TRI-STATE

March 8, 2021

Ms. Janet Binns
Environmental Protection Specialist
Colorado Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

RE: New Horizon North Mine
Permit No. C-2010-089
Technical Revision No. 24
Water Monitoring Program

Dear Mrs. Binns:

Tri-State Generation and Transmission Association (Tri-State), is the parent company to Elk Ridge Mining and Reclamation, LLC (ERMR) New Horizon North Mine. Therefore, Tri-State on the behalf of the ERMR is submitting technical revision 24 (TR-24) to Permit No. C-2010-089.

With TR-24, Tri-State is proposing several modifications to the water-monitoring program. The Division has the most recent annual hydrology report that was submitted on December 21, 2020. That report contains all surface and groundwater data the Division may need to review TR-24. The monitoring locations proposed to be relinquished and a short justification for each, are described in detail below. The locations of these monitoring sites can also be found on Maps 2.04.5-1, 2.04.7-1, and 2.04.7-10 in Permit No. C-2010-089.

Surface Water – Irrigation Water

On Meehan Draw there are a total of three down gradient and two up gradient surface water monitoring locations. The value of five surface water-monitoring sites on Meehan Draw is not readily apparent, and Tri-State is proposing to relinquish upgradient site SW-N208, which is located on a small tributary to Meehan Draw. Upgradient site SW-N207 will remain in the monitoring program and is an appropriate location to acquire water quality data to continue to define the upgradient condition on Meehan Draw. As for the downgradient condition on Meehan Draw, Tri-State is proposing to retain monitoring of site SW-N202 where Meehan Draw exits the permit boundary. This location also captures discharges from NHN Pond-002 if it was to discharge. Tri-State is proposing to relinquish monitoring of sites SW-N215 and SW-N216, which are further downgradient of site SW-N202. The two sites proposed to be released from monitoring requirements are a duplicate of site SW-N202, and they are also receiving waters that Tri-State does not have any control over, nor is the water they are receiving impacted in any manner by continuing reclamation activities. Retaining site SW-N202 is suitable to continue to evaluate any potential impacts from ongoing reclamation activities, and any potential water long-term impact trends from the mine. Moreover, as stated in Section 2.05.6(3) of the permit, sites SW-N215 and SW-N216 were to be sampled for one year only prior to mining occurring, and for four quarters following reclamation. New Horizon North has collected data from the fourth quarter of 2013 through the fourth quarter of 2020 which is above and beyond the eight quarters (pre/post mining) as required by the permit.

Two surface water sites, SW-N217 and SW-N218, are on the San Miguel River and are both are proposed to be released from the monitoring program. Similar to sites SW-N215 and SW-N216, both of the sites on the San Miguel River were permitted to acquire data for four quarters prior to mining commencing and some samples, the permit is unclear, post mining. Both sites have been monitoring in a much more robust manner than was required as Tri-State has data for both site beginning in second quarter of 2012 through the fourth quarter of 2020. Should there be a need to assess potential impacts to the San Miguel River, an extensive data set is available. Another issue that is presented by continued monitoring of sites SW-N217 and SW-N218 is all of the other surface and ground water influences that may be impacting the San Miguel River from the large watershed that contributes to the river that are not associated with the New Horizon North Mine. Tri-State believes surface water data acquired directly downgradient of the New Horizon North permit boundary provides the best indicators if an impact is occurring, not a vast distance downgradient where there are so many outside factors to consider in a water quality evaluation.

Surface water sites SW-N209 and SW-N210 are representative of irrigation water on the Second Park Lateral upgradient of the New Horizon North Mine. New Horizon North does not have any control of the quality of water delivered by the Colorado Cooperative Ditch Company, and the water delivered and associated quality is utilized by all waters users connected to the Second Park Lateral regardless of the quality of water delivered. There is a healthy data set acquired from monitoring this location over the years, and if the data is needed for an evaluation of revegetation success or other reasons, a data set is available. Tri-State believes there is not any additional value to continue monitoring this location when it cannot control the water quality delivered, nor does continued monitoring provide any additional evaluations of potential mining related impacts. Revegetation success at New Horizon North for the irrigated pastures area is tied to proper management of the irrigated pastures from the application of irrigation water and fertilizers, where appropriate, versus the water quality being delivered by the Colorado Cooperative Ditch Company.

On Tuttle Draw two surface water sites, SW-N1 and SW-N3, are monitored for both New Horizon North Mine and New Horizon Mine (Permit No. C-1981-008). Potential impacts from New Horizon North Mine to Tuttle Draw are extremely limited to potential discharges from NHN Pond-001, which has never discharged to date. NHN Pond-001 is oversized and the vast majority of the reporting watershed is reclaimed and has strong vegetative growth due to the irrigated pasture areas and is nearing the timeframe for Phase II bond release; therefore, the likelihood of any discharge occurring from NHN Pond-001 is exceedingly limited. Any potential impacts to Tuttle Draw, if they were to occur, would be from New Horizon Mine and associated discharges from sediment ponds in that permit area, and not New Horizon North

Mine. Therefore, removing these two sites from New Horizon North monitoring program is prudent, as both sites will continued to be monitoring for New Horizon Mine and potential impacts from that permit area.

New Horizon North Mine currently monitors two spoil springs (SS #1 and SS #2) which are located at the toe of the backfill from the Old Peabody Mine (Nucla Mine). Both are located outside the permit boundary. Data from both sites was used in the original permit application to help determine potential impacts from spoil water for New Horizon North. SS #2 has never discharged since monitoring commenced; therefore, after many years of monitoring it is appropriate to release this site from continued monitoring. As described in the permit, backfill saturation from New Horizon North was predicted to emanate from SS #1 several years after mining commenced. Flows rates from SS #1 have not increased since mining ceased nor post mining during reclamation with irrigation water applied to a large portion of the disturbed area. Therefore, the predicated impact from New Horizon North creating a spoil spring at SS #1 has not occurred, and it is appropriate to stop monitoring this location. Further, the Division nor Tri-State can state with any accuracy that the water discharging from SS #1 is from New Horizon North. Given the location of SS #1 at the toe of the Old Peabody Mine, backfill and flow from this spoil spring has been documented since at least 1987 which is long before any mining was conducted at New Horizon North. Given these facts, any potential impacts from SS #1 are more than likely attached directly to the Old Peabody Mine and not New Horizon North.

Sampling Frequency – Parameters Analyzed

Also proposed under TR-24, is a revised sampling frequency for both surface and groundwater monitoring locations. Currently, New Horizon North acquires field parameters from both surface and ground water on a monthly basis, and samples and laboratory analysis are obtained on a quarterly basis. Due to staffing constraints at a reclaimed mine, and to provide continuity with staffing, Tri-State proposes to remove the monthly field parameters requirement for both surface and groundwater. The field parameters will continue to be gathered quarterly during each sampling event for each surface water site or groundwater well.

Current laboratory parameters analyzed for both surface water and groundwater is extraordinarily robust. As the Division is aware, typical constituents of concern from coal mining operations in the Colorado are typically TSS, pH, manganese, acidity, TDS, sulfate, and total and dissolved iron. Tri-State is proposing to reduce the parameters that are monitored to the same parameters that Tri-State is sampling at the adjacent New Horizon Mine (Permit No. C-1981-008). This proposed change also corresponds to, but is not all inclusive of, the parameter list suggested on Table 1 in the Division guidance document, "*Guidelines for the Collection of Baseline Water Quality and Overburden Geochemistry Data*". The Division can also refer to the recently submitted (December 21, 2020) annual hydrology report to see the complete data set for that is currently sampled at New Horizon North Mine and how the current analytical results are trending.

TRI-STATE

Included in this technical revision are a revision application, a proposed public notice, and a change of index sheet to ease incorporation of this technical revision into the permit document. If you should have any additional questions or concerns, please feel free to contact Tony Tennyson at (970) 326-3560 or ttennyson@tristategt.org.

Sincerely,

DocuSigned by:
Daniel Casiraro
B70D69F114324DE...

Daniel J. Casiraro
Senior Manager
Environmental Services

DJC:TT:der

Enclosures

cc: Frank Ferris (via email)
Chris Gilbreath (via email)
Tony Tennyson (via email)
File:G474-11.3(21)c-4

CHANGE SHEET FOR PERMIT REVISIONS, TECHNICAL REVISION, AND MINOR REVISIONS

Mine Company Name: **New Horizon North Mine**

Date: **March 8, 2021**

Permit Number: **C-2010-089**

Revision Description: **TR-24 Water Monitoring Program**

Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
1	Map 2.04.5-1		Map 2.04.5-1 is being removed from the permit.
2	Section 2.04.7 cover page (1 page)	Section 2.04.7 cover page (1 page)	A note has been added to Section 2.04.7 cover page.
2	Map 2.04.7-1	Map 2.04.7-1	Map 2.04.7-1 has been updated.
2	Map 2.04.7-10		Map 2.04.7-10 is being removed from the permit.
3			No Changes
3			No Changes
4	Section 2.05.6(3) Table of Contents 2 pages and Pages 1 through 28 (30 total pages)	Section 2.05.6(3) Table of Contents 2 pages and Pages 1 through 27 (29 total pages)	Section 2.05.6(3) has been updated and brought up to date in a newer verision of Word so the entire section is being submitted.
4	Appendix 2.05.6(3) Pages 1 through 4 (4 pages)	Appendix 2.05.6(3) Pages 1 and 2 (2 pages)	Appendix 2.05.6(3) Hydrologic Monitoring Plan has been updated.

SECTION 2.04.7
HYDROLOGY DESCRIPTION

Note: Information regarding surface and groundwater monitoring sites cited in this section of the permit may be have been abandoned and remain in the permit for a historical and baseline information. Please refer to Appendix 2.05.6(3)-3 for the actual surface and groundwater monitoring plan and locations.

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SECTION 2.05.6(3)
PROTECTION OF THE HYDROLOGIC BALANCE

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Protection of the Hydrologic Balance

This section is divided into discussions: one of the “Protection of the Hydrologic Balance” and the other of the “Probable Hydrologic Consequences of Mining”. Significant data have been collected over the years at the New Horizon #1 Mine and the adjacent existing New Horizon 2 Mine which allows making better predictions for both topics.

A) Protection of the Hydrologic Balance

Introduction

Surface mining activities to be conducted at the New Horizon North (NHN) mining area outlined in this permit application have been planned to minimize impacts on the hydrologic balance. Mining, reclamation, and monitoring plans and data reporting have been developed to be consistent with the findings of the Probable Hydrologic Consequences analysis presented at the end of this section. The following discussion addresses mining, reclamation, and monitoring plans, and data reporting in the context of how they relate to ground and surface water protection and monitoring. References to those sections which contain details regarding mining and reclamation plans and practices have been also incorporated. Finally, discussions on water rights are also included.

