TECHNICAL MEMORANDUM

JACOBS

Initial Structural Stability Assessment, Ponds B1, B2, and B3, Reid Gardner Generating Station

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DATE:	April 14, 2018
JACOBS PROJECT NO.:	703526

This technical memorandum contains the initial structural stability assessment for Ponds B1, B2, and B3, which was performed to satisfy the requirements of §257.73(d) of the U.S. Environmental Protection Agency's Coal Combustion Residuals (CCR) Rule. This initial assessment must be placed in the Station's operating record not later than April 17, 2018 per §257.100(e)(3)(v), §257.73(f)(1) and §257.105(f)(10). Within 30 days of placement, the State Director must be notified as required by §257.106(f)(9) and §257.106(d). Also, within 30 days of placement, the assessment must be placed on a publicly accessible Internet site per §257.107(f)(9) and §257.107(d). The initial assessment must be certified by a qualified professional engineer (§257.73(d)(3)); and per §257.73(f)(3), an assessment must be performed every 5 years starting from the date that this initial assessment is placed in the operating record. Future assessments must meet the same requirements for certification, record keeping, notification, and posting on a publicly accessible Internet site.

This initial structural stability assessment also serves as the second annual professional engineer's impoundment inspection as allowed by §257.83(b)(4)(ii). The first annual professional engineer's inspection was dated July 13, 2017. Because this structural stability assessment serves as the second annual inspection, the deadline for completing the third annual inspection will be one year from the date that this structural stability assessment is placed in the operating record. Future structural stability assessments may also serve as future annual professional engineer's inspections as allowed by the CCR Rule.

Regulatory Background

Ponds B1, B2, and B3 are inactive CCR surface impoundments that no longer contain CCR or lining systems and are currently being closed. Notifications of intent to initiate closure were placed in the Station's operating record by December 17, 2015, and posted to the publicly accessible internet site by January 16, 2016 (CH2M, 2015a, 2015b, and 2015c). These notifications were prepared to satisfy the early-closure provisions in §257.100 of the CCR Rule. However, on June 14, 2016, the United States District Court of Appeals for the District of Columbia Circuit vacated, or removed, the early-closure provisions in §257.100. On August 5, 2016, the USEPA proposed revisions to §257.100 which required inactive CCR surface impoundments to comply with all requirements applicable to existing CCR surface impoundments, including the requirement for a structural stability assessment per §257.73(d).

Ponds B1, B2, and B3 were designed, permitted, and constructed prior to the publication of the CCR Rule and in conformance with applicable State regulations. The applicable regulations included water

pollution control regulations (Nevada Administrative Code [NAC] 445A), dam safety regulations (NAC 535), and the Nevada Division of Environmental Protection (NDEP), Bureau of Water Pollution Control's (BWPC) technical guidance documents.

Operational Background

According to record drawings, Ponds B1, B2, and B3 were originally constructed with lined earthen embankments (Jacobs, 2018a). The liner system consisted of two layers of high-density polyethylene geomembrane and interstitial leak detection and collection systems. The ponds stopped receiving CCR and non-CCR waste on October 14, 2015. Because the ponds contained CCR and liquids after October 14, 2015, they met the definition of inactive CCR surface impoundments per §257.53 of the CCR Rule.

Field closure operations for Ponds B1, B2, and B3 began in September of 2016. Based on personal visual observations and record surveys, CCR and liner systems were removed from the ponds by the end of 2017. The Station is no longer operational and, as a result, can no longer create wastewater. Additionally, the ponds have been rendered incapable of receiving wastewater because the inlet pipe to Ponds B1, B2, and B3 has been disabled in three locations. The ends of the inlet pipes have been buried, the upstream valves nearest the ponds have been closed, and farther upstream an airgap has been installed in the conveyance pipeline.

Assessment of Impoundment Design and Construction Documentation

This section contains an assessment of the design and construction documentation for Ponds B1, B2, and B3, to include addressing the minimum requirements for assessment documentation listed in §257.73(d)(1)(i) thru §257.73(d)(1)(vii). Much of the design and construction documentation is contained in the Construction History for Ponds B1, B2, and B3 (Jacobs, 2018a), which includes the attachments listed below.

