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HYDROLOGIC MONITORING PROGRAM
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attempt to minimize the amount of additional background variability in the water quality data. With the installation of downgradient surface site HGSD3, HGTI abandoned monitoring at HGSD2. Upon release of the rail loop and the Tie Across haul road HGTI abandoned HGSD1 and HGSD3 with PR-03.

Upon final release of the rail loop to the recreation trail, the Colorado Wastewater Discharge Permit System permit was terminated and the two pond outfalls (001 and 002) associated with the spillways of the two sedimentation ponds located at the loadout (Truck Loop Pond and Rail Loop Pond) where abandoned. The ponds remained as livestock ponds. Locations of each surface water monitoring site and NPDES outfall are presented on Exhibits 12-1, Facilities Map, 12-2, Surface Water Control Map, and Figure 13-1, Monitoring Site Location Map in Tabs 12 and 13. Discharge and water quality data collected at the five surface water monitoring sites are presented in Tab 7, Hydrologic Description of this PAP.

Ground Water Monitoring. Ground water monitoring was initiated at the loadout facility by H-G in 1987 and utilized two shallow monitoring wells. The wells were installed to monitor shallow ground water in alluvial/colluvial deposits and shallow bedrock (Lewis Shale). The wells (upgradient shallow well (HGDAL1) and downgradient shallow well (HGDAL2)) were located proximate to the facilities area; however, upon examination of the monitoring program as part of HGTI's facility permitting effort, HGTI determined the wells were not positioned above and below all disturbance associated with the facilities area (see Exhibit 12-2). Figure 13-2, Completion Report for Downgradient Shallow Well, presents a well completion sketch for the downgradient shallow well (HGDAL2), which was completed in 1987 (by HGCC). HGTI is unable to locate a well completion report for upgradient shallow well, HGDAL1, however it is HGTI's understanding that this monitoring well was completed in a similar manner and at a similar depth as depicted in Figure 13-2. Monitoring for levels and water quality was conducted semiannually (spring and fall) beginning in 1987, excepting 1988 and 1990, when an additional sampling round was performed at both wells during the summer. Since monitor wells HGDAL1 and HGDAL2 were partially completed in the Lewis Shall, HGTI and CDMG have concerns the data from the wells may not be representative of Dry Creek alluvial chemistry.
As a consequence, a third well, HGDAL3, was installed approximately 800 feet downgradient of the facilities area and associated disturbance on October 28, 1993. Well completion and aquifer test information for HGDAL3 are presented in Tab 7, Attachment 7-2.

A majority of the ground and surface water monitoring conducted by HGCC was performed after the last of the coal stockpile at the loadout facility was shipped out in 1986. From 1986 through 1992, the loadout had remained inactive and all coal storage, handling, and shipping activities were discontinued. Therefore, the data collected from 1987 through 1992 was only minimally influenced by the small remaining amount of coal left on site (coal stockpile leachate) or activities associated with the loadout, and may be considered to reflect natural conditions. Since 1993, HGTI has shipped approximately 170,000 tons of coal in 17 trains. A small pile of coal remains at the coal stacker for the annual scale test.

Since November 1995, only well HGDAL3 has been monitored as part of the groundwater monitoring program. HGTI added monitor well HGDAL4 to the monitoring program during 2005 as part of TR-06. These wells are monitored semiannually for water levels, field water quality parameters (pH, temperature, and conductivity) and parameter suite presented in Table 13-2, Groundwater Parameter List.

HGTI abandoned monitor wells HGDAL1 and HGDAL2 in September 2007. Well HGDAL3 was abandoned in 2021 and HDGAL4 will be abandoned in 2026. The wells were abandoned in accordance to the rules of the Colorado Division of Water Resources and Rule 4.07.3(3) of the Rules and Regulations of the Mined Land Reclamation Board for Coal Mining. Abandonment reports are present in Tab7.

Monitoring Site IDs. Different monitoring site name identifiers have been established for all historic monitoring sites, as well as the new stream and alluvial well monitoring sites. The following list provides the new names (IDs) and any corresponding historic names used.

Historic Names or Descriptions	New Site IDs
Upstream Surface Water Monitoring Site	HGSD1
Downstream Surface Water Monitoring Site	HGSD2
New Downstream Surface Water Monitoring Site	HGSD3
Upgradient Shallow	HGDAL1 (abandoned)
Downgradient Shallow	HGDAL2 (abandoned)
“Replacement” Downgradient Alluvial Well	HGDAL3
“New” Upgradient Alluvial Well	HGDAL4
CDPS Outfall 001A (Truck Loop Pond)	Truck Loop Pond
CDPS Outfall 002A (Rail Loop Pond)	Rail Loop Pond

Figure 13-1 Monitoring Site Location Map depicts the locations of all monitor sites and includes HGTI’s ID designations.

Monitoring Rationale and Methodology. Considerable discussion has occurred between PWCC and CDMG staff regarding monitoring approaches, sites, and frequencies in development of the operational monitoring program during Technical Revision No. 1. The following summarizes the conclusions reached.

