REPORT

COAL COMBUSTION RESIDUALS LANDFILL GROUNDWATER MONITORING SYSTEM CERTIFICATION

Nucla Station Ash Disposal Facility

Nucla, Colorado

Submitted To: Tri-State Generation and Transmission Association, Inc.
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October 16, 2017 **1779126B**

Golder Associates

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1.0 INTRODUCTION

Golder Associates Inc. (Golder) has prepared this report to certify that the groundwater monitoring system that has been designed and constructed for the coal combustion residuals (CCR) landfill that serves the Nucla Generating Station, which is owned and operated by Tri-State Generation and Transmission Association, Inc. (Tri-State), meets the requirements of 40 CFR 257.91.

2.0 FACILITY INFORMATION

Tri-State owns and operates the Nucla Generating Station, a 100-megawatt circulating fluidized bed coal-fired electric generating plant located near the town of Nucla, Colorado. Tri-State disposes of CCRs from the Nucla Generating Station in an existing Tri-State-owned CCR landfill, the Nucla Station Ash Disposal Facility (the Facility), which is located approximately 2.5 miles southeast of the Nucla Generating Station. Within the 81.65-acre property, the CCR disposal footprint comprises approximately 61 acres (see Figure 1).

2.1 Geology and Hydrogeology

Near-surface geology at the Nucla Station Ash Disposal Facility is generally characterized by a thin layer (0 to 15 feet thick) of unconsolidated regolith underlain by 0 to approximately 110 feet of the Dakota Sandstone, approximately 90 to 210 feet of the Burro Canyon Formation, and the Morrison Formation, which is approximately 700 to 800 feet thick regionally. The uppermost aquifer at the site is within the Morrison Formation.

The Morrison aquifer is characterized as highly heterogeneous with zones that are variably transmissive and/or subjected to variable amounts of confining pressure. This characterization is supported by the differences in groundwater levels, water column heights, and recovery times observed in the monitoring wells that have been installed to serve as the groundwater monitoring system for the Facility. Sandstone lenses in the Morrison aquifer vary considerably with respect to transmissivity (i.e., thickness and hydraulic conductivity) and horizontal extent due to the alluvial, shoreline, and lacustrine environments that deposited the Salt Wash and Brushy Basin Members of the Morrison Formation, resulting in interbedded siltstone, mudstone, claystone, and shale units. Groundwater elevation data suggest a general westerly and southerly groundwater flow direction in the Morrison aquifer in the vicinity of the Nucla Station Ash Disposal Facility. However, the heterogeneity and interbedded nature of the Morrison Formation beneath the Facility, coupled with the observation that groundwater levels in the monitoring wells continue to stabilize at the time of this report's preparation, confound the ability to precisely discern groundwater flow direction and hydraulic connection.

3.0 GROUNDWATER MONITORING SYSTEM

The groundwater monitoring system for the Facility consists of five monitoring wells, as shown on Figure 1. The monitoring wells are MO-1, MO-2, MO-3, MO-4, and MO-5.

3.1 Information Reviewed

Golder reviewed information from the operating record documenting the design, installation, and development of the monitoring wells and/or describing hydrogeologic conditions at the site to help assess the adequacy of the groundwater monitoring system. The information reviewed included:

GeoTrans, Inc. (2002). Engineering Design and Operations Report, Nucla, Colorado Ash Disposal Facility. Prepared on behalf of Tri-State Generation and Transmission Association, Inc. March 2002.

Golder Associates Inc. (2017). Site Characterization Report, Nucla Station Ash Disposal Facility, Montrose County, Colorado. Report prepared for Tri-State Generation and Transmission Association, Inc. Project 1538934-16B. June 21, 2017.

Western Colorado Testing, Inc., and J.F.T. Agapito & Associates, Inc. (1987). Final Report – Geological and Geohydrological Evaluation of Dry Storage Site, Nucla CFB Demonstration Project. Report prepared on behalf of Colorado-Ute Electric Association, Inc. July 8, 1987.