Ground Water Protection

The discussion for ground water protection has been divided into three parts: 1) ground water quality; 2) ground water quantity; and 3) ground water monitoring:

Ground Water Quality

Mining practices that involve replacement of spoil material into mine pits are detailed in Section 2.05.4(2)(c), Backfilling and Grading. Topsoil and overburden handling procedures are detailed in Section 2.05.4(2)(d), Topsoil Redistribution. These handling procedures were developed after reviewing the physical and chemical properties of the overburden and coal in the NHN permit area (see Section 2.04.6, Geology). Extensive testing of the spoil (backfill) water quality (pH of about 7.0) at the New Horizon 1 area has shown that areas that have a higher pyritic content in the shale (which can result in oxidation of the pyrite, resulting in a lowering of the pH and an increase in Total Dissolved Solids) have been neutralized by both the neutralization potential of the majority of the backfill and the higher pH of the irrigation water (pH of 8.0 to 8.5). This process will occur over hundreds of years in the backfill until the water quality gradually approaches that of the typical overburden water, which is high in TDS. In the Probable Hydrologic Consequences Item 5),”potential impacts of replaced spoil on groundwater quality”, this oxidation and its impacts are discussed in extensive detail. Overall, the impacts to the groundwater quality and the waters downstream are not significant, although they occur for a lengthy period of time. NHN has developed plans for sampling overburden during mining to identify the quantity and quality of deleterious material (see Section 2.05.4(2)(c), Backfilling and Grading).

Water in the surrounding undisturbed ground water system exhibits a relatively high degree of mineralization, (see Section 2.04.7, Hydrology Description). Well yields are low. Recharge to the local undisturbed ground water system is directly from both the 2nd Park Lateral irrigation ditch (and associated laterals) and excess irrigation water runoff from flood irrigation. The irrigation ditch water and runoff infiltrate and percolate into the weathered zone of the bedrock. Prior to mining at NHN, the 2nd Park Lateral ditch will be diverted through a HDPE pipeline in order to prevent disrupting water delivery to downstream 2nd Park Lateral shareholders. The diversion of the 2nd Park lateral will also result in a "drying up" of the overburden zone prior to mining which will reduce water inflows into the pit. After mining, backfilling, and reclamation has advanced far enough north, the HDPE diversion pipeline will be moved to the original 2nd Park Lateral right-of-way. The structural attitude of the strata, strike northwest – dip southwest, (see Section 2.04.6 Geology Description), will result in post mine irrigation water percolating through the backfill material and migrating to the south along the top of the underburden (path of least resistance) to the toe of backfill where it will issue as springs tributary to Tuttle Draw (area south of Meehan Draw) as shown in Figure 2.05.6(3)-1 presented later in this Section. This situation is illustrated by the effects of the old Peabody Nucla Mine (see Section 2.04.7 Hydrology Description). Due to the self-draining effect resulting from the structural attitude only relatively small areas (rolls in the floor of the LDX Seam, etc.) of backfill material may be partially saturated. The springs issuing from the toe of the old Nucla Mine Spoil Spring #1 and Spoil Spring #2 (SS #1 and SS #2, see New Horizon 1 permit) backfill material have a calcium magnesium sulfate type water quality with an average TDS of about 3,650 and average pH of about 7.0.

The normal mixing that takes place as overburden is shot, loaded and placed in the backfill and the overall high degree of neutralization potential of the spoil material will minimize changes in ground water quality. See following discussion on Probable Hydrologic Consequences. Based on the mining experience at the adjacent New Horizon Mine, the physical character of the overburden, and the chemical analyses performed on samples taken from the lithologic units to be affected by mining (see Section 2.04.6, Geology Description), the backfill material is classified as either suitable or non-suitable. The weathered bedrock which is located immediately below the soil horizons (referred to as suitable or free dig material) has been oxidized and is both physically and chemically altered from the parent bedrock. The physical alteration of weathering, (to depths of 25 or 30 ft.), weakens the original bed rock material to the point that it can be loaded directly into trucks (free dig material) without the time and expense of drilling and blasting it. This weathered overburden material is typically light brown in color and sharply contrasts with the underlying un-weathered much stronger light gray siltstones and sandstones to the gray and dark brown to black shale and carbonaceous shale. The un-weathered material is referred to as un-suitable material. The suitable and un-suitable material is handled separately at New Horizon Mine and this method is planned for NHN Mine. The un-weathered or un-suitable material is blast casted and dozer pushed across and into the bottom of the pit. The weathered suitable material is loaded and hauled around the ends of the pit and is placed on the unsuitable material as a cap, (see Sections 2.05.4(2)(c) Backfilling and Grading and 2.05.4(2)(d) Topsoil Redistribution). The separation of materials (suitable and unsuitable) will help prevent the runoff from more toxic un-oxidized backfill materials from contaminating surface water and place the more toxic percolating ground water (leachate of un-oxidized backfill) below the root zone.

It is not anticipated that NHN will transfer ownership or use of any wells completed within NHN permit area. Bore holes, shafts, wells, and auger holes will be cased and/or sealed to prevent possible ground water degradation from the mixing of waters of different quality within the bore holes and acid or toxic surface runoff entering the bore holes. A specific plan for sealing of bore holes, exploration holes, auger holes, wells, and shafts is presented in Section 2.05.6(3)(b)(v), Hydrologic Reclamation Plan.

Ground Water Quantity

Typical backfilling methods largely involve the use of dozers and trucks (see Section 2.05.4(2)(c), Backfilling and Grading). Replaced spoil materials exhibit greater porosities and hydraulic conductivities because of increased void volumes, regardless of how the spoil material is replaced in the pits. Seepage from the irrigation network has provided an artificial source of recharge to the undisturbed shallow ground water system. Spoil replacement (backfilling) using methods outlined in Section 2.05.4(2)(c), Backfilling and Grading, will allow the infiltration and percolation of storm event water and irrigation water through the backfill. Due to the structural attitude, it is unlikely that the backfill will ever be re-saturated over time. The NHN permit area is located in a semi-arid climate which averages about 12.5 inches of precipitation annually, (see Section 2.04.8 Climatological Information). Evapotranspiration rates in the vicinity are relatively high (see Section 2.04.7, Hydrology Description). Textural analyses performed on potential backfill materials generally indicate that sandy clay loam materials will be replaced in the pits (see Section 2.04.6, Geology Description). Consequently, infiltration rates in reclaimed areas are expected to be slow to moderate which will help water retention in the topsoil and sub-soil. However, the upstream and downstream (above and below the 2nd Park Lateral diversion) irrigation ditches and laterals will continue to recharge the bedrock zones. Again, the irrigation network has provided an artificial source of recharge to the Dakota Formation coal strata bedrock zones in the NHN permit area.

Overburden and topsoil handling, reconditioning, and revegetation methods (outlined in Sections 2.05.4(2)(d), Topsoil Redistribution, and 2.05.4(2)(e), Revegetation,) will maximize the potential for establishing reclaimed areas that will exhibit infiltration rates and capacities adequate for insuring at least pre-mining rates and capacities. Timely reseeding and mulching of redistributed topsoil will augment the retention and eventual downward infiltration of soil moisture. Textures of topsoil material will generally range from sandy loam to loam, and topsoil material will exhibit moderate infiltration rates. Deep ripping of re-graded backfill material, followed by topsoil placement, chisel plowing, and disking will improve the infiltration potential of the reclaimed medium. Water accumulating in the pit(s) will be removed by pumping the water to a sediment pond that will, at the time of pumping, have a sufficient available storage capacity, including the prescribed volume for the 10-year, 24-hour storm. Design criteria for all ponds are addressed in Section 2.05.3(3), Mine Facilities, and include plans for storage of additional volumes pumped from pits or sumps. Maintenance of available storage capacity in the ponds involves dewatering and sediment removal.

Ground Water Monitoring

Since 1979, Peabody (New Horizon Mine's predecessor) and NHN have installed an extensive network of 46 hydrologic monitoring wells to monitor the shallow bed rock zones beneath both the New Horizon 1 and the New Horizon 2 mining areas. A number of these wells were located within or in close proximity to the NHN permit area (see Map 2.04.7-1 in Section 2.04.7). This information has been supplemented by the addition of nine hydrologic monitoring wells which were installed during 2008 for baseline hydrologic data collection. These wells (numbered GW-N47 through GW-N55) are described in Section 2.04.7 and the data collected presented in Appendices 2.04.7-1. All ground water monitoring installations will be removed upon completion of the post mining hydrologic monitoring phase of the Hydrologic Monitoring Program.

Three (3) additional ground water monitoring wells were installed in the southwestern portion of the NHN permit area. The locations of these 3 wells are shown on Map 2.04.7-1. Ground water monitor well GW-N56 will monitor the underburden (UB), well GW-N57 will monitor the coal zone (Coal) and well GW-N58 will monitor the overburden. After review of additional data and consultation with DRMS, ground water monitoring wells GW-N56, GW-N57, and GW-N58 have been designated as points of compliance. The completion diagrams for the three monitoring wells are shown on Figure 3 of Appendix 2.04.7-1. Appendix 2.05.6(3)-4 contains State Engineer approved well permits for the New Horizon North Mine.

All ground water data collected from monitoring wells in each future water year will be compiled and submitted to DRMS in the form of the New Horizon Annual Hydrology Report (AHR). The AHRs will be submitted within three months after the end of each water year.

<u>Surface Water Protection</u>

Section 2.05.3(3), Mine Facilities, contains descriptions, designs, and plans for a sediment ponds, roads, diversions, and culverts that will be constructed and utilized at New Horizon North mining area during mining. All facilities that are discussed in Section 2.05.3(3) have been designed to ensure that the hydrologic balance is protected. The discussion for surface water protection has been separated into three parts: 1) surface water quality; 2) surface water quantity; and 3) surface water monitoring.

Surface Water Quality

Sediment ponds will be adequately designed and will be constructed during operations for controlling surface water runoff from disturbed and reclaimed areas. An NPDES permit will be obtained from Water Quality Control Division, Colorado Department of Public Health and Environment to allow the discharge of water from the sediment ponds. The design of the ponds has been developed to prevent additional contributions of sediment to stream flow outside the permit area, to minimize erosion, and incorporates detention times sufficient to ensure that all applicable effluent standards will be met. The pond discharge structures are designed according to standard engineering design procedures for protecting against erosion via emplacement of riprap and/or energy dissipaters. The pond will be removed and reclaimed when the entire watershed reporting to the pond has been approved for Phase II bond release. The impact of a sediment pond and runoff from reclaimed areas on the quality of receiving streams was found to be of minimal significance (see Probable Hydrologic Consequences at the end of this section).

