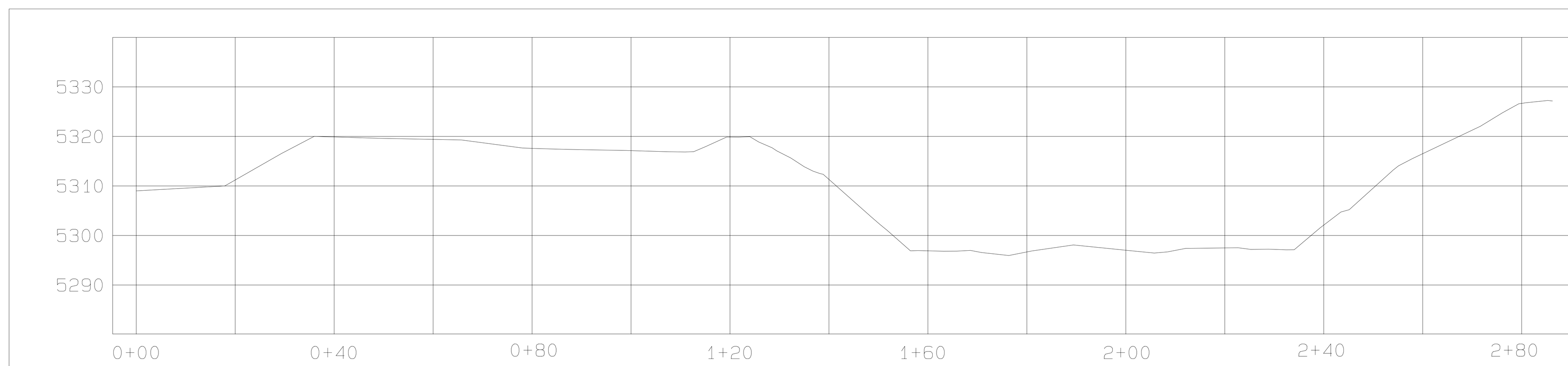
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5297	0.06	0.12	0.00
5298	0.18	0.20	0.12
5299	0.22	0.23	0.32
5300	0.23	0.24	0.55
5301	0.25	0.26	0.79
5302	0.27	0.28	1.05
5303	0.29	0.30	1.33
5304	0.31	0.32	1.63
5305	0.33	0.34	1.95
5306	0.35	0.37	2.29
5307	0.38	0.39	2.66
5308	0.40	0.42	3.05
5309	0.43	0.45	3.47
5310	0.46	0.48	3.91
5311	0.49	0.51	4.39
5312	0.52	0.54	4.90
5313	0.55	0.57	5.43
5314	0.58	0.61	6.00
5315	0.62	0.67	6.60

NOTES

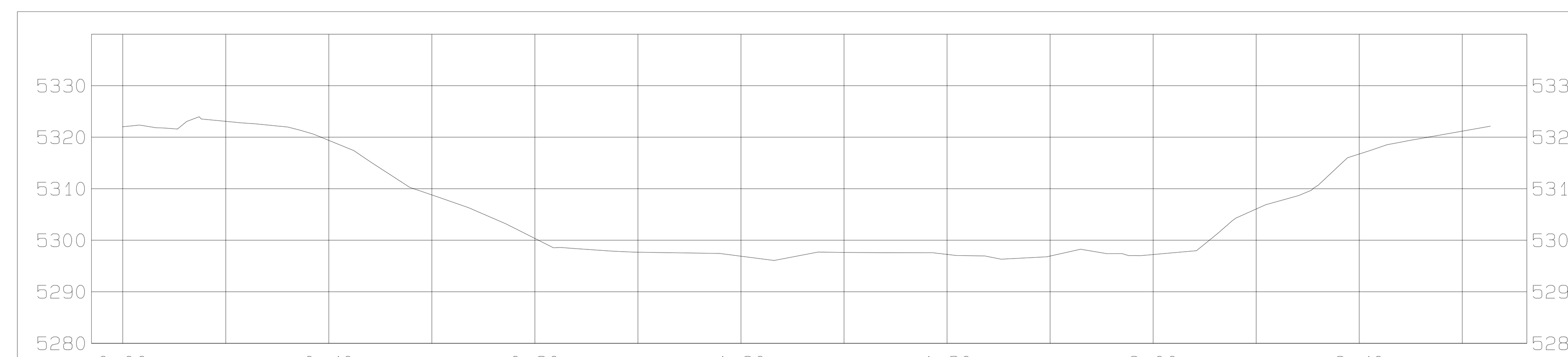
1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. Refer to Table 11-5AG for "blueline" elevation.
3. Refer to Exhibit 11-13D for watershed information.
4. Gauge Post Base Elevation : 5296.36





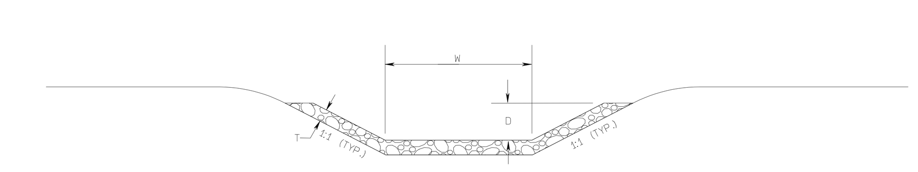
X-SECTION A-A'

SCALE: 1"=20'

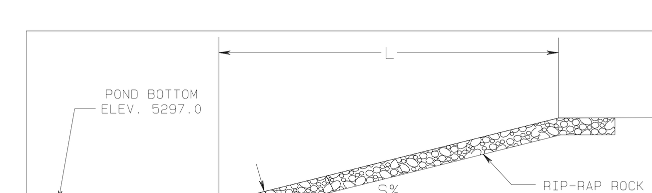


X-SECTION B-B'

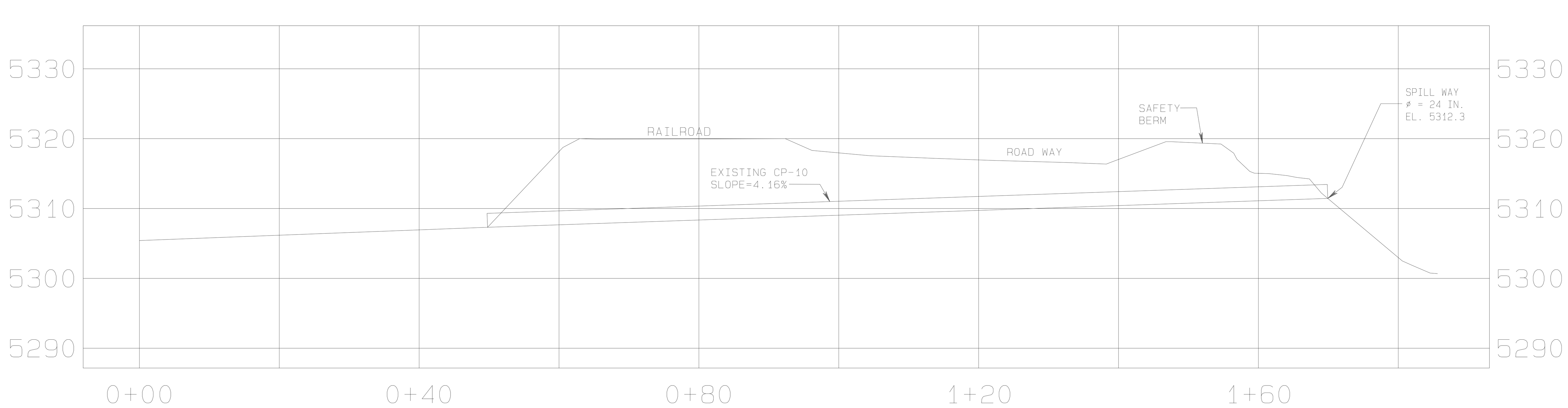
SCALE: 1"=20'



TYPICAL RIP-RAP INLET X-SECTION
NTS



TYPICAL RIP-RAP INLET PROFILE
N.T.S.



X-SECTION C-C'

SCALE: 1"=10'

INLET SCHEDULE

INLET	L (ft)	S (%)	W (ft)	D (ft)	T (ft)	RIP RAP ROCK d50 (in.)
NW	82.0	13.0	7.5	1.0	1.0	9.0
NE	103.0	14.0	6.5	1.0	1.0	9.0
SW	30.0	20.0	4.0	1.0	1.0	9.0
SE	35.0	21.0	4.0	1.0	1.0	9.0

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this impoundment has been constructed in accordance with the approved design plans and that this information shown is complete and accurate to the best of my knowledge. Exceptions are noted below.

1. The riprap size placed (D50=9") in the SW Inlet is smaller than the design size (D50=12"). The current and AOC watershed are significantly smaller than design.The riprap placed is of sufficient size.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.L.S.	CHIEF ENG.
A	12/10/99	PJF	SUBMITTED TO OSM.	BH	MC	LR		

APPROVALS

EXHIBIT 26-58

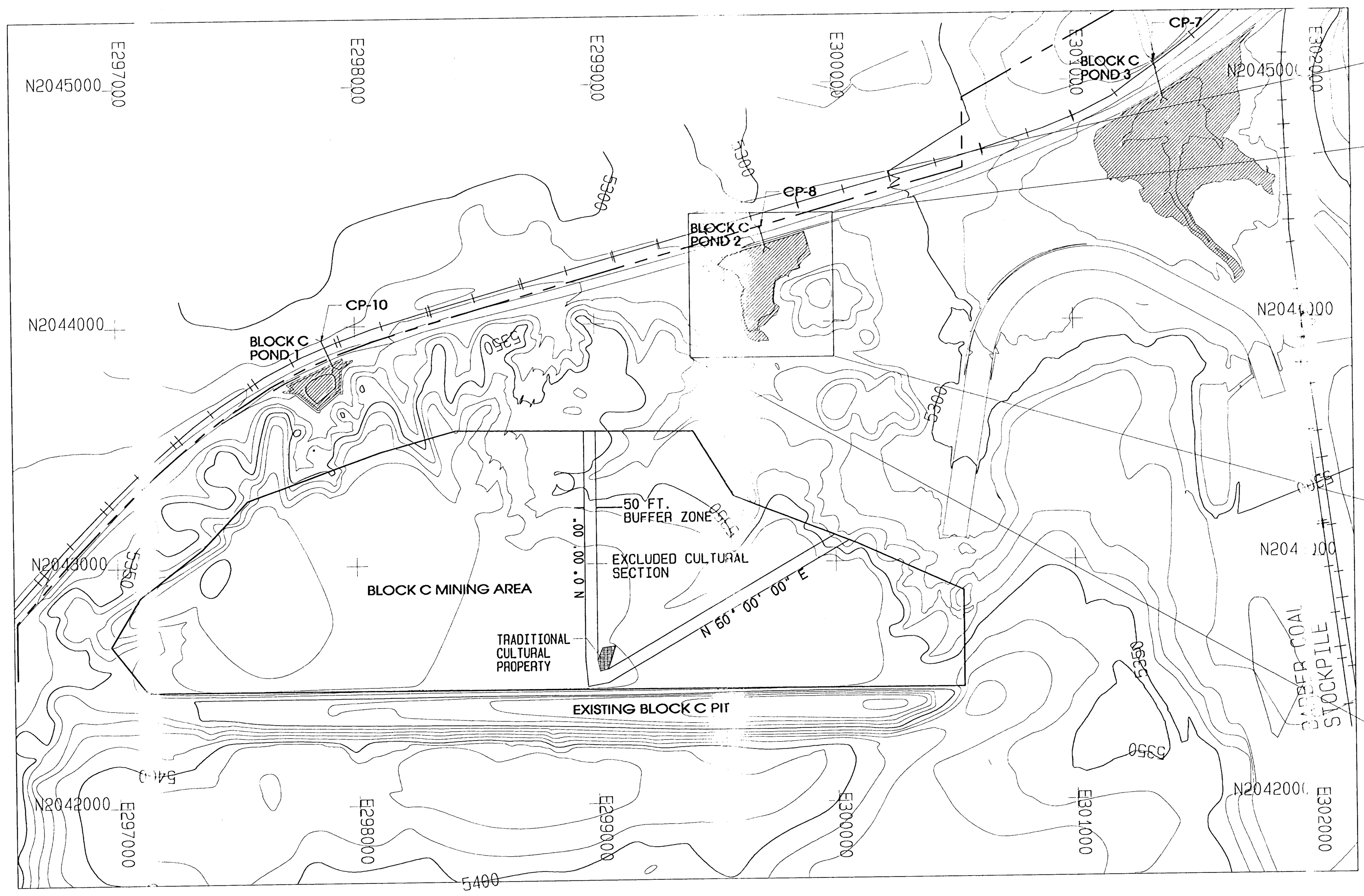
NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

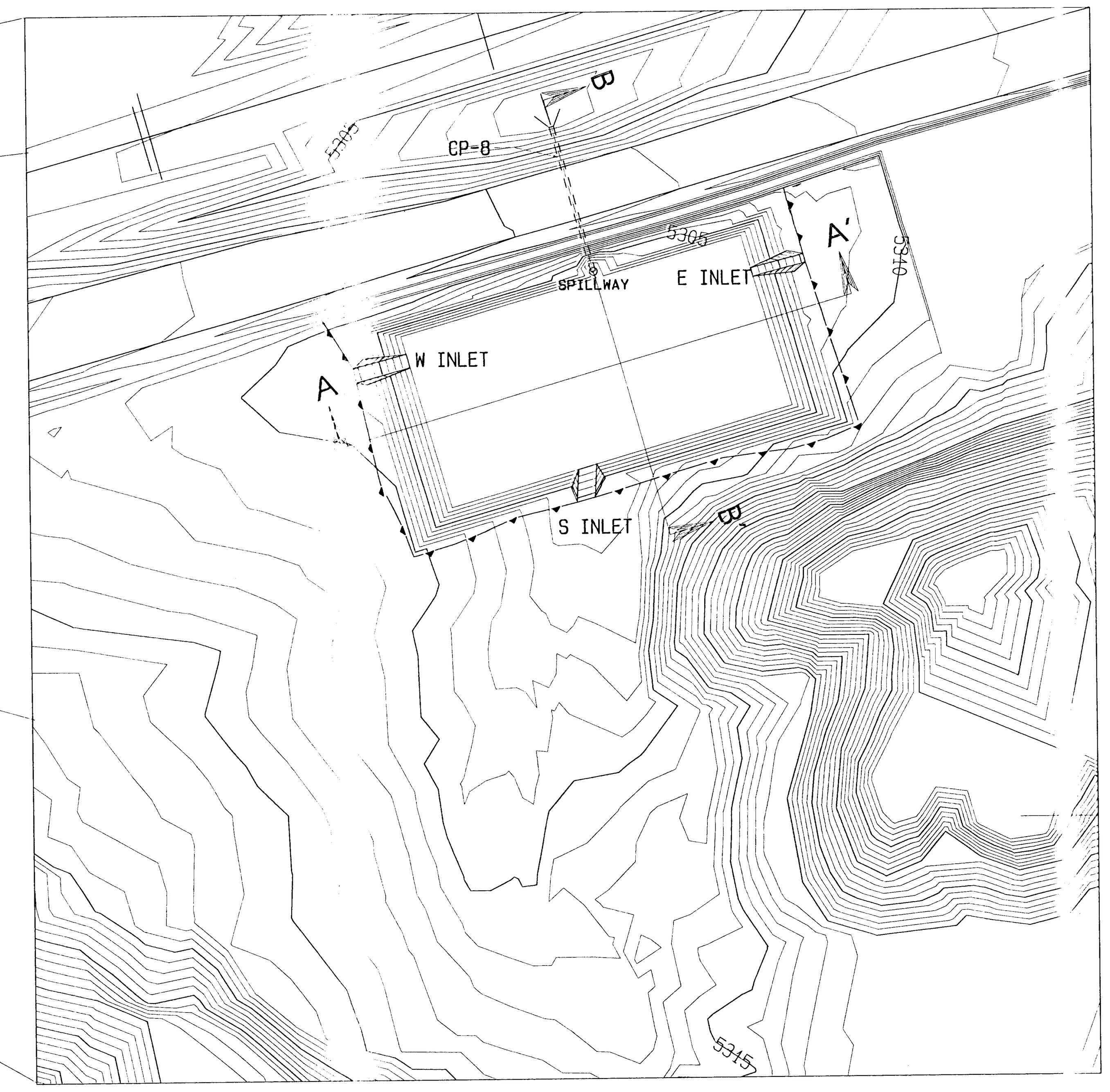
BLOCK-C POND 1
AS-BUILT

PREPARED BY PJF	DRAWN BY PJF	SCALE: AS NOTED
APPROVED BY LR	DATE 12/03/99	

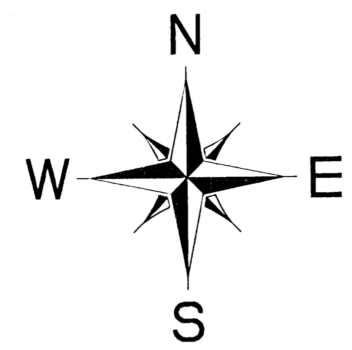
PATH: G: \Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBIT\11-133, 134, &135-BLK-C POND



BLOCK C LOCATION MAP
SCALE: 1" = 300'



BLOCK C POND 2
SCALE: 1" = 50'



LEGEND

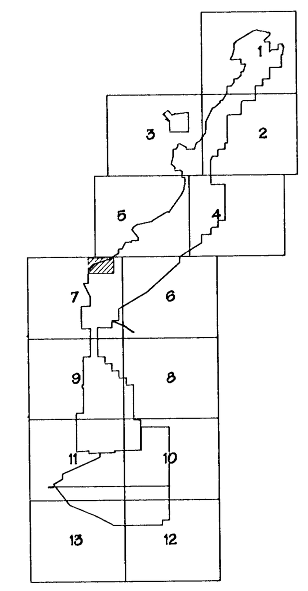
ROAD
LEASE LINE
WATERSHED
BERM
IRRIGATION LINE
CULVERT
DXM
DRAINAGE
RAILROAD
TREES
POWERLINE
x5338.5 SPOT ELEVATION
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
218 5422.45
L-30 LEASE CORNER

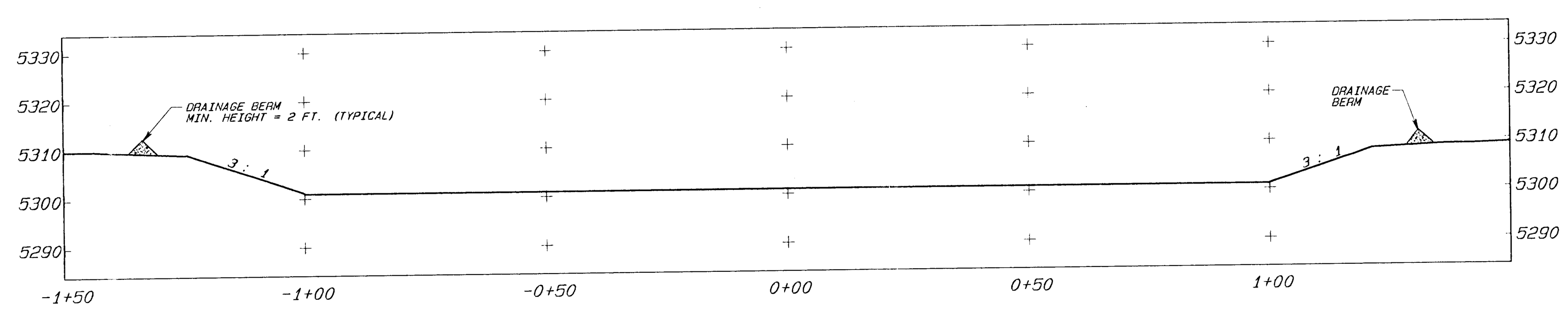
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5301	0.46	0.00	0.00
5302	0.49	0.48	0.48
5303	0.53	0.51	0.99
5304	0.56	0.55	1.54
5305	0.60	0.59	2.13
5306	0.67	0.64	2.77
5307	0.79	0.74	3.51
5308	0.92	0.86	4.37
5309	1.17	1.05	5.42
5310	1.53	1.36	6.79
5311	2.00	1.78	8.57
5312	2.51	2.27	10.84

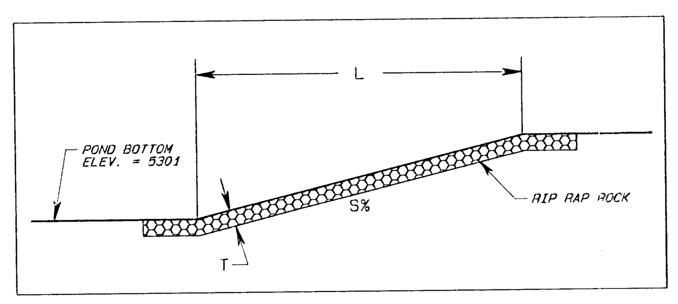
NOTES

1. For hydrology and design information refer to Appendix 11- AA in the approved PAP.
2. Construct berms to drain into inlet entrances. Field locate as required.
3. Refer to Table 11-5AH for "blueline" elevation.
4. Refer to Exhibit 11-13D for watershed information.

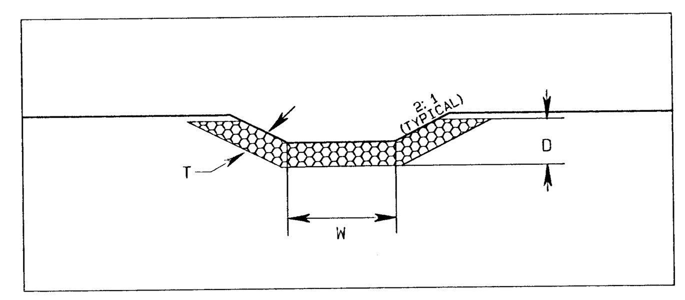




SECTION A-A'
SCALE: 1" = 20'



TYPICAL INLET PROFILE
NTS



TYPICAL INLET CROSS SECTION
NTS

CERTIFICATION STATEMENT

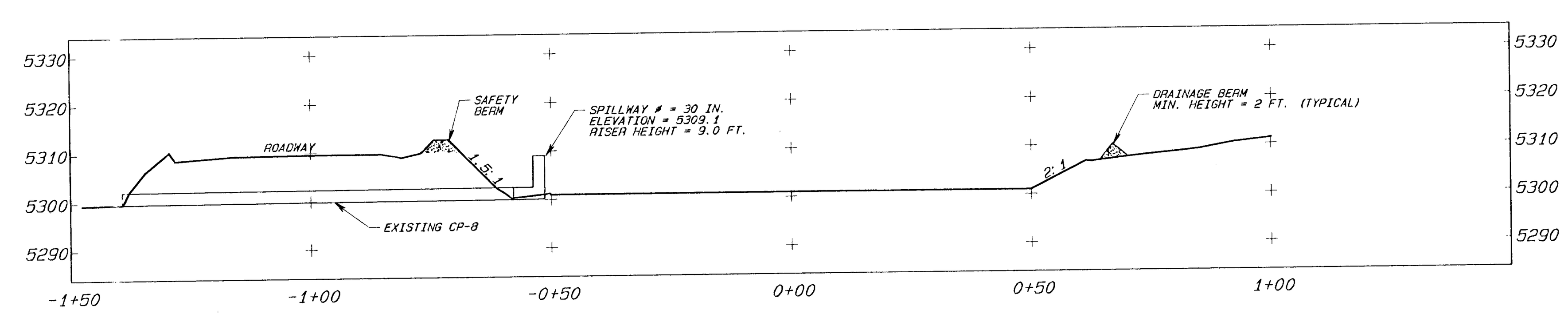
I, Leonard Raymond, hereby certify that this drawing has been reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

1-21-99

INLET SCHEDULE

INLET	L ft	S %	W ft	D ft	T ft	RIP RAP ROCK d50 in
E	28.0	25.0	5.0	1.0	1.13	9.0
S	16.0	25.0	10.0	1.0	1.13	9.0
W	28.0	25.0	8.0	1.0	1.13	9.0



SECTION B-B'
SCALE: 1" = 20'

MAY 1999 APPROVED

REV. No.	DATE SUBMITTED	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	DATE APPOVED BY OSM
A	01/29/99	BH	SUBMITTED TO OSM FOR APPROVAL					

APPROVALS

EXHIBIT 26-59

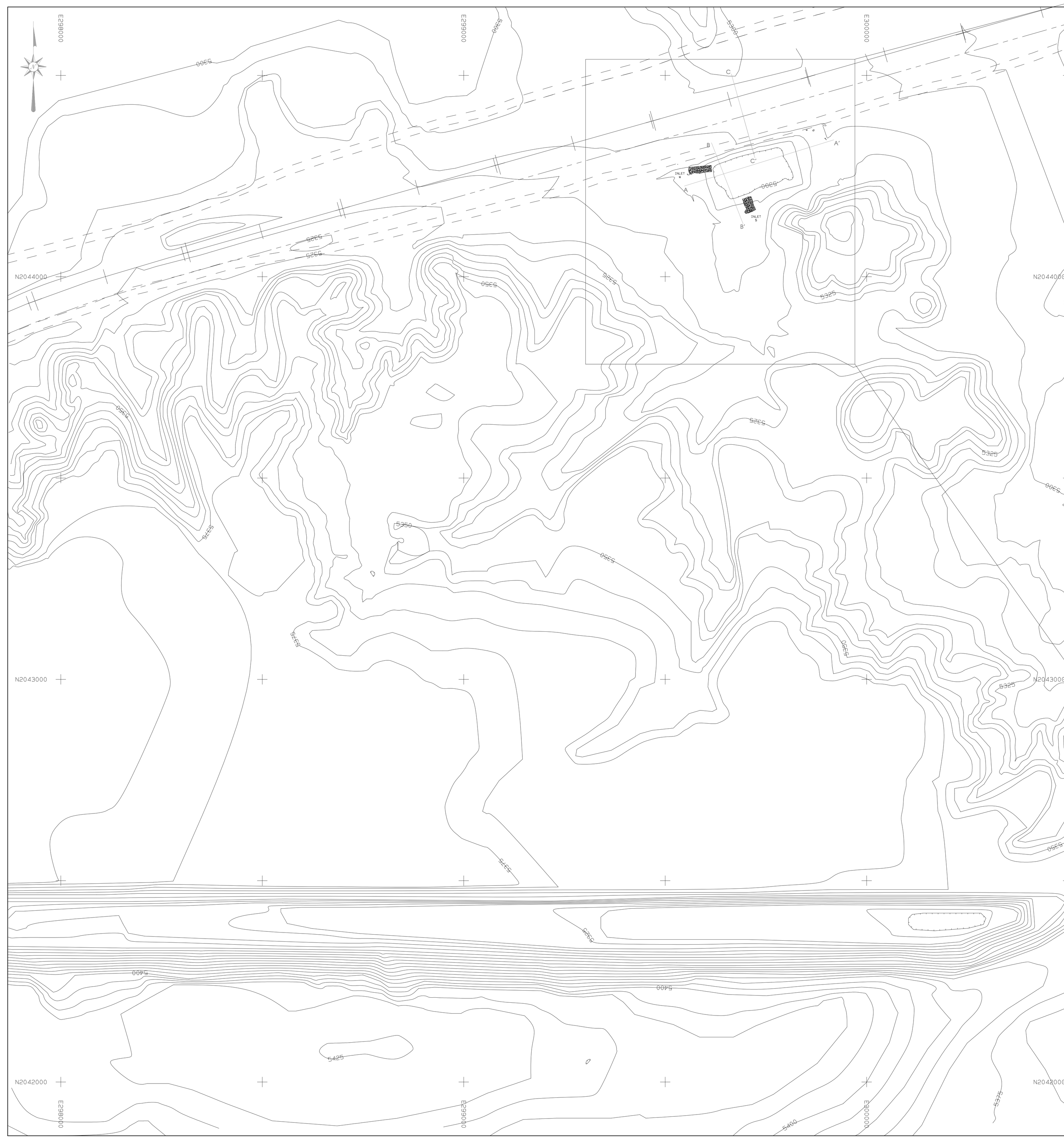
NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

BLOCK C POND 2
DESIGN

PREPARED BY BH	DRAWN BY BH	SCALE AS NOTED
APPROVED BY LR	DATE 01/29/99	REF DWG
DWG LOC J: \OSM_SUBM\PER_PROG\CH_11\11-133, 134, &135\bcdesign.pro		



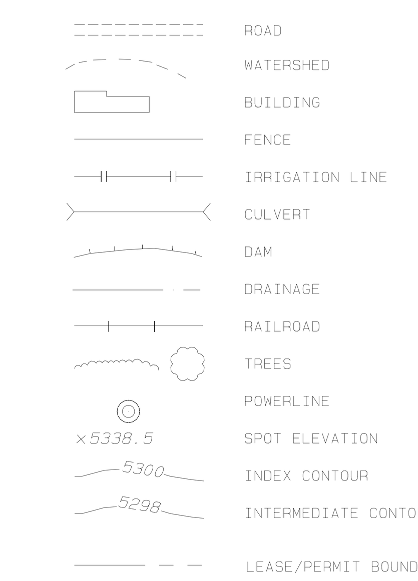
BLOCK-C POND-2 LOCATION MAP

SCALE: 1"=200'

BLOCK-C POND 2

SCALE: 1"=50'

LEGEND

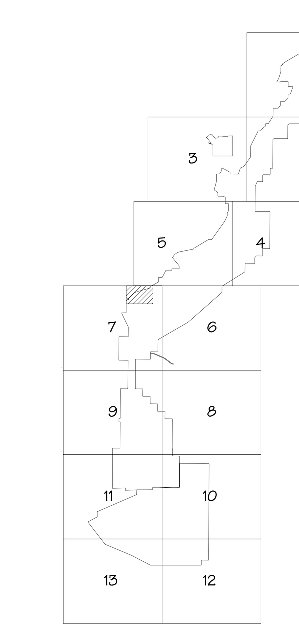


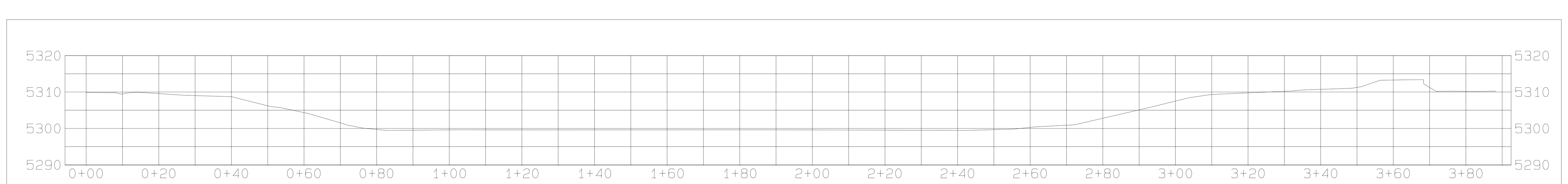
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5300	0.36	0.41	0.00
5301	0.46	0.49	0.41
5302	0.51	0.53	0.90
5303	0.55	0.58	1.44
5304	0.60	0.63	2.01
5305	0.65	0.69	2.64
5306	0.71	0.78	3.33
5307	0.83	0.91	4.10
5308	0.98	1.08	5.01
5309	1.17	1.36	6.10
5310	1.52	1.76	7.45
5311	1.98	2.26	9.22

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. Refer to Table 11-5AH for "blueline" elevation.
3. Refer to Exhibit 11-13D for watershed information.
4. Gauge Post Base Elevation : 5298.58



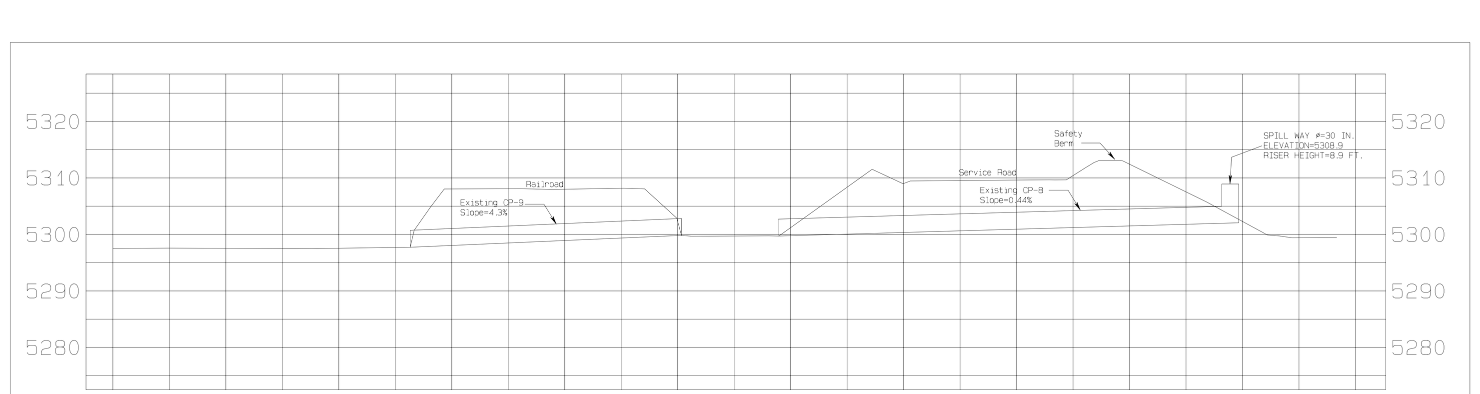


X-SECTION A-A'

SCALE: 1"=20'

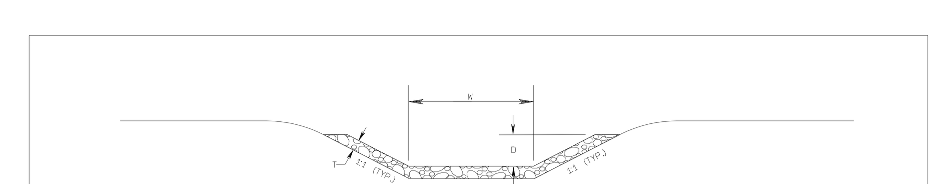
X-SECTION B-B'

SCALE: 1"=20'

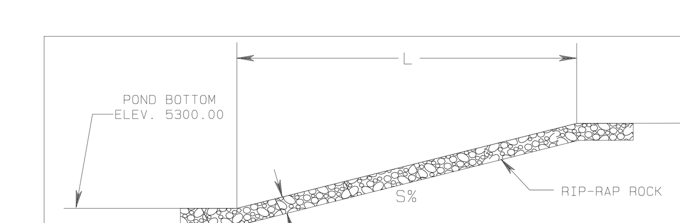


X-SECTION C-C'

SCALE: 1"=20'



TYPICAL RIP-RAP INLET X-SECTION
NTS



TYPICAL RIP-RAP INLET PROFILE
N.T.S.

INLET SCHEDULE

INLET	L (ft)	S (%)	W (ft)	D (ft)	T (ft)	RIP RAP ROCK d50 (in.)
W	57.0	15.0	7.0	1.0	1.0	9.0
S	38.0	15.0	7.5	1.0	1.0	9.0

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this impoundment has been constructed in accordance with the approved design plans and that this information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.L.S.	CHIEF ENG.
A	12/10/99	PJF	SUBMITTED TO OSM.	BH	MC	LR		

APPROVALS

EXHIBIT 26-60

NAVAJO COAL COMPANY

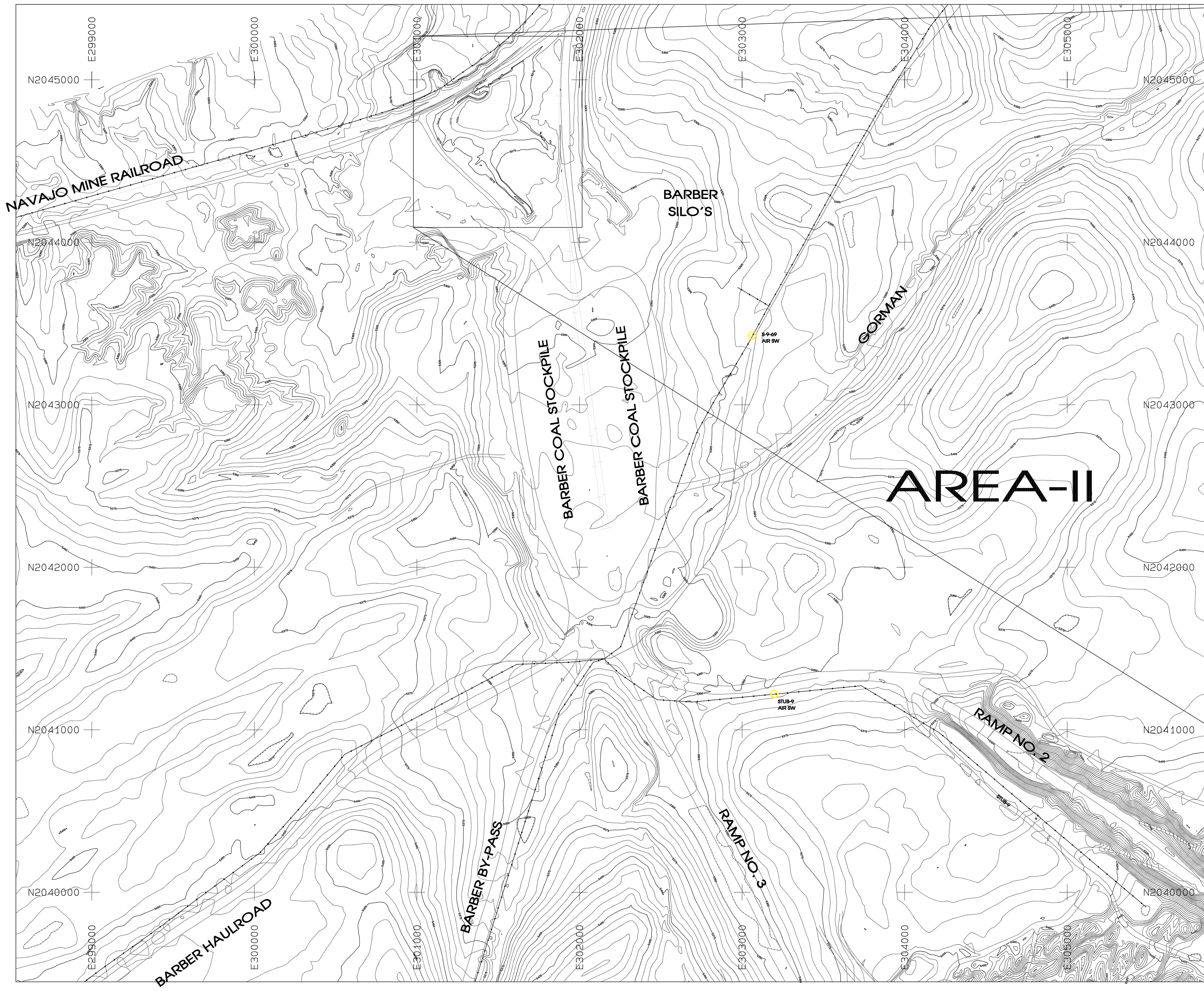
NAVAJO MINE
SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

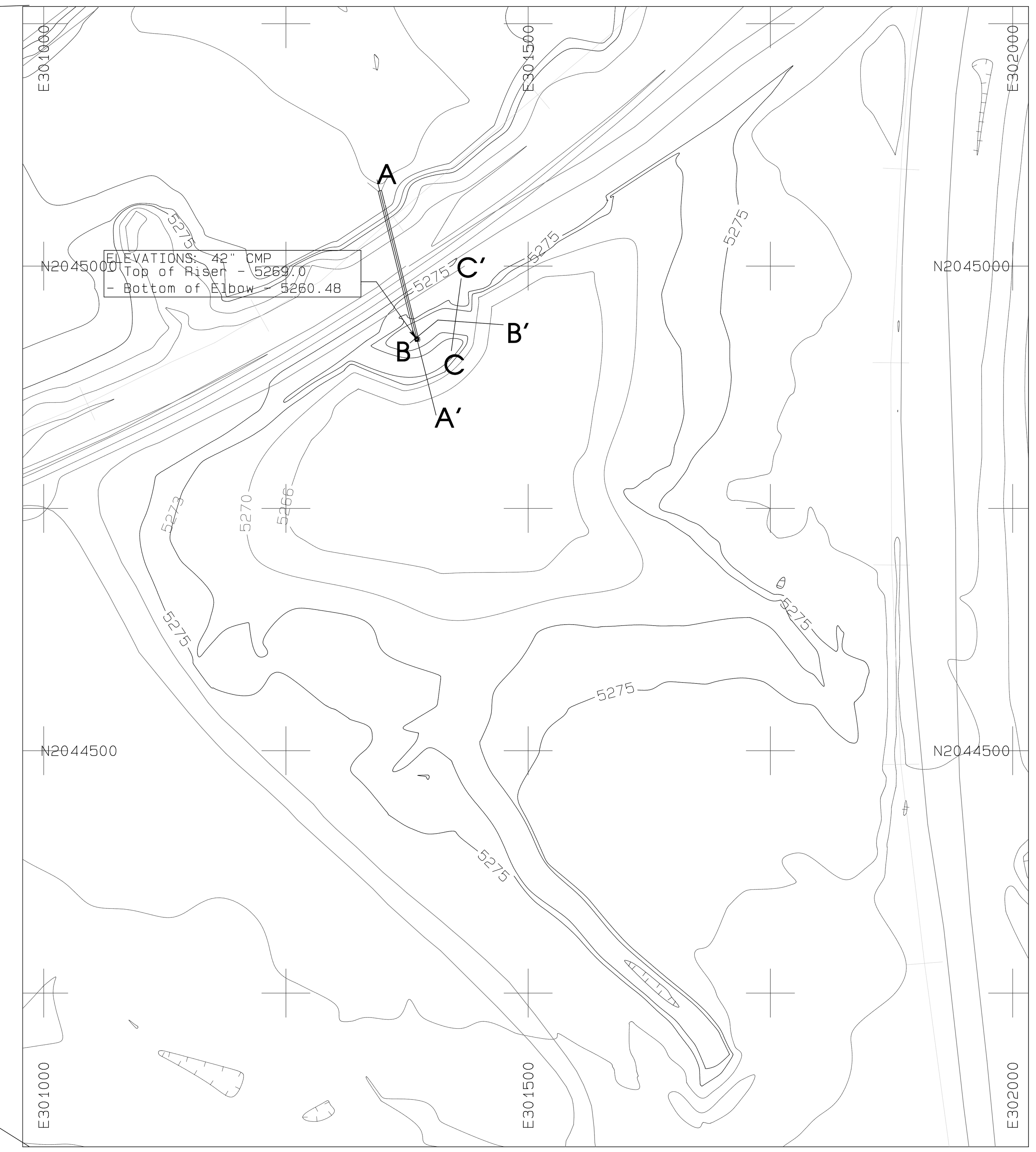
BLOCK-C POND 2
AS-BUILT

PREPARED BY PJF	DRAWN BY PJF	SCALE: AS NOTED
APPROVED BY LR	DATE 12/03/99	

PATH : G:\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBIT\11-133, 134, &135-BLK-C P



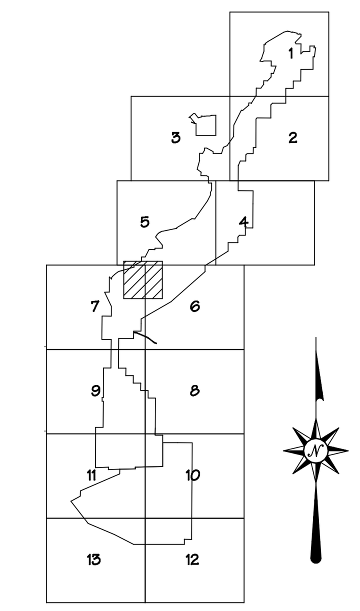
Location Map
Scale 1" = 500'



Project Area
Scale 1" = 100'

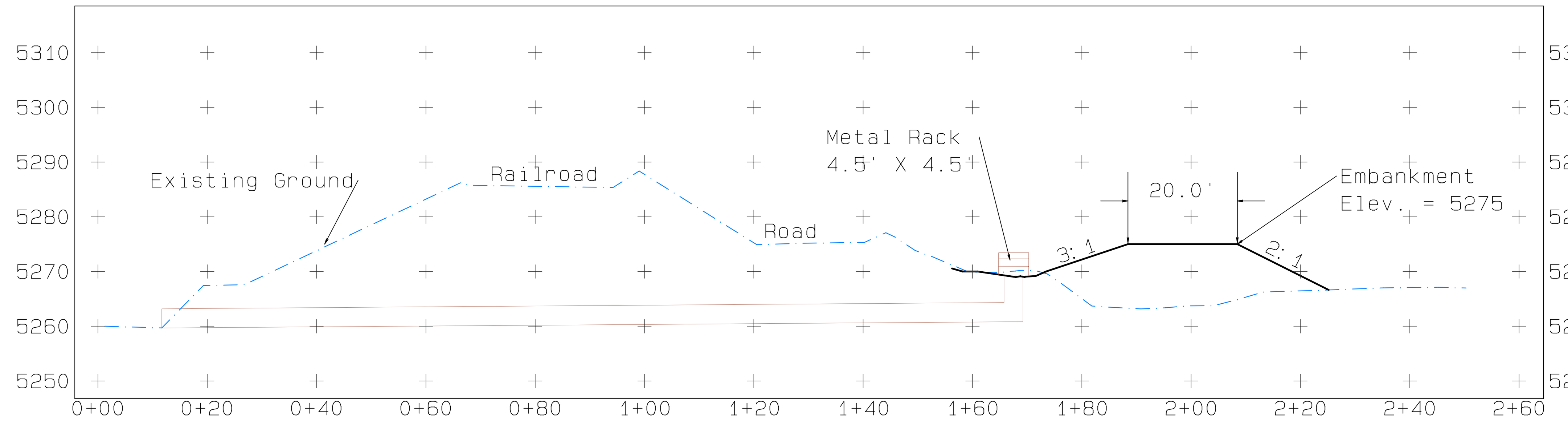
LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- LEASE/PERMIT BOUNDARY



NOTES

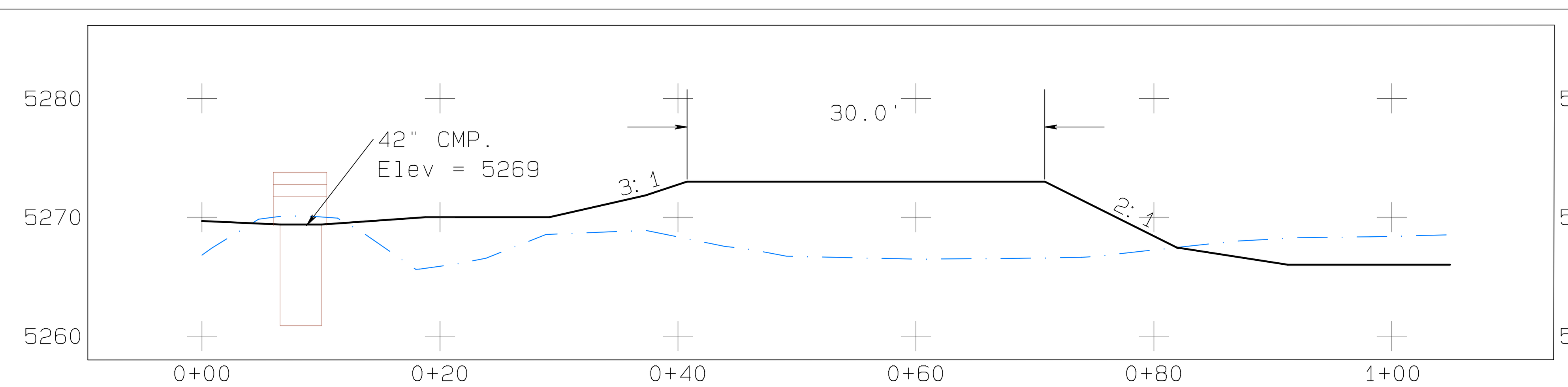
1. For hydrology and design information refer to Appendix 11-AA in the Approved PAP.
2. Refer to Table 11-5AI for "blueline" elevation.
3. Refer to Exhibit 11-13C and 11-13D for watershed information.
4. Gauge Post Base Elevation 5266.0



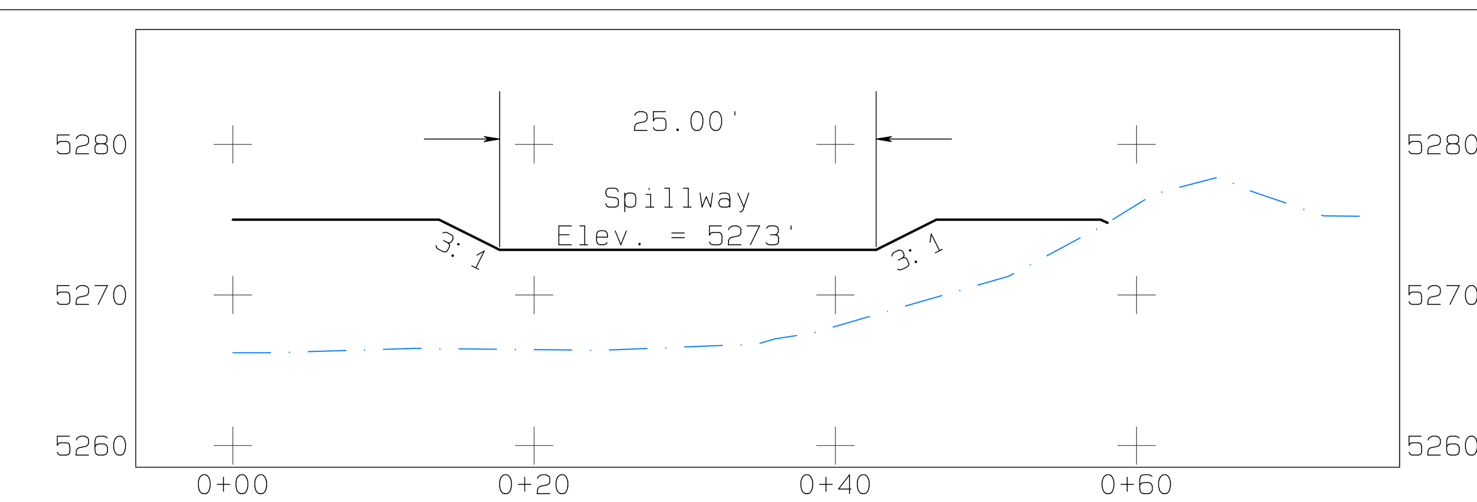
PROFILE A-A'
Scale 1" = 20'

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5266	1.46	0.00	0.00
5267	1.65	1.55	1.55
5268	1.87	1.77	3.32
5269	2.10	1.98	5.30
5270	2.35	2.22	7.52
5271	2.73	2.54	10.06
5272	3.20	2.96	13.02
5273	4.23	3.70	16.72
5274	5.40	3.81	21.53
5275	6.50	5.94	27.47



Profile B-B'
Scale 1"=10'



Profile C-C'
Scale 1"=10'

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

KEVIN A. BAHE
NEW MEXICO
17850
REGISTERED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.
A	8/7/07	SS	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	LR	MC	LR

APPROVALS

EXHIBIT 26-61

BHP BILLITON NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS

P.O.BOX 1717 FRUITLAND, NEW MEXICO 87416/PHONE 505-598-5861/FAX 505-598-3361

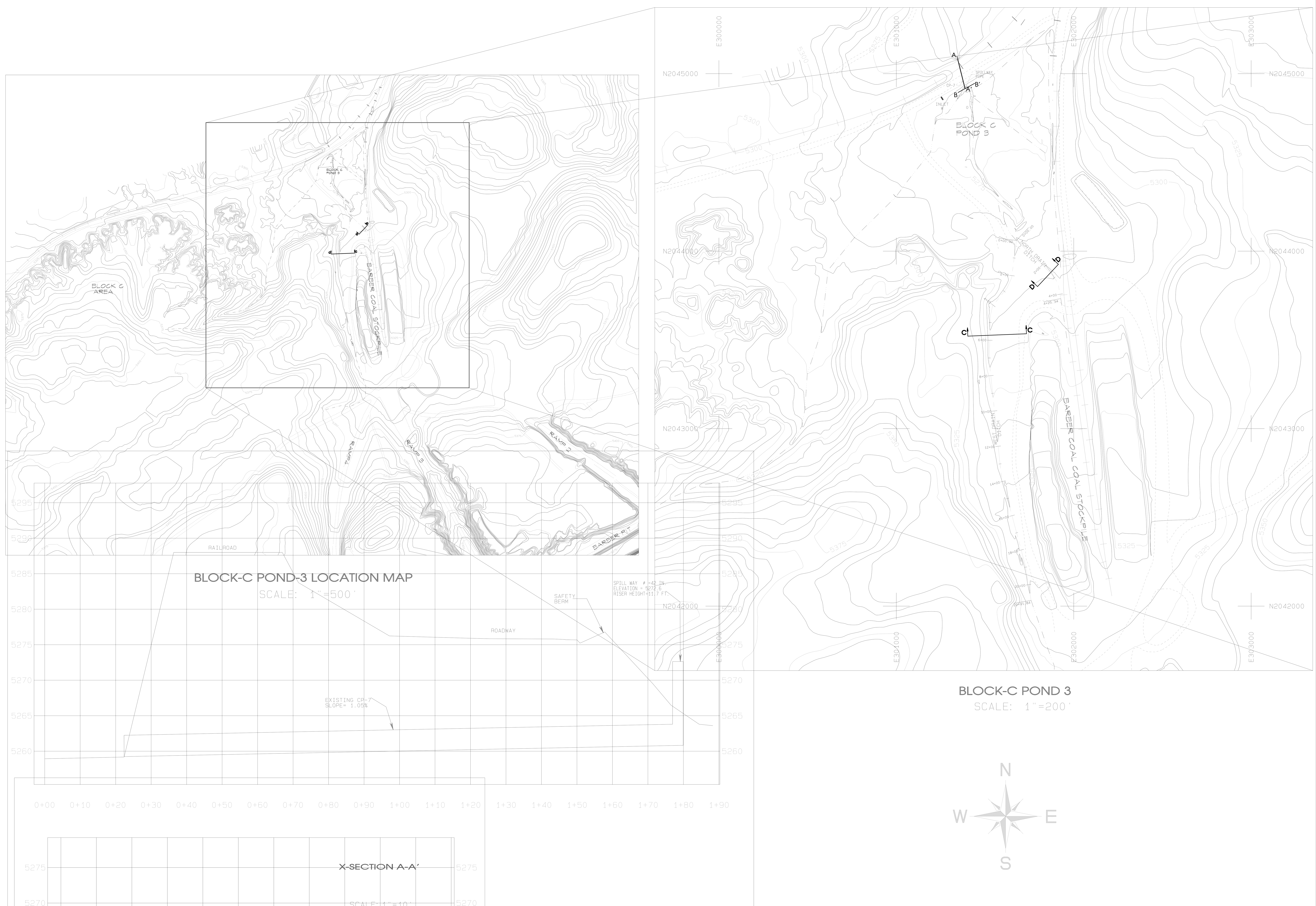
Block C Pond 3
Design

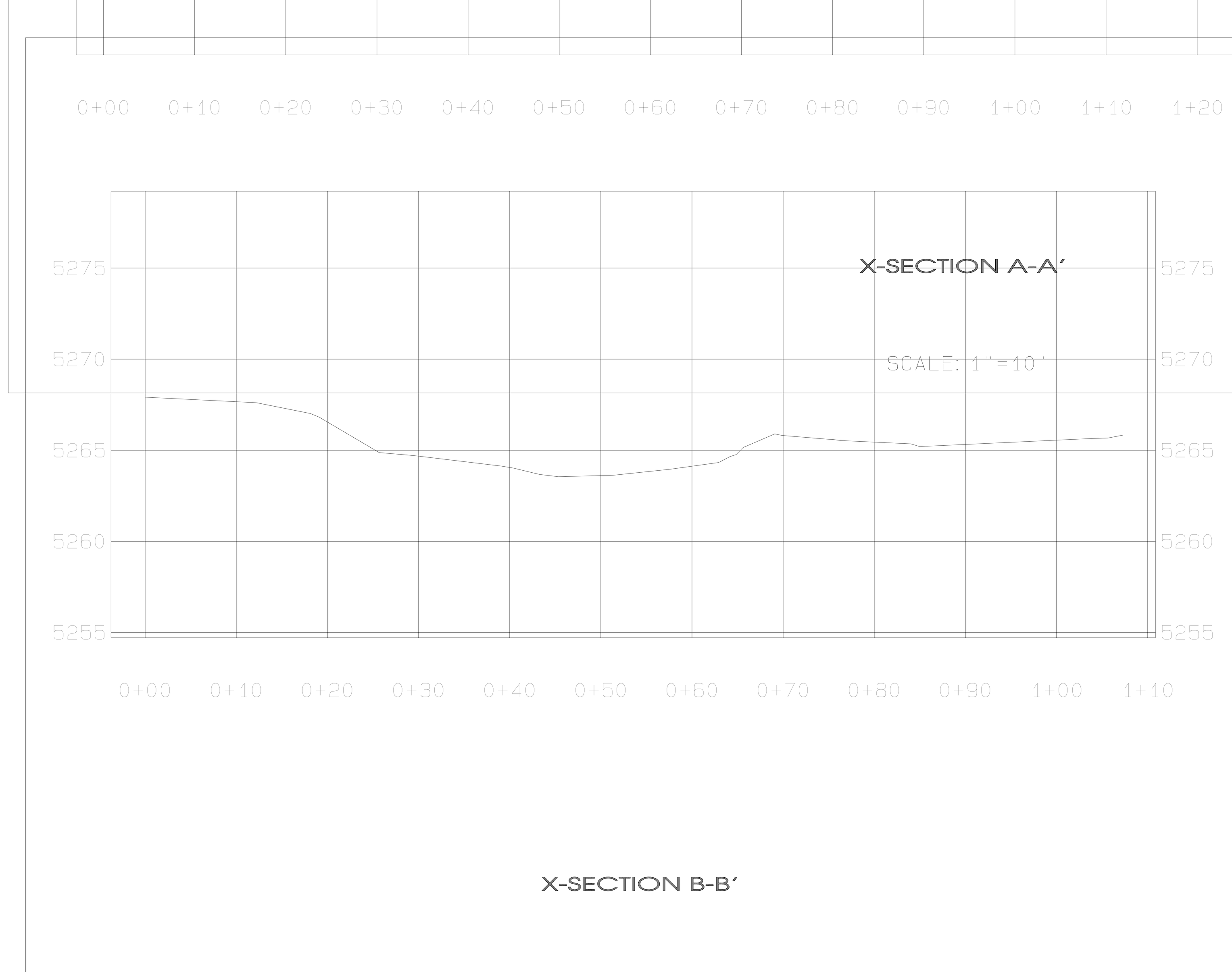
PREPARED BY SS	DRAWN BY SS	SCALE 1"= 200'
APPROVED BY LR	DATE 8/08/07	

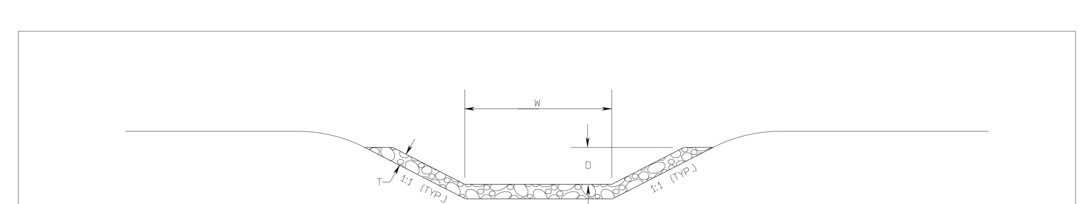
PATH: \\ENCNMCFMN-SRV02\Data\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBITS\11-133_135

Path: \\ENCNMCFMN-SRV02\Data\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBITS\11-133_135-BLK-C PDS 1_2_3\design\BLK-C PD-3 11-135A.pro

PJFoster \Plot time: Wed Nov 05 15:11:45 2008



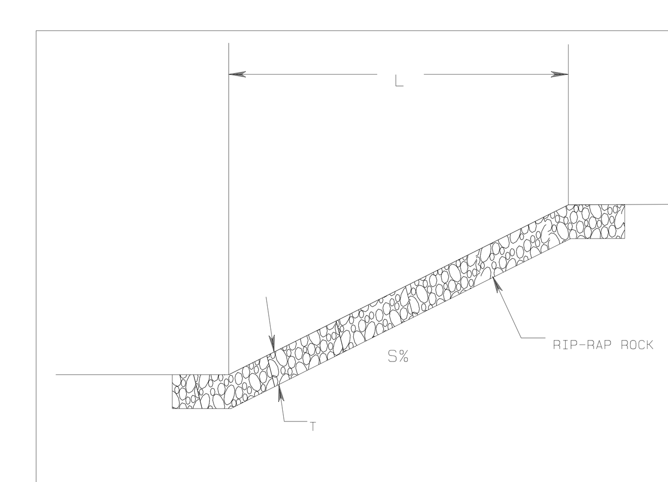




TYPICAL RIP-RAP INLET X-SECTION
NTS

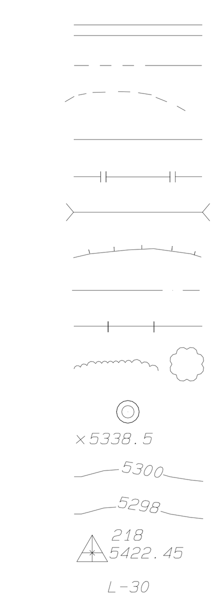
INLET SCHEDULE

INLET	L (ft)	S (%)	W (ft)	D (ft)	T (ft)	RIP RAP ROCK d50 (in.)
W	21.0	12.0	2.5	1.0	0.5	4.0



TYPICAL RIP-RAP INLET PROFILE
N.T.S.

LEGEND

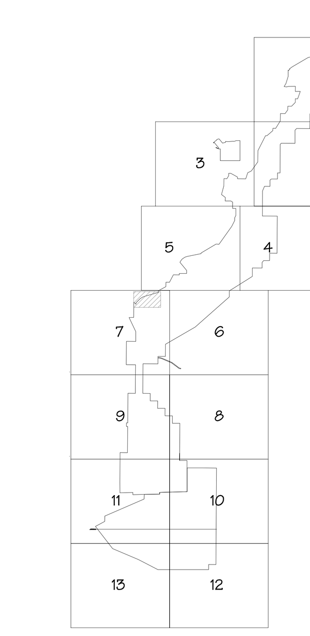


STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5261	0.00	0.00	0.00
5262	0.00	0.00	0.00
5263	0.01	0.01	0.01
5264	0.03	0.02	0.03
5265	0.09	0.06	0.09
5266	0.25	0.17	0.26
5267	0.41	0.33	0.59
5268	0.71	0.56	1.15
5269	1.11	0.91	2.06
5270	1.75	1.43	3.49
5271	2.58	2.17	5.66
5272	3.51	3.05	8.70
5273	4.41	3.96	12.66
5274	5.46	4.94	17.60
5275	6.57	6.02	23.61

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. Refer to Table 11-5AI for additional data.
3. Refer to Exhibit 11-13C and 11-13D for watershed information.
4. Gauge Post Base Elevation : 5264.08



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this impoundment has been constructed in accordance with the approved design plans and that this information shown is complete and accurate to the best of my knowledge.

REV. No.	DATE SUBMITTED	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	DATE APPOVED BY OSM
B	01/08/02	RY	-INCREASED INLET RISER HEIGHT FROM 10.7 TO 11.7. -REMOVED AND BACKFILL BARBER POND 1. -MODIFIED THE SURFACE DRAINAGE ON THE WEST SIDE OF THE COAL STOCK PILE. -ADDED EXHIBIT 11-135B (PROFILE AND CROSS SECTION MAP).	RY	MC	LR		
A	12/10/99	LR	SUBMITTED TO OSM	BH	MC	LR		

APPROVALS

EXHIBIT 26-62

NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

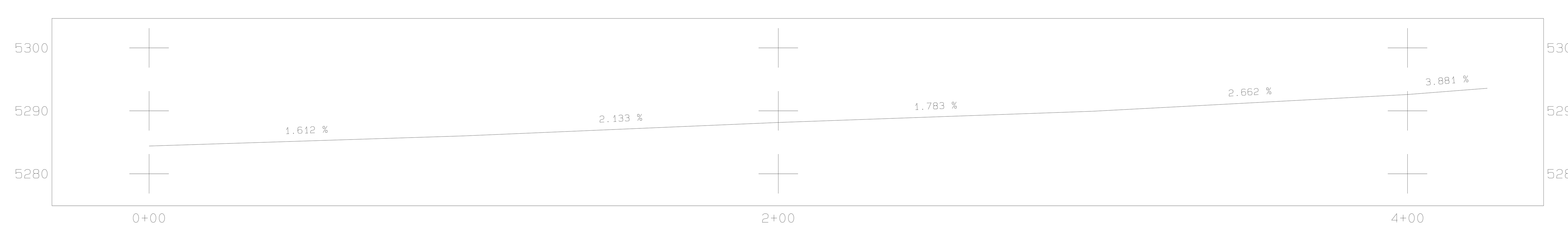
BLOCK C POND 3
AS-BUILT

PREPARED BY PJF	DRAWN BY PJF	SCALE AS NOTED
APPROVED BY LR	DATE 12/03/99	REF DWG

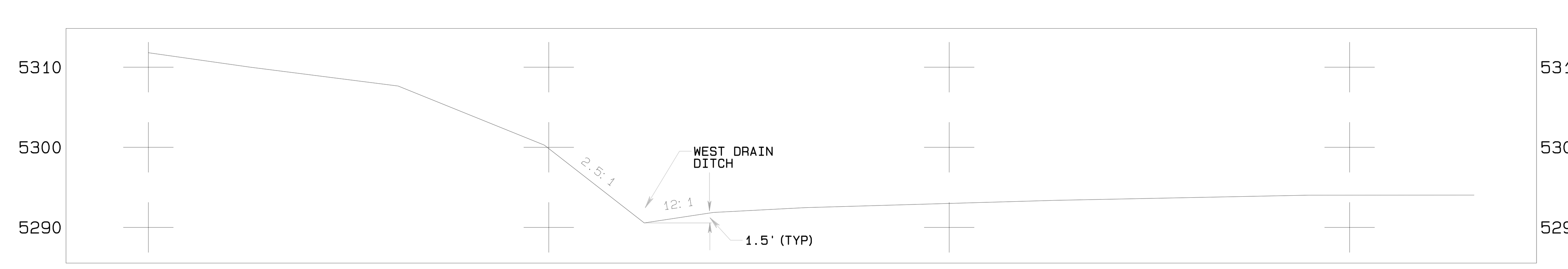
DWG LOC G:\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBIT\11-133, 134, &135-BLK-C

PROFILE OF WEST DRAIN DITCH

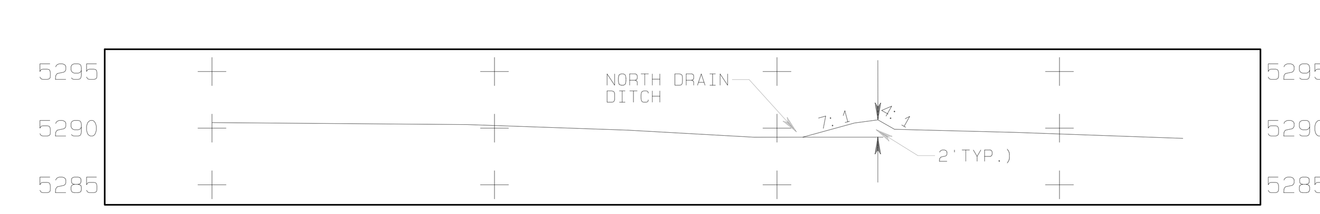
HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=50'



PROFILE OF NORTH DRAIN DITCH



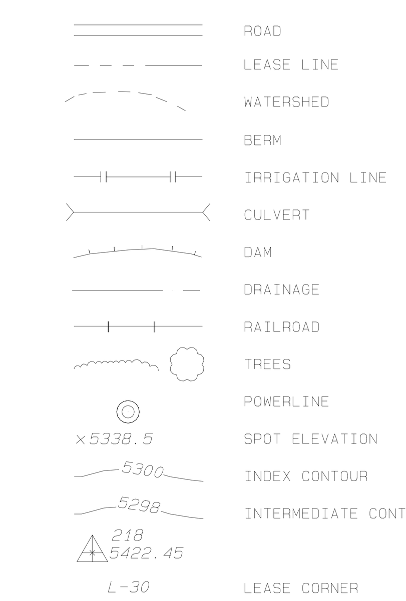
TYPICAL SECTION C - C



TYPICAL SECTION D - D

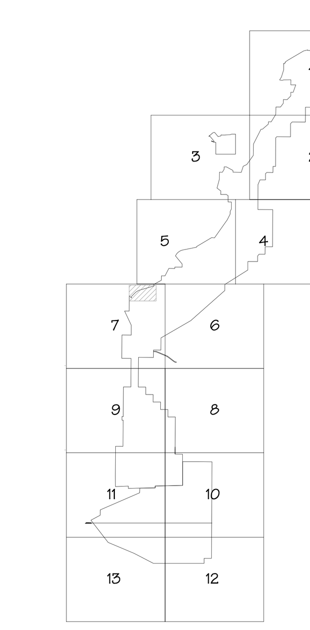
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=10'

LEGEND



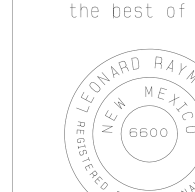
NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. Refer to Table 11-5AI for additional data.
3. Refer to Exhibit 11-13C and 11-13D for watershed information.
4. Gauge Post Base Elevation : 5264.08



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this impoundment has been constructed in accordance with the approved design plans and that this information shown is complete and accurate to the best of my knowledge.



REV. No.	DATE SUBMITTED	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	DATE APPOVED BY OSM
A	6/6/02	LR	SUBMITTED TO OSM FOR REVIEW	RY	MC	LR		

EXHIBIT 26-63

NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS
BHP NAVAJO COAL COMPANY

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

BLOCK C POND 3
TYPICAL SECTION AND PROFILE OF MODIFIED SURFACE DRAINAGE
AS-BUILT

PREPARED BY RY	DRAWN BY RY	SCALE AS NOTED
APPROVED BY LR	DATE 06/06/02	REF DWG

DWG LOC G:\Departments\Gs\OSM_SUBM\PER_PROG\CH_11_PAP EXHIBIT\11-133, 134, &135-BLK-C

PLAN VIEW

CONTOUR INT: 2 FT
SCALE: 1"=100'

LEGEND

ROAD
BUILDING
FENCE
CULVERT
DRAINAGE
POWERLINE
INDEX CONTOUR
INTERMEDIATE CONTOUR
PERMIT/LEASE BOUNDARY

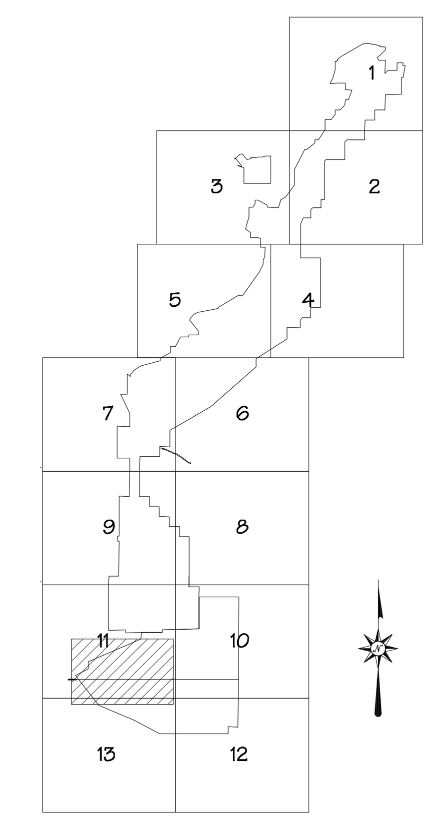
NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.

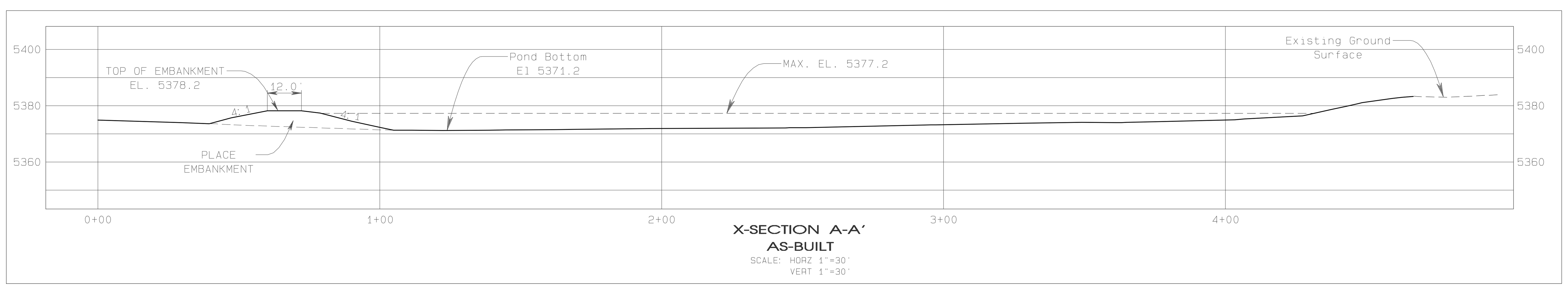
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5371.2	0.00		
5372	0.29	0.1	0.1
5373	0.88	0.6	0.7
5374	1.47	1.2	1.9
5375	2.35	1.9	3.8
5376	3.00	2.7	6.5
5377	3.49	3.2	9.7
5378	3.83	3.7	13.4
5379	4.17	4.0	17.4

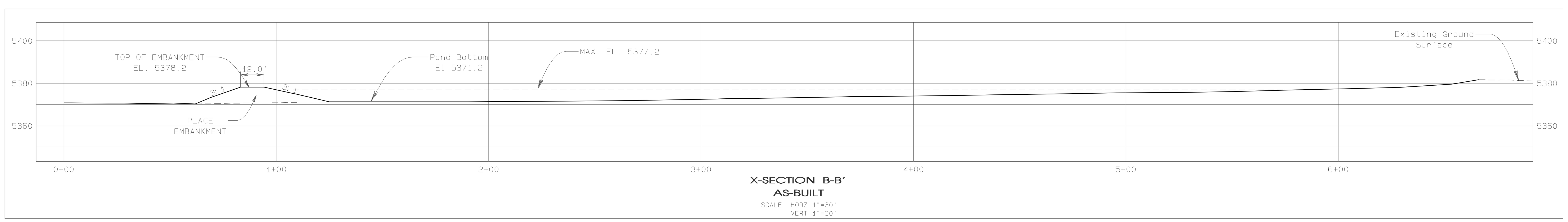
Crest of Embankment 5378.2
As-Built Volume at Crest Elevation 14.2



SCALE AS NOTED



X-SECTION A-A'
AS-BUILT
SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION B-B'
AS-BUILT
SCALE: HORZ 1"=30'
VERT 1"=30'

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this embankment has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge except as noted below:

1. Only minor elevation differences for pond bottom and embankment crest.

RON C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

REVISION	DATE
UPDATED A4N DEVELOPMENT AND SUBMITTED TO OSM FOR REVIEW	8/26/09
PREPARED AS-BUILT FOR AREA4 NORTH POND-406 AND SUBMITTED TO OSM FOR REVIEW	1/19/2010

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO: NM 9263
SRVYR of RECORD:
REG. NO:

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

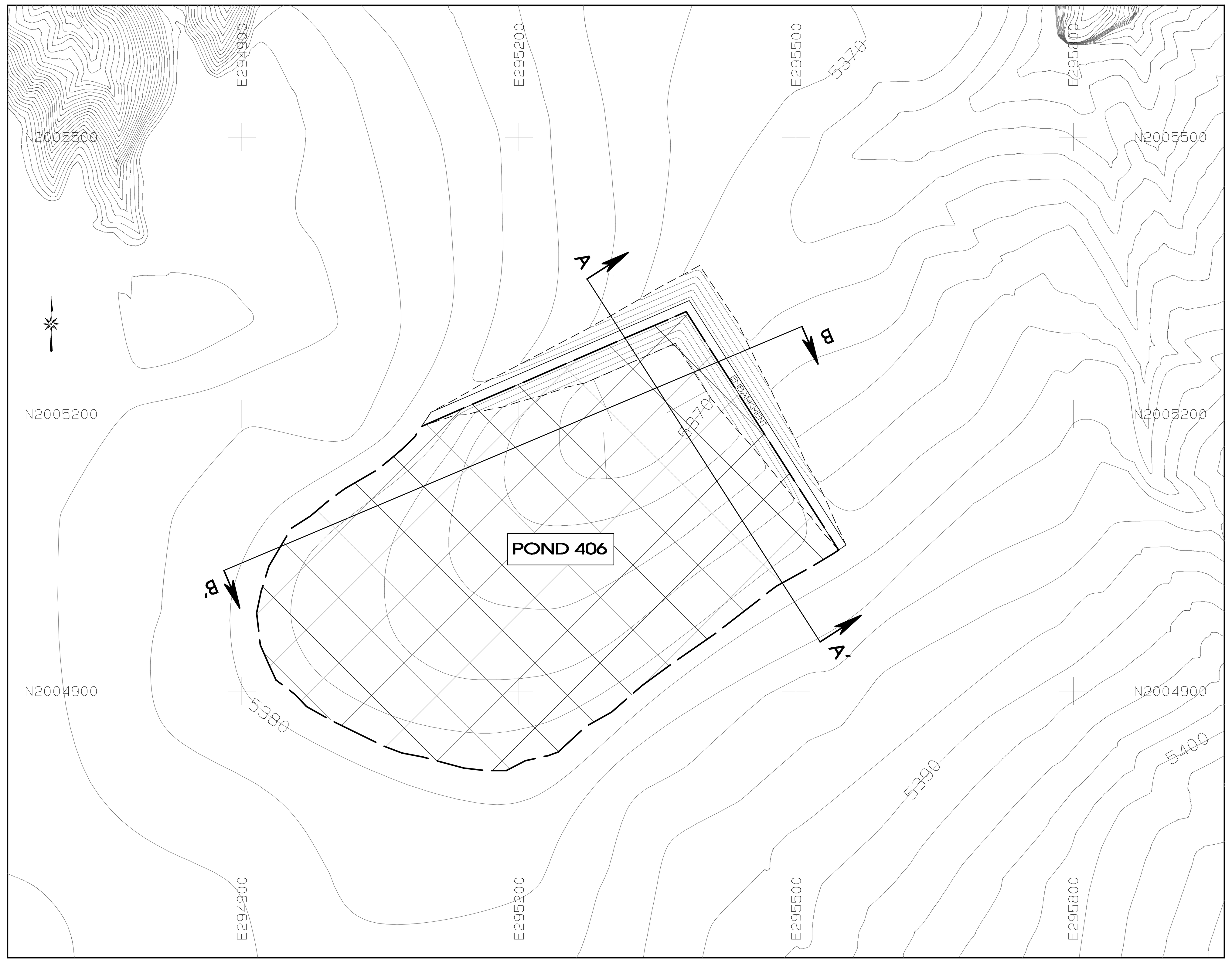
PROJECT: A4N
DATE: AUG. 8, 2009
DESIGNED BY: RCV
DRAWN BY: PJFOSTER
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

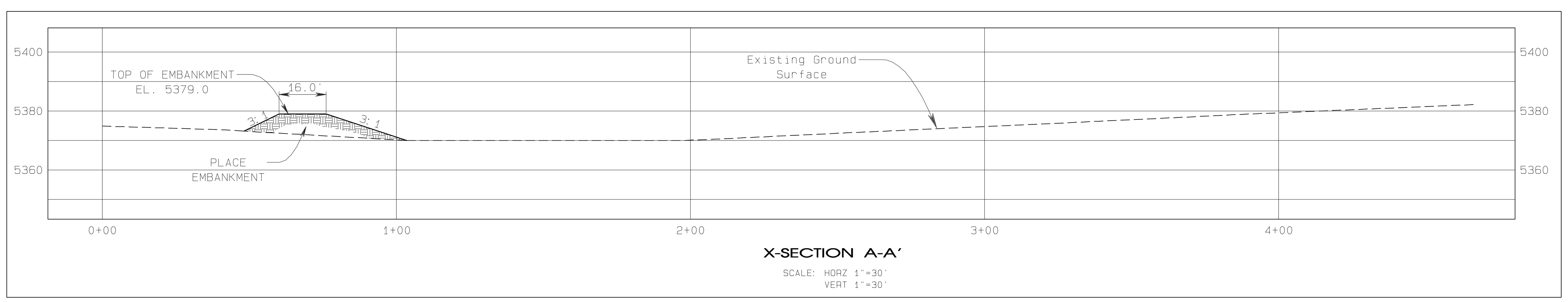
EXHIBIT 26-64
AREA 4 NORTH
POND 406
As-Built

DRAWING
SHEET
OF 0

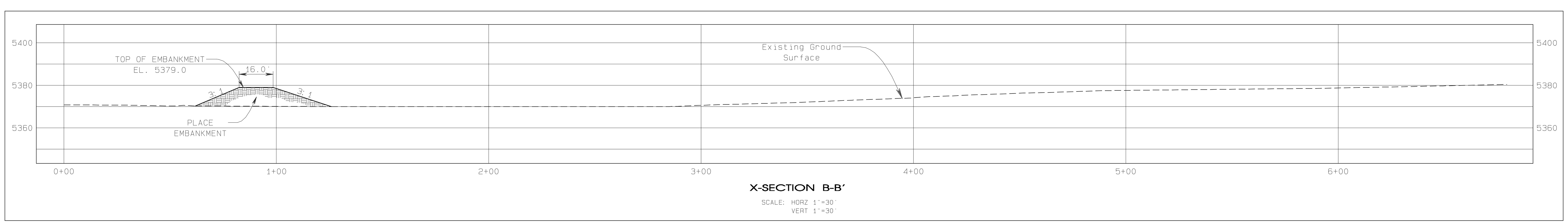
S:\Gis\Permit F\Ch 11\Exhibit 11-15G\Exh 11-15G_Pond-406_As-Built.pro
Thu Mar 11 07:22:50 2010



PLAN VIEW
CONTOUR INT: 2 FT
SCALE: 1"=100'



X-SECTION A-A'
SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION B-B'
SCALE: HORZ 1"=30'
VERT 1"=30'

LEGEND

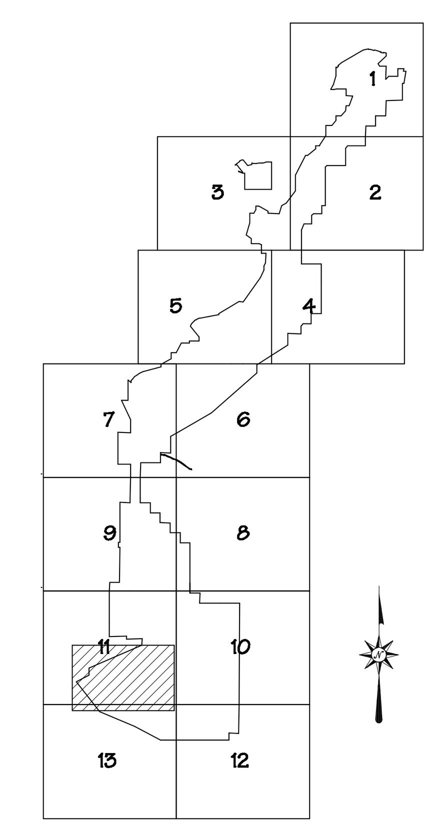
- ROAD
- BUILDING
- FENCE
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5370	0.36	0.00	0.00
5371	0.54	0.5	0.50
5372	0.78	0.7	1.10
5373	1.09	0.90	2.00
5374	1.51	1.30	3.30
5375	1.92	1.70	5.10
5376	2.43	2.20	7.20
5377	2.95	2.70	9.90
5378	3.58	3.30	13.20
5379	4.26	3.90	17.10



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

REVISION	DATE
09-A UPDATED A4N DEVELOPMENT AND SUBMITTED TO OSM FOR REVIEW	8/28/09
11-A AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	FEB-2011

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO: NM 9263
SRVYR of RECORD:
REG. NO:

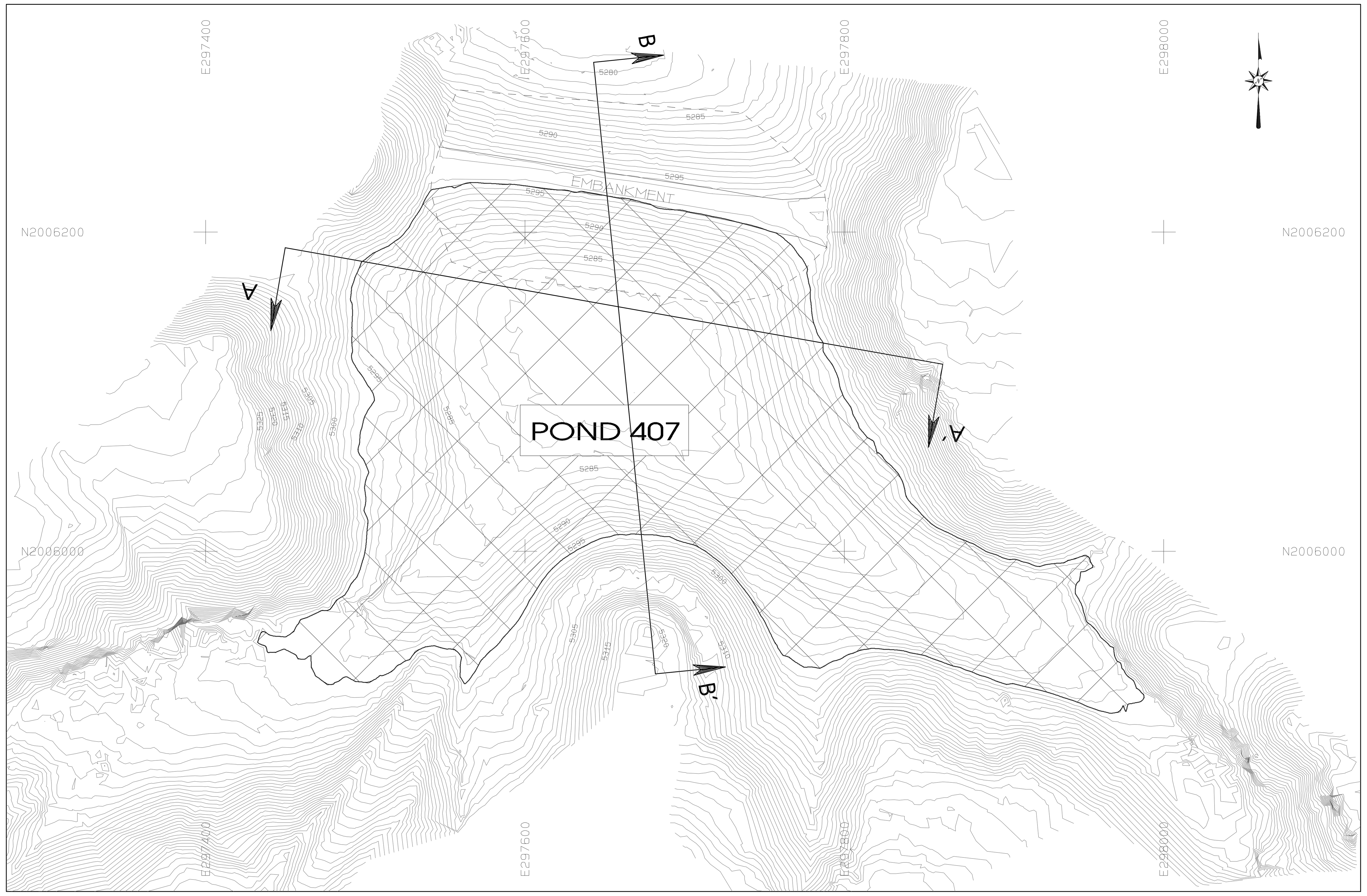
bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

PROJECT: A4N
DATE: AUG. 8, 2009
DESIGNED BY: RCV
DRAWN BY: PJFOSTER
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

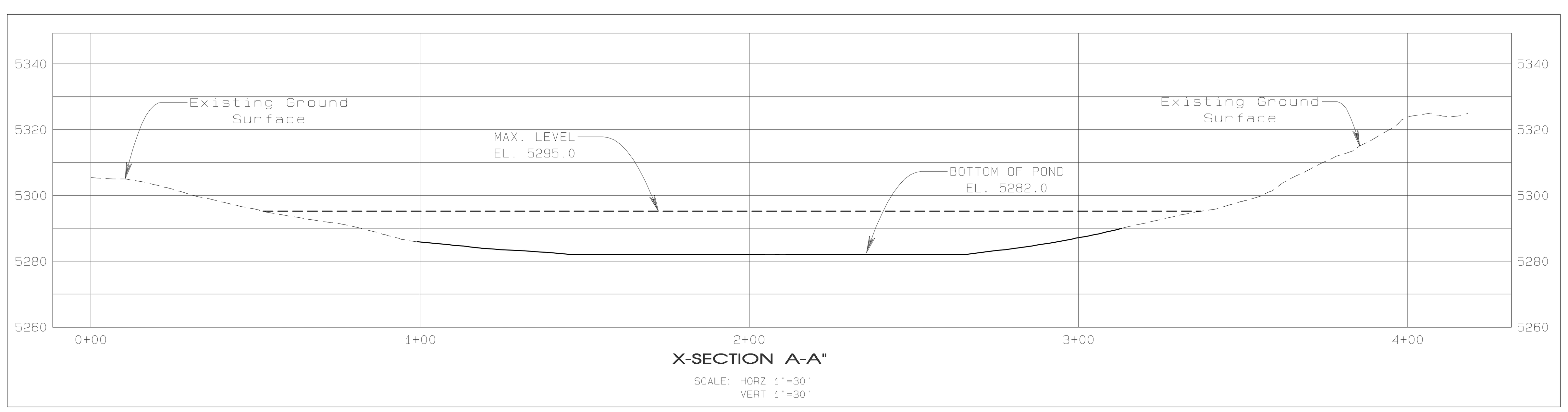
EXHIBIT 26-64
AREA 4 NORTH
POND 406
Design

DRAWING
SHEET
OF 0



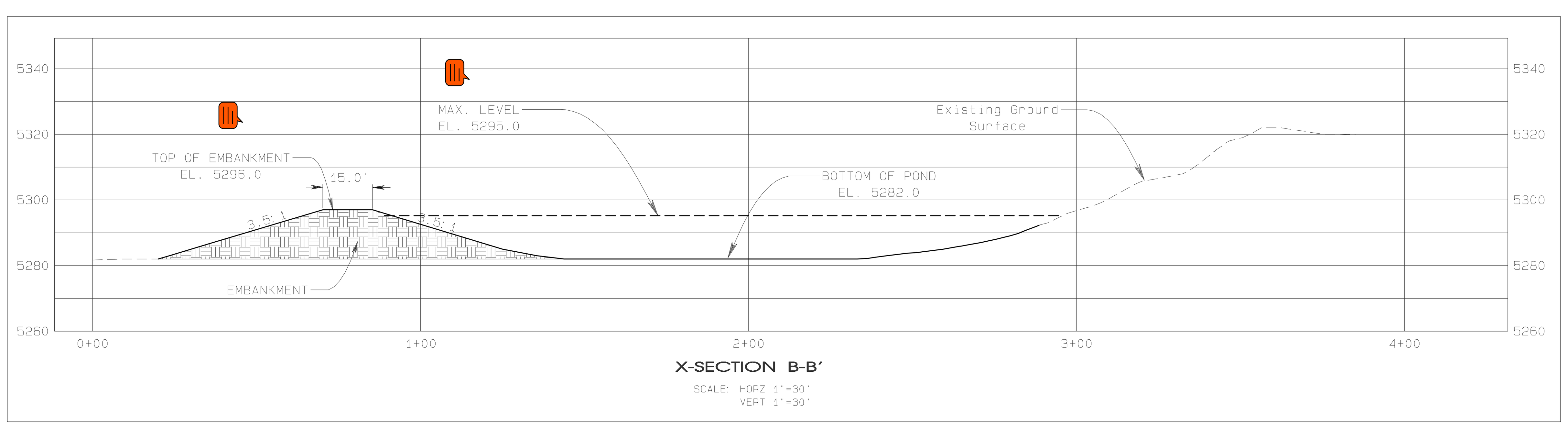
PLAN VIEW

SCALE: 1"=50'



X-SECTION A-A'

SCALE: HORZ 1"=30' VERT 1"=30'



X-SECTION B-B'

SCALE: HORZ 1"=30' VERT 1"=30'

LEGEND

ROAD
BUILDING
FENCE
CULVERT
DRAINAGE
POWERLINE
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
PERMIT/LEASE BOUNDARY

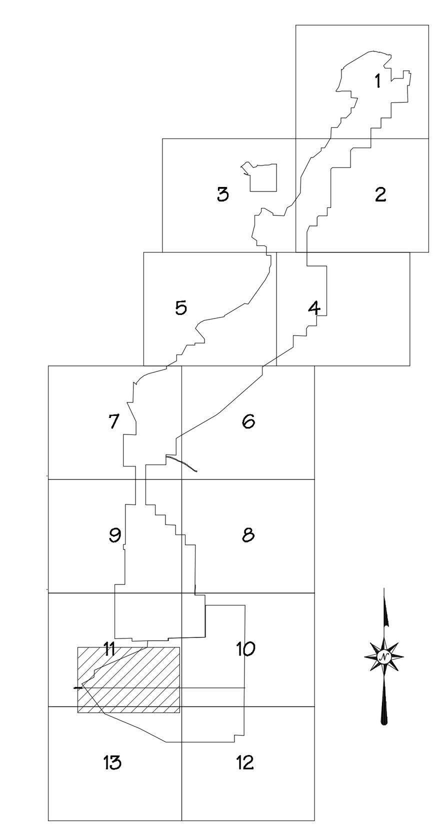
NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-7 of the NM PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5282	0.23	0.0	0.0
5283	0.36	0.3	0.3
5284	0.49	0.4	0.7
5285	0.61	0.6	1.3
5286	0.72	0.7	1.9
5287	0.83	0.8	2.7
5288	0.94	0.9	3.6
5289	1.06	1.0	4.6
5290	1.18	1.1	5.7
5291	1.31	1.2	7.0
5292	1.45	1.4	8.3
5293	1.61	1.5	9.9
5294	1.77	1.7	11.6
5295	1.92	1.8	13.4
5296	2.09	2.0	15.4
5297	2.26	2.2	17.6

Crest of Embankment 5296.0
As-Built Volume at Crest Elevation 15.4



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this impoundment has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of by knowledge.

REVISION		DATE
09-A	UPDATED A4N DEVELOPMENT AND SUBMITTED TO OSM FOR REVIEW	8/28/09
10-A	PREPARED AS-BUILT FOR POND A4N 407 AND SUBMITTED TO OSM FOR REVIEW	2-09-10

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO: NM 9263
SRVYR of RECORD:
REG. NO:

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE

PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

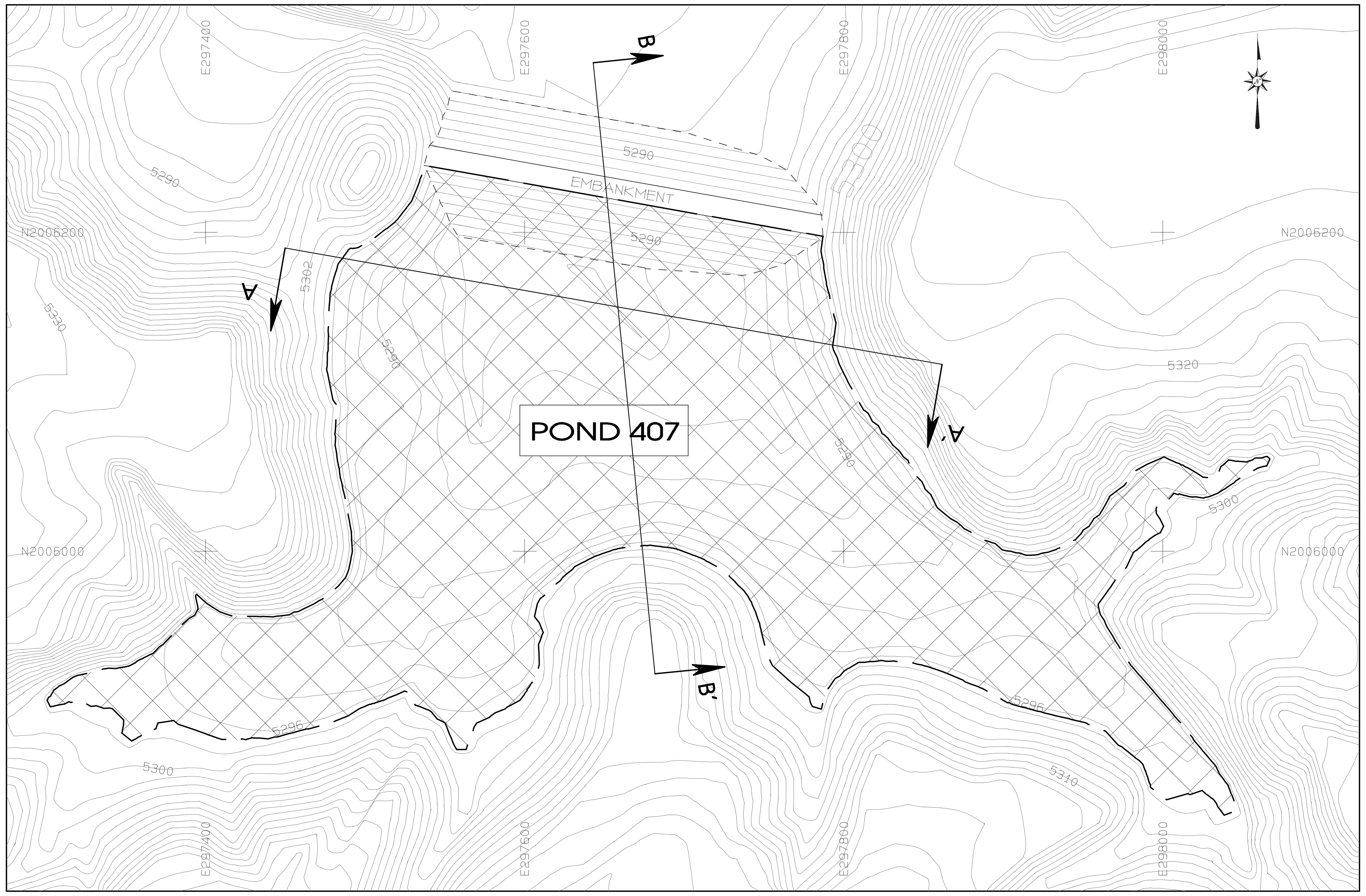
PROJECT: A4N
DATE: AUG. 8, 2009
DESIGNED BY: RCV
DRAWN BY: PJFOSTER
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 26-65
AREA 4 NORTH POND 407 AS-BUILT

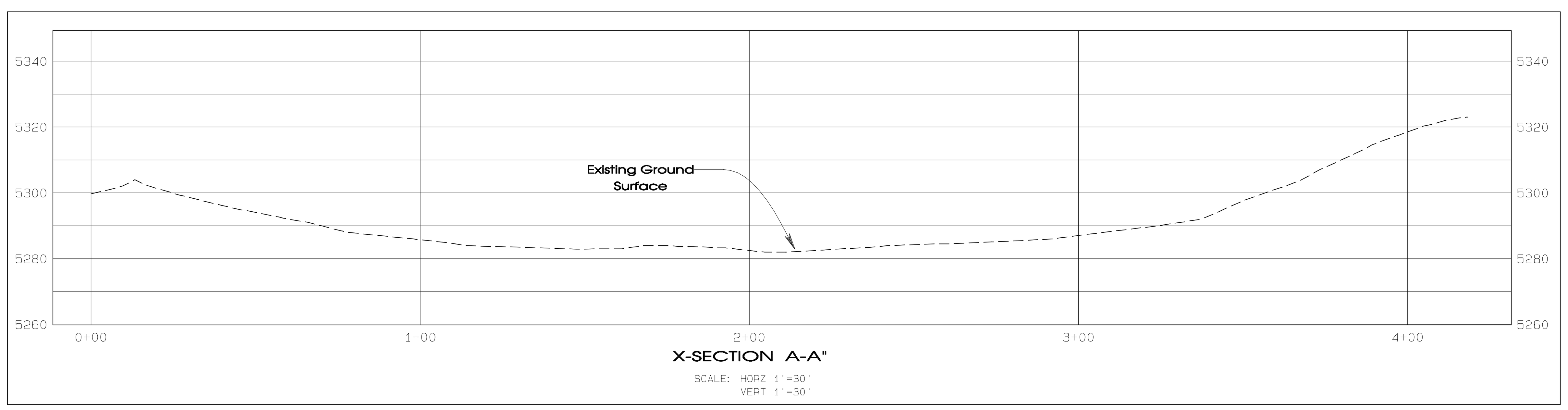
DRAWING

SHEET OF 0



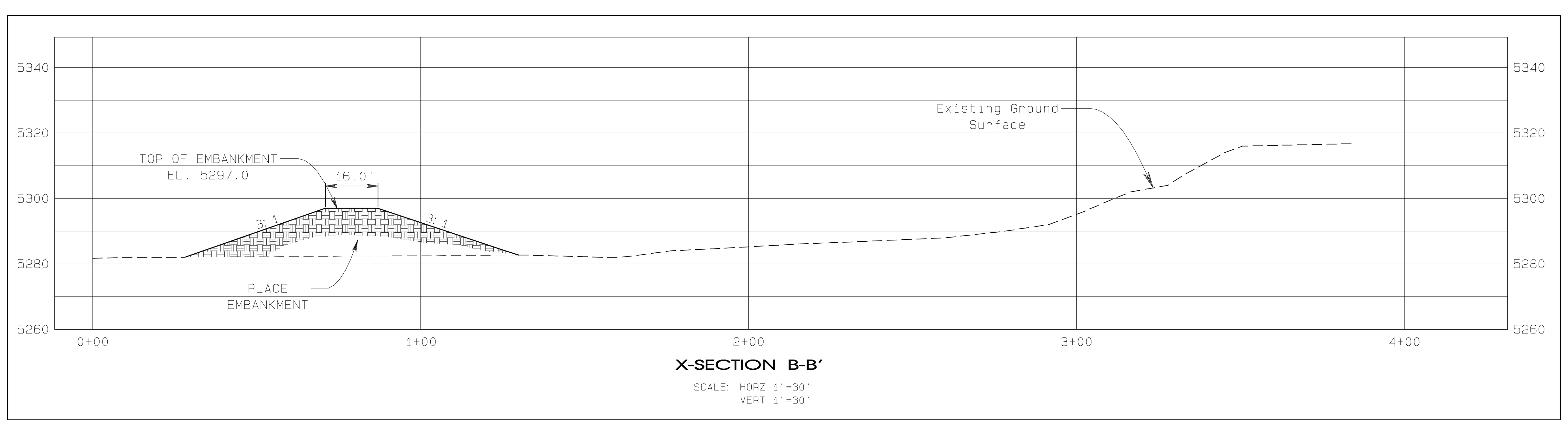
PLAN VIEW

SCALE: 1"=50'



X-SECTION A-A'

SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION B-B'

SCALE: HORZ 1"=30'
VERT 1"=30'

LEGEND

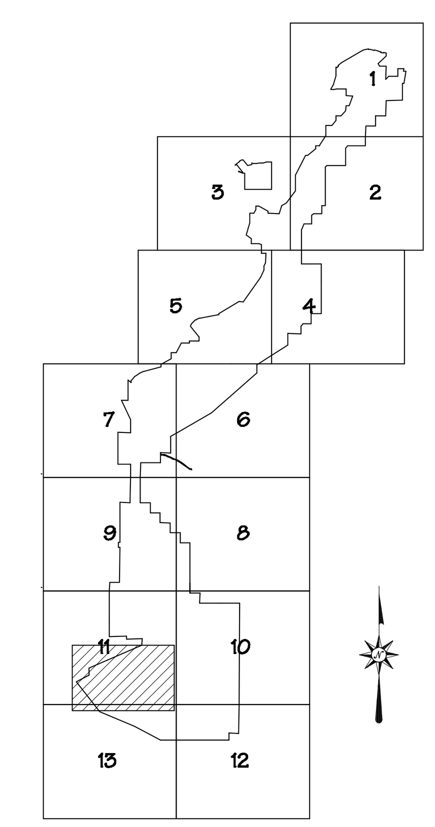
- ROAD
- BUILDING
- FENCE
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5282	0.01	0.00	0.00
5284	0.14	0.10	0.10
5286	0.44	0.60	0.70
5288	0.81	1.20	2.00
5290	1.22	2.00	4.00
5292	1.64	2.90	6.90
5294	2.09	3.70	10.60
5296	2.54	4.60	15.20
5297	2.79	2.70	17.90



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

RON C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

REVISION	DATE
09-A UPDATED 4AN DEVELOPMENT AND SUBMITTED TO OSM FOR REVIEW	8/28/09
11-A AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	FEB-2011

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO: NM 9263
SRVYR of RECORD:
REG. NO:

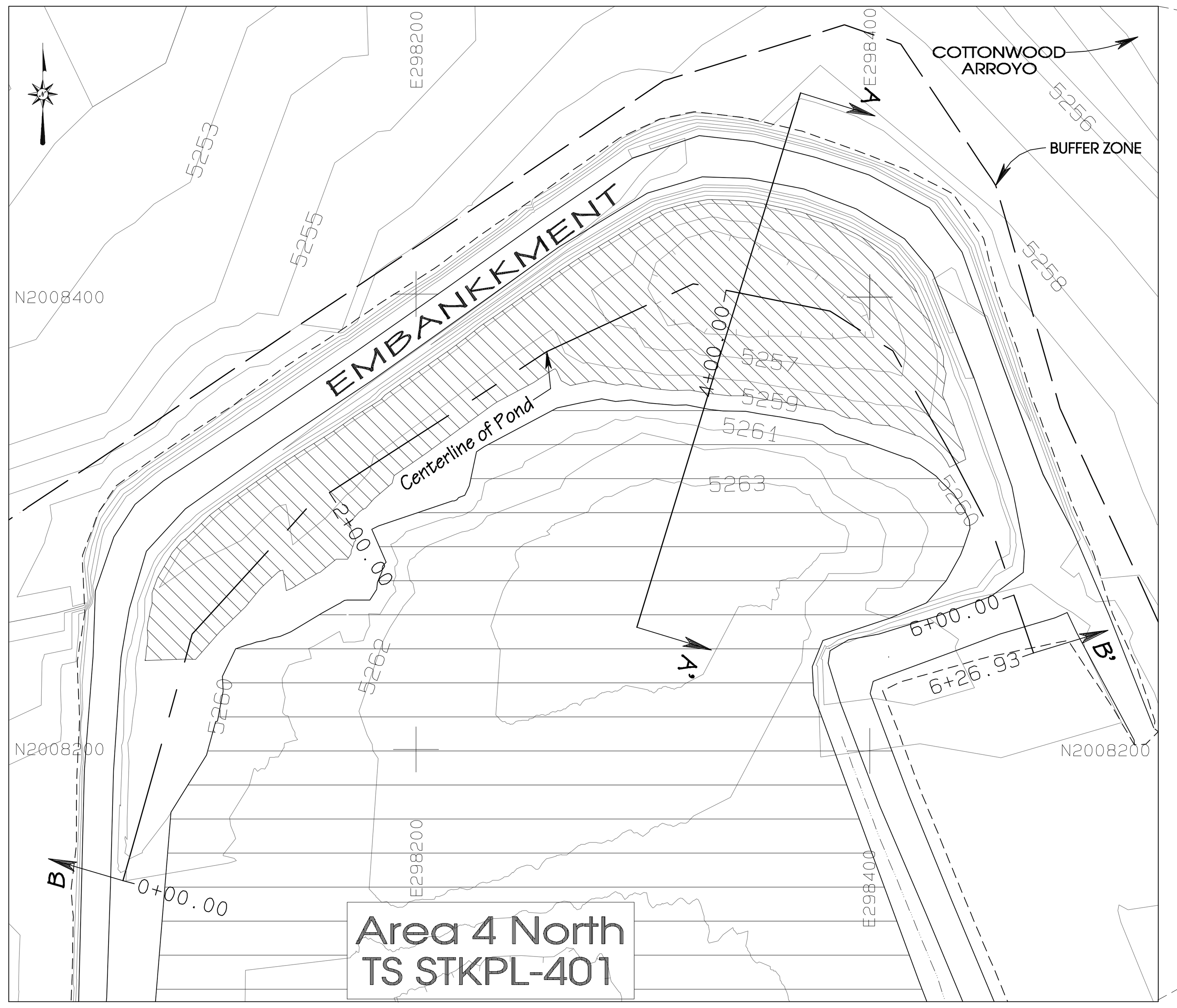
bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

PROJECT: 4AN
DATE: AUG.8,2009
DESIGNED BY: RCV
DRAWN BY: PJFOSTER
CHECKED BY: RCV
APPROVED BY: RCV

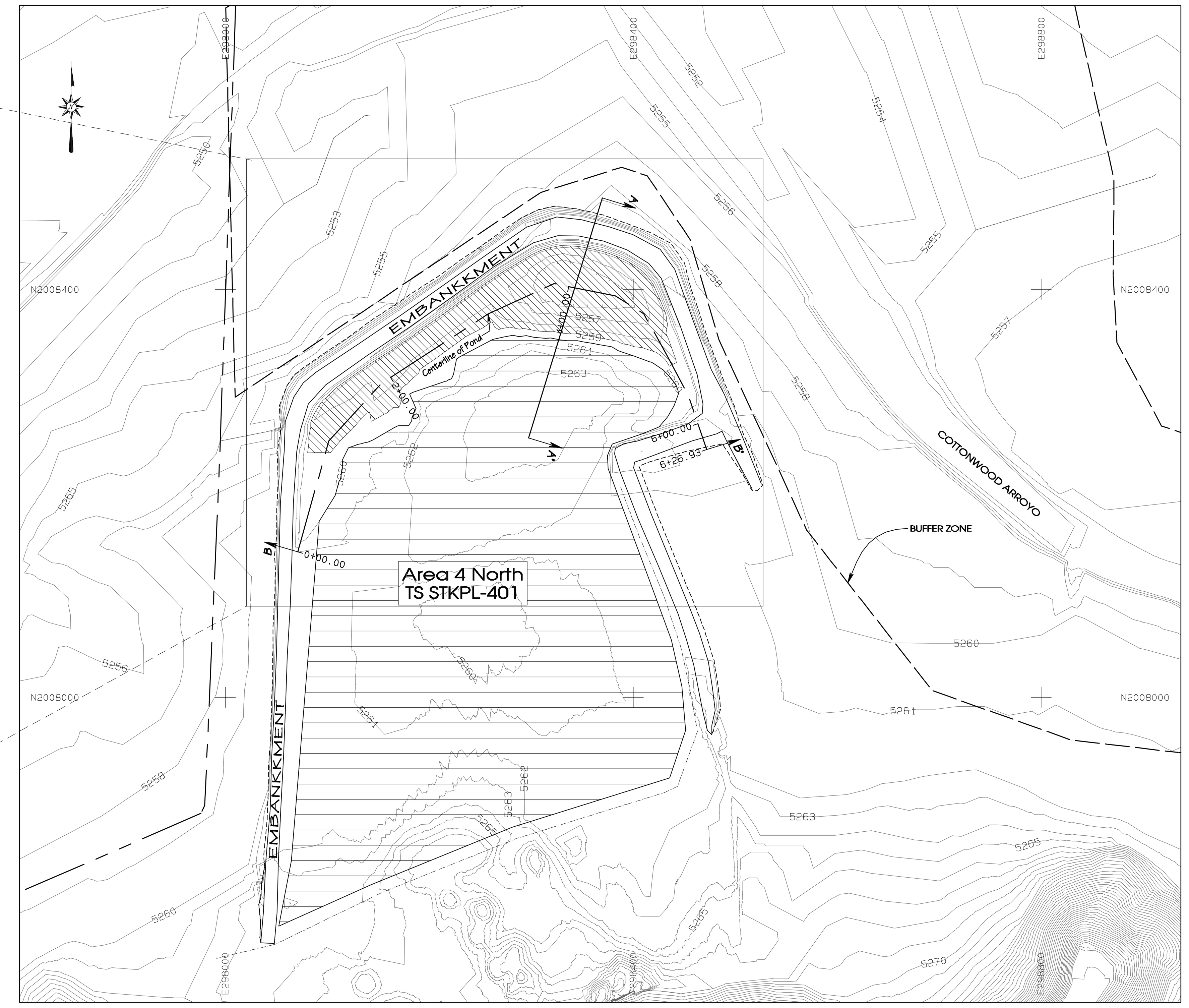
PLAN, PROFILE AND SECTION

EXHIBIT 26-65
AREA 4 NORTH POND 407 Design

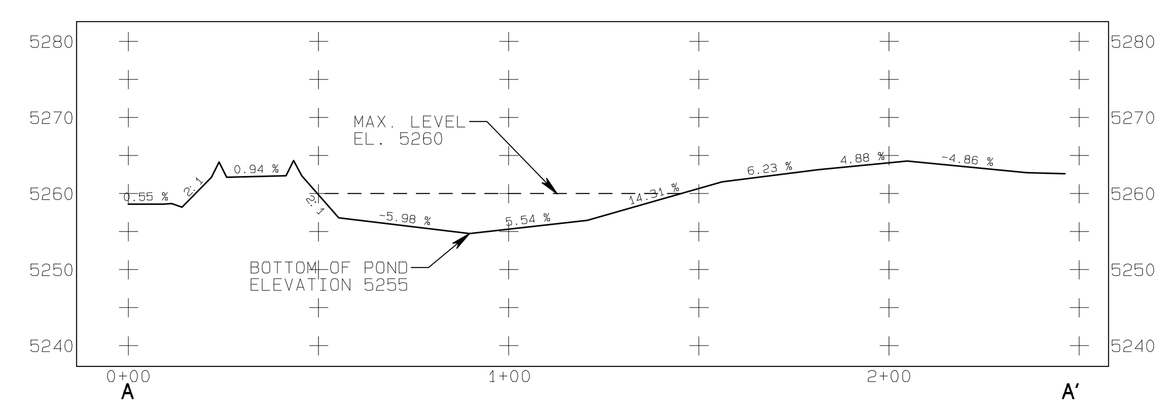
DRAWING
SHEET OF 0



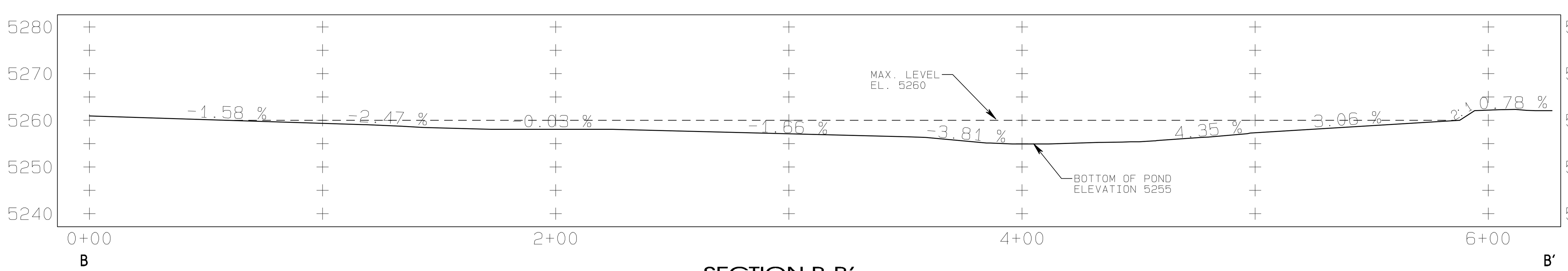
PLAN VIEW
CONTOUR INT: 1 FT
SCALE: 1"=50'



PLAN VIEW
SCALE: 1"=100'



SECTION A-A'
SCALE: HORIZ 1"=40'
VERT 1"=20'



SECTION B-B'
SCALE: HORIZ 1"=40'
VERT 1"=20'

LEGEND

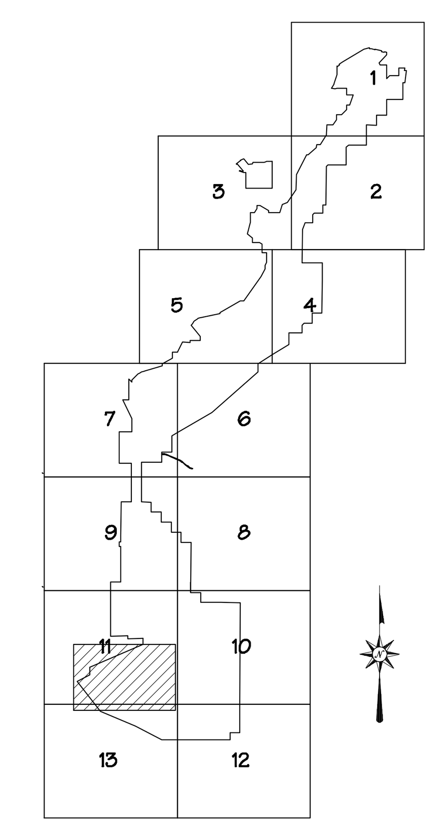
- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5254.8	0.00	0.0	0.0
5255	0.005	0.0	0.0
5256	0.073	0.0	0.0
5257	0.195	0.1	0.2
5258	0.342	0.3	0.4
5259	0.540	0.4	0.9
5260	0.712	0.5	1.5



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this Impoundment has been constructed in accordance with the Approved Design Plans except:
* Pond bottom at El. 5255 (Design was El. 5254).
* Embankment to El. 5261 (Design was El. 5259).
* Storage capacity 1.5 Ac-Ft.(Design was 0.5 Ac-Ft).

REVISION		DATE
1	SUBMITTED TO OSM FOR APPROVAL	8-28-09
2	PREPARED AS-BUILT AND SUBMITTED TO OSM FOR REVIEW (NOT SUBMITTED)	12-02-09
11-A	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	1-26-2011

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO. 9293
SRVYR of RECORD:
REG. NO.

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

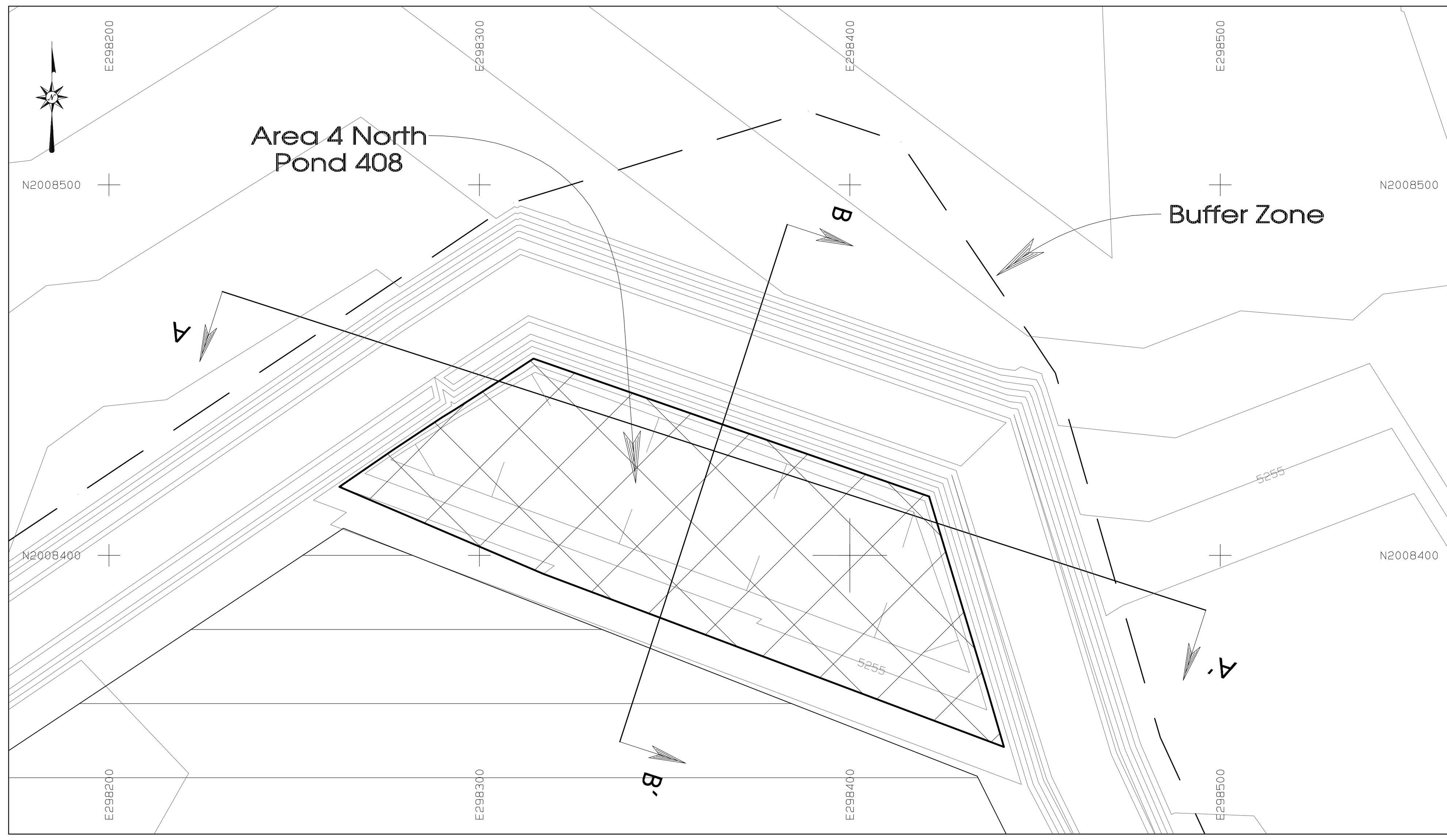
ACCOUNT:
DATE: Dec 02, 2009
DESIGNED BY: RY
DRAWN BY: PJF
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

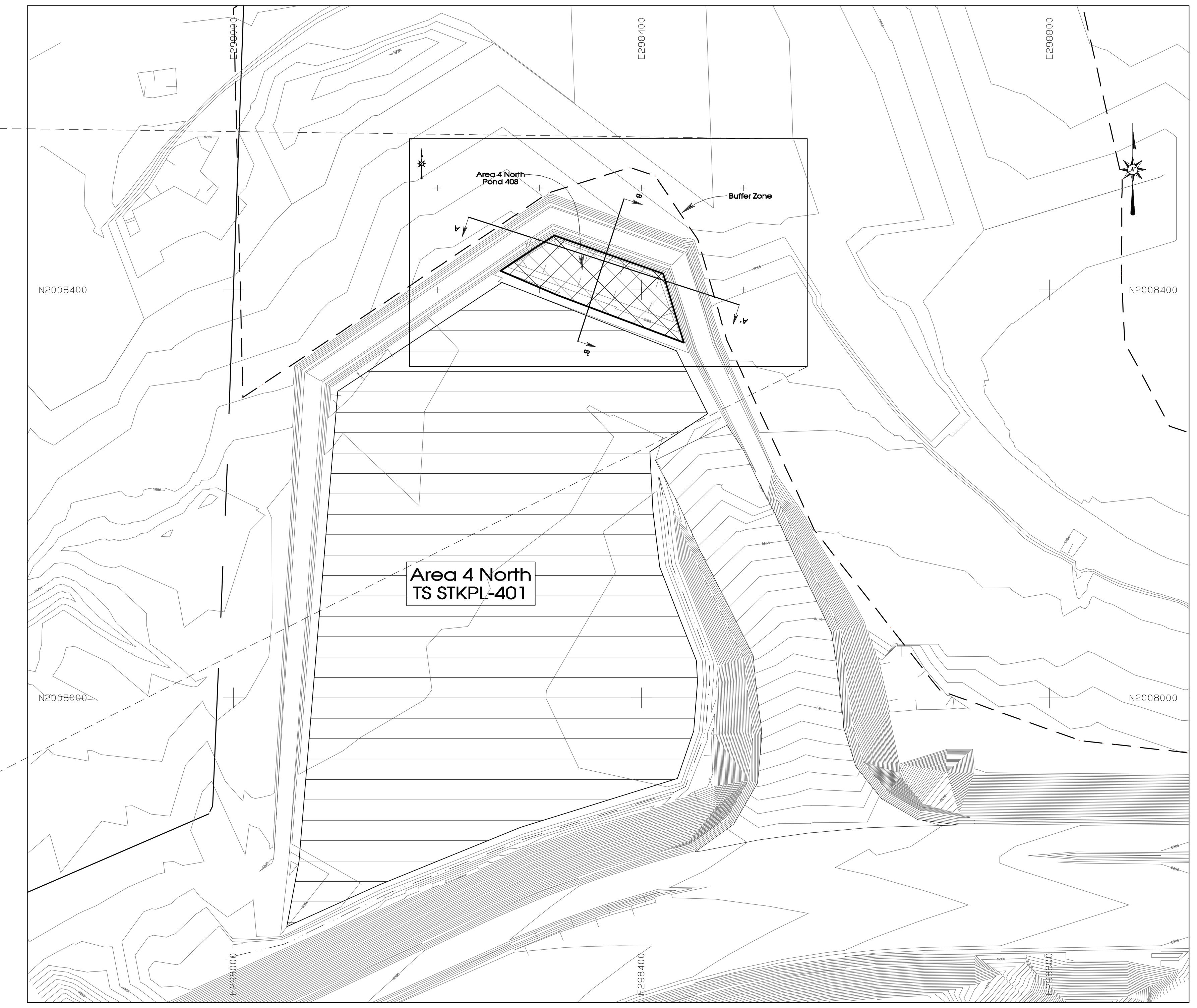
EXHIBIT 26-66
Area 4 North Pond 408 As-Built

DRAWING

SHEET 1 OF 1



PLAN VIEW
CONTOUR INT: 1 FT
SCALE: 1"=30'



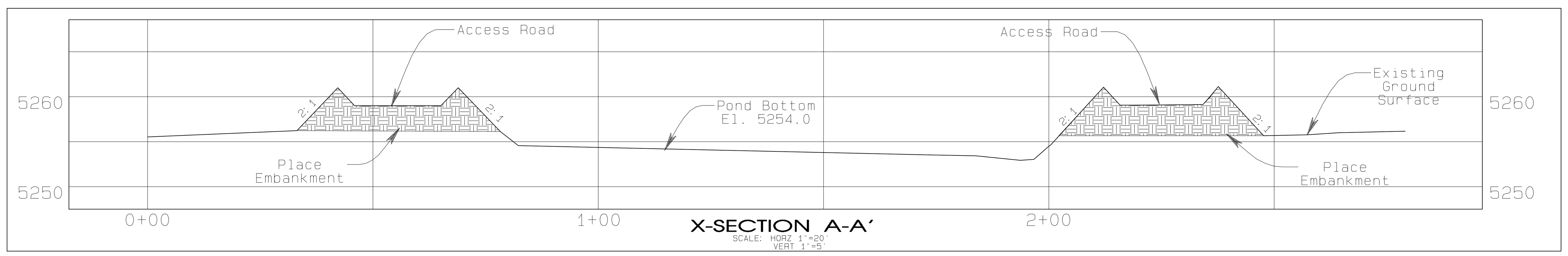
PLAN VIEW
SCALE: 1"=100'

LEGEND

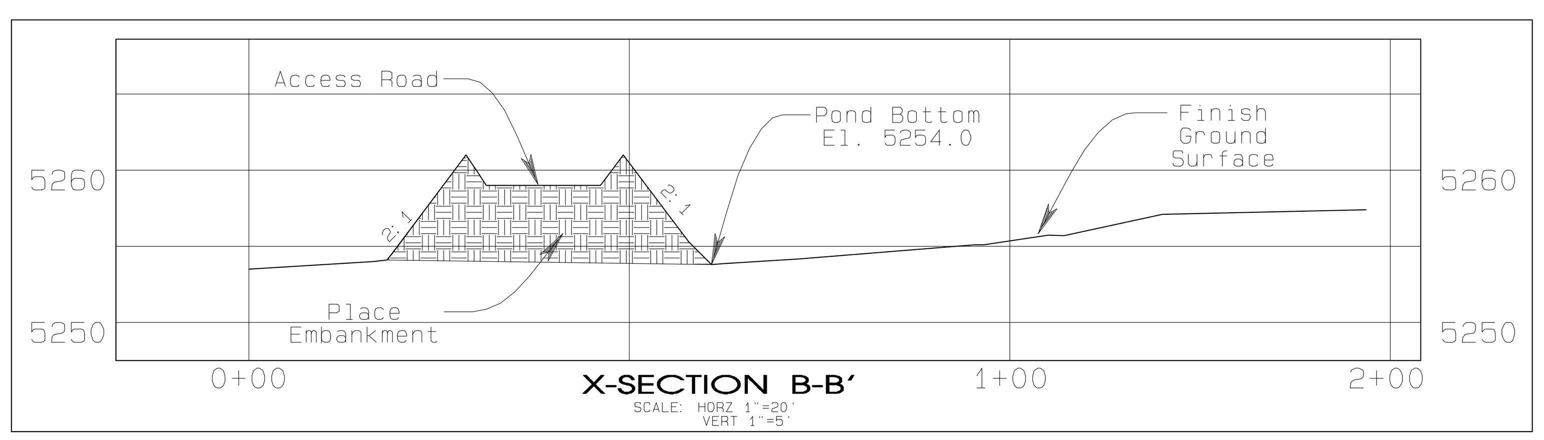
	ROAD
	WATERSHED
	BUILDING
	FENCE
	IRRIGATION LINE
	CULVERT
	DAM
	DRAINAGE
	RAILROAD
	TREES
	POWERLINE
×5338.5	SPOT ELEVATION
5300	INDEX CONTOUR
5298	INTERMEDIATE CONTOUR
218 5422.45 L-30	LEASE CORNER
	PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.



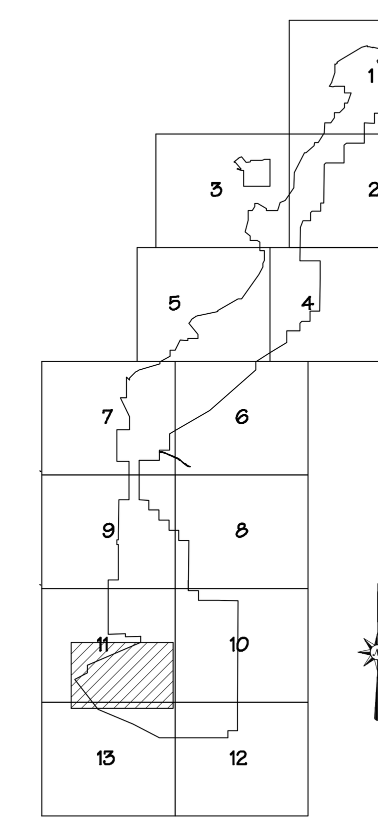
X-SECTION A-A'
SCALE: HORZ 1"=20 VERT 1"=5



X-SECTION B-B'
SCALE: HORZ 1"=20 VERT 1"=5

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5254	0.11	0.00	0.00
5255	0.15	0.10	0.10
5256	0.19	0.20	0.30
5257	0.24	0.20	0.50



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

Ron C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

REVISION		DATE
1	SUBMITTED TO OSM FOR APPROVAL	8-28-09
11-A	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	FEB-2011

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO. 9293
SRVYR of RECORD:
REG. NO.

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3200/FAX 505-598-3361

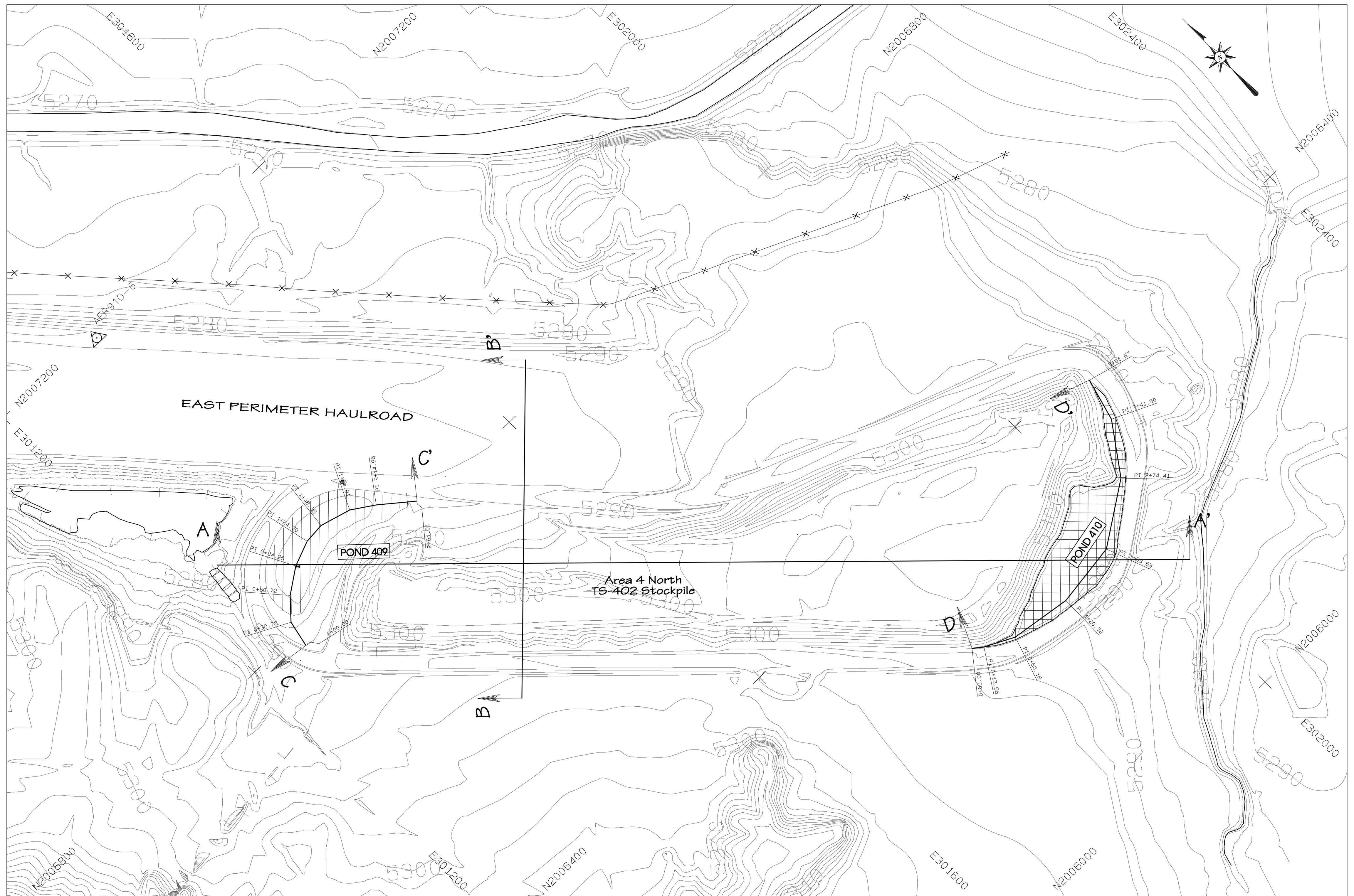
ACCOUNT:
DATE: AUG.23,2009
DESIGNED BY: RY
DRAWN BY: PJF
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 26-67
Area 4 North Pond 408 Design

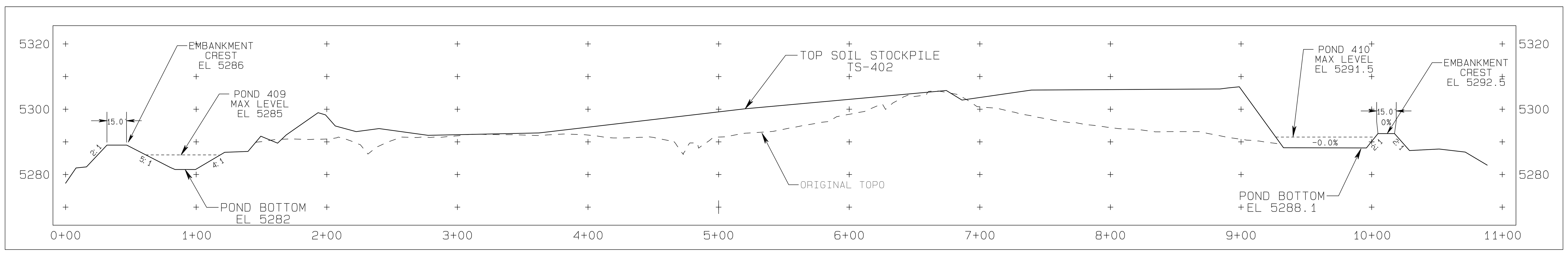
DRAWING
SHEET
OF

Path: G:\Gs\Permit F\Ch 11\Exh 11-15B_A4N Pd 408\OSM Subm-12011\Exh 11-15B_Pond-408_Design.pro Plot Date/Time: Tue Feb 8,2011 / 8:24:12



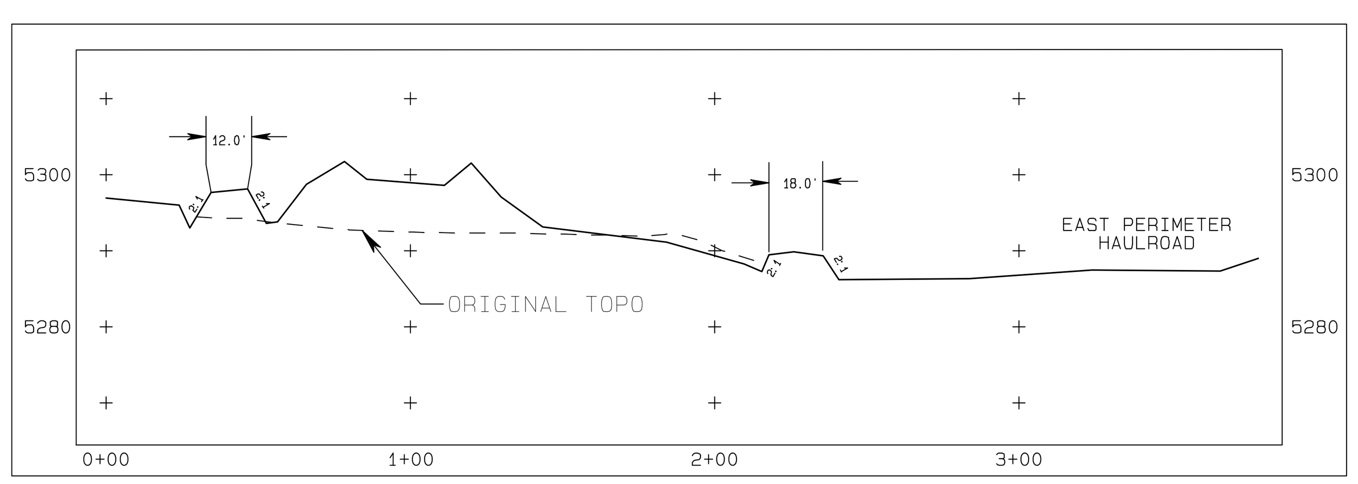
PLAN VIEW

SCALE 1"=100'
CONTOUR INTERVAL: 2 FT.



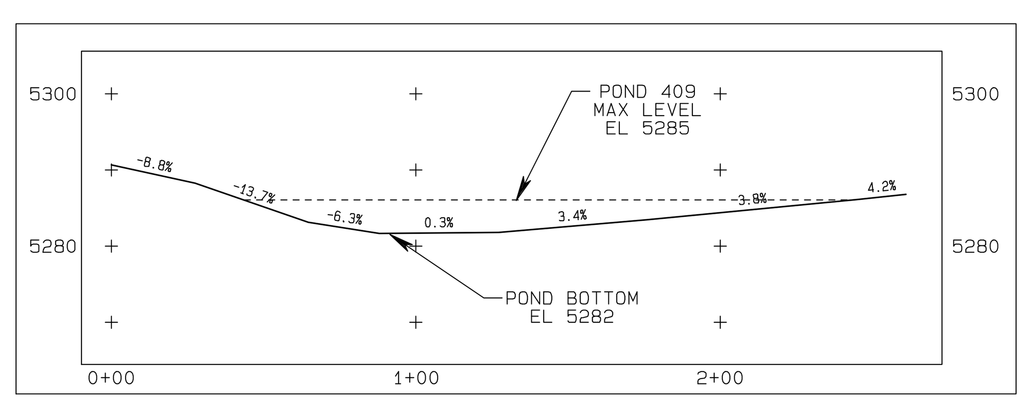
SECTION A-A'

SCALE HORIZ 1"=50'
VERT 1"=20



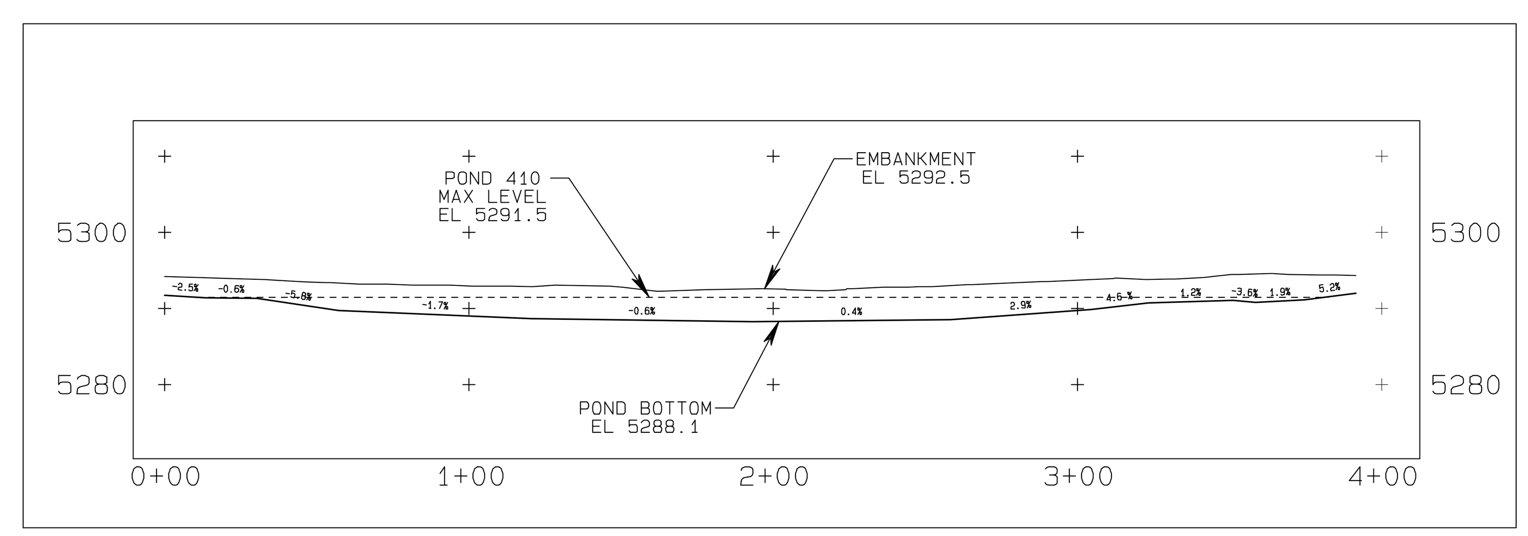
SECTION B-B'

SCALE HORIZ 1"=50'
VERT 1"=20



SECTION C-C'

SCALE HORIZ 1"=50'
VERT 1"=20



SECTION D-D'

SCALE HORIZ 1"=50'
VERT 1"=20

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 the NM PAP.

STAGE STORAGE DATA
A4 NORTH POND-409

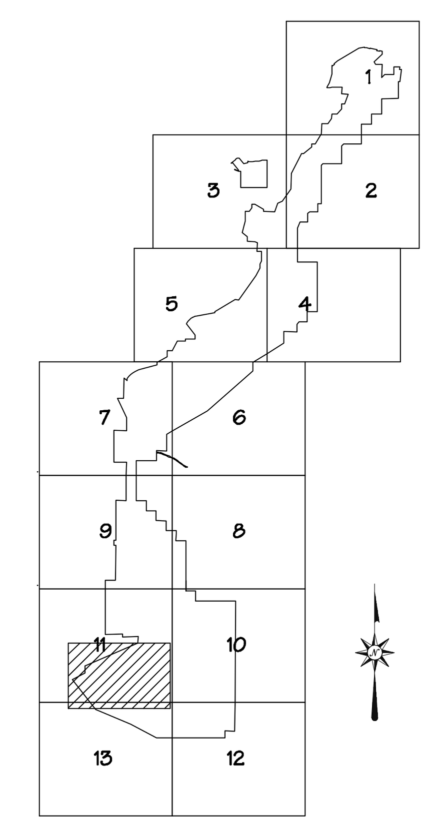
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5282	0.02	0.0	0.01
5283	0.06	0.0	0.05
5284	0.10	0.1	0.13
5285	0.15	0.1	0.26
5286	0.22	0.2	0.44

Crest Elevation 5286.0
Capacity @ Crest El.(Ac-Ft.) 0.44
Max. Water Elevation 5285.0
Capacity @ Max.Water Level(Ac-Ft.) 0.26

STAGE STORAGE DATA
A4 NORTH POND-410

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5288.1	0.00	0.0	0.00
5289	0.12	0.1	0.05
5290	0.21	0.2	0.21
5291	0.25	0.2	0.44
5292	0.29	0.3	0.71
5293	0.33	0.3	1.02

Crest Elevation 5292.5
Capacity @ Crest El.(Ac-Ft.) 0.9
Max. Water Elevation 5291.5
Capacity @ Max.Water Level(Ac-Ft.) 0.6



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this Impoundment has been constructed in accordance with the Approved Design Plans except:
* Pond 409 capacity 0.44 Ac-Ft(Design was 0.2 Ac-Ft)
* Pond 410 capacity 0.9 Ac-Ft(Design was 0.4 Ac-Ft)

Ron C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

	REVISION	DATE
1	SUBMITTED TO OSM FOR APPROVAL	12/12/04
2	SUBMITTED TO OSM FOR APPROVAL	08/31/09
3	PREPARED AS-BUILT SUBMITTED TO OSM FOR REVIEW	12/03/09
4	UPDATED AS-BUILT SUBMITTED TO OSM FOR REVIEW	8-11-10
5	UPDATED AS-BUILT FOR A4N POND 410, SUBMITTED TO OSM FOR REVIEW (NOT SUBMITTED)	11-02-10
11-4	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	1-26-2011

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

ACCOUNT:
DATE: Dec.03,2009
DESIGNED BY: RY
DRAWN BY: PJFoster
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 26-68
Area 4 North
Pond 409 AND 410
As-Built

DRAWING

SHEET 1
OF 1

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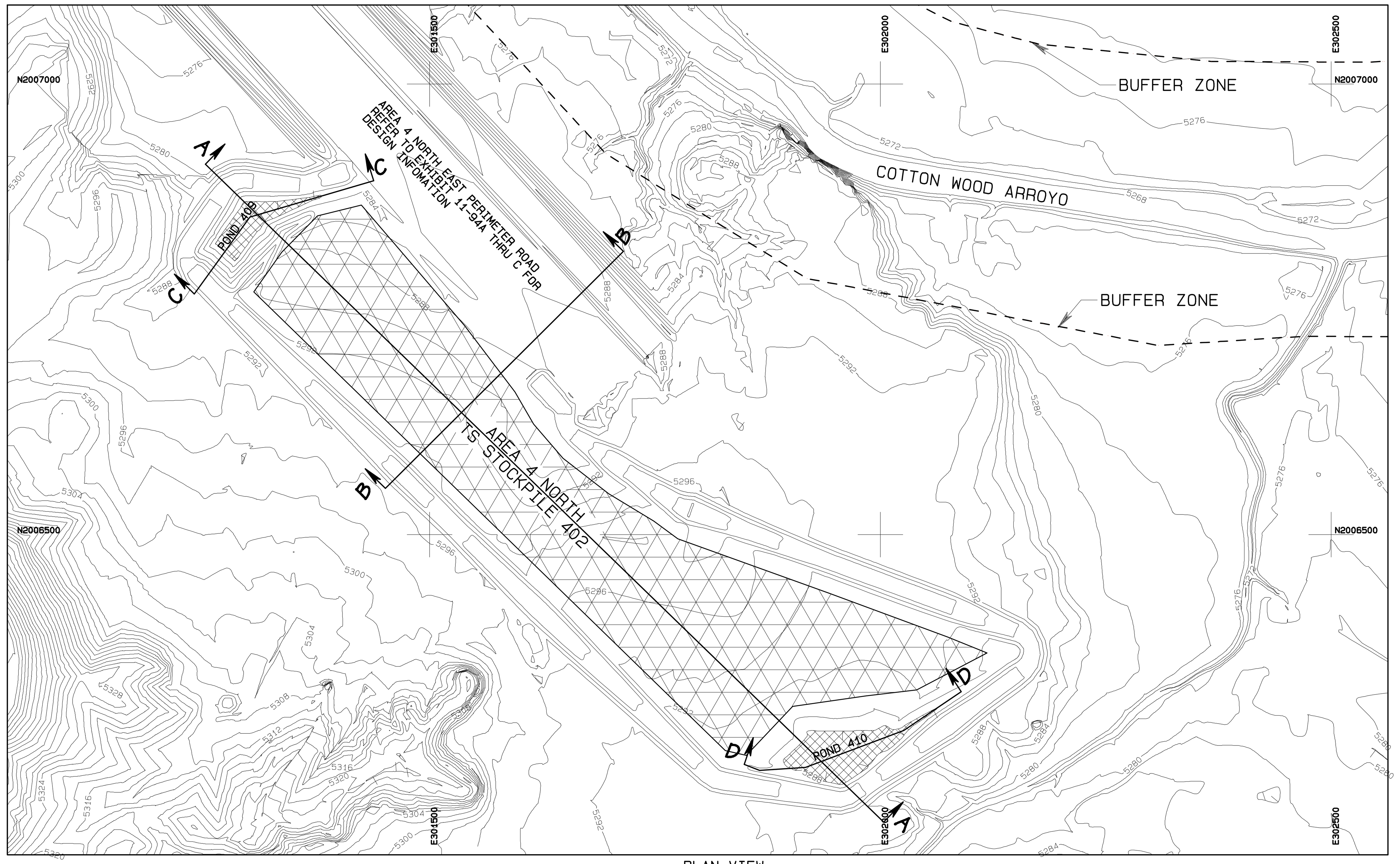
Wed Jan 26 12:51:44 2011

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

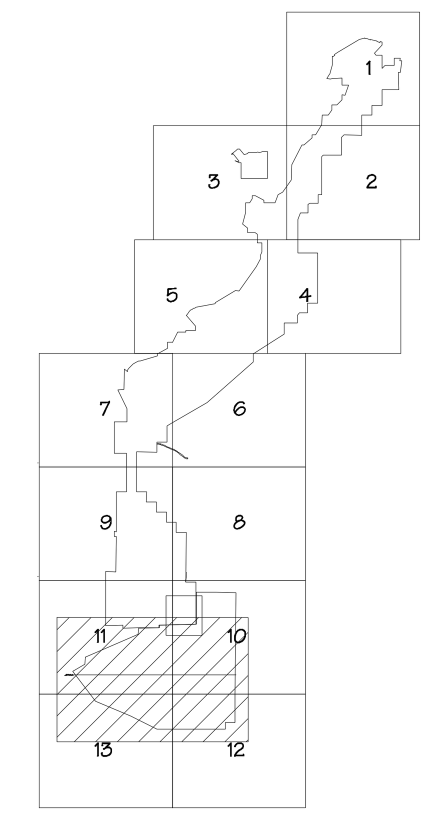


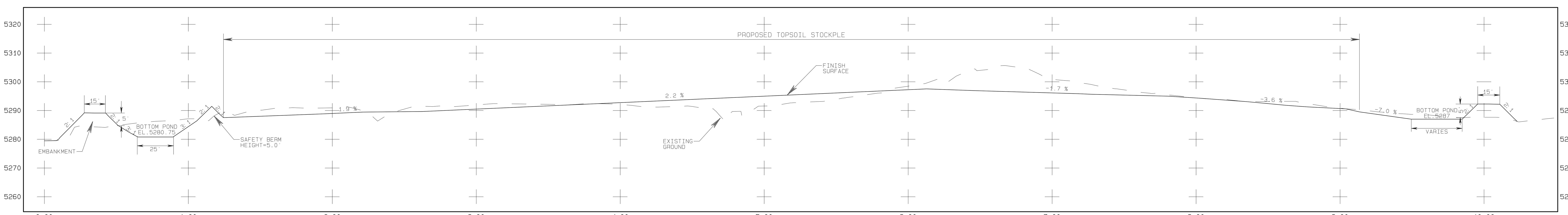
PLAN VIEW
1"=100'

N W E S

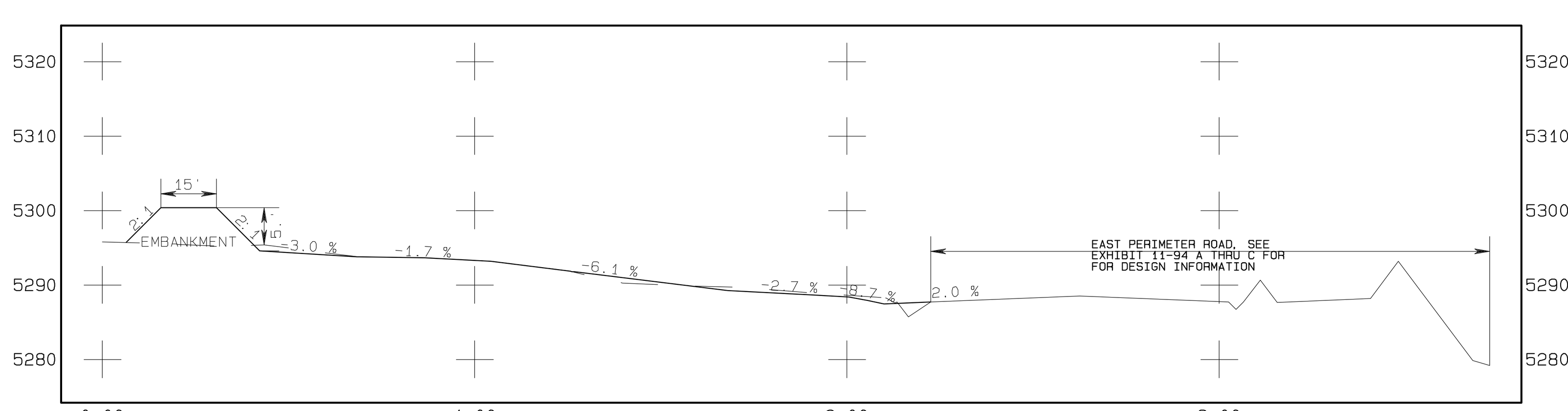
NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 the NM PAP.

