SECTION 35

HYDROLOGIC RECLAMATION PLAN

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SECTION 35

HYDROLOGIC RECLAMATION PLAN

LIST OF EXHIBITS

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35.2-1	Reconstructed Stream Channels and SEDCAD Subwatersheds for the Pinabete Permit Area
35.2-2	Part 13 Main Channel Reconstructed Geofluv Design (Sheet 1 of 4)
35.2-2	Part 13 Main Channel Reconstructed Geofluv Design (Sheet 2 of 4)
35.2-2	Part 13 Main Channel Reconstructed Geofluv Design (Sheet 3 of 4)
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SECTION 35

HYDROLOGIC RECLAMATION PLAN

LIST OF APPENDICES

APPENDIX NUMBER	APPENDIX TITLE
35.A	SEDCAD Model Results for Pinabete Tributary Part 13

SECTION 35

HYDROLOGIC RECLAMATION PLAN

LIST OF REVISIONS DURING PERMIT TERM

REV. NUMBER	REVISION DESCRIPTION	DATE APPROVED

SECTION 35 HYDROLOGIC RECLAMATION PLAN

The objective of the hydrologic reclamation plan and associated mitigation measures is to minimize disturbance to the hydrologic balance within and adjacent to the Pinabete Mine Plan permit area (permit area) and to prevent material damage to the hydrologic balance outside the permit area. This hydrologic reclamation plan has been developed in a sequential approach starting with the baseline hydrologic information, the mine plan, and the initial assessment of the probable hydrologic consequences (PHC) (Section 41). The hydrologic reclamation plan includes the measures taken during and after proposed mining to ensure attainment of the hydrologic performance standards. The PHC assessment describes the process for estimating hydrologic impacts and documents any remaining unmitigated impacts.

35.1 Drainage and Sediment Control Structures Removal and Reclamation

The drainage and sediment control structures, identified in Section 25 (Sediment Control Plan) and Section 26 (Drainage Control Plan), will be removed and reclaimed once the structures are no longer needed to manage surface water runoff and sedimentation within a watershed. The area of these structures will be regraded according to the FSC to provide for positive drainage, then topdressed and seeded according to the topsoil redistribution plan and revegetation plan presented in Section 36 (Post-Reclamation Soil) and Section 37 (Post-Reclamation Vegetation), respectively. Once the regraded areas have been reclaimed and erosion rates are less than or equal to the pre-mine rates, the areas will be reconnected to the natural drainages that surround the mine permit area in accordance with 40 CFR part 434 Subpart H. The anticipated reclamation date for the drainage and sediment control structures is provided in Table 26.2-1.

BNCC may take advantage of temporary drainage and sediment control structures to opportunistically establish small area depressions during the final surface configuration (FSC) regrading. The creation of these small area depressions will enhance post-mining topographic diversity, act as seasonal surface water collection sites, and create microhabitats for post-reclamation wildlife and vegetation communities. Small area depressions have specific design criteria, presented in Section 34 (Post-Reclamation Topography), and unlike permanent impoundments do not require design approval from the Office of Surface Mining Reclamation and Enforcement (OSM) prior to construction. However, OSM must authorize the retention of small depressions prior to bond release.

35.1.1 Sedimentation Ponds and Siltation Structures Removal and Reclamation

Sedimentation ponds and siltation structures are intended to manage and retain runoff and sediment from disturbed areas. BNCC will remove the sediment control ponds and siltation structures by regrading all dams, berms, ditches, and embankments into the FSC to provide for positive drainage. In cases where the sediment contained in the pond or siltation structure cannot be graded into the FSC, the material will be transported and placed in the mine pit or other designated area. Non-earthen materials, such as geotextiles and pond liners, will be removed and disposed of with non-coal solid waste materials in accordance with the procedures presented in Section 20 (Mining Operations) and applicable regulations.

35.1.2 Temporary Impoundments Removal and Reclamation

Temporary impoundments are structures intended to minimize surface water inflows from undisturbed areas (e.g., highwall impoundments). BNCC will remove all temporary impoundments by regrading the associated dams, berms, ditches, and embankments into the FSC to provide for positive drainage. In cases where the sediment contained in the temporary impoundment cannot be graded into the FSC, the material will be transported and placed in the mine pit or other designated area. Nonearthen materials, such as geotextiles and pond liners, will be removed and disposed of with non-coal solid waste materials in the procedures presented in Section 20 (Mining Operations) and applicable regulations.

35.1.3 Temporary Diversions Removal and Reclamation

The drainage control plan, presented in Section 26, contains two categories of temporary diversions; intermittent stream diversions and miscellaneous flow diversions. This permit application does not anticipate any need for intermittent stream diversions since the planned mining operations will avoid impacts to the South Fork of the Cottonwood Arroyo and Pinabete Arroyo channels. Miscellaneous flow diversions are diversion structures that have a watershed less than 1 square mile (sq mi). These miscellaneous flow diversions are generally used for site-specific drainage control plans, such as diverting surface flows around structures or facilities. Further discussion on temporary diversions, including their anticipated reclamation dates, is provided in Section 26 (Drainage Control Plan).

Temporary diversions, identified in the drainage control plan (Section 26), will be removed when they are no longer needed to convey surface water around disturbance areas. Material that was stockpiled during construction of a temporary diversion may be used during the removal and reclamation process. All berms, ditches, embankments, and unused stockpiled materials will be graded into the FSC. The area will be topdressed and seeded according to the topsoil redistribution plan and revegetation plan presented in Section 36 (Post-Reclamation Soil) and Section 37 (Post-Reclamation Vegetation), respectively. In cases where the sediment contained in the temporary diversion or its attenuation structures cannot be graded into the FSC, the material will be transported and placed in the mine pit or other designated area. To the extent practicable, all riprap will be removed and recycled for beneficial use in other parts of the operation. Nonearthen materials such as geotextiles, gabion baskets, and liners, will be removed and disposed of with non-coal solid waste materials in accordance with the procedures presented in Section 20 (Mining Operations) and applicable regulations.

35.1.4 Removal and Reclamation of Other Drainage and Sediment Control Structures

During mining and reclamation operations, BNCC will use best technology currently available (BTCA) measures, including but not limited to diversion, berms, rock-lined down drains, riprap, silt fences, straw bales, and fiber rolls, to control surface water drainage and sediment transport. Further information on the sediment control plan is presented in Section 25. These same measures are known as best management practices (BMP) under Clean Water Act permitting. The two terms, BTCA measures and BMP, may be used interchangeably within this permit application package (PAP). These measures will be removed and reclaimed when they are no longer needed to control drainage and sediment from disturbed areas. These structures, along with a description of their construction, operation, use, maintenance, and approximate removal and reclamation dates, are identified in the sediment control and drainage control plans contained in Sections 25 and 26, respectively. When BTCA measures are replaced or are no longer needed they will be removed and disposed of with non-coal solid waste in accordance with the procedures presented in Section 20 (Mining Operations) and applicable regulations. Inert material, such as rock riprap, may be recycled for other BTCA measures or placed within the mine backfill material. Sediments and earthen materials associated with the BTCA measures will be handled as previously described in this section. Non-earthen materials, such as geotextiles and straw bales, will be removed and disposed of with non-coal solid waste materials in accordance with the procedures presented in Section 20 (Mining Operations) and applicable regulations. The disturbed areas associated with the BTCA measures will be topdressed and seeded.

35.2 Post-reclamation Drainage

BNCC utilized fluvial geomorphic reclamation approaches as detailed in Section 34 (Post-Reclamation Topography) and Section 38 (Post-Reclamation Surface Stabilization and Sediment Control) to design the FSC, but recognizes that there may be some circumstances where a traditional reclamation approach may be appropriate. The traditional reclamation approach utilizes “hard-engineered” structures, such as down drains, terraces, etc., to achieve surface stabilization and sediment control. The fluvial geomorphic reclamation approach utilizes site-specific fluvial geomorphic data, including but not limited to drainage density, tributary lengths and associated areas, sinuosity, width to depth ratios, and length between channels, to develop an FSC that conveys waters and sediment in a manner and volume comparable with pre-mine conditions. The combination of these approaches enables BNCC to meet the objectives of the FSC as described below:

1. Achieve mass balance while maximizing contemporaneous regrade acreage between ramps,
2. Achieve positive drainage from all areas including pits and ramps,
3. Develop an adequate drainage density,
4. Allow development of stable drainage channels,
5. Support the approved post-mining land use.

To the extent practicable, the post-reclamation watersheds have been designed to be comparable in size and have confluence locations similar to the pre-mining watersheds. Adjacent ephemeral tributary drainages to the South Fork of the Cottonwood Arroyo, Pinabete Arroyo, or other drainages will be reconstructed, using fluvial geomorphic principles, from the confluence with the undisturbed channel and designed channel. The drainage pattern and alignment of the reconstructed South Fork of the Cottonwood Arroyo and Pinabete Arroyo tributaries will differ slightly as a result of mining activities.

BNCC is not requesting a variance for mountain-top removal operations, or steep slope mining as these are not applicable to this permit application.

35.2.1 Post-reclamation Watersheds

The post-reclamation watersheds were delineated in a similar manner as the pre-mine watersheds presented in Section 18 (Water Resources). Post-reclamation watersheds and subwatersheds were delineated for each of the major arroyos including Cottonwood Arroyo and tributaries, Pinabete Arroyo, and tributaries to the Chaco River, within and adjacent to the permit area based on the FSC digital elevation models (DEMs). These delineations were used in SEDCAD™ 4 (SEDCAD) modeling to determine flood flows and sediment yields for the post-reclamation watershed and subwatershed conditions (Appendix 41.D). The SEDCAD modeling also allows for comparison of pre-mining and post-reclamation watershed conditions. The results of this comparison are discussed in Section 41 (Probable Hydrologic Consequences). Exhibit 35.2-1 presents the post-reclamation SEDCAD watershed delineations and FSC contours for the permit area.

35.2.2 Post-reclamation Drainage Structures

BNCC does not plan to leave any temporary sedimentation ponds and/or impoundments as post-reclamation drainage structures. Permanent impoundments, which function as post-reclamation drainage structures, are discussed in Section 35.2.4.

Temporary post-reclamation BMPs (e.g., silt fences, straw bales, or fiber rolls) may be used as needed to comply with applicable National Pollutant Discharge Elimination System (NPDES) regulations. These BMPs will be removed once they are no longer needed and prior to final bond release.

The permit area is intersected by two main ephemeral drainages, Pinabete Arroyo and South Fork of the Cottonwood Arroyo. These drainages only flow in response to precipitation events or occasionally from snow-melt runoff. However, these drainages are classified as intermittent stream channels based on the definition provided in 30 CFR 701.5. Utilizing fluvial geomorphic and traditional reclamation principles and implementing the surface stabilization and sediment control plan presented in Section 38 (Post-Reclamation Surface Stabilization and Sediment Control), BNCC will reconstruct portions of the tributaries impacted by mining and reclamation activities. These measures, both of which rely on scientifically proven engineering practices, emphasize landform construction and erosion controls to achieve sediment-control goals. The reconstructed drainages within the permit area and the associated post-reclamation SEDCAD watersheds are presented on Exhibit 35.2-1.

35.2.2.1 Reconstructed Intermittent Stream Channels

The Pinabete Arroyo and South Fork of the Cottonwood Arroyo channels (Exhibit 35.2-1) will not require reconstruction since mining and reclamation activities will not impact these intermittent stream channels.