Plans for sampling overburden after backfilling and grading have been developed and are presented in Section 2.05.4(2)(d), Topsoil Redistribution. Based on these plans, surface runoff from disturbed reclaimed areas will not come in contact with materials that would contribute to elevated levels of acid or toxic constituents.

Topsoil handling procedures (Section 2.05.4(2)(d), Topsoil Redistribution) and revegetation methods (Section 2.05.4(2)(e), Revegetation) have been developed to stabilize the landscape, prevent erosion, and minimize the additional contributions of sediment to runoff. They include: the seeding of temporary disturbance and topsoil piles; mulching, chisel plowing and deep ripping; cover cropping; and timely reseeding of reclaimed areas (regraded and topsoiled) with seed mixes designed for rapid establishment and development of effective hydrologic cover. Those areas that are affected by mining will be graded to post mining topographies that generally feature slopes no greater than 5:1. In combination with the reclamation and topsoil handling techniques, reduced slopes will minimize the potential for erosion due to accelerated sheet wash or gullying.

Diversions will be designed according to accepted design criteria, and will be built to minimize erosion and prevent additional contributions of sediment by limiting the flow velocities and tractive forces that cause erosion. Temporary diversions in place longer than a growing season will be seeded with a temporary seed mix as outlined in Section 2.05.4(2)(e). Diversions have been designed to maximize geomorphic stability while minimizing disturbance. All temporary diversions will be removed and reclaimed after mining activities have been completed. Plans have been developed for water rights augmentation pumping that will meet effluent limitations and minimize erosion. Drainage from haulage and access roads will be routed to the sediment pond. Where necessary, culverts will be designed and constructed using approved engineering design criteria to minimize erosion and prevent the contribution of additional sediment to runoff.

Surface Water Quantity

The Operations Plan - New Horizon North (Map 2.05.3-1) details pond diversion and culvert locations that will control all drainage into, through and out of New Horizon North mining area. Surface water flow at NHN is primarily the product of seasonal irrigation, (See Section 2.04.7). The 2nd Park Lateral will be diverted through a HDPE pipeline around the mining area. Once mining has advanced far enough to the north, the HDPE pipeline will be moved to the approximate original 2nd Park Lateral right-of-way. Downstream irrigation water flow will not be interrupted. The plan has been developed for insuring that changes in surface water quantities are minimized. The impact of designed structures proposed for the New Horizon North mining area (sediment pond, diversion ditches, culverts, etc.), was determined to have no significant effect on surface water quantity (see Probable Hydrologic Consequences at the end of this section).

The sediment ponds have been designed according to acceptable engineering criteria to contain (at a minimum) the 10-year, 24-hour runoff volumes. NHN will ensure that the ponds maintain this capacity by dewatering and/or excavating excessive sediment accumulated according to plans outlined in Section 2.05.3(3), Mine Facilities. Diversions have been designed to pass the 10-year, 24-hour runoff volumes in accordance with approved engineering design criteria. Culverts and road drainage-ways will insure that runoff originating from disturbance areas will be controlled and routed through sediment ponds to minimize changes in surface water quantities.

The post mining landscape is designed to protect the hydrologic balance by establishing slopes that generally will not exceed 5:1. Any highwall reductions will result in maximum slopes not to exceed 5:1. Reclaimed hillsides proposed for the New Horizon North mining area approximate the original pre-mining contours. Topsoil material will exhibit infiltration rates generally similar to pre-mining soils. At the NHN Mine, future reclaimed areas will be manipulated mechanically using chisel plowing and ripping of graded and top-soiled areas in combination with timely reseeding to minimize overland flow rates and volumes.

Surface Water Monitoring

NHN will continue to collect data from surface water monitoring sites list in Appendix 2.05.6(3)-3, (see Section 2.04.7 and Appendix 2.04.7-2). Irrigation water will be reintroduced in the Garvey parcel during the reclamation phase of the NHN Mine. This will be a sprinkling type of system in contrast to the current "flood" system.

The surface water monitoring will be maintained for the life of the mining operation or until such a time as DRMS may agree that they are no longer necessary. Surface water monitoring installations, if any, will be removed upon completion of the post mining phase of the Hydrologic Monitoring Program.

All surface water data collected at each monitoring site in each future water year will be compiled and submitted to DRMS in the form of the New Horizon Annual Hydrology Report (AHR) within three months after the end of each water year.

<u>**Water Rights and Alternative Water Supplies**</u>

Introduction Ground water rights (water wells) within the immediate region (1 mile radius) around the New Horizon North permit area are listed in Table 2.04.7-4 and the locations are shown on Map 2.04.7-8 of Section 2.04.7 Hydrology Description. In all, 30 ground water rights have been identified in the vicinity of the New Horizon North mining areas. All monitoring wells installed by the permittee and domestic wells within the surrounding area are shown on Map 2.04.7-8. Analyses and programs integral to the Water Rights Plan are presented in Section 2.05.6(3) and 2.05.6(3)(b)(v) of the permit. Pit inflow volumes and pit pumpage drawdown projections are discussed and presented in Probable Hydrologic Consequences at the end of this section. Impacts of mining discharges on downstream water quality and the shallow ground water quality for water use considerations are also presented in Probable Hydrologic Consequences at the end of this section. Finally, the detailed water rights plan which integrates the above-referenced information is presented in Appendix 2.05.6(3)-1a.

Water Rights Protection and Mitigation Plan

The following discussion briefly summarizes the approach to the water rights plan. All ground and surface water rights within 1 mile radius of the New Horizon North Mine have been documented. Pit inflow and pit pumpage drawdown analyses were performed and tabulated. Drawdowns and pit bottom elevations were compared against water righted well production zone elevations to determine which wells could potentially be impacted by the mining induced drawdowns. Similarly, surface water rights within the one-foot drawdown contours were identified as those surface water rights which could potentially be impacted by the mining induced drawdowns. Drawdown depletion rates were then estimated at the different surface water right locations and replacement rates were determined for each.

Calculations were performed to estimate industrial uses of surface water and evaporative losses from the sediment ponds receiving runoff from the mining areas. An augmentation plan was then developed for augmenting these surface water losses during each month of the irrigation period and storing water during the winter months, (see Table 12 in Appendix 2.05.6(3)-1b, WRS, LLC Report on Water Augmentation Plan).

Calculations were performed for Tuttle, Coal Creek Canyon and the San Miguel River to determine if mine discharges would diminish receiving water quality to the extent that surface water rights would be injured. Table 2.05.6(3)-2 (presented in a succeeding discussion in this section) shows the results of the calculations which were conducted by weight averaging TDS content (by flow in cfs) of the mine discharges and the receiving waters. Presently, there are no surface water rights (or users) of the irrigation runoff water primarily because there is no practical way to divert the water in the stream bottoms by means of gravity flow to upland tillable areas in either Tuttle Draw or Coal Creek Canyon. The effect on the quality of San Miguel varies from about 5% TDS during low flow (irrigation season) to 0.4% TDS during periods of high flow (non-irrigation season). This was determined not to be a significant impact and no mitigation is required.

Alternative Water Supplies

NHN owns absolute direct flow and storage rights which it will use in conjunction with operations in the New Horizon North mining area ("NHN Mine"). In addition, New Horizon filed an application with the District Court, Water Division No. 4 to confirm its appropriation of conditional water rights for the NHN Mine and a final decree was signed on August 6, 2013 for Case No. 10CW208. A copy of this final decree is included in Appendix 2.05.6(3)-1c. NHN will make these conditional water rights absolute once mining activities begin and it can divert or store water and put that water to beneficial use. Pursuant to those decrees, NHN has the right to use water in priority under Colorado water law. NHN's professional consulting water engineer has determined that the drainage basins in which NHN will operate its NHN Mine are not over-appropriated, meaning that NHN will be largely able to operate its water rights in priority vis a vis other water users.

In addition, in drought periods when water may not be available for use under NHN's existing decree, Colorado water law permits NHN to use its water out-of-priority so long as it mitigates injury to senior water users. The mitigation of injury to other water users caused by out-of-priority depletions is called a plan for augmentation. Typically, a plan for augmentation replaces out-of-priority depletions to the stream with an alternative source of water. A plan for augmentation was also approved by District Court, Water Division No. 4 in the final decree for Case No. 10CW208.

In this plan for augmentation, NHN will use the following alternative water sources to mitigate any ground or surface water rights impacts. NHN owns 115 shares of the Colorado Cooperative Ditch Company ("CCC Ditch"). CCC Ditch owns water rights that are senior to water rights that may be injured in part during dry periods by mining activities. NHN changed 27 shares of the CCC Ditch for augmentation use in a previous decree (Decree in Case No. 88CW55, Water Division No. 4, dated April 2, 1990). These 27 shares represent up to 2.205 cfs direct flow from the CCC Ditch. By that Decree, these 27 shares allow NHN use of up to 97.8 acre-feet of senior water from the CCC Ditch to augment out-of-priority depletions. NHN has the ability to change additional shares of CCC Ditch to augment its future uses.

NHN's water rights engineering consultant has determined that augmentation during the non-irrigation season will not be required as local water users do not irrigate during this time. Off season ditch runs for filling cisterns and stock ponds will continue unabated through the HDPE pipeline that will be in place to divert the 2nd Park Lateral irrigation flow. NHN will have direct flow, storage water and groundwater rights to meet its water demands in non-irrigation months. In conclusion, existing water court decrees together with the determinations of the professional water engineering consultant, ensure that NHN has adequate water rights for the NHN Mine.

Irrigation

The NHN Permit area has (since about 1910) and is currently serviced by an extensive man-made irrigation system. The water, primarily used for flood irrigation, is diverted from the San Miguel River approximately 15 miles east of the New Horizon North Mine by the Colorado Cooperative Ditch Company. The irrigation ditches transect drainage basins and commonly run along the basin divides (see Map 2.04.7-1 for location of main irrigation ditch). The main irrigation ditches have a network of feeder ditches running from them for irrigating more distant fields. These ditches are a source of ground water recharge, causing ground water mounding in the shallow ground water bedrock system. The effects of seasonal water mounding near the NHN permit area are apparent from monitor well water levels and hydrographs (see Appendix 2.04.7-1 of Section 2.04.7). Perennial flow occurs in Tuttle Draw and Coal Creek Canyon tributaries as a result of ground water discharge and return flow from the irrigation of the upland area. Site inspections confirm that water used for irrigation is obtained from the San Miguel River and no flood irrigation water is obtained from Tuttle Draw or Meehan Draw.