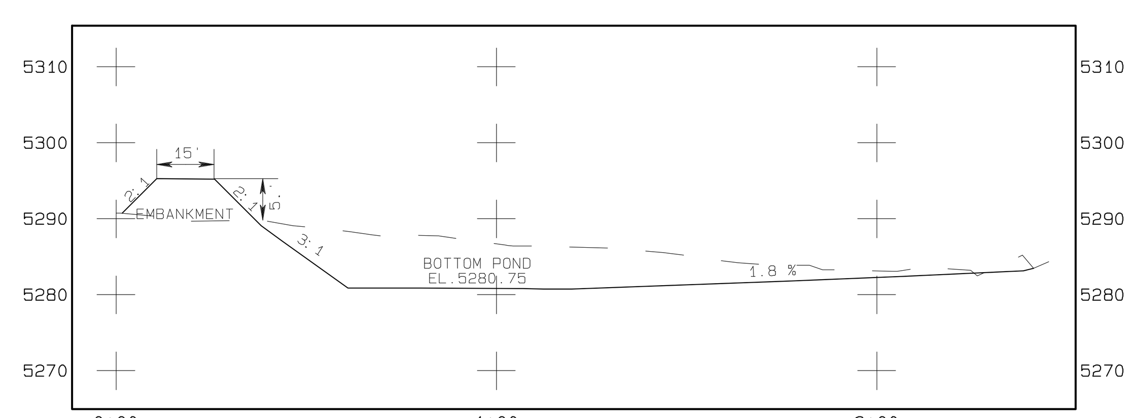




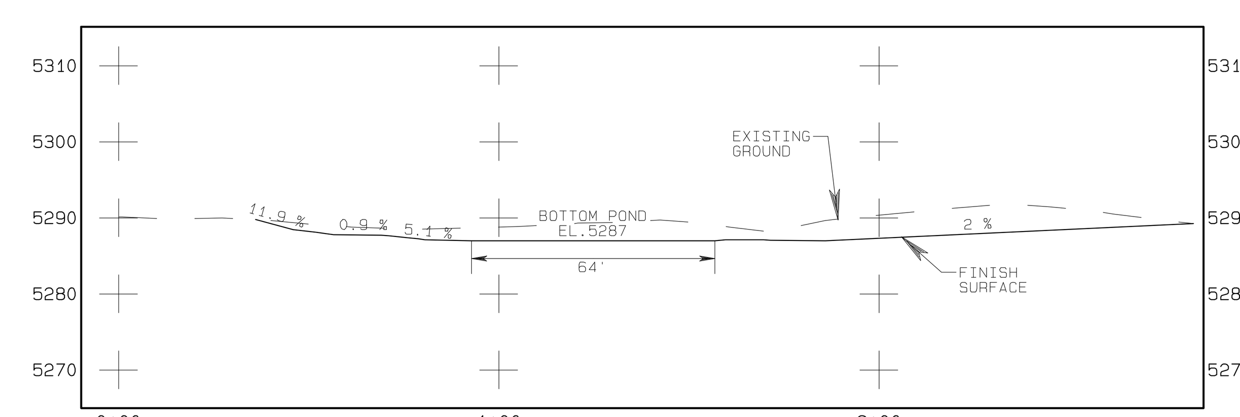
Profile A - A



Section B - B



Profile C - C



Profile D - D

Above Cross Section and Profiles
SCALE : Horizontal 1"=40'
Vertical 1"=20

SCALE AS NOTED

STAGE STORAGE DATA FOR POND 409

ELEV	AREA	VOLUME	CUM. VOLUME
feet	acres	ac-ft	ac-ft
5280.75	0.0	0.0	0.00
5281	0.04	0.0	0.0
5282	0.06	0.1	0.5
5283	0.08	0.1	0.13
5284	0.13	0.1	0.23

STAGE STORAGE DATA FOR POND 410

ELEV	AREA	VOLUME	CUM. VOLUME
feet	acres	ac-ft	ac-ft
5287	0.0	0.0	0.00
5288	0.12	0.1	0.1
5289	0.17	0.1	0.2
5290	0.26	0.2	0.4

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

REVISION	DATE
1 SUBMITTED TO OSM FOR APPROVAL	08/28/09
2	
3	
4	
5	

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO. 9263
SRVYR of RECORD:
REG. NO.

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

ACCOUNT:
DATE: AUGUST 28, 2009
DESIGNED BY: RCV
DRAWN BY: RY
CHECKED BY: RCV
APPROVED BY: RCV

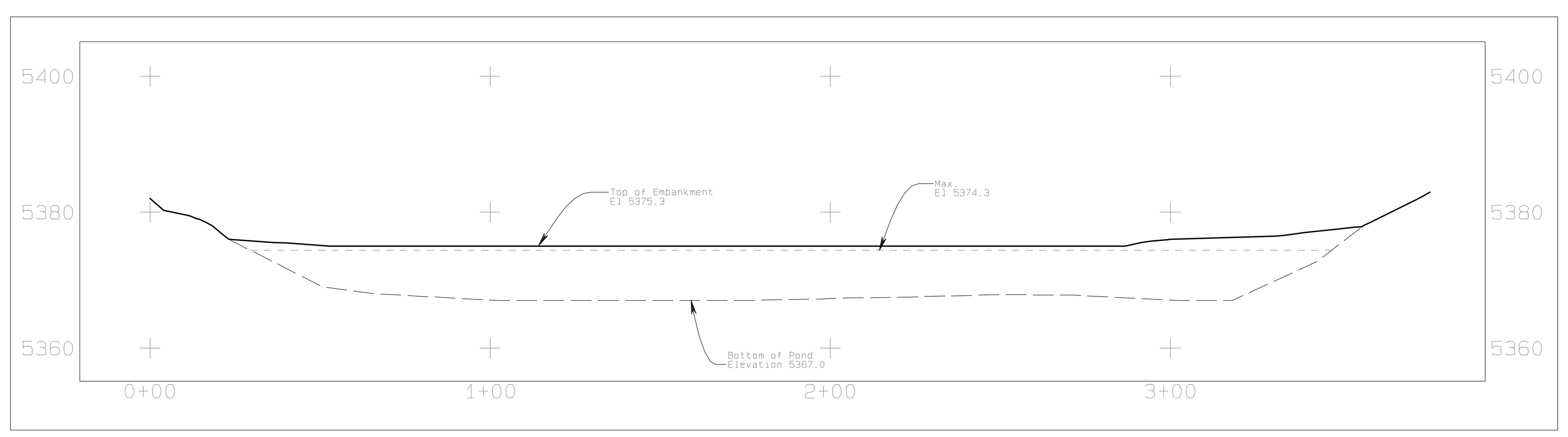
PLAN, PROFILE AND SECTIONS

EXHIBIT 26-69
AREA 4 NORTH
POND 409 AND 410
Design

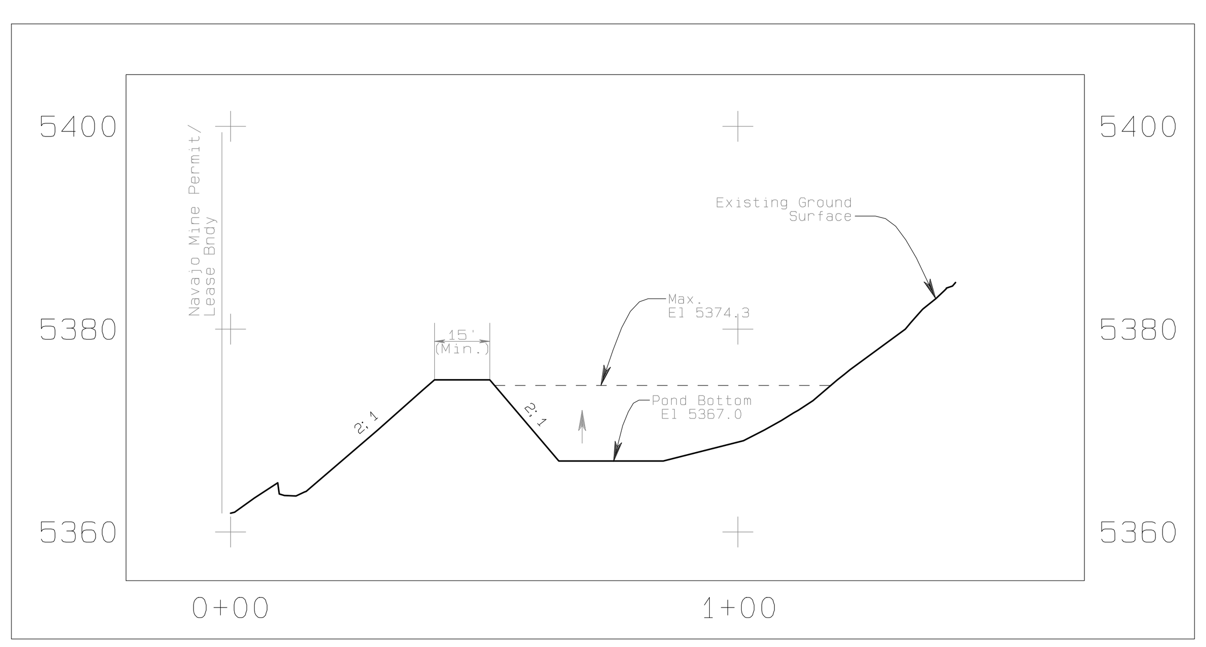
DRAWING
SHEET 1 OF 1

Project Desc.: Path: G:\Gs\Permit F\Ch 11\Exh 11-159_A4N Pds 409-410\Design Data\A4N POND 409 AND 410_Design.pro Plot Date/Time: Tue Aug 9, 2011 / 9:32:26

PLAN VIEW
1"=40'



CROSS SECTION A - A'
SCALE - H - 1"=40'
V - 1"=20'



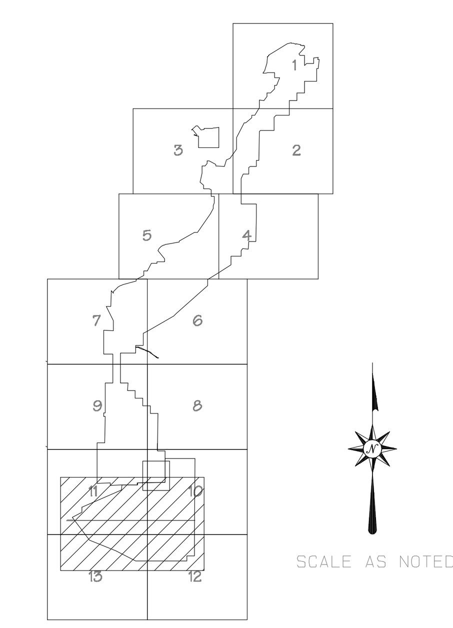
CROSS SECTION B - B'
SCALE - H - 1"=30'
V - 1"=15'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
1. Refer to Exhibit 11-13F for watershed information and location of ponds.



SCALE AS NOTED

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5367	0.05	0.0	0.00
5368	0.13	0.1	0.09
5369	0.18	0.2	0.25
5370	0.21	0.2	0.44
5371	0.25	0.2	0.67
5372	0.28	0.3	0.93
5373	0.32	0.3	1.23
5374	0.35	0.3	1.57
5375	0.39	0.4	1.94
5376	0.43	0.4	2.35

Pond Crest/Spillway Elevation 5375.3
As-Built Volume @ Crest (Ac-Ft) 2.1
Design Max. Water Elevation 5374.3
Capicity @ Max. Water Elevation 1.7
Required Volume (100 yr.6 hr.) (Ac-Ft) 1.2

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this structure has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge, except as noted below:

1. Only minor elevation differences for pond bottom and embankment crest.

REVISION	DATE
1 PREPARED FOR SUBMITTAL TO OSM.	1-28-10
2 PREPARED AS-BUILT FOR A4N POND-411 AND SUBMITTED TO OSM FOR REVIEW	7-28-10
3	
4	

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9863
SRVYR of RECORD:
REG. NO:

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO 87416 PHONE 505-598-3200/FAX 505-598-3361

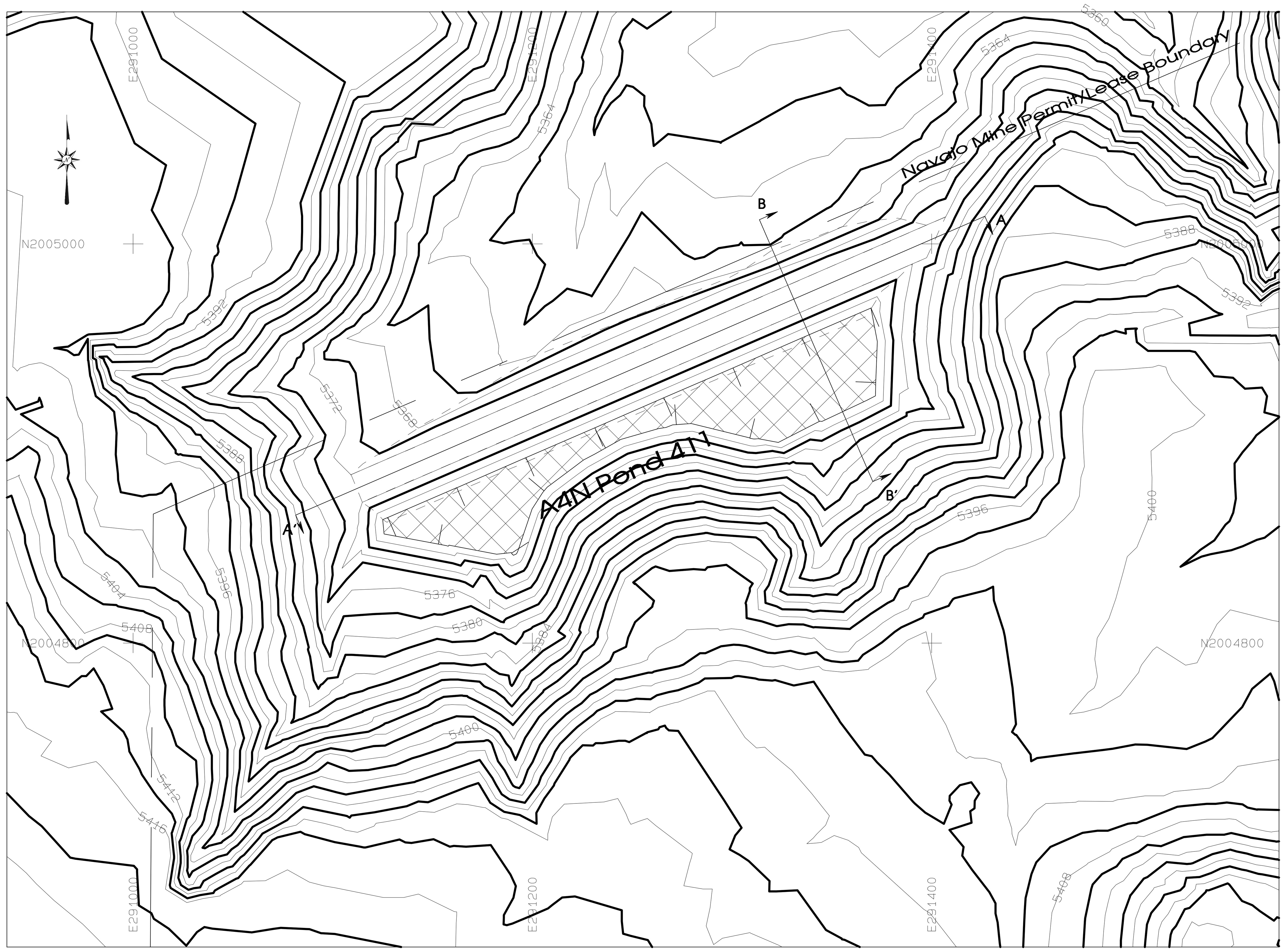
ACCOUNT:
DATE: AUGUST 31, 2009
DESIGNED BY: REV
DRAWN BY: RV
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTIONS

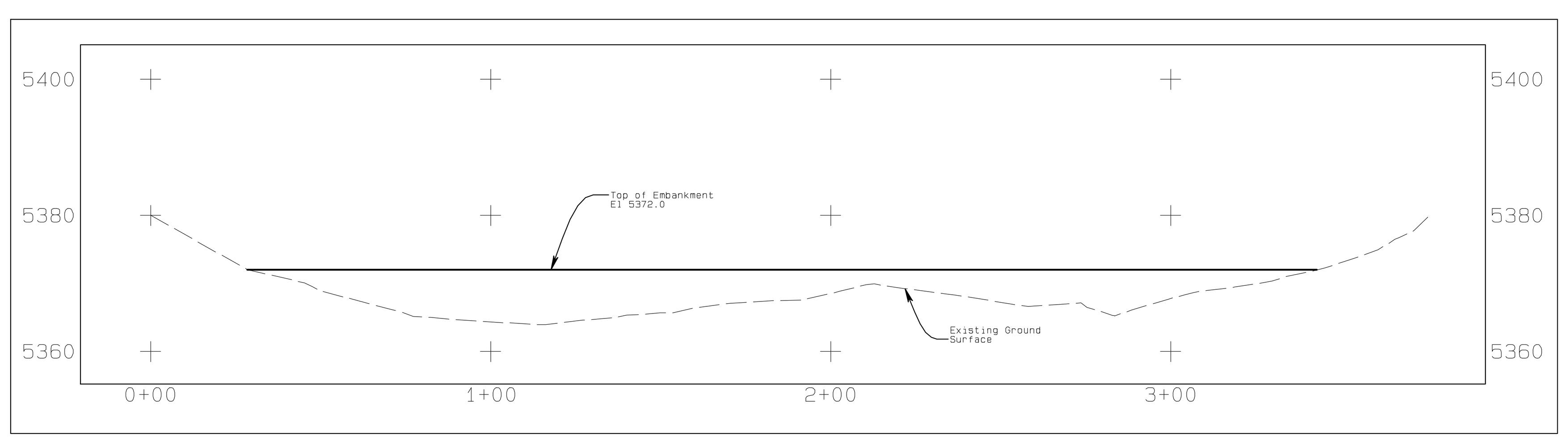
EXHIBIT 26-70
AREA 4 NORTH
POND 411
As-Built

DRAWING
SHEET 1 OF 1

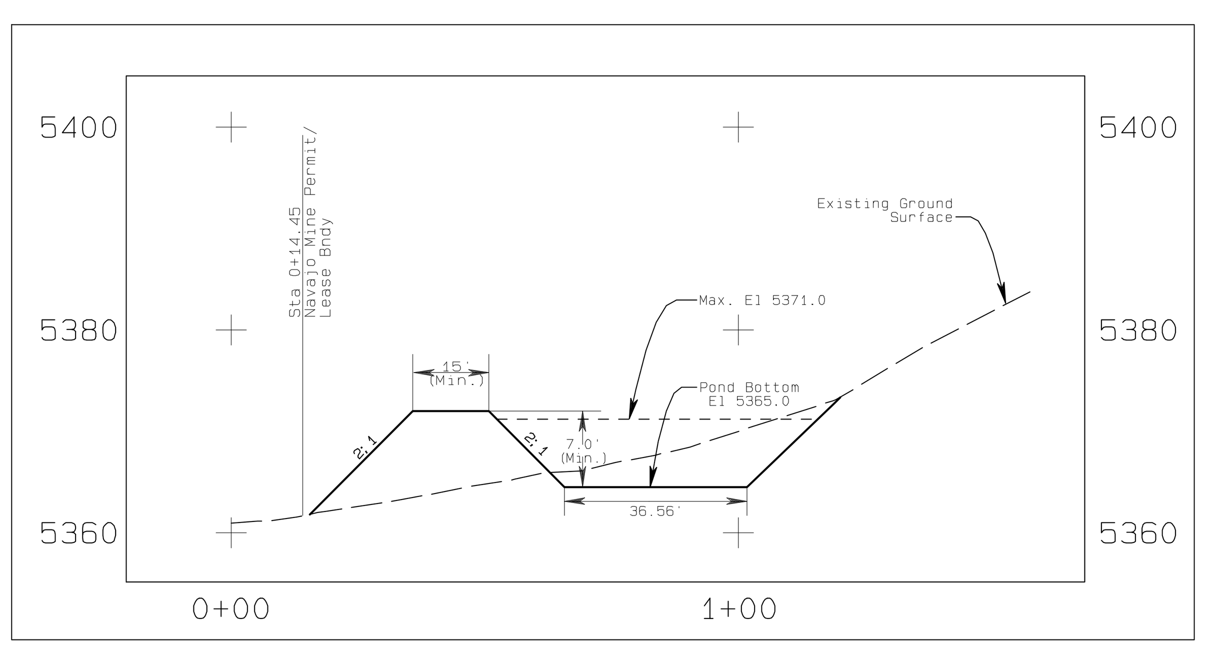
G:\GIS\Permit F\Ch 11\Exhibit 11-161\As-Built Data\Exh 11-161_A4N Pond-411_As-Built.pro
Mon Aug 9,2010 / 7:20:47



PLAN VIEW
1"=40'



CROSS SECTION A - A'
SCALE - H - 1"=40'
V - 1"=20'



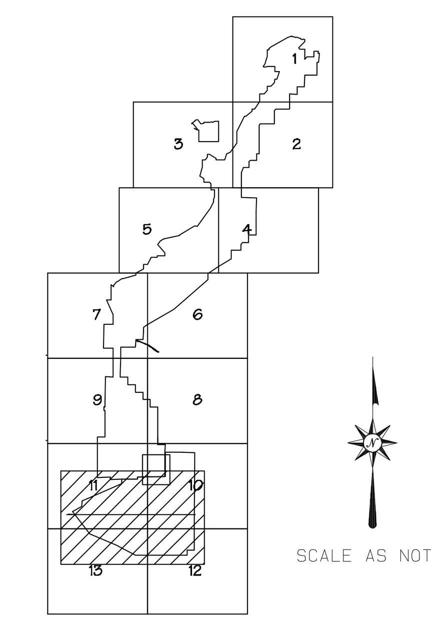
CROSS SECTION B - B'
SCALE - H - 1"=30'
V - 1"=15'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
1. Refer to Exhibit 11-13F for watershed information and location of ponds.



STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5365	0.13	0.0	0.0
5366	0.162	0.1	0.1
5368	0.217	0.4	0.5
5370	0.276	1.5	1.0
5372	0.344	0.6	1.6

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

Ron C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

REVISION	DATE
1 PREPARED FOR SUBMITTAL TO OSM.	1-28-10
2	
3	
4	
5	

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416, PHONE 505-598-3209/FAX 505-598-3361

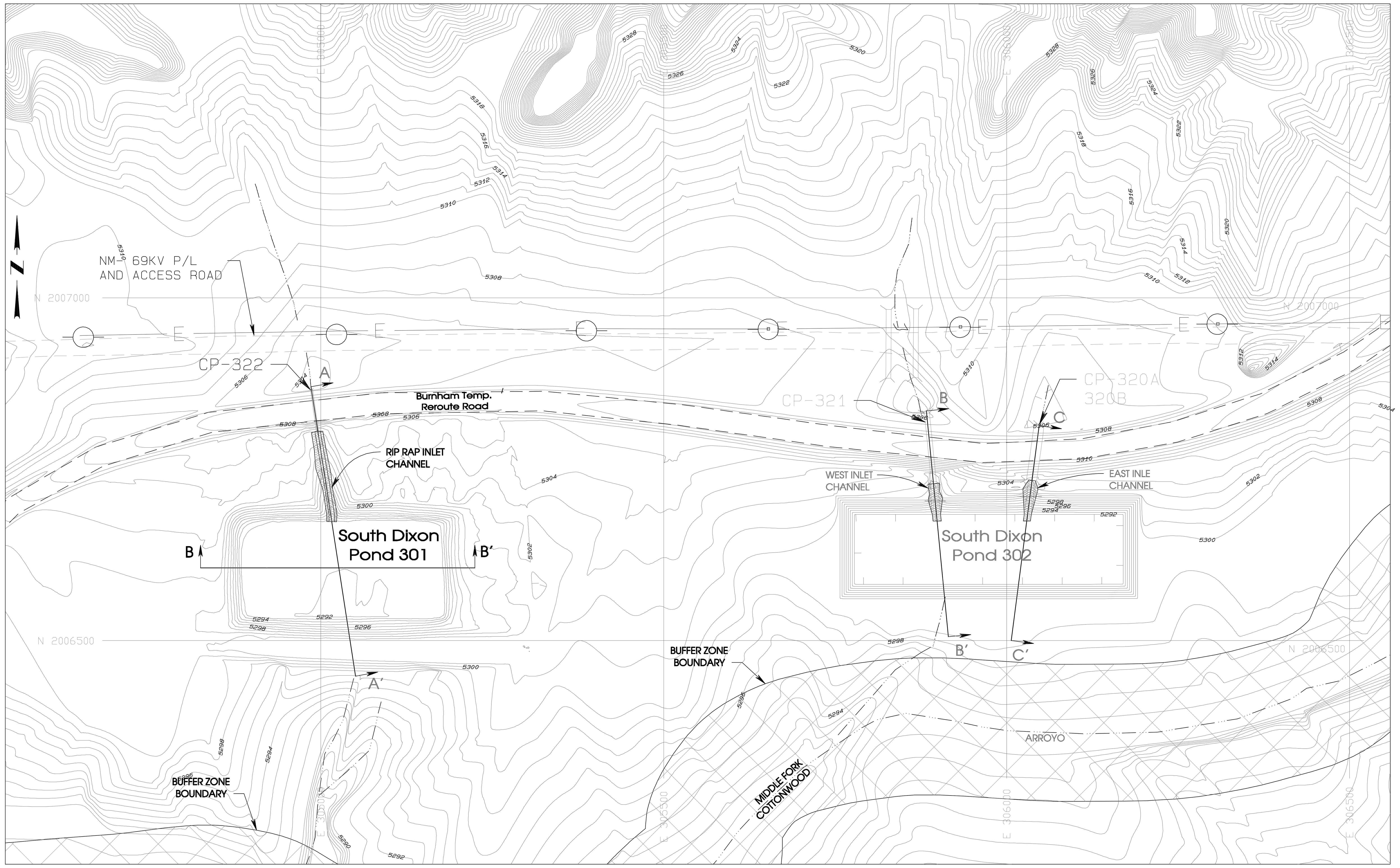
ACCOUNT:
DATE: AUGUST 31, 2009
DESIGNED BY: REV
DRAWN BY: RY
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTIONS

EXHIBIT 26-71
AREA 4 NORTH
POND 411
Design

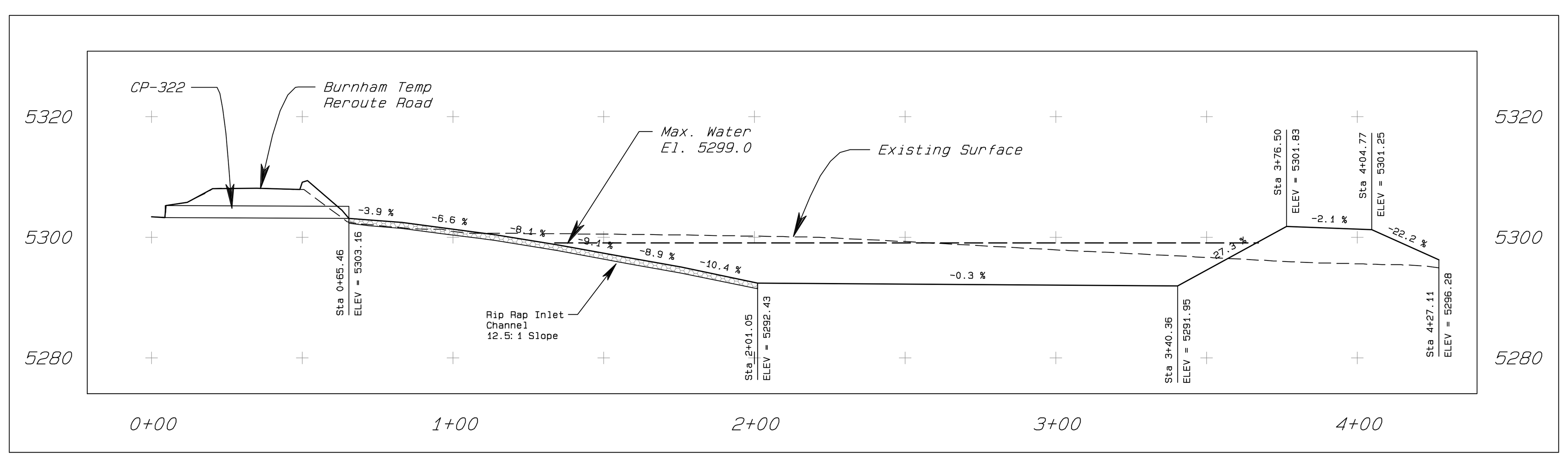
DRAWING
SHEET 1
OF 1

G:\Gs\Permit F\Ch 11\Exhibit 11-161\Design Data\Exh 11-161_A4N POND-411.pro
Mon Jun 14, 2010 / 12:37:33

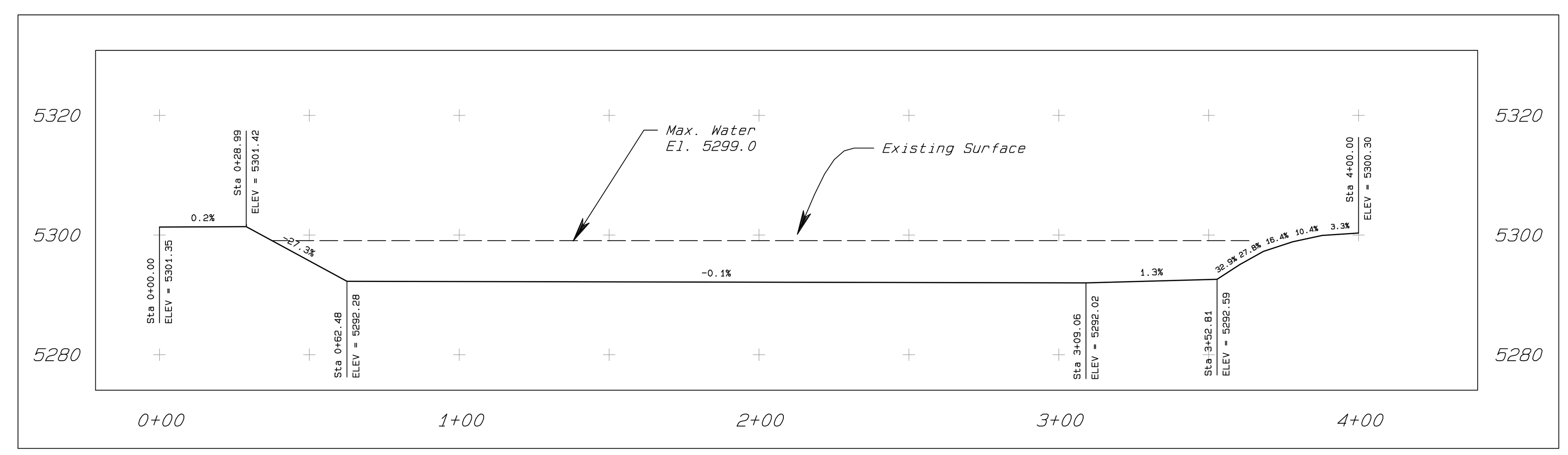


PLAN VIEW

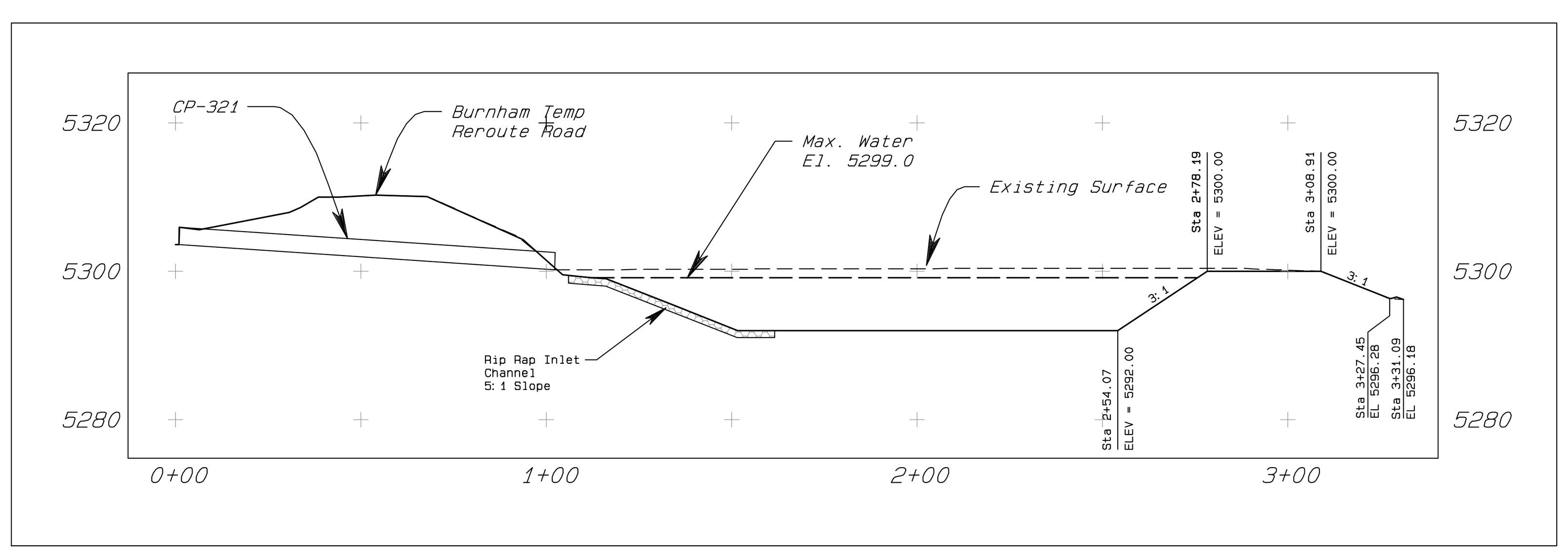
SCALE: 1"=100'



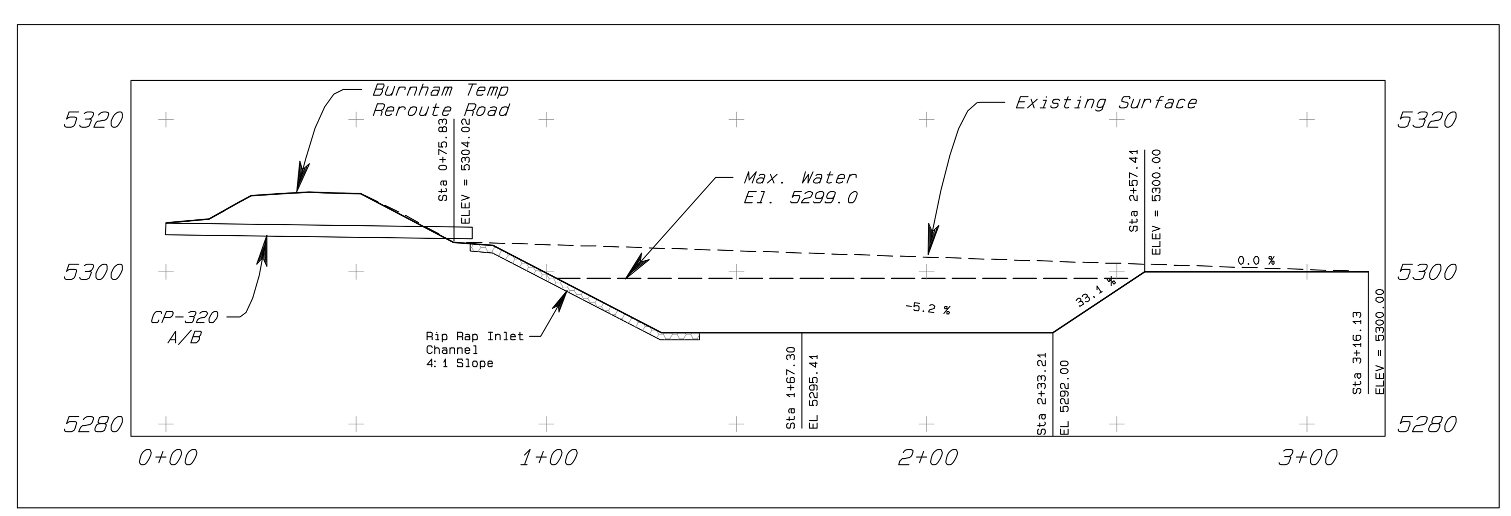
POND-301
PROFILE VIEW A-A'
SCALE: H 1"=40'
V 1"=20'



POND 301
PROFILE VIEW B-B'
SCALE: H 1"=40'
V 1"=20'



PROFILE VIEW B-B'
SCALE: H 1"=40'
V 1"=20'



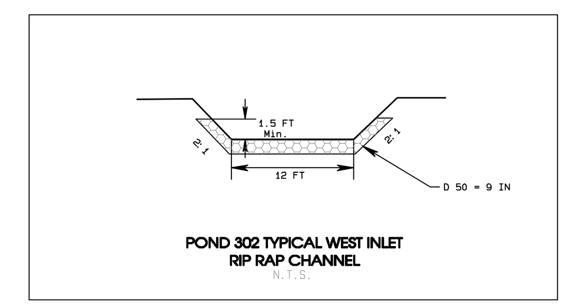
PROFILE VIEW C-C'
SCALE: H 1"=40'
V 1"=20'

SOUTH DIXON POND 301 STAGE STORAGE DATA

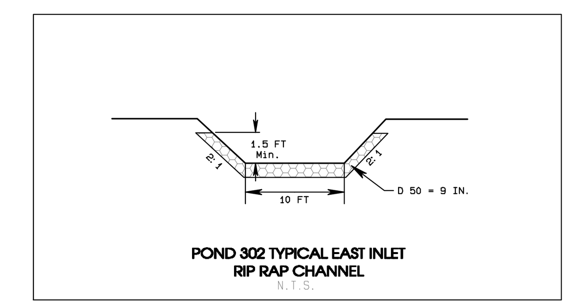
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5292	0.11	0.00	0.00
5293	0.94	0.53	0.53
5294	1.01	0.98	1.50
5295	1.08	1.05	2.55
5296	1.15	1.12	3.67
5297	1.23	1.19	4.86
5298	1.32	1.28	6.13
5299	1.44	1.38	7.52
5300	1.64	1.54	9.05

SOUTH DIXON POND-302 STAGE STORAGE DATA

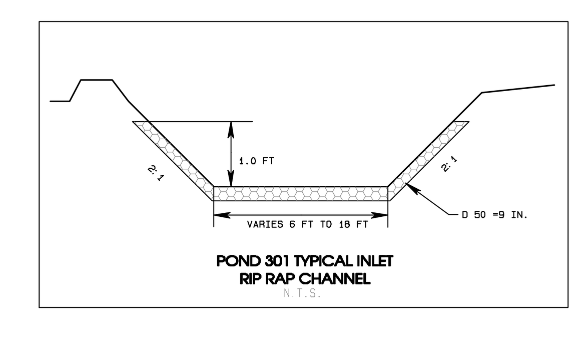
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5292	0.92	0.0	0.0
5293	0.99	1.0	1.0
5294	1.06	1.0	2.0
5295	1.13	1.1	3.1
5296	1.20	1.2	4.2
5297	1.28	1.2	5.5
5298	1.35	1.3	6.8
5299	1.44	1.4	8.2
5300	1.52	1.5	9.7



POND 302 TYPICAL WEST INLET RIP RAP CHANNEL

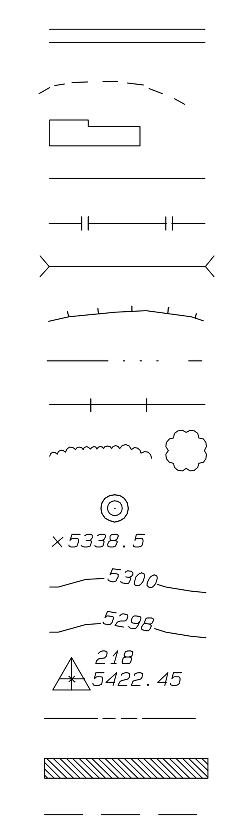


POND 302 TYPICAL EAST INLET RIP RAP CHANNEL



POND 301 TYPICAL INLET RIP RAP CHANNEL

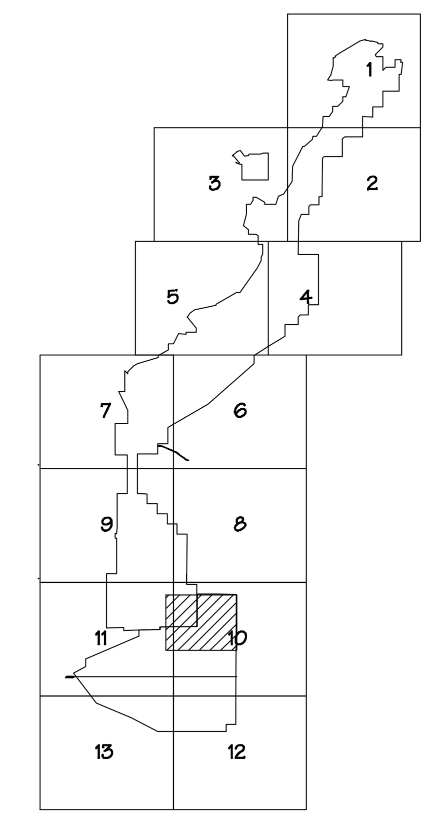
LEGEND



ROAD
TRAIL
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
x5338.5 SPOT ELEVATION
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
218 5422.45 CONTROL
LEASE
LOCATION
WATERSHED

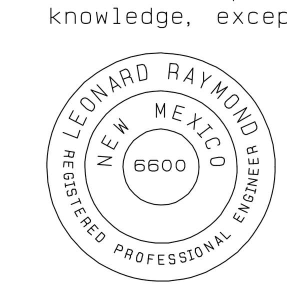
NOTES

1. For hydrology and design information refer to Table 11-5 in the approved PAP.
2. The watershed areas for culverts are shown on Exhibit 11-13E.



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this pond (Pond 301) has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge, except as noted below.



1. Only the construction of Pond 301 has been completed to date, Pond 302 will be built at a later date. When the construction of Pond 302 is completed this drawing will be updated.
2. The bottom width of the inlet channel into Pond 301 varies from 6' to 18'. The riprap placed at the narrowest section and steepest slope will be stable for the 10 yr-6 hr strom event. The SEDCAD data in the PAP has been revised accordingly.

REVISION		DATE
1	PREPARED POND DESIGN AND SUBMITTED TO OSM	
2	PREPARED AS-BUILT FOR POND 301 AND SUBMITTED TO OSM FOR REVIEW.	11-29-10
3		
4		

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON VAN VALKENBURG
REG. NO. 9263
SRVYR of RECORD:
REG. NO.

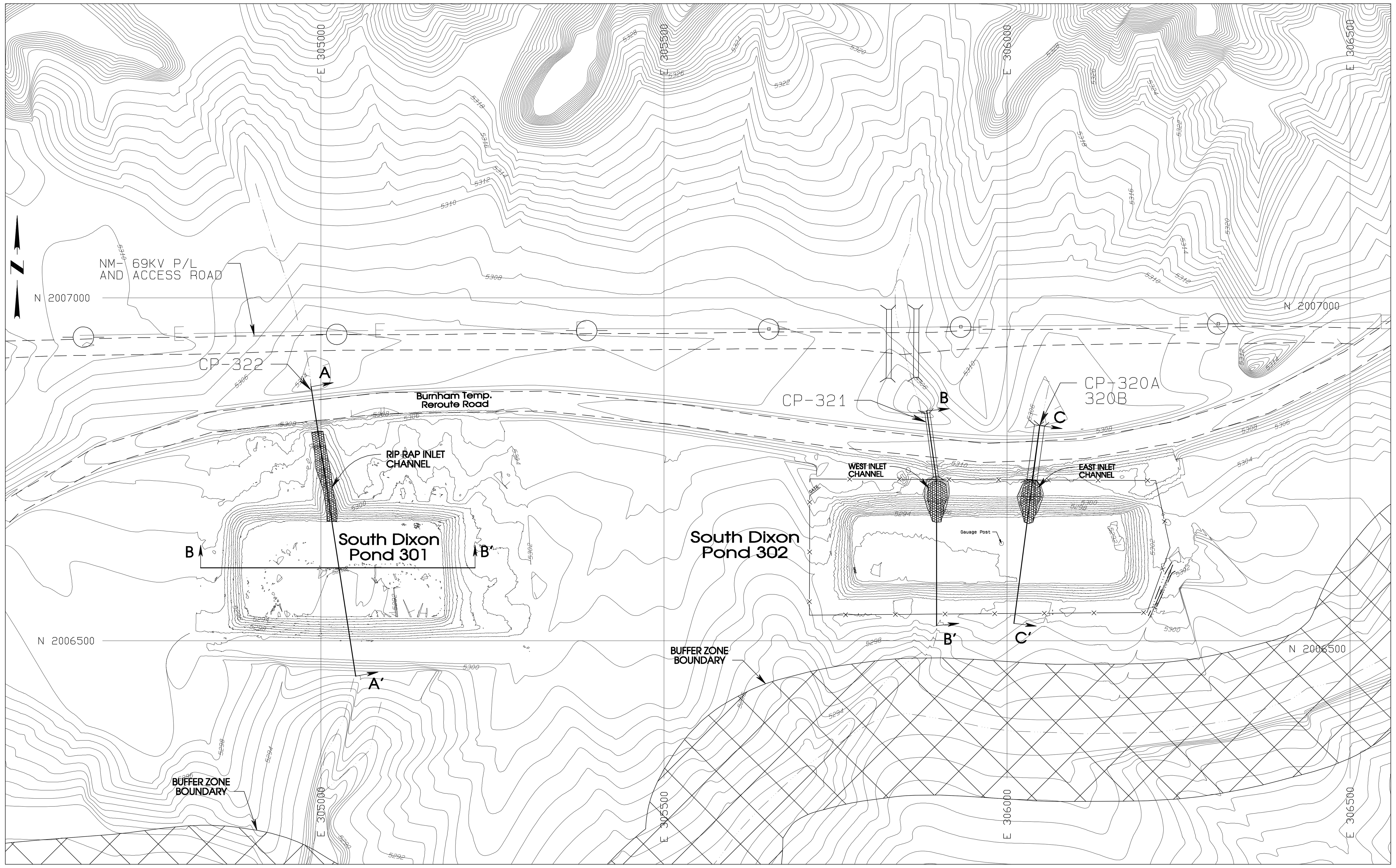
BHP-NAVAJO COAL CO.
PO BOX 155, FRUITLAND, NEW MEXICO, 87416

PROJECT: South Dixon Ponds-301/302
DATE: FEB. 16, 2010
DESIGNED BY: FGorman
DRAWN BY: PJFoster
CHECKED BY: RCV
APPROVED BY: RCV

LOCATION MAP/ PLAN/PROFILE VIEW AND SECTIONS

EXHIBIT 26-72
SOUTH DIXON
PONDS 301 (AS-BUILT) AND 302 (APPROVED DESIGN)

DRAWING
SHEET 1 OF 1



PLAN VIEW

SCALE: 1"=100'

SOUTH DIXON POND 301 STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5292	0.11	0.00	0.00
5293	0.94	0.53	0.53
5294	1.01	0.98	1.50
5295	1.08	1.05	2.55
5296	1.15	1.12	3.67
5297	1.23	1.19	4.86
5298	1.32	1.28	6.13
5299	1.44	1.38	7.52
5300	1.64	1.54	9.05

SOUTH DIXON POND-302 STAGE STORAGE DATA

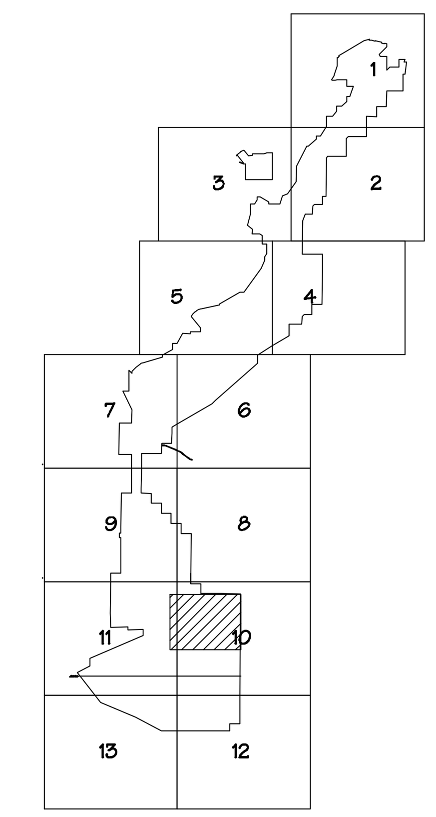
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5291	0.00	0.0	0.0
5292	0.28	0.14	0.14
5293	0.90	0.59	0.73
5294	0.96	1.93	1.66
5295	1.02	0.99	2.65
5296	1.09	1.06	3.71
5297	1.17	1.13	4.84
5298	1.26	1.21	6.05
5299	1.35	1.30	7.35
5300	1.44	1.39	8.75

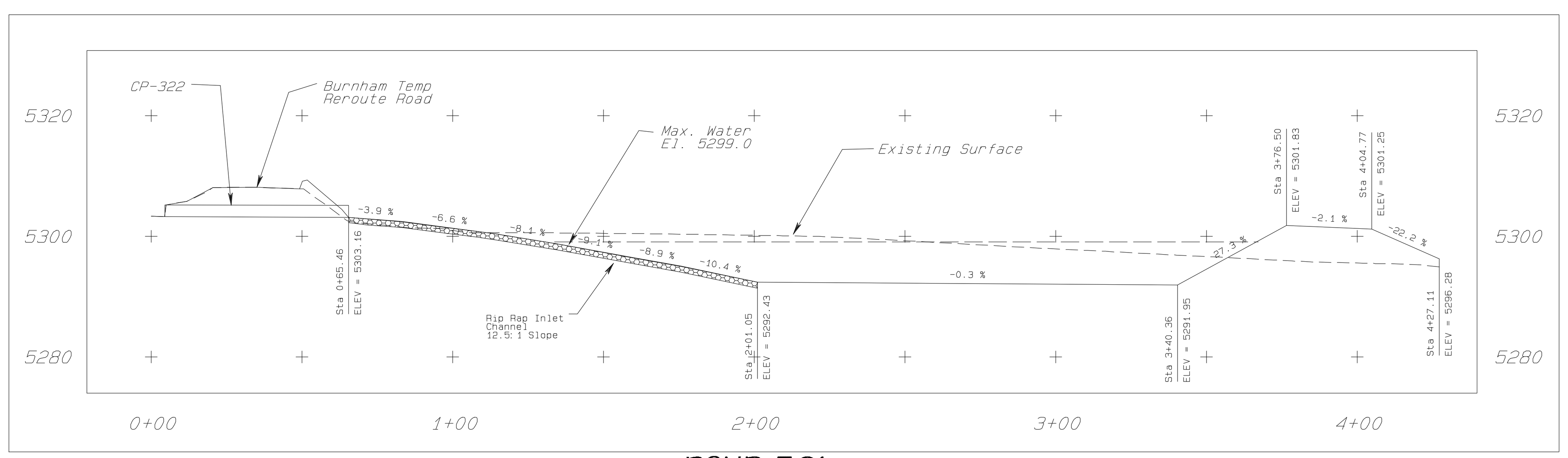
LEGEND

- ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 CONTROL
- LEASE
- LOCATION
- WATERSHED

NOTES

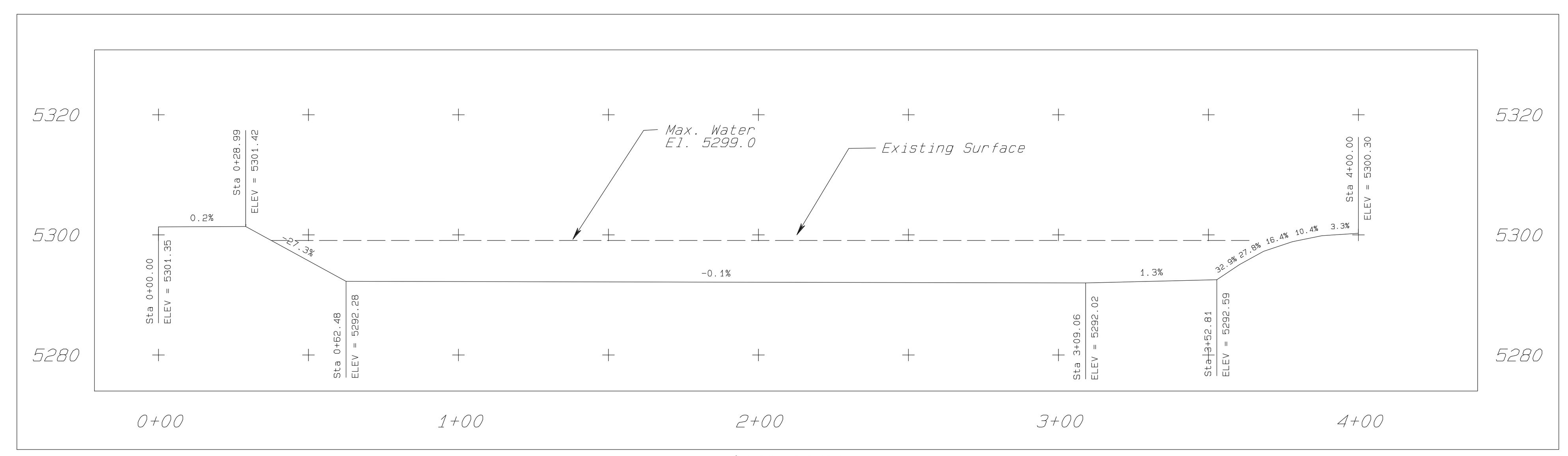
1. For hydrology and design information refer to Table 11-5 in the approved PAP.
2. The watershed areas for the ponds are shown on Exhibit 11-13E.





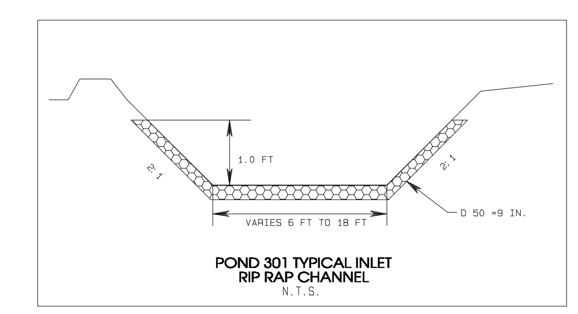
POND-301
PROFILE VIEW A-A'

SCALE: H 1"=40'
V 1"=20'

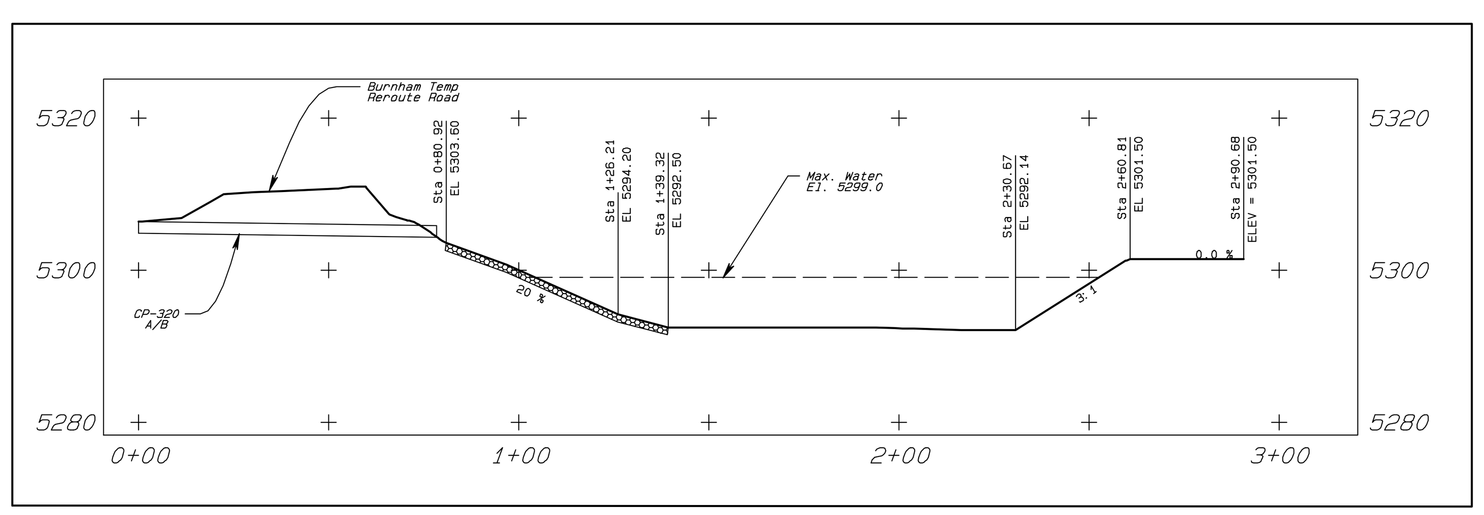


POND 301
PROFILE VIEW B-B'

SCALE: H 1"=40'
V 1"=20'

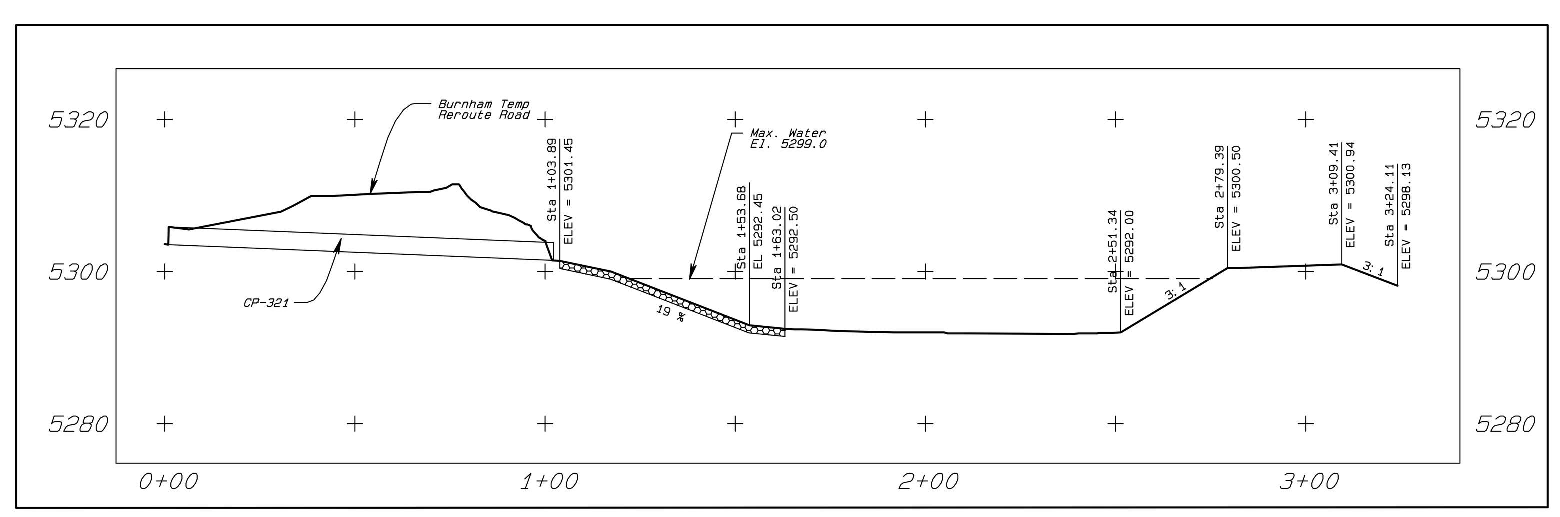


POND 301 TYPICAL INLET
RIP RAP CHANNEL
N.T.S.



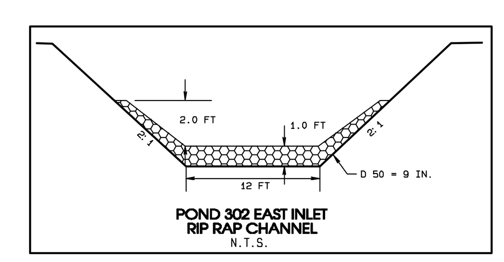
POND 302 - PROFILE VIEW B-B'

SCALE: H 1"=40'
V 1"=20'

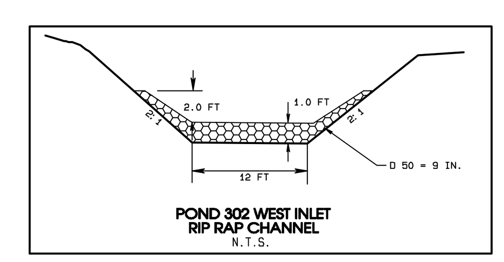


POND 302 - PROFILE VIEW C-C'

SCALE: H 1"=40'
V 1"=20'



POND 302 EAST INLET
RIP RAP CHANNEL
N.T.S.



POND 302 WEST INLET
RIP RAP CHANNEL
N.T.S.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this pond (Pond 301) has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge, except as noted below.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

1. The east inlet to Pond 302 was built at a gradient less than design 19% vs 25%. It was also built wider than design 12 feet vs 10 feet. The SedCAD was updated accordingly.
2. The bottom width of the inlet channel into Pond 301 varies from 6' to 18'. The riprap placed at the narrowest section and steepest slope will be stable for the 10 yr-6 hr strom event. The SEDCAD data in the PAP has been revised accordingly.

REVISION		Rev By	DATE
1	PREPARED POND DESIGN AND SUBMITTED TO OSM FOR REVIEW.		3-03-10
2	PREPARED AS-BUILT FOR POND 301 AND SUBMITTED TO OSM FOR REVIEW.		11-29-10
11-A	PREPARED AS-BUILT FOR POND 302 AND SUBMITTED TO OSM FOR REVIEW.	PJF	10-27-11

PROJECT: South Dixon Ponds-301/302	PROJECT MANAGER: F. GORMAN
DATE: FEB. 16, 2010	ENGR. of RECORD: RON VAN VALKENBURG
DESIGNED BY: FGorman	REG. NO: 9263
DRAWN BY: PJFoster	SRVYR of RECORD:
CHECKED BY: RCV	REG. NO:
APPROVED BY: RCV	

bhpbilliton

BHP NAVAJO COAL COMPANY
NAVAJO MINE

PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 / PHONE 505-598-4200/FAX 505-598-3361

LOCATION MAP/
PLAN/PROFILE VIEW
AND SECTIONS

EXHIBIT 26-73

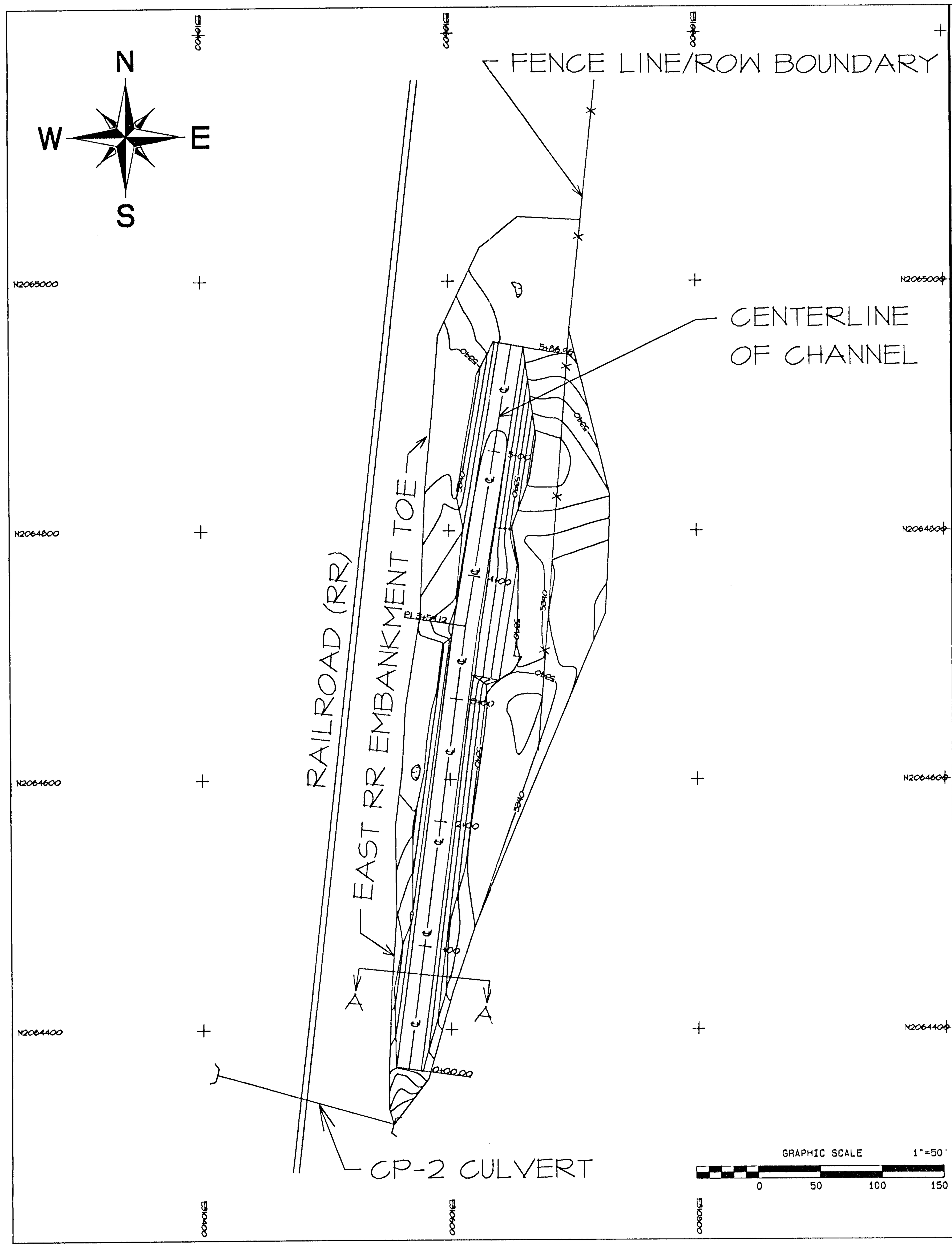
AREA-3

SOUTH DIXON
PONDS 301 (AS-BUILT) AND
PONDS 302 (AS-BUILT / 10-27-11)

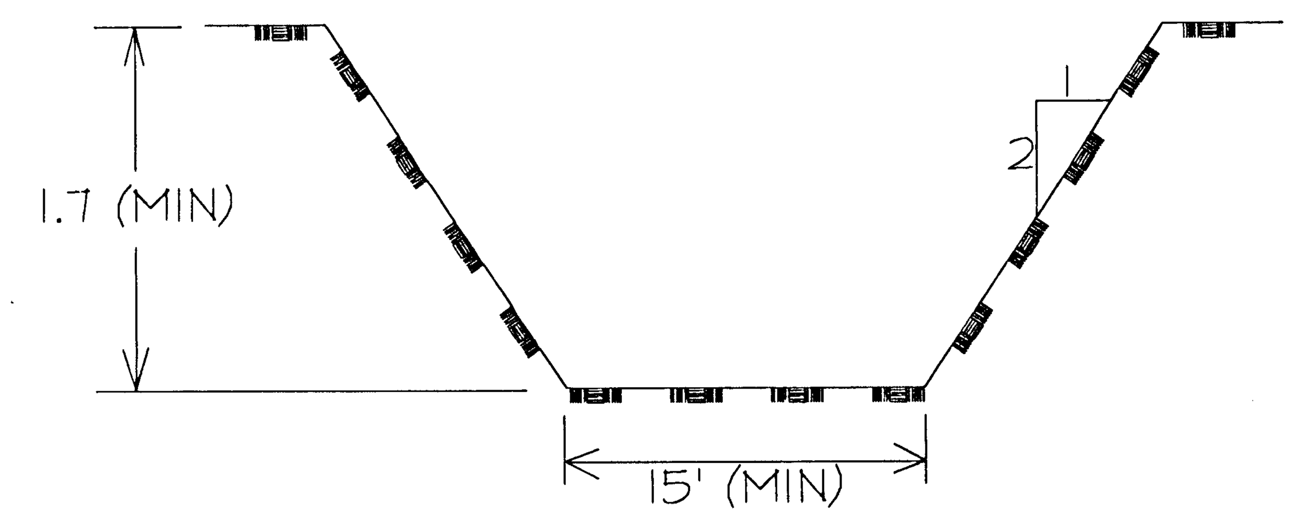
DRAWING

SHEET 1
OF 1

G:\Gs\Permit_F\Ch_11\Exh 11-162_S Dixon Pds 301-302\As-Built-Pd-302\Exh 11-162_S DX Ponds-302_As-Built.pro
Mon Nov 07 08:01:57 2011

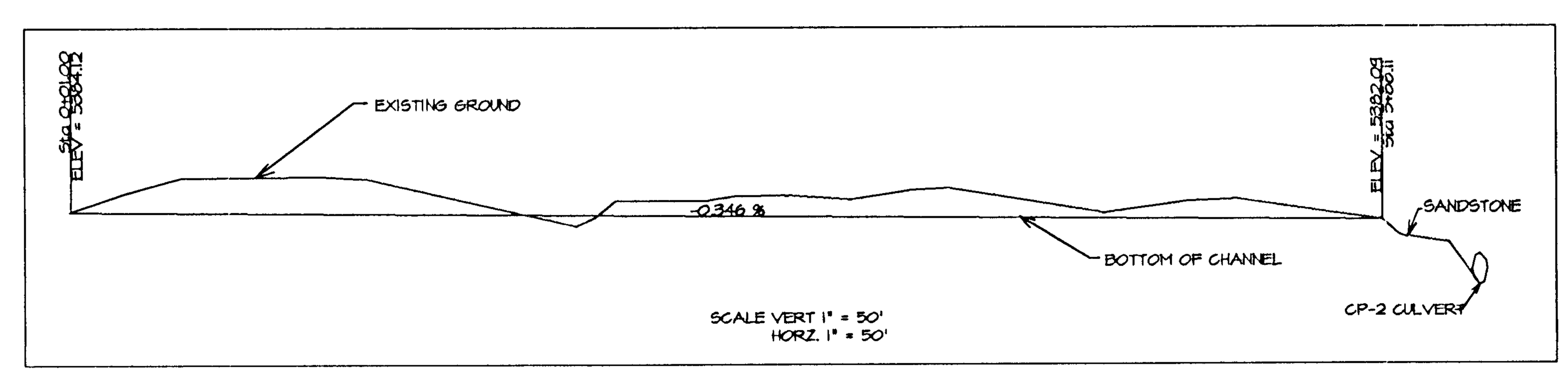


PLAN VIEW



SECTION A-A
TYPICAL CHANNEL SECTION

DWG. NTS



PROFILE

LEGEND

RAILROAD
CULVERT
FENCE LINE
CENTERLINE

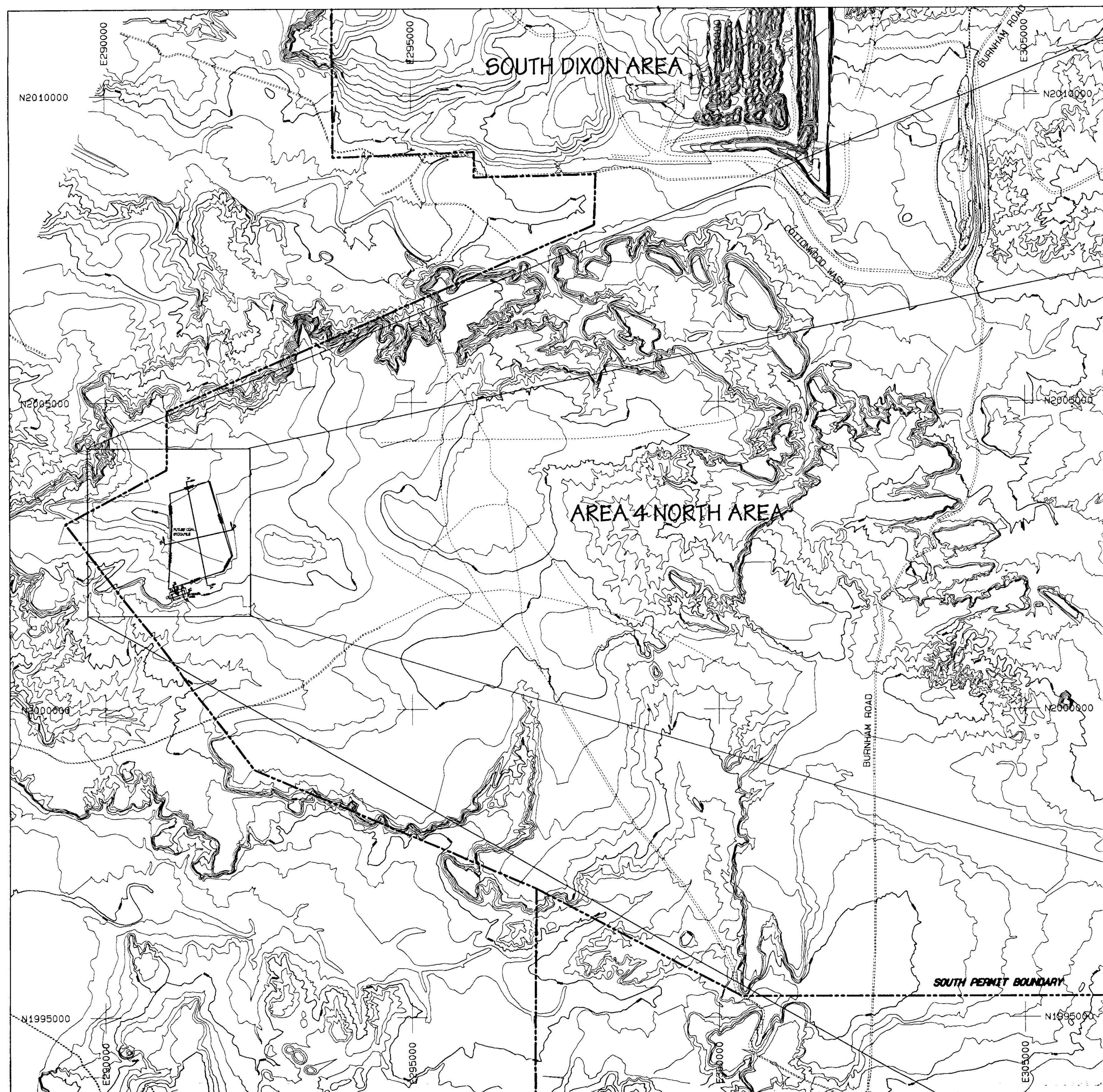
REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
A	1-16-95	E.T.	SUBMIT TO OSM FOR APPROVAL					

EXHIBIT 26-75

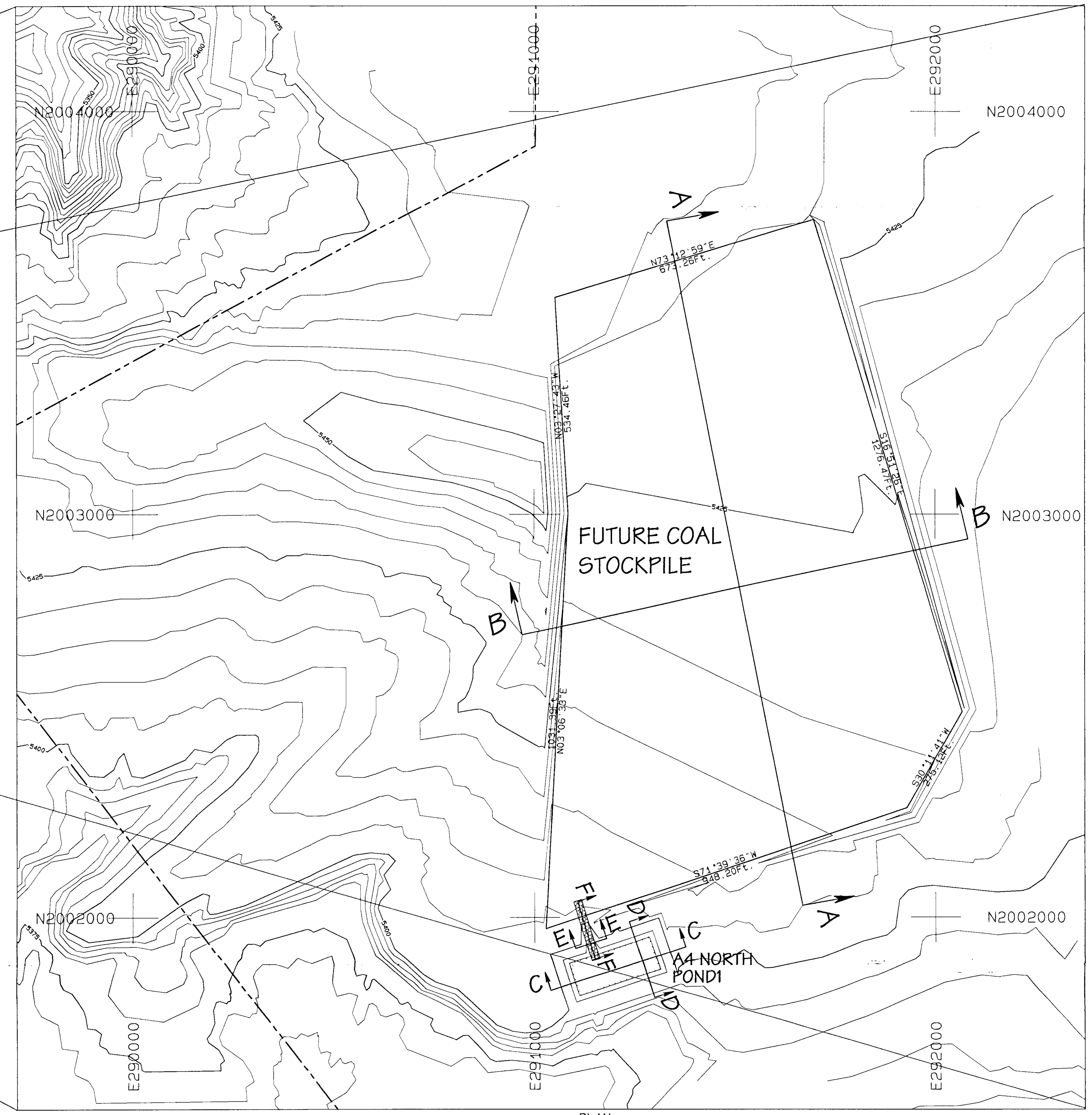
BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

RAILROAD SIDE DITCH\CHANNEL AT CP-2 CULVERT

PREPARED BY E.T.	DRAWN BY E.T.	SCALE AS NOTED
APPROVED BY L.R.	DATE 08-07-95	DWG. LOC.
DWG. NO,	REF. DWG.	



LOCATION MAP
Scale: 1" = 1500'



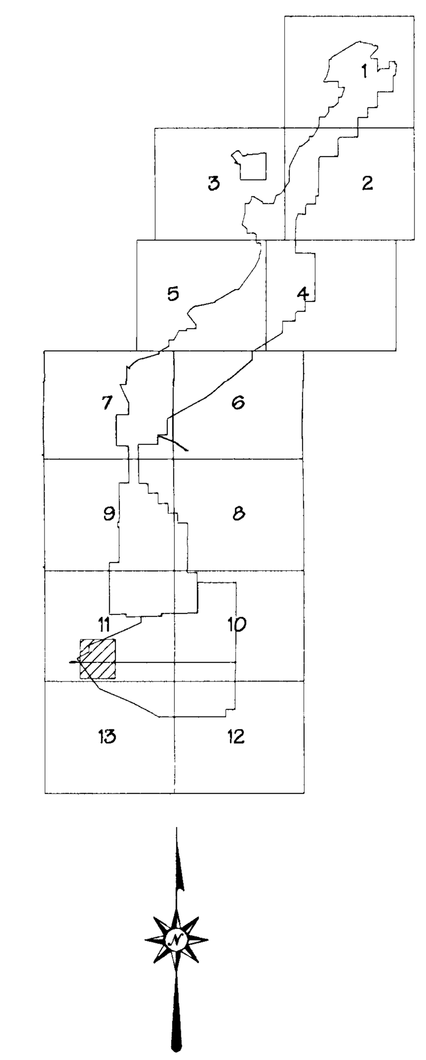
PLAN
Scale: 1" = 200'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 LEASE CORNER
- L-30
- PERMIT/LEASE BOUNDARY

NOTES

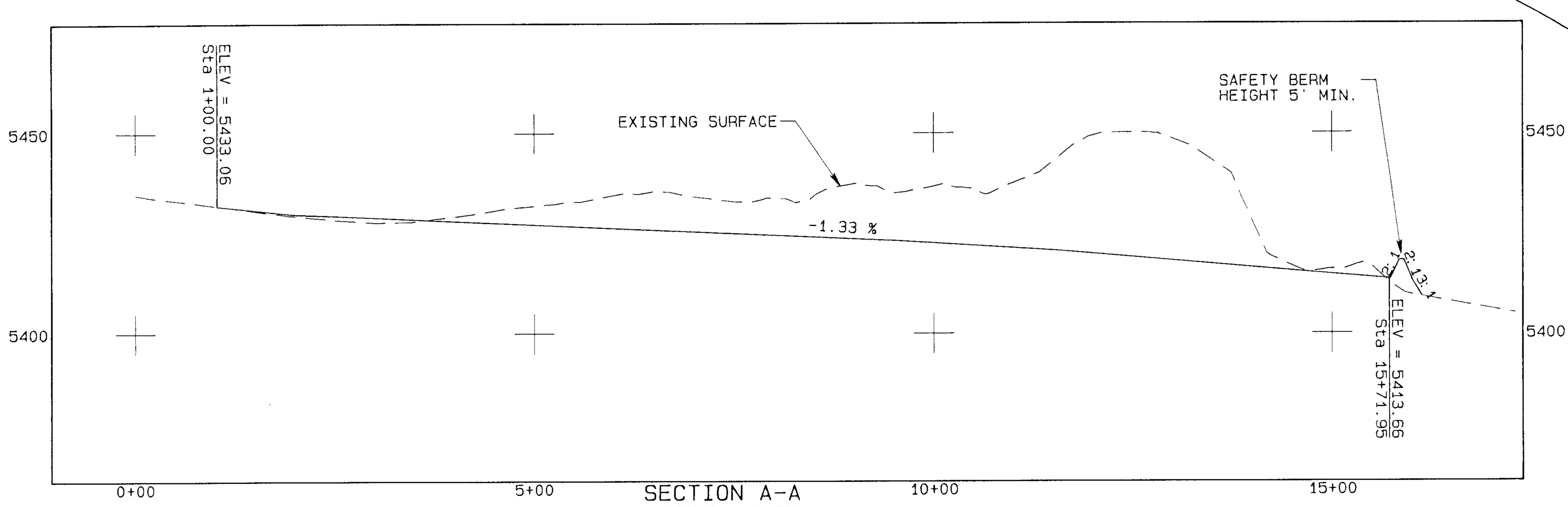
1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13F.



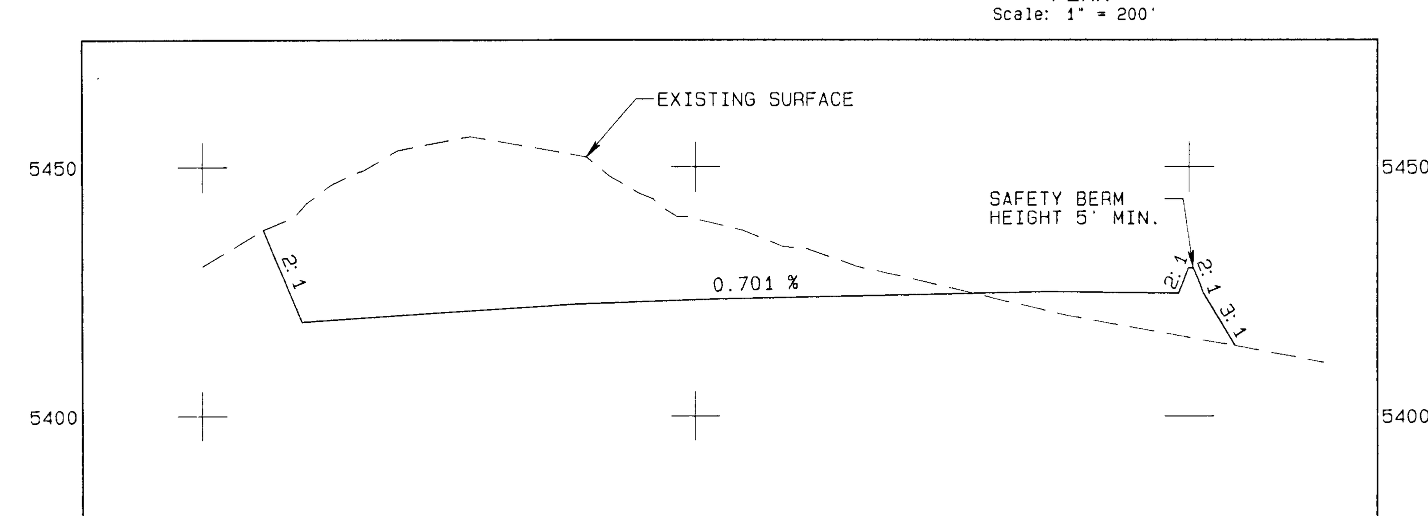
SCALE AS NOTED

STAGE STORAGE DATA

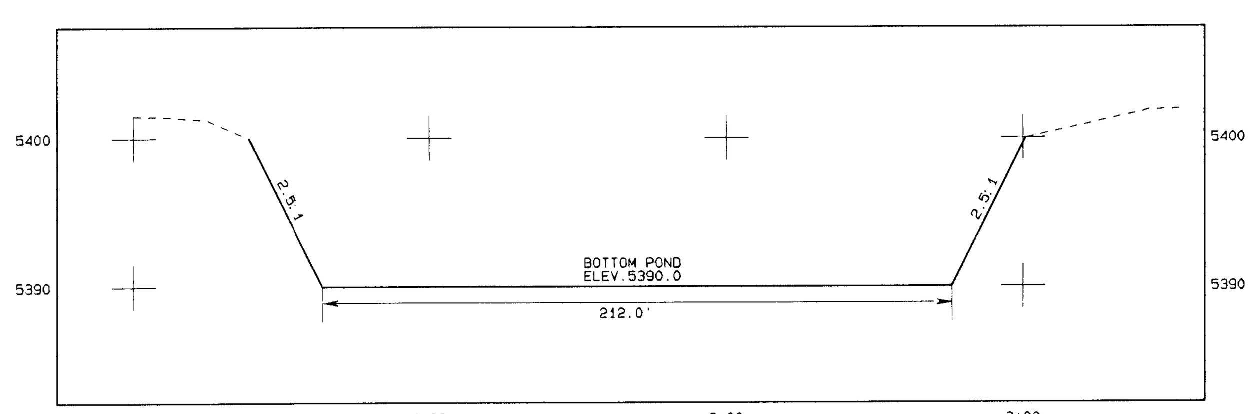
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5390	0.42	0.00	0.00
5391	0.46	0.44	0.44
5392	0.50	0.48	0.92
5393	0.54	0.52	1.44
5394	0.58	0.56	2.00
5395	0.63	0.60	2.61
5396	0.67	0.65	3.25
5397	0.72	0.69	3.95
5398	0.77	0.74	4.69
5399	0.82	0.79	5.48
5400	0.87	0.84	6.32



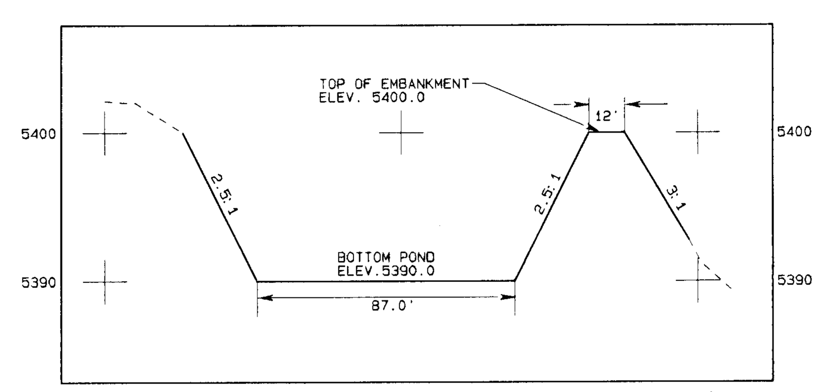
SECTION A-A
HORIZONTAL=1"=150'
VERTICAL=1"=30'



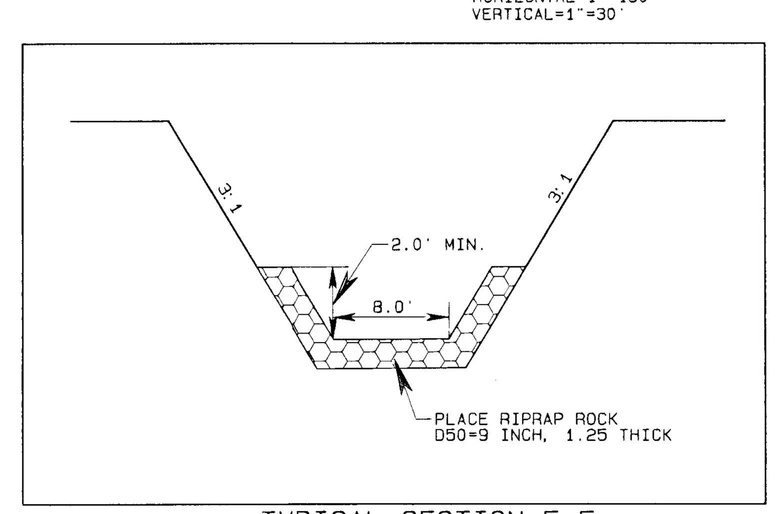
SECTION B-B
HORIZONTAL=1"=150'
VERTICAL=1"=30'



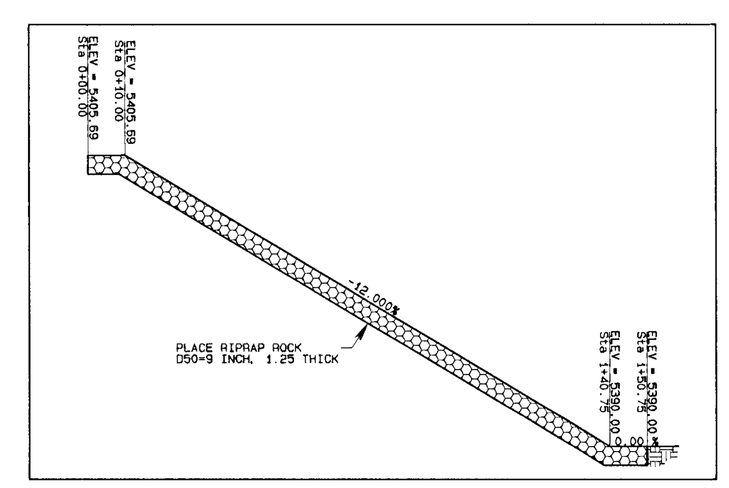
SECTION C-C
HORIZONTAL=1"=50'
VERTICAL=1"=10'



SECTION D-D
HORIZONTAL=1"=50'
VERTICAL=1"=10'



TYPICAL SECTION E-E
N.T.S



TYPICAL SECTION F-F
N.T.S

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

12-14-04

11-16-04

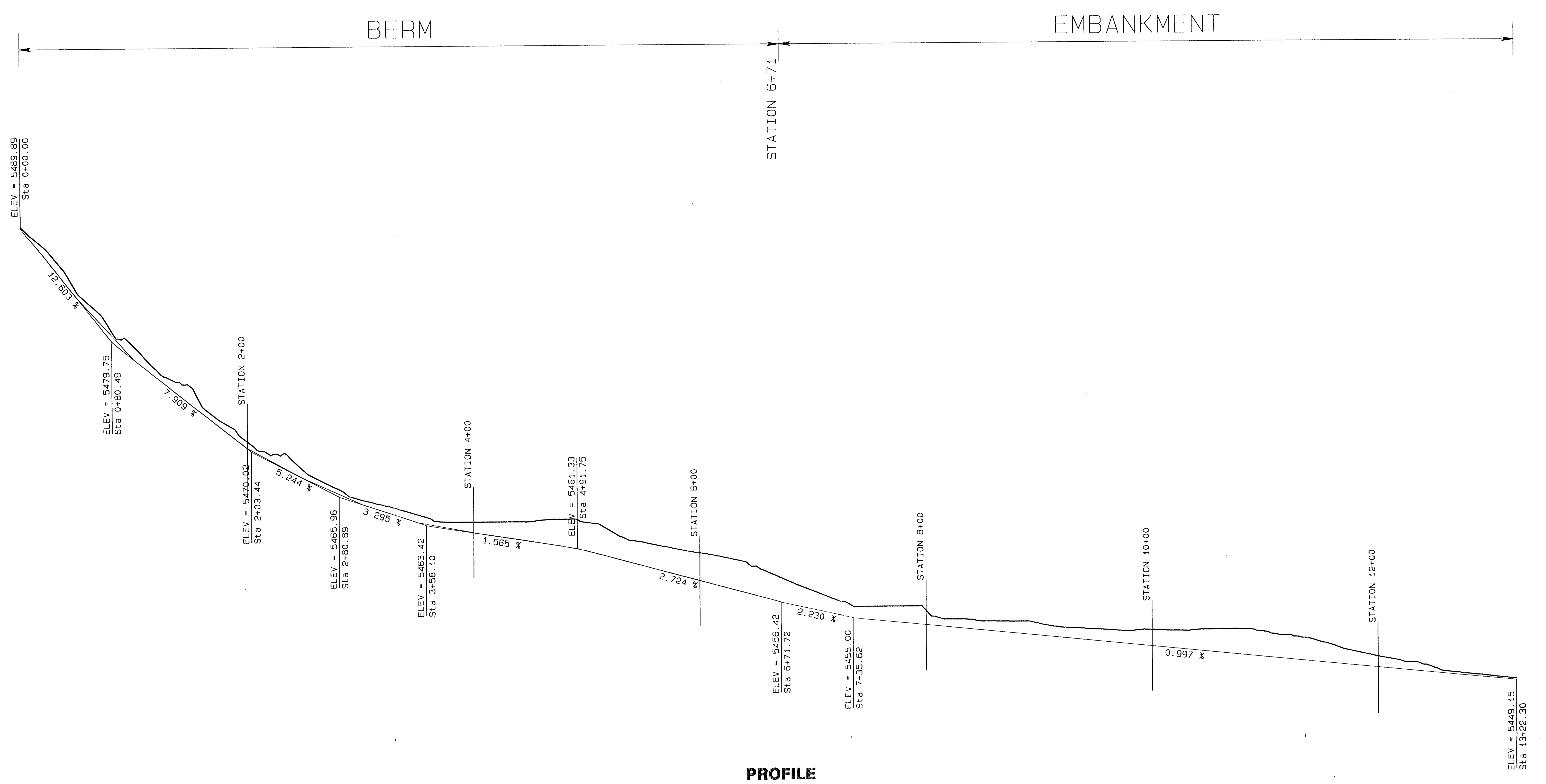
SHEET 1 OF 1	DRAWING
EXHIBIT 26-76 AREA 4 NORTH POND 1 DESIGN	PLAN, PROFILE AND SECTION
ACCOUNT:	
DATE:	11-16-04
DESIGNED BY:	RY
DRAWN BY:	RY
CHECKED BY:	LR
APPROVED BY:	LR

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

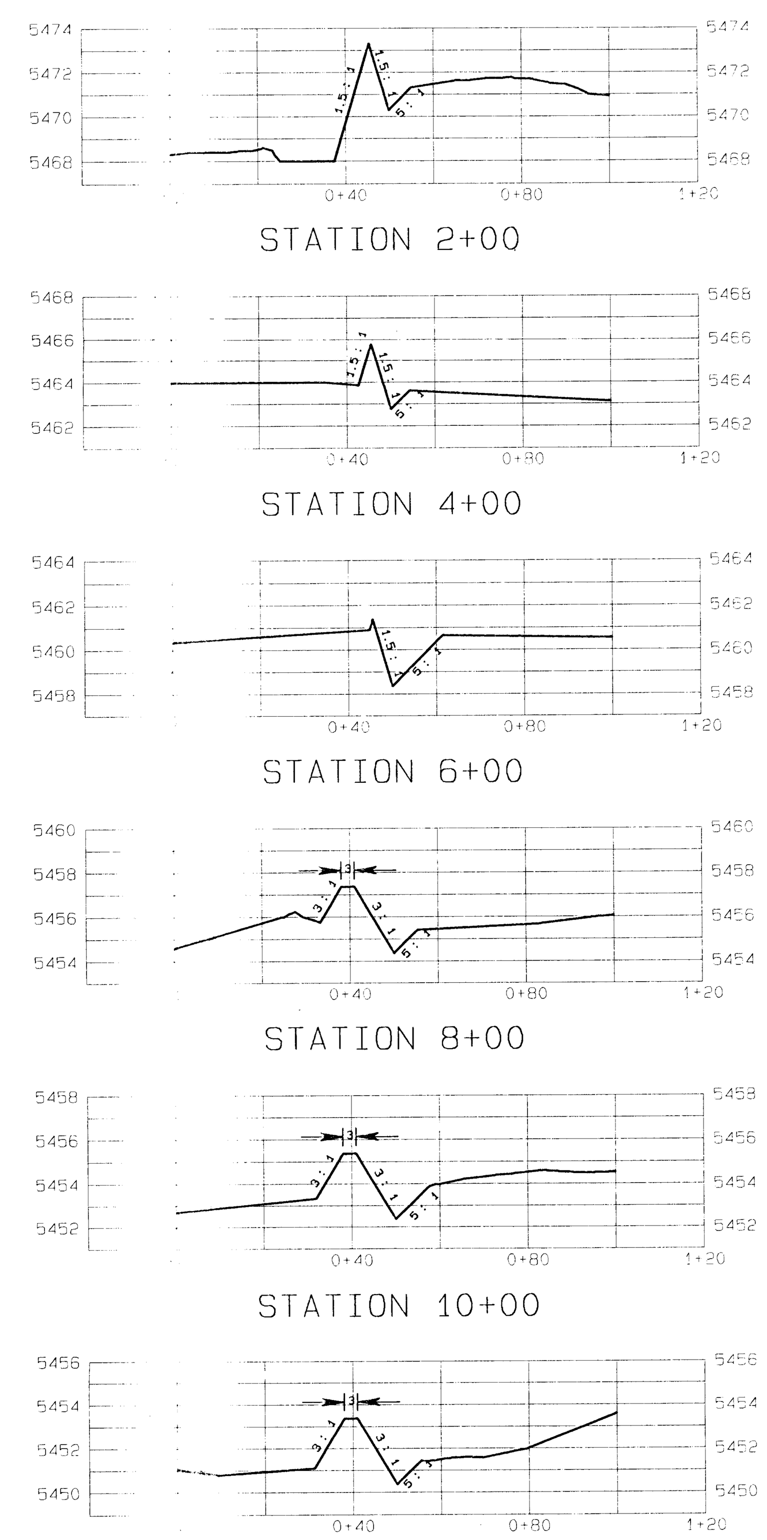
PROJECT MANAGER:	DR
ENGR. of RECORD:	LR
REG. NO:	6600
SRVYR of RECORD:	
REG. NO:	

REV NO.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	RY	11-19-04
2			
3			
4			
5			

Path: C:\Ray\Terramodel_1\Area 4 North\DESIGN\ponds\pond1.pro

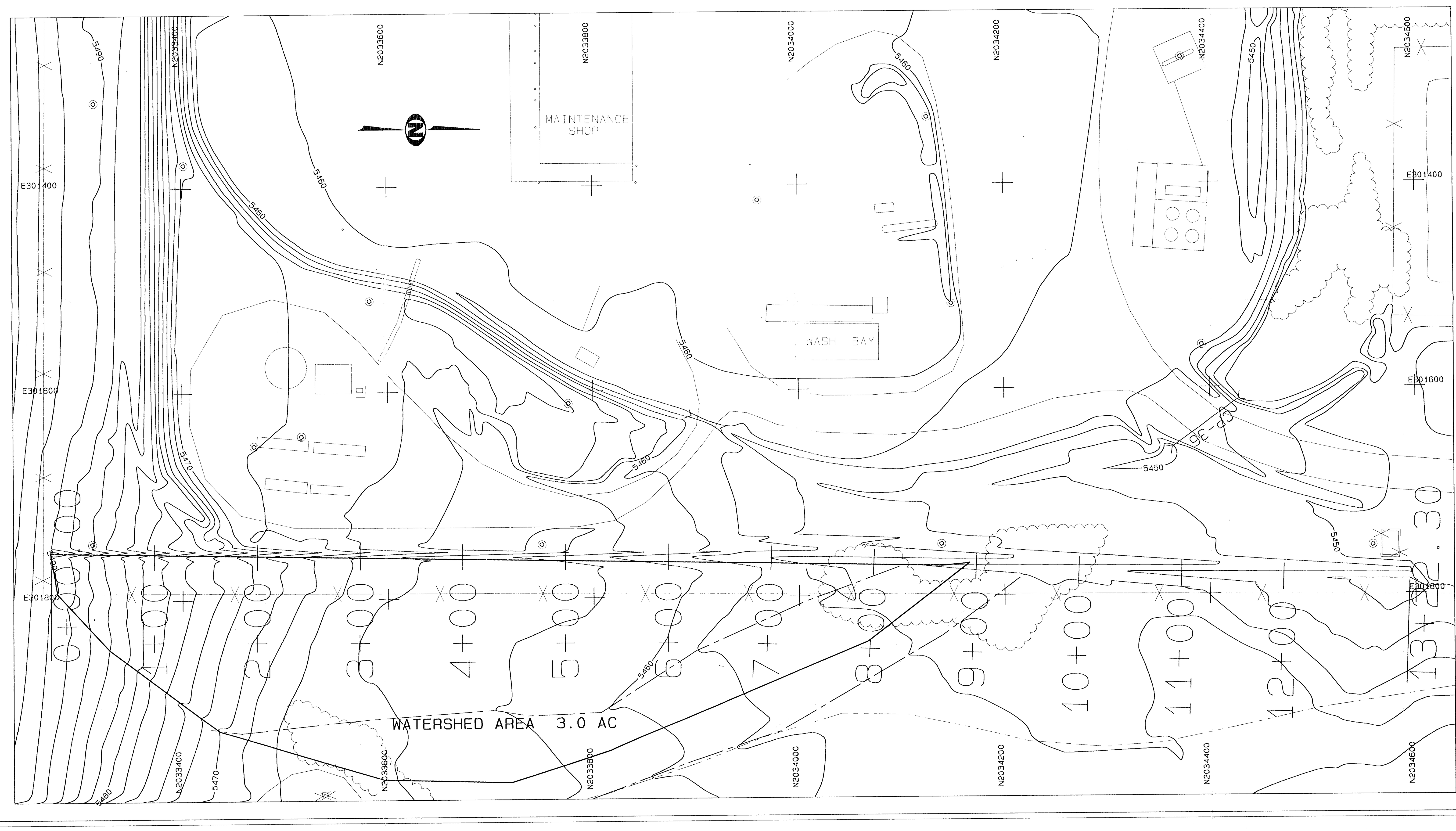


PROFILE
HOR: 1" = 50'
VER: 1" = 5'



SECTIONS
HOR: 1" = 50'
VER: 1" = 5'

PLAN
SCALE: 1" = 50'



LEGEND

PIPELINE
POWER POLE
SHRUBS
CULVERT
DRAINAGE

NOTES

REFER TO APPENDIX 11-Z FOR DESIGN INFORMATION

Certification Statement

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information is accurate and complete to the best of my knowledge.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER
8-24-96

DEC 1996
APPROVED

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
A	4/96	BTS	SUBMITTED TO OSM FOR APPROVAL	BTS		JR		

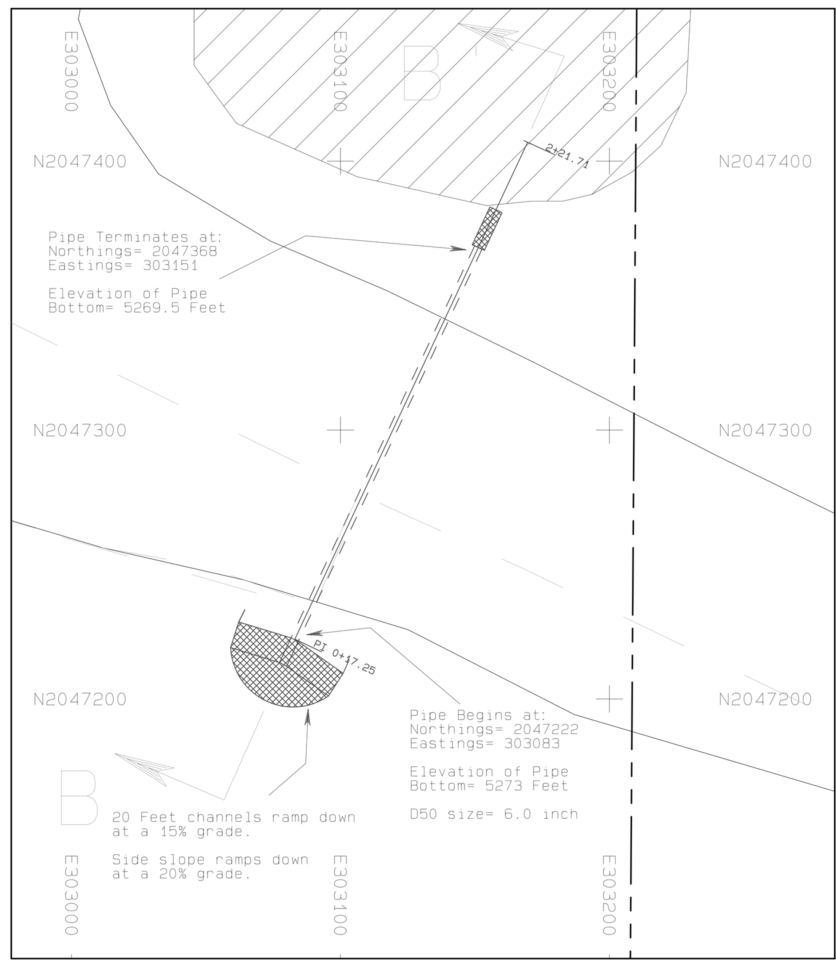
APPROVALS

EXHIBIT 26-77

BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

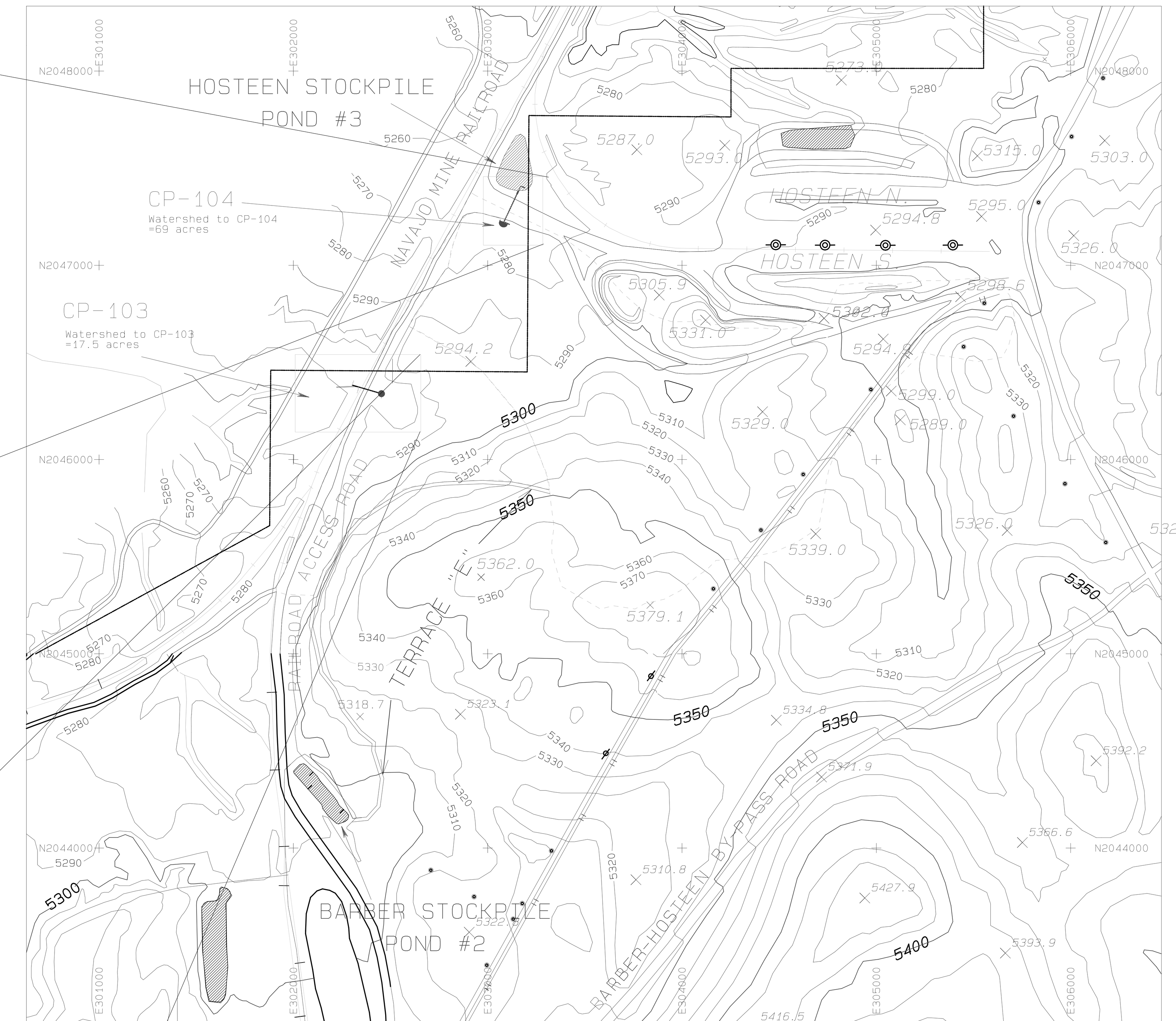
AREA 3 SHOP TEMPORARY DIVERSION PLAN, PROFILE & CROSS-SECTIONS

PREPARED BY BTS	DRAWN BY BTS	SCALE AS NOTED
APPROVED BY LR	DATE 4/22/96	DWG. LOC.
DWG. NO.	REF. DWG.	



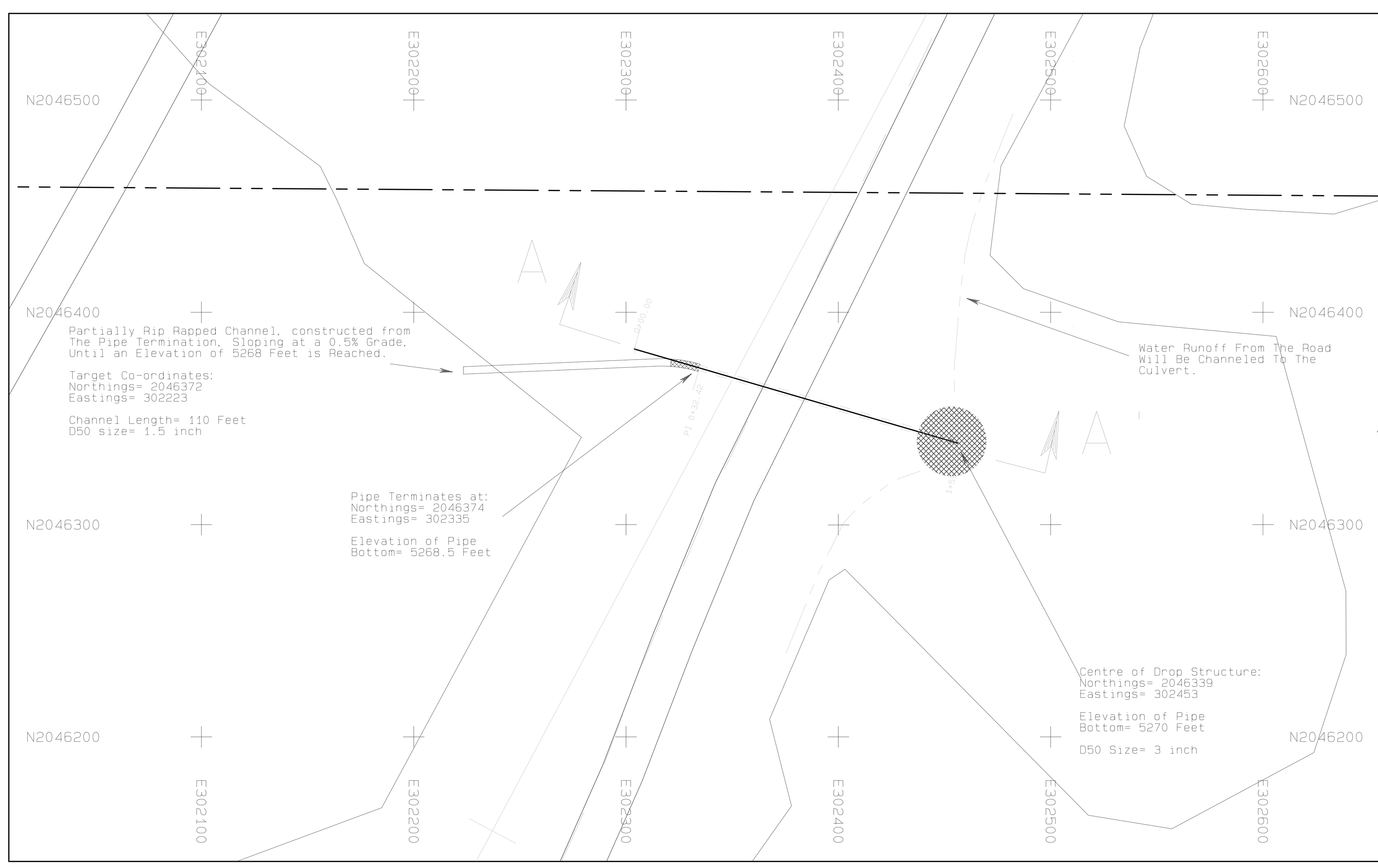
PLAN VIEW: CP-104 CULVERT

SCALE: 1"=40'



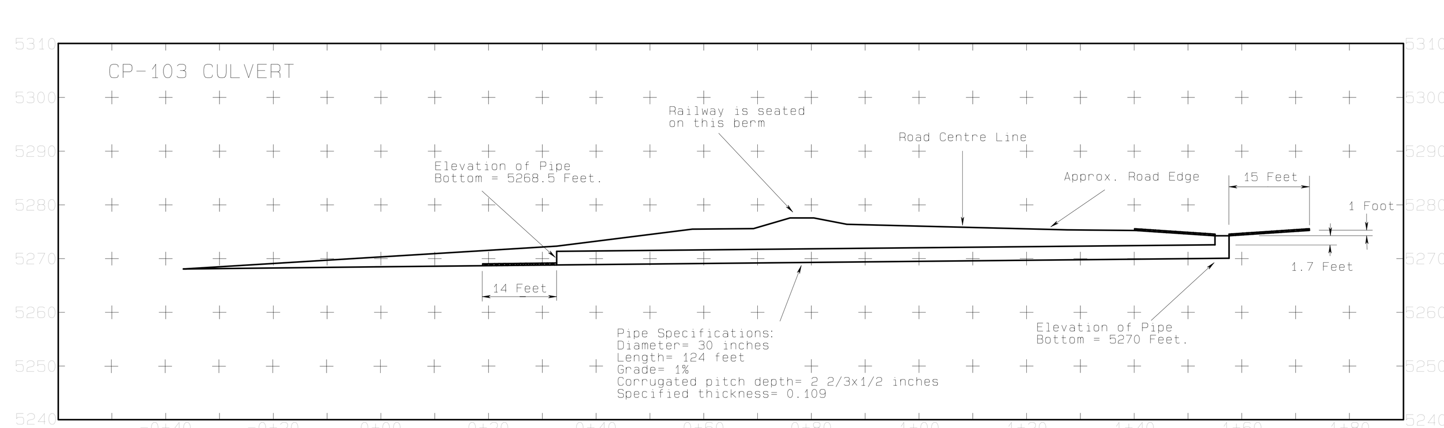
LOCATION MAP

SCALE: 1"=400'



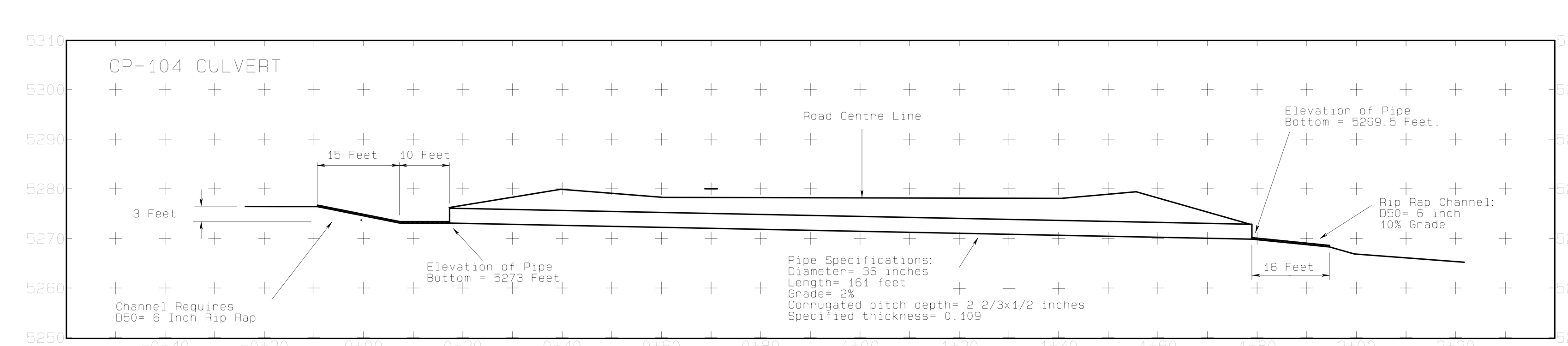
PLAN VIEW: CP-103 CULVERT

SCALE: 1"=40'



SECTION A A'

SCALE: 1"=20'



SECTION B B'

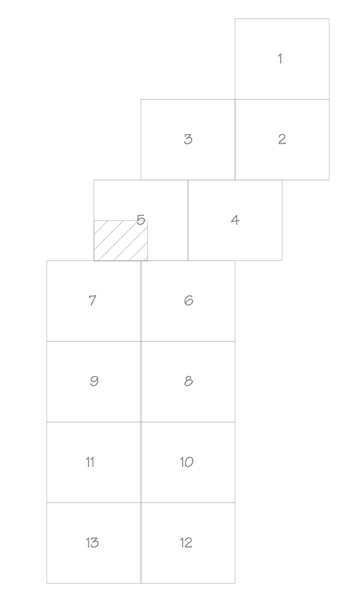
SCALE: 1"=20'

LEGEND

	PAVED ROAD
	DIRT ROAD
	HAUL ROAD
	TRAIL
	BUILDING
	FENCE
	IRRIGATION LINE
	CULVERT
	DAM
	DRAINAGE
	RAILROAD
	TREES
	POWERLINE
× 5338.5	SPOT ELEVATION
5300	INDEX CONTOUR
	INTERMEDIATE CONTOUR
218 5422.45	HORIZ. & VERT. CONTROL
L-30	LEASE CORNER
	LEASE BOUNDARY
	POND
	WATERSHED

NOTE:

DESIGN DATA PERTAINING TO THIS DIAGRAM CAN BE FOUND IN APPENDIX 11-V



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
A	02/19/97	RH	SUBMITTED TO OSM FOR APPROVAL					

APPROVALS

EXHIBIT 26-78

NAVAJO COAL COMPANY

NAVAJO MINE

SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

CULVERTS CP 103 AND CP 104

PLANS, SECTIONS and DETAILS

PREPARED BY RH	DRAWN BY RH	SCALE AS NOTED
APPROVED BY LR	DATE 02/19/97	REF DWG
DWG LOC		

LOCATION MAP
Scale: 1" = 300'

PLAN
Scale: 1" = 70'

STAGE STORAGE DATA

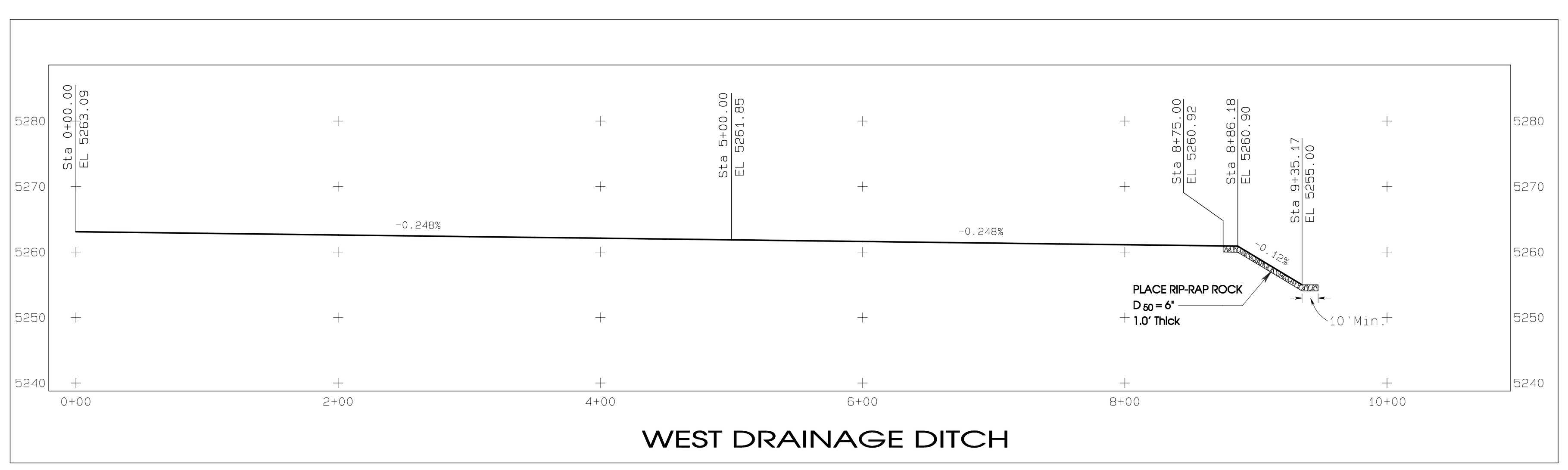
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5255	0.95	0.00	0.00
5256	1.00	0.98	0.98
5257	1.04	1.02	1.99
5258	1.08	1.06	3.05
5259	1.13	1.11	4.16
5260	1.18	1.16	5.32
5261	1.24	1.21	6.52
5262	1.39	1.31	7.83
5263	1.48	1.43	9.26

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

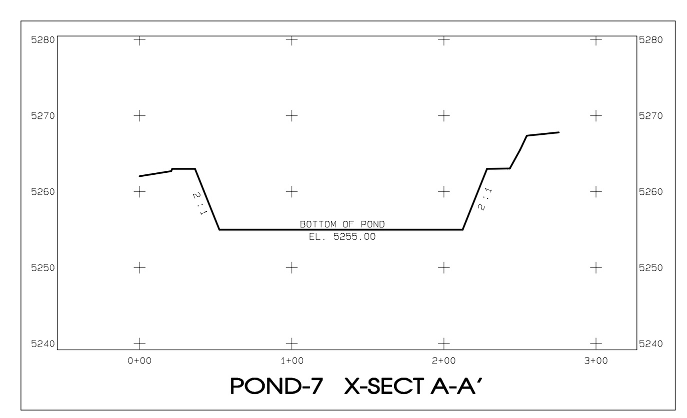
NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13F.



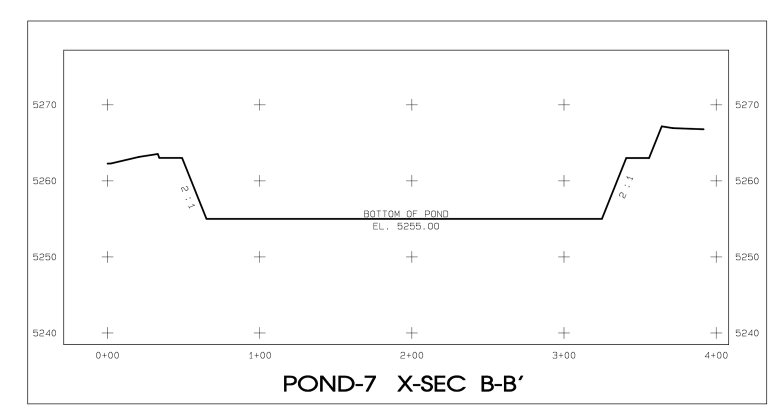
WEST DRAINAGE DITCH

HORIZONTAL=1"=100'
VERTICAL=1"=20'



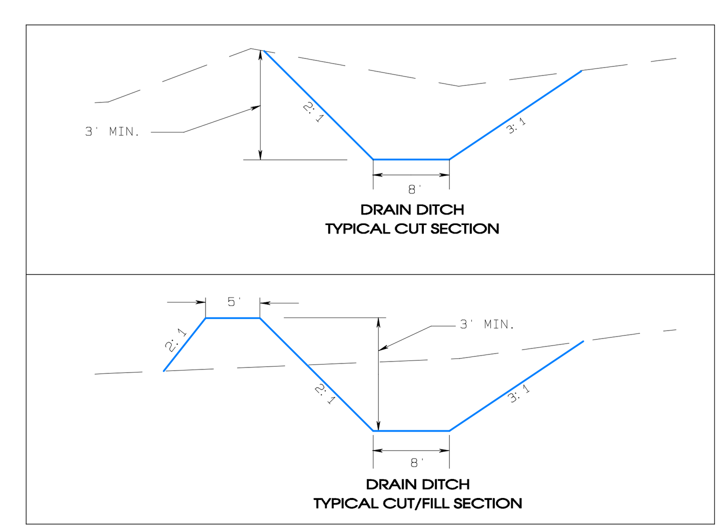
POND-7 X-SECT A-A'

HORIZONTAL=1"=80'
VERTICAL=1"=20'

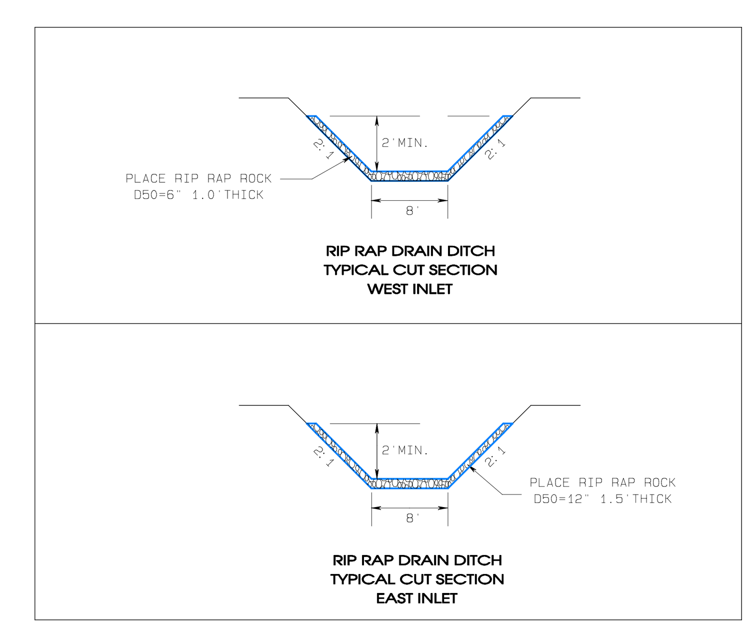


POND-7 X-SEC B-B'

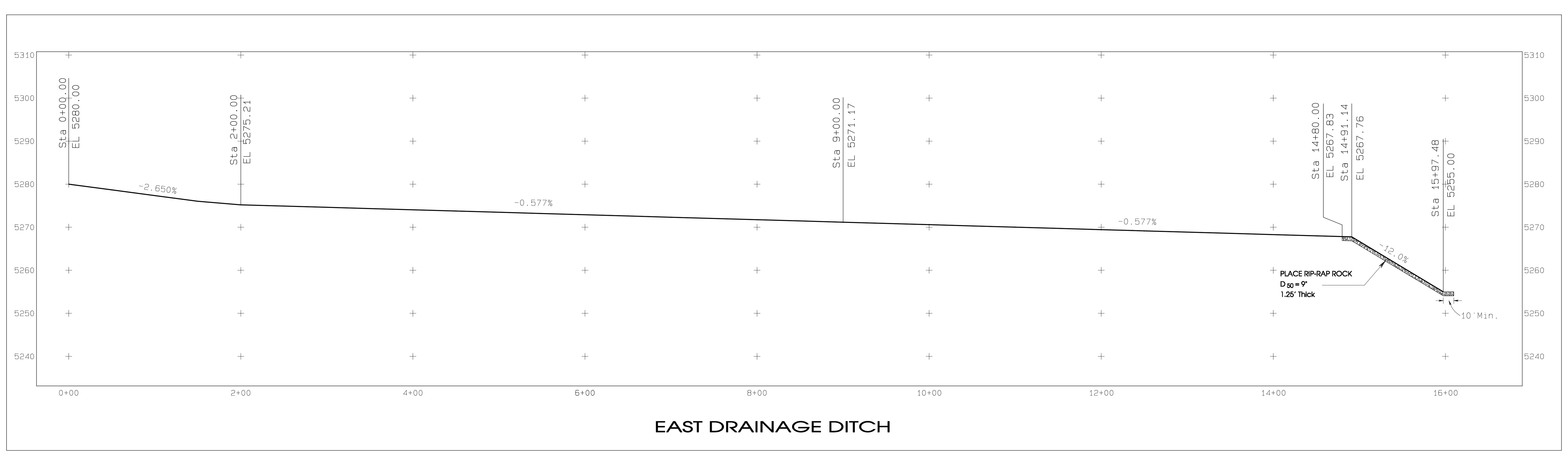
HORIZONTAL=1"=80'
VERTICAL=1"=20'



N.T.S.

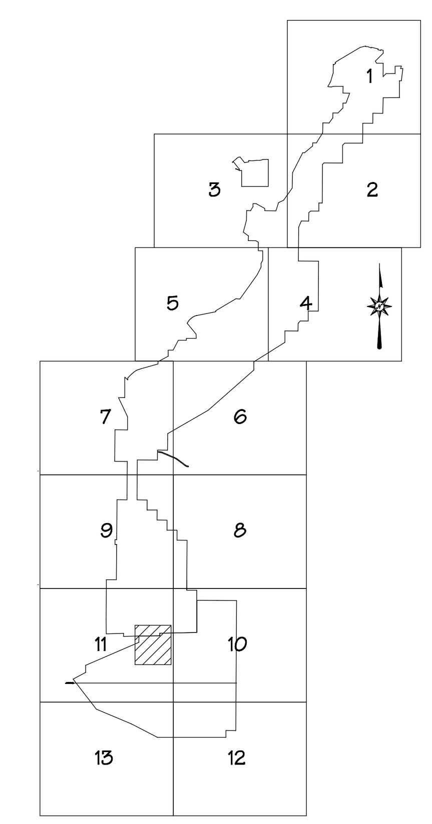


N.T.S.



EAST DRAINAGE DITCH

HORIZONTAL=1"=100'
VERTICAL=1"=20'



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

EXHIBIT 26-79
AREA 4 NORTH POND 7 DESIGN

PLAN, PROFILE AND SECTION

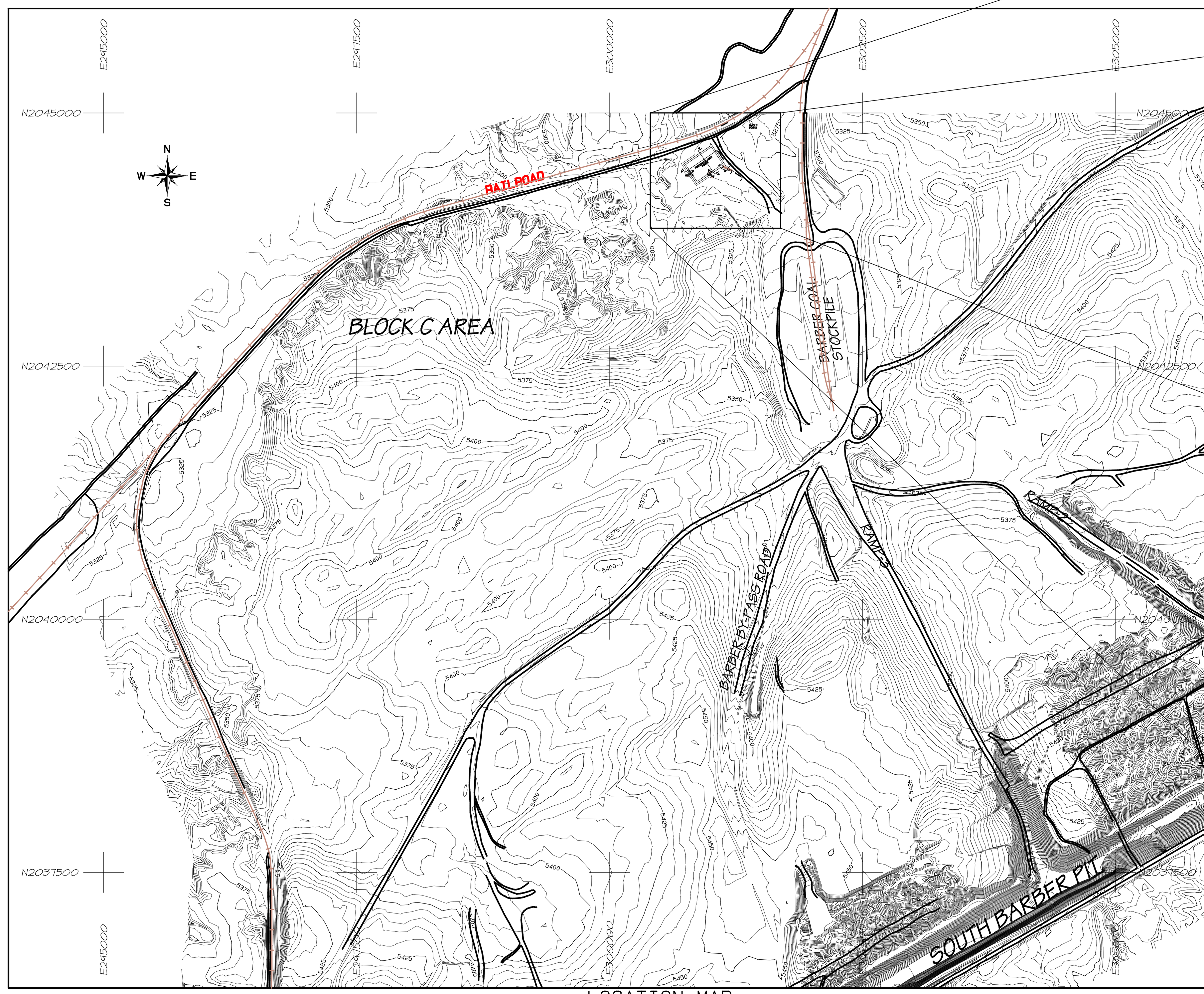
ACCOUNT:
DATE: 11-19-04
DESIGNED BY: PJF
DRAWN BY: PJF
CHECKED BY: LR
APPROVED BY: LR

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

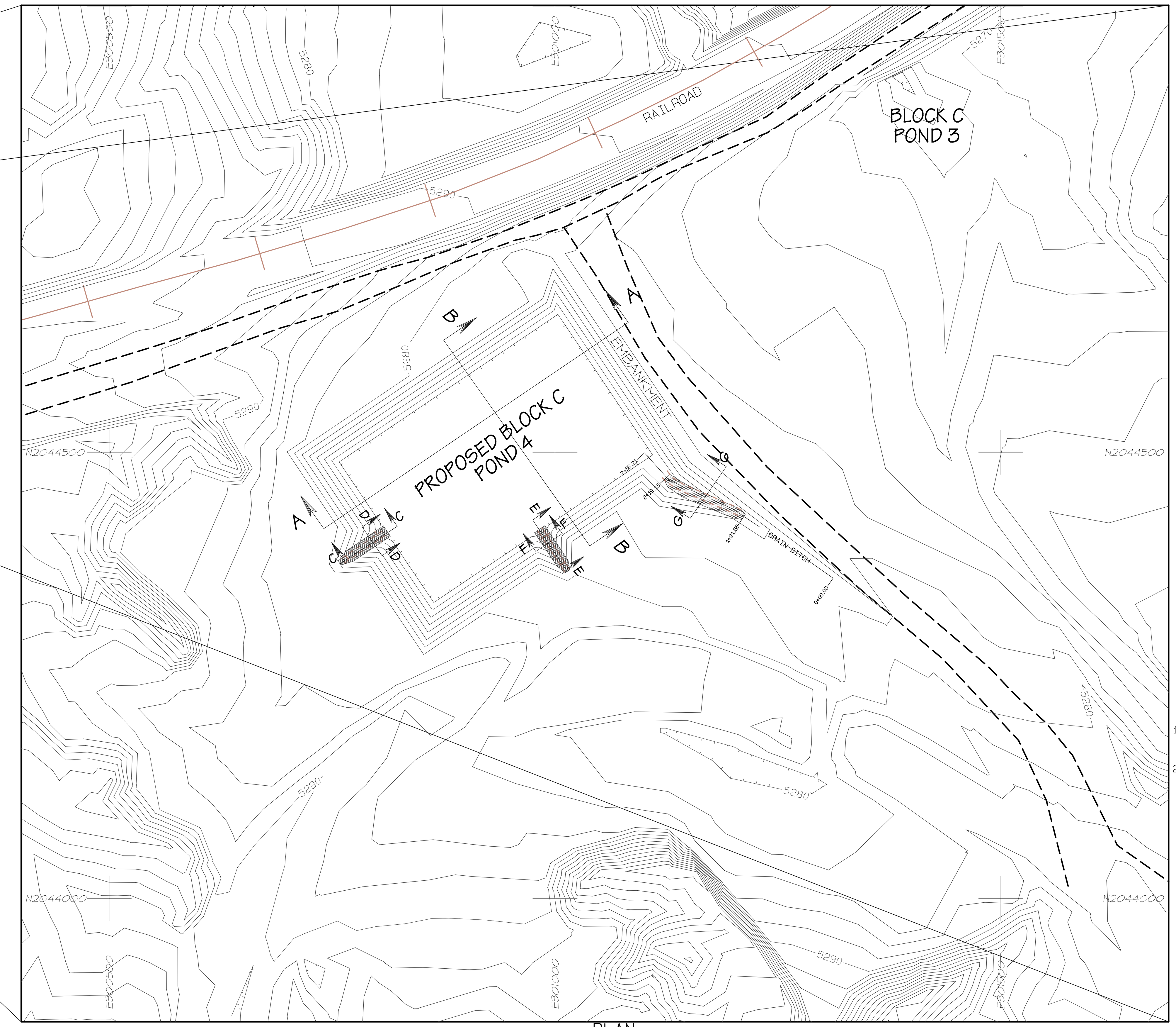
PROJECT MANAGER: DR
ENGR. of RECORD: LR
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

REV NO.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	PJF	11-09-04
2			
3			
4			
5			

DRAWING
SHEET 1 OF 1



LOCATION MAP
Scale: 1" = 1000'



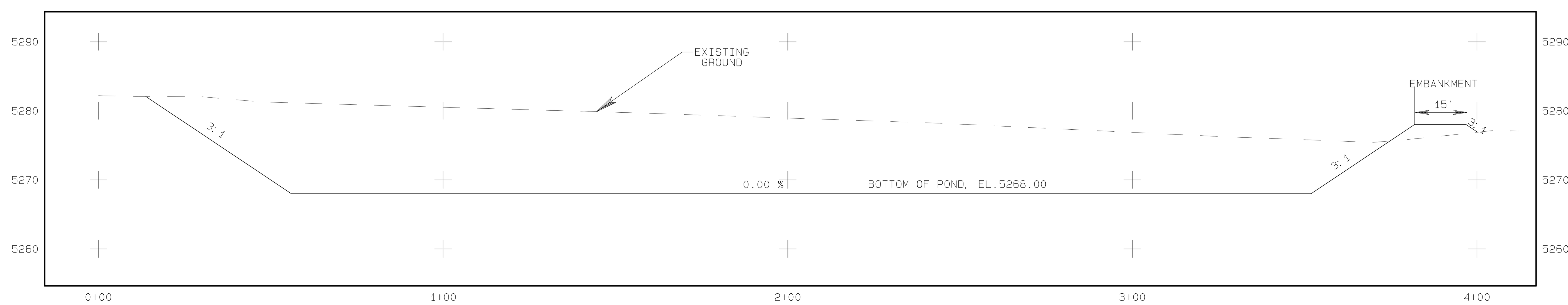
PLAN
Scale: 1" = 100'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- x5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

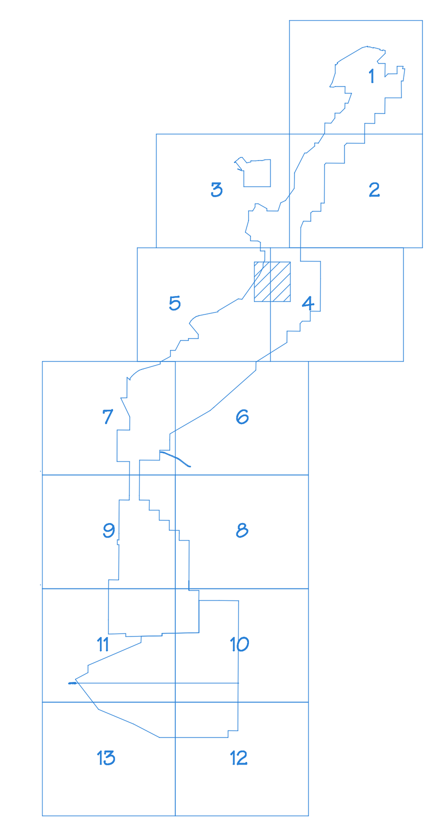
1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-130.