The upgradient surface water and ground water variability (potential contaminant sources from irrigation return flows, adjacent dryland farming drainage and seeps, and seeps or subsurface flow from the Lewis shale, and adjacent industrial sites [i.e., Routt County Road and Bridge Department Shop]) cannot be totally eliminated or quantified regardless of the location of upgradient monitors. Gain loss studies performed on Dry Creek during 1993 (see Tabs 7 and 15) do not indicate that groundwater inflow from either side of the Dry Creek drainage into Dry Creek is occurring during the principal growing season. Because of the positioning of alluvial Wells HGDAL1 and HGDAL2, their completion and the timing of their construction, the baseline data from these wells may not be representative of Dry Creek alluvial aquifer chemistry. Chemistry information obtained from the new downgradient alluvial well (HGDAL3) indicates the true alluvial chemistry in this well is very similar to the chemistry depicted by Wells HGDAL1 and HGDAL2. A coal leachate study and impact analysis performed in winter 1993/1994 (see Tab 15, Table 15-1) demonstrates the coal leachate will not measurably impact the Dry Creek and alluvial water quality and is not responsible for the existing water quality observed in the data from monitor well HGDAL3. The alluvial aquifer has been and continues to be unsuitable for use as irrigation or stock water. Dry Creek has been and continues to be unsuitable for irrigation use and suitable to marginally suitable for stock use. The downstream and downgradient monitor locations immediately below the facilities area replace monitoring sites HGSD2 and HGDAL2 and remove the potential for any additional downgradient natural chemical variability to be introduced in the water quality analyses.

At the request of CDMG, HGTI revisited the potential for shallow alluvial groundwater contamination to the alluvial ground water system downgradient of the Loadout Facility in 2005. The evaluation is presented in Appendix 7-2, shallow Alluvial Groundwater Evaluation. In summary, the evaluation indicates that the regional alluvial groundwater is generally of “limited use and quality”, and that there appears to be no significant impact from the Loadout to alluvial groundwater chemistry downgradient of the facilities area. Samples from collections both upgradient and downgradient had a total dissolved concentrations that exceed 10,000 milligrams per liter, which is the groundwater standard for agriculture water. To verify the conclusions presented in Appendix 7-2, HGTI installed a new

HGDAL1 and HGDAL2, PWCC will negotiate with CDMG as to whether Dry Creek stream water quality monitoring immediately above Walker Ditch should be implemented to confirm whether the alluvial aquifer increases at the loadout pose any spatially significant stream water quality and use potential problems immediately above the flood irrigated fields fed by Walker Ditch.

The stream water quality adjacent to and immediately below the loadout is suitable for livestock use. Water quality trend analyses previously described will be utilized to determine if persistent concentration changes are occurring that might exceed the livestock use standards. Persistent degradation changes to Dry Creek at Site HGSD3 will be considered significant if livestock standards are exceeded, thus precluding the potential water use. These impact trend analyses will be performed annually and submitted as part of the annual hydrologic data reports. The trend analyses require a minimum of four data points, so the first such analyses will not be performed until 1995.

REVISED MONITORING PROGRAM (2016 TR-11)(Terminated PR-03)

The current (2005-2016) monitoring program consists of spring and fall full-suite water quality sampling of upstream and downstream surface and ground water sites. In addition, National Pollutant Discharge Elimination System (NPDES) monitoring occurs at two outfalls. The tipple area was fully reclaimed in 2011. The office area was fully reclaimed in 2013. Vegetation is coming back very well. Only the rail track remains.

Since the tipple and office areas are fully reclaimed, the surface and ground water quality parameter lists were revised in TR11 submitted in 2016. Surface water monitoring at sites HGSD1 and HGSD3 in the spring and fall will be retained. Ground water monitoring at wells HGDAL3 and HGDAL4 will be reduced from semiannual to annual (spring), which is consistent with the monitoring programs for the adjacent Peabody Energy closed mines, Seneca II-W and Yoast. NPDES monitoring will be continued per the NPDES permit.

Data from the upstream (HGSD1) and downstream (HGSD3) surface water sites for the last five years (2011 to 2015) were compared to the receiving stream standards for lower Dry Creek (Yampa Segment 13h, Regulation No. 33, June 2014). Parameters that exceeded the standards were total recoverable (TR) iron, nitrites, and dissolved selenium. Those parameters will be analyzed as part of the new surface water parameter list, Table 13-3. In addition, to be consistent with Colorado Department of Reclamation, Mining, and Safety (CDRMS) requirements and surface water parameter lists from adjacent mining areas, the following parameters will also be monitored: flow, temperature, conductivity, pH, manganese, total dissolved solids (TDS) and total suspended solids (TSS).

Data from upgradient (HGDAL4) and downgradient (HGDAL3) wells for the last five years (2011 to 2015) were compared to Colorado Department of Public Health and Safety (CDPHE) ground water agricultural use standards (CDPHE, Reg. 41, 2008). Parameters that exceeded the standards were boron and manganese. According to the CDPHE, the 750 ug/l boron standard is set for sensitive crops, and that the limit otherwise is 5000 ug/l. None of these sensitive plant species are grown commercially in this area. The highest boron value from a HGT well was 920 mg/l, therefore, boron monitoring will be discontinued. Manganese monitoring will be retained. To be consistent with CDRMS requirements and ground water parameter lists from adjacent mining areas, the following parameters will also be monitored: depth to water, temperature, conductivity, pH, iron and total dissolved solids (TDS). All parameters will be analyzed as part of the new ground water parameter list, Table 13-4.

2021 PR-2

With the approval of PR-2 the land use for majority of the Rail loop and Rail Spur will be changed to recreation. Following SL2, releasing the recreation area, groundwater well HGDAL3 will no longer be required to be monitored. HGDAL3 will be removed and abandoned prior to the transfer of the property to the Town of Hayden.

2025 PR-3

Upon approval of PR-3 HGT will be terminating all hydrology monitoring and will no longer be required to submit Annual Hydrology Reports. With only 6.8 acres remaining in the permit area there remains no hydrological monitoring sites.