35.2.2.2 Reconstructed Miscellaneous Flow Stream Channels

The design of reconstructed tributary miscellaneous flow channels was completed in conjunction with the design of the FSC of Area 4 North and Area 4 South. Design assumptions and details are discussed in Appendix 34.A. These minor tributaries will have steeper channel profiles and the subwatersheds will have smaller drainage areas than the channels described under Section 35.2.2.1. The channel profile will be concave and tie in with the undisturbed tributaries to Pinabete Arroyo and Cottonwood Arroyo at slopes that support long-term stability. The head elevation and head slope will vary based on the topography established after backfilling and grading of the adjacent areas. The design and construction of the miscellaneous flow channels will follow the fluvial geomorphic principles or traditional reclamation principles outlined in Section 38 (Post-Reclamation Surface Stabilization and Sediment Control). The channel type will reflect a Rosgen Type A or Type C classification depending on slope (Rosgen 1996). The channels will contain up to the 50 year 6 hour (50yr-6hr) event within a defined bed and bank or valley channel, as appropriate. BNCC will not reestablish a bed of coarse-textured material or redistribute topdressing in the upper reaches of these minor tributaries (Section 36 Post-Reclamation Soil). The minor tributary subwatershed floodplains will be revegetated; the flood-prone and bank-full areas will not be directly revegetated to ensure that vegetation encroachment does not impact the long-term stability and performance of the reconstructed channel. To the extent practicable, the bottoms of swales will be revegetated. Further discussion on the post-reclamation vegetation and the revegetation plan is provided in Section 37 (Post-Reclamation Vegetation).

There are three Pinabete Arroyo tributaries reconstructed as a result of mining and reclamation operations which are labeled Part 10, Part 11 and Part 13 on Exhibit 35.2-1. These reconstructed Pinabete Arroyo tributary channels will follow along the backfilled location for ramps and final pit locations. The slope and elevation of the reconstructed Pinabete Arroyo tributary channels from the Part 10, Part 11 and Part 13 watersheds will tie in with the undisturbed Pinabete Arroyo tributary channels. As described in Section 38 (Post-Reclamation Surface Stabilization and Sediment Control), there may be reaches along the reconstructed channels and adjacent to tie-in locations where transient aggradation, degradation, and bank erosion may occur to a degree that is commensurate with natural fluvial geomorphic processes and dynamic equilibrium adjustments.

The profile and cross sections of the Part 13 reconstructed Pinabete Arroyo tributary channel designs are provided in Exhibit 35.2-2. Design flow depths and velocities for the 50yr-6hr storm event for typical cross sections for each segment of "Part 13" reconstructed Pinabete Arroyo tributary channel are provided in Exhibit 35.2-2. Design flows, flow depths and channel velocities for the 50yr-6hr precipitation event were obtained from the SEDCAD post-mine model of the Part 13 tributary channel that is included in Appendix 35.A.

There are nine Cottonwood Arroyo miscellaneous flow tributaries impacted by mining operations labeled Part 1 through Part 9 on Exhibit 35.2-1. All these tributaries function as ephemeral streams and have watershed sizes less than 1 sq mi, classifying them as miscellaneous flow channels. These minor tributaries tie into the undisturbed tributary channels along the south side of the Cottonwood Arroyo and the South Fork of the Cottonwood Arroyo. The design of the reconstructed Cottonwood Arroyo tributary channels was also completed in conjunction with the design of the FSC of permit area. Design assumptions and details are discussed in Appendix 34.A. Detailed plan and profile designs have not been provided for these reconstructed watersheds due to the small size of affected drainage areas.

There is one Chaco minor tributary impacted by mining operations labeled Part 12 on Exhibit 35.2-1. This small tributary ties into the undisturbed tributary channel near the western permit boundary. Detailed plan and profile designs have not been provided due to the small size of affected watershed area.

35.2.3 Permanent Diversions

BNCC does not plan to leave any permanent diversions in place once reclamation activities and bond release are complete. Therefore, this section does not apply.

35.2.4 Permanent Impoundments

BNCC does not plan to leave any permanent impoundments after reclamation activities are complete and bond release has been obtained. Therefore, this section does not apply.

Refer to Section 35.5 for a discussion of the protection and replacement of water rights of present users and to Section 33 (Post-Reclamation Roads, Buildings, Facilities, and Other Structures) for details on the construction of replacement water resources.

35.3 Acid and Toxic Drainage Control

Based on the overburden characterization study presented in Section 17 (Geologic Information), BNCC does not anticipate the need to treat any acid or toxic drainage during mining or reclamation operations or in the post-reclamation environment. The overburden characterization study concluded that there were no widespread occurrences of potentially acid-or toxic-forming materials (PATFM) present in the permit area. Therefore, these materials will not require any special handling or disposal procedures. The small quantities of PATFM and other material unsuitable for plant growth will be placed in mined-out areas and handled in a manner that protects the environmental resources and will not impact surface drainages or the FSC. The placement of this material is discussed in Section 20 (Mining Operations) and Section 34 (Post-Reclamation Topography).

BNCC will conduct surface and groundwater monitoring according to the monitoring plans provided in Section 42 (Monitoring, Maintenance, Inspections, and Examinations).

35.4 Restoration of Ground Water Recharge Capacity

Mining and reclamation activities in the permit area will increase the recharge capacity of the disturbed area because the in-situ strata are replaced with unconsolidated backfill (Section 41, Probable Hydrologic Consequences). This unconsolidated backfill has a higher hydraulic conductivity than the undisturbed strata. No special effort will be required to restore the groundwater recharge capacity from surface infiltration over the general disturbance area. The post-reclamation groundwater recharge capacity is discussed in Section 41 (Probable Hydrologic Consequences).

As described in Section 41 (Probable Hydrologic Consequences), the modeled post-reclamation recharge rate estimate for the permit area is 0.04 inches per year. This is about twice the pre-mining groundwater recharge rate discussed in Section 18 (Water Resources) and summarized in Table 41.3-1. The pre-mining groundwater recharge rate estimated by Stone (1987) for undisturbed areas at Navajo Mine ranged from 0.002 to 0.09 in/yr. Groundwater modeling predicts it may take as long as 1,000 years for the mine backfill to reach a final steady-state potentiometric level. The post-reclamation groundwater recharge capacity and rates and steady-state groundwater modeling were determined as part of the probable hydrologic consequences assessment and are discussed in greater detail in Section 41.

35.5 Protection and Replacement of Water Rights of Present Users

BNCC holds water rights Surface Permit Number 2838 issued by the New Mexico Office of the State Engineer. This diversionary surface water usage is for irrigation of reclaimed areas of the mine, dust suppression, and other appropriate uses.

During mining development, BNCC will disrupt surface water availability to six ephemeral or intermittent impoundments (Exhibit 18.1-2). The use of livestock impoundment features is limited by the availability of sufficient water from precipitation events and the naturally poor quality of the surface water. Pre-mining water resource information is provided in Section 18. BNCC may provide alternative sources for livestock watering (e.g., water tanks) to customary land users holding grazing permits for affected areas within the BNCC lease. BNCC may replace the lost water sources should BNCC find that the water users are still in need of the sources that existed pre-mine. Should the customary land user require alternative water sources after reclamation, BNCC may replace livestock impoundments affected by mining with post-reclamation livestock impoundments or wells, as deemed appropriate by BNCC. The replacement livestock impoundments or wells will provide comparable water quantity and quality for use in livestock watering to pre-mine impoundments. BNCC does not intend for any impoundments or tanks to be used as a source of domestic water, as local sources of surface and groundwater do not meet drinking water standards. BNCC will coordinate with OSM and with customary land users to determine the locations of potential impoundments or wells as a part of preparations for Phase III bond release. Additional information about these post-reclamation structures is included in Section 33 (Post-Reclamation Roads, Buildings, Facilities, and Other Structures). The post-reclamation changes to surface water quantity and quality are presented in Section 41 (Probable Hydrologic Consequences).

35.6 Steps to Meet Federal, State, and Tribal Water Quality Laws, Regulations, and Standards

BNCC will comply with Sections 401, 402, and 404 of the Clean Water Act. As described in Section 8 (Compliance with Air and Water Quality Laws and Regulations) of this PAP, BNCC will obtain the appropriate coverage under Section 402, which is administered by the U.S. Environmental Protection Agency (USEPA) Region 9 for lands within the Navajo Nation; Section 404, which is administered through the U.S. Army Corps of Engineers (USACE); and Section 401 certification, which is administered through the Navajo Nation Environmental Protection Agency (NNEPA).

BNCC will meet the water quality standards through various practices described throughout this section and following the methods and procedures outlined in Section 25 (Sediment Control Plan) for controlling sediment during surface coal mining and reclamation operations. Constructing stable drainages and surfaces according to the FSC and the post-reclamation surface stabilization and sediment control plan will prevent additional contributions of sediment and suspended solids to drainages within and adjacent to the permit area. Reclaimed drainages and associated watersheds will be reconnected to the natural drainage system (i.e., not affected by mining) in accordance with 40 CFR part 434 Subpart H.

Section 41 (Probable Hydrologic Consequences) describes the analysis and demonstrates how the various mitigation and preventive measures described in this section will ensure BNCC complies with applicable water quality laws, regulations, and standards.

35.7 Steps to Minimize Hydrologic Balance Disturbances and Prevent Material Damage

In accordance with 30 CFR 780.21(h), BNCC is submitting this hydrologic reclamation plan, which has been designed to:

- Minimize to the extent possible disturbances to the hydrologic balance within the permit and adjacent areas;
- Prevent to the extent possible material damage to the hydrologic balance outside the permit area;
- Assure the protection or replacement of water rights; and
- Support the approved post-mining land use.

BNCC will utilize this plan and other sections of the PAP to comply with 30 CFR 816.41 through 816.43 and to prevent to the extent possible adverse impacts to the hydrologic balance within and outside the permit area.

<u>Groundwater Protection and Monitoring</u>

Material unsuitable for plant growth will be placed in mined-out areas and handled in a manner that protects environmental resources and minimizes adverse impacts to the groundwater regime. The measures and procedures to handle this material are discussed in Section 20 (Mining Operations) and Section 34 (Post-Reclamation Topography). The groundwater monitoring plan, presented in Section 42 (Monitoring, Maintenance, Inspections, and Examinations), has been developed to monitor changes in the quantity and quality of the groundwater resource during mining and subsequent reclamation. Baseline groundwater sampling, presented in Section 18 (Water Resources), indicated the potential use of groundwater, i.e., livestock watering, within and adjacent to the permit area is limited due low permeability and yield and poor water quality. The potential use of groundwater in the reclaimed area will also be negligible due to the low yield and water quality, as discussed in Section 41 (Probable Hydrologic Consequences).

Groundwater model simulations presented in Section 41 (Probable Hydrologic Consequences) show groundwater changes expected from mining and reclamation activities. Removal of the interbedded strata by mining and the replacement with a more uniform and isotropic backfill material results in a lower water table in the backfilled spoil relative to pre-mining, but higher potentiometric conditions at the base of the backfilled pit. The steady-state heads in the mine spoil are much more uniform with depth, in comparison with the large vertical gradients and perched groundwater prior to mining.

Resaturated mine backfill will develop as a result of recharge from precipitation, lateral inflow from the coals and interburden of the Fruitland Formation, and upward flow from the Pictured Cliffs Sandstone (PCS) formation. Although modeled backfill recharge rates were estimated to be twice the pre-mine rate, model results indicate that it may take as long as 1,000 years for groundwater levels to recover in the backfill to a steady-state condition. Recovery rates may actually be slower if the post-reclamation recharge rates are closer to the pre-mine rates. Groundwater flow will be predominantly toward the backfilled mine pit as water levels recover in the backfill (Section 41, Probable Hydrologic Consequences). Once water levels rise sufficiently in the mine backfill, groundwater will flow at a very slow rate from the backfill into the lower coal seams of the Fruitland Formation, into the PCS, and toward the topographic lows along the alluvial channels of the Cottonwood Arroyo (Section 41, Probable Hydrologic Consequences).