- U.S. Geological Survey topographic map
- Geotechnical Report used for impoundment design
- Record Drawings for closure operations
- Construction Specifications
- Area Capacity Curves

Foundation and Abutment Stability (§257.73(d)(1)(i))

The foundations and abutments of Ponds B1, B2, and B3 were designed and constructed to be stable according to information referenced in the Construction History for Ponds B1, B2, and B3, (Jacobs, 2018a). The dam safety permit application included bearing capacity and slope stability analyses of the foundation and abutment soils (Nevada Power Company, 2008a, 2008b, and 2008c). The specifications also set forth minimum requirements for preparation and stabilization of foundation and abutment soils. Recent analysis has determined that the embankments do not have the required factor of safety for the liquefaction failure scenario (Jacobs, 2018d). And as described in that analysis, this failure mode does not have the potential to cause a release to the environment, and it is recommended that the ponds continue with closure operations per CCR Rule requirements.

Slope Protection (§257.73(d)(1)(ii))

Ponds B1, B2, and B3 have been designed and built with "adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown" according to information referenced in the Construction History for Ponds B1, B2, and B3 (Jacobs, 2018a). The interior embankment slopes no longer require slope protection measures because the ponds are being closed and no longer impound water or CCR. The exterior embankment slopes are protected with by a 6-inch-thick thick layer of aggregate overlying a geotextile (Stanley Consultants, 2008a and 2008b). The embankment crests are protected by a road with gravel surfacing.

Compaction (§257.73(d)(1)(iii))

Ponds B1, B2, and B3 were designed and constructed with sufficient mechanical compaction "to withstand the range of loading conditions in the CCR unit" according to the information referenced in the Construction History for Ponds B1, B2, and B3 (Jacobs, 2018a). The design specifications (Nevada Power Company, 2008a, 2008b, and 2008c) stipulated that fill be compacted to at least 95 percent of the maximum dry density as determined by ASTM D698 (ASTM International, 2012). The specifications also required relative compaction was measured with a sand cone or a nuclear density gauge.

Vegetated Slopes (§257.73(d)(1)(iv))

The requirement for vegetated slopes does not apply to Ponds B1, B2, and B3. The interior embankment slopes no longer require vegetation or other slope protection measures because the ponds are being closed and they no longer impound water or CCR (Jacobs, 2018a). The exterior embankment slopes are protected by an alternate form of slope protection, a 6-inch-thick thick layer of aggregate overlying a geotextile (Stanley Consultants, 2008a and 2008b). The embankment crests are protected by a road with gravel surfacing.

Spillway (§257.73(d)(1)(v))

Ponds B1, B2, and B3 were constructed without spillways as allowed by State dam regulations (NAC 535.240) and as described in State dam safety guidelines published by from the Nevada Division of Water Resources (State of Nevada, 2018). The guidelines state that "most effluent, process fluid and tailing impoundments are exempt from having a spillway, however, there must be diversion channels to route flood flows around the structure and/or sufficient freeboard designed into the structure to accommodate the required precipitation event."

In order to meet the requirements of §257.73(d)(1)(v)(B) and §257.73(d)(1)(v)(B)(3) of the CCR Rule, "the combined capacity of all spillways [for Ponds B1, B2, and B3] must adequately manage flow during and following the peak discharge from a 100-year flood." The 100-year event is relevant because the ponds have been classified as having a low hazard potential (Jacobs, 2018b). The ponds meet this CCR Rule requirement without using spillways because the volumetric impoundment capacity in the ponds far exceeds the volume of direct precipitation that would fall in the ponds during a 100-year event (CH2M, 2016). In addition, calculations in the Inflow Design Flood Control System Plan (Jacobs, 2018c) demonstrate that flow will not enter the ponds from the 100-year flood.

Hydraulic Structures (§257.73(d)(1)(vi))

The only hydraulic structures passing through the embankments are inlet pipes to Ponds B1, B2, and B3, which have been disabled in three locations. The ends of the inlet pipes have been buried, the upstream valves nearest the ponds have been closed, and farther upstream an airgap has been installed in the conveyance pipeline. There are no hydraulic structures underlying the base of the pond.