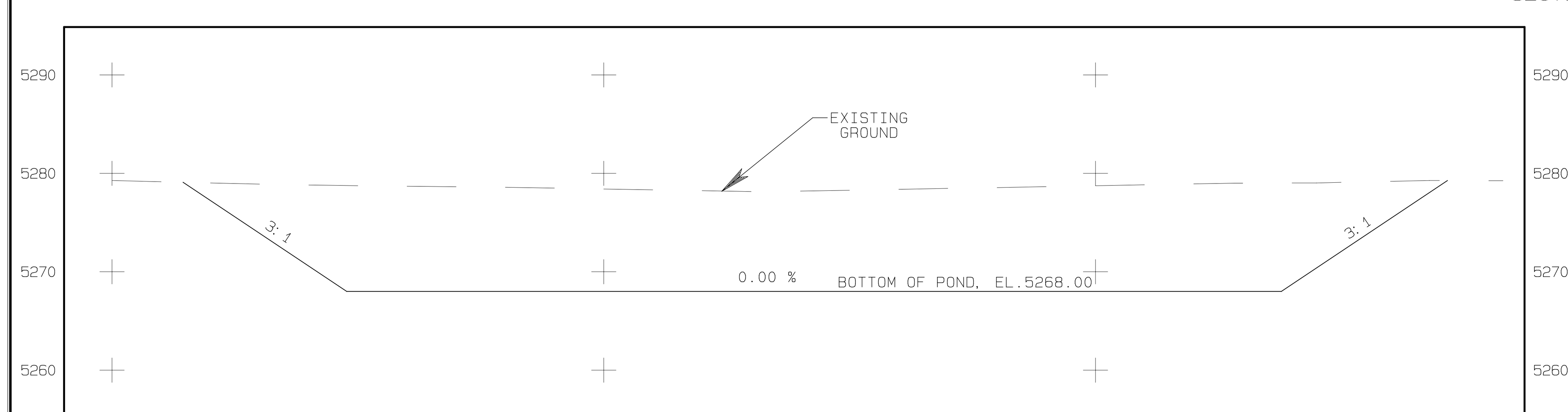
SECTION A

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5268	1.29	0.00	0.00
5269	1.37	1.33	1.33
5270	1.45	1.41	2.75
5271	1.54	1.49	4.24
5272	1.62	1.58	5.82
5273	1.71	1.66	7.48
5274	1.80	1.75	9.24
5275	1.90	1.85	11.09
5276	2.01	1.95	13.04
5277	2.23	2.12	15.15
5278	2.71	2.47	17.62

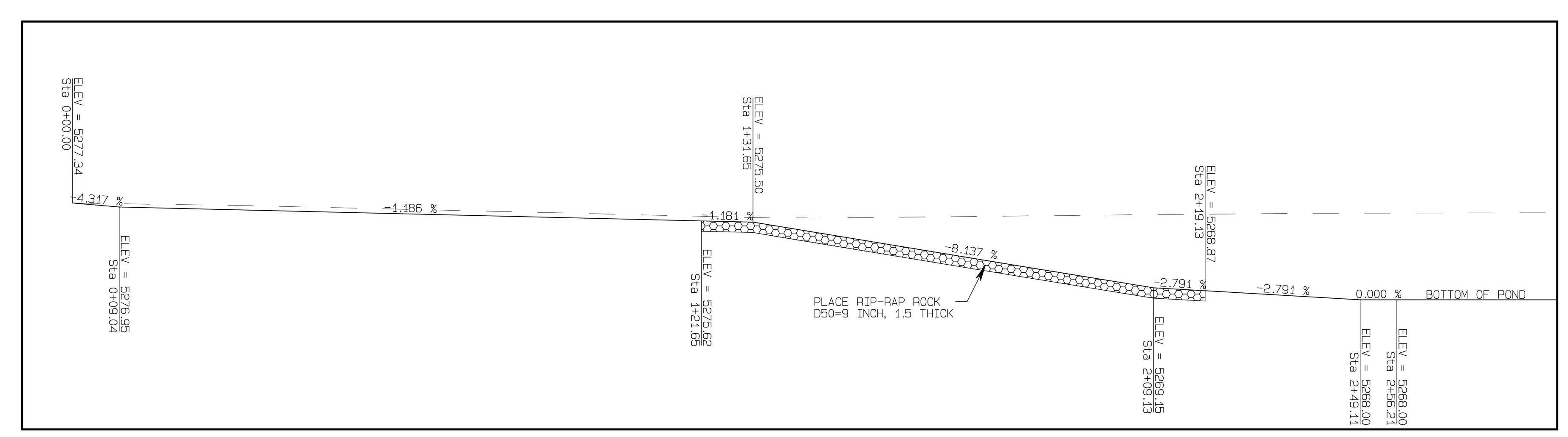


SCALE AS NOTED



SECTION B

ABOVE CROSS SECTIONS AND PROFILE
HORIZONTAL=1"=25'
VERTICAL=1"=4'

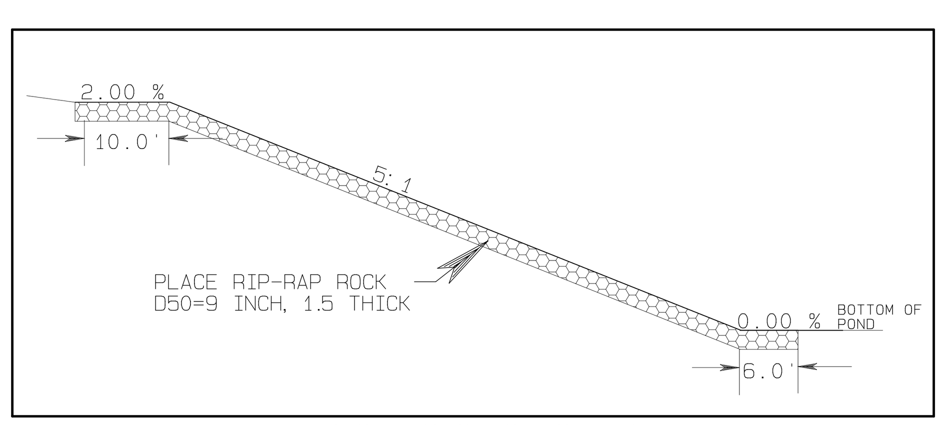


PROFILE OF CENTERLINE DRAIN DITCH

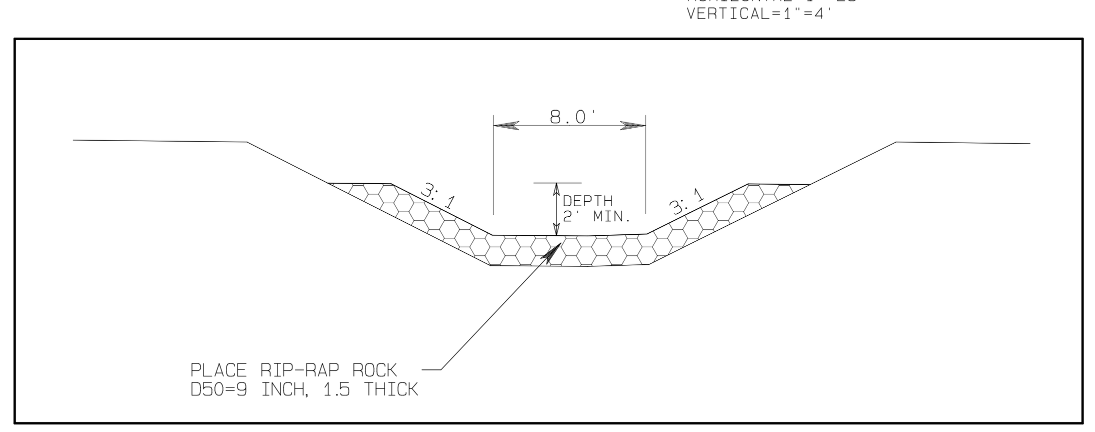
CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

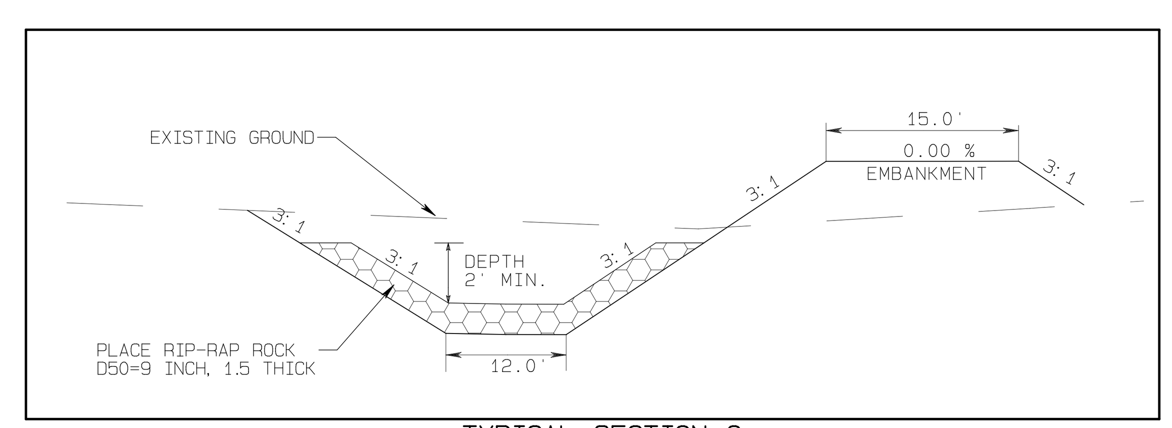
KEVIN A. BAHE
NEW MEXICO
17850
LICENSED PROFESSIONAL ENGINEER



TYPICAL SECTION C AND E
NTS



TYPICAL SECTION D AND F
NTS



TYPICAL SECTION G
NTS

REV NO.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	RY	7-20-07
2			
3			
4			
5			

PROJECT MANAGER: KB
ENGR. of RECORD: LR
REG. NO: 5600
SRVYR of RECORD:
REG. NO:

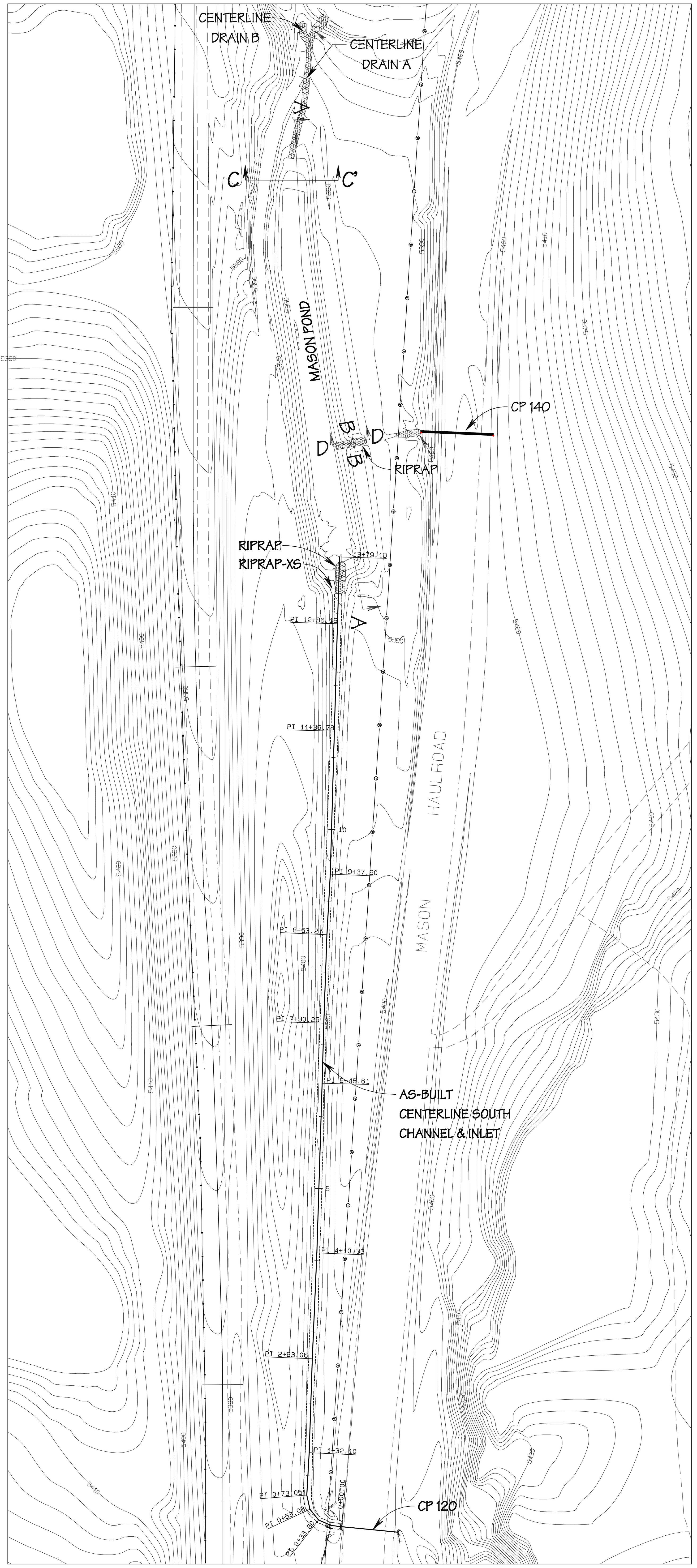
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT:
DATE: 7-20-07
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: KB
APPROVED BY: KB

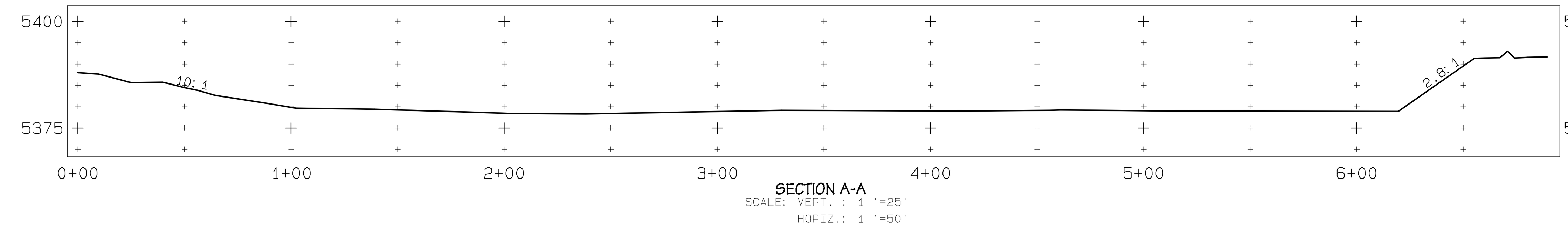
PLAN, PROFILE AND SECTIONS

EXHIBIT 26-80
BLOCK C POND 4 DESIGN

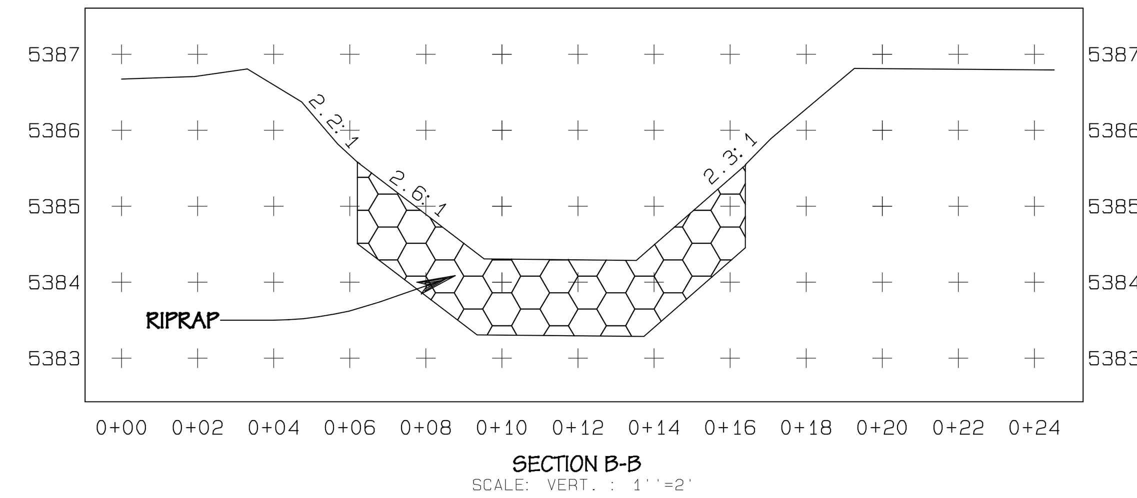
DRAWING
SHEET 1 OF 1



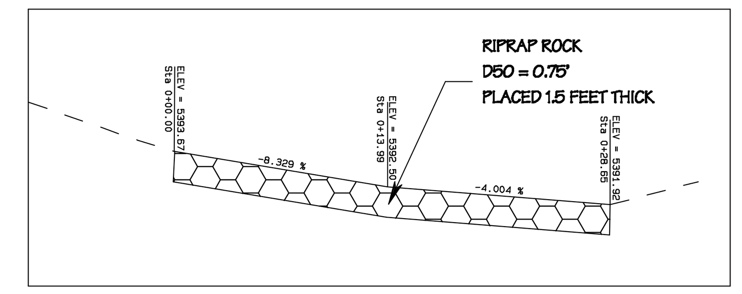
PLAN
SCALE: HORIZ.: 1''=100'



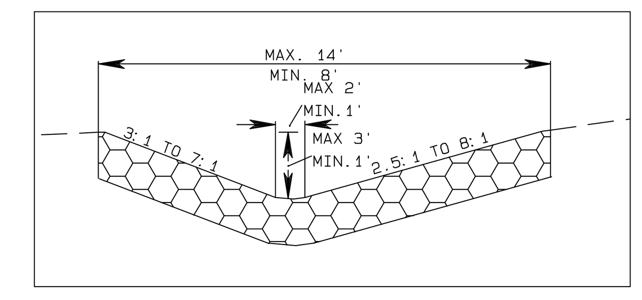
SECTION A-A
SCALE: VERT.: 1''=25'
HORIZ.: 1''=50'



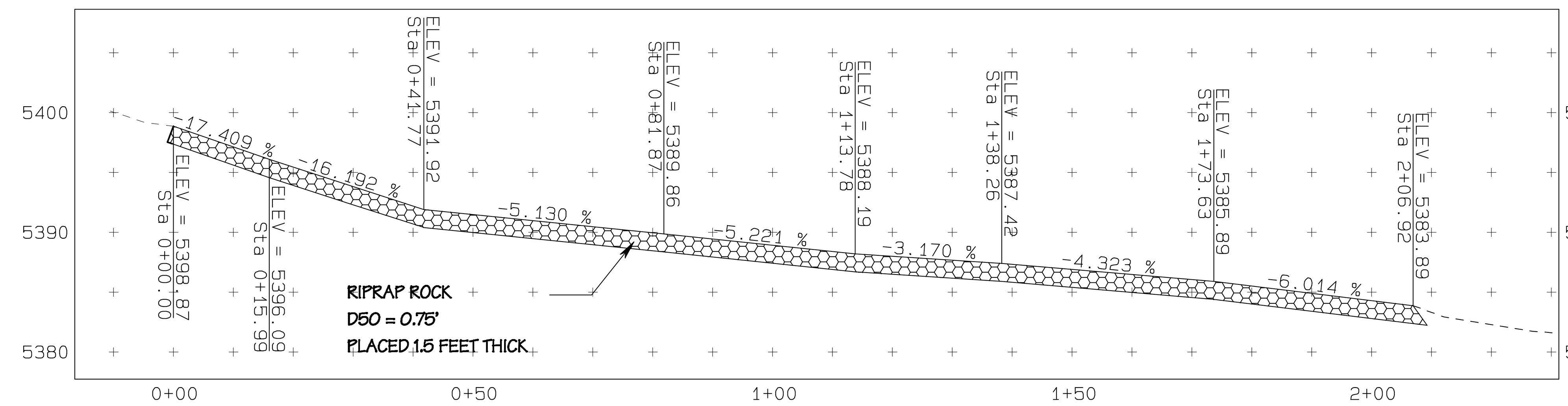
SECTION B-B
SCALE: VERT.: 1''=2'
HORIZ.: 1''=4'



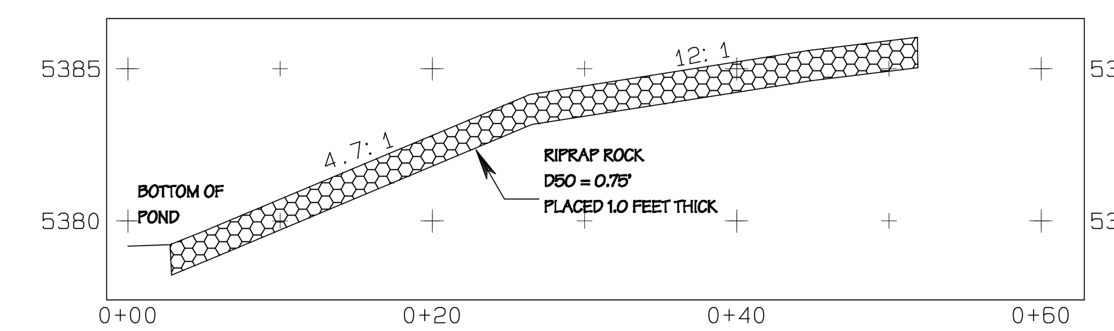
CENTERLINE PROFILE DRAIN B
SCALE: VERT.: 1''=5'
HORIZ.: 1''=10'



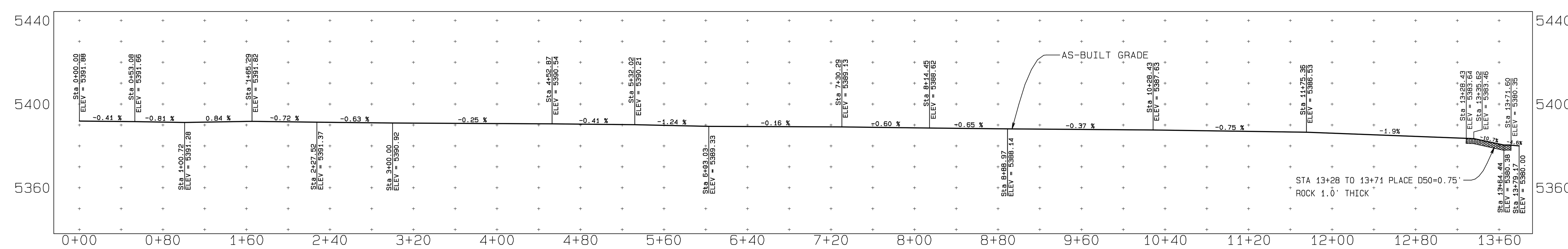
TYPICAL SECTION OF DRAIN A AND B
N.T.S



CENTERLINE PROFILE DRAIN A
SCALE: VERT.: 1''=10'
HORIZ.: 1''=20'



PROFILE D-D
SCALE: VERT.: 1''=5'
HORIZ.: 1''=10'



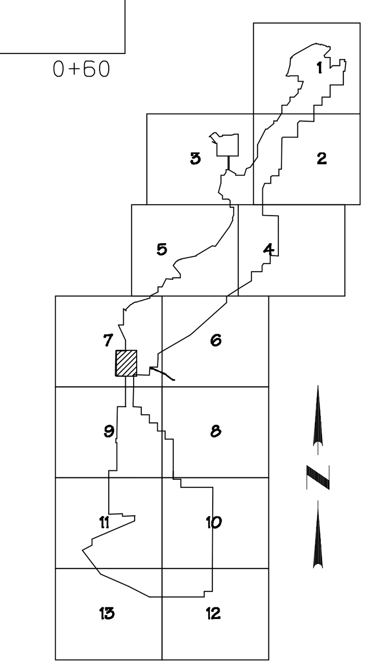
CENTERLINE PROFILE SOUTH CHANNEL/INLET
SCALE: VERT.: 1''=40'
HORIZ.: 1''=80'

LEGEND

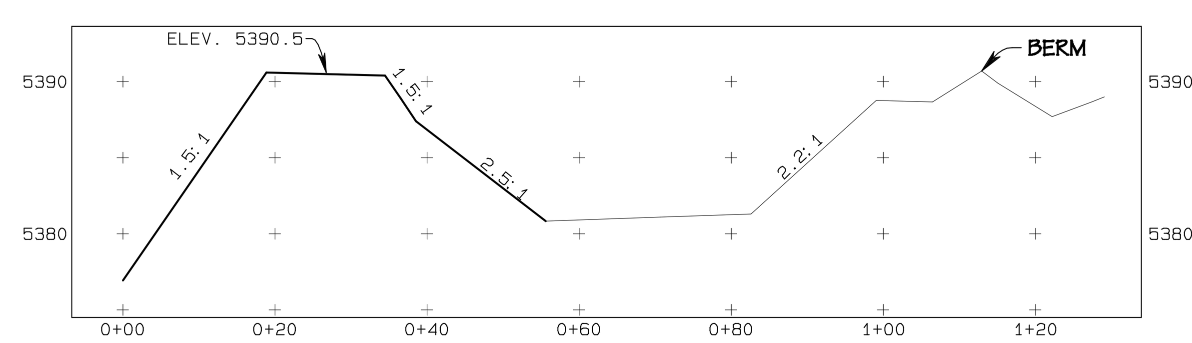
- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- LEASE LINE

NOTES:

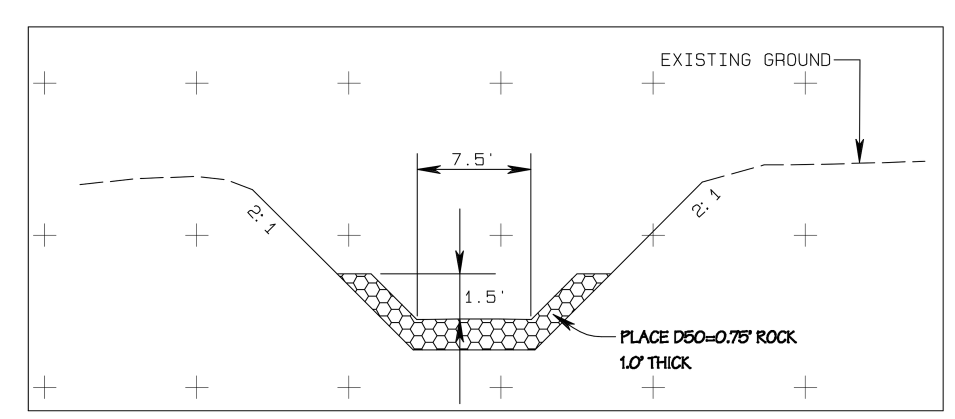
1. FOR HYDROLOGY AND DESIGN INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.
2. THE POND LOCATION AND WATERSHED AREA ARE PRESENTED ON EXHIBIT 11-130.



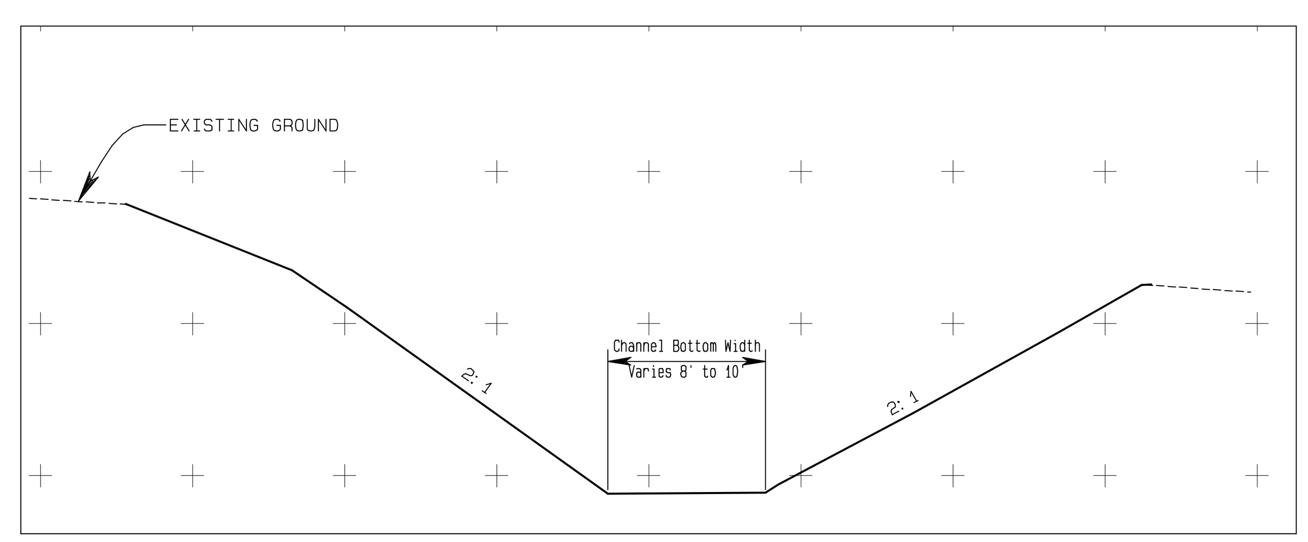
ELEV.	AREA (AC)	INC. VOLUME	CUM. VOLUME (AC-FT)
5379.0	0.28	0.00	0.00
5380.0	0.48	0.38	0.38
5381.0	0.55	0.52	0.89
5382.0	0.62	0.59	1.48
5383.0	0.72	0.67	2.15
5384.0	0.83	0.77	2.92
5385.0	0.96	0.89	3.82
5386.0	1.10	1.03	4.84
5387.0	1.37	1.23	6.08
5388.0	1.90	1.64	7.71
5389.0	2.85	2.38	10.09
5390.0	3.35	3.10	13.19



AS-BUILT SECTION C-C
SCALE: VERT.: 1''=10'
HORIZ.: 1''=20'



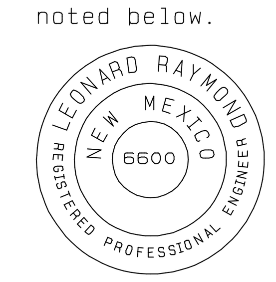
TYPICAL AS-BUILT RIP-RAP SECTION
SOUTH CHANNEL
SCALE: VERT.: 1''=5'
HORIZ.: 1''=10'



TYPICAL AS-BUILT SECTION
SOUTH CHANNEL
SCALE: VERT.: 1''=5'
HORIZ.: 1''=10'

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this pond has been constructed in accordance with the approved design plans and that the information shown is complete and accurate to the best of my knowledge, except as noted below.



1. THE CHANNEL GRADE IN THE SOUTH CHANNELVARIES FROM DESIGN. THE FLOW VELOCITY WAS CHECKED AT THE MAXIMUM GRADE (1.9%), AT THAT GRADE THE VELOCITY IS LESS THEN THE EROSIVE VELOCITY
2. THE GRADE OF THE RIP-RAP IN THE SOUTH CHANNEL IS GREATER THEN DESIGN (10.7% vs 8.0%), THE D50=0.75' RIP-RAP SIZE IS ADEQUATE AT THE MAXIMUM GRADE

	REVISION	DATE
11-A	Modified Mason Pond and submitted to OSM for Review.	Jan. 18, 2011
12-A	Prepared As-Built for Mason Pond and submitted to OSM for Review.	May 10, 2012

PROJECT MANAGER: Ferguson Gorman
ENGR. of RECORD: Leonard Raymond
REG. NO: NM-6600
SRVYR of RECORD: Wilson Begay
REG. NO: NM-18628

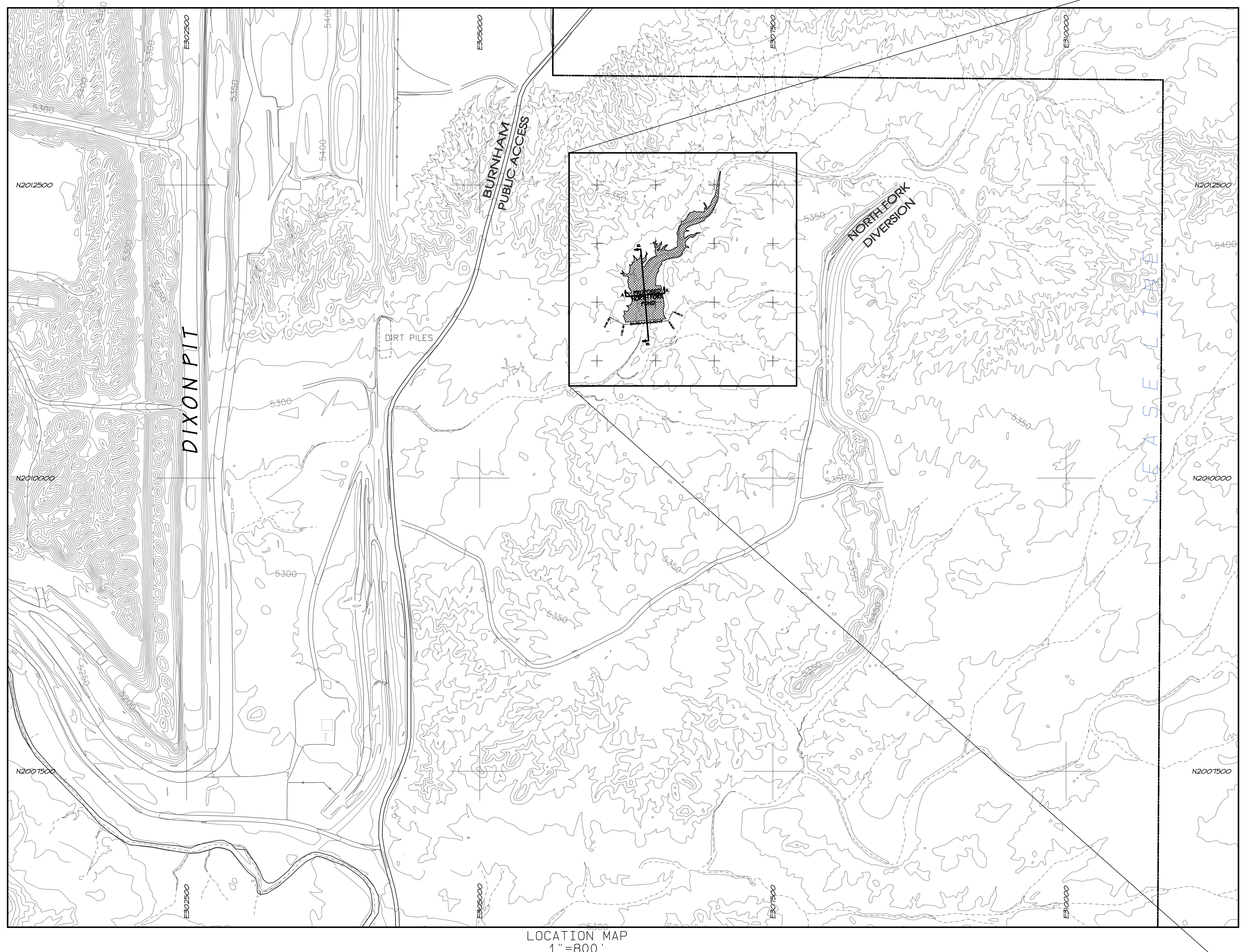
bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 / PHONE 505-598-4200/FAX 505-598-3361

PROJECT:
DATE:
DESIGNED BY: Leonard Raymond
DRAWN BY: P. Foster
CHECKED BY: L. Raymond
APPROVED BY: L. Raymond

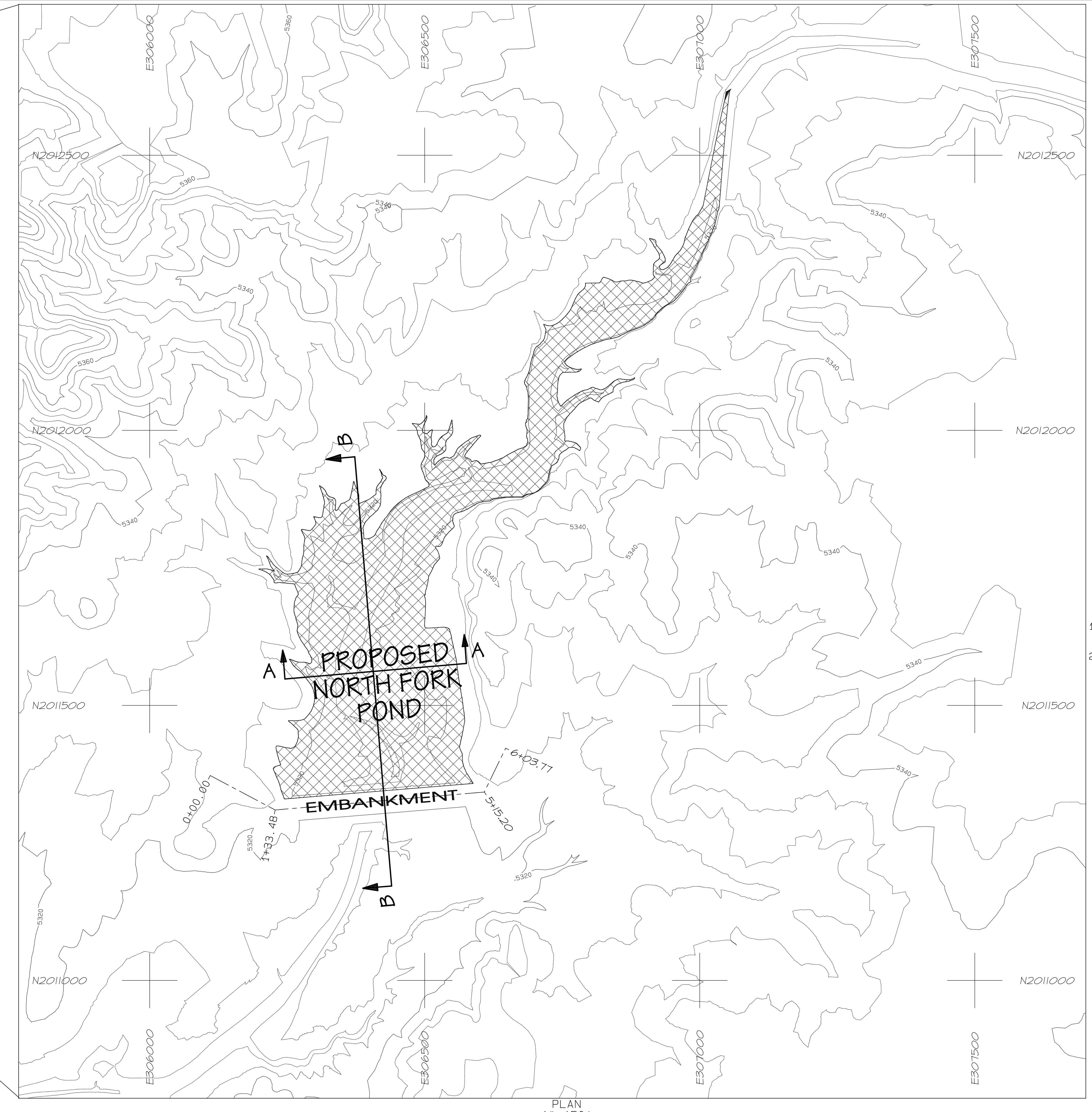
PLAN, PROFILE, AND SECTIONS

Exhibit 26-81
MASON POND MODIFICATION
AS-BUILT

DRAWING
SHEET 1 OF 1



LOCATION MAP
1"=800'



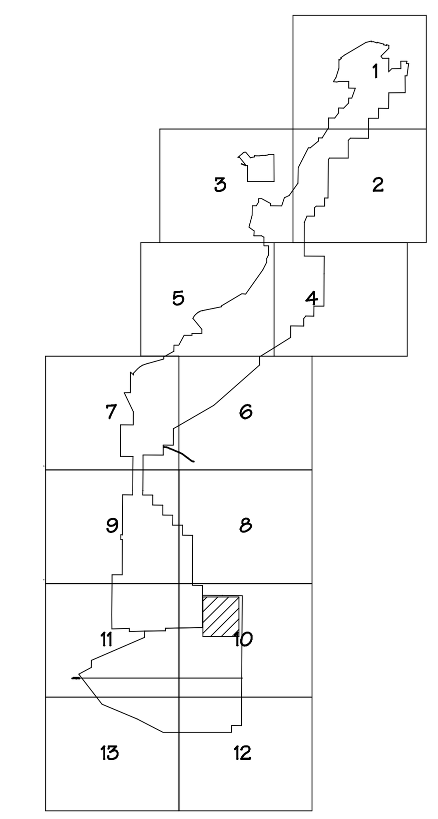
PLAN
1"=150'

LEGEND

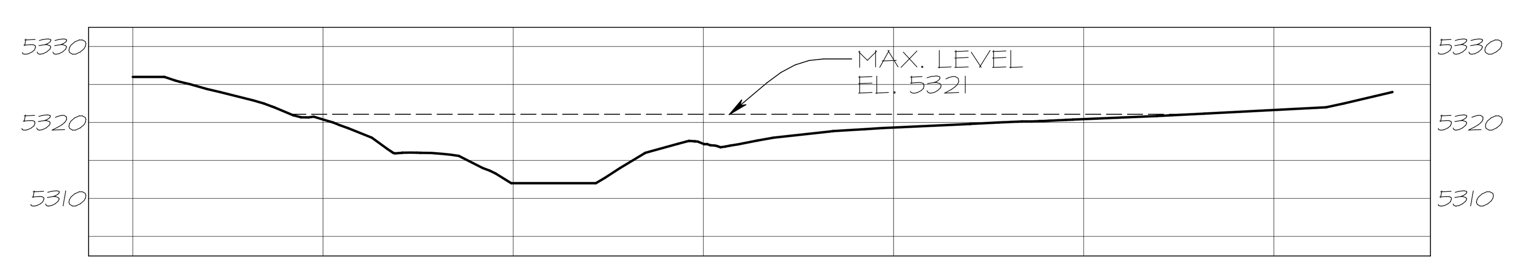
- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

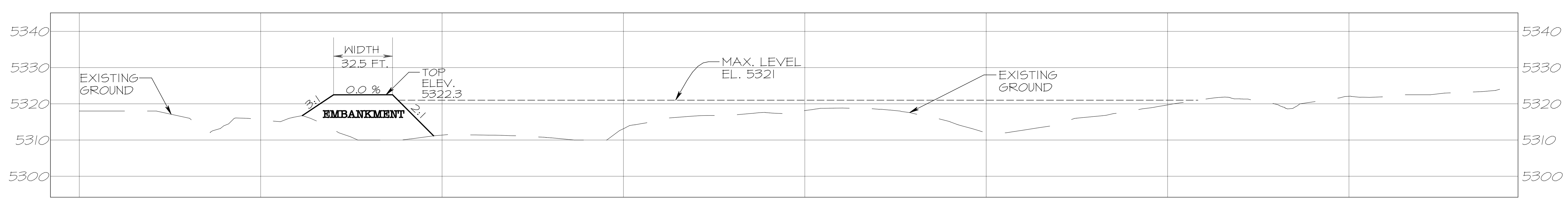
1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13E.



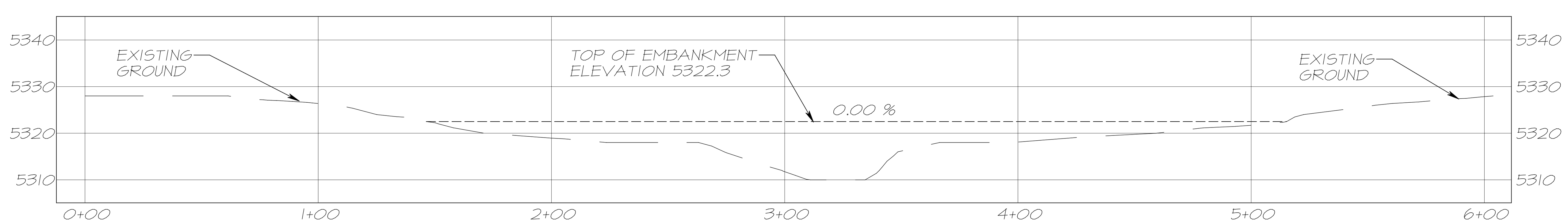
SCALE AS NOTED



SECTION A - A



SECTION B - B



PROFILE (CENTERLINE OF EMBANKMENT)

ABOVE CROSS SECTIONS AND PROFILE
HORIZONTAL 1"=40'
VERTICAL 1"=20'

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5310	0.03	0.00	0.00
5312	0.21	0.2	0.2
5314	0.45	0.7	0.9
5316	0.96	1.4	2.3
5318	1.72	2.7	5.0
5320	3.05	4.8	9.7
5322	4.82	7.9	17.6
5324	7.65	12.5	30.1

Design Pond Crest Elevation - 5322.3
Design Volume (Ac-ft.) - 19.50

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

Ron C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

Original Signed by P.E.

REV NO.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO OSM FOR APPROVAL	RCV	1-19-08
2	Updated Exhibit and submitted to OSM for Review.	PJF	7-15-08
3			
4			
5			

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT:
DATE: 1-19-08
DESIGNED BY: RCV
DRAWN BY: RY
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 26-82
NORTH FORK POND DESIGN

DRAWING

SHEET 1 OF 1

EXPLANATION

WATERSHED	ACREAGE	STATUS
A-1	25	RAILROAD CORRIDOR
A-2	6	UNDISTURBED
B-1	104	RECLAIMED
B-2	39	RECLAIMED
B-3	20	RECLAIMED
B-4	13	RECLAIMED
C	21	RAILROAD CORRIDOR

LEGEND

- RAILROAD
- ROAD
- 5393.0 SPOT ELEVATIONS
- POWERLINE
- SURVEY CONTROL POINT
- SURFACE WATER DRAINAGE PATTERN
- ACTIVE MINING AREA BERM
- WATERSHED BOUNDARY

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

5-4-04

Notes:

1. For Design Data refer to Appendix 11-E.
2. For Location and Details of Structures refer to Exhibit 11-14P and 11-14T.

SEP 2004 APPROVED

REV. NO.	DATE	REVISIONS	APPROVALS DRAFT BY:	ENGR.	CHIEF ENGR.	P.E.
1	2-28-92	WATERSHED BOUNDARIES, BERMS & FLOW ARROWS	RJF	JEO	GAP	RCV
2	8/25/93	CHANGED EXHIBIT NO. TO 11-53, CHANGED CO. NAME CHANGED EXHIBIT NO's in DETAIL DWGS.	JG			
3	4-27-04	Updated exhibit and submitted to OSM for	PJF	LR		

BHP MINERALS INTERNATIONAL

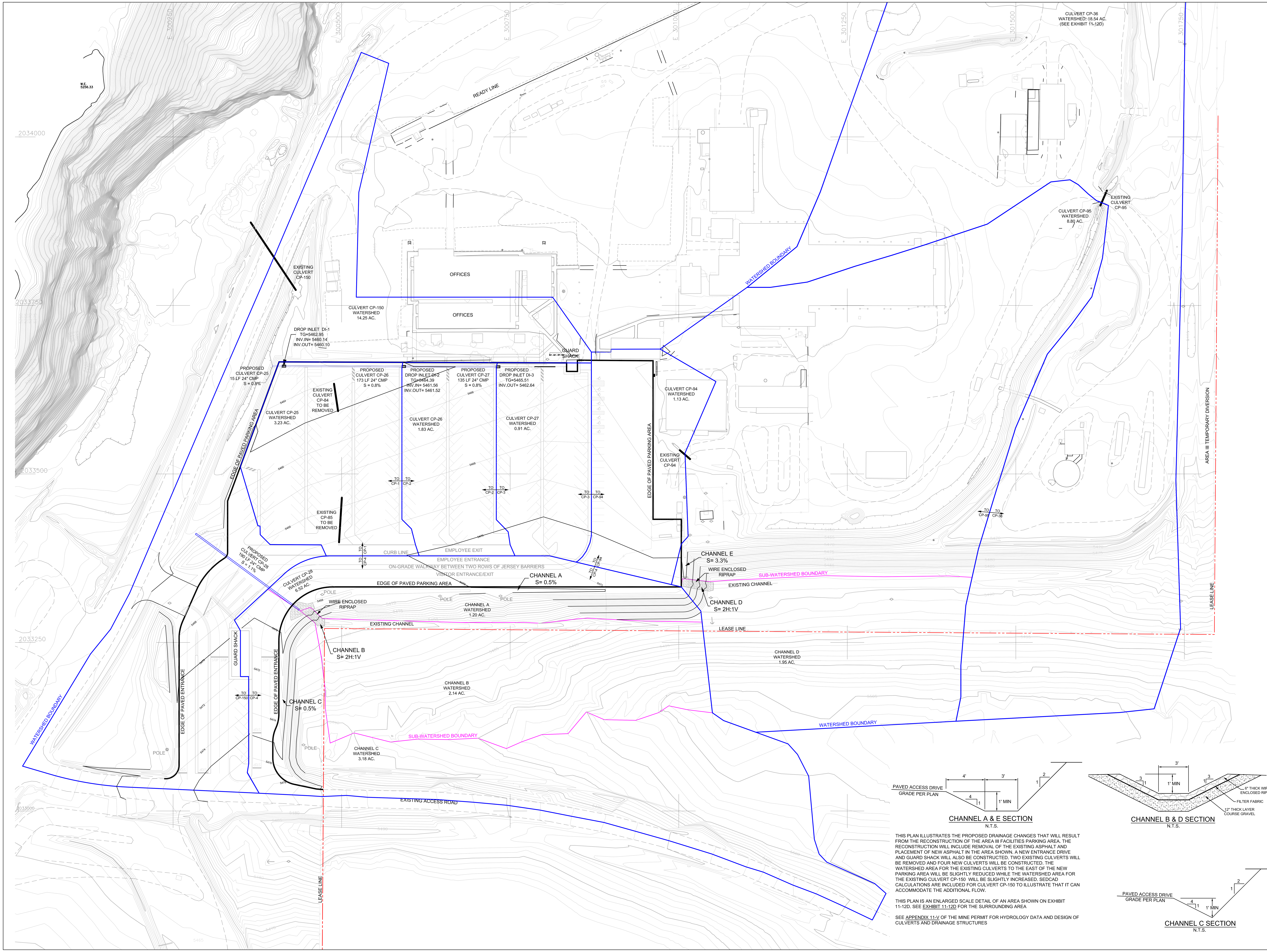
NAVAJO MINE

FRUITLAND, NEW MEXICO

SPUR–D WATERSHEDS

EXHIBIT 26-83

DRAWN BY PF/JEO	SCALE 1"=300'	PREPARED BY JEO
APPROVED BY GAP	DATE 12-06-91	
DRAWING NO.	LOCATION NO. MF-D2a	



THIS PLAN ILLUSTRATES THE PROPOSED DRAINAGE CHANGES THAT WILL RESULT FROM THE RECONSTRUCTION OF THE AREA III FACILITIES PARKING AREA. THE RECONSTRUCTION WILL INCLUDE REMOVAL OF THE EXISTING ASPHALT AND PLACEMENT OF NEW ASPHALT IN THE AREA SHOWN. A NEW ENTRANCE DRIVE AND GUARD SHACK WILL ALSO BE CONSTRUCTED. TWO EXISTING CULVERTS WILL BE REMOVED AND FOUR NEW CULVERTS WILL BE CONSTRUCTED. THE WATERSHED AREA FOR THE EXISTING CULVERTS TO THE EAST OF THE NEW PARKING AREA WILL BE SLIGHTLY REDUCED WHILE THE WATERSHED AREA FOR THE EXISTING CULVERT CP-150 WILL BE SLIGHTLY INCREASED. SEDCAD CALCULATIONS ARE INCLUDED FOR CULVERT CP-150 TO ILLUSTRATE THAT IT CAN ACCOMMODATE THE ADDITIONAL FLOW.

THIS PLAN IS AN ENLARGED SCALE DETAIL OF AN AREA SHOWN ON EXHIBIT 11-12D, SEE EXHIBIT 11-12D FOR THE SURROUNDING AREA

SEE APPENDIX 11-V OF THE MINE PERMIT FOR HYDROLOGY DATA AND DESIGN OF CULVERTS AND DRAINAGE STRUCTURES

THE EXISTING TOPOGRAPHY AND OTHER EXISTING FEATURES AS SHOWN ARE THE RESULT OF MERGING THE FOLLOWING TOPOGRAPHIC FILES PROVIDED BY BHP BILLITON NAVAJO MINE.:
-TOPO SURVEYS-PARKING LOT
-A3LIGHT VEHICLE & PEDESTRIAN SEPARATION LAYOUT
-11DEC-1FT_S.DXF

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	G.S.	P.E.
A-12	6-12-12	PR	RE-CONSTRUCTED PARKING AREA DELETED CULVERTS CP-84 & CP-85 ADDED CULVERTS CP-1, CP-2, CP-3 & CP-4			GM

CERTIFICATION STATEMENT:
I,GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

GEORGE A. MADRID NEW MEXICO 9110 REGISTERED PROFESSIONAL ENGINEER
6-12-12

GEOMAT INC.
915 Malta Avenue ◆ Farmington, NM 87401 ◆ (505) 327-7928

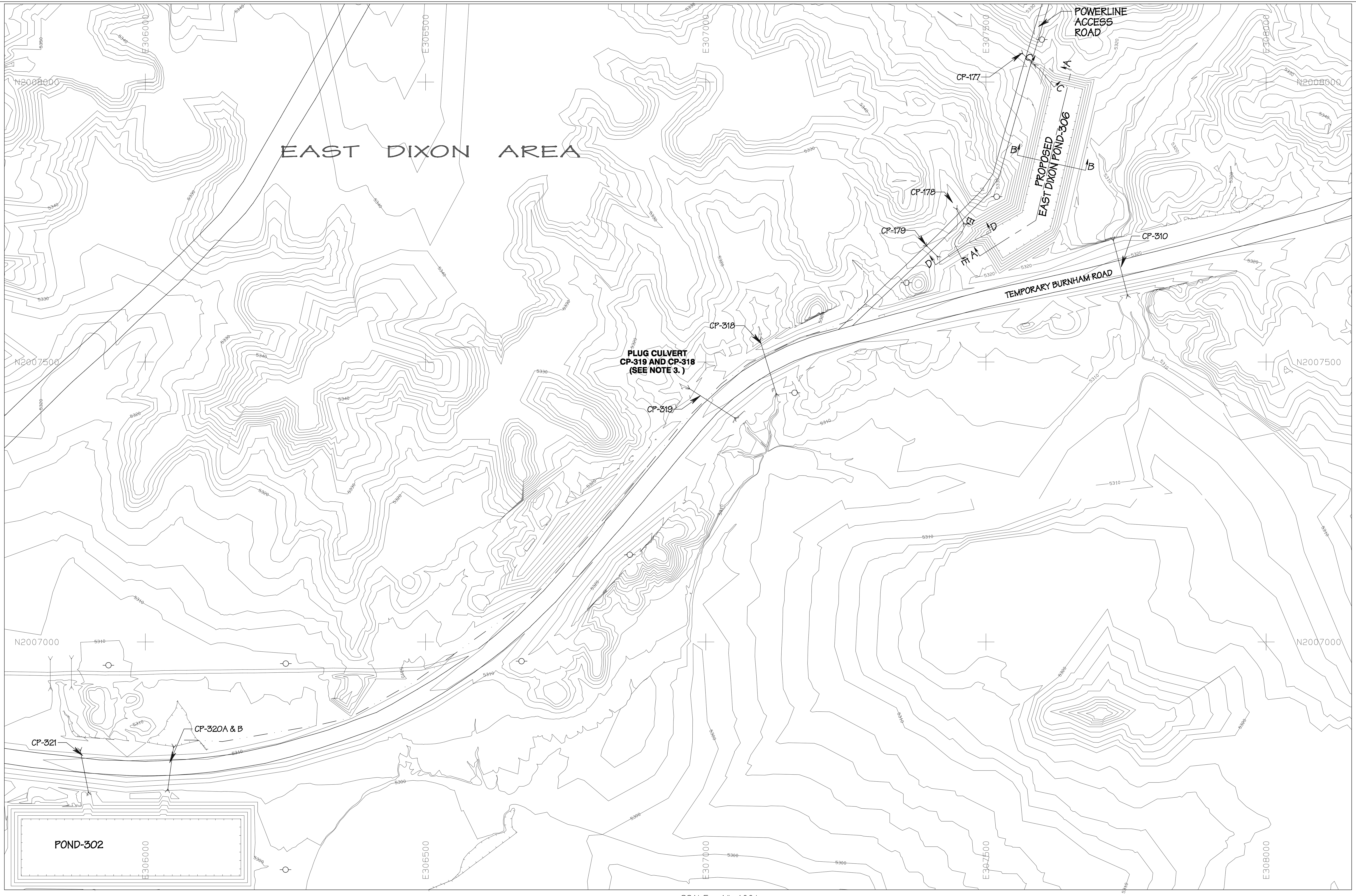
Exhibit 26-84

bhpbilliton

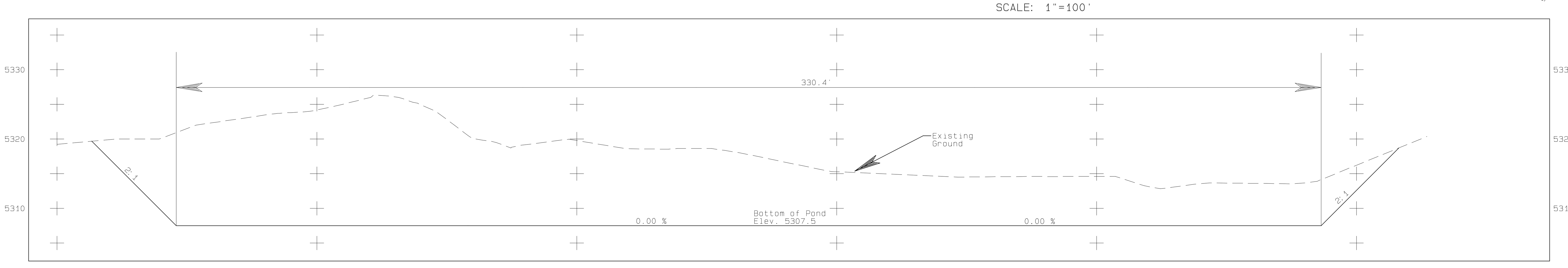
BHP Navajo Coal Company
P.O. Box 1717 Fruitland,New Mexico,87416
Phone: 505-598-4200 Fax: 505-598-3361

AREA—III FACILITIES CULVERT LOCATIONS & WATERSHED AREAS

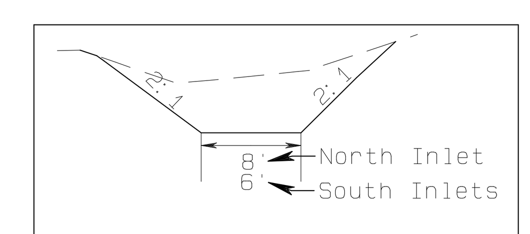
PREPARED BY: PAR | DATE: JUNE 12, 2012 | SCALE: 1"=60'
GEOMAT PROJECT #122-1505



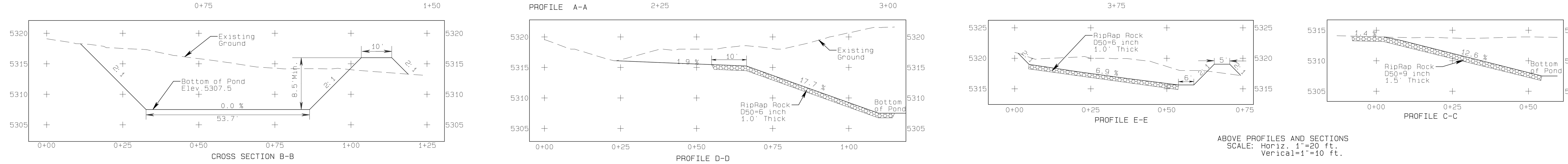
SCALE: 1"=100'



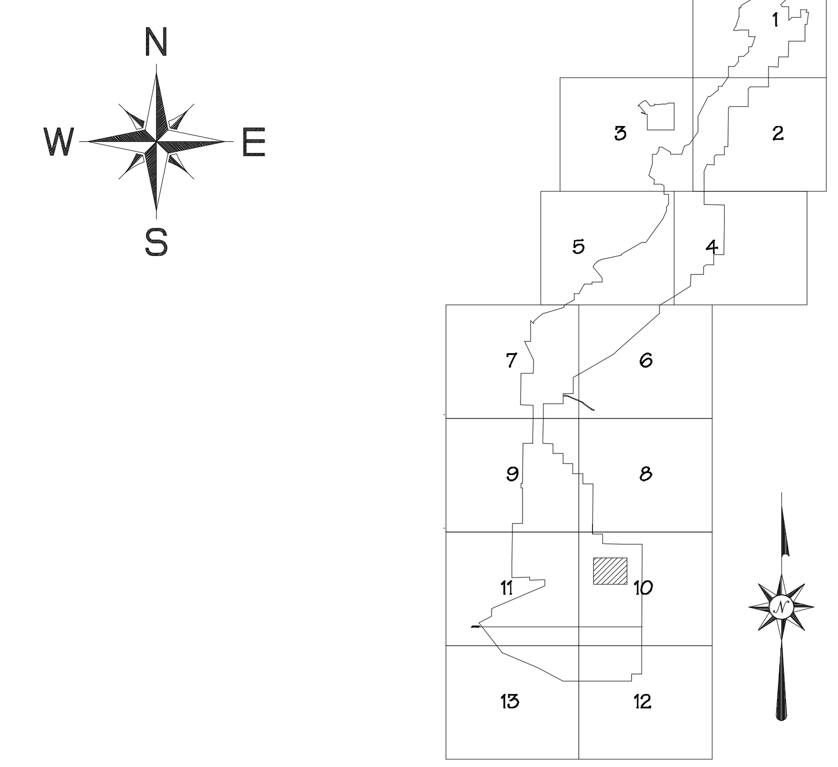
PROFILE A-A



TYPICAL CUT SECTION
NORTH AND SOUTH DRAIN INLETS
N.T.S



ABOVE PROFILES AND SECTIONS
SCALE: Horiz. 1"=20 ft.
Verical=1"=10 ft.



LEGEND

- ROAD
- EXISTING CULVERTS
- WATERSHED BOUNDARY
- DRAINAGE
- POWERLINE
- INDEX CONTOUR (5300)
- INTERMEDIATE CONTOUR
- LEASE CORNER (L-30)
- PERMIT/LEASE BOUNDARY
- FENCE LINE
- IRRIGATION LINE

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for culverts are shown on Exhibit 11-13E
3. Culvert CP-318 and CP-318 will be plugged. The flows that went to the culverts will be diverted along the Temporary Burnham Road via the side ditch to Culvert CP-320A & CP-320B or Pond 302.

DIXON POND 306 STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5307.5	0.40	0.00	0.00
5308	0.42	0.21	0.21
5309	0.46	0.44	0.65
5310	0.50	0.48	1.12
5311	0.54	0.52	1.64
5312	0.58	0.56	2.20
5313	0.62	0.60	2.80
5314	0.67	0.65	3.45
5315	0.74	0.70	4.15
5316	0.89	0.81	4.97

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

REVISION		DATE
12-A	Submitted to OSM for Approval	6-5-12
12-B	Added Note 3, Culverts locations and Extended map area to Pond-302.	6-29-12

PROJECT MANAGER: J.G
ENGR. of RECORD: LR
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

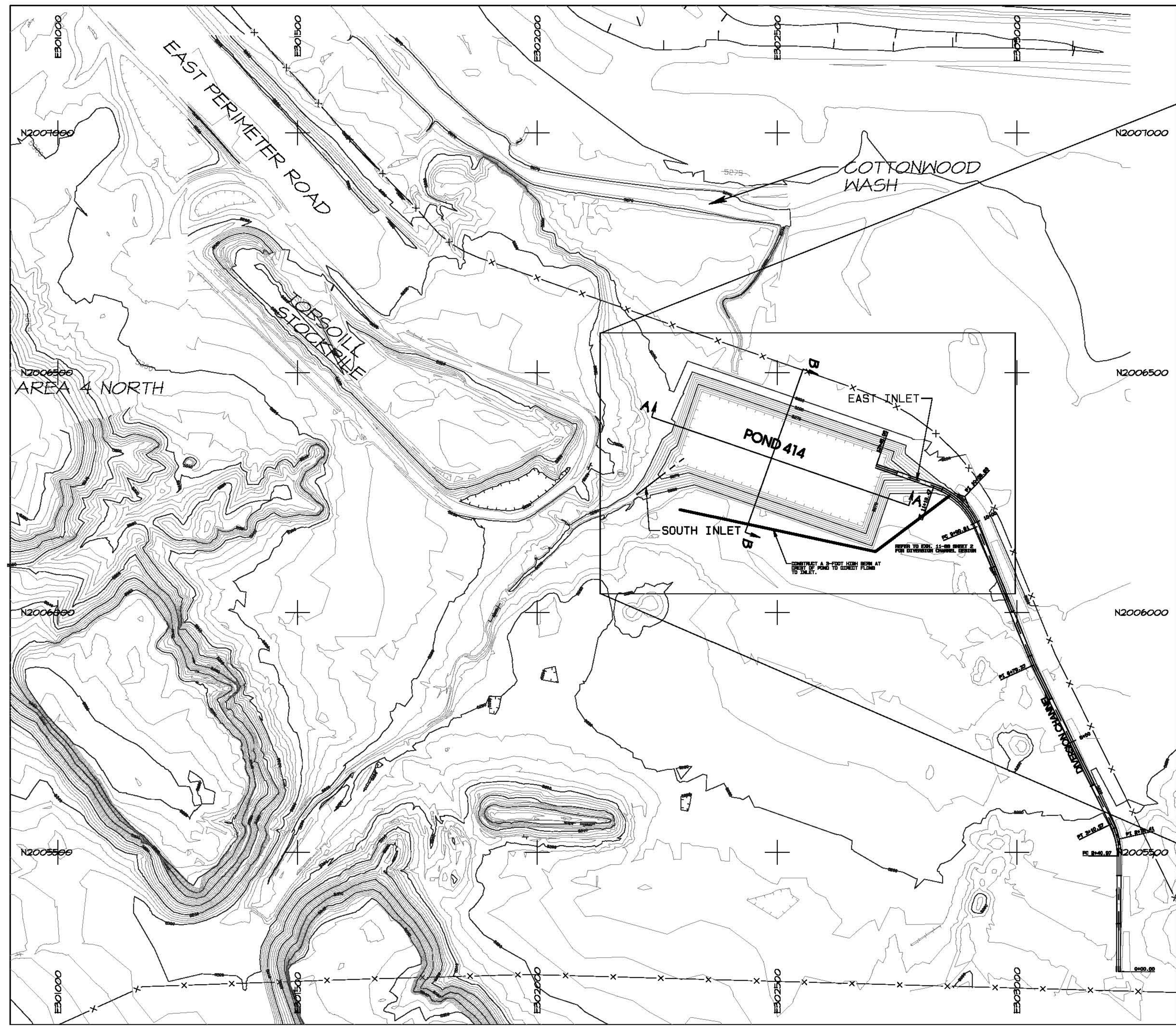
bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

PROJECT: EAST DIXON POND DESIGN
DATE: 5-29-12
DESIGN BY: RY
DRAWN BY: RY
CHECKED BY: LR
APPROVED BY: LR

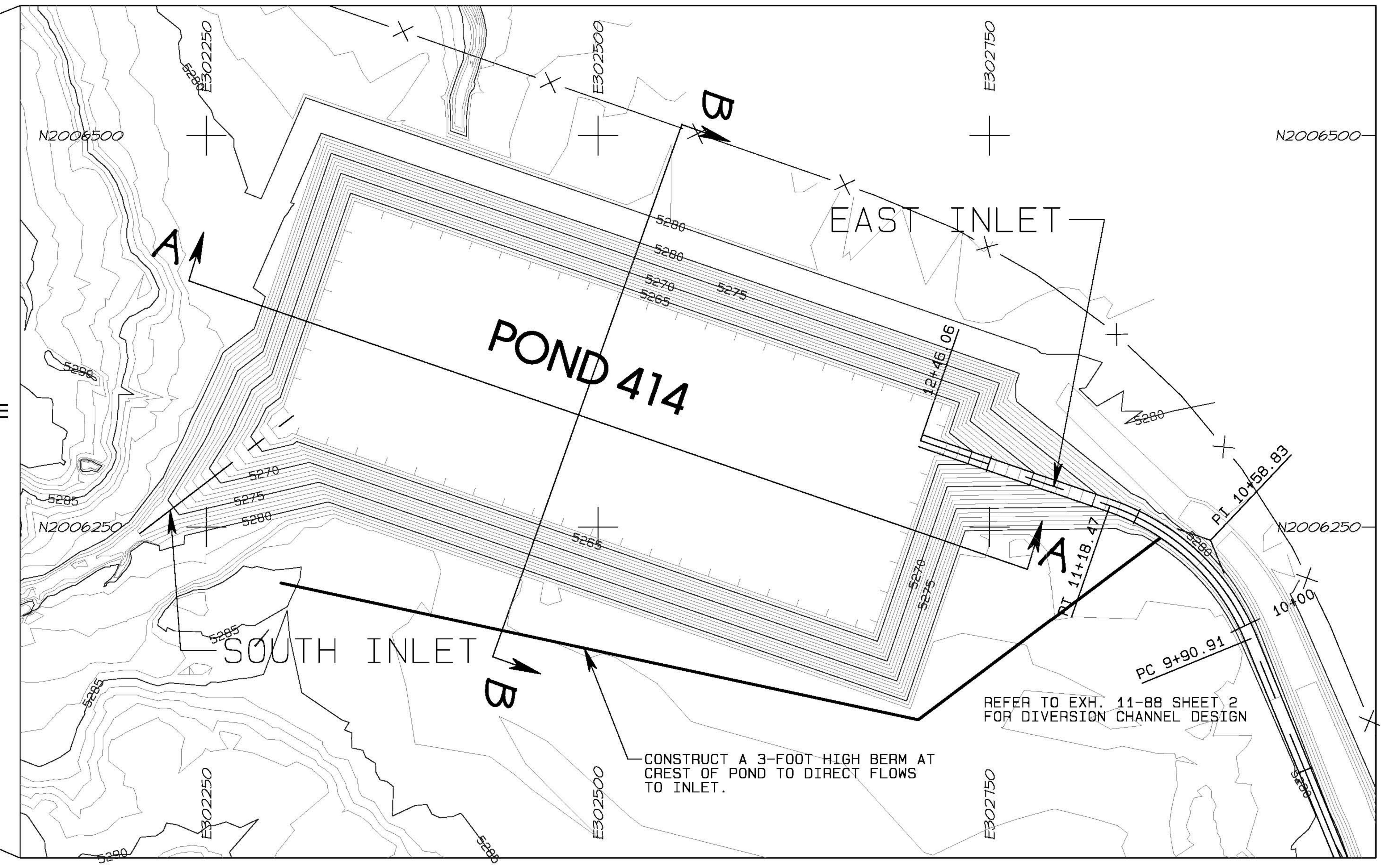
PLAN, PROFILE AND SECTIONS

Exhibit 26-85
DIXON POND-306
DESIGN

DRAWING
SHEET 1 OF 1



LOCATION MAP
1"=200'



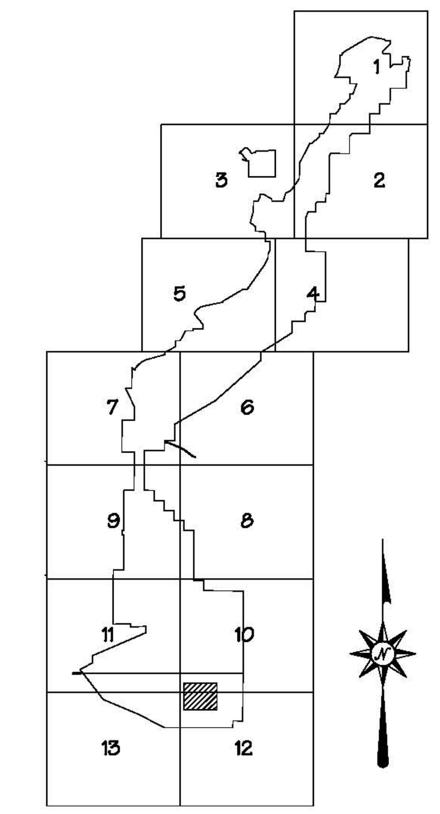
PLAN
1"=60'

LEGEND

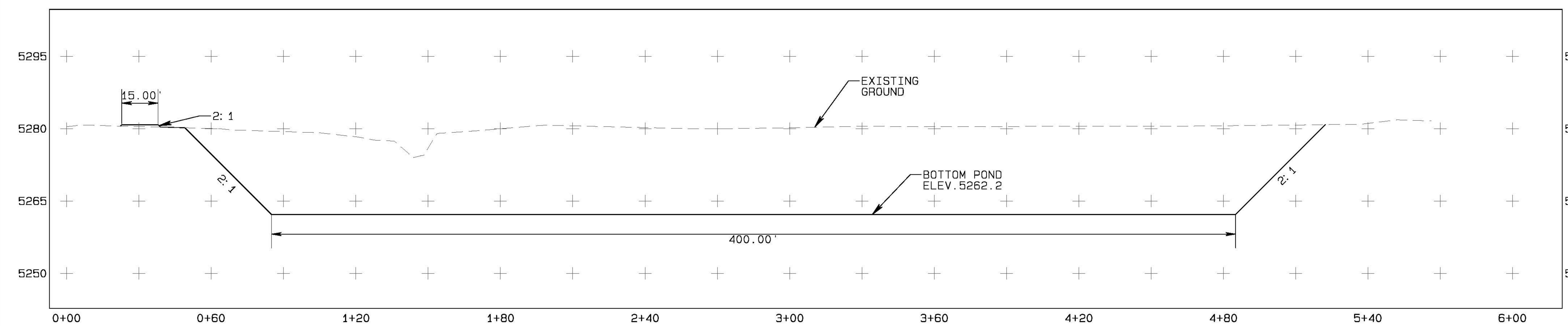
- ROAD
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- L-30 L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY
- WATER LINE
- IRRIGATION LINE

NOTES

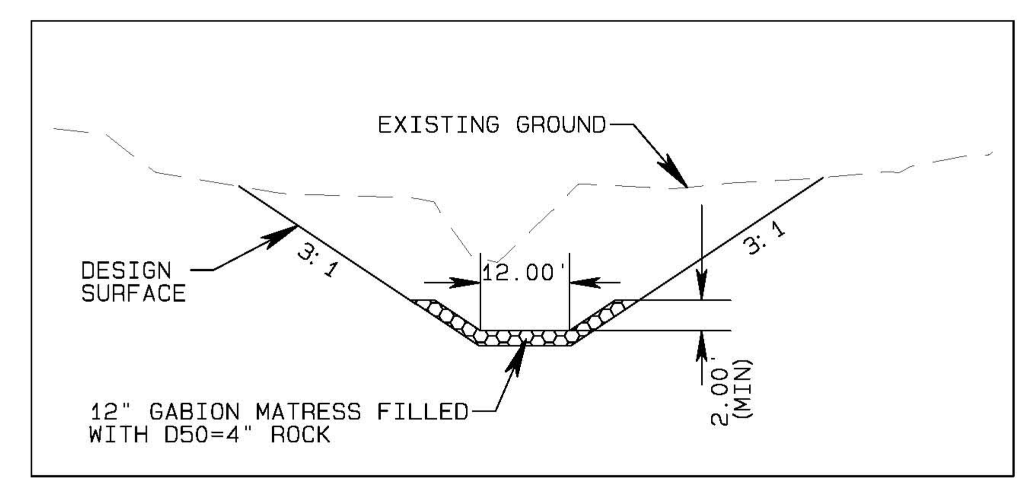
1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for the impoundments are shown on Exhibit 11-13F.



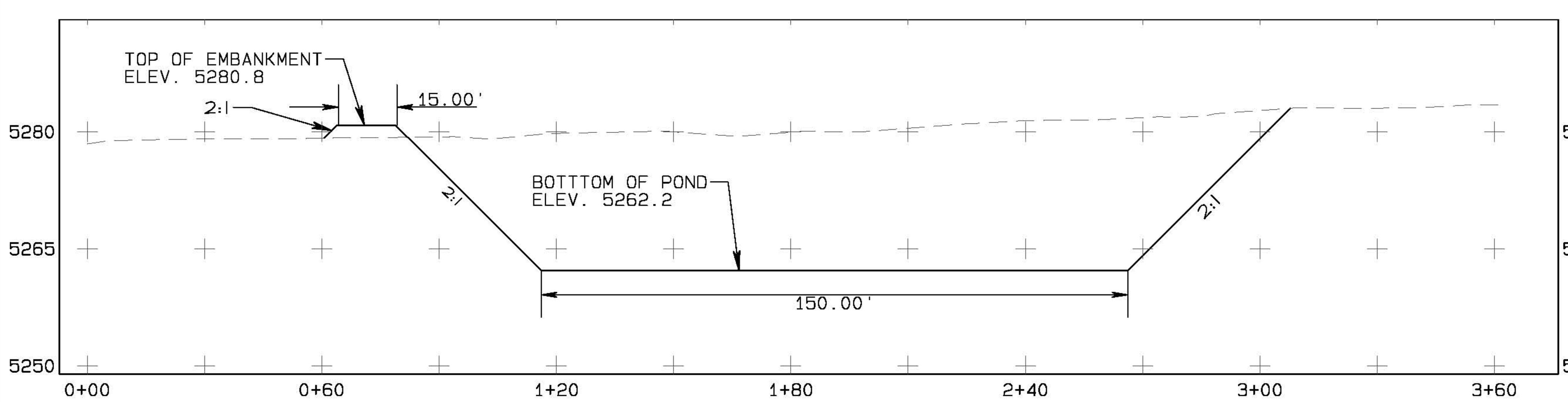
SCALES AS NOTED



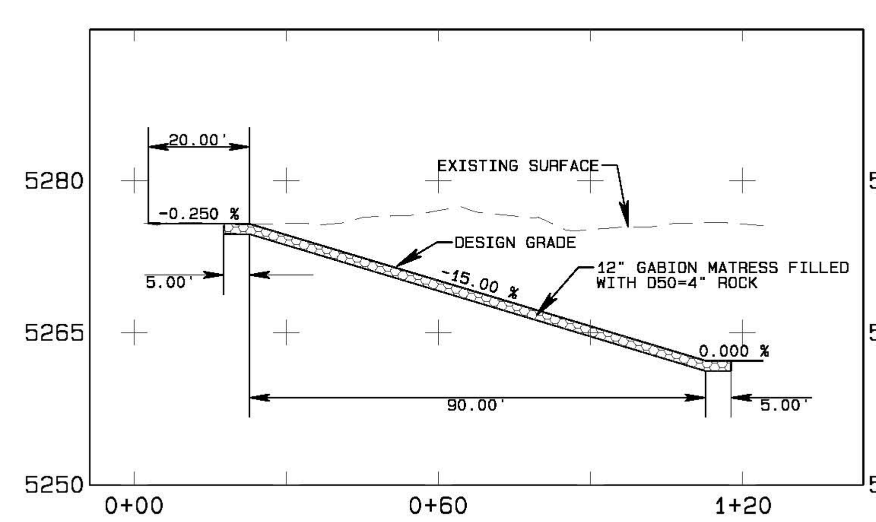
PROFILE A - A
HORZ.=1"=30'
VERT.=1"=15'



TYPICAL SECTION SOUTH INLET
N.T.S.



SECTION B - B
HORZ.=1"=20'
VERT.=1"=10'



PROFILE SOUTH INLET
HORZ.=1"=30'
VERT.=1"=15'

A4N POND 414
STAGE STORAGE DATA

ELEV	AREA AC.	VOLUME AC-FT	CUM. VOLUME AC-FT
5262.2	1.38	0.00	0.00
5263.0	1.42	1.12	1.12
5264.0	1.48	1.45	2.57
5265.0	1.54	1.51	4.08
5266.0	1.60	1.57	5.64
5267.0	1.66	1.63	7.27
5268.0	1.72	1.69	8.96
5269.0	1.79	1.75	10.71
5270.0	1.85	1.82	12.53
5271.0	1.92	1.89	14.42
5272.0	2.00	1.96	16.38
5273.0	2.07	2.03	18.41
5274.0	2.14	2.11	20.52
5275.0	2.22	2.18	22.70
5276.0	2.30	2.26	24.96
5277.0	2.39	2.35	27.31
5278.0	2.51	2.45	29.76
5279.0	2.64	2.57	32.33
5280.0	2.82	2.73	35.06
5280.8	3.13	2.38	37.44

VOLUME AT THE UPSTREAM TOE IS 18.11 AC-FT AT ELEVATION 5275.85.

VOLUME ABOVE THE UPSTREAM TOE IS 19.33 AC-FT.

POND CAPACITY IS 34.52 AC-FT (ELEV. 5279.8) PLUS 1-FT FREEBOARD.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

REVISION		DATE
12-A	Submitted to OSM for Approval	10-16-12
13-A	Modified design and submitted to OSM for review and approval	4-12-13

PROJECT MANAGER: J.S
ENGR. of RECORD: LR
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

PROJECT: POND DESIGN
DATE: 10-16-12
DESIGN BY: RY
DRAWN BY: RY
CHECKED BY: LR
APPROVED BY: LR

PLAN, PROFILE AND SECTIONS

EXHIBIT 26-86
POND 414

DESIGN

DRAWING
SHEET 1 OF 2

EXHIBIT 26-86
POND 414
DIVERSION CHANNEL

DESIGN

PLAN, PROFILE AND SECTIONS

DRAWING

SHEET 2 OF 2

PROJECT:	POND DESIGN
DATE:	10-16-12
DESIGN BY:	RY
DRAWN BY:	RY
CHECKED BY:	LR
APPROVED BY:	LR

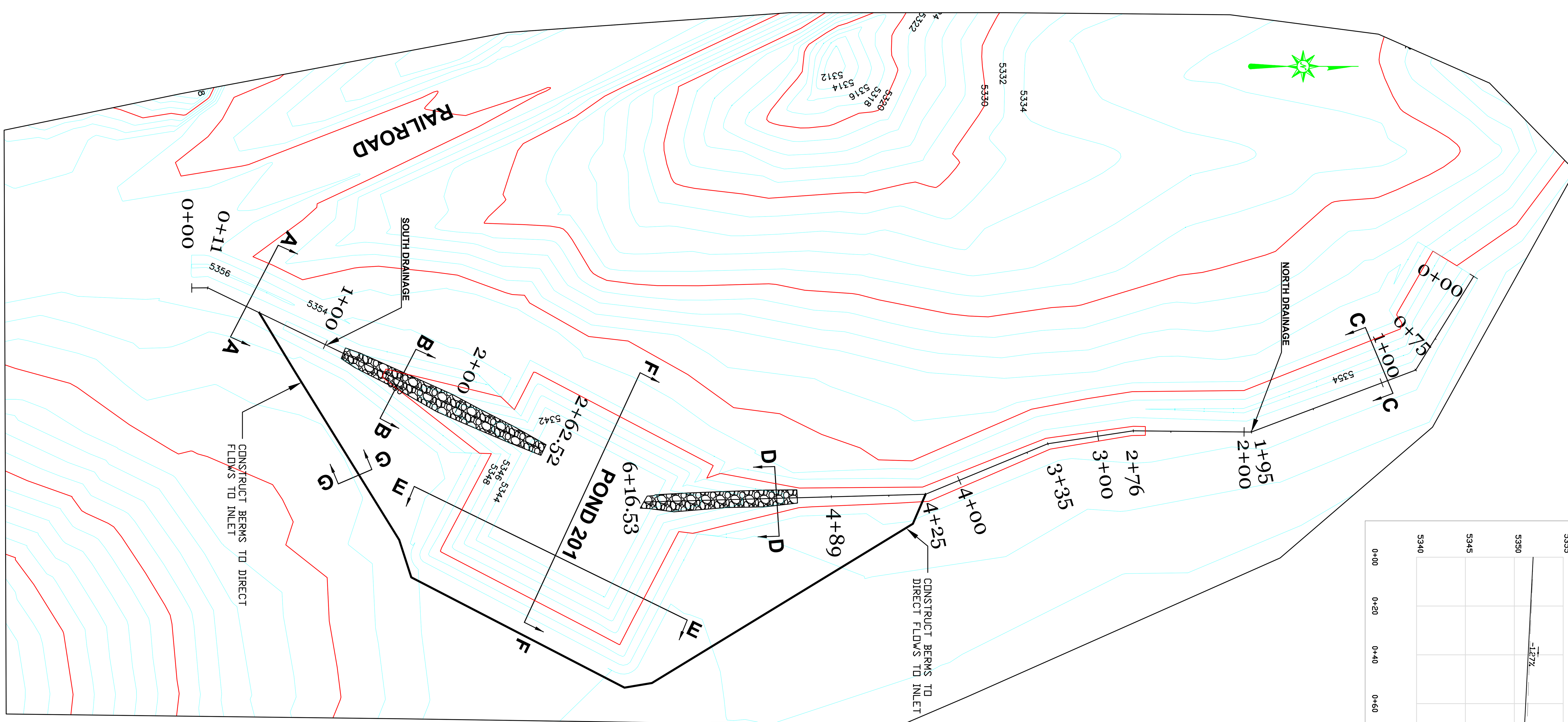
bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE

PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

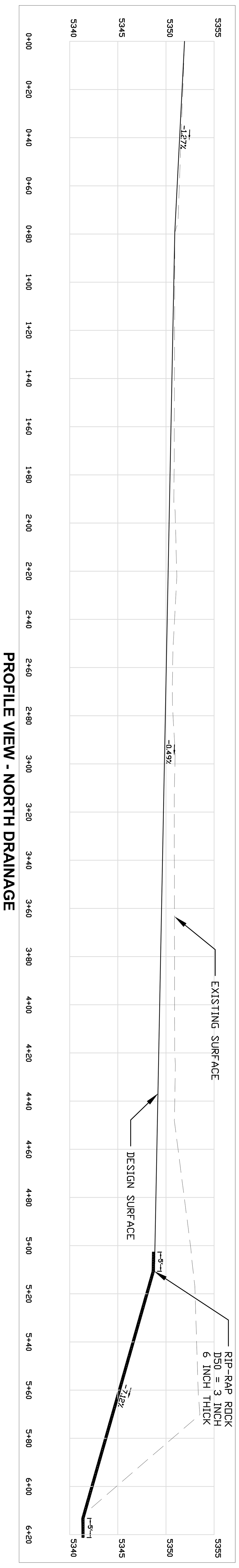
PROJECT MANAGER:	J.S
ENGR. of RECORD:	LR
REG. NO:	6600
SRVYR of RECORD:	
REG. NO:	

	REVISION	DATE
13-A	Submitted to OSM for Approval	4-11-13

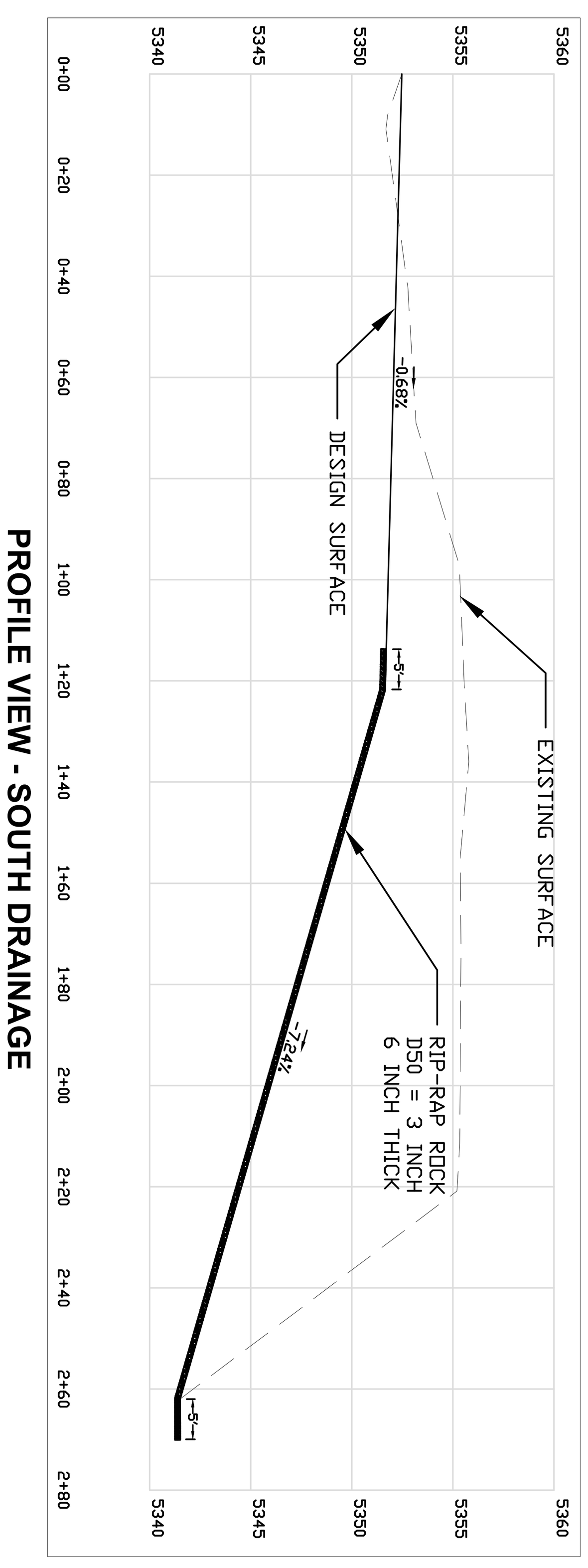
PLAN VIEW
SCALE 1" = 50'



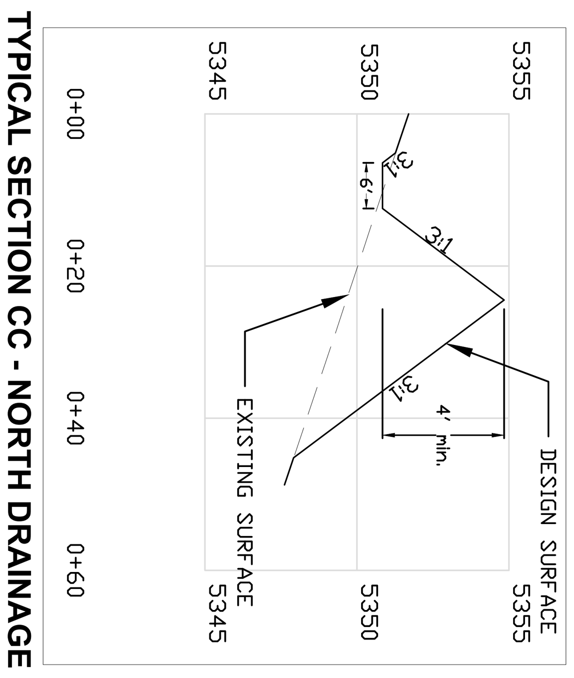
PROFILE VIEW - NORTH DRAINAGE
STAT. 0+00 to 6+16.53
SCALE 1" = 30.77'



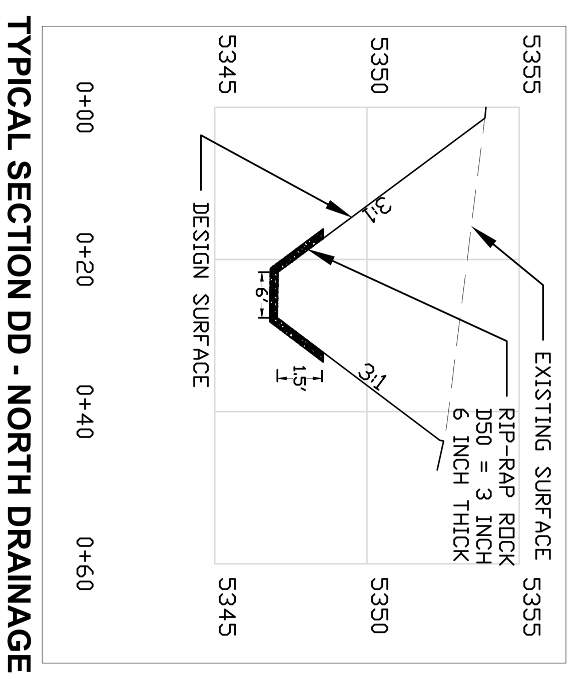
PROFILE VIEW - SOUTH DRAINAGE
STAT. 0+00 to 2+62.52
1" = 30.77'



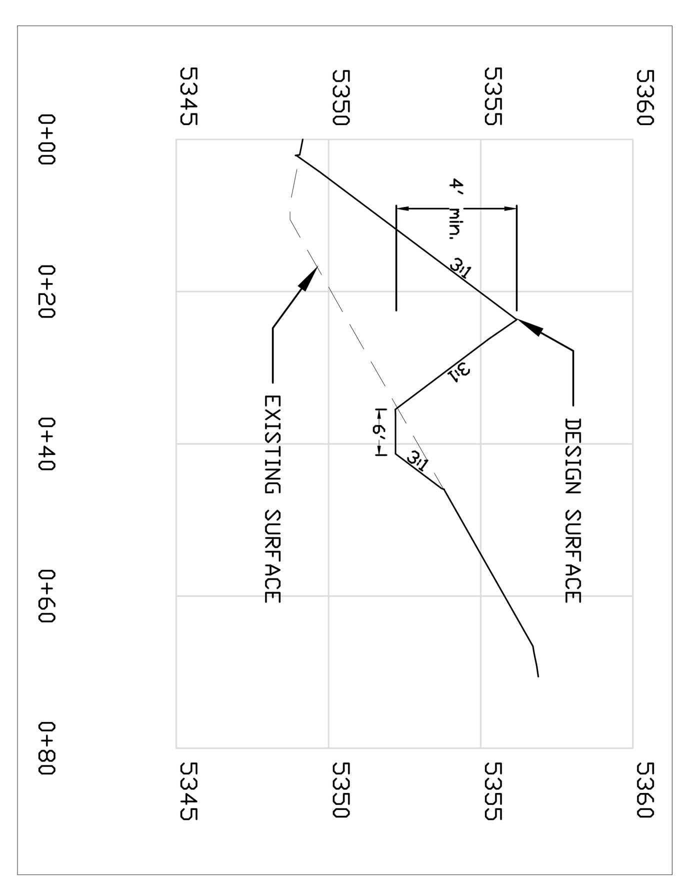
TYPICAL SECTION CC - NORTH DRAINAGE
STAT. 0+00 to 5+20
NTS



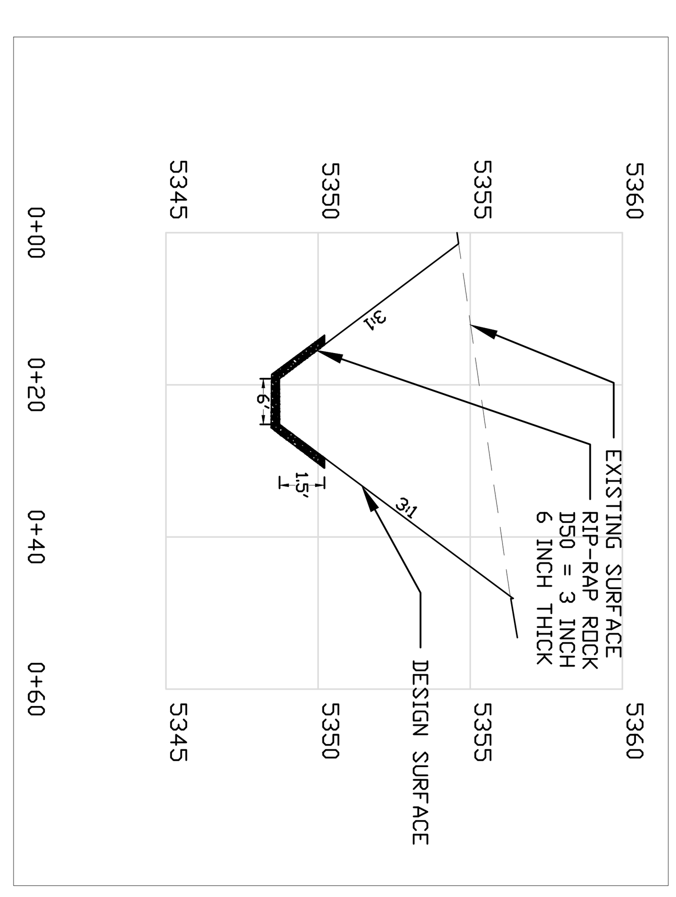
TYPICAL SECTION DD - NORTH DRAINAGE
STAT. 5+20 to 6+16.53
NTS



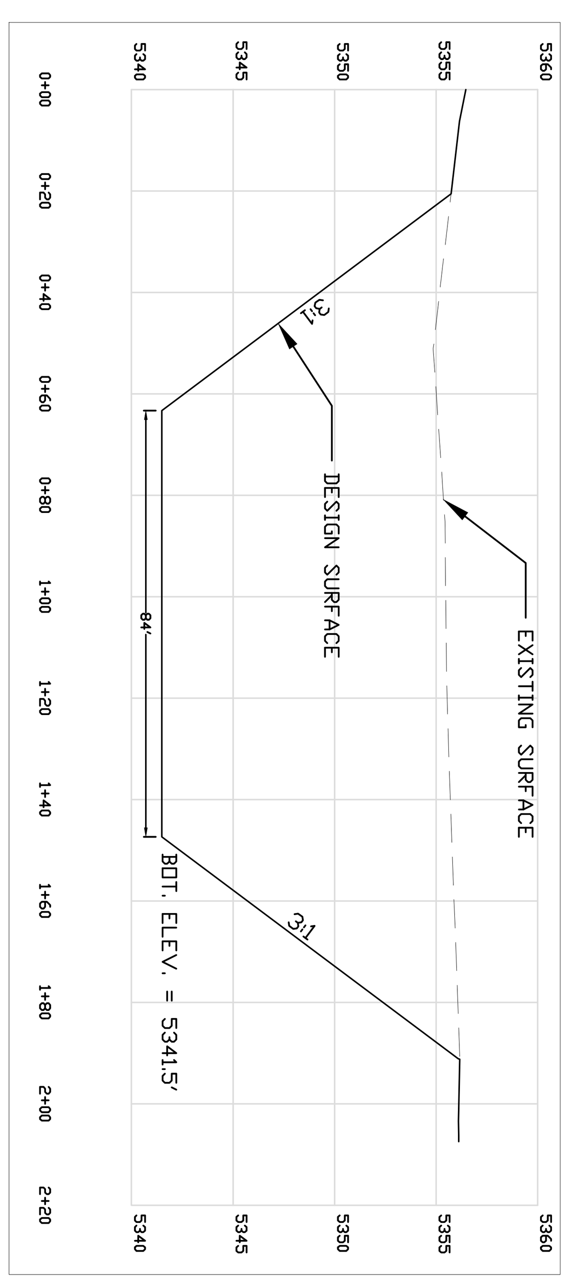
TYPICAL SECTION AA - SOUTH DRAINAGE
STAT. 0+00 to 1+40
NTS



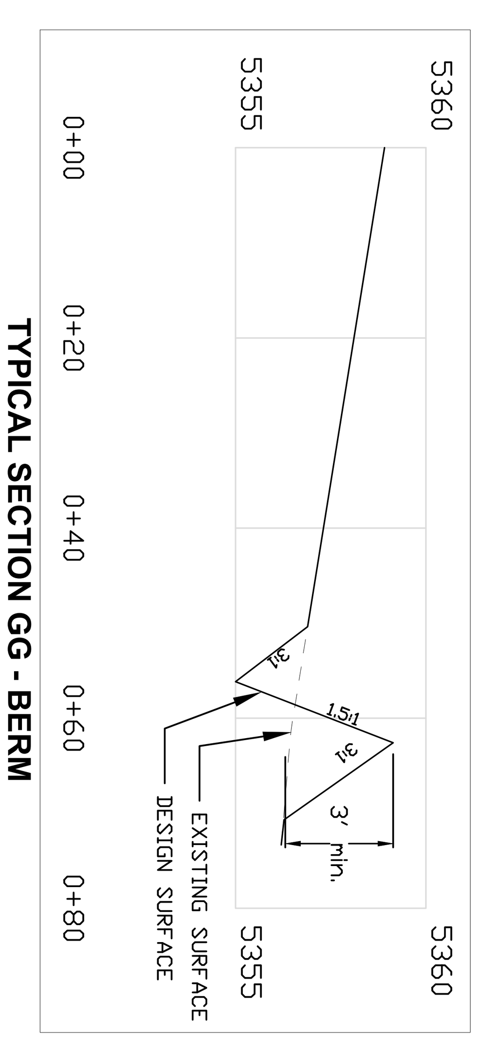
TYPICAL SECTION BB - SOUTH DRAINAGE
STAT. 1+40 to 2+62.52
NTS



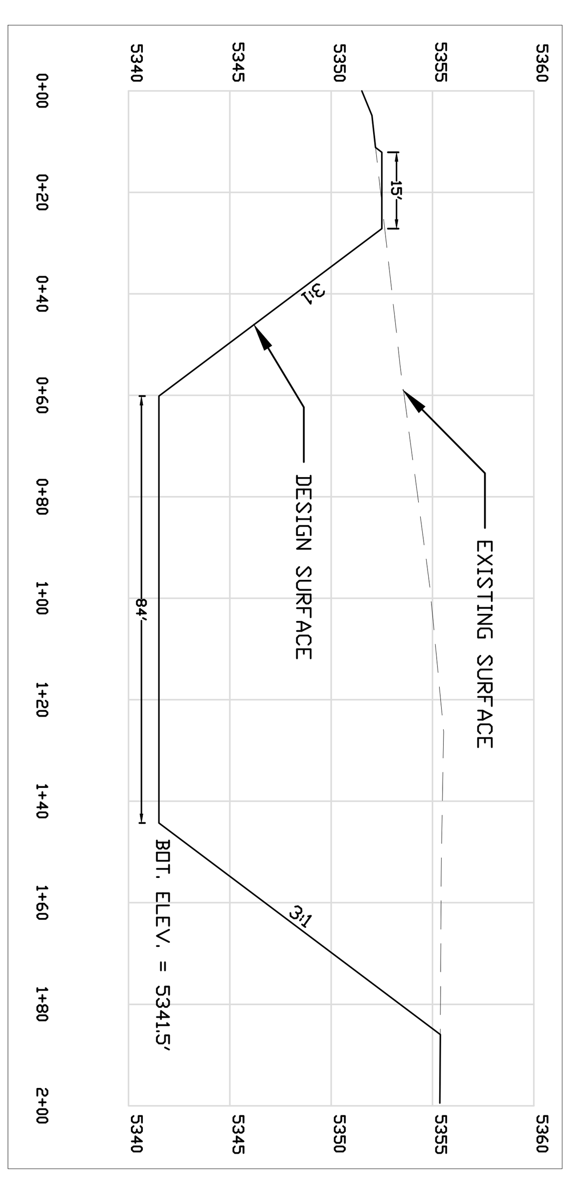
TYPICAL SECTION EE - POND 201 NORTH TO SOUTH
NTS



TYPICAL SECTION GG - BERM
NTS



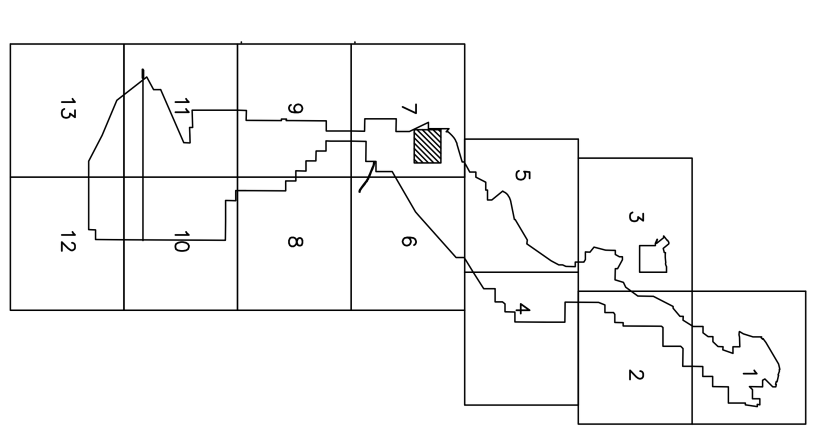
TYPICAL SECTION FF - POND 201 EAST TO WEST
NTS



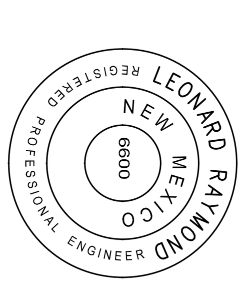
POND 201
STAGE STORAGE DATA

ELEV. (FT)	AREA (FT^2)	AREA (AC)	INC. VOL (AC-FT)	ACCUM. VOL. (AC-FT)
5341.5	7,568.8	0.17	0	0
5342	8,097.9	0.19	0.09	0.09
5343	9,227.5	0.21	0.20	0.29
5344	10,441.4	0.24	0.23	0.51
5345	11,740.8	0.27	0.25	0.77
5346	13,044.5	0.30	0.28	1.05
5347	14,429.9	0.33	0.32	1.37
5348	15,912.5	0.37	0.35	1.72
5349	17,466.6	0.40	0.38	2.10
5350	19,098.7	0.44	0.42	2.52
5351	20,808.8	0.48	0.46	2.98
5352	22,642.1	0.52	0.50	3.48

NOTES:
1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.
2. THE WATERSHED FOR POND 201 IS SHOWN IN 11-13D

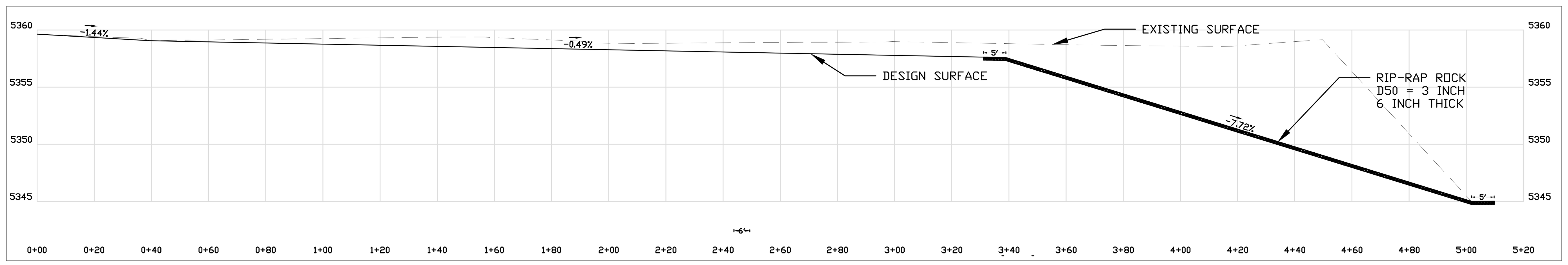


CERTIFICATION STATEMENT
I, Leonard Raymond hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

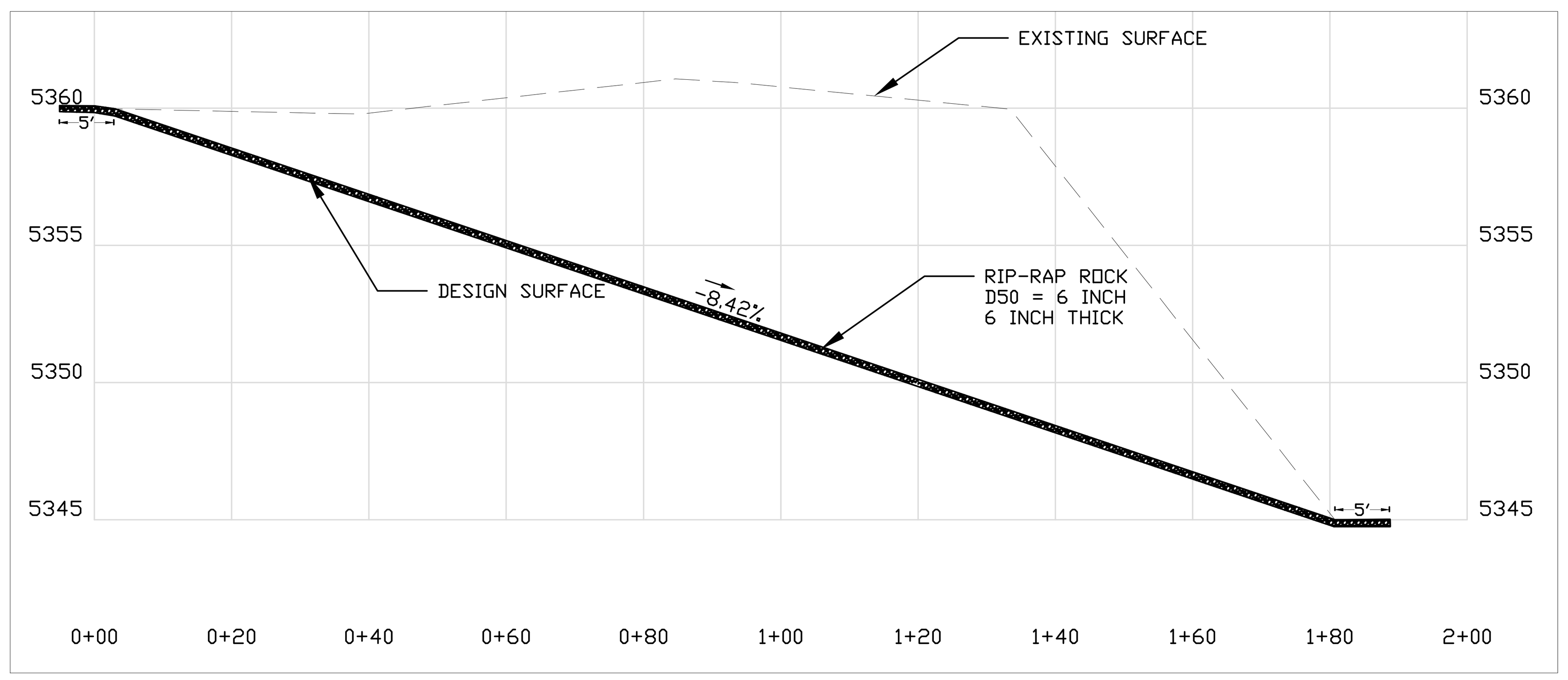


DRAWING	**EXHIBIT 26-87**	PLAN, PROFILES AND SECTIONS	bhpbilliton	PROJECT: Area 2 Pond 201
SHEET 1 OF 1	AREA 2 POND 201 DESIGN		BHP NAVAJO COAL COMPANY NAVAJO MINE PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 / PHONE 505-598-4200/FAX 505-598-3361	

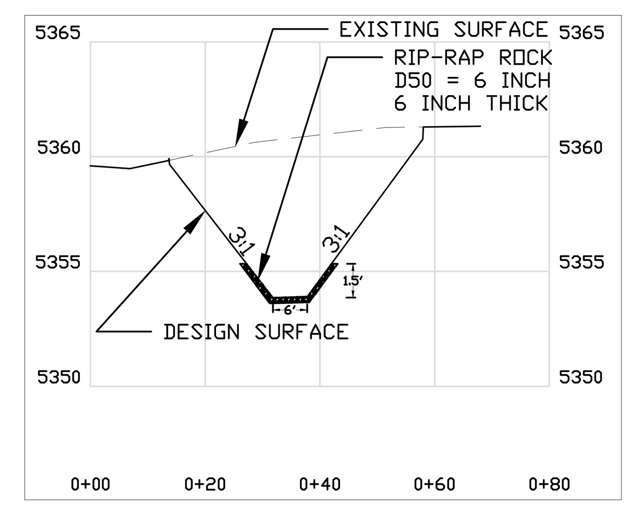
PROJECT: Area 2 Pond 201	PROJECT MANAGER: Ramsey R. Yazzie		REVISION	Rev	DATE
DATE: 03-01-13	ENGR. of RECORD: Leonard Raymond	13-A	SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	RY	03/12/2013
DESIGNED BY: Ramsey R. Yazzie	REG. NO: NM_6600				
DRAWN BY: Ramsey R. Yazzie	SRVYR of RECORD: Wilson Begay				
CHECKED BY: L. Raymond	REG. NO: NM_18628				
APPROVED BY: L. Raymond					



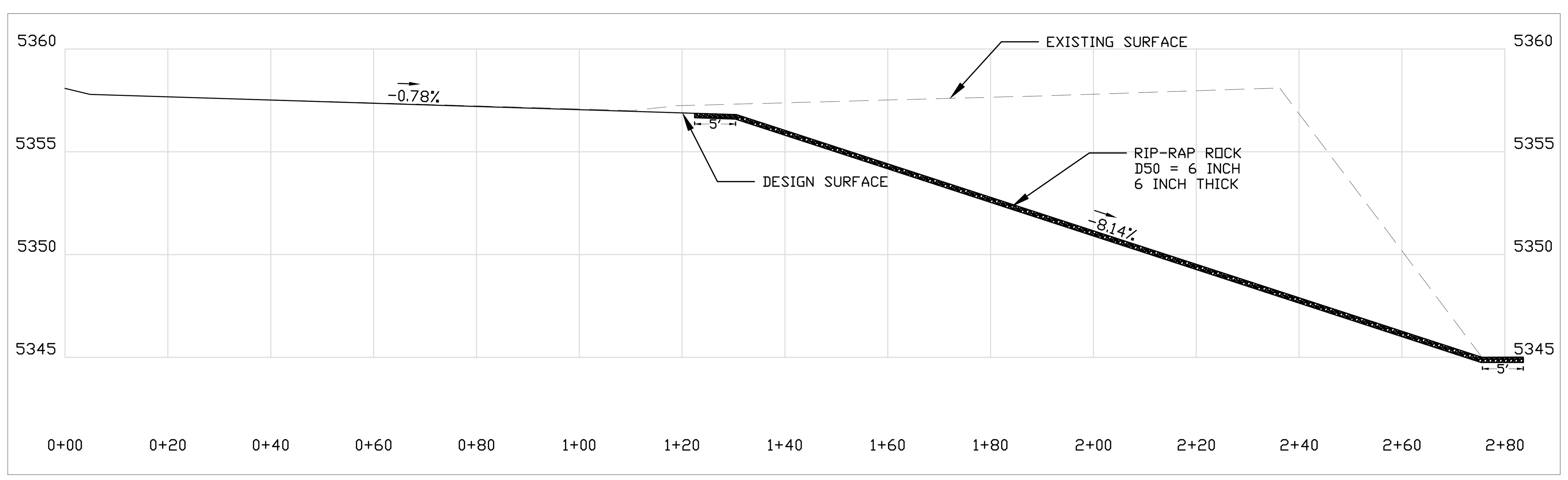
PROFILE VIEW - NORTH DRAINAGE
STAT. 0+00 to 5+05.85
SCALE 1" = 30.77'



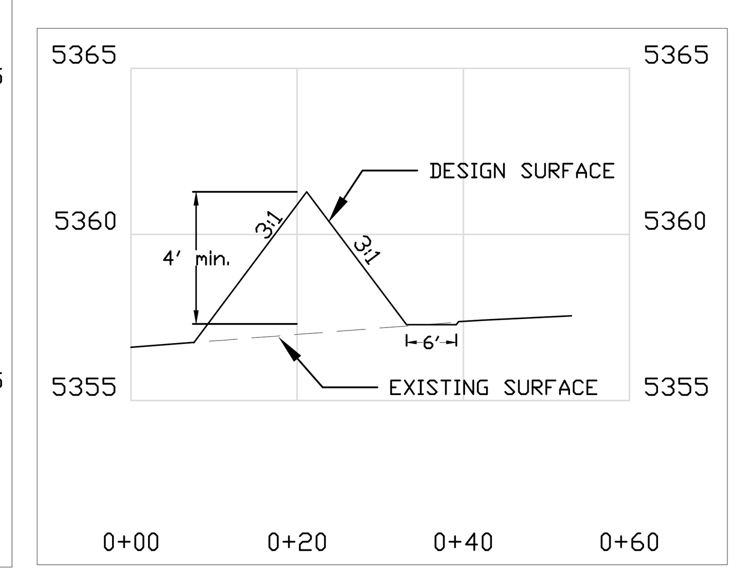
PROFILE VIEW - EAST DRAINAGE
STAT. 0+00 to 1+71.99
1" = 20'



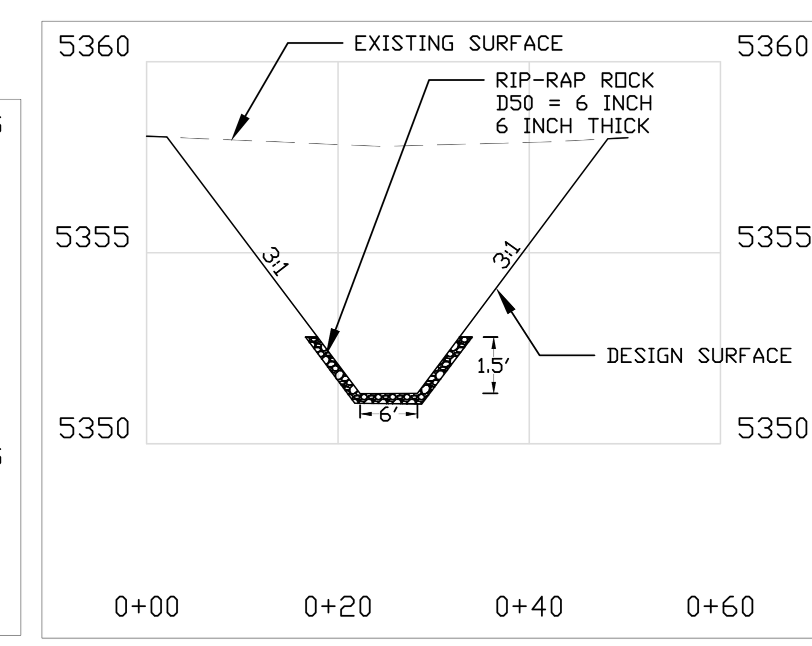
TYPICAL SECTION HH - EAST DRAINAGE
STAT. 0+00 to 1+71.99
NTS



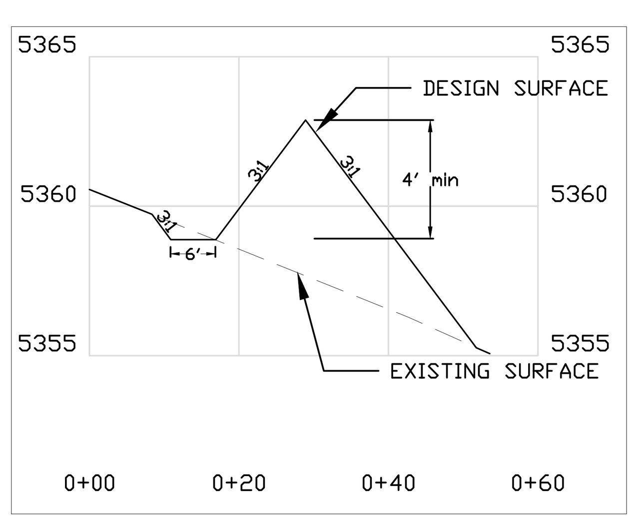
PROFILE VIEW - SOUTH DRAINAGE
STAT. 0+00 to 2+76.63
1" = 20'



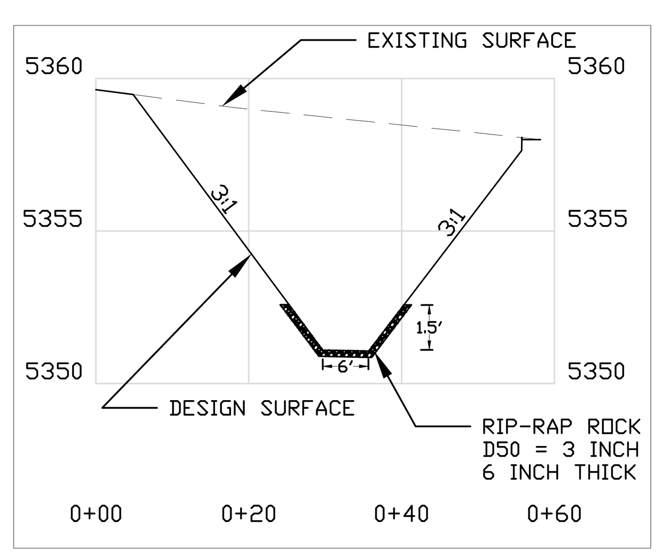
TYPICAL SECTION KK - SOUTH DRAINAGE
STAT. 0+00 to 1+90
NTS



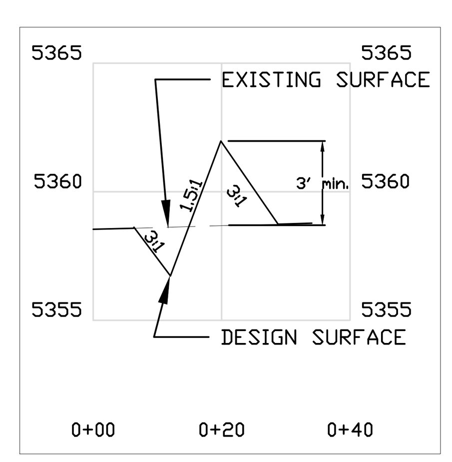
TYPICAL SECTION LL - SOUTH DRAINAGE
STAT. 1+90 to 2+76.63
NTS



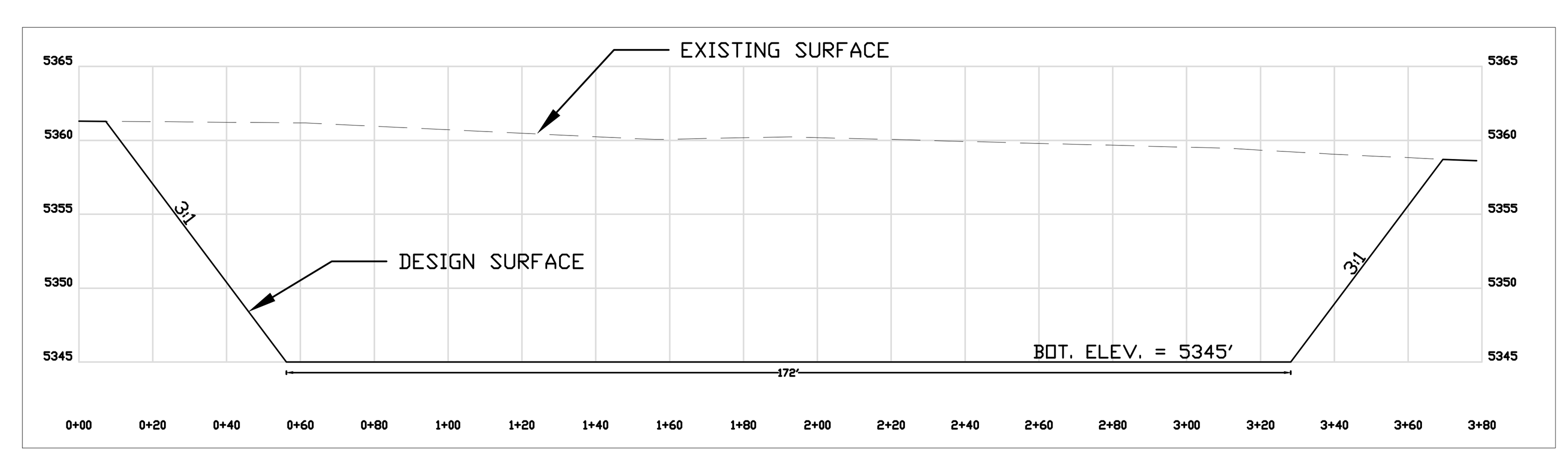
TYPICAL SECTION II - NORTH DRAINAGE
STAT. 0+00 to 4+20
NTS



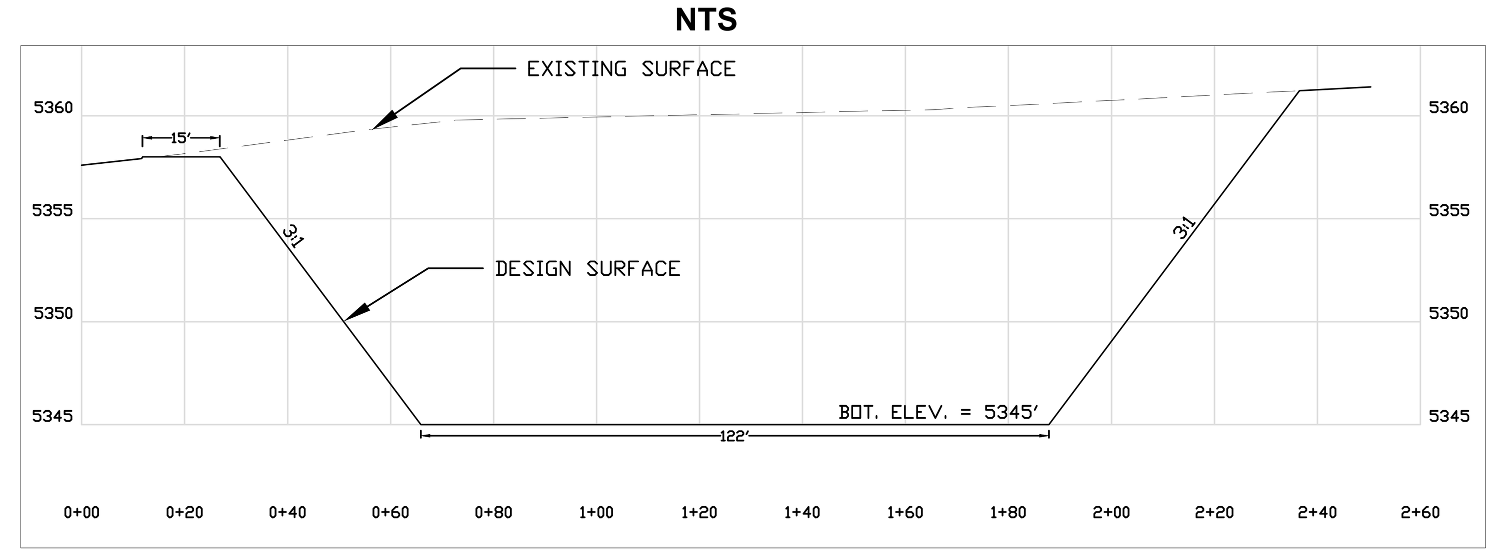
TYPICAL SECTION JJ - NORTH DRAINAGE
STAT. 4+20 to 5+05.85
NTS



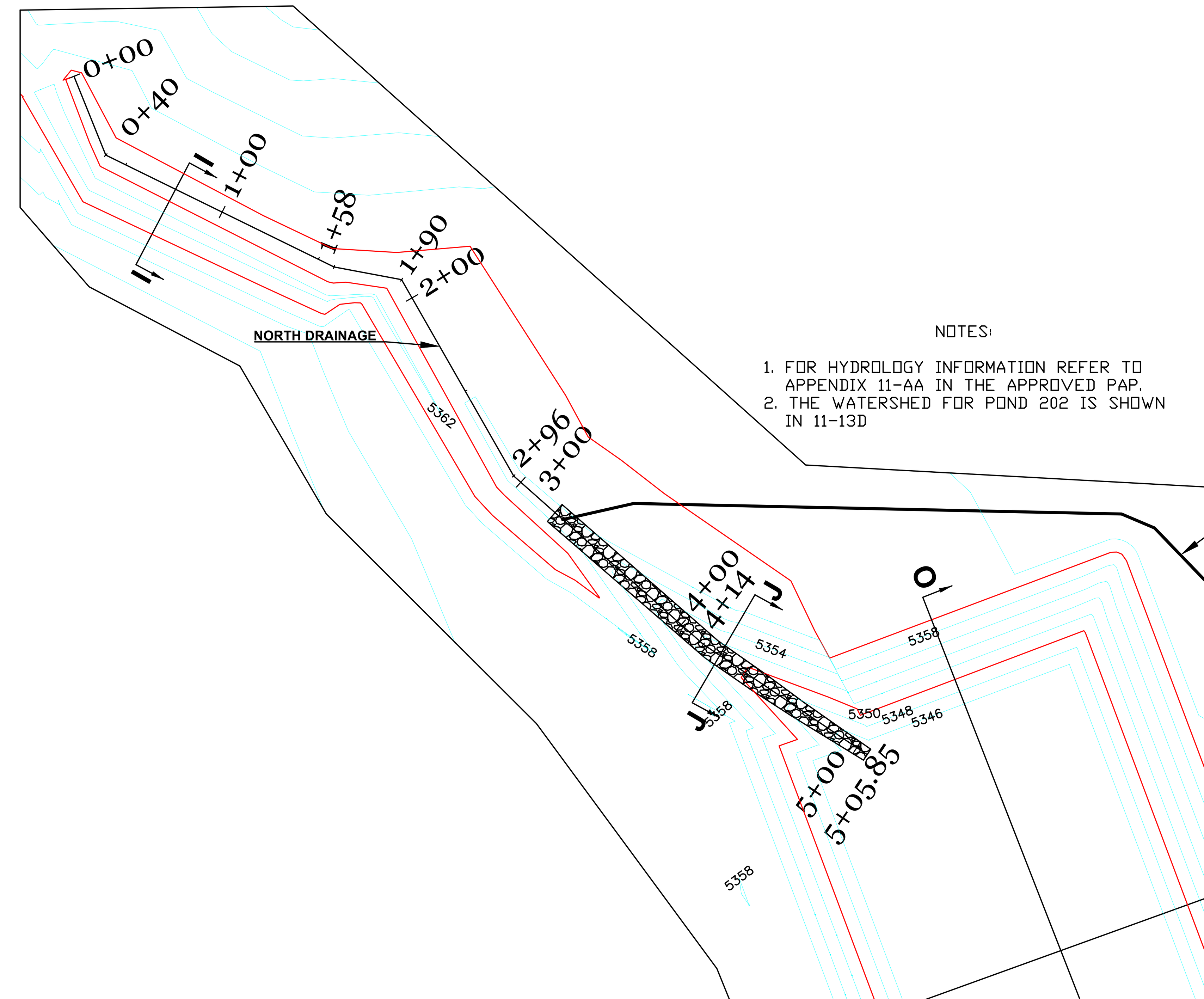
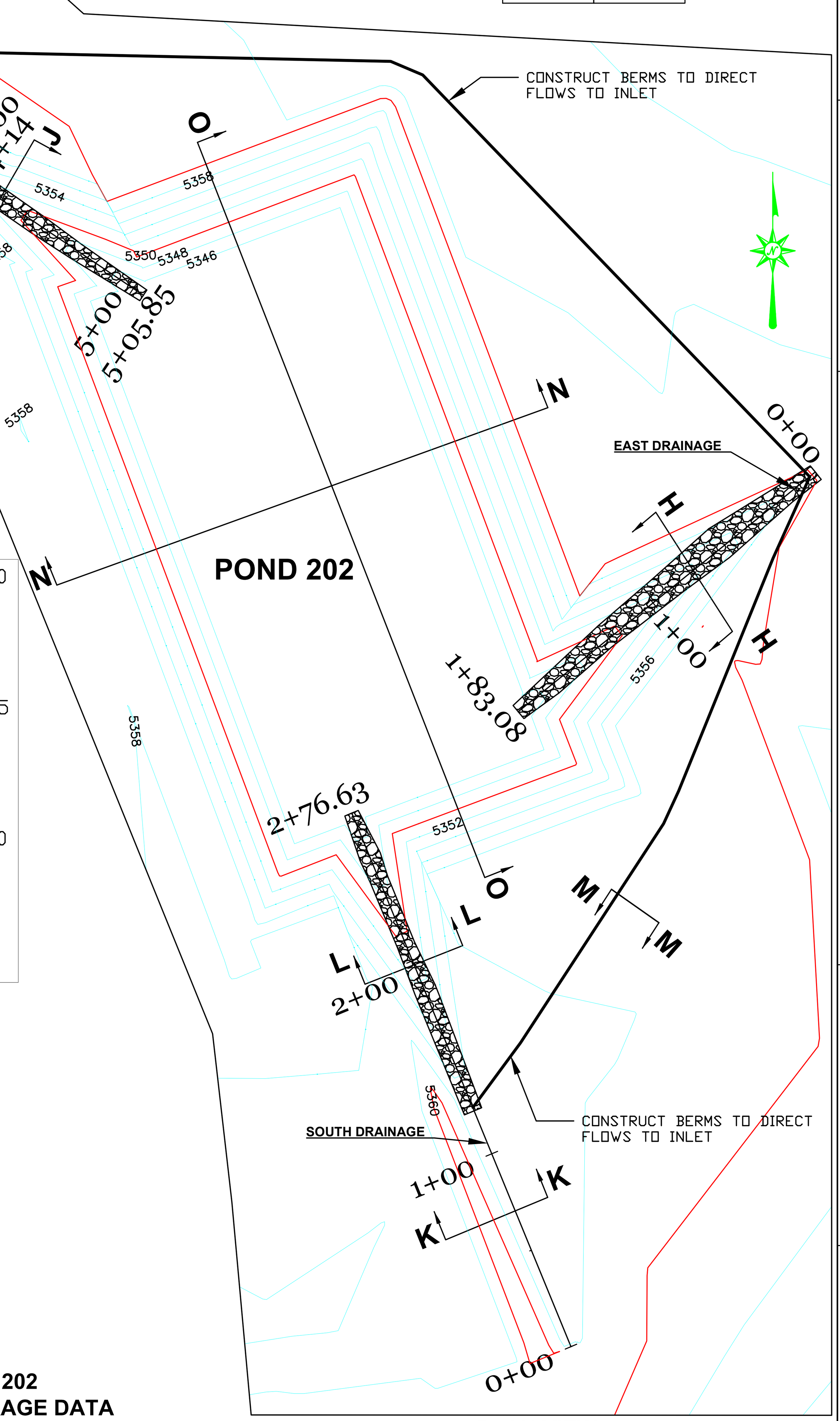
TYPICAL SECTION MM - BERM
NTS



TYPICAL SECTION OO - POND 202 NORTH TO SOUTH
NTS

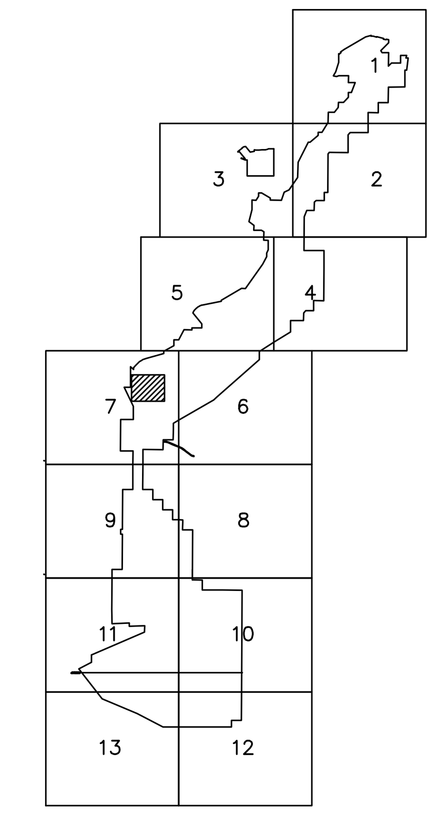


TYPICAL SECTION NN - POND 202 EAST TO WEST
NTS

PLAN VIEW
SCALE 1" = 50'

NOTES:
1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.
2. THE WATERSHED FOR POND 202 IS SHOWN IN 11-13D



POND 202
STAGE STORAGE DATA

ELEV. (FT)	AREA (FT²)	AREA (AC)	INC. VOL (AC-FT)	ACCU M. VOL. (AC-FT)
5345	33,183.4	0.76	0	0
5346	35,583.4	0.82	0.79	0.79
5347	38,055.4	0.87	0.85	1.63
5348	40,599.4	0.93	0.90	2.54
5349	43,215.3	0.99	0.96	3.50
5350	45,903.3	1.05	1.02	4.52
5351	48,663.3	1.12	1.09	5.61
5352	51,495.3	1.18	1.15	6.76
5353	54,399.3	1.25	1.22	7.97
5354	57,375.2	1.32	1.28	9.26
5355	60,423.2	1.39	1.35	10.61
5356	63,543.2	1.46	1.42	12.03
5357	66,735.2	1.53	1.50	13.53
5358	69,999.7	1.61	1.57	15.10

CERTIFICATION STATEMENT
I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

PROJECT: Area 2 Pond 202	PROJECT MANAGER: Ramsey R. Yazzie		REVISION	Rev BY	DATE
DATE: 03-01-13	ENGR. of RECORD: Leonard Raymond	13-A	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	RY	03/12/2013
DESIGNED BY: Ramsey R. Yazzie	REG. NO: NM_6600				
DRAWN BY: Ramsey R. Yazzie	SRVYR of RECORD: Wilson Begay				
CHECKED BY: L. Raymond	REG. NO: NM_18628				
APPROVED BY: L. Raymond					

bhpbilliton
BHP NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717,FRUITLAND,NEW MEXICO,87416 / PHONE 505-598-4200/FAX 505-598-3361

PLAN, PROFILES AND SECTIONS

EXHIBIT 26-88

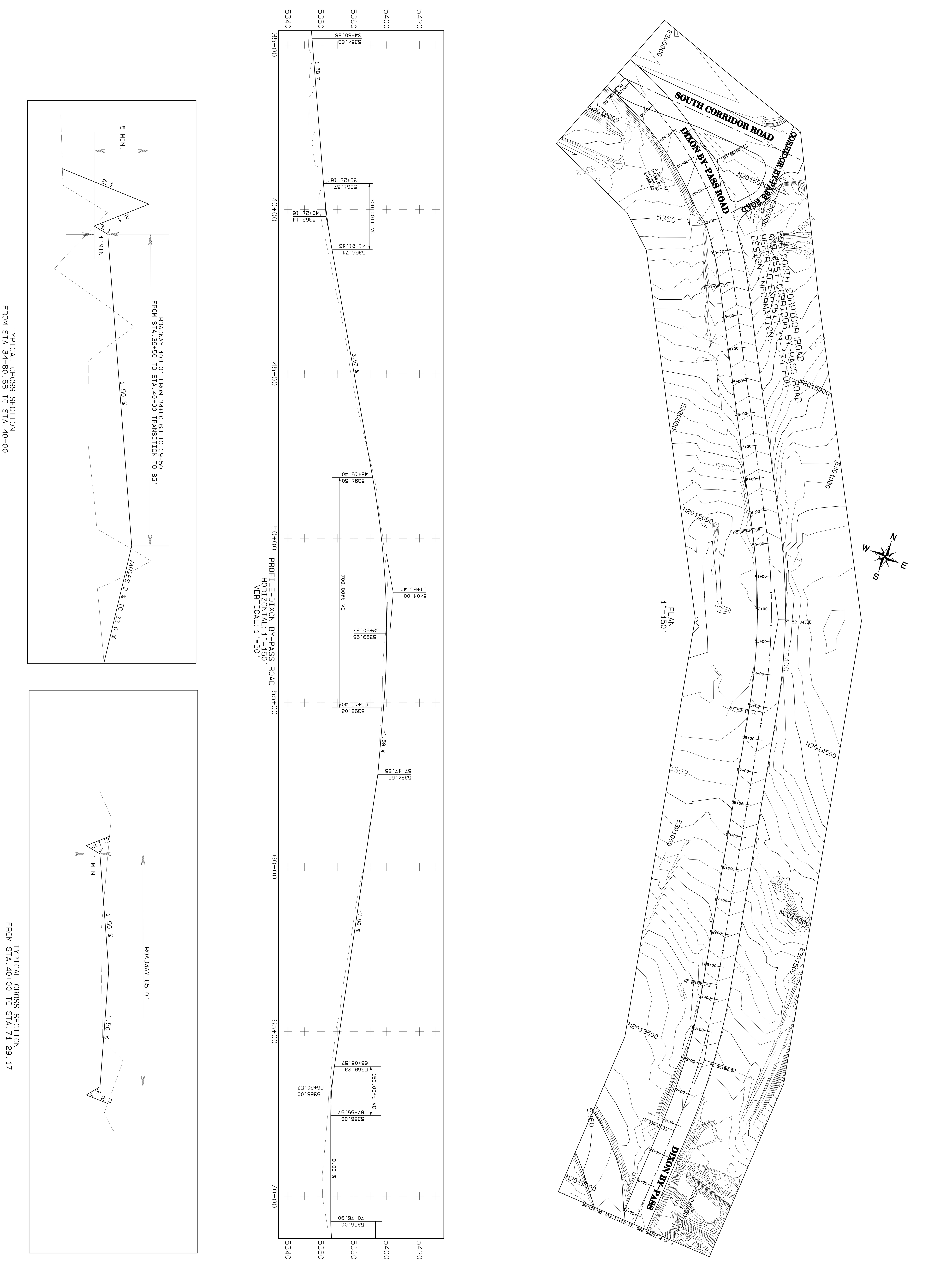
AREA 2
POND 202
DESIGN

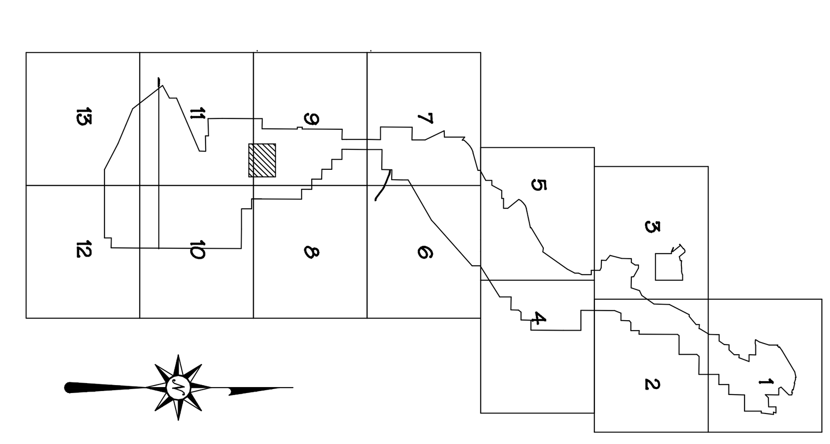
DRAWING
SHEET 1 OF 1

EXHIBIT 26-89 CORRIDOR ROADS DESIGN	PLAN, PROFILE AND SECTIONS	PROJECT: ROADS RE-ALIGNMENT DATE: 5-28-13 DESIGN BY: RY DRAWN BY: RY CHECKED BY: LR APPROVED BY: LR	bhpbilliton NAVAJO COAL COMPANY NAVAJO MINE PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361	PROJECT MANAGER: J.S ENGR. of RECORD: LR REG. NO: 6600 SRVYR. of RECORD: REG. NO:

REVISION		DATE
13-A	Submitted to OSM for Approval	05-28-13
13-B	EDITED DWG. TITLE AND POND NAME AND SUBMITTED TO OSM FOR APPROVAL	08-8-13

DRAWING
SHEET 1 OF 1





LEGEND

- ROAD
- CULVERT
- DRAINAGE
- POWERLINE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- LEASE CORNER
- PERMIT/LEASE BOUNDARY
- WATER LINE
- IRRIGATION LINE

NOTES

1. For hydrology and design information refer to Appendix 11-V in the approved PAP.
2. The watershed areas for culverts are shown on Exhibit 11-12E

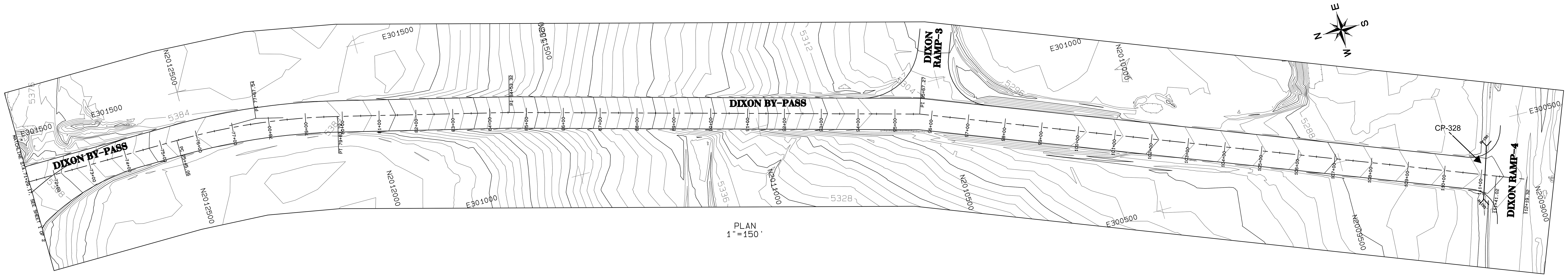
CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

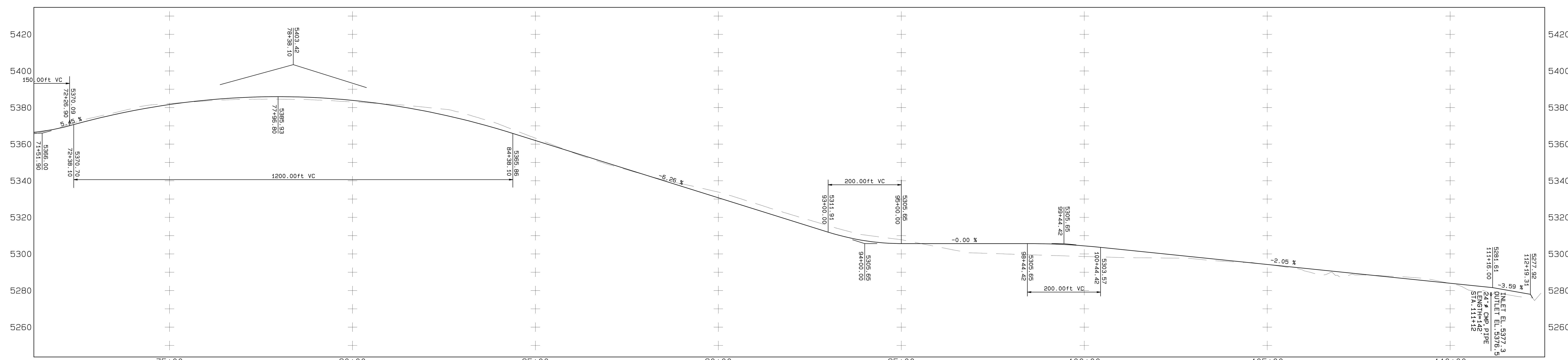
LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

DRAWING SHEET 1 OF 2	EXHIBIT 26-90 DIXON BY-PASS ROAD DESIGN	PLAN, PROFILE AND SECTIONS	PROJECT: ROADS RE-ALIGNMENT DATE: 5-30-13 DESIGN BY: RY DRAWN BY: RY CHECKED BY: LR APPROVED BY: LR	bhpbilliton NAVAJO COAL COMPANY NAVAJO MINE PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361	PROJECT MANAGER: J.S ENGR. of RECORD: LR REG. NO: 6600 SRVYR of RECORD: REG. NO:

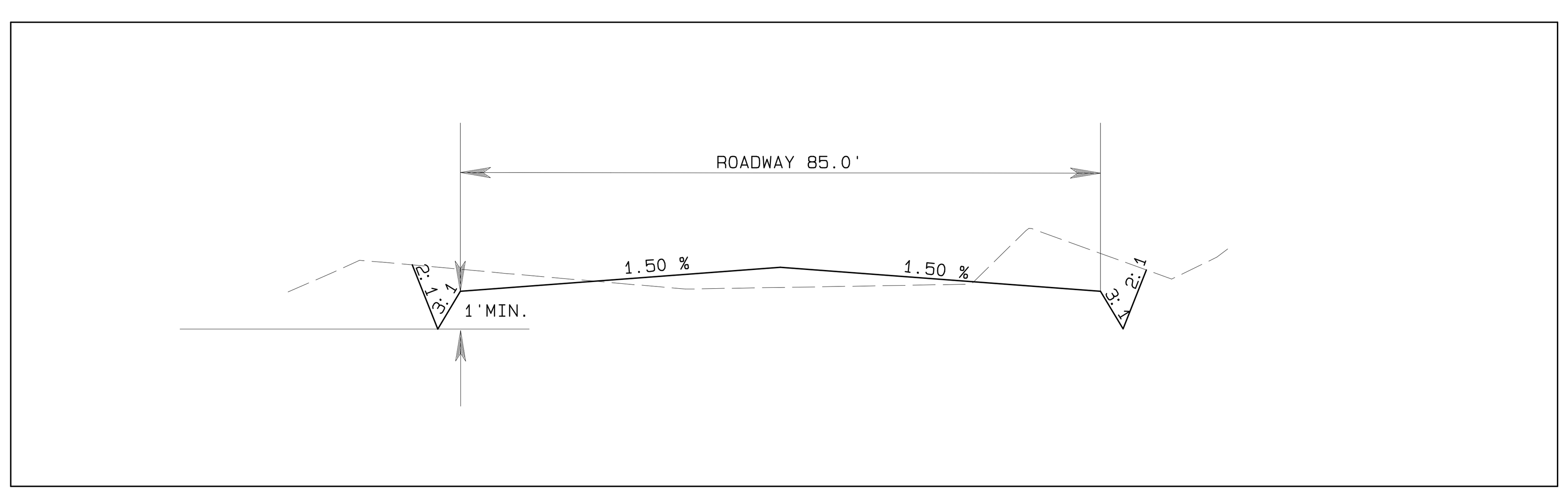
	REVISION	DATE
12-A	Submitted to OSM for Approval	05-30-13



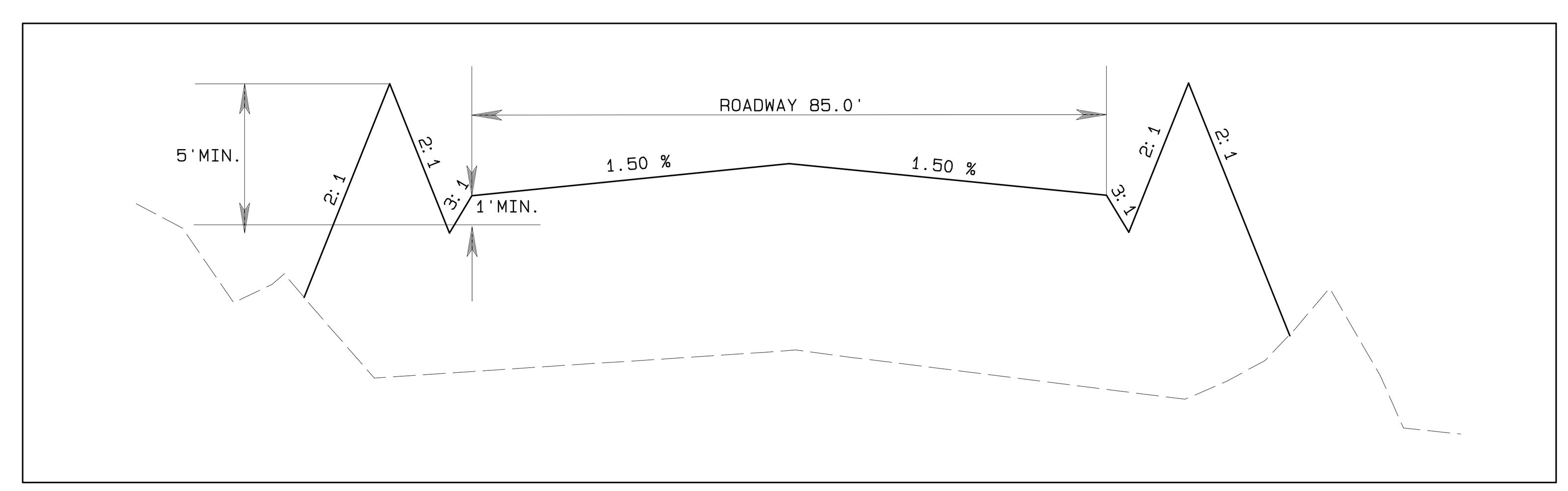
PLAN
1"=150'



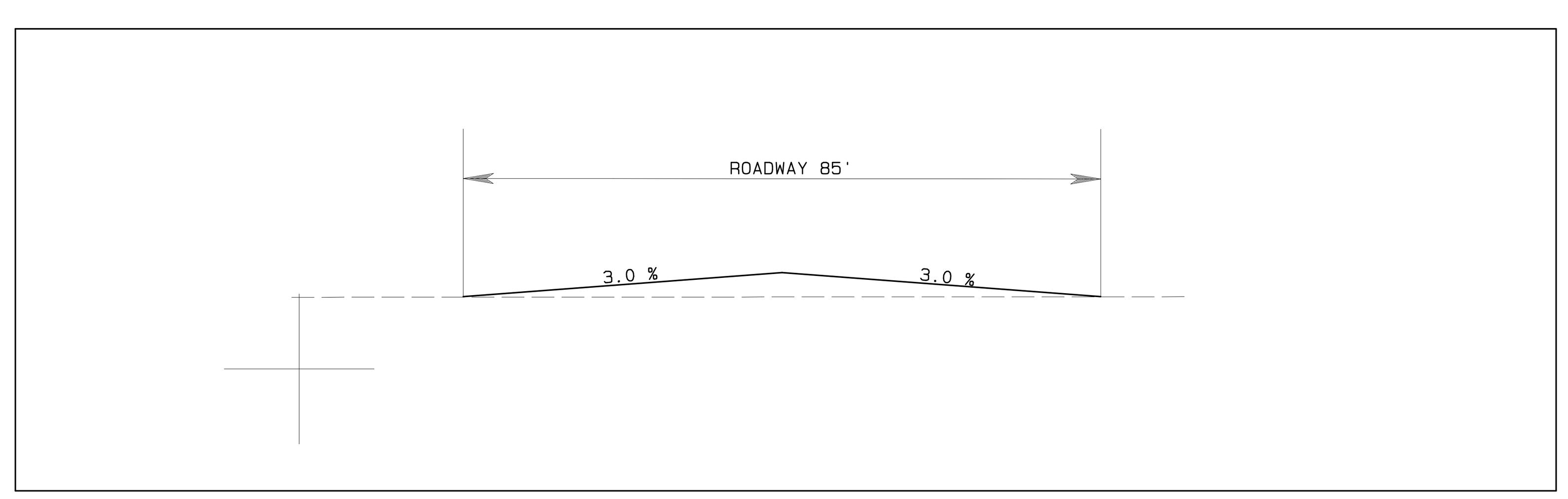
PROFILE-DIXON BY-PASS ROAD
HORIZONTAL: 1"=150'
VERTICAL: 1"=30'



TYPICAL CROSS SECTION
FROM STA.71+29.17 TO STA.97+00



TYPICAL CROSS SECTION
FROM STA.97+00 TO STA.111+24



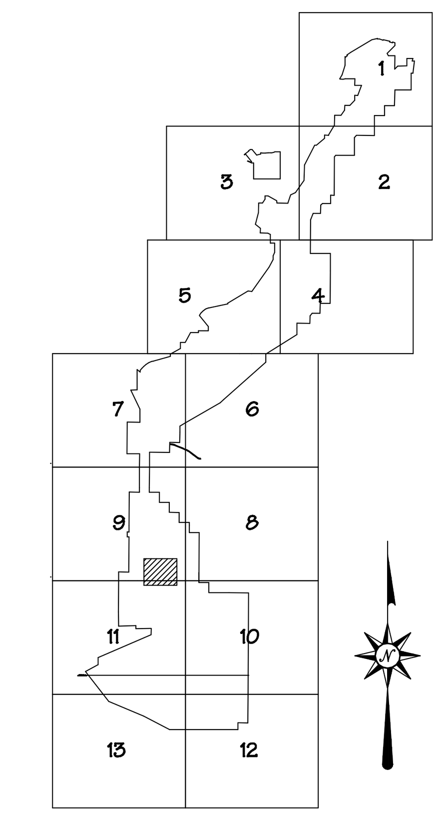
TYPICAL CROSS SECTION
FROM STA.111+24 TO STA.112+19.31

LEGEND

- ROAD
- CULVERT
- DRAINAGE
- POWERLINE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- LEASE CORNER
- PERMIT/LEASE BOUNDARY
- WATER LINE
- IRRIGATION LINE

NOTES

1. For hydrology and design information refer to Appendix 11-V in the approved PAP.
2. The watershed areas for culverts are shown on Exhibit 11-12E



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

REVISION	DATE
12-A Submitted to OSM for Approval	05-30-13

PROJECT MANAGER: J.S
ENGR. of RECORD: LR
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

PROJECT: ROADS RE-ALIGNMENT
DATE: 5-30-13
DESIGN BY: RY
DRAWN BY: RY
CHECKED BY: LR
APPROVED BY: LR

PLAN, PROFILE AND SECTIONS

EXHIBIT 26-90
DIXON BY-PASS ROAD
DESIGN

DRAWING
SHEET 2 OF 2

NOTES

1. For hydrology and design information refer to Appendix 11-V in the approved PAP.
2. The watershed areas for culverts are shown on Exhibit 11-12E

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

PROJECT MANAGER:	J.S
ENGR. of RECORD:	LR
REG. NO:	6600
SRVYR of RECORD:	
REG. NO:	

	REVISION	DATE
12-A	Submitted to OSM for Approval	05-30-13

EXHIBIT 26-91

DIXON RAMP-2 HAUL ROAD

DESIGN

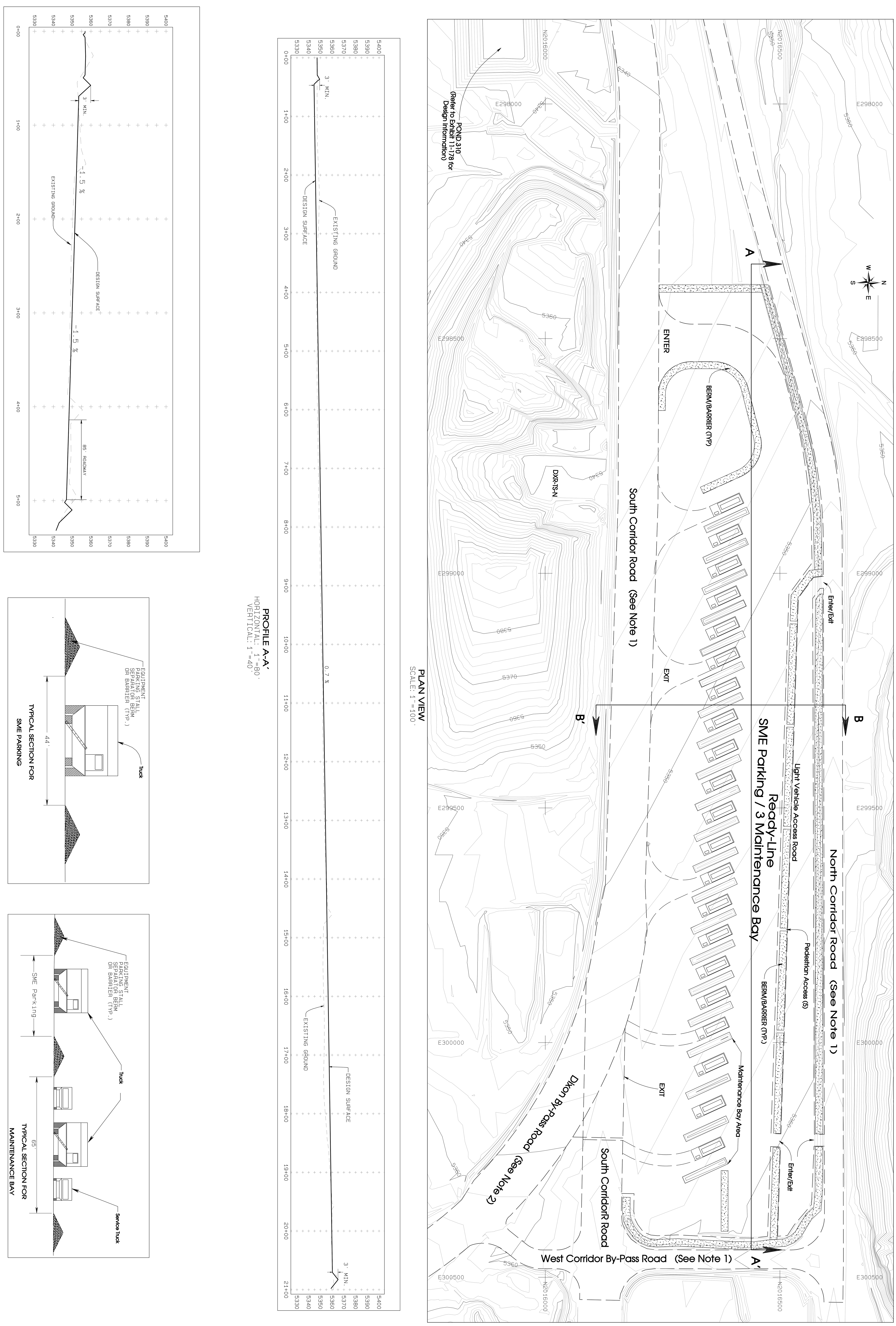
PLAN, PROFILE AND SECTIONS

PROJECT: ROADS RE-ALIGNMENT
DATE: 5-30-13
DESIGN BY: RY
DRAWN BY: RY
CHECKED BY: LR
APPROVED BY: LR

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE

PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

DRAWING
SHEET 1 OF 1



NOTES

1. For North & South Corridor Road and West Corridor By-pass Road refer to Exhibit 11-174 for Design Information
2. For Dixon By-Pass Road, refer to Exhibit 11-175 for Design Information

LEGEND

- ROAD
- CULVERT
- DRAINAGE
- POWERLINE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- LEASE CORNER
- PERMIT/LEASE BOUNDARY
- WATER LINE
- IRIGATION LINE

CERTIFICATION STATEMENT

I Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 26-92

CORRIDOR READY LINE DESIGN

PLAN, PROFILE AND SECTIONS

PROJECT:	AREA 3 CORRIDOR READY LINE
DATE:	5-30-13
DESIGN BY:	RY
DRAWN BY:	PJF
CHECKED BY:	LR
APPROVED BY:	LR

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

PROJECT MANAGER:	J.S
ENGR. of RECORD:	LR
REG. NO:	6600
SRVYR of RECORD:	
REG. NO:	

	REVISION	DATE
13-A	Submitted to OSM for Approval	05-30-13
13-B	CORRECTED MAINT. BAY DIMENSION AND SUBMITTED TO OSM FOR APPROVAL.	08-09-13

DRAWING
SHEET 1 OF 1

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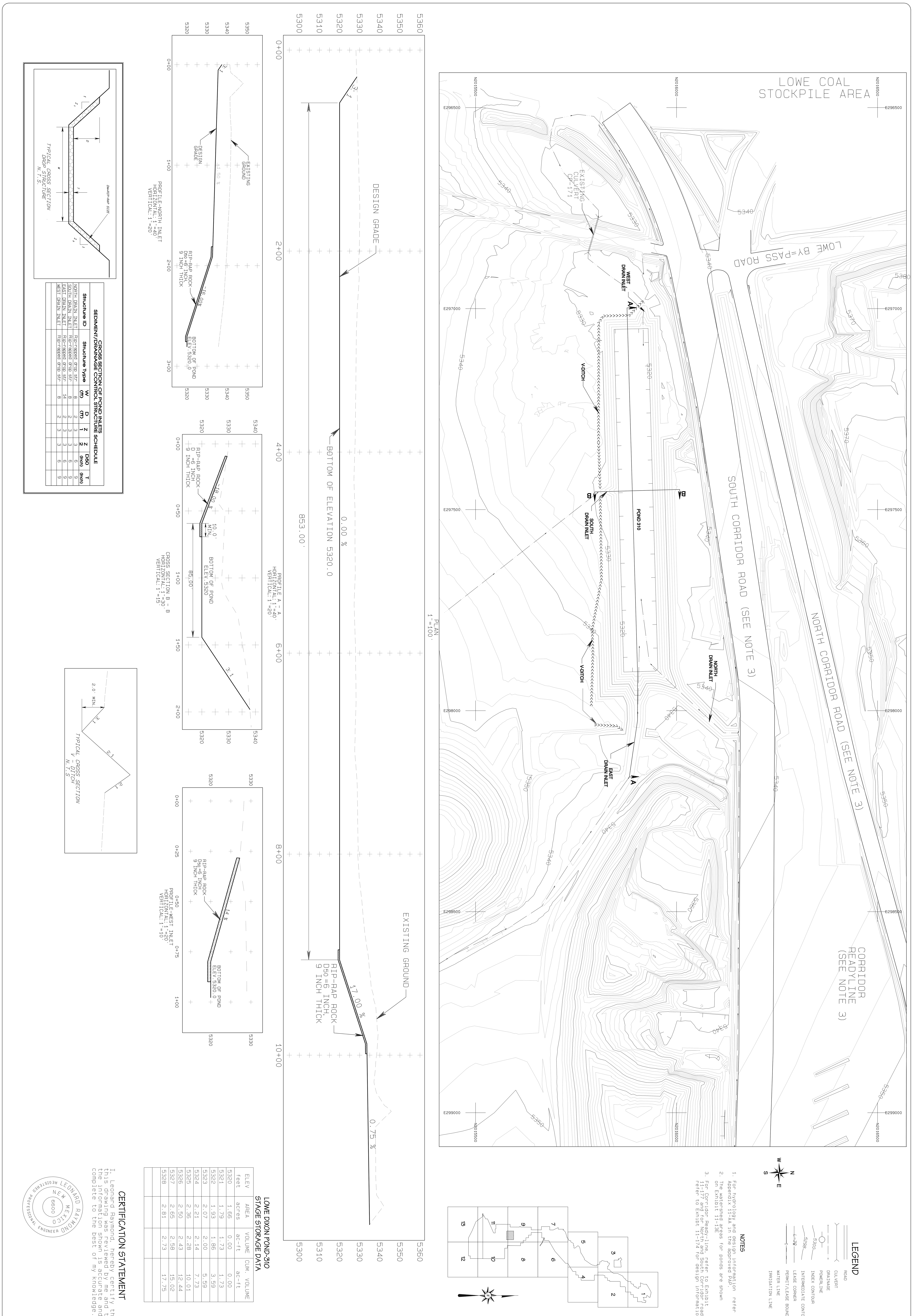
Fri Aug 09 14:17:30 2013



CROSS SECTION OF POND INLETS
SEDIMENT/DRAINAGE CONTROL STRUCTURE SCHEDULE

Structure ID	Structure Type	W (ft)	D (ft)	Z 1	Z 2	D50 (inch)	T (inch)
NORTH DRAIN INLET	Rip-rapped drop str	8	2	3	3	6	9
SOUTH DRAIN INLET	Rip-rapped drop str	8	2	3	3	6	9
EAST DRAIN INLET	Rip-rapped drop str	14	2	3	3	6	9
WEST DRAIN INLET	Rip-rapped drop str	8	2	3	3	6	9

LOWE DIXON POND-310
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5320	1.66	0.00	0.00
5321	1.79	1.73	1.73
5322	1.93	1.86	3.59
5323	2.07	2.00	5.59
5324	2.21	2.14	7.73
5325	2.36	2.28	10.01
5326	2.50	2.43	12.44
5327	2.65	2.58	15.02
5328	2.81	2.73	17.75

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

LEGEND

ROAD
CULVERT
DRAINAGE
POWERLINE
INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE CORNER
PERMIT/LEASE BOUNDARY
WATER LINE
IRRIGATION LINE

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for ponds are shown on Exhibit 11-13E
3. For Corridor Ready-line, refer to Exhibit 11-177 and for North and South Corridor road refer to Exhibt 11-174 for design information.