Transport simulation modeling results, presented in Section 41 (Probable Hydrologic Consequences) show several flow paths from backfilled pits with most of the flow vertical to PCS, a minor amount of flow downdip through the unmined coals and shales of the Fruitland Formation, and some flow through alluvium of Cottonwood Arroyo. Background total dissolved solids (TDS) concentrations in PCS are similar to, if not higher than, the TDS levels expected for spoil water. Thus, the primary direction for spoil water migration is into a water-bearing zone that has higher TDS concentrations. Groundwater in the mine spoils, after reclamation, is predicted to have higher concentrations of TDS than the pre-mine Fruitland Formation and Cottonwood Arroyo alluvium. However, the TDS concentrations in the alluvium of Cottonwood Arroyo are not expected to increase significantly a result of mining because the contribution from spoil water is much smaller than the contribution from alluvial recharge and upgradient alluvial flows. The estimated increase in TDS concentrations within the alluvium is within the variation of the measured baseline concentrations. Likewise, the TDS concentrations in the alluvium of Cottonwood Arroyo would not be expected to increase significantly in the event that the TDS concentrations in spoil water are higher than predicted (Section 41 Probable Hydrologic Consequences).

The primary factor controlling the fate and transport of water in mine spoils is the extremely low rate of flow from the mine backfill that will occur as a result of the low recharge rates and low hydraulic conductivity of the mine backfill. Based on these results, mining is estimated to have little effect on the long-term post-reclamation TDS concentrations in the groundwater in the PCS and the alluvium of Cottonwood Arroyo down gradient of the mine areas (Section 41, Probable Hydrologic Consequences). Groundwater flow from the mine backfill will be insufficient to sustain intermittent or perennial baseflow in streams or flow at seeps and springs.

Surface Water Protection and Monitoring

The surface water monitoring plan, presented in Section 42 (Monitoring, Maintenance, Inspections, and Examinations), has been developed to monitor changes in the quantity and quality of the surface water resources during mining and reclamation activities. The fluvial geomorphic and traditional reclamation approaches utilized in the permit area will replicate the pre-mine landscape and reduce surface erosion and sediment yield to less than or equal to pre-mine conditions. The fluvial geomorphic and traditional reclamation approaches are discussed in Section 34 (Post-Mining Topography) and Section 38 (Post-

Reclamation Surface Stabilization and Sediment Control). Post-reclamation sedimentology is discussed in Section 41 (Probable Hydrologic Consequences). BNCC will use a combination of the BTCA measures and BMPs, presented in Section 25 (Sediment Control and Section) and Section 38 (Post-Reclamation Surface Stabilization and Sediment Control), to control sediment and maintain water quality.

Surface materials unsuitable for plant growth will be placed in mined-out areas and handled in a manner that protects environmental resources and minimizes adverse surface water impacts. The measures and procedures to handle this material are discussed in Section 20 (Mining Operations) and Section 34 (Post-Reclamation Topography).

<u>Acid and Toxic-Forming Materials</u>

The handling of PATFM will be conducted in a manner to prevent adverse impacts to surface water and groundwater is presented in Section 20 (Mining Operations) and Section 34 (Post-Reclamation Topography).

<u>Transfer of Wells</u>

Upon completion of mining, all wells will become the property of the Navajo Nation, as specified in BNCC's lease agreement. Any wells that the Navajo Nation does not want to maintain will be removed and the area reclaimed. Further discussion on the removal and retention of wells in the post-reclamation landscape is provided in Section 32 (Temporary Structures and Facilities Removal and Reclamation) and Section 33 (Post-Reclamation Roads, Building, Facilities, and Other Structures), respectively.

<u>Water Rights and Replacement</u>

The protection and replacement of water rights of present users is discussed in Section 35.5.

<u>Discharges Into an Underground Mine</u>

No underground mining is anticipated within the permit area, therefore, the potential for discharges to an underground mine does not exist.

<u>Post-mining Land Use</u>

Area disturbed by mining will be reclaimed to a grazing post-mining land use (PMLU) that is consistent with the pre-mining land use, described in Section 30 (Post-Reclamation Land Use) and Section 10 (Land Use), respectively. The reclamation of the area will be accomplished in a manner to minimize disturbance of the hydrologic balance within and adjacent to the permit area and prevent material damage to the hydrologic balance outside of the permit area. This will be accomplished by following methods and procedures described in the operation plan, sediment control plan, reclamation plan and monitoring plans found in Sections 20 through 23, Sections 25 through 26, Sections 30 through 39, and Section 42, respectively, of this PAP.

35.8 Alluvial Valley Floor Reclamation Plan

OSM has determined that there are no alluvial valley floors present within or adjacent to the permit area. Therefore, this section is not applicable. The negative alluvial valley floor determination is provided in Section 19 (Alluvial Valley Floors).

35.9 Hydrologic Reclamation Plan Information Collection and Analysis

Fluvial geomorphic principles presented in the surface stabilization plan in Section 38 (Post-Reclamation Surface Stabilization and Sediment Control) and Natural Regrade with Geofluv™ software were used to develop the channel designs presented in the hydrologic reclamation plan. Model inputs for the reconstruction designs are included in Appendix 34.A.

SEDCAD modeling for the operational and post-reclamation channel designs is contained in Appendix 41.C and Appendix 41.D, respectively, with baseline channel modeling contained in Appendix 18.B. The subwatershed information was developed using Carlson Civil Suite 2008, AutoCAD®, and ArcGIS® software. The base mapping used to develop subwatersheds is a combination of 10-feet-contoured aerial flight and digital elevation model (DEM) data of United States Geologic Survey (USGS) 7.5 minute topographic quadrangle maps (NMRGIS 2009; USGS 2009). All DEM analysis was performed utilizing the Spatial Analyst extension for ArcGIS® on DEM images projected to the North American Datum of 1927 State Plane New Mexico West coordinate system and in standard units (feet) of measure. Soils information for the SEDCAD modeling came from detailed baseline surveys, presented in Section 14 (Soil), of the permit area and Natural Resources Conservation Service surveys (Keetch 1980) of the adjacent areas outside of the permit area. Underlying assumptions that form the basis of all SEDCAD modeling are presented in Section 38 (Post-Reclamation Surface Stabilization and Sediment Control).

35.10 Certification of Designs and Exhibits

Certified exhibits for this section of the PAP are available for review upon request at either BNCC's offices or OSM, Western Region, technical office in Denver, Colorado. Certified as-built drawings will be kept on file at the mine site and made available upon request.

Personnel

Persons or organizations responsible for data collection, analysis, and preparation of this permit application package section:

Ron Van Valkenburg	Norwest Corporation

Kent Applegate — Denver, Colorado

Matt Owens

BHP Navajo Coal Company

References

Hanson, G. J., K. M. Robinson, and K. R. Cook. 2001. Prediction of Headcut Migration Using a Deterministic Approach. Transactions of the ASAE. Vol. 44(3):525–531.

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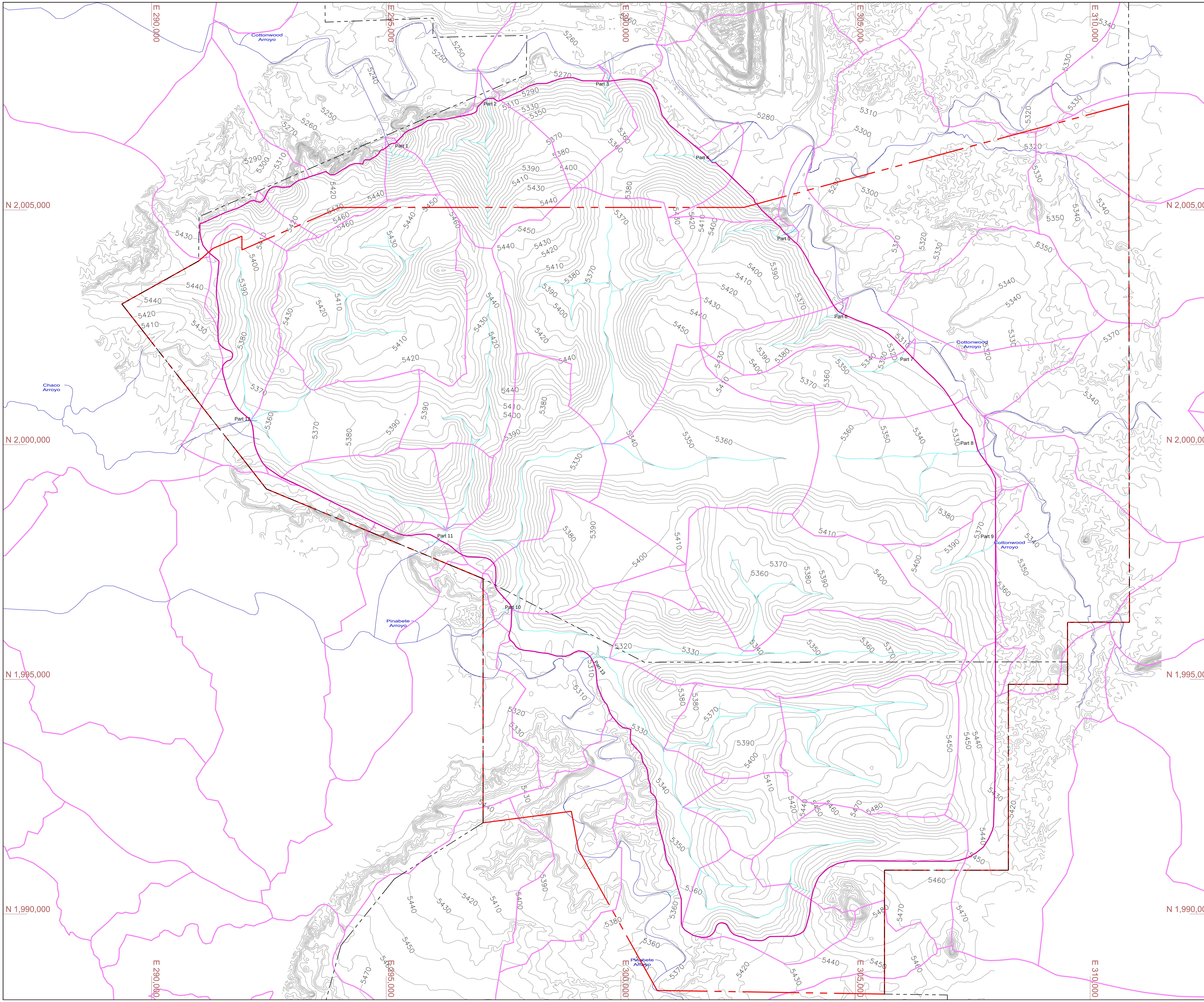


LEGEND

- PERMIT BOUNDARY
- LEASE BOUNDARY
- GRADING LIMIT
- WATERSHED BOUNDARY
- EXISTING DRAINAGE
- 5320 FSC CONTOURS
- FSC DRAINAGE LINE

0 600 1200 1800
FEET

CONTOUR INTERVAL: 10'

Original certified signed exhibits are maintained at the mine site and at OSM.