Stability of Wet Downstream Slope (§257.73(d)(1)(vii))

Based on personal observations, the exterior side slopes of Ponds B1, B2, and B3 are stable under the rapid drawdown scenario. In 2014 the exterior side slopes were inundated by two 100+ year floods from the adjacent Muddy River within a 60-day period, and they showed no signs of instability, movement, nor erosion as and after the water receded. And because the ponds are now empty, their ability to resist failure under rapid drawdown condition is even greater.

Impoundment Inspection

Nathan Betts, a qualified Nevada-registered professional engineer employed by Jacobs, inspected Ponds B1, B2, and B3 on April 3, 2018. The inspection included a review of available information, a visual

inspection of the impoundments, a visual inspection of hydraulic structures, and discussions with Station personnel. This section of the assessment is organized to be consistent with §257.83(b) of the CCR Rule.

Available Information

The information available regarding the status and condition of Ponds B1, B2, and B3 was reviewed on and before April 3, 2018. No discrepancies, deficiencies, or significant items were found during the review of available information. Information from the operating record and other sources was reviewed as part of this inspection, including the following items:

- The previous annual impoundment inspection (document dated July 13, 2017)
- Record Drawings for the Ponds BE Solids Removal Project (CH2M, 2018).

Visual Inspection of CCR Units

Ponds B1, B2, and B3 were visually inspected on the morning of April 3, 2018. The inspection occurred in sunny, calm conditions with temperatures between 46 to 51 degrees Fahrenheit, 18 to 22 percent humidity, and a barometric pressure of 30.01 to 30.07 inches.[1]

No signs of distress or malfunctions were observed during the visual inspection of Ponds B1, B2, and B3.

Visual Inspection of Hydraulic Structures

Visible portions of the hydraulic structures running through Ponds B1, B2, and B3 were visually inspected as part of the inspection of the CCR unit. The only hydraulic structures passing through the embankments are inlet pipes to the ponds, which have been disabled in three locations. The ends of the inlet pipes have been buried, the upstream valves nearest the ponds have been closed, and farther upstream an airgap has been installed in the conveyance pipeline. There are no hydraulic structures underlying the base of the pond. The visual inspection of the Ponds B1, B2, and B3 hydraulic structures revealed no indications that the structural integrity or continued safe and reliable operation of the pond has been adversely affected.

Changes in Geometry

Visual inspection and comparisons with the record drawings and the previous annual impoundment inspection indicates that the geometries of Ponds B1 and B3 have not been altered since they were constructed, or since the previous annual inspection. Pond B2 contained CCR at the time of the last inspection but is has since been removed along with embankments separating it from the other ponds. No other changes in the geometry of Pond B2 has occurred since the record drawings were created (CH2M, 2018).

Instrumentation

There is no instrumentation at Ponds B1, B2, and B3.

Approximate Impounded Water Levels

Ponds B1, B2, and B3 were empty at the time of inspection. Ponds B1 and B3 have not impounded water since the last inspection. Pond B2 impounded residual amounts of water at the time of the last inspection, but it has since been removed.

[1] Data for the St. George Airport per Weather Underground website, https://www.wunderground.com/history/airport/KSGU/2018/4/3/DailyHistory.html?req_city=Mesquite&req_state=NV&req_statename=Nevada&reqdb.zip=89024&reqdb.magic=1&reqdb.wmo=99999, accessed on April 11, 2018.

Storage Capacity

Ponds B1, B2, and B3 are empty and have adequate capacity to impound direct precipitation. However, the ponds have no capacity for impounding CCR nor other wastewater streams because the bottom liners have been removed as part of the field closure activities that began in September 2016.

Approximate Volume of CCR

Ponds B1, B2, and B3 were empty at the time of inspection. Ponds B1 and B3 have not impounded CCR since the last inspection. Pond B2 impounded CCR at the time of the last inspection, but that CCR has since been removed.

Structural Weaknesses

No actual or potential structural weaknesses were observed during the visual inspection of Ponds B1, B2, and B3. Also, no conditions were observed that were disrupting or have the potential to disrupt the operation and safety of the ponds and appurtenant structures.