3.2 Number, Locations, and Depths of Monitoring Wells

40 CFR 257.91 includes the following requirements for the number, locations, and depths of monitoring wells:

- The groundwater monitoring well system must yield sufficient groundwater samples from the uppermost aquifer to accurately represent background water quality
- The groundwater monitoring system must yield sufficient groundwater samples from the uppermost aquifer to accurately represent the quality of groundwater passing the waste boundary
- The number, spacing, and depths of monitoring wells must be based on characterization of the uppermost aquifer and overlying materials
- The groundwater monitoring system must include at least one upgradient monitoring well and at least three downgradient monitoring wells

On account of the heterogeneity and interbedded nature of the Morrison Formation beneath the Facility, monitoring wells were installed around all four sides of the Facility to help ensure that the groundwater monitoring system would yield sufficient groundwater samples to accurately represent background water quality and the quality of groundwater passing the waste boundary for a wide range of potential groundwater flow directions. The number and spacing of the monitoring wells were selected based on the hydrogeologic conditions at the site and the aerial extent of the active CCR landfill, such that impacts to groundwater quality in the uppermost aquifer can be detected along potential flow pathways if they occur. For the purpose of meeting the requirements of 40 CFR 257.91(c)(1), the monitoring well having the highest groundwater elevation (MO-1) can be considered to be the upgradient monitoring well and the remaining monitoring

wells can be considered to be the downgradient monitoring wells. The depths of the monitoring wells were selected such that the monitoring wells are screened in the Morrison Formation to yield groundwater samples that are representative of water quality in the uppermost aquifer. The number of monitoring wells included in the groundwater monitoring system for the Facility exceeds the minimum number of monitoring wells required under 40 CFR 257(c)(1); correspondingly, the information provided in this report is sufficient to meet the requirements of 40 CFR 257.91.

3.3 Monitoring Well Casing

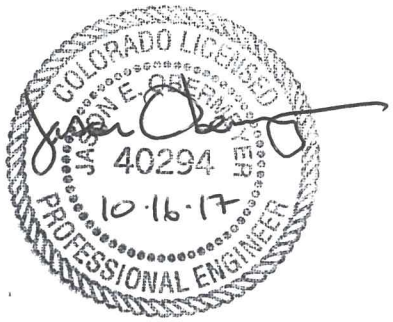
40 CFR 257.91(e) includes the following requirements for monitoring well construction:

- Monitoring wells must be cased to maintain borehole integrity
- The casing must be screened or perforated and packed with sand or gravel to enable collection of groundwater samples
- The annular space above the sampling depth must be sealed to prevent impacts to groundwater