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE'D BY	E.Q.	P.E.	DATE CERTIFIED
12-A	Mar 2012	NL	PREPARED FOR SUBMITTAL TO OSM	NL			

APPROVALS

CERTIFICATION STATEMENT

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

PAUL J. KOS NEW MEXICO 18889 LICENSED PROFESSIONAL ENGINEER

3-29-2012

EXHIBIT 35.2-1

BHP NAVAJO COAL COMPANY

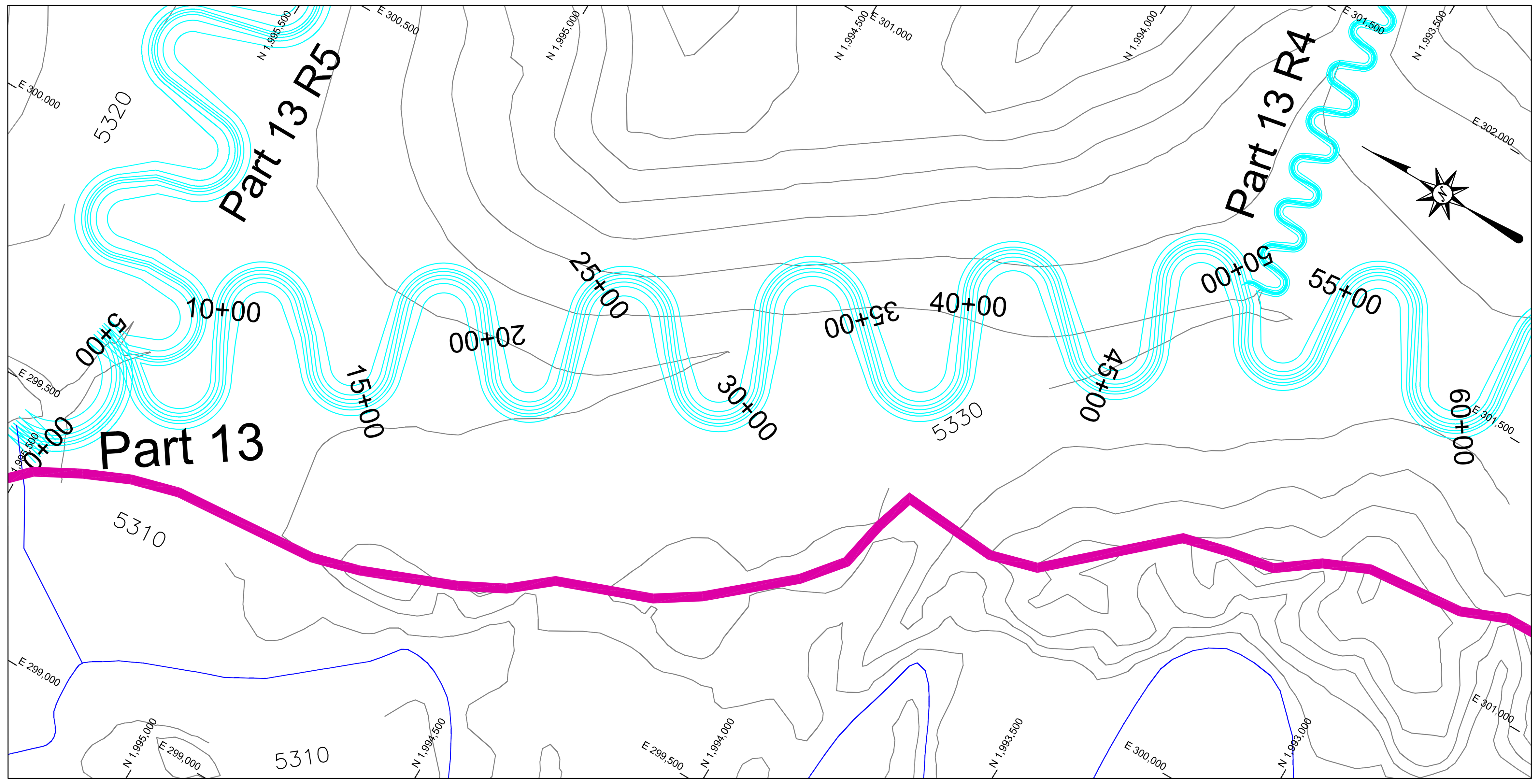
bhpbilliton

P.O. BOX 1717
FRUITLAND, NEW MEXICO 87416

PHONE (505) 598-4200
Fax (505) 598-4229

PINABETE PERMIT STREAM CHANNELS AND WATERSHEDS

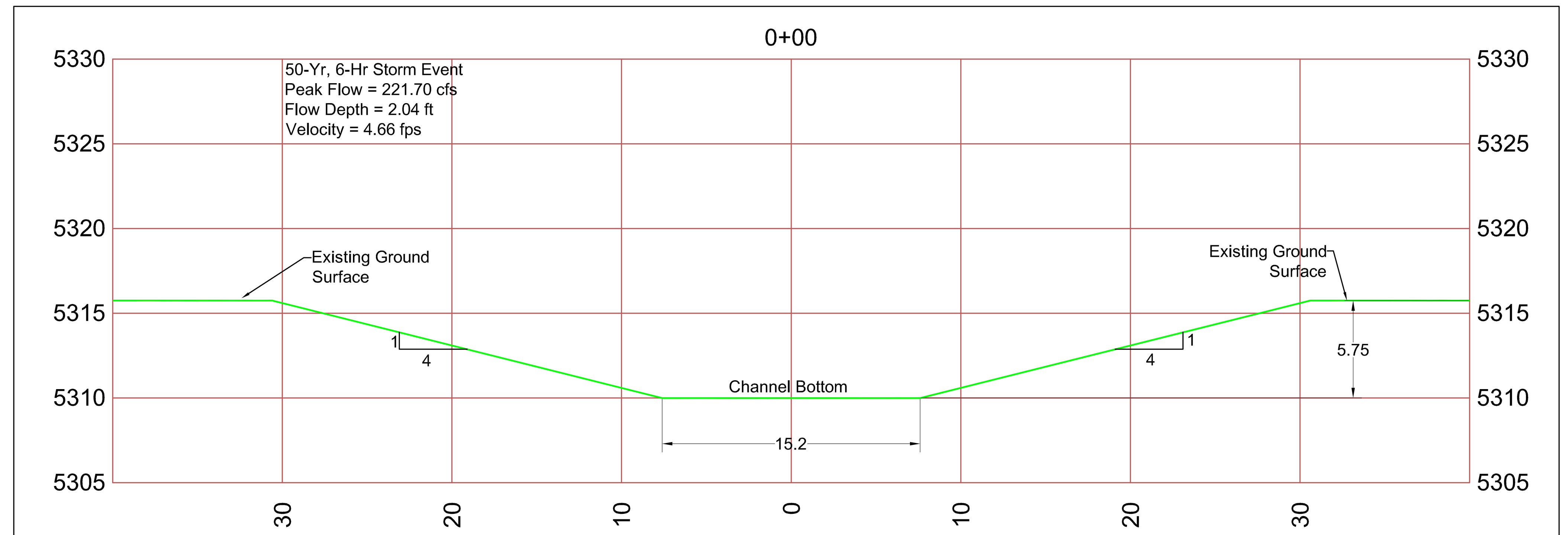
PREPARED BY NL	DRAWN BY NL	SCALE: 1" = 600'
APPROVED BY	DATE 03/29/2012	



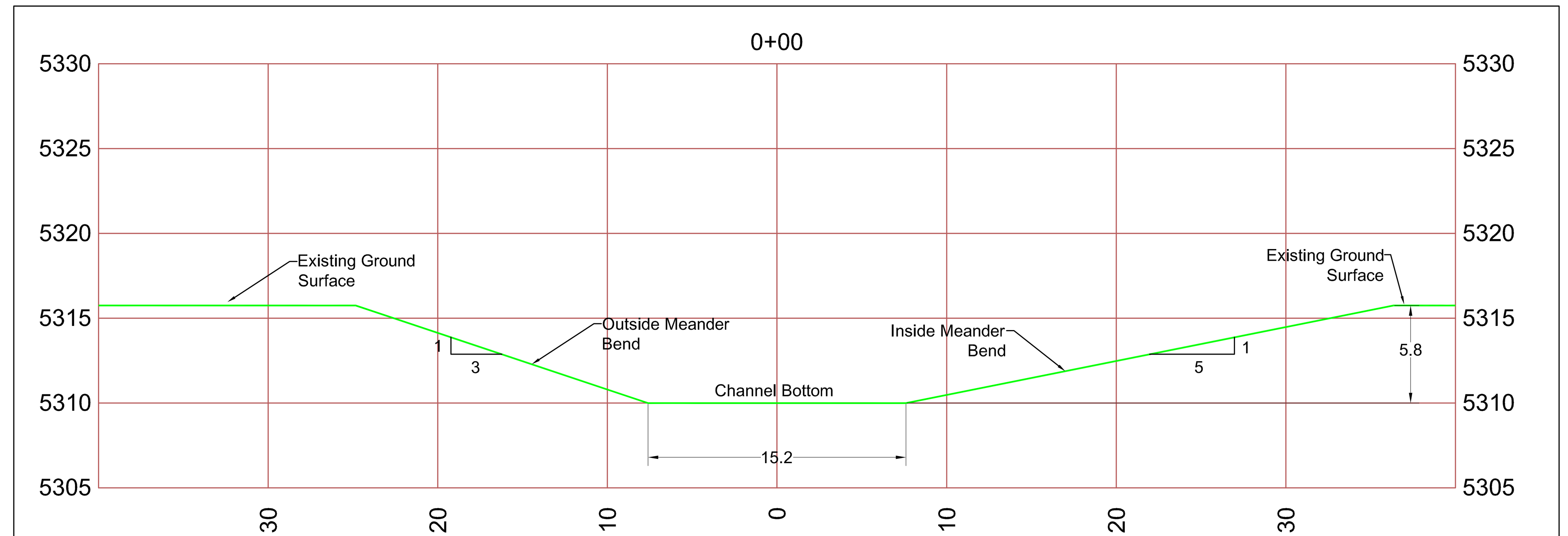
SCALE: 1" = 200'

PART 13 MAIN CHANNEL PLAN VIEW

NOTE: PRIOR TO CONSTRUCTION, DESIGN CONTOURS WILL BE MODIFIED TO ACCOMODATE CHANNEL MEANDERS.

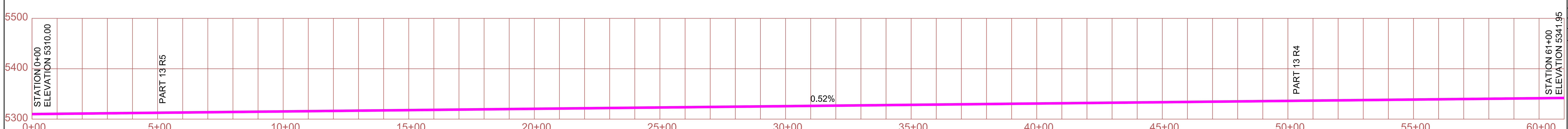


TYPICAL CHANNEL SECTION
NTS



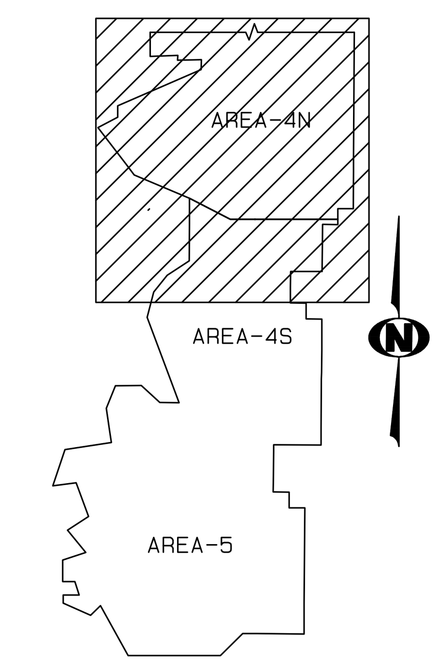
TYPICAL MEANDER SECTION
NTS

NOTE:
CHANNEL BOTTOM WIDTH RANGES FROM 15.2 FT AT STA 0+00 TO 13.6 FT AT STA 61+00.
CHANNEL DEPTH RANGES FROM 5.75 FT AT STA 0+00 TO 5.16 FT AT STA 61+00.