EXHIBIT 26-93

POND 310
DESIGN

PLAN, PROFILE AND SECTIONS

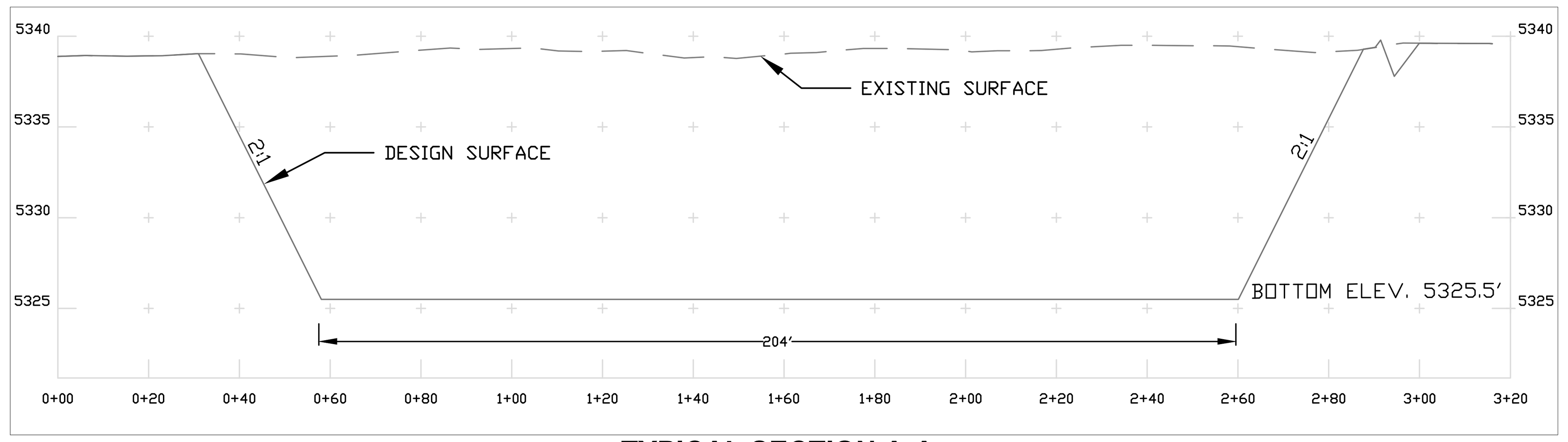
PROJECT: ROADS RE-ALIGNMENT
DATE: 5-30-13
DESIGN BY: RY
DRAWN BY: RY
CHECKED BY: LR
APPROVED BY: LR

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

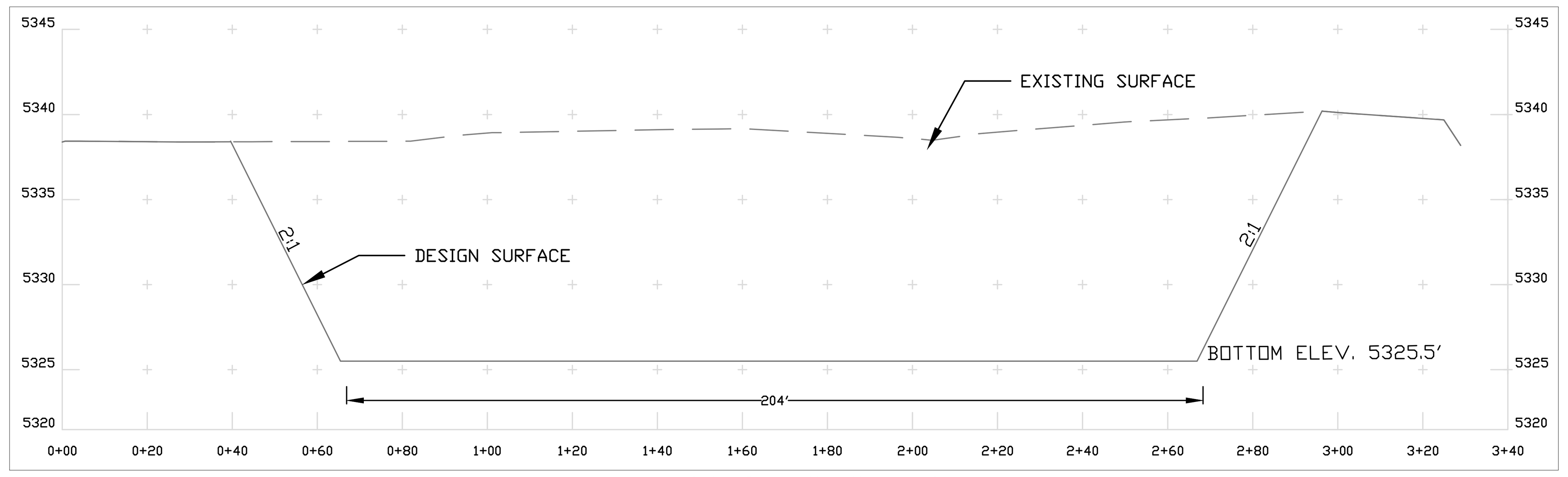
PROJECT MANAGER: J.S
ENGR. of RECORD: LR
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

	REVISION	DATE
13-A	Submitted to OSM for Approval	05-30-13
13-B	LABELED GRID FOR NORTH INLET, EDITTED POND NAME, CALLED OUT RIPRAP SIZE ON SECTION B-B AND SUBMITTED TO OSM FOR APPROVAL.	08-05-13

DRAWING
SHEET 1 OF 1



TYPICAL SECTION A-A
HORIZ.: 1" = 30' VERT.: 1" = 5'

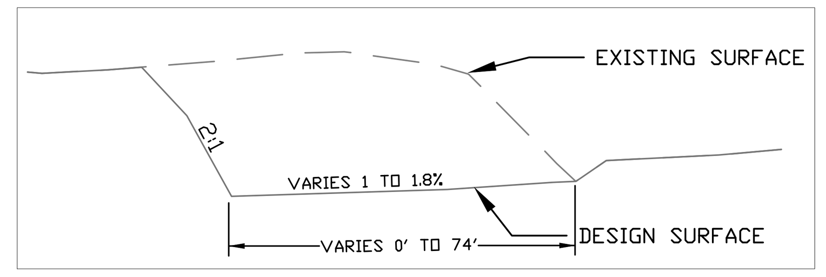


TYPICAL SECTION B-B
HORIZ.: 1" = 30' VERT.: 1" = 5'

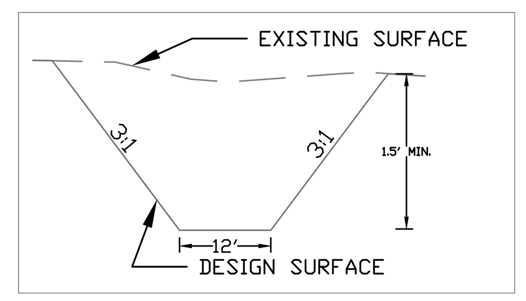
LOWE POND 311 STORAGE TABLE

ELEV. (FT)	AREA (AC)	INC. VOL (AC-FT)	ACCUM. VOL. (AC-FT)
5325.5	0.93	0	0
5326	0.95	0.47	0.47
5327	0.99	0.97	1.45
5328	1.04	1.02	2.46
5329	1.08	1.06	3.52
5330	1.12	1.10	4.62
5331	1.18	1.15	5.77
5332	1.25	1.21	6.98
5333	1.37	1.31	8.30
5334	1.63	1.50	9.80
5335	1.98	1.80	11.60

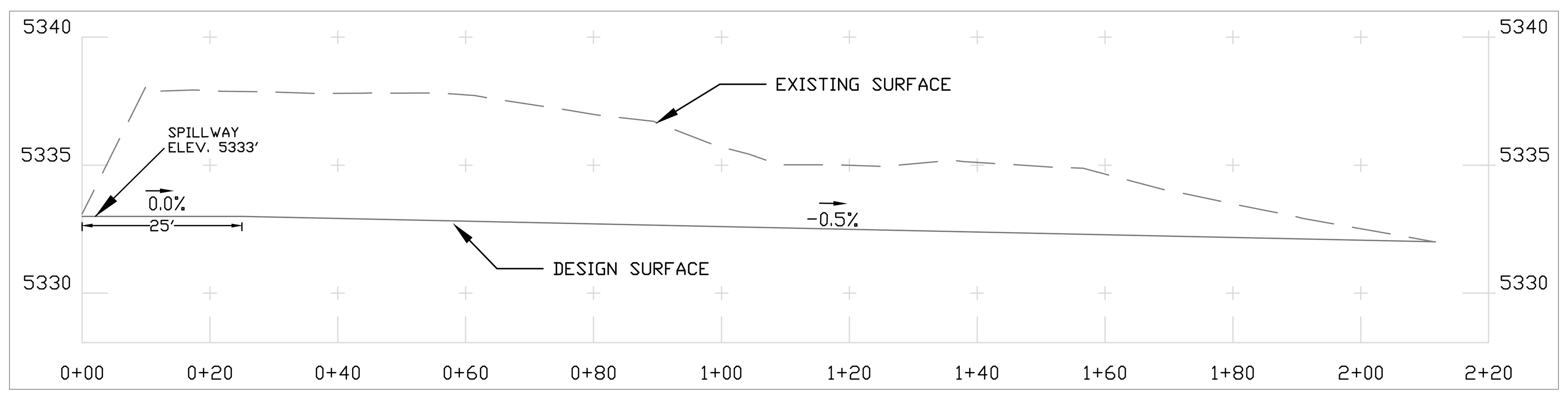
SPILLWAY ELEV. 5,333'
DESIGN STORM VOL. 6.9 AC. FT



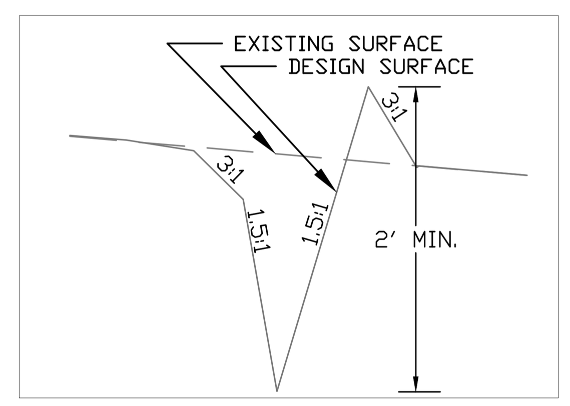
TYPICAL SECTION G-G
HORIZ.: 1" = 20' VERT.: 1" = 5'



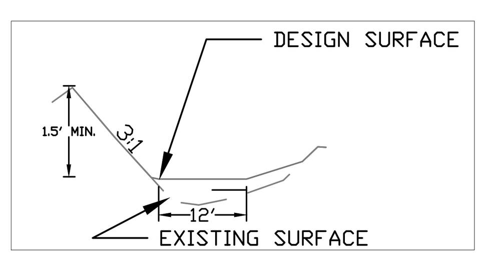
TYPICAL SECTION H-H
NTS



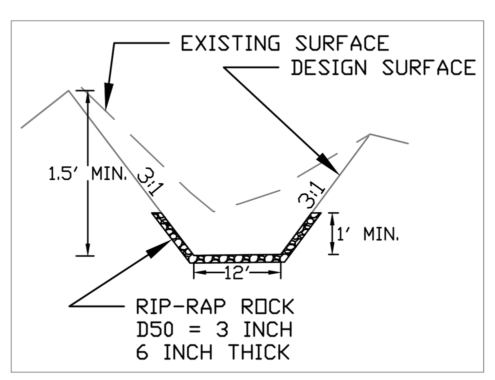
PROFILE VIEW - SPILLWAY
STAT. 0+00 to 2+11.66
HORIZ.: 1" = 20' VERT.: 1" = 5'



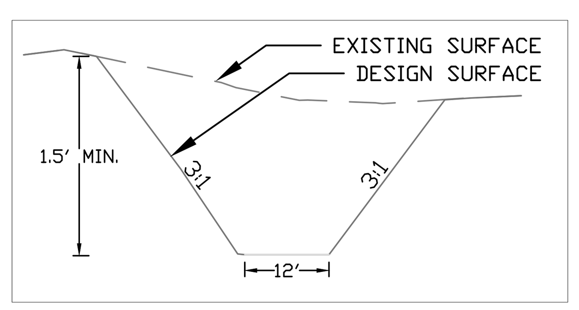
TYPICAL SECTION I-I
NTS



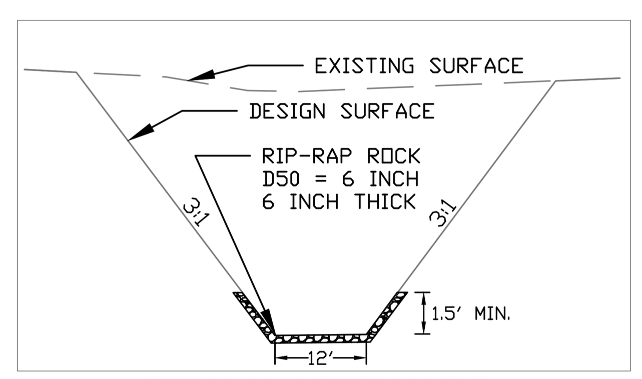
TYPICAL SECTION C-C
STAT. 0+00 to 1+74.08
NTS



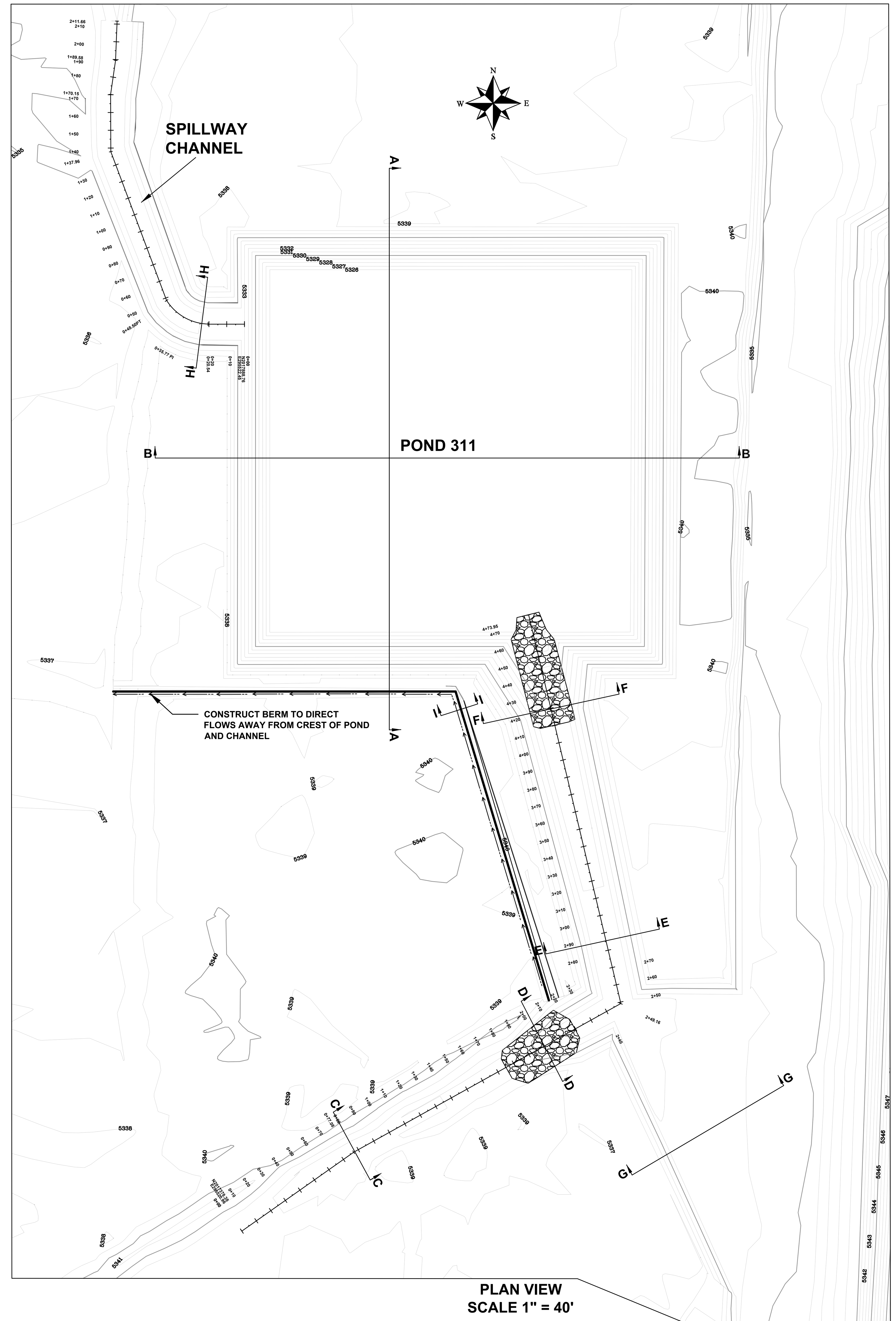
TYPICAL SECTION D-D
STAT. 1+74.08 to 2+19.25
NTS



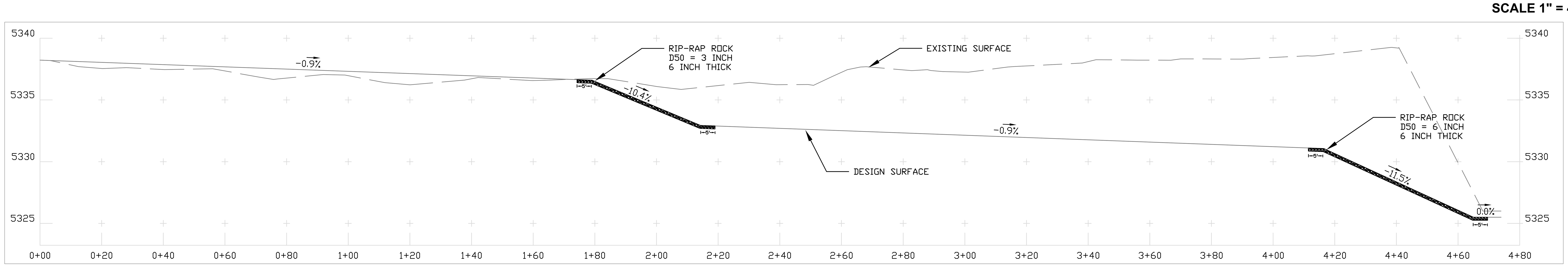
TYPICAL SECTION E-E
STAT. 2+19.25 to 4+11.47
NTS



TYPICAL SECTION F-F
STAT. 4+11.47 to 4+73.95
NTS



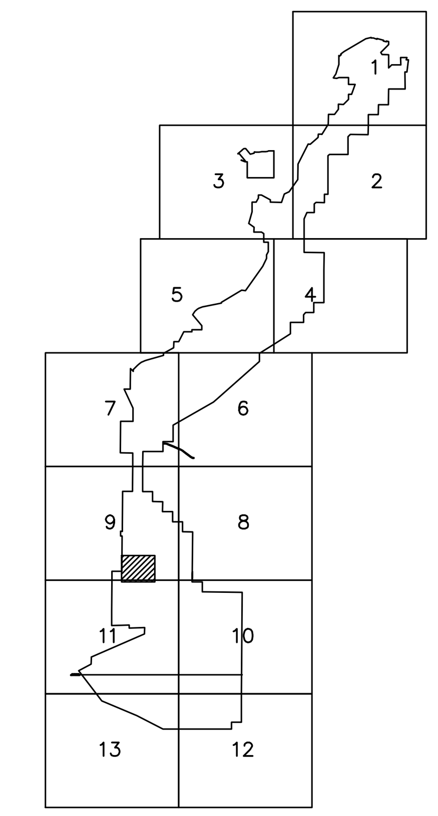
PLAN VIEW
SCALE 1" = 40'



PROFILE VIEW - SOUTH DRAINAGE
STAT. 0+00 to 4+73.95
H. Scale: 1" = 20' V. Scale: 1" = 5'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- SPOT ELEVATION
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- LEASE CORNER
- LEASE/PERMIT BOUNDARY



NOTES:

1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.
2. THE WATERSHED FOR LOWE POND IS SHOWN IN EXHIBIT 11-13E

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.
13-A	06/13/13	RRY	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	RRY	TR	LR

EXHIBIT 26-94

bhpbilliton

BHP Navajo Coal Company

P.O. Box 1717
Fruitland,New Mexico,87416
Phone: 505-598-4200
Fax: 505-598-3361

POND 311
PLAN, PROFILE, AND SECTION

Prepared By: RRY	Drawn By: DESIGN	Scale: VARIES
Approved By: LR	Plot Date: 6/27/13	Layout: 24X36_LS

Drawing: Lowe Pond Design FINAL EXHIBIT DRAWINGS.dwg

Appendix 26.A

Lowe Railroad Embankments #2 Modification

Appendix 26.A

Lowe Railroad Embankment #2 Modification

Due to reformatting of the Navajo Mine PAP, the following references in this appendix have been changed, deleted or renumbered:

NM-0003F Paper Reference	NM-0003F Electronic Permit
Exhibit 11-13E	Exhibit 26-12
Exhibit 11-67	Exhibit 26-14
Exhibit 11-67A	Exhibit 26-15
Table 11-5Q	Table 26-5.11
Table 11-5R	Table 26-5.12
Appendix 11-AA	Appendix 26.C
Chapter 11 Section 11.5.4.2	Part 4 Section 26.2.1
Sediment Ponds	Sediment Ponds

Lowe Railroad MSHA Impoundment

Background

The Lowe Railroad MSHA Impoundment (MSHA ID No. 1211-NM-09-00097-01) is located immediately north of the Lowe Coal Stockpile in Area III, see Exhibit 11-13E. The impoundment was constructed in 1981 when the railroad was extended further south to facilitate mining operations. The impoundment's embankment has a maximum height of approximately 50 feet with side slopes of 1.5 horizontal to 1.0 vertical. The top width of the embankment is 35 feet. The maximum capacity of the impoundment is approximately 100 acre-feet.

Within the Lowe Railroad MSHA Impoundment watershed there are two smaller impoundments (Lowe Railroad Impoundments #1 and #2) and a topsoil stockpile (LWR1_TS_W), see Exhibit 11-67 and 11-67A, respectively. Both Lowe Railroad Impoundments #1 and #2 were designed as total containment structures, 100 year-6 hour storm event, therefore no spillway were required (30 CFR 816.49(a)(9)(ii)(B)) and will retain surface runoff and sediment generated from the areas disturbed by mining activities. In addition, the impoundments will keep the 100 year-6 hour flood from impacting the topsoil stockpile.

Hazard Classification

In the event of a failure of the MSHA Impoundment Embankment, the potential for loss of life or significant property damage downstream is very low. There are no dwellings, public buildings, commercial buildings, or public transportation/utilities downstream of the MSHA Impoundment. Additionally, it will not constitute a hazard to mine employees and equipment since it is downstream of the active pit and reclamation activities. Lowe Railroad Impoundment would be classified as a low hazard dam.

Lowe Railroad Impoundments #1 and #2 were designed to safely retain the 100 year – 6 hour runoff of 6.87 and 6.55 acre-feet, respectively. The capacity of Impoundment #1 is 19.20 acre-feet and Impoundment #2 has a capacity of 18.37 acre-feet. Both structures will retain surface water runoff and sediment storage. Water and/or sediment level will be kept below the maximum permissible level, see NM-0003E Chapter 11 Sediment Ponds 11.5.4.2 for additional information on the maximum permissible level.

Watershed Area

Lowe Railroad Impoundment #1 has a watershed of 105.73 acres. The watershed drainage is from the Lowe Coal Stockpile, overburden material adjacent to the Lowe bypass road, and part of the topsoil stockpile material. Impoundment #2 has a watershed of 133.27 acres. The drainage extends north to the mid point of the Neck Road, see Exhibit 11-13E for the watershed boundaries.

Design Criteria

The design criteria and key assumptions made for the hydrology analysis for Lowe Railroad Impoundments #1 and #2, are as follows:

Lowe Railroad MSHA Impoundment

1. The design storm event for both impoundments is 100 year-6 hour, see Appendix 11-AA for SedCad Modeling analysis.

2. The capacity to store runoff from a 100 year – 6 hour storm will be maintained at all times. Water and/or sediment will not be higher than the maximum permissible level see tables 11-5Q and 11-5R. This is the elevation at which the impoundment can no longer contain the designed storm event. If the water and/or sediment exceed the permissible level then it will either be pumped and/or cleaned to an acceptable elevation.

3. Since the railroad embankment has the potential to impound 100 acre-feet of water and is about 50 feet high the MSHA impoundment criteria is applicable as required by 30 CFR 77.216.

Stability Analysis

The slope stability analysis for Lowe MSHA Impoundment was performed by Western Technologies, Incorporated located in Farmington, New Mexico. For more information, refer to the analysis report titled "Lowe Railroad Impoundment #1 – Stability Analysis", can be found in this appendix. Note: Lowe Railroad MSHA Impoundment is referred to as Lowe Railroad Embankment #1 in the stability analysis report.

The static factors of safety for the upstream and downstream slopes of the railroad embankment are 3.1 and 3.7, respectively. This indicates that the railroad embankment is stable and meets the minimum safety factor of 1.5. Modifications to Impoundments #1 and #2 have not affected the stability of the Railroad embankment; therefore; the report is still valid.

Summary

Lowe Railroad Impoundments #1 and #2 will safely retain the 100 year -6 hour storm event. If a storm exceeds the designed storm event, the railroad embankment has the potential to 100 acre-feet of water. Therefore, it is considered a MSHA Impoundment. The Railroad embankment meets the minimum static safety factor if such an event were to happen.

Lowe Railroad MSHA Impoundment

Modifications

April 2008 Impoundments #1 and #2 were both modified due to an OSM Notice of Violation, the berm breached on the topsoil stockpile and the 100 year-6 hour storm floodplain had the potential to impact the topsoil stockpile. The impoundments were redesigned to contain the 100 year- 6 hour storm event. The north embankment on Impoundment #1 was raised and the spillway on Impoundment #2 was closed. The western topsoil berm is now the railroad embankment. This will reduce the loss of topsoil in the event of a 100 year- 6 hour storm.

In 1995, Impoundment #2 was modified based on a September and October, 1994 OSM/AFO inspection. The inspection was an observance of seepage on the western boundary of the impoundment. BHP installed a 3 ½'spoil clay liner. The permeability of the spoil material was tested by AGRA Earth & Environment. Clay liner is shown on the as-built design, Exhibit 11-67A. For additional information see Lowe Railroad Embankment #2 Modification on the following page, this includes the permeability results.

NAVAJO MINE

LOWE RAILROAD EMBANKMENT #2 MODIFICATION

BHP Minerals International Inc. is proposing to modify the Lowe Railroad Embankment #2 impoundment. This embankment is located along the railroad just north of Lowe Stockpile (also see EXHIBIT 11-13E, "Area III Impoundments and Pond Location/Watershed Areas", for location). The embankment occasionally contains surface water runoff to the east of the railroad. In addition, EXHIBIT's 11-67 and 11-67a shows the location of the embankment and the drainage area. This modification addresses the seepage of water from the western face of the Lowe Railroad Embankment #2. This situation was observed by OSM/AFO during a September and October, 1994 inspection.

BHP proposes that we level the area and backfill the pond with approximately 28,600 cyds of existing spoil material. The clay material from the existing North Lowe Pit spoil pile will be used. Once the area has been completely leveled from elevations 5325' down to 5310', the area will be covered with 3 1/2' of clay liner material. The spoil clay material was tested for permeability by AGRA Earth & Environmental. A copy of the AGRA laboratory results are provided within the appendix. A portion of railroad embankment will also be lined with the clay material. The proposed work modification is shown on EXHIBIT 11-67 as cross-sections C-C and D-D.

Currently the basin capacity is 18.18 acre-feet at 5320' elevation. It was determined the highest point of elevation was 5325' before it drops back down in elevation. After the spoil clay material has been brought in and compacted and backfilled against the railroad embankment, the basin capacity is calculated to be 16.39 acre-feet at elevation 5325' which is substantially greater than the required

(12/08/95;12/26/95)

capacity of 12.32 acre-feet for a 100-yr., 6-hr. storm.

Lowe Railroad Embankment #2 watersheds are approximately 105.1 acres of mostly disturbed land. The SEDCAD+ analysis provided in APPENDIX 11-AA is valid for the embankment modification proposal. The modification will compile with Federal regulation 30 CFR 816.46, which requires that a sedimentation pond without a spillway contain runoff generated from a 100-yr., 6-hr event. Runoff quantities were determined using the SEDCAD+ computer model.

(12/08/95;12/26/95)

AGRA
Earth & Environmental

AGRA Earth &
Environmental, Inc.
2060 Afton Place
Farmington, New Mexico 87401
Tel (505) 327-7928
Fax (505) 326-5721

LABORATORY REPORT

Client: BHP Minerals - Navajo Mine Area III
P.O. Box 155
Fruitland, NM 87416

AGRA Project No.: C95-9506

February 2, 1995
Page (1 of 1)

Project Lowe Pond #2 Liner
Location Navajo Mine Area III

Type of Material Clay
Source of Material Lowe Stockpile Northeast
Requested By E. Tsosie **Date** 1/10/95 **Sampled By** L. Waresback/AGRA **Date**1/10/95
Submitted By L. Waresback/AGRA **Date** 1/10/95

Reviewed By L. Waresback

Sieve Analysis, ASTM

Sieve Size	Accumulative Percent Passing	Specification
3"		
2 1/2"		
2"		
1 1/2"		
1"		
3/4"		
1/2"	100	
3/8"	98	
1/4"	--	
No. 4	96	
No. 8	93	
No. 10	92	
No. 16	91	
No. 30	88	
No. 40	87	
No. 50	86	
No. 100	83	
No. 200	78	

Moisture-Density Relationship, Test Method ASTM D698A

Maximum Dry Density: 98.1 pcf	Optimum Moisture Content: 20.5 percent

Plasticity Index, ASTM D4318

	Results	Specification
Liquid Limit (LL)	63	
Plastic Limit (PL)	21	
Plasticity Index (PI=LL-PL)	42	

Other

Permeability 8.4 x 10^{-9}cm/sec. Spec. 1.0 x 10^{-7} cm/sec. minimum
Remolded to 95% of ASTM D698 at Optimum Moisture Content.

Distribution:Client, Billimg /mir

Engineering & Environmental Services

AGRA
Earth & Environmental

AGRA Earth &
Environmental, Inc.
2060 Afton Place
Farmington, New Mexico 87401
Tel (505) 327-7928
Fax (505) 326-5721

LABORATORY REPORT

Client: BHP Minerals - Navajo Mine Area III
P.O. Box 155
Fruitland, NM 87416

AGRA Project No.: C95-9506

February 2, 1995
Page (1 of 1)

Project Lowe Pond #2 Liner
Location Navajo Mine Area III

Type of Material Clay
Source of Material Lowe Pit West
Requested By E. Tsosie Date 1/10/95 Sampled By L. Waresback/AGRA Date1/10/95
Submitted By L. Waresback/AGRA Date 1/10/95

Reviewed By L. Waresback

Sieve Analysis, ASTM

ieve Size	Accumulative Percent Passing	Specification
3"		
2 1/2"		
2"		
1 1/2"		
1"		
3/4"	100	
1/2"	98	
3/8"	97	
1/4"	--	
No. 4	92	
No. 8	89	
No. 10	88	
No. 16	85	
No. 30	83	
No. 40	82	
No. 50	81	
No. 100	79	
No. 200	76	

Moisture-Density Relationship, Test Method ASTM D698A

Maximum Dry Density: 102.9pcf Optimum Moisture Content: 18.0 percent

Plasticity Index, ASTM D4318

	Results	Specification
Liquid Limit (LL)	49	
Plastic Limit (PL)	25	
Plasticity Index (PI=LL-PL)	24	

Other

Permeability 1.3 x 10^{-8}cm/sec. Spec. 1.0 x 10^{-7} cm/sec. minimum
Remolded to 95% of ASTM D698 at Optimum Moisture Content.

stribution:Client, Billimg /mir

Engineering & Environmental Services

Lowe Railroad Embankment #2 As-Built/ Modification

Reclamation on the eastern edge of Lowe Railroad Embankment #2 Pond has changed the topography so that the current pond can retain over 20 acre-feet. Therefore, the pond must be modified or permitted by MSHA. To eliminate this problem, a spillway has been added to the western end of the pond along the 5324' elevation. The crest of the spillway extends 426' southwards at elevation 5324'. When topography starts to break, the spillway slopes 434' downward at -7.3% towards Lowe Railroad Embankment #1. The pond will contain 11.11 acre-feet at the 5324' elevation. The pond must hold 8.07 acre-feet to contain the 10 year, 24-hour storm event. The spillway is designed for the 25 year, 6-hour storm event, and the peak stage is at 5325.09' elevation. This allows for one foot of free board in the spillway.

The spillway outflow channel will show signs of scouring during an overflow event from the spillway. In the past, overflow through the spillways have been very infrequent; especially, since the average annual rainfall for the area is only 7.0 inches. The outflow channel will be inspected and maintained. Any sediment generated will be retained in Lowe Railroad Embankment #1, immediately downstream, and it will not leave the permit area.

Pages 11-Q-9 through 11-Q-28 left blank

Due to text updates

LOWE RAILROAD IMPOUNDMENT #1

STABILITY ANALYSIS

MAR 1998
APPROVED

11-Q-29

02-1690

GEOTECHNICAL EVALUATION

LOWE RAILROAD EMBANKMENT I
AREA III - NAVAJO MINE
FRUITLAND, NEW MEXICO
JOB NO. 3127JC127

Prepared for:

BHP - NAVAJO MINE

August 8, 1997

LAWRENCE E. CYNOVA
NEW MEXICO
7864
REGISTERED PROFESSIONAL ENGINEER
8-8-97

Lawrence E. Cynova, P.E.
Geotechnical Engineer

Jon C. Schwindt, P.E.
Vice President

APPROVED
MAR 1998

11-Q-30

02-1691

August 8, 1997

BHP - Navajo Mine
P.O. Box 1717
Fruitland, New Mexico 87416

Attn: Mr. Leonard Raymond

Re: Geotechnical Evaluation
Lowe Railroad Embankment I
Area III - Navajo Mine
Fruitland, New Mexico

Job No. 3127JC127

Western Technologies Inc. has completed the geotechnical evaluation for the existing Lowe Railroad Embankment I at Navajo Mine, south of Fruitland, New Mexico. This study was performed in general accordance with our verbal/telephone quote and BHP purchase order AG9559 on July 24, 1997. The original study for this project was conducted in January of 1988. This report is to cover additional depth of water behind the railroad embankment. The results of our evaluation, including the field observations, borings logs and the geotechnical recommendations are attached.

We appreciate being of service to you in the geotechnical engineering phase of this project. If conditions change, or if you have any questions concerning this report and consulting services, please do not hesitate to contact us. We look forward to working with you on future projects.

Sincerely,
WESTERN TECHNOLOGIES INC.
Geotechnical Engineering Services

Lawrence E. Cynova, P.E.
Geotechnical Engineer

Copies to: Addressee (4)

APPROVED
MAR 1998

TABLE OF CONTENTS

GEOTECHNICAL EVALUATION
LOWE RAILROAD EMBANKMENT I
FRUITLAND, NEW MEXICO
JOB NO. 3127JC127

1.0 PURPOSE

This report contains the results of our geotechnical evaluation of the existing railroad slope located at the Lowe Railroad Embankment I, Area III of the Navajo Mine, south of Fruitland, New Mexico. The purpose of these services is to determine the depth of fill, material types and stability of the existing slopes.

2.0 PROJECT DESCRIPTION

Project information supplied by Mr. Leonard Raymond, indicates that the railroad embankment was constructed in about 1981. The embankment has a railroad and service road and is about 35 feet in width. The railroad fill is several thousand feet in length. Our work was primarily concerned with the deep fill which is approximately 600 feet in length. It is understood that this empoundment area has a small drainage area and the maximum water behind the embankment will be at elevation 5308. The embankment is approximately 50 feet in height at its highest point. The area behind the embankment is dry about 70 percent of the time. After a precipitation event and if significant water is present behind embankment, the water will be pumped/hauled away.

3.0 SCOPE OF SERVICES

3.1 Field Exploration

Two borings were drilled to depths ranging from 41 to 42 feet below existing site grades on the existing railroad embankment area. A field log was prepared for each boring. The final logs describe the materials encountered, their thicknesses, and locations where samples were obtained. The Unified Soil Classification System was used to classify soils. The soil classification symbols appear on the boring logs and are briefly described in Appendix A.

3.2 Labortory Analyses

Laboratory analyses were performed on representative soil samples to aid in material classification and to estimate pertinent engineering properties of the on-site soils for preparation of this report. Testing was performed in general accordance with applicable ASTM specifications. The following tests were performed and the results are presented in Appendix B.

- Water content
- Dry density
- Shear strength-direct shear

3.3 Analyses and Report

Analyses was performed and this report was prepared for the exclusive purpose of providing geotechnical engineering information and recommendations. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken. We are available to discuss the scope of such studies with you.

4.0 SITE CONDITIONS

4.1 Surface

The Lowe Railroad Embankment I is located just north of Lowe Stockpile loading area. The general site drainage is to the west down a wash. Spoils piles and a top dressing stockpiles are located east and northeast of the Railroad Embankment. The site contained a sparse to moderate growth of weeds, grass, and brush. Rock outcrops at many locations surrounding this site.

4.2 Geologic History

The material located at the Lowe Railroad Embankment appears to have been cut from the surrounding hills and mesas and placed as fill. This material probably originated as flood plain and valley alluvium deposits derived from the cretaceous sedimentary beds of the Fruitland Formation.

This formation consists of gray to brown shale and claystone interbedded with tan to yellow sandstone and coal. It was deposited as coastal swamp and floodplain deposits which accumulated behind and above the near shore sands of the Pictured Cliff Sandstone, also of cretaceous age. The Fruitland Formation remains one of the most important coal horizons in the San Juan Basin.

5.0 ANALYSIS PROCEDURES

5.1 General

The slope stability analysis was conducted on the highest section of the embankment where water is stored after precipitation runoff. A fully loaded coal train was assumed to be on the railroad embankment during this analysis.

5.2 Material Properties

The sandy clay materials encountered in the embankment areas have moderate to high cohesion and moderate to moderately high angles of internal friction. The direct shear tests were conducted at or slightly above existing moisture contents for embankment materials and in the saturated condition for ponds materials. The large particle size of the embankment materials caused difficulty in trimming soils samples and therefore soil samples were remolded to near in-place densities. The claystone or shale under the soils at the embankments was assumed to have high cohesion and low to moderately high angles of internal friction. Based upon our observations and our experience with similar materials, the following material properties were assigned to the existing slope materials:

Sandy Clay - Native Area
Dry unit weight - 107 (pcf) pounds per cubic foot
Angle of internal friction - 20°
Cohesion - 300 (pcf) pounds per cubic foot

Sandy Clay - Saturated Zone
Dry unit weight - 95 (pcf) pounds per cubic foot
Angle of internal friction - 20°
Cohesion - 300 (pcf) pounds per cubic foot

Sandy Clay - Embankment Area
Dry unit weight - 107 (pcf) pounds per cubic foot
Angle of internal friction - 32°
Cohesion - 1400 (pcf) pounds per cubic foot

Claystone
Dry unit weight - 110 (pcf) pounds per cubic foot
Angle of internal friction - 0°
Cohesion - 10,000 (psf) pounds per cubic foot

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5.3 Slope Stability Analysis

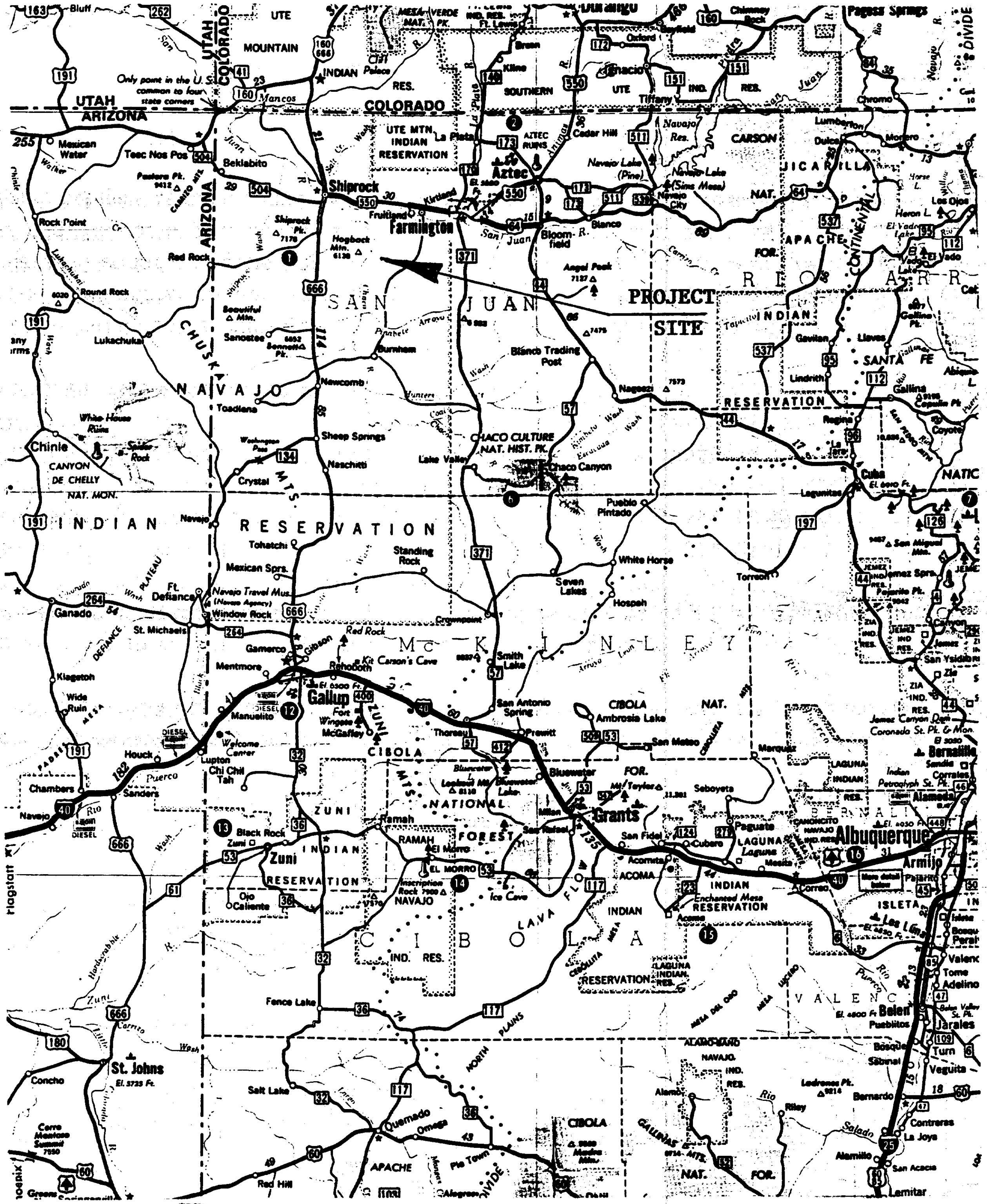
The static stability of the existing slope was analyzed using strength parameters from test results and estimates from observations and past experience with similar materials. The analysis was conducted on the slope configuration (Plate 3) as measured in the field by BHP personel. A computer program (SB Slope developed by Von Guten Engineering Software) using simplified Bishop's Analysis was performed for the existing slope configurations.

The following table presents the results of the analysis:

Section	Analysis	Factor of Safety
Downstream	Circle 1	3.7
Upstream	Circle 2	3.1

A minimum static factor of safety of 1.5 is required for embankments by the Mine Safety & Health Administration.

Based upon laboratory test results, estimates of soil parameters and our computer analysis, the upstream and downstream slope of the railroad embankment meets the static factor of safety.



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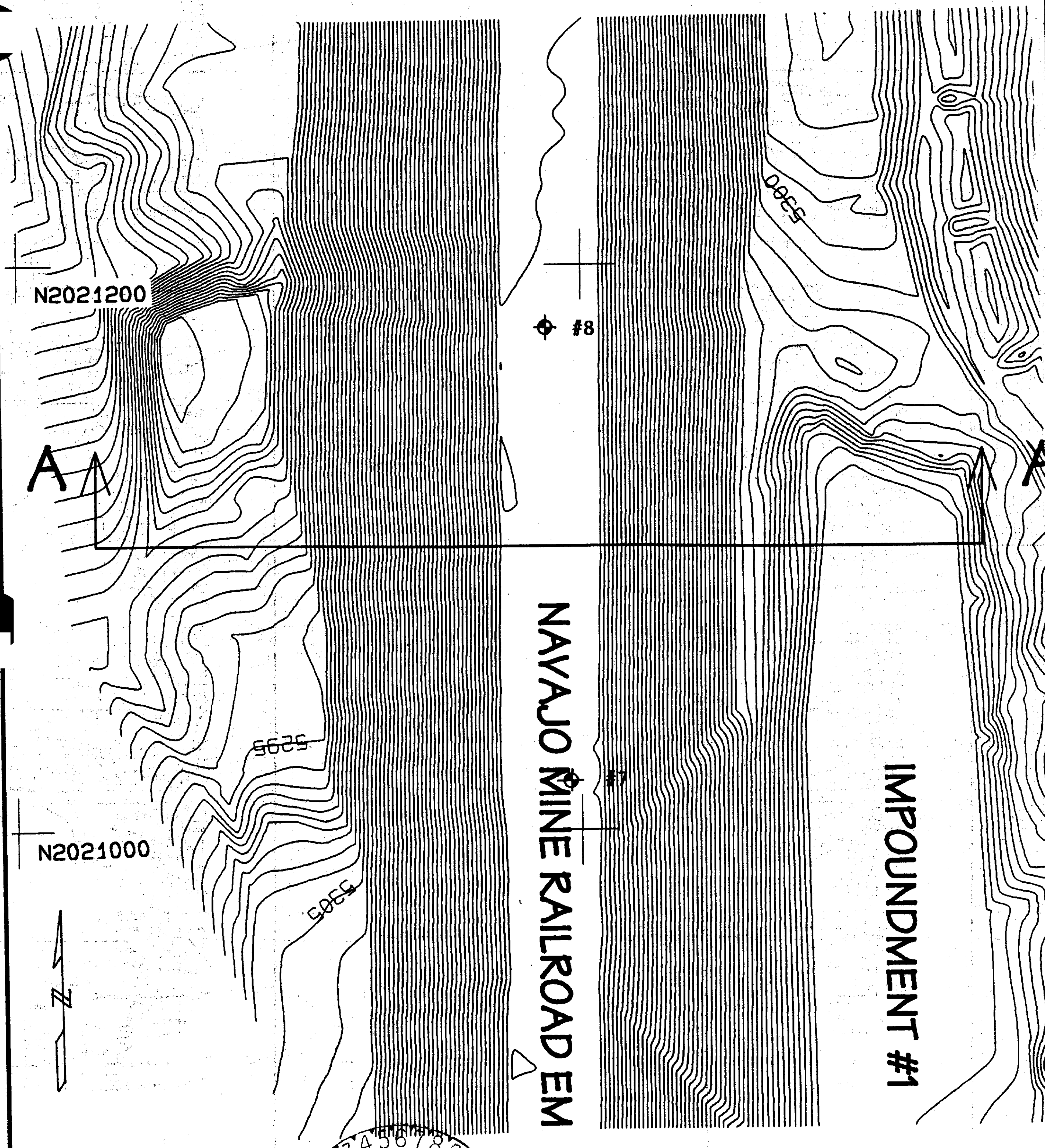
LOWE RAILROAD EMBANKMENT I	
Vicinity Map	
Western Technologies Inc.	
Job No.: 3127JC127	Plate: 1

11 Q 37

02-1698



LEGEND

BORING

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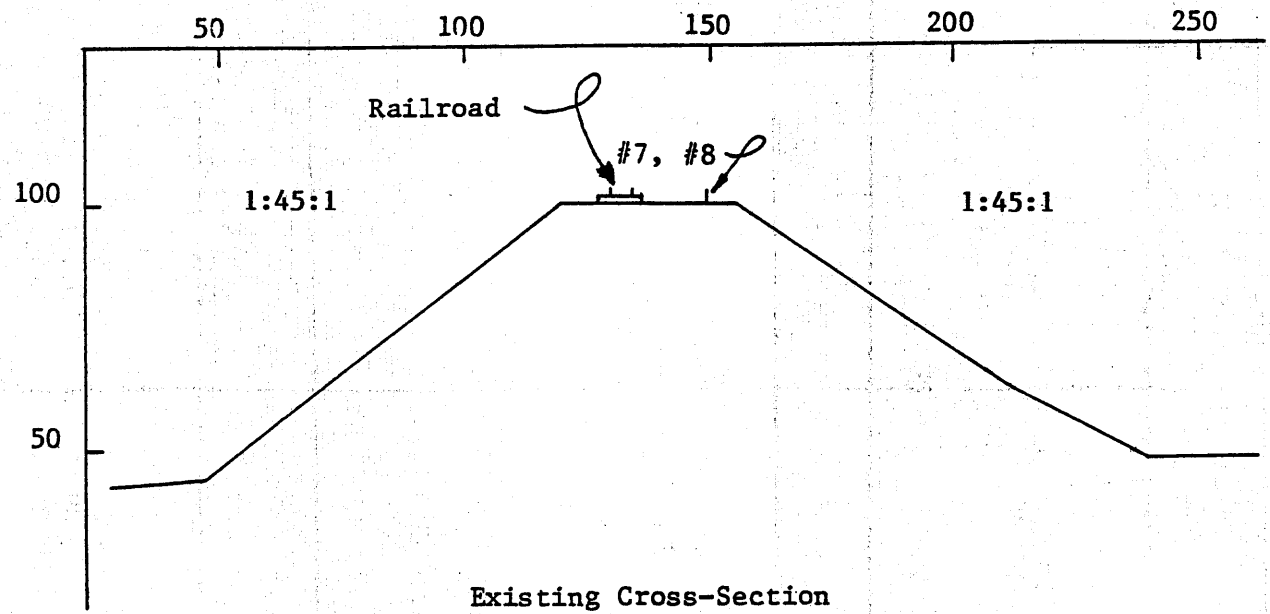
11-O-38

LOWE RAILROAD EMBANKMENT I	
Boring Location Diagram	
Western Technologies Inc.	
Job No.: 3127JC127	Plate: 2



Existing Cross-Section

Slopes are shown as horizontal to vertical

LOWE RAILROAD EMBANKMENT I	
Slope Profile	
Western Technologies Inc.	
Job No.: 3127JC127	Plate: 3

Allowable Soil Bearing Capacity	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
Backfill	A specified material placed and compacted in a confined area.
Base Course	A layer of specified material placed on a subgrade or subbase.
Base Course Grade	Top of base course.
Bench	A horizontal surface in a sloped deposit.
Caisson	A concrete foundation element cast in a circular excavation which may have an enlarged base. Sometimes referred to as a cast-in-place pier.
Concrete Slabs-on-Grade	A concrete surface layer cast directly upon a base, subbase or subgrade.
Crushed Rock Base Course	A base course composed of crushed rock of a specified gradation.
Differential Settlement	Unequal settlement between or within foundation elements of a structure.
Engineered Fill	Specified material placed and compacted to specified density and/or moisture conditions under observations of a representative of a soil engineer.
Existing Fill	Materials deposited through the action of man prior to exploration of the site.
Existing Grade	The ground surface at the time of field exploration.
Expansive Potential	The potential of a soil to expand (increase in volume) due to absorption of moisture.
Fill	Materials deposited by the actions of man.
Finished Grade	The final grade created as a part of the project.
Gravel Base Course	A base course composed of naturally occurring gravel with a specified gradation.
Heave	Upward movement
Native Grade	The naturally occurring ground surface.
Native Soil	Naturally occurring on-site soil.
Rock	A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation.
Sand & Gravel Base	A base course of sand and gravel of a specified gradation.
Sand Base Course	A base course composed primarily of sand of a specified gradation.
Scarify	To mechanically loosen soil or break down existing soil structure.
Settlement	Downward movement.
Soil	Any unconsolidated material composed of discrete solid particles, derived from the physical and/or chemical disintegration of vegetable or mineral matter, which can be separated by gentle mechanical means such as agitation in water.
Strip	To remove from present location.
Subbase	A layer of specified material placed to form a layer between the subgrade and base course.
Subbase Grade	Top of subbase.
Subgrade	Prepared native soil surface.

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11-Q-40

LOWE RAILROAD EMBANKMENT I	
Definition of Terminology	
Western Technologies Inc.	
Job No.: 3127JC127	Plate: A-1

02-1701

COARSE-GRAINED SOILS
LESS THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size
GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES LESS THAN 5% FINES	
GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% FINES	
GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% FINES	
SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size
SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	
SM	SILTY SANDS, SAND-SILT MIXTURES, MORE THAN 12% FINES	
SC	CLAYEY SANDS, SAND-CLAY MIXTURES, MORE THAN 12% FINES	

NOTE: Coarse-grained soils receive dual symbols if they contain 5 to 12% fines (e.g. SW-SM, GP-GC, etc.)

FINE-GRAINED SOILS
MORE THAN 50% FINES

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	SILTS AND CLAYS Liquid limits less than 50
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
OL	ORGANIC SILTS OR ORGANIC SILT-CLAYS OF LOW PLASTICITY	
MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit more than 50
CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
PT	PEAT, MUCK, AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

NOTE: Fine-grained soils may receive dual classification based upon plasticity characteristics

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	ABOVE 12 in.
COBBLES	3 in. to 12 in.
GRAVEL	No. 4 to 3 in.
Coarse	3/4 in. to 3 in.
Fine	No. 4 to 3/4 in.
SAND	No. 200 to No. 4
Coarse	No. 10 to No. 4
Medium	No. 40 to No. 10
Fine	No. 200 to No.40
*Fines (Silt or Clay)	BELOW No. 200

NOTE: Only sizes smaller than three inches are used to classify soils

CONSISTENCY

CLAYS & SILTS	BLOWS/FOOT*
VERY SOFT	0-2
SOFT	2-4
FIRM	4-8
STIFF	8-16
VERY STIFF	16-32
HARD	Over 32

RELATIVE DENSITY

SANDS & GRAVELS	BLOWS/FOOT*
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	Over 50

*Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1 3/8" ID) split spoon (ASTM D1586)

PLASTICITY OF FINE GRAINED SOILS

PLASTICITY INDEX	TERM
0	Non-Plastic
1 - 7	Low
8 - 25	Medium
Over 25	High

DEFINITION OF MOISTURE CONTENT

DRY
SLIGHTLY DAMP
DAMP
MOIST
WET
SATURATED

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11-Q-41

LOWE RAILROAD EMBANKMENT I	
Method of Soil Classification	
Western Technologies Inc.	
Job No.: 3127JC127	Plate: A-2

The number shown in "BORING NO." refers to the approximate location of the same number indicated on the "Boring Location Diagram" as positioned in the field by measurements from existing features.

"ELEVATION" refers to ground surface elevation at the boring location established by the client.

"TYPE SIZE BORING" refers to the exploratory equipment used in the boring wherein HSA = hollow stem auger.

"N" in Blows/Foot" refers to the number of blows of a 140-pound weight, dropped 30 inches, required to advance a two-inch-outside-diameter split-barrel sampler a distance of 1 foot, Standard Penetration Test (ASTM D1586). Refusal to penetration is defined as more than 100 blows per foot.

"R" in Blows/Foot" refers to the number of blows of a 140-pound weight, dropped 30 inches, required to advance a 2.42-inch-inside-diameter ring sampler a distance of 1 foot. Refusal to penetration is considered more than 50 blows per foot.

"Sample Type" refers to the form of sample recovery, in which N = Split-barrel sample, R = Ring sample, G = Grab Sample.

"Dry Density, pcf" refers to the laboratory-determined dry density in pounds per cubic foot. The symbol "NR" indicates that no sample was recovered.

"Water Content, %" refers to the laboratory-determined moisture content in percent (ASTM D2216).

"Unified Classification" refers to the soil type as defined by "Method of Soil Classification". The soils were classified visually in the field and, where appropriate, classifications were modified by visual examination of samples in the laboratory and/or by appropriate tests.

These notes and boring logs are intended for use in conjunction with the purposes of our services defined in the text. Boring log data should not be construed as part of the construction plans nor as defining construction conditions.

Boring logs depict our interpretations of subsurface conditions at the locations and on the date(s) noted. Variations in subsurface conditions and soil characteristics may occur between borings. Groundwater levels may fluctuate due to seasonal variations and other factors.

The stratification lines shown on the boring logs represent our interpretation of the approximate boundary between soil types based upon visual field classification. The transition between materials is approximate and may be far more or less gradual than indicated.

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LOWE RAILROAD EMBANKMENT I	
Boring Log Notes	
Western Technologies Inc.	
Job No.: 3127JC127	Plate: A-3

11-Q-42

...MARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY D... OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS ...CATION.

DATE DRILLED: 11-25-1987

DRILL RIG TYPE: CME-55

BORING TYPE/SIZE: HSA/7"

BORING NO. 7

LOCATION: See Boring Location Diagram

ELEVATION: 5338 Feet

FIELD ENGR: S. Wood

WATER CONTENT (%)	DRY DENSITY (LBS/CU.FT)	SAMPLE TYPE	BLOWS/FT. R or N	BLOWS/FT. C	DEPTH	USCS
		G				
12.8	101	R	50/11"		5	
		N	49			
		N	54		10	
7.5	110	R	50/6"		15	
		N	50/5.5"			
		N	50		20	
	NR	R	50/6"		25	
		N	51			
		N	49		30	
		N	74		35	
		N	50/4"		40	
					45	
					50	
					55	
					60	

SOIL DESCRIPTION

FILL 0 TO 34.5 FEET SANDY CLAY; tan, damp to slightly damp, stiff to very stiff, some lumps of weather shale, some scattered pieces of sandstone, some gravel top 3 inches of surface, sandstone boulder 15 to 16.5 feet, brown carbonaceous shale below 29 feet.

SHALE; brown to orange, slightly damp, claystone, weathered.

SHALE; tan, slightly damp, fine sand and claystone, moderate cementation.

Auger Refusal 42 Feet

APPROVED MAR 1998

GROUNDWATER ENCOUNTERED NO: X YES:____ DEPTH:____ DATE: 11-25-1987

NOTES

LOWE RAILROAD EMBANKMENT I	
Boring Log	
Western Technologies Inc.	
Job No.: 3127JC127	Plate: A-4

11-Q-43

DATE DRILLED: 11-25-1987	**BORING NO. 8**	LOCATION: See Boring Location Diagram
DRILL RIG TYPE: CME-55		ELEVATION: 5338 Feet
BORING TYPE/SIZE: HSA/7"		FIELD ENGR: S. Wood

WATER CONTENT (%)	DRY DENSITY (LBS/CU.FT)	SAMPLE TYPE	BLOWS/FT. R or N	BLOWS/FT. C	DEPTH	USCS	SOIL DESCRIPTION
		G			0		FILL 0 TO 34.5 FEET SANDY CLAY; tan, very stiff, damp to slightly damp, some pieces of weathered shale and sandstone, sandstone boulder from 7.5 to 8 feet, some gravel on surface.
10.3	111	R	50/6"		5		
		N	50				
11.5	109	R	50/9"		10		
10.5	103	R	50/8"				
11.0	106	R	50/6"		15		
		N	49				
		N	46		20		
		N	66		25		
7	107	R	50/8"		30		
		N	44				
		N	81		35		SHALE; brown, black to orange, stiff to hard, slightly damp to damp, carbonaceous, some coal, some claystone.
		N	57		40		
					41		Auger Refusal At 41 Feet

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GROUNDWATER ENCOUNTERED NO: X YES:____ DEPTH:____ DATE: 11-25-1987

NOTES

LOWE RAILROAD EMBANKMENT I	
Boring Log	
Western Technologies Inc.	
Job No.: 3127JC127	Plate: A-5

11-Q-44

SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DI... OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS ...CATION.

02-1705

SOIL PROPERTIES

Boring No.	Depth (ft)	Soil Class.	Soil Property: Initial Dry Density (pcf)	Soil Property: Initial Water Content (%)	Shear Strength: C (ksf)	Shear Strength: φ (Deg)	Perm.: K (Cm/Sec)	Specific Gravity	Water Soluble Matter (ppm): Salts	Water Soluble Matter (ppm): Sulfates	Remarks
7	9-14.5	CL	107	11.0	0.3	20					DS
8	0-20	CL	107	10.8	1.4	37					DS
8	29-31.5	CL	107	11.0	1.5	32					DS

NOTE: Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.

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LEGEND
Shear Strength Test Method

DS Direct Shear
DS Direct Shear (Saturated)
UC Unconfined Compression
UU Unconsolidated Undrained
CU Consolidated Undrained w/pore pressure
CU Consolidated Undrained
CD Consolidated Drained

REMARKS
1. Compacted density (approximately 95% of ASTM D698 at moisture value slightly below optimum)
2. Visual Classification
3. Constant head
4. Falling head

LOWE RAILROAD EMBANKMENT I

Soil Properties

Western Technologies Inc.

Job No.: 3127JC127 | Plate: B-1

11-O-45

02-1706

SI[illegible]LOPE

Simplified Bishop Slope Stability Analysis

PROJECT: Lowe Railroad embankment I
LOCATION: Fruitland, NM
FILE: LOWEIII
COMPLETE SLOPE CROSS SECTION

SOIL*	DENSITY	COHESION	PHI
1	95.0	300.0	20.0
2	107.0	1400.0	32.0
3	110.0	10000.0	0.0

CIRCLE	X	Y	RADIUS	FS
1	95.0	380.0	80.0	3.75

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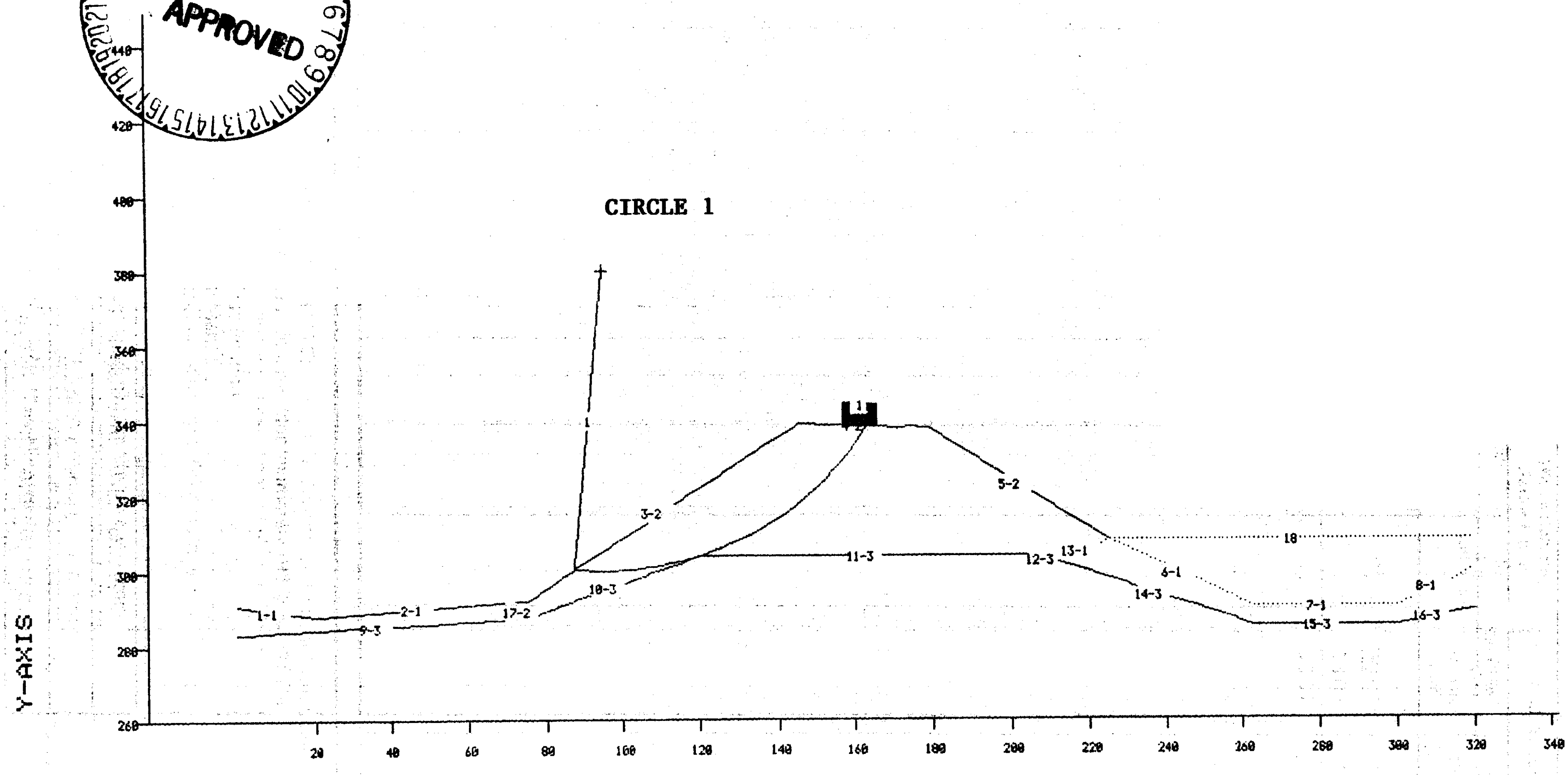

* Number after hyphen('-') is Soil Type

Western Technologies Inc. - Phoenix, AZ

SBSLOPE

Simplified Bishop Slope Stability Analysis

PROJECT:
LOCATION: Fruitland, NM
FILE: LOWEIV
COMPLETE SLOPE CROSS SECTION

SOIL*	DENSITY	COHESION	PHI
1	95.0	300.0	20.0
2	107.0	1400.0	32.0
3	110.0	10000.0	0.0

CIRCLE	X	Y	RADIUS	FS
1	240.0	390.0	92.0	3.13

MAR 1998
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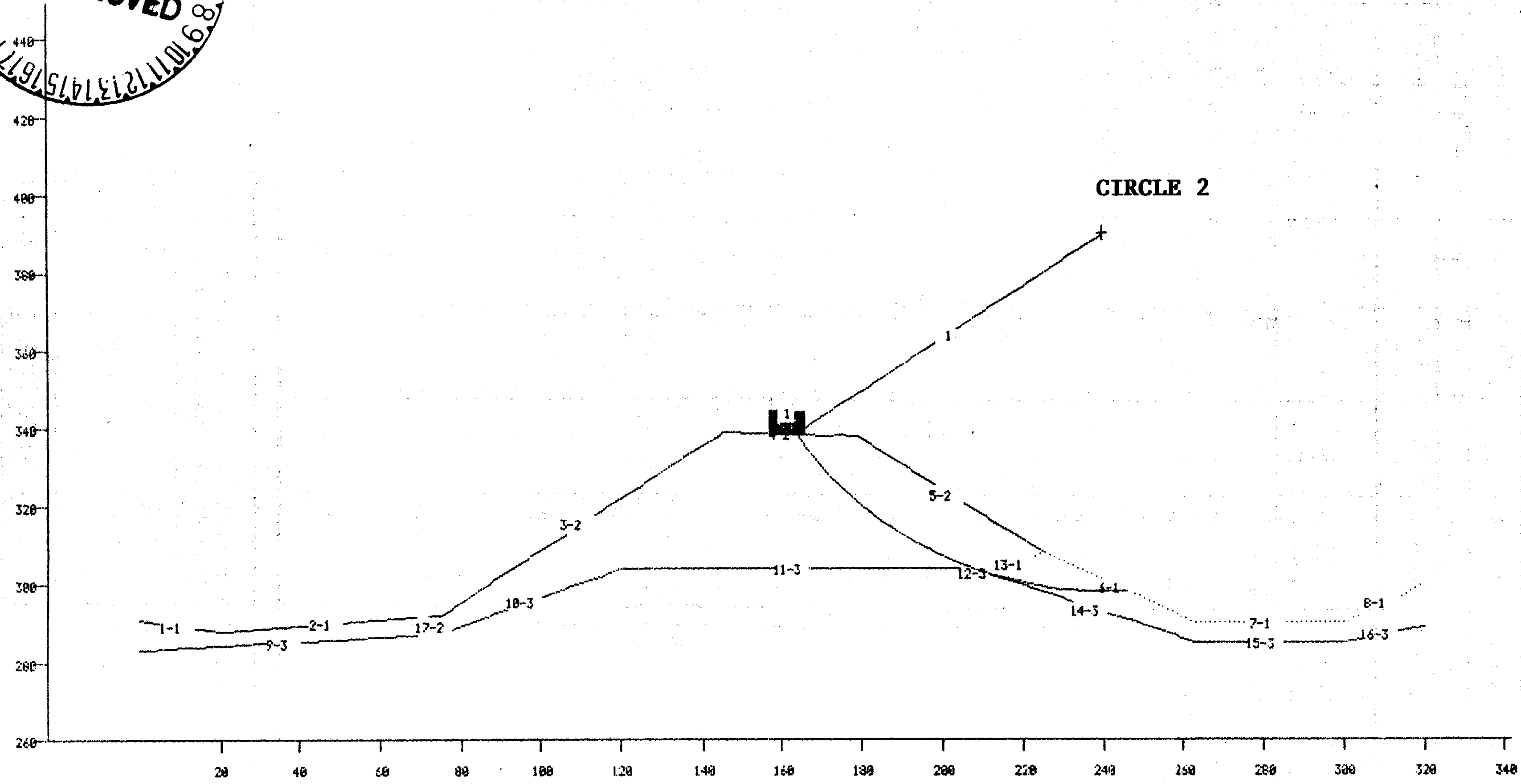

X-AXIS * Number after hyphen('-') is Soil Type

Western Technologies Inc. - Phoenix, AZ

MAR 1998
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APPENDIX 26.B

NAVAJO MINE RAILROAD
SEDIMENT AND DRAINAGE CONTROL STRUCTURES

DESIGN DATA

MAY 1998

Appendix 26.B
Navajo Mine Railroad Sediment and Drainage Control Structures

Due to reformatting of the Navajo Mine PAP, the following references in this appendix have been changed, deleted, or renumbered:

NM-0003F Paper Permit	NM-0003F Electronic Permit
Appendix 11-V	Appendix 23.A
Chapter 11 Sediment Ponds 11.5.6.2.2	Part 4 Section 26.1.5

NAVAJO MINE RAILROAD
SEDIMENT AND DRAINAGE CONTROL STRUCTURES

To comply with the EPA Storm Water Regulation, BHP has verified the performance of all drainage control structures along the railroad. In cases where the flow velocity exceeded the erosive velocity and erosion was visible, structures were designed to control and minimize the contribution of sediment to surface runoff outside the permit area.

The drainage control structures along the railroad were evaluated per the procedure and criteria outlined in Chapter 11, Section 11.5.6.2.2 of the mine permit. All watersheds and existing drainage control structures were surveyed to identify the following; the locations of structures, watershed areas and structure dimensions (see Table A attached) for all drainage structures. After completing the field survey, the watersheds and structures were modeled with SEDCAD+ computer software to determine the adequacy of the existing structures and where new structures need to be placed. There are numerous small watershed areas ranging from 0.1 to 8 acres. Instead of making a separate analysis for each individual watershed, a worst case hydrology analysis was done for 0.5, 1.0, 2.0, 4.0, 6.0 and 8.0 acres watersheds. The peak discharges from the worst case hydrology analysis were used in the hydraulic analysis of ditches/channels having watersheds of equivalent or smaller size. For the worst case hydrology runs, the time of concentration (T_c) was assumed to be zero, giving conservative peak discharges which will be used to design the drainage/erosion control structures. Utilizing the data from the worst case runs, all structures were modeled with the SEDCAD+ channel utility. If the watershed for any structure was larger than 8.0 acres, the watershed was modeled separately.

The constructed flow paths associated with the railroad, including side ditches, berms/ditch combinations and relief ditches were hydraulically evaluated. The SEDCAD+ channel design utility was used to check the flow velocities in the ditches or channels. The procedures and criteria outlined in Chapter 11, Section 11.5.6.2.2 of the mine permit were followed to determine the type of structure or BMP to be applied. Table A "Drainage Control Structures" summarizes the type of BMP's applied or needed to be installed.

At the north end of the Big Fill, on the west side, there are five straw bale barriers (check dams) placed in series in the ditch along the toe of the embankment. The watershed area for the ditch is small, approximately 1.7 acres. The straw bale barriers appear to be functioning effectively. The section of ditch containing the straw bale barriers does not receive water from the railroad side ditch immediately upstream. The surface runoff collected by the side ditch is diverted into a downdrain pipe, which runs along the toe of the embankment parallel to the ditch. The downdrain pipe terminates and releases the flow into the ditch downstream of the straw bale barriers at a point where the ditch grade shallows out. These straw bale barriers will be retained and maintained. No technical evaluation was done on the straw bale barriers.

The railroad utilizes a large number of downdrains, several of which are fed by lengthy drainage paths running along the side of the railroad access route. During the survey, three downdrain pipes and four culverts were found that were not included in Appendix 11-V for culverts and downdrains. A downdrain pipe was also added on the Barber Stockpile Spur. The designs for these are included in this submittal package and the appropriate exhibits and tables were updated.

The surface runoff at the coal preparation plant and the North Facilities which includes the section of railroad within that vicinity, is collected and retained in either the North Cells (Cells A, A2, B, and C) or Pond 5. The surface runoff from these areas is primary sheet flow on flat surfaces with low grades. The runoff is collected in low gradient swales that divert the runoff into culverts going to Cell A or Pond 5. No erosion was observed in this area during the survey. Not all ditches were checked in this area, since the runoff and sediment is retained.

Three surface disturbances along the railroad were identified during the surveys. It appears that the disturbance was made in efforts to maintain the berms and silt fences nearby. These areas will be seeded, mulched and crimped to stabilize the surface and improve hydrologic conditions.

During the survey several storage areas for the railroad track maintenance supplies were noted and are shown on Exhibits 11-14K through 11-14T. These storage areas contain rails, rail ties, and railroad ballast.

Appendix 26.C

Sediment Ponds Impoundments Hydrology Calculations

Appendix 26.C

Sediment Ponds Impoundments Hydrology Calculations

Due to reformatting of the Navajo Mine PAP, the following references in this appendix have been changed, deleted or renumbered:

NM-0003F Paper	NM-0003F Electronic
Text 11.5.4.3	Section 26.2.3
Exhibit 11-1	Exhibit 26-19
Exhibit 11-2	Exhibit 26-20
Exhibit 11-4	Exhibit 26-21
Exhibit 11-5	Exhibit 26-22
Exhibit 11-6	Exhibit 26-23
Exhibit 11-13C	Exhibit 26-10
Exhibit 11-13D	Exhibit 26-11
Exhibit 11-13E	Exhibit 26-12
Exhibit 11-13F	Exhibit 26-25
Exhibit 11-50	Exhibit 26-39
Exhibit 11-88	Exhibit 26-86
Exhibit 11-106	Exhibit 26-13
Exhibit 11-105A	Deleted
Exhibit 11-110	Exhibit 26-76
Exhibit 11-111	Exhibit 26-44
Exhibit 11-113B	Deleted
Exhibit 11-115	Exhibit 26-46
Exhibit 11-118	Exhibit 26-50
Exhibit 11-127D	Exhibit 26-55
Exhibit 11-132	Deleted
Exhibit 11-136	Exhibit 26-80
Exhibit 11-139	Exhibit 26-26
Exhibit 11-150	Deleted
Exhibit 11-151	As-built folder
Exhibit 11-152	Exhibit 26-82
Exhibit 11-156	Exhibit 26-64
Exhibit 11-157	Exhibit 26-65

Exhibit 11-158	Exhibit 26-66
Exhibit 11-159	Exhibit 26-68
Exhibit 11-161	Exhibit 26-70
Exhibit 11-162	Exhibit 26-72 (Pond 301) Exhibit 26-73 (Pond 302)
Exhibit 11-169	Exhibit 26-85
Exhibit 11-171	Exhibit 22-18
Exhibit 11-172	Exhibit 26-87
Exhibit 11-173	Exhibit 26-88
Exhibit 11-178	Exhibit 26-92
Exhibit 11-179	Exhibit 26-93

APPENDIX 26.C

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TOPIC	PAGE NO.

Sediment Ponds/Impoundments Hydrology Calculations:

APPENDIX 26.C

TABLE OF CONTENTS

TOPIC	**PAGE NO.**

Sediment Ponds/Impoundments Hydrology Calculations Cont:

NORTH CELLS MODIFICATION
NORTH CELL A, B, & C

The watershed area is presented on Exhibit 11-113B and the pond design is presented on Exhibit 11-106. The hydrology model is presented on the attach sheet.

Revised June 2010

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NORTH SEWER POND 100 YEAR, 6 HOUR, HYDROLOGY CALCULATION

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\NSEWER

Date: 02-13-1996

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\NSEWER User: Brian Sambirsky
Date: 02-13-1996 Time: 12:23:16
North Sewer Pond 100 Year, 6 Hour, Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	2.20	100	M	0.001	0.000	0.000	0.0	0.38	6.43
		Type: Null			Label: N. Sewer Pond					
111	Structure	2.20							0.38	
111	Total IN/OUT	2.20							0.38	6.43

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\NSEWER User: Brian Sambirsky
Date: 02-13-1996 Time: 12:23:16
North Sewer Pond 100 Year, 6 Hour, Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	25.00	20.00	4.47	0.00	0.001		

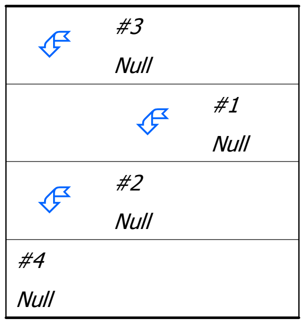
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.120	0.305	
Null	#2	==>	#4	0.008	0.406	INLET TO CELL A
Null	#3	==>	#4	0.028	0.372	INLET TO CELL A
Null	#4	==>	End	0.000	0.000	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.78	9.00	1,153.00	2.65	0.120
#1	**Muskingum K:**					**0.120**
#2	8. Large gullies, diversions, and low flowing streams	5.98	14.00	234.00	7.33	0.008
#2	**Muskingum K:**					**0.008**
#3	8. Large gullies, diversions, and low flowing streams	2.73	14.00	513.00	4.95	0.028
#3	**Muskingum K:**					**0.028**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	56.100	56.100	70.73	4.22
#1	93.200	93.200	50.07	3.34
#2	55.600	148.800	79.04	6.23
#4	10.000	214.900	138.41	11.39

Structure Detail:

Structure #3 (Null)

INLET TO CELL A

Structure #1 (Null)

Structure #2 (Null)

INLET TO CELL A

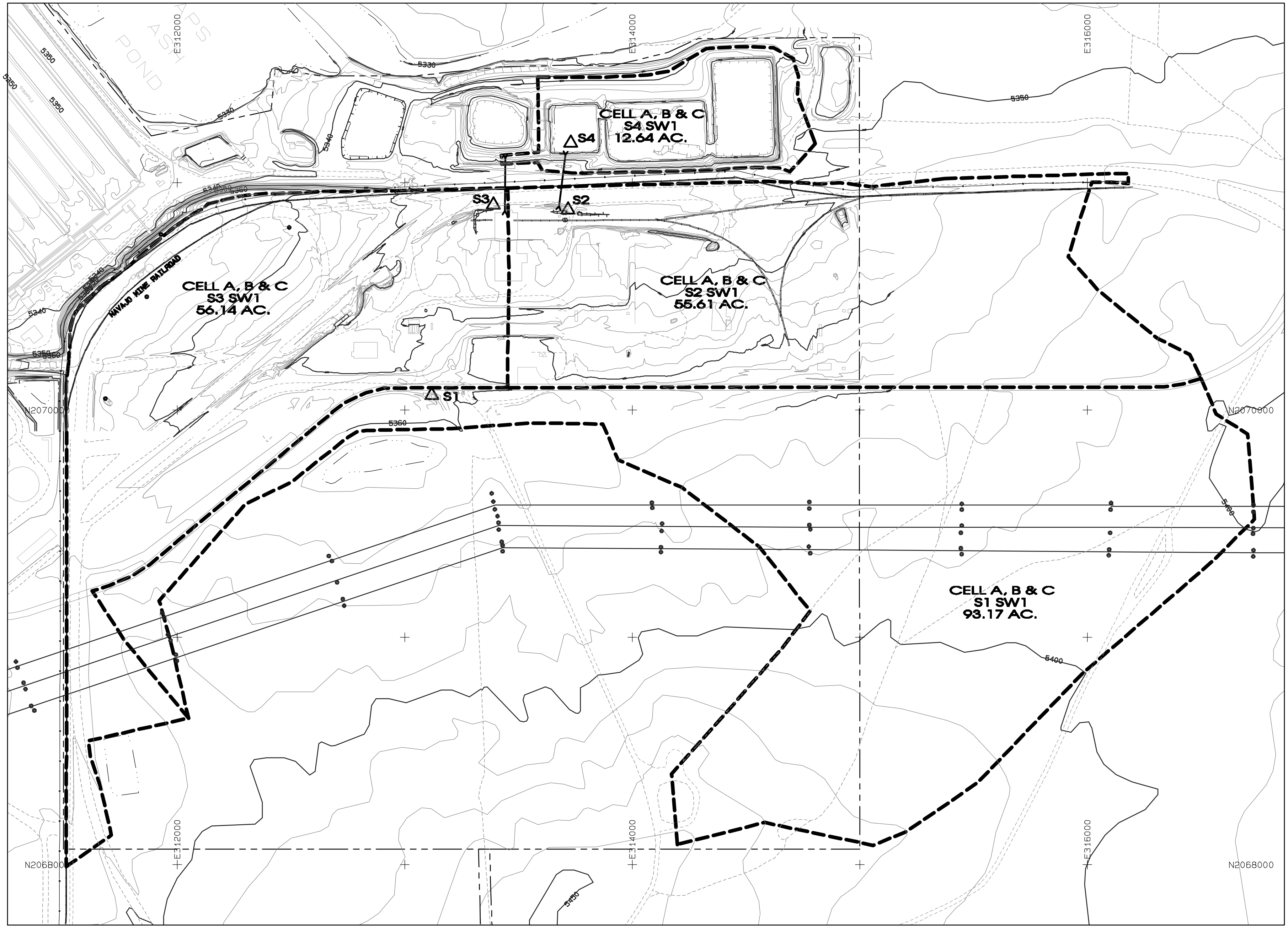
Structure #4 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	56.100	0.346	0.000	0.000	91.000	M	70.73	4.223
	Σ	**56.100**						**70.73**	**4.223**
#1	1	93.200	0.433	0.000	0.000	80.000	M	50.07	3.337
	Σ	**93.200**						**50.07**	**3.337**
#2	1	55.600	0.415	0.000	0.000	88.000	S	32.12	2.893
	Σ	**148.800**						**79.04**	**6.230**
#4	1	10.000	0.005	0.000	0.000	91.000	M	23.92	0.939
	Σ	**214.900**						**138.41**	**11.392**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.26	22.00	973.00	1.500	0.180
		8. Large gullies, diversions, and low flowing streams	1.50	50.00	3,344.00	3.660	0.253
#1	**1**	**Time of Concentration:**					**0.433**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.15	33.00	1,534.00	1.460	0.291
		8. Large gullies, diversions, and low flowing streams	1.31	20.00	1,532.00	3.420	0.124
#2	**1**	**Time of Concentration:**					**0.415**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	3.71	17.00	458.00	1.920	0.066
		8. Large gullies, diversions, and low flowing streams	1.12	36.00	3,206.00	3.170	0.280
#3	**1**	**Time of Concentration:**					**0.346**



NORTH CELL A, B & C
HYDROLOGY MODEL

CIVIL SOFTWARE DESIGN

SEDCAD- Version 3

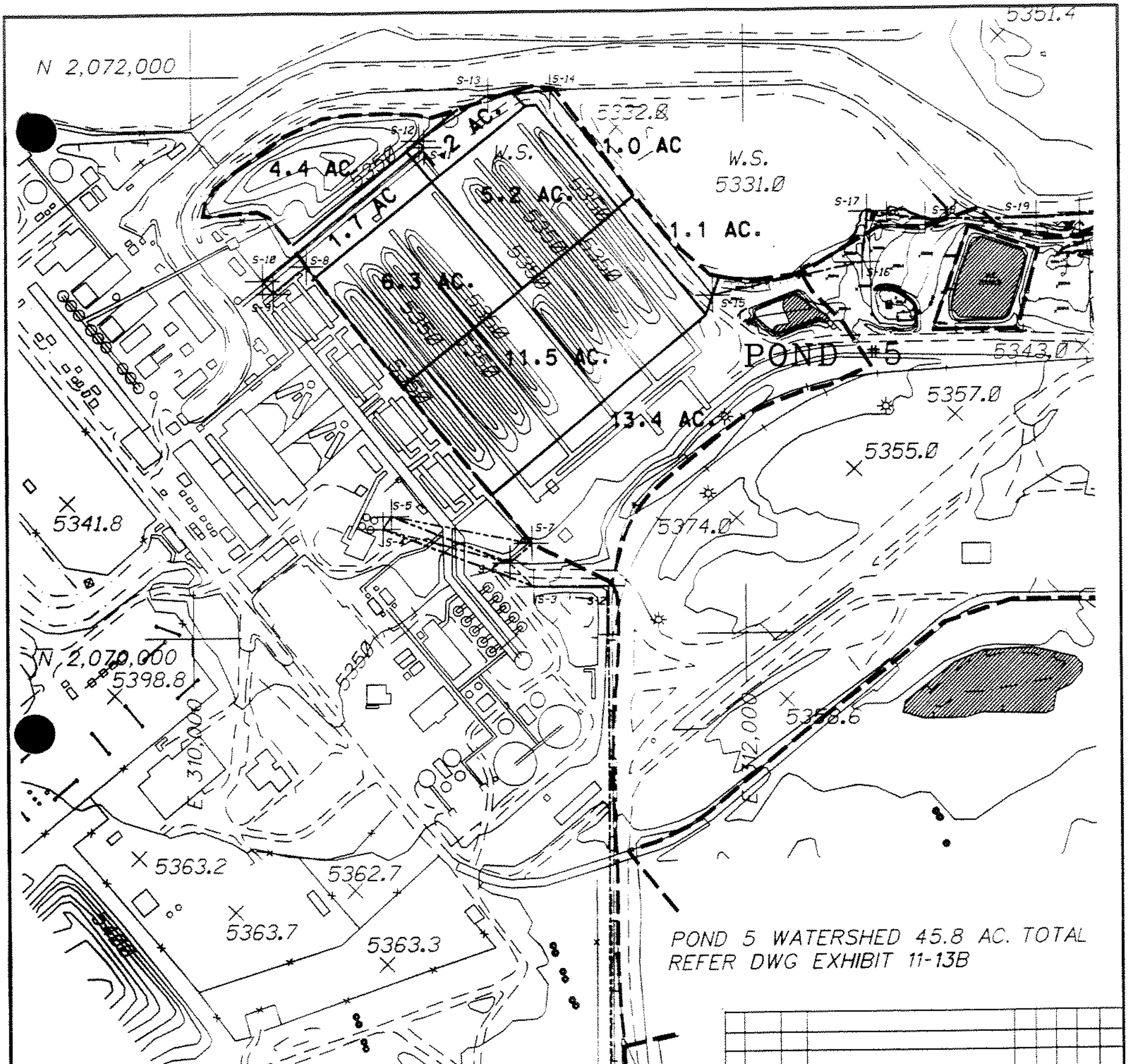
POND 5 PUMP SIMULATION WITH LIFT STATIONS #2, 3 AND 4

by

Name: LR

Company Name: BHP MINERALS
File Name: G:\USER\kfraylr\PD5\PD5HYD.doc

Date: 06-29-1998



CERTIFICATION STATEMENT

I, Leonard Raymond, nereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knownleag.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

8-4-98

REV. NO.	DATE	DRAFT-ST	REVISION DESCRIPTION	ENG.	E.D.	P.E.	P.S.	CHIEF ENG.
A	5-14-97	PJF	SUBMITTED TO OSM FOR APPROVAL					
				APPROVALS				

BHP NAVAJO COAL COMPANY

NAVAJO MINE

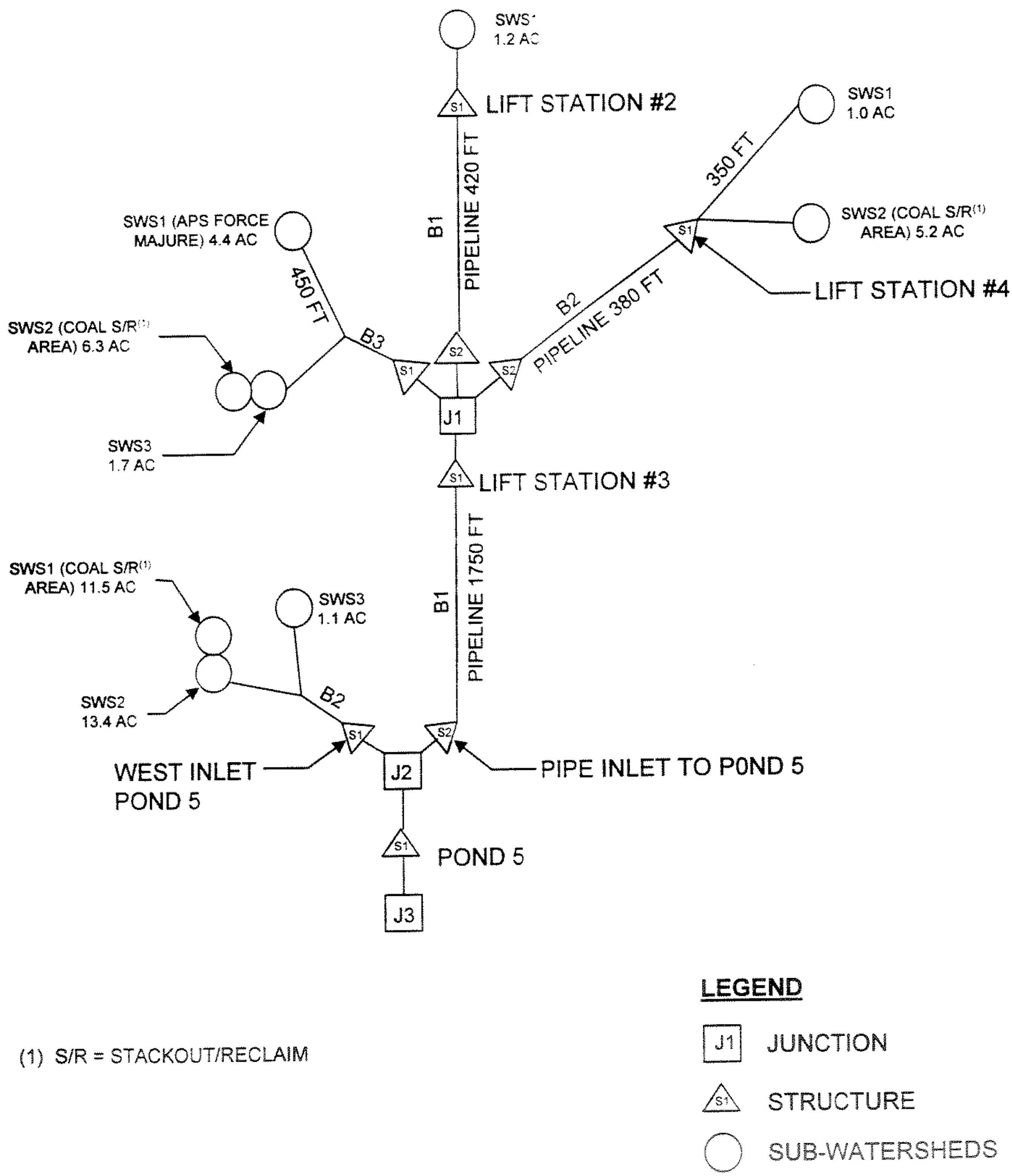
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

POND 5

WATERSHED SUB-DIVISIONS

PREPARED BY PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE MAY 13, 1997	DWG. LOC
PATH		

POND 5
SEDCAD MODELING SCHEMATIC



(1) S/R = STACKOUT/RECLAIM

g:\...\submittal\water\structures\080498a2.vsd

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: A:\PD5HYD User: LR
Date: 06-29-1998 Time: 08:26:25
POND 5 PUMP SIMULATION WITH LIFT STATIONS #2, 3 AND 4
Storm: 2.00 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.20	91	M	0.137	0.000	0.000	0.0	0.12	2.15
		Type: Null		Label: LIFT STATION #2						
111	Structure	1.20							0.12	
111	Total IN/OUT	1.20							0.12	2.15
112	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null		Label: PIPE LIFT STA 2 TO 3						
112	Structure	0.00							0.12	
112	Total IN/OUT	1.20							0.12	2.02
111 to 112 Routing						0.054	0.277			
121	1	1.00	91	M	0.196	0.045	0.277	0.0	0.10	1.68
121	2	5.20	60	M	0.074	0.000	0.000	0.0	0.03	0.58
		Type: Null		Label: LIFT STATION #4						
121	Structure	6.20							0.12	
121	Total IN/OUT	6.20							0.12	2.12
122	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null		Label: PIPE LIFT STA 4 TO 3						
122	Structure	0.00							0.12	
122	Total IN/OUT	6.20							0.12	2.12
121 to 122 Routing						0.049	0.277			
131	1	4.40	60	M	0.035	0.058	0.277	0.0	0.02	0.49
131	2	6.30	60	M	0.065	0.000	0.000	0.0	0.03	0.71
131	3	1.70	91	M	0.117	0.000	0.000	0.0	0.16	3.83
		Type: Null		Label: WATERSHEDS TO LS #3						
131	Structure	12.40							0.21	
131	Total IN/OUT	12.40							0.21	4.76

```
==========================================================================================
211  1                  0.00     0  M   0.000  0.000 0.000     0.0     0.00      0.00
                        Type: Null   Label: LIFT STATION #3
211 Structure           0.00                                           0.46
------------------------------------------------------------------------------------------
211 Total IN/OUT     19.80                                             0.46      8.58
==========================================================================================
112 to 211 Routing                             0.001 0.319
==========================================================================================
212  1                  0.00     0  M   0.000  0.000 0.000     0.0     0.00      0.00
                      Type: Null   Label: NORTH INLET TO PD 5
212 Structure           0.00                                           0.46
------------------------------------------------------------------------------------------
212 Total IN/OUT     19.80                                             0.46      6.72
==========================================================================================
211 to 212 Routing                             0.229 0.277
==========================================================================================
221  1                 11.50    60  M   0.176  0.000 0.000     0.0     0.06      0.59
221  2                 13.40    91  M   0.205  0.000 0.000     0.0     1.30     22.11
221  3                  1.10    91  M   0.196  0.000 0.000     0.0     0.11      1.85
                       Type: Null   Label: WEST INLET TO PD 5
221 Structure          26.00                                           1.46
------------------------------------------------------------------------------------------
221 Total IN/OUT     26.00                                             1.46     23.99
==========================================================================================
311  1                  0.00     0  M   0.000  0.000 0.000     0.0     0.00      0.00
                              Type: Pond   Label: POND 5
311 Structure           0.00                                           1.92
------------------------------------------------------------------------------------------
311 Total IN         45.80                                             1.92     28.26
311 Total OUT                                                          1.92      3.12
==========================================================================================
212 to 311 Routing                             0.001 0.319
==========================================================================================
```

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: A:\PD5HYD User: LR
Date: 06-29-1998 Time: 08:26:25
POND 5 PUMP SIMULATION WITH LIFT STATIONS #2, 3 AND 4
Storm: 2.00 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	350.00	0.50	0.71	0.14	0.137		
1	2	1	1	-a	5	500.00	0.50	0.71	0.20	0.196		
1	2	1	1	-1	8	350.00	0.50	2.12	0.05		0.045	0.277
1	2	1	2	-a	5	600.00	5.00	2.24	0.07	0.074		
1	3	1	1	-a	5	400.00	10.00	3.16	0.04	0.035		
1	3	1	1	-1	8	450.01	0.50	2.12	0.06		0.058	0.277
1	3	1	2	-a	5	550.00	5.45	2.34	0.07	0.065		
1	3	1	3	-a	5	300.00	0.50	0.71	0.12	0.117		
2	2	1	1	-a	5	1100.00	3.00	1.73	0.18	0.176		
2	2	1	2	-a	5	1300.00	3.08	1.75	0.21	0.205		
2	2	1	3	-a	5	500.00	0.50	0.71	0.20	0.196		

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: A:\PD5HYD User: LR
Date: 06-29-1998 Time: 08:26:25
POND 5 PUMP SIMULATION WITH LIFT STATIONS #2, 3 AND 4
Storm: 2.00 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

=====================
LAST POND ONLY TABLE
=====================

J3, B1, S1
POND 5

Drainage Area from J3, B1, S1, SWS's 1: 0.0 acres
Total Contributing Drainage Area: 45.8 acres

DISCHARGE OPTIONS:

Input a Known Discharge

POND RESULTS:

Permanent Pool (ac-ft)
0.0

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	1.92	28.26
OUT	1.92	3.12

Peak Elevation	Hydrograph Detention Time (hrs)
5331.3	3.09

****

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: A:\PD5HYD User: LR
Date: 06-29-1998 Time: 08:26:25
POND 5 PUMP SIMULATION WITH LIFT STATIONS #2, 3 AND 4
Storm: 2.00 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J3, B1, S1
POND 5

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 45.8 acres

SW#1: Input Discharge

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
5328.40	0.00	0.39	0.00	0.00	
5328.41	0.01	0.39	0.00	0.00	
5328.90	0.50	0.42	0.20	3.12	
5329.00	0.60	0.43	0.25	3.12	
5329.40	1.00	0.45	0.42	3.12	
5329.90	1.50	0.47	0.65	3.12	
5330.00	1.60	0.47	0.70	3.12	
5330.40	2.00	0.49	0.89	3.12	
5330.90	2.50	0.51	1.13	3.12	
5331.00	2.60	0.51	1.19	3.12	
5331.26	2.86	0.52	1.32	3.12	Peak Stage
5331.40	3.00	0.53	1.39	3.12	
5331.90	3.50	0.55	1.66	3.12	
5332.40	4.00	0.57	1.94	3.12	
5332.90	4.50	0.59	2.23	3.12	
5333.00	4.60	0.60	2.29	3.12	

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

BARBER LOADOUT 100 YEAR, 6HOUR HYDROLOGY CALCULATION

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: A:\SEDCAD\BARBER-6

Date: 09-29-1995

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: A:\SEDCAD\BARBER-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:34:57
Barber Loadout 100 year, 6hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

BS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
11	1	3.60	89	M	0.010	0.000	0.000	0.0	0.33	8.01
		Type: Null			Label: Barber Loadout					
11	Structure	3.60							0.33	
11	Total IN/OUT	3.60							0.33	8.01

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: A:\SEDCAD\BARBER-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:34:57
Barber Loadout 100 year, 6hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	-a	5	140.00	14.29	3.78	0.01	0.010		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AREA III SHOP POND 100 YEAR, 6 HOUR HYDROLOGY CALCULATION

by

Name: Brian Sambirsky

Company Name: BHP MINERALS

File Name: C:\BRIAN\A3SHOP

Date: 03-08-1996

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\A3SHOP User: Brian Sambirsky
Date: 03-08-1996 Time: 12:29:30
Area III Shop Pond 100 Year, 6 Hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	33.15	88	M	0.299	0.000	0.000	0.0	2.82	42.26
		Type: Null		Label: Area III Shop Pond						
111	Structure	33.15							2.82	
111	Total IN/OUT	33.15							2.82	42.26

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\A3SHOP User: Brian Sambirsky
Date: 03-08-1996 Time: 12:29:30
Area III Shop Pond 100 Year, 6 Hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	1800.00	2.78	1.67	0.30	0.299		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AREA III SEWER POND 100 YEAR, 6 HOUR HYDROLOGY CALCULATION

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: A:\SEDCAD\A3SEWE-6

Date: 09-29-1995

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: A:\SEDCAD\A3SEWE-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:35:47
Area III Sewer Pond 100 year, 6 hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

3S	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
11	1	1.20	89	M	0.000	0.000	0.000	0.0	0.11	2.67
		Type: Null			Label: Area III Sewer					
.1	Structure	1.20							0.11	
.1	Total IN/OUT	1.20							0.11	2.67

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: A:\SEDCAD\A3SEWE-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:35:47
Area III Sewer Pond 100 year, 6 hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
.	1	1	1	-a	5	15.00	33.33	5.77	0.00	0.000		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

LOWE LOADOUT 100 YEAR, 6 HOUR HYDROLOGY CALCULATION

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: A:\SEDCAD\LOWE-6

Date: 09-29-1995

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: A:\SEDCAD\LOWE-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:36:37
Lowe Loadout 100 year, 6 hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

BS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
11	1	3.40	89	M	0.001	0.000	0.000	0.0	0.31	7.57
		Type: Null			Label: Lowe Loadout					
11	Structure	3.40							0.31	
11	Total IN/OUT	3.40							0.31	7.57

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: A:\SEDCAD\LOWE-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:36:37
Lowe Loadout 100 year, 6 hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	-a	5	30.00	40.00	6.32	0.00	0.001		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NORTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT

by

Name: BEN HOSKIE

Company Name: BHP MINERALS
File Name: C:\BEN\PONDS\NWDXPND

Date: 07-05-1998

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\PONDS\NWDXPND User: BEN HOSKIE
Date: 07-15-1998 Time: 16:05:04
NORTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	62.20	83	M	0.452	0.000	0.000	0.0	3.96	47.84
		Type: Null			Label: NW DIXON POND					
111	Structure	62.20							3.96	
111	Total IN/OUT	62.20							3.96	47.84

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\PONDS\NWDXPND User: BEN HOSKIE
Date: 07-05-1998 Time: 16:05:04
NORTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2162.00	1.76	1.33	0.45	0.452		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION - BARBER STOCKPILE POND #1

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\BARBER1

Date: 06-13-1996

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-13-1996 Time: 07:55:44
As built design hydrology calculation - barber stockpile pond #1
Storm: 1.58 inches, 10 year-24 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	146.60	82	M	0.905	0.000	0.000	0.0	4.81	25.37
		Type: Null		Label: Barber Stockpile #1						
111	Structure	146.60							4.81	
111	Total IN/OUT	146.60							4.81	25.37

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-13-1996 Time: 07:55:44
As built design hydrology calculation - barber stockpile pond #1
Storm: 1.58 inches, 10 year-24 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	4575.00	1.97	1.40	0.91	0.905		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION - BARBER STOCKPILE #1 SPILLWAY

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\BARBER1

Date: 06-19-1996

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-19-1996 Time: 12:27:04
As built design hydrology calculation - barber stockpile #1 spillway
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	146.60	82	M	0.905	0.000	0.000	0.0	4.95	36.56
		Type: Pond		Label: Barber Stockpile #1						
111	Structure	146.60							4.95	
111	Total IN	146.60							4.95	36.56
111	Total OUT								4.95	26.52

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-19-1996 Time: 12:27:04
As built design hydrology calculation - barber stockpile #1 spillway
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	4575.00	1.97	1.40	0.91	0.905		

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-19-1996 Time: 12:27:04
As built design hydrology calculation - barber stockpile #1 spillway
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
Barber Stockpile #1

Drainage Area from J1, B1, S1, SWS(s)1: 146.6 acres
Total Contributing Drainage Area: 146.6 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	5289.6
Crest Length (ft)	20.0
Z:1 (Left and Right)	5.0 4.0
Bottom Width (ft)	20.0

D RESULTS:

Permanent Pool (ac-ft)
9.9

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-19-1996 Time: 12:27:04
As built design hydrology calculation - barber stockpile #1 spillway
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Barber Stockpile #1

Drainage Area from J1, B1, S1, SWS(s)1: 146.6 acres
Total Contributing Drainage Area: 146.6 acres

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
5280.00	0.0	0.0
5281.00	0.0	0.0
5282.00	0.0	0.0
5283.00	0.0	0.0
5284.00	0.0	0.0
5285.00	0.0	0.0
5286.00	0.0	0.0
5287.00	0.0	0.0
5288.00	0.0	0.0
5289.00	0.0	0.0
5289.60	0.0	0.0
5290.00	13.3	13.3
5290.20	19.9	19.9
5290.30	25.8	25.8
5290.40	33.9	33.9
5290.50	41.9	41.9
5290.60	51.6	51.6
5291.00	96.7	96.7
5291.10	109.9	109.9
5291.60	190.8	190.8
5292.00	270.6	270.6

****

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-19-1996 Time: 12:27:04
As built design hydrology calculation - barber stockpile #1 spillway
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Barber Stockpile #1

Drainage Area from J1, B1, S1, SWS(s)1: 146.6 acres
Total Contributing Drainage Area: 146.6 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
5280.00	0.00	0.58	0.00	0.00	
5281.00	1.00	0.66	0.62	0.00	
5282.00	2.00	0.75	1.32	0.00	
5283.00	3.00	0.83	2.11	0.00	
5284.00	4.00	0.94	3.00	0.00	
5285.00	5.00	1.03	3.98	0.00	
5286.00	6.00	1.14	5.07	0.00	
5287.00	7.00	1.25	6.26	0.00	
5288.00	8.00	1.38	7.58	0.00	
5289.00	9.00	1.50	9.02	0.00	
5289.60	9.60	1.58	9.94	0.00	Stage of SW#1
5290.00	10.00	1.64	10.59	13.28	
5290.20	10.20	1.66	10.92	19.92	
5290.30	10.30	1.67	11.08	25.75	
5290.31	10.31	1.67	11.10	26.52	Peak Stage
5290.40	10.40	1.68	11.25	33.85	
5290.50	10.50	1.68	11.42	41.88	
5290.60	10.60	1.69	11.59	51.61	
5291.00	11.00	1.73	12.27	96.71	
5291.10	11.10	1.74	12.44	109.88	
5291.60	11.60	1.77	13.32	190.79	
5292.00	12.00	1.80	14.04	270.63	

****

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	4.95	36.56
OUT	4.95	26.52

Peak Elevation	Hydrograph Detention Time (hrs)
5290.3	0.00

****

Barber Stockpile Pond 2

This pond has a single closed spillway. It is re-evaluated as a total containment structure for the 100 year-6 hour storm. The curve number was adjusted to account for the reclaimed lands. Refer to Section 11.5.4.3 of the mine permit for discussion on ponds with a single closed spillway. The pond location and watershed areas are presented on Exhibit 11-13 C & D.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Barber #2

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	106.600	106.600	82.12	5.72
	Out			0.00	0.00

Structure Detail:

Structure #1 (Pond)

Barber #2

Pond Inputs:

Initial Pool Elev:	5,273.10
Initial Pool:	0.00 ac-ft

Drop Inlet

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev
48.00	8.30	48.00	145.00	2.21	0.0160	5,287.10

Drop Inlet

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev
48.00	8.30	42.00	145.00	2.21	0.0160	5,287.10

Pond Results:

Peak Elevation:	~~5,283.28~~
Dewater Time:	0.00 days

5284.65

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
5,273.00	0.000	0.000	0.000	
5,273.10	0.004	0.000	0.000	
5,273.50	0.023	0.005	0.000	
5,274.00	0.070	0.027	0.000	
5,274.50	0.110	0.072	0.000	
5,275.00	0.160	0.139	0.000	
5,275.50	0.211	0.232	0.000	
5,276.00	0.270	0.352	0.000	
5,276.50	0.336	0.503	0.000	
5,277.00	0.410	0.689	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,277.50	0.454	0.905	0.000		
5,278.00	0.500	1.143	0.000		
5,278.50	0.530	1.401	0.000		
5,279.00	0.560	1.673	0.000		
5,279.50	0.585	1.959	0.000		
5,280.00	0.610	2.258	0.000		
5,280.50	0.640	2.570	0.000		
5,281.00	0.670	2.898	0.000		
5,281.50	0.695	3.239	0.000		
5,282.00	0.720	3.593	0.000		
5,282.50	0.750	3.960	0.000		
5,283.00	0.780	4.342	0.000		
5,283.28	0.793	4.567	0.000	0.00	Peak Stage
5,283.50	0.805	4.739	0.000		
5,284.00	0.830	5.147	0.000		
5,284.50	0.860	5.570	0.000	Elev. 5284.65	Peak Stage
5,285.00	0.890	6.007	0.000		
5,285.50	0.915	6.458	0.000		
5,286.00	0.940	6.922	0.000		
5,286.50	0.972	7.400	0.000		
5,287.00	1.004	7.894	0.000		
5,287.10	1.010	7.994	0.000		Spillway #1 Spillway #2
5,287.50	1.032	8.403	19.703		
5,288.00	1.060	8.926	66.511		
5,288.50	1.110	9.468	129.047		
5,288.80	1.140	9.805	157.769		

Detailed Discharge Table

Elevation	Drop Inlet (cfs)	Drop Inlet (cfs)	Combined Total Discharge (cfs)
5,273.00	0.000	0.000	0.000
5,273.10	0.000	0.000	0.000
5,273.50	0.000	0.000	0.000
5,274.00	0.000	0.000	0.000
5,274.50	0.000	0.000	0.000
5,275.00	0.000	0.000	0.000
5,275.50	0.000	0.000	0.000

Elevation	Drop Inlet (cfs)	Drop Inlet (cfs)	Combined Total Discharge (cfs)
5,276.00	0.000	0.000	0.000
5,276.50	0.000	0.000	0.000
5,277.00	0.000	0.000	0.000
5,277.50	0.000	0.000	0.000
5,278.00	0.000	0.000	0.000
5,278.50	0.000	0.000	0.000
5,279.00	0.000	0.000	0.000
5,279.50	0.000	0.000	0.000
5,280.00	0.000	0.000	0.000
5,280.50	0.000	0.000	0.000
5,281.00	0.000	0.000	0.000
5,281.50	0.000	0.000	0.000
5,282.00	0.000	0.000	0.000
5,282.50	0.000	0.000	0.000
5,283.00	0.000	0.000	0.000
5,283.50	0.000	0.000	0.000
5,284.00	0.000	0.000	0.000
5,284.50	0.000	0.000	0.000
5,285.00	0.000	0.000	0.000
5,285.50	0.000	0.000	0.000
5,286.00	0.000	0.000	0.000
5,286.50	0.000	0.000	0.000
5,287.00	0.000	0.000	0.000
5,287.10	0.000	0.000	0.000
5,287.50	9.852	9.852	19.703
5,288.00	33.256	33.256	66.511
5,288.50	64.524	64.524	129.047
5,288.80	78.884	78.884	157.769

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	106.600	0.202	0.000	0.000	81.900	M	82.12	5.723
	Σ	**106.600**						**82.12**	**5.723**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	11.07	30.00	271.00	3.320	0.022
		8. Large gullies, diversions, and low flowing streams	2.35	70.00	2,978.08	4.590	0.180
#1	**1**	**Time of Concentration:**					**0.202**

Barber Stockpile Pond 3

The curve number was adjusted to account for the reclaimed lands. The pond location and watershed area are presented on Exhibit 11-13 C & D.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Barber Stkp Pd 3

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	59.770	59.770	4.28	1.13
	Out			0.35	0.98

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	59.770	0.734	0.000	0.000	76.000	M	4.28	1.132
	Σ	**59.770**						**4.28**	**1.132**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.73	60.00	3,464.00	1.310	0.734
#1	**1**	**Time of Concentration:**					**0.734**

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	59.770	59.770	7.51	1.13
	Out			0.63	1.03

Structure Detail:

Structure #1 (Pond)

Barber Stkp Pd 3

Pond Inputs:

Initial Pool Elev:	5,348.30
Initial Pool:	3.65 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	250.00	2.00	0.0180	5,348.30	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,350.10	30.00	2.00:1	2.00:1	16.00

Pond Results:

Peak Elevation:	5,348.71
Dewater Time:	1.38 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
5,342.00	0.000	0.000	0.000	
5,342.50	0.013	0.002	0.000	
5,343.00	0.050	0.017	0.000	
5,343.50	0.085	0.050	0.000	
5,344.00	0.130	0.104	0.000	
5,344.50	0.135	0.170	0.000	
5,345.00	0.140	0.239	0.000	
5,345.50	0.409	0.370	0.000	
5,346.00	0.820	0.671	0.000	
5,346.50	1.042	1.136	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,347.00	1.290	1.718	0.000		
5,347.50	1.436	2.399	0.000		
5,348.00	1.590	3.155	0.000		
5,348.30	1.724	3.652	0.000		Spillway #1
5,348.50	1.815	4.006	0.213	20.11*	
5,348.71	1.913	4.403	0.632	13.00	Peak Stage
5,349.00	2.050	4.971	1.233		
5,349.50	2.284	6.054	2.716		
5,350.00	2.530	7.257	3.646		
5,350.10	2.557	7.512	3.681		Spillway #2
5,350.50	2.664	8.555	16.839		
5,351.00	2.800	9.921	33.291		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,342.00	0.000	0.000	0.000
5,342.50	0.000	0.000	0.000
5,343.00	0.000	0.000	0.000
5,343.50	0.000	0.000	0.000
5,344.00	0.000	0.000	0.000
5,344.50	0.000	0.000	0.000
5,345.00	0.000	0.000	0.000
5,345.50	0.000	0.000	0.000
5,346.00	0.000	0.000	0.000
5,346.50	0.000	0.000	0.000
5,347.00	0.000	0.000	0.000
5,347.50	0.000	0.000	0.000
5,348.00	0.000	0.000	0.000
5,348.30	0.000	0.000	0.000
5,348.50	(3)>0.213	0.000	0.213
5,349.00	(3)>1.233	0.000	1.233
5,349.50	(3)>2.716	0.000	2.716
5,350.00	(5)>3.646	0.000	3.646
5,350.10	(5)>3.681	0.000	3.681
5,350.50	(5)>3.820	13.019	16.839
5,351.00	(6)>3.995	29.296	33.291

Hosteen Stockpile Pond 1

The curve number was adjusted to account for the reclaimed lands. The pond location and watershed area are presented on Exhibit 11-13 C & D.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Hosteen Stkp Pd 1

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	155.540	155.540	22.17	4.01
	Out			10.73	4.01

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	155.540	0.507	0.000	0.000	79.100	M	22.17	4.008
	Σ	**155.540**						**22.17**	**4.008**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.97	68.00	1,712.00	1.990	0.238
		8. Large gullies, diversions, and low flowing streams	1.88	75.00	3,990.00	4.110	0.269
#1	**1**	**Time of Concentration:**					**0.507**

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	155.540	155.540	35.34	4.01
	Out			16.02	4.01

Structure Detail:

Structure #1 (Pond)

Hosteen Stkp Pd 1

Pond Inputs:

Initial Pool Elev:	5,272.20
Initial Pool:	10.63 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,272.20	30.00	11.60:1	9.30:1	8.00

Pond Results:

Peak Elevation:	5,272.94
Dewater Time:	0.35 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
5,258.00	0.080	0.000	0.000	
5,258.50	0.112	0.048	0.000	
5,259.00	0.150	0.113	0.000	
5,259.50	0.183	0.196	0.000	
5,260.00	0.220	0.297	0.000	
5,260.50	0.254	0.415	0.000	
5,261.00	0.290	0.551	0.000	
5,261.50	0.333	0.707	0.000	
5,262.00	0.380	0.885	0.000	
5,262.50	0.424	1.086	0.000	
5,263.00	0.470	1.309	0.000	
5,263.50	0.514	1.555	0.000	
5,264.00	0.560	1.824	0.000	
5,264.50	0.609	2.116	0.000	
5,265.00	0.660	2.433	0.000	
5,265.50	0.780	2.793	0.000	
5,266.00	0.910	3.215	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,266.50	0.984	3.688	0.000		
5,267.00	1.060	4.199	0.000		
5,267.50	1.090	4.736	0.000		
5,268.00	1.120	5.289	0.000		
5,268.50	1.155	5.857	0.000		
5,269.00	1.190	6.444	0.000		
5,269.50	1.225	7.047	0.000		
5,270.00	1.260	7.668	0.000		
5,270.50	1.300	8.308	0.000		
5,271.00	1.340	8.968	0.000		
5,271.50	1.380	9.648	0.000		
5,272.00	1.420	10.348	0.000		
5,272.20	1.438	10.634	0.000		Spillway #1
5,272.50	1.465	11.069	6.463	6.40	
5,272.94	1.505	11.729	16.022	1.90	Peak Stage
5,273.00	1.510	11.813	17.241		
5,273.50	1.565	12.581	54.572		
5,274.00	1.620	13.377	115.502		
5,274.50	1.689	14.205	203.538		
5,275.00	1.760	15.067	328.686		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,258.00	0.000	0.000
5,258.50	0.000	0.000
5,259.00	0.000	0.000
5,259.50	0.000	0.000
5,260.00	0.000	0.000
5,260.50	0.000	0.000
5,261.00	0.000	0.000
5,261.50	0.000	0.000
5,262.00	0.000	0.000
5,262.50	0.000	0.000
5,263.00	0.000	0.000
5,263.50	0.000	0.000
5,264.00	0.000	0.000
5,264.50	0.000	0.000

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,265.00	0.000	0.000
5,265.50	0.000	0.000
5,266.00	0.000	0.000
5,266.50	0.000	0.000
5,267.00	0.000	0.000
5,267.50	0.000	0.000
5,268.00	0.000	0.000
5,268.50	0.000	0.000
5,269.00	0.000	0.000
5,269.50	0.000	0.000
5,270.00	0.000	0.000
5,270.50	0.000	0.000
5,271.00	0.000	0.000
5,271.50	0.000	0.000
5,272.00	0.000	0.000
5,272.20	0.000	0.000
5,272.50	6.463	6.463
5,273.00	17.241	17.241
5,273.50	54.572	54.572
5,274.00	115.502	115.502
5,274.50	203.538	203.538
5,275.00	328.686	328.686

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION FOR BARBER STOCKPILE #2 POND

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\HOSTEEN2

Date: 12-21-1995

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:03:16
As built design hydrology calculation - Hosteen Stockpile #2 Pond
Storm: 1.58 inches, 10 year-24 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	122.80	83	M	0.754	0.000	0.000	0.0	4.36	26.55
	Type: Null				Label: Hosteen #2 Pond					
111	Structure	122.80							4.36	
111	Total IN/OUT	122.80							4.36	26.55

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:03:16
As built design hydrology calculation - Hosteen Stockpile #2 Pond
Storm: 1.58 inches, 10 year-24 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	4330.00	2.54	1.59	0.75	0.754		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION - HOSTEEN STOCKPILE #2 SPILLWAY

by

Name: Brian Sambirsky

Company Name: BHP MINERALS

File Name: C:\BRIAN\HOSTEEN2

Date: 12-21-1995

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:01:46
As built design hydrology calculation - Hosteen Stockpile #2 Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	122.80	83	M	0.754	0.000	0.000	0.0	4.48	37.71
		Type: Pond			Label: Hosteen #2 Pond					
111	Structure	122.80							4.48	
111	Total IN	122.80							4.48	37.71
111	Total OUT								3.96	2.23

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:01:46
As built design hydrology calculation - Hosteen Stockpile #2 Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	4330.00	2.54	1.59	0.75	0.754		

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:01:46
As built design hydrology calculation - Hosteen Stockpile #2 Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
Hosteen #2 Pond

Drainage Area from J1, B1, S1, SWS(s)1: 122.8 acres
Total Contributing Drainage Area: 122.8 acres

DISCHARGE OPTIONS:

	Trickle Tube	Emergency Spillway
Riser Diameter (in)	----	----
Riser Height (ft)	----	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	80.00	----
Barrel Slope (%)	2.25	----
nning's n of Pipe	0.012	----
ʼillway Elevation	5302.1	----
Lowest Elevation of Holes	----	----
# of Holes/Elevation	----	----
Entrance Loss Coefficient	0.9	----
Tailwater Depth (ft)	0.0	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5305.4
Crest Length (ft)	----	20.0
Z:1 (Left and Right)	-- --	3.0 3.0
Bottom Width (ft)	----	8.0

POND RESULTS:

Permanent Pool (ac-ft)
14.6

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	4.48	37.71
OUT	3.96	2.23

Peak Elevation	Hydrograph Detention Time (hrs)
5303.2	0.00

****

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS

Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky

Date: 12-21-1995 Time: 10:01:46

As built design hydrology calculation - Hosteen Stockpile #2 Spillway

Storm: 1.60 inches, 25 year- 6 hour, type II-65

Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1

Hosteen #2 Pond

Drainage Area from J1, B1, S1, SWS(s)1: 122.8 acres

Total Contributing Drainage Area: 122.8 acres

Elevation	Trickle Tube (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
5291.00	0.0	0.0	0.0
5292.00	0.0	0.0	0.0
5293.00	0.0	0.0	0.0
5294.00	0.0	0.0	0.0
5295.00	0.0	0.0	0.0
5296.00	0.0	0.0	0.0
5297.00	0.0	0.0	0.0
5298.00	0.0	0.0	0.0
5299.00	0.0	0.0	0.0
5300.00	0.0	0.0	0.0
5301.00	0.0	0.0	0.0
5302.00	0.0	0.0	0.0
5302.10	0.0	0.0	0.0
5303.00	1.8	0.0	1.8
5304.00	4.2	0.0	4.2
5305.00	5.8	0.0	5.8
5305.40	6.2	0.0	6.2
5306.00	6.9	8.3	15.2
5306.10	6.9	10.8	17.8
5306.20	7.0	14.3	21.4
5306.30	7.1	17.9	25.0
5306.40	7.1	22.2	29.4
5306.90	7.5	49.0	56.5
5307.00	7.6	55.8	63.4

****

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:01:46
As built design hydrology calculation - Hosteen Stockpile #2 Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Hosteen #2 Pond

Drainage Area from J1, B1, S1, SWS(s)1: 122.8 acres
Total Contributing Drainage Area: 122.8 acres

SW#1: Trickle Tube
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
5291.00	0.00	0.00	0.00	0.00	
5292.00	1.00	0.26	0.09	0.00	
5293.00	2.00	0.45	0.44	0.00	
5294.00	3.00	0.69	1.00	0.00	
5295.00	4.00	0.86	1.78	0.00	
5296.00	5.00	1.05	2.73	0.00	
5297.00	6.00	1.27	3.89	0.00	
5298.00	7.00	1.51	5.28	0.00	
5299.00	8.00	1.82	6.94	0.00	
5300.00	9.00	2.16	8.93	0.00	
5301.00	10.00	2.66	11.33	0.00	
5302.00	11.00	3.21	14.26	0.00	
5302.10	11.10	3.27	14.59	0.00	Stage of SW#1
5303.00	12.00	3.77	17.75	1.81	
5303.18	12.18	3.89	18.47	2.23	Peak Stage
5304.00	13.00	4.37	21.82	4.22	
5305.00	14.00	4.90	26.45	5.75	
5305.40	14.40	5.13	28.46	6.23	Stage of SW#2
5306.00	15.00	5.47	31.64	15.18	
5306.10	15.10	5.54	32.19	17.76	
5306.20	15.20	5.61	32.75	21.35	
5306.30	15.30	5.68	33.31	24.96	
5306.40	15.40	5.75	33.88	29.36	
5306.90	15.90	6.09	36.84	56.48	
5307.00	16.00	6.16	37.46	63.40	

****

Hosteen Stockpile Pond 3

This pond has a single closed spillway. It is re-evaluated as a total containment structure for the 100 year-6 hour storm. The curve number was adjusted to account for the reclaimed lands. Refer to Section 11.5.4.3 of the mine permit for discussion on ponds with a single closed spillway. The pond location and watershed areas are presented on Exhibit 11-13 C & D.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Hosteen #3

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	135.210	135.210	68.03	6.76
	Out			0.00	0.00

Structure Detail:

Structure #1 (Pond)

Hosteen #3

Pond Inputs:

Initial Pool Elev:	5,263.10
Initial Pool:	0.00 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Entrance Loss Coefficient	Tailwater Depth (ft)
24.00	140.00	0.93	0.0160	5,274.80	0.90	0.00

Pond Results:

Peak Elevation:	5,273.01
Dewater Time:	0.00 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
5,263.00	0.000	0.000	0.000	
5,263.10	0.002	0.000	0.000	
5,263.50	0.010	0.002	0.000	
5,264.00	0.030	0.012	0.000	
5,264.50	0.095	0.041	0.000	
5,265.00	0.197	0.113	0.000	
5,265.50	0.335	0.244	0.000	
5,266.00	0.510	0.454	0.000	
5,266.50	0.535	0.715	0.000	
5,267.00	0.561	0.989	0.000	
5,267.50	0.588	1.277	0.000	
5,268.00	0.615	1.577	0.000	
5,268.50	0.643	1.892	0.000	
5,269.00	0.671	2.220	0.000	
5,269.50	0.700	2.563	0.000	
5,270.00	0.730	2.921	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,270.50	0.757	3.293	0.000		
5,271.00	0.784	3.678	0.000		
5,271.50	0.812	4.077	0.000		
5,272.00	0.840	4.490	0.000		
5,272.50	0.889	4.922	0.000		
5,273.00	0.940	5.379	0.000		
5,273.01	0.940	5.387	0.000	0.00	Peak Stage
5,273.50	0.989	5.861	0.000		
5,274.00	1.040	6.369	0.000		
5,274.50	1.104	6.905	0.000		
5,274.80	1.144	7.242	0.000		Spillway #1
5,275.00	1.170	7.473	0.575		
5,275.50	1.239	8.075	2.457		
5,276.00	1.310	8.713	5.509		
5,276.50	1.384	9.386	9.288		
5,277.00	1.460	10.097	13.620		
5,277.50	1.539	10.847	17.484		
5,278.00	1.620	11.636	19.790		

Detailed Discharge Table

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,263.00	0.000	0.000
5,263.10	0.000	0.000
5,263.50	0.000	0.000
5,264.00	0.000	0.000
5,264.50	0.000	0.000
5,265.00	0.000	0.000
5,265.50	0.000	0.000
5,266.00	0.000	0.000
5,266.50	0.000	0.000
5,267.00	0.000	0.000
5,267.50	0.000	0.000
5,268.00	0.000	0.000
5,268.50	0.000	0.000
5,269.00	0.000	0.000
5,269.50	0.000	0.000
5,270.00	0.000	0.000

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,270.50	0.000	0.000
5,271.00	0.000	0.000
5,271.50	0.000	0.000
5,272.00	0.000	0.000
5,272.50	0.000	0.000
5,273.00	0.000	0.000
5,273.50	0.000	0.000
5,274.00	0.000	0.000
5,274.50	0.000	0.000
5,274.80	0.000	0.000
5,275.00	(3)>0.575	0.575
5,275.50	(3)>2.457	2.457
5,276.00	(3)>5.509	5.509
5,276.50	(3)>9.288	9.288
5,277.00	(3)>13.620	13.620
5,277.50	(5)>17.484	17.484
5,278.00	(6)>19.790	19.790

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	135.210	0.452	0.000	0.000	80.900	M	68.03	6.763
	Σ	**135.210**						**68.03**	**6.763**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	7.29	45.00	617.00	2.700	0.063
		8. Large gullies, diversions, and low flowing streams	1.60	85.00	5,318.00	3.790	0.389
#1	**1**	**Time of Concentration:**					**0.452**

Pages 87 – 88 blank due to text changes

Lowe Railroad Impoundment #1

Impoundment has a watershed of 105.73 acres and designed to contain the 100 year-6 hour strom event (Total Containment); therefore, no spillway is required.

Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87414

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Lowe Railroad Impoundment #1

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	105.730	105.730	89.73	6.84

Structure Detail:

Structure #1 (Null)

Lowe Railroad Impoundment #1

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	85.180	0.500	0.000	0.000	89.000	M	81.66	5.820
	2	9.850	0.180	0.000	0.000	84.200	F	14.06	0.594
	3	10.700	0.061	0.000	0.000	78.000	M	14.67	0.431
	Σ	**105.730**						**89.73**	**6.845**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	0.82	40.00	4,878.00	2.710	0.500
#1	**1**	**Time of Concentration:**					**0.500**
#1	2	8. Large gullies, diversions, and low flowing streams	2.98	100.00	3,357.00	5.170	0.180
#1	**2**	**Time of Concentration:**					**0.180**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	5.71	30.00	525.00	2.390	0.061
#1	**3**	**Time of Concentration:**					**0.061**

Lowe Railroad Impoundment #2

Impoundment has a watershed of 133.27 acres and designed to contain the 100 year-6 hour storm event (Total Containment); therefore, no spillway is required.

Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87414

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Lowe Railroad Impoundment #2

#1

Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	133.270	133.270	103.69	6.65

Structure Detail:

Structure #1 (Null)

Lowe Railroad Impoundment #2

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	129.020	0.500	0.000	0.000	81.800	F	102.97	6.483
	2	4.250	0.064	0.000	0.000	78.000	M	5.83	0.171
	Σ	**133.270**						**103.69**	**6.654**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	0.82	40.00	4,878.04	2.710	0.500
#1	**1**	**Time of Concentration:**					**0.500**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	6.14	35.00	570.00	2.470	0.064
#1	**2**	**Time of Concentration:**					**0.064**

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION FOR LOWE STOCKPILE POND

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\LCOALSP

Date: 12-21-1995

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP User: Brian Sambirsky
Date: 12-21-1995 Time: 10:09:35
As built design hydrology calculation for Lowe Stockpile Pond
Storm: 1.58 inches, 10 year-24 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	51.80	89	M	1.365	0.000	0.000	0.0	2.99	13.35
		Type: Null		Label: Lowe Stockpile Pond						
111	Structure	51.80							2.99	
111	Total IN/OUT	51.80							2.99	13.35

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP
User: Brian Sambirsky
Date: 12-21-1995 Time: 10:09:35
As built design hydrology calculation for Lowe Stockpile Pond
Storm: 1.58 inches, 10 year-24 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	3924.00	0.64	0.80	1.37	1.365		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION FOR LOWE STOCKPILE POND SPILLWAY

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\LCOALSP

Date: 12-21-1995

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP User: Brian Sambirsky
Date: 12-21-1995 Time: 10:07:50
As built design hydrology calculation for Lowe Stockpile Pond Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	51.80	89	M	1.365	0.000	0.000	0.0	3.05	17.52
		Type: Pond		Label: Lowe Stockpile Pond						
111	Structure	51.80								
									3.05	
111	Total IN	51.80								
111	Total OUT								3.05	17.52
									3.05	15.28

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP User: Brian Sambirsky
Date: 12-21-1995 Time: 10:07:50
As built design hydrology calculation for Lowe Stockpile Pond Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3924.00	0.64	0.80	1.37	1.365		

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP
User: Brian Sambirsky
Date: 12-21-1995 Time: 10:07:50
As built design hydrology calculation for Lowe Stockpile Pond Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
Lowe Stockpile Pond

Drainage Area from J1, B1, S1, SWS(s)1: 51.8 acres
Total Contributing Drainage Area: 51.8 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	5313.6
Crest Length (ft)	26.0
Z:1 (Left and Right)	4.0 2.7
Bottom Width (ft)	16.0

POND RESULTS:

Permanent Pool (ac-ft)
5.6

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	3.05	17.52
OUT	3.05	15.28

Peak Elevation	Hydrograph Detention Time (hrs)
5314.2	0.00

****

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP User: Brian Sambirsky
Date: 12-21-1995 Time: 10:07:50
As built design hydrology calculation for Lowe Stockpile Pond Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Lowe Stockpile Pond

Drainage Area from J1, B1, S1, SWS(s)1: 51.8 acres
Total Contributing Drainage Area: 51.8 acres

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
5300.80	0.0	0.0
5301.00	0.0	0.0
5301.80	0.0	0.0
5302.00	0.0	0.0
5302.80	0.0	0.0
5303.00	0.0	0.0
5303.80	0.0	0.0
5304.00	0.0	0.0
5304.80	0.0	0.0
5305.00	0.0	0.0
5305.80	0.0	0.0
5306.00	0.0	0.0
5306.80	0.0	0.0
5307.00	0.0	0.0
5307.80	0.0	0.0
5308.80	0.0	0.0
5309.80	0.0	0.0
5310.80	0.0	0.0
5311.80	0.0	0.0
5312.80	0.0	0.0
5313.60	0.0	0.0
5313.80	5.5	5.5
5314.30	19.4	19.4
5314.40	25.3	25.3
5314.50	31.5	31.5

****

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP
User: Brian Sambirsky
Date: 12-21-1995 Time: 10:07:50
As built design hydrology calculation for Lowe Stockpile Pond Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Lowe Stockpile Pond

Drainage Area from J1, B1, S1, SWS(s)1: 51.8 acres
Total Contributing Drainage Area: 51.8 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
5300.80	0.00	0.00	0.00	0.00	
5301.00	0.20	0.01	0.00	0.00	
5301.80	1.00	0.08	0.03	0.00	
5302.00	1.20	0.11	0.05	0.00	
5302.80	2.00	0.20	0.18	0.00	
5303.00	2.20	0.23	0.22	0.00	
5303.80	3.00	0.32	0.44	0.00	
5304.00	3.20	0.35	0.51	0.00	
5304.80	4.00	0.39	0.80	0.00	
5305.00	4.20	0.40	0.88	0.00	
5305.80	5.00	0.43	1.22	0.00	
5306.00	5.20	0.44	1.30	0.00	
5306.80	6.00	0.46	1.66	0.00	
5307.00	6.20	0.47	1.76	0.00	
5307.80	7.00	0.49	2.14	0.00	
5308.80	8.00	0.52	2.65	0.00	
5309.80	9.00	0.56	3.20	0.00	
5310.80	10.00	0.59	3.77	0.00	
5311.80	11.00	0.63	4.39	0.00	
5312.80	12.00	0.67	5.04	0.00	
5313.60	12.80	0.70	5.59	0.00	Stage of SW#1
5313.80	13.00	0.70	5.73	5.54	
5314.15	13.35	0.74	5.98	15.28	Peak Stage
5314.30	13.50	0.75	6.09	19.41	
5314.40	13.60	0.76	6.17	25.30	
5314.50	13.70	0.77	6.24	31.51	

****

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SOUTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT

by

Name: BEN HOSKIE

Company Name: BHP MINERALS
File Name: C:\BEN\PONDS\SWDXPND

Date: 07-05-1998

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\PONDS\SWDXPND User: BEN HOSKIE
Date: 07-05-1998 Time: 15:58:23
SOUTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

STORM #1:

User-Defined Distribution

Label: type II-65

	Accumulated Time (hrs)	Accumulated Dimensionless Depth
1	0.0	0.000
2	0.5	0.006
3	1.0	0.012
4	1.5	0.019
5	2.0	0.026
6	2.5	0.034
7	3.0	0.043
8	3.5	0.055
9	4.0	0.067
10	4.5	0.083
11	5.0	0.105
12	5.5	0.139
13	6.0	0.711
14	6.5	0.789
15	7.0	0.819
16	7.5	0.837
17	8.0	0.851
18	8.5	0.861
19	9.0	0.872
20	9.5	0.880
21	10.0	0.888
22	10.5	0.894
23	11.0	0.900
24	11.5	0.905
25	12.0	0.910
26	12.5	0.915
27	13.0	0.920
28	13.5	0.925
29	14.0	0.930
30	14.5	0.934
31	15.0	0.938
32	15.5	0.943
33	16.0	0.947

34	16.5	0.951
35	17.0	0.954
36	17.5	0.958
37	18.0	0.962
38	18.5	0.966
39	19.0	0.969
40	19.5	0.973
41	20.0	0.976
42	20.5	0.979
43	21.0	0.982
44	21.5	0.985
45	22.0	0.988
46	22.5	0.991
47	23.0	0.994
48	23.5	0.997
49	24.0	1.000

****

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS

Filename: C:\BEN\PONDS\SWDXPND User: BEN HOSKIE

Date: 07-05-1998 Time: 15:58:23

SOUTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT

Storm: 2.10 inches, 100 year- 6 hour, type II-65

Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	37.80	80	F	0.355	0.000	0.000	0.0	2.01	33.73
		Type: Null		Label: SOUTHWEST DIXON POND						
111	Structure	37.80							2.01	
111	Total IN/OUT	37.80							2.01	33.73

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\PONDS\SWDXPND User: BEN HOSKIE
Date: 07-15-1998 Time: 15:58:23
SOUTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	872.52	7.45	2.73	0.09			
				-b	5	872.52	7.45	2.73	0.09			
				-c	5	872.52	7.45	2.73	0.09			
				-d	5	872.52	7.45	2.73	0.09	0.355		

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

VINNEL POND HYDROLOGY

by

Name: BEN HOSKIE

Company Name: BHP MINERALS
File Name: C:\BEN\VINNEL\VINNEL

Date: 04-23-1998

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\VINNEL User: BEN HOSKIE
Date: 04-23-1998 Time: 12:17:53
VINNEL POND HYDROLOGY
Storm: 1.58 inches, 10 year-24 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	19.10	76	M	0.194	0.000	0.000	0.0	0.33	2.84
111	2	70.00	76	M	0.754	0.061	0.352	0.0	1.21	4.68
			Type: Null		Label: J1B1S1					
111 Structure		89.10							1.54	
111 Total IN/OUT		89.10							1.54	6.00
121	1	187.40	76	M	1.829	0.000	0.000	0.0	3.24	7.23
			Type: Culvert		Label: CP-123					
121 Structure		187.40							3.24	
121 Total IN/OUT		187.40							3.24	7.23
211	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
			Type: Pond		Label: VINNEL POND					
211 Structure		0.00							4.78	
211 Total IN		276.50							4.78	11.06
211 Total OUT									4.78	10.05
111 to 211 Routing						0.021	0.387			

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\VINNEL User: BEN HOSKIE
Date: 04-23-1998 Time: 12:17:53
VINNEL POND HYDROLOGY
Storm: 1.58 inches, 10 year-24 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1315.00	3.54	1.88	0.19	0.194		
1	1	1	2	-a	5	2850.00	1.10	1.05	0.75	0.754		
1	1	1	2	-1	8	900.15	1.83	4.06	0.06		0.061	0.352
1	2	1	1	-a	5	6785.00	1.06	1.03	1.83	1.829		
2	1	1	1	-a	8	455.00	3.85	5.88	0.02	0.000		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

VINNEL POND HYDROLOGY - SPILLWAY

by

Name: BEN HOSKIE

Company Name: BHP MINERALS
File Name: C:\BEN\VINNEL\SPILL\SPILL

Date: 04-23-1998

Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SPILL\SPILL User: BEN HOSKIE
Date: 04-23-1998 Time: 07:52:14
VINNEL POND HYDROLOGY - SPILLWAY
Storm: 1.60 inches, 25 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	19.10	76	M	0.194	0.000	0.000	0.0	0.34	5.24
111	2	70.00	76	M	0.754	0.061	0.352	0.0	1.26	8.79
			Type: Null			Label: J1B1S1				
111	Structure	89.10							1.60	
111	Total IN/OUT	89.10							1.60	11.04
121	1	187.40	76	M	1.829	0.000	0.000	0.0	3.37	13.14
			Type: Culvert			Label: CP-123				
121	Structure	187.40							3.37	
121	Total IN/OUT	187.40							3.37	13.14
211	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
			Type: Pond			Label: VINNEL POND				
211	Structure	0.00							4.97	
211	Total IN	276.50							4.97	19.60
211	Total OUT								4.97	17.95
111 to 211	Routing					0.021	0.387			

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SPILL\SPILL User: BEN HOSKIE
Date: 04-23-1998 Time: 07:52:14
VINNEL POND HYDROLOGY - SPILLWAY
Storm: 1.60 inches, 25 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr	Muskingum K (hr)	X
1	1	1	1	-a	5	1315.00	3.54	1.88	0.19	0.194		
1	1	1	2	-a	5	2850.00	1.10	1.05	0.75	0.754		
1	1	1	2	-1	8	900.15	1.83	4.06	0.06		0.061	0.352
1	2	1	1	-a	5	6785.00	1.06	1.03	1.83	1.829		
2	1	1	1	-a	8	455.00	3.85	5.88	0.02	0.000		

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SPILL\SPILL User: BEN HOSKIE
Date: 04-23-1998 Time: 07:52:14
VINNEL POND HYDROLOGY - SPILLWAY
Storm: 1.60 inches, 25 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J2, B1, S1
VINNEL POND

Drainage Area from J2, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 276.5 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	5369.1
Crest Length (ft)	20.0
Z:1 (Left and Right)	3.0 3.0
Bottom Width (ft)	26.7

POND RESULTS:

Permanent Pool (ac-ft)
10.5

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	4.97	19.60
OUT	4.97	17.95

Peak Elevation	Hydrograph Detention Time (hrs)
5369.5	0.00

****

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SPILL\SPILL User: BEN HOSKIE
Date: 04-23-1998 Time: 07:52:14
VINNEL POND HYDROLOGY - SPILLWAY
Storm: 1.60 inches, 25 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J2, B1, S1
VINNEL POND

Drainage Area from J2, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 276.5 acres

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
5356.00	0.0	0.0
5356.50	0.0	0.0
5357.00	0.0	0.0
5357.50	0.0	0.0
5358.00	0.0	0.0
5358.50	0.0	0.0
5359.00	0.0	0.0
5359.50	0.0	0.0
5360.00	0.0	0.0
5360.50	0.0	0.0
5361.00	0.0	0.0
5361.50	0.0	0.0
5362.00	0.0	0.0
5362.50	0.0	0.0
5363.00	0.0	0.0
5363.50	0.0	0.0
5364.00	0.0	0.0
5364.50	0.0	0.0
5365.00	0.0	0.0
5365.50	0.0	0.0
5366.00	0.0	0.0
5366.50	0.0	0.0
5367.00	0.0	0.0
5367.50	0.0	0.0
5368.00	0.0	0.0
5368.50	0.0	0.0
5369.00	0.0	0.0
5369.10	0.0	0.0
5369.50	17.2	17.2
5369.70	25.7	25.7
5369.80	33.1	33.1
5369.90	43.2	43.2
5370.00	53.1	53.1

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SPILL\SPILL User: BEN HOSKIE
Date: 04-23-1998 Time: 07:52:14
VINNEL POND HYDROLOGY - SPILLWAY
Storm: 1.60 inches, 25 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J2, B1, S1
VINNEL POND

Drainage Area from J2, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 276.5 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
5356.00	0.00	0.00	0.00	0.00	
5356.50	0.50	0.07	0.01	0.00	
5357.00	1.00	0.26	0.09	0.00	
5357.50	1.50	0.37	0.25	0.00	
5358.00	2.00	0.50	0.46	0.00	
5358.50	2.50	0.56	0.73	0.00	
5359.00	3.00	0.63	1.03	0.00	
5359.50	3.50	0.66	1.35	0.00	
5360.00	4.00	0.69	1.69	0.00	
5360.50	4.50	0.71	2.04	0.00	
5361.00	5.00	0.74	2.40	0.00	
5361.50	5.50	0.77	2.78	0.00	
5362.00	6.00	0.80	3.17	0.00	
5362.50	6.50	0.82	3.57	0.00	
5363.00	7.00	0.85	3.99	0.00	
5363.50	7.50	0.88	4.42	0.00	
5364.00	8.00	0.91	4.87	0.00	
5364.50	8.50	0.94	5.33	0.00	
5365.00	9.00	0.97	5.81	0.00	
5365.50	9.50	1.00	6.31	0.00	
5366.00	10.00	1.04	6.82	0.00	
5366.50	10.50	1.09	7.35	0.00	
5367.00	11.00	1.14	7.90	0.00	
5367.50	11.50	1.19	8.48	0.00	
5368.00	12.00	1.23	9.09	0.00	
5368.50	12.50	1.29	9.72	0.00	
5369.00	13.00	1.34	10.37	0.00	
5369.10	13.10	1.35	10.51	0.00	Stage of SW#1
5369.50	13.50	1.41	11.06	17.16	
5369.52	13.52	1.41	11.09	17.95	Peak Stage
5369.70	13.70	1.44	11.35	25.74	
5369.80	13.80	1.45	11.49	33.09	
5369.90	13.90	1.47	11.64	43.20	
5370.00	14.00	1.48	11.78	53.12	

SEDCAD+ RIPRAP CHANNEL DESIGN

VINNEL POND INLET

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	19.60 cfs	
Slope	8.60 %	
Sideslopes (L and R)	4.20:1	4.20:1
Bottom Width	14.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.17 ft
with Freeboard	0.47 ft
Top Width	15.43 ft
with Freeboard	17.95 ft
Velocity	7.85 fps
Cross Sectional Area	2.50 sq ft
Hydraulic Radius	0.16 ft
Manning's n	0.031
Froude Number	3.44
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

VINNEL POND HYDROLOGY - EAST SIDE DITCH

by

Name: BEN HOSKIE

Company Name: BHP MINERALS
File Name: C:\BEN\VINNEL\SDITCH\SD

Date: 04-23-1998

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SDITCH\SD User: BEN HOSKIE
Date: 04-23-1998 Time: 10:43:28
VINNEL POND HYDROLOGY - EAST SIDE DITCH
Storm: 1.80 inches, 2 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	19.10	76	M	0.194	0.000	0.000	0.0	0.01	0.06
111	2	70.00	76	M	0.754	0.061	0.352	0.0	0.04	0.16
			Type: Null			Label: J1B1S1				
111	Structure	89.10							0.05	
111	Total IN/OUT	89.10							0.05	0.21
121	1	187.40	76	M	1.829	0.000	0.000	0.0	0.10	0.34
			Type: Culvert			Label: CP-123				
121	Structure	187.40							0.10	
121	Total IN/OUT	187.40							0.10	0.34
211	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
			Type: Pond		Label: VINNEL POND					
211	Structure	0.00							0.15	
211	Total IN	276.50							0.15	0.53
211	Total OUT								0.16	0.52
111 to 211 Routing						0.021	0.387			

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SDITCH\SD User: BEN HOSKIE
Date: 04-23-1998 Time: 10:43:28
VINNEL POND HYDROLOGY - EAST SIDE DITCH
Storm: 1.80 inches, 2 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1315.00	3.54	1.88	0.19	0.194		
1	1	1	2	-a	5	2850.00	1.10	1.05	0.75	0.754		
1	1	1	2	-1	8	900.15	1.83	4.06	0.06		0.061	0.352
1	2	1	1	-a	5	6785.00	1.06	1.03	1.83	1.829		
2	1	1	1	-a	8	455.00	3.85	5.88	0.02	0.000		

SEDCAD+ ERODIBLE CHANNEL DESIGN

BIGHAN RECLAIM RUNOFF - EAST SIDE DITCH

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	0.34 cfs	
Slope	4.20 %	
Sideslopes	3.00:1 (L)	2.00:1 (R)
Manning's n	0.025	
Max. Velocity	5.00 fps	
Material	SPOIL	
Freeboard	None	

RESULTS:

Actual Discharge	0.34 cfs
Depth	0.22 ft
with Freeboard	0.00 ft
Top Width	1.12 ft
with Freeboard	0.00 ft
Velocity	2.70 fps
Cross Sectional Area	0.13 sq ft
Hydraulic Radius	0.10 ft
Froude Number	1.42

Lowe Impoundment #1

Lowe Permanent Impoundment was changed to Lowe Impoundment #1. No max. sediment or water level because this structure is not conidered a sediment structure. Spillway will be designed for a 25 yr- 6hr storm event.

Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87414

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#3	0.052	0.343	North Inlet - Structure 2
Null	#2	==>	#3	0.000	0.453	East Inlet - Structure 3
Pond	#3	==>	End	0.000	0.000	Pond - Structure 14

#2 *Null*
#1 *Null*
#3 *Pond*

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	1.55	11.00	710.00	3.73	0.052
#1	**Muskingum K:**					**0.052**
#2	8. Large gullies, diversions, and low flowing streams	30.00	3.00	10.00	16.43	0.000
#2	**Muskingum K:**					**0.000**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2		804.310	804.310	189.79	24.43
#1		838.460	838.460	125.79	25.61
#3	In	0.000	1,642.770	279.19	50.04
	Out			241.91	50.04

Structure Detail:

Structure #2 (Null)

East Inlet - Structure 3

Structure #1 (Null)

North Inlet - Structure 2

Structure #3 (Pond)

Pond - Structure 14

Pond Inputs:

Initial Pool Elev:	5,346.00 ft
Initial Pool:	12.73 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,346.00	50.00	4.50:1	4.50:1	50.00

Pond Results:

Peak Elevation:	5,347.56 ft
Dewater Time:	0.61 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,340.00	0.920	0.000	0.000		
5,341.00	1.520	1.208	0.000		
5,342.00	1.760	2.846	0.000		
5,343.00	2.010	4.730	0.000		
5,344.00	2.350	6.907	0.000		
5,345.00	2.860	9.508	0.000		
5,346.00	3.600	12.731	0.000		Spillway #1
5,346.50	3.915	14.609	47.137	11.20	
5,347.00	4.230	16.645	94.274	1.25	
5,347.56	4.594	19.172	241.908	2.30	Peak Stage
5,348.00	4.880	21.196	360.209		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,340.00	0.000	0.000
5,341.00	0.000	0.000
5,342.00	0.000	0.000
5,343.00	0.000	0.000
5,344.00	0.000	0.000
5,345.00	0.000	0.000
5,346.00	0.000	0.000
5,346.50	47.137	47.137
5,347.00	94.274	94.274
5,348.00	360.209	360.209

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	256.850	2.055	0.510	0.336	83.500	M	37.90	7.774
	2	138.830	0.315	0.510	0.336	83.500	M	75.09	4.219
	3	54.830	0.221	0.510	0.336	83.500	M	34.64	1.674
	4	98.180	0.277	0.176	0.362	83.500	M	56.37	2.989
	5	111.920	0.466	0.176	0.362	83.500	M	48.73	3.393
	6	37.910	0.159	0.418	0.309	83.500	M	26.65	1.172
	7	105.790	0.386	0.000	0.000	83.500	M	51.46	3.206
	Σ	**804.310**						**189.79**	**24.427**
#1	1	549.140	2.696	0.436	0.369	83.600	M	65.42	16.758
	2	191.140	0.472	0.000	0.000	83.600	M	83.31	5.848
	3	98.180	0.205	0.000	0.000	83.600	M	64.19	3.005
	Σ	**838.460**						**125.79**	**25.611**
#3	Σ	**1,642.770**						**279.19**	**50.038**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.77	60.00	7,840.00	0.870	2.503
		8. Large gullies, diversions, and low flowing streams	1.22	28.00	2,301.00	3.300	0.193
#1	**1**	**Time of Concentration:**					**2.696**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	3.97	23.00	580.00	1.990	0.080
		8. Large gullies, diversions, and low flowing streams	2.60	178.00	6,838.00	4.840	0.392
#1	**2**	**Time of Concentration:**					**0.472**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	13.68	45.00	329.00	3.690	0.024
		8. Large gullies, diversions, and low flowing streams	3.12	108.00	3,466.00	5.290	0.181
#1	**3**	**Time of Concentration:**					**0.205**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	46.00	5,799.00	0.890	1.809
		8. Large gullies, diversions, and low flowing streams	3.31	160.00	4,837.00	5.450	0.246
#2	**1**	**Time of Concentration:**					**2.055**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	4.93	75.00	1,521.00	2.220	0.190

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.98	70.00	2,345.00	5.180	0.125
#2	**2**	**Time of Concentration:**					**0.315**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	6.42	83.00	1,293.00	2.530	0.141
		8. Large gullies, diversions, and low flowing streams	3.21	50.00	1,559.00	5.370	0.080
#2	**3**	**Time of Concentration:**					**0.221**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	8.98	60.00	668.00	2.990	0.062
		8. Large gullies, diversions, and low flowing streams	2.82	110.00	3,900.00	5.030	0.215
#2	**4**	**Time of Concentration:**					**0.277**
#2	5	5. Nearly bare and untilled, and alluvial valley fans	4.11	50.00	1,216.00	2.020	0.167
		8. Large gullies, diversions, and low flowing streams	1.86	82.00	4,404.00	4.090	0.299
#2	**5**	**Time of Concentration:**					**0.466**
#2	6	5. Nearly bare and untilled, and alluvial valley fans	9.01	53.00	588.00	3.000	0.054
		8. Large gullies, diversions, and low flowing streams	1.64	24.00	1,463.05	3.840	0.105
#2	**6**	**Time of Concentration:**					**0.159**
#2	7	5. Nearly bare and untilled, and alluvial valley fans	3.83	50.00	1,304.00	1.950	0.185
		8. Large gullies, diversions, and low flowing streams	1.42	37.00	2,598.13	3.580	0.201
#2	**7**	**Time of Concentration:**					**0.386**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	1.36	87.00	6,414.00	3.490	0.510
#2	**1**	**Muskingum K:**					**0.510**
#2	2	8. Large gullies, diversions, and low flowing streams	1.36	87.00	6,414.00	3.490	0.510
#2	**2**	**Muskingum K:**					**0.510**
#2	3	8. Large gullies, diversions, and low flowing streams	1.36	87.00	6,414.03	3.490	0.510
#2	**3**	**Muskingum K:**					**0.510**
#2	4	8. Large gullies, diversions, and low flowing streams	2.20	62.00	2,822.00	4.440	0.176
#2	**4**	**Muskingum K:**					**0.176**
#2	5	8. Large gullies, diversions, and low flowing streams	2.20	62.00	2,822.03	4.440	0.176
#2	**5**	**Muskingum K:**					**0.176**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	6	8. Large gullies, diversions, and low flowing streams	0.84	35.00	4,143.48	2.750	0.418
#2	**6**	**Muskingum K:**					**0.418**

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Page 135 to 138

Lowe Hole 3 Pond 2

The watershed area is presented on Exhibit 11-13D&E. The as-built is presented on Exhibit 127D. This run reflects the reconstruction of the spillway in February 2003.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Lowe Hole 3 Pond 2

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	628.700	628.700	113.71	34.30
	Out			109.09	34.20

Structure Detail:

Structure #1 (Pond)

Lowe Hole 3 Pond 2

Pond Inputs:

Initial Pool Elev:	5,352.50
Initial Pool:	9.79 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,352.50	25.00	8.00:1	9.50:1	10.80

Pond Results:

Peak Elevation:	5,354.17
Dewater Time:	1.00 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
5,343.50	0.038	0.000	0.000	
5,344.00	0.171	0.048	0.000	
5,344.50	0.373	0.181	0.000	
5,345.00	0.652	0.434	0.000	
5,345.50	0.829	0.803	0.000	
5,346.00	1.028	1.267	0.000	
5,346.50	1.069	1.791	0.000	
5,347.00	1.110	2.336	0.000	
5,347.50	1.147	2.900	0.000	
5,348.00	1.184	3.482	0.000	
5,348.50	1.223	4.084	0.000	
5,349.00	1.262	4.705	0.000	
5,349.50	1.302	5.346	0.000	
5,350.00	1.342	6.007	0.000	
5,350.50	1.402	6.693	0.000	
5,351.00	1.463	7.409	0.000	
5,351.50	1.545	8.161	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,352.00	1.630	8.955	0.000		
5,352.50	1.725	9.793	0.000		Spillway #1
5,353.00	1.820	10.680	0.713	15.04*	
5,353.50	2.010	11.637	34.257	6.90	
5,353.60	2.049	11.840	42.386	0.35	
5,354.00	2.207	12.690	84.318	0.95	
5,354.17	2.369	13.095	109.087	0.85	Peak Stage
5,354.50	2.554	13.880	157.028		
5,355.00	2.926	15.248	259.761		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,343.50	0.000	0.000
5,344.00	0.000	0.000
5,344.50	0.000	0.000
5,345.00	0.000	0.000
5,345.50	0.000	0.000
5,346.00	0.000	0.000
5,346.50	0.000	0.000
5,347.00	0.000	0.000
5,347.50	0.000	0.000
5,348.00	0.000	0.000
5,348.50	0.000	0.000
5,349.00	0.000	0.000
5,349.50	0.000	0.000
5,350.00	0.000	0.000
5,350.50	0.000	0.000
5,351.00	0.000	0.000
5,351.50	0.000	0.000
5,352.00	0.000	0.000
5,352.50	0.000	0.000
5,353.00	0.713	0.713
5,353.50	34.257	34.257
5,353.60	42.386	42.386
5,354.00	84.318	84.318

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,354.50	157.028	157.028
5,355.00	259.761	259.761

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	628.700	2.360	0.000	0.000	88.000	M	113.71	34.299
	Σ	**628.700**						**113.71**	**34.299**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.06	250.00	12,150.00	1.430	2.360
#1	**1**	**Time of Concentration:**					**2.360**

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	628.700	628.700	23.79	7.70
	Out			21.51	7.61

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Lowehole-3, Pond-3 As Built

PJF

BHP Coal Company - Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: (505) 598-3206

General Information

Storm Information:

Storm Type:	Type II-65
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.100 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	lowehole-3 pond

#1
Null

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	39.610	0.191	0.000	0.000	79.670	M	32.45	2.01
	Σ	**39.610**						**32.45**	**2.01**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.89	98.00	1,665.00	2.420	0.191
#1	**1**	**Time of Concentration:**					**0.191**

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

LOWE HOLE 3 POND 3 INLET HYDROLOGY

by

Name: RUSSELL HARRIS

Company Name: BHP MINERALS
File Name: C:\RUSSWORK\LOWE_PON\LH3_PD3I

Date: 09-03-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\RUSSWORK\LOWE_PON\LH3_PD3I User: RUSSELL HARRIS
Date: 09-03-1997 Time: 12:50:53
LOWE HOLE 3 POND 3 INLET HYDROLOGY
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	11.70	80	M	0.116	0.000	0.000	0.0	0.19	6.03
		Type: Null			Label: LH3PD3INLET					
111	Structure	11.70							0.19	
111	Total IN/OUT	11.70							0.19	6.03

SEDCAD+ ERODIBLE CHANNEL DESIGN

LH3 POND 3 INLET DESIGN

Limiting Velocity Technique
Sediment-laden Water

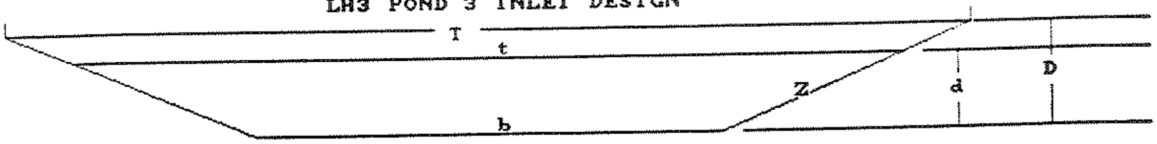
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	6.03 cfs	
Slope	4.00 %	
Sideslopes	3.00:1 (L)	3.00:1 (R)
Bottom Width	8.00 ft	
Manning's n	0.020	
Max. Velocity	5.00 fps	
Material	SPOIL, SHALE/SANDSTONE COBBLES	
Freeboard	1 ft	

RESULTS:

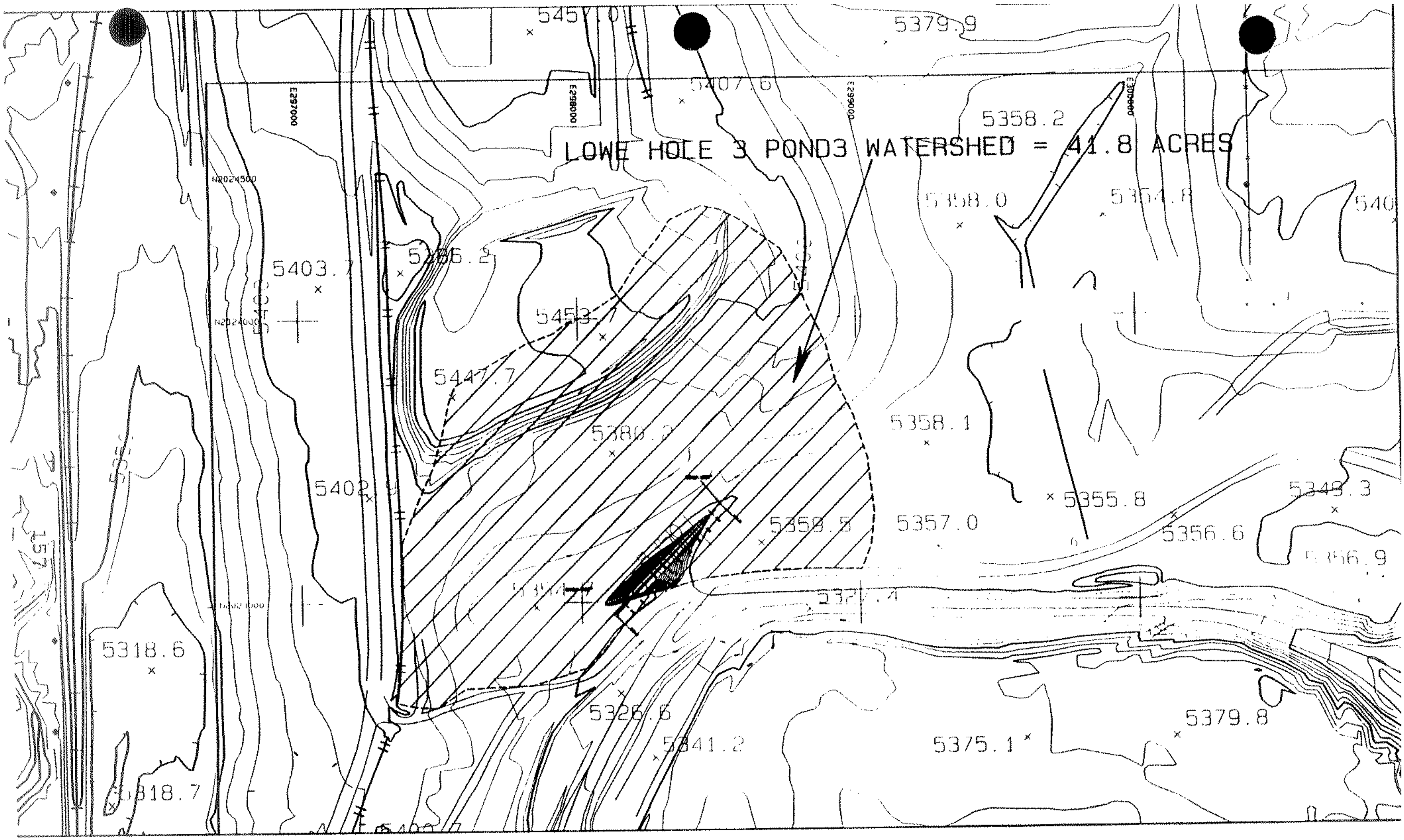
Actual Discharge	6.03 cfs
Depth	0.17 ft
with Freeboard	1.17 ft
Top Width	8.99 ft
with Freeboard	14.99 ft
Velocity	4.30 fps
Cross Sectional Area	1.40 sq ft
Hydraulic Radius	0.16 ft
Froude Number	1.92

SEDCAD+ CHANNEL DESIGN
LH3 POND 3 INLET DESIGN



MATERIAL: SPOIL, SHALE/SANDSTONE COBBLES
Limiting Variable: Velocity = 5.000 fps
Sediment-laden Water

						w/ Freeboard:
ischarge	=	6.03 cfs	Depth (d)	=	0.17	(D = 1.17) ft
ottom (b)	=	8.00 ft	Top width (t)	=	8.99	(T = 14.99) ft
ide slopes (Z)	=	3.0:1(L) 3.0:1(R)	Velocity	=	4.30 fps	
ed Slope	=	4.00 %	Hydraulic Radius	=	0.16 ft	
anning's n	=	0.020	Froude number	=	1.92	


LOWE HOLE 3 POND3 WATERSHED = 41.8 ACRES
E297000
E298000
E299000
E300000
N2024500
N2024000
5379.9
5407.6
5358.2
5358.0
5354.8
5403.7
5453.7
5447.7
5358.1
5355.8
5349.3
5402.9
5359.5
5357.0
5356.6
5318.6
5326.6
5341.2
5375.1
5379.8
157

EMPLOYEE COAL DUMP

100YR-6HR STORM EVENT, NO SPILLWAY REQUIRED.

UPDATED AS-BUILT WITH THE A3 BYPASS ROAD RE-ALIGNED. REFER TO EXHIBIT 11-132 FOR UPDATED AS-BUILT DATA.

R. Yazzie

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: (505) 598-3317

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	EMCD POND

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.730	6.730	11.42	0.55

Structure Detail:

Structure #1 (Null)

EMCD POND

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	6.730	0.151	0.000	0.000	89.000	M	11.42	0.549
	Σ	**6.730**						**11.42**	**0.549**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.05	6.15	299.74	1.430	0.058
		8. Large gullies, diversions, and low flowing streams	2.41	37.66	1,564.98	4.650	0.093
#1	**1**	**Time of Concentration:**					**0.151**

Block C Pond 1

This pond has a single closed spillway. It is re-evaluated as a total containment structure for the 100 year-6 hour storm. The curve number was adjusted to account for the reclaimed lands. Refer to Section 11.5.4.3 of the mine permit for discussion on ponds with a single closed spillway. The pond location and watershed areas are presented on Exhibit 11-13 C & D.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	BC POND 1

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	49.480	49.480	38.54	2.49
	Out			0.00	0.00

Structure Detail:

Structure #1 (Pond)

BC POND 1

Pond Inputs:

Initial Pool Elev:	5,296.25
Initial Pool:	0.00 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Entrance Loss Coefficient	Tailwater Depth (ft)
24.00	120.00	4.16	0.0160	5,312.30	0.50	0.00

Pond Results:

Peak Elevation:	~~5,305.23~~ 5306.53
Dewater Time:	0.00 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
5,296.00	0.000	0.000	0.000	
5,296.25	0.008	0.001	0.000	
5,296.50	0.022	0.004	0.000	
5,297.00	0.064	0.025	0.000	
5,297.50	0.113	0.069	0.000	
5,298.00	0.177	0.141	0.000	
5,298.50	0.195	0.234	0.000	
5,299.00	0.215	0.336	0.000	
5,299.50	0.224	0.446	0.000	
5,300.00	0.233	0.560	0.000	
5,300.50	0.241	0.679	0.000	
5,301.00	0.249	0.801	0.000	
5,301.50	0.258	0.928	0.000	
5,302.00	0.267	1.059	0.000	
5,302.50	0.276	1.195	0.000	
5,303.00	0.286	1.336	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
5,303.50	0.296	1.481	0.000	
5,304.00	0.307	1.632	0.000	
5,304.50	0.317	1.788	0.000	
5,305.00	0.328	1.949	0.000	
5,305.23	0.333	2.025	0.000	~~0.00 Peak Stage~~
5,305.50	0.338	2.116	0.000	
5,306.00	0.349	2.288	0.000	
5,306.50	0.362	2.465	0.000	Elev 5306.53 Peak Stage
5,307.00	0.374	2.649	0.000	
5,307.50	0.387	2.840	0.000	
5,308.00	0.401	3.037	0.000	
5,308.50	0.415	3.241	0.000	
5,309.00	0.430	3.452	0.000	
5,309.50	0.444	3.671	0.000	
5,310.00	0.458	3.896	0.000	
5,310.50	0.472	4.129	0.000	
5,311.00	0.486	4.368	0.000	
5,311.50	0.500	4.614	0.000	
5,312.00	0.514	4.868	0.000	
5,312.30	0.524	5.023	0.000	Spillway #1
5,312.50	0.530	5.129	0.407	
5,313.00	0.545	5.398	2.457	
5,313.50	0.562	5.674	5.509	
5,314.00	0.579	5.960	9.288	
5,314.50	0.600	6.254	13.667	
5,315.00	0.622	6.560	17.519	

Detailed Discharge Table

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,296.00	0.000	0.000
5,296.25	0.000	0.000
5,296.50	0.000	0.000
5,297.00	0.000	0.000
5,297.50	0.000	0.000
5,298.00	0.000	0.000
5,298.50	0.000	0.000
5,299.00	0.000	0.000

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,299.50	0.000	0.000
5,300.00	0.000	0.000
5,300.50	0.000	0.000
5,301.00	0.000	0.000
5,301.50	0.000	0.000
5,302.00	0.000	0.000
5,302.50	0.000	0.000
5,303.00	0.000	0.000
5,303.50	0.000	0.000
5,304.00	0.000	0.000
5,304.50	0.000	0.000
5,305.00	0.000	0.000
5,305.50	0.000	0.000
5,306.00	0.000	0.000
5,306.50	0.000	0.000
5,307.00	0.000	0.000
5,307.50	0.000	0.000
5,308.00	0.000	0.000
5,308.50	0.000	0.000
5,309.00	0.000	0.000
5,309.50	0.000	0.000
5,310.00	0.000	0.000
5,310.50	0.000	0.000
5,311.00	0.000	0.000
5,311.50	0.000	0.000
5,312.00	0.000	0.000
5,312.30	0.000	0.000
5,312.50	(3)>0.407	0.407
5,313.00	(3)>2.457	2.457
5,313.50	(3)>5.509	5.509
5,314.00	(3)>9.288	9.288
5,314.50	(3)>13.667	13.667
5,315.00	(5)>17.519	17.519

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	49.480	0.160	0.000	0.000	81.000	M	38.54	2.493
	Σ	**49.480**						**38.54**	**2.493**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.68	23.00	405.00	2.380	0.047
		8. Large gullies, diversions, and low flowing streams	3.96	97.00	2,449.00	5.970	0.113
#1	**1**	**Time of Concentration:**					**0.160**

Block C Pond 2

This pond has a single closed spillway. It is re-evaluated as a total containment structure for the 100 year-6 hour storm. The curve number was adjusted to account for the reclaimed lands. Refer to Section 11.5.4.3 of the mine permit for discussion on ponds with a single closed spillway. The pond location and watershed areas are presented on Exhibit 11-13 C & D.

Pages 87 – 88 blank due to text changes

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Block C Pd 2

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	66.640	66.640	62.07	4.42
	Out			0.00	0.00

Structure Detail:

Structure #1 (Pond)

Block C Pd 2

Pond Inputs:

Initial Pool Elev:	5,300.20
Initial Pool:	0.00 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Entrance Loss Coefficient	Tailwater Depth (ft)
24.00	120.00	3.00	0.0160	5,308.90	0.50	0.00

Pond Results:

Peak Elevation:	~~5,306.42~~ 5307.41
Dewater Time:	0.00 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,300.00	0.359	0.000	0.000		
5,300.20	0.378	0.074	0.000		
5,300.50	0.407	0.191	0.000		
5,301.00	0.458	0.408	0.000		
5,301.50	0.482	0.643	0.000		
5,302.00	0.507	0.890	0.000		
5,302.50	0.528	1.149	0.000		
5,303.00	0.549	1.418	0.000		
5,303.50	0.571	1.698	0.000		
5,304.00	0.594	1.989	0.000		
5,304.50	0.618	2.292	0.000		
5,305.00	0.643	2.607	0.000		
5,305.50	0.676	2.937	0.000		
5,306.00	0.710	3.284	0.000		
5,306.42	0.760	3.595	0.000	~~0.00~~	~~Peak Stage~~
5,306.50	0.767	3.653	0.000		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,307.00	0.827	4.051	0.000	Elev. 5307.41 Peak Stage	
5,307.50	0.897	4.482	0.000		
5,308.00	0.970	4.949	0.000		
5,308.50	1.068	5.458	0.000		
5,308.90	1.149	5.902	0.000		Spillway #1
5,309.00	1.169	6.018	0.145		
5,309.50	1.338	6.644	1.951		
5,310.00	1.518	7.358	4.838		
5,310.50	1.740	8.171	8.478		
5,311.00	1.978	9.100	12.746		

Detailed Discharge Table

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,300.00	0.000	0.000
5,300.20	0.000	0.000
5,300.50	0.000	0.000
5,301.00	0.000	0.000
5,301.50	0.000	0.000
5,302.00	0.000	0.000
5,302.50	0.000	0.000
5,303.00	0.000	0.000
5,303.50	0.000	0.000
5,304.00	0.000	0.000
5,304.50	0.000	0.000
5,305.00	0.000	0.000
5,305.50	0.000	0.000
5,306.00	0.000	0.000
5,306.50	0.000	0.000
5,307.00	0.000	0.000
5,307.50	0.000	0.000
5,308.00	0.000	0.000
5,308.50	0.000	0.000
5,308.90	0.000	0.000
5,309.00	(3)>0.145	0.145
5,309.50	(3)>1.951	1.951
5,310.00	(3)>4.838	4.838
5,310.50	(3)>8.478	8.478

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,311.00	(3)>12.746	12.746

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	66.640	0.208	0.000	0.000	85.000	M	62.07	4.416
	Σ	**66.640**						**62.07**	**4.416**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	8.27	67.00	810.00	2.870	0.078
		8. Large gullies, diversions, and low flowing streams	2.54	57.00	2,242.00	4.780	0.130
#1	**1**	**Time of Concentration:**					**0.208**

BLOCK C POND 3

This Pond is evaluated as a total containment structure for the 100 year-6 hour storm. The curve number was adjusted to account for the reclaimed lands. This pond location and watershed areas are presented on Exhibit 11-13 C&D.

Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

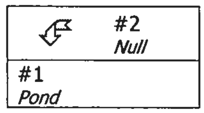
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	BLOCK C POND 3
Null	#2	==>	#1	0.257	0.346	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	1.62	57.00	3,527.00	3.81	0.257
#2	**Muskingum K:**					**0.257**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2		137.510	137.510	90.84	8.89
#1	In	36.910	174.420	98.09	14.69
	Out			44.92	14.69

Structure Detail:

Structure #2 (Null)

Structure #1 (Pond)

BLOCK C POND 3

Pond Inputs:

Permanent Pool Elev:	5,273.00
Permanent Pool:	16.72 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,273.00	30.00	3.00:1	3.00:1	25.00

Pond Results:

Peak Elevation:	5,273.81
H'graph Detention Time:	1.01 hrs
Dewater Time:	0.43 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,266.00	1.460	0.000	0.000		
5,266.50	1.554	0.753	0.000		
5,267.00	1.650	1.554	0.000		
5,267.50	1.758	2.406	0.000		
5,268.00	1.870	3.313	0.000		
5,268.50	1.983	4.276	0.000		
5,269.00	2.100	5.297	0.000		
5,269.50	2.223	6.377	0.000		
5,270.00	2.350	7.521	0.000		
5,270.50	2.536	8.742	0.000		
5,271.00	2.730	10.058	0.000		
5,271.50	2.960	11.480	0.000		
5,272.00	3.200	13.020	0.000		
5,272.50	3.697	14.743	0.000		
5,273.00	4.230	16.723	0.000		Spillway #1
5,273.50	4.797	18.978	27.710	9.10	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,273.81	5.178	20.561	44.919	1.20	Peak Stage
5,274.00	5.400	21.526	55.420		
5,274.50	5.937	24.360	121.915		
5,275.00	6.500	27.468	198.623		

Detailed Discharge Table

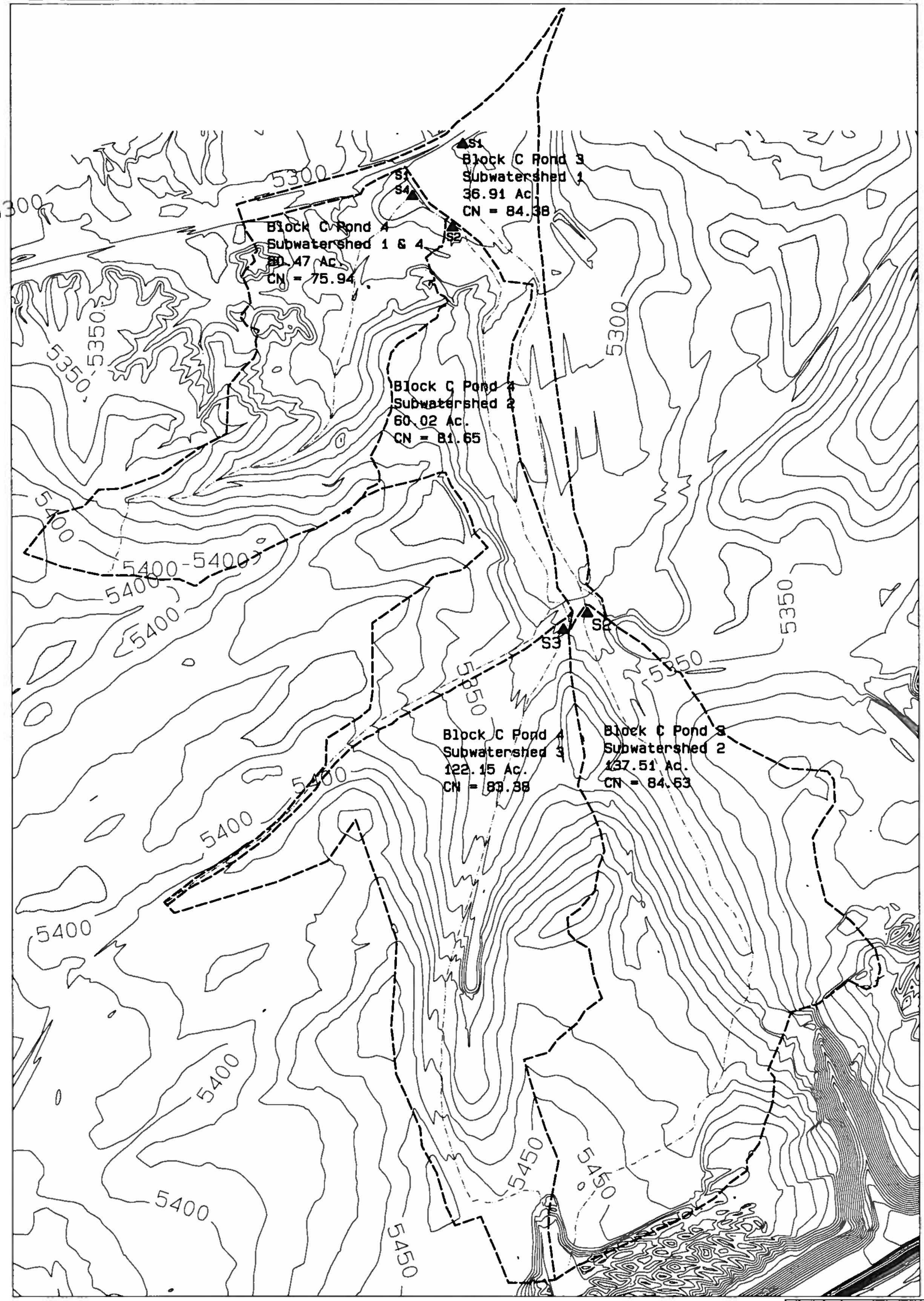
Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,266.00	0.000	0.000
5,266.50	0.000	0.000
5,267.00	0.000	0.000
5,267.50	0.000	0.000
5,268.00	0.000	0.000
5,268.50	0.000	0.000
5,269.00	0.000	0.000
5,269.50	0.000	0.000
5,270.00	0.000	0.000
5,270.50	0.000	0.000
5,271.00	0.000	0.000
5,271.50	0.000	0.000
5,272.00	0.000	0.000
5,272.50	0.000	0.000
5,273.00	0.000	0.000
5,273.50	27.710	27.710
5,274.00	55.420	55.420
5,274.50	121.915	121.915
5,275.00	198.623	198.623

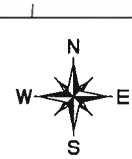
Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	137.510	0.569	0.000	0.000	84.630	M	90.84	8.89
	S	**137.510**						**90.84**	**8.89**
#1	1	36.910	0.267	0.000	0.000	84.380	M	35.45	2.35
	S	**174.420**						**98.09**	**14.69**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.56	53.00	3,398.59	3.740	0.252
		8. Large gullies, diversions, and low flowing streams	3.06	9.00	294.50	5.240	0.015
#1	**1**	**Time of Concentration:**					**0.267**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	5.60	146.00	2,606.25	2.360	0.306
		8. Large gullies, diversions, and low flowing streams	1.01	29.00	2,859.50	3.020	0.263
#2	**1**	**Time of Concentration:**					**0.569**





A	7/16/07		BLOCK-C POND 3 WATERSHED MODIFIED AND POND 4 ADDED.				

EXHIBIT 11-13D

BHP NAVAJO COAL COMPANY

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

STRUCTURE NETWORKING
BLOCK-C POND 3 AND POND 4
SUBWATERSHED
MAP

PREPARED BY	DRAWN BY PJF	SCALE 1"=1000'
APPROVED BY	DATE 7-16-07	

Block-C Pond 4

The watershed for the impoundment is presented on Exhibit 11-13D. The detail design is presented on Exhibit 11-136.

The pond is design to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

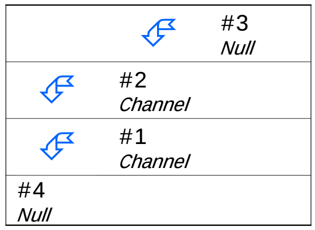
General Information

Storm Information:

Storm Type:	TYPE II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#4	0.000	0.000	
Channel	#2	==>	#4	0.014	0.368	
Null	#3	==>	#2	0.231	0.344	
Null	#4	==>	End	0.000	0.000	Block-C Pond 4



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	2.48	6.00	241.76	4.72	0.014
#2	**Muskingum K:**					**0.014**
#3	8. Large gullies, diversions, and low flowing streams	1.57	49.00	3,121.63	3.75	0.231
#3	**Muskingum K:**					**0.231**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	122.150	122.150	83.98	7.26
#2	60.020	182.170	106.02	10.43
#1	80.470	80.470	22.32	2.76
#4	0.000	262.640	128.27	13.19

Structure Detail:

Structure #3 (Null)

Structure #2 (Riprap Channel)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	8.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.73 ft	1.73 ft
Top Width:	16.39 ft	22.39 ft
Velocity*:		
X-Section Area:	10.38 sq ft	
Hydraulic Radius:	0.624	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Riprap Channel)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	20.0			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.20 ft	0.00 ft

	w/o Freeboard	w/ Freeboard
Top Width:	9.17 ft	0.00 ft
Velocity*:		
X-Section Area:	1.68 sq ft	
Hydraulic Radius:	0.182	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Null)

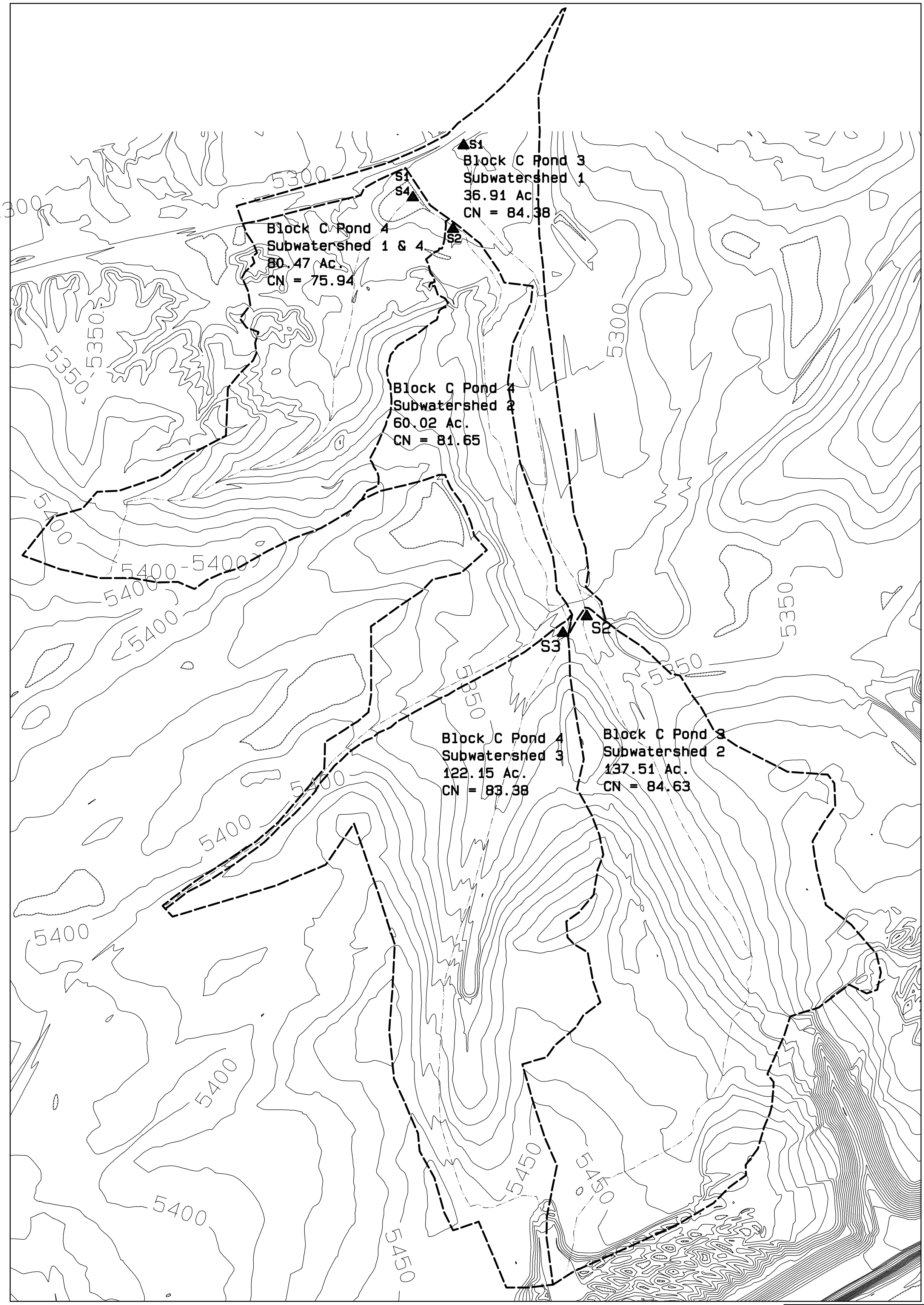
Block-C Pond 4

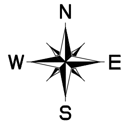
Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	122.150	0.349	0.000	0.000	83.380	M	83.98	7.26
	S	**122.150**						**83.98**	**7.26**
#2	1	60.020	0.416	0.000	0.000	81.650	M	33.48	3.17
	S	**182.170**						**106.02**	**10.43**
#1	1	80.470	0.595	0.000	0.000	75.940	M	22.32	2.76
	S	**80.470**						**22.32**	**2.76**
#4	**S**	**262.640**						**128.27**	**13.19**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	6.44	35.00	543.36	2.030	0.074
		5. Nearly bare and untilled, and alluvial valley fans	3.06	100.00	3,269.04	1.740	0.521
#1	**1**	**Time of Concentration:**					**0.595**
#2	1	8. Large gullies, diversions, and low flowing streams	2.61	90.00	3,445.87	4.840	0.197
		8. Large gullies, diversions, and low flowing streams	1.54	45.00	2,926.82	3.710	0.219
#2	**1**	**Time of Concentration:**					**0.416**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.70	10.00	586.99	1.300	0.125
		8. Large gullies, diversions, and low flowing streams	3.08	131.00	4,259.27	5.260	0.224
#3	**1**	**Time of Concentration:**					**0.349**





REV. No.	Date Submitted	DRAFT. BY	REVISION DESCRIPTION	ENG.	C.G.	PE
A	7/16/07	SS	BLOCK-C POND 3 WATERSHED MODIFIED AND POND 4 ADDED.	SS	KJ	LR

APPROVALS

EXHIBIT 11-13D

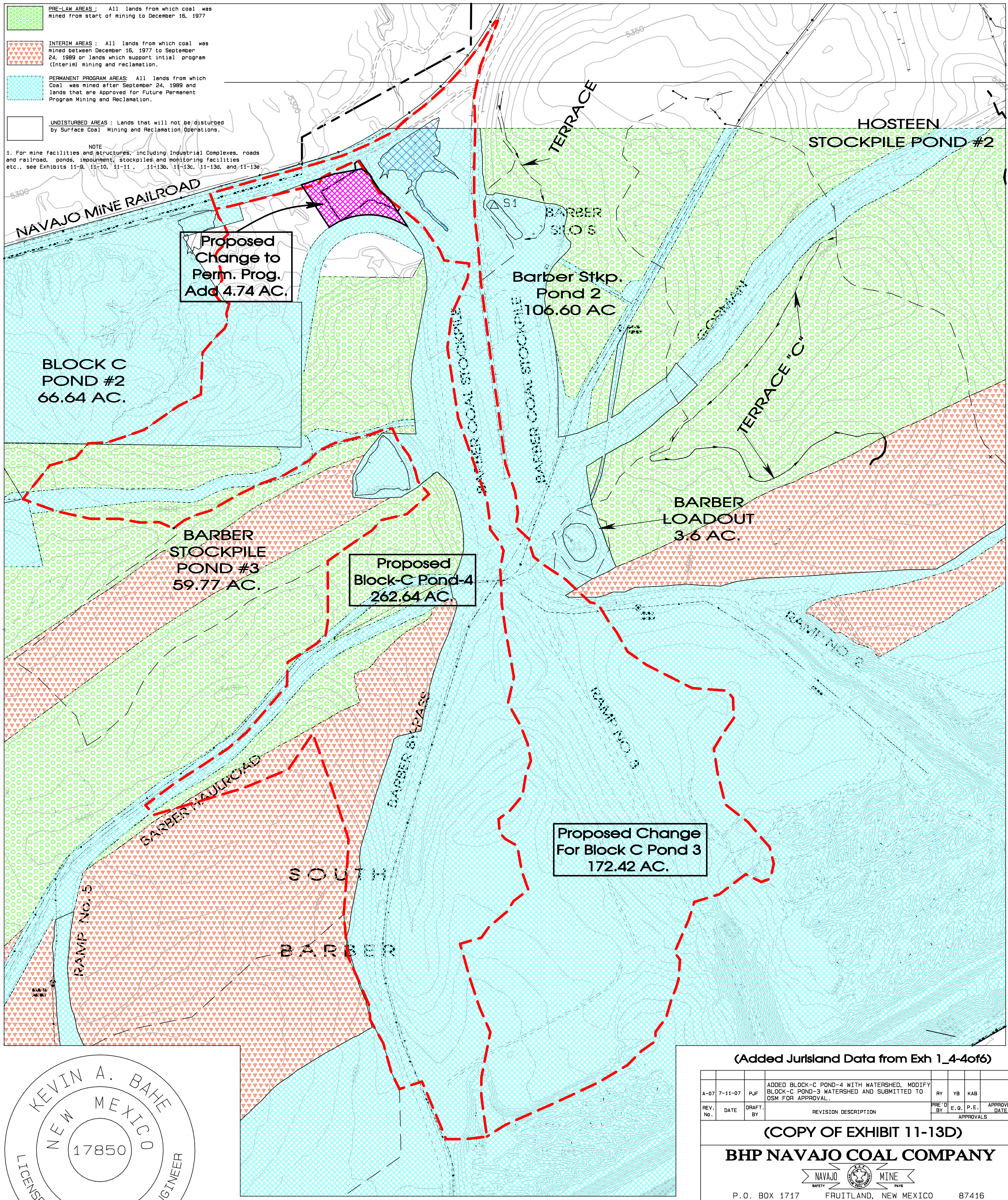
BHP NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

STRUCTURE NETWORKING
BLOCK-C POND 3 AND POND 4
SUBWATERSHED
MAP

PREPARED BY BSkeet	DRAWN BY PJF	SCALE 1"=1000'
APPROVED BY	DATE 7-16-07	



KEVIN A. BAHE
NEW MEXICO
17850
LICENSED PROFESSIONAL ENGINEER

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

(Added Jurisland Data from Exh 1_4-4of6)

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE'D BY	E.G.	P.E.	APPROVED DATE
A-07	7-11-07	PJF	ADDED BLOCK-C POND-4 WITH WATERSHED, MODIFY BLOCK-C POND-3 WATERSHED AND SUBMITTED TO OSM FOR APPROVAL.	RY	YB	KAB	

APPROVALS

(COPY OF EXHIBIT 11-13D)

BHP NAVAJO COAL COMPANY

NAVAJO MINE
SAFETY PAYS

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

AREA-II
IMPOUNDMENT AND
POND LOCATIONS/
WATERSHED AREAS

PREPARED BY BS/PJF	DRAWN BY PJF	SCALE 1" = 500'	
APPROVED BY	DATE Nov. 26, 1995		

MAP LOCATION: (See Lower Left Corner)

Pages 194-210 Blank due to text edits.

Mason Pond Modification
10 yr - 6 hr Storm Event

The location and watershed area are presented on Exhibit 11-13D. The pond modification is presented on Exhibit 11-139. The culverts (CP-120 & 140) and the inlet structures to the pond are design for the 10 yr - 6 hr storm event.

The hydrology model is presented on the attach sheet.

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

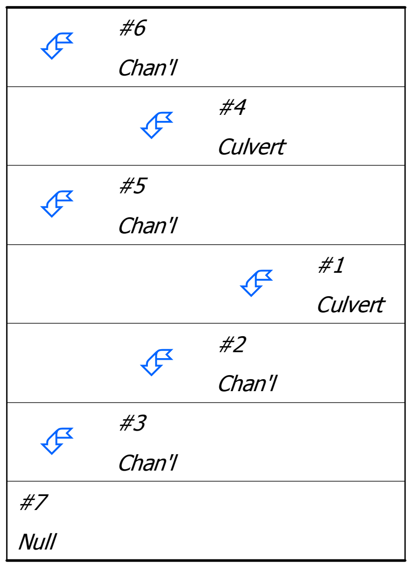
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	#2	0.178	0.289	CULVERT CP-120
Channel	#2	==>	#3	0.000	0.000	SO CHAN TO MASON PD
Channel	#3	==>	#7	0.000	0.000	SO INLET
Culvert	#4	==>	#5	0.007	0.399	CULVERT CP-140
Channel	#5	==>	#7	0.000	0.000	EAST INLET
Channel	#6	==>	#7	0.000	0.000	NORTH INLET NORTH INLET
Null	#7	==>	End	0.000	0.000	MASON POND



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.60	9.00	1,492.00	2.32	0.178
#1	**Muskingum K:**					**0.178**
#4	8. Large gullies, diversions, and low flowing streams	5.03	9.20	183.00	6.72	0.007
#4	**Muskingum K:**					**0.007**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6	4.800	4.800	2.72	0.07
#4	19.300	19.300	14.35	0.40
#5	5.600	24.900	20.54	0.60
#1	95.200	95.200	35.03	1.83
#2	6.600	101.800	34.10	2.02
#3	0.000	101.800	34.10	2.02
#7	1.700	133.200	37.20	2.76

Structure Detail:

Structure #6 (Riprap Channel)

NORTH INLET

NORTH INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
1.00	3.0:1	3.0:1	6.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.72 cfs	
Depth:	0.28 ft	1.28 ft
Top Width:	2.67 ft	8.67 ft
Velocity*:		
X-Section Area:	0.51 sq ft	
Hydraulic Radius:	0.185 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Culvert)

CULVERT CP-140

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	1.50	0.0160	4.00	0.00	0.90

Culvert Results:

Design Discharge = 14.35 cfs

Minimum pipe diameter: 1 - 21 inch pipe(s) required

Structure #5 (Riprap Channel)

EAST INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	21.3	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	20.54 cfs	
Depth:	0.56 ft	1.56 ft
Top Width:	7.33 ft	13.33 ft
Velocity:	6.53 fps	
X-Section Area:	3.15 sq ft	
Hydraulic Radius:	0.419 ft	
Froude Number:	1.76	
Manning's n:	0.0590	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Structure #1 (Culvert)

CULVERT CP-120

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	1.90	0.0160	5.00	0.00	0.90

Culvert Results:

Design Discharge = 35.03 cfs

Minimum pipe diameter: 1 - 30 inch pipe(s) required

Structure #2 (Erodible Channel)

SO CHAN TO MASON PD

Trapezoidal Erodible Channel Inputs:

Material: Spoils & Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	3.0:1	3.0:1	0.6	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	34.10 cfs	
Depth:	0.94 ft	1.94 ft
Top Width:	13.65 ft	19.65 ft
Velocity:	3.34 fps	
X-Section Area:	10.20 sq ft	
Hydraulic Radius:	0.731 ft	
Froude Number:	0.68	

Structure #3 (Riprap Channel)

SO INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
7.50	3.0:1	3.0:1	8.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	34.10 cfs	
Depth:	0.41 ft	1.41 ft
Top Width:	9.94 ft	15.94 ft
Velocity*:		
X-Section Area:	3.55 sq ft	
Hydraulic Radius:	0.352 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Null)

MASON POND

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	4.800	0.050	0.000	0.000	80.500	M	2.72	0.070
	Σ	**4.800**						**2.72**	**0.070**
#4	1	19.300	0.103	0.000	0.000	83.600	M	14.35	0.402
	Σ	**19.300**						**14.35**	**0.402**
#5	1	5.600	0.075	0.000	0.000	89.000	M	6.19	0.203
	Σ	**24.900**						**20.54**	**0.605**
#1	1	95.200	0.272	0.000	0.000	84.900	M	35.03	1.831
	Σ	**95.200**						**35.03**	**1.831**
#2	1	6.600	0.270	0.000	0.000	89.000	M	3.61	0.192
	Σ	**101.800**						**34.10**	**2.022**
#3	Σ	**101.800**						**34.10**	**2.022**
#7	1	1.700	0.020	0.000	0.000	89.000	M	1.88	0.062
	Σ	**133.200**						**37.20**	**2.759**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.06	14.00	231.00	2.460	0.026
		8. Large gullies, diversions, and low flowing streams	1.46	47.00	3,216.00	3.620	0.246
#1	**1**	**Time of Concentration:**					**0.272**
#2	1	8. Large gullies, diversions, and low flowing streams	0.88	24.00	2,732.00	2.810	0.270
#2	**1**	**Time of Concentration:**					**0.270**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	9.42	42.00	446.00	3.060	0.040
		8. Large gullies, diversions, and low flowing streams	1.69	15.00	888.00	3.890	0.063
#4	**1**	**Time of Concentration:**					**0.103**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	10.58	11.00	104.00	3.250	0.008
		8. Large gullies, diversions, and low flowing streams	2.39	27.00	1,132.00	4.630	0.067
#5	**1**	**Time of Concentration:**					**0.075**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	7.41	14.00	189.00	2.720	0.019

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	5.48	43.00	785.00	7.020	0.031
#6	**1**	**Time of Concentration:**					**0.050**

Mason Pond Modification
100 yr - 6 hr Storm Event

The location and watershed area are presented on Exhibit 11-13D. The pond modification is presented on Exhibit 11-139. The culverts (CP-120 & 140) and the inlet structures to the pond are design for the 10 yr - 6 hr storm event.

The hydrology model is presented on the attach sheet.

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

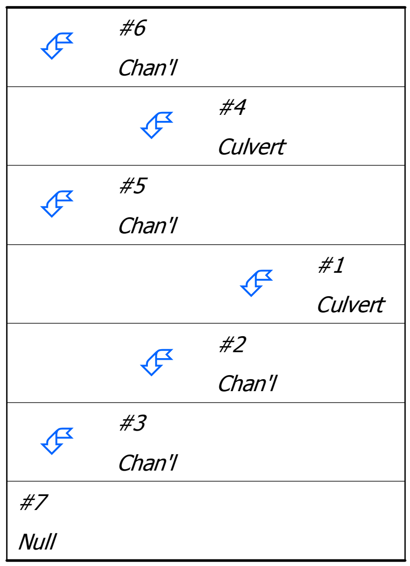
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	#2	0.178	0.289	CULVERT CP-120
Channel	#2	==>	#3	0.000	0.000	SO CHAN TO MASON PD
Channel	#3	==>	#7	0.000	0.000	SO INLET
Culvert	#4	==>	#5	0.007	0.399	CULVERT CP-140
Channel	#5	==>	#7	0.000	0.000	EAST INLET
Channel	#6	==>	#7	0.000	0.000	NORTH INLET NORTH INLET
Null	#7	==>	End	0.000	0.000	MASON POND



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.60	9.00	1,492.00	2.32	0.178
#1	**Muskingum K:**					**0.178**
#4	8. Large gullies, diversions, and low flowing streams	5.03	9.20	183.00	6.72	0.007
#4	**Muskingum K:**					**0.007**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6	4.800	4.800	7.26	0.22
#4	19.300	19.300	34.06	1.12
#5	5.600	24.900	46.50	1.58
#1	95.200	95.200	90.66	4.83
#2	6.600	101.800	89.57	5.27
#3	0.000	101.800	89.57	5.27
#7	1.700	133.200	96.40	7.22

Structure Detail:

Structure #6 (Riprap Channel)

NORTH INLET

NORTH INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
1.00	3.0:1	3.0:1	6.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.26 cfs	
Depth:	0.35 ft	1.35 ft
Top Width:	3.11 ft	9.11 ft
Velocity*:		
X-Section Area:	0.72 sq ft	
Hydraulic Radius:	0.224 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Culvert)

CULVERT CP-140

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	1.50	0.0160	4.00	0.00	0.90

Culvert Results:

Design Discharge = 34.06 cfs

Minimum pipe diameter: 1 - 30 inch pipe(s) required

Structure #5 (Riprap Channel)

EAST INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	21.3	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	46.50 cfs	
Depth:	0.81 ft	1.81 ft
Top Width:	8.86 ft	14.86 ft
Velocity:	8.93 fps	
X-Section Area:	5.21 sq ft	
Hydraulic Radius:	0.571 ft	
Froude Number:	2.05	
Manning's n:	0.0530	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Structure #1 (Culvert)

CULVERT CP-120

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	1.90	0.0160	5.00	0.00	0.90

Culvert Results:

Design Discharge = 90.66 cfs

Minimum pipe diameter: 1 - 48 inch pipe(s) required

Structure #2 (Erodible Channel)

SO CHAN TO MASON PD

Trapezoidal Erodible Channel Inputs:

Material: Spoils & Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	3.0:1	3.0:1	0.6	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	89.57 cfs	
Depth:	1.58 ft	2.58 ft
Top Width:	17.49 ft	23.49 ft
Velocity:	4.44 fps	
X-Section Area:	20.15 sq ft	
Hydraulic Radius:	1.120 ft	
Froude Number:	0.73	

Structure #3 (Riprap Channel)

SO INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
7.50	3.0:1	3.0:1	8.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	89.57 cfs	
Depth:	0.79 ft	1.79 ft
Top Width:	12.25 ft	18.25 ft
Velocity*:		
X-Section Area:	7.81 sq ft	
Hydraulic Radius:	0.625 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Null)

MASON POND

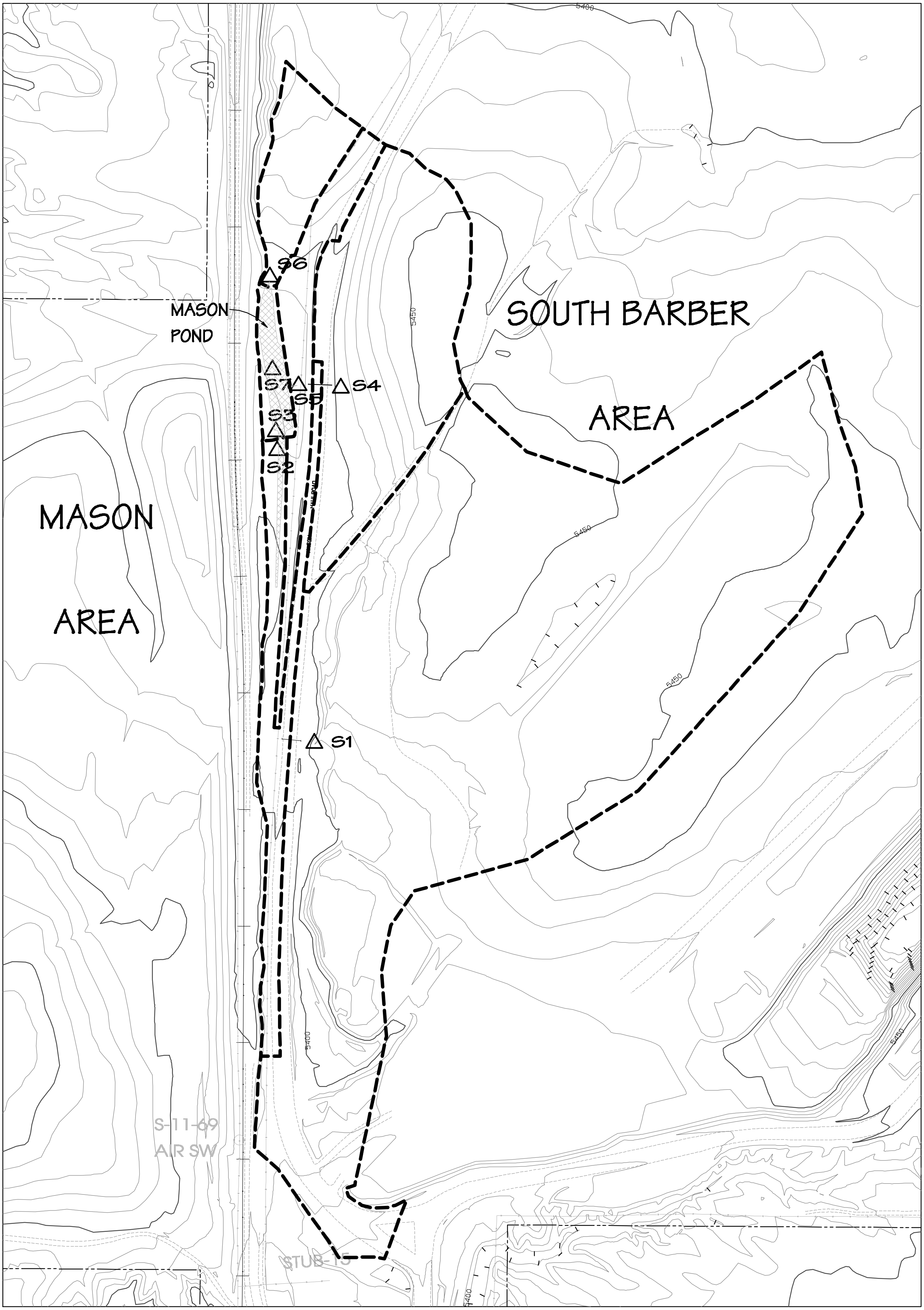
Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	4.800	0.050	0.000	0.000	80.500	M	7.26	0.223
	Σ	**4.800**						**7.26**	**0.223**
#4	1	19.300	0.103	0.000	0.000	83.600	M	34.06	1.118
	Σ	**19.300**						**34.06**	**1.118**
#5	1	5.600	0.075	0.000	0.000	89.000	M	12.45	0.464
	Σ	**24.900**						**46.50**	**1.581**
#1	1	95.200	0.272	0.000	0.000	84.900	M	90.66	4.834
	Σ	**95.200**						**90.66**	**4.834**
#2	1	6.600	0.270	0.000	0.000	89.000	M	8.13	0.438
	Σ	**101.800**						**89.57**	**5.272**
#3	Σ	**101.800**						**89.57**	**5.272**
#7	1	1.700	0.020	0.000	0.000	89.000	M	3.78	0.141
	Σ	**133.200**						**96.40**	**7.217**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.06	14.00	231.00	2.460	0.026
		8. Large gullies, diversions, and low flowing streams	1.46	47.00	3,216.00	3.620	0.246
#1	**1**	**Time of Concentration:**					**0.272**
#2	1	8. Large gullies, diversions, and low flowing streams	0.88	24.00	2,732.00	2.810	0.270
#2	**1**	**Time of Concentration:**					**0.270**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	9.42	42.00	446.00	3.060	0.040
		8. Large gullies, diversions, and low flowing streams	1.69	15.00	888.00	3.890	0.063
#4	**1**	**Time of Concentration:**					**0.103**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	10.58	11.00	104.00	3.250	0.008
		8. Large gullies, diversions, and low flowing streams	2.39	27.00	1,132.00	4.630	0.067
#5	**1**	**Time of Concentration:**					**0.075**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	7.41	14.00	189.00	2.720	0.019

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	5.48	43.00	785.00	7.020	0.031
#6	**1**	**Time of Concentration:**					**0.050**



MASON POND
HYDROLOGY MODEL

CR Pond 4

Worst Case Runoff Volume - AOC Topo

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Embk. to CR Pond 4

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	142.100	142.100	81.91	10.05

Structure Detail:

Structure #1 (Erodible Channel)

Embk. to CR Pond 4

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
7.00	2.0:1	2.0:1	1.3	0.0300	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.42 ft	2.42 ft
Top Width:	12.69 ft	16.69 ft
Velocity:	5.84 fps	
X-Section Area:	14.01 sq ft	
Hydraulic Radius:	1.049	
Froude Number:	0.98	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	142.100	0.804	0.000	0.000	86.000	M	81.91	10.05
	S	**142.100**						**81.91**	**10.05**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.74	131.00	4,778.00	1.650	0.804
#1	**1**	**Time of Concentration:**					**0.804**

<u>CR Pond 4</u>

As-built for CR Pond 4. Modified the east channel during the construction of Cottonwood Crossing and Staging Area.

Shawn Smith

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CR Pond 4

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	45.800	45.800	40.10	2.38

Structure Detail:

Structure #1 (Null)

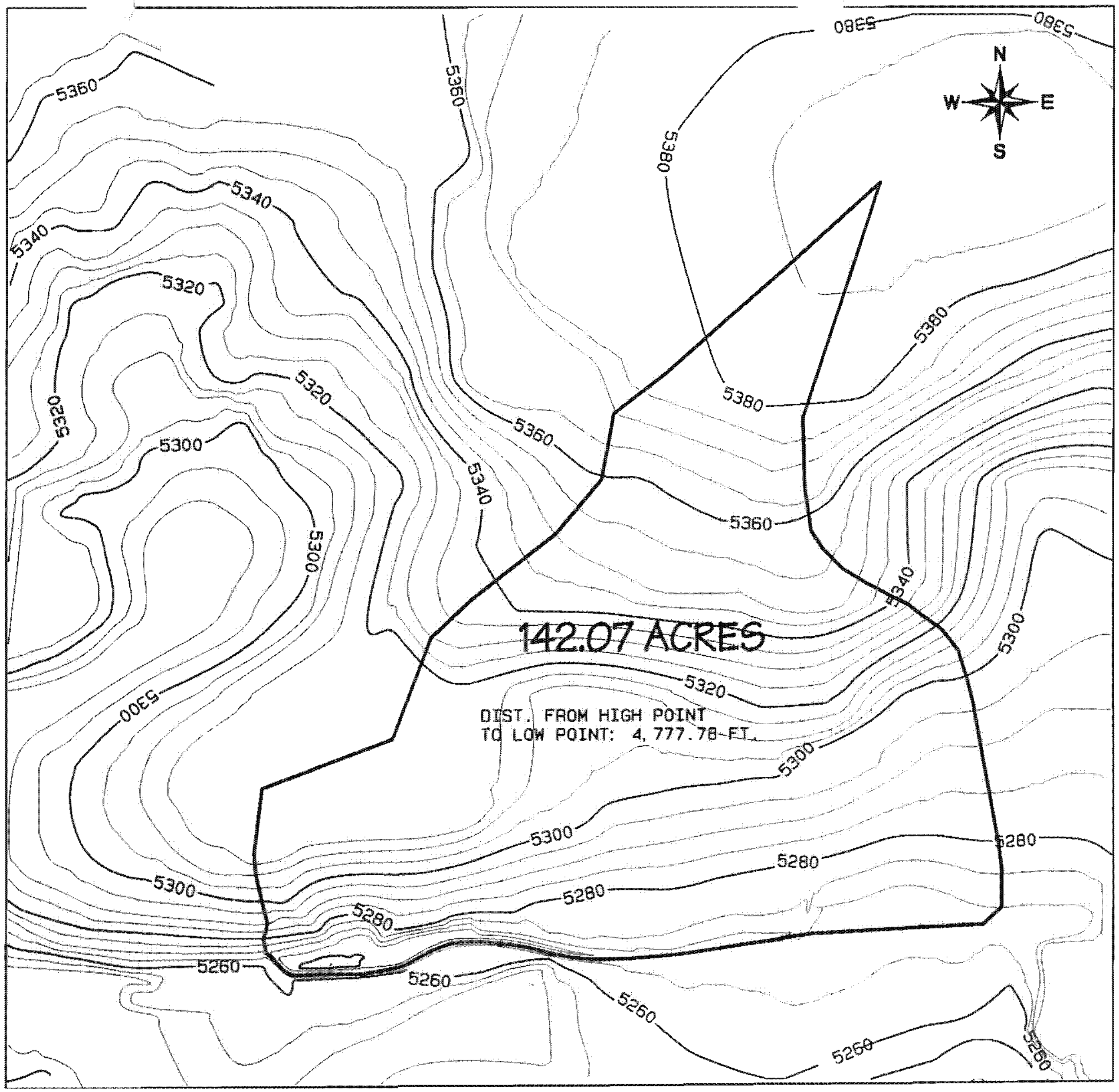
CR Pond 4

Subwatershed Hydrology Detail:

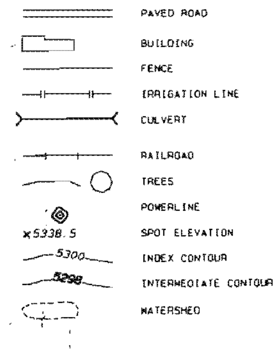
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	28.200	0.141	0.000	0.000	78.000	M	21.30	1.14
	2	17.600	0.265	0.000	0.000	86.000	M	18.80	1.25
	S	**45.800**						**40.10**	**2.38**

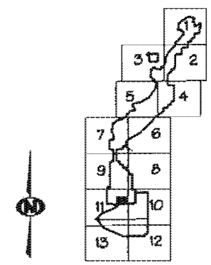
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	7.69	25.00	325.00	2.770	0.032
		8. Large gullies, diversions, and low flowing streams	1.64	25.00	1,520.00	3.840	0.109
#1	**1**	**Time of Concentration:**					**0.141**
#1	2	8. Large gullies, diversions, and low flowing streams	0.50	10.00	2,020.20	2.110	0.265
#1	**2**	**Time of Concentration:**					**0.265**



LEGEND





REV. NO.	DATE	DRAFT BY	REVISION DESCRIPTION					
B	8-07-00	PJF	Revised Watershed Bndy for CR Pond 4	LR	MC	LR		
A	10-20-98	RY	Generated Watershed for CR#4 Pond based on AOC surface.					

NAVAJO COAL COMPANY

NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

AREA 3

SOUTH DIXON
COLLYER ROAD POND 4

PREPARED BY RY	DRAWN BY RY	SCALE 1" = 800'
APPROVED BY LR	DATE 10-20-98	REF DWG
DWG LOC D:\LOWE-DIXON\AREA3-TOPO-PTS.pro		

South Dixon Pond 4

The watershed is shown on Exhibit 11-13E and the pond design is presented on Exhibit 11-118.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	44.900	44.900	52.81	4.35

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	44.900	0.315	0.000	0.000	91.000	M	52.81	4.35
	S	**44.900**						**52.81**	**4.35**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.23	98.50	2,330.03	2.050	0.315
#1	**1**	**Time of Concentration:**					**0.315**

PAGES 234 THROUGH 259 BLANK
DUE TO SOUTH DIXON PONDS 5 AND 6 REMOVAL

North Fork Highwall Impoundment As-built

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#2	0.000	0.000	NF Highwll Imp.
Channel	#2	==>	End	0.000	0.000	Riprapped out flow chan

#1
Pond

#2
Chan'l

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	73.400	73.400	59.19	5.03
	Out			17.13	5.03
#2		0.000	73.400	17.13	5.03

Structure Detail:

Structure #1 (Pond)

NF Highwll Imp.

Pond Inputs:

Initial Pool Elev:	5,288.10
Initial Pool:	7.82 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,288.10	32.00	3.00:1	3.00:1	14.50

Pond Results:

Peak Elevation:	5,288.67
Dewater Time:	0.53 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,280.00	0.000	0.000	0.000		
5,281.00	0.010	0.004	0.000		
5,282.00	0.050	0.031	0.000		
5,283.00	0.140	0.122	0.000		
5,284.00	0.340	0.355	0.000		
5,285.00	0.730	0.878	0.000		
5,286.00	1.680	2.050	0.000		
5,287.00	3.000	4.359	0.000		
5,288.00	3.260	7.488	0.000		
5,288.10	3.310	7.817	0.000		Spillway #1
5,288.67	3.594	9.824	17.127	12.60	Peak Stage
5,289.00	3.760	10.996	27.118		
5,289.70	4.800	13.985	83.947		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,280.00	0.000	0.000
5,281.00	0.000	0.000
5,282.00	0.000	0.000
5,283.00	0.000	0.000
5,284.00	0.000	0.000
5,285.00	0.000	0.000
5,286.00	0.000	0.000
5,287.00	0.000	0.000
5,288.00	0.000	0.000
5,288.10	0.000	0.000
5,289.00	27.118	27.118
5,289.70	83.947	83.947

Structure #2 (Riprap Channel)

Riprapped out flow chan

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
13.00	2.5:1	2.5:1	5.7	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	17.13 cfs	
Depth:	0.21 ft	1.21 ft
Top Width:	14.04 ft	19.04 ft
Velocity*:		
X-Section Area:	2.82 sq ft	
Hydraulic Radius:	0.199	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	73.400	0.346	0.000	0.000	91.000	M	59.19	5.029
	Σ	**73.400**						**59.19**	**5.029**
#2	**Σ**	**73.400**						**17.13**	**5.029**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.75	27.00	400.00	2.590	0.042
		8. Large gullies, diversions, and low flowing streams	5.50	55.00	1,000.00	7.030	0.039
		5. Nearly bare and untilled, and alluvial valley fans	2.50	30.00	1,200.00	1.580	0.210
		8. Large gullies, diversions, and low flowing streams	1.00	6.00	600.00	3.000	0.055
#1	**1**	**Time of Concentration:**					**0.346**

Area 4 North Pond 1

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-110.

The pond is design to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

The inlet structure to the pond is design to be stable for the 25 year- 6 hour storm event and the capacity design is for the 100 year-6 hour storm.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Area 4 North Pd 1 & ripraped inlet str.

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	40.400	40.400	31.13	2.77

Structure Detail:

Structure #1 (Riprap Channel)

Area 4 North Pd 1 & ripraped inlet str.

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	12.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	31.13 cfs	
Depth:	0.33 ft	1.33 ft
Top Width:	9.99 ft	15.99 ft
Velocity*:		
X-Section Area:	2.98 sq ft	
Hydraulic Radius:	0.295	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	40.400	0.385	0.000	0.000	91.000	M	31.13	2.768
	Σ	**40.400**						**31.13**	**2.768**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.59	5.00	853.00	0.760	0.311
		8. Large gullies, diversions, and low flowing streams	3.16	45.00	1,423.00	5.330	0.074
#1	**1**	**Time of Concentration:**					**0.385**

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	40.400	40.400	44.00	3.92

Structure Detail:

Structure #1 (Riprap Channel)

Area 4 North Pd 1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	12.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	44.00 cfs	
Depth:	0.43 ft	1.43 ft
Top Width:	10.57 ft	16.57 ft
Velocity*:		
X-Section Area:	3.98 sq ft	
Hydraulic Radius:	0.372	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Area 4 North Pond 3

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-115.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Area 4 North Pond 3

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	8.600	8.600	21.09	0.83

Structure Detail:

Structure #1 (Null)

Area 4 North Pond 3

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	8.600	0.019	0.000	0.000	91.000	M	21.09	0.833
	Σ	**8.600**						**21.09**	**0.833**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.00	6.00	100.00	2.440	0.011
		8. Large gullies, diversions, and low flowing streams	20.95	88.00	420.00	13.730	0.008
#1	**1**	**Time of Concentration:**					**0.019**

Area 4 North Pond 4

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-118.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

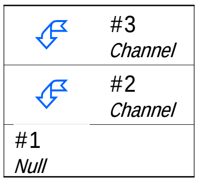
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 4
Channel	#2	==>	#1	0.013	0.443	Southwest Berm to Pond 4
Channel	#3	==>	#1	0.006	0.452	Northeast Berm to Pond 4



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	19.68	124.00	630.00	13.30	0.013
#2	**Muskingum K:**					**0.013**
#3	8. Large gullies, diversions, and low flowing streams	28.57	100.00	350.00	16.03	0.006
#3	**Muskingum K:**					**0.006**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	0.200	0.200	0.49	0.02
#2	6.600	6.600	16.19	0.64
#1	39.500	46.300	75.64	4.49

Structure Detail:

Structure #3 (Erodible Channel)

Northeast Berm to Pond 4

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	1.3	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.35 ft	1.35 ft
Top Width:	1.41 ft	5.41 ft
Velocity:	1.98 fps	
X-Section Area:	0.25 sq ft	
Hydraulic Radius:	0.157	
Froude Number:	0.83	

Structure #2 (Erodible Channel)

Southwest Berm to Pond 4

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	1.5:1	3.0:1	0.2	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.94 ft	1.94 ft
Top Width:	10.21 ft	14.71 ft
Velocity:	2.13 fps	
X-Section Area:	7.59 sq ft	
Hydraulic Radius:	0.715	
Froude Number:	0.44	

Structure #1 (Null) Area 4N Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	0.200	0.033	0.000	0.000	91.000	M	0.49	0.02
	S	**0.200**						**0.49**	**0.02**
#2	1	6.600	0.084	0.000	0.000	91.000	M	16.19	0.64
	S	**6.600**						**16.19**	**0.64**
#1	1	39.500	0.133	0.000	0.000	91.000	M	63.76	3.83
	S	**46.300**						**75.64**	**4.49**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	15.00	572.01	1.610	0.098
		8. Large gullies, diversions, and low flowing streams	9.89	120.00	1,213.00	9.430	0.035
#1	**1**	**Time of Concentration:**					**0.133**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.45	10.00	155.00	2.540	0.016
		8. Large gullies, diversions, and low flowing streams	2.25	25.00	1,110.00	4.500	0.068
#2	**1**	**Time of Concentration:**					**0.084**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.22	4.00	180.00	1.490	0.033
#3	**1**	**Time of Concentration:**					**0.033**

Area 4 North Pond 4

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-118.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

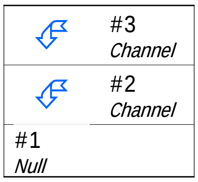
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 4
Channel	#2	==>	#1	0.013	0.443	Southwest Berm to Pond 4
Channel	#3	==>	#1	0.006	0.452	Northeast Berm to Pond 4



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	19.68	124.00	630.00	13.30	0.013
#2	**Muskingum K:**					**0.013**
#3	8. Large gullies, diversions, and low flowing streams	28.57	100.00	350.00	16.03	0.006
#3	**Muskingum K:**					**0.006**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	0.200	0.200	0.27	0.01
#2	6.600	6.600	8.98	0.32
#1	39.500	46.300	38.57	2.57

Structure Detail:

Structure #3 (Erodible Channel)

Northeast Berm to Pond 4

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	1.3	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.28 ft	1.28 ft
Top Width:	1.13 ft	5.13 ft
Velocity:	1.72 fps	
X-Section Area:	0.16 sq ft	
Hydraulic Radius:	0.127	
Froude Number:	0.80	

Structure #2 (Erodible Channel)

Southwest Berm to Pond 4

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	1.5:1	3.0:1	0.2	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.67 ft	1.67 ft
Top Width:	9.03 ft	13.53 ft
Velocity:	1.77 fps	
X-Section Area:	5.06 sq ft	
Hydraulic Radius:	0.543	
Froude Number:	0.42	

Structure #1 (Null) Area 4N Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	0.200	0.033	0.000	0.000	91.000	M	0.27	0.01
	S	**0.200**						**0.27**	**0.01**
#2	1	6.600	0.084	0.000	0.000	91.000	M	8.98	0.32
	S	**6.600**						**8.98**	**0.32**
#1	1	39.500	0.133	0.000	0.000	91.000	M	33.48	1.91
	S	**46.300**						**38.57**	**2.57**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	15.00	572.01	1.610	0.098
		8. Large gullies, diversions, and low flowing streams	9.89	120.00	1,213.00	9.430	0.035
#1	**1**	**Time of Concentration:**					**0.133**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.45	10.00	155.00	2.540	0.016
		8. Large gullies, diversions, and low flowing streams	2.25	25.00	1,110.00	4.500	0.068
#2	**1**	**Time of Concentration:**					**0.084**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.22	4.00	180.00	1.490	0.033
#3	**1**	**Time of Concentration:**					**0.033**

South Barber Pond - Ramp 5

Pond design is presented on Exhibit 11-050. The watershed area is shown on Exhibit 11-13D.

W. Napoleon

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Fruitland, NM 87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Barber R5 Pond

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	157.400	157.400	70.00	5.43

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	106.190	0.281	0.000	0.000	76.000	M	45.55	3.661
	2	51.210	0.221	0.000	0.000	76.000	M	24.44	1.766
	Σ	**157.400**						**70.00**	**5.426**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.79	13.56	756.94	1.330	0.158
		8. Large gullies, diversions, and low flowing streams	2.61	56.24	2,155.83	4.840	0.123
#1	**1**	**Time of Concentration:**					**0.281**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.31	10.00	432.56	1.520	0.079
		8. Large gullies, diversions, and low flowing streams	2.38	56.40	2,374.73	4.620	0.142
#1	**2**	**Time of Concentration:**					**0.221**

Lowe-Dixon Diversion Pond
Lowe-Dixon Diversion North Pond A

These impoundments are for stormwater control of surface water runoff from undisturbed areas upstream of Lowe Pit. There is no minimum storage containment requirement. A spillway for the Lowe-Dixon Diversion Pond is designed for a 25 yr - 6 hr storm event shown in this hydrology model.

The watershed subdivisions for the model are presented on Exhibit 11-13E. The plan, profile and typical sections are presented on Exhibit 11-150 and 11-151.

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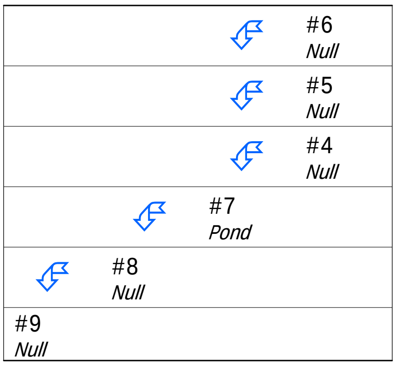
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#4	==>	#7	0.000	0.000	North inlet to LDD Pond
Null	#5	==>	#7	0.000	0.000	East inlet to LDD Pond
Null	#6	==>	#7	0.000	0.000	South inlet to LDD Pond
Pond	#7	==>	#8	0.000	0.000	Lowe-Dixon Diversion (LDD) Pond
Null	#8	==>	#9	0.000	0.000	LDD North Pond A
Null	#9	==>	End	0.000	0.000	Lowe Pit



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6		86.260	86.260	28.88	4.05
#5		25.510	25.510	15.97	1.20
#4		1,450.720	1,450.720	486.18	78.49
#7	In Out	40.670	1,603.160	537.50 423.69	85.72 85.72
#8		11.100	1,614.260	425.99	86.38
#9		0.000	1,614.260	425.99	86.38

Structure Detail:

Structure #6 (Null)

South inlet to LDD Pond

Structure #5 (Null)

East inlet to LDD Pond

Structure #4 (Null)

North inlet to LDD Pond

Structure #7 (Pond)

Lowe-Dixon Diversion (LDD) Pond

Pond Inputs:

Permanent Pool Elev:	5,387.70
Permanent Pool:	16.89 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,387.70	40.00	5.00:1	4.00:1	52.00

Pond Results:

Peak Elevation:	5,389.77
H'graph Detention Time:	0.37 hrs
Dewater Time:	0.38 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,376.00	0.000	0.000	0.000		
5,377.00	0.055	0.018	0.000		
5,378.00	0.220	0.147	0.000		
5,379.00	0.406	0.455	0.000		
5,380.00	0.648	0.977	0.000		
5,381.00	0.898	1.747	0.000		
5,382.00	1.188	2.786	0.000		
5,383.00	1.520	4.136	0.000		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,384.00	1.892	5.839	0.000		
5,385.00	2.448	8.003	0.000		
5,386.00	3.076	10.759	0.000		
5,387.00	3.700	14.142	0.000		
5,387.70	4.166	16.895	0.000		Spillway #1
5,387.80	4.230	17.313	13.721	4.80	
5,388.00	4.358	18.172	41.297	1.10	
5,389.00	5.970	23.315	179.045	2.00	
5,389.77	7.441	28.637	423.693	1.30	Peak Stage
5,390.00	7.835	30.197	495.419		
5,391.00	9.254	38.731	955.522		
5,392.00	10.790	48.743	1,564.630		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,376.00	0.000	0.000
5,377.00	0.000	0.000
5,378.00	0.000	0.000
5,379.00	0.000	0.000
5,380.00	0.000	0.000
5,381.00	0.000	0.000
5,382.00	0.000	0.000
5,383.00	0.000	0.000
5,384.00	0.000	0.000
5,385.00	0.000	0.000
5,386.00	0.000	0.000
5,387.00	0.000	0.000
5,387.70	0.000	0.000
5,387.80	13.721	13.721
5,388.00	41.297	41.297
5,389.00	179.045	179.045
5,390.00	495.419	495.419
5,391.00	955.522	955.522
5,392.00	1,564.630	1,564.630

Structure #8 (Null)

LDD North Pond A

Structure #9 (Null)

Lowe Pit

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	86.260	0.958	0.000	0.000	86.100	M	28.88	4.05
	S	**86.260**						**28.88**	**4.05**
#5	1	25.510	0.356	0.000	0.000	86.100	M	15.97	1.20
	S	**25.510**						**15.97**	**1.20**
#4	1	470.600	1.257	0.387	0.350	87.000	M	138.69	23.75
	2	166.700	1.396	0.534	0.354	81.100	M	26.77	5.16
	3	66.500	0.818	0.534	0.354	82.600	M	18.27	2.34
	4	96.300	0.766	0.389	0.341	90.200	M	52.64	6.21
	5	54.100	0.199	0.389	0.341	93.000	M	68.18	4.30
	6	112.200	0.398	0.332	0.342	92.700	M	109.83	8.72
	7	56.900	0.238	0.183	0.333	93.000	M	68.75	4.52
	8	89.500	0.413	0.183	0.333	91.900	M	81.35	6.56
	9	226.200	0.610	0.000	0.000	87.500	M	116.05	11.87
	10	78.400	0.397	0.000	0.000	85.400	M	43.92	3.48
	11	33.320	0.591	0.000	0.000	86.100	M	15.57	1.57
	S	**1,450.720**						**486.18**	**78.49**
#7	1	35.270	0.650	0.000	0.000	86.100	M	15.48	1.66
	2	5.400	0.000	0.000	0.000	89.000	M	8.98	0.32
	S	**1,603.160**						**537.50**	**85.72**
#8	1	11.100	0.258	0.000	0.000	89.000	M	9.95	0.65
	S	**1,614.260**						**425.99**	**86.38**
#9	**S**	**1,614.260**						**425.99**	**86.38**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.08	35.00	3,237.00	1.030	0.872
		8. Large gullies, diversions, and low flowing streams	2.41	155.00	6,442.00	4.650	0.384
#4	**1**	**Time of Concentration:**					**1.257**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	0.86	37.00	4,286.00	0.920	1.294
		8. Large gullies, diversions, and low flowing streams	4.10	92.00	2,243.00	6.070	0.102
#4	**2**	**Time of Concentration:**					**1.396**
#4	3	5. Nearly bare and untilled, and alluvial valley fans	0.93	23.00	2,478.00	0.960	0.717

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	3.83	82.00	2,141.00	5.870	0.101
#4	**3**	**Time of Concentration:**					**0.818**
#4	4	5. Nearly bare and untilled, and alluvial valley fans	0.63	10.00	1,582.00	0.790	0.556
		8. Large gullies, diversions, and low flowing streams	3.62	157.00	4,332.00	5.710	0.210
#4	**4**	**Time of Concentration:**					**0.766**
#4	5	5. Nearly bare and untilled, and alluvial valley fans	8.38	73.00	871.00	2.890	0.083
		8. Large gullies, diversions, and low flowing streams	2.64	54.00	2,043.00	4.870	0.116
#4	**5**	**Time of Concentration:**					**0.199**
#4	6	5. Nearly bare and untilled, and alluvial valley fans	4.90	80.00	1,632.02	2.210	0.205
		8. Large gullies, diversions, and low flowing streams	2.57	86.00	3,346.04	4.800	0.193
#4	**6**	**Time of Concentration:**					**0.398**
#4	7	5. Nearly bare and untilled, and alluvial valley fans	12.89	70.00	543.00	3.590	0.042
		8. Large gullies, diversions, and low flowing streams	1.40	35.00	2,508.00	3.540	0.196
#4	**7**	**Time of Concentration:**					**0.238**
#4	8	5. Nearly bare and untilled, and alluvial valley fans	3.98	30.00	754.00	1.990	0.105
		8. Large gullies, diversions, and low flowing streams	1.87	85.00	4,548.00	4.100	0.308
#4	**8**	**Time of Concentration:**					**0.413**
#4	9	5. Nearly bare and untilled, and alluvial valley fans	2.53	40.00	1,584.00	1.580	0.278
		8. Large gullies, diversions, and low flowing streams	1.61	73.00	4,546.00	3.800	0.332
#4	**9**	**Time of Concentration:**					**0.610**
#4	10	5. Nearly bare and untilled, and alluvial valley fans	3.26	50.00	1,536.00	1.800	0.237
		8. Large gullies, diversions, and low flowing streams	1.21	23.00	1,901.00	3.290	0.160
#4	**10**	**Time of Concentration:**					**0.397**
#4	11	5. Nearly bare and untilled, and alluvial valley fans	2.00	60.00	3,000.00	1.410	0.591
#4	**11**	**Time of Concentration:**					**0.591**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	2.21	42.00	1,900.02	1.480	0.356
#5	**1**	**Time of Concentration:**					**0.356**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	1.45	60.00	4,140.21	1.200	0.958
#6	**1**	**Time of Concentration:**					**0.958**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	1.43	40.00	2,788.03	1.190	0.650

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	**1**	**Time of Concentration:**					**0.650**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	1.88	24.00	1,275.03	1.370	0.258
#8	**1**	**Time of Concentration:**					**0.258**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	8. Large gullies, diversions, and low flowing streams	1.76	98.00	5,553.03	3.980	0.387
#4	**1**	**Muskingum K:**					**0.387**
#4	2	8. Large gullies, diversions, and low flowing streams	1.90	151.00	7,950.00	4.130	0.534
#4	**2**	**Muskingum K:**					**0.534**
#4	3	8. Large gullies, diversions, and low flowing streams	1.90	151.00	7,950.00	4.130	0.534
#4	**3**	**Muskingum K:**					**0.534**
#4	4	8. Large gullies, diversions, and low flowing streams	1.49	76.00	5,117.00	3.650	0.389
#4	**4**	**Muskingum K:**					**0.389**
#4	5	8. Large gullies, diversions, and low flowing streams	1.49	76.00	5,117.00	3.650	0.389
#4	**5**	**Muskingum K:**					**0.389**
#4	6	8. Large gullies, diversions, and low flowing streams	1.50	66.00	4,388.00	3.670	0.332
#4	**6**	**Muskingum K:**					**0.332**
#4	7	8. Large gullies, diversions, and low flowing streams	1.29	29.00	2,252.00	3.400	0.183
#4	**7**	**Muskingum K:**					**0.183**
#4	8	8. Large gullies, diversions, and low flowing streams	1.29	29.00	2,252.00	3.400	0.183
#4	**8**	**Muskingum K:**					**0.183**

Pages 364 through 376 removed by Rev 1002 submitted to OSM 1-13-10

North Fork Pond

This highwall pond is designed to contain the 100 yr - 6 hr storm event, therefore no spillway is required.

The watershed detail is presented on Exhibit 11-13E. The design plan, profile and typical sections are presented on Exhibit 11-152.

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General Information

Storm Information:

Storm Type:	Type II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	North Fork Pond

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	198.700	198.700	117.98	18.12

Structure Detail:

Structure #1 (Null)

North Fork Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	198.700	1.083	0.299	0.298	90.000	M	120.71	18.12
	S	**198.700**						**117.98**	**18.12**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.02	10.00	980.00	1.010	0.269
		5. Nearly bare and untilled, and alluvial valley fans	2.28	101.00	4,425.36	1.510	0.814
#1	**1**	**Time of Concentration:**					**1.083**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	0.70	19.00	2,702.00	2.510	0.299
#1	**1**	**Muskingum K:**					**0.299**

Area 4 North
Perimeter Road Pond 401

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-01.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 401

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	21.400	21.400	42.07	1.45

Structure Detail:

Structure #1 (Null)

Perimeter Road Pond 401

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	21.400	0.059	0.000	0.000	85.300	M	42.07	1.45
	S	**21.400**						**42.07**	**1.45**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	4.56	62.00	1,360.00	6.400	0.059
#1	**1**	**Time of Concentration:**					**0.059**

Area 4 North
Perimeter Road Pond 402

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-02.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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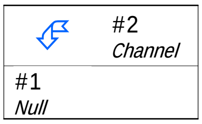
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 402
Channel	#2	==>	#1	0.000	0.000	Road Channel-East



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	60.800	60.800	88.97	5.21
#1	17.900	78.700	121.10	1.53

Structure Detail:

Structure #2 (Erodible Channel)

Road Channel-East

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	3.0:1	1.5:1	0.8	0.0250	1.00			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.43 ft	2.43 ft
Top Width:	14.42 ft	18.92 ft
Velocity:	5.56 fps	
X-Section Area:	16.00 sq ft	
Hydraulic Radius:	1.065	
Froude Number:	0.93	

Structure #1 (Null)

Perimeter Road Pond 402

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	60.800	0.139	0.000	0.000	89.000	M	88.97	5.21
	S	**60.800**						**88.97**	**5.21**
#1	1	17.900	0.015	0.000	0.000	89.000	M	40.87	1.53
	S	**78.700**						**121.10**	**1.53**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	15.00	6.00	40.00	3.870	0.002
		8. Large gullies, diversions, and low flowing streams	15.00	84.00	560.00	11.610	0.013
#1	**1**	**Time of Concentration:**					**0.015**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	10.00	150.00	2.580	0.016
		8. Large gullies, diversions, and low flowing streams	3.90	103.00	2,640.01	5.920	0.123
#2	**1**	**Time of Concentration:**					**0.139**

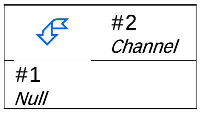
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 402
Channel	#2	==>	#1	0.000	0.000	Road Channel-East



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	60.800	60.800	50.91	3.58
#1	17.900	78.700	68.56	6.26

Structure Detail:

Structure #2 (Erodible Channel)

Road Channel-East

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	3.0:1	1.5:1	0.8	0.0250	1.00			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.05 ft	2.05 ft
Top Width:	12.72 ft	17.22 ft
Velocity:	4.69 fps	
X-Section Area:	10.86 sq ft	
Hydraulic Radius:	0.825	
Froude Number:	0.89	

Structure #1 (Null)

Perimeter Road Pond 402

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	60.800	0.139	0.000	0.000	89.000	M	50.91	3.58
	S	**60.800**						**50.91**	**3.58**
#1	1	17.900	0.015	0.000	0.000	89.000	M	24.18	1.05
	S	**78.700**						**68.56**	**6.26**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	15.00	6.00	40.00	3.870	0.002
		8. Large gullies, diversions, and low flowing streams	15.00	84.00	560.00	11.610	0.013
#1	**1**	**Time of Concentration:**					**0.015**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	10.00	150.00	2.580	0.016
		8. Large gullies, diversions, and low flowing streams	3.90	103.00	2,640.01	5.920	0.123
#2	**1**	**Time of Concentration:**					**0.139**

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	12.0	1.00		

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.48 ft	1.48 ft
Top Width:	10.86 ft	16.86 ft
Velocity*:		
X-Section Area:	4.49 sq ft	
Hydraulic Radius:	0.408	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Area 4 North
Perimeter Road Pond 404

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-04.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 404

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	9.800	9.800	22.38	0.84

Structure Detail:

Structure #1 (Null)

Perimeter Road Pond 404

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	9.800	0.012	0.000	0.000	89.000	M	22.38	0.84
	S	**9.800**						**22.38**	**0.84**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	10.48	44.00	420.00	9.710	0.012
#1	**1**	**Time of Concentration:**					**0.012**

Area 4 North Pond 405

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-5.

The pond is design to retain the 100 yr-6 hr storm event. No spillway is required.

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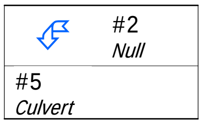
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#2	==>	#5	0.000	0.000	A4N Pond 405
Culvert	#5	==>	End	0.000	0.000	CP-189 Culvert under road



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	89.700	89.700	131.26	7.68
#5	0.000	89.700	131.26	7.68

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	89.700	0.146	0.000	0.000	89.000	M	131.26	7.68
	S	**89.700**						**131.26**	**7.68**
#5	**S**	**89.700**						**131.26**	**7.68**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	4.59	155.00	3,380.07	6.420	0.146
#2	**1**	**Time of Concentration:**					**0.146**

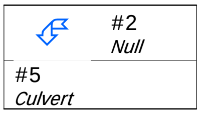
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#2	==>	#5	0.000	0.000	A4N Pond 405
Culvert	#5	==>	End	0.000	0.000	CP-189 Culvert under road



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	89.700	89.700	84.63	3.62
#5	0.000	89.700	84.63	3.62

Structure Detail:

Structure #2 (Null)

A4N Pond 405

Structure #5 (Culvert)

CP-189 Culvert under road

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
280.00	5.70	0.0150	23.00	0.00	0.90

Culvert Results:

Minimum pipe diameter required: 30 inches

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	89.700	0.146	0.000	0.000	89.000	F	84.63	3.62
	S	**89.700**						**84.63**	**3.62**
#5	**S**	**89.700**						**84.63**	**3.62**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	4.59	155.00	3,380.07	6.420	0.146
#2	**1**	**Time of Concentration:**					**0.146**

Area 4 North Pond 406

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-156.

The pond is designed to retain the 100-yr 6-hr storm event, therefore a spillway is not required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 406

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	238.100	238.100	97.07	9.83

Structure Detail:

Structure #1 (Null)

A4N Pond 406

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	238.100	0.578	0.000	0.000	78.300	M	97.07	9.83
	S	**238.100**						**97.07**	**9.83**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.87	20.00	1,070.03	1.360	0.218
		8. Large gullies, diversions, and low flowing streams	1.00	39.00	3,890.00	3.000	0.360
#1	**1**	**Time of Concentration:**					**0.578**

Area 4 North Pond 407

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-157.

The pond is designed to retain the 100-yr 6-hr storm event, therefore a spillway is not required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 407

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	124.800	124.800	142.00	9.98

Structure Detail:

Structure #1 (Null)

A4N Pond 407

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	124.800	0.306	0.000	0.000	87.900	M	142.00	9.98
	S	**124.800**						**142.00**	**9.98**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	6.00	760.00	0.880	0.239
		8. Large gullies, diversions, and low flowing streams	6.41	118.00	1,840.00	7.590	0.067
#1	**1**	**Time of Concentration:**					**0.306**

Area 4 North Pond 408

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-158.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

RYazzie

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 408

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.180	6.180	12.52	0.44

Structure Detail:

Structure #1 (Null)

A4N Pond 408

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	6.180	0.105	0.000	0.000	86.000	M	12.52	0.44
	S	**6.180**						**12.52**	**0.44**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.33	1.00	75.00	1.150	0.018
		8. Large gullies, diversions, and low flowing streams	0.66	5.10	767.60	2.440	0.087
#1	**1**	**Time of Concentration:**					**0.105**

Area 4 North Pond 3

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-115.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Area 4 North Pond 3

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	8.600	8.600	21.09	0.83

Structure Detail:

Structure #1 (Null)

Area 4 North Pond 3

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	8.600	0.019	0.000	0.000	91.000	M	21.09	0.833
	Σ	**8.600**						**21.09**	**0.833**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.00	6.00	100.00	2.440	0.011
		8. Large gullies, diversions, and low flowing streams	20.95	88.00	420.00	13.730	0.008
#1	**1**	**Time of Concentration:**					**0.019**

Area 4 North Pond 4

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-118.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

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PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

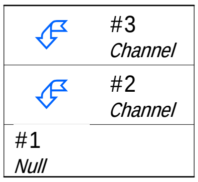
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 4
Channel	#2	==>	#1	0.013	0.443	Southwest Berm to Pond 4
Channel	#3	==>	#1	0.006	0.452	Northeast Berm to Pond 4



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	19.68	124.00	630.00	13.30	0.013
#2	**Muskingum K:**					**0.013**
#3	8. Large gullies, diversions, and low flowing streams	28.57	100.00	350.00	16.03	0.006
#3	**Muskingum K:**					**0.006**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	0.200	0.200	0.49	0.02
#2	6.600	6.600	16.19	0.64
#1	39.500	46.300	75.64	4.49

Structure Detail:

Structure #3 (Erodible Channel)

Northeast Berm to Pond 4

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	1.3	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.35 ft	1.35 ft
Top Width:	1.41 ft	5.41 ft
Velocity:	1.98 fps	
X-Section Area:	0.25 sq ft	
Hydraulic Radius:	0.157	
Froude Number:	0.83	

Structure #2 (Erodible Channel)

Southwest Berm to Pond 4

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	1.5:1	3.0:1	0.2	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.94 ft	1.94 ft
Top Width:	10.21 ft	14.71 ft
Velocity:	2.13 fps	
X-Section Area:	7.59 sq ft	
Hydraulic Radius:	0.715	
Froude Number:	0.44	

Structure #1 (Null) Area 4N Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	0.200	0.033	0.000	0.000	91.000	M	0.49	0.02
	S	**0.200**						**0.49**	**0.02**
#2	1	6.600	0.084	0.000	0.000	91.000	M	16.19	0.64
	S	**6.600**						**16.19**	**0.64**
#1	1	39.500	0.133	0.000	0.000	91.000	M	63.76	3.83
	S	**46.300**						**75.64**	**4.49**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	15.00	572.01	1.610	0.098
		8. Large gullies, diversions, and low flowing streams	9.89	120.00	1,213.00	9.430	0.035
#1	**1**	**Time of Concentration:**					**0.133**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.45	10.00	155.00	2.540	0.016
		8. Large gullies, diversions, and low flowing streams	2.25	25.00	1,110.00	4.500	0.068
#2	**1**	**Time of Concentration:**					**0.084**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.22	4.00	180.00	1.490	0.033
#3	**1**	**Time of Concentration:**					**0.033**

Area 4 North Pond 4

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-118.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

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Fruitland, NM 87416

Phone: 505 598 2007

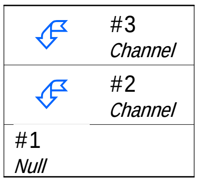
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 4
Channel	#2	==>	#1	0.013	0.443	Southwest Berm to Pond 4
Channel	#3	==>	#1	0.006	0.452	Northeast Berm to Pond 4



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	19.68	124.00	630.00	13.30	0.013
#2	**Muskingum K:**					**0.013**
#3	8. Large gullies, diversions, and low flowing streams	28.57	100.00	350.00	16.03	0.006
#3	**Muskingum K:**					**0.006**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	0.200	0.200	0.27	0.01
#2	6.600	6.600	8.98	0.32
#1	39.500	46.300	38.57	2.57

Structure Detail:

Structure #3 (Erodible Channel)

Northeast Berm to Pond 4

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	1.3	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.28 ft	1.28 ft
Top Width:	1.13 ft	5.13 ft
Velocity:	1.72 fps	
X-Section Area:	0.16 sq ft	
Hydraulic Radius:	0.127	
Froude Number:	0.80	

Structure #2 (Erodible Channel)

Southwest Berm to Pond 4

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	1.5:1	3.0:1	0.2	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.67 ft	1.67 ft
Top Width:	9.03 ft	13.53 ft
Velocity:	1.77 fps	
X-Section Area:	5.06 sq ft	
Hydraulic Radius:	0.543	
Froude Number:	0.42	

Structure #1 (Null) Area 4N Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	0.200	0.033	0.000	0.000	91.000	M	0.27	0.01
	S	**0.200**						**0.27**	**0.01**
#2	1	6.600	0.084	0.000	0.000	91.000	M	8.98	0.32
	S	**6.600**						**8.98**	**0.32**
#1	1	39.500	0.133	0.000	0.000	91.000	M	33.48	1.91
	S	**46.300**						**38.57**	**2.57**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	15.00	572.01	1.610	0.098
		8. Large gullies, diversions, and low flowing streams	9.89	120.00	1,213.00	9.430	0.035
#1	**1**	**Time of Concentration:**					**0.133**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.45	10.00	155.00	2.540	0.016
		8. Large gullies, diversions, and low flowing streams	2.25	25.00	1,110.00	4.500	0.068
#2	**1**	**Time of Concentration:**					**0.084**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.22	4.00	180.00	1.490	0.033
#3	**1**	**Time of Concentration:**					**0.033**

Area 4 North
Perimeter Road Pond 401

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-01.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 401

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	21.400	21.400	42.07	1.45

Structure Detail:

Structure #1 (Null)

Perimeter Road Pond 401

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	21.400	0.059	0.000	0.000	85.300	M	42.07	1.45
	S	**21.400**						**42.07**	**1.45**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	4.56	62.00	1,360.00	6.400	0.059
#1	**1**	**Time of Concentration:**					**0.059**

Area 4 North
Perimeter Road Pond 402

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-02.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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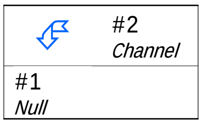
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 402
Channel	#2	==>	#1	0.000	0.000	Road Channel-East



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	60.800	60.800	88.97	5.21
#1	17.900	78.700	121.10	1.53

Structure Detail:

Structure #2 (Erodible Channel)

Road Channel-East

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	3.0:1	1.5:1	0.8	0.0250	1.00			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.43 ft	2.43 ft
Top Width:	14.42 ft	18.92 ft
Velocity:	5.56 fps	
X-Section Area:	16.00 sq ft	
Hydraulic Radius:	1.065	
Froude Number:	0.93	

Structure #1 (Null)

Perimeter Road Pond 402

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	60.800	0.139	0.000	0.000	89.000	M	88.97	5.21
	S	**60.800**						**88.97**	**5.21**
#1	1	17.900	0.015	0.000	0.000	89.000	M	40.87	1.53
	S	**78.700**						**121.10**	**1.53**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	15.00	6.00	40.00	3.870	0.002
		8. Large gullies, diversions, and low flowing streams	15.00	84.00	560.00	11.610	0.013
#1	**1**	**Time of Concentration:**					**0.015**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	10.00	150.00	2.580	0.016
		8. Large gullies, diversions, and low flowing streams	3.90	103.00	2,640.01	5.920	0.123
#2	**1**	**Time of Concentration:**					**0.139**

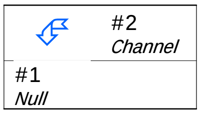
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 402
Channel	#2	==>	#1	0.000	0.000	Road Channel-East



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	60.800	60.800	50.91	3.58
#1	17.900	78.700	68.56	6.26

Structure Detail:

Structure #2 (Erodible Channel)

Road Channel-East

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	3.0:1	1.5:1	0.8	0.0250	1.00			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.05 ft	2.05 ft
Top Width:	12.72 ft	17.22 ft
Velocity:	4.69 fps	
X-Section Area:	10.86 sq ft	
Hydraulic Radius:	0.825	
Froude Number:	0.89	

Structure #1 (Null)

Perimeter Road Pond 402

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	60.800	0.139	0.000	0.000	89.000	M	50.91	3.58
	S	**60.800**						**50.91**	**3.58**
#1	1	17.900	0.015	0.000	0.000	89.000	M	24.18	1.05
	S	**78.700**						**68.56**	**6.26**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	15.00	6.00	40.00	3.870	0.002
		8. Large gullies, diversions, and low flowing streams	15.00	84.00	560.00	11.610	0.013
#1	**1**	**Time of Concentration:**					**0.015**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	10.00	150.00	2.580	0.016
		8. Large gullies, diversions, and low flowing streams	3.90	103.00	2,640.01	5.920	0.123
#2	**1**	**Time of Concentration:**					**0.139**

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	12.0	1.00		

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.48 ft	1.48 ft
Top Width:	10.86 ft	16.86 ft
Velocity*:		
X-Section Area:	4.49 sq ft	
Hydraulic Radius:	0.408	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

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Area 4N Pond 403

REV 1105

Pages 401 through 406

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Area 4N Pond 404 and 405

REV 1306

Pages 407 through 422

Area 4 North Pond 406

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-156.

The pond is designed to retain the 100-yr 6-hr storm event, therefore a spillway is not required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 406

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	238.100	238.100	97.07	9.83

Structure Detail:

Structure #1 (Null)

A4N Pond 406

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	238.100	0.578	0.000	0.000	78.300	M	97.07	9.83
	S	**238.100**						**97.07**	**9.83**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.87	20.00	1,070.03	1.360	0.218
		8. Large gullies, diversions, and low flowing streams	1.00	39.00	3,890.00	3.000	0.360
#1	**1**	**Time of Concentration:**					**0.578**

Area 4 North Pond 407

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-157.

The pond is designed to retain the 100-yr 6-hr storm event, therefore a spillway is not required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 407

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	124.800	124.800	142.00	9.98

Structure Detail:

Structure #1 (Null)

A4N Pond 407

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	124.800	0.306	0.000	0.000	87.900	M	142.00	9.98
	S	**124.800**						**142.00**	**9.98**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	6.00	760.00	0.880	0.239
		8. Large gullies, diversions, and low flowing streams	6.41	118.00	1,840.00	7.590	0.067
#1	**1**	**Time of Concentration:**					**0.306**

Area 4 North Pond 408

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-158.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

RYazzie

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 408

#1 *Null*

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.180	6.180	12.52	0.44

Structure Detail:

Structure #1 (Null)

A4N Pond 408

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	6.180	0.105	0.000	0.000	86.000	M	12.52	0.44
	S	**6.180**						**12.52**	**0.44**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.33	1.00	75.00	1.150	0.018
		8. Large gullies, diversions, and low flowing streams	0.66	5.10	767.60	2.440	0.087
#1	**1**	**Time of Concentration:**					**0.105**

Area 4 North Pond 409

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-159

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

RYazzie

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Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 409

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	2.830	2.830	5.73	0.20

Structure Detail:

Structure #1 (Null)

A4N Pond 409

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	2.830	0.044	0.000	0.000	86.000	M	5.73	0.20
	S	**2.830**						**5.73**	**0.20**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.12	2.90	56.60	2.260	0.006
		8. Large gullies, diversions, and low flowing streams	2.24	13.80	614.75	4.490	0.038
#1	**1**	**Time of Concentration:**					**0.044**

Area 4 North Pond 410

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-159

The pond is design to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

RYazzie

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Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 410

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	2.370	2.370	4.80	0.17

Structure Detail:

Structure #1 (Null)

A4N Pond 410

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	2.370	0.059	0.000	0.000	86.000	M	4.80	0.17
	S	**2.370**						**4.80**	**0.17**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.67	1.90	113.50	1.290	0.024
		8. Large gullies, diversions, and low flowing streams	1.76	9.00	510.00	3.980	0.035
#1	**1**	**Time of Concentration:**					**0.059**

Area 4 North Pond 411

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-161

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

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Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 411

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.500	12.500	30.66	1.21

Structure Detail:

Structure #1 (Null)

A4N Pond 411

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.500	0.077	0.000	0.000	91.000	M	30.66	1.210
	Σ	**12.500**						**30.66**	**1.210**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.79	5.00	280.00	1.330	0.058
		8. Large gullies, diversions, and low flowing streams	9.85	65.00	660.00	9.410	0.019
#1	**1**	**Time of Concentration:**					**0.077**

Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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Phone: 505 598 2007

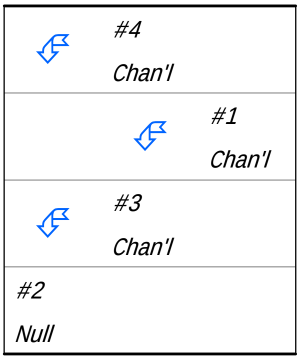
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	26.73	1.06
#1	5.300	5.300	13.00	0.51
#3	3.400	8.700	21.34	0.84
#2	11.000	30.600	75.05	2.96

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	26.73 cfs	
Depth:	0.21 ft	1.21 ft
Top Width:	11.26 ft	17.26 ft
Velocity*:		
X-Section Area:	2.24 sq ft	
Hydraulic Radius:	0.197 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Drainage Ditch

Trapezoidal Erodible Channel Inputs:

Material: Stiff clay very colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
4.00	3.0:1	3.0:1	3.2	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.00 cfs	
Depth:	0.48 ft	1.48 ft
Top Width:	6.90 ft	12.90 ft
Velocity:	4.94 fps	
X-Section Area:	2.63 sq ft	
Hydraulic Radius:	0.373 ft	
Froude Number:	1.41	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	21.34 cfs	
Depth:	0.30 ft	1.30 ft
Top Width:	7.81 ft	13.81 ft
Velocity*:		
X-Section Area:	2.08 sq ft	
Hydraulic Radius:	0.263 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 412

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	10.900	0.108	0.000	0.000	91.000	M	26.73	1.055
	Σ	**10.900**						**26.73**	**1.055**
#1	1	5.300	0.064	0.000	0.000	91.000	M	13.00	0.513
	Σ	**5.300**						**13.00**	**0.513**
#3	1	3.400	0.031	0.000	0.000	91.000	M	8.34	0.329
	Σ	**8.700**						**21.34**	**0.842**
#2	1	11.000	0.082	0.000	0.000	91.000	M	26.98	1.065
	Σ	**30.600**						**75.05**	**2.963**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr-6 hr storm events, respectively.

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PO Box 1717
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Phone: 505 598 2007

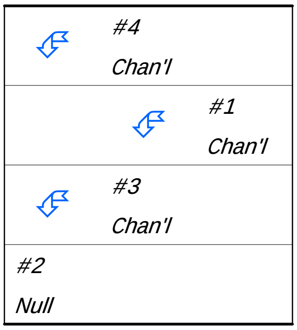
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	14.83	0.53
#1	5.300	5.300	7.21	0.26
#3	3.400	8.700	11.84	0.42
#2	11.000	30.600	41.64	1.48

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	14.83 cfs	
Depth:	0.13 ft	1.13 ft
Top Width:	10.79 ft	16.79 ft
Velocity*:		
X-Section Area:	1.38 sq ft	
Hydraulic Radius:	0.127 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Drainage Ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	3.2	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.21 cfs	
Depth:	0.85 ft	1.85 ft
Top Width:	3.40 ft	7.40 ft

	w/o Freeboard	w/ Freeboard
Velocity:	4.99 fps	
X-Section Area:	1.44 sq ft	
Hydraulic Radius:	0.380 ft	
Froude Number:	1.35	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.84 cfs	
Depth:	0.19 ft	1.19 ft
Top Width:	7.15 ft	13.15 ft
Velocity*:		
X-Section Area:	1.26 sq ft	
Hydraulic Radius:	0.175 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 412

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	10.900	0.108	0.000	0.000	91.000	M	14.83	0.527
	Σ	**10.900**						**14.83**	**0.527**
#1	1	5.300	0.064	0.000	0.000	91.000	M	7.21	0.256
	Σ	**5.300**						**7.21**	**0.256**
#3	1	3.400	0.031	0.000	0.000	91.000	M	4.63	0.164
	Σ	**8.700**						**11.84**	**0.420**
#2	1	11.000	0.082	0.000	0.000	91.000	M	14.97	0.532
	Σ	**30.600**						**41.64**	**1.479**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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Phone: 505 598 2007

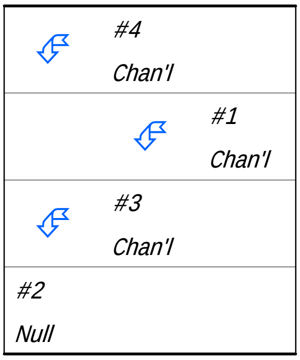
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	19.91	0.75
#1	5.300	5.300	9.68	0.36
#3	3.400	8.700	15.89	0.60
#2	11.000	30.600	55.89	2.09

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	19.91 cfs	
Depth:	0.17 ft	1.17 ft
Top Width:	11.00 ft	17.00 ft
Velocity*:		
X-Section Area:	1.75 sq ft	
Hydraulic Radius:	0.158 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Drainage Ditch

Trapezoidal Erodible Channel Inputs:

Material: Stiff clay very colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
4.00	3.0:1	3.0:1	3.2	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.68 cfs	
Depth:	0.41 ft	1.41 ft
Top Width:	6.46 ft	12.46 ft
Velocity:	4.50 fps	
X-Section Area:	2.15 sq ft	
Hydraulic Radius:	0.326 ft	
Froude Number:	1.38	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	15.89 cfs	
Depth:	0.24 ft	1.24 ft
Top Width:	7.44 ft	13.44 ft
Velocity*:		
X-Section Area:	1.61 sq ft	
Hydraulic Radius:	0.214 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 412

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	10.900	0.108	0.000	0.000	91.000	M	19.91	0.746
	Σ	**10.900**						**19.91**	**0.746**
#1	1	5.300	0.064	0.000	0.000	91.000	M	9.68	0.363
	Σ	**5.300**						**9.68**	**0.363**
#3	1	3.400	0.031	0.000	0.000	91.000	M	6.21	0.233
	Σ	**8.700**						**15.89**	**0.595**
#2	1	11.000	0.082	0.000	0.000	91.000	M	20.09	0.753
	Σ	**30.600**						**55.89**	**2.093**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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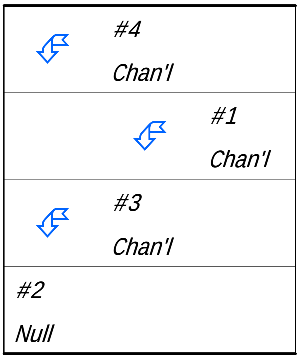
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Inlet B (West)
Channel	#4	==>	#2	0.000	0.000	Inlet A (East)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**
#4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#4	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	5.500	5.500	13.49	0.53
#1	1.300	1.300	2.10	0.10
#3	0.500	1.800	3.17	0.15
#2	3.000	10.300	24.02	0.97

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (East)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.49 cfs	
Depth:	0.18 ft	1.18 ft
Top Width:	7.07 ft	13.07 ft
Velocity*:		
X-Section Area:	1.16 sq ft	
Hydraulic Radius:	0.163 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	2.0	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.10 cfs	
Depth:	0.66 ft	1.66 ft
Top Width:	1.99 ft	4.99 ft
Velocity:	3.19 fps	
X-Section Area:	0.66 sq ft	
Hydraulic Radius:	0.276 ft	
Froude Number:	0.98	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	32.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.17 cfs	
Depth:	0.05 ft	1.05 ft
Top Width:	4.27 ft	10.27 ft
Velocity*:		
X-Section Area:	0.19 sq ft	
Hydraulic Radius:	0.044 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 413

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	5.500	0.120	0.002	0.431	91.000	M	13.49	0.533
	Σ	**5.500**						**13.49**	**0.533**
#1	1	1.300	0.156	0.000	0.000	91.000	M	2.10	0.102
	Σ	**1.300**						**2.10**	**0.102**
#3	1	0.500	0.011	0.000	0.455	91.000	M	1.23	0.048
	Σ	**1.800**						**3.17**	**0.151**
#2	1	3.000	0.030	0.000	0.000	91.000	M	7.36	0.290
	Σ	**10.300**						**24.02**	**0.974**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	4.00	360.00	1.050	0.095
		8. Large gullies, diversions, and low flowing streams	9.76	83.00	850.00	9.370	0.025
#4	**1**	**Time of Concentration:**					**0.120**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	33.33	15.00	45.00	17.320	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**1**	**Muskingum K:**					**0.000**
#4	1	8. Large gullies, diversions, and low flowing streams	12.38	13.00	105.00	10.550	0.002
#4	**1**	**Muskingum K:**					**0.002**

Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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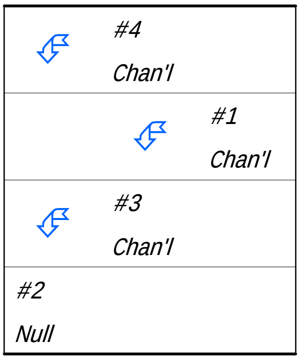
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Inlet B (West)
Channel	#4	==>	#2	0.000	0.000	Inlet A (East)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**
#4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#4	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	5.500	5.500	7.49	0.27
#1	1.300	1.300	1.10	0.05
#3	0.500	1.800	1.65	0.08
#2	3.000	10.300	13.21	0.49

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (East)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.49 cfs	
Depth:	0.11 ft	1.11 ft
Top Width:	6.68 ft	12.68 ft
Velocity*:		
X-Section Area:	0.72 sq ft	
Hydraulic Radius:	0.107 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	2.0	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.10 cfs	
Depth:	0.52 ft	1.52 ft
Top Width:	1.56 ft	4.56 ft
Velocity:	2.71 fps	
X-Section Area:	0.41 sq ft	
Hydraulic Radius:	0.216 ft	
Froude Number:	0.94	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	32.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.65 cfs	
Depth:	0.03 ft	1.03 ft
Top Width:	4.19 ft	10.19 ft
Velocity*:		
X-Section Area:	0.13 sq ft	
Hydraulic Radius:	0.031 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 413

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	5.500	0.120	0.002	0.431	91.000	M	7.49	0.266
	Σ	**5.500**						**7.49**	**0.266**
#1	1	1.300	0.156	0.000	0.000	91.000	M	1.10	0.051
	Σ	**1.300**						**1.10**	**0.051**
#3	1	0.500	0.011	0.000	0.455	91.000	M	0.68	0.024
	Σ	**1.800**						**1.65**	**0.075**
#2	1	3.000	0.030	0.000	0.000	91.000	M	4.08	0.145
	Σ	**10.300**						**13.21**	**0.486**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	4.00	360.00	1.050	0.095
		8. Large gullies, diversions, and low flowing streams	9.76	83.00	850.00	9.370	0.025
#4	**1**	**Time of Concentration:**					**0.120**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	33.33	15.00	45.00	17.320	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**1**	**Muskingum K:**					**0.000**
#4	1	8. Large gullies, diversions, and low flowing streams	12.38	13.00	105.00	10.550	0.002
#4	**1**	**Muskingum K:**					**0.002**

Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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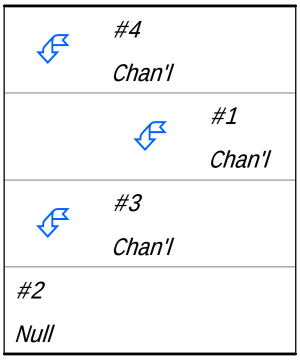
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Inlet B (West)
Channel	#4	==>	#2	0.000	0.000	Inlet A (East)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**
#4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#4	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	5.500	5.500	10.05	0.38
#1	1.300	1.300	1.52	0.07
#3	0.500	1.800	2.29	0.11
#2	3.000	10.300	17.81	0.69

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (East)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.05 cfs	
Depth:	0.14 ft	1.14 ft
Top Width:	6.85 ft	12.85 ft
Velocity*:		
X-Section Area:	0.91 sq ft	
Hydraulic Radius:	0.132 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	2.0	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.52 cfs	
Depth:	0.59 ft	1.59 ft
Top Width:	1.76 ft	4.76 ft
Velocity:	2.94 fps	
X-Section Area:	0.52 sq ft	
Hydraulic Radius:	0.244 ft	
Froude Number:	0.96	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	32.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.29 cfs	
Depth:	0.00 ft	
Top Width:	0.00 ft	
Velocity:	0.00 fps	
X-Section Area:	0.00 sq ft	
Hydraulic Radius:	0.000 ft	
Froude Number:	0.00	
Manning's n:	0.0000	
Dmin:	0.00 in	
D50:	0.00 in	
Dmax:	0.00 in	

Structure #2 (Null)

A4N Pond 413

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	5.500	0.120	0.002	0.431	91.000	M	10.05	0.376
	Σ	**5.500**						**10.05**	**0.376**
#1	1	1.300	0.156	0.000	0.000	91.000	M	1.52	0.072
	Σ	**1.300**						**1.52**	**0.072**
#3	1	0.500	0.011	0.000	0.455	91.000	M	0.91	0.034
	Σ	**1.800**						**2.29**	**0.107**
#2	1	3.000	0.030	0.000	0.000	91.000	M	5.48	0.205
	Σ	**10.300**						**17.81**	**0.688**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	4.00	360.00	1.050	0.095
		8. Large gullies, diversions, and low flowing streams	9.76	83.00	850.00	9.370	0.025
#4	**1**	**Time of Concentration:**					**0.120**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	33.33	15.00	45.00	17.320	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**1**	**Muskingum K:**					**0.000**
#4	1	8. Large gullies, diversions, and low flowing streams	12.38	13.00	105.00	10.550	0.002
#4	**1**	**Muskingum K:**					**0.002**

Area 4 North Pond 410

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-159

The pond is design to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

RYazzie

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 410

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	2.370	2.370	4.80	0.17

Structure Detail:

Structure #1 (Null)

A4N Pond 410

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	2.370	0.059	0.000	0.000	86.000	M	4.80	0.17
	S	**2.370**						**4.80**	**0.17**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.67	1.90	113.50	1.290	0.024
		8. Large gullies, diversions, and low flowing streams	1.76	9.00	510.00	3.980	0.035
#1	**1**	**Time of Concentration:**					**0.059**

Area 4 North Pond 411

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-161

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

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Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 411

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.500	12.500	30.66	1.21

Structure Detail:

Structure #1 (Null)

A4N Pond 411

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.500	0.077	0.000	0.000	91.000	M	30.66	1.210
	Σ	**12.500**						**30.66**	**1.210**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.79	5.00	280.00	1.330	0.058
		8. Large gullies, diversions, and low flowing streams	9.85	65.00	660.00	9.410	0.019
#1	**1**	**Time of Concentration:**					**0.077**

Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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Phone: 505 598 2007

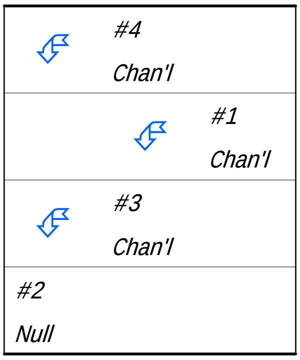
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	26.73	1.06
#1	5.300	5.300	13.00	0.51
#3	3.400	8.700	21.34	0.84
#2	11.000	30.600	75.05	2.96

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	26.73 cfs	
Depth:	0.21 ft	1.21 ft
Top Width:	11.26 ft	17.26 ft
Velocity*:		
X-Section Area:	2.24 sq ft	
Hydraulic Radius:	0.197 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Drainage Ditch

Trapezoidal Erodible Channel Inputs:

Material: Stiff clay very colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
4.00	3.0:1	3.0:1	3.2	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.00 cfs	
Depth:	0.48 ft	1.48 ft
Top Width:	6.90 ft	12.90 ft
Velocity:	4.94 fps	
X-Section Area:	2.63 sq ft	
Hydraulic Radius:	0.373 ft	
Froude Number:	1.41	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	21.34 cfs	
Depth:	0.30 ft	1.30 ft
Top Width:	7.81 ft	13.81 ft
Velocity*:		
X-Section Area:	2.08 sq ft	
Hydraulic Radius:	0.263 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 412

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	10.900	0.108	0.000	0.000	91.000	M	26.73	1.055
	Σ	**10.900**						**26.73**	**1.055**
#1	1	5.300	0.064	0.000	0.000	91.000	M	13.00	0.513
	Σ	**5.300**						**13.00**	**0.513**
#3	1	3.400	0.031	0.000	0.000	91.000	M	8.34	0.329
	Σ	**8.700**						**21.34**	**0.842**
#2	1	11.000	0.082	0.000	0.000	91.000	M	26.98	1.065
	Σ	**30.600**						**75.05**	**2.963**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr-6 hr storm events, respectively.

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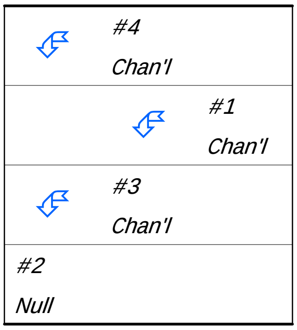
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	14.83	0.53
#1	5.300	5.300	7.21	0.26
#3	3.400	8.700	11.84	0.42
#2	11.000	30.600	41.64	1.48

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	14.83 cfs	
Depth:	0.13 ft	1.13 ft
Top Width:	10.79 ft	16.79 ft
Velocity*:		
X-Section Area:	1.38 sq ft	
Hydraulic Radius:	0.127 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Drainage Ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	3.2	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.21 cfs	
Depth:	0.85 ft	1.85 ft
Top Width:	3.40 ft	7.40 ft

	w/o Freeboard	w/ Freeboard
Velocity:	4.99 fps	
X-Section Area:	1.44 sq ft	
Hydraulic Radius:	0.380 ft	
Froude Number:	1.35	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.84 cfs	
Depth:	0.19 ft	1.19 ft
Top Width:	7.15 ft	13.15 ft
Velocity*:		
X-Section Area:	1.26 sq ft	
Hydraulic Radius:	0.175 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 412

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	10.900	0.108	0.000	0.000	91.000	M	14.83	0.527
	Σ	**10.900**						**14.83**	**0.527**
#1	1	5.300	0.064	0.000	0.000	91.000	M	7.21	0.256
	Σ	**5.300**						**7.21**	**0.256**
#3	1	3.400	0.031	0.000	0.000	91.000	M	4.63	0.164
	Σ	**8.700**						**11.84**	**0.420**
#2	1	11.000	0.082	0.000	0.000	91.000	M	14.97	0.532
	Σ	**30.600**						**41.64**	**1.479**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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Phone: 505 598 2007

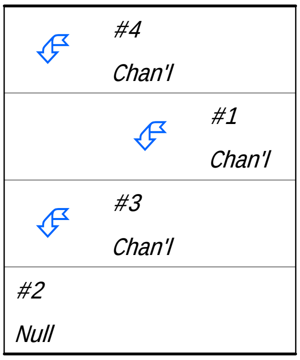
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	19.91	0.75
#1	5.300	5.300	9.68	0.36
#3	3.400	8.700	15.89	0.60
#2	11.000	30.600	55.89	2.09

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	19.91 cfs	
Depth:	0.17 ft	1.17 ft
Top Width:	11.00 ft	17.00 ft
Velocity*:		
X-Section Area:	1.75 sq ft	
Hydraulic Radius:	0.158 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Drainage Ditch

Trapezoidal Erodible Channel Inputs:

Material: Stiff clay very colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
4.00	3.0:1	3.0:1	3.2	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.68 cfs	
Depth:	0.41 ft	1.41 ft
Top Width:	6.46 ft	12.46 ft
Velocity:	4.50 fps	
X-Section Area:	2.15 sq ft	
Hydraulic Radius:	0.326 ft	
Froude Number:	1.38	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	15.89 cfs	
Depth:	0.24 ft	1.24 ft
Top Width:	7.44 ft	13.44 ft
Velocity*:		
X-Section Area:	1.61 sq ft	
Hydraulic Radius:	0.214 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 412

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	10.900	0.108	0.000	0.000	91.000	M	19.91	0.746
	Σ	**10.900**						**19.91**	**0.746**
#1	1	5.300	0.064	0.000	0.000	91.000	M	9.68	0.363
	Σ	**5.300**						**9.68**	**0.363**
#3	1	3.400	0.031	0.000	0.000	91.000	M	6.21	0.233
	Σ	**8.700**						**15.89**	**0.595**
#2	1	11.000	0.082	0.000	0.000	91.000	M	20.09	0.753
	Σ	**30.600**						**55.89**	**2.093**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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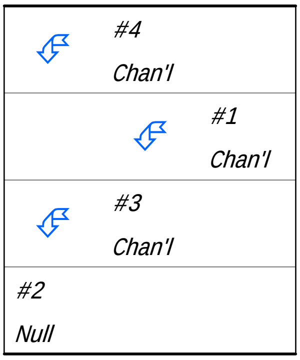
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Inlet B (West)
Channel	#4	==>	#2	0.000	0.000	Inlet A (East)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**
#4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#4	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	5.500	5.500	13.49	0.53
#1	1.300	1.300	2.10	0.10
#3	0.500	1.800	3.17	0.15
#2	3.000	10.300	24.02	0.97

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (East)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.49 cfs	
Depth:	0.18 ft	1.18 ft
Top Width:	7.07 ft	13.07 ft
Velocity*:		
X-Section Area:	1.16 sq ft	
Hydraulic Radius:	0.163 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	2.0	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.10 cfs	
Depth:	0.66 ft	1.66 ft
Top Width:	1.99 ft	4.99 ft
Velocity:	3.19 fps	
X-Section Area:	0.66 sq ft	
Hydraulic Radius:	0.276 ft	
Froude Number:	0.98	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	32.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.17 cfs	
Depth:	0.05 ft	1.05 ft
Top Width:	4.27 ft	10.27 ft
Velocity*:		
X-Section Area:	0.19 sq ft	
Hydraulic Radius:	0.044 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 413

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	5.500	0.120	0.002	0.431	91.000	M	13.49	0.533
	Σ	**5.500**						**13.49**	**0.533**
#1	1	1.300	0.156	0.000	0.000	91.000	M	2.10	0.102
	Σ	**1.300**						**2.10**	**0.102**
#3	1	0.500	0.011	0.000	0.455	91.000	M	1.23	0.048
	Σ	**1.800**						**3.17**	**0.151**
#2	1	3.000	0.030	0.000	0.000	91.000	M	7.36	0.290
	Σ	**10.300**						**24.02**	**0.974**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	4.00	360.00	1.050	0.095
		8. Large gullies, diversions, and low flowing streams	9.76	83.00	850.00	9.370	0.025
#4	**1**	**Time of Concentration:**					**0.120**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	33.33	15.00	45.00	17.320	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**1**	**Muskingum K:**					**0.000**
#4	1	8. Large gullies, diversions, and low flowing streams	12.38	13.00	105.00	10.550	0.002
#4	**1**	**Muskingum K:**					**0.002**

Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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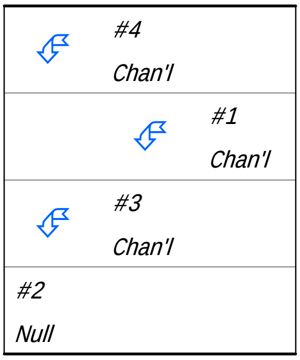
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Inlet B (West)
Channel	#4	==>	#2	0.000	0.000	Inlet A (East)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**
#4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#4	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	5.500	5.500	7.49	0.27
#1	1.300	1.300	1.10	0.05
#3	0.500	1.800	1.65	0.08
#2	3.000	10.300	13.21	0.49

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (East)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.49 cfs	
Depth:	0.11 ft	1.11 ft
Top Width:	6.68 ft	12.68 ft
Velocity*:		
X-Section Area:	0.72 sq ft	
Hydraulic Radius:	0.107 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	2.0	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.10 cfs	
Depth:	0.52 ft	1.52 ft
Top Width:	1.56 ft	4.56 ft
Velocity:	2.71 fps	
X-Section Area:	0.41 sq ft	
Hydraulic Radius:	0.216 ft	
Froude Number:	0.94	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	32.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.65 cfs	
Depth:	0.03 ft	1.03 ft
Top Width:	4.19 ft	10.19 ft
Velocity*:		
X-Section Area:	0.13 sq ft	
Hydraulic Radius:	0.031 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 413

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	5.500	0.120	0.002	0.431	91.000	M	7.49	0.266
	Σ	**5.500**						**7.49**	**0.266**
#1	1	1.300	0.156	0.000	0.000	91.000	M	1.10	0.051
	Σ	**1.300**						**1.10**	**0.051**
#3	1	0.500	0.011	0.000	0.455	91.000	M	0.68	0.024
	Σ	**1.800**						**1.65**	**0.075**
#2	1	3.000	0.030	0.000	0.000	91.000	M	4.08	0.145
	Σ	**10.300**						**13.21**	**0.486**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	4.00	360.00	1.050	0.095
		8. Large gullies, diversions, and low flowing streams	9.76	83.00	850.00	9.370	0.025
#4	**1**	**Time of Concentration:**					**0.120**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	33.33	15.00	45.00	17.320	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**1**	**Muskingum K:**					**0.000**
#4	1	8. Large gullies, diversions, and low flowing streams	12.38	13.00	105.00	10.550	0.002
#4	**1**	**Muskingum K:**					**0.002**

Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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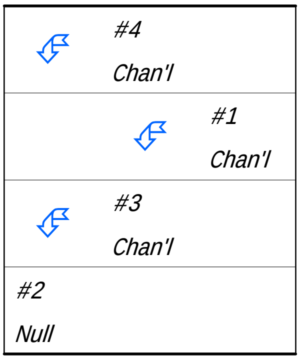
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Inlet B (West)
Channel	#4	==>	#2	0.000	0.000	Inlet A (East)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**
#4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#4	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	5.500	5.500	10.05	0.38
#1	1.300	1.300	1.52	0.07
#3	0.500	1.800	2.29	0.11
#2	3.000	10.300	17.81	0.69

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (East)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.05 cfs	
Depth:	0.14 ft	1.14 ft
Top Width:	6.85 ft	12.85 ft
Velocity*:		
X-Section Area:	0.91 sq ft	
Hydraulic Radius:	0.132 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	2.0	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.52 cfs	
Depth:	0.59 ft	1.59 ft
Top Width:	1.76 ft	4.76 ft
Velocity:	2.94 fps	
X-Section Area:	0.52 sq ft	
Hydraulic Radius:	0.244 ft	
Froude Number:	0.96	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	32.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.29 cfs	
Depth:	0.00 ft	
Top Width:	0.00 ft	
Velocity:	0.00 fps	
X-Section Area:	0.00 sq ft	
Hydraulic Radius:	0.000 ft	
Froude Number:	0.00	
Manning's n:	0.0000	
Dmin:	0.00 in	
D50:	0.00 in	
Dmax:	0.00 in	

Structure #2 (Null)

A4N Pond 413

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	5.500	0.120	0.002	0.431	91.000	M	10.05	0.376
	Σ	**5.500**						**10.05**	**0.376**
#1	1	1.300	0.156	0.000	0.000	91.000	M	1.52	0.072
	Σ	**1.300**						**1.52**	**0.072**
#3	1	0.500	0.011	0.000	0.455	91.000	M	0.91	0.034
	Σ	**1.800**						**2.29**	**0.107**
#2	1	3.000	0.030	0.000	0.000	91.000	M	5.48	0.205
	Σ	**10.300**						**17.81**	**0.688**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	4.00	360.00	1.050	0.095
		8. Large gullies, diversions, and low flowing streams	9.76	83.00	850.00	9.370	0.025
#4	**1**	**Time of Concentration:**					**0.120**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	33.33	15.00	45.00	17.320	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**1**	**Muskingum K:**					**0.000**
#4	1	8. Large gullies, diversions, and low flowing streams	12.38	13.00	105.00	10.550	0.002
#4	**1**	**Muskingum K:**					**0.002**

Pond 301

The watershed for Pond 301 is shown on Exhibit 11-13E. The detail design is on Exhibit 11-162.

This pond is designed to retain the 100 yr-6 hr storm event, therefore no spillway is required.

R. Yazzie

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

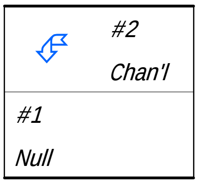
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 301
Channel	#2	==>	#1	0.000	0.000	Inlet Channel



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	32.900	32.900	50.60	2.44
#1	0.000	32.900	50.60	2.44

Structure Detail:

Structure #2 (Riprap Channel)

Inlet Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
18.00	2.0:1	2.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	50.60 cfs	
Depth:	0.32 ft	1.32 ft
Top Width:	19.27 ft	23.27 ft
Velocity*:		
X-Section Area:	5.90 sq ft	
Hydraulic Radius:	0.304 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

POND 301

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	32.900	0.154	0.000	0.000	90.000	M	50.60	2.437
	Σ	**32.900**						**50.60**	**2.437**
#1	Σ	**32.900**						**50.60**	**2.437**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	5. Nearly bare and untilled, and alluvial valley fans	4.29	6.00	140.00	2.070	0.018
		8. Large gullies, diversions, and low flowing streams	2.55	60.00	2,353.00	4.790	0.136
#2	**1**	**Time of Concentration:**					**0.154**

Pond 301

The watershed for Pond 301 is shown on Exhibit 11-13E. The detail design is on Exhibit 11-162.

The inlet channel is designed to be stable for the 10 yr-6 hr storm event.

Nov 2010

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

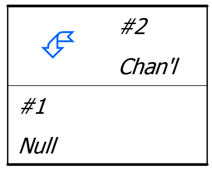
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 301
Channel	#2	==>	#1	0.000	0.000	Inlet Channel



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	32.900	32.900	23.50	1.07
#1	0.000	32.900	23.50	1.07

Structure Detail:

Structure #2 (Riprap Channel)

Inlet Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	2.0:1	2.0:1	10.0	0.70		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	23.50 cfs	
Depth:	0.32 ft	1.02 ft
Top Width:	7.30 ft	10.10 ft
Velocity*:		
X-Section Area:	2.15 sq ft	
Hydraulic Radius:	0.289 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

POND 301

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	32.900	0.154	0.000	0.000	90.000	M	23.50	1.068
	Σ	**32.900**						**23.50**	**1.068**
#1	Σ	**32.900**						**23.50**	**1.068**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	5. Nearly bare and untilled, and alluvial valley fans	4.29	6.00	140.00	2.070	0.018
		8. Large gullies, diversions, and low flowing streams	2.55	60.00	2,353.00	4.790	0.136
#2	**1**	**Time of Concentration:**					**0.154**

Pond 302

The watershed for this impoundment is shown on Exhibit 11-13E. The impoundment design is on Exhibit 11-162.

The pond is designed to retain the runoff from the 100-yr 6-hr storm event, therefore no spillway is required.

R. Yazzie

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

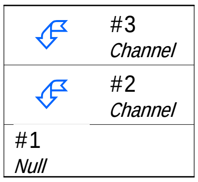
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 302
Channel	#2	==>	#1	0.000	0.000	West Inlet
Channel	#3	==>	#1	0.000	0.000	East Inlet



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	9.940	9.940	23.54	0.91
#2	28.400	28.400	67.27	2.59
#1	3.400	41.740	98.87	3.81

Structure Detail:

Structure #3 (Riprap Channel)

East Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	2.0:1	2.0:1	25.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.14 ft	1.14 ft
Top Width:	10.58 ft	14.58 ft
Velocity*:		
X-Section Area:	1.48 sq ft	
Hydraulic Radius:	0.139	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Riprap Channel)

West Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	2.0:1	2.0:1	20.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.35 ft	1.35 ft
Top Width:	13.40 ft	17.40 ft
Velocity*:		
X-Section Area:	4.45 sq ft	
Hydraulic Radius:	0.328	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

POND 302

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	9.940	0.029	0.000	0.000	90.000	M	23.54	0.91
	S	**9.940**						**23.54**	**0.91**
#2	1	28.400	0.121	0.000	0.000	90.000	M	67.27	2.59
	S	**28.400**						**67.27**	**2.59**
#1	1	3.400	0.017	0.000	0.000	90.000	M	8.05	0.31
	S	**41.740**						**98.87**	**3.81**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	4.16	119.64	1.860	0.017
#1	**1**	**Time of Concentration:**					**0.017**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.33	4.00	120.00	1.820	0.018
		8. Large gullies, diversions, and low flowing streams	3.20	64.00	2,000.00	5.360	0.103
#2	**1**	**Time of Concentration:**					**0.121**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	25.00	20.00	80.00	5.000	0.004
		8. Large gullies, diversions, and low flowing streams	5.97	40.00	670.00	7.330	0.025
#3	**1**	**Time of Concentration:**					**0.029**

Pond 302

The watershed for this impoundment is shown on Exhibit 11-13E. The impoundment design is on Exhibit 11-162.

The inlets to the pond are design to be stable for 10 yr -6 hr storm event.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87416
Phone: 505 598 2007

General Information

Storm Information:

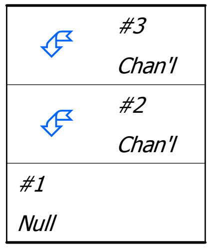
Storm Type:	NM TYPE II 70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.500 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	9.940	9.940	15.82	0.57
#2	28.400	28.400	45.19	1.61
#1	3.400	41.740	66.42	2.37

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 302
Channel	#2	==>	#1	0.000	0.000	West Inlet
Channel	#3	==>	#1	0.000	0.000	East Inlet



Structure Detail:

Structure #3 (Riprap Channel)

East Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	4.0:1	4.0:1	19.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	15.82 cfs	
Depth:	0.11 ft	1.11 ft
Top Width:	12.88 ft	20.88 ft
Velocity*:		
X-Section Area:	1.37 sq ft	
Hydraulic Radius:	0.106 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Riprap Channel)

West Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	4.0:1	4.0:1	20.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	45.19 cfs	
Depth:	0.26 ft	1.26 ft
Top Width:	14.04 ft	22.04 ft
Velocity*:		
X-Section Area:	3.32 sq ft	
Hydraulic Radius:	0.236 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

POND 302

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	9.940	0.029	0.000	0.000	90.000	M	15.82	0.565
	Σ	**9.940**						**15.82**	**0.565**
#2	1	28.400	0.121	0.000	0.000	90.000	M	45.19	1.615
	Σ	**28.400**						**45.19**	**1.615**
#1	1	3.400	0.017	0.000	0.000	90.000	M	5.41	0.193
	Σ	**41.740**						**66.42**	**2.373**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	4.16	119.64	1.860	0.017
#1	**1**	**Time of Concentration:**					**0.017**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.33	4.00	120.00	1.820	0.018
		8. Large gullies, diversions, and low flowing streams	3.20	64.00	2,000.00	5.360	0.103
#2	**1**	**Time of Concentration:**					**0.121**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	25.00	20.00	80.00	5.000	0.004
		8. Large gullies, diversions, and low flowing streams	5.97	40.00	670.00	7.330	0.025
#3	**1**	**Time of Concentration:**					**0.029**

POND 5 & CELL A2

The watershed areas for the ponds are presented on Exhibit 11-13B. The design for Pond 5 and Cell A2 are presented on Exhibits 11-105A and 11-106, respectively. The hydrology for Pond 5 was updated in conjunction with the North Cells design modification. The hydrology model for Pond 5 and Cell A2 is attach.

Updated June 2010

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#3	0.054	0.277	LIFT STATION 2
Null	#2	==>	#3	0.049	0.277	LIFT STATION 4
Null	#3	==>	#4	0.229	0.277	LIFT STATION 3
Null	#4	==>	#6	0.000	0.000	
Null	#5	==>	#6	0.000	0.000	
Pond	#6	==>	#7	0.000	0.000	POND 5
Null	#7	==>	End	0.000	0.000	CELL A2

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#5		13.100	13.100	5.16	0.24
#2		6.600	6.600	2.45	0.13
#1		1.200	1.200	1.88	0.09
#3		9.500	17.300	10.59	0.60
#4		0.000	17.300	9.10	0.60
#6	In	11.500	41.900	36.53	1.92
	Out			2.25	1.92
#7		10.000	51.900	16.28	2.67

Structure Detail:

Structure #5 (Null)

Structure #2 (Null)

LIFT STATION 4

Structure #1 (Null)

LIFT STATION 2

Structure #3 (Null)

LIFT STATION 3

Structure #4 (Null)

Structure #6 (Pond)

POND 5

Pond Inputs:

Initial Pool Elev:	5,328.75 ft
Initial Pool:	0.14 ac-ft

Pond Results:

Peak Elevation:	5,331.72 ft
Dewater Time:	0.14 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
5,328.40	0.390	0.000	0.000	
5,328.41	0.391	0.004	0.000	
5,328.60	0.403	0.079	0.000	
5,328.75	0.413	0.141	0.000	
5,329.00	0.430	0.246	2.250	
5,329.40	0.446	0.421	2.250	
5,330.00	0.470	0.696	2.250	
5,330.40	0.486	0.887	2.250	
5,331.00	0.510	1.186	2.250	
5,331.40	0.526	1.393	2.250	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,331.72	0.539	1.565	2.250	3.45	Peak Stage
5,332.00	0.550	1.716	2.250		
5,332.40	0.570	1.939	2.250		
5,333.00	0.600	2.290	2.250		

Detailed Discharge Table

Elevation (ft)	User-input discharge (cfs)	Combined Total Discharge (cfs)
5,328.40	0.000	0.000
5,328.41	0.000	0.000
5,328.60	0.000	0.000
5,328.75	0.000	0.000
5,329.00	2.250	2.250
5,329.40	2.250	2.250
5,330.00	2.250	2.250
5,330.40	2.250	2.250
5,331.00	2.250	2.250
5,331.40	2.250	2.250
5,332.00	2.250	2.250
5,332.40	2.250	2.250
5,333.00	2.250	2.250

Structure #7 (Null)

CELL A2

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	12.500	0.176	0.000	0.000	70.000	M	4.27	0.191
	2	0.600	0.198	0.000	0.000	91.000	M	0.90	0.045
	Σ	**13.100**						**5.16**	**0.236**
#2	1	0.500	0.198	0.045	0.277	91.000	M	0.75	0.038
	2	6.100	0.238	0.000	0.000	70.000	M	1.80	0.092
	Σ	**6.600**						**2.45**	**0.130**
#1	1	1.200	0.138	0.000	0.000	91.000	M	1.88	0.092
	Σ	**1.200**						**1.88**	**0.092**
#3	1	1.700	0.055	0.058	0.277	91.000	M	4.07	0.160
	2	1.300	0.119	0.000	0.000	91.000	M	3.11	0.122
	3	6.500	0.218	0.000	0.000	70.000	M	2.00	0.098
	Σ	**17.300**						**10.59**	**0.601**
#4	Σ	**17.300**						**9.10**	**0.601**
#6	1	11.500	0.069	0.000	0.000	91.000	M	27.51	1.080
	Σ	**41.900**						**36.53**	**1.917**
#7	1	10.000	0.256	0.000	0.000	91.000	M	14.03	0.754
	Σ	**51.900**						**16.28**	**2.671**

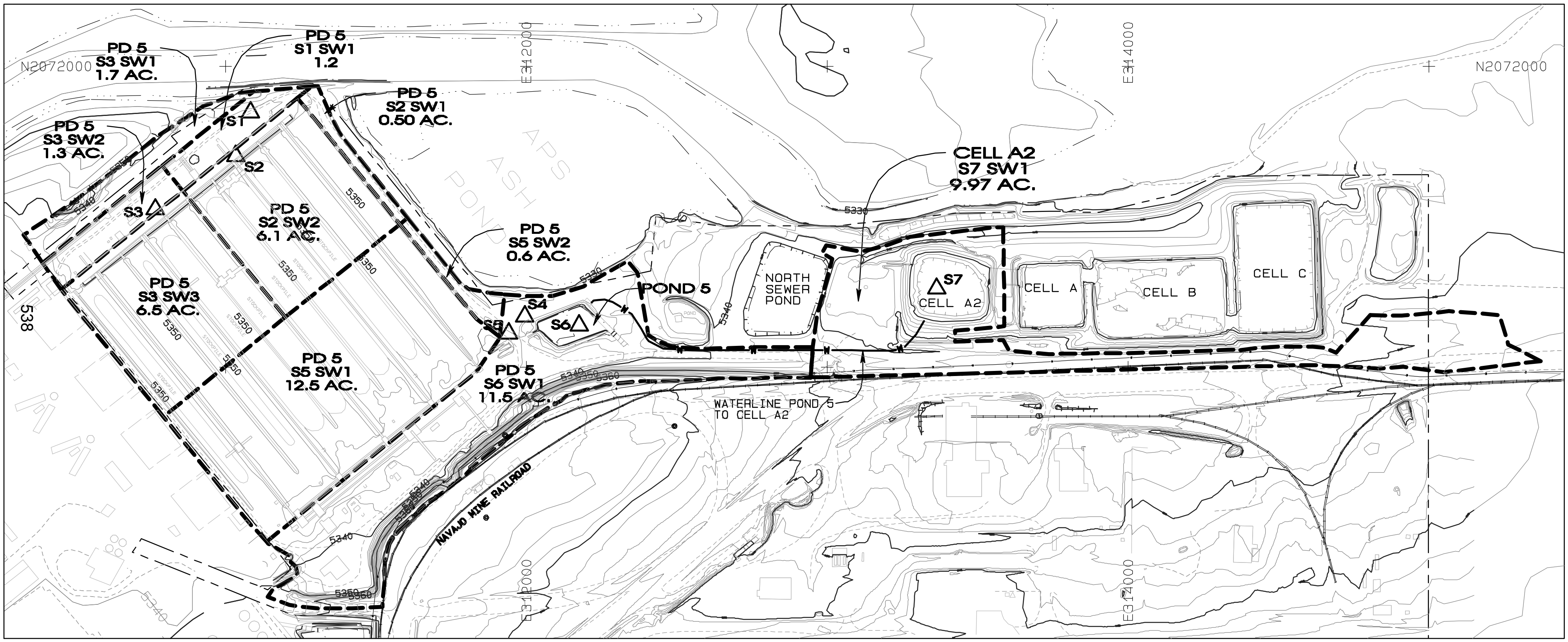
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.50	1.75	350.00	0.700	0.138
#1	**1**	**Time of Concentration:**					**0.138**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	0.50	2.50	500.00	0.700	0.198
#2	**1**	**Time of Concentration:**					**0.198**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	0.50	3.00	600.00	0.700	0.238
#2	**2**	**Time of Concentration:**					**0.238**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	16.00	400.00	2.000	0.055
#3	**1**	**Time of Concentration:**					**0.055**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.50	1.50	300.00	0.700	0.119
#3	**2**	**Time of Concentration:**					**0.119**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	3	5. Nearly bare and untilled, and alluvial valley fans	0.50	2.75	550.00	0.700	0.218
#3	**3**	**Time of Concentration:**					**0.218**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	3.00	33.00	1,100.00	1.730	0.176
#5	**1**	**Time of Concentration:**					**0.176**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	0.50	2.50	500.00	0.700	0.198
#5	**2**	**Time of Concentration:**					**0.198**
#6	1	8. Large gullies, diversions, and low flowing streams	3.00	39.00	1,300.00	5.190	0.069
#6	**1**	**Time of Concentration:**					**0.069**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	3.00	242.00	1.110	0.060
		8. Large gullies, diversions, and low flowing streams	1.15	26.00	2,266.00	3.210	0.196
#7	**1**	**Time of Concentration:**					**0.256**

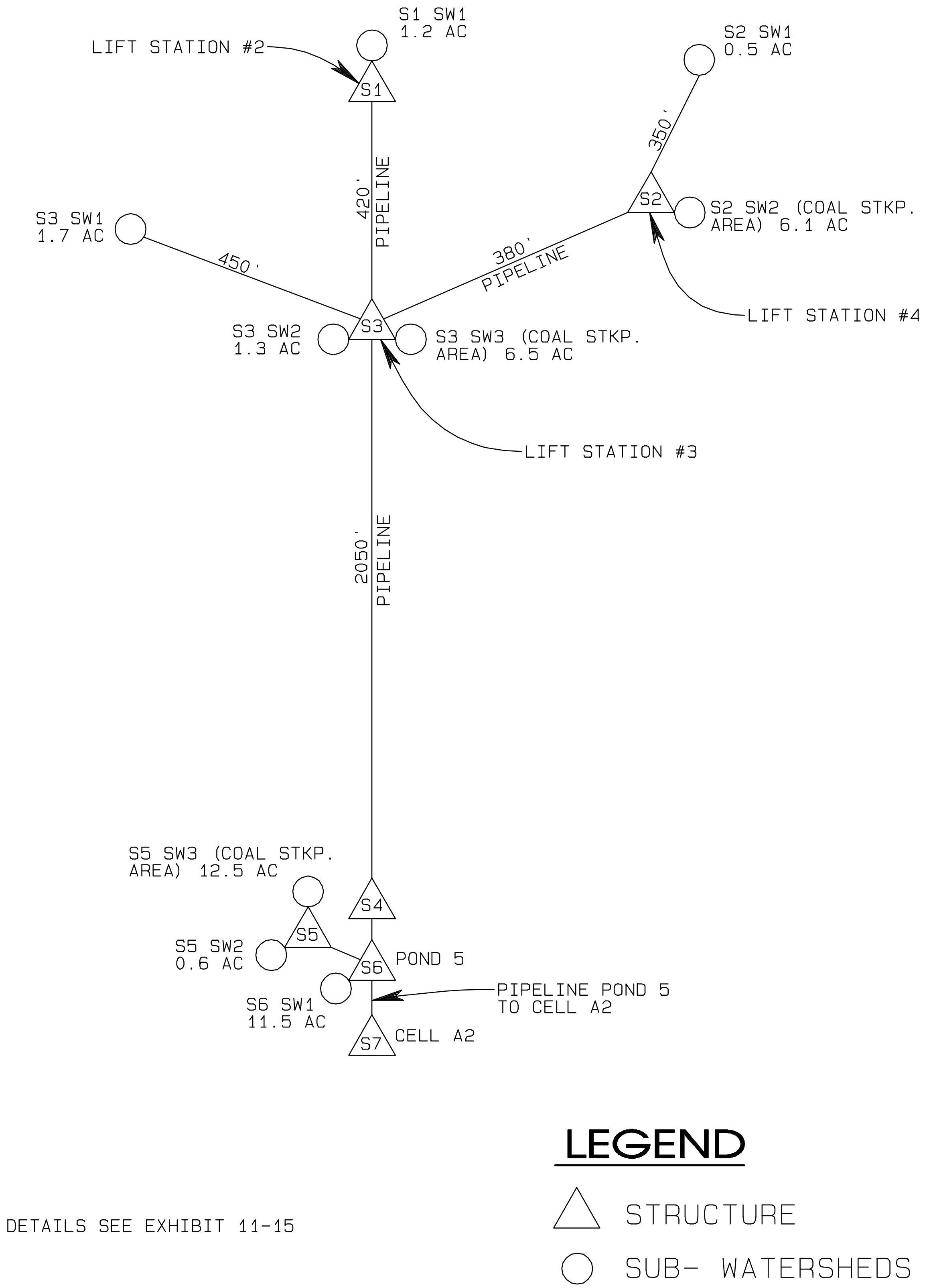
Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	0.50	1.75	350.00	2.120	0.045
#2	**1**	**Muskingum K:**					**0.045**
#3	1	8. Large gullies, diversions, and low flowing streams	0.50	2.25	450.00	2.120	0.058
#3	**1**	**Muskingum K:**					**0.058**



POND 5 & CELL A2
HYDROLOGY MODEL

POND 5 & CELL A2
SEDCAD MODELING SCHEMATIC



FOR MORE DETAILS SEE EXHIBIT 11-15

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Pages 540 through 554

DIXON POND-306

The watershed for this impoundment is shown on exhibit 11-13E. The impoindment design on Exhibit 11-169

The Pond is designed to retain the runoff from the 100 yr - 6 hr storm event, therefore no spillway is required.