With regard to the agricultural water quality standards, the San Miguel River water delivered by the irrigation ditches is more suitable for irrigation purposes than the waters in the Tuttle Draw or Coal Creek Canyon tributaries. The agricultural suitability (National Academy of Sciences. 1972. Water Quality Criteria 1972: National Academy of Engineering, Washington, D.C. p. 335) of surface water in the permit area falls within the category of water that can only be used for salt tolerant plants on permeable soils with careful management practices (TDS from 2,000 to 5,000 mg/l). Using the same classification system, water supplied by the 2nd Park Lateral irrigation ditch with a TDS of 500 mg/l and lower (although a slightly higher pH of 8.0 and higher) has no detrimental effects on plants as witnessed by the success of irrigation in the area. Since the early part of this century, it has been a regional practice to obtain water for irrigation from the San Miguel River. Because of the incised nature of the drainage channels, it is difficult to flood irrigate from them. From field reconnaissance investigations, no cases of water being pumped from these draws for irrigation purposes, has been discovered.

Sub-irrigation

A small amount of sub-irrigation does occur along the drainage channels. Much of the ground water along these draws is a result of seepage through the weathered zone of the bedrock from the irrigation ditches. In areas where the sub-irrigation occurs, the vegetation and soil quickly dry up when the ditch is turned off from October to April. The sub-irrigation along the drainage bottoms of the NHN permit area is not considered extensive enough to support agricultural development.

Conclusion

DRMS concluded in its Decision and Findings of Compliance Document (1983) for Peabody's New Horizon Mine that no alluvial valley floors exist in either the New Horizon permit area or the potentially affected area (Tuttle Draw) associated with the New Horizon Mine. The tributaries of Tuttle Draw and Coal Creek Canyon are developed on and have incised a dip slope. The water in the drainages runs on top of weathered bedrock strata. The incised channels, with perennial flow, make it infeasible to construct a gravity flow flood irrigation system. NHN therefore concludes that no alluvial valley floors exist along the potentially affected area of Tuttle Draw and Coal Creek Canyon and their tributaries. This conclusion is substantiated by the results of an EPA alluvial valley floor study (EPA 1977) which addresses most coal mining areas of the west and the fact that flood irrigation from drainages is not being practiced.

Hydrology Monitoring Plan

NHN has developed a baseline hydrological monitoring program for the NHN Permit area with the advice and consent of DRMS. This monitoring program will continue for the foreseeable future and is proposed to be used with possible minor modifications during the mining and reclamation operations. The monitoring program is described in Appendix 2.05.6(3)-3.

B) PROBABLE HYDROLOGIC CONSEQUENCES

Previous mining by NHN at the New Horizon Mine and Peabody's experience while mining at the old Nucla mine have provided the experience upon which the determinations of "Probable Hydrologic Consequences" are founded. This experience is documented in the New Horizon 1 and New Horizon 2 permit documents and the "Annual Hydrology" reports. The knowledge provided by the long term hydrologic monitoring in relation to the earlier baseline data allows more accurate prediction of consequences than would otherwise occur. Peabody Coal Company performed extensive and detailed computer modeling to determine probable hydrologic consequences of mining for the New Horizon Mine. Details of the computer modeling are available in Attachment 2.05.6(3)-2 of New Horizon 2 Mine permit. While some of the old Peabody Nucla Mine monitoring was suspended in 1987, some of the monitoring holes and surface water monitoring sites have been revisited (monitoring resumed in 1st quarter of 2007) as part of the "2 year close out" for the New Horizon 1 permit area. Three "old" ground water monitoring holes of particular interest that have been monitored during 2008 and 2009 include GW-N3, GW-N8, and GW-N9.

As indicated on Figure 2.05.6(3)-1, hydraulic flow south of Meehan Draw at the New Horizon North Mine will generally travel from north to south through the boxcut area and into the old backfill south of the Old Peabody Nucla Mine Highwall. During excavation of the initial boxcut, a buffer of unmined coal and overburden was left in place at the location of the old Peabody Highwall (see Map 2.05.4-2). The purpose of this "buckwall" is to maintain a buffer between the mine spoils from previous surface mining activities and the current active mining pit to provide a safe working environment in the active mining area. An opening was cut into the "buckwall" at the location of the center pit ramp to allow access from the surface into the boxcut. This notch will allow for hydraulic flow between the NHN backfill and the old backfill through the boxcut as depicted on Figure 2.05.6(3)-1. Therefore, the Probable Hydrologic Consequences should not be affected by the presence of the "buckwall".

Probable impacts and therefore probable hydrologic consequences have been identified (see Attachment 2.05.6(3)-2 of the New Horizon 1 Mine Permit). A summary of the hydrologic consequences is presented in Appendix 2.05.6(3)-2 of this section of the application as Table 2.05.6(3)-2a. This table incorporates new findings with the findings from both the New Horizon #1 and #2 mine permits. These probable impacts were either determined to have no short or long term significance, or a plan has been presented to mitigate those impacts determined to have significance. Potential impacts to the hydrologic balance and the likelihood that these impacts will occur are given below.

<u>Interruption of Groundwater Flow and Drawdown</u>

The bedrock zones, overburden and coal, will be exposed or daylighted by the NHN excavation. There are no users or beneficial uses for the relatively small amount of ground water that is currently moving through the bedrock zones toward the cropline to the southwest. Recharge from irrigation (the major source of recharge) will continue to the east, north and west of the NHN permit area as it currently does. Irrigation water that now infiltrates into the bedrock zones at NHN will be diverted around the mining area in a HDPE pipeline. Seepage out of the northward advancing high-wall will be diminished from what is currently being experienced from the old Peabody high-wall because the annual recharge from irrigation water flowing across the permit area will be eliminated.

In order to develop the impact assessment for groundwater flow and drawdown, two different methodologies were utilized. First, the monitoring data from the old Peabody Nucla Mine were analyzed to determine the annual volume of flow into the pit from actual observations and to also determine the distance of drawdown (cone of depression) observed as the old Peabody Nucla Mine advanced to the north (see Map 2.04.7-1, "Old Peabody Nucla Mine Highwall"). The second method involved the determination of pit inflow rates and drawdown in the adjacent overburden and coal zones as a result of groundwater drainage from the bedrock zones into the pit utilizing a version of the groundwater flow model MODFLOW. A description of the modeling procedures and the assumptions used are provided in Appendix 2.05.6(3)-2.

Observation and Analysis

Flow from the old mine backfill (SS#1, #2, and #3, see New Horizon 1 Mine Permit) indicate that total seepage from that high-wall varied from a low of about 17 gpm (during periods of no irrigation) to a high of about 52 gpm during irrigation season. The high flow rates average about 42 gpm and the irrigation season is about 165 days long. The low flow rates average about 17 gpm and represent no irrigation for about 200 days per year. The average annual flow rate is therefore on the order of about 28 gpm or about 5390 ft^3/day. This flow rate compares well with the flow rate of about 27 gpm calculated by subtracting the flow in Nygren Draw (SW-N6) from the flow rate at NPDES 001, (see Table 2.04.7-5 in Section 2.04.7). This further suggests that once the irrigation water is diverted into the HDPE pipeline that highwall seepage should be more on the order of about 17gpm (< 3300 ft^3/day) and then decrease as the bedrock zones dry out.

The bedrock zones are tight, with low transmissivity (measured OB and Coal Zone transmissivity and hydraulic conductivity at 58 ft^2/day and 2.1 ft/day respectively at GW-N9) which results in limited but steep cones of depression. The old Peabody Nucla Mine (New Horizon #1 Area) is again instructive as the hydrograph of GW-N8 (see pg. 7-1-75 of New Horizon 1 Mine Area Permit) shows the water level was first affected by the mining in November 1980. At that time the coal face was about 760 ft from hole GW-N8. Total draw down at GW-N8 after 2 years and 9 months was 12.24 ft. Monitor hole GW-N9 at a distance of 854 ft from the final high-wall has never been affected, (see GW-N8 and GW-N9 hydrographs in Appendix 2.05.6(3)-2; Figures 2.05.6(3)-2a and 2.05.6(3)-2b). Based on the evaluation of these observations, water level drawdown in the bedrock zones is expected to only extend about 590 feet beyond the permit boundary. NHN's hydrologic consultant, Bishop-Brogden Associates, Inc. (BBA), prepared Figures 2.05.6(3)-2f and 2.05.6(3)-2g in order to illustrate the observations at GW's N8 and N9. These two figures are contained in Appendix 2.05.6(3)-2. Figure 2.05.6(3)-2c in Appendix 2.05.6(3)-2, is an illustration of the projected draw down from an ideal pit in a stationary position based on the evaluation of the GW-8 and GW-9 hydrographs. Water level measurements were suspended at GW's-N8 and N9 from 1987 through 2007 and the "old" highwall was reclaimed in 1992. Water level monitoring at these two holes was resumed during 2008 and 2009 as part of the 2 year "close out" monitoring for New Horizon #1 Area Permit.

Water levels in GW-N8 have recovered about 80% of the maximum draw down since the highwall was reclaimed. The 2nd Park Lateral continued to flow during irrigation seasons during the period that GW-N8 and GW-N9 have been monitored and groundwater mounding (seasonal irrigation water infiltration) is apparent on the hydrographs. Maximum draw down occurred in 2.75 years; however, the pit along with backfilling and reclamation will migrate at about 550 ft per year or about 1510 ft in 2.75 years. The sense is that water levels in the adjacent bedrock zones will begin to recover before maximum draw down is realized.

Modeling

Transient simulations were performed for the New Horizon Mine (see New Horizon #2 Area permit) for a five-year period, using the maximum drawdown estimates for the overburden and coal. These drawdown results were expressed as a maximum at the pit and are expressed as a conical depression which results in decreased drawdown at further distance from the mine. For the overburden, the pit drawdown was 5 feet for years 1 and 2, 8 feet during year 3, 15 feet during year 4, and 30 feet during year 5. The drawdown for the coal simulation was 8 feet during year 1, 5.8 feet during year 2, 6 feet during year 3, 7.3 feet during year 4, and 8 feet during year 5. The simulations for New Horizon Mine indicated that the zero impact contour for the overburden and coal after five years of mining is approximately 4,000 feet. Further, the overburden and coal drawdown contours at New Horizon Mine did not intersect any of the model boundaries, therefore, no impact of the San Miguel River from drawdown in the deeper part of the overburden or coal were predicted. However, some of these predictions do not directly correlate with actual observations made at the old Peabody Nucla Mine (New Horizon #1 Area). For instance, draw down observed at ground water monitoring hole GW-N8 (see New horizon #1 area permit) was first detected (November 1980) when the coal face was only about 760 ft from the location of GW-N8. Suggesting that at NHN Mine the zero draw down contour is much closer to the pit face than 4000 feet and the cone of depression is much steeper. Further, during the same period another ground water monitoring hole GW-N9 located only about 854 ft north of the final highwall showed no response (and has not to date) to the drainage from the old Peabody highwall. Version v.2.8.2 of MODFLOW was used to make several simulations of the expected cone of depression. These simulations utilized the hydraulic conductivity value (2.1 ft/day) that was measured at GW-N9. The MODFLOW runs (Figure 2.05.6(3)-2d and Figure 2.05.6(3)-2e) are contained in Appendix 2.05.6(3)-2 and agree well with the interpretation presented on Figure 2.05.6(3)-2c which is also contained in the Appendix 2.05.6(3)-2. Calculated average daily pit inflow for the coal and overburden zones (K value 2.1, gradient 0.055, pit length 2217 and saturated thickness of 15 ft) is about 3840 cubic ft/day or about 20 gpm in year 1 and declining in subsequent years as the bedrock zones dry out as the result of diverting the 2nd Park Lateral water through the HDPE pipeline. As a matter of clarification, the HDPE pipeline will be moved to the approximate location of the 2nd Park Lateral after mining, backfilling and replacement of top soil has progressed far enough north. This is expected to require about 3 to 4 years after mining begins. The HDPE pipeline will be retained to prevent the irrigation water from draining into the very permeable pit backfill. This will also prevent the direct loss of irrigation water along the course of 2nd Park Lateral as occurs now. The HDPE pipeline will allow for sprinkler irrigation which is much more efficient than flood irrigation. NHN will monitor the bedrock zones and pit discharge in order to refine the extent of drawdown. The hydrological monitoring program should provide reasonably accurate measurements of the effects of mining. While there are no known uses for the bedrock zone water, NHN (as described in the water augmentation plan), has a 114 acre-foot consumptive use right on the Colorado Cooperative Company ditch which could be used to mitigate any potential impact on surface water right users from pit inflow drawdown.