Horizontal: 1" = 200'
Vertical : 1" = 100'

PART 13 MAIN CHANNEL PROFILE



Original certified signed exhibits are maintained at the mine site and at OSM.

PREPARED FOR SUBMITTAL TO OSM

CERTIFICATION STATEMENT

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

PAUL J. KOS NEW MEXICO 18889 LICENSED PROFESSIONAL ENGINEER

3-29-2012

EXHIBIT 35.2-2

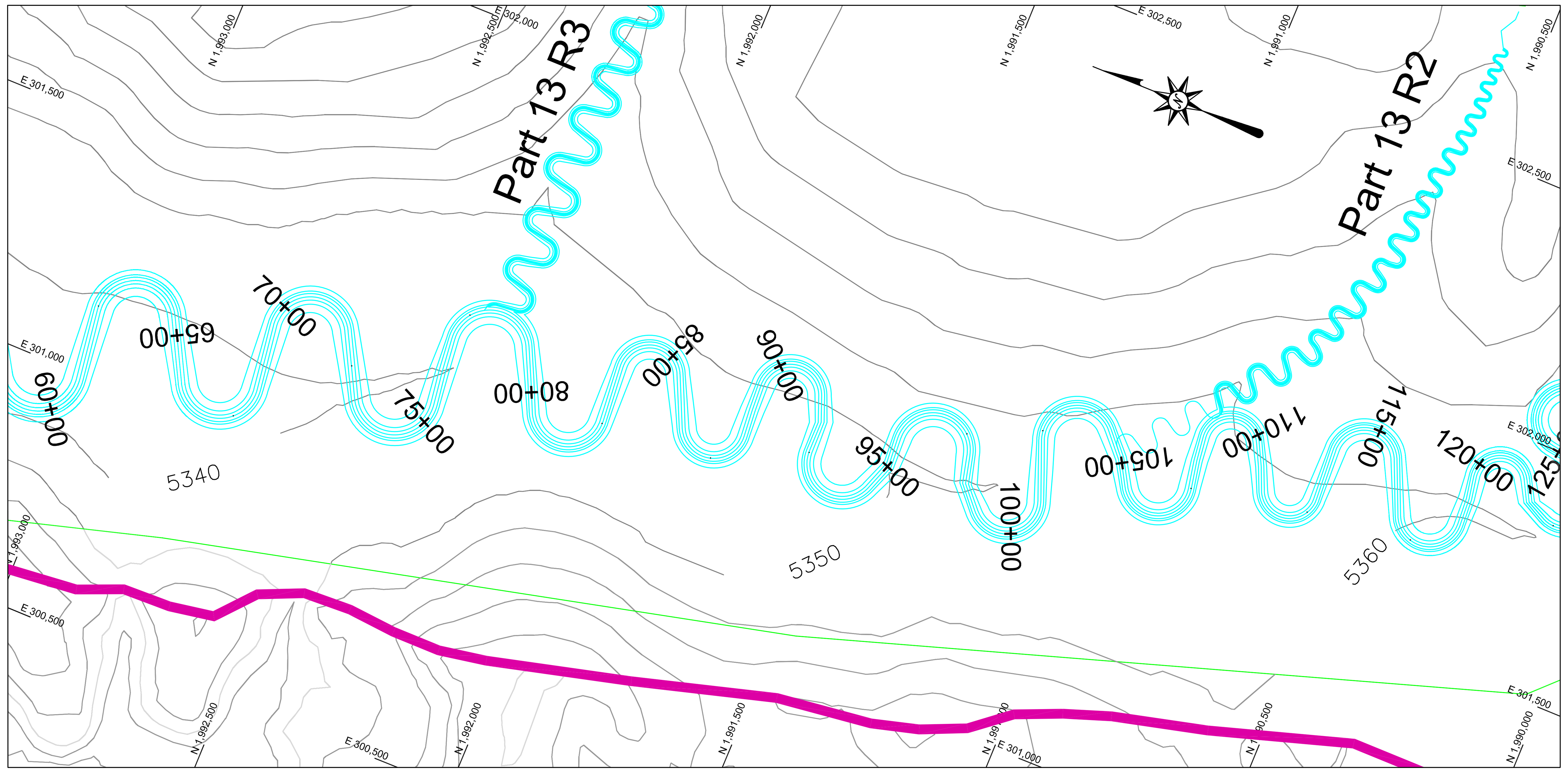
bhpbilliton

BHP Navajo Coal Company

P.O. Box 1717 Fruitland, New Mexico 87416

PINABETE PERMIT
PART 13 MAIN CHANNEL
RECONSTRUCTED GEOFLUV DESIGN

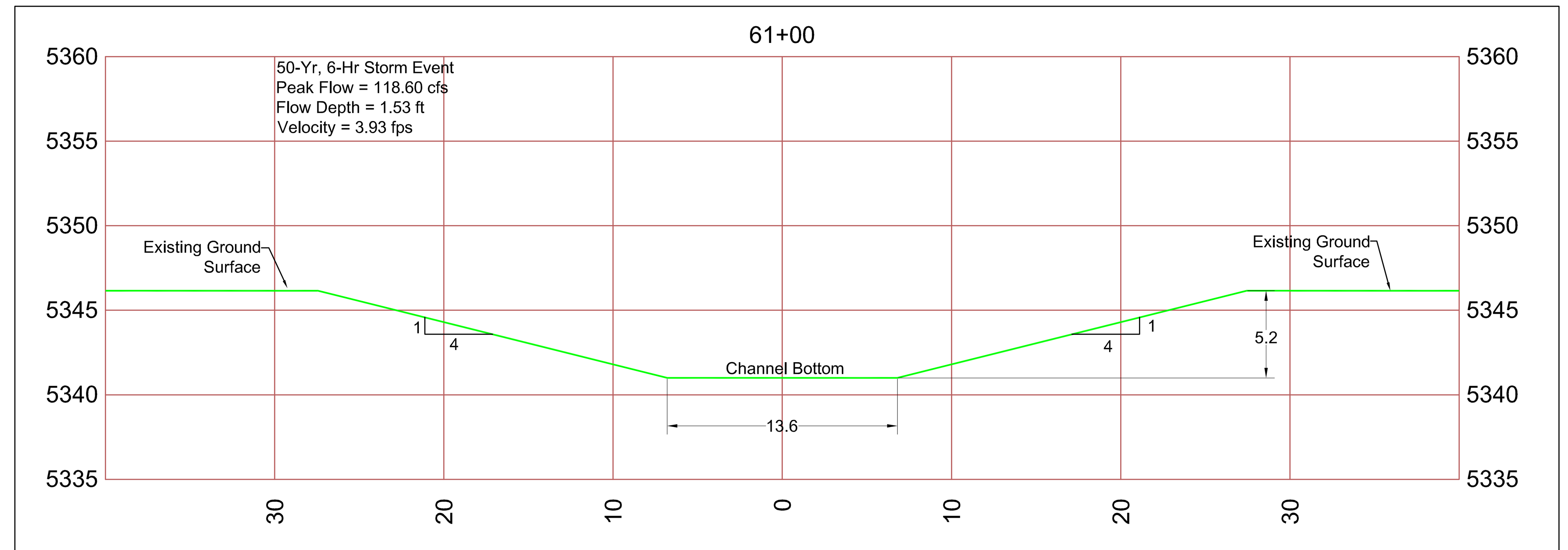
PREPARED BY KW | DRAWN BY KW | SCALE: AS NOTED
APPROVED BY | DATE 03/29/2012 | SHEET 1 OF 4



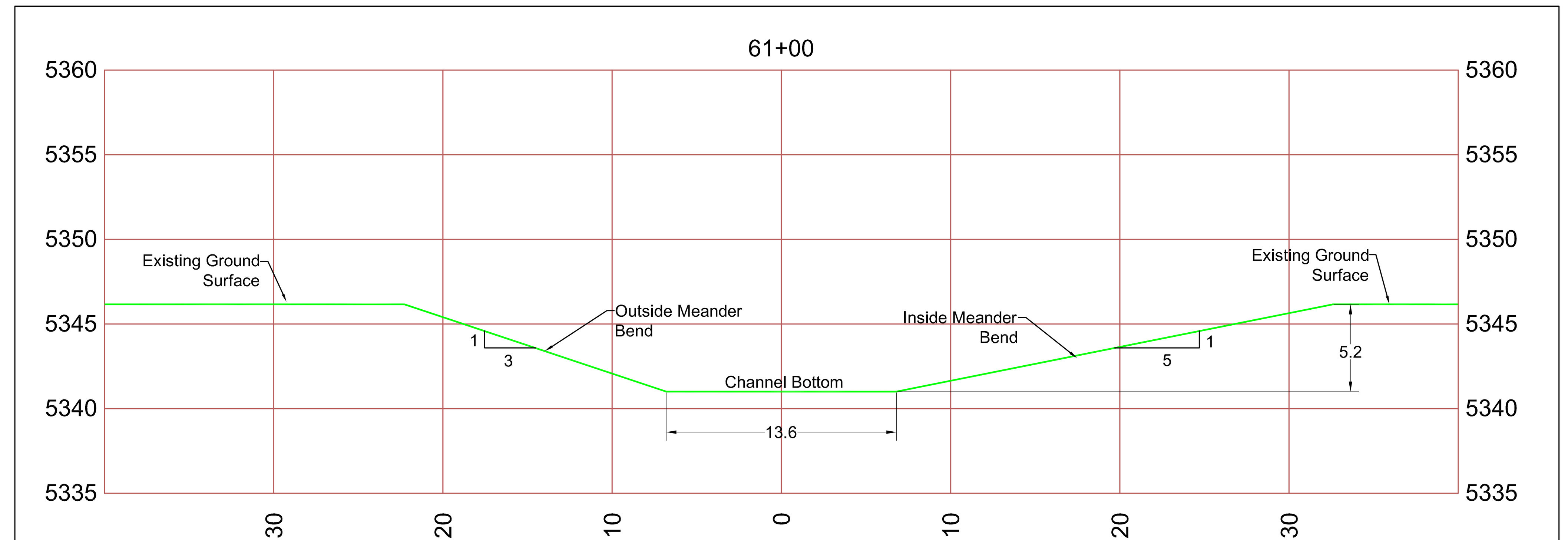
SCALE: 1" = 200'

PART 13 MAIN CHANNEL PLAN VIEW

NOTE: PRIOR TO CONSTRUCTION, DESIGN CONTOURS WILL BE MODIFIED TO ACCOMODATE CHANNEL MEANDERS.