R. Yazzie

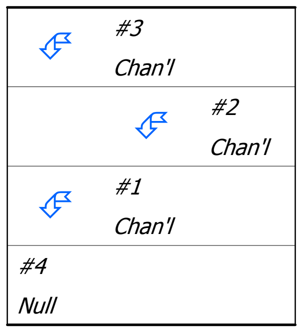
General Information

Storm Information:

Storm Type:	TYPE 11-70_RY
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#4	0.000	0.000	SOUTH INLET
Channel	#2	==>	#1	0.002	0.399	DRAIN INTO S0UTH INLET
Channel	#3	==>	#4	0.000	0.000	NORTH INLET
Null	#4	==>	End	0.000	0.000	DIXON POND-306



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	5.04	3.38	67.00	6.73	0.002
#2	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	58.230	58.230	70.67	3.33
#2	0.730	0.730	1.67	0.06
#1	0.850	1.580	3.61	0.14
#4	1.860	61.670	71.53	3.60

Structure Detail:

Structure #3 (Riprap Channel)

NORTH INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	2.0:1	2.0:1	12.6			

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	70.67 cfs	
Depth:	0.88 ft	
Top Width:	11.53 ft	
Velocity:	8.19 fps	
X-Section Area:	8.63 sq ft	
Hydraulic Radius:	0.722 ft	
Froude Number:	1.67	
Manning's n:	0.0520	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Structure #2 (Riprap Channel)

DRAIN INTO SOUTH INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	2.0:1	2.0:1	6.7			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.67 cfs	
Depth:	0.07 ft	
Top Width:	6.29 ft	
Velocity*:		
X-Section Area:	0.45 sq ft	
Hydraulic Radius:	0.072 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Riprap Channel)

SOUTH INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	2.0:1	2.0:1	17.7			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.61 cfs	
Depth:	0.06 ft	
Top Width:	6.24 ft	
Velocity*:		
X-Section Area:	0.37 sq ft	
Hydraulic Radius:	0.058 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Null)

DIXON POND-306

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	58.230	0.181	0.000	0.000	86.000	M	70.67	3.332
	Σ	**58.230**						**70.67**	**3.332**
#2	1	0.730	0.013	0.000	0.461	89.000	M	1.67	0.062
	Σ	**0.730**						**1.67**	**0.062**
#1	1	0.850	0.015	0.000	0.000	89.000	M	1.94	0.073
	Σ	**1.580**						**3.61**	**0.135**
#4	1	1.860	0.012	0.000	0.000	86.000	M	3.77	0.131
	Σ	**61.670**						**71.53**	**3.599**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	14.10	1.10	7.80	3.750	0.000
		8. Large gullies, diversions, and low flowing streams	5.67	22.70	400.30	7.140	0.015
#1	**1**	**Time of Concentration:**					**0.015**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.12	2.40	39.23	2.470	0.004
		8. Large gullies, diversions, and low flowing streams	7.10	19.00	267.53	7.990	0.009
#2	**1**	**Time of Concentration:**					**0.013**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.72	20.00	349.88	2.390	0.040
		8. Large gullies, diversions, and low flowing streams	1.61	31.19	1,937.83	3.800	0.141
#3	**1**	**Time of Concentration:**					**0.181**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	11.92	1.58	13.25	3.450	0.001
		8. Large gullies, diversions, and low flowing streams	2.48	4.73	190.66	4.720	0.011
#4	**1**	**Time of Concentration:**					**0.012**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	9. Small streams flowing bankfull	5.04	3.38	67.00	20.210	0.000
#2	**1**	**Muskingum K:**					**0.000**

GILMORE SILOS
POND 309A

For pond location and watershed refer to Exhibit 11-13E. The pond design is presented on Exhibit 11-171. Hydrology model is presented on the attach sheet.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: (505) 598-3317

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.970 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pond 309A

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	2.800	2.800	7.19	0.30

Structure Detail:

Structure #1 (Null)

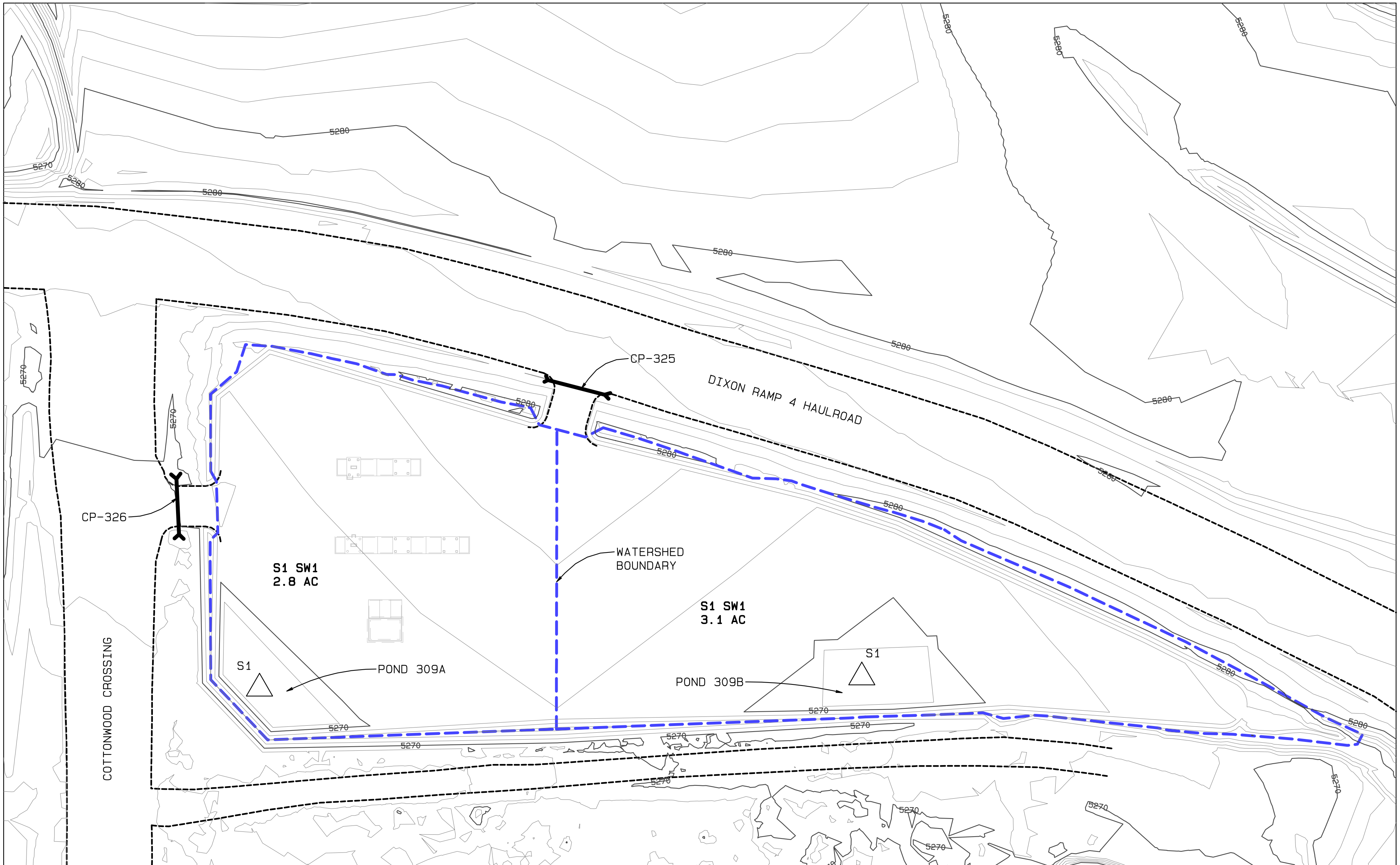
Pond 309A

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	2.800	0.065	0.000	0.000	93.000	M	7.19	0.300
	Σ	**2.800**						**7.19**	**0.300**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.29	14.00	426.00	1.810	0.065
#1	**1**	**Time of Concentration:**					**0.065**



GILMORE SILOS (AN & HEF)
WATER & SEDIMENT CONTROL STRUCTURES (PONDS)
HYDROLOGY MODEL

GILMORE SILOS

POND 309B

For pond location and watershed refer to Exhibit 11-13E. The pond design is presented on Exhibit 11-171. The hydrology model is presented on the attach sheet.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: (505) 598-3317

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.970 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pond 309B

#1

Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	3.080	3.080	7.91	0.33

Structure Detail:

Structure #1 (Null)

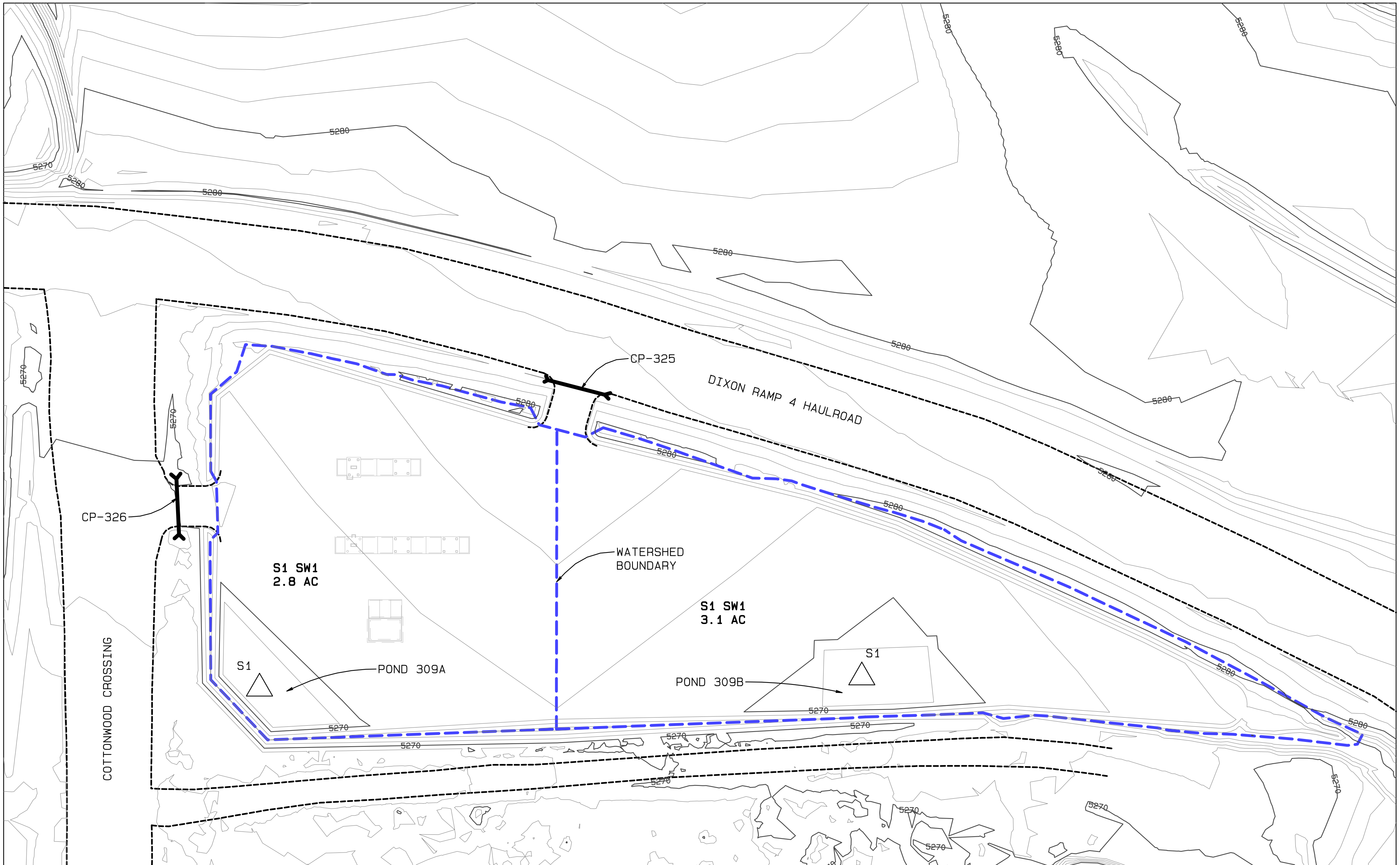
Pond 309B

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	3.080	0.049	0.000	0.000	93.000	M	7.91	0.330
	Σ	**3.080**						**7.91**	**0.330**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.98	14.00	352.00	1.990	0.049
#1	**1**	**Time of Concentration:**					**0.049**



GILMORE SILOS (AN & HEF)
WATER & SEDIMENT CONTROL STRUCTURES (PONDS)
HYDROLOGY MODEL

POND 414 AND DIVERSION CHANNEL
10-YEAR 6-HOUR

The pond is design to retain the surface runoff from the 100-yr 6-hr storm event.

The diversion channel and inlet structures to the pond are design to be stable for the 10-yr 6-hr storm event.

The watershed area for the pond is presented on Exh. 11-13F.

The designs for the pond and diversion channel are presented on Exh. 11-88 Sheet 1 & 2.

The gabion design for the South Inlet is attach.

The schematic of the hydrology model is shown on the attach sheet.

LR

BHP Navajo Coal Company

Fruitland, NM 87416

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#3	0.264	0.328	
Channel	#2	==>	#4	0.000	0.000	DIVERSION CHANNEL
Null	#3	==>	#5	0.000	0.000	SOUTH INLET (GABIONS)
Channel	#4	==>	#5	0.000	0.000	EAST INLET
Null	#5	==>	End	0.000	0.000	POND 414

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	1.17	36.00	3,080.00	3.24	0.264
#1	**Muskingum K:**					**0.264**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	61.330	61.330	24.79	1.46
#4	0.000	61.330	24.79	1.46
#1	292.100	292.100	116.78	8.45
#3	123.390	415.490	133.47	11.38
#5	0.000	476.820	142.92	12.84

Structure Detail:

Structure #2 (Erodible Channel)

DIVERSION CHANNEL

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	2.0:1	2.0:1	1.7	0.0270	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.79 cfs	
Depth:	0.59 ft	1.59 ft
Top Width:	10.34 ft	14.34 ft
Velocity:	4.61 fps	
X-Section Area:	5.38 sq ft	
Hydraulic Radius:	0.506 ft	
Froude Number:	1.13	

Structure #4 (Riprap Channel)

EAST INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
9.00	3.0:1	3.0:1	12.0			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.79 cfs	
Depth:	0.26 ft	
Top Width:	10.55 ft	
Velocity*:		
X-Section Area:	2.53 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.238 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

Structure #3 (Null)

SOUTH INLET (GABIONS)

Structure #5 (Null)

POND 414

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	61.330	0.347	0.000	0.000	87.000	M	24.79	1.462
	Σ	**61.330**						**24.79**	**1.462**
#4	**Σ**	**61.330**						**24.79**	**1.462**
#1	1	292.100	0.503	0.000	0.000	89.000	M	116.78	8.449
	Σ	**292.100**						**116.78**	**8.449**
#3	1	123.390	0.379	0.000	0.000	87.000	M	47.57	2.928
	Σ	**415.490**						**133.47**	**11.377**
#5	**Σ**	**476.820**						**142.92**	**12.839**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.82	47.00	1,230.01	1.950	0.175
		8. Large gullies, diversions, and low flowing streams	1.75	82.00	4,685.17	3.960	0.328
#1	**1**	**Time of Concentration:**					**0.503**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	4.44	11.00	248.00	2.100	0.032
		8. Large gullies, diversions, and low flowing streams	5.49	65.00	1,183.00	7.030	0.046
		5. Nearly bare and untilled, and alluvial valley fans	2.03	28.00	1,380.00	1.420	0.269
#2	**1**	**Time of Concentration:**					**0.347**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	17.00	923.00	1.350	0.189
		8. Large gullies, diversions, and low flowing streams	3.21	118.00	3,680.00	5.370	0.190
#3	**1**	**Time of Concentration:**					**0.379**

POND 414 AND DIVERSION CHANNEL
100-YEAR 6-HOUR

The pond is design to retain the surface runoff from the 100-yr 6-hr storm event.

The diversion channel and inlet structures to the pond are design to be stable for the 10-yr 6-hr storm event.

The watershed area for the pond is presented on Exh. 11-13F.

The designs for the pond and diversion channel are presented on Exh. 11-88 Sheet 1 & 2.

The gabion design for the South Inlet is attach.

The schematic of the hydrology model is shown on the attach sheet.

LR

BHP Navajo Coal Company

Fruitland, NM 87416

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.970 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#3	0.264	0.328	
Channel	#2	==>	#4	0.000	0.000	DIVERSION CHANNEL
Null	#3	==>	#5	0.000	0.000	SOUTH INLET (GABIONS)
Channel	#4	==>	#5	0.000	0.000	EAST INLET
Null	#5	==>	End	0.000	0.000	POND 414

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	1.17	36.00	3,080.00	3.24	0.264
#1	**Muskingum K:**					**0.264**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	61.330	61.330	61.10	3.61
#4	0.000	61.330	61.10	3.61
#1	292.100	292.100	272.58	19.47
#3	123.390	415.490	316.18	26.70
#5	0.000	476.820	341.91	30.30

Structure Detail:

Structure #2 (Erodible Channel)

DIVERSION CHANNEL

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	2.0:1	2.0:1	1.7	0.0270	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	61.10 cfs	
Depth:	0.99 ft	1.99 ft
Top Width:	11.94 ft	15.94 ft
Velocity:	6.21 fps	
X-Section Area:	9.83 sq ft	
Hydraulic Radius:	0.792 ft	
Froude Number:	1.21	

Structure #4 (Riprap Channel)

EAST INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
9.00	3.0:1	3.0:1	12.0			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	61.10 cfs	
Depth:	0.51 ft	
Top Width:	12.05 ft	
Velocity*:		
X-Section Area:	5.35 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.438 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

Structure #3 (Null)

SOUTH INLET (GABIONS)

Structure #5 (Null)

POND 414

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	61.330	0.347	0.000	0.000	87.000	M	61.10	3.609
	Σ	**61.330**						**61.10**	**3.609**
#4	**Σ**	**61.330**						**61.10**	**3.609**
#1	1	292.100	0.503	0.000	0.000	89.000	M	272.58	19.469
	Σ	**292.100**						**272.58**	**19.469**
#3	1	123.390	0.379	0.000	0.000	87.000	M	117.85	7.226
	Σ	**415.490**						**316.18**	**26.695**
#5	**Σ**	**476.820**						**341.91**	**30.304**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.82	47.00	1,230.01	1.950	0.175
		8. Large gullies, diversions, and low flowing streams	1.75	82.00	4,685.17	3.960	0.328
#1	**1**	**Time of Concentration:**					**0.503**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	4.44	11.00	248.00	2.100	0.032
		8. Large gullies, diversions, and low flowing streams	5.49	65.00	1,183.00	7.030	0.046
		5. Nearly bare and untilled, and alluvial valley fans	2.03	28.00	1,380.00	1.420	0.269
#2	**1**	**Time of Concentration:**					**0.347**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	17.00	923.00	1.350	0.189
		8. Large gullies, diversions, and low flowing streams	3.21	118.00	3,680.00	5.370	0.190
#3	**1**	**Time of Concentration:**					**0.379**

Title: Pond 414
Description: South Inlet Structure

Folder:
Date: 3/18/2013

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Run n.1

Gradient [%]	15.00	Froude number	3.44
Discharge [ft3/s]	133.50	Cross section [ft2]	9.06
Water level [ft]	0.65	Wetted perimeter [ft]	16.11
Average velocity [ft/s]	14.73	Hydraulic radius [ft]	0.56

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
1	6.33	9.48	1.00							
1.1	6.33			5.00	3.25	Reno mattress 9"	N	4.73	5.23	Y
4	12.00	15.58	1.00							
4.1	12.00			5.00	3.76	Reno mattress 12"	N	6.20	7.01	Y
7	6.33	9.48	1.00							
7.1	6.33			5.00	3.25	Reno mattress 9"	N	4.73	5.23	Y

590

Title: Pond 414
Description: South Inlet Structure

Folder:
Date: 3/18/2013

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Materials used

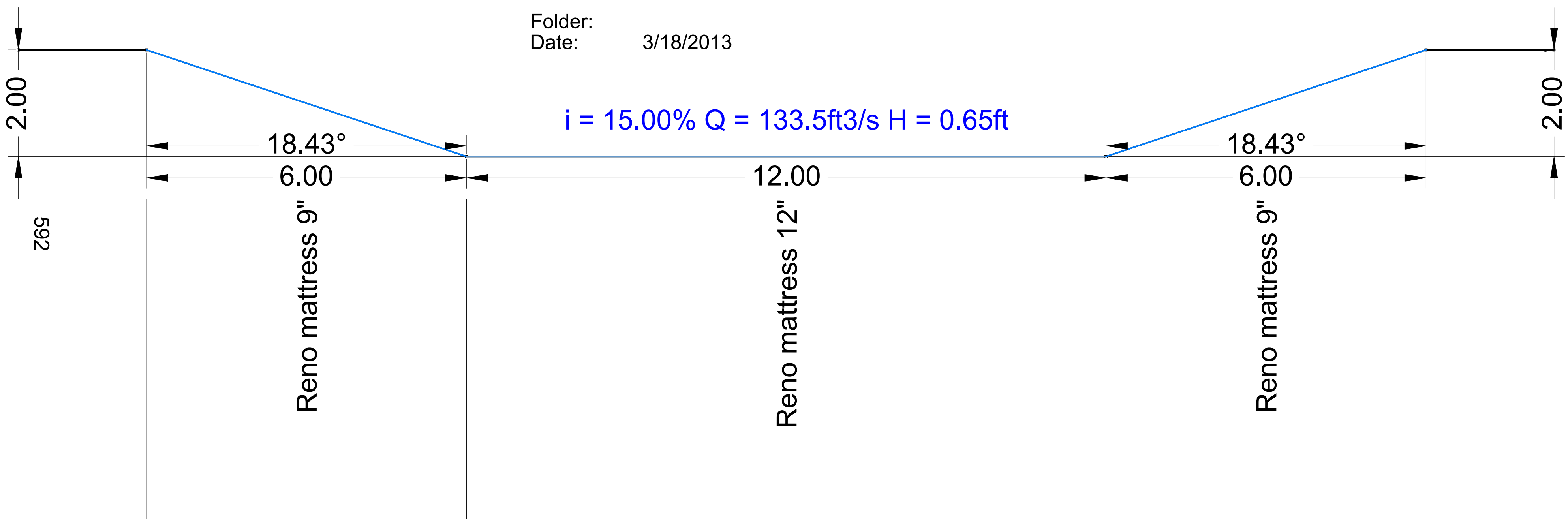
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Reno mattress 9"	0.0277	5.62	N	4.73	0.76	165.51		0.140
Reno mattress 12"	0.0277	7.01	N	5.90	0.82	165.51		0.140

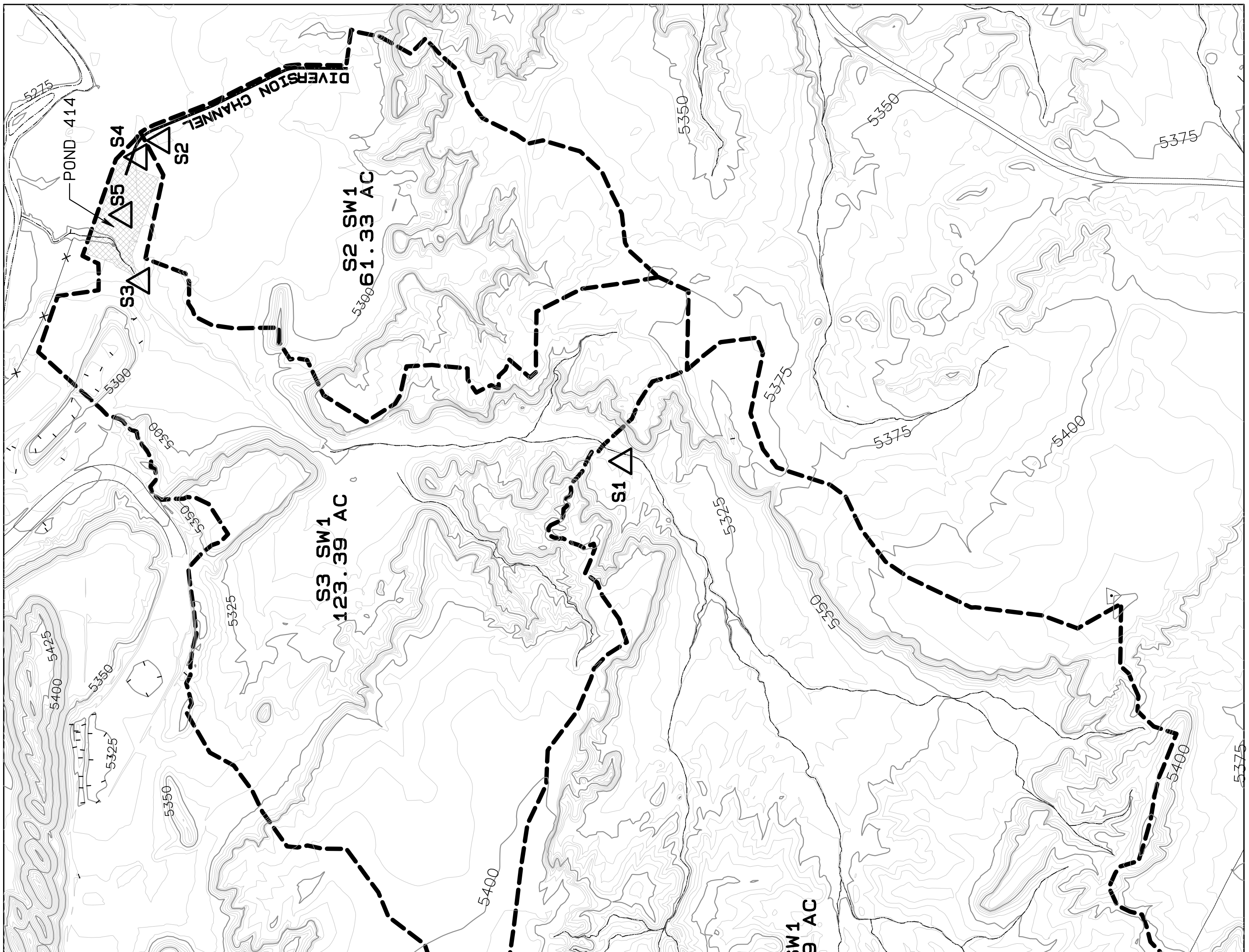
Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Pond 414
Description: South Inlet Structure

Folder:
Date: 3/18/2013





HYDROLOGY MODEL SCHEMATIC
POND 414

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Area 4N Pond 415

REV 1212

Pages 594 through 611

A2 Pond 201

The watershed for pond 201 is shown on Exhibit 11-13D. The detail design is on Exhibit 172.

The pond is designed to retain a 100 yr- 6 hr storm event. No spillway is required.

The channels and inlets to the pond are designed to be stable for a 10 yr-6 hr storm event.

The schematic of the structure networking for pond 201 is attached.

Ramsey R. Yazzie

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POBox 1717
Fruitland, NM 87416

Phone: 505-598-3282
Email: Ramsey.R.Yazzie@bhpbillliton.com

General Information

Storm Information:

Storm Type:	TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.970 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#6	==>	#13	0.000	0.000	South Channel Diversion
Channel	#11	==>	#14	0.000	0.000	North Channel Diversion
Null	#12	==>	End	0.000	0.000	Pond 201
Channel	#13	==>	#12	0.000	0.000	South Channel Rip Rap
Channel	#14	==>	#12	0.000	0.000	North Channel Rip Rap

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#11	6.100	6.100	6.72	0.34
#14	0.000	6.100	6.72	0.34
#6	20.500	20.500	11.18	1.61
#13	0.000	20.500	11.18	1.61
#12	0.000	26.600	11.80	1.95

Structure Detail:

Structure #11 (Erodible Channel)

North Channel Diversion

Trapezoidal Erodible Channel Inputs:

Material: Spoils - Shale and Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	1.3	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.72 cfs	
Depth:	0.36 ft	1.36 ft
Top Width:	8.16 ft	14.16 ft
Velocity:	2.64 fps	
X-Section Area:	2.55 sq ft	
Hydraulic Radius:	0.308 ft	
Froude Number:	0.83	

Structure #14 (Riprap Channel)

North Channel Rip Rap

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	7.1	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.72 cfs	
Depth:	0.14 ft	1.14 ft
Top Width:	6.86 ft	12.86 ft
Velocity*:		
X-Section Area:	0.92 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.133 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #6 (Erodible Channel)

South Channel Diversion

Trapezoidal Erodible Channel Inputs:

Material: Spoils - Shale and Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	0.7	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.18 cfs	
Depth:	0.57 ft	1.57 ft
Top Width:	9.44 ft	15.44 ft
Velocity:	2.52 fps	
X-Section Area:	4.43 sq ft	
Hydraulic Radius:	0.460 ft	
Froude Number:	0.65	

Structure #13 (Riprap Channel)

South Channel Rip Rap

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	7.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.18 cfs	
Depth:	0.20 ft	1.20 ft
Top Width:	7.21 ft	13.21 ft
Velocity*:		
X-Section Area:	1.33 sq ft	
Hydraulic Radius:	0.183 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #12 (Null)

Pond 201

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#11	1	6.100	0.223	0.000	0.000	86.000	M	6.72	0.337
	Σ	**6.100**						**6.72**	**0.337**
#14	Σ	**6.100**						**6.72**	**0.337**
#6	1	20.500	1.726	0.000	0.000	89.000	F	11.18	1.608
	Σ	**20.500**						**11.18**	**1.608**
#13	Σ	**20.500**						**11.18**	**1.608**
#12	Σ	**26.600**						**11.80**	**1.946**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	72.50	6,526.53	1.050	1.726
#6	**1**	**Time of Concentration:**					**1.726**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	5.49	103.50	1,886.34	2.340	0.223
#11	**1**	**Time of Concentration:**					**0.223**

A2 Pond 201

The watershed for pond 201 is shown on Exhibit 11-13D. The detail design is on Exhibit 172.

The channels and inlets to the pond are designed to be stable for a 10 yr-6 hr storm event.

The schematic of the structure networking for pond 201 is attached.

Ramsey R. Yazzie

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General Information

Storm Information:

Storm Type:	TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#6	==>	#13	0.000	0.000	South Channel Diversion
Channel	#11	==>	#14	0.000	0.000	North Channel Diversion
Null	#12	==>	End	0.000	0.000	Pond 201
Channel	#13	==>	#12	0.000	0.000	South Channel Rip Rap
Channel	#14	==>	#12	0.000	0.000	North Channel Rip Rap

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#11	6.100	6.100	2.73	0.13
#14	0.000	6.100	2.73	0.13
#6	20.500	20.500	4.76	0.70
#13	0.000	20.500	4.76	0.70
#12	0.000	26.600	5.03	0.83

Structure Detail:

Structure #11 (Erodible Channel)

North Channel Diversion

Trapezoidal Erodible Channel Inputs:

Material: Spoils - Shale and Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	1.3	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.73 cfs	
Depth:	0.21 ft	1.21 ft
Top Width:	7.28 ft	13.28 ft
Velocity:	1.93 fps	
X-Section Area:	1.42 sq ft	
Hydraulic Radius:	0.193 ft	
Froude Number:	0.77	

Structure #14 (Riprap Channel)

North Channel Rip Rap

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	7.1	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.73 cfs	
Depth:	0.09 ft	1.09 ft
Top Width:	6.52 ft	12.52 ft
Velocity*:		
X-Section Area:	0.55 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.083 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #6 (Erodible Channel)

South Channel Diversion

Trapezoidal Erodible Channel Inputs:

Material: Spoils - Shale and Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	0.7	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.76 cfs	
Depth:	0.35 ft	1.35 ft
Top Width:	8.12 ft	14.12 ft
Velocity:	1.91 fps	
X-Section Area:	2.49 sq ft	
Hydraulic Radius:	0.303 ft	
Froude Number:	0.61	

Structure #13 (Riprap Channel)

South Channel Rip Rap

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	7.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.76 cfs	
Depth:	0.12 ft	1.12 ft
Top Width:	6.69 ft	12.69 ft
Velocity*:		
X-Section Area:	0.73 sq ft	
Hydraulic Radius:	0.109 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #12 (Null)

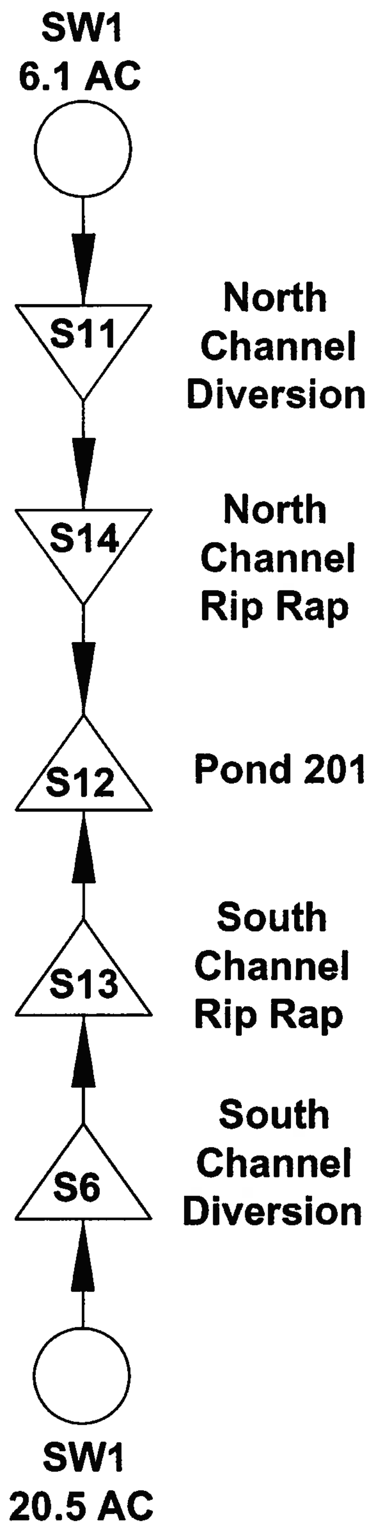
Pond 201

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#11	1	6.100	0.223	0.000	0.000	86.000	M	2.73	0.132
	Σ	**6.100**						**2.73**	**0.132**
#14	Σ	**6.100**						**2.73**	**0.132**
#6	1	20.500	1.726	0.000	0.000	89.000	F	4.76	0.698
	Σ	**20.500**						**4.76**	**0.698**
#13	Σ	**20.500**						**4.76**	**0.698**
#12	Σ	**26.600**						**5.03**	**0.830**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	72.50	6,526.53	1.050	1.726
#6	**1**	**Time of Concentration:**					**1.726**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	5.49	103.50	1,886.34	2.340	0.223
#11	**1**	**Time of Concentration:**					**0.223**



POND 201
SEDCAD MODELING
SCHEMATIC

LEGEND

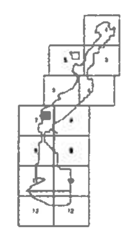
STRUCTURE

WATERSHED

FLOWS INTO

NOTES

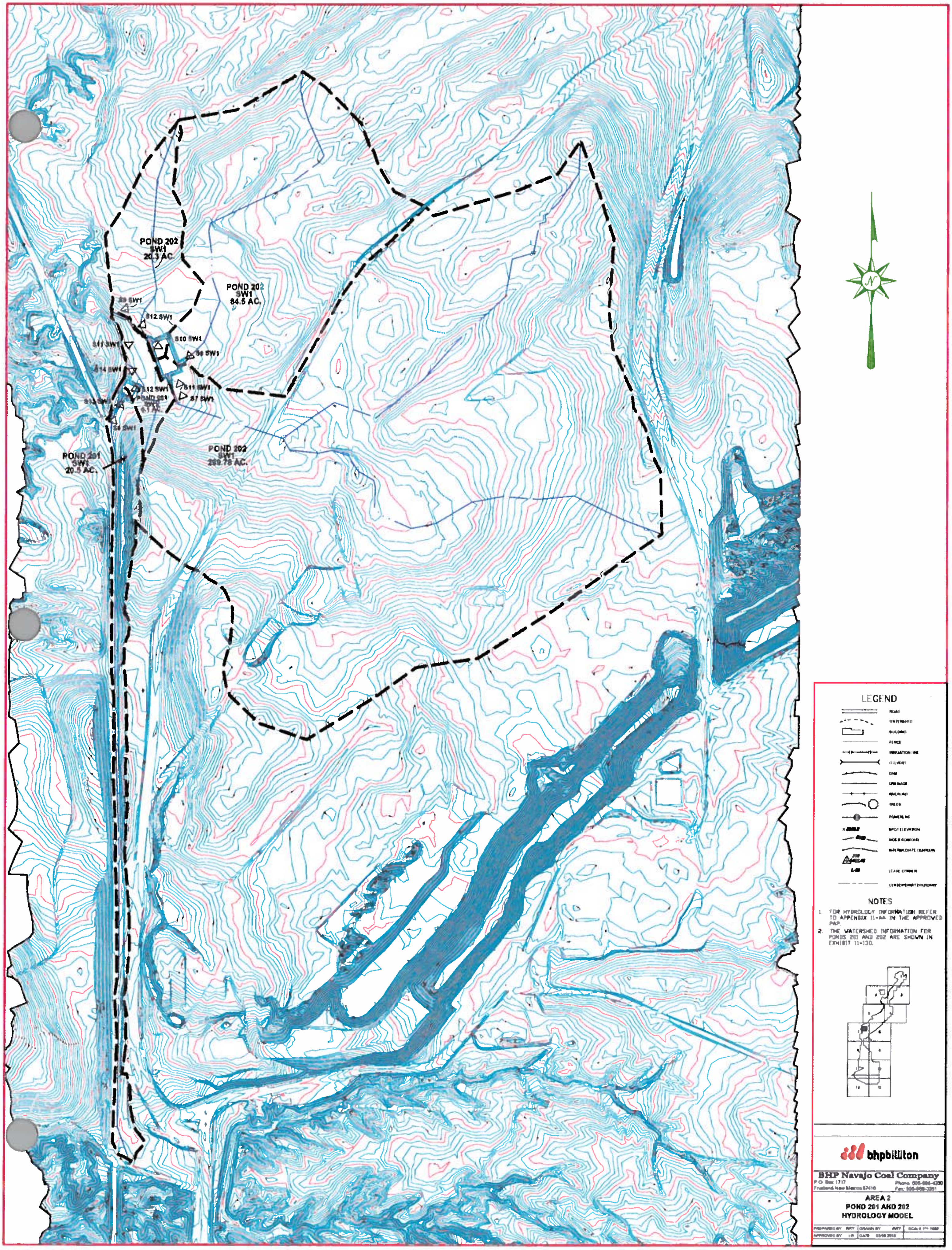
1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX II-AA IN THE APPROVED PAP.
2. THE WATERSHED INFORMATION FOR POND 201 IS SHOWN IN EXHIBIT II-13D.



bhpbilliton

BHP Navajo Coal Company
P O Box 1717
Fruitland New Mexico 87416

AREA 2
POND 201
MODELING SCHEMATIC



POND 202
SW1
20.3 AC.
POND 202
SW1
84.5 AC.
S12 SW1
S10 SW1
S11 SW1
S14 SW1
S12 SW1
S11 SW1
S7 SW1
POND 202
SW1
289.78 AC.
POND 201
SW1
20.5 AC.
LEGEND
NOTES
1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.
2. THE WATERSHED INFORMATION FOR PONDS 201 AND 202 ARE SHOWN IN EXHIBIT 11-130.
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BHP Navajo Coal Company
AREA 2
POND 201 AND 202
HYDROLOGY MODEL

A2 Pond 202

The watershed for the impoundment is presented on Exhibit 11-13D. The detail design is presented on Exhibit 173.

The pond is designed to retain a 100 yr-6 hr storm event. No spillway is requied.

The channels and inlets to the pond are designed to be stable for the 10 yr-6 hr storm event.

The schematic of the structure networking for Pond 202 is attached.

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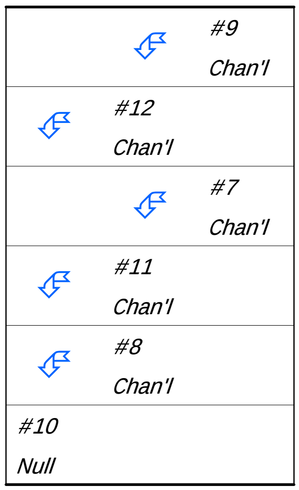
General Information

Storm Information:

Storm Type:	TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.970 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#7	==>	#11	0.000	0.000	South Channel Diversion
Channel	#8	==>	#10	0.000	0.000	East Channel
Channel	#9	==>	#12	0.000	0.000	North Channel Diversion
Null	#10	==>	End	0.000	0.000	Pond 202
Channel	#11	==>	#10	0.000	0.000	South Channel Rip Rap
Channel	#12	==>	#10	0.000	0.000	North Channel Rip Rap



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#9	20.300	20.300	24.00	0.67
#12	0.000	20.300	24.00	0.67
#7	299.780	299.780	124.88	7.93
#11	0.000	299.780	124.88	7.93
#8	84.500	84.500	52.94	2.28
#10	0.000	404.580	157.94	10.89

Structure Detail:

Structure #9 (Erodible Channel)

North Channel Diversion

Trapezoidal Erodible Channel Inputs:

Material: Spoils-Shale and Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	1.4	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.00 cfs	
Depth:	0.71 ft	1.71 ft
Top Width:	10.27 ft	16.27 ft
Velocity:	4.15 fps	
X-Section Area:	5.79 sq ft	
Hydraulic Radius:	0.551 ft	
Froude Number:	0.97	

Structure #12 (Riprap Channel)

North Channel Rip Rap

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	7.7	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.00 cfs	
Depth:	0.35 ft	1.35 ft
Top Width:	8.11 ft	14.11 ft
Velocity*:		
X-Section Area:	2.48 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.302 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Erodible Channel)

South Channel Diversion

Trapezoidal Erodible Channel Inputs:

Material: Spoils-Shale and Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	0.8	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	124.88 cfs	
Depth:	1.97 ft	2.97 ft
Top Width:	17.82 ft	23.82 ft
Velocity:	5.32 fps	
X-Section Area:	23.46 sq ft	
Hydraulic Radius:	1.271 ft	
Froude Number:	0.82	

Structure #11 (Riprap Channel)

South Channel Rip Rap

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	8.1	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	124.88 cfs	
Depth:	0.99 ft	1.99 ft
Top Width:	11.96 ft	17.96 ft
Velocity*:		
X-Section Area:	8.92 sq ft	
Hydraulic Radius:	0.726 ft	
Froude Number*:		
Manning's n*:		
Dmin:	6.00 in	
D50:	18.00 in	
Dmax:	22.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #8 (Riprap Channel)

East Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	8.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	52.94 cfs	
Depth:	0.61 ft	1.61 ft
Top Width:	9.68 ft	15.68 ft
Velocity*:		
X-Section Area:	4.81 sq ft	
Hydraulic Radius:	0.487 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #10 (Null)

Pond 202

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#9	1	20.300	0.121	0.000	0.000	76.000	M	24.00	0.672
	Σ	**20.300**						**24.00**	**0.672**
#12	Σ	**20.300**						**24.00**	**0.672**
#7	1	299.780	0.388	0.000	0.000	76.000	M	124.88	7.934
	Σ	**299.780**						**124.88**	**7.934**
#11	Σ	**299.780**						**124.88**	**7.934**
#8	1	84.500	0.160	0.000	0.000	76.000	M	52.94	2.280
	Σ	**84.500**						**52.94**	**2.280**
#10	Σ	**404.580**						**157.94**	**10.886**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	1	8. Large gullies, diversions, and low flowing streams	1.56	82.00	5,248.00	3.750	0.388
#7	**1**	**Time of Concentration:**					**0.388**
#8	1	8. Large gullies, diversions, and low flowing streams	2.19	56.00	2,559.18	4.430	0.160
#8	**1**	**Time of Concentration:**					**0.160**
#9	1	8. Large gullies, diversions, and low flowing streams	2.75	60.00	2,178.01	4.970	0.121
#9	**1**	**Time of Concentration:**					**0.121**

A2 Pond 202

The watershed for the impoundment is presented on Exhibit 11-13D. The detail design is presented on Exhibit 173.

The channels and inlets to the pond are designed to be stable for the 10 yr-6 hr storm event.

The schematic of the structure networking for Pond 202 is attached.

Ramsey R. Yazzie

BHP Billiton
POBox 1717
Fruitland, NM 87416

Phone: 505-598-3282
Email: Ramsey.R.Yazzie@bhpbillliton.com

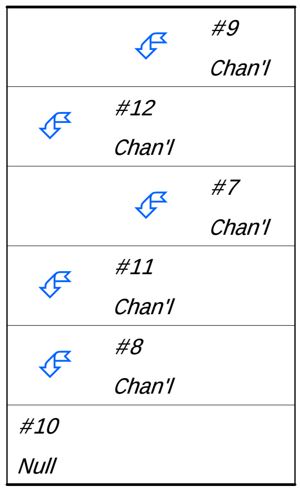
General Information

Storm Information:

Storm Type:	TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#7	==>	#11	0.000	0.000	South Channel Diversion
Channel	#8	==>	#10	0.000	0.000	East Channel
Channel	#9	==>	#12	0.000	0.000	North Channel Diversion
Null	#10	==>	End	0.000	0.000	Pond 202
Channel	#11	==>	#10	0.000	0.000	South Channel Rip Rap
Channel	#12	==>	#10	0.000	0.000	North Channel Rip Rap



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#9	20.300	20.300	6.97	0.16
#12	0.000	20.300	6.97	0.16
#7	299.780	299.780	26.00	1.90
#11	0.000	299.780	26.00	1.90
#8	84.500	84.500	12.00	0.55
#10	0.000	404.580	32.33	2.60

Structure Detail:

Structure #9 (Erodible Channel)

North Channel Diversion

Trapezoidal Erodible Channel Inputs:

Material: Spoils-Shale and Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	1.4	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.97 cfs	
Depth:	0.35 ft	1.35 ft
Top Width:	8.13 ft	14.13 ft
Velocity:	2.79 fps	
X-Section Area:	2.50 sq ft	
Hydraulic Radius:	0.304 ft	
Froude Number:	0.88	

Structure #12 (Riprap Channel)

North Channel Rip Rap

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	7.7	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.97 cfs	
Depth:	0.14 ft	1.14 ft
Top Width:	6.86 ft	12.86 ft
Velocity*:		
X-Section Area:	0.92 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.133 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Erodible Channel)

South Channel Diversion

Trapezoidal Erodible Channel Inputs:

Material: Spoils-Shale and Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	0.8	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	26.00 cfs	
Depth:	0.88 ft	1.88 ft
Top Width:	11.27 ft	17.27 ft
Velocity:	3.43 fps	
X-Section Area:	7.59 sq ft	
Hydraulic Radius:	0.656 ft	
Froude Number:	0.74	

Structure #11 (Riprap Channel)

South Channel Rip Rap

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	8.1	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	26.00 cfs	
Depth:	0.37 ft	1.37 ft
Top Width:	8.22 ft	14.22 ft
Velocity*:		
X-Section Area:	2.63 sq ft	
Hydraulic Radius:	0.315 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #8 (Riprap Channel)

East Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	8.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	12.00 cfs	
Depth:	0.20 ft	1.20 ft
Top Width:	7.22 ft	13.22 ft
Velocity*:		
X-Section Area:	1.35 sq ft	
Hydraulic Radius:	0.185 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #10 (Null)

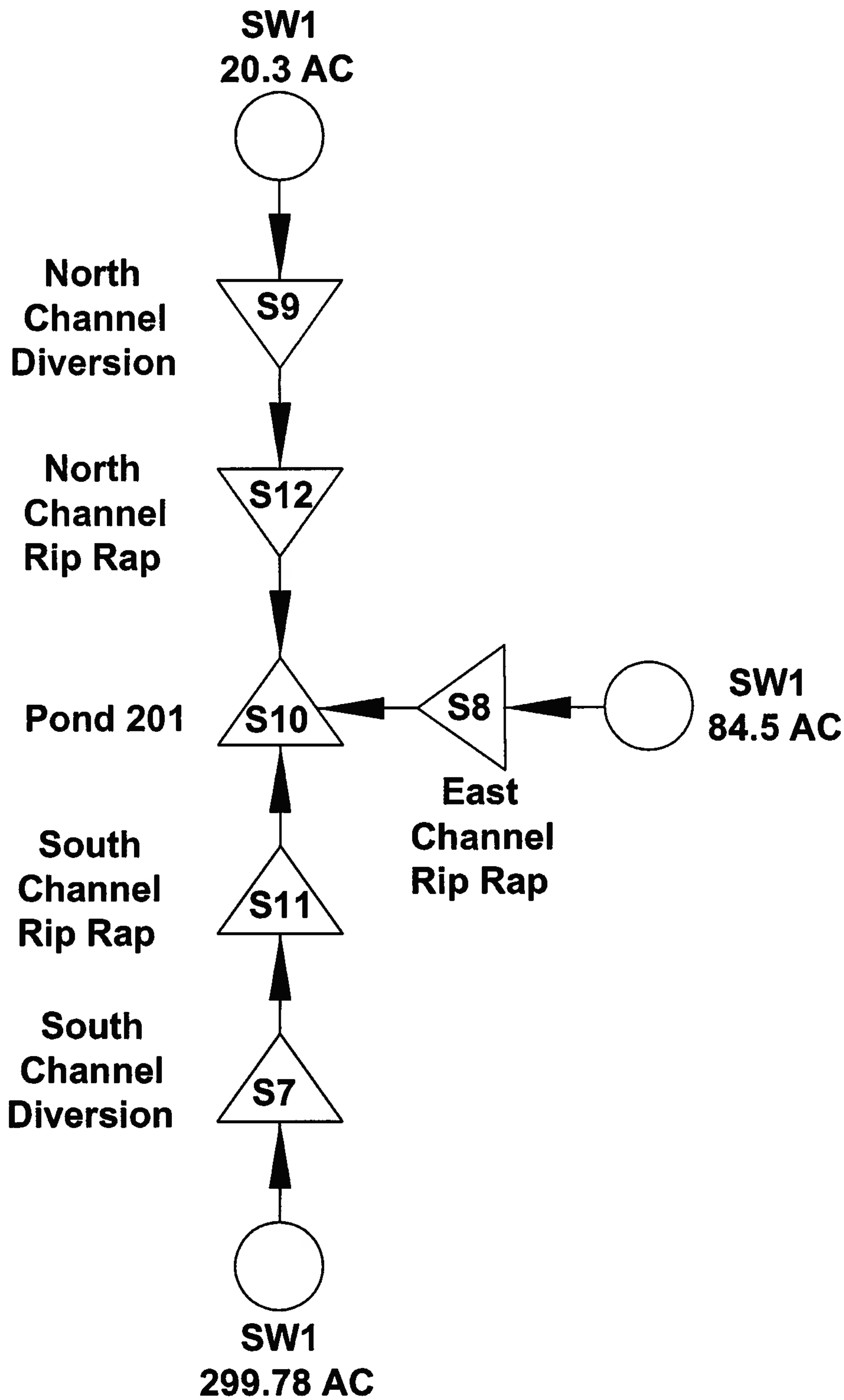
Pond 202

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#9	1	20.300	0.121	0.000	0.000	76.000	M	6.97	0.161
	Σ	**20.300**						**6.97**	**0.161**
#12	Σ	**20.300**						**6.97**	**0.161**
#7	1	299.780	0.388	0.000	0.000	76.000	M	26.00	1.899
	Σ	**299.780**						**26.00**	**1.899**
#11	Σ	**299.780**						**26.00**	**1.899**
#8	1	84.500	0.160	0.000	0.000	76.000	M	12.00	0.546
	Σ	**84.500**						**12.00**	**0.546**
#10	Σ	**404.580**						**32.33**	**2.605**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	1	8. Large gullies, diversions, and low flowing streams	1.56	82.00	5,248.00	3.750	0.388
#7	**1**	**Time of Concentration:**					**0.388**
#8	1	8. Large gullies, diversions, and low flowing streams	2.19	56.00	2,559.18	4.430	0.160
#8	**1**	**Time of Concentration:**					**0.160**
#9	1	8. Large gullies, diversions, and low flowing streams	2.75	60.00	2,178.01	4.970	0.121
#9	**1**	**Time of Concentration:**					**0.121**



POND 202
SEDCAD MODELING SCHEMATIC

LEGEND

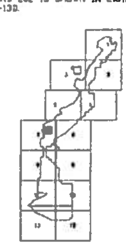
STRUCTURE

WATERSHED

FLOWS INTO

NOTES

1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.
2. THE WATERSHED INFORMATION FOR POND 202 IS SHOWN IN EXHIBIT 11-130.



bhpbilliton

BHP Navajo Coal Company
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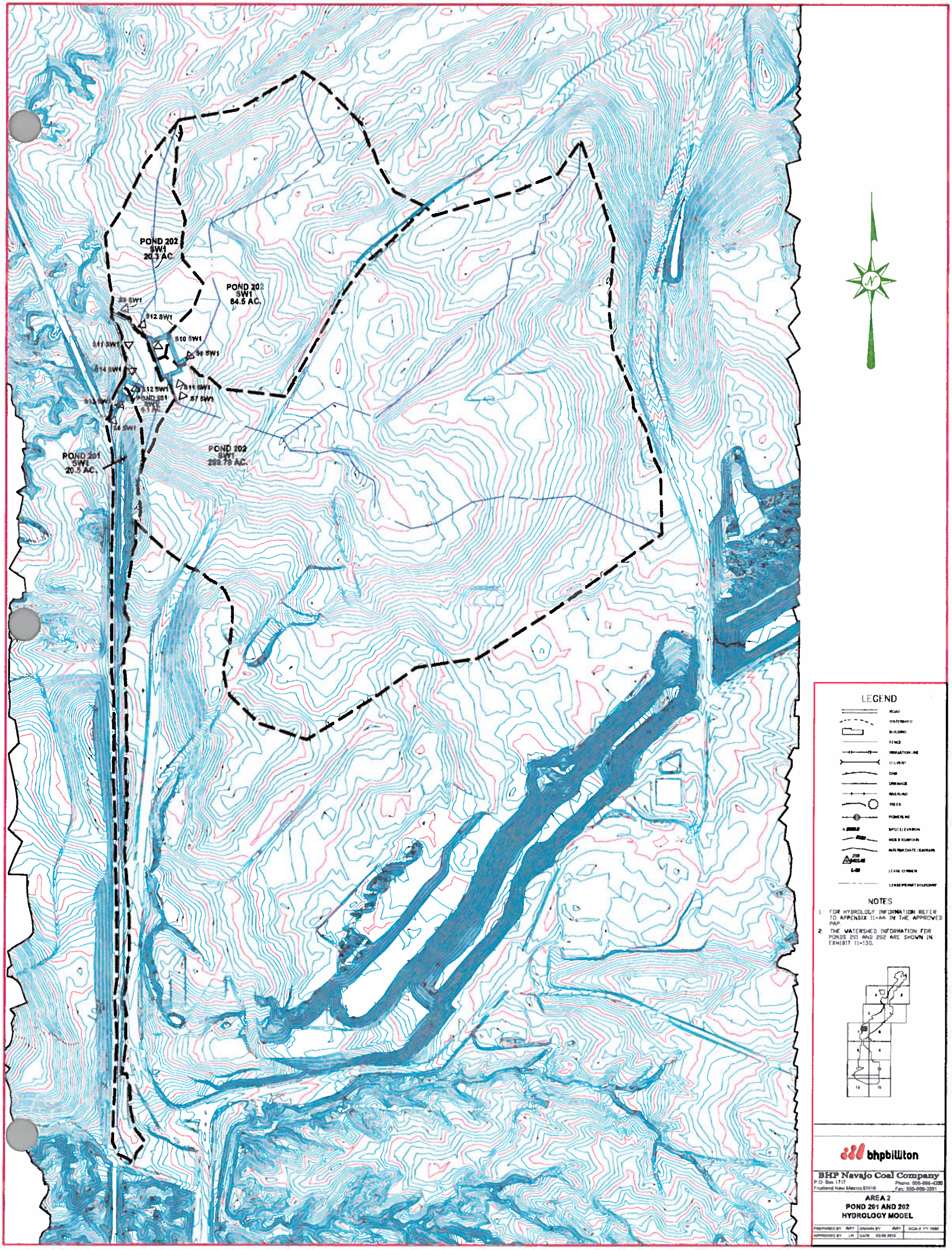
Fruitland New Mexico 87416

AREA 2
POND 202
MODELING SCHEMATIC



POND 202
SW1
20.3 AC.
POND 202
SW1
84.5 AC.
POND 202
SW1
POND 201
SW1
20.5 AC.
LEGEND
NOTES
1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.
2. THE WATERSHED INFORMATION FOR PONDS 201 AND 202 ARE SHOWN IN EXHIBIT 11-130.
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BHP Navajo Coal Company
AREA 2
POND 201 AND 202
HYDROLOGY MODEL

<u>POND 310</u>
<u>100 YEAR-6 HOUR</u>

The watershed for Pond 310 is shown on Exhibit 11-13E. The design is presented on Exhibit 11-178. The pond is designed to retain a 100 yr- 6 hr storm event. No spillway is required. The channels and inlets to the pond are designed to be stable for a 10 yr- 6 hr storm event. A schematic of the hydrology model is attached.

R. Yazzie

BHP Navajo Coal Company

Fruitland, NM 87416

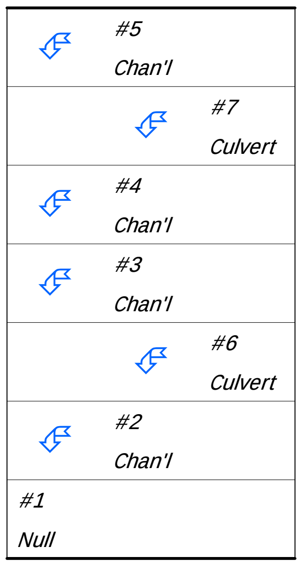
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.970 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pond 310
Channel	#2	==>	#1	0.000	0.000	West Channel
Channel	#3	==>	#1	0.000	0.000	South Channel
Channel	#4	==>	#1	0.000	0.000	East Channel
Channel	#5	==>	#1	0.000	0.000	North Channel
Culvert	#6	==>	#2	0.000	0.000	CP-171
Culvert	#7	==>	#4	0.000	0.000	CP-327



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#5	24.130	24.130	24.45	1.33
#7	71.130	71.130	46.71	2.59
#4	161.830	232.960	111.47	8.44
#3	34.520	34.520	29.02	1.27
#6	19.480	19.480	27.87	1.32
#2	14.120	33.600	46.06	1.96
#1	6.760	331.970	141.08	13.38

Structure Detail:

Structure #5 (Riprap Channel)

North Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	16.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.45 cfs	
Depth:	0.24 ft	1.24 ft
Top Width:	9.46 ft	15.46 ft
Velocity*:		
X-Section Area:	2.12 sq ft	
Hydraulic Radius:	0.223 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Culvert)

CP-327

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
142.00	2.00	0.0150	3.00	0.00	0.90

Culvert Results:

Design Discharge = 46.71 cfs

Minimum pipe diameter: 1 - 54 inch pipe(s) required

Structure #4 (Riprap Channel)

East Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
14.00	3.0:1	3.0:1	17.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	111.47 cfs	
Depth:	0.52 ft	1.52 ft
Top Width:	17.10 ft	23.10 ft
Velocity*:		
X-Section Area:	8.03 sq ft	
Hydraulic Radius:	0.465 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Riprap Channel)

South Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	29.02 cfs	
Depth:	0.26 ft	1.26 ft
Top Width:	9.56 ft	15.56 ft
Velocity*:		

	w/o Freeboard	w/ Freeboard
X-Section Area:	2.28 sq ft	
Hydraulic Radius:	0.236 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #6 (Culvert)

CP-171

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
91.00	1.88	0.0150	6.00	0.00	0.90

Culvert Results:

Design Discharge = 27.87 cfs

Minimum pipe diameter: 1 - 24 inch pipe(s) required

Structure #2 (Riprap Channel)

West Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	14.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	46.06 cfs	
Depth:	0.42 ft	1.42 ft
Top Width:	10.51 ft	16.51 ft
Velocity*:		
X-Section Area:	3.87 sq ft	
Hydraulic Radius:	0.364 ft	
Froude Number*:		
Manning's n*:		

	w/o Freeboard	w/ Freeboard
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

Pond 310

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	24.130	0.285	0.000	0.000	86.000	M	24.45	1.329
	Σ	**24.130**						**24.45**	**1.329**
#7	1	71.130	0.231	0.300	0.303	80.000	M	52.80	2.593
	Σ	**71.130**						**46.71**	**2.593**
#4	1	161.830	0.679	0.000	0.000	80.000	M	65.48	5.849
	Σ	**232.960**						**111.47**	**8.442**
#3	1	34.520	0.162	0.000	0.000	80.000	M	29.02	1.272
	Σ	**34.520**						**29.02**	**1.272**
#6	1	19.480	0.125	0.028	0.302	89.000	M	27.87	1.323
	Σ	**19.480**						**27.87**	**1.323**
#2	1	14.120	0.084	0.000	0.000	80.000	M	20.98	0.639
	Σ	**33.600**						**46.06**	**1.962**
#1	1	6.760	0.130	0.000	0.000	86.000	M	8.23	0.378
	Σ	**331.970**						**141.08**	**13.384**

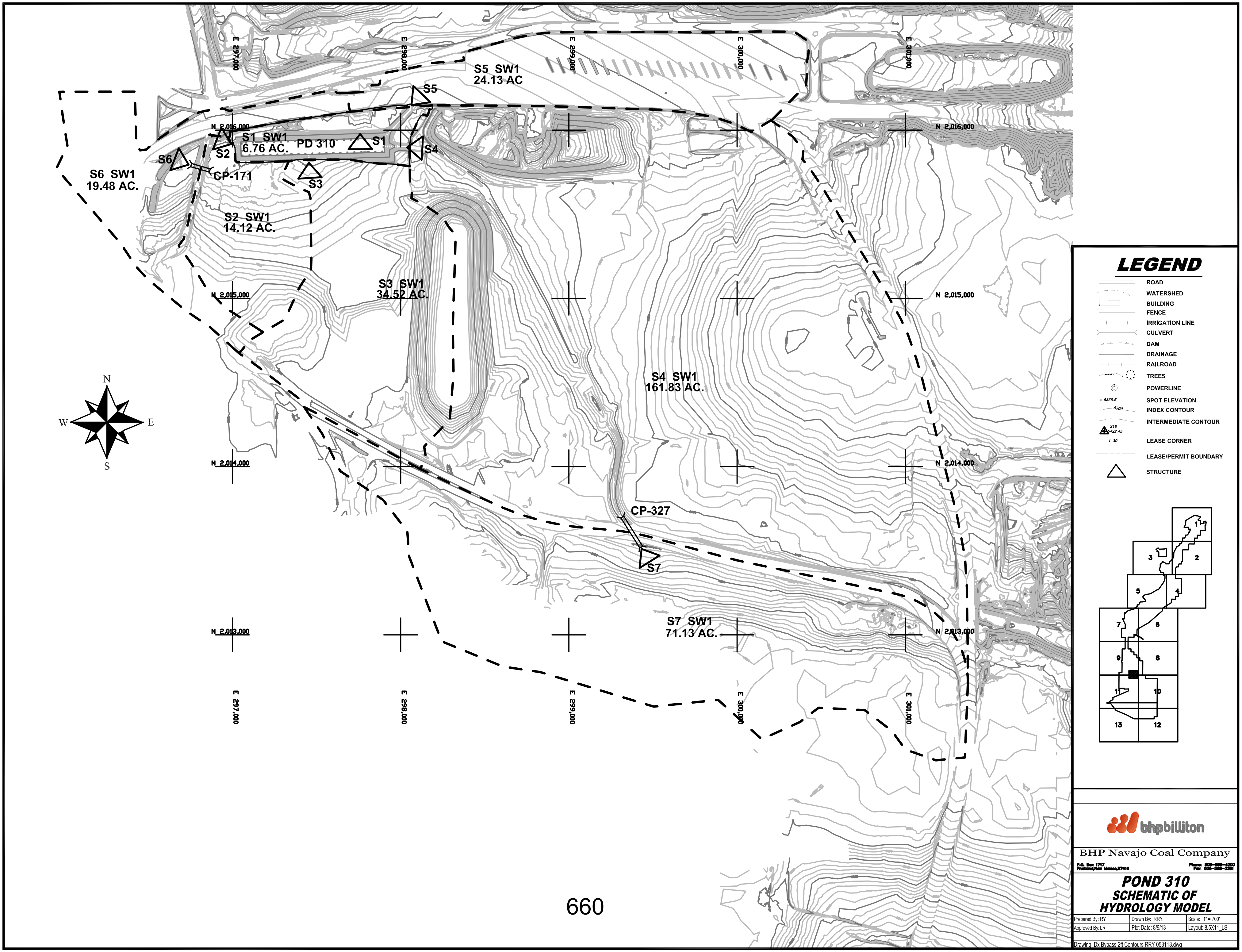
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.26	16.00	706.43	1.500	0.130
#1	**1**	**Time of Concentration:**					**0.130**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	1.64	2.00	122.29	1.270	0.026
		8. Large gullies, diversions, and low flowing streams	3.42	40.00	1,170.72	5.540	0.058
#2	**1**	**Time of Concentration:**					**0.084**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	3.71	8.00	215.91	1.920	0.031
		8. Large gullies, diversions, and low flowing streams	1.79	34.00	1,896.47	4.010	0.131
#3	**1**	**Time of Concentration:**					**0.162**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	0.91	11.94	1,308.06	0.950	0.382
		8. Large gullies, diversions, and low flowing streams	0.71	19.35	2,709.32	2.530	0.297
#4	**1**	**Time of Concentration:**					**0.679**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	1.15	2.00	173.39	1.070	0.045

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	0.95	24.00	2,528.44	2.920	0.240
#5	**1**	**Time of Concentration:**					**0.285**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	3.82	10.00	261.87	1.950	0.037
		8. Large gullies, diversions, and low flowing streams	2.14	30.00	1,399.05	4.390	0.088
#6	**1**	**Time of Concentration:**					**0.125**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	2.50	315.05	0.890	0.098
		8. Large gullies, diversions, and low flowing streams	1.84	36.00	1,956.41	4.060	0.133
#7	**1**	**Time of Concentration:**					**0.231**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	1	8. Large gullies, diversions, and low flowing streams	0.75	2.00	266.31	2.590	0.028
#6	**1**	**Muskingum K:**					**0.028**
#7	1	8. Large gullies, diversions, and low flowing streams	0.76	21.50	2,826.34	2.610	0.300
#7	**1**	**Muskingum K:**					**0.300**



S5 SW1
24.13 AC
S5
S1 SW1
6.76 AC.
PD 310
S1
S2
S4
S6
CP-171
S3
S6 SW1
19.48 AC.
S2 SW1
14.12 AC.
S3 SW1
34.52 AC.
S4 SW1
161.83 AC.
CP-327
S7
S7 SW1
71.13 AC.
N
S
E
W
N 2,016,000
N 2,015,000
N 2,014,000
N 2,013,000
E 297,000
E 298,000
E 299,000
E 300,000
E 301,000
LEGEND
ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE CORNER
LEASE/PERMIT BOUNDARY
STRUCTURE
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BHP Navajo Coal Company
P.O. Box 1717
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POND 310
SCHEMATIC OF
HYDROLOGY MODEL
Prepared By: RY
Drawn By: RRY
Scale: 1" = 700'
Approved By: LR
Plot Date: 8/9/13
Layout: 8.5X11_LS
Drawing: Dx Bypass 2ft Contours RRY 053113.dwg

POND 310
10 YEAR-6 HOUR

The watershed for Pond 310 is shown on Exhibit 11-13E. The design is presented on Exhibit 11-178. The pond is designed to retain a 100 yr- 6 hr storm event. No spillway is required. The channels and inlets to the pond are designed to be stable for a 10 yr- 6 hr storm event. A schematic of the hydrology model is attached.

R. Yazzie

BHP Navajo Coal Company

Fruitland, NM 87416

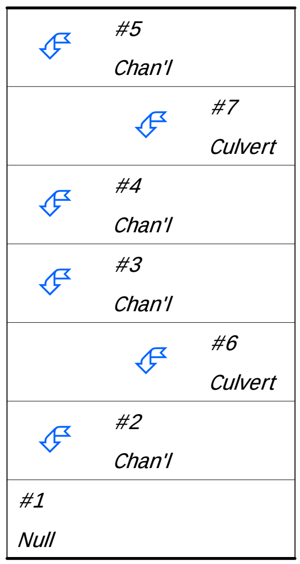
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Pond 310
Channel	#2	==>	#1	0.000	0.000	West Channel
Channel	#3	==>	#1	0.000	0.000	South Channel
Channel	#4	==>	#1	0.000	0.000	East Channel
Channel	#5	==>	#1	0.000	0.000	North Channel
Culvert	#6	==>	#2	0.000	0.000	CP-171
Culvert	#7	==>	#4	0.000	0.000	CP-327



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#5	24.130	24.130	9.70	0.52
#7	71.130	71.130	13.57	0.79
#4	161.830	232.960	31.94	2.56
#3	34.520	34.520	8.91	0.39
#6	19.480	19.480	12.78	0.57
#2	14.120	33.600	18.23	0.77
#1	6.760	331.970	43.72	4.38

Structure Detail:

Structure #5 (Riprap Channel)

North Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	16.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.70 cfs	
Depth:	0.12 ft	1.12 ft
Top Width:	8.71 ft	14.71 ft
Velocity*:		
X-Section Area:	0.99 sq ft	
Hydraulic Radius:	0.114 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Culvert)

CP-327

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
142.00	2.00	0.0150	3.00	0.00	0.90

Culvert Results:

Design Discharge = 13.57 cfs

Minimum pipe diameter: 1 - 21 inch pipe(s) required

Structure #4 (Riprap Channel)

East Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
14.00	3.0:1	3.0:1	17.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	31.94 cfs	
Depth:	0.17 ft	1.17 ft
Top Width:	15.05 ft	21.05 ft
Velocity*:		
X-Section Area:	2.54 sq ft	
Hydraulic Radius:	0.168 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Riprap Channel)

South Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	8.91 cfs	
Depth:	0.10 ft	1.10 ft
Top Width:	8.61 ft	14.61 ft
Velocity*:		

	w/o Freeboard	w/ Freeboard
X-Section Area:	0.85 sq ft	
Hydraulic Radius:	0.098 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #6 (Culvert)

CP-171

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
91.00	1.88	0.0150	6.00	0.00	0.90

Culvert Results:

Design Discharge = 12.78 cfs

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Structure #2 (Riprap Channel)

West Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	14.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	18.23 cfs	
Depth:	0.21 ft	1.21 ft
Top Width:	9.24 ft	15.24 ft
Velocity*:		
X-Section Area:	1.78 sq ft	
Hydraulic Radius:	0.192 ft	
Froude Number*:		
Manning's n*:		

	w/o Freeboard	w/ Freeboard
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

Pond 310

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	24.130	0.285	0.000	0.000	86.000	M	9.70	0.519
	Σ	**24.130**						**9.70**	**0.519**
#7	1	71.130	0.231	0.300	0.303	80.000	M	15.82	0.786
	Σ	**71.130**						**13.57**	**0.786**
#4	1	161.830	0.679	0.000	0.000	80.000	M	18.37	1.773
	Σ	**232.960**						**31.94**	**2.559**
#3	1	34.520	0.162	0.000	0.000	80.000	M	8.91	0.386
	Σ	**34.520**						**8.91**	**0.386**
#6	1	19.480	0.125	0.028	0.302	89.000	M	12.78	0.574
	Σ	**19.480**						**12.78**	**0.574**
#2	1	14.120	0.084	0.000	0.000	80.000	M	7.61	0.194
	Σ	**33.600**						**18.23**	**0.768**
#1	1	6.760	0.130	0.000	0.000	86.000	M	3.39	0.148
	Σ	**331.970**						**43.72**	**4.380**

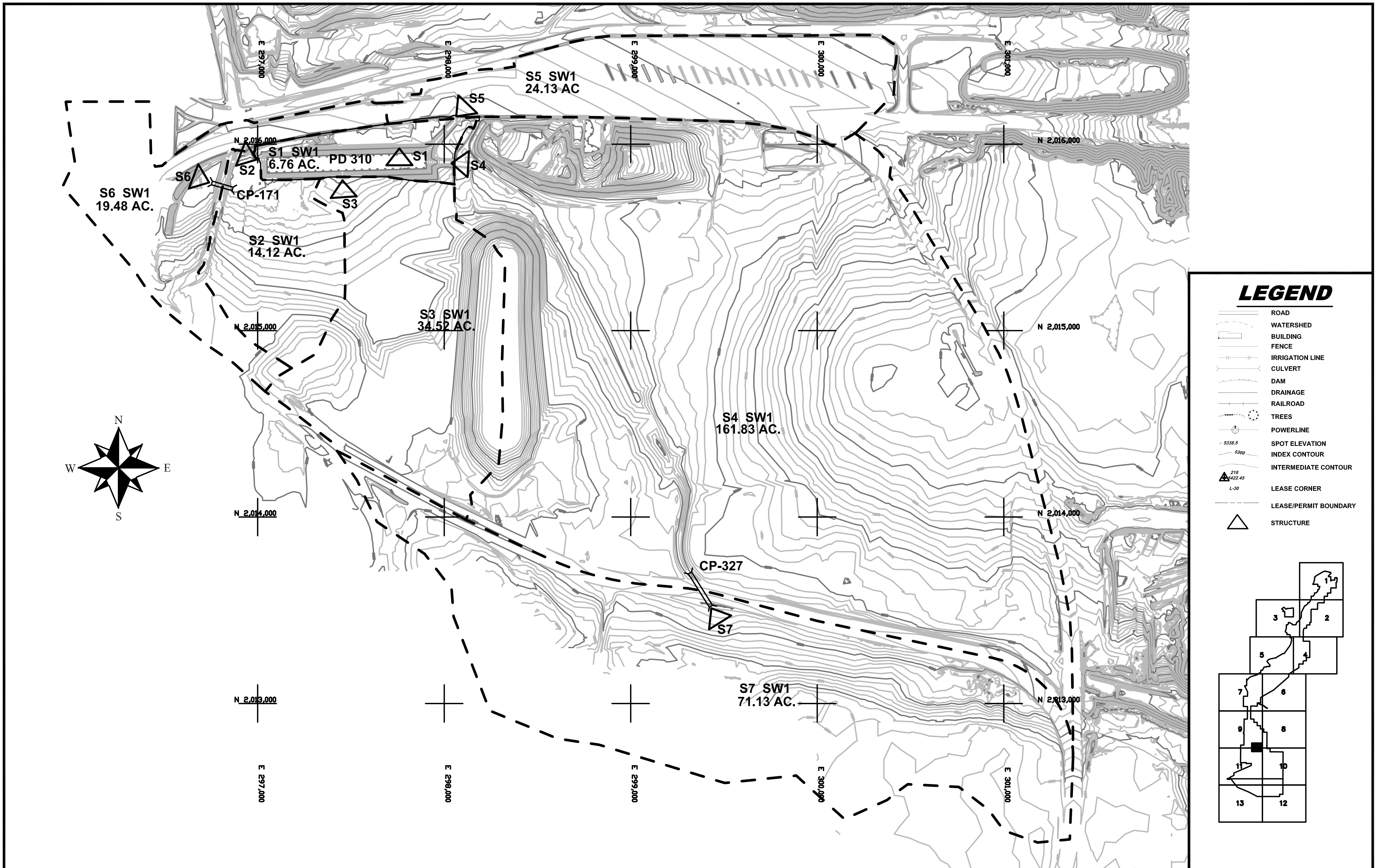
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.26	16.00	706.43	1.500	0.130
#1	**1**	**Time of Concentration:**					**0.130**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	1.64	2.00	122.29	1.270	0.026
		8. Large gullies, diversions, and low flowing streams	3.42	40.00	1,170.72	5.540	0.058
#2	**1**	**Time of Concentration:**					**0.084**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	3.71	8.00	215.91	1.920	0.031
		8. Large gullies, diversions, and low flowing streams	1.79	34.00	1,896.47	4.010	0.131
#3	**1**	**Time of Concentration:**					**0.162**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	0.91	11.94	1,308.06	0.950	0.382
		8. Large gullies, diversions, and low flowing streams	0.71	19.35	2,709.32	2.530	0.297
#4	**1**	**Time of Concentration:**					**0.679**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	1.15	2.00	173.39	1.070	0.045

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	0.95	24.00	2,528.44	2.920	0.240
#5	**1**	**Time of Concentration:**					**0.285**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	3.82	10.00	261.87	1.950	0.037
		8. Large gullies, diversions, and low flowing streams	2.14	30.00	1,399.05	4.390	0.088
#6	**1**	**Time of Concentration:**					**0.125**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	2.50	315.05	0.890	0.098
		8. Large gullies, diversions, and low flowing streams	1.84	36.00	1,956.41	4.060	0.133
#7	**1**	**Time of Concentration:**					**0.231**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	1	8. Large gullies, diversions, and low flowing streams	0.75	2.00	266.31	2.590	0.028
#6	**1**	**Muskingum K:**					**0.028**
#7	1	8. Large gullies, diversions, and low flowing streams	0.76	21.50	2,826.34	2.610	0.300
#7	**1**	**Muskingum K:**					**0.300**



bhpbilliton

BHP Navajo Coal Company

P.O. Box 1717
Fruitland,New Mexico,87416

POND 310
SCHEMATIC OF HYDROLOGY MODEL

Prepared By: RY	Drawn By: RRY	Scale: 1" = 700'
Approved By: LR	Plot Date: 8/9/13	Layout: 8.5X11_LS

Drawing: Dx Bypass 2ft Contours RRY 053113.dwg

Pond 311

The watershed for the impoundment is presented on Exhibit 11-13E. The detail design is presented on Exhibit 11-179.

The pond is designed to retain a 10 year 24 hour storm.

The spillway is designed for a 25 year 6 hour storm event.

The channel is designed to be stable during a 10 year 6 hour storm event.

The hydrology structure schematic for Pond 311 is attached.

Ramsey R. Yazzie

BHP Billiton
POBox 1717
Fruitland, NM 87416

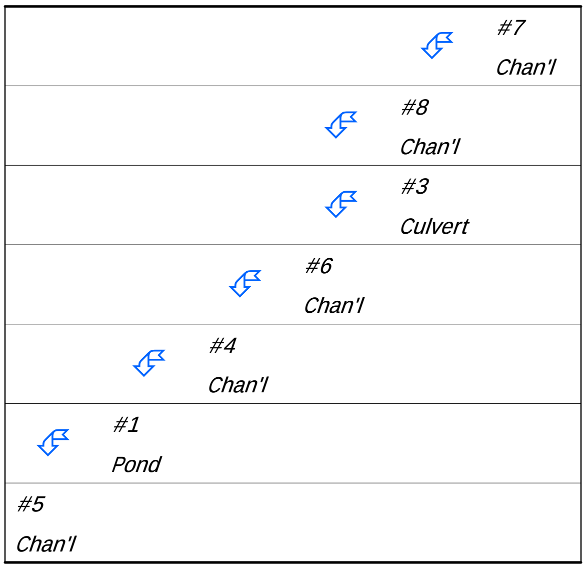
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.610 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#5	0.000	0.000	Pond 311
Culvert	#3	==>	#6	0.896	0.267	CP-45
Channel	#4	==>	#1	0.000	0.000	South Rip Rap Channel 2
Channel	#5	==>	End	0.000	0.000	Spillway Channel
Channel	#6	==>	#4	0.000	0.000	South Channel 2
Channel	#7	==>	#8	0.000	0.000	South Channel 1
Channel	#8	==>	#6	0.000	0.000	South Rip Rap Channel 1



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	5. Nearly bare and untilled, and alluvial valley fans	1.40	50.00	3,580.23	1.18	0.842
	8. Large gullies, diversions, and low flowing streams	2.62	25.00	954.52	4.85	0.054
#3	**Muskingum K:**					**0.896**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#7		11.900	11.900	9.83	0.57
#8		0.100	12.000	9.85	0.58
#3		219.700	219.700	48.71	4.98
#6		26.600	258.300	42.67	6.82
#4		0.100	258.400	42.67	6.82
#1	In	1.400	259.800	42.71	6.90
	Out			32.05	6.82
#5		0.000	259.800	32.05	6.82

Structure Detail:

Structure #7 (Erodible Channel)

South Channel 1

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	0.9	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.83 cfs	
Depth:	0.31 ft	1.31 ft
Top Width:	13.85 ft	19.85 ft
Velocity:	2.47 fps	
X-Section Area:	3.99 sq ft	
Hydraulic Radius:	0.286 ft	
Froude Number:	0.81	

Structure #8 (Riprap Channel)

South Rip Rap Channel 1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	10.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.85 cfs	
Depth:	0.10 ft	1.10 ft
Top Width:	12.61 ft	18.61 ft
Velocity*:		
X-Section Area:	1.25 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.099 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Culvert)

CP-45

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	0.05	0.0150	5.00	0.00	0.90

Culvert Results:

Design Discharge = 48.71 cfs

Minimum pipe diameter: 1 - 36 inch pipe(s) required

Structure #6 (Erodible Channel)

South Channel 2

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	0.9	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	42.67 cfs	
Depth:	0.72 ft	1.72 ft
Top Width:	16.33 ft	22.33 ft
Velocity:	4.17 fps	
X-Section Area:	10.24 sq ft	
Hydraulic Radius:	0.618 ft	
Froude Number:	0.93	

Structure #4 (Riprap Channel)

South Rip Rap Channel 2

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	11.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	42.67 cfs	
Depth:	0.32 ft	1.32 ft
Top Width:	13.91 ft	19.91 ft
Velocity*:		
X-Section Area:	4.13 sq ft	
Hydraulic Radius:	0.295 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Pond)

Pond 311

Pond Inputs:

Initial Pool Elev:	5,333.00 ft
Initial Pool:	8.28 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,333.00	25.00	3.00:1	3.00:1	12.00

Pond Results:

Peak Elevation:	5,334.03 ft
Dewater Time:	1.19 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,325.50	0.934	0.000	0.000		
5,326.00	0.954	0.472	0.000		
5,326.50	0.974	0.954	0.000		
5,326.92	0.991	1.367	0.000		
5,327.00	0.994	1.446	0.000		
5,327.50	1.015	1.948	0.000		
5,328.00	1.036	2.461	0.000		
5,328.50	1.058	2.985	0.000		
5,329.00	1.079	3.519	0.000		
5,329.50	1.102	4.064	0.000		
5,330.00	1.124	4.621	0.000		
5,330.50	1.147	5.188	0.000		
5,331.00	1.177	5.769	0.000		
5,331.50	1.207	6.365	0.000		
5,332.00	1.251	6.980	0.000		
5,332.50	1.296	7.616	0.000		
5,333.00	1.371	8.283	0.000		Spillway #1
5,333.50	1.377	8.970	0.771	10.78*	
5,334.00	1.634	9.721	29.820	17.70	
5,334.03	1.602	9.774	32.048	0.15	Peak Stage
5,334.50	1.801	10.580	65.875		
5,335.00	1.975	11.524	112.817		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,325.50	0.000	0.000
5,326.00	0.000	0.000
5,326.50	0.000	0.000
5,326.92	0.000	0.000
5,327.00	0.000	0.000
5,327.50	0.000	0.000
5,328.00	0.000	0.000
5,328.50	0.000	0.000
5,329.00	0.000	0.000
5,329.50	0.000	0.000
5,330.00	0.000	0.000

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,330.50	0.000	0.000
5,331.00	0.000	0.000
5,331.50	0.000	0.000
5,332.00	0.000	0.000
5,332.50	0.000	0.000
5,333.00	0.000	0.000
5,333.50	0.771	0.771
5,334.00	29.820	29.820
5,334.50	65.875	65.875
5,335.00	112.817	112.817

Structure #5 (Erodible Channel)

Spillway Channel

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	0.5	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	32.05 cfs	
Depth:	0.72 ft	1.72 ft
Top Width:	16.32 ft	22.32 ft
Velocity:	3.14 fps	
X-Section Area:	10.20 sq ft	
Hydraulic Radius:	0.616 ft	
Froude Number:	0.70	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#7	1	11.900	0.179	0.000	0.000	89.000	M	9.83	0.574
	Σ	**11.900**						**9.83**	**0.574**
#8	1	0.100	0.009	0.000	0.000	89.000	M	0.14	0.004
	Σ	**12.000**						**9.85**	**0.578**
#3	1	219.700	0.444	0.444	0.324	80.000	M	53.76	4.980
	Σ	**219.700**						**48.71**	**4.980**
#6	1	26.600	5.410	0.000	0.000	89.000	M	2.25	1.261
	Σ	**258.300**						**42.67**	**6.819**
#4	1	0.100	0.010	0.000	0.000	89.000	M	0.14	0.004
	Σ	**258.400**						**42.67**	**6.823**
#1	1	1.400	0.001	0.000	0.000	89.000	M	1.91	0.080
	Σ	**259.800**						**42.71**	**6.903**
#5	Σ	**259.800**						**32.05**	**6.820**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	3.98	0.10	2.50	5.980	0.000
		5. Nearly bare and untilled, and alluvial valley fans	48.08	12.50	26.00	6.930	0.001
#1	**1**	**Time of Concentration:**					**0.001**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	25.00	954.52	1.610	0.164
		8. Large gullies, diversions, and low flowing streams	1.40	50.00	3,580.37	3.540	0.280
#3	**1**	**Time of Concentration:**					**0.444**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	5.56	5.00	90.00	2.350	0.010
#4	**1**	**Time of Concentration:**					**0.010**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	0.14	10.00	7,183.90	0.370	5.393
		8. Large gullies, diversions, and low flowing streams	0.65	1.00	155.01	2.400	0.017
#6	**1**	**Time of Concentration:**					**5.410**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	1.13	2.00	177.00	1.060	0.046

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	0.93	13.00	1,393.65	2.890	0.133
#7	**1**	**Time of Concentration:**					**0.179**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	6.60	6.00	90.95	2.560	0.009
#8	**1**	**Time of Concentration:**					**0.009**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	25.00	954.52	1.610	0.164
		8. Large gullies, diversions, and low flowing streams	1.40	50.00	3,580.37	3.540	0.280
#3	**1**	**Muskingum K:**					**0.444**

Pond 311

The watershed for the impoundment is presented on Exhibit 11-13E. The detail design is presented on Exhibit 11-179.

The pond is designed to retain a 10 year 24 hour storm.

The spillway is designed for a 25 year 6 hour storm event.

The channel is designed to be stable during a 10 year 6 hour storm event.

The hydrology structure schematic for Pond 311 is attached.

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POBox 1717
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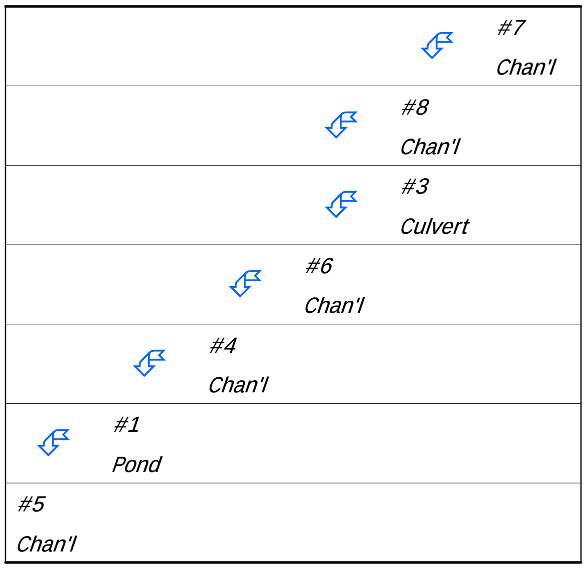
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.500 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#5	0.000	0.000	Pond 311
Culvert	#3	==>	#6	0.896	0.267	CP-45
Channel	#4	==>	#1	0.000	0.000	South Rip Rap Channel 2
Channel	#5	==>	End	0.000	0.000	Spillway Channel
Channel	#6	==>	#4	0.000	0.000	South Channel 2
Channel	#7	==>	#8	0.000	0.000	South Channel 1
Channel	#8	==>	#6	0.000	0.000	South Rip Rap Channel 1



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	5. Nearly bare and untilled, and alluvial valley fans	1.40	50.00	3,580.23	1.18	0.842
	8. Large gullies, diversions, and low flowing streams	2.62	25.00	954.52	4.85	0.054
#3	**Muskingum K:**					**0.896**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#7		11.900	11.900	10.80	0.51
#8		0.100	12.000	10.82	0.51
#3		219.700	219.700	54.40	4.17
#6		26.600	258.300	47.56	5.79
#4		0.100	258.400	47.56	5.80
#1	In	1.400	259.800	47.60	5.87
	Out			36.20	5.84
#5		0.000	259.800	36.20	5.84

Structure Detail:

Structure #7 (Erodible Channel)

South Channel 1

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	0.9	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.80 cfs	
Depth:	0.33 ft	1.33 ft
Top Width:	13.96 ft	19.96 ft
Velocity:	2.55 fps	
X-Section Area:	4.23 sq ft	
Hydraulic Radius:	0.301 ft	
Froude Number:	0.82	

Structure #8 (Riprap Channel)

South Rip Rap Channel 1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	10.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.82 cfs	
Depth:	0.11 ft	1.11 ft
Top Width:	12.65 ft	18.65 ft
Velocity*:		
X-Section Area:	1.34 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.106 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Culvert)

CP-45

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	0.05	0.0150	5.00	0.00	0.90

Culvert Results:

Design Discharge = 54.40 cfs

Minimum pipe diameter: 1 - 36 inch pipe(s) required

Structure #6 (Erodible Channel)

South Channel 2

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	0.9	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	47.56 cfs	
Depth:	0.77 ft	1.77 ft
Top Width:	16.61 ft	22.61 ft
Velocity:	4.32 fps	
X-Section Area:	11.00 sq ft	
Hydraulic Radius:	0.652 ft	
Froude Number:	0.94	

Structure #4 (Riprap Channel)

South Rip Rap Channel 2

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	11.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	47.56 cfs	
Depth:	0.35 ft	1.35 ft
Top Width:	14.09 ft	20.09 ft
Velocity*:		
X-Section Area:	4.55 sq ft	
Hydraulic Radius:	0.320 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Pond)

Pond 311

Pond Inputs:

Initial Pool Elev:	5,333.00 ft
Initial Pool:	8.28 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,333.00	25.00	3.00:1	3.00:1	12.00

Pond Results:

Peak Elevation:	5,334.09 ft
Dewater Time:	0.68 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,325.50	0.934	0.000	0.000		
5,326.00	0.954	0.472	0.000		
5,326.50	0.974	0.954	0.000		
5,326.92	0.991	1.367	0.000		
5,327.00	0.994	1.446	0.000		
5,327.50	1.015	1.948	0.000		
5,328.00	1.036	2.461	0.000		
5,328.50	1.058	2.985	0.000		
5,329.00	1.079	3.519	0.000		
5,329.50	1.102	4.064	0.000		
5,330.00	1.124	4.621	0.000		
5,330.50	1.147	5.188	0.000		
5,331.00	1.177	5.769	0.000		
5,331.50	1.207	6.365	0.000		
5,332.00	1.251	6.980	0.000		
5,332.50	1.296	7.616	0.000		
5,333.00	1.371	8.283	0.000		Spillway #1
5,333.50	1.377	8.970	0.771	10.78*	
5,334.00	1.634	9.721	29.820	5.20	
5,334.09	1.626	9.873	36.200	0.25	Peak Stage
5,334.50	1.801	10.580	65.875		
5,335.00	1.975	11.524	112.817		

Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,325.50	0.000	0.000
5,326.00	0.000	0.000
5,326.50	0.000	0.000
5,326.92	0.000	0.000
5,327.00	0.000	0.000
5,327.50	0.000	0.000
5,328.00	0.000	0.000
5,328.50	0.000	0.000
5,329.00	0.000	0.000
5,329.50	0.000	0.000
5,330.00	0.000	0.000

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,330.50	0.000	0.000
5,331.00	0.000	0.000
5,331.50	0.000	0.000
5,332.00	0.000	0.000
5,332.50	0.000	0.000
5,333.00	0.000	0.000
5,333.50	0.771	0.771
5,334.00	29.820	29.820
5,334.50	65.875	65.875
5,335.00	112.817	112.817

Structure #5 (Erodible Channel)

Spillway Channel

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	0.5	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	36.20 cfs	
Depth:	0.77 ft	1.77 ft
Top Width:	16.64 ft	22.64 ft
Velocity:	3.27 fps	
X-Section Area:	11.06 sq ft	
Hydraulic Radius:	0.655 ft	
Froude Number:	0.71	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#7	1	11.900	0.179	0.000	0.000	89.000	M	10.80	0.506
	Σ	**11.900**						**10.80**	**0.506**
#8	1	0.100	0.009	0.000	0.000	89.000	M	0.15	0.004
	Σ	**12.000**						**10.82**	**0.511**
#3	1	219.700	0.444	0.444	0.324	80.000	M	60.07	4.169
	Σ	**219.700**						**54.40**	**4.169**
#6	1	26.600	5.410	0.000	0.000	89.000	M	2.43	1.112
	Σ	**258.300**						**47.56**	**5.792**
#4	1	0.100	0.010	0.000	0.000	89.000	M	0.15	0.004
	Σ	**258.400**						**47.56**	**5.797**
#1	1	1.400	0.001	0.000	0.000	89.000	M	2.12	0.073
	Σ	**259.800**						**47.60**	**5.870**
#5	Σ	**259.800**						**36.20**	**5.843**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	3.98	0.10	2.50	5.980	0.000
		5. Nearly bare and untilled, and alluvial valley fans	48.08	12.50	26.00	6.930	0.001
#1	**1**	**Time of Concentration:**					**0.001**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	25.00	954.52	1.610	0.164
		8. Large gullies, diversions, and low flowing streams	1.40	50.00	3,580.37	3.540	0.280
#3	**1**	**Time of Concentration:**					**0.444**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	5.56	5.00	90.00	2.350	0.010
#4	**1**	**Time of Concentration:**					**0.010**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	0.14	10.00	7,183.90	0.370	5.393
		8. Large gullies, diversions, and low flowing streams	0.65	1.00	155.01	2.400	0.017
#6	**1**	**Time of Concentration:**					**5.410**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	1.13	2.00	177.00	1.060	0.046

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	0.93	13.00	1,393.65	2.890	0.133
#7	**1**	**Time of Concentration:**					**0.179**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	6.60	6.00	90.95	2.560	0.009
#8	**1**	**Time of Concentration:**					**0.009**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	25.00	954.52	1.610	0.164
		8. Large gullies, diversions, and low flowing streams	1.40	50.00	3,580.37	3.540	0.280
#3	**1**	**Muskingum K:**					**0.444**

Pond 311

The watershed for the impoundment is presented on Exhibit 11-13E. The detail design is presented on Exhibit 11-179.

The pond is designed to retain a 10 year 24 hour storm.

The spillway is designed for a 25 year 6 hour storm event.

The channel is designed to be stable during a 10 year 6 hour storm event.

The hydrology structure schematic for Pond 311 is attached.

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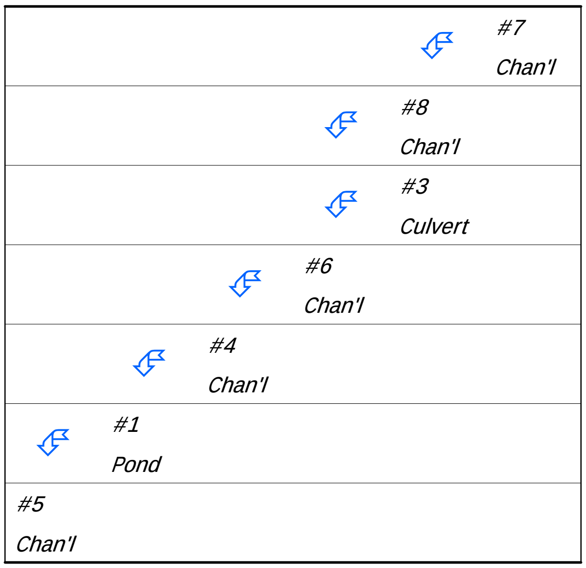
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#5	0.000	0.000	Pond 311
Culvert	#3	==>	#6	0.896	0.267	CP-45
Channel	#4	==>	#1	0.000	0.000	South Rip Rap Channel 2
Channel	#5	==>	End	0.000	0.000	Spillway Channel
Channel	#6	==>	#4	0.000	0.000	South Channel 2
Channel	#7	==>	#8	0.000	0.000	South Channel 1
Channel	#8	==>	#6	0.000	0.000	South Rip Rap Channel 1



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	5. Nearly bare and untilled, and alluvial valley fans	1.40	50.00	3,580.23	1.18	0.842
	8. Large gullies, diversions, and low flowing streams	2.62	25.00	954.52	4.85	0.054
#3	**Muskingum K:**					**0.896**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#7		11.900	11.900	7.62	0.35
#8		0.100	12.000	7.64	0.35
#3		219.700	219.700	29.86	2.41
#6		26.600	258.300	26.63	3.53
#4		0.100	258.400	26.63	3.53
#1	In	1.400	259.800	26.66	3.58
	Out			18.64	3.56
#5		0.000	259.800	18.64	3.56

Structure Detail:

Structure #7 (Erodible Channel)

South Channel 1

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	0.9	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.62 cfs	
Depth:	0.27 ft	1.27 ft
Top Width:	13.59 ft	19.59 ft
Velocity:	2.25 fps	
X-Section Area:	3.40 sq ft	
Hydraulic Radius:	0.248 ft	
Froude Number:	0.79	

Structure #8 (Riprap Channel)

South Rip Rap Channel 1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	10.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.64 cfs	
Depth:	0.08 ft	1.08 ft
Top Width:	12.51 ft	18.51 ft
Velocity*:		
X-Section Area:	1.04 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.083 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Culvert)

CP-45

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	0.05	0.0150	5.00	0.00	0.90

Culvert Results:

Design Discharge = 29.86 cfs

Minimum pipe diameter: 1 - 30 inch pipe(s) required

Structure #6 (Erodible Channel)

South Channel 2

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	0.9	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	26.63 cfs	
Depth:	0.55 ft	1.55 ft
Top Width:	15.30 ft	21.30 ft
Velocity:	3.55 fps	
X-Section Area:	7.51 sq ft	
Hydraulic Radius:	0.485 ft	
Froude Number:	0.89	

Structure #4 (Riprap Channel)

South Rip Rap Channel 2

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	11.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	26.63 cfs	
Depth:	0.22 ft	1.22 ft
Top Width:	13.30 ft	19.30 ft
Velocity*:		
X-Section Area:	2.73 sq ft	
Hydraulic Radius:	0.204 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Pond)

Pond 311

Pond Inputs:

Initial Pool Elev:	5,333.00 ft
Initial Pool:	8.28 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,333.00	25.00	3.00:1	3.00:1	12.00

Pond Results:

Peak Elevation:	5,333.81 ft
Dewater Time:	0.65 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,325.50	0.934	0.000	0.000		
5,326.00	0.954	0.472	0.000		
5,326.50	0.974	0.954	0.000		
5,326.92	0.991	1.367	0.000		
5,327.00	0.994	1.446	0.000		
5,327.50	1.015	1.948	0.000		
5,328.00	1.036	2.461	0.000		
5,328.50	1.058	2.985	0.000		
5,329.00	1.079	3.519	0.000		
5,329.50	1.102	4.064	0.000		
5,330.00	1.124	4.621	0.000		
5,330.50	1.147	5.188	0.000		
5,331.00	1.177	5.769	0.000		
5,331.50	1.207	6.365	0.000		
5,332.00	1.251	6.980	0.000		
5,332.50	1.296	7.616	0.000		
5,333.00	1.371	8.283	0.000		Spillway #1
5,333.50	1.377	8.970	0.771	10.78*	
5,333.81	1.584	9.432	18.637	4.85	Peak Stage
5,334.00	1.634	9.721	29.820		
5,334.50	1.801	10.580	65.875		
5,335.00	1.975	11.524	112.817		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,325.50	0.000	0.000
5,326.00	0.000	0.000
5,326.50	0.000	0.000
5,326.92	0.000	0.000
5,327.00	0.000	0.000
5,327.50	0.000	0.000
5,328.00	0.000	0.000
5,328.50	0.000	0.000
5,329.00	0.000	0.000
5,329.50	0.000	0.000
5,330.00	0.000	0.000

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,330.50	0.000	0.000
5,331.00	0.000	0.000
5,331.50	0.000	0.000
5,332.00	0.000	0.000
5,332.50	0.000	0.000
5,333.00	0.000	0.000
5,333.50	0.771	0.771
5,334.00	29.820	29.820
5,334.50	65.875	65.875
5,335.00	112.817	112.817

Structure #5 (Erodible Channel)

Spillway Channel

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	0.5	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	18.64 cfs	
Depth:	0.53 ft	1.53 ft
Top Width:	15.16 ft	21.16 ft
Velocity:	2.61 fps	
X-Section Area:	7.14 sq ft	
Hydraulic Radius:	0.466 ft	
Froude Number:	0.67	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#7	1	11.900	0.179	0.000	0.000	89.000	M	7.62	0.350
	Σ	**11.900**						**7.62**	**0.350**
#8	1	0.100	0.009	0.000	0.000	89.000	M	0.11	0.003
	Σ	**12.000**						**7.64**	**0.353**
#3	1	219.700	0.444	0.444	0.324	80.000	M	33.14	2.407
	Σ	**219.700**						**29.86**	**2.407**
#6	1	26.600	5.410	0.000	0.000	89.000	M	1.67	0.768
	Σ	**258.300**						**26.63**	**3.528**
#4	1	0.100	0.010	0.000	0.000	89.000	M	0.11	0.003
	Σ	**258.400**						**26.63**	**3.531**
#1	1	1.400	0.001	0.000	0.000	89.000	M	1.55	0.051
	Σ	**259.800**						**26.66**	**3.581**
#5	Σ	**259.800**						**18.64**	**3.558**

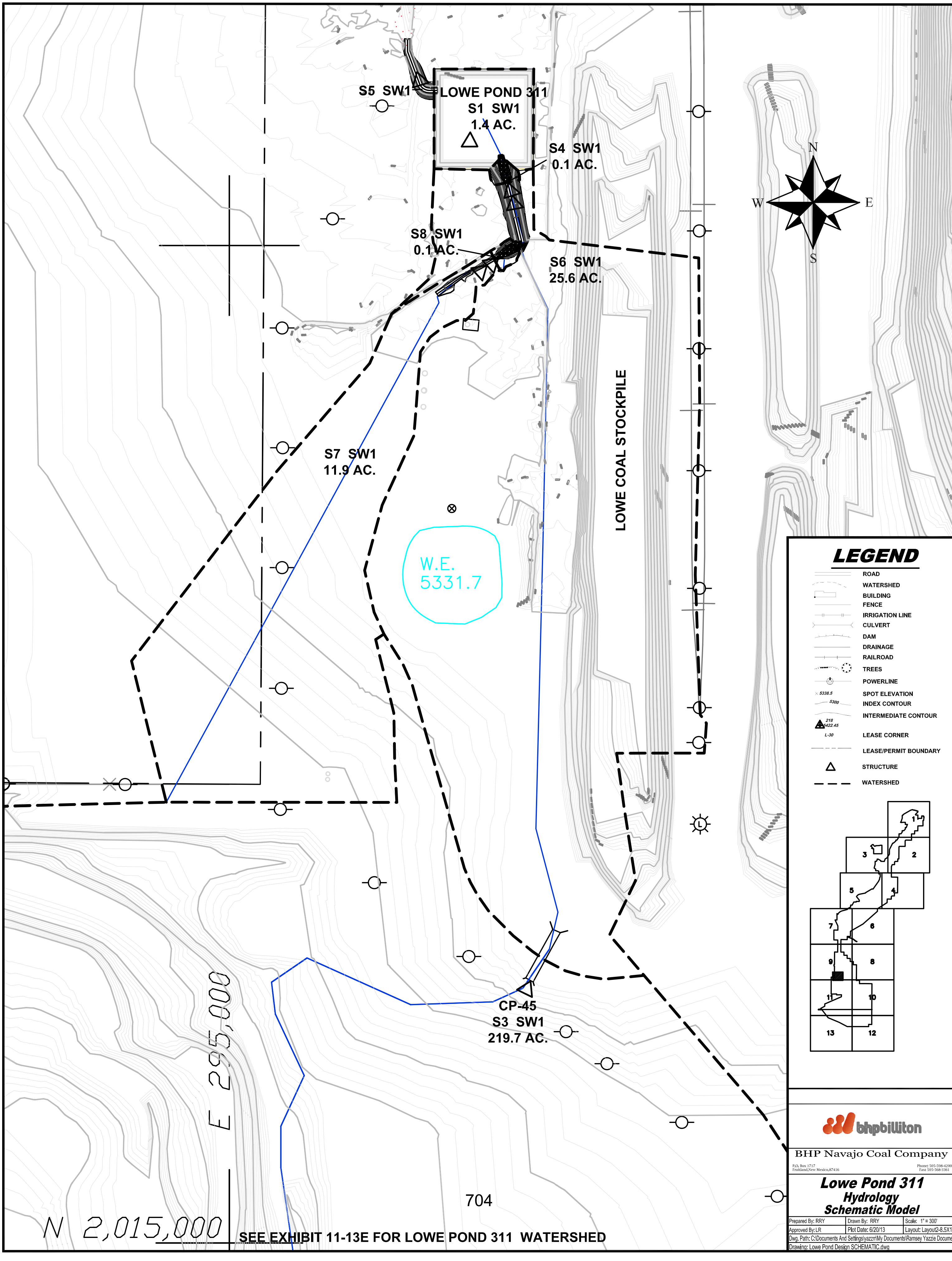
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	3.98	0.10	2.50	5.980	0.000
		5. Nearly bare and untilled, and alluvial valley fans	48.08	12.50	26.00	6.930	0.001
#1	**1**	**Time of Concentration:**					**0.001**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	25.00	954.52	1.610	0.164
		8. Large gullies, diversions, and low flowing streams	1.40	50.00	3,580.37	3.540	0.280
#3	**1**	**Time of Concentration:**					**0.444**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	5.56	5.00	90.00	2.350	0.010
#4	**1**	**Time of Concentration:**					**0.010**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	0.14	10.00	7,183.90	0.370	5.393
		8. Large gullies, diversions, and low flowing streams	0.65	1.00	155.01	2.400	0.017
#6	**1**	**Time of Concentration:**					**5.410**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	1.13	2.00	177.00	1.060	0.046

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	0.93	13.00	1,393.65	2.890	0.133
#7	**1**	**Time of Concentration:**					**0.179**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	6.60	6.00	90.95	2.560	0.009
#8	**1**	**Time of Concentration:**					**0.009**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	25.00	954.52	1.610	0.164
		8. Large gullies, diversions, and low flowing streams	1.40	50.00	3,580.37	3.540	0.280
#3	**1**	**Muskingum K:**					**0.444**



S5 SW1
LOWE POND 311
S1 SW1
1.4 AC.
S4 SW1
0.1 AC.
S8 SW1
0.1 AC.
S6 SW1
25.6 AC.
S7 SW1
11.9 AC.
W.E.
5331.7
LOWE COAL STOCKPILE
CP-45
S3 SW1
219.7 AC.
E 2,295,000
N 2,015,000
N
S
E
W
LEGEND
ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE CORNER
LEASE/PERMIT BOUNDARY
STRUCTURE
WATERSHED
1
2
3
4
5
6
7
8
9
10
11
12
13
BHP Navajo Coal Company
P.O. Box 1717
Fruitland,New Mexico,87416
Phone: 505-598-4200
Fax: 505-568-3361
Lowe Pond 311
Hydrology
Schematic Model
Prepared By: RRY
Drawn By: RRY
Scale: 1" = 300'
Approved By: LR
Plot Date: 6/20/13
Layout: Layout2-8.5X11_P
Dwg. Path: C:\Documents And Settings\yazzrr\My Documents\Ramsey Yazzie Documents\Projects\Curren
Drawing: Lowe Pond Design SCHEMATIC.dwg
SEE EXHIBIT 11-13E FOR LOWE POND 311 WATERSHED

Appendix 26.D

Highwall Impoundment Design and As-Built Information

APPENDIX 26.D
TABLE OF CONTENTS

STANDARD DESIGN FOR HIGHWALL IMPOUNDMENTS

Objective

The objective is to develop a standard design that would allow the mine to construct highwall impoundments without site specific designs, using an approved standard design. The standard design would be incorporated into the mine's approved PAP. It would address only the impoundments with spillways and would comply with the applicable parts of CFR 30 Part 816.46.

The impoundments without a spillway or those relying on storage capacity to totally retain the runoff from the design storm event would not be included in the standard design. Site specific designs for these would be developed and submitted for approval prior to construction.

General Description

At Navajo Mine the mining pits are advancing in the upstream direction towards the east. The highwall impoundments are located upstream of the immediate mining area (IMA) on the highwall side of the pit. The primary function of these impoundments is to control or minimizes the inflow of the surface runoff into the IMA. The intent is to retain all or a portion of the smaller intensity but more frequently occurring precipitation events, thereby enhancing the safety of the work areas in the IMA (i.e., topsoil removal, truck/shovel, blasting, and mining operations).

These impoundments although not intended to protect the environment will retain some sediment. In the a event of a discharge, the water released along with any sediment generated will be retained in the pit downstream. The discharges from these impoundments have no chance of leaving the permit area. Discharge through the spillways would be very infrequent, since the annual rainfall for the area is 6 to 7 inches which generates infrequent surface runoff. The impoundment would be dry and empty a majority of the time.

The capacity of future highwall impoundments will be less than 10 acre-feet. The existing highwall impoundments are all less than 10 ac-ft, except for Sunflower #1 which has a capacity of 12.23 ac-ft. A watershed map and the stage storage tables for the existing impoundments are attached. These are small impoundments that will not constitute a hazard to the general public, mine employees, mine equipment and public transportation/utilities. The potential for loss of life and property damage is very low. They will all be classified as low hazard potential dams.

Design Approach and Application

The primary step in the design approach would be to establish a design criteria that would not be too overly conservative, yet simplify and reduce the number of analysis required. This was done by evaluating watersheds of existing impoundments and using the data to establish the design criteria. To demonstrate that the design criteria and assumptions made will give conservative results, the results of the hydrological analysis using actual conditions were compared to those using the established design criteria. The design criteria established for the standard design gave conservative results in almost all cases except for one. For more details on the comparison see discussion under Comparison of Actual vs Criteria for Standard Design.

Two drawings have been developed, one for the as-builts (Highwall Impoundments As-builts) and the other for the standard design (Highwall Impoundments Standard Design). The Highwall Impoundments As-builts drawing shows the as-built dimensions of all the existing highwall impoundments. This drawing will be updated as additional highwall impoundments are constructed. The updates will be submitted to OSM for review.

The Highwall Impoundments Standard Design drawing will be used to construct future highwall impoundments needed to meet operational needs. This exhibit was developed using the design criteria outlined below. The Highwall Impoundments Standard Design drawing shows a typical section for the spillway and embankment, and also a spillway schedule.
The spillway schedule shows the watershed sizes, the associated CN's, peak discharges and the required spillway size. After determining the watershed size and the CN the spillway schedule will be used to determine the spillway size required.

Design Criteria

The design criteria will address only impoundments with spillways. Site specific designs will be developed for impoundments without spillways and submitted to OSM for approval. To simplify and also narrow down the number of analysis required, conservative design parameters applicable to a range of conditions will be used. Listed below are the design criteria that would be used.

- The curve number (CN) will be selected based on the percentage of badlands (Ba) within the watershed. Refer to the discussion below on curve numbers. The criteria below will be used to select the curve number.

If Badlands $\geq$ 80%,	CN = 93
If Badlands $\geq$ 50% < 80%,	CN = 90
If badlands > 0% < 50%,	CN = 86
If Badlands = 0%,	CN = 83

- The criteria below will be used to determine the parameters needed to calculate the time of concentration (t_c). Refer to discussion below on the time of concentration.
  - ◊ The drainage length will be equal to 1.5 times the side distance of an equivalent square watershed area.
  - ◊ The slope of the drainage length will be equal to 4 percent.
  - ◊ The land use type/condition will be "nearly bare and untilled (overland flow) and alluvial valley fans".
- The spillway will safety pass the peak discharge from the 25 year - 6 hour precipitation event.
- The effect of routing the storm through the impoundment will not be considered for sizing the spillway (conservative).
- The spillway will have a one foot freeboard when flowing.
- The spillway will not have a protective lining for erosion. Refer to discussion below on spillway.
- Impoundment capacity will be less than 10 ac-ft.

Curve Number

The approach outlined below to arrive at a curve number for the undisturbed lands upstream of the IMA is only for the purpose of developing a standard design for highwall impoundments. The approach is based on the assumption that the soils upstream of the IMA have similar properties and distribution as the soils that would be salvaged for topdressing. The soils upstream of the IMA and within the permit area if deemed suitable will be salvaged for topdressing. The suitable topdressing material upstream of the highwall impoundments have not yet been removed, but have been analyzed and are included in the topsoil balance calculations. A weighted curve number will be calculated by using the percentage of Badlands making-up the watershed. The percent of the watershed that is other than Badlands will be assigned a curve number of 80 which is the curve number calculated for the reclaimed lands. The portion that is Badlands will be assigned a curve number of 93.

The curve number selected will be based on the percentage of badlands within the watershed. To simplify and yet be conservative the criteria below will be used for selecting the curve number.

If Badlands ≥ 80%, CN = 93
If Badlands ≥ 50% < 80%, CN = 90
If Badlands >0% < 50%, CN = 86
If Badlands = 0%, CN = 83

Time of Concentration

The time of concentration (t_c) is a function of the land use type/condition, the configuration of the watershed, and the slope and length of the drainage length. The discharge rate from a watershed is dependent on the magnitude of the t_c value, smaller values give higher discharge rates. Watersheds with short drainage lengths or steep slopes have smaller t_c values. A square watershed will have the shortest drainage length, however actual watershed configurations are more elongated. To establish a simplified but conservative method for calculating the t_c, the watersheds for the existing highwall impoundments were evaluated. The watershed map of the existing impoundments is attached. The configuration of the watersheds were compared to an equivalent square watershed. The side distance of an equivalent square area was determined for each watershed. Then a ratio between the drainage length and the side distance of the square was determined. The slopes of the drainage lengths were also determined. See TABLE A below for the values determined. The ratio of the drainage length to the side distance of an equivalent square area ranged from 1.2 to 3.8 with an average of 2.1. The slope of the drainage length ranged from 0.8 to 6.4 percent with an average of 3.3 percent. Using the data from TABLE A the criteria below was established to determine the parameters that will be used to calculate the t_c.

- The ratio of the drainage length to the side distance of an equivalent square area will be equal to 1.5 or the drainage length will be equal to 1.5 times the side distance of an equivalent square area. This ratio is less than the average value and is less than all values in the table except for one. It will in most cases give conservative t_c values.

- The slope of the drainage length will be equal to 4 percent. This slope is steeper than the average slope and is less than four of the slope values in the table. This coupled with a short or conservative drainage length, will in almost all cases give conservative t_c values.
- The land use type/condition will be "nearly bare and untilled (overland flow) and alluvial valley fans".

The procedure outlined above for determining the t_c is only for the purpose of developing a standard design for highwall impoundments.

TABLE A

Impoundment Id.	Watershed Area (acres)	Delta Elev. (ft)	Drainage Length (DL) (ft)	Side Dist. of Square (SS) (ft)	Ratio DL:SS	Slope of Drainage Length (%)
Yazzie Stockpond #1	125.5	210	5200	2338	2.2	4.0
Yazzie Stockpond #2	174.1	200	5652	2754	2.1	3.5
So. Hosteen Stockpond #1	80.1	155	3750	1868	2.0	4.1
So. Hosteen Stockpond #2	37.7	70	2250	1282	1.8	3.1
So. Hosteen Stockpond #3	157.3	249	4300	2618	1.6	5.8
Stub 16 Impoundment #2	20.2	103	2150	938	2.3	4.8
Stub 16 Impoundment #3	10.6	87	1350	680	2.0	6.4
Stub 18 Impoundment	103.4	135	3850	2122	1.8	3.5
Sunflower #1	24.6	17	1250	1035	1.2	1.4
Area 3 Temp. Div. Imp. #2	69.9	31	4100	1745	2.3	0.8
Area 3 Temp. Div. Imp. #3	20.8	35	1600	952	1.7	2.2
Area 3 Temp. Div. Imp. #5	11.6	46	2700	711	3.8	1.7
Area 3 Temp. Div. Imp. #7	55.5	59	3600	1555	2.3	1.6
				Average	2.1	3.3

Comparison of Actual vs Criteria for Standard Design

To demonstrate that the design criteria established for the highwall impoundments will give conservative results in almost all cases, the values for t_c , CN, and Q were determined for the actual conditions and compared to the values determined by applying the design criteria established. The watersheds for the existing highwall impoundments were used to make this demonstration. The Sedcad+ computer software was utilized to determine the values. The Sedcad+ computer runs for the hydrological analysis for both cases are attached . The CN derived by applying the design criteria established is in-line with the actual CN values. See TABLE C for derivation of the actual CN values. The t_c and Q values derived from the design criteria are in most cases conservative, except for South Hosteen Stockpond #3. See TABLE B for comparison of the derived values. The peak discharge (Q') for South Hosteen Stockpond #3 derived by applying the design criteria established is less than the actual discharge. The difference is 5.7 cfs or 4.0 percent of actual discharge. This difference is insignificant since other conservative assumptions are made for the design of the spillway. Spillway will be designed to pass the peak discharge with a one foot freeboard without considering the effect of routing through the impoundment. The peak stage in the impoundment will never rise above the one foot freeboard for the design storm event (25 year - 6 hour).

Spillway Design

The maximum discharge rate with one foot freeboard were determined for the standard spillway sizes shown on TABLE D. The Sedcad+ basin discharge utility was used to determined the maximum discharge rates. The Sedcad+ computer runs for the spillways are attached. TABLE D summarizes the maximum discharge rate for the standard spillway sizes. For watershed sizes ranging from 25 to 700 acres, TABLE D was used to select a spillway size that will pass the peak discharge from a 25 year - 6 hour storm event. Attached are the Sedcad+ computer runs or the hydrological analysis for determining the peak discharges for watershed sizes 25 to 700 acres. The design criteria established above was applied in the analysis. The Spillway Schedule on the Highwall Impoundments Standard Design drawing shows the spillway sizes that will pass the peak discharge (25 yr. - 6 hr) from selected watershed sizes ranging from 25 to 700 acres. The CN's associated with each watershed size are also shown. After determining the watershed size and the CN associated with the watershed, the Spillway Schedule on the Highwall Impoundments Standard Design drawing can be used the determine the spillway size required.

Discharge through the spillways are very infrequent since the annual rainfall for the area is only 6 to 7 inches. The existing spillways have no protective lining for erosion. Very minimal amount of erosion have occurred in the spillways during these overflows. The water discharged through the spillway and any sediment generated have been retained in the pits downstream. Adverse environmental impact to streamflow outside the permit area due to either discharge of pollutants or excessive sediment is not possible since the pit will intercept and retain the flow before it leaves the permit area. The spillways of the existing and future highwall impoundments will not be lined for erosion protection, since only minimal amount of erosion is anticipated and the potential of any water or sediment leaving the permit area is very unlikely. The spillway will be inspected, any damages identified will be repaired promptly.

The capacity of future highwall impoundments will be less than 10 ac-ft and classified as a low hazard potential dam. These impoundments are small, in the event of a failure they will not be an imminent danger to employees and equipment working in the pits. The potential for loss of life and property damage is very low.

As-builts

The dimensions of the existing highwall impoundments are shown on the Highwall Impoundments As-builts drawing. The spillways for the existing impoundments were checked to insure that they would pass the design storm event. The Sedcad+ computer runs are attached. The Highwall Impoundments As-builts drawing will be updated as additional impoundments are constructed. Updates will be submitted to OSM for review.

Inspection and Maintenance

The regular quarterly and annual inspections will be done for the highwall impoundments. Any maintenance items identified during these inspections will be corrected or repaired promptly.

TABLE B

HIGHWALL IMPOUNDMENTS
COMPARISON OF HYDROLOGICAL ANALYSIS
ACTUAL VS CRITERIA FOR STANDARD DESIGN

Impoundment Id:	Curve Number		Time of Concentration		Peak Discharge (25 yr - 6 hr)	
	CN [2]	CN' [1]	t_c	t_c' [1]	Q	Q' [1]
Yazzie Stockpond #1	93.0	93.0	0.718	0.487	92.8	118.1
Yazzie Stockpond #2	91.9	93.0	0.834	0.573	106.6	148.9
South Hosteen Stockpond #1	92.4	93.0	0.512	0.389	70.0	84.7
South Hosteen Stockpond #2	92.7	93.0	0.354	0.266	85.6	98.4
South Hosteen Stockpond #3	92.8	93.0	0.496	0.545	144.3	138.6
Stub 16 Impoundment #2	93.0	93.0	0.272	0.195	24.9	27.8
Stub 16 Impoundment #3	93.0	93.0	0.147	0.141	15.5	15.5
Stub 18 Impoundment	82.0	83.0	0.571	0.442	34.9	45.2
Sunflower #1	82.0	83.0	0.297	0.215	12.3	15.6
Area 3 Temp. Div. Imp. #2	81.6/89.0	83.0	1.251	0.363	15.6	34.3
Area 3 Temp. Div. Imp. #3	82.0/89.0	83.0	0.257	0.198	17.6	32.1
Area 3 Temp. Div. Imp. #5	89.0	90.0	0.556	0.133	18.9	29.6
Area 3 Temp. Div. Imp. #7	86.4/89.0	86.0	0.781	0.322	29.8	37.4

(1) CN', tc, and Q' were determined by applying the design criteria established for the standard design for highwall impoundment.

(2) Two curve numbers are indicated when a subwatershed having a different CN was routed via a channel.

TABLE C

CURVE NUMBERS
FOR WATERSHEDS OF EXISTING IMPOUNDMENTS

Impoundment Id	Watershed (ac)	Soil Mapping Unit	Area (ac)	Hydrologic Group	CN	% of Watershed	Watershed CN
Yazzie Stockpond #1	125.5	Ba	125.5	D	93.0	100.0	93.0
Yazzie Stockpond #2	174.1	Ba	156.8	D	93.0	90.1	91.9
		Az	17.3	B	82.0	9.9	
South Hosteen Stockpond #1	80.1	Ba	75.2	D	93.0	93.8	92.4
		Fx	4.9	B	84.0	6.1	
South Hosteen Stockpond #2	37.7	Ba	36.7	D	93.0	97.3	92.7
		Az	1.0	B	82.0	2.7	
South Hosteen Stockpond #3	157.3	Ba	150.4	D	93.0	95.6	92.8
		Fx	3.5	B	84.0	2.2	
		Fa	3.4	D	93.0	2.2	
Stub 16 Impoundment #2	20.2	Ba	20.2	D	93.0	100.0	93.0
Stub 16 Impoundment #3	10.6	Ba	10.6	D	93.0	100.0	93.0
Stub 18 Impoundment	103.4	Da	103.4	B	82.0	100.0	82.0
Sunflower #1	24.6	Db	8.2	B	82.0	33.3	82.0
		Du	16.4	B	82.0	66.7	
Area 3 Temp. Div. Imp. #2	69.9	Db	14.4	B	82.0	20.5	81.6
		Du	36.2	B	82.0	51.8	
		Dw	12.4	B	80.0	17.7	
		Du	7.0	B (disturbed)	89.0	10.0	89.0
Area 3 Temp. Div. Imp. #3	20.8	Du	9.7	B	82.0	46.6	82.0
		Du	11.1	B (disturbed)	89.0	53.4	89.0
Area 3 Temp. Div. Imp. #5	11.6	Bb	6.0	D (disturbed)	89.0	51.7	89.0
		Du	5.6	B (disturbed)	89.0	48.3	
Area 3 Temp. Div. Imp. #7	55.5	Bb	20.8	D	93.0	37.5	86.4
		Du	31.5	B	82.0	56.8	
		Du	3.2	B (disturbed)	89.0	5.8	89.0

TABLE D

HIGHWALL IMPOUNDMENT
STANDARD SPILLWAY SIZES

Depth[1] (ft)	Width[2] (ft)	Discharge[3] (cfs)	Depth[1] (ft)	Width[2] (ft)	Discharge[3] (cfs)
2.00	10.0	25.5	3.25	10.0	119.0
	15.0	36.4		15.0	160.9
	20.0	47.3		20.0	202.9
	25.0	58.3		25.0	245.0
2.25	10.0	36.7		30.0	287.2
	15.0	51.9	3.50	10.0	153.3
	20.0	67.1		15.0	204.9
	25.0	82.3		20.0	256.8
2.50	10.0	56.9		25.0	308.7
	15.0	79.3		30.0	360.6
	20.0	101.8	3.75	10.0	179.3
	25.0	124.2		15.0	237.9
2.75	10.0	72.2		20.0	296.7
	15.0	99.7		25.0	355.7
	20.0	127.3		30.0	414.7
	25.0	154.9			
3.00	10.0	98.5			
	15.0	134.3			
	20.0	170.2			
	25.0	206.2			
	30.0	242.2			

(1) From top of embankment to bottom of spillway with 3:1 side slopes.
(2) With a crest length of 25 feet.
(3) Maximum discharge with a one foot freeboard.

HIGHWALL IMPOUNDMENTS

SEDCAD+ COMPUTER RUNS

EXISTING IMPOUNDMENTS
USING ACTUAL CONDITIONS

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

YAZZIE STOCKPOND #1

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\YSPD1

Date: 03-13-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\YSPD1 User: LR
Date: 03-13-1997 Time: 12:16:38
YAZZIE STOCKPOND #1
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	125.50	93	M	0.718	0.000	0.000	0.0	9.98	92.78
			Type: Null		Label: POND					
111	Structure	125.50							9.98	
111	Total IN/OUT	125.50							9.98	92.78

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\YSPD1 User: LR
Date: 03-13-1997 Time: 12:16:38
YAZZIE STOCKPOND #1
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	5200.00	4.04	2.01	0.72	0.718		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

YAZZIE STOCKPOND #2

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\YSPD2

Date: 03-13-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\YSPD2 User: LR
Date: 03-13-1997 Time: 12:22:14
YAZZIE STOCKPOND #2
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	174.10	92	M	0.834	0.000	0.000	0.0	12.76	106.64
			Type: Null		Label: POND					
111	Structure	174.10							12.76	
111	Total IN/OUT	174.10							12.76	106.64

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\YSPD2 User: LR
Date: 03-13-1997 Time: 12:22:14
YAZZIE STOCKPOND #2
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	5650.00	3.54	1.88	0.83	0.834		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SOUTH HOSTEEN STOCKPOND #1 AND 2

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\SHSPD1

Date: 03-13-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SHSPD1 User: LR
Date: 03-13-1997 Time: 12:43:11
SOUTH HOSTEEN STOCKPOND #1 AND 2
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	80.10	92	M	0.512	0.000	0.000	0.0	6.09	69.97
		Type: Null		Label: SO HOSTEEN STKPD #1						
111	Structure	80.10							6.09	
111	Total IN/OUT	80.10							6.09	69.97
112	1	37.70	93	M	0.354	0.000	0.000	0.0	2.93	40.75
		Type: Null		Label: SO HOSTEEN STKPD #2						
112	Structure	37.70							9.02	
112	Total IN/OUT	117.80							9.02	85.64
111 to 112	Routing					0.245	0.316			

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SHSPD1 User: LR
Date: 03-13-1997 Time: 12:43:11
SOUTH HOSTEEN STOCKPOND #1 AND 2
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3750.00	4.13	2.03	0.51	0.512		
1	1	2	1	-a	5	2250.00	3.11	1.76	0.35	0.354		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SOUTH HOSTEEN STOCKPOND #3

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\SHSPD3

Date: 03-13-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SHSPD3 User: LR
Date: 03-13-1997 Time: 12:16:45
SOUTH HOSTEEN STOCKPOND #3
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	157.30	93	M	0.496	0.000	0.000	0.0	12.32	144.33
			Type: Null			Label: POND				
111	Structure	157.30							12.32	
111	Total IN/OUT	157.30							12.32	144.33

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SHSPD3 User: LR
Date: 03-13-1997 Time: 12:16:45
SOUTH HOSTEEN STOCKPOND #3
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	4300.00	5.79	2.41	0.50	0.496		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

STUB 16 IMPOUNDMENT #2

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\S16IMP2

Date: 03-13-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S16IMP2 User: LR
Date: 03-13-1997 Time: 12:31:58
STUB 16 IMPOUNDMENT #2
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	20.20	93	M	0.272	0.000	0.000	0.0	1.61	24.85
			Type: Null			Label: POND				
111	Structure	20.20							1.61	
111	Total IN/OUT	20.20							1.61	24.85

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S16IMP2 User: LR
Date: 03-13-1997 Time: 12:31:58
STUB 16 IMPOUNDMENT #2
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2150.00	4.79	2.19	0.27	0.272		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

STUB 16 IMPOUNDMENT #3

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\S16IMP3

Date: 03-13-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S16IMP3 User: LR
Date: 03-13-1997 Time: 13:11:43
STUB 16 IMPOUNDMENT #3
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	10.60	93	M	0.147	0.000	0.000	0.0	0.84	15.48
			Type: Null		Label: POND					
111	Structure	10.60							0.84	
111	Total IN/OUT	10.60							0.84	15.48

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S16IMP3 User: LR
Date: 03-13-1997 Time: 13:11:43
STUB 16 IMPOUNDMENT #3
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1350.00	6.44	2.54	0.15	0.147		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

STUB 18 IMPOUNDMENT

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\S18IMP

Date: 03-13-1997

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S18IMP User: LR
Date: 03-13-1997 Time: 12:22:01
STUB 18 IMPOUNDMENT
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	103.40	82	M	0.571	0.000	0.000	0.0	3.46	34.87
			Type: Null		Label: POND					
111	Structure	103.40							3.46	
111	Total IN/OUT	103.40							3.46	34.87

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S18IMP User: LR
Date: 03-13-1997 Time: 12:22:01
STUB 18 IMPOUNDMENT
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3850.00	3.51	1.87	0.57	0.571		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SUNFLOWER #1

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\SUNFL1

Date: 03-13-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SUNFL1 User: LR
Date: 03-13-1997 Time: 12:16:43
SUNFLOWER #1
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	24.60	82	M	0.297	0.000	0.000	0.0	0.82	12.29
			Type: Null		Label: POND					
111	Structure	24.60							0.82	
111	Total IN/OUT	24.60							0.82	12.29

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SUNFL1 User: LR
Date: 03-13-1997 Time: 12:16:43
SUNFLOWER #1
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1250.00	1.36	1.17	0.30	0.297		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AREA 3 TEMPORARY DIVERSION IMPOUNDMENT #2, 3, AND 5

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\A3TD235

Date: 03-13-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\A3TD235 User: LR
Date: 03-13-1997 Time: 12:16:32
AREA 3 TEMPORARY DIVERSION IMPOUNDMENT #2, 3, AND 5
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	59.90	82	M	1.141	0.105	0.329	0.0	1.94	12.06
111	2	10.00	89	M	0.922	0.000	0.000	0.0	0.59	4.53
		Type: Null		Label: A3 TEMP DIV IMP 2						
111	Structure	69.90							2.53	
111	Total IN/OUT	69.90							2.53	15.61
112	1	10.00	82	M	0.187	0.070	0.359	0.0	0.33	6.18
112	2	10.80	89	M	0.453	0.000	0.000	0.0	0.64	7.72
		Type: Null		Label: A3 TEMP DIV IMP 3						
112	Structure	20.80							3.50	
112	Total IN/OUT	90.70							3.50	17.56
111 to 112 Routing						0.414	0.220			
113	1	11.60	89	M	0.556	0.000	0.000	0.0	0.68	7.35
		Type: Null		Label: A3 TEMP DIV IMP 5						
113	Structure	11.60							4.18	
113	Total IN/OUT	102.30							4.18	18.90
112 to 113 Routing						0.370	0.267			

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\A3TD235 User: LR
Date: 03-13-1997 Time: 12:16:32
AREA 3 TEMPORARY DIVERSION IMPOUNDMENT #2, 3, AND 5
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3000.00	0.53	0.73	1.14	1.141		
1	1	1	1	-1	8	1250.09	1.20	3.29	0.11		0.105	0.32[illegible]
1	1	1	2	-a	5	2850.00	0.74	0.86	0.92	0.922		
1	1	2	1	-a	5	900.00	1.78	1.33	0.19	0.187		
1	1	2	1	-1	8	1100.24	2.09	4.34	0.07		0.070	0.35[illegible]
1	1	2	2	-a	5	2000.00	1.50	1.22	0.45	0.453		
[illegible]	1	3	1	-a	5	2700.00	1.81	1.35	0.56	0.556		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AREA 3 TEMPORARY DIVERSION IMPOUNDMENT #7

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\A3TD7

Date: 03-13-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\A3TD7 User: LR
Date: 03-13-1997 Time: 12:21:50
AREA 3 TEMPORARY DIVERSION IMPOUNDMENT #7
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	52.30	86	M	0.290	0.512	0.211	0.0	2.52	38.29
111	2	3.20	89	M	0.412	0.000	0.000	0.0	0.19	2.41
			Type: Null			Label: POND				
111	Structure	55.50							2.71	
111	Total IN/OUT	55.50							2.71	29.84

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\A3TD7 User: LR
Date: 03-13-1997 Time: 12:21:50
AREA 3 TEMPORARY DIVERSION IMPOUNDMENT #7
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1550.00	2.19	1.48	0.29	0.290		
1	1	1	1	-1	5	1650.10	1.09	1.04	0.44			
				-2	8	500.00	0.40	1.90	0.07		0.512	0.211
1	1	1	2	-a	5	1050.00	0.50	0.71	0.41	0.412		

HIGHWALL IMPOUNDMENTS

SEDCAD+ COMPUTER RUNS

EXISTING IMPOUNDMENTS
USING THE CRITERIA FOR STANDARD DESIGN

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

YAZZIE STOCKPOND #1 - USING CRITERIA FOR STANDARD DESIGN

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\YSPD1A

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\YSPD1A User: LR
Date: 03-13-1997 Time: 12:21:53
YAZZIE STOCKPOND #1 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	125.50	93	M	0.487	0.000	0.000	0.0	9.98	118.13
			Type: Null		Label: POND					
111	Structure	125.50							9.98	
111	Total IN/OUT	125.50							9.98	118.13

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\YSPD1A User: LR
Date: 03-13-1997 Time: 12:21:53
YAZZIE STOCKPOND #1 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J B S SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1 1 1 1	-a	5	3507.00	4.00	2.00	0.49	0.487		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

YAZZIE STOCKPOND #2 - USING CRITERIA FOR STANDARD DESIGN

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\YSPD2A

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\YSPD2A User: LR
Date: 03-13-1997 Time: 12:21:54
YAZZIE STOCKPOND #2 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	174.10	93	M	0.573	0.000	0.000	0.0	13.84	148.87
		Type: Null			Label: POND				
111 Structure	174.10							13.84	
111 Total IN/OUT	174.10							13.84	148.87

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\YSPD2A User: LR
Date: 03-13-1997 Time: 12:21:54
YAZZIE STOCKPOND #2 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	4130.00	4.00	2.00	0.57	0.573		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SOUTH HOSTEEN STOCKPOND #1 AND 2 - USING CRITERIA FOR STANDARD DESIGN

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\SHSPD1A

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SHSPD1A User: LR
Date: 03-13-1997 Time: 12:21:56
SOUTH HOSTEEN STOCKPOND #1 AND 2 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	80.10	93	M	0.389	0.000	0.000	0.0	6.37	84.66
		Type: Null		Label: SO HOSTEEN STKPD #1						
111	Structure	80.10							6.37	
111	Total IN/OUT	80.10							6.37	84.66
112	1	37.70	93	M	0.266	0.000	0.000	0.0	3.00	46.74
		Type: Null		Label: SO HOSTEEN STKPD #2						
112	Structure	37.70							9.37	
112	Total IN/OUT	117.80							9.37	98.37
111 to 112	Routing					0.245	0.316			

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SHSPD1A User: LR
Date: 03-13-1997 Time: 12:21:56
SOUTH HOSTEEN STOCKPOND #1 AND 2 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2802.00	4.00	2.00	0.39	0.389		
1	1	2	1	-a	5	1922.00	4.00	2.00	0.27	0.266		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SOUTH HOSTEEN STOCKPOND #3 - USING CRITERIA FOR STANDARD DESIGN

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\SHSPD3A

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SHSPD3A User: LR
Date: 03-13-1997 Time: 12:21:59
SOUTH HOSTEEN STOCKPOND #3 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	157.30	93	M	0.545	0.000	0.000	0.0	12.51	138.63
			Type: Null		Label: POND					
111	Structure	157.30							12.51	
111	Total IN/OUT	157.30							12.51	138.63

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SHSPD3A User: LR
Date: 03-13-1997 Time: 12:21:59
SOUTH HOSTEEN STOCKPOND #3 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3926.00	4.00	2.00	0.55	0.545		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

STUB 16 IMPOUNDMENT #2 - USING CRITERIA FOR STANDARD DESIGN

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\S16IMP2A

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S16IMP2A User: LR
Date: 03-13-1997 Time: 12:22:03
STUB 16 IMPOUNDMENT #2 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	20.20	93	M	0.195	0.000	0.000	0.0	1.61	27.75
		Type: Null		Label: POND					
111 Structure	20.20							1.61	
111 Total IN/OUT	20.20							1.61	27.75

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S16IMP2A User: LR
Date: 03-13-1997 Time: 12:22:03
STUB 16 IMPOUNDMENT #2 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	1407.00	4.00	2.00	0.20	0.195		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

STUB 16 IMPOUNDMENT #3 - USING CRITERIA FOR STANDARD DESIGN

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\S16IMP3A

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S16IMP3A User: LR
Date: 03-13-1997 Time: 12:22:04
STUB 16 IMPOUNDMENT #3 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	10.60	93	M	0.141	0.000	0.000	0.0	0.84	15.48
			Type: Null		Label: POND					
111	Structure	10.60							0.84	
111	Total IN/OUT	10.60							0.84	15.48

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S16IMP3A User: LR
Date: 03-13-1997 Time: 12:22:04
STUB 16 IMPOUNDMENT #3 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1019.00	4.00	2.00	0.14	0.141		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

STUB 18 IMPOUNDMENT - USING CRITERIA FOR STANDARD DESIGN

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\S18IMPA

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S18IMPA User: LR
Date: 03-13-1997 Time: 12:22:12
STUB 18 IMPOUNDMENT - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	103.40	83	M	0.442	0.000	0.000	0.0	3.77	45.24
			Type: Null			Label: POND				
111	Structure	103.40							3.77	
111	Total IN/OUT	103.40							3.77	45.24

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\S18IMPA User: LR
Date: 03-13-1997 Time: 12:22:12
STUB 18 IMPOUNDMENT - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	3183.00	4.00	2.00	0.44	0.442		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SUNFLOWER #1 - USING CRITERIA FOR STANDARD DESIGN

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\SUNFL1A

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SUNFL1A User: LR
Date: 03-13-1997 Time: 12:22:11
SUNFLOWER #1 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	24.60	83	M	0.215	0.000	0.000	0.0	0.90	15.62
		Type: Null		Label: POND					
111 Structure	24.60								
								0.90	
111 Total IN/OUT	24.60							0.90	15.62

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\SUNFL1A User: LR
Date: 03-13-1997 Time: 12:22:11
SUNFLOWER #1 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1553.00	4.00	2.00	0.22	0.215		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AREA 3 TEMP DIVERSION IMP #2, 3, AND 5 - USING CRITERIA FOR STD DESIGN

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\A3TD235A

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\A3TD345A User: LR
Date: 03-13-1997 Time: 12:22:06
AREA 3 TEMP DIVERSION IMP #2, 3, AND 5 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	69.90	83	M	0.363	0.000	0.000	0.0	2.55	34.34
111	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null		Label: A3 TEMP DIV IMP 2						
111	Structure	69.90							2.55	
111	Total IN/OUT	69.90							2.55	34.34
112	1	20.80	83	M	0.198	0.000	0.000	0.0	0.76	13.66
112	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Null		Label: A3 TEMP DIV IMP 3						
112	Structure	20.80							3.31	
112	Total IN/OUT	90.70							3.31	32.08
111 to 112	Routing					0.414	0.220			
113	1	11.60	83	M	0.148	0.000	0.000	0.0	0.42	8.20
		Type: Null		Label: A3 TEMP DIV IMP 5						
113	Structure	11.60							3.73	
113	Total IN/OUT	102.30							3.73	29.61
112 to 113	Routing					0.370	0.267			

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\A3TD345A User: LR
Date: 03-13-1997 Time: 12:22:06
AREA 3 TEMP DIVERSION IMP #2, 3, AND 5 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2617.00	4.00	2.00	0.36	0.363		
1	1	1	2	-a	5	2850.00	0.74	0.86	0.92	0.000		
1	1	2	1	-a	5	1428.00	4.00	2.00	0.20	0.198		
1	1	2	2	-a	5	2000.00	1.50	1.22	0.45	0.000		
1	1	3	1	-a	5	1066.00	4.00	2.00	0.15	0.148		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AREA 3 TEMP DIVERSION IMPOUNDMENT #7 - USING CRITERIA FOR STD DESIGN

by

Name: LR

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\A3TD7A

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\A3TD7A User: LR
Date: 03-13-1997 Time: 12:21:49
AREA 3 TEMP DIVERSION IMPOUNDMENT #7 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	55.50	86	M	0.323	0.000	0.000	0.0	2.59	37.38
111	2	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
			Type: Null			Label: POND				
111	Structure	55.50							2.59	
111	Total IN/OUT	55.50							2.59	37.38

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\A3TD7A User: LR
Date: 03-13-1997 Time: 12:21:49
AREA 3 TEMP DIVERSION IMPOUNDMENT #7 - CRITERIA FOR STANDARD DESIGN
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2332.00	4.00	2.00	0.32	0.323		
1	1	1	2	-a	5	1050.00	0.50	0.71	0.41	0.000		

HIGHWALL IMPOUNDMENTS

SEDCAD+ COMPUTER RUNS

EXISTING SPILLWAYS

SEDCAD+ BASIN DISCHARGE UTILITY

YAZZIE STOCKPOND #1 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	105.50
Crest Length	20.000 feet
Z:1 (Left)	1.50:1
Z:1 (Right)	3.00:1
Bottom Width	8.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
105.00	0.0	0.0
105.50	0.0	0.0
106.00	6.7	6.7
106.10	8.1	8.1
106.20	10.5	10.5
106.30	13.8	13.8
106.40	17.2	17.2
106.50	21.2	21.2
107.00	45.8	45.8

Existing spillway will not pass the peak discharge from the 25 yr - 6 hr storm event.

SEDCAD+ BASIN DISCHARGE UTILITY

YAZZIE STOCKPOND #2 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	105.30
Crest Length	23.000 feet
Z:1 (Left)	2.00:1
Z:1 (Right)	1.50:1
Bottom Width	12.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
105.00	0.0	0.0
105.30	0.0	0.0
105.50	4.2	4.2
106.00	14.7	14.7
106.10	19.1	19.1
106.20	23.6	23.6
106.30	28.9	28.9
106.50	40.7	40.7
106.80	61.3	61.3
107.00	77.0	77.0

Existing spillway will not pass the peak discharge from the 25 yr - 6 hr storm event.