Impact on Groundwater Rights

Groundwater rights (water wells) within the immediate region (1-mile radius) around the NHN permit area are listed in Table 2.04.7-4 and shown on Map 2.04.7-8 of Section 2.04.7. In total, 29 ground water rights (wells) have been identified in the vicinity of the New Horizon North mining area. Although Table 2.04.7-4 lists 33 wells, one well (#92752) has been abandoned and three wells (#236014, #236015 and #236016) are Montrose County monitoring holes. One well (Meehan Well #253229) will be mined through. The Meehan Well is on land under an option to purchase that will be executed at the time of permit approval and is producing from the Morrison Fm. (Brushy Basin Member) and will be appropriately plugged prior to being mined through. All of the remaining 27 well intakes are too deep to be affected by the pit pumping induced drawdowns in the overburden aquifer. These wells are installed in the Brushy Basin Member of the Morrison Formation. These strata are below the Dakota coal strata to be mined. Impermeable shale isolates coal strata to be mined from the Morrison wells' aquifer.

One potable water well (PW-001) will be drilled to provide water for showers, sanitation, and drinking water, vehicle washing and for fire water back up. This well will be completed in the Brushy Basin Member of Morrison Formation and will be designed to produce 5 to 10 gpm. The well will be about 200 to 220 ft. deep. Well PW-001 will be located in the SW1/4, SE1/4, SW1/4 of Section 25, Township 47 North, Range 16 West, at an elevation of about 5690 ft. (msl) as shown on Map 2.05.3-1 and described in Section 2.05.3 of this application. Map 2.04.7-8 (Section 2.04.7 of this application) shows the location of the existing water wells. NHN's water consultant, Bishop-Brogden Associates, Inc. (BBA), has determined the potable water needs for the NHN Mine at 0.61 acre-ft per year. Average pumping rate to fulfill this need is a modest 0.38 gpm. Potable well PW-001 is located the following distances from existing permitted wells:

Well Permit #	Distance, Ft.
11801	2,754
116113	2,530
179418	3,970
83553	4,365
74597	4,098
253099	4,350

BBA's work shows that the closest permitted well (#116113) would be expected to see a drawdown after 20 years of 0.62ft. Much farther away, permitted well (#83553) would be expected to see a drawdown of 0.53 ft after 20 years of pumping. BBA reports that these levels of drawdowns are insignificant and represent less than 1% of the available drawdown. None of the permitted wells are located within 600 ft. of PW-001 and no waiver of the 600 ft. statutory limit would be necessary from the State Engineer's office. BBA's report is contained in its entirety in Appendix 2.05.6(3)-1a.

Impact of Spoil Material on Groundwater Flow and Recharge

The mine pit floor will remain open only until the coal has been removed. The pit width will be about 110 ft wide as it is at the adjacent New Horizon Mine. At NHN, each pit advance will take about 2 months so the pit floor is only exposed for a few weeks at a time at most. Water levels in the bed rock zones (overburden, coal, and underburden) will decline in response to the pit face advancement to the north. The bedrock strata will be exposed along 3 sides. The pit side walls will be covered in a relatively short period of time by the advancing backfill and reclamation. Irrigation of the areas to the east, north and west of the permit area will continue unabated throughout the mine life and thereafter and will continue to recharge the bedrock zones in those areas. Monitor hole GW-N8 (see Figure 2.05.6(3)-2a, Appendix 2.05.6(3)-2) experienced a water level decline of about 12.2 ft. in the overburden and coal zone in response to the mining at the old Peabody Nucla Mine. Following backfill and reclamation of the old Peabody highwall (in early 1992), the bedrock zone (OB and Coal) water level at GW-N8 has recovered about 10 ft or 80% of its decline in a period of less than 20 years. This indicates, that following mining the water level in the bedrock zones immediately adjacent to the mined out area that experienced decline will recover. Within the permit area, and south of Meehan Draw (see Map 2.04.7-1), the structural attitude at NHN (see Map 2.04.7-2) is such that irrigation and precipitation water percolating through the reclaimed backfill material will drain to the south along the path of least resistance and issue as spring(s) tributary to Tuttle Draw. Figure 2.05.6(3)-1 is a generalized north-south cross-section showing the down gradient drainage through the NHN Mine backfill material. The backfill overburden material at NHN Mine will be placed in the mine pit areas using 3 techniques: 1) cast blasting, 2) end dumping of trucks from the spoil bench and 3) dozing. Following top soil stripping, the top bench or free dig zone (weathered zone, suitable material) is loaded into trucks using a hydraulic excavator and hauled around the pit and placed on the top of unsuitable material (unweathered overburden). After removal of the top bench (free dig), the unweathered material is cast blasted (a majority of this material requires re-handling) across the pit to the bottom of the backfill area. Dozers and the shovel and trucks remove the remaining overburden and clean off the top of coal. This backfilling technique greatly increases the permeability of the backfill material in comparison to the original overburden. Due to truck dumping from the spoil bench, large rock will settle near the bottom of the pit and provides permeable channels for groundwater flow. As an example, the hydraulic conductivity (K) of the backfill, as measured in monitor hole GW-N27, is 40 ft/day, which is far greater than the K value measurement made in the overburden at GW-N9 (see New Horizon 1 Area Permit) of 2.1 ft/day. The old Peabody Nucla Mine site (New Horizon 1 Area) has experienced continued seasonal irrigation and runoff return flow infiltration from the 2nd Park Lateral since the final reclamation (1st Qrt. 1992). Water infiltrating from this irrigation and precipitation have percolated and moved through the bedrock zones and then drained into and through the backfill and saturated it until water discharges at the low point of the base of the coal which is at SS #1, (see Map 2.04.7-1 for location). Flow from this spring fluctuates in response to the use of irrigation from a low of about 17 gpm to a high of about 52 gpm with an average annual flow of around 27gpm (or about 44 acre-ft/yr). This flow represents the bedrock zones discharging and draining through the backfill. The NHN Mine will be analogous to the old Nucla Mine with the exception that unlike the "old" mine (not irrigated) portions of NHN Mine backfill will be irrigated. Irrigation of the surface could begin as early as Spring 2015. Once irrigation resumes, surface irrigation water will infiltrate into the backfill and then drain toward the southwest along the floor of coal and issue as a spring in the same vicinity as existing SS #1. As a matter of clarification, the HDPE pipeline will be moved to the approximate location of the 2nd Park Lateral after mining, backfilling and replacement of top soil has progressed far enough north. This was expected to require about 3 to 4 years after mining begins, but flows from the SS #1 have not increased above pre-mine levels. The HDPE pipeline will be retained to prevent the irrigation water from draining into the very permeable pit backfill. This will also prevent the direct loss of irrigation water along the course (sides and bottom) of 2nd Park Lateral ditch as occurs now. The HDPE pipeline will allow for sprinkler irrigation which is much more efficient method of irrigating than is flood irrigation and will further help limit the loss of water to the backfill by infiltration.