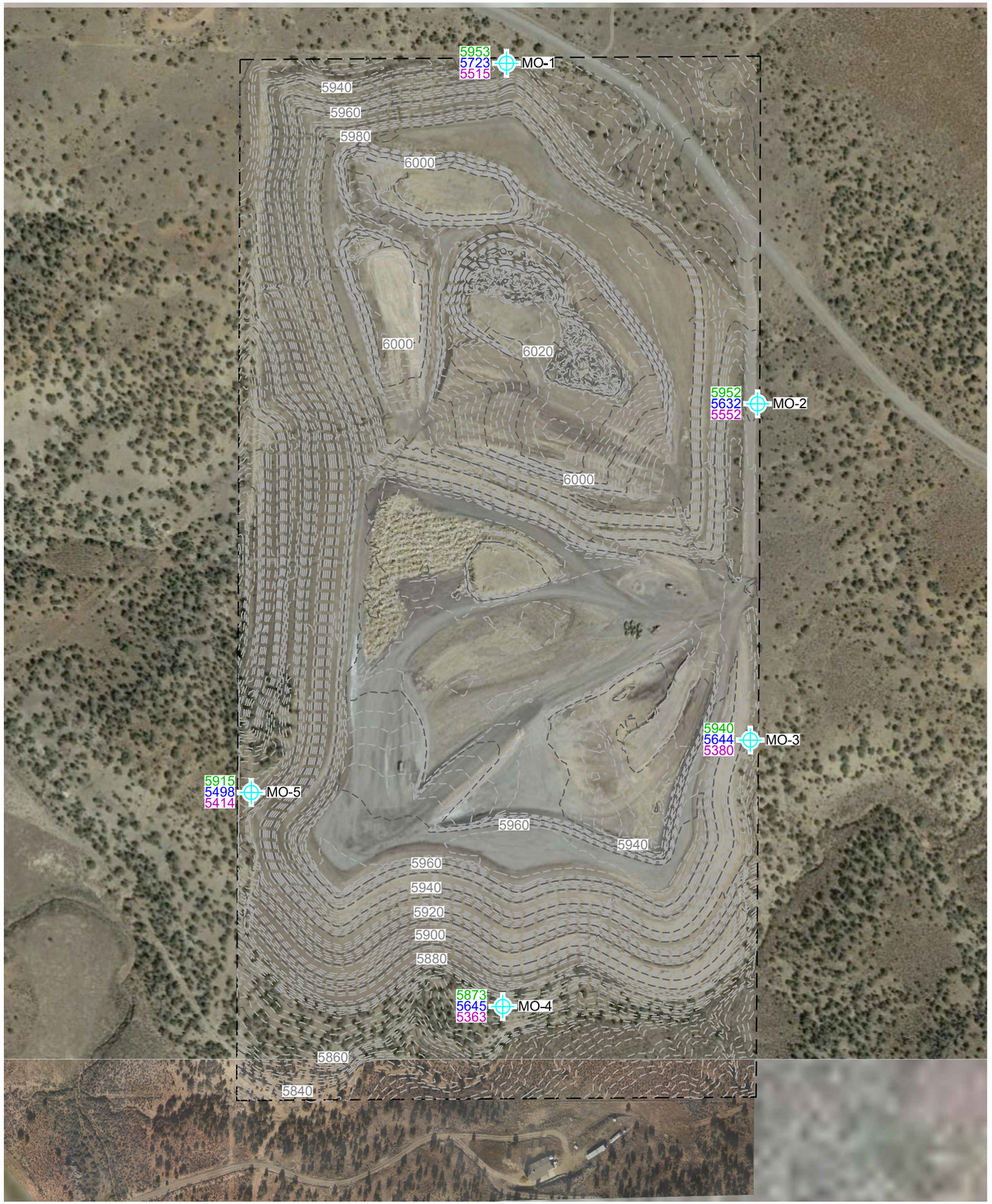
The monitoring wells at the Facility have polyvinyl chloride (PVC) casings to maintain the integrity of the monitoring well boreholes. The casings are screened within the uppermost aquifer and packed with sand to enable collection of groundwater samples from the uppermost aquifer. The annular space above the screened interval in each monitoring well is sealed with a bentonite seal and a cement-bentonite grout seal.

4.0 CERTIFICATION

Based upon the review described in this report, the undersigned Professional Engineer registered in Colorado certifies that the groundwater monitoring system for the Nucla Station Ash Disposal Facility has been designed and constructed to meet the requirements of 40 CFR 257.91.



FIGURE



LEGEND

- PROPERTY BOUNDARY
- EXISTING GROUND TOPOGRAPHY
- MO-1 MONITORING WELL
- 5915 GROUND SURFACE ELEVATION
- 5915 GROUNDWATER ELEVATION (JULY 2017)
- 5915 BOTTOM OF MONITORING WELL ELEVATION

0 150 300
SCALE FEET

CLIENT
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WESTMINSTER, COLORADO 80234

CONSULTANT
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YYYY-MM-DD	2017-10-12
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PREPARED	KAC
REVIEWED	JEO
APPROVED	RRJ

PROJECT
NUCLA STATION ASH DISPOSAL FACILITY
COAL COMBUSTION RESIDUALS LANDFILL
GROUNDWATER MONITORING SYSTEM CERTIFICATION

TITLE
MONITORING WELL LOCATIONS

PROJECT NO. 1779126B | REV. 1 | FIGURE 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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