SEDCAD+ BASIN DISCHARGE UTILITY

SOUTH HOSTEEN STOCKPOND #1 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.90
Crest Length	27.000 feet
Z:1 (Left)	4.00:1
Z:1 (Right)	5.00:1
Bottom Width	5.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.90	0.0	0.0
104.00	0.1	0.1
104.50	0.8	0.8
104.60	7.4	7.4
104.70	9.9	9.9
104.80	12.7	12.7
104.90	16.0	16.0
105.00	20.0	20.0
105.40	40.6	40.6
105.50	46.6	46.6
105.90	75.5	75.5
106.00	84.3	84.3
106.40	125.6	125.6
106.50	137.8	137.8
106.90	193.2	193.2
107.00	208.7	208.7

SEDCAD+ BASIN DISCHARGE UTILITY

SOUTH HOSTEEN STOCKPOND #2 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.50
Crest Length	30.000 feet
Z:1 (Left)	1.50:1
Z:1 (Right)	1.50:1
Bottom Width	13.700 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.20	0.0	0.0
103.30	0.0	0.0
103.40	0.0	0.0
103.50	0.0	0.0
104.00	11.1	11.1
104.20	15.5	15.5
104.30	20.0	20.0
104.40	24.9	24.9
104.50	30.2	30.2
105.00	66.3	66.3
105.50	107.7	107.7
106.00	160.7	160.7
106.50	225.7	225.7
107.00	300.5	300.5

SEDCAD+ BASIN DISCHARGE UTILITY

SOUTH HOSTEEN STOCKPOND #3 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.50
Crest Length	30.000 feet
Z:1 (Left)	1.50:1
Z:1 (Right)	1.50:1
Bottom Width	13.700 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	11.1	11.1
104.20	15.5	15.5
104.30	20.0	20.0
104.40	24.9	24.9
104.50	30.2	30.2
105.00	66.3	66.3
105.50	107.7	107.7
106.00	160.7	160.7
106.50	225.7	225.7
107.00	300.5	300.5

SEDCAD+ BASIN DISCHARGE UTILITY

STUB 16 IMPOUNDMENT #2 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.70
Crest Length	48.000 feet
Z:1 (Left)	1.90:1
Z:1 (Right)	1.80:1
Bottom Width	12.800 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.70	0.0	0.0
104.00	5.4	5.4
104.40	12.6	12.6
104.50	16.7	16.7
104.60	20.8	20.8
104.70	25.2	25.2
105.00	44.2	44.2
105.20	59.2	59.2
105.50	81.7	81.7
105.70	98.4	98.4
106.00	127.3	127.3
106.20	148.3	148.3
106.50	184.1	184.1
106.70	209.9	209.9
107.00	253.2	253.2

SEDCAD+ BASIN DISCHARGE UTILITY

STUB 16 IMPOUNDMENT #3 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.50
Crest Length	36.000 feet
Z:1 (Left)	1.90:1
Z:1 (Right)	2.20:1
Bottom Width	11.500 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
105.00	9.0	9.0
105.20	12.6	12.6
105.30	16.4	16.4
105.40	20.7	20.7
105.50	25.3	25.3
106.00	56.9	56.9
106.50	95.8	95.8
107.00	143.8	143.8

SEDCAD+ BASIN DISCHARGE UTILITY

STUB 18 IMPOUNDMENT - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	102.60
Crest Length	45.000 feet
Z:1 (Left)	2.30:1
Z:1 (Right)	2.50:1
Bottom Width	17.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
102.60	0.0	0.0
103.00	9.8	9.8
103.30	17.1	17.1
103.40	22.5	22.5
103.50	28.2	28.2
103.60	34.3	34.3
104.00	68.9	68.9
104.10	79.0	79.0
104.50	120.6	120.6
104.60	132.2	132.2
105.00	183.6	183.6
105.10	197.6	197.6
105.50	262.6	262.6
105.60	280.2	280.2
106.00	357.6	357.6
106.10	378.4	378.4
106.50	470.0	470.0
106.60	494.4	494.4
107.00	592.1	592.1

SEDCAD+ BASIN DISCHARGE UTILITY

SUNFLOWER #1 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.90
Crest Length	38.000 feet
Z:1 (Left)	4.30:1
Z:1 (Right)	5.20:1
Bottom Width	15.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.90	0.0	0.0
104.00	2.4	2.4
104.50	14.4	14.4
104.60	16.8	16.8
104.70	22.1	22.1
104.80	28.1	28.1
104.90	34.7	34.7
105.00	42.5	42.5
105.40	81.0	81.0
105.50	91.8	91.8
105.90	141.6	141.6
106.00	155.4	155.4
106.40	217.3	217.3
106.50	236.1	236.1
106.90	319.8	319.8
107.00	342.9	342.9

SEDCAD+ BASIN DISCHARGE UTILITY

AREA 3 TEMP. DIVERSION IMP. #2 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.30
Crest Length	35.000 feet
Z:1 (Left)	1.50:1
Z:1 (Right)	1.50:1
Bottom Width	9.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.30	0.0	0.0
104.50	2.8	2.8
105.00	9.9	9.9
105.10	12.9	12.9
105.20	16.2	16.2
105.30	19.8	19.8
105.50	28.6	28.6
105.80	44.4	44.4
106.00	55.5	55.5
106.30	74.3	74.3
106.50	88.3	88.3
106.80	111.4	111.4
107.00	129.5	129.5

SEDCAD+ BASIN DISCHARGE UTILITY

AREA 3 TEMP. DIVERSION IMP. #3 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	102.00
Crest Length	18.000 feet
Z:1 (Left)	2.00:1
Z:1 (Right)	2.00:1
Bottom Width	40.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	32.4	32.4
102.60	38.9	38.9
102.70	50.2	50.2
102.80	64.9	64.9
102.90	79.6	79.6
103.00	96.4	96.4
103.50	195.7	195.7
104.00	321.9	321.9
104.50	470.8	470.8
105.00	640.9	640.9
105.50	831.5	831.5
106.00	1042.0	1042.0
106.50	1272.3	1272.3
107.00	1522.1	1522.1

SEDCAD+ BASIN DISCHARGE UTILITY

AREA 3 TEMP. DIVERSION IMP. #7 - EXISTING SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.90
Crest Length	50.000 feet
Z:1 (Left)	2.00:1
Z:1 (Right)	4.00:1
Bottom Width	10.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
104.90	0.0	0.0
105.00	1.5	1.5
105.50	8.7	8.7
105.60	10.2	10.2
105.70	13.6	13.6
105.80	17.0	17.0
105.90	20.7	20.7
106.00	25.8	25.8
106.40	51.4	51.4
106.50	57.9	57.9
106.90	87.9	87.9
107.00	96.9	96.9

HIGHWALL IMPOUNDMENTS

SEDCAD+ COMPUTER RUNS

WATERSHED SIZES 25 TO 700 ACRES
USING THE CRITERIA FOR STANDARD DESIGN

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW25CN93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW25CN93 User: lr
Date: 03-14-1997 Time: 11:42:05
HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	25.00	93	M	0.217	0.000	0.000	0.0	1.99	33.27
		Type: Null		Label: POND					
111 Structure	25.00							1.99	
111 Total IN/OUT	25.00							1.99	33.27

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW25CN93 User: lr
Date: 03-14-1997 Time: 11:42:05
HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1565.00	4.00	2.00	0.22	0.217		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW25CN90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW25CN90 User: lr
Date: 03-14-1997 Time: 11:01:09
HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	25.00	90	M	0.217	0.000	0.000	0.0	1.59	27.04
			Type: Null		Label: POND					
111	Structure	25.00							1.59	
111	Total IN/OUT	25.00							1.59	27.04

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW25CN90 User: lr
Date: 03-14-1997 Time: 11:01:09
HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1565.00	4.00	2.00	0.22	0.217		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW25CN86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW25CN86 User: lr
Date: 03-14-1997 Time: 11:01:13
HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	25.00	86	M	0.217	0.000	0.000	0.0	1.17	20.17
			Type: Null		Label: POND					
111	Structure	25.00							1.17	
111	Total IN/OUT	25.00							1.17	20.17

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW25CN86 User: lr
Date: 03-14-1997 Time: 11:01:13
HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1565.00	4.00	2.00	0.22	0.217		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW25CN83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW25CN83 User: lr
Date: 03-14-1997 Time: 11:01:11
HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	25.00	83	M	0.217	0.000	0.000	0.0	0.91	15.81
			Type: Null		Label: POND					
111	Structure	25.00							0.91	
111	Total IN/OUT	25.00							0.91	15.81

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW25CN83 User: lr
Date: 03-14-1997 Time: 11:01:11
HIGHWALL IMPOUNDMENT - 25 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	1565.00	4.00	2.00	0.22	0.217		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW50CN93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW50CN93 User: lr
Date: 03-14-1997 Time: 11:01:16
HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	50.00	93	M	0.307	0.000	0.000	0.0	3.98	58.67
			Type: Null			Label: POND				
111	Structure	50.00							3.98	
111	Total IN/OUT	50.00							3.98	58.67

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW50CN93 User: lr
Date: 03-14-1997 Time: 11:01:16
HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2214.00	4.00	2.00	0.31	0.307		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW50CN90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW50CN90 User: lr
Date: 03-14-1997 Time: 11:01:14
HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharg (cfs)
111	1	50.00	90	M	0.307	0.000	0.000	0.0	3.18	47.06
			Type: Null		Label: POND					
111	Structure	50.00							3.18	
111	Total IN/OUT	50.00							3.18	47.06

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW50CN90 User: lr
Date: 03-14-1997 Time: 11:01:14
HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2214.00	4.00	2.00	0.31	0.307		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW50CN86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW50CN86 User: lr
Date: 03-14-1997 Time: 11:01:18
HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	50.00	86	M	0.307	0.000	0.000	0.0	2.33	34.53
			Type: Null			Label: POND				
111	Structure	50.00							2.33	
111	Total IN/OUT	50.00							2.33	34.53

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW50CN86 User: lr
Date: 03-14-1997 Time: 11:01:18
HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2214.00	4.00	2.00	0.31	0.307		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW50CN83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW50CN83 User: lr
Date: 03-14-1997 Time: 11:01:20
HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	50.00	83	M	0.307	0.000	0.000	0.0	1.82	26.87
		Type: Null			Label: POND				
111 Structure	50.00							1.82	
111 Total IN/OUT	50.00							1.82	26.87

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW50CN83 User: lr
Date: 03-14-1997 Time: 11:01:20
HIGHWALL IMPOUNDMENT - 50 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2214.00	4.00	2.00	0.31	0.307		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW75CN93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW75CN93 User: lr
Date: 03-14-1997 Time: 11:01:21
HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	75.00	93	M	0.376	0.000	0.000	0.0	5.96	80.52
		Type: Null			Label: POND					
111	Structure	75.00							5.96	
111	Total IN/OUT	75.00							5.96	80.52

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW75CN93 User: lr
Date: 03-14-1997 Time: 11:01:21
HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2711.00	4.00	2.00	0.38	0.376		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW75CN90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW75CN90 User: lr
Date: 03-14-1997 Time: 11:01:23
HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	75.00	90	M	0.376	0.000	0.000	0.0	4.77	64.24
			Type: Null		Label: POND					
111	Structure	75.00							4.77	
111	Total IN/OUT	75.00							4.77	64.24

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW75CN90 User: lr
Date: 03-14-1997 Time: 11:01:23
HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2711.00	4.00	2.00	0.38	0.376		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW75CN86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW75CN86 User: lr
Date: 03-14-1997 Time: 11:01:25
HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	75.00	86	M	0.376	0.000	0.000	0.0	3.50	46.73
			Type: Null			Label: POND				
111	Structure	75.00							3.50	
111	Total IN/OUT	75.00							3.50	46.73

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW75CN86 User: lr
Date: 03-14-1997 Time: 11:01:25
HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2711.00	4.00	2.00	0.38	0.376		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW75CN83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW75CN83 User: lr
Date: 03-14-1997 Time: 11:01:27
HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	75.00	83	M	0.376	0.000	0.000	0.0	2.73	36.11
	Type: Null Label: POND									
111	Structure	75.00							2.73	
111	Total IN/OUT	75.00							2.73	36.11

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW75CN83 User: lr
Date: 03-14-1997 Time: 11:01:27
HIGHWALL IMPOUNDMENT - 75 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2711.00	4.00	2.00	0.38	0.376		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW100C93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW100C93 User: lr
Date: 03-14-1997 Time: 11:01:28
HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	100.00	93	M	0.434	0.000	0.000	0.0	7.95	100.17
			Type: Null		Label: POND					
111	Structure	100.00							7.95	
111	Total IN/OUT	100.00							7.95	100.17

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW100C93 User: lr
Date: 03-14-1997 Time: 11:01:28
HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	3131.00	4.00	2.00	0.43	0.434		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW100C90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW100C90 User: lr
Date: 03-14-1997 Time: 11:01:30
HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	100.00	90	M	0.434	0.000	0.000	0.0	6.36	79.46
		Type: Null			Label: POND					
111	Structure	100.00							6.36	
111	Total IN/OUT	100.00							6.36	79.46

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW100C90 User: lr
Date: 03-14-1997 Time: 11:01:30
HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3131.00	4.00	2.00	0.43	0.434		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW100C86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW100C86 User: lr
Date: 03-14-1997 Time: 11:01:32
HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	100.00	86	M	0.434	0.000	0.000	0.0	4.66	57.58
			Type: Null			Label: POND				
111	Structure	100.00							4.66	
111	Total IN/OUT	100.00							4.66	57.58

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW100C86 User: lr
Date: 03-14-1997 Time: 11:01:32
HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3131.00	4.00	2.00	0.43	0.434		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW100C83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW100C83 User: lr
Date: 03-14-1997 Time: 11:01:34
HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	100.00	83	M	0.434	0.000	0.000	0.0	3.65	44.25
			Type: Null		Label: POND					
111	Structure	100.00							3.65	
111	Total IN/OUT	100.00							3.65	44.25

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW100C83 User: lr
Date: 03-14-1997 Time: 11:01:34
HIGHWALL IMPOUNDMENT - 100 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	3131.00	4.00	2.00	0.43	0.434		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW150C93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW150C93 User: lr
Date: 03-14-1997 Time: 11:01:35
HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	150.00	93	M	0.532	0.000	0.000	0.0	11.93	134.13
			Type: Null		Label: POND					
111	Structure	150.00							11.93	
111	Total IN/OUT	150.00							11.93	134.13

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW150C93 User: lr
Date: 03-14-1997 Time: 11:01:35
HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	3834.00	4.00	2.00	0.53	0.532		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW150C90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW150C90 User: lr
Date: 03-14-1997 Time: 11:01:37
HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	150.00	90	M	0.532	0.000	0.000	0.0	9.53	105.70
			Type: Null		Label: POND					
111	Structure	150.00							9.53	
111	Total IN/OUT	150.00							9.53	105.70

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW150C90 User: lr
Date: 03-14-1997 Time: 11:01:37
HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3834.00	4.00	2.00	0.53	0.532		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW150C86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW150C86 User: lr
Date: 03-14-1997 Time: 11:01:39
HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	150.00	86	M	0.532	0.000	0.000	0.0	7.00	76.31
			Type: Null		Label: POND					
111	Structure	150.00							7.00	
111	Total IN/OUT	150.00							7.00	76.31

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW150C86 User: lr
Date: 03-14-1997 Time: 11:01:39
HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3834.00	4.00	2.00	0.53	0.532		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW150C83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW150C83 User: lr
Date: 03-14-1997 Time: 11:01:41
HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	150.00	83	M	0.532	0.000	0.000	0.0	5.47	58.33
		Type: Null Label: POND								
111	Structure	150.00							5.47	
111	Total IN/OUT	150.00							5.47	58.33

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW150C83 User: lr
Date: 03-14-1997 Time: 11:01:41
HIGHWALL IMPOUNDMENT - 150 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3834.00	4.00	2.00	0.53	0.532		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW200C93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW200C93 User: lr
Date: 03-14-1997 Time: 11:01:42
HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	200.00	93	M	0.614	0.000	0.000	0.0	15.90	163.75
			Type: Null		Label: POND					
111	Structure	200.00							15.90	
111	Total IN/OUT	200.00							15.90	163.75

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW200C93 User: lr
Date: 03-14-1997 Time: 11:01:42
HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	4427.00	4.00	2.00	0.61	0.614		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW200C90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW200C90 User: lr
Date: 03-14-1997 Time: 11:01:48
HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	200.00	90	M	0.614	0.000	0.000	0.0	12.71	129.02
			Type: Null		Label: POND					
111	Structure	200.00							12.71	
111	Total IN/OUT	200.00							12.71	129.02

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW200C90 User: lr
Date: 03-14-1997 Time: 11:01:48
HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	4427.00	4.00	2.00	0.61	0.614		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW200C86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW200C86 User: lr
Date: 03-14-1997 Time: 11:01:44
HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	200.00	86	M	0.614	0.000	0.000	0.0	9.33	92.72
			Type: Null			Label: POND				
111	Structure	200.00							9.33	
111	Total IN/OUT	200.00							9.33	92.72

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW200C86 User: lr
Date: 03-14-1997 Time: 11:01:44
HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	4427.00	4.00	2.00	0.61	0.614		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW200C83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW200C83 User: lr
Date: 03-14-1997 Time: 11:01:46
HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	200.00	83	M	0.614	0.000	0.000	0.0	7.29	70.70
			Type: Null		Label: POND					
111	Structure	200.00							7.29	
111	Total IN/OUT	200.00							7.29	70.70

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW200C83 User: lr
Date: 03-14-1997 Time: 11:01:46
HIGHWALL IMPOUNDMENT - 200 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	4427.00	4.00	2.00	0.61	0.614		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW300C93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW300C93 User: lr
Date: 03-14-1997 Time: 11:27:37
HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	300.00	93	M	0.753	0.000	0.000	0.0	23.85	214.81
			Type: Null		Label: POND					
111	Structure	300.00							23.85	
111	Total IN/OUT	300.00							23.85	214.81

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW300C93 User: lr
Date: 03-14-1997 Time: 11:27:37
HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	5422.00	4.00	2.00	0.75	0.753		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW300C90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW300C90 User: lr
Date: 03-14-1997 Time: 11:27:38
HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	300.00	90	M	0.753	0.000	0.000	0.0	19.07	169.35
			Type: Null			Label: POND				
111	Structure	300.00							19.07	
111	Total IN/OUT	300.00							19.07	169.35

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW300C90 User: lr
Date: 03-14-1997 Time: 11:27:38
HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	5422.00	4.00	2.00	0.75	0.753		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW300C86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW300C86 User: lr
Date: 03-14-1997 Time: 11:27:40
HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	300.00	86	M	0.753	0.000	0.000	0.0	13.99	121.18
Type: Null Label: POND									
111 Structure	300.00							13.99	
111 Total IN/OUT	300.00							13.99	121.18

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW300C86 User: lr
Date: 03-14-1997 Time: 11:27:40
HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	5422.00	4.00	2.00	0.75	0.753		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW300C83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW300C83 User: lr
Date: 03-14-1997 Time: 11:27:42
HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	300.00	83	M	0.753	0.000	0.000	0.0	10.94	92.22
			Type: Null		Label: POND					
111	Structure	300.00							10.94	
111	Total IN/OUT	300.00							10.94	92.22

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW300C83 User: lr
Date: 03-14-1997 Time: 11:27:42
HIGHWALL IMPOUNDMENT - 300 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	5422.00	4.00	2.00	0.75	0.753		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW400C93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW400C93 User: lr
Date: 03-14-1997 Time: 11:27:44
HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	400.00	93	M	0.869	0.000	0.000	0.0	31.80	259.47
			Type: Null		Label: POND					
111	Structure	400.00							31.80	
111	Total IN/OUT	400.00							31.80	259.47

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW400C93 User: lr
Date: 03-14-1997 Time: 11:27:44
HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	6261.00	4.00	2.00	0.87	0.869		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW400C90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW400C90 User: lr
Date: 03-14-1997 Time: 11:27:46
HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	400.00	90	M	0.869	0.000	0.000	0.0	25.42	204.67
			Type: Null		Label: POND					
111	Structure	400.00							25.42	
111	Total IN/OUT	400.00							25.42	204.67

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS

Filename: C:\LR\HW_IMP\HYD\HW400C90 User: lr

Date: 03-14-1997 Time: 11:27:46

HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 90

Storm: 1.60 inches, 25 year- 6 hour, Type II-65

Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	6261.00	4.00	2.00	0.87	0.869		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW400C86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW400C86 User: lr
Date: 03-14-1997 Time: 11:27:47
HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	400.00	86	M	0.869	0.000	0.000	0.0	18.65	146.21
			Type: Null		Label: POND					
111	Structure	400.00							18.65	
111	Total IN/OUT	400.00							18.65	146.21

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW400C86 User: lr
Date: 03-14-1997 Time: 11:27:47
HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	6261.00	4.00	2.00	0.87	0.869		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW400C83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW400C83 User: lr
Date: 03-14-1997 Time: 11:27:49
HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharg (cfs)
111	1	400.00	83	M	0.869	0.000	0.000	0.0	14.58	111.64
			Type: Null		Label: POND					
111	Structure	400.00							14.58	
111	Total IN/OUT	400.00							14.58	111.64

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW400C83 User: lr
Date: 03-14-1997 Time: 11:27:49
HIGHWALL IMPOUNDMENT - 400 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	6261.00	4.00	2.00	0.87	0.869		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW500C93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW500C93 User: lr
Date: 03-14-1997 Time: 11:27:51
HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	500.00	93	M	0.972	0.000	0.000	0.0	39.75	300.19
			Type: Null		Label: POND					
111	Structure	500.00							39.75	
111	Total IN/OUT	500.00							39.75	300.19

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW500C93 User: lr
Date: 03-14-1997 Time: 11:27:51
HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	7000.00	4.00	2.00	0.97	0.972		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW500C90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW500C90 User: lr
Date: 03-14-1997 Time: 11:27:53
HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	500.00	90	M	0.972	0.000	0.000	0.0	31.78	236.53
			Type: Null		Label: POND					
111	Structure	500.00							31.78	
111	Total IN/OUT	500.00							31.78	236.53

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW500C90 User: lr
Date: 03-14-1997 Time: 11:27:53
HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	7000.00	4.00	2.00	0.97	0.972		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW500C86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW500C86 User: lr
Date: 03-14-1997 Time: 11:27:55
HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	500.00	86	M	0.972	0.000	0.000	0.0	23.32	**168.87**
			Type: Null		Label: POND					
111	Structure	500.00							23.32	
111	Total IN/OUT	500.00							23.32	168.87

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW500C86 User: lr
Date: 03-14-1997 Time: 11:27:55
HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	7000.00	4.00	2.00	0.97	0.972		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW500C83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW500C83 User: lr
Date: 03-14-1997 Time: 11:27:58
HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	500.00	83	M	0.972	0.000	0.000	0.0	18.23	129.07
			Type: Null		Label: POND					
111	Structure	500.00							18.23	
111	Total IN/OUT	500.00							18.23	129.07

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW500C83 User: lr
Date: 03-14-1997 Time: 11:27:58
HIGHWALL IMPOUNDMENT - 500 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	7000.00	4.00	2.00	0.97	0.972		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW600C93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW600C93 User: lr
Date: 03-14-1997 Time: 11:27:56
HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	600.00	93	M	1.065	0.000	0.000	0.0	47.70	337.42
	Type: Null Label: POND									
111	Structure	600.00							47.70	
111	Total IN/OUT	600.00							47.70	337.42

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW600C93 User: lr
Date: 03-14-1997 Time: 11:27:56
HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	7668.00	4.00	2.00	1.07	1.065		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW600C90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW600C90 User: lr
Date: 03-14-1997 Time: 11:28:00
HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	600.00	90	M	1.065	0.000	0.000	0.0	38.13	265.69
			Type: Null		Label: POND					
111	Structure	600.00							38.13	
111	Total IN/OUT	600.00							38.13	265.69

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW600C90 User: lr
Date: 03-14-1997 Time: 11:28:00
HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	7668.00	4.00	2.00	1.07	1.065		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW600C86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW600C86 User: lr
Date: 03-14-1997 Time: 11:28:02
HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	600.00	86	M	1.065	0.000	0.000	0.0	27.98	189.64
		Type: Null		Label: POND					
111 Structure	600.00							27.98	
111 Total IN/OUT	600.00							27.98	189.64

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW600C86 User: lr
Date: 03-14-1997 Time: 11:28:02
HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	7668.00	4.00	2.00	1.07	1.065		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW600C83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW600C83 User: lr
Date: 03-14-1997 Time: 11:28:04
HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	600.00	83	M	1.065	0.000	0.000	0.0	21.88	145.05
			Type: Null		Label: POND					
111	Structure	600.00							21.88	
111	Total IN/OUT	600.00							21.88	145.05

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW600C83 User: lr
Date: 03-14-1997 Time: 11:28:04
HIGHWALL IMPOUNDMENT - 600 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	7668.00	4.00	2.00	1.07	1.065		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 93

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW700C93

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW700C93 User: lr
Date: 03-14-1997 Time: 11:28:05
HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	700.00	93	M	1.150	0.000	0.000	0.0	55.65	372.07
			Type: Null		Label: POND					
111	Structure	700.00							55.65	
111	Total IN/OUT	700.00							55.65	372.07

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW700C93 User: lr
Date: 03-14-1997 Time: 11:28:05
HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 93
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	8283.00	4.00	2.00	1.15	1.150		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 90

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW700C90

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW700C90 User: lr
Date: 03-14-1997 Time: 11:28:07
HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	700.00	90	M	1.150	0.000	0.000	0.0	44.49	292.85
			Type: Null		Label: POND					
111	Structure	700.00							44.49	
111	Total IN/OUT	700.00							44.49	292.85

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW700C90 User: lr
Date: 03-14-1997 Time: 11:28:07
HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 90
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	8283.00	4.00	2.00	1.15	1.150		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 86

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW700C86

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW700C86 User: lr
Date: 03-14-1997 Time: 11:28:13
HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	700.00	86	M	1.150	0.000	0.000	0.0	32.64	209.05
	Type: Null Label: POND									
111	Structure	700.00							32.64	
111	Total IN/OUT	700.00							32.64	209.05

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW700C86 User: lr
Date: 03-14-1997 Time: 11:28:13
HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 86
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	8283.00	4.00	2.00	1.15	1.150		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 83

by

Name: lr

Company Name: BHP MINERALS
File Name: C:\LR\HW_IMP\HYD\HW700C83

Date: 03-14-1997

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW700C83 User: lr
Date: 03-14-1997 Time: 11:28:11
HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	700.00	83	M	1.150	0.000	0.000	0.0	25.52	159.97
		Type: Null			Label: POND				
111 Structure	700.00							25.52	
111 Total IN/OUT	700.00							25.52	159.97

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\LR\HW_IMP\HYD\HW700C83 User: lr
Date: 03-14-1997 Time: 11:28:11
HIGHWALL IMPOUNDMENT - 700 ACRE WATERSHED, CN = 83
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	8283.00	4.00	2.00	1.15	1.150		

HIGHWALL IMPOUNDMENTS

SEDCAD+ COMPUTER RUNS

STANDARD SPILLWAY SIZES

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	105.00
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	10.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
105.00	0.0	0.0
105.50	9.0	9.0
105.70	12.6	12.6
105.80	16.5	16.5
105.90	20.7	20.7
106.00	25.5	25.5
106.50	56.9	56.9
107.00	98.5	98.5

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	105.00
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	15.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
105.00	0.0	0.0
105.50	13.1	13.1
105.70	18.3	18.3
105.80	23.9	23.9
105.90	29.7	29.7
106.00	36.4	36.4
106.50	79.3	79.3
107.00	134.3	134.3

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	105.00
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	20.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
105.00	0.0	0.0
105.50	17.2	17.2
105.70	24.0	24.0
105.80	31.2	31.2
105.90	38.7	38.7
106.00	47.3	47.3
106.50	101.8	101.8
107.00	170.2	170.2

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	105.00
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	25.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
105.00	0.0	0.0
105.50	21.2	21.2
105.70	29.7	29.7
105.80	38.6	38.6
105.90	47.8	47.8
106.00	58.3	58.3
106.50	124.2	124.2
107.00	206.2	206.2

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.75
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	10.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
104.75	0.0	0.0
105.00	1.3	1.3
105.40	3.4	3.4
105.50	12.6	12.6
105.60	16.5	16.5
105.70	20.7	20.7
105.80	25.5	25.5
105.90	30.8	30.8
106.00	36.7	36.7
106.20	49.7	49.7
106.50	72.2	72.2
106.70	89.3	89.3
107.00	119.0	119.0

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.75
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	15.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
104.75	0.0	0.0
105.00	2.0	2.0
105.40	5.1	5.1
105.50	18.3	18.3
105.60	23.9	23.9
105.70	29.7	29.7
105.80	36.4	36.4
105.90	43.8	43.8
106.00	51.9	51.9
106.20	69.6	69.6
106.50	99.7	99.7
106.70	122.3	122.3
107.00	160.9	160.9

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.75
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	20.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
104.75	0.0	0.0
105.00	2.6	2.6
105.40	6.7	6.7
105.50	24.0	24.0
105.60	31.2	31.2
105.70	38.7	38.7
105.80	47.3	47.3
105.90	56.8	56.8
106.00	67.1	67.1
106.20	89.5	89.5
106.50	127.3	127.3
106.70	155.3	155.3
107.00	202.9	202.9

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.75
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	25.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
104.75	0.0	0.0
105.00	3.2	3.2
105.40	8.4	8.4
105.50	29.7	29.7
105.60	38.6	38.6
105.70	47.8	47.8
105.80	58.3	58.3
105.90	69.9	69.9
106.00	82.3	82.3
106.20	109.5	109.5
106.50	154.9	154.9
106.70	188.4	188.4
107.00	245.0	245.0

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.50
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	10.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
104.75	4.5	4.5
105.00	9.0	9.0
105.20	12.6	12.6
105.30	16.5	16.5
105.40	20.7	20.7
105.50	25.5	25.5
105.60	30.8	30.8
105.70	36.7	36.7
105.80	43.0	43.0
105.90	49.7	49.7
106.00	56.9	56.9
106.20	72.2	72.2
106.50	98.5	98.5
106.70	119.0	119.0
107.00	153.3	153.3

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.50
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	15.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
104.75	6.5	6.5
105.00	13.1	13.1
105.20	18.3	18.3
105.30	23.9	23.9
105.40	29.7	29.7
105.50	36.4	36.4
105.60	43.8	43.8
105.70	51.9	51.9
105.80	60.5	60.5
105.90	69.6	69.6
106.00	79.3	79.3
106.20	99.7	99.7
106.50	134.3	134.3
106.70	160.9	160.9
107.00	204.9	204.9

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.50
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	20.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
104.75	8.6	8.6
105.00	17.2	17.2
105.20	24.0	24.0
105.30	31.2	31.2
105.40	38.7	38.7
105.50	47.3	47.3
105.60	56.8	56.8
105.70	67.1	67.1
105.80	78.0	78.0
105.90	89.5	89.5
106.00	101.8	101.8
106.20	127.3	127.3
106.50	170.2	170.2
106.70	202.9	202.9
107.00	256.8	256.8

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.50
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	25.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.50	0.0	0.0
104.75	10.6	10.6
105.00	21.2	21.2
105.20	29.7	29.7
105.30	38.6	38.6
105.40	47.8	47.8
105.50	58.3	58.3
105.60	69.9	69.9
105.70	82.3	82.3
105.80	95.5	95.5
105.90	109.5	109.5
106.00	124.2	124.2
106.20	154.9	154.9
106.50	206.2	206.2
106.70	245.0	245.0
107.00	308.7	308.7

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.25
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	10.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.25	0.0	0.0
104.50	1.3	1.3
104.75	2.7	2.7
104.90	3.4	3.4
105.00	12.6	12.6
105.10	16.5	16.5
105.20	20.7	20.7
105.30	25.5	25.5
105.40	30.8	30.8
105.50	36.7	36.7
105.60	43.0	43.0
105.70	49.7	49.7
105.80	56.9	56.9
105.90	64.4	64.4
106.00	72.2	72.2
106.20	89.3	89.3
106.50	119.0	119.0
106.70	141.4	141.4
107.00	179.3	179.3

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.25
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	15.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.25	0.0	0.0
104.50	2.0	2.0
104.75	3.9	3.9
104.90	5.1	5.1
105.00	18.3	18.3
105.10	23.9	23.9
105.20	29.7	29.7
105.30	36.4	36.4
105.40	43.8	43.8
105.50	51.9	51.9
105.60	60.5	60.5
105.70	69.6	69.6
105.80	79.3	79.3
105.90	89.3	89.3
106.00	99.7	99.7
106.20	122.3	122.3
106.50	160.9	160.9
106.70	189.7	189.7
107.00	237.9	237.9

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.25
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	20.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.25	0.0	0.0
104.50	2.6	2.6
104.75	5.2	5.2
104.90	6.7	6.7
105.00	24.0	24.0
105.10	31.2	31.2
105.20	38.7	38.7
105.30	47.3	47.3
105.40	56.8	56.8
105.50	67.1	67.1
105.60	78.0	78.0
105.70	89.5	89.5
105.80	101.8	101.8
105.90	114.2	114.2
106.00	127.3	127.3
106.20	155.3	155.3
106.50	202.9	202.9
106.70	238.2	238.2
107.00	296.7	296.7

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.25
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	25.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.25	0.0	0.0
104.50	3.2	3.2
104.75	6.5	6.5
104.90	8.4	8.4
105.00	29.7	29.7
105.10	38.6	38.6
105.20	47.8	47.8
105.30	58.3	58.3
105.40	69.9	69.9
105.50	82.3	82.3
105.60	95.5	95.5
105.70	109.5	109.5
105.80	124.2	124.2
105.90	139.2	139.2
106.00	154.9	154.9
106.20	188.4	188.4
106.50	245.0	245.0
106.70	286.7	286.7
107.00	355.7	355.7

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.00
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	10.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.25	4.5	4.5
104.50	9.0	9.0
104.70	12.6	12.6
104.75	12.6	12.6
104.80	16.5	16.5
104.90	20.7	20.7
105.00	25.5	25.5
105.10	30.8	30.8
105.20	36.7	36.7
105.30	43.0	43.0
105.40	49.7	49.7
105.50	56.9	56.9
105.60	64.4	64.4
105.70	72.2	72.2
105.80	80.5	80.5
105.90	89.3	89.3
106.00	98.5	98.5
106.20	119.0	119.0
106.50	153.3	153.3
106.70	179.3	179.3
107.00	222.4	222.4

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.00
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	15.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.25	6.5	6.5
104.50	13.1	13.1
104.70	18.3	18.3
104.75	18.3	18.3
104.80	23.9	23.9
104.90	29.7	29.7
105.00	36.4	36.4
105.10	43.8	43.8
105.20	51.9	51.9
105.30	60.5	60.5
105.40	69.6	69.6
105.50	79.3	79.3
105.60	89.3	89.3
105.70	99.7	99.7
105.80	110.7	110.7
105.90	122.3	122.3
106.00	134.3	134.3
106.20	160.9	160.9
106.50	204.9	204.9
106.70	237.9	237.9
107.00	291.9	291.9

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.00
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	20.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.25	8.6	8.6
104.50	17.2	17.2
104.70	24.0	24.0
104.75	24.0	24.0
104.80	31.2	31.2
104.90	38.7	38.7
105.00	47.3	47.3
105.10	56.8	56.8
105.20	67.1	67.1
105.30	78.0	78.0
105.40	89.5	89.5
105.50	101.8	101.8
105.60	114.2	114.2
105.70	127.3	127.3
105.80	141.0	141.0
105.90	155.3	155.3
106.00	170.2	170.2
106.20	202.9	202.9
106.50	256.8	256.8
106.70	296.7	296.7
107.00	361.8	361.8

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.00
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	25.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.25	10.6	10.6
104.50	21.2	21.2
104.70	29.7	29.7
104.75	29.7	29.7
104.80	38.6	38.6
104.90	47.8	47.8
105.00	58.3	58.3
105.10	69.9	69.9
105.20	82.3	82.3
105.30	95.5	95.5
105.40	109.5	109.5
105.50	124.2	124.2
105.60	139.2	139.2
105.70	154.9	154.9
105.80	171.3	171.3
105.90	188.4	188.4
106.00	206.2	206.2
106.20	245.0	245.0
106.50	308.7	308.7
106.70	355.7	355.7
107.00	431.8	431.8

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SIZE SPILLWAY
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	104.00
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	30.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
104.00	0.0	0.0
104.25	12.7	12.7
104.50	25.3	25.3
104.70	35.4	35.4
104.75	35.4	35.4
104.80	46.0	46.0
104.90	56.8	56.8
105.00	69.2	69.2
105.10	82.9	82.9
105.20	97.5	97.5
105.30	113.0	113.0
105.40	129.4	129.4
105.50	146.7	146.7
105.60	164.2	164.2
105.70	182.6	182.6
105.80	201.7	201.7
105.90	221.5	221.5
106.00	242.2	242.2
106.20	287.2	287.2
106.50	360.6	360.6
106.70	414.7	414.7
107.00	502.0	502.0

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.75
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	10.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.75	0.0	0.0
104.00	1.3	1.3
104.40	3.4	3.4
104.50	12.6	12.6
104.60	16.5	16.5
104.70	20.7	20.7
105.00	36.7	36.7
105.20	49.7	49.7
105.50	72.2	72.2
105.70	89.3	89.3
106.00	119.0	119.0
106.20	141.4	141.4
106.50	179.3	179.3
106.70	207.5	207.5
107.00	253.9	253.9

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.75
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	15.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.75	0.0	0.0
104.00	2.0	2.0
104.40	5.1	5.1
104.50	18.3	18.3
104.60	23.9	23.9
104.70	29.7	29.7
105.00	51.9	51.9
105.20	69.6	69.6
105.50	99.7	99.7
105.70	122.3	122.3
106.00	160.9	160.9
106.20	189.7	189.7
106.50	237.9	237.9
106.70	273.3	273.3
107.00	331.0	331.0

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.75
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	20.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.75	0.0	0.0
104.00	2.6	2.6
104.40	6.7	6.7
104.50	24.0	24.0
104.60	31.2	31.2
104.70	38.7	38.7
105.00	67.1	67.1
105.20	89.5	89.5
105.50	127.3	127.3
105.70	155.3	155.3
106.00	202.9	202.9
106.20	238.2	238.2
106.50	296.7	296.7
106.70	339.4	339.4
107.00	408.6	408.6

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.75
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	25.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.75	0.0	0.0
104.00	3.2	3.2
104.40	8.4	8.4
104.50	29.7	29.7
104.60	38.6	38.6
104.70	47.8	47.8
105.00	82.3	82.3
105.20	109.5	109.5
105.50	154.9	154.9
105.70	188.4	188.4
106.00	245.0	245.0
106.20	286.7	286.7
106.50	355.7	355.7
106.70	405.7	405.7
107.00	486.3	486.3

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.75
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	30.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.75	0.0	0.0
104.00	3.9	3.9
104.40	10.0	10.0
104.50	35.4	35.4
104.60	46.0	46.0
104.70	56.8	56.8
105.00	97.5	97.5
105.20	129.4	129.4
105.50	182.6	182.6
105.70	221.5	221.5
106.00	287.2	287.2
106.20	335.3	335.3
106.50	414.7	414.7
106.70	472.0	472.0
107.00	564.2	564.2

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.50
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	10.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.75	4.5	4.5
104.00	9.0	9.0
104.20	12.6	12.6
104.30	16.5	16.5
104.40	20.7	20.7
104.50	25.5	25.5
104.60	30.8	30.8
104.70	36.7	36.7
105.00	56.9	56.9
105.20	72.2	72.2
105.50	98.5	98.5
105.70	119.0	119.0
106.00	153.3	153.3
106.20	179.3	179.3
106.50	222.4	222.4
106.70	253.9	253.9
107.00	305.3	305.3

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.50
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	15.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.75	6.5	6.5
104.00	13.1	13.1
104.20	18.3	18.3
104.30	23.9	23.9
104.40	29.7	29.7
104.50	36.4	36.4
104.60	43.8	43.8
104.70	51.9	51.9
105.00	79.3	79.3
105.20	99.7	99.7
105.50	134.3	134.3
105.70	160.9	160.9
106.00	204.9	204.9
106.20	237.9	237.9
106.50	291.9	291.9
106.70	331.0	331.0
107.00	394.4	394.4

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.50
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	20.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.75	8.6	8.6
104.00	17.2	17.2
104.20	24.0	24.0
104.30	31.2	31.2
104.40	38.7	38.7
104.50	47.3	47.3
104.60	56.8	56.8
104.70	67.1	67.1
105.00	101.8	101.8
105.20	127.3	127.3
105.50	170.2	170.2
105.70	202.9	202.9
106.00	256.8	256.8
106.20	296.7	296.7
106.50	361.8	361.8
106.70	408.6	408.6
107.00	484.0	484.0

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.50
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	25.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.75	10.6	10.6
104.00	21.2	21.2
104.20	29.7	29.7
104.30	38.6	38.6
104.40	47.8	47.8
104.50	58.3	58.3
104.60	69.9	69.9
104.70	82.3	82.3
105.00	124.2	124.2
105.20	154.9	154.9
105.50	206.2	206.2
105.70	245.0	245.0
106.00	308.7	308.7
106.20	355.7	355.7
106.50	431.8	431.8
106.70	486.3	486.3
107.00	573.8	573.8

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.50
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	30.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.50	0.0	0.0
103.75	12.7	12.7
104.00	25.3	25.3
104.20	35.4	35.4
104.30	46.0	46.0
104.40	56.8	56.8
104.50	69.2	69.2
104.60	82.9	82.9
104.70	97.5	97.5
105.00	146.7	146.7
105.20	182.6	182.6
105.50	242.2	242.2
105.70	287.2	287.2
106.00	360.6	360.6
106.20	414.7	414.7
106.50	502.0	502.0
106.70	564.2	564.2
107.00	663.8	663.8

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.25
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	10.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.25	0.0	0.0
103.50	1.3	1.3
103.75	2.7	2.7
103.90	3.4	3.4
104.00	12.6	12.6
104.10	16.5	16.5
104.20	20.7	20.7
104.30	25.5	25.5
104.40	30.8	30.8
104.50	36.7	36.7
104.60	43.0	43.0
104.70	49.7	49.7
105.00	72.2	72.2
105.20	89.3	89.3
105.50	119.0	119.0
105.70	141.4	141.4
106.00	179.3	179.3
106.20	207.5	207.5
106.50	253.9	253.9
106.70	287.6	287.6
107.00	342.6	342.6

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.25
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	15.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.25	0.0	0.0
103.50	2.0	2.0
103.75	3.9	3.9
103.90	5.1	5.1
104.00	18.3	18.3
104.10	23.9	23.9
104.20	29.7	29.7
104.30	36.4	36.4
104.40	43.8	43.8
104.50	51.9	51.9
104.60	60.5	60.5
104.70	69.6	69.6
105.00	99.7	99.7
105.20	122.3	122.3
105.50	160.9	160.9
105.70	189.7	189.7
106.00	237.9	237.9
106.20	273.3	273.3
106.50	331.0	331.0
106.70	372.7	372.7
107.00	439.9	439.9

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.25
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	20.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.25	0.0	0.0
103.50	2.6	2.6
103.75	5.2	5.2
103.90	6.7	6.7
104.00	24.0	24.0
104.10	31.2	31.2
104.20	38.7	38.7
104.30	47.3	47.3
104.40	56.8	56.8
104.50	67.1	67.1
104.60	78.0	78.0
104.70	89.5	89.5
105.00	127.3	127.3
105.20	155.3	155.3
105.50	202.9	202.9
105.70	238.2	238.2
106.00	296.7	296.7
106.20	339.4	339.4
106.50	408.6	408.6
106.70	458.2	458.2
107.00	537.8	537.8

SEDCAD+ BASIN DISCHARGE UTILITY

HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.25
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	25.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.25	0.0	0.0
103.50	3.2	3.2
103.75	6.5	6.5
103.90	8.4	8.4
104.00	29.7	29.7
104.10	38.6	38.6
104.20	47.8	47.8
104.30	58.3	58.3
104.40	69.9	69.9
104.50	82.3	82.3
104.60	95.5	95.5
104.70	109.5	109.5
105.00	154.9	154.9
105.20	188.4	188.4
105.50	245.0	245.0
105.70	286.7	286.7
106.00	355.7	355.7
106.20	405.7	405.7
106.50	486.3	486.3
106.70	543.9	543.9
107.00	636.0	636.0

SEDCAD+ BASIN DISCHARGE UTILITY
HIGHWALL IMPOUNDMENT - STANDARD SPILLWAY SIZE
EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	103.25
Crest Length	25.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	30.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	0.0	0.0
103.25	0.0	0.0
103.50	3.9	3.9
103.75	7.7	7.7
103.90	10.0	10.0
104.00	35.4	35.4
104.10	46.0	46.0
104.20	56.8	56.8
104.30	69.2	69.2
104.40	82.9	82.9
104.50	97.5	97.5
104.60	113.0	113.0
104.70	129.4	129.4
105.00	182.6	182.6
105.20	221.5	221.5
105.50	287.2	287.2
105.70	335.3	335.3
106.00	414.7	414.7
106.20	472.0	472.0
106.50	564.2	564.2
106.70	629.8	629.8
107.00	734.4	734.4

HIGHWALL IMPOUNDMENTS

SEDCAD+ COMPUTER RUNS

AS-BUILT SPILLWAYS

AUGUST 27, 1997

SEDCAD+ BASIN DISCHARGE UTILITY

YAZZIE STOCKPOND #1 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	102.50
Crest Length	23.400 feet
Z:1 (Left)	1.80:1
Z:1 (Right)	3.00:1
Bottom Width	20.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	0.0	0.0
103.00	17.2	17.2
103.20	24.1	24.1
103.30	31.4	31.4
103.40	38.8	38.8
103.50	47.3	47.3
104.00	100.0	100.0
104.50	166.9	166.9
105.00	249.9	249.9
105.50	348.9	348.9
106.00	463.0	463.0
106.50	592.3	592.3
107.00	737.3	737.3
107.50	898.1	898.1
108.00	1075.0	1075.0

SEDCAD+ BASIN DISCHARGE UTILITY

YAZZIE STOCKPOND #2 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.20
Crest Length	27.800 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	2.80:1
Bottom Width	24.500 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.20	0.0	0.0
101.50	12.2	12.2
101.90	28.4	28.4
102.00	36.7	36.7
102.10	45.6	45.6
102.20	55.5	55.5
102.50	92.0	92.0
102.70	120.3	120.3
103.00	164.8	164.8
103.20	197.6	197.6
103.50	254.3	254.3
103.70	295.6	295.6
104.00	365.0	365.0
104.20	414.9	414.9
104.50	495.2	495.2
104.70	552.4	552.4
105.00	643.9	643.9
105.20	708.6	708.6
105.50	811.3	811.3
105.70	883.6	883.6
106.00	997.7	997.7
106.20	1077.7	1077.7
106.50	1203.6	1203.6
107.00	1429.3	1429.3
107.20	1525.2	1525.2
107.50	1675.2	1675.2
108.00	1941.8	1941.8

SEDCAD+ BASIN DISCHARGE UTILITY

SOUTH HOSTEEN STOCKPOND #1 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	102.00
Crest Length	29.700 feet
Z:1 (Left)	5.00:1
Z:1 (Right)	4.50:1
Bottom Width	5.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	0.0	0.0
102.50	5.2	5.2
102.70	7.3	7.3
102.80	9.8	9.8
102.90	12.6	12.6
103.00	15.8	15.8
103.50	41.1	41.1
104.00	75.8	75.8
104.50	126.5	126.5
105.00	195.9	195.9
105.50	283.5	283.5
106.00	390.6	390.6
106.50	518.1	518.1
107.00	667.3	667.3
107.50	839.0	839.0
108.00	1034.1	1034.1

SEDCAD+ BASIN DISCHARGE UTILITY

SOUTH HOSTEEN STOCKPOND #2 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.10
Crest Length	33.000 feet
Z:1 (Left)	6.00:1
Z:1 (Right)	2.20:1
Bottom Width	20.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.10	0.0	0.0
101.50	13.0	13.0
101.80	22.7	22.7
101.90	29.6	29.6
102.00	37.1	37.1
102.10	45.3	45.3
102.50	89.5	89.5
102.60	102.5	102.5
103.00	156.8	156.8
103.10	172.1	172.1
103.50	242.0	242.0
103.60	261.2	261.2
104.00	351.1	351.1
104.10	375.6	375.6
104.50	482.1	482.1
104.60	510.9	510.9
105.00	637.2	637.2
105.10	671.0	671.0
105.50	810.5	810.5
105.60	847.5	847.5
106.00	1007.9	1007.9
106.10	1050.4	1050.4
106.50	1229.9	1229.9
107.00	1476.4	1476.4
107.10	1528.8	1528.8
107.50	1748.4	1748.4
108.00	2046.4	2046.4

SEDCAD+ BASIN DISCHARGE UTILITY

SOUTH HOSTEEN STOCKPOND #3 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.30
Crest Length	32.000 feet
Z:1 (Left)	1.50:1
Z:1 (Right)	1.50:1
Bottom Width	14.500 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.30	0.0	0.0
101.50	4.6	4.6
102.00	16.1	16.1
102.10	20.8	20.8
102.20	25.9	25.9
102.30	31.5	31.5
102.50	45.2	45.2
102.80	69.1	69.1
103.00	85.5	85.5
103.30	112.8	112.8
103.50	133.6	133.6
103.80	167.5	167.5
104.00	193.4	193.4
104.30	235.2	235.2
104.50	265.0	265.0
104.80	312.9	312.9
105.00	347.3	347.3
105.30	401.9	401.9
105.50	439.5	439.5
105.80	499.0	499.0
106.00	541.1	541.1
106.30	607.5	607.5
106.50	653.9	653.9
107.00	777.3	777.3
107.30	856.6	856.6
107.50	911.6	911.6
108.00	1056.9	1056.9

SEDCAD+ BASIN DISCHARGE UTILITY

STUB 16 IMPOUNDMENT #2 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.00
Crest Length	45.000 feet
Z:1 (Left)	3.00:1
Z:1 (Right)	3.00:1
Bottom Width	12.500 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	9.2	9.2
101.70	12.9	12.9
101.80	17.2	17.2
101.90	21.6	21.6
102.00	26.4	26.4
102.50	62.4	62.4
103.00	106.9	106.9
103.50	163.2	163.2
104.00	236.2	236.2
104.50	325.2	325.2
105.00	432.7	432.7
105.50	549.3	549.3
106.00	685.6	685.6
106.50	838.9	838.9
107.00	1009.8	1009.8
107.50	1198.8	1198.8
108.00	1406.5	1406.5

SEDCAD+ BASIN DISCHARGE UTILITY

STUB 16 IMPOUNDMENT #3 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.00
Crest Length	34.000 feet
Z:1 (Left)	2.20:1
Z:1 (Right)	3.20:1
Bottom Width	12.500 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	10.1	10.1
101.70	14.1	14.1
101.80	18.4	18.4
101.90	23.1	23.1
102.00	28.3	28.3
102.50	64.2	64.2
103.00	108.5	108.5
103.50	164.7	164.7
104.00	237.5	237.5
104.50	323.9	323.9
105.00	427.0	427.0
105.50	539.5	539.5
106.00	669.7	669.7
106.50	815.6	815.6
107.00	977.7	977.7
107.50	1156.3	1156.3
108.00	1352.1	1352.1

SEDCAD+ BASIN DISCHARGE UTILITY

STUB 18 IMPOUNDMENT - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.50
Crest Length	48.000 feet
Z:1 (Left)	3.40:1
Z:1 (Right)	3.30:1
Bottom Width	14.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
102.00	10.1	10.1
102.20	14.2	14.2
102.30	18.9	18.9
102.40	23.6	23.6
102.50	28.7	28.7
103.00	69.3	69.3
103.50	117.8	117.8
104.00	181.3	181.3
104.50	261.6	261.6
105.00	360.6	360.6
105.50	478.1	478.1
106.00	610.2	610.2
106.50	762.0	762.0
107.00	932.8	932.8
107.50	1123.3	1123.3
108.00	1333.9	1333.9

SEDCAD+ BASIN DISCHARGE UTILITY

SUNFLOWER #1 IMPOUNDMENT - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.90
Crest Length	38.000 feet
Z:1 (Left)	4.30:1
Z:1 (Right)	5.20:1
Bottom Width	15.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
101.90	0.0	0.0
102.00	2.4	2.4
102.50	14.4	14.4
102.60	16.8	16.8
102.70	22.1	22.1
102.80	28.1	28.1
102.90	34.7	34.7
103.00	42.5	42.5
103.40	81.0	81.0
103.50	91.8	91.8
103.90	141.6	141.6
104.00	155.4	155.4
104.40	217.3	217.3
104.50	236.1	236.1
104.90	319.8	319.8
105.00	342.9	342.9
105.40	444.0	444.0
105.50	472.8	472.8
105.90	598.4	598.4
106.00	629.2	629.2
106.40	761.3	761.3
106.50	798.3	798.3
106.90	956.6	956.6
107.00	998.7	998.7
107.50	1225.0	1225.0
107.90	1425.4	1425.4
108.00	1478.3	1478.3

SEDCAD+ BASIN DISCHARGE UTILITY

AREA 3 TEMP. DIVERSION IMPOUNDMENT #2 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.30
Crest Length	35.000 feet
Z:1 (Left)	2.10:1
Z:1 (Right)	1.80:1
Bottom Width	9.400 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.30	0.0	0.0
101.50	3.0	3.0
102.00	10.5	10.5
102.10	13.7	13.7
102.20	17.2	17.2
102.30	21.1	21.1
102.50	30.6	30.6
102.80	47.8	47.8
103.00	60.0	60.0
103.30	80.7	80.7
103.50	96.3	96.3
103.80	122.1	122.1
104.00	142.5	142.5
104.30	175.9	175.9
104.50	200.2	200.2
104.80	239.7	239.7
105.00	268.9	268.9
105.30	316.1	316.1
105.50	347.8	347.8
105.80	398.4	398.4
106.00	435.3	435.3
106.30	494.1	494.1
106.50	535.5	535.5
107.00	647.3	647.3
107.30	720.0	720.0
107.50	770.9	770.9
108.00	906.8	906.8

SEDCAD+ BASIN DISCHARGE UTILITY

AREA 3 TEMP. DIVERSION IMPOUNDMENT #3 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.00
Crest Length	18.000 feet
Z:1 (Left)	2.00:1
Z:1 (Right)	2.00:1
Bottom Width	40.000 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	32.4	32.4
101.60	38.9	38.9
101.70	50.2	50.2
101.80	64.9	64.9
101.90	79.6	79.6
102.00	96.4	96.4
102.50	195.7	195.7
103.00	321.9	321.9
103.50	470.8	470.8
104.00	640.9	640.9
104.50	831.5	831.5
105.00	1042.0	1042.0
105.50	1272.3	1272.3
106.00	1522.1	1522.1
106.50	1791.3	1791.3
107.00	2079.9	2079.9
107.50	2387.9	2387.9
108.00	2715.3	2715.3

SEDCAD+ BASIN DISCHARGE UTILITY

AREA 3 TEMP. DIVERSION IMPOUNDMENT #5 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.80
Crest Length	25.000 feet
Z:1 (Left)	4.30:1
Z:1 (Right)	3.20:1
Bottom Width	10.400 feet

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
101.80	0.0	0.0
102.00	3.8	3.8
102.50	13.4	13.4
102.60	17.6	17.6
102.70	22.1	22.1
102.80	27.2	27.2
103.00	39.5	39.5
103.30	61.8	61.8
103.50	78.8	78.8
103.80	108.2	108.2
104.00	131.2	131.2
104.30	170.1	170.1
104.50	199.7	199.7
104.80	248.9	248.9
105.00	285.1	285.1
105.30	344.5	344.5
105.50	387.6	387.6
105.80	457.7	457.7
106.00	508.1	508.1
106.30	589.4	589.4
106.50	647.4	647.4
106.80	740.4	740.4
107.00	806.4	806.4
107.50	985.7	985.7
107.80	1103.4	1103.4
108.00	1186.2	1186.2

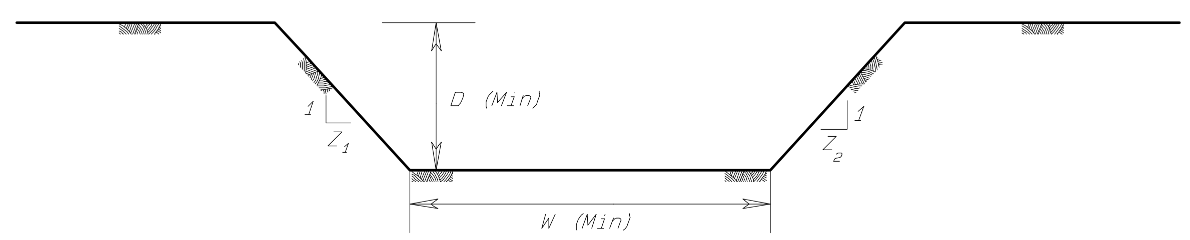
SEDCAD+ BASIN DISCHARGE UTILITY

AREA 3 TEMP. DIVERSION IMPOUNDMENT #7 - AS-BUILT SPILLWAY

EMERGENCY SPILLWAY INPUTS:

Emergency Spillway Elevation	101.90
Crest Length	50.000 feet
Z:1 (Left)	5.00:1
Z:1 (Right)	1.70:1
Bottom Width	12.600 feet

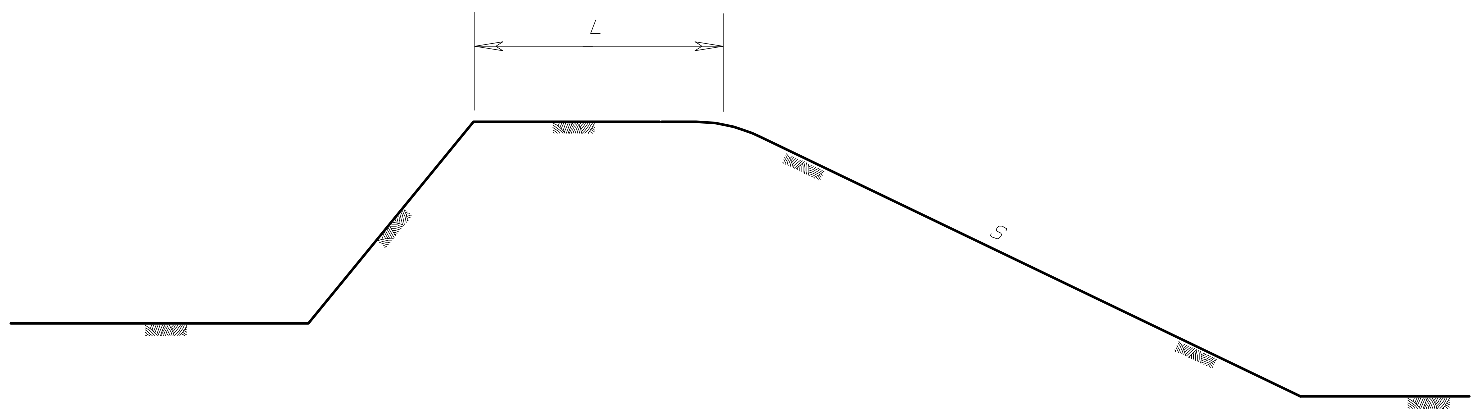
Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
100.00	0.0	0.0
100.50	0.0	0.0
101.00	0.0	0.0
101.50	0.0	0.0
101.90	0.0	0.0
102.00	1.8	1.8
102.50	10.9	10.9
102.60	12.7	12.7
102.70	16.9	16.9
102.80	21.1	21.1
102.90	25.7	25.7
103.00	32.0	32.0
103.40	63.2	63.2
103.50	71.2	71.2
103.90	107.5	107.5
104.00	118.3	118.3
104.40	167.1	167.1
104.50	181.0	181.0
104.90	241.9	241.9
105.00	259.3	259.3
105.40	335.2	335.2
105.50	355.9	355.9
105.90	445.1	445.1
106.00	469.1	469.1
106.40	572.2	572.2
106.50	599.7	599.7
106.90	717.1	717.1
107.00	748.3	748.3
107.50	915.7	915.7
107.90	1063.5	1063.5
108.00	1102.5	1102.5



D includes 1'-0" of Freeboard

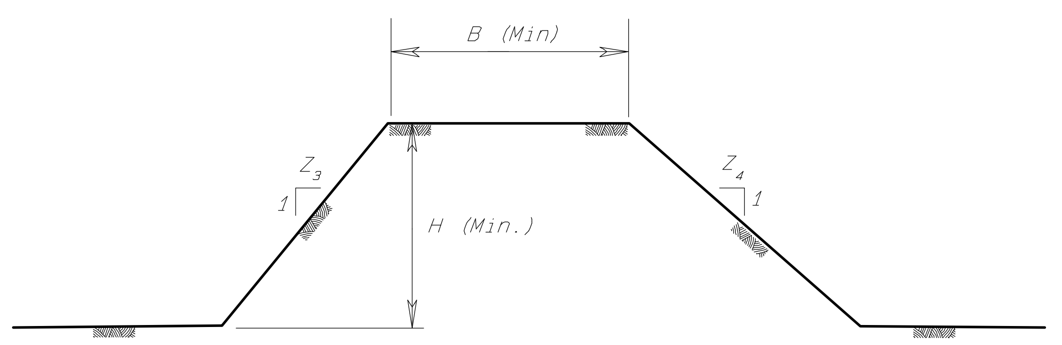
SPILLWAY SECTION

N.T.S.



SPILLWAY PROFILE

N.T.S.



H measured at the upstream toe of the embankment.

EMBANKMENT SECTION

N.T.S.

AS-BUILT DIMENSIONS

Impoundment Id.	Watershed Area (acres)	Peak Discharge (cfs)	Spillway (1)						Embankment (1)				Comments:
			W (ft)	D (ft)	Z_1	Z_2	L (ft)	S (%)	B (ft)	H (ft)	Z_3	Z_4	
Yazzie Stockpond #1	125.5	92.8	20.0	2.5	1.8	3.0	23.4	25.0	15.2	5.1	2.0	2.8	REMOVED BY MINING ADVANCEMENT
Yazzie Stockpond #2	174.1	116.2	24.5	2.8	3.0	2.8	27.8	16.0	15.1	4.7	2.6	2.2	REMOVED BY MINING ADVANCEMENT
South Hosteen Stockpond #1	80.1	73.3	5.0	3.0	5.0	4.5	29.7	6.0	16.5	4.6	2.1	2.0	REMOVED BY MINING ADVANCEMENT
South Hosteen Stockpond #2	37.7	89.3	20.0	3.9	6.0	2.2	33.0	4.5	14.2	6.2	2.0	2.0	REMOVED BY MINING ADVANCEMENT
South Hosteen Stockpond #3	157.3	115.7	14.5	3.7	1.5	1.5	32.0	12.0	18.0	4.5	2.3	2.0	REMOVED BY MINING ADVANCEMENT
Stub 16 Impoundment #2	20.2	24.9	12.5	4.0	3.0	3.0	45.0	7.0	38.0	8.1	2.8	3.6	REMOVED BY MINING ADVANCEMENT
Stub 16 Impoundment #3	10.6	15.5	12.5	3.0	2.2	3.2	34.0	15.0	36.0	6.1	2.2	2.0	REMOVED BY MINING ADVANCEMENT
Stub 18 Impoundment	103.4	69.8	14.0	4.5	3.4	3.3	48.0	7.0	12.5	10.0	2.0	2.0	REMOVED BY MINING ADVANCEMENT
Sunflower #1	24.6	17.3	15.0	3.1	4.3	5.2	38.0	2.2	9.0	7.5	4.2	3.9	REMOVED BY MINING ADVANCEMENT
Area 3 Temp. Div. Imp. #2	69.9	21.8	9.4	2.7	2.1	1.8	35.0	6.0	10.0	6.2	4.2	2.9	REMOVED BY MINING ADVANCEMENT
Area 3 Temp. Div. Imp. #3	20.8	23.9	40.0	20.0	2.0	2.0	18.0	2.5	18.0	5.8	4.0	40.0	REMOVED BY MINING ADVANCEMENT
Area 3 Temp. Div. Imp. #5	11.6	25.2	10.4	2.2	4.3	3.2	25.0	1.5	20.0	9.5	2.0	1.5	REMOVED BY MINING ADVANCEMENT
Area 3 Temp. Div. Imp. #7	55.5	21.9	12.6	2.1	5.0	1.7	50.0	0.5	73.0	8.5	2.9	4.0	REMOVED BY MINING ADVANCEMENT
Area 3 Highwall Pond 303	155.9	136.2	15.0	2.4	3.0	3.0	30.0	0.5	15.0	8.4	2.0	2.5	

(1) The data under each impoundment are the current dimensions of the structure
These indicate that the existing structures are adequate.

Note: For supporting design data refer to Appendix 11-II "Highwall Impoundment Design and As-Built Information" in the Mine Permit.

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
10-A	7-21-10	PJF	ADDED A3 HIGHWALL POND 303 TO AS-BUILT DIMENSIONS TABLE AND SUBMITTED TO OSM FOR REIVEW.	RY	YB	RCV		
C	10-30-97	PJF	REMOVED EXHIBIT No.	LR	PS	LR		
B	08-27-97	FTJ	REVISED TABLE					
A	03-27-97	PJF	SUBMITTED TO OSM FOR APPROVAL					
				APPROVALS				

BHP NAVAJO COAL COMPANY

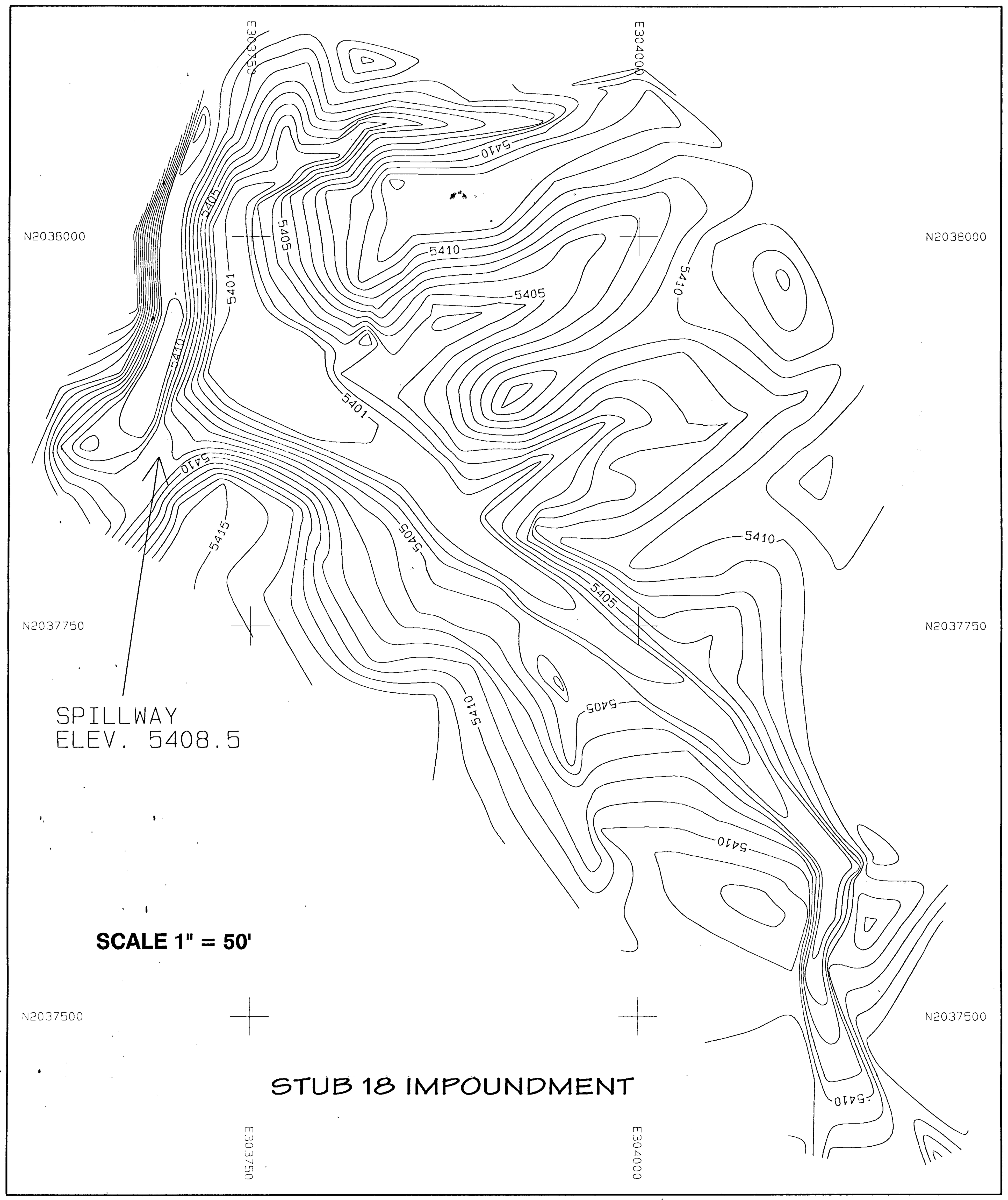
NAVAJO MINE
SAFETY PAYS

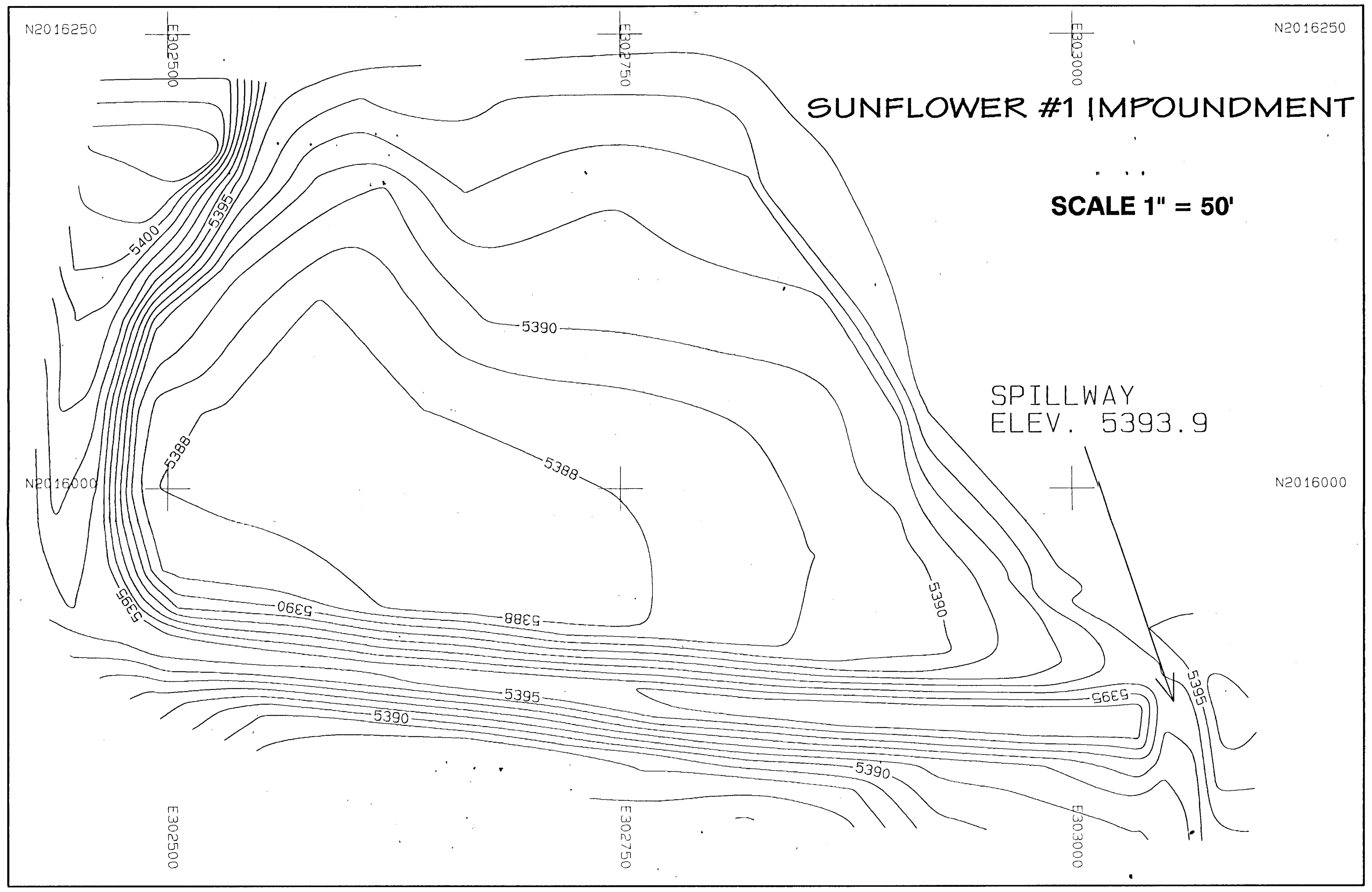
P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

HIGHWALL IMPOUNDMENTS
"AS BUILT"

PREPARED BY LR	DRAWN BY PJF	SCALE AS NOTED
APPROVED BY LR	DATE 03-25-97	

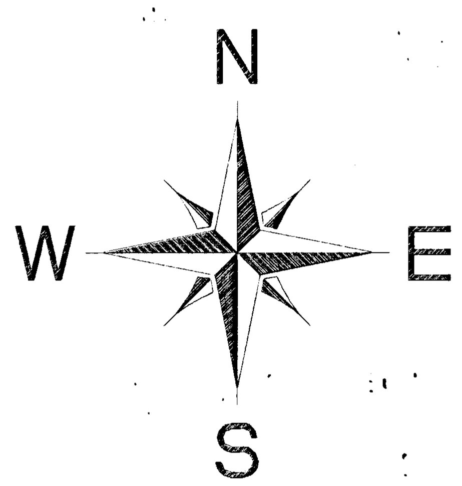
PATH: G:\Gs\Permit F\Ch 11\HWSTR\HGWLIMP_X-SECT.pro





SUNFLOWER #1
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5388	0.58	0.00	0.00
5389	1.19	0.89	0.89
5390	1.69	1.45	2.34
5391	2.16	1.94	4.28
5392	2.54	2.37	6.65
5393	2.86	2.72	9.37
5393.9	3.18	2.86	12.23



STUB 18 IMPOUNDMENT
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5401	0.15	0.00	0.00
5402	0.31	0.23	0.23
5403	0.47	0.40	0.63
5404	0.70	0.59	1.22
5405	0.98	0.85	2.07
5406	1.33	1.17	3.24
5407	1.74	1.55	4.79
5408	2.21	1.99	6.78
5408.5	2.44	1.22	8.00

CERTIFICATION STATEMENT

I. Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

5-6-97

APPROVED JUN 1997

REVISION	DATE
1 FOR OSM REVIEW	05-05-97
2	
3	
4	
5	

PROJECT MANAGER: GREG PERKINS
ENGR. of RECORD: LEONARD RAYMOND
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.

PO BOX 155, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: PRJD_151N/185N
DATE: MAY 05, 1997
DESIGNED BY: F.T. JOHNSON
DRAWN BY: F.T. JOHNSON
CHECKED BY: LEONARD RAYMOND
APPROVED BY: LEONARD RAYMOND

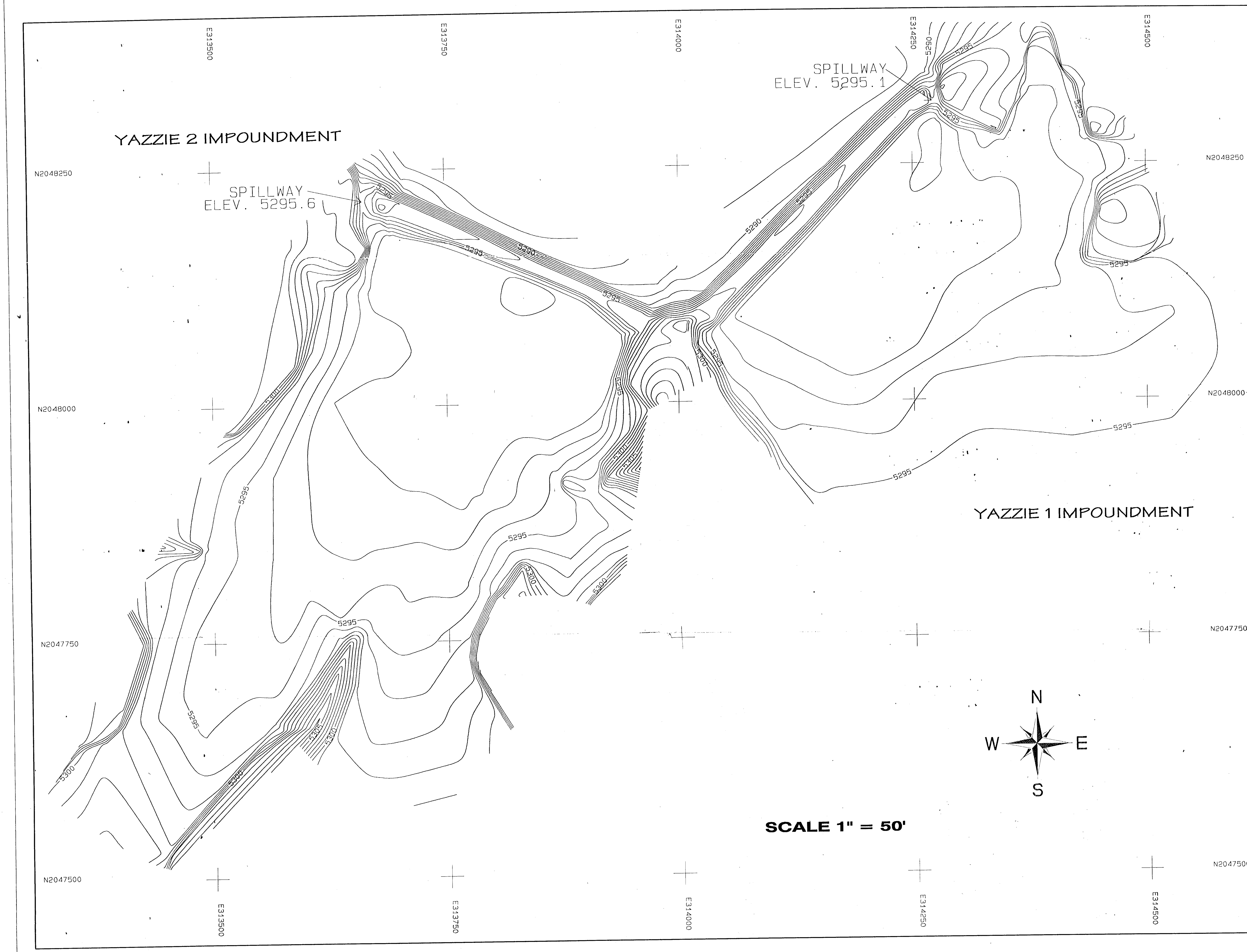
PLAN

HIGHWALL IMPOUNDMENTS
SUNFLOWER #1 AND STUB 18
(PRJD_proj_name2)

DRAWING

SHEET
OF 0

Path: G:\USER\JOHNSON.FTJ\TMODEL\HIGHWALL\HIGHWALL.PRO Plot time: Mon May 05 10:19:59 1997



SCALE 1" = 50'

YAZZIE 1 IMPOUNDMENT
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5291	0.04	0.00	0.00
5292	0.98	0.52	0.52
5293	1.60	1.30	1.82
5294	2.30	1.96	3.78
5295	3.31	2.82	6.60
5295.1	3.41	0.34	6.94

YAZZIE 2 IMPOUNDMENT
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5291	0.04	0.00	0.00
5292	1.21	0.63	0.63
5293	1.80	1.52	2.15
5294	2.36	2.10	4.25
5295	3.10	2.75	7.00
5295.6	3.54	2.12	9.12

CERTIFICATION STATEMENT
I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

5-6-97

APPROVED JUN 1997

REVISION	DATE
1 FOR OSM REVIEW	05-05-97
2	
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PROJECT MANAGER: GREG PERKINS
ENGR. of RECORD: LEONARD RAYMOND
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
PO BOX 155, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: PRJD_151N/185N
DATE: MAY 05, 1997
DESIGNED BY: F.T. JOHNSON
DRAWN BY: F.T. JOHNSON
CHECKED BY: LEONARD RAYMOND
APPROVED BY: LEONARD RAYMOND

PLAN

HIGHWALL IMPOUNDMENTS
YAZZIE 1 AND YAZZIE 2
(PRJD_proj_name2)

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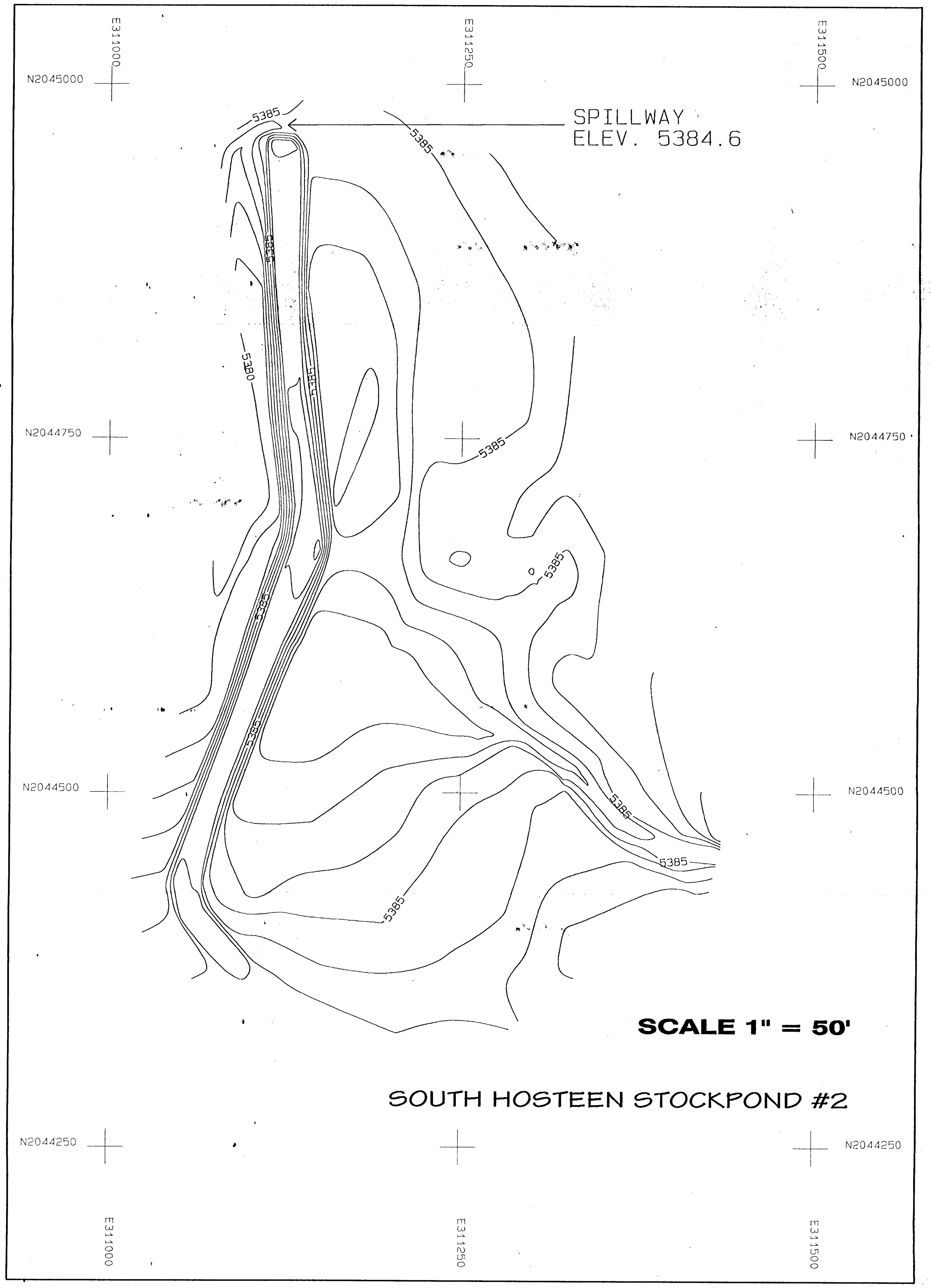

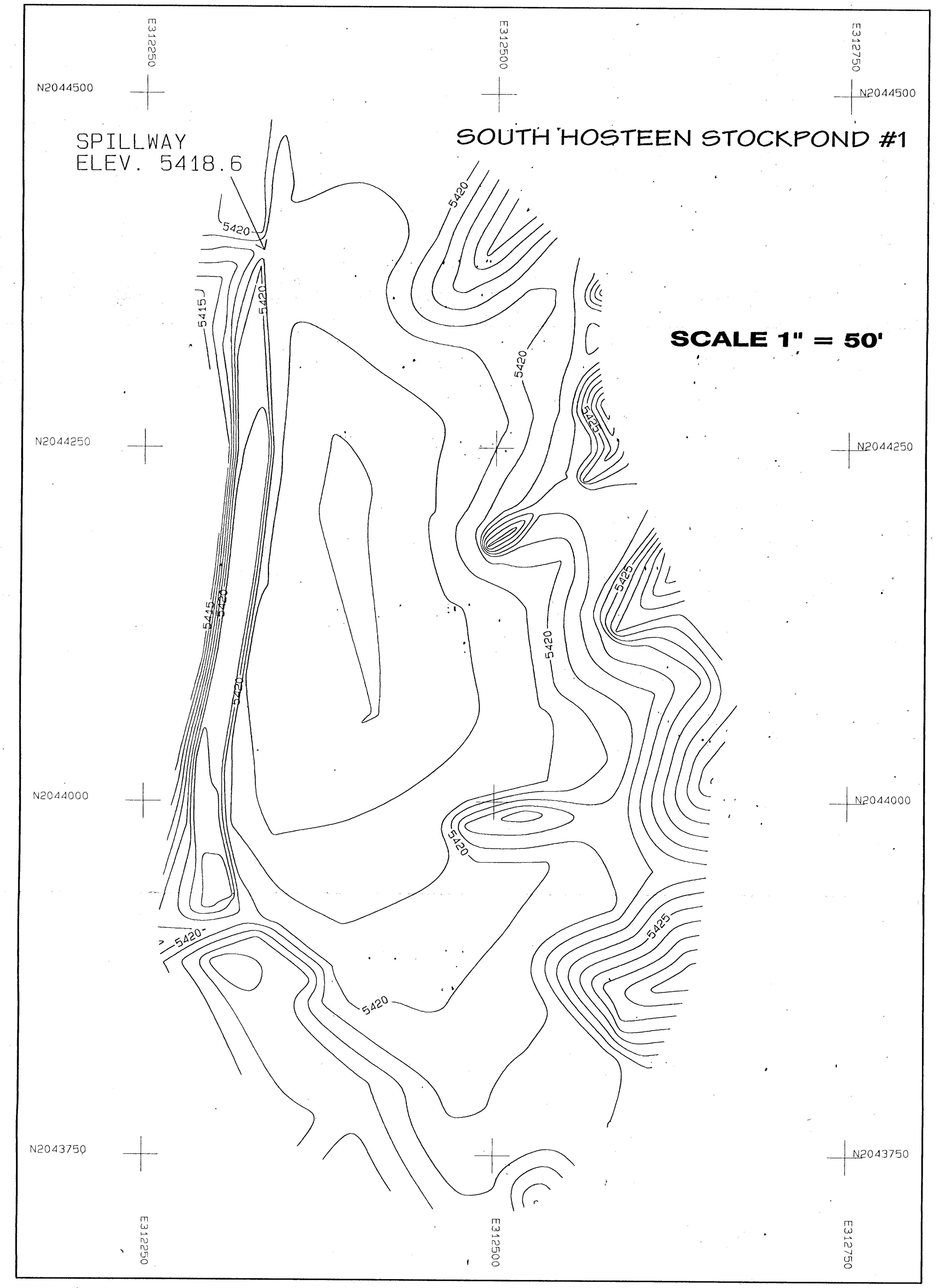

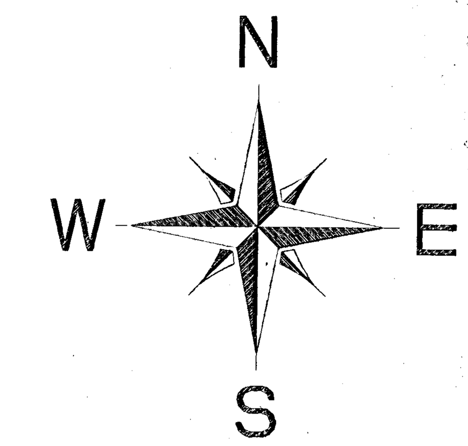

SOUTH HOSTEEN #1
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5417	0.10	0.00	0.00
5418	0.96	0.53	0.53
5418.6	1.48	0.89	1.42

SOUTH HOSTEEN #2
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5382	0.24	0.00	0.00
5383	0.69	0.47	0.47
5384	1.12	0.69	1.16
5384.6	1.38	0.83	1.99

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

5-6-97

JUN 1997 APPROVED

REVISION	DATE
1 FOR OSM REVIEW	05-05-97
2	
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PROJECT MANAGER: GREG PERKINS
ENGR. of RECORD: LEONARD RAYMOND
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.

PO BOX 155, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: PRJD_151N/185N
DATE: MAY 05, 1997
DESIGNED BY: F.T. JOHNSON
DRAWN BY: F.T. JOHNSON
CHECKED BY: LEONARD RAYMOND
APPROVED BY: LEONARD RAYMOND

PLAN

HIGHWALL IMPOUNDMENTS
SOUTH HOSTEEN STOCKPONDS
(PRJD_proj_name2)

DRAWING

SHEET 0 OF

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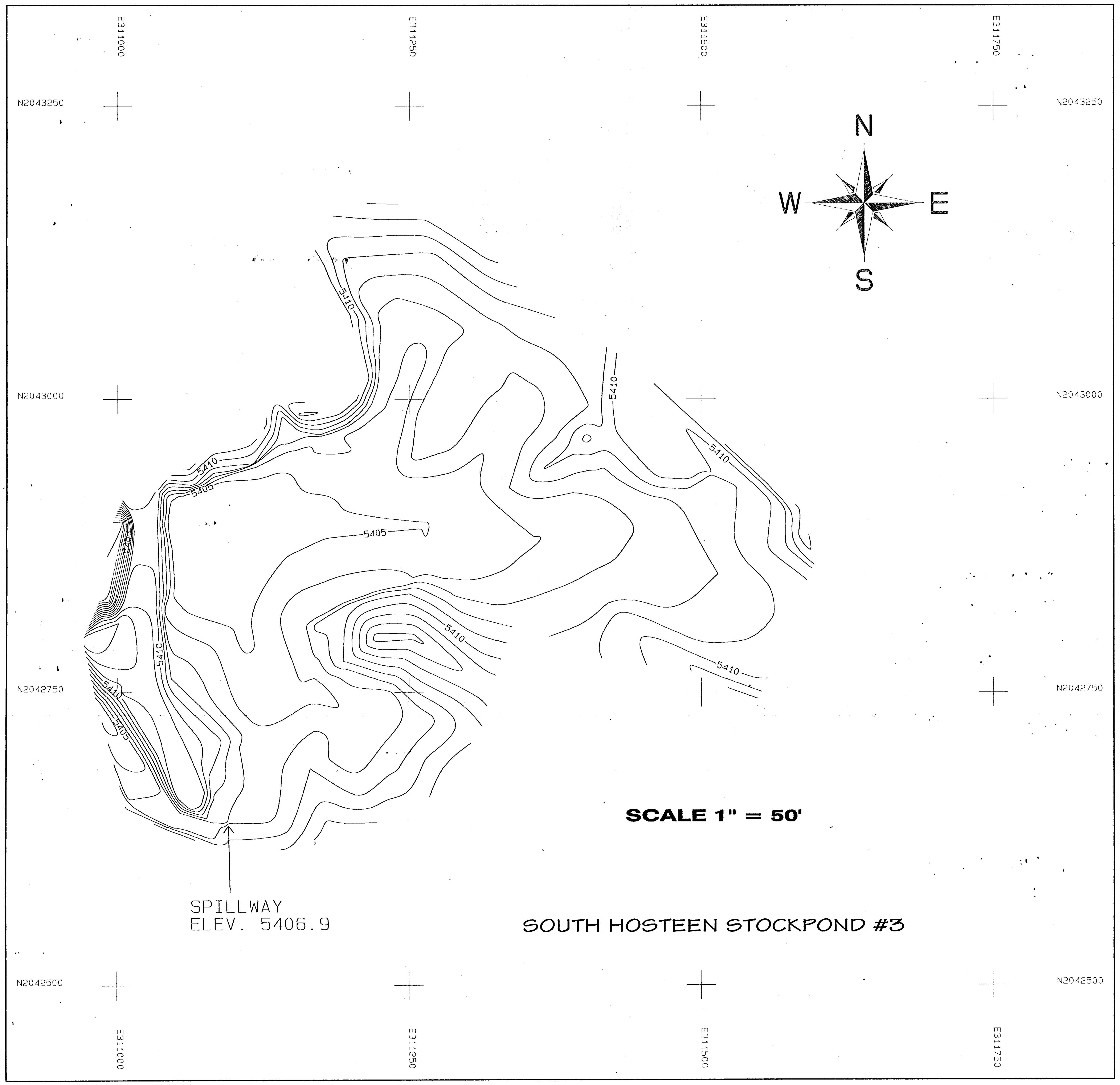


SOUTH HOSTEEN #3
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5405	0.32	0.00	0.00
5406	0.91	0.62	0.62
5406.9	1.44	1.30	1.92

CERTIFICATION STATEMENT
I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER
5-6-97

APPROVED JUN 1997

REVISION	DATE
1 FOR OSM REVIEW	05-05-97

PROJECT MANAGER: GREG PERKINS
ENGR. of RECORD: LEONARD RAYMOND
REG. NO. 6600
SRVYR of RECORD:
REG. NO.

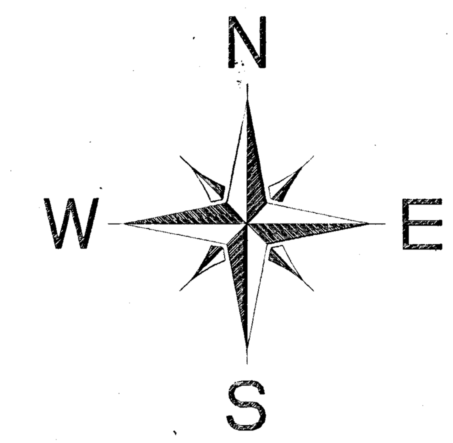
BHP-NAVAJO COAL CO.
PO BOX 155, FRUITLAND, NEW MEXICO, 87416

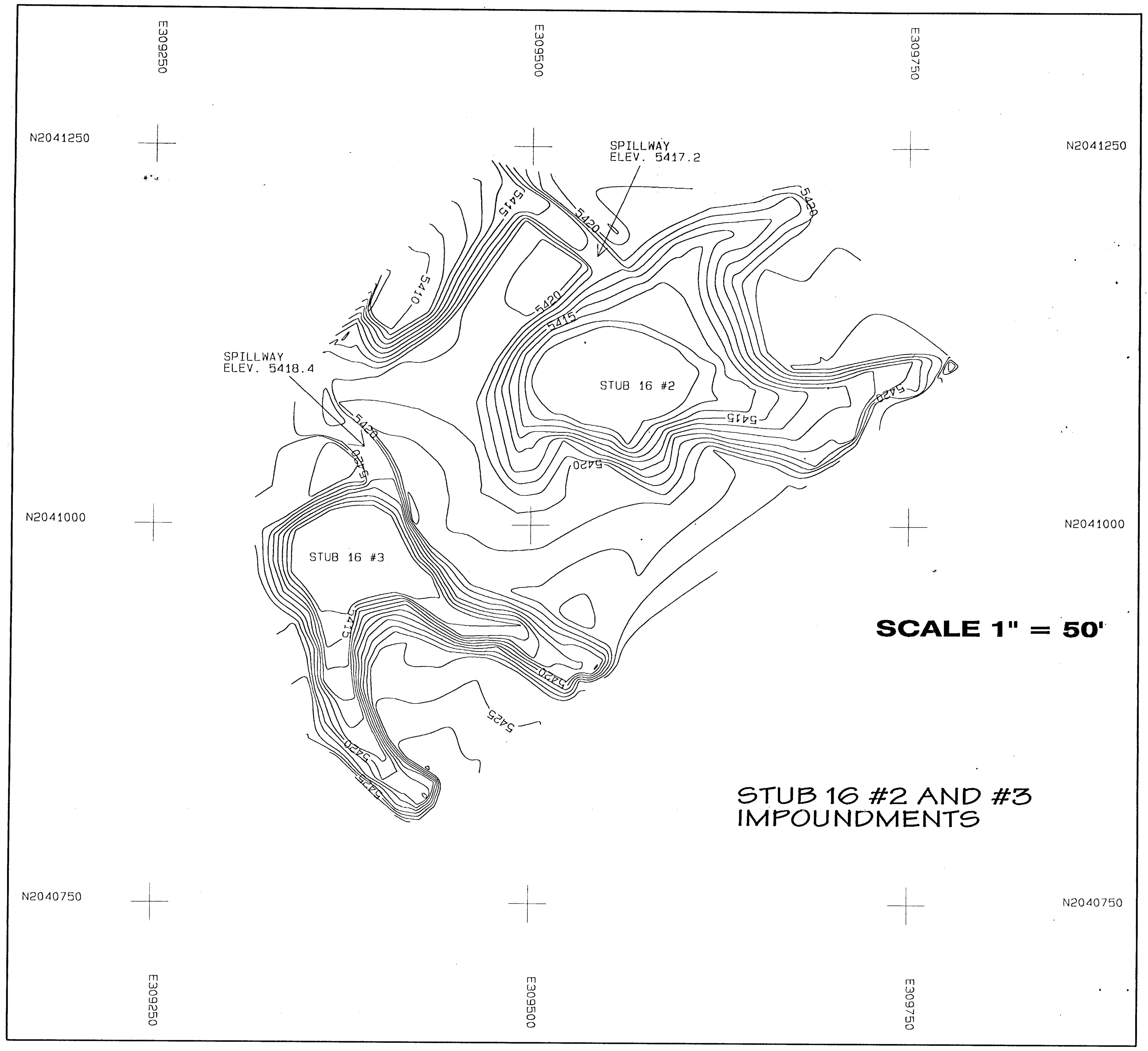
ACCOUNT: PRJD_151N/185N
DATE: MAY 05, 1997
DESIGNED BY: F.T. JOHNSON
DRAWN BY: F.T. JOHNSON
CHECKED BY: LEONARD RAYMOND
APPROVED BY: LEONARD RAYMOND

PLAN

HIGHWALL IMPOUNDMENTS
SOUTH HOSTEEN STOCKPONDS
(PRJD_proj_name2)

DRAWING
SHEET 0 OF





SCALE 1" = 50'

STUB 16 #2 AND #3
IMPOUNDMENTS

STUB 16 #2
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME. ac-ft
5411	9.2E-06	0.00	0.00
5412	0.13	0.06	0.06
5413	0.17	0.15	0.21
5414	0.24	0.21	0.42
5415	0.30	0.27	0.69
5416	0.37	0.34	1.03
5417	0.46	0.42	1.45
5417.2	0.48	0.10	1.55

STUB 16 #3
STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5414	0.11	0.00	0.00
5415	0.14	0.12	0.12
5416	0.17	0.16	0.28
5417	0.21	0.19	0.47
5418	0.25	0.23	0.70
5418.4	0.27	0.11	0.81

CERTIFICATION STATEMENT
I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

5-6-97

APPROVED
JUN 1997

REVISION	DATE
1 FOR OSM REVIEW	05-05-97
2	
3	
4	
5	

PROJECT MANAGER: GREG PERKINS
ENGR. of RECORD: LEONARD RAYMOND
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
PO BOX 155, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: PRJD_151N/18SN
DATE: MAY 05, 1997
DESIGNED BY: F.T. JOHNSON
DRAWN BY: F.T. JOHNSON
CHECKED BY: LEONARD RAYMOND
APPROVED BY: LEONARD RAYMOND

PLAN

HIGHWALL IMPOUNDMENTS
STUB 16 #2 AND #3
(PRJD_proj_name2)

DRAWING
SHEET
OF 0

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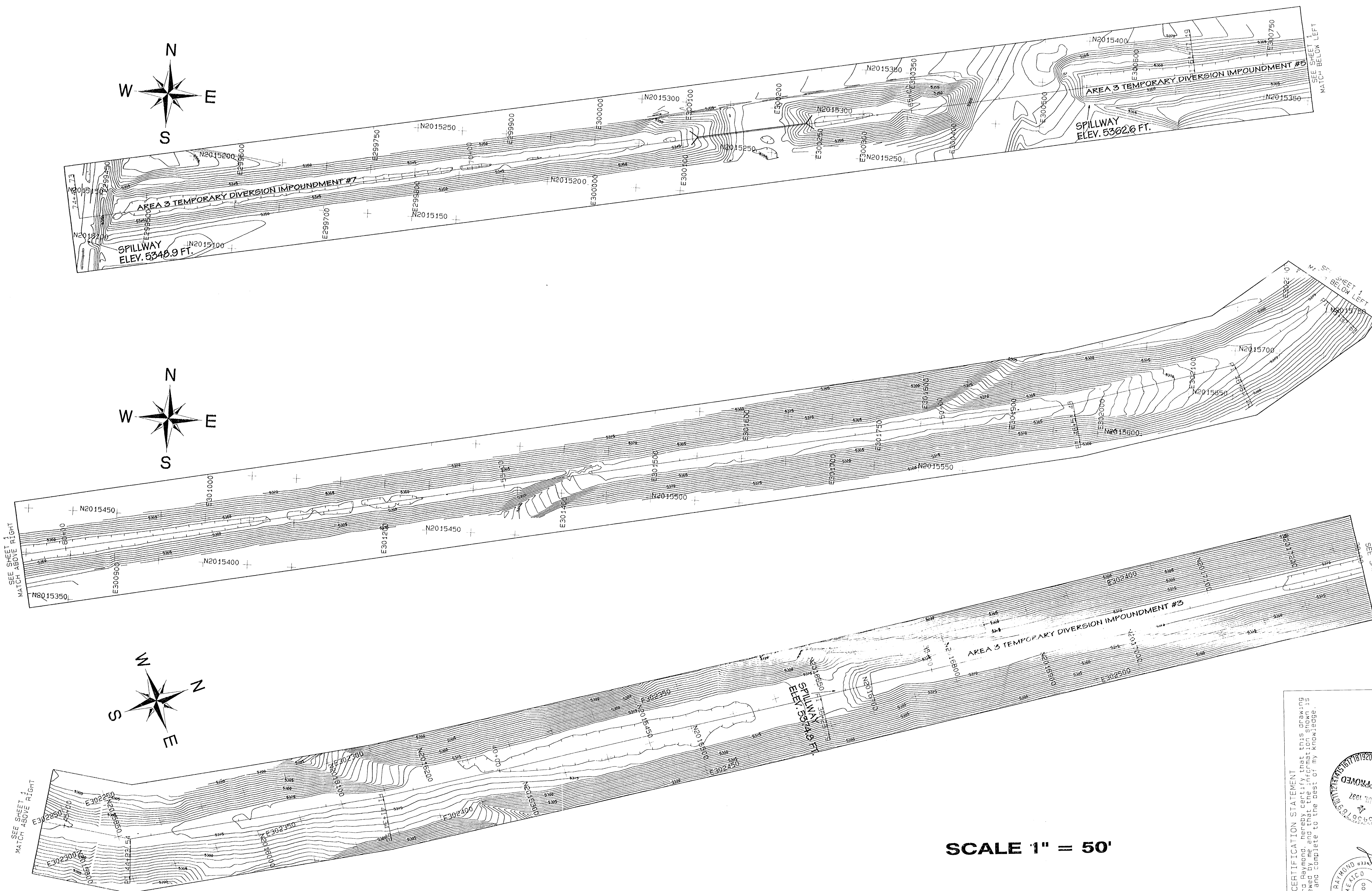

SCALE 1" = 50'

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

APPROVED JUL 1997

REVISION	DATE
FOR OSM REVIEW	06-11-97

PROJECT MANAGER: GREG PERKINS
ENGR. of RECORD: LEONARD RAYMOND
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.

PO BOX 155, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: PRJD_151N/185N
DATE: JUNE 11, 1997
DESIGNED BY: F.T. JOHNSON
DRAWN BY: F.T. JOHNSON
CHECKED BY: LEONARD RAYMOND
APPROVED BY: LEONARD RAYMOND

PLAN

HIGHWALL IMPOUNDMENTS

AREA 3 TEMPORARY DIVERSION IMPOUNDMENTS

DRAWING P-1
SHEET OF 2 0

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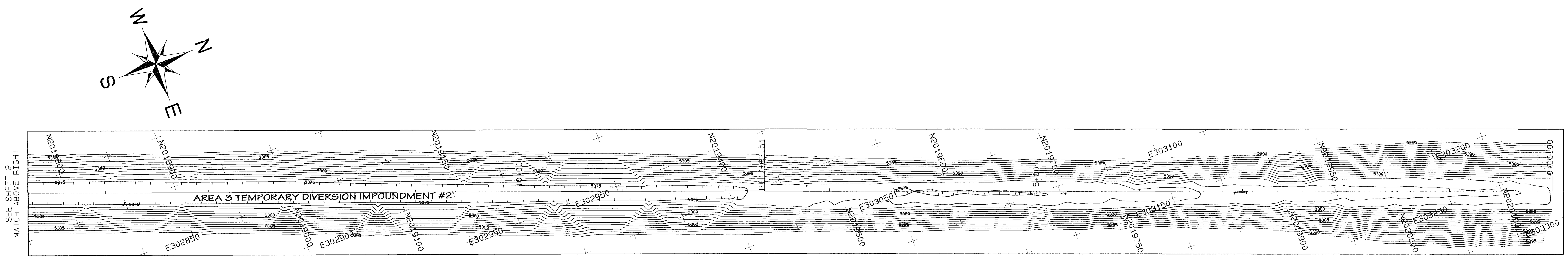


AREA 3 TEMPORARY DIVERSION IMPOUNDMENT #2 STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5375	0.31	0.00	0.00
5376	0.59	0.45	0.45
5376.9	0.84	0.76	1.21

AREA 3 TEMPORARY DIVERSION IMPOUNDMENT #3 STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5370	0.55	0.00	0.00
5371	0.74	0.65	0.65
5372	1.02	0.89	1.54
5373	1.41	1.22	2.76
5374	1.62	1.52	4.28
5374.8	1.79	1.43	5.71

AREA 3 TEMPORARY DIVERSION IMPOUNDMENT #5 STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5359	0.21	0.00	0.00
5360	0.40	0.31	0.31
5361	0.49	0.45	0.76
5362	0.79	0.64	1.40
5362.6	0.97	0.58	1.98

AREA 3 TEMPORARY DIVERSION IMPOUNDMENT #7 STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5343	0.09	0.00	0.00
5344	0.26	0.18	0.18
5345	0.37	0.32	0.50
5346	0.44	0.40	0.90
5347	0.55	0.73	1.63
5348	0.65	0.86	2.49
5348.9	0.74	0.67	3.16

APPROVED JUL 1997

SCALE 1" = 50'

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

APPROVED JUL 1997

BHP-NAVAJO COAL CO.

PO BOX 155, FRUITLAND, NEW MEXICO, 87416

PROJECT MANAGER: GREG PERKINS
ENGR. of RECORD: LEONARD RAYMOND
REG. NO. 6600

FOR OSM REVIEW 06-11-97

DATE: JUNE 11, 1997
DESIGNED BY: F. T. JOHNSON
DRAWN BY: F. T. JOHNSON
CHECKED BY: LEONARD RAYMOND
APPROVED BY: LEONARD RAYMOND

PLAN

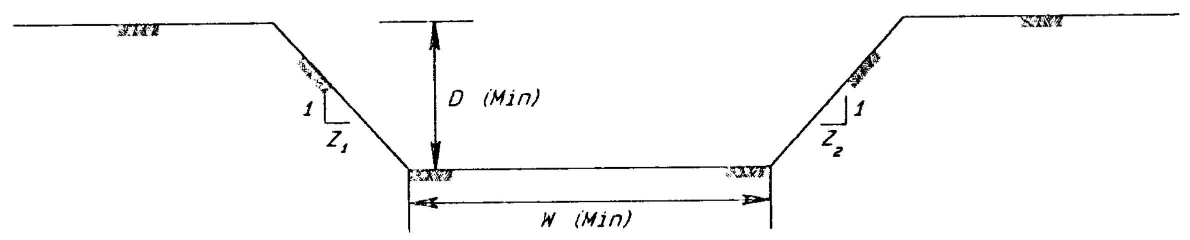
HIGHWALL IMPOUNDMENTS

AREA 3 TEMPORARY DIVERSION IMPOUNDMENTS

Plot time: Thu Jun 12 06:58:40 1997

DRAWING P-2

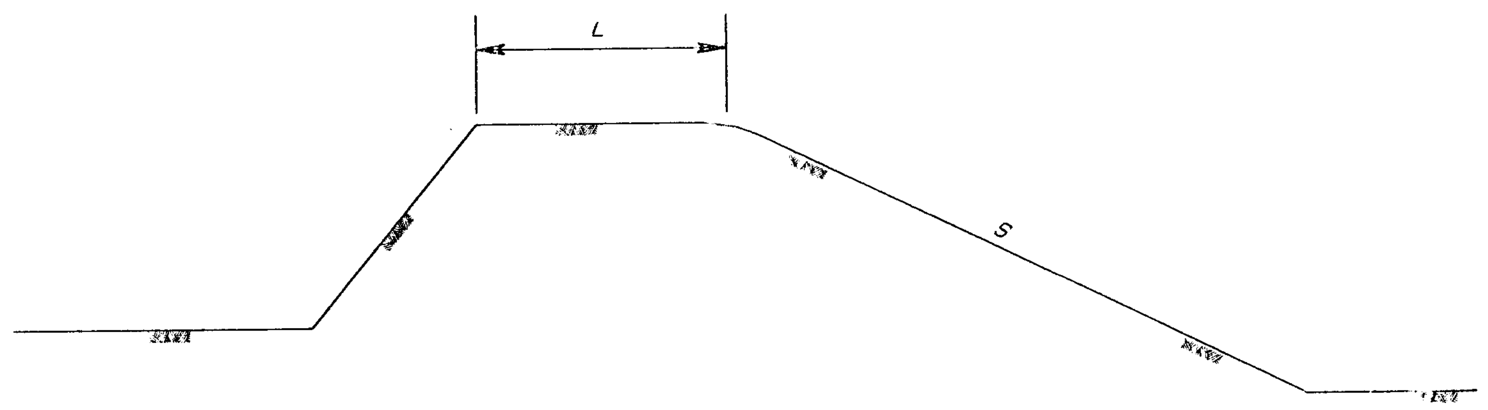
SHEET 2 OF 2



D includes 1'-0" of Freeboard

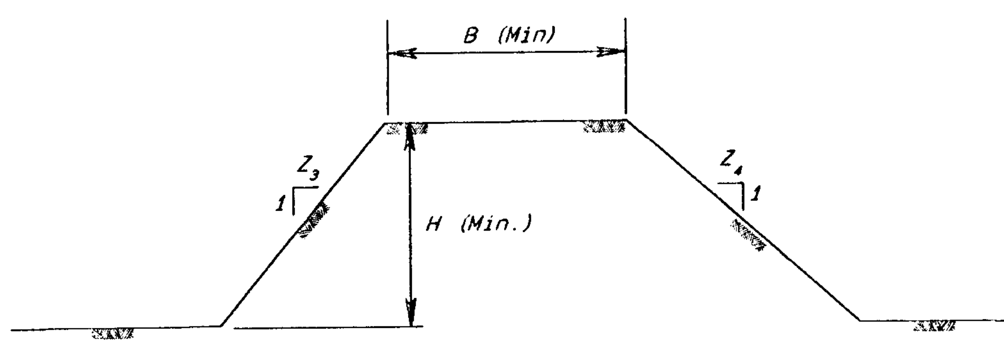
SPILLWAY SECTION

N.T.S.



SPILLWAY PROFILE

N.T.S.



H measured at the upstream toe of the embankment.

EMBANKMENT SECTION

N.T.S.

AS-BUILT DIMENSIONS

Impoundment Id	Watershed Area (acres)	Peak Discharge (cfs)	Spillway (1)						Embankment (1)				Comments
			W (ft)	D	Z_1	Z_2	L (ft)	S (%)	B (ft)	H (ft)	Z_3	Z_4	
Yazzie Stockpond #1	125.5	92.8	20.0	[illegible]	1.8	3.0	23.4	25.0	15.2	5.1	2.0	2.8	
Yazzie Stockpond #2	174.1	116.2	24.5	2.8	3.0	2.8	27.6	16.0	15.1	4.7	2.6	2.2	
South Hosteen Stockpond #1	80.1	73.3	5.0	[illegible]	5.0	4.5	29.7	6.0	16.5	4.6	2.1	2.0	
South Hosteen Stockpond #2	37.7	89.3	20.0	3.3	6.0	2.2	33.0	4.5	14.2	6.2	2.0	2.0	
South Hosteen Stockpond #3	157.3	115.7	14.5	3.7	1.5	1.5	32.0	12.0	18.0	4.5	2.3	2.0	
Stub 16 Impoundment #2	20.2	24.3	12.5	4.0	3.0	3.0	45.0	7.0	38.0	8.1	2.8	3.6	
Stub 16 Impoundment #3	[illegible]	15.5	12.5	3.0	2.2	3.2	34.0	15.0	36.0	5.1	2.2	2.0	
Stub 18 Impoundment	103.4	69.8	[illegible]	4.5	3.4	3.3	48.0	7.0	12.5	10.0	2.0	2.0	
Sunflower #1	24.6	17.3	[illegible]	3.1	4.3	5.2	38.0	2.2	9.0	7.5	4.2	3.9	
Area 3 Temp. Div. Imp. #2	59.9	21.8	9.4	2.7	2.1	1.8	35.0	6.0	10.0	6.2	4.2	2.9	
Area 3 Temp. Div. Imp. #3	20.8	23.9	40.0	20.0	2.0	2.0	18.0	2.5	18.0	5.8	4.0	40.0	
Area 3 Temp. Div. Imp. #5	[illegible]	[illegible]	10.4	2.2	4.3	3.2	25.0	1.5	20.0	9.5	2.0	1.6	
Area 3 Temp. Div. Imp. #7	56.5	21.9	12.5	2.1	5.0	1.7	50.0	0.5	73.0	8.5	2.9	4.0	

(1) The data under each impoundment are the current dimensions of the structure. These indicate that the existing structures are adequate.

Note: For supporting design data refer to Appendix 11-II "Highwall Impoundment Design and As-Built Information" in the Mine Permit.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

L. Raymond 11-21-97

DEC 1997
APPROVED
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.S.	P.E.	P.S.	CHIEF ENG.
C	10-30-97	PJF	REMOVED EXHIBIT NO.		PS			
B	08-27-97	FTJ	REVISED TABLE					
A	03-27-97	PJF	SUBMITTED TO OSM FOR APPROVAL					
				APPROVALS				

BHP NAVAJO COAL COMPANY

NAVAJO MINE

SAFETY PAYS

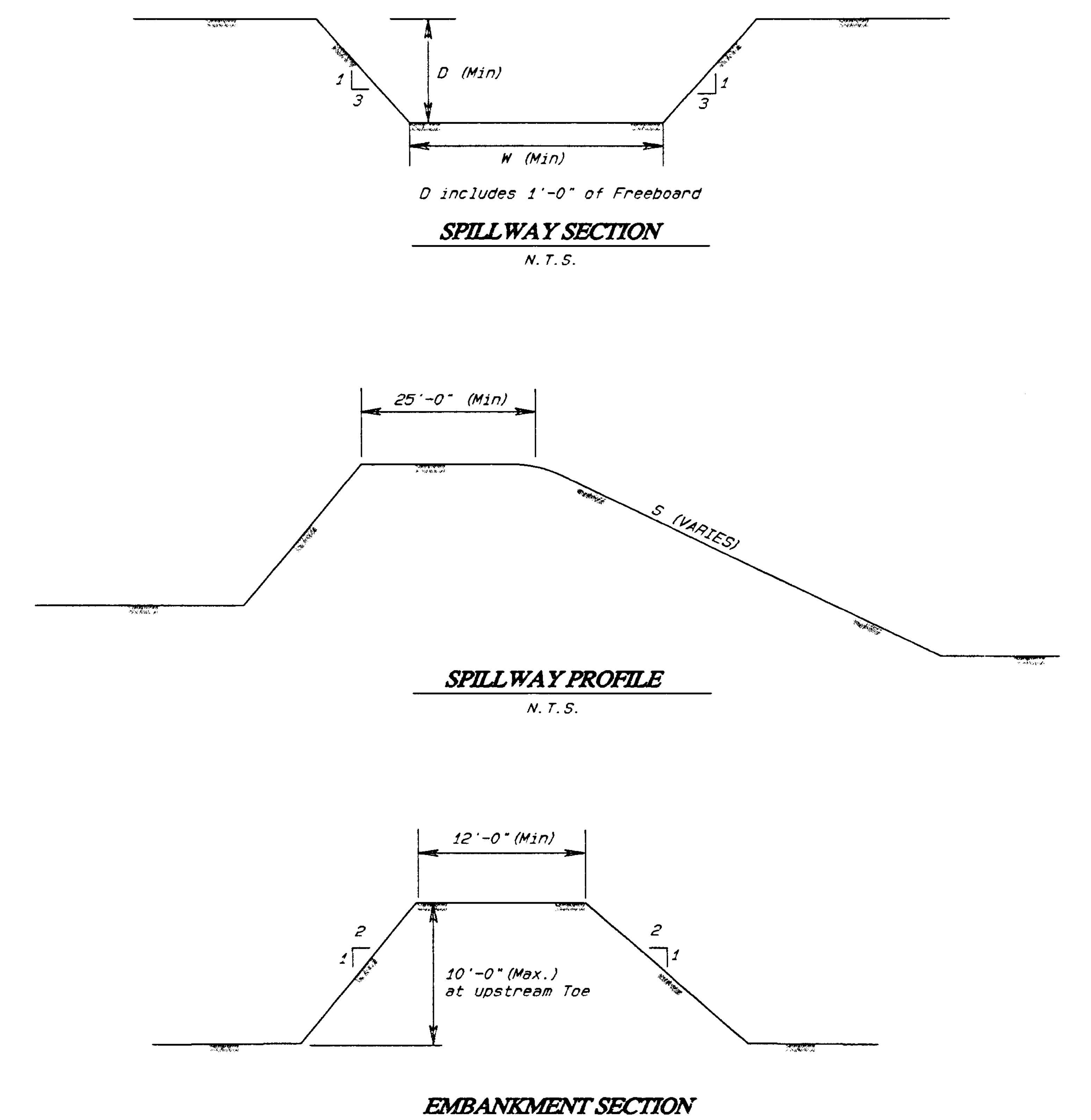
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

HIGHWALL IMPOUNDMENTS

"AS BUILT"

PREPARED BY LR	DRAWN BY PJF	SCALE AS NOTED
APPROVED BY LR	DATE 03-25-97	MYLAR LOC. A13-2

PATH: J:\OSM_SUBM\PER_PROG\CH_11\HWSTR\HGWLIMP.PRO



SPILLWAY SECTION
N.T.S.

SPILLWAY PROFILE
N.T.S.

EMBANKMENT SECTION
N.T.S.

SPILLWAY SCHEDULE

Watershed Area (acres)	CN	Discharge Peak (cfs)	Spillway D (ft)	Spillway W (ft)
25.0	93.0	33.3	2.00	15.00
	90.0	27.0	2.00	15.00
	86.0	20.2	2.00	10.00
	83.0	15.8	2.00	10.00
50.0	93.0	58.7	2.25	20.00
	90.0	47.1	2.00	20.00
	86.0	34.5	2.00	15.00
	83.0	26.9	2.00	15.00
75.0	93.0	80.5	2.25	25.00
	90.0	64.2	2.25	20.00
	86.0	46.7	2.00	20.00
	83.0	36.1	2.00	15.00
100.0	93.0	100.2	2.50	20.00
	90.0	79.5	2.25	25.00
	86.0	57.6	2.25	20.00
	83.0	44.3	2.00	20.00
150.0	93.0	134.1	2.75	25.00
	90.0	105.7	2.50	25.00
	86.0	76.3	2.25	25.00
	83.0	58.3	2.00	25.00
200.0	93.0	163.8	3.00	20.00
	90.0	129.0	2.75	20.00
	86.0	92.7	2.50	20.00
	83.0	70.7	2.25	20.00
300.0	93.0	214.8	3.00	30.00
	90.0	169.4	3.00	20.00
	86.0	121.2	2.50	25.00
	83.0	92.2	2.50	20.00
400.0	93.0	259.5	3.25	30.00
	90.0	204.7	3.00	25.00
	86.0	146.2	2.75	25.00
	83.0	111.6	2.50	25.00
500.0	93.0	300.2	3.50	25.00
	90.0	236.5	3.25	25.00
	86.0	168.9	3.00	20.00
	83.0	129.1	2.75	20.00
600.0	93.0	337.4	3.50	30.00
	90.0	265.7	3.25	30.00
	86.0	189.6	3.00	25.00
	83.0	145.1	2.75	25.00
700.0	93.0	372.1	3.75	30.00
	90.0	292.9	3.50	25.00
	86.0	209.1	3.00	25.00
	83.0	160.0	3.00	20.00

Note: For supporting design data refer to Appendix 11-II "Highwall Impoundment Design and As-built Information" in the Mine Permit.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

APPROVED DEC 1997

LEONARD RAYMOND NEW MEXICO 5600 PROFESSIONAL ENGINEER

11-24-97

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.	P.S.	CHIEF ENG.
B	10-30-97	PJF	REMOVED EXHIBIT No.		PS			
A	03-27-97	PJF	SUBMITTED TO OSM FOR APPROVAL					

APPROVALS

BHP NAVAJO COAL COMPANY

NAVAJO MINE

SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

HIGHWALL IMPOUNDMENTS

STANDARD DESIGN

PREPARED BY LR	DRAWN BY PJF	SCALE AS NOTED
APPROVED BY LR	DATE 03-25-97	MYLAR LOC. A13-2

PATH: J:\OSM_SUBM\PER_PROG\CH_11\HWSTR\HGWLIMP.PRO

Appendix 26.E

North Fork Diversion Channel

February 2001

NORTH FORK DIVERSION CHANNEL

HYDROLOGY

FEBRUARY 2001

NORTH FORK DIVERSION CHANNEL

Hydrology model for the North Fork Diversion Channel. Refer to Exhibit 11-142A for the SEDCAD watershed subdivisions and Exhibit 11-142B & 142C for design plan, profile, and sections.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

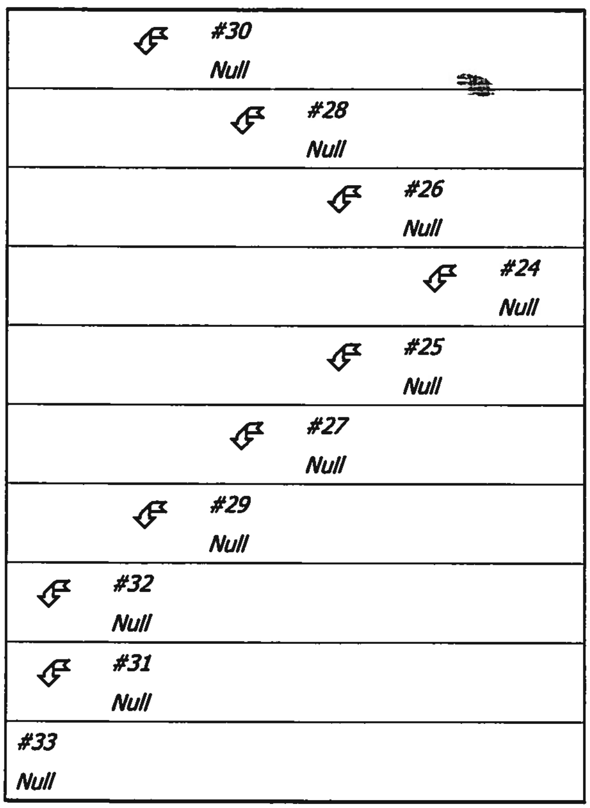
General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#24	==>	#25	0.964	0.340	
Null	#25	==>	#27	1.454	0.333	
Null	#26	==>	#27	1.454	0.333	
Null	#27	==>	#29	0.800	0.323	
Null	#28	==>	#29	0.800	0.323	
Null	#29	==>	#32	0.479	0.298	
Null	#30	==>	#32	0.479	0.298	
Null	#31	==>	#33	0.000	0.000	
Null	#32	==>	#33	0.000	0.000	
Null	#33	==>	End	0.000	0.000	Inlet to North Fork Diversion



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#24	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,568.00	3.62	0.964
#24	**Muskingum K:**					**0.964**
#25	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.00	3.39	1.454
#25	**Muskingum K:**					**1.454**
#26	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.62	3.39	1.454
#26	**Muskingum K:**					**1.454**
#27	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#27	**Muskingum K:**					**0.800**
#28	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#28	**Muskingum K:**					**0.800**
#29	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#29	**Muskingum K:**					**0.479**
#30	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#30	**Muskingum K:**					**0.479**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#30	476.400	476.400	0.20	0.04
#28	1,217.900	1,217.900	127.50	21.24
#26	2,486.400	2,486.400	5.44	2.30
#24	8,061.800	8,061.800	6.64	4.91
#25	1,015.700	9,077.500	25.38	9.08
#27	1,783.700	13,347.600	51.42	18.56
#29	966.000	15,531.500	173.24	56.11
#32	293.700	16,301.600	178.81	63.51
#31	957.100	957.100	135.01	21.90
#33	0.000	17,258.700	243.60	85.41

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#30	1	476.400	1.131	0.000	0.000	73.100	M	0.20	0.043
	Σ	**476.400**						**0.20**	**0.043**
#28	1	772.300	0.657	0.523	0.334	90.400	M	106.00	13.472
	2	445.600	0.587	0.000	0.000	90.400	M	65.74	7.773
	Σ	**1,217.900**						**127.50**	**21.244**
#26	1	447.600	2.192	0.000	0.000	74.200	M	0.34	0.114
	2	2,038.800	3.000	0.000	0.000	77.000	M	5.10	2.186
	Σ	**2,486.400**						**5.44**	**2.300**
#24	1	2,607.500	5.367	2.377	0.305	75.200	M	2.02	1.246
	2	2,331.900	4.813	2.431	0.304	74.700	M	1.48	0.833
	3	1,758.500	2.231	1.788	0.297	76.200	M	3.66	1.366
	4	1,363.900	2.618	0.000	0.000	77.000	M	3.63	1.463
	Σ	**8,061.800**						**6.64**	**4.907**
#25	1	515.200	0.990	0.342	0.357	78.200	M	3.32	0.833
	2	130.500	0.787	0.342	0.357	78.100	M	0.89	0.204
	3	370.000	0.516	0.000	0.000	85.700	M	25.34	3.140
	Σ	**9,077.500**						**25.38**	**9.084**
#27	1	354.400	0.612	1.233	0.337	83.100	M	11.81	1.882
	2	305.200	0.529	1.054	0.328	84.000	M	14.02	1.922
	3	289.800	0.692	0.551	0.328	75.500	M	0.59	0.162
	4	253.000	0.361	0.551	0.328	79.400	M	3.26	0.579
	5	581.300	0.980	0.000	0.000	82.300	M	12.58	2.629
	Σ	**13,347.600**						**51.42**	**18.559**
#29	1	508.800	0.409	0.416	0.312	89.500	M	80.63	7.795
	2	233.200	0.521	0.291	0.312	91.600	M	44.78	4.818
	3	224.000	0.467	0.000	0.000	90.000	M	35.63	3.690
	Σ	**15,531.500**						**173.24**	**56.106**
#32	1	293.700	0.576	0.000	0.000	93.000	M	65.60	7.363
	Σ	**16,301.600**						**178.81**	**63.512**
#31	1	431.100	0.588	0.450	0.336	91.500	M	75.71	8.782
	2	325.800	0.432	0.149	0.327	93.000	M	85.40	8.167
	3	200.200	0.373	0.000	0.000	92.900	M	55.57	4.950
	Σ	**957.100**						**135.01**	**21.900**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#33	**Σ**	**17,258.700**						**243.60**	**85.412**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#24	1	5. Nearly bare and untilled, and alluvial valley fans	1.71	430.00	25,118.00	1.300	5.367
#24	**1**	**Time of Concentration:**					**5.367**
#24	2	5. Nearly bare and untilled, and alluvial valley fans	1.84	430.00	23,393.00	1.350	4.813
#24	**2**	**Time of Concentration:**					**4.813**
#24	3	5. Nearly bare and untilled, and alluvial valley fans	1.82	155.00	8,498.00	1.350	1.748
		8. Large gullies, diversions, and low flowing streams	0.84	40.00	4,771.00	2.740	0.483
#24	**3**	**Time of Concentration:**					**2.231**
#24	4	5. Nearly bare and untilled, and alluvial valley fans	1.24	50.00	4,042.00	1.110	1.011
		8. Large gullies, diversions, and low flowing streams	0.49	60.00	12,150.00	2.100	1.607
#24	**4**	**Time of Concentration:**					**2.618**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	0.51	10.00	1,950.00	0.710	0.762
		8. Large gullies, diversions, and low flowing streams	1.81	60.00	3,322.00	4.030	0.228
#25	**1**	**Time of Concentration:**					**0.990**
#25	2	5. Nearly bare and untilled, and alluvial valley fans	1.11	25.00	2,254.00	1.050	0.596
		8. Large gullies, diversions, and low flowing streams	2.36	75.00	3,178.00	4.600	0.191
#25	**2**	**Time of Concentration:**					**0.787**
#25	3	5. Nearly bare and untilled, and alluvial valley fans	3.23	30.00	929.00	1.790	0.144
		8. Large gullies, diversions, and low flowing streams	2.45	154.00	6,297.00	4.690	0.372
#25	**3**	**Time of Concentration:**					**0.516**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	1.20	103.00	8,602.00	1.090	2.192
#26	**1**	**Time of Concentration:**					**2.192**
#26	2	5. Nearly bare and untilled, and alluvial valley fans	1.23	120.00	9,780.00	1.100	2.469
		8. Large gullies, diversions, and low flowing streams	2.18	184.00	8,454.00	4.420	0.531
#26	**2**	**Time of Concentration:**					**3.000**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.32	50.00	1,158.02	2.070	0.155
		8. Large gullies, diversions, and low flowing streams	2.53	198.00	7,838.16	4.760	0.457
#27	**1**	**Time of Concentration:**					**0.612**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	5.26	30.00	570.00	2.290	0.069
		8. Large gullies, diversions, and low flowing streams	3.15	278.00	8,822.00	5.320	0.460
#27	**2**	**Time of Concentration:**					**0.529**
#27	3	5. Nearly bare and untilled, and alluvial valley fans	16.33	80.00	490.00	4.040	0.033
		8. Large gullies, diversions, and low flowing streams	2.15	225.00	10,443.00	4.400	0.659
#27	**3**	**Time of Concentration:**					**0.692**
#27	4	5. Nearly bare and untilled, and alluvial valley fans	12.43	65.00	523.00	3.520	0.041
		8. Large gullies, diversions, and low flowing streams	3.49	225.00	6,454.00	5.600	0.320
#27	**4**	**Time of Concentration:**					**0.361**
#27	5	5. Nearly bare and untilled, and alluvial valley fans	9.40	25.00	266.00	3.060	0.024
		8. Large gullies, diversions, and low flowing streams	2.32	364.00	15,700.00	4.560	0.956
#27	**5**	**Time of Concentration:**					**0.980**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	40.00	762.00	2.290	0.092
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**1**	**Time of Concentration:**					**0.657**
#28	2	5. Nearly bare and untilled, and alluvial valley fans	25.86	105.00	406.00	5.080	0.022
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**2**	**Time of Concentration:**					**0.587**
#29	1	5. Nearly bare and untilled, and alluvial valley fans	11.58	30.00	259.00	3.400	0.021
		8. Large gullies, diversions, and low flowing streams	3.61	288.00	7,976.00	5.700	0.388
#29	**1**	**Time of Concentration:**					**0.409**
#29	2	5. Nearly bare and untilled, and alluvial valley fans	8.06	40.00	496.00	2.830	0.048
		8. Large gullies, diversions, and low flowing streams	2.90	252.00	8,693.55	5.100	0.473
#29	**2**	**Time of Concentration:**					**0.521**
#29	3	5. Nearly bare and untilled, and alluvial valley fans	7.25	25.00	345.00	2.690	0.035

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.26	158.00	7,001.00	4.500	0.432
#29	**3**	**Time of Concentration:**					**0.467**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	35.00	710.00	2.220	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	243.00	14,540.00	3.870	1.043
#30	**1**	**Time of Concentration:**					**1.131**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.91	15.00	515.00	1.700	0.084
		8. Large gullies, diversions, and low flowing streams	2.74	247.00	9,006.00	4.960	0.504
#31	**1**	**Time of Concentration:**					**0.588**
#31	2	5. Nearly bare and untilled, and alluvial valley fans	7.46	25.00	335.00	2.730	0.034
		8. Large gullies, diversions, and low flowing streams	2.18	138.00	6,335.00	4.420	0.398
#31	**2**	**Time of Concentration:**					**0.432**
#31	3	5. Nearly bare and untilled, and alluvial valley fans	3.84	20.00	521.00	1.950	0.074
		8. Large gullies, diversions, and low flowing streams	2.24	108.00	4,826.00	4.480	0.299
#31	**3**	**Time of Concentration:**					**0.373**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	22.00	632.00	1.860	0.094
		8. Large gullies, diversions, and low flowing streams	1.56	101.00	6,494.00	3.740	0.482
#32	**1**	**Time of Concentration:**					**0.576**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#24	1	8. Large gullies, diversions, and low flowing streams	0.79	180.00	22,769.00	2.660	2.377
#24	**1**	**Muskingum K:**					**2.377**
#24	2	8. Large gullies, diversions, and low flowing streams	0.78	180.00	23,111.00	2.640	2.431
#24	**2**	**Muskingum K:**					**2.431**
#24	4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#24	**4**	**Muskingum K:**					**0.000**
#25	1	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**1**	**Muskingum K:**					**0.342**
#25	2	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#25	**2**	**Muskingum K:**					**0.342**
#25	3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#25	**3**	**Muskingum K:**					**0.000**
#27	1	8. Large gullies, diversions, and low flowing streams	1.38	216.00	15,629.00	3.520	1.233
#27	**1**	**Muskingum K:**					**1.233**
#27	2	8. Large gullies, diversions, and low flowing streams	1.17	144.00	12,301.00	3.240	1.054
#27	**2**	**Muskingum K:**					**1.054**
#27	3	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**3**	**Muskingum K:**					**0.551**
#27	4	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**4**	**Muskingum K:**					**0.551**
#28	1	8. Large gullies, diversions, and low flowing streams	1.30	84.00	6,445.17	3.420	0.523
#28	**1**	**Muskingum K:**					**0.523**
#29	1	8. Large gullies, diversions, and low flowing streams	0.88	37.00	4,210.00	2.810	0.416
#29	**1**	**Muskingum K:**					**0.416**
#29	2	8. Large gullies, diversions, and low flowing streams	0.88	26.00	2,949.00	2.810	0.291
#29	**2**	**Muskingum K:**					**0.291**
#31	1	8. Large gullies, diversions, and low flowing streams	1.35	76.00	5,639.00	3.480	0.450
#31	**1**	**Muskingum K:**					**0.450**
#31	2	8. Large gullies, diversions, and low flowing streams	1.15	20.00	1,734.00	3.220	0.149
#31	**2**	**Muskingum K:**					**0.149**

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	5 yr - 6 hr
Rainfall Depth:	1.100 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#30	476.400	476.400	5.05	1.30
#28	1,217.900	1,217.900	253.26	41.01
#26	2,486.400	2,486.400	33.98	13.87
#24	8,061.800	8,061.800	48.15	37.81
#25	1,015.700	9,077.500	67.51	49.99
#27	1,783.700	13,347.600	149.85	85.35
#29	966.000	15,531.500	373.04	158.08
#32	293.700	16,301.600	385.04	172.34
#31	957.100	957.100	249.28	39.41
#33	0.000	17,258.700	471.63	211.76

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#30	476.400	476.400	12.85	2.98
#28	1,217.900	1,217.900	348.89	55.85
#26	2,486.400	2,486.400	65.87	26.07
#24	8,061.800	8,061.800	94.58	74.22
#25	1,015.700	9,077.500	103.41	93.53
#27	1,783.700	13,347.600	236.67	153.83
#29	966.000	15,531.500	535.73	253.00
#32	293.700	16,301.600	553.89	272.97
#31	957.100	957.100	333.75	52.17
#33	0.000	17,258.700	646.50	325.15

NORTH FORK DIVERSION CHANNEL

CHANNEL DESIGN

FEBRUARY 2001

North Fork Diversion Channel, Sta. 0+00 to 26+37 and Sta. 31+50 to 39+80, 2yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	3.0:1	3.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	244.00 cfs	
Depth:	2.17 ft	3.17 ft
Top Width:	38.00 ft	44.00 ft
Velocity:	3.58 fps	
X-Section Area:	68.22 sq ft	
Hydraulic Radius:	1.763	
Froude Number:	0.47	

North Fork Diversion Channel, Sta. 26+57 to 26+88, 2yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	1.5:1	3.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	244.00 cfs	
Depth:	2.21 ft	3.21 ft
Top Width:	34.94 ft	39.44 ft
Velocity:	3.69 fps	
X-Section Area:	66.19 sq ft	
Hydraulic Radius:	1.845	
Froude Number:	0.47	

North Fork Diversion Channel, Sta. 27+08 to 27+85, 2yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	1.5:1	2.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	244.00 cfs	
Depth:	2.24 ft	3.24 ft
Top Width:	32.84 ft	36.34 ft
Velocity:	3.77 fps	
X-Section Area:	64.80 sq ft	
Hydraulic Radius:	1.904	
Froude Number:	0.47	

North Fork Diversion Channel, Sta. 28+05 to 29+30, 2yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	1.5:1	1.5:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	244.00 cfs	
Depth:	2.26 ft	3.26 ft
Top Width:	31.78 ft	34.78 ft
Velocity:	3.81 fps	
X-Section Area:	64.12 sq ft	
Hydraulic Radius:	1.935	
Froude Number:	0.47	

North Fork Diversion Channel, Sta. 29+50 to 31+30, 2yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	3.0:1	2.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	244.00 cfs	
Depth:	2.19 ft	3.19 ft
Top Width:	35.97 ft	40.97 ft
Velocity:	3.65 fps	
X-Section Area:	66.87 sq ft	
Hydraulic Radius:	1.817	
Froude Number:	0.47	

North Fork Diversion Channel, Sta. 0+00 to 26+37 and Sta. 31+50 to 39+80, 5yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	3.0:1	3.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	472.00 cfs	
Depth:	3.13 ft	4.13 ft
Top Width:	43.75 ft	49.75 ft
Velocity:	4.39 fps	
X-Section Area:	107.44 sq ft	
Hydraulic Radius:	2.400	
Froude Number:	0.49	

North Fork Diversion Channel, Sta. 26+57 to 26+88, 5yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	1.5:1	3.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	472.00 cfs	
Depth:	3.21 ft	4.21 ft
Top Width:	39.46 ft	43.96 ft
Velocity:	4.56 fps	
X-Section Area:	103.55 sq ft	
Hydraulic Radius:	2.537	
Froude Number:	0.50	

North Fork Diversion Channel, Sta. 27+08 to 27+85, 5yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	1.5:1	2.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	472.00 cfs	
Depth:	3.28 ft	4.28 ft
Top Width:	36.48 ft	39.98 ft
Velocity:	4.68 fps	
X-Section Area:	100.86 sq ft	
Hydraulic Radius:	2.639	
Froude Number:	0.50	

North Fork Diversion Channel, Sta. 28+05 to 29+30, 5yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	1.5:1	1.5:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	472.00 cfs	
Depth:	3.32 ft	4.32 ft
Top Width:	34.96 ft	37.96 ft
Velocity:	4.74 fps	
X-Section Area:	99.52 sq ft	
Hydraulic Radius:	2.692	
Froude Number:	0.50	

North Fork Diversion Channel, Sta. 29+50 to 31+30, 5yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	3.0:1	2.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	472.00 cfs	
Depth:	3.18 ft	4.18 ft
Top Width:	40.91 ft	45.91 ft
Velocity:	4.50 fps	
X-Section Area:	104.87 sq ft	
Hydraulic Radius:	2.489	
Froude Number:	0.50	

North Fork Diversion Channel, Sta. 0+00 to 26+37 and Sta. 31+50 to 39+80, 10yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	3.0:1	3.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	647.00 cfs	
Depth:	3.71 ft	4.71 ft
Top Width:	47.25 ft	53.25 ft
Velocity:	4.83 fps	
X-Section Area:	134.00 sq ft	
Hydraulic Radius:	2.765	
Froude Number:	0.51	

North Fork Diversion Channel, Sta. 26+57 to 26+88, 10yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	1.5:1	3.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	647.00 cfs	
Depth:	3.83 ft	4.83 ft
Top Width:	42.24 ft	46.74 ft
Velocity:	5.02 fps	
X-Section Area:	128.76 sq ft	
Hydraulic Radius:	2.936	
Froude Number:	0.51	

North Fork Diversion Channel, Sta. 27+08 to 27+85, 10yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	1.5:1	2.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	647.00 cfs	
Depth:	3.93 ft	4.93 ft
Top Width:	38.74 ft	42.24 ft
Velocity:	5.17 fps	
X-Section Area:	125.12 sq ft	
Hydraulic Radius:	3.065	
Froude Number:	0.51	

North Fork Diversion Channel, Sta. 28+05 to 29+30, 10yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	1.5:1	1.5:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	647.00 cfs	
Depth:	3.98 ft	4.98 ft
Top Width:	36.94 ft	39.94 ft
Velocity:	5.25 fps	
X-Section Area:	123.30 sq ft	
Hydraulic Radius:	3.133	
Froude Number:	0.51	

North Fork Diversion Channel, Sta. 29+50 to 31+30, 10yr-6hr Storm Event

Material: Shale and clays

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
25.00	3.0:1	2.0:1	0.3	0.0310	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	647.00 cfs	
Depth:	3.79 ft	4.79 ft
Top Width:	43.94 ft	48.94 ft
Velocity:	4.96 fps	
X-Section Area:	130.55 sq ft	
Hydraulic Radius:	2.876	
Froude Number:	0.51	

NORTH FORK DIVERSION CHANNEL

RIPRAPPED DOWNDRAIN DESIGNS FOR SIDE DRAINAGES

FEBRUARY 2001

NORTH FORK DIVERSION CHANNEL

Hydrology model and designs for rip-rapped downdrains. Refer to attached 8 1/2 X 11 sheet for watershed subdivisions. The location of the downdrains are shown on Exhibit 11-142B & 11-142C.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

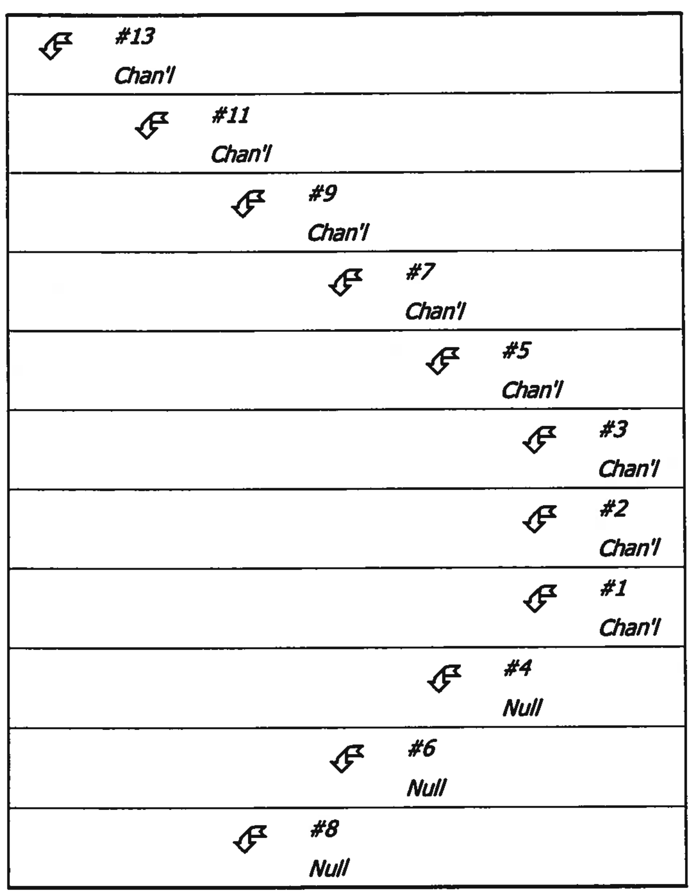
General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#4	0.041	0.236	Downdrain @ Sta. 1+55
Channel	#2	==>	#4	0.000	0.000	Downdrain @ Sta. 3+50
Channel	#3	==>	#4	0.000	0.000	Downdrain @ Sta. 3+80
Null	#4	==>	#6	0.063	0.237	
Channel	#5	==>	#6	0.000	0.000	Downdrain @ Sta. 7+30
Null	#6	==>	#8	0.045	0.237	
Channel	#7	==>	#8	0.000	0.000	Downdrain @ Sta. 9+82
Null	#8	==>	#10	0.199	0.237	
Channel	#9	==>	#10	0.000	0.000	Downdrain @ Sta. 20+80
Null	#10	==>	#12	0.093	0.237	
Channel	#11	==>	#12	0.000	0.000	Downdrain @ Sta. 25+95
Null	#12	==>	#14	0.070	0.238	
Channel	#13	==>	#14	0.000	0.000	Downdrain @ Sta. 29+85
Null	#14	==>	End	0.000	0.000	



#10 *Null*
#12 *Null*
#14 *Null*

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.26	0.58	225.00	1.52	0.041
#1	**Muskingum K:**					**0.041**
#2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#2	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.26	0.92	350.07	1.53	0.063
#4	**Muskingum K:**					**0.063**
#6	8. Large gullies, diversions, and low flowing streams	0.26	0.66	252.00	1.53	0.045
#6	**Muskingum K:**					**0.045**
#8	8. Large gullies, diversions, and low flowing streams	0.26	2.89	1,098.00	1.53	0.199
#8	**Muskingum K:**					**0.199**
#10	8. Large gullies, diversions, and low flowing streams	0.26	1.35	515.00	1.53	0.093
#10	**Muskingum K:**					**0.093**
#12	8. Large gullies, diversions, and low flowing streams	0.26	1.03	390.00	1.54	0.070
#12	**Muskingum K:**					**0.070**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#13	8.020	8.020	10.45	0.46
#11	1.620	1.620	2.11	0.09
#9	6.850	6.850	8.93	0.40
#7	2.190	2.190	2.85	0.13
#5	5.780	5.780	7.53	0.33
#3	2.250	2.250	2.93	0.13
#2	37.760	37.760	29.33	2.19
#1	4.920	4.920	6.41	0.28
#4	0.000	44.930	34.27	2.60
#6	0.000	50.710	37.13	2.94
#8	0.000	52.900	39.99	3.06
#10	0.000	59.750	35.60	3.46
#12	0.000	61.370	34.94	3.55
#14	0.000	69.390	36.39	4.02

Structure Detail:

Structure #13 (Riprap Channel)

Downdrain @ Sta. 29+85

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
5.00	3.0:1	3.0:1	15.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.45 cfs	
Depth:	0.16 ft	1.16 ft
Top Width:	5.98 ft	11.98 ft
Velocity*:		
X-Section Area:	0.90 sq ft	
Hydraulic Radius:	0.149	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #11 (Riprap Channel)

Downdrain @ Sta. 25+95

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.00	3.0:1	3.0:1	15.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.11 cfs	
Depth:	0.12 ft	1.12 ft
Top Width:	2.70 ft	8.70 ft
Velocity*:		
X-Section Area:	0.28 sq ft	
Hydraulic Radius:	0.101	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #9 (Riprap Channel)

Downdrain @ Sta. 20+80

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
5.00	3.0:1	3.0:1	15.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	8.93 cfs	
Depth:	0.15 ft	1.15 ft
Top Width:	5.88 ft	11.88 ft
Velocity*:		
X-Section Area:	0.80 sq ft	
Hydraulic Radius:	0.135	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Riprap Channel)

Downdrain @ Sta. 9+82

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	20.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.85 cfs	
Depth:	0.07 ft	1.07 ft
Top Width:	4.41 ft	10.41 ft
Velocity*:		
X-Section Area:	0.29 sq ft	
Hydraulic Radius:	0.064	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Riprap Channel)

Downdrain @ Sta. 7+30

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
5.00	3.0:1	3.0:1	15.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.53 cfs	
Depth:	0.13 ft	1.13 ft
Top Width:	5.79 ft	11.79 ft
Velocity*:		
X-Section Area:	0.71 sq ft	
Hydraulic Radius:	0.121	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Riprap Channel)

Downdrain @ Sta. 3+80

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	20.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.93 cfs	
Depth:	0.07 ft	1.07 ft
Top Width:	4.41 ft	10.41 ft
Velocity*:		
X-Section Area:	0.29 sq ft	
Hydraulic Radius:	0.065	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Riprap Channel)

Downdrain @ Sta. 3+50

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	29.33 cfs	
Depth:	0.33 ft	1.33 ft
Top Width:	7.98 ft	13.98 ft
Velocity*:		
X-Section Area:	2.30 sq ft	
Hydraulic Radius:	0.285	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Riprap Channel)

Downdrain @ Sta. 1+55

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	15.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.41 cfs	
Depth:	0.14 ft	1.14 ft
Top Width:	4.81 ft	10.81 ft
Velocity*:		
X-Section Area:	0.60 sq ft	
Hydraulic Radius:	0.123	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Null)

Structure #6 (Null)

Structure #8 (Null)

Structure #10 (Null)

Structure #12 (Null)

Structure #14 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#13	1	8.020	0.110	0.000	0.000	93.000	M	10.45	0.464
	Σ	**8.020**						**10.45**	**0.464**
#11	1	1.620	0.029	0.000	0.000	93.000	M	2.11	0.094
	Σ	**1.620**						**2.11**	**0.094**
#9	1	6.850	0.049	0.000	0.000	93.000	M	8.93	0.397
	Σ	**6.850**						**8.93**	**0.397**
#7	1	2.190	0.048	0.000	0.000	93.000	M	2.85	0.127
	Σ	**2.190**						**2.85**	**0.127**
#5	1	5.780	0.079	0.000	0.000	93.000	M	7.53	0.335
	Σ	**5.780**						**7.53**	**0.335**
#3	1	2.250	0.035	0.000	0.000	93.000	M	2.93	0.130
	Σ	**2.250**						**2.93**	**0.130**
#2	1	37.760	0.235	0.000	0.000	93.000	M	29.33	2.186
	Σ	**37.760**						**29.33**	**2.186**
#1	1	4.920	0.104	0.000	0.000	93.000	M	6.41	0.285
	Σ	**4.920**						**6.41**	**0.285**
#4	Σ	**44.930**						**34.27**	**2.601**
#6	Σ	**50.710**						**37.13**	**2.935**
#8	Σ	**52.900**						**39.99**	**3.062**
#10	Σ	**59.750**						**35.60**	**3.459**
#12	Σ	**61.370**						**34.94**	**3.552**
#14	Σ	**69.390**						**36.39**	**4.017**

Subwatershed Time of Concentration Details:

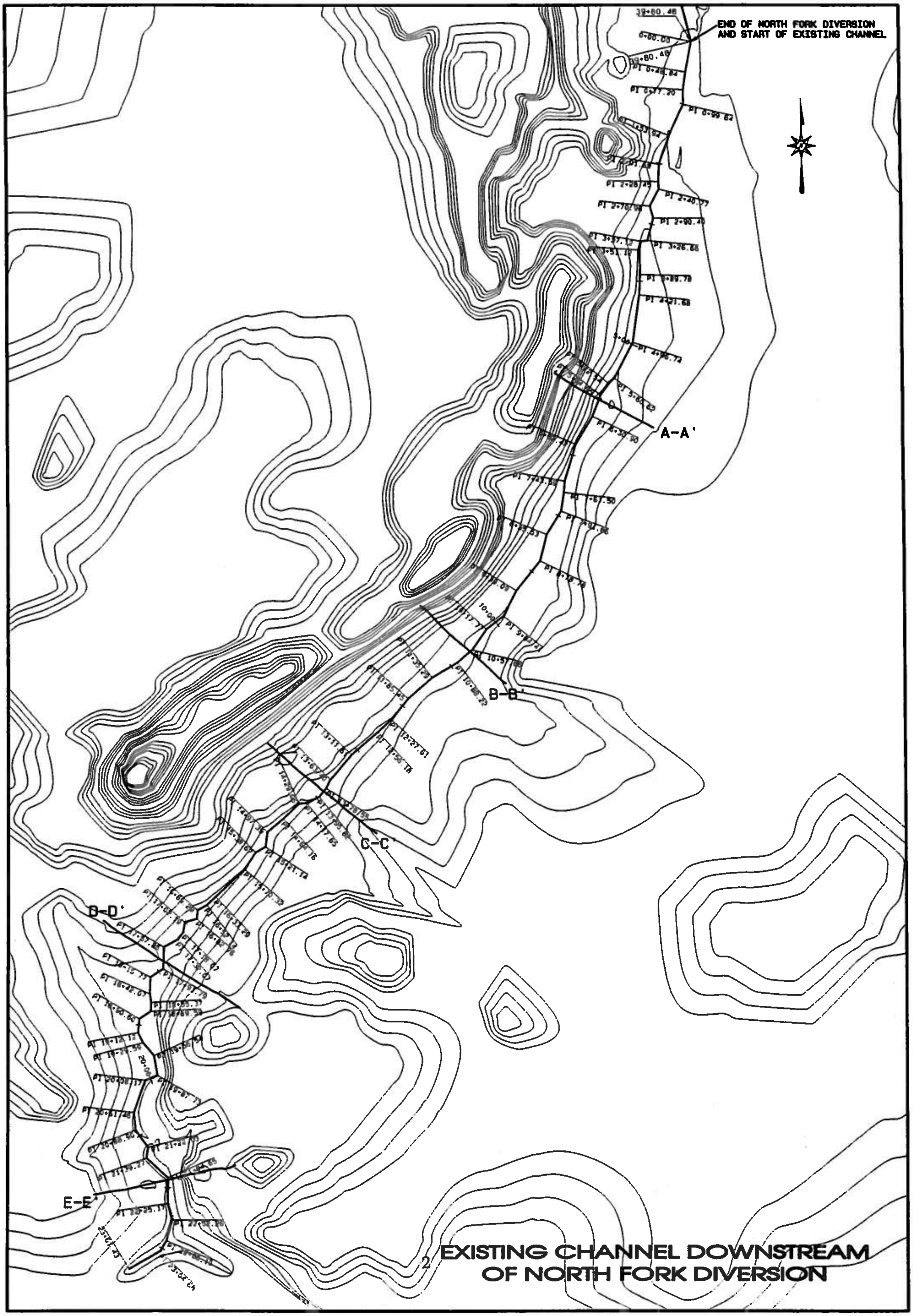
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.35	20.00	460.00	2.080	0.061
		8. Large gullies, diversions, and low flowing streams	1.98	13.00	658.00	4.210	0.043

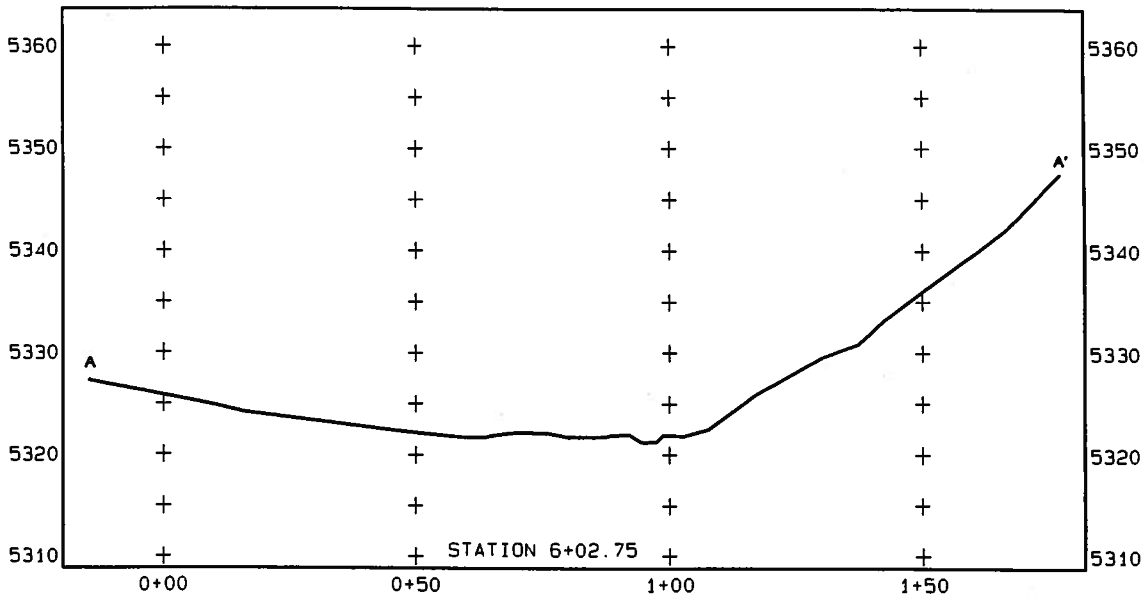
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**1**	**Time of Concentration:**					**0.104**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.56	32.00	900.00	1.880	0.132
		8. Large gullies, diversions, and low flowing streams	2.06	33.00	1,601.00	4.300	0.103
#2	**1**	**Time of Concentration:**					**0.235**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	23.00	23.00	100.00	4.790	0.005
		8. Large gullies, diversions, and low flowing streams	2.37	12.00	506.00	4.610	0.030
#3	**1**	**Time of Concentration:**					**0.035**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	6.18	21.00	340.00	2.480	0.038
		8. Large gullies, diversions, and low flowing streams	1.91	12.00	627.00	4.150	0.041
#5	**1**	**Time of Concentration:**					**0.079**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	20.00	300.00	2.580	0.032
		8. Large gullies, diversions, and low flowing streams	2.46	7.00	284.00	4.700	0.016
#7	**1**	**Time of Concentration:**					**0.048**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	10.33	31.00	300.00	3.210	0.025
		8. Large gullies, diversions, and low flowing streams	2.44	10.00	409.00	4.690	0.024
#9	**1**	**Time of Concentration:**					**0.049**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	7.00	14.00	200.00	2.640	0.021
		8. Large gullies, diversions, and low flowing streams	3.37	6.00	178.00	5.500	0.008
#11	**1**	**Time of Concentration:**					**0.029**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	3.67	11.00	300.00	1.910	0.043
		8. Large gullies, diversions, and low flowing streams	2.38	27.00	1,133.00	4.630	0.067
#13	**1**	**Time of Concentration:**					**0.110**

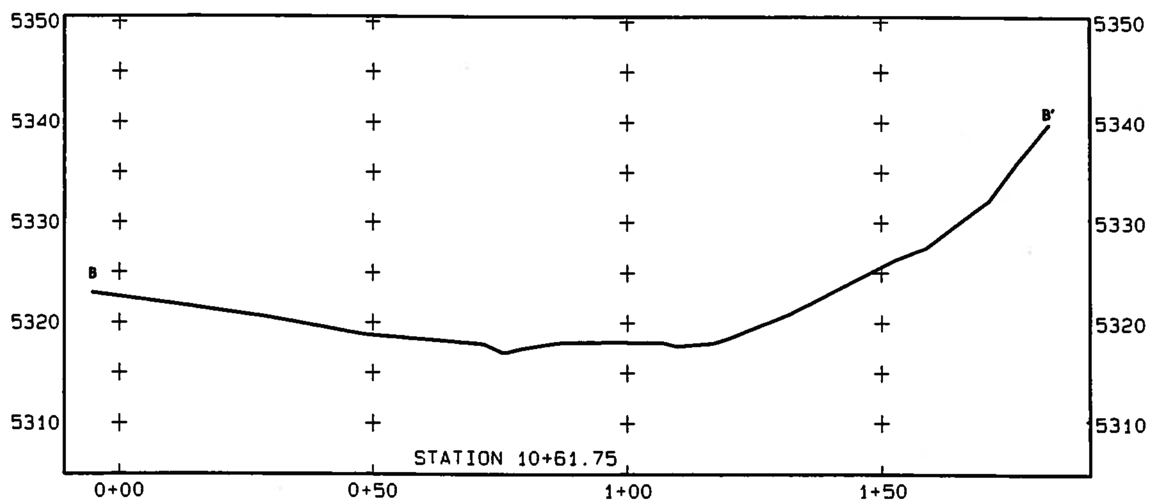
NORTH FORK DIVERSION CHANNEL

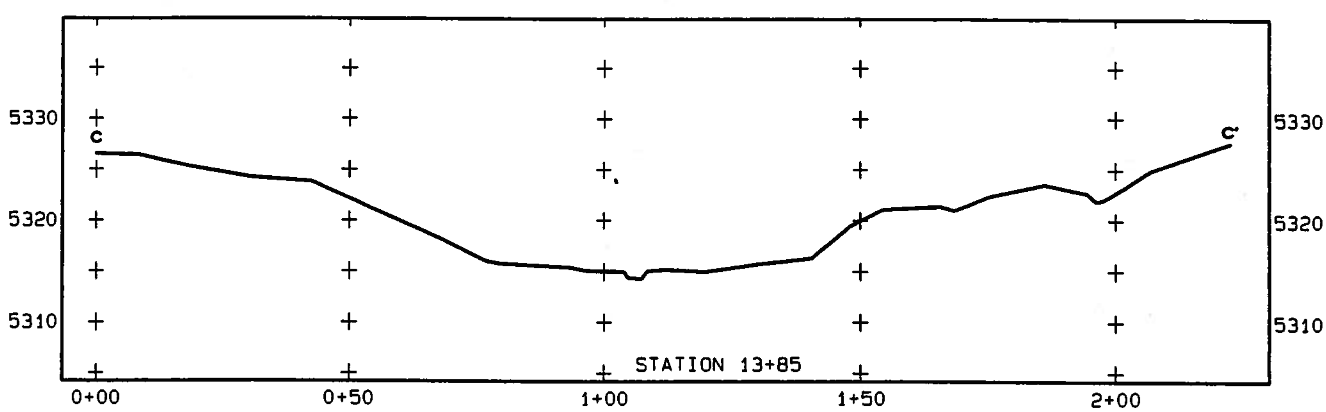
HYDRAULIC EVALUATION OF THE REACH IN THE NATURAL DRAINAGE

FEBRUARY 2001

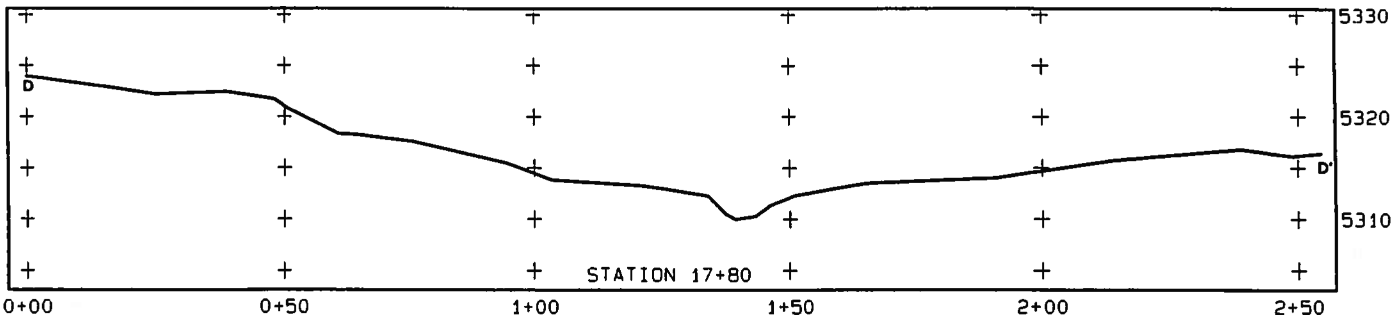

END OF NORTH FORK DIVERSION
AND START OF EXISTING CHANNEL
39+80.48
A-A'
B-B'
C-C'
D-D'
E-E'
EXISTING CHANNEL DOWNSTREAM
OF NORTH FORK DIVERSION

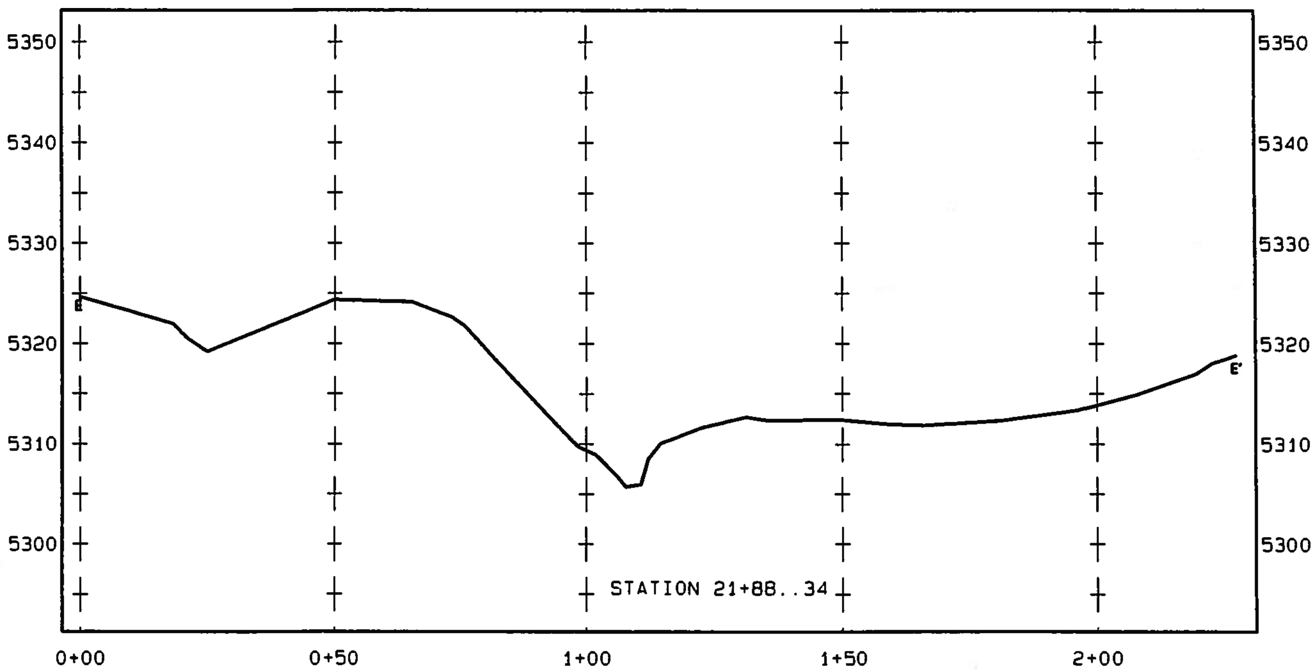






SCALE: H - 1"=40'
V - 1"=20'





SCALE: H - 1"=40'
V - 1"=20'

NORTH FORK DIVERSION CHANNEL
X-SECTION DATA FOR EXISTING DRAINAGE

				PERIMETER (ft)											
	CHANNEL DEPTH (ft)	INCERMENTAL AREA (sq ft)	ACCUMLATIVE AREA (sq ft)	WETTED	TOTAL	@ H2O SURFACE	LT OVERBANK FLOW, n=0.042	LT BANK, n=O.035	BOTTOM, n=0.030	RT BANK, n=0.035	RT OVERBANK FLOW, n=0.042	COMPOSITE n-VALUE	CENTERLINE STA. / EL.	UPSTREAM STA. / EL.	DOWN STREAM STA / EL.
X-SECTION-A-A' @ Sta. 6+02.75															
	0.00	0.00	0.00	0.00	0.00	0.00							6+02.75	5+02.75	7+02.75
	0.50	2.10	2.10	5.80	11.30	5.50		1.67	2.69	1.11		0.033	5321.23	5322.35	5320.36
	1.00	18.50	20.60	57.10	113.90	56.80	21.92	2.50	2.69	1.55	6.91	0.040		1.12	-0.87
	1.50	30.70	51.30	68.40	136.30	67.90	51.84	2.50	2.69	1.55	9.51	0.041		S= 1.00%	
	2.00	36.50	87.80	78.30	156.10	77.80	60.29	2.50	2.69	1.55	11.00	0.041			
	2.50	40.10	127.90	78.80	175.50	96.70	68.78	2.50	2.69	1.55	12.50	0.041			
	3.00	47.10	175.00	106.70	194.10	87.40	76.41	2.50	2.69	1.55	14.00	0.041			
	3.50	49.10	224.10	103.20	205.60	102.40	80.74	2.50	2.69	1.55	15.48	0.041			
	4.00	53.00	277.10	109.80	218.60	108.80	85.77	2.50	2.69	1.55	16.98	0.041			
	4.50	56.60	333.70	116.40	231.70	115.30	91.15	2.50	2.69	1.55	18.47	0.041			
	5.00	59.10	392.80	124.90	245.30	120.40	95.05	2.50	2.69	1.55	20.19	0.041			
X-SECTION B-B' @ Sta. 10+61.75															
	0.00	0.00	0.00	0.00	0.00	0.00							10+61.75	9+61.75	11+61.75
	0.50	2.00	2.00	7.40	14.80	7.40		2.01	0.89	4.71		0.034	5316.83	5317.97	5316.3
	1.00	7.90	9.90	29.20	57.90	28.70	3.02	3.64	0.89	11.01		0.036		1.14	-0.53
	1.50	27.20	37.10	64.50	128.70	64.20	15.58	3.64	0.89	11.01	33.31	0.040		S= 0.84%	
	2.00	35.80	72.90	76.90	153.50	76.60	25.53	3.64	0.89	11.01	35.79	0.041			
	2.50	40.20	113.10	84.80	169.30	84.50	31.00	3.64	0.89	11.01	38.27	0.041			
	3.00	44.00	157.10	92.80	185.10	92.30	36.62	3.64	0.89	11.01	40.90	0.041			
	3.50	48.00	205.10	100.60	200.70	100.10	41.80	3.64	0.89	11.01	43.24	0.041			
	4.00	51.40	256.50	109.90	219.30	109.40	48.91	3.64	0.89	11.01	45.50	0.041			
	4.50	59.30	315.80	119.10	237.60	118.50	56.02	3.64	0.89	11.01	47.58	0.041			
	5.00	60.70	376.50	128.20	255.70	127.50	63.12	3.64	0.89	11.01	49.57	0.041			
	5.50	65.70	442.20	137.40	273.90	136.50	70.23	3.64	0.89	11.01	51.57	0.041			
X-SECTION-C-C' @ Sta. 13+85															
	0.00	0.00	0.00	0.00	0.00	0.00							13+85.00	12+85	14+85
	0.50	1.50	1.50	4.20	8.10	3.90		0.60	2.68	0.94		0.032	5314.14	5315.09	5312.8
	1.00	7.00	8.50	30.20	59.90	29.70	9.47	0.92	2.68	1.42	15.68	0.040		0.95	-1.34
	1.50	20.00	28.50	52.70	104.90	52.20	24.71	0.92	2.68	1.42	22.96	0.041		S= 1.14%	
	2.00	29.90	58.40	65.20	129.90	64.70	28.26	0.92	2.68	1.42	31.98	0.041			
	2.50	31.80	90.20	68.60	136.50	67.90	30.35	0.92	2.68	1.42	33.24	0.041			
	3.00	36.10	126.30	72.00	143.10	71.10	32.44	0.92	2.68	1.42	34.53	0.041			
	3.50	35.50	161.80	75.40	149.70	74.30	34.53	0.92	2.68	1.42	35.82	0.041			
	4.00	38.20	200.00	78.70	156.30	77.60	36.64	0.92	2.68	1.42	37.11	0.041			
	4.50	40.50	240.50	82.40	163.50	81.10	39.01	0.92	2.68	1.42	38.40	0.041			
	5.00	41.00	281.50	86.10	170.70	84.60	41.37	0.92	2.68	1.42	39.69	0.041			

n-values:

Left overbank flow	0.042
Left bank	0.035
Bottom	0.03
Right bank	0.035
Right overbank flow	0.042

NORTH FORK DIVERSION CHANNEL
X-SECTION DATA FOR EXISTING DRAINAGE

				PERIMETER (ft)											
	CHANNEL DEPTH (ft)	INCERMENTAL AREA (sq ft)	ACCUMLATIVE AREA (sq ft)	WETTED	TOTAL	@ H2O SURFACE	LT OVERBANK FLOW, n=0.042	LT BANK, n=0.035	BOTTOM, n=0.030	RT BANK, n=0.035	RT OVERBANK FLOW, n=0.042	COMPOSITE n-VALUE	CENTERLINE STA. / EL.	UPSTREAM STA. / EL.	DOWN STREAM STA. / EL.
X-SECTION-D-D' @ Sta. 17+80															
	0.00	0.00	0.00	0.00	0.00	0.00							17+80.00	16+80	18+80
	0.50	2.00	2.00	6.50	12.90	6.40		1.92	3.97	0.63		0.032	5309.99	5310.88	5309
	1.00	3.70	5.70	9.00	17.70	8.70		2.98	3.97	2.06		0.033		0.89	-0.99
	1.50	5.00	10.70	11.80	23.10	11.30		4.06	3.97	3.78		0.033		S=	0.94%
	2.00	6.50	17.20	15.50	30.30	14.80		5.14	3.97	6.37		0.034			
	2.50	8.50	25.70	22.40	44.00	21.60	2.36	5.84	3.97	7.99	2.27	0.036			
	3.00	14.00	39.70	35.60	69.80	34.20	8.96	5.84	3.97	7.99	8.28	0.038			
	3.50	19.90	59.60	50.80	100.70	49.90	19.11	5.84	3.97	7.99	13.88	0.039			
	4.00	36.20	95.80	90.40	176.60	86.20	31.37	5.84	3.97	7.99	37.99	0.040			
	4.50	46.10	141.90	98.30	195.70	97.40	34.15	5.84	3.97	7.99	46.40	0.041			
	5.00	51.00	192.90	107.80	214.50	106.70	36.95	5.84	3.97	7.99	53.02	0.041			
	5.50	55.30	248.20	122.60	233.20	110.60	39.80	5.84	3.97	7.99	59.63	0.041			
X-SECTION-E-E' @ Sta. 21+88.34															
	0.00	0.00	0.00	0.00	0.00	0.00							21+88.34	20+88.34	22+88.34
	0.50	1.34	1.34	4.20	8.10	3.90		0.96	2.93	0.30		0.031	5305.81	5307.06	5305.15
	1.00	2.26	3.60	5.70	10.70	5.00		1.91	2.93	0.87		0.032		1.25	-0.66
	1.50	2.80	6.40	7.40	13.60	6.20		2.99	2.93	1.44		0.033		S=	0.96%
	2.00	3.40	9.80	9.00	16.50	7.50		4.08	2.93	2.12		0.033			
	2.50	4.00	13.80	10.70	19.40	8.70		5.16	2.93	2.59		0.034			
	3.00	4.70	18.50	12.50	22.60	10.10		6.25	2.93	3.31		0.034			
	3.50	5.60	24.10	15.20	27.80	12.60	1.33	6.66	2.93	4.24		0.035			
	4.00	7.10	31.20	18.30	33.90	15.60	3.57	6.66	2.93	5.16		0.036			
	4.50	8.30	39.50	21.00	39.00	18.00	4.66	6.66	2.93	5.73	1.02	0.036			
	5.00	9.80	49.30	24.70	46.20	21.50	5.75	6.66	2.93	5.73	3.43	0.037			
	5.50	11.70	61.00	28.40	53.40	25.00	6.84	6.66	2.93	5.73	6.19	0.038			
	6.00	13.30	74.30	32.30	61.20	28.90	7.92	6.66	2.93	5.73	9.12	0.038			
	6.50	15.10	89.40	38.60	72.50	33.90	9.01	6.66	2.93	5.73	13.18	0.039			
	7.00	45.10	134.50	99.80	194.60	94.80	10.10	6.66	2.93	5.73	73.24	0.041			
	7.50	49.90	184.40	107.20	210.40	103.20	11.19	6.66	2.93	5.73	80.67	0.041			

n-values:

Left overbank flow	0.042
Left bank	0.035
Bottom	0.03
Right bank	0.035
Right overbank flow	0.042

NORTH FORK DIVERSION CHANNEL
STAGE FLOW DATA FOR EXISTING DRAINAGE

Channel Bed Slope S = 1.00 %

STAGE FLOW @ Sta 6+02.75 (Section A-A' existing channel)

Flow Depth (Ft)	Area (Sq Ft)	Wetted Perimeter (Ft)	Hydraulic Radius	Composite n-value	Peak Flow (CFS)	Average Velocity (FPS)	Froude number
0.00	0.00	0.00	0.00		0.00	0.00	
0.50	2.10	5.80	0.36	0.033	4.86	2.31	0.58
1.00	20.60	57.10	0.36	0.040	38.35	1.86	0.33
1.50	51.30	68.40	0.75	0.041	153.02	2.98	0.43
2.00	87.80	78.30	1.12	0.041	341.99	3.90	0.49
2.50	127.90	78.80	1.62	0.041	636.96	4.98	0.56
3.00	175.00	106.70	1.64	0.041	876.34	5.01	0.51
3.50	224.10	103.20	2.17	0.041	1,353.30	6.04	0.57
4.00	277.10	109.80	2.52	0.041	1,849.15	6.67	0.59
4.50	333.70	116.40	2.87	0.041	2,423.62	7.26	0.60
5.00	392.80	124.90	3.14	0.041	3,033.75	7.72	0.61

FLOW DEPTH AND AVERAGE VELOCITY AT PEAK FLOWS

Storm Event	Peak Flow (cfs)	Flow Depth (ft)	Average Velocity (fps)	Froude number
2 year - 6 hour	244.00	1.74	3.42	0.46
5 year - 6 hour	472.00	2.22	4.37	0.52
10 year - 6 hour	647.00	2.52	4.98	0.55

NORTH FORK DIVERSION CHANNEL
STAGE FLOW DATA FOR EXISTING DRAINAGE

Channel Bed Slope S = 0.84 %

STAGE FLOW @ 10+61.75 (Sta. Section B-B' existing channel)

Flow Depth (Ft)	Area (Sq Ft)	Wetted Perimeter (Ft)	Hydraulic Radius	Composite n-value	Peak Flow (CFS)	Average Velocity (FPS)	Froude number
0.00	0.00	0.00	0.00		0.00	0.00	
0.50	2.00	7.40	0.27	0.034	3.30	1.65	0.41
1.00	9.90	29.20	0.34	0.036	18.19	1.84	0.32
1.50	37.10	64.50	0.58	0.040	86.66	2.34	0.34
2.00	72.90	76.90	0.95	0.041	236.36	3.24	0.40
2.50	113.10	84.80	1.33	0.041	459.42	4.06	0.45
3.00	157.10	92.80	1.69	0.041	746.61	4.75	0.48
3.50	205.10	100.60	2.04	0.041	1,101.64	5.37	0.51
4.00	256.50	109.90	2.33	0.041	1,504.95	5.87	0.52
4.50	315.80	119.10	2.65	0.041	2,014.47	6.38	0.53
5.00	376.50	128.20	2.94	0.041	2,567.80	6.82	0.54
5.50	442.20	137.40	3.22	0.041	3,202.25	7.24	0.54

FLOW DEPTH AND AVERAGE VELOCITY AT PEAK FLOWS

Storm Event	Peak Flow (cfs)	Flow Depth (ft)	Average Velocity (fps)	Froude number
2 year - 6 hour	244.00	2.02	3.27	0.41
5 year - 6 hour	472.00	2.52	4.09	0.45
10 year - 6 hour	647.00	2.83	4.51	0.47

NORTH FORK DIVERSION CHANNEL
STAGE FLOW DATA FOR EXISTING DRAINAGE

Channel Bed Slope S = 1.14 %

STAGE FLOW @ Sta. 13+85 (Section C-C' existing channel)

Flow Depth (Ft)	Area (Sq Ft)	Wetted Perimeter (Ft)	Hydraulic Radius	Composite n-value	Peak Flow (CFS)	Average Velocity (FPS)	Froude number
0.00	0.00	0.00	0.00		0.00	0.00	
0.50	1.50	4.20	0.36	0.032	3.77	2.51	0.63
1.00	8.50	30.20	0.28	0.040	14.34	1.69	0.30
1.50	28.50	52.70	0.54	0.041	73.29	2.57	0.37
2.00	58.40	65.20	0.90	0.041	209.74	3.59	0.45
2.50	90.20	68.60	1.31	0.041	418.62	4.64	0.52
3.00	126.30	72.00	1.75	0.041	710.49	5.63	0.57
3.50	161.80	75.40	2.15	0.041	1,041.08	6.43	0.61
4.00	200.00	78.70	2.54	0.041	1,440.36	7.20	0.63
4.50	240.50	82.40	2.92	0.041	1,899.22	7.90	0.66
5.00	281.50	86.10	3.27	0.041	2,397.26	8.52	0.67

FLOW DEPTH AND AVERAGE VELOCITY AT PEAK FLOWS

Storm Event	Peak Flow (cfs)	Flow Depth (ft)	Average Velocity (fps)	Froude number
2 year - 6 hour	244.00	2.08	3.76	0.46
5 year - 6 hour	472.00	2.59	4.82	0.53
10 year - 6 hour	647.00	2.89	5.41	0.56

NORTH FORK DIVERSION CHANNEL
STAGE FLOW DATA FOR EXISTING DRAINAGE

Channel Bed Slope S = 0.94 %

STAGE FLOW @ Sta. 18+80 (Section D-D' existing channel)

Flow Depth (Ft)	Area (Sq Ft)	Wetted Perimeter (Ft)	Hydraulic Radius	Composite n-value	Peak Flow (CFS)	Average Velocity (FPS)	Froude number
0.00	0.00	0.00	0.00		0.00	0.00	
0.50	2.00	6.50	0.31	0.032	4.11	2.05	0.51
1.00	5.70	9.00	0.63	0.033	18.49	3.24	0.57
1.50	10.70	11.80	0.91	0.033	43.47	4.06	0.58
2.00	17.20	15.50	1.11	0.034	79.06	4.60	0.57
2.50	25.70	22.40	1.15	0.036	114.35	4.45	0.50
3.00	39.70	35.60	1.12	0.038	162.62	4.10	0.42
3.50	59.60	50.80	1.17	0.039	244.46	4.10	0.39
4.00	95.80	90.40	1.06	0.040	356.56	3.72	0.33
4.50	141.90	98.30	1.44	0.041	646.75	4.56	0.38
5.00	192.90	107.80	1.79	0.041	1,012.21	5.25	0.41
5.50	248.20	122.60	2.02	0.041	1,411.05	5.69	0.43

FLOW DEPTH AND AVERAGE VELOCITY AT PEAK FLOWS

Storm Event	Peak Flow (cfs)	Flow Depth (ft)	Average Velocity (fps)	Froude number
2 year - 6 hour	244.00	3.50	4.10	0.39
5 year - 6 hour	472.00	4.20	4.05	0.35
10 year - 6 hour	647.00	4.50	4.56	0.38

NORTH FORK DIVERSION CHANNEL
STAGE FLOW DATA FOR EXISTING DRAINAGE

Channel Bed Slope S = 0.96 %

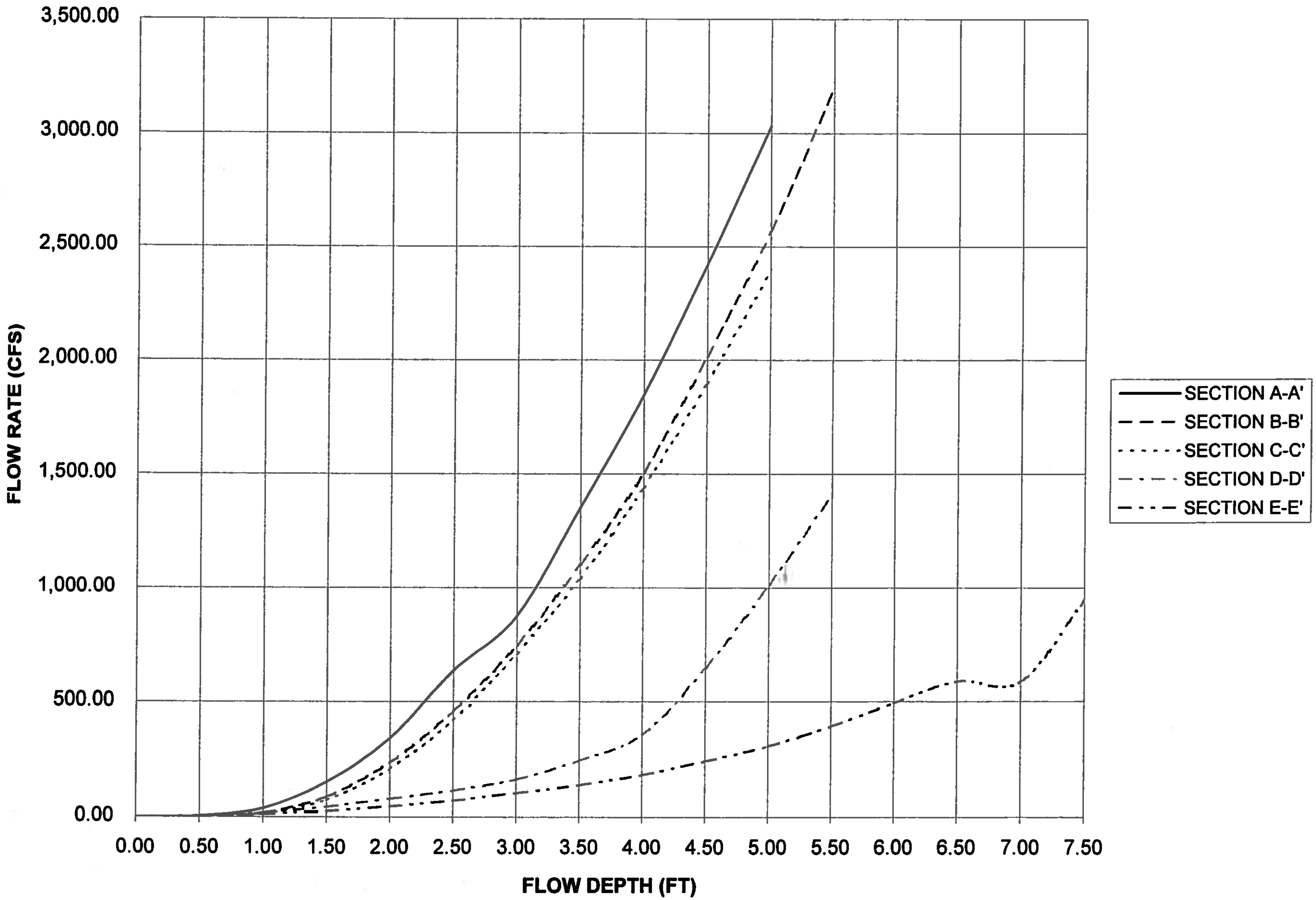
STAGE FLOW @ Sta. 21+88 (Section E-E' existing channel)

Flow Depth (Ft)	Area (Sq Ft)	Wetted Perimeter (Ft)	Hydraulic Radius	Composite n-value	Peak Flow (CFS)	Average Velocity (FPS)	Froude number
0.00	0.00	0.00	0.00		0.00	0.00	
0.50	1.34	4.20	0.32	0.031	2.88	2.15	0.54
1.00	3.60	5.70	0.63	0.032	11.88	3.30	0.58
1.50	6.40	7.40	0.86	0.033	25.62	4.00	0.58
2.00	9.80	9.00	1.09	0.033	45.26	4.62	0.58
2.50	13.80	10.70	1.29	0.034	70.90	5.14	0.57
3.00	18.50	12.50	1.48	0.034	103.63	5.60	0.57
3.50	24.10	15.20	1.59	0.035	137.90	5.72	0.54
4.00	31.20	18.30	1.70	0.036	182.46	5.85	0.52
4.50	39.50	21.00	1.88	0.036	242.34	6.14	0.51
5.00	49.30	24.70	2.00	0.037	307.60	6.24	0.49
5.50	61.00	28.40	2.15	0.038	392.61	6.44	0.48
6.00	74.30	32.30	2.30	0.038	493.77	6.65	0.48
6.50	89.40	38.60	2.32	0.039	588.98	6.59	0.46
7.00	134.50	99.80	1.35	0.041	586.88	4.36	0.29
7.50	184.40	107.20	1.72	0.041	945.34	5.13	0.33

FLOW DEPTH AND AVERAGE VELOCITY AT PEAK FLOWS

Storm Event	Peak Flow (cfs)	Flow Depth (ft)	Average Velocity (fps)	Froude number
2 year - 6 hour	244.00	4.51	6.14	0.51
5 year - 6 hour	472.00	5.89	6.60	0.48
10 year - 6 hour	647.00	7.08	4.49	0.30

NORTH FORK DIVERSION - EXISTING CHANNEL FLOW RATING CURVES



NORTH FORK DIVERSION CHANNEL
AS-BUILT

CHANNEL DESIGN

JULY 2002

NORTH FORK DIVERSION CHANNEL - AS-BUILT

FLOW DEPTHS AND VELOCITIES AT PEAK FLOWS

		2 year-6 hour		5 year-6 hour		10 year-6 hour	
Channel Reach (% grade)	Channel Material	Flow Depth (ft)	Velocity (fps)	Flow Depth (ft)	Velocity (fps)	Flow Depth (ft)	Velocity (fps)
Sta. 3+00 to 5+00, 10+00 to 18+00 & 28+00 to 36+00 @ max. grade, (0.852%)	Sandstone	1.74	5.52	2.49	6.76	2.95	7.42
Sta. 0+00 to 3+00, 5+00 to 10+00, 18+00 to 28+00 & 36+00 to 39+70 @ max. grade, (0.321%)	Shale	2.22	4.05	3.22	4.99	3.83	5.49
Sta. 2+49 Min. Channel Depth (0.227%)	Shale/Clay	2.52	3.36	3.50	4.03	4.08	4.39

The flow velocities in the reaches in sandstone material at maximum grade (0.852%) exceeds 5 fps, these reaches are in competent sandstone formation capable of withstanding flow velocities up to 15 fps. In the reaches that are in shale material at maximum grade (0.321%) the velocities for the 2 and 5 year peak flows are less than 5 fps. The limiting flow velocity or erosive velocity for shale is 5 fps. Some erosion can be expected to occur during the 10 year 6 hour storm event when the flow velocity exceeds 5 fps.