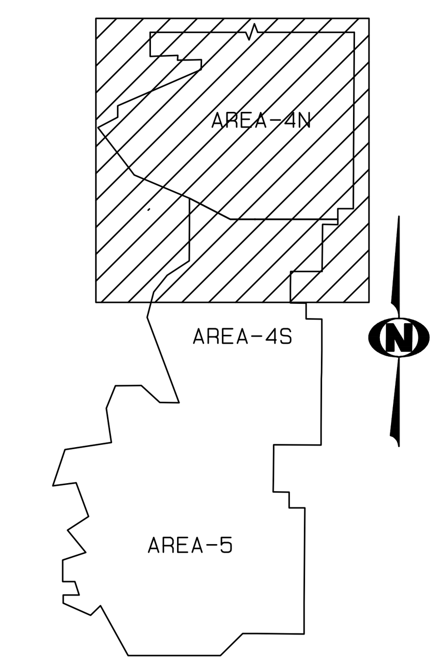


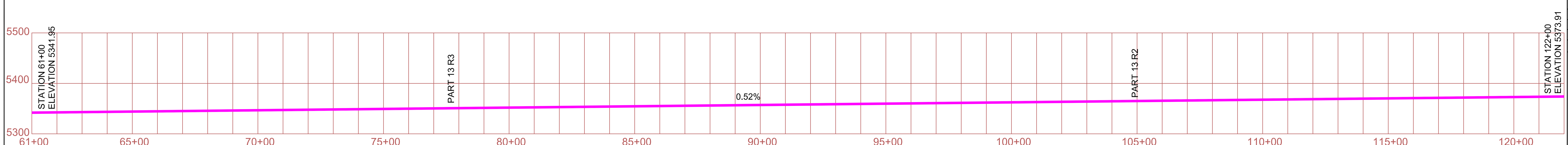
TYPICAL CHANNEL SECTION
NTS



TYPICAL MEANDER SECTION
NTS

NOTE:
CHANNEL BOTTOM WIDTH RANGES FROM 13.6 FT AT STA 61+00 TO 10.8 FT AT STA122+00.
CHANNEL DEPTH RANGES FROM 5.16 FT AT STA 61+00 TO 4.11 FT AT STA 122+00.





Horizontal: 1" = 200'
Vertical : 1" = 100'

PART 13 MAIN CHANNEL PROFILE

Original certified signed exhibits are maintained at the mine site and at OSM.

CERTIFICATION STATEMENT

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

PAUL J. KOS NEW MEXICO 18889 LICENSED PROFESSIONAL ENGINEER

3-29-2012

EXHIBIT 35.2-2

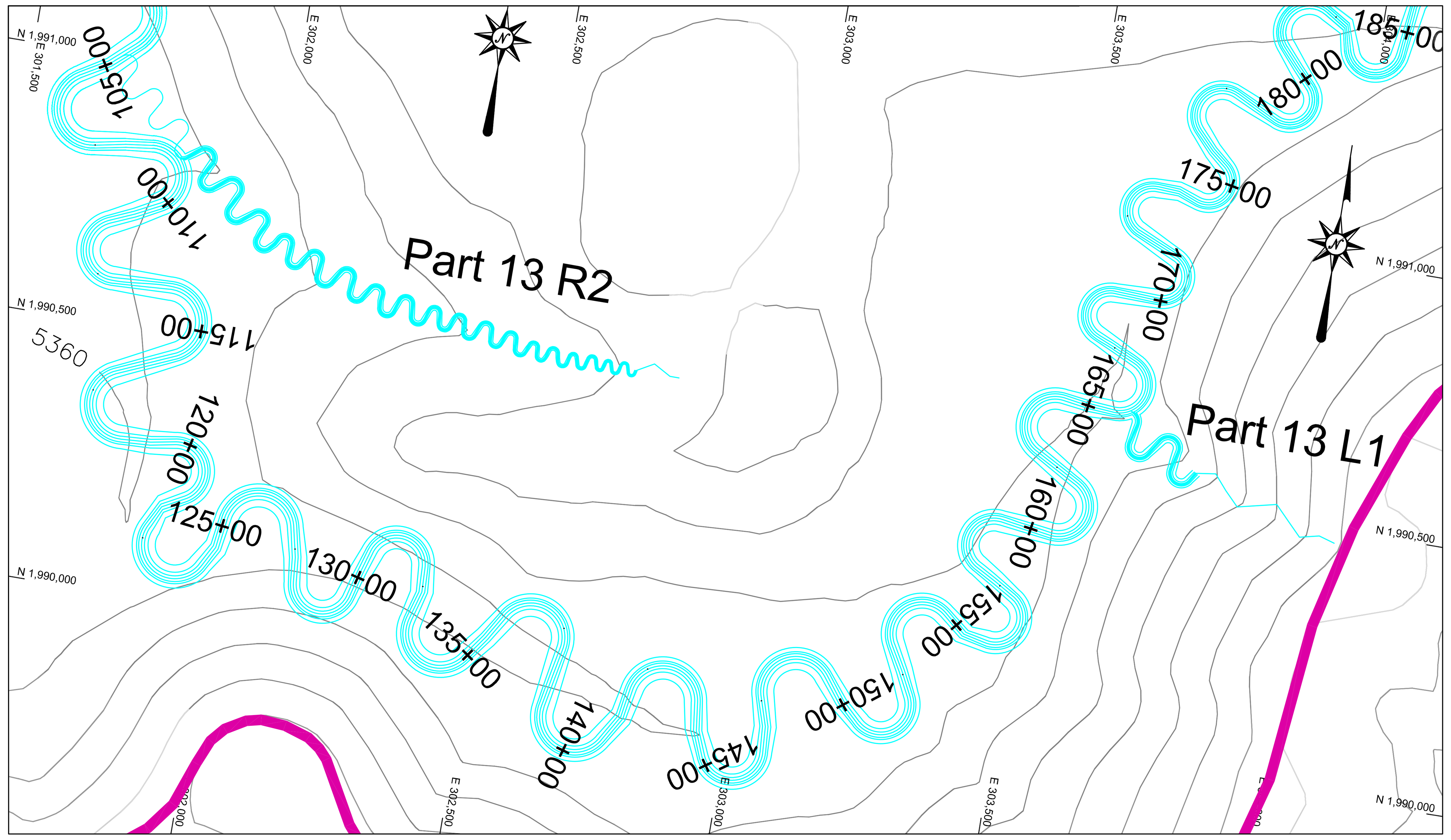
bhpbilliton

BHP Navajo Coal Company

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

PINABETE PERMIT
PART 13 MAIN CHANNEL
RECONSTRUCTED GEOFLUV DESIGN

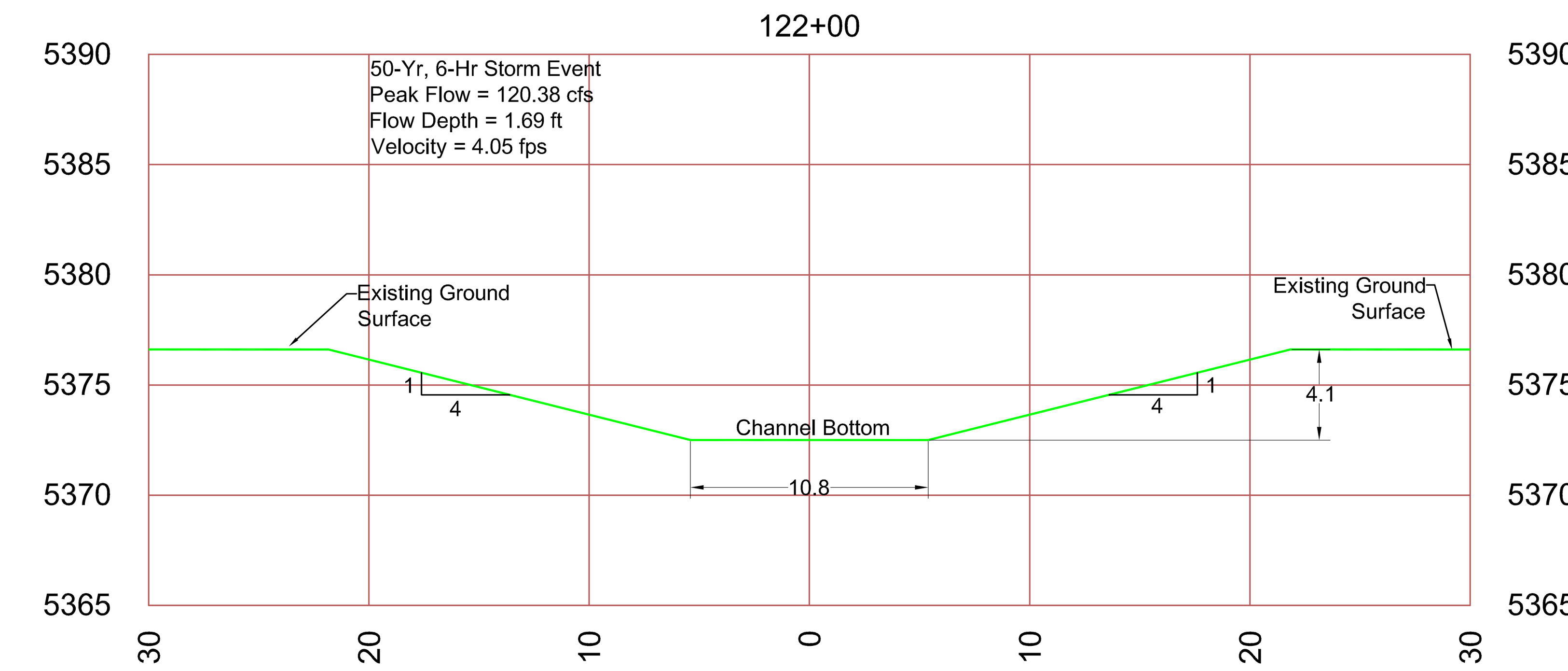
PREPARED BY KW	DRAWN BY KW	SCALE: AS NOTED	
APPROVED BY	DATE 03/29/2012	SHEET 2 OF 4	



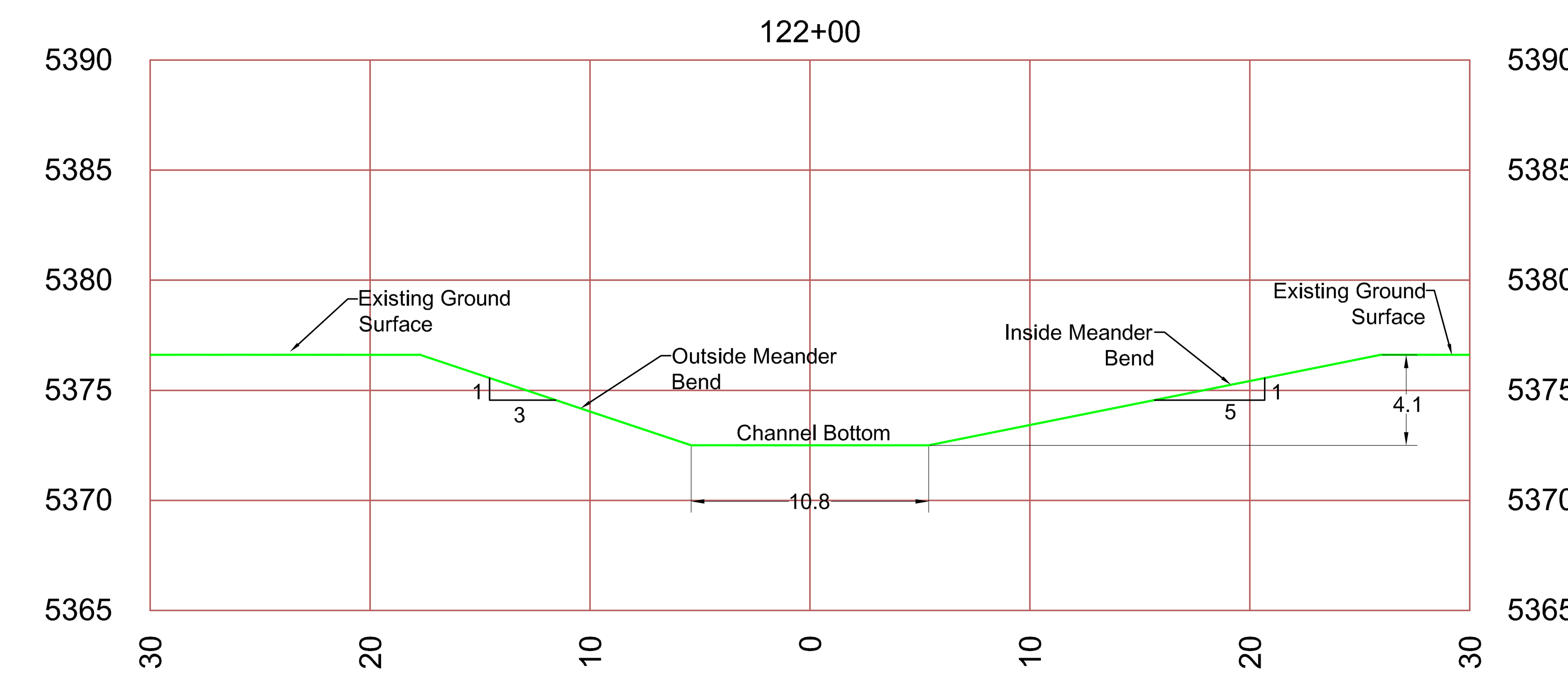
SCALE: 1" = 200'

PART 13 MAIN CHANNEL PLAN VIEW

NOTE: PRIOR TO CONSTRUCTION, DESIGN CONTOURS WILL BE MODIFIED TO ACCOMODATE CHANNEL MEANDERS.