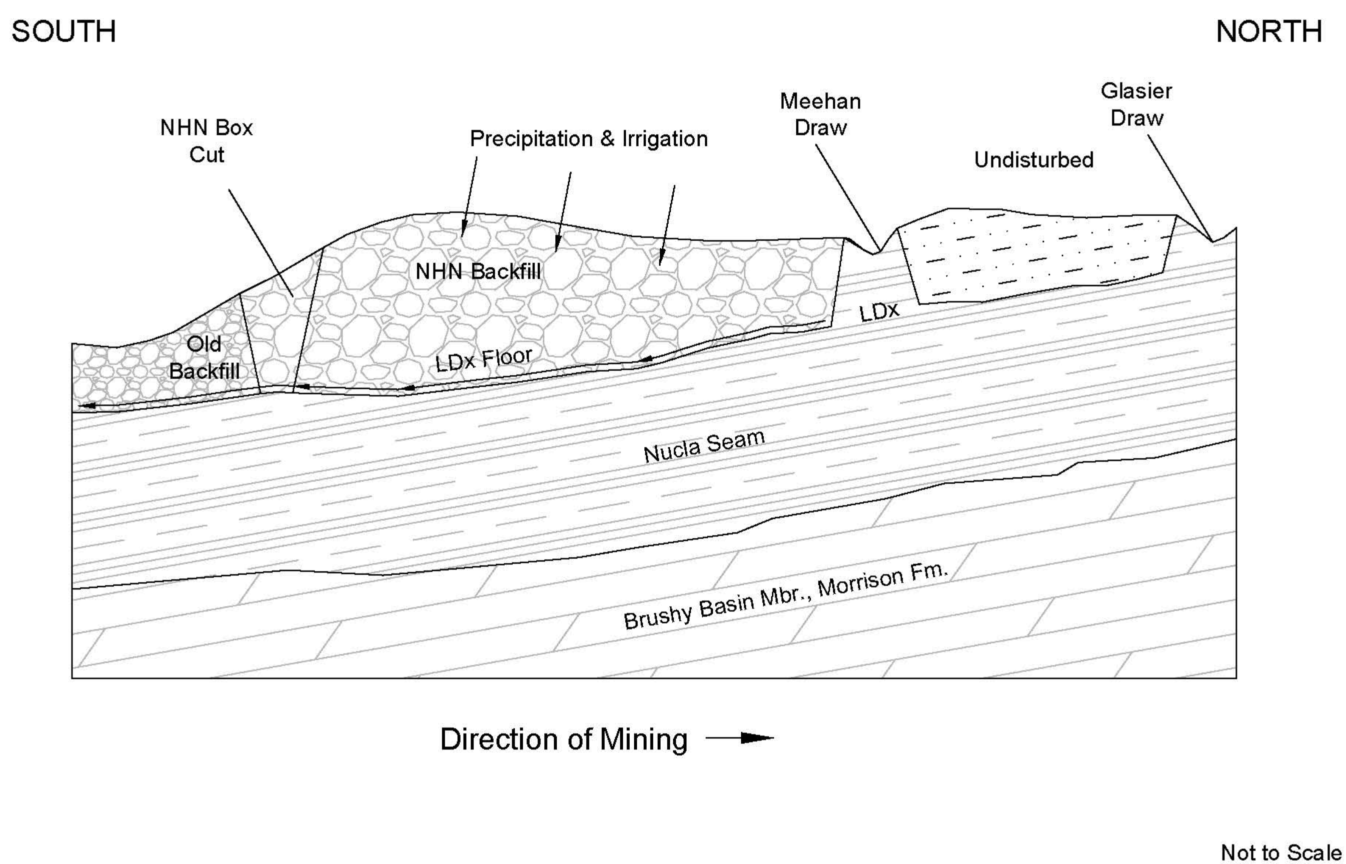
The amount of irrigation water that will drain through the backfill is estimated by first considering how much water will be used for irrigation. The Garvey parcel (about 37 acres) north of the 2nd Park Lateral will be irrigated with 27 shares of CCC ditch water, (see Map 2.04.10-1). The Meehan parcel (about 38 acres) may be irrigated with about 20 shares of CCC ditch water. Each share equates to 0.0308 cfs or about 10.08 acre-ft over the 165 day irrigation season. The Garvey parcel will therefore receive about 272 acre-ft/yr or about 7.15 ac-ft/acre/yr of water while the Meehan parcel receives about 202 ac-ft/acre/yr or about 5.3 ft/acre of water. Section 2.04.10, Vegetation, describes the Meehan "irrigated pasture" and the Garvey "intensely managed irrigated pasture". Not all of this irrigation water will infiltrate the backfill as some water will run off toward Meehan Draw as irrigation return water, some water will be lost to the atmosphere through evaporation, and some water will be lost through plant-take up and evapotranspiration.

Flow gain in Meehan Draw through the irrigation water return is about 213 acre-ft /yr which is over 30 percent of the water used for irrigation. The annual evaporation rate is approximately 60 inches per year (NOAA-National Weather Service, Montrose No. 1 Evaporation Station) of which the majority occurs during the warmer drier months that coincide with the irrigation season. NHN estimates that evaporation during the irrigation season could result in loss of 2.5 ac-ft/ac. The evapotranspiration rate for the permit area is estimated at 2.1 ft/year (see Section 2.04.7, Evapotranspiration). These loss figures, added together, would result in very little water being available for infiltration at the Garvey parcel. Adding the loss values for the Meehan parcel would result in negative values. Percolation and infiltration rates into the reclaimed soil is estimated to be moderate (0.6 to 2.0 inches per hour) suggesting that the reclaimed soil will be more acceptable to infiltration than the original soil which should reduce the runoff return flow.

The New Horizon 2 Area Permit predicts that 13 inches/yr of irrigation water will infiltrate (recharge) the backfill. Therefore, with a total of 75 irrigated acres in backfill about 81 acre-ft of recharge to the reclaimed backfill would occur per year. As stated earlier, irrigation at NHN Mine could begin as early as the irrigation season of 2015. The backfill material will be relatively dry and will initially absorb moisture. However, channeling of infiltrating irrigation water through more permeable zones will most likely occur. Experience at the New Horizon Mine indicates that the backfill could begin draining irrigation water within a few months of resumption of irrigation on the reclaimed backfill or as early as late summer or early fall of 2015. The flow through the backfill would increase gradually as more of the reclaimed surface is irrigated. At maximum steady state, the backfill flow (at full infiltration rate of 81ac-ft/yr) would average about 0.11 cfs or about 50 gpm.

The flow rates through the backfill material will be significantly higher than through the bedrock (hydraulic conductivity of 40 ft/day, versus 2.1 ft/day). Water seeping in from all three sides of the excavated pit is not expected to recharge the bedrock zones as the water will follow the path of least resistance and flow to the south along the pit floor as is now the case at the old Peabody Nucla Mine (New Horizon #1 Area permit). This water was expected to continue to issue as a spring at SS #1 location (see Map 2.04.7-1), but overall flow rates from the SS #1 have not increased, and flows currently emanating from the location are similar to pre-mine flows from the Old Peabody Mine backfill.

FIGURE 2.05.6(3)-1
North-South Section Showing Drainage in Backfill



Backfilling of pit walls and continued irrigation adjacent to the permit boundary will allow ground water levels to recover as demonstrated by the 80% recovery of the water levels at GW-N8 in less than 20 years. The ground water from the Dakota bedrock zones has not been used to date because of poor quality and low production potential. Further, the “bedrock” seepage water will continue to flow tributary to Tuttle Draw maintaining the hydrologic balance of the San Miguel River. Infiltrating irrigation water on the reclaimed backfill will also travel the path of least resistance and issue at the SS# 1 location as increased flows tributary to Tuttle Draw and The San Miguel River. The impact of the backfill material on the ground water flow and recharge is therefore minimal. Two quarters (6 months) prior to initiation of mining activity at NHN, flow and water quality monitoring (field parameters) at the SS# 1 location will be resumed in order to detect and evaluate changes to the spring flow. The ground water aquifer below the Dakota coal, (the Brushy Basin Member of the Morrison Formation) has much better water quality and will not be affected by mining and reclamation at NHN Mine. Shale layers below the mined coals prevent interaction between the spoil and this aquifer, which gets its recharge up dip and away from the mine operations.

Containment of Pit Inflow and Impacts on Water Quality

All runoff and pit pumpage from disturbed areas will be routed through approved NPDES sedimentation pond(s). These pond(s) will be designed and constructed to impound runoff and pit pumpage from areas disturbed by mining and provide sufficient residence time to insure that the pond discharge water chemistry meets the effluent requirements specified in the NPDES Permit. A review of the chemical and flow data indicates that the potential for any discharge from any NPDES pond to exceed receiving stream or federal standards is minimal. A copy of the approved NPDES permit is on file at the New Horizon North Mine office and is available for review at the Division’s request.

Potential Impacts of Replaced Spoil on Groundwater Quality

Since the mining operation will disrupt the overburden above the LDX Seam and remove the LDX Seam, these are the only two stratigraphic zones that will be affected by the operation. As described in the section on overburden water quality, the pre-mine quality of the overburden water is poor, with TDS generally in the 3000 ppm range and some ions exceeding limits for most water uses. The primary potential for impacts to ground water quality will occur from increased water infiltration causing an accelerated oxidation of pyrite in the backfill material. Other salts may also dissolve more readily in the highly permeable backfill. The potential for minor amounts of sulfuric acid production could cause lower pH, which would then result in higher rates of dissolution of other chemical compounds in the spoil, resulting in higher TDS. The water draining through the backfill will most likely not saturate the back fill south of Meehan Draw, (see Figure 2.05.6(3)-1) but rather drain to the south and issue as a spring at the SS# 1 location.

Spoil Water Chemistry

Concerning impacts from the conversion of overburden to backfill material, the available data indicate that a small proportion of the overburden may produce acid through the oxidation of pyrite. Based on laboratory tests on overburden cores, calcite is present throughout the overburden. Calcite serves two functions. First, it buffers the pH of the water, which overall tends to slow the oxidation of pyrite, slowing the production of acid. Second, it will neutralize the acid that is produced. The core samples that exhibited low paste pH are surrounded by non-acid producing, calcite-bearing rocks. The water that contacts the low-paste pH materials will have first reacted with calcite, and therefore developed a pH-buffer capacity of its own. The groundwater monitoring data indicate that mixed overburden and interburden waters have near neutral pH. Sample pH's less than 6 are associated only with the lower Dakota coal. Where the coal's permeability is high enough to produce about 5 gpm during sampling, the acid-producing reactions do not appear to be fast enough to maintain the pH of the water less than 5. Oxidation rates may increase because of the mining process. However, the rate of oxidation is only one of the constraints on the production of acid. Other constraints are imposed by the quantity of calcite present and the reactivity of the pyrite. The paste-pH test, conducted under oxidizing conditions, indicates that a very small proportion of the overburden is likely to produce acid. This overburden is generally located in a thin zone immediately above the coals. The acid that is produced should be quickly neutralized.

The ability of the calcite in the overburden spoil to neutralize any acid produced is dependent upon a number of factors such as:

a) The uniform distribution of calcite in the replaced overburden,
b) The higher transmissivity of the backfill allows irrigation water with higher levels of oxygen to move quickly through the spoil, resulting in faster breakdown of the pyrite in the backfill,
c) High void channels developing in the backfill at the bottom of the pit which may serve as the primary conduit for flow in the backfill,
d) The quantity of calcite available in the areas needed most,
e) Other chemistry which may influence the neutralization reactions.

For these reasons, there is a possibility that water leaching through backfill may result in a higher level of TDS for some period of time, until pyrite in the overburden spoil is fully oxidized and removed. This was found to occur at the Seneca II Coal Mine in northwest Colorado and was the subject of a study by the USGS in 1994. Sampling data gathered through the last 13 years at the New Horizon Mine suggests that some pyrite is oxidizing but is being neutralized, as described below.

The analysis of geochemical controls on groundwater quality at the New Horizon #1 Mine backfill suggests that the water chemistry and concentrations of most elements of concern are controlled by mineralogical reactions that will resist changes in water chemistry. It appears that any pyrite

(FeS_2) oxidation gets neutralized by calcite ($CaCO_3$) present in the same spoil material. This results in the iron precipitating as iron oxides. The slightly higher than normal pH of the natural water means that there is sufficient acid-neutralizing ions such as hydroxyl (OH-) or bicarbonate (HCO_3^-) in solution to absorb the acidic hydrogen (H+) ions produced by the pyrite oxidation. Soluble sulfate (SO_4^{-2}) ions are also produced by the pyrite oxidation, and they are quickly taken up by the calcite to produce calcium sulfate or gypsum ($CaSO_4$), which is not very soluble and also precipitates out of solution, especially when the pH of the solution is near normal. The (CO_3^{-2}) anion in the calcite goes in solution to replace the sulfate. Calcium stays as a solid in the new gypsum produced. Overall, the net change to the water quality is not significant as compared to overburden water, but some pyrite has been converted to other solid compounds: gypsum and iron oxides such as limonite. Strong support for this occurring is seen in the water quality comparison of overburden ground water to spoil water. From historic data, (see New Horizon 1 Area permit) ground water monitoring hole GW-N9 is north of the mined areas of New Horizon #1 and water quality has not been affected by the mine since the flow gradient is from the northeast to the southwest and is best to use in the comparison. SS#1, which developed near the southwestern end of the reclaimed mine (old Peabody Nucla Mine) best represents the spoil water quality. Table 2.05.6(3)-1 shows the chemistry of these waters sampled at the same time.