The minimum channel embankment height is approximately 8.5 feet at Station 2+49. The maximum flow depth during the peak flow from the 10 year-6 hour storm event is 4.1 feet. Thus, the channel is capable of safely passing the peak flow form the 10 year-6 hour storm event with a freeboard of 4.4 feet.

NORTH FORK DIVERSION CHANNEL - AS-BUILT
CHANNEL BED MATERIAL

CHANNEL REACH	CHANNEL BED MATERIAL	MAXIMUM GRADE	MINIMUM GRADE
0+00 to 3+00	Shale/Clay	0.227	n/a
3+00 to 5+00	Sandstone	0.852	n/a
5+00 to 10+00	Shale	0.287	n/a
10+00 to 18+00	Sandstone	0.835	0.022
18+00 to 28+00	Shale	0.321	0.169
28+00 to 36+00	Sandstone	0.456	0.179
36+00 to 39+70	Shale	0.309	n/a

NORTH FORK DIVERSION CHANNEL - AS-BUILT

CHANNEL DATA (STA 3+78)

Bottom Channel Width (ft)	W =	19.50	
Side Slopes (Z1:1)	Z1 =	3.70	
(Z2:1)	Z2 =	3.10	
Manning's Roughness Coefficient	n =	0.031	
Channel Bed Slope (%)	S =	0.852	(max.)
D50 Riprap Size (ft)	D50=	n/a	

STAGE FLOW AND VELOCITIES @ MAX. GRADE IN SANDSTONE CUT

Flow Depth (Ft)	Area (Sq Ft)	Wetted Perimeter (Ft)	Hydraulic Radius	Discharge Rate (CFS)	Velocity (FPS)
0.00	0.00	19.50	0.00	0.00	0.00
0.25	5.09	21.27	0.24	8.66	1.70
0.50	10.60	23.05	0.46	27.95	2.64
0.75	16.54	24.82	0.67	55.90	3.38
1.00	22.90	26.59	0.86	91.92	4.01
1.25	29.69	28.36	1.05	135.80	4.57
1.50	36.90	30.14	1.22	187.50	5.08
1.75	44.54	31.91	1.40	247.06	5.55
2.00	52.60	33.68	1.56	314.59	5.98
2.25	61.09	35.45	1.72	390.23	6.39
2.50	70.00	37.23	1.88	474.13	6.77
2.75	79.34	39.00	2.03	566.47	7.14
3.00	89.10	40.77	2.19	667.44	7.49
3.25	99.29	42.54	2.33	777.22	7.83
3.50	109.90	44.32	2.48	896.03	8.15
3.75	120.94	46.09	2.62	1024.05	8.47
4.00	132.40	47.86	2.77	1161.49	8.77
4.25	144.29	49.63	2.91	1308.55	9.07

FLOW DEPTH AND VELOCITY BY STORM EVENTS

Storm Event	Peak Flow (cfs)	Flow Depth (ft)	Flow Velocity (fps)
2 year - 6 hour	244.00	1.74	5.52
5 year - 6 hour	472.00	2.49	6.76
10 year - 6 hour	647.00	2.95	7.42

NORTH FORK DIVERSION CHANNEL - AS-BUILT

CNANNEL DATA (STA 26+74)

Bottom Channel Width (ft)	W =	21.80	
Side Slopes (Z1:1)	Z1 =	2.00	
(Z2:1)	Z2 =	2.70	
Manning's Roughness Coefficient	n =	0.031	
Channel Bed Slope (%)	S =	0.321	(max.)
D50 Riprap Size (ft)	D50=	N/A	

STAGE FLOW AND VELOCITIES @ MAX. GRADE IN SHALE CUT

Flow Depth (Ft)	Area (Sq Ft)	Wetted Perimeter (Ft)	Hydraulic Radius	Discharge Rate (CFS)	Velocity (FPS)
0.00	0.00	21.80	0.00	0.00	0.00
0.25	5.60	23.08	0.24	5.90	1.05
0.50	11.49	24.36	0.47	18.91	1.65
0.75	17.67	25.64	0.69	37.51	2.12
1.00	24.15	26.92	0.90	61.16	2.53
1.25	30.92	28.19	1.10	89.58	2.90
1.50	37.99	29.47	1.29	122.62	3.23
1.75	45.35	30.75	1.47	160.19	3.53
2.00	53.00	32.03	1.65	202.25	3.82
2.25	60.95	33.31	1.83	248.79	4.08
2.50	69.19	34.59	2.00	299.81	4.33
2.75	77.72	35.87	2.17	355.33	4.57
3.00	86.55	37.15	2.33	415.41	4.80
3.25	95.67	38.42	2.49	480.06	5.02
3.50	105.09	39.70	2.65	549.35	5.23
3.75	114.80	40.98	2.80	623.33	5.43
4.00	124.80	42.26	2.95	702.06	5.63
4.25	135.10	43.54	3.10	785.60	5.82
4.50	145.69	44.82	3.25	874.00	6.00

FLOW DEPTH AND VELOCITY BY STORM EVENTS

Storm Event	Peak Flow (cfs)	Flow Depth (ft)	Flow Velocity (fps)
2 year - 6 hour	244.00	2.22	4.05
5 year - 6 hour	472.00	3.22	4.99
10 year - 6 hour	647.00	3.83	5.49

NORTH FORK DIVERSION CHANNEL - AS-BUILT

CHANNEL DATA (2+49)

Bottom Channel Width (ft)	W =	17.30
Side Slopes (Z1:1)	Z1 =	3.80
(Z2:1)	Z2 =	5.40
Manning's Roughness Coefficient	n =	0.031
Channel Bed Slope (%)	S =	0.227 (min.)
D50 Riprap Size (ft)	D50=	N/A

STAGE FLOW AND VELOCITY @ MIN. GRADE AND MIN. CHANNEL DEPTH

Flow Depth (Ft)	Area (Sq Ft)	Wetted Perimeter (Ft)	Hydraulic Radius	Discharge Rate (CFS)	Velocity (FPS)
0.00	0.00	17.30	0.00	0.00	0.00
0.25	4.61	19.66	0.23	4.00	0.87
0.50	9.80	22.01	0.45	13.05	1.33
0.75	15.56	24.37	0.64	26.39	1.70
1.00	21.90	26.72	0.82	43.89	2.00
1.25	28.81	29.08	0.99	65.58	2.28
1.50	36.30	31.43	1.15	91.55	2.52
1.75	44.36	33.79	1.31	121.92	2.75
2.00	53.00	36.14	1.47	156.86	2.96
2.25	62.21	38.50	1.62	196.50	3.16
2.50	72.00	40.85	1.76	241.03	3.35
2.75	82.36	43.21	1.91	290.59	3.53
3.00	93.30	45.56	2.05	345.36	3.70
3.25	104.81	47.92	2.19	405.50	3.87
3.50	116.90	50.27	2.33	471.18	4.03
3.75	129.56	52.63	2.46	542.57	4.19
4.00	142.80	54.98	2.60	619.83	4.34
4.25	156.61	57.34	2.73	703.12	4.49

FLOW DEPTH AND VELOCITY BY STORM EVENTS

Storm Event	Peak Flow (cfs)	Flow Depth (ft)	Flow Velocity (fps)
2 year - 6 hour	244.00	2.52	3.36
5 year - 6 hour	472.00	3.50	4.03
10 year - 6 hour	647.00	4.08	4.39

NORTH FORK DIVERSION CHANNEL RIP-RAPPED DOWNDRAINS AS-BUILT

Hydrology model and designs for rip-rapped downdrains. For the watershed subdivisions, refer to the 8 1/2 X 11 sheet in the original design submitted. The location and details of the downdrains are presented on Exhibit 11-142D & 11-142E.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

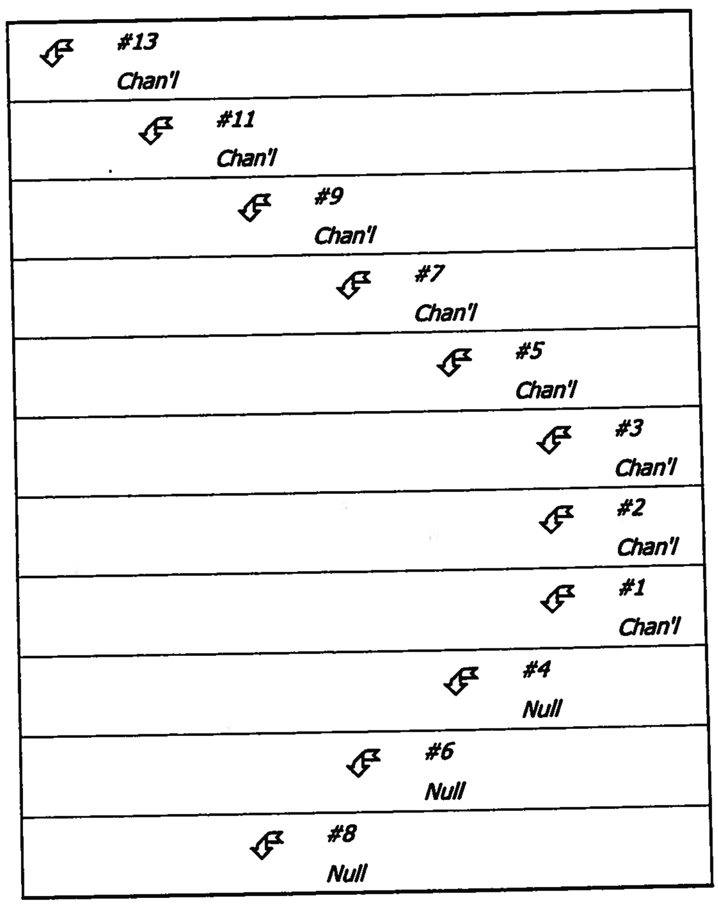
General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#4	0.041	0.236	Downdrain @ Sta. 1+59
Channel	#2	==>	#4	0.000	0.000	Downdrain @ Sta. 3+55
Channel	#3	==>	#4	0.000	0.000	Sta. 3+80 Sandstone Downdrain
Null	#4	==>	#6	0.063	0.237	
Channel	#5	==>	#6	0.000	0.000	Downdrain @ Sta. 7+43
Null	#6	==>	#8	0.045	0.237	
Channel	#7	==>	#8	0.000	0.000	Downdrain @ Sta. 9+89
Null	#8	==>	#10	0.199	0.237	
Channel	#9	==>	#10	0.000	0.000	Downdrain @ Sta. 20+84
Null	#10	==>	#12	0.093	0.237	
Channel	#11	==>	#12	0.000	0.000	Downdrain @ Sta. 26+16
Null	#12	==>	#14	0.070	0.238	
Channel	#13	==>	#14	0.000	0.000	Downdrain @ Sta. 29+88
Null	#14	==>	End	0.000	0.000	



#10 *Null*
#12 *Null*
#14 *Null*

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.26	0.58	225.00	1.52	0.041
#1	**Muskingum K:**					**0.041**
#2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#2	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.26	0.92	350.07	1.53	0.063
#4	**Muskingum K:**					**0.063**
#6	8. Large gullies, diversions, and low flowing streams	0.26	0.66	252.00	1.53	0.045
#6	**Muskingum K:**					**0.045**
#8	8. Large gullies, diversions, and low flowing streams	0.26	2.89	1,098.00	1.53	0.199
#8	**Muskingum K:**					**0.199**
#10	8. Large gullies, diversions, and low flowing streams	0.26	1.35	515.00	1.53	0.093
#10	**Muskingum K:**					**0.093**
#12	8. Large gullies, diversions, and low flowing streams	0.26	1.03	390.00	1.54	0.070
#12	**Muskingum K:**					**0.070**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#13	8.020	8.020	5.06	0.20
#11	1.620	1.620	1.02	0.04
#9	6.850	6.850	4.32	0.17
#7	2.190	2.190	1.38	0.05
#5	5.780	5.780	3.64	0.14
#3	2.250	2.250	1.42	0.06
#2	37.760	37.760	12.84	0.95
#1	4.920	4.920	3.10	0.12
#4	0.000	44.930	14.33	1.13
#6	0.000	50.710	15.20	1.27
#8	0.000	52.900	16.58	1.33
#10	0.000	59.750	14.78	1.50
#12	0.000	61.370	14.77	1.54
#14	0.000	69.390	15.55	1.74

Structure Detail:

Structure #13 (Riprap Channel)

Downdrain @ Sta. 29+88

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	10.7	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.06 cfs	
Depth:	0.14 ft	1.14 ft
Top Width:	4.87 ft	10.87 ft
Velocity*:		
X-Section Area:	0.64 sq ft	
Hydraulic Radius:	0.130	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #11 (Riprap Channel)

Downdrain @ Sta. 26+16

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	23.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.02 cfs	
Depth:	0.03 ft	1.03 ft
Top Width:	4.20 ft	10.20 ft
Velocity*:		
X-Section Area:	0.14 sq ft	
Hydraulic Radius:	0.033	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #9 (Riprap Channel)

Downdrain @ Sta. 20+84

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
5.00	3.0:1	3.0:1	21.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.32 cfs	
Depth:	0.06 ft	1.06 ft
Top Width:	5.38 ft	11.38 ft
Velocity*:		
X-Section Area:	0.33 sq ft	
Hydraulic Radius:	0.061	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Riprap Channel)

Downdrain @ Sta. 9+89

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	3.0:1	3.0:1	24.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.38 cfs	
Depth:	0.04 ft	1.04 ft
Top Width:	3.26 ft	9.26 ft
Velocity*:		
X-Section Area:	0.13 sq ft	
Hydraulic Radius:	0.041	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Riprap Channel)

Downdrain @ Sta. 7+43

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	2.0:1	2.0:1	20.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.64 cfs	
Depth:	0.08 ft	1.08 ft
Top Width:	3.34 ft	7.34 ft
Velocity*:		
X-Section Area:	0.27 sq ft	
Hydraulic Radius:	0.079	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Nonerodible Channel)

Sta. 3+80 Sandstone Downdrain

Trapezoidal Nonerodible Channel Inputs:

Material: Sandstone

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.00	2.0:1	2.0:1	24.0	0.0290	1.00		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.42 cfs	
Depth:	0.12 ft	1.12 ft
Top Width:	2.46 ft	6.46 ft
Velocity:	5.50 fps	
X-Section Area:	0.26 sq ft	
Hydraulic Radius:	0.102	
Froude Number:	3.00	

Structure #2 (Riprap Channel)

Downdrain @ Sta. 3+55

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	12.84 cfs	
Depth:	0.25 ft	1.25 ft
Top Width:	5.52 ft	11.52 ft
Velocity*:		
X-Section Area:	1.20 sq ft	
Hydraulic Radius:	0.215	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Riprap Channel)

Downdrain @ Sta. 1+59

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	3.0:1	3.0:1	15.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.10 cfs	
Depth:	0.11 ft	1.11 ft
Top Width:	3.65 ft	9.65 ft
Velocity*:		

	w/o Freeboard	w/ Freeboard
X-Section Area:	0.36 sq ft	
Hydraulic Radius:	0.097	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Null)

Structure #6 (Null)

Structure #8 (Null)

Structure #10 (Null)

Structure #12 (Null)

Structure #14 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#13	1	8.020	0.110	0.000	0.000	93.000	M	5.06	0.201
	Σ	**8.020**						**5.06**	**0.201**
#11	1	1.620	0.029	0.000	0.000	93.000	M	1.02	0.041
	Σ	**1.620**						**1.02**	**0.041**
#9	1	6.850	0.049	0.000	0.000	93.000	M	4.32	0.172
	Σ	**6.850**						**4.32**	**0.172**
#7	1	2.190	0.048	0.000	0.000	93.000	M	1.38	0.055
	Σ	**2.190**						**1.38**	**0.055**
#5	1	5.780	0.079	0.000	0.000	93.000	M	3.64	0.145
	Σ	**5.780**						**3.64**	**0.145**
#3	1	2.250	0.035	0.000	0.000	93.000	M	1.42	0.056
	Σ	**2.250**						**1.42**	**0.056**
#2	1	37.760	0.235	0.000	0.000	93.000	M	12.84	0.947
	Σ	**37.760**						**12.84**	**0.947**
#1	1	4.920	0.104	0.000	0.000	93.000	M	3.10	0.123
	Σ	**4.920**						**3.10**	**0.123**
#4	Σ	**44.930**						**14.33**	**1.126**
#6	Σ	**50.710**						**15.20**	**1.271**
#8	Σ	**52.900**						**16.58**	**1.326**
#10	Σ	**59.750**						**14.78**	**1.498**
#12	Σ	**61.370**						**14.77**	**1.538**
#14	Σ	**69.390**						**15.55**	**1.740**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.35	20.00	460.00	2.080	0.061
		8. Large gullies, diversions, and low flowing streams	1.98	13.00	658.00	4.210	0.043

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**1**	**Time of Concentration:**					**0.104**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.56	32.00	900.00	1.880	0.132
		8. Large gullies, diversions, and low flowing streams	2.06	33.00	1,601.00	4.300	0.103
#2	**1**	**Time of Concentration:**					**0.235**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	23.00	23.00	100.00	4.790	0.005
		8. Large gullies, diversions, and low flowing streams	2.37	12.00	506.00	4.610	0.030
#3	**1**	**Time of Concentration:**					**0.035**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	6.18	21.00	340.00	2.480	0.038
		8. Large gullies, diversions, and low flowing streams	1.91	12.00	627.00	4.150	0.041
#5	**1**	**Time of Concentration:**					**0.079**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	20.00	300.00	2.580	0.032
		8. Large gullies, diversions, and low flowing streams	2.46	7.00	284.00	4.700	0.016
#7	**1**	**Time of Concentration:**					**0.048**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	10.33	31.00	300.00	3.210	0.025
		8. Large gullies, diversions, and low flowing streams	2.44	10.00	409.00	4.690	0.024
#9	**1**	**Time of Concentration:**					**0.049**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	7.00	14.00	200.00	2.640	0.021
		8. Large gullies, diversions, and low flowing streams	3.37	6.00	178.00	5.500	0.008
#11	**1**	**Time of Concentration:**					**0.029**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	3.67	11.00	300.00	1.910	0.043
		8. Large gullies, diversions, and low flowing streams	2.38	27.00	1,133.00	4.630	0.067
#13	**1**	**Time of Concentration:**					**0.110**

Appendix 26.F

Emma's Pond Design and As-Built

Appendix 26.F

Emma's Pond Design and As-Builts

Due to reformatting of the Navajo Mine PAP, the following references in this appendix have been changed, deleted or renumbered:

NM-0003F Paper Permit	NM-0003F Electronic Permit
Exhibit 11-13B	Exhibit 26-9
Exhibit 11-33	Exhibit 26-27

Emma's Pond
100 yr - 6 hr Event

The location and watershed area are presented on Exhibit 11-13B. The pond design is presented on Exhibit 11-33.

UPDATED JUNE 2010

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

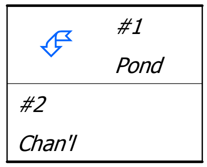
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#2	0.000	0.000	Emma's Pond
Channel	#2	==>	End	0.000	0.000	Spillway/Outflow chan



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	91.500	91.500	76.22	3.34
	Out			13.70	3.34
#2		0.000	91.500	13.70	3.34

Structure Detail:

Structure #1 (Pond)

Emma's Pond

Pond Inputs:

Initial Pool Elev:	5,359.80 ft
Initial Pool:	9.53 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,359.80	25.00	3.10:1	4.10:1	9.00

Pond Results:

Peak Elevation:	5,360.44 ft
Dewater Time:	0.60 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,354.70	0.000	0.000	0.000		
5,355.00	0.160	0.016	0.000		
5,355.70	0.894	0.350	0.000		
5,356.00	1.330	0.682	0.000		
5,356.70	1.789	1.770	0.000		
5,357.00	2.000	2.337	0.000		
5,357.70	2.346	3.857	0.000		
5,358.00	2.500	4.583	0.000		
5,358.70	2.702	6.404	0.000		
5,359.00	2.790	7.227	0.000		
5,359.70	2.957	9.239	0.000		
5,359.80	2.981	9.535	0.000		Spillway #1
5,360.00	3.030	10.137	4.312	11.40	
5,360.44	3.149	11.498	13.698	2.90	Peak Stage
5,360.70	3.218	12.324	19.396		
5,361.00	3.300	13.301	34.907		
5,361.70	3.544	15.696	87.462		
5,362.00	3.650	16.775	117.724		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,354.70	0.000	0.000
5,355.00	0.000	0.000
5,355.70	0.000	0.000
5,356.00	0.000	0.000
5,356.70	0.000	0.000
5,357.00	0.000	0.000
5,357.70	0.000	0.000
5,358.00	0.000	0.000
5,358.70	0.000	0.000
5,359.00	0.000	0.000
5,359.70	0.000	0.000
5,359.80	0.000	0.000
5,360.00	4.312	4.312
5,360.70	19.396	19.396
5,361.00	34.907	34.907
5,361.70	87.462	87.462
5,362.00	117.724	117.724

Structure #2 (Riprap Channel)

Spillway/Outflow chan

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
9.00	3.0:1	3.0:1	5.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.70 cfs	
Depth:	0.18 ft	1.18 ft
Top Width:	10.09 ft	16.09 ft
Velocity*:		
X-Section Area:	1.73 sq ft	
Hydraulic Radius:	0.170 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	

	w/o Freeboard	w/ Freeboard
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	91.500	0.156	0.000	0.000	80.000	M	76.22	3.335
	Σ	**91.500**						**76.22**	**3.335**
#2	Σ	**91.500**						**13.70**	**3.336**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.79	25.00	432.00	2.400	0.050
		8. Large gullies, diversions, and low flowing streams	3.33	70.00	2,103.00	5.470	0.106
#1	**1**	**Time of Concentration:**					**0.156**

Emma's Pond
25 yr - 6 hr Event

The location and watershed area are presented on Exhibit 11-13B. The pond design is presented on Exhibit 11-33.

UPDATED JUNE 2010

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

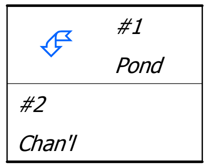
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.500 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#2	0.000	0.000	Emma's Pond
Channel	#2	==>	End	0.000	0.000	Spillway/Outflow chan



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	91.500	91.500	41.25	1.77
	Out			7.14	1.77
#2		0.000	91.500	7.14	1.77

Structure Detail:

Structure #1 (Pond)

Emma's Pond

Pond Inputs:

Initial Pool Elev:	5,359.80 ft
Initial Pool:	9.53 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,359.80	25.00	3.10:1	4.10:1	9.00

Pond Results:

Peak Elevation:	5,360.13 ft
Dewater Time:	0.55 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,354.70	0.000	0.000	0.000		
5,355.00	0.160	0.016	0.000		
5,355.70	0.894	0.350	0.000		
5,356.00	1.330	0.682	0.000		
5,356.70	1.789	1.770	0.000		
5,357.00	2.000	2.337	0.000		
5,357.70	2.346	3.857	0.000		
5,358.00	2.500	4.583	0.000		
5,358.70	2.702	6.404	0.000		
5,359.00	2.790	7.227	0.000		
5,359.70	2.957	9.239	0.000		
5,359.80	2.981	9.535	0.000		Spillway #1
5,360.00	3.030	10.137	4.312	11.75	
5,360.13	3.069	10.546	7.136	1.50	Peak Stage
5,360.70	3.218	12.324	19.396		
5,361.00	3.300	13.301	34.907		
5,361.70	3.544	15.696	87.462		
5,362.00	3.650	16.775	117.724		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,354.70	0.000	0.000
5,355.00	0.000	0.000
5,355.70	0.000	0.000
5,356.00	0.000	0.000
5,356.70	0.000	0.000
5,357.00	0.000	0.000
5,357.70	0.000	0.000
5,358.00	0.000	0.000
5,358.70	0.000	0.000
5,359.00	0.000	0.000
5,359.70	0.000	0.000
5,359.80	0.000	0.000
5,360.00	4.312	4.312
5,360.70	19.396	19.396
5,361.00	34.907	34.907
5,361.70	87.462	87.462
5,362.00	117.724	117.724

Structure #2 (Riprap Channel)

Spillway/Outflow chan

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
9.00	3.0:1	3.0:1	5.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.14 cfs	
Depth:	0.11 ft	1.11 ft
Top Width:	9.68 ft	15.68 ft
Velocity*:		
X-Section Area:	1.06 sq ft	
Hydraulic Radius:	0.109 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	

	w/o Freeboard	w/ Freeboard
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	91.500	0.156	0.000	0.000	80.000	M	41.25	1.770
	Σ	**91.500**						**41.25**	**1.770**
#2	**Σ**	**91.500**						**7.14**	**1.771**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.79	25.00	432.00	2.400	0.050
		8. Large gullies, diversions, and low flowing streams	3.33	70.00	2,103.00	5.470	0.106
#1	**1**	**Time of Concentration:**					**0.156**

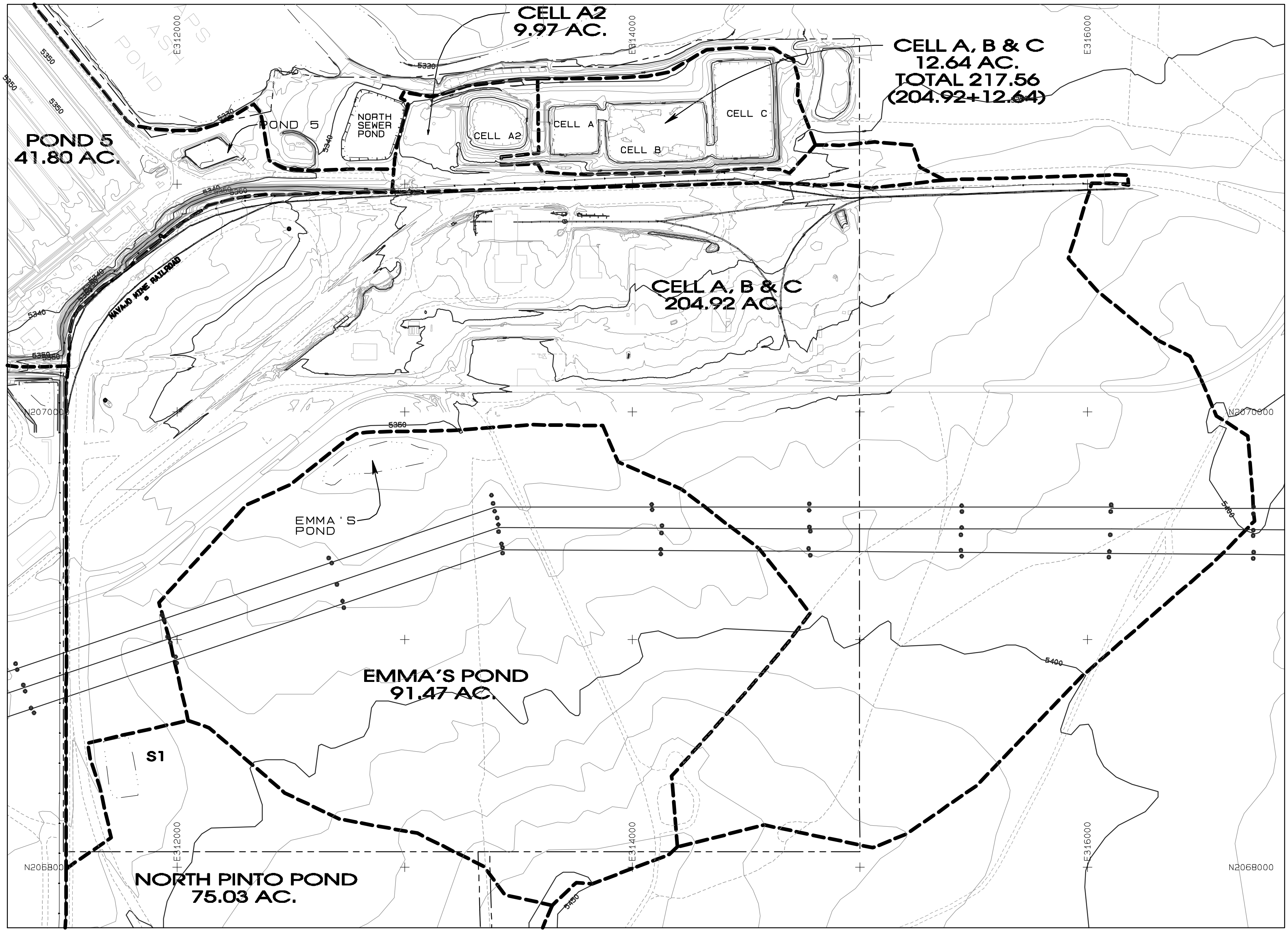


EXHIBIT 11-13B PARTIAL PLAN
EMMA'S POND WATERSHED
1" = 600'

Appendix 26.H

North Pinto Modification Design and As-Built

Appendix 26.H
North Pinto Modification Design and As-Built

Due to reformatting of the Navajo Mine PAP, the following references (formerly Appendix 29-M under NM-0003C; Appendix 11-G under NM-0003F Paper Permit) in this appendix have been changed, deleted or renumbered:

NM-0003C Reference	NM-0003D	NM-0003F Paper	NM-0003F Electronic
Exhibit 29-2 or Exhibit 29-3A	Exhibit 11-36	Exhibit 11-35	Exhibit 26-29

NORTH PINTO POND MODIFICATION

Due to reformatting of the Navajo Mine PAP, the following references in this appendix (formerly Appendix 29-M under NM-0003C) have been changed, deleted or renumbered:

NM-0003C Reference	NM-0003D Reference
Exhibit 29-2 or Exhibit 29-3A	Exhibit 11-36

NAVAJO MINE

NORTH PINTO POND HYDROLOGY

BHP Minerals International Inc. is proposing to alter the existing hydrology design for the Navajo Mine's North Pinto Pond area. The new hydrology design will entail the modification of the existing North Pinto sedimentation pond and its inlet channel. The construction and modification proposed are to enable the Navajo Mine to better control the surface runoff from the upstream watersheds of Pinto Pond from entering the North Shop and coal handling facilities.

Pinto pond's watersheds are approximately 87 acres of mostly undisturbed land. The exceptions are the haul road and a residence that utilize a small portion of the watershed. For the purposes of this design, however, the watersheds were assumed undisturbed. A soil curve number of 80 was designated for this area. For hydrological analysis, this area has been divided into two (2) subwatersheds labelled as A and B. These configurations and their associated hydrological structures are shown on the attached map, exhibit 29-2.

Federal regulation 30 CFR 816.46 (c)(2)(iii) requires that a sedimentation pond contain the runoff generated for a 100 year-6 hour (2.10 inches) storm event when excluding a combination spillway from the hydrological design. The proposed enlargement of Pinto Pond is designed to meet these regulations. In addition, the pond has been expanded to contain twenty-five (25) years of sediment yield from its respective watershed.

The culvert shown on exhibit 29-2 was constructed to divert watershed A runoff from the haul road to Pinto Pond. This culvert was modelled using the peak discharge from Watershed "A" for a 10 year-6 hour storm event. This diversion meets the requirements of federal regulation 30 CFR 816.43 (b)(3).

Navajo Mine is proposing to modify the inlet and outlet channels at the culvert. The runoff entering the culvert comes from Channel 1 located on the southwest side of Pinto haul road. The runoff exiting the culvert flows through Channel 2 into Pinto Pond. These proposed hydrological structures are designed for a 10 year-6 hour storm event, therefore satisfying federal regulation 30 CFR 816.43 (b)(3).

Channel 3 shown on exhibit 29-2 is designed to divert runoff from entering the south east corner of Pinto Pond to the existing inlet channel. This channel will help in the prevention of rilling on the south and east side slopes of Pinto Pond. Channel 3 was modelled using the peak discharge from Watershed "B" for a 2 year-6 hour storm event, hence satisfying federal regulation 30 CFR 816.43 (c)(3).

Precipitation values used in these designs were taken from the Navajo Mine's Reclamation Surface Stabilization Design Handbook, Table "C", BHP-Utah International Inc.

The SEDCAD Hydrology Software Package (Version 3.0) was used for the designs of hydrological structures within this packet. Utilizing a user-defined storm and routing network structures, this package is capable of predicting the hydrological, hydraulic, and sediment runoff response of disturbed and undisturbed lands. The model outputs have been used to evaluate hydrologic structure performance. The specific design information and SEDCAD models are contained in the following pages.

STATEMENT OF CERTIFICATION

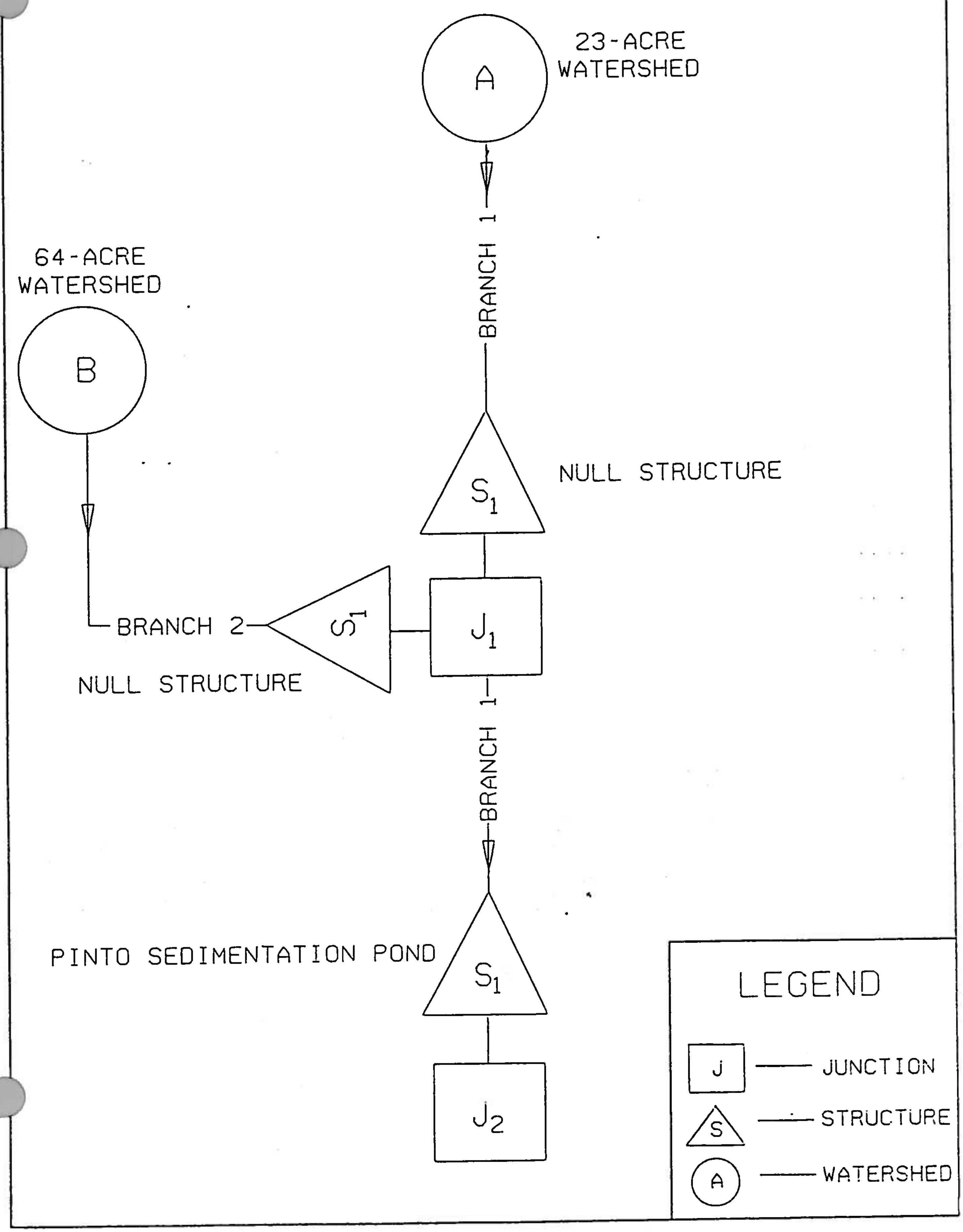
The hydrologic stuctures found in the following pages have been designed using current, prudent engineering practices and have been certified by a qualified, registered professional engineer in accordance with 30 CFR 816.49 (a) (2).

RON C. VAN VALKENBURG
NEW MEXICO
9023
REGISTERED PROFESSIONAL ENGINEER

Signed Ron Van Valkenburg

Date 5-15-92

PINTO POND AREA
SEDCAD ROUTING SCHEMATIC



BHP–UTAH INTERNATIONAL
SEDCAD COMPUTER MODEL
WATERSHED INPUTS

NAVAJO MINE
PINTO POND

WATERSHED	A	B
Total Acres	23.00	64.00
Undisturbed	23.00	64.00
Disturbed	0.00	0.00
Spoil	0.00	0.00
Curve Number (CN)		
Undisturbed	80.00	80.00
Disturbed	80.00	80.00
Spoil	93.00	93.00
Watershed CN	80.00	80.00
Control Practice Factor (CP)		
Undisturbed	0.373	0.373
Disturbed	0.393	0.393
Spoil	1.000	1.000
Watershed CP	0.373	0.373
Soil Erodibility Factor (K)		
Undisturbed	0.30	0.30
Disturbed	0.15	0.15
Spoil	0.30	0.30
Watershed K	0.30	0.30
Tc Utilizing Velocity (hr)	0.308	0.563
Length of Slope (ft)	200	200
Ave. Slope (%)	3.30%	3.40%
Length–Slope Factors (LS)		
MUSLE LS Factor	0.389	0.401
"m"	0.3	0.3
"theta"	0.03	0.03
RUSLE LS Factor	0.542	0.542
"m"	0.3	0.3
"slope factor"	0.40	0.40

BHP–UTAH INTERNATIONAL
AVERAGE ANNUAL SOIL LOSS
UTILIZING THE "MUSLE" OR "RUSLE" EQUATION

NAVAJO MINE
PINTO POND

WATERSHED	A	B
Total Acres	23	64
Undisturbed	23	64
Disturbed	0	0
Spoil	0	0
Rainfall Erosivity (R)	20	20
Soil Erodibility Factor (K)		
Undisturbed	0.30	0.30
Disturbed	0.15	0.15
Spoil	0.30	0.30
Watershed K	0.30	0.30
Length–Slope Factors (LS)		
MUSLE LS Factor	0.389	0.401
"m"	0.3	0.3
"theta"	0.03	0.03
RUSLE LS Factor	NA	NA
"m"	0.3	0.3
"slope factor"	0.400	0.400
Control Practice Factor (CP)		
Undisturbed	0.373	0.373
Disturbed	0.393	0.393
Spoil	1.000	1.000
Watershed CP	0.373	0.373
Sediment Yields		
Tons/Acre/Year	0.87	0.90
Tons/Year	20.00	57.39
Acre–Feet/Year	0.01	0.03
5 Yr Sediment Vol. (ac–ft)	0.06	0.17
10 Yr Sediment Vol. (ac–ft)	0.12	0.34
15 Yr Sediment Vol. (ac–ft)	0.18	0.51
20 Yr Sediment Vol. (ac–ft)	0.24	0.68
25 Yr Sediment Vol. (ac–ft)	0.29	0.84
Total Sediment Vol. (ac–ft) for A & B		1.13

NAVAJO MINE

NORTH PINTO SEDIMENTATION POND

The North Pinto sedimentation pond is designed to contain the 4.53 ac.-ft. runoff from a 100 year-6 hour storm event and a 25 year sediment deposition. The pond will not overflow unless a storm event of greater precipitation than a 100 year event occurs, or if successive storms immediately follow a 100 year-6 hour event.

A gauge post will be installed in the pond to monitor the pond volume. Water and sediment levels will be maintained below the 5374.5 elevation to insure that the design capacity is available. Periodic cleaning will be performed as needed. Water will be pumped below the design capacity level within 10 days following a runoff event. Water will be pumped to water trucks for distribution on roads, or will be pumped to and contained in a mining pit.

Watersheds "A" and "B" shown on Exhibit 29-3a are routed to this pond. The total watershed encompasses 87 acres of type Az soil, with a soil curve number of 80. For the purposes of SEDCAD, the channel material contains characteristics that model "Fine Sand Colloidal" and "Sandy Loam Noncolloidal" both at velocities of 2.5 fps.

A SEDCAD computer run performed on the Pinto sedimentation pond for the 100 year-6 hour storm event has been included in this packet and the results are summarized below.

Design Summary: 100 Year-6 Hour Storm Event (2.10 Inches)
Acres = 87

	Pond #1
Drainage Area (Acres)	87
Runoff Volume (Ac.-Ft.)	4.53
25 Year Sediment Volume (Ac.-Ft.)	1.13
Total Storage Capacity (Ac.-Ft.)	5.66
Elevation Top of Pond	5381.5
Elevation of Pond Bottom	5373.0
Maximum Water/Sediment Level	5374.5

****
POND VOLUMES USING BOTTOM DIMENSIONS
****

**** INPUT DATA USING BOTTOM DIMENSIONS ****

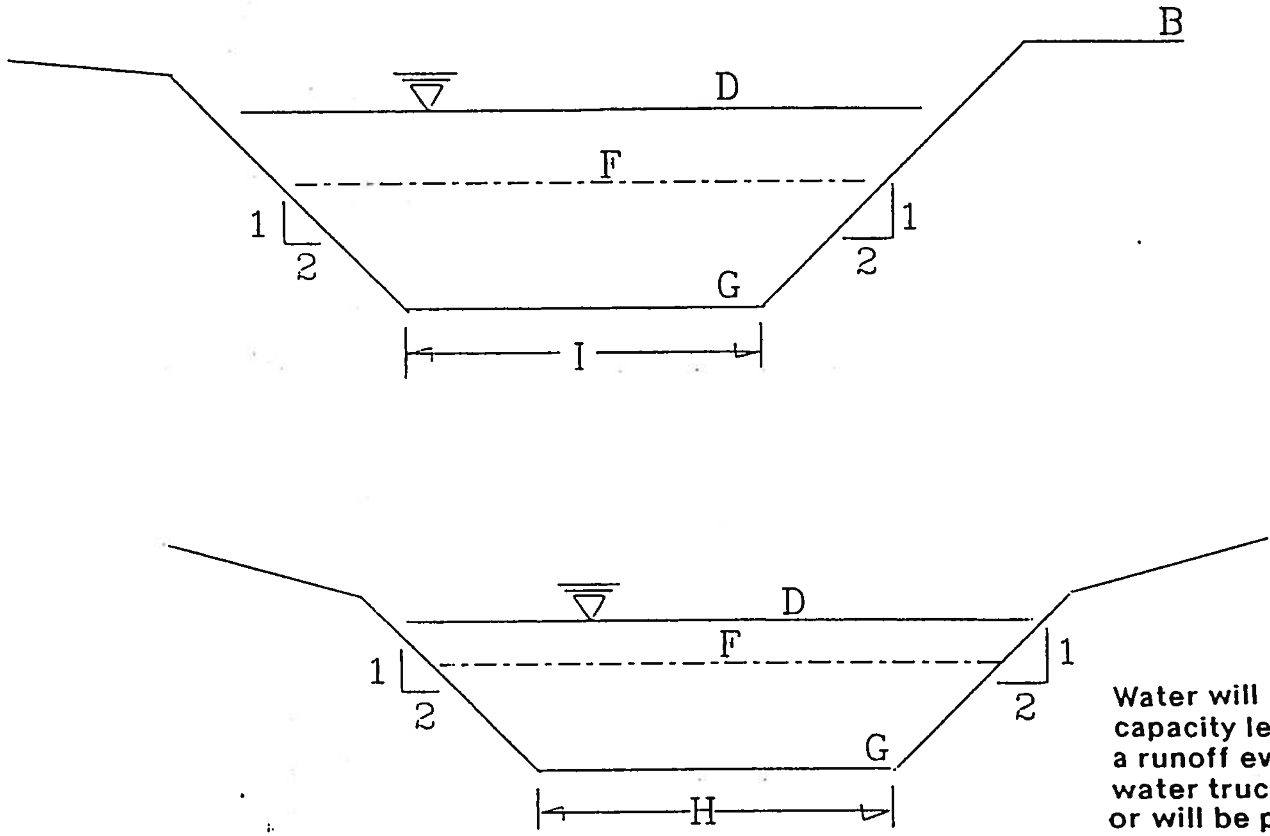
POND NUMBER....................	PINTO POND
LENGTH OF POND	315 FT
WIDTH OF POND	93 FT
DEPTH OF POND	8.5 FT
ONE SIDE SLOPE OF LENGTH	2
ONE SIDE SLOPE OF LENGTH	2
ONE SIDE SLOPE OF WIDTH......	2
ONE SIDE SLOPE OF WIDTH......	2

****** POND RESULTS INCREMENTALY ******

ELEVATION	VOLUME AC.FT.	SURFACE AC.	DEPTH FT.
5373.0	0.00	0.67	0.00
5373.5	0.34	0.69	0.50
5374.0	0.69	0.71	1.00
5374.5	1.05	0.73	1.50
5375.0	1.42	0.75	2.00
5375.5	1.80	0.77	2.50
5376.0	2.19	0.79	3.00
5376.5	2.59	0.81	3.50
5377.0	3.00	0.83	4.00
5377.5	3.42	0.85	4.50
5378.0	3.85	0.87	5.00
5378.5	4.29	0.89	5.50
5379.0	4.74	0.91	6.00
5379.5	5.20	0.93	6.50
5380.0	5.67	0.95	7.00
5380.5	6.15	0.97	7.50
5381.0	6.64	1.00	8.00
5381.5	7.15	1.02	8.50

***** POND RESULTS *****

THE POND VOLUME IS ...... 7.145061 AC.FT
THE TOP DIMENSIONS ARE... 349 FT. X 127 FT.
THE SURFACE AREA IS... 1.017516 AC.



Water will be pumped below the design capacity level within 10 days following a runoff event. Water will be pumped to water trucks for distribution on roads, or will be pumped to and contained in a mining pit.

ITEM	DIM.	ELEV. ·DIM.
ELEV. OF TOP OF DAM	B	5381.5
ELEV. OF POND BOTTOM	G	5373.0
TOP WIDTH OF DAM (ft.)	A	NA (INCISED)
DESIGNED MAX. WAT. LEVEL	D	5380.0
TOE OF EMBANKMENT	E	NA (INCISED)
MAX SEDIMENT LEVEL	F	5374.5
BOTTOM LENGTH (ft.)	H	315.0
BOTTOM WIDTH (ft.)	I	93.0

NOT TO SCALE

RON C. VAN VALKENBURG NEW MEXICO 9261 REGISTERED PROFESSIONAL ENGINEER

Ron Van Valkenburg 5-11-92

BHP MINERALS INTERNATIONAL INC.

NAVAJO MINE

FRUITLAND, NEW MEXICO USA

POND CROSS SECTIONS

Pinto Pond

DRAWN BY SYP	SCALE N/A	
APPROVED BY	DATE 03/20/92	
DRAWING NO	LOCATION NO.	

NAVAJO MINE

PINTO SEDIMENTATION POND

CHANNEL 1

The existing Channel 1 diverts the runoff from watershed "A" to the Pinto Culvert. The proposed modification of Channel 1 will reduce the sediment accumulation at the Pinto Culvert inlet, and it is shown on Exhibit 29-2.

Watershed "A" is 23 acres of undisturbed land with an average curve number of 80. The proposed channel is designed to pass the runoff from a 10 year-6 hour storm event. The SEDCAD model indicates a peak flow of 4.47 cfs from this watershed, which will produce a flow depth of 0.52 feet. Flow velocities are more than 2.5 fps for an erodible channel, therefore, erosion control measures (rip rap with a D50 of 9") will be required.

To design the channel, the SEDCAD Utility computer program was used. The design details and typical cross-section for this structure follow.

Design Summary:

Channel Depth (Ft.)	2.0
Channel Bottom Width (Ft.)	3.0
Channel Inner Side Slopes	2:1
Channel Outer Side Slopes	3:1
Channel Slope (%)	1.0
Peak Stage: 10 Year-6 Hour (Ft.)	0.52
Freeboard (Ft.)	1.48
Required Flow (cfs)	4.47
Velocity (fps)	2.13
Lining	D50 9" Rip Rap

SEDCAD+ RIPRAP CHANNEL DESIGN
----

channel 1 10yr-6hr

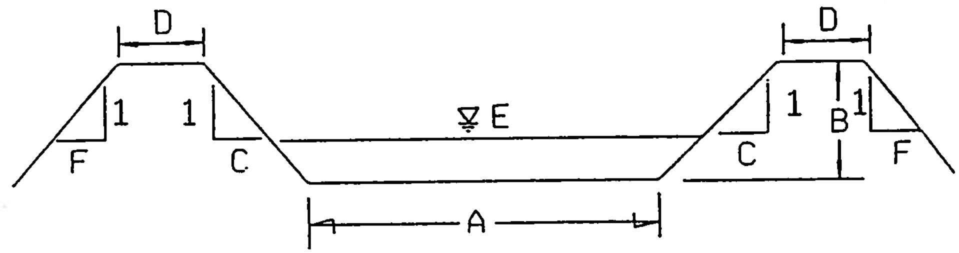
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	4.47 cfs	
Slope	1.00 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	3.00 feet	
Freeboard	1.48 ft	

RESULTS:

Mild Slope Design

Depth	0.52 ft
with Freeboard	2.00 ft
Top Width	5.08 ft
with Freeboard	11.00 ft
Velocity	2.13 fps
Cross Sectional Area	2.10 sq ft
Hydraulic Radius	0.39 ft
Manning's n	0.038
Froude Number	0.58
Dmax	1.500 ft (18.00 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)



CHANNEL 1
CROSS-SECTION

ITEM	DIM.	ELEV./DIM.
BOTTOM WIDTH (FT)	A	3.0
CHANNEL DEPTH (FT)	B	2.0
SIDE SLOPES (C:1)	C	2:1
BERM WIDTH (FT)	D	1.0
PEAK STAGE (FT)	E	0.52
CHANNEL SLOPE (%)		1.0
MAX VELOCITY (FPS)		2.13
'DESIGN CFS		4.47
LINING		Rip Rap
D_{50} (where needed)		9"
SIDE SLOPES (F:1)	F	3:1

NOT TO SCALE

BHP MINERALS INTERNATIONAL INC.

NAVAJO MINE

FRUITLAND, NEW MEXICO USA

CHANNEL 1 CROSS-SECTION

DRAWN BY SYP	SCALE N/A		
APPROVED BY	DATE 08/02/92		
DRAWING NO.		LOCATION NO.	

NAVAJO MINE

PINTO SEDIMENTATION POND

CHANNEL 2

The existing Channel 2 passes the runoff from Pinto Culvert to the Pinto Pond inlet spillway. The proposed modification of Channel 2 will reduce the rate of sediment deposition in Pinto Pond. The location is shown on Exhibit 29-2.

The proposed channel is designed to pass the runoff from a 10 year-6 hour storm event. The runoff entering Channel 2 is via the watershed "A", Channel 1, and Pinto Culvert and from natural drainages from watershed "B". The SEDCAD model indicates a combined peak flow of 12.12 cfs from watershed "A" and "B", which will produce a flow depth of 0.79 feet. Flow velocities are more than 2.5 fps for an erodible channel, therefore, erosion control measures (rip rap with a D50 of 9") will be required.

To design the channel, the SEDCAD Utility computer program was used. The design details and typical cross-section for this structure follow.

Design Summary:

Channel Depth (Ft.)	2.0
Channel Bottom Width (Ft.)	3.0
Channel Inner Side Slopes	2:1
Channel Outer Side Slopes	3:1
Channel Slope (%)	1.6
Peak Stage: 10 Year-6 Hour (Ft.)	0.79
Freeboard (Ft.)	1.21
Required Flow (cfs)	12.12
Velocity (fps)	3.37
Lining	D50 9" Rip Rap

SEDCAD+ RIPRAP CHANNEL DESIGN

channel 2 10yr-6hr

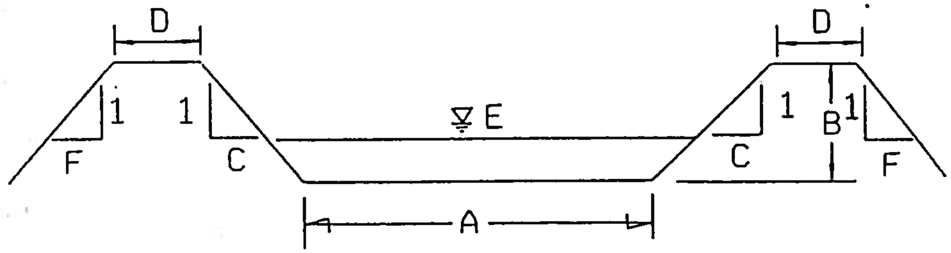
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	12.12 cfs	
Slope	1.60 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	3.00 feet	
Freeboard	1.21 ft	

RESULTS:

Mild Slope Design

Depth	0.79 ft
with Freeboard	2.00 ft
Top Width	6.15 ft
with Freeboard	10.99 ft
Velocity	3.37 fps
Cross Sectional Area	3.60 sq ft
Hydraulic Radius	0.55 ft
Manning's n	0.038
Froude Number	0.78
Dmax	1.500 ft (18.00 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)



CHANNEL 2
CROSS-SECTION

ITEM	DIM.	ELEV.-DIM.
BOTTOM WIDTH (FT)	A	3.0
CHANNEL DEPTH (FT)	B	2.0
SIDE SLOPES (C:1)	C	2:1
BERM WIDTH (FT)	D	1.0
PEAK STAGE (FT)	E	0.79
CHANNEL SLOPE (%)		1.6
MAX VELOCITY (FPS)		3.37
'DESIGN CFS		12.12
LINING		Rip Rap
D_{50} (where needed)		9"
SIDE SLOPES (F:1)	F	3:1

NOT TO SCALE

BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO USA

CHANNEL 2 CROSS-SECTION

DRAWN BY SYP	SCALE N/A	
APPROVED BY	DATE 06/02/92	
DRAWING NO.	LOCATION NO.	

NAVAJO MINE

PINTO SEDIMENTATION POND

CHANNEL 3

The proposed Channel 3 will redirect watershed "B" from entering the south east corner of Pinto Pond to the existing inlet spillway. This channel will help in the prevention of rilling on the south and east side slopes of Pinto Pond. The location is shown on exhibit 29-2.

Watershed "B" is 64 acres of undisturbed land with an average curve number of 80. The proposed channel is designed to pass the runoff from a 2 year-6 hour storm event. The SEDCAD model indicates a peak flow of 1.76 cfs from this watershed which will produce a flow depth of 0.21 feet. Flow velocities are less than 2.5 fps, therefore, erosion control measures will not be required.

To design the channel, the SEDCAD utility computer program was used. The design details and typical cross-section for this structure follow.

Design Summary:

Channel Depth (Ft.)	2.0
Channel Bottom Width (Ft.)	3.0
Channel Inner Side Slopes	2:1
Channel Outer Side Slopes	3:1
Channel Slope (%)	1.0
Peak Stage: 2 Year-6 Hour (Ft.)	0.21
Freeboard (Ft.)	1.79
Required Flow (cfs)	1.76
Velocity (fps)	2.42
Lining	Grass/Dirt

SEDCAD+ ERODIBLE CHANNEL DESIGN

channel 3 2year-6hour

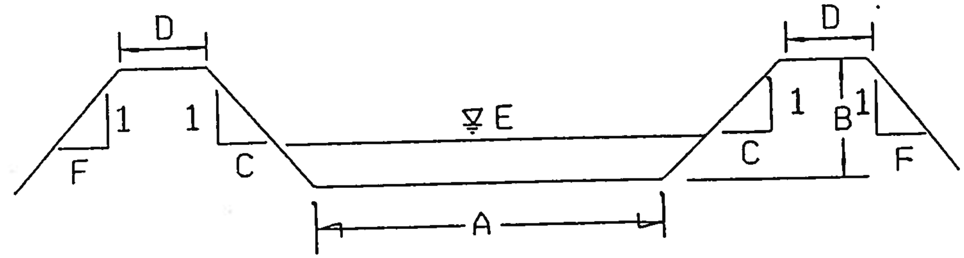
Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	1.76 cfs	
Slope	1.00 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Bottom Width	3.00 ft	
Manning's n	0.020	
Max. Velocity	2.50 fps	
Material	SANDY LOAM NONCOLLOIDAL	
Freeboard	1.79 ft	

RESULTS:

Actual Discharge	1.76 cfs
Depth	0.21 ft
with Freeboard	2.00 ft
Top Width	3.85 ft
with Freeboard	11.01 ft
Velocity	2.42 fps
Cross Sectional Area	0.73 sq ft
Hydraulic Radius	0.18 ft
Froude Number	0.98



CHANNEL 3
CROSS-SECTION

ITEM	DIM.	ELEV/DIM
BOTTOM WIDTH (FT)	A	3.0
CHANNEL DEPTH (FT)	B	2.0
SIDE SLOPES (C:1)	C	2:1
BERM WIDTH (FT)	D	1.0
PEAK STAGE (FT)	E	0.21
CHANNEL SLOPE (%)		1.0
MAX VELOCITY (FPS)		2.42
'DESIGN CFS		1.76
LINING		Grass/Dirt
D_{50} (where needed)		N/A
SIDE SLOPES (F:1)	F	3:1

NOT TO SCALE

BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO USA

CHANNEL 3 CROSS-SECTION

DRAWN BY SYP	SCALE N/A		
APPROVED BY	DATE 06/02/92		
DRAWING NO.		LOCATION NO.	

NAVAJO MINE

PINTO HAUL ROAD CULVERT

The culvert shown on exhibit 29-2 was constructed to divert Watershed "A" runoff from the haul road to Pinto Pond. Runoff from Watershed "A" drains to the northernmost corner of the watershed passing through Channel 1. This runoff is then routed by Pinto Culvert to the inlet channel (Channel 2). This culvert was modelled using the peak discharge from Watershed "A" for a 10 year-6 hour storm event.

The design details and typical cross-sections are included in the following pages.

Design Summary:

Culvert Inlet Elev. (Ft.)	5386.8
Culvert Outlet Elev. (Ft.)	5382.9
Culvert Diameter (Ft.)	2.0
Pipe Length (Ft.)	158.9
Design Discharge (cfs)	4.47

SEDCAD+ CULVERT SIZING UTILITY

PINTO CULVERT

Design Discharge	=	4.470	cfs
Entrance Loss Coefficient	=	0.5	
Pipe Length	=	158.900	feet
Pipe Slope	=	2.400	%
Manning's n	=	0.016	
Maximum Headwater	=	3.200	feet
Tailwater Depth	=	0.000	feet

Smallest Diameter Required to Pass Flow is 12 inches

PERFORMANCE CURVES:

Diameter: 8 inches

Headwater (ft)	Discharge (cfs)	Control	Flow Type
0.32	0.00		0
0.64	0.00		0
0.96	0.00		0
1.28	0.00		0
1.60	0.00		0
1.92	0.00		0
2.24	0.00		0
2.56	0.00		0
2.88	0.00		0
3.20	0.00		0
3.52	0.00		0
3.84	1.92	Outlet	6
4.16	2.01	Outlet	6
4.48	2.04	Outlet	6
4.80	2.07	Outlet	6

Diameter: 9 inches

Headwater (ft)	Discharge (cfs)	Control	Flow Type
0.32	0.00		0
0.64	0.00		0
0.96	0.00		0
1.28	0.00		0
1.60	0.00		0
1.92	0.00		0
2.24	0.00		0
2.56	0.00		0
2.88	0.00		0
3.20	0.00		0
3.52	0.00		0
3.84	2.56	Outlet	6
4.16	2.63	Outlet	6
4.48	2.70	Outlet	6
4.80	2.77	Outlet	6

Diameter: 12 inches

Headwater (ft)	Discharge (cfs)	Control	Flow Type
0.32	0.00		0
0.64	0.00		0
0.96	0.00		0
1.28	0.00		0
1.60	0.00		0
1.92	0.00		0
2.24	0.00		0
2.56	0.00		0
2.88	0.00		0
3.20	0.00		0
3.52	0.00		0
3.84	5.45	Outlet	6
4.16	5.57	Outlet	6
4.48	5.70	Outlet	6
4.80	5.83	Outlet	6

Diameter: 15 inches

Headwater (ft)	Discharge (cfs)	Control	Flow Type
0.32	0.00		0
0.64	0.00		0
0.96	0.00		0
1.28	0.00		0
1.60	0.00		0
1.92	0.00		0
2.24	0.00		0
2.56	0.00		0
2.88	0.00		0
3.20	0.00		0
3.52	0.00		0
3.84	9.48	Outlet	6
4.16	9.71	Outlet	6
4.48	9.94	Outlet	6
4.80	10.15	Outlet	6

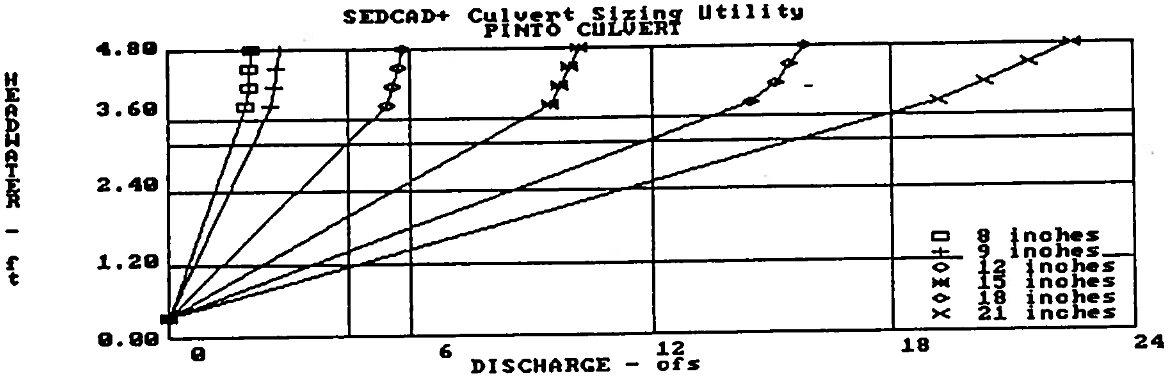
Diameter: 18 inches

Headwater (ft)	Discharge (cfs)	Control	Flow Type
0.32	0.00		0
0.64	0.00		0
0.96	0.00		0
1.28	0.00		0
1.60	0.00		0
1.92	0.00		0
2.24	0.00		0
2.56	0.00		0
2.88	0.00		0
3.20	0.00		0

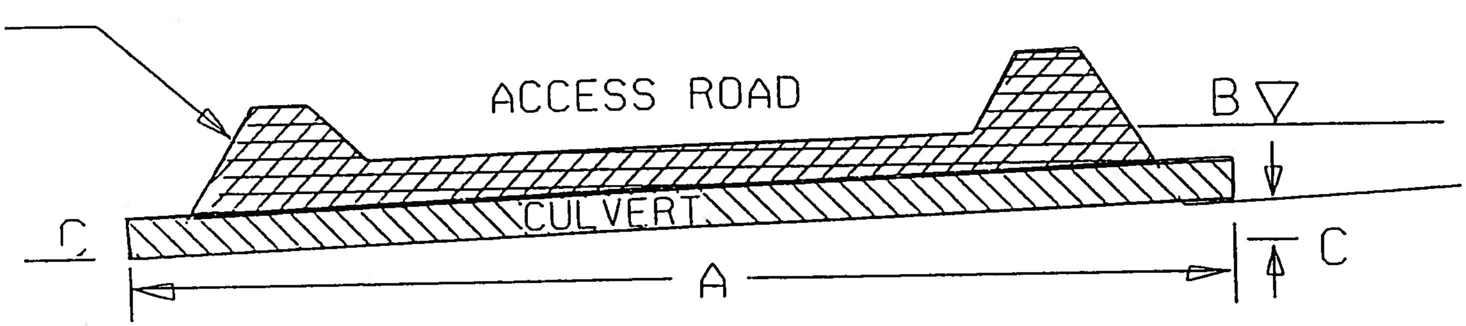
3.52	0.00		0
3.84	14.52	Outlet	6
4.16	15.12	Outlet	6
4.48	15.47	Outlet	6
4.80	15.83	Outlet	6

Diameter: 21 inches

Headwater (ft)	Discharge (cfs)	Control	Flow Type
0.32	0.00		0
0.64	0.00		0
0.96	0.00		0
1.28	0.00		0
1.60	0.00		0
1.92	0.00		0
2.24	0.00		0
2.56	0.00		0
2.88	0.00		0
3.20	0.00		0
3.52	0.00		0
3.84	19.22	Inlet	5
4.16	20.37	Inlet	5
4.48	21.47	Inlet	5
4.80	22.51	Inlet	5



SEDCAD+ Culvert Sizing Utility
PINTO CULVERT
HEADWATER - ft
4.80
3.60
2.40
1.20
0.00
0
6
12
18
24
DISCHARGE - cfs
8 inches
9 inches
12 inches
15 inches
18 inches
21 inches



ACCESS ROAD CULVERT

NOT TO SCALE

BHP-UTAH INTERNATIONAL INC.
NAVAJ MINE
FRUITLAND, NEW MEXICO USA

PINTO CULVERT
TYPICAL CROSS-SECTIONS

DRAWN BY SYP	SCALE N/A	
APPROVED BY	DATE 04/01/92	
DRAWING NO.		LOCATION NO

ITEM	DIM.	ELEV.-DIM.
CULVERT LENGTH	A	158.9 (Ft)
HEADWATER	B	3.2 (Ft)
ELEVATION CHANGE	C	3.9 (Ft)

North Pinto Pond

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	76.900	76.900	42.40	3.60

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	76.900	0.332	0.000	0.000	80.000	M	42.40	3.605
	Σ	**76.900**						**42.40**	**3.605**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.41	75.00	2,200.00	1.840	0.332
#1	**1**	**Time of Concentration:**					**0.332**

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION FOR NORTH PINTO POND CHANNEL 2

by

Name: Brian Sambirsky

Company Name: BHP MINERALS

File Name: C:\BRIAN\NPINTOCH

Date: 12-19-1995

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\NPINTOCH User: Brian Sambirsky
Date: 12-19-1995 Time: 09:44:26
As built design hydrology calculation for North Pinto Pond Channel 2
Storm: 1.30 inches, 10 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	21.30	83	M	0.330	0.000	0.000	0.0	0.48	6.65
		Type: Null			Label: CP-37 Influence					
111	Structure	21.30							0.48	
111	Total IN/OUT	21.30							0.48	6.65
211	1	55.60	83	M	0.350	0.000	0.000	0.0	1.25	16.77
		Type: Null			Label: North Pinto Pond					
211	Structure	55.60							1.73	
211	Total IN/OUT	76.90							1.73	23.42
111 to 211 Routing						0.028	0.249			
		Type: Null			Label: North Pinto Pond					
311	Structure	55.60							1.73	
311	Total IN/OUT	76.90							1.73	23.42
211 to 311 Routing						0.000	0.000			

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\NPINTOCH User: Brian Sambirsky
Date: 12-19-1995 Time: 09:44:26
As built design hydrology calculation for North Pinto Pond Channel 2
Storm: 1.30 inches, 10 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2150.00	3.26	1.81	0.33	0.330		
2	1	1	1	-a	5	2120.00	2.83	1.68	0.35	0.350		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION FOR NORTH PINTO POND CHANNEL 3

by

Name: Brian Sambirsky

Company Name: BHP MINERALS

File Name: C:\BRIAN\NPINTOCH

Date: 12-19-1995

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\NPINTOCH User: Brian Sambirsky
Date: 12-19-1995 Time: 09:54:18
As built design hydrology calculation for North Pinto Pond Channel 3
Storm: 0.80 inches, 2 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	21.30	83	M	0.330	0.000	0.000	0.0	0.11	1.28
		Type: Null		Label: CP-37 Influence						
111	Structure	21.30							0.11	
111	Total IN/OUT	21.30							0.11	1.28
211	1	55.60	83	M	0.350	0.000	0.000	0.0	0.29	3.22
		Type: Null		Label: North Pinto Pond						
211	Structure	55.60							0.40	
211	Total IN/OUT	76.90							0.40	4.50
111 to 211	Routing					0.028	0.249			
		Type: Null		Label: North Pinto Pond						
311	Structure	55.60							0.40	
311	Total IN/OUT	76.90							0.40	4.50
211 to 311	Routing					0.000	0.000			

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\BRIAN\NPINTOCH User: Brian Sambirsky
Date: 12-19-1995 Time: 09:54:18
As built design hydrology calculation for North Pinto Pond Channel 3
Storm: 0.80 inches, 2 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2150.00	3.26	1.81	0.33	0.330		
2	1	1	1	-a	5	2120.00	2.83	1.68	0.35	0.350		

SEDCAD+ RIPRAP CHANNEL DESIGN

Channel 1 10yr-6hr

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	12.29 cfs	
Slope	1.00 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	3.00 feet	
Freeboard	1.1 ft	

RESULTS:

Mild Slope Design

Depth	0.90 ft
with Freeboard	2.00 ft
Top Width	6.59 ft
with Freeboard	10.99 ft
Velocity	2.86 fps
Cross Sectional Area	4.30 sq ft
Hydraulic Radius	0.61 ft
Manning's n	0.038
Froude Number	0.62
Dmax	1.500 ft (18.00 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

Channel 2 10yr-6hr

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	23.42 cfs	
Slope	1.60 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	3.00 feet	
Freeboard	0.98 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	1.02 ft
with Freeboard	2.00 ft
Top Width	7.08 ft
with Freeboard	11.00 ft
Velocity	4.55 fps
Cross Sectional Area	5.14 sq ft
Hydraulic Radius	0.68 ft
Manning's n	0.032
Froude Number	0.94
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

Channel 3 2yr-6hr

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	3.22 cfs	
Slope	1.00 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	3.00 feet	
Freeboard	1.57 ft	

RESULTS:

Mild Slope Design

Depth	0.43 ft
with Freeboard	2.00 ft
Top Width	4.73 ft
with Freeboard	11.01 ft
Velocity	1.92 fps
Cross Sectional Area	1.67 sq ft
Hydraulic Radius	0.34 ft
Manning's n	0.038
Froude Number	0.57
Dmax	1.500 ft (18.00 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

Appendix 26.I

North Pond Expansion Cell A2

Appendix 26.I

North Pond Expansion – Cell A2

Due to reformatting of the Navajo Mine PAP, the following references in this appendix have been changed, deleted or renumbered:

NM-0003C	NM-0003D
Exhibit 29-IJ	Exhibit 11-24
Exhibit 29-IK	Exhibit 11-49

NM-0003F Paper	NM-0003F Electronic
Exhibit 11-13B	Exhibit 26-9
Exhibit 11-16	Exhibit 22-8
Exhibit 11-17	Exhibit 22-9 Sheet 1 of 2
Exhibit 11-18	Exhibit 22-9 Sheet 2 of 2
Exhibit 11-21	Exhibit 22-10
Exhibit 11-22	Exhibit 22-11
Exhibit 11-23	Exhibit 22-12
Exhibit 11-24	Exhibit 22-13
Exhibit 11-25	Exhibit 22-14
Exhibit 11-106	Exhibit 26-13
Exhibit 11-49A was removed with REV 1012	

Cell A 2 Expansion Pond

The cell A 2 expansion pond is adjacent to the presently existing ponds in the North pond system near 20071200N, 313500E. The North pond 1 system consists of four (4) distinct cells namely A, A 2, B, and C. These ponds are linked by overflow spillways protected by an oil skimmer located at the outlet from cell A. The ponds in conjunction with Pond 5 are designed to catch and contain all runoff from the north office, shop, and coal handling facility. At present, the capacity of these ponds when cells B and C are empty, contains the 100 - yr., 6-hour storm event. The addition of the cell A 2 pond provides an operating buffer of storm capacity for those times when the ponds are not empty.

Location of cell A 2 , as well as design and construction details can be seen on the accompanying maps and diagrams, see EXHIBIT 11-12 to 11-25. As-Builts for North Pond 1 (North Cells) can be found on EXHIBIT 11-49a and 11-106.

Design

The Pond

The cell A 2 Pond provides approximately 5 additional acre feet of capacity, to the present total capacity of approximately 29 acre feet available in the Pond 1 system. The slope of the sides of the pond were constructed at least 3:1.

The Spillway

A level spillway at an elevation of 5329.5 feet allows water to flow between cells A and A2. The Spillway is lined with 6” of concrete. The spillway is 50’ wide at the base with sides sloping up at 2:1.

Operation Sequence

The pond 1 drainage system is designed to deliver all runoff to cells A and A2. For this reason, cells A and A2 can be considered primary cells. Once either of these cells is filled to and elevation of 5329.5, it will overflow through the spillway into the other primary cell. Only when both cells are filled to an elevation of 5330 will water flow from cell A through the oil skimmer to cell B. Once cell B is filled to an elevation of 5330 ft. will water flow into cell C. Cell A 2 will be kept at an appropriate depth to allow for containment of the 100 - yr. 6 - hr. storm event, in conjunction with cells B and C.

Pumping Plan

Water and sediment levels are maintained at a level which will ensure that the designed capacity is available. Cleaning of the pond will be performed as needed. Water levels will be pumped to below design capacity within ten working days of a significant runoff event.

Appendix 26.J

South Dixon Ponds 1, 2 & 3 Hydrology

Appendix 26.J

South Dixon Ponds 1, 2 & 3 Hydrology

Due to reformatting of the Navajo Mine PAP, the following references in this appendix have been changed, deleted or renumbered:

NM-0003F Paper	NM-0003F Electronic
Exhibit 11-13 E	Exhibit 26-12
Exhibit 11-51C	Exhibit 26-41
Exhibit 11-51D	Exhibit 26-42
Exhibit 11-117A	Exhibit 26-48

APPENDIX 26.J

South Dixon Ponds 1 to 3 Hydrology

TABLE OF CONTENTS

South Dixon Pond #1

The as-built is presented on Exhibit 11-51C. The location and watershed area are presented on Exhibit 11-13E. The SedCad model was updated on 11/20/08 by Shawn Smith to reflect current watershed. Structure 1 watershed increase from 287.23 to 285.19 acres. The watershed boundary was modified using actual surveys and aerial flight data.

LR

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87414

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

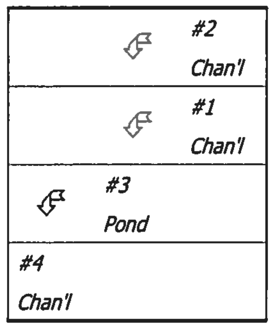
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.000	0.000	NW Inlet
Channel	#2	==>	#3	0.000	0.000	SE Inlet
Pond	#3	==>	#4	0.000	0.000	South Dixon Pond 1
Channel	#4	==>	End	0.000	0.000	Spillway Outflow



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2		11.270	11.270	3.23	0.25
#1		285.190	285.190	70.01	6.38
#3	In	0.000	296.460	73.11	6.63
	Out			39.52	6.63
#4		0.000	296.460	39.52	6.63

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	11.270	0.333	0.000	0.000	80.000	M	3.23	0.253
	Σ	**11.270**						**3.23**	**0.253**
#1	1	285.190	0.430	0.000	0.000	80.000	M	70.01	6.378
	Σ	**285.190**						**70.01**	**6.378**
#3	1	0.000	0.000	0.000	0.000	1.000	0.00	0.000	
	Σ	**296.460**						**73.11**	**6.631**
#4	Σ	**296.460**						**39.52**	**6.631**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.47	30.00	671.00	2.110	0.088
		8. Large gullies, diversions, and low flowing streams	2.23	123.00	5,517.00	4.470	0.342
#1	**1**	**Time of Concentration:**					**0.430**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.03	58.00	1,913.00	1.740	0.305
		8. Large gullies, diversions, and low flowing streams	3.16	17.00	538.00	5.330	0.028
#2	**1**	**Time of Concentration:**					**0.333**

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2		11.270	11.270	4.35	0.25
#1		285.190	285.190	94.36	6.38
#3	In	0.000	296.460	98.51	6.63
	Out			61.11	6.63
#4		0.000	296.460	61.11	6.63

Structure Detail:

Structure #3 (Pond)

South Dixon Pond 1

Pond Inputs:

Initial Pool Elev:	5,246.90 ft
Initial Pool:	11.89 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,246.90	25.00	3.00:1	3.00:1	15.00

Pond Results:

Peak Elevation:	5,248.17 ft
Dewater Time:	0.26 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,237.00	0.777	0.000	0.000		
5,237.01	0.779	0.008	0.000		
5,238.00	1.006	0.889	0.000		
5,239.00	1.058	1.921	0.000		
5,240.00	1.107	3.003	0.000		
5,241.00	1.157	4.135	0.000		
5,242.00	1.207	5.317	0.000		
5,243.00	1.258	6.550	0.000		
5,244.00	1.311	7.834	0.000		
5,245.00	1.368	9.173	0.000		
5,246.00	1.430	10.572	0.000		
5,246.90	1.488	11.885	0.000		Spillway #1
5,247.00	1.495	12.035	3.988	3.30	
5,248.00	1.555	13.560	43.833	2.70	
5,248.17	1.557	13.823	61.111	0.30	Peak Stage
5,249.00	1.602	15.138	147.308		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,237.00	0.000	0.000
5,237.01	0.000	0.000
5,238.00	0.000	0.000
5,239.00	0.000	0.000
5,240.00	0.000	0.000
5,241.00	0.000	0.000
5,242.00	0.000	0.000
5,243.00	0.000	0.000
5,244.00	0.000	0.000
5,245.00	0.000	0.000
5,246.00	0.000	0.000
5,246.90	0.000	0.000
5,247.00	3.988	3.988
5,248.00	43.833	43.833
5,249.00	147.308	147.308

Structure Detail:

Structure #4 (Riprap Channel)

Spillway Outflow

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	12.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	61.11 cfs	
Depth:	0.42 ft	1.42 ft
Top Width:	14.52 ft	20.52 ft
Velocity*:		
X-Section Area:	5.58 sq ft	
Hydraulic Radius:	0.380 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2		11.270	11.270	2.43	0.15
#1		285.190	285.190	52.31	3.68
#3	In	0.000	296.460	54.70	3.83
	Out			29.54	3.83
#4		0.000	296.460	29.54	3.83

Structure Detail:

Structure #2 (Riprap Channel)

SE Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	15.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.43 cfs	
Depth:	0.05 ft	1.05 ft
Top Width:	8.32 ft	14.32 ft
Velocity*:		
X-Section Area:	0.44 sq ft	
Hydraulic Radius:	0.052 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure Detail:

Structure #1 (Riprap Channel)

NW Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

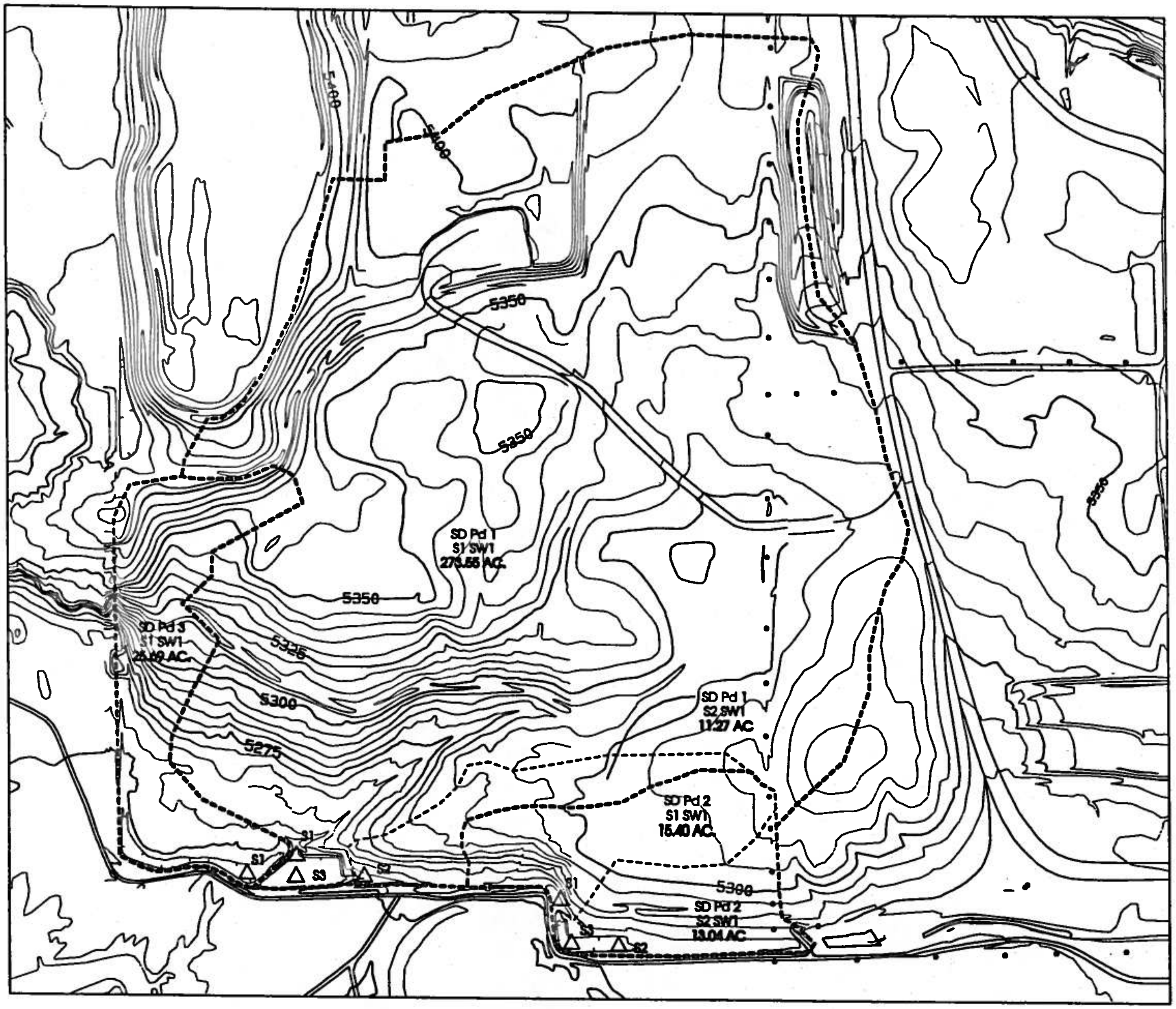
Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	15.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	52.31 cfs	
Depth:	0.44 ft	1.44 ft
Top Width:	10.66 ft	16.66 ft
Velocity*:		
X-Section Area:	4.14 sq ft	
Hydraulic Radius:	0.383 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.



SOUTH DIXON POND 1, 2 AND 3
HYDROLOGY MODEL (11/2005)
NTS

South Dixon Pond 2
Design Modification

The erosion of north bank of the Cottonwood Wash is encroaching onto the pond embankment. The embankment also functions as a roadway for residences west of the mine lease. To prevent possible breach of the embankment and enhance the safety of the road, a reach of the embankment was realigned. The design modification of the embankment is presented on Exhibit 11-117A. The location and watershed area are presented on Exhibit 11-13E. The hydrology model is presented on a 8 1/2 X 11 sheet attached.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

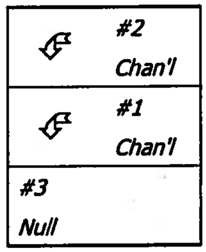
General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.000	0.000	NW Inlet
Channel	#2	==>	#3	0.000	0.000	East Inlet
Null	#3	==>	End	0.000	0.000	South Dixon Pd 2



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	13.040	13.040	16.54	0.61
#1	15.400	15.400	9.85	0.72
#3	0.000	28.440	23.15	1.33

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	13.040	0.123	0.000	0.000	80.000	M	16.54	0.611
	Σ	**13.040**						**16.54**	**0.611**
#1	1	15.400	0.236	0.000	0.000	80.000	M	9.85	0.722
	Σ	**15.400**						**9.85**	**0.722**
#3	Σ	**28.440**						**23.15**	**1.333**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.08	42.00	1,362.00	1.750	0.216
		8. Large gullies, diversions, and low flowing streams	5.70	30.00	526.00	7.160	0.020
#1	**1**	**Time of Concentration:**					**0.236**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	9.68	64.00	661.00	3.110	0.059
		8. Large gullies, diversions, and low flowing streams	1.75	16.00	916.00	3.960	0.064
#2	**1**	**Time of Concentration:**					**0.123**

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	13.040	13.040	6.43	0.21
#1	15.400	15.400	3.22	0.25
#3	0.000	28.440	7.84	0.46

Structure Detail:

Structure #2 (Riprap Channel)

East Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	2.0:1	2.0:1	14.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.43 cfs	
Depth:	0.11 ft	1.11 ft
Top Width:	6.43 ft	10.43 ft
Velocity*:		
X-Section Area:	0.66 sq ft	
Hydraulic Radius:	0.102	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Riprap Channel)

NW Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	2.0:1	2.0:1	15.0	1.00		

Riprap Channel Results:

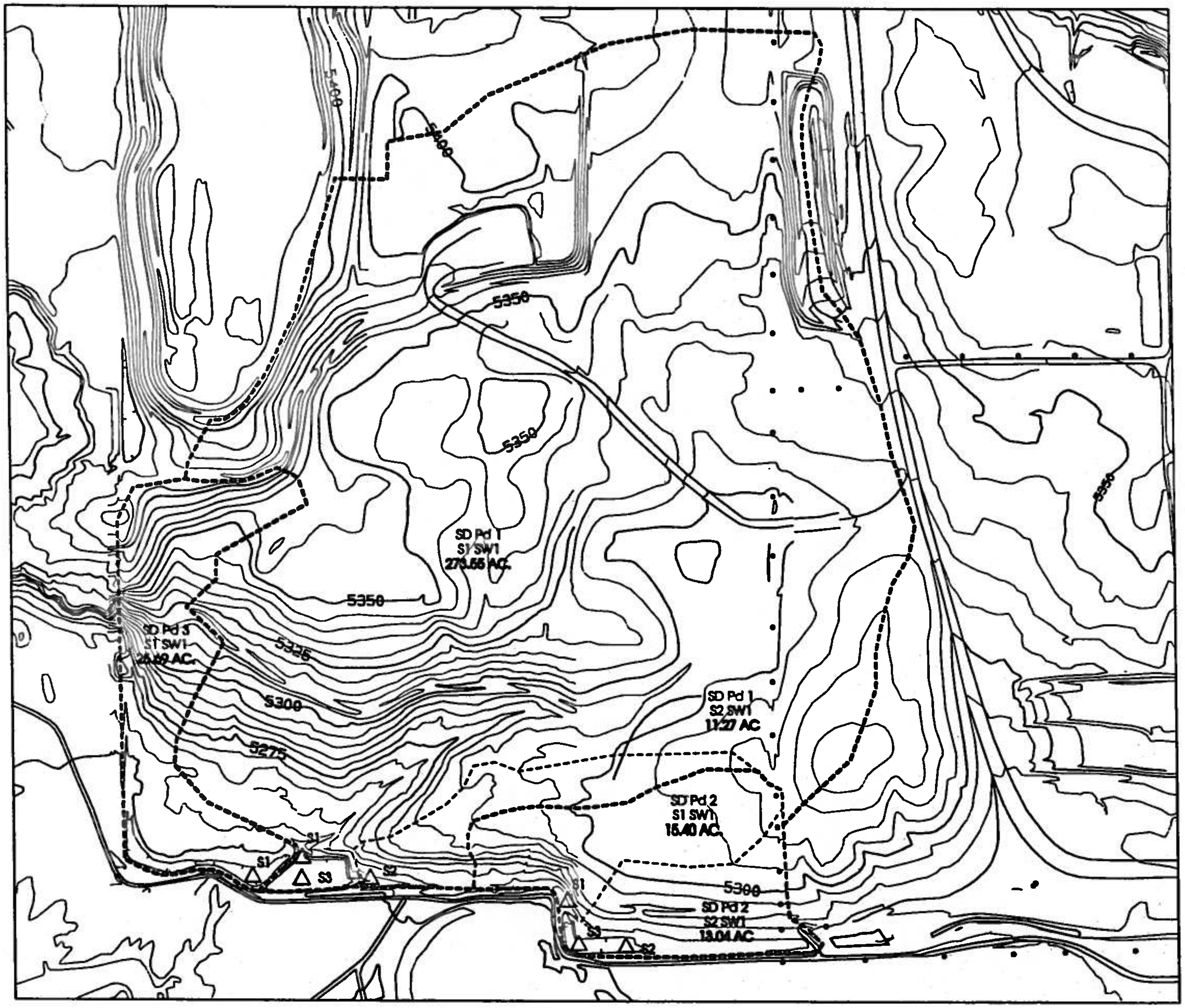
Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.22 cfs	
Depth:	0.06 ft	1.06 ft
Top Width:	8.24 ft	12.24 ft
Velocity*:		
X-Section Area:	0.50 sq ft	
Hydraulic Radius:	0.060	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Null)

South Dixon Pd 2



SOUTH DIXON POND 1, 2 AND 3
HYDROLOGY MODEL (11/2005)
NTS

South Dixon Pond 3

The as-built is presented on Exhibit 11-51D. The location and watershed area are presented on Exhibit 11-13E. The watershed boundary was modified using actual surveys and aerial flight data.

LR

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87414

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	South Dixon Pd 3

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	28.180	28.180	22.60	1.05

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	28.180	0.204	0.000	0.000	80.000	M	22.60	1.055
	Σ	**28.180**						**22.60**	**1.055**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	10.32	105.00	1,017.00	3.210	0.088
		8. Large gullies, diversions, and low flowing streams	1.86	32.00	1,719.00	4.090	0.116
#1	**1**	**Time of Concentration:**					**0.204**

Appendix 26.K

Spur D Drainage/Sediment Control

May 2004

Appendix 26.K

Spur D Drainage/Sediment Control

Due to reformatting of the Navajo Mine PAP, the following references in this appendix have been changed, deleted or renumbered:

NM-0003F Paper Permit	NM-0003F Electronic Permit
Exhibit 11-53	Exhibit 26-83
Exhibit 11-14P	Exhibit in As-built
Exhibit 1-14T	Exhibit in As-built
Exhibit 11-14S	Exhibit in As-built

NAVAJO MINE RAILROAD
DRAINAGE/SEDIMENT CONTROL AT SPUR D

The drainage and erosion control structures for the railroad at Spur D consist of a diversion berm on the east side and riprap lined channels on both the east and west side. The watershed subdivisions are presented on Exhibit 11-53. The location and details of the drainage control structures are presented on Exhibits 11-14P and 11-14T.

A diversion berm was constructed at the top of the slope that is directly east of culvert CP-16. The berm will divert the surface runoff from watershed "B1" into drop-structure "DS-484L" as presented on Exhibit 11-53 and 11-14P. The diversion berm will prevent formation of gullies and rills on the slope, thus reducing the sediment load to the downstream flow. The diversion berm is design for the peak discharge from the 10 year-24 hour storm event. Typical section of the diversion berm is shown on Exhibit 11-14S.

Drop-structures DS-481+50L, DS-484L, and DS-484R are design for the peak discharge from the 10 year-6 hour storm event. Refer to the schedule on Exhibit 11-14T for the channel dimensions and the riprap size placed.

Railroad Drainage/Sediment Control at Spur D - East Side

The watershed subdivisions are presented on Exhibit 11-53. The location and details of the drainage control structures are presented on Exhibits 11-14P and 11-14T.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

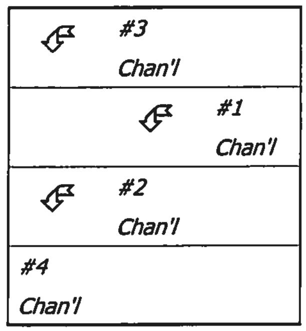
General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	Diversion Berm
Channel	#2	==>	#4	0.000	0.000	Dropstructure DS-484L
Channel	#3	==>	#4	0.000	0.000	Dropstructure DS-481+50L
Channel	#4	==>	End	0.000	0.000	Dropstructure DS-484



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	39.000	39.000	8.02	0.63
#1	104.000	104.000	19.45	1.68
#2	21.000	125.000	28.54	2.53
#4	0.000	164.000	36.39	3.16

Structure Detail:

Structure #3 (Riprap Channel)

Dropstructure DS-481+50L

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	20.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	8.02 cfs	
Depth:	0.10 ft	1.10 ft
Top Width:	6.57 ft	12.57 ft
Velocity*:		
X-Section Area:	0.60 sq ft	
Hydraulic Radius:	0.091	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Diversion Berm

Trapezoidal Erodible Channel Inputs:

Material: Ordinary firm loam

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
4.00	6.0:1	2.0:1	1.0	0.0300	1.00			3.5

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	19.45 cfs	
Depth:	0.81 ft	1.81 ft
Top Width:	10.47 ft	18.47 ft
Velocity:	3.33 fps	
X-Section Area:	5.85 sq ft	
Hydraulic Radius:	0.548	
Froude Number:	0.78	

Structure #2 (Riprap Channel)

Dropstructure DS-484L

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	9.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	28.54 cfs	
Depth:	0.28 ft	1.28 ft
Top Width:	11.70 ft	17.70 ft
Velocity*:		
X-Section Area:	3.07 sq ft	
Hydraulic Radius:	0.260	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Riprap Channel)

Dropstructure DS-484

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	36.39 cfs	
Depth:	0.34 ft	1.34 ft
Top Width:	12.04 ft	18.04 ft
Velocity*:		
X-Section Area:	3.74 sq ft	
Hydraulic Radius:	0.308	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	39.000	0.244	0.000	0.000	80.000	M	8.02	0.630
	Σ	**39.000**						**8.02**	**0.630**
#1	1	104.000	0.292	0.000	0.000	80.000	M	19.45	1.681
	Σ	**104.000**						**19.45**	**1.681**
#2	1	21.000	0.409	0.000	0.000	89.000	M	9.10	0.847
	Σ	**125.000**						**28.54**	**2.528**
#4	Σ	**164.000**						**36.39**	**3.159**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.41	75.00	1,700.00	2.100	0.224
		8. Large gullies, diversions, and low flowing streams	3.57	50.00	1,400.00	5.660	0.068
#1	**1**	**Time of Concentration:**					**0.292**
#2	1	8. Large gullies, diversions, and low flowing streams	1.67	95.00	5,700.00	3.870	0.409
#2	**1**	**Time of Concentration:**					**0.409**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	3.59	52.00	1,450.00	1.890	0.213
		8. Large gullies, diversions, and low flowing streams	4.29	30.00	700.00	6.210	0.031
#3	**1**	**Time of Concentration:**					**0.244**

Railroad Drainage/Sediment Control at Spur D - West Side

The watershed subdivisions are presented on Exhibit 11-53. The location and details of the drainage control structures are presented on Exhibits 11-14P and 11-14T.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Dropsturcture DS-484R

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	31.000	31.000	10.60	1.25

Structure Detail:

Structure #1 (Riprap Channel)

Dropsturcture DS-484R

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	3.0:1	3.0:1	7.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.60 cfs	
Depth:	0.30 ft	1.30 ft
Top Width:	4.82 ft	10.82 ft
Velocity*:		
X-Section Area:	1.19 sq ft	
Hydraulic Radius:	0.241	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	25.000	0.523	0.000	0.000	89.000	M	9.50	1.009
	2	6.000	0.058	0.000	0.000	89.000	M	6.11	0.242
	Σ	**31.000**						**10.60**	**1.251**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.36	90.00	6,600.00	3.500	0.523
#1	**1**	**Time of Concentration:**					**0.523**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	20.00	30.00	150.00	4.470	0.009
		8. Large gullies, diversions, and low flowing streams	3.81	40.00	1,050.00	5.850	0.049
#1	**2**	**Time of Concentration:**					**0.058**

Appendix 26.L

Lowe Dixon Temporary Diversion

Inlet Redesign SEDCAD Backup

October 1995

TABLE OF CONTENTS

ITEMS DESCRIPTION	PAGE #

+ - denotes new modified inlets for As-Builts.

LOWE / DIXON TEMPORARY DIVERSION - INLET REDESIGN

1.0 LOCATION AND FUNCTION:

The Lowe / Dixon Temporary Diversion, is currently located on the eastern portion of the Lowe / Dixon lease boundary and was constructed in 1994 and 1995. The approved discussion in the NM-0003D PAP, CHAPTER 11, TABLE 11-9; and EXHIBIT's 11-68 through 11-72 contain the design criteria for the diversion. The structure was constructed as a means to divert water from entering the Lowe and Dixon Pits, as well as other mine areas.

2.0 BACKGROUND AND CONCERN:

During an inspection on September 14, 1995, by the Office of Surface Mining/Albuquerque Field Office (OSM/AFO), minor erosion was noted on all four of the inlets on the east side of the diversion (inlets 3 and 4 having the most erosion). A breach (south of inlet four) was also discovered in the berm which currently diverts water along the top edge of the diversion to inlet structure 4 and a natural drainage south of inlet structure four. The designs for inlets 1 through 4 were deemed to be inadequate and AFO requested that they be redesigned. Thus, a submittal containing corrective updates would be made to Navajo Mine's "Operation Plan" portion of the NM-0003D PAP pertaining to the diversion.

The areas of concern are the four inlets (drop structures) on the east side of the diversion and an area where an old road approaches the diversion (south of inlet four). Navajo Mine has evaluated the four inlets located on the east side of the diversion, based on the enclosed redesign criteria. These changes will not alter the function of the diversion or change the purpose of the drop structures.

3.0 UPGRADE DESIGNS (Surface Water Drainage and Corrective Action):

The current Lowe / Dixon Temporary Diversion water drainage was designed using a SCSII storm type. In our re-evaluation, a SCSII-65 storm type (the appropriate storm type) was utilized which increases the peak flows (cfs) contributing to the inlets and the diversion itself. The inlet slopes used to calculate the rip-rap size required was also under estimated. The proper slope to be used is the maximum encountered which is slightly higher in all cases. Using these new parameters in SEDCAD+ Version 3, the design rip-rap sizes changed for 3 of the inlets (inlets two through four).

- For inlet two the design rip-rap D_{50} went from 1.5″ to 3.0″, fortunately inlet two has been constructed with the appropriate sized rip-rap.

- Inlet three was constructed with the 1.5″ D_{50} material on the upper portion and 6″ - 9″ D_{50} material on the lower portions. From the new SEDCAD the upper rip-rap should be increased from 1.5″ D_{50} material to 6.0″ D_{50} material (some of this has already been placed) and shows that the rip-rap placed on the lower portion is adequate.

- Inlet four has the same design problem as inlet three and has also already had some of the larger required material placed.

Inlets one and two, will have 3.0" rip-rap[1] added to the upper portions and any location containing rip-rap smaller than 3.0" D_{50} material will be upgraded with at least 3.0" or greater D_{50} material. Inlets three and four, will have 6.0" rip-rap[1] added to the upper portions and any location containing rip-rap smaller than 6.0" D_{50} material will be upgraded with at least 6.0" or greater D_{50} material.

Another factor that was addressed is how the flows enter the inlets. The inlets were designed and built to receive water from the top end, but currently the diversion berms are setup to route flows to the inlet structures causing a good portion of the designed capacity to enter the sides of the inlets. Entry points were evaluated and will require larger rip-rap and its placement made to suit field conditions. Another measure to control the flows will be to add short diversion berms parallel to the inlets along the upper portions of the inlets, this will route all incoming flows to properly rip-rapped receiving points (this berm material, a relatively small quantity will come directly from the diversion site). Updated EXHIBIT 11-72B attached to this submittal, provides the new hydrologic parameters, rip-rap sizes, and design drawings of alteration on inlets one through four. New APPENDIX 11-W contains the backup calculations for the alterations.

[1] Rip-rap for remaining changes will come from one of two locations. Either from existing acceptable sources for rip-rap on the mine; or from off-site sources such as ARCO (an aggregate sales company).

In order to address the site where the old road meets the safety berm (previously breached), the berm size will be increased, and the catch drain on the east side of the berm will be re-cut so that flows from the road will drain north towards inlet four, and south towards natural drainage.

For the integrity of the diversion itself, there were no problems seen, and is currently capable of accommodating even higher design flows. The approved reclamation measures outlined in CHAPTER 12 of the PAP, Section 12.3.5, "Reclamation of Diversion Structures", will still apply. As a result of the re-evaluation, the only change that needs to be addressed for the diversion are current NM-0003D, CHAPTER 11 items: text page 11-71 (TABLE 11-9) and page 11-76a; plus EXHIBIT's 11-72A and 11-72B. It should be noted that design revisions per AFO's immediate corrective action request have been added to the current "As-Built" maps included with this letter.

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

LOWE DIVERSION WATERSHED ANALYSIS

by

Name: DJR

Company Name: BHP MINERALS
File Name: C:\SEDCAD3\LOWDV_DR

Date: 10-01-1995

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LOWDV_DR User: DJR
Date: 10-01-1995 Time: 14:51:34
LOWE DIVERSION WATERSHED ANALYSIS
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

STORM #1:

User-Defined Distribution

Label: type II-65

	Accumulated Time (hrs)	Accumulated Dimensionless Depth
1	0.0	0.000
2	0.5	0.006
3	1.0	0.012
4	1.5	0.019
5	2.0	0.026
6	2.5	0.034
7	3.0	0.043
8	3.5	0.055
9	4.0	0.067
10	4.5	0.083
11	5.0	0.105
12	5.5	0.139
13	6.0	0.711
14	6.5	0.789
15	7.0	0.819
16	7.5	0.837
17	8.0	0.851
18	8.5	0.861
19	9.0	0.872
20	9.5	0.880
21	10.0	0.888
22	10.5	0.894
23	11.0	0.900
24	11.5	0.905
25	12.0	0.910
26	12.5	0.915
27	13.0	0.920
28	13.5	0.925
29	14.0	0.930
30	14.5	0.934
31	15.0	0.938
32	15.5	0.943
33	16.0	0.947
34	16.5	0.951
35	17.0	0.954
36	17.5	0.958
37	18.0	0.962

38	18.5	0.966
39	19.0	0.969
40	19.5	0.973
41	20.0	0.976
42	20.5	0.979
43	21.0	0.982
44	21.5	0.985
45	22.0	0.988
46	22.5	0.991
47	23.0	0.994
48	23.5	0.997
49	24.0	1.000

****

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LOWDV_DR User: DJR
Date: 10-01-1995 Time: 14:51:34
LOWE DIVERSION WATERSHED ANALYSIS
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	131.20	80	M	0.470	1.251	0.273	0.0	2.12	22.59
111	2	49.20	83	M	0.560	1.251	0.273	0.0	1.11	11.01
111	3	94.90	88	M	0.310	1.038	0.254	0.0	3.49	51.45
111	4	86.90	89	M	0.330	0.925	0.252	0.0	3.51	50.14
111	5	53.30	89	M	0.190	1.038	0.254	0.0	2.15	39.20
111	6	77.30	89	M	0.350	0.739	0.230	0.0	3.12	43.33
111	7	72.40	89	M	0.300	0.739	0.230	0.0	2.92	43.73
111	8	102.30	80	M	0.300	0.557	0.170	0.0	1.65	23.08
			Type: Null		Label: Main Inlet					
111 Structure		667.50							20.07	
111 Total IN/OUT		667.50							20.07	166.29
112	1	116.20	84	M	0.570	0.764	0.221	0.0	2.90	28.88
112	2	68.10	88	M	0.460	0.249	0.267	0.0	2.50	29.82
			Type: Null		Label: Main Inlet Wing					
112 Structure		184.30							25.47	
112 Total IN/OUT		851.80							25.47	202.05
111 to 112 Routing						0.000	0.000			
121	1	76.80	79	M	0.350	0.000	0.000	0.0	1.10	13.85
			Type: Null		Label: Inlet @ 17+50					
121 Structure		76.80							1.10	
121 Total IN/OUT		76.80							1.10	13.85
211	1	66.70	80	M	0.350	0.000	0.000	0.0	1.08	13.77
			Type: Null		Label: Inlet @ 27+30					
211 Structure		66.70							27.65	
211 Total IN/OUT		995.30							27.65	193.32
112 to 211 Routing						0.390	0.146			
212	1	87.20	80	M	0.310	0.000	0.000	0.0	1.41	19.30
			Type: Null		Label: Inlet @ 40+10					
212 Structure		87.20							29.06	

```
212 Total IN/OUT  1082.50
                                                               29.06   183.50
==============================================================================
211 to 212 Routing                          0.510 0.146
==============================================================================
      1              262.10   80  M    0.600  0.000 0.000    0.0    4.24    38.48
                        Type: Null    Label: Inlet @ 62+00
213 Structure        262.10
                                                               33.30
------------------------------------------------------------------------------
213 Total IN/OUT  1344.60
                                                               33.30   173.29
==============================================================================
212 to 213 Routing                          0.870 0.146
==============================================================================
```

SEDCAD+ ERODIBLE CHANNEL DESIGN

LOWE DIVERSION CHANNEL - TYPICAL #1

Limiting Velocity Technique
Sediment-laden Water

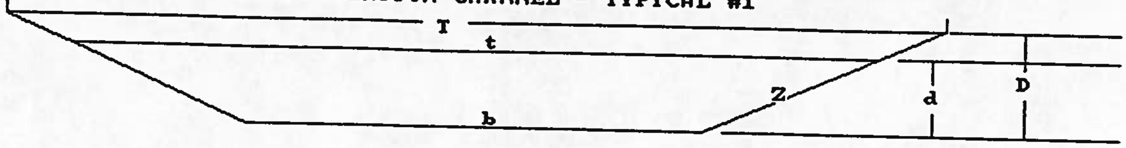
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	202.05 cfs	
Slope	0.30 %	
Sideslopes	2.30:1 (L)	2.50:1 (R)
Bottom Width	80.20 ft	
Manning's n	0.025	
Max. Velocity	5.00 fps	
Material		
Freeboard	1 ft	

RESULTS:

Actual Discharge	202.05 cfs
Depth	0.85 ft
with Freeboard	1.85 ft
Top Width	84.29 ft
with Freeboard	89.09 ft
Velocity	2.88 fps
Cross Sectional Area	70.15 sq ft
Hydraulic Radius	0.83 ft
Froude Number	0.56

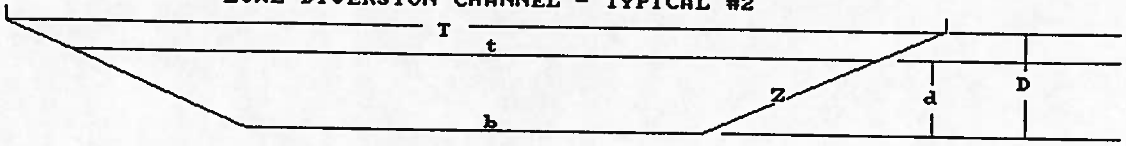
SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION CHANNEL - TYPICAL #1



MATERIAL:
Limiting Variable: Velocity = 5.000 fps
Sediment-laden Water

Discharge	= 202.05 cfs			w/ Freeboard:
Bottom (b)	= 80.20 ft	Depth (d)	= 0.85	(D = 1.85) ft
Side slopes (Z)	= 2.3:1(L) 2.5:1(R)	Top width (t)	= 84.29	(T = 89.09) ft
Bed Slope	= 0.30 %	Velocity	= 2.88 fps	
Manning's n	= 0.025	Hydraulic Radius	= 0.83 ft	
		Froude number	= 0.56	

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION CHANNEL - TYPICAL #2



MATERIAL:
Limiting Variable: Velocity = 5.000 fps
Sediment-laden Water

Discharge	= 202.05 cfs		Depth (d)	= 2.14	w/ Freeboard: (D = 3.14) ft
Bottom (b)	= 15.30 ft		Top width (t)	= 26.02	(T = 31.02) ft
Side slopes (Z)	= 2.5:1(L)	2.5:1(R)	Velocity	= 4.56 fps	
Bed Slope	= 0.30 %		Hydraulic Radius	= 1.65 ft	
Manning's n	= 0.025		Froude number	= 0.62	

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION CHANNEL - TYPICAL #3

INPUT VALUES:

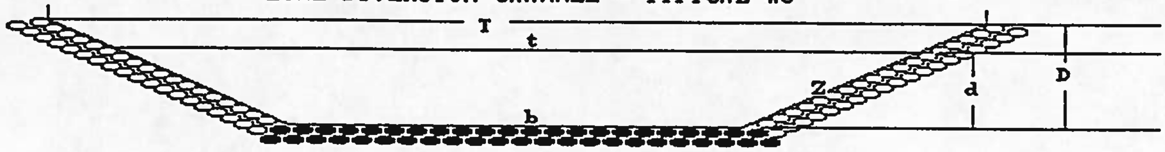
Shape	TRAPEZOIDAL	
Discharge	173.29 cfs	
Slope	0.30 %	
Sideslopes (L and R)	2.40:1	2.80:1
Bottom Width	15.50 feet	
Freeboard	1 ft	

RESULTS:

Mild Slope Design

Depth	2.44 ft
with Freeboard	3.44 ft
Top Width	28.20 ft
with Freeboard	33.40 ft
Velocity	3.25 fps
Cross Sectional Area	53.37 sq ft
Hydraulic Radius	1.83 ft
Manning's n	0.038
Froude Number	0.42
Dmax	1.500 ft (18.00 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION CHANNEL - TYPICAL #3



Riprap - Mild Slope Design

Discharge	= 173.29 cfs	Depth (d)	= 2.44	w/ Freeboard: (D = 3.44) ft
Bottom (b)	= 15.50 ft	Top width (t)	= 28.20	(T = 33.40) ft
Side slopes (Z)	= 2.4:1(L) 2.8:1(R)	Velocity	= 3.25 fps	
Bed Slope	= 0.30 %	Hydraulic Radius	= 1.83 ft	
Manning's n	= 0.038	Froude number	= 0.42	

Dmax = 1.50 ft (18.00 in)
D50 = 0.75 ft (9.00 in)
D10 = 0.25 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION CHANNEL - TYPICAL #4

INPUT VALUES:

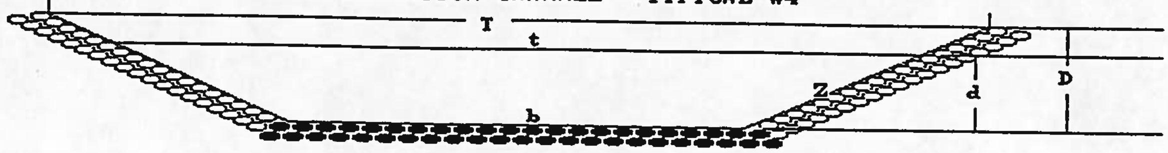
Shape	TRAPEZOIDAL	
Discharge	173.29 cfs	
Slope	6.00 %	
Sideslopes (L and R)	1.50:1	1.20:1
Bottom Width	11.10 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	1.46 ft
with Freeboard	2.46 ft
Top Width	15.03 ft
with Freeboard	17.73 ft
Velocity	9.11 fps
Cross Sectional Area	19.03 sq ft
Hydraulic Radius	1.19 ft
Manning's n	0.045
Froude Number	1.43
Dmax	0.938 ft (11.25 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION CHANNEL - TYPICAL #4



Riprap - Steep Slope Design - PADER Method

					w/ Freeboard:
Discharge	= 173.29 cfs	Depth (d)	=	1.46	(D = 2.46) ft
Bottom (b)	= 11.10 ft	Top width (t)	=	15.03	(T = 17.73) ft
Side slopes (Z)	= 1.5:1(L) 1.2:1(R)	Velocity	=	9.11 fps	
Bed Slope	= 6.00 %	Hydraulic Radius	=	1.19 ft	
Manning's n	= 0.045	Froude number	=	1.43	

Dmax = 0.94 ft (11.25 in)
D50 = 0.75 ft (9.00 in)
D10 = 0.25 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION CHANNEL - TYPICAL #5

INPUT VALUES:

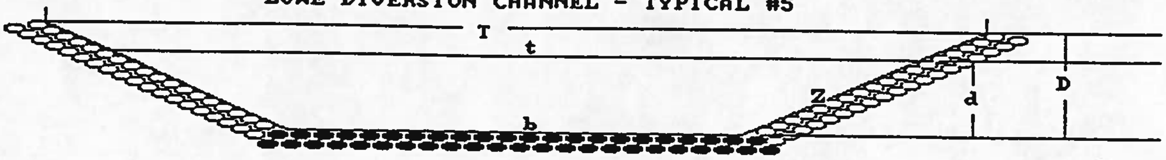
Shape	TRAPEZOIDAL	
Discharge	173.29 cfs	
Slope	2.20 %	
Sideslopes (L and R)	2.50:1	3.60:1
Bottom Width	14.90 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	1.38 ft
with Freeboard	2.38 ft
Top Width	23.31 ft
with Freeboard	29.41 ft
Velocity	6.58 fps
Cross Sectional Area	26.34 sq ft
Hydraulic Radius	1.11 ft
Manning's n	0.036
Froude Number	1.09
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION CHANNEL - TYPICAL #5



Riprap - Steep Slope Design - PADER Method

```
Discharge          = 173.29 cfs                Depth (d)           =  1.38 (D =   2.38) ft
Bottom (b)         =  14.90 ft                 Top width (t)       = 23.31 (T =  29.41) ft
Side slopes (Z)    = 2.5:1(L)   3.6:1(R)       Velocity            =  6.58 fps
Bed Slope          =   2.20 %                  Hydraulic Radius    =  1.11 ft
Manning's n        =  0.036                    Froude number       =  1.09
                          Dmax = 0.63 ft ( 7.50 in)
                          D50  = 0.50 ft ( 6.00 in)
                          D10  = 0.17 ft ( 2.00 in)
```

(w/ Freeboard: D and T values in parentheses)

SEDCAD+ ERODIBLE CHANNEL DESIGN

LOWE DIVERSION CHANNEL - TYPICAL #2

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	202.05 cfs	
Slope	0.30 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Bottom Width	15.30 ft	
Manning's n	0.025	
Max. Velocity	5.00 fps	
Material		
Freeboard	1 ft	

RESULTS:

Actual Discharge	202.05 cfs
Depth	2.14 ft
with Freeboard	3.14 ft
Top Width	26.02 ft
with Freeboard	31.02 ft
Velocity	4.56 fps
Cross Sectional Area	44.32 sq ft
Hydraulic Radius	1.65 ft
Froude Number	0.62

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION - MAIN INLET

INPUT VALUES:

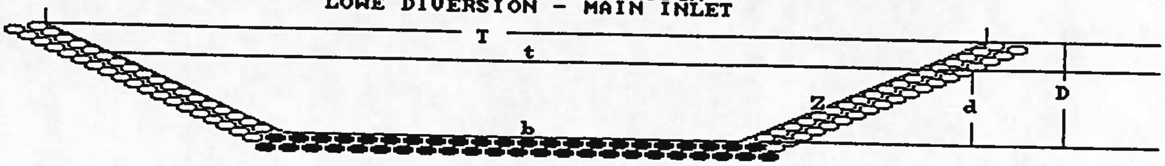
Shape	TRAPEZOIDAL	
Discharge	166.29 cfs	
Slope	0.30 %	
Sideslopes (L and R)	2.50:1	2.50:1
Bottom Width	15.00 feet	
Freeboard	1 ft	

RESULTS:

Mild Slope Design

Depth	2.43 ft
with Freeboard	3.43 ft
Top Width	27.17 ft
with Freeboard	32.17 ft
Velocity	3.24 fps
Cross Sectional Area	51.34 sq ft
Hydraulic Radius	1.83 ft
Manning's n	0.038
Froude Number	0.42
Dmax	1.500 ft (18.00 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION - MAIN INLET



Riprap - Mild Slope Design

Discharge	= 166.29 cfs	Depth (d)	= 2.43 (D = 3.43) ft (w/ Freeboard:)
Bottom (b)	= 15.00 ft	Top width (t)	= 27.17 (T = 32.17) ft
Side slopes (Z)	= 2.5:1(L) 2.5:1(R)	Velocity	= 3.24 fps
Bed Slope	= 0.30 %	Hydraulic Radius	= 1.83 ft
Manning's n	= 0.038	Froude number	= 0.42

Dmax = 1.50 ft (18.00 in)
D50 = 0.75 ft (9.00 in)
D10 = 0.25 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION - MAIN INLET WING

INPUT VALUES:

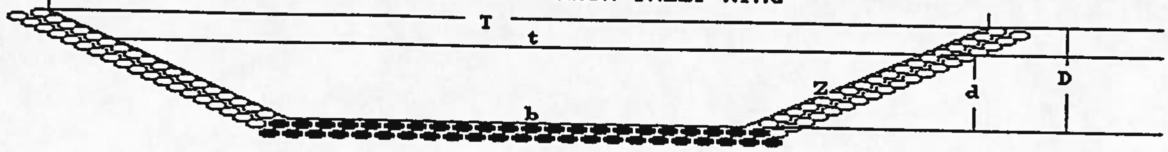
Shape	TRAPEZOIDAL	
Discharge	35.76 cfs	
Slope	0.30 %	
Sideslopes (L and R)	2.50:1	5.00:1
Bottom Width	12.00 feet	
Freeboard	1 ft	

RESULTS:

Mild Slope Design

Depth	1.12 ft
with Freeboard	2.12 ft
Top Width	20.37 ft
with Freeboard	27.87 ft
Velocity	1.98 fps
Cross Sectional Area	18.05 sq ft
Hydraulic Radius	0.87 ft
Manning's n	0.038
Froude Number	0.37
Dmax	1.500 ft (18.00 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION - MAIN INLET WING



Riprap - Mild Slope Design

Discharge	= 35.76 cfs			w/ Freeboard:	
Bottom (b)	= 12.00 ft	Depth (d)	= 1.12	(D = 2.12)	ft
Side slopes (Z)	= 2.5:1(L) 5.0:1(R)	Top width (t)	= 20.37	(T = 27.87)	ft
Bed Slope	= 0.30 %	Velocity	= 1.98 fps		
Manning's n	= 0.038	Hydraulic Radius	= 0.87 ft		
		Froude number	= 0.37		

Dmax = 1.50 ft (18.00 in)
D50 = 0.75 ft (9.00 in)
D10 = 0.25 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 18+00

INPUT VALUES:

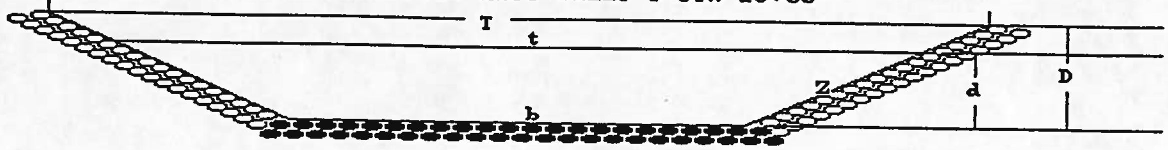
Shape	TRAPEZOIDAL	
Discharge	13.85 cfs	
Slope	20.75 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	12.50 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.24 ft
with Freeboard	1.24 ft
Top Width	13.45 ft
with Freeboard	17.45 ft
Velocity	4.51 fps
Cross Sectional Area	3.07 sq ft
Hydraulic Radius	0.23 ft
Manning's n	0.056
Froude Number	1.66
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 18+00



Riprap - Steep Slope Design - PADER Method

Discharge	= 13.85 cfs	Depth (d)	= 0.24	(D = 1.24) ft	w/ Freeboard:
Bottom (b)	= 12.50 ft	Top width (t)	= 13.45	(T = 17.45) ft	
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)	Velocity	= 4.51 fps		
Bed Slope	= 20.75 %	Hydraulic Radius	= 0.23 ft		
Manning's n	= 0.056	Froude number	= 1.66		

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 18+00

INPUT VALUES:

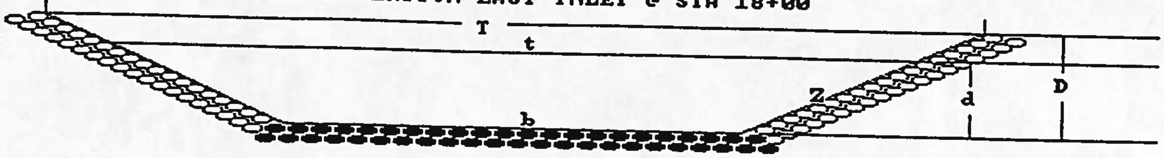
Shape	TRAPEZOIDAL	
Discharge	13.85 cfs	
Slope	20.75 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	6.25 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.34 ft
with Freeboard	1.34 ft
Top Width	7.59 ft
with Freeboard	11.59 ft
Velocity	5.96 fps
Cross Sectional Area	2.32 sq ft
Hydraulic Radius	0.30 ft
Manning's n	0.051
Froude Number	1.90
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 18+00



Riprap - Steep Slope Design - PADER Method

```
Discharge          =   13.85 cfs                                              w/ Freeboard:
Bottom (b)         =    6.25 ft              Depth (d)          =   0.34 (D =       1.34) ft
Side slopes (Z)    = 2.0:1(L)   2.0:1(R)     Top width (t)      =   7.59 (T =      11.59) ft
Bed Slope          =   20.75 %               Velocity           =   5.96 fps
Manning's n        =    0.051                Hydraulic Radius   =   0.30 ft
                                             Froude number      =   1.90
                    Dmax = 0.31 ft ( 3.75 in)
                    D50  = 0.25 ft ( 3.00 in)
                    D10  = 0.08 ft ( 1.00 in)
```

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 24+45

INPUT VALUES:

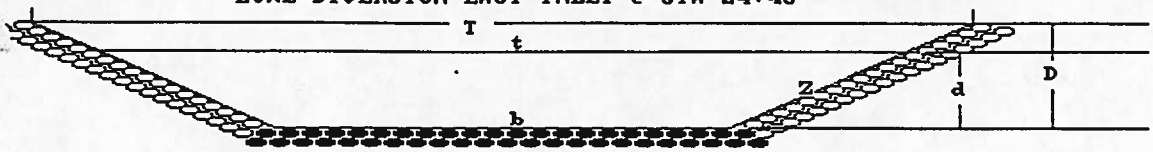
Shape	TRAPEZOIDAL	
Discharge	13.77 cfs	
Slope	21.45 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	12.20 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.24 ft
with Freeboard	1.24 ft
Top Width	13.16 ft
with Freeboard	17.16 ft
Velocity	4.53 fps
Cross Sectional Area	3.04 sq ft
Hydraulic Radius	0.23 ft
Manning's n	0.057
Froude Number	1.66
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 24+45



Riprap - Steep Slope Design - PADER Method

					w/ Freeboard:
Discharge	= 13.77 cfs		Depth (d)	= 0.24	(D = 1.24) ft
Bottom (b)	= 12.20 ft		Top width (t)	= 13.16	(T = 17.16) ft
Side slopes (Z)	= 2.0:1(L)	2.0:1(R)	Velocity	= 4.53 fps	
Bed Slope	= 21.45 %		Hydraulic Radius	= 0.23 ft	
Manning's n	= 0.057		Froude number	= 1.66	

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 24+45

INPUT VALUES:

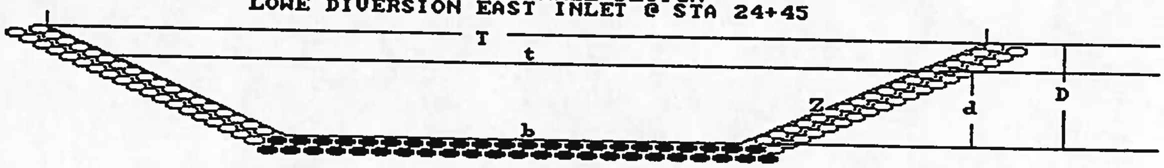
Shape	TRAPEZOIDAL	
Discharge	13.77 cfs	
Slope	21.45 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	6.10 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.34 ft
with Freeboard	1.34 ft
Top Width	7.44 ft
with Freeboard	11.44 ft
Velocity	6.05 fps
Cross Sectional Area	2.27 sq ft
Hydraulic Radius	0.30 ft
Manning's n	0.051
Froude Number	1.93
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 24+45



Riprap - Steep Slope Design - PADER Method

Discharge	= 13.77 cfs	Depth (d)	= 0.34	w/ Freeboard: (D = 1.34) ft	
Bottom (b)	= 6.10 ft	Top width (t)	= 7.44	(T = 11.44) ft	
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)	Velocity	= 6.05 fps		
Bed Slope	= 21.45 %	Hydraulic Radius	= 0.30 ft		
Manning's n	= 0.051	Froude number	= 1.93		

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 39+64

INPUT VALUES:

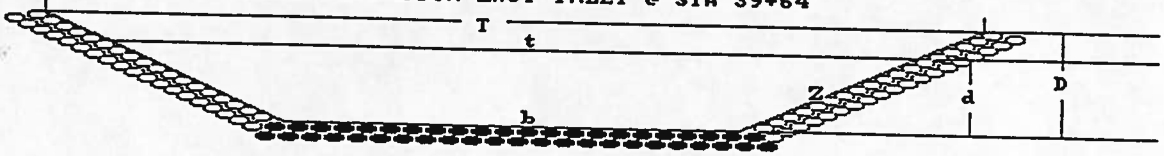
Shape	TRAPEZOIDAL	
Discharge	19.30 cfs	
Slope	28.41 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	10.80 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.28 ft
with Freeboard	1.28 ft
Top Width	11.92 ft
with Freeboard	15.92 ft
Velocity	6.06 fps
Cross Sectional Area	3.19 sq ft
Hydraulic Radius	0.26 ft
Manning's n	0.054
Froude Number	2.06
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 39+64



Riprap - Steep Slope Design - PADER Method

Discharge	= 19.30 cfs			w/ Freeboard:	
Bottom (b)	= 10.80 ft	Depth (d)	= 0.28	(D =	1.28) ft
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)	Top width (t)	= 11.92	(T =	15.92) ft
Bed Slope	= 28.41 %	Velocity	= 6.06 fps		
Manning's n	= 0.054	Hydraulic Radius	= 0.26 ft		
		Froude number	= 2.06		

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 39+64

INPUT VALUES:

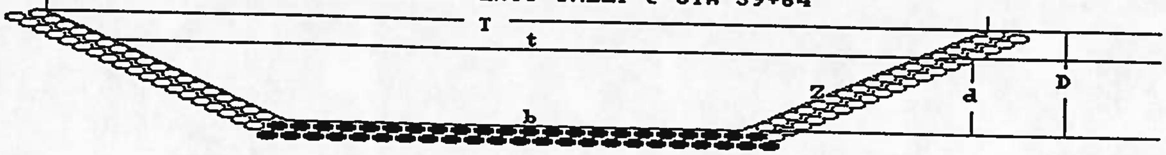
Shape	TRAPEZOIDAL	
Discharge	19.30 cfs	
Slope	28.41 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	5.40 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.46 ft
with Freeboard	1.46 ft
Top Width	7.26 ft
with Freeboard	11.26 ft
Velocity	6.56 fps
Cross Sectional Area	2.94 sq ft
Hydraulic Radius	0.39 ft
Manning's n	0.065
Froude Number	1.82
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 39+64



Riprap - Steep Slope Design - PADER Method

Discharge	= 19.30 cfs	Depth (d)	= 0.46	w/ Freeboard: (D = 1.46) ft	
Bottom (b)	= 5.40 ft	Top width (t)	= 7.26	(T = 11.26) ft	
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)	Velocity	= 6.56 fps		
Bed Slope	= 28.41 %	Hydraulic Radius	= 0.39 ft		
Manning's n	= 0.065	Froude number	= 1.82		

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 64+00

INPUT VALUES:

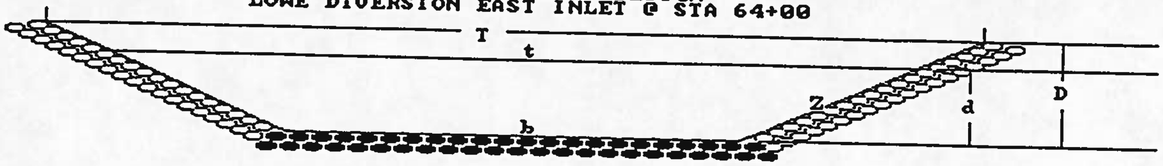
Shape	TRAPEZOIDAL	
Discharge	38.48 cfs	
Slope	15.73 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	16.50 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.37 ft
with Freeboard	1.37 ft
Top Width	17.98 ft
with Freeboard	21.98 ft
Velocity	6.02 fps
Cross Sectional Area	6.40 sq ft
Hydraulic Radius	0.35 ft
Manning's n	0.049
Froude Number	1.78
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 64+00



Riprap - Steep Slope Design - PADER Method

Discharge	= 38.48 cfs				w/ Freeboard:
Bottom (b)	= 16.50 ft		Depth (d)	= 0.37	(D = 1.37) ft
Side slopes (Z)	= 2.0:1(L)	2.0:1(R)	Top width (t)	= 17.98	(T = 21.98) ft
Bed Slope	= 15.73 %		Velocity	= 6.02 fps	
Manning's n	= 0.049		Hydraulic Radius	= 0.35 ft	
			Froude number	= 1.78	

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 64+00

INPUT VALUES:

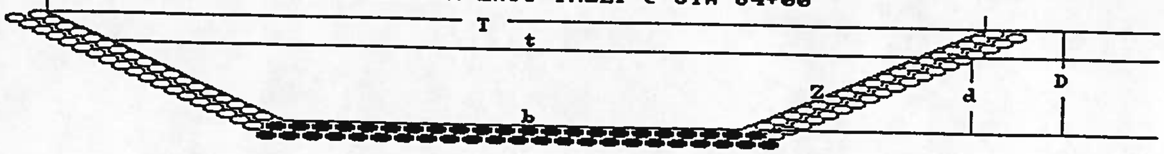
Shape	TRAPEZOIDAL	
Discharge	38.48 cfs	
Slope	15.73 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	8.25 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.62 ft
with Freeboard	1.62 ft
Top Width	10.72 ft
with Freeboard	14.72 ft
Velocity	6.57 fps
Cross Sectional Area	5.85 sq ft
Hydraulic Radius	0.53 ft
Manning's n	0.059
Froude Number	1.57
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 64+00



Riprap - Steep Slope Design - PADER Method

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                                                                w/ Freeboard:
Discharge          =  38.48 cfs          Depth (d)          =  0.62 (D =   1.62) ft
Bottom (b)         =   8.25 ft           Top width (t)      = 10.72 (T =  14.72) ft
Side slopes (Z)    = 2.0:1(L)  2.0:1(R)  Velocity           =  6.57 fps
Bed Slope          =  15.73 %            Hydraulic Radius   =  0.53 ft
Manning's n        =   0.059             Froude number      =  1.57
                          Dmax = 0.63 ft ( 7.50 in)
                          D50  = 0.50 ft ( 6.00 in)
                          D10  = 0.17 ft ( 2.00 in)
```

Civil Software Design

SEDCAD+ Version 3

LOWE DIVERSION INLET @ STA. 26+45 AS-BUILT ANALYSIS

by

Name: BH

Company Name: BHP MINERALS

Date: 08-08-97

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ 26+45

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	13.77 cfs	
Slope	17.52 %	
Sideslopes (L and R)	2.00:1	2.10:1
Bottom Width	9.30 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.13 ft
with Freeboard	1.13 ft
Top Width	9.85 ft
with Freeboard	13.95 ft
Velocity	10.72 fps
Cross Sectional Area	1.28 sq ft
Hydraulic Radius	0.13 ft
Manning's n	0.035
Froude Number	5.23
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

Civil Software Design

SEDCAD+ Version 3

LOWE DIVERSION INLET @ STA. 64+00 AS-BUILT ANALYSIS

by

Name: BH

Company Name: BHP MINERALS

Date: 08-08-97

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 64+00

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	38.48 cfs	
Slope	11.70 %	
Sideslopes (L and R)	2.71:1	1.62:1
Bottom Width	5.00 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.81 ft	
with Freeboard	1.81 ft	
Top Width	8.52 ft	
with Freeboard	12.85 ft	
Velocity	6.99 fps	
Cross Sectional Area	5.50 sq ft	
Hydraulic Radius	0.62 ft	
Manning's n	0.053	
Froude Number	1.53	
Dmax	0.625 ft	(7.50 in)
D50	0.500 ft	(6.00 in)
D10	0.167 ft	(2.00 in)