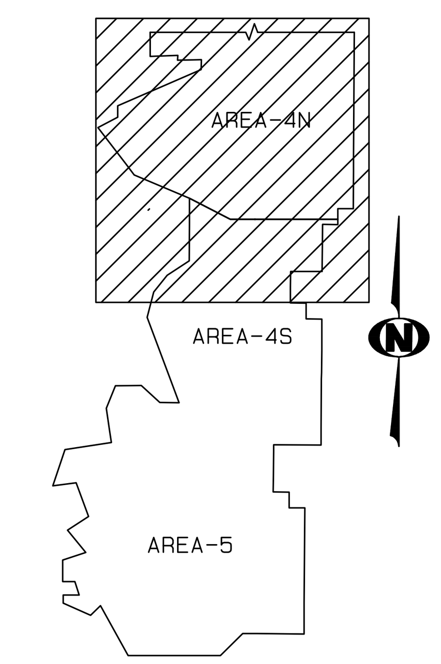


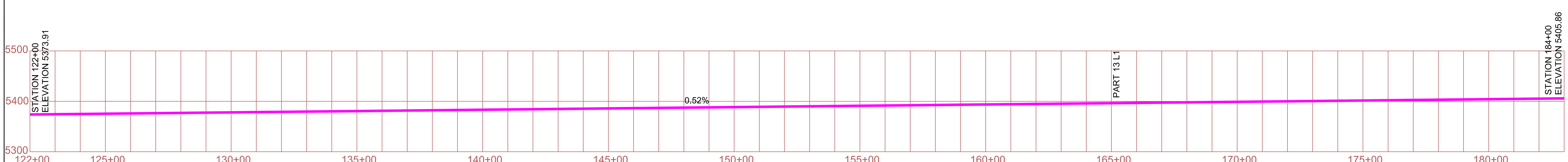
TYPICAL CHANNEL SECTION
NTS



TYPICAL MEANDER SECTION
NTS

NOTE:
CHANNEL BOTTOM WIDTH RANGES FROM 10.8 FT AT STA 122+00 TO 8.6 FT AT STA 184+00.
CHANNEL DEPTH RANGES FROM 4.11 FT AT STA 122+00 TO 3.24 FT AT STA 184+00.





Horizontal: 1" = 200'
Vertical : 1" = 100'

PART 13 MAIN CHANNEL PROFILE

Original certified signed exhibits are maintained at the mine site and at OSM.

CERTIFICATION STATEMENT

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PAUL J. KOS NEW MEXICO 18889 LICENSED PROFESSIONAL ENGINEER

3-29-2012

EXHIBIT 35.2-2

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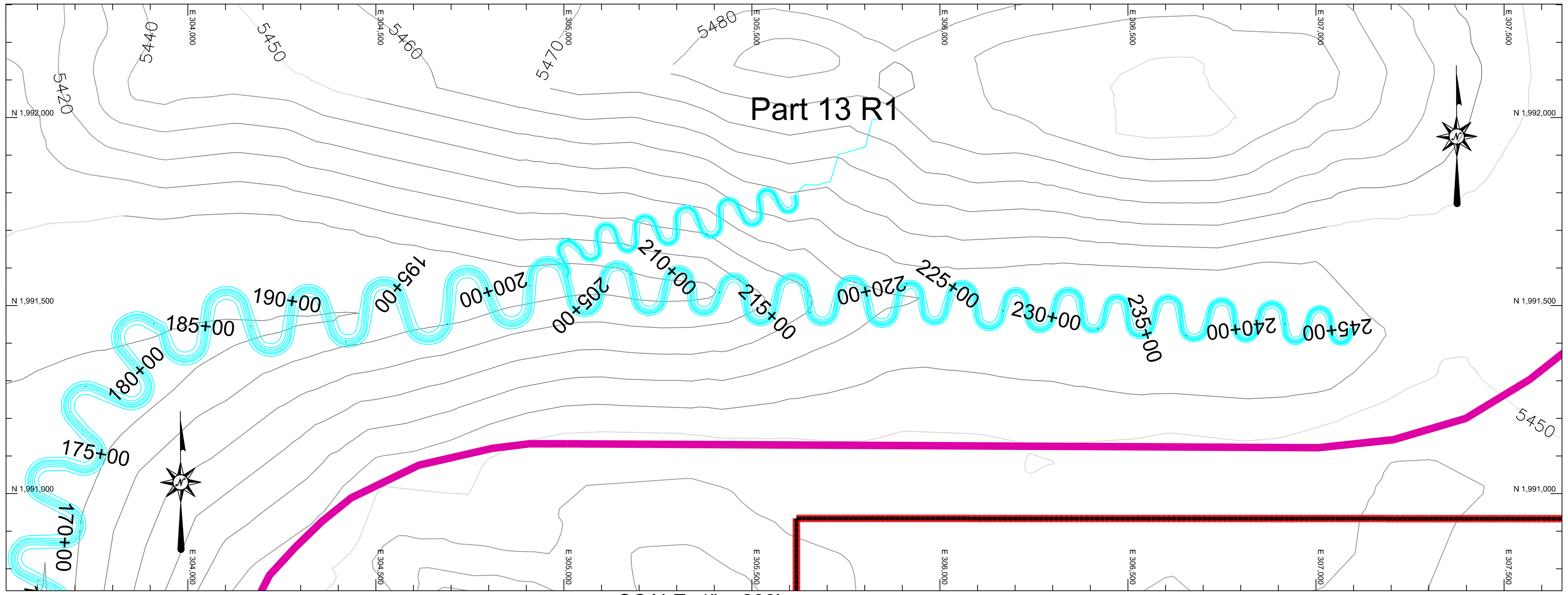
Fruitland,New Mexico,87416
Phone: 505-598-4200
Fax: 505-598-3361

PINABETE PERMIT
PART 13 MAIN CHANNEL
RECONSTRUCTED GEOFLUV DESIGN

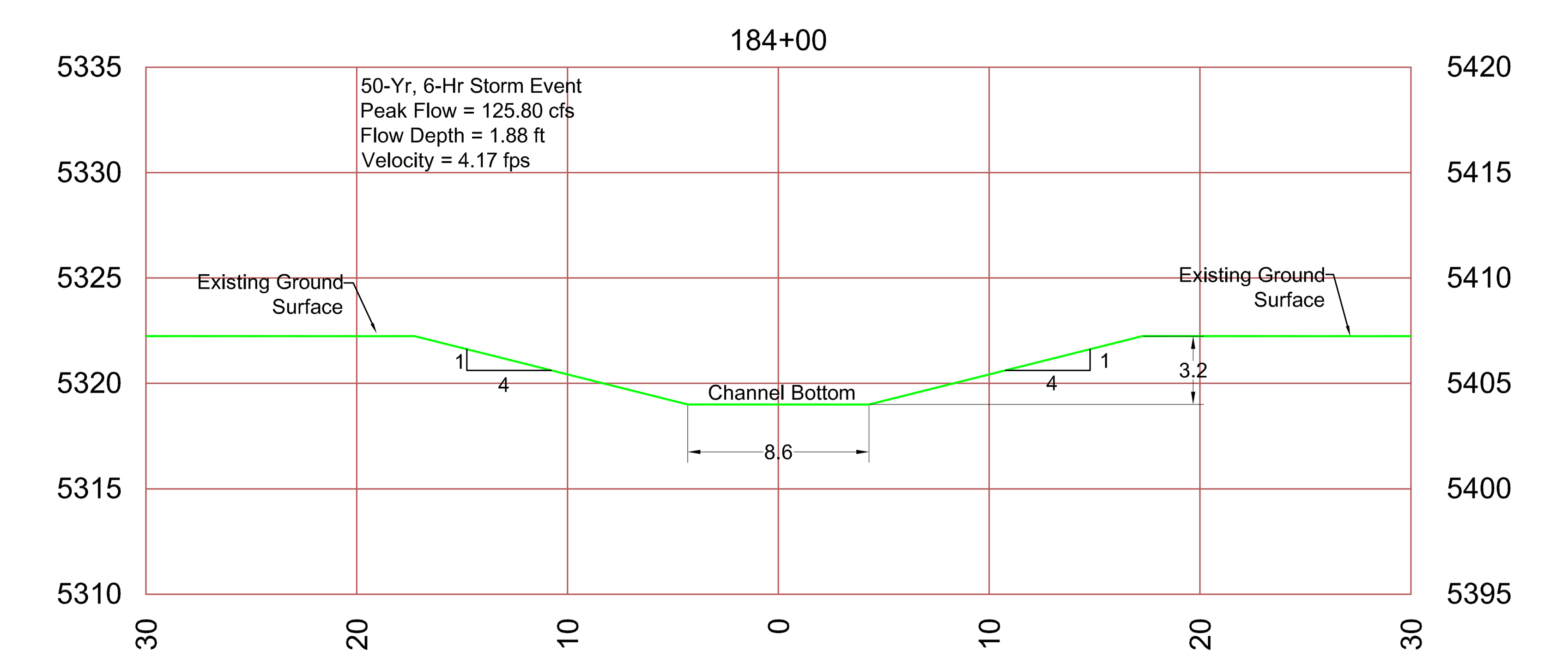
PREPARED BY KW	DRAWN BY KW	SCALE: AS NOTED
APPROVED BY	DATE 03/29/2012	SHEET 3 OF 4