It is important to understand what is truly different from the pre-mine condition to the backfill condition. In the pre-mine condition, good quality water from the irrigation ditches infiltrates through the soil and through the more permeable strata and picks up dissolved solids. The water quality becomes poor (approx. 3000 ppm TDS), but this process takes a very long time since the water moves very slowly through the tight strata with low hydraulic conductivity, (K value of 2.1 ft/day at GW-N9).

In the case of the old Peabody backfill (New Horizon #1 Area permit), the hydraulic conductivity is 40 ft/day (at GW-N27) and the potential is high that much more irrigation water could be recharged rapidly through the more permeable, broken backfill material. The old Peabody backfill gets its recharge from both seepage from the bedrock zones (mostly overburden), and from irrigation water surface runoff. The old backfill is not directly recharged from irrigation itself as the old backfill is not irrigated. The distinction being that, pristine ditch water is not entering the old Peabody backfill but that runoff and bedrock water is. The average TDS of the irrigation ditch water is only about 200 mg/l and pH of 8.3, (see Table 2.04.7-6, SW-N209). Runoff water is 2 to 3 times higher in TDS and in streams the TDS is 5 to 6 times higher, (see Table 2.04.7-7, SW-N202). The better quality water infiltrating the backfill picks up dissolved solids as in the case of the overburden; however, it simply does so much more rapidly. Water infiltrating into the spoil at the upper end of the New Horizon #1 spoil may only spend 15-45 days in the spoil before the water is discharged at the spring. Yet, during this short time, it has managed to become approximately the same quality as the overburden water. Due to the increased porosity and higher level of oxygen in the rapidly infiltrating water, the pyrite breaks down at a faster rate but this reaction is buffered by both the higher pH of the water and the calcite in the replaced overburden. Therefore, the overall impacts to groundwater water quality are the following:

Table 2.05.6(3)-1
Pre-Mine Water Quality Comparison-Overburden Water (GW-N9) vs. Spoil Water (SS#1)

Sample Date	11/1995		08/1996		08/1998		08/1999		08/2000		03/2001	
Parameter	**GW-N9**	**Spoil Spr.**	**GW-N9**	**Spoil Spr.**	**GW-N9**	**Spoil Spr.**	**GW-N9**	**Spoil Spr.**	**GW-N9**	**Spoil Spr.**	**GW-N9**	**Spoil Spr.**
Sulfate	1,820	2,020	2,010	2,000	2,020	790	Not Sampled	1,240	1,840	1,890	2,200	1,980
Magnesium	157	222	224	220	218	102		151	158	190	236	215
Iron Total	14.8	0.06	1.64	0.09	0.74	1.3		0.62	0.42	0.73	0.27	1.18
Bicarbonate	292	415	323	411	330	295		322	280	368	302	419
Calcium	564	537	549	555	550	269		398	555	542	567	541
TDS	2,950	3,280	3,120	3,210	3,350	1,560		2,120	2,740	3,280	3,210	3,050
Flow in cfs	-	0.09	-	0.17	-	0.26		0.40	-	0.26	-	0.18

A) In the pre-mine condition, a large portion of the irrigation water runs off the surface and picks up some TDS in the fields and is gathered in return ditches. In the post-mine condition, a large portion of the irrigation water will infiltrate the backfill due to the increase in porosity. The TDS and pH of the backfill water at the New Horizon North Mine is expected to approximate that of the overburden water quality, resulting in minimal impact to the ground water quality. Water movement through the spoil will be considerably faster than the movement in the overburden.

B) SS #1 location will continue to discharge water from the Old Peabody mine backfill to down gradient surface water. This is an impact, not related to the NHN, rather a pre-existing mining operations, as flows have not increase for SS #1since mining and reclamation activities have occurred at NHN.

C) Once the pyrite is oxidized and easily dissolved salts are washed out of the spoil, the water in the spoil springs will gradually get lower in TDS until sometime in the distant future, the spoil spring water quality will get better than the overburden quality. As dissolution of the backfill continues, the backfill water will approach the irrigation water quality. Time periods for this to occur are given later in this section.

Spoil Water Infiltration Into Backfill

Any accumulated spoil water may enter one or more of the minor sandstone beds of the overburden in the backfill. This annual infiltration is calculated below assuming a 10' average backfill height, a hydraulic conductivity of 2.1'/day (from GW-N9) and a hydraulic gradient of 0.053 (based on the water level gradients along the old Peabody Highwall).

Seepage into the backfill is equal to: (10' average backfill height) x (1,900' wide seepage area) x (hydraulic conductivity of 2.1'/day) x (hydraulic gradient of 0.053) x (1/43,560 cu. ft. per ac- ft.) x (365 days per year) is equal to 17.7 ac-ft per year, or an average of about 11 gpm. It is strongly believed that spoil water seepage into the backfill will not have any significant impact on water quality, flow rates, well usage, etc. due to four reasons:

1) As described in this section, the water quality of the spoil water will be at a maximum 6% to 10% higher in TDS than the existing overburden water quality, which is relatively poor. Regardless of the seepage rates into the sandstone zones, the water quality will be very similar and consistent with the overburden, with a TDS from 2,800 to 3,500 ppm.
2) Due to the low seepage rates, the movement is very slow.
3) The sandstones above the Dakota coals have historically been too poor in quality and too low in flow rates to provide for useful wells. For this reason, no known wells in the vicinity of the mine area have been completed in the Dakota Formation. It is very unlikely that any new wells will be completed in the Dakota Formation in the vicinity since the Brushy Basin Member of the Morrison Formation provides significantly better water quality and flow rate and is located only 160 feet deeper than the Dakota LDX Seam at NHN permit area.
4) The local wells are completed in the Brushy Basin Member of the Morrison Formation, which is below the Dakota coals. Although this zone has significantly better quality water, these sandstones are separated from the spoil by shale layers with very low permeability; therefore, these aquifers cannot be affected by the spoil water.

Impact of Backfill Water Quality on Surface Water Quality

Spoil Water Quality

The chemistry of the water interacting with the spoil is described in the previous section. In order to determine the impact of the spoil water quality on the surface water, it is first necessary to predict the expected quality of the spoil leachate for the NHN Mine. The principal impact from a quality perspective is that any irrigation water will seep rapidly through the spoil, increase in TDS and then was estimated to discharge through SS #1. SS #1 is directly tied to the old Peabody Nucla Mine, (see New Horizon #1 Area permit). The water discharged from this spring is an impact to from an adjacent mining operation, since flows from SS #1 have not increased as predicted from mining and reclamation activities at NHN. The potential impact that may be present is tied to the Old Peabody Nucla Mine and not NHN.

Timeframes of Elevated TDS in Spoil Water

The time period that these slightly elevated levels of TDS in the spoil water and spoil spring discharges is difficult to calculate. In 1994, the USGS did a detailed study of the impacts of infiltration into spoil at the Seneca II Coal Mine in Routt County, CO. This study is Water Resources Investigations Report 92-4187 titled *Hydrology and Geochemistry of a Surface Coal Mine in Northwest Colorado*. Lysimeters were installed to measure infiltration rates into the spoil, and samples of inflow water, spoil water and spring discharge was analyzed for the entire area. It was determined that pyrite oxidation was the principal cause of elevated TDS, and that the percent of pyrite in the spoil was the determining factor in the length of time that the TDS would be elevated in the spoil water. A spoil pyrite content of 1% by weight, for example, was predicted to fully oxidize in 1600 years (their Table 18). TDS levels in the spoil water were approximately 4500 ppm, which was a significant increase over the overburden aquifer water in the area. The coal mine overburden at that site is somewhat younger (upper Cretaceous) in age but is similar in lithologic character to that of the adjacent New Horizon Mine. The USGS study methodology was used as a basis to predict the time frames of slightly elevated TDS in the spoil water at the New Horizon Mine, (see New Horizon #2 Area permit Section 2.05.6(3)). The sulfur content in the overburden at NHN is similar to that at the New Horizon Mine (see Table 2.04.6-2, Section 2.04.6 of this application). The result of that prediction indicated that about 800 years would be required to oxidize the sulfur in the overburden at the New Horizon Mine and therefore about 800 years to oxidize the sulfur at NHN Mine. As the oxidation of the pyrite is the main source of increased TDS in backfill water quality, elevated TDS from spoil water springs could remain for several centuries.

The NHN Mine will have two significant differences to the results observed at Seneca II. First, the calcite present in the spoil at NHN permit area seems to react with acid produced by the oxidation of pyrite and take a substantial amount of sulfate from solution directly into solid calcium sulfate. This keeps the dissolved solids content somewhat constant no matter how high or low the inflow water quality is with regard to TDS. Second, the Seneca II site is a dry-land reclaimed area where the only recharge into the spoil is a minor amount from precipitation and seepage from the underburden aquifers. Total measured discharge from the spoil was only 3" per year. The NHN Mine will be partially irrigated with water of better quality over a large portion (45%) of the year. As described earlier, this results in a total movement through the spoil of approximately 13" per year (81 ac-ft). Since the amount of water moving through the NHN backfill is greater, it should oxidize the pyrite more rapidly and also flush other salts which are contributing to the increase in TDS at a higher rate. For this reason, a ratio of the discharge at both sites could be used to predict the time frame of slightly elevated spoil water quality. This ratio - 3"/13", as applied to 1500 years results in a time frame of 346 years until all the pyrite is oxidized. When considering all the variables involved, this means that it could dissipate within a range of 200 to 500 years. The TDS should begin to drop before this time. Once the pyrite is fully oxidized and other salts are flushed out, the backfill water quality should approach the existing stream water quality, possibly dropping to 800 to 1200 mg/l TDS. It is not likely that the backfill water will ever reach the low TDS of the ditch- run water as seepage from the overburden zones into the backfill will continue as long as the 2nd Park irrigation continues.

Impacts To Receiving Waters - Tuttle Draw

As described earlier, drainage through the NHN backfill material will move to the south following the path of least resistance along the pit floor and was predicted to come to the surface at the general location of SS #1, (see Map 2.04.7-1), but an increase in flow rate from SS #1 has not occurred since mining cease at NHN. SS #1, is the spoil water discharge from the old Peabody Nucla Mine (New Horizon #1 Area permit) and has been monitored since 1987. Spoil Spring #1 water mixes with irrigation runoff and return water from Nygren Draw and then discharges into Tuttle Draw located about 1600 ft. downstream from the spoil spring. Tuttle Draw enters the San Miguel River approximately 2 miles to the southwest.