Changes

This section describes changes to Ponds B1, B2, and B3 since the previous annual inspection. CCR and liquid has been removed from Pond B2, and the interior embankments separating Pond B2 from the other ponds have been removed. Recent analysis has determined that the embankments do not have the required factor of safety for the liquefaction failure scenario (Jacobs, 2018d). And as described in that analysis, this failure mode does not have the potential to cause a release to the environment, and it is recommended that the ponds continue with closure operations per CCR Rule requirements. Otherwise, no significant changes were identified and no changes were identified that may affect the stability or operation of the ponds.

Structural Deficiencies and Corrective Measures

This section describes structural stability deficiencies and recommended corrective measures as required by §257.73(d)(2). No structural stability deficiencies were identified as part of this assessment. And as described in the safety factor analysis (Jacobs, 2018d), the liquefaction slope stability failure mode does not have the potential to cause a release to the environment, and it is recommended that the ponds continue with closure operations per CCR Rule requirements.

Closing

Based on the records review and observations made during the inspection, the operations and maintenance of the ponds is “consistent with generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein” (§257.73(d)(1)). The operations and maintenance is also consistent with the original pond design. No signs of “significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation” of hydraulic structures was observed ((§257.73(d)(1)(vi)). In addition, no signs of distress or malfunctions were observed during the site visit. No corrective actions are recommended at this time.

Certification

This section contains the written certification by a qualified professional engineer as required by §257.73(d)(3) of the CCR Rule.

This initial structural stability assessment was conducted in accordance with the requirements of §257.73(d) of the CCR Rule.

References

ASTM International. 2012. *D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 ((600 kN-m/m^3)).* January.

CH2M. 2015a. *Notification of Intent to Initiate Closure, Pond B1, Reid Gardner Generating Station.* December 14.

CH2M. 2015b. *Notification of Intent to Initiate Closure, Pond B2, Reid Gardner Generating Station.* December 14.

CH2M. 2015c. *Notification of Intent to Initiate Closure, Pond B3, Reid Gardner Generating Station.* December 14.

CH2M. 2016. *Ponds BE Solids Removal Design Report.* Application for Decommission, Breach, or Removal of a Dam. June 9.

CH2M. 2018. Extract from *Drawings for the Ponds B-E Solids Removal Project, Reid Gardner Station, Moapa, Nevada.* Record Drawings. February 27.

Jacobs. 2018a. *Construction History, Ponds B1, B2, and B3, Reid Gardner Generating Station.* Technical Memorandum. April 11.

Jacobs. 2018b. *Initial Hazard Potential Classification Assessment, Ponds B1, B2, and B3, Reid Gardner Generating Station.* Technical Memorandum. April 12.

Jacobs. 2018c. *Inflow Design Flood Control System Plan, Ponds B1, B2, and B3, Reid Gardner Generating Station.* Report. April 14.

Jacobs. 2018d. *Safety Factor Assessment, Ponds B1, B2, and B3, Reid Gardner Generating Station (Slope Stability)*. Technical Memorandum. April 13.

Nevada Power Company (now NV Energy). 2008a. *Dam Safety Permit, Pond B-1, Nevada Power Company, Reid Gardner Station Ponds,* June.

Nevada Power Company (now NV Energy). 2008b. *Dam Safety Permit, Pond B-2, Nevada Power Company, Reid Gardner Station Ponds,* June.

Nevada Power Company (now NV Energy). 2008c. *Dam Safety Permit, Pond B-3, Nevada Power Company, Reid Gardner Station Ponds,* June.

Stanley Consultants. 2008a. *Ponds B1 & B2 Liner Design, Nevada Power Company, Reid Gardner Station, Moapa, Nevada.* Record Drawings. September 1.

Stanley Consultants. 2008b. *Pond B3 Liner Design, Nevada Power Company, Reid Gardner Station, Moapa, Nevada.* Record Drawings. September 1.

State of Nevada. 2018. *Dam Safety Gu*idelines – Spillway Design website. http://water.nv.gov/DamSpillwayDesign.aspx. Division of Water Resources Dam Safety Program. Last updated February 14.