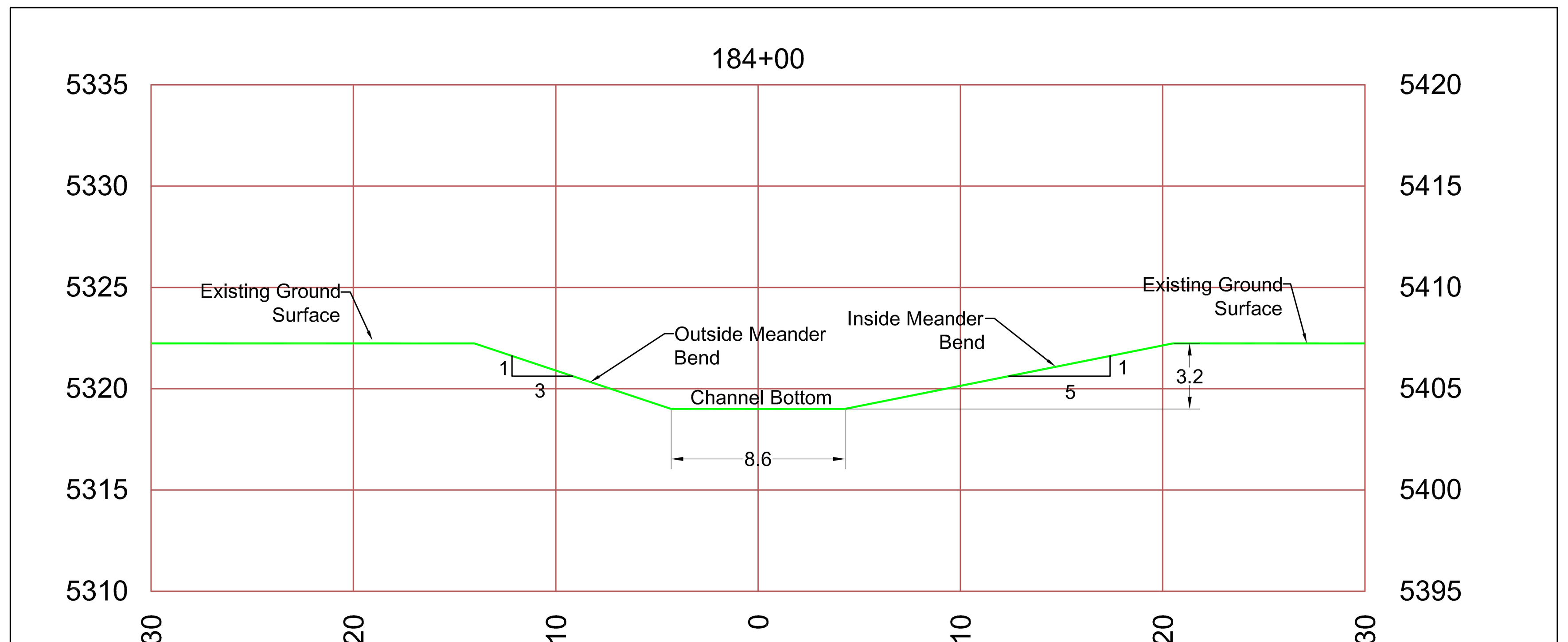
SCALE: 1" = 200'

PART 13 MAIN CHANNEL PLAN VIEW

NOTE: PRIOR TO CONSTRUCTION, DESIGN CONTOURS WILL BE MODIFIED TO ACCOMODATE CHANNEL MEANDERS.

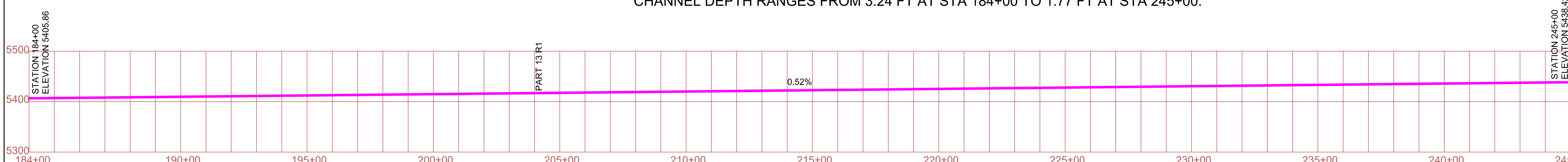


TYPICAL CHANNEL SECTION NTS



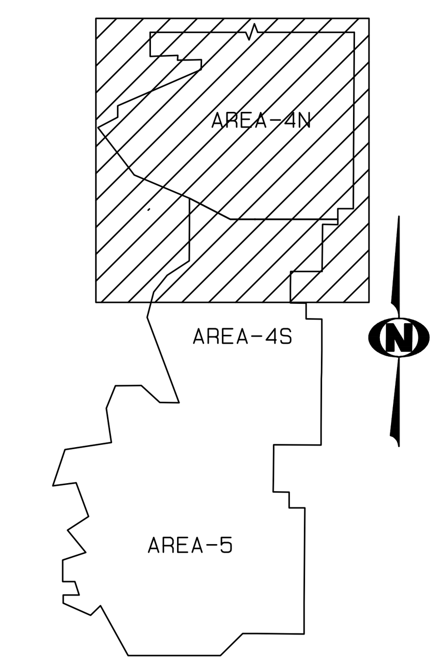
TYPICAL MEANDER SECTION NTS

NOTE:
CHANNEL BOTTOM WIDTH RANGES FROM 8.6 FT AT STA 184+00 TO 4.7 FT AT STA 245+00.
CHANNEL DEPTH RANGES FROM 3.24 FT AT STA 184+00 TO 1.77 FT AT STA 245+00.



Horizontal: 1" = 200'
Vertical : 1" = 100'

PART 13 MAIN CHANNEL PROFILE



Original certified signed exhibits are maintained at the mine site and at OSM.

PREPARED FOR SUBMITTAL TO OSM

REV. NO. | DATE | DRAFT BY | REVISION DESCRIPTION | ENG | E.Q. | P.S. | APPROVALS

CERTIFICATION STATEMENT

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

PAUL J. KOS NEW MEXICO 18889 LICENSED PROFESSIONAL ENGINEER

3-29-2012

EXHIBIT 35.2-2

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

PINABETE PERMIT
PART 13 MAIN CHANNEL
RECONSTRUCTED GEOFLUV DESIGN

PREPARED BY KW | DRAWN BY KW | SCALE: AS NOTED
APPROVED BY | DATE 03/29/2012 | SHEET 4 OF 4

Appendix 35.A

SEDCAD Model Results for Pinabete Tributary Part 13

Pinabete Post Mine Tributrary "Part 13"

50-year, 6-hour storm event 1.76 inches

Art O'Hayre

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	50 yr - 6 hr
Rainfall Depth:	1.760 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#7	0.618	0.280	Sta 60+00 S8 SW13b
Channel	#2	==>	#1	0.568	0.280	Sta 120+00 S8 SW8
Channel	#3	==>	#2	0.617	0.280	Sta 180+00 S8 SW 9
Null	#4	==>	#1	0.494	0.280	S8 SW12
Null	#5	==>	#7	0.618	0.280	S8 SW14
Null	#6	==>	#5	0.314	0.276	S8 SW10
Channel	#7	==>	End	0.000	0.000	Sation 0+00 SA SW13a

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	0.52	25.00	4,807.69	2.16	0.618
#1	**Muskingum K:**					**0.618**
#2	8. Large gullies, diversions, and low flowing streams	0.52	22.98	4,420.00	2.16	0.568
#2	**Muskingum K:**					**0.568**
#3	8. Large gullies, diversions, and low flowing streams	0.52	24.96	4,800.00	2.16	0.617
#3	**Muskingum K:**					**0.617**
#4	8. Large gullies, diversions, and low flowing streams	0.52	20.00	3,846.15	2.16	0.494
#4	**Muskingum K:**					**0.494**

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	8. Large gullies, diversions, and low flowing streams	0.52	25.00	4,807.69	2.16	0.618
#5	**Muskingum K:**					**0.618**
#6	7. Paved area and small upland gullies	1.09	26.00	2,380.08	2.10	0.314
#6	**Muskingum K:**					**0.314**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6	221.000	221.000	142.75	8.06
#5	90.000	311.000	146.49	11.35
#4	64.000	64.000	49.92	2.35
#3	197.000	197.000	125.80	7.20
#2	112.000	309.000	120.38	11.29
#1	72.200	445.200	118.60	16.28
#7	57.800	814.000	221.70	29.74

Structure Detail:

Structure #6 (Null)

S8 SW10

Structure #5 (Null)

S8 SW14

Structure #4 (Null)

S8 SW12

Structure #3 (Erodible Channel)

Sta 180+00 S8 SW 9

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

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)
8.60	4.0:1	4.0:1	0.5	0.0300				5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	125.80 cfs	
Depth:	1.88 ft	
Top Width:	23.60 ft	
Velocity:	4.17 fps	
X-Section Area:	30.19 sq ft	
Hydraulic Radius:	1.255 ft	
Froude Number:	0.65	

Structure #2 (Erodible Channel)

Sta 120+00 S8 SW8

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

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)
10.80	4.0:1	4.0:1	0.5	0.0300				5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	120.38 cfs	
Depth:	1.69 ft	
Top Width:	24.34 ft	
Velocity:	4.05 fps	
X-Section Area:	29.74 sq ft	
Hydraulic Radius:	1.201 ft	
Froude Number:	0.65	

Structure #1 (Erodible Channel)

Sta 60+00 S8 SW13b

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

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)
13.60	4.0:1	4.0:1	0.5	0.0300				5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	118.60 cfs	
Depth:	1.53 ft	
Top Width:	25.84 ft	
Velocity:	3.93 fps	
X-Section Area:	30.16 sq ft	
Hydraulic Radius:	1.151 ft	
Froude Number:	0.64	

Structure #7 (Erodible Channel)

Sation 0+00 SA SW13a

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

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)
15.20	4.0:1	4.0:1	0.5	0.0300				5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	221.70 cfs	
Depth:	2.04 ft	
Top Width:	31.49 ft	
Velocity:	4.66 fps	
X-Section Area:	47.54 sq ft	
Hydraulic Radius:	1.486 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)
#6	1	221.000	0.388	0.000	0.000	83.300	M	142.75	8.061
	Σ	**221.000**						**142.75**	**8.061**
#5	1	90.000	0.301	0.000	0.000	83.300	M	66.06	3.291
	Σ	**311.000**						**146.49**	**11.352**
#4	1	64.000	0.259	0.000	0.000	83.300	M	49.92	2.346
	Σ	**64.000**						**49.92**	**2.346**
#3	1	197.000	0.396	0.000	0.000	83.300	M	125.80	7.197
	Σ	**197.000**						**125.80**	**7.197**
#2	1	112.000	0.412	0.000	0.000	83.300	M	69.91	4.096
	Σ	**309.000**						**120.38**	**11.293**
#1	1	72.200	0.348	0.000	0.000	83.300	M	49.45	2.644
	Σ	**445.200**						**118.60**	**16.283**
#7	1	57.800	0.772	0.000	0.000	83.300	M	23.61	2.107
	Σ	**814.000**						**221.70**	**29.742**

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	5.11	45.00	880.00	2.260	0.108
		8. Large gullies, diversions, and low flowing streams	0.84	20.00	2,380.00	2.750	0.240
#1	**1**	**Time of Concentration:**					**0.348**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	9.90	200.00	2,020.01	3.140	0.178
		8. Large gullies, diversions, and low flowing streams	0.83	19.20	2,307.00	2.730	0.234
#2	**1**	**Time of Concentration:**					**0.412**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.71	80.00	1,400.02	2.390	0.162
		8. Large gullies, diversions, and low flowing streams	0.83	19.20	2,307.00	2.730	0.234
#3	**1**	**Time of Concentration:**					**0.396**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	70.00	1,400.00	2.230	0.174

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.67	40.00	1,500.00	4.890	0.085
#4	**1**	**Time of Concentration:**					**0.259**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	60.00	1,200.00	2.230	0.149
		8. Large gullies, diversions, and low flowing streams	1.81	40.20	2,216.00	4.040	0.152
#5	**1**	**Time of Concentration:**					**0.301**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	60.00	1,200.00	2.230	0.149
		8. Large gullies, diversions, and low flowing streams	1.75	60.00	3,422.11	3.970	0.239
#6	**1**	**Time of Concentration:**					**0.388**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	5.93	80.00	1,350.00	2.430	0.154
		8. Large gullies, diversions, and low flowing streams	0.52	25.00	4,807.69	2.160	0.618
#7	**1**	**Time of Concentration:**					**0.772**