Historic sample data (since 1987) from surface water sites, NPDES 001 (Peabody Mine pond), SW-N3, and the San Miguel River has shown that the concentration of TDS in these sources varies inversely with the flow volume. Total dissolved solids (TDS) increase during the low flow periods and decrease during the high flow periods. For NPDES 001 and SW-N3 high flows correspond with the irrigation season; however, the San Miguel River is typically in low flow condition during the irrigation season. During the non-irrigation season flows from NPDES 001 and SW-N3 are low and TDS is higher while the San Miguel TDS is lower due to the higher flow, (see Table 2.05.6(3)-4 of New Horizon #2 Area permit). This presents both a high and low flow case which are complicated by the fact that spoil spring flow predicted to occur after the New Horizon Mine has been reclaimed has not yet occurred. Therefore, the impacts to the receiving waters will be evaluated for both high and low cases, with and without irrigation, and including the predicted spoil spring flows from New Horizon Mine and the existing spoil spring flow from the old Peabody Nucla Mine (New Horizon 1 permit area). The irrigation case corresponds to the September/October time period when flows are fairly low in the San Miguel River. The non-irrigation period corresponds to March/April when flows in the San Miguel are usually at peak. As described previously, irrigation of the reclaimed NHN Mine will produce a flow in the spoil of about 81 ac-ft./yr,(at full irrigation). Over the length of the irrigation season (165 days) this is an average of about 0.248 cfs. During the non-irrigation season the flow from the NHN backfill spring will mimic flow levels from the old Peabody Mine or about 0.041 cfs. The TDS values for the NHN backfill spring discharge were averaged from sample analyses from NPDES 001 discharges from 1987 to 2000 and reported on Table 2.05.6(3)-4 of the New Horizon #2 Area permit. The Tuttle Draw TDS and flow values were also averaged from analyses and measurements from 1987 through 2000 and likewise reported, (see Table 2.05.6(3)-4 of the New Horizon #2 Area permit), as taken at surface water site SW-N3. Table 2.05.6(3)-2b included in Appendix 2.05.6(3)-2 shows this information for these as well as other sample points.

Table 2.05.6(3)-2 shows the predicted impact of the NHN backfill spring discharge on the receiving waters of Tuttle Draw. During the irrigation season, the predicted TDS for Tuttle Draw is an increase of about 9 mg/l or about 0.5%. During the non-irrigation season the predicted TDS for Tuttle Draw is an increase of 26 mg/l or about 1.2%.

The spoil water inflows from NHN Mine will influence the quality of Tuttle Draw to a minor degree. However, within about 2 miles, this flow enters the San Miguel River where the flow is so much larger than the Tuttle Draw flow that the impact is negligible. Further, the water in Tuttle Draw is too high in dissolved solids for domestic drinking water or for use in irrigation without treatment. Also, these impacts are for the time when the spoil material is leaching salts at a maximum. As described earlier, the TDS levels will drop over time as pyrite is oxidized and other salts are leached out of the spoil which will lessen the impact to the waters downstream over time. Six months prior to NHN Mine startup, monitoring of SS #1, and SW-N3 (on Tuttle Draw) will be resumed if at that time it has been suspended. The approved "hydrologic monitoring plan" is described in Appendix 2.05.6(3)-3 at the end of this section.

Effects Of Mining On The Local Geomorphology

Impacts from mining on the local geomorphology will be long term, but appear to be of minimal significance. The reclaimed land will be graded to enhance irrigation and restore similar drainage patterns to those which existed on the area prior to mining. The increased runoff and consequent erosion potential on disturbed basins in the mining area due to the temporary loss of topsoil structure should be of minimal significance since all disturbed areas will be protected by a system of sediment ponds. Contour ripping, mulching and revegetation have been demonstrated to minimize soil erosion and will be used to mitigate the increased runoff potential until the topsoil structure is developed. Irrigation will help this to occur rapidly.

Effects Of Sediment Ponds On Channel Characteristics and Downstream Users

Potential impacts of sediment ponds on downstream users will involve possible reductions in flow due to impounded water. The water augmentation plan (included in the Appendix 2.05.6(3)-1c to this Section) discusses the available water which will be used should impacts be identified. NHN currently has rights to a sufficient quantity of water to supply all users associated with the mining activities, plus an additional quantity of water that can be used to mitigate any impact to downstream users.

Effects Of Sediment Pond Discharge On Surface Water Quality

The effects of sediment ponds on surface water quality will be negligible because each sediment structure has been designed to minimize impacts to the hydrologic balance. The ponds involve such minor areas of disturbance that chemical and sediment changes in the flows will be immeasurable.

Effects of Runoff from Reclaimed Areas on the Quality Of Streamflow

Due to the relatively small area of disturbance in the NHN Mine area, any reductions in runoff will have only a minimal impact on streamflow quantity, as flow in Tuttle Draw is dominated by irrigation return flow. Decreased sediment loads predicated by SEDCAD (see New Horizon #2 Area permit) indicate that reclamation efforts conducted in the mining area will ensure that additional contributions of suspended sediment in runoff from reclaimed areas will not occur. Irrigation of reclaimed area will utilize sprinklers instead of flood irrigation that should further reduce erosion and sediment load. Based on past operating history at both Nucla Mine and the adjacent New Horizon Mine, no significant trend toward higher concentrations of the selected parameters has been detected. In addition, the pond discharge will be monitored in accordance with NPDES discharge limitations and any potential impact will be identified. Therefore, runoff from the reclaimed area should have no significant impact over time on the quality of receiving stream waters. As a result, post mining land uses which currently occur in the area should not be affected due to the projected mining plan.

Summary

The discussion presented herein of the probable hydrologic consequences of the NHN mine plan identifies the potential effects of mining. Table 2.05.6(3)-2a located in Appendix 2.05.6(3)-2 of this permit application summarizes the discussion by listing the probable hydrologic consequences and the results of the analysis of each. As can be seen, all of the probable impacts have been determined to be of a short term nature, of minimal significance, or a plan has been presented to mitigate those determined to have some significance. As a result, mining and post mining effects to the current land uses should be negligible.

Table 2.05.6(3)-2
NHN Backfill Springs Predicted Impact on Receiving Streams

	Irrigating Season		**Non-Irrigating Season**	
Source/Stream	**Flow (cfs)**	**TDS (mg/l)**	**Flow (cfs)**	**TDS (mg/l)**
Old Peabody Mine (Nucla Mine) SS #1 Discharge – Outside of NHN Permit Boundary(1)	0.248	1,967	0.041	2,885
Tuttle Draw Stream Quality(1)	3.816	1,817	0.965	2,244
Predicted Tuttle Draw Stream Quality	***4.064***	***1,826***	***1.006***	***2,270***

(1)Includes predicted impacts from SS #1 at the Old Peabody Mine.

Hydrological Monitoring Plan

The text in Section 2.05.6(3) describes the basis for monitoring various ground water and surface water monitoring sites. Map 2.04.7-1 provides the locations of all the monitoring sites at New Horizon North Mine.

Groundwater Monitoring

Nine groundwater sites will be monitored quarterly at the New Horizon North Mine as described below. These sites include locations to monitor the coal, underburden, and overburden aquifers.

- GW-N50 monitors the underburden aquifer and represents the up gradient condition.
- GW-N51 monitors the Dakota coal aquifer and represents the up gradient condition.
- GW-N52 monitors the overburden aquifer and represents the up gradient condition.
- GW-N53 monitors the underburden aquifer and represents the down gradient condition.
- GW-N54 monitors the Dakota coal aquifer which represents the down gradient condition.
- GW-N55 monitors the overburden aquifer which represents the down gradient condition.
- GW-N56 monitors the underburden aquifer down-dip of the mining area. This well is a point of compliance location.
- GW-N57 monitors the Dakota coal aquifer down-dip of the mining area. This well is a point of compliance location.
- GW-N58 monitors the overburden aquifer down-dip of the mining area. This well is a point of compliance location.

For all groundwater wells, field parameters will be collected quarterly which will include water level, temperature, pH, and conductivity. Sampling will also occur quarterly, and laboratory analyses will occur on the parameters listed below:

pH	Conductivity at 25°C	Total Dissolved Solids	Bicarbonate (HCO_3^-)^D	Calcium (Ca^{+2})^D
Magnesium (Mg^{+2})^D	Ammonia (NH_3)^D	Nitrate^D	Phosphate (PO_4^{-3} as P)^D	Sodium (Na^+)^D
Sulfate (SO_4^{-2})^D	Arsenic (As)^D	Iron (Fe)^D	Lead (Pb)^D	Manganese (Mn)^D
Mercury (Hg)^D	Selenium (Se)^D	Zinc (Zn)^D	Alkalinity	Alumium^D
Carbonate^D	Chloride^D	Nitrogen as Nitrate^D	Nitrogen as Nitrite^D	Iron^D
Lead^D	Molybdenum^D	Potassium	Sodium	Cation/Anion Balance

D= Dissolved

Surface Water Monitoring

Four surface water sites will be monitored for the New North Horizon Mine. These sites include locations along Meehan Draw and Nygren Draw.

- SW-N202 is located on Meehan Draw and represents the downstream condition below mining and reclamation areas.
- SW-N207 is located on Meehan Draw and represents and up gradient condition.
- SW-N213 is located on Nygren Draw and represents the up gradient condition.
- SW-N214 is located on Nygren Draw and represents the down gradient condition below mining and reclamation areas.

For all surface water locations, field parameters will be collected quarterly which will include flow, temperature, pH, and conductivity. Sampling will also occur quarterly, and laboratory analyses will occur on the parameters listed below:

pH	Conductivity @ 25°C	Total Dissolved Solids	Total Suspended Solids
Calcium (Ca^{+2})^{D}	Magnesium (Mg^{+2})^{D}	Ammonia (NH_3)	Nitrate-Nitrite^{D}
Sodium (Na^{+})^{D}	Sulfate (SO_4^{-})^{D}	Arsenic (As)^{TR}	Iron (Fe)^{TR}
Mercury (Hg)^{T}	Manganese (Mn)^{D}	Selenium (Se)^{D}	Zinc (Zn)^{TR}
Phosphorus (PO_4 as P)^{T}	Lead (Pb)^{TR}	Bicarbonate (HCO_3)	Sodium Absorption Ratio (SAR)
Chloride (Cl^{-})^{D}	Aluminum (Al)^{TR}	Cadmium (Cd)^{TR}	Copper (Cu)^{D}

D = Dissolved
T = Total
TR = Total Recoverable