

Office of Environmental Management – Grand Junction



**Moab UMTRA Project
Crescent Junction Disposal Cell Interim
Completion Report Addendum H**

Revision 1

January 2019



**U.S. Department
of Energy**

Office of Environmental Management

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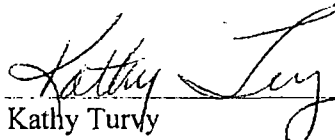
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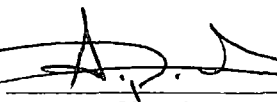
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Crescent Junction Disposal Cell Interim Completion Report
Addendum H**

Revision 1

Review and Approval


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1/25/2019
Date


Greg D. Church
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1/25/19
Date

Revision History

Revision	Date	Reason for Revision
0	December 2018	Initial issue.
1	January 2019	Revision included clarification of content in various sections.

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Acronyms and Abbreviations

ASME	American Society of Mechanical Engineers
ASTM	ASTM International
CAES	Computer Aided Earthmoving System
CAT	Caterpillar
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOE O	DOE Order
ft	foot/feet
NQA	Nuclear Quality Assurance
QA	quality assurance
Ra-226	radium-226
RAC	Remedial Action Contract or Contractor
RAIP	Remedial Action Inspection Plan
RAP	Remedial Action Plan
RRM	residual radioactive material
TAC	Technical Assistance Contract or Contractor
UMTRA	Uranium Mill Tailings Remedial Action
yd ³	cubic yards

Executive Summary

This *Crescent Junction Disposal Cell Interim Completion Report Addendum H* documents the construction of a portion of the disposal cell near Crescent Junction, Utah. The disposal cell is being constructed under the U.S. Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) Project. The purpose of the disposal cell is to isolate and stabilize uranium mill tailings and other contaminated materials, known as residual radioactive material (RRM), removed from the former millsite in Moab, Utah. The disposal cell is designed to be effective for 1,000 years to the extent reasonably achievable, with a minimum performance period of 200 years.

The Crescent Junction disposal cell will require many years to construct. Multiple Interim Completion Reports will be prepared to compile and document data collected during the ongoing construction process. These Interim Completion Reports will be written in the format of sequential addenda referenced in a Final Completion Report that will be prepared to address the entire cell construction.

This Addendum addresses activities performed by North Wind Portage, the DOE Remedial Action Contractor (RAC) for the Moab Project, from October 1, 2017, through September 30, 2018. This Report includes placement of 316,385 cubic yards (yd³) of RRM.

This Addendum also demonstrates that the referenced portion of the disposal cell was constructed in accordance with the *Moab UMTRA Project Final Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at the Crescent Junction, Utah, Disposal Site* (RAP) (DOE-EM/GJ1547). The RAP received conditional concurrence from the U.S. Nuclear Regulatory Commission. Included in this Report are a critical review, design assessment, and remedial action assessment of activities performed during this Report period. Associated data tables, photographs, laboratory results, and other supporting documentation are also provided.

The Moab Project follows the American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance-1 (NQA-1) requirements for quality assurance (QA), including conducting audits and surveillances during the design and construction of the cell.

1.0 Introduction

The scope of the Moab Project is to relocate RRM from the former uranium ore-processing facility and from off-site properties known as vicinity properties in Moab, Utah, to an engineered disposal cell constructed near Crescent Junction, Utah. Most of the processing buildings at the Moab site were demolished and placed in the southern corner of the tailings pile. An interim cover was placed over the tailings pile as part of decommissioning activities between 1988 and 1995. The estimated volume of the tailings pile before relocation began was 12 million yd³ (16 million tons). The RRM is being transported to Crescent Junction primarily by rail.

The Moab site is located about 3 miles northwest of the city of Moab in Grand County. The Crescent Junction site is located northeast of the junction of Interstate 70 and U.S. Highway 191, approximately 30 miles north of the Moab site, also in Grand County (see Figure 1). The completed disposal cell will generally be rectangular and will encompass approximately 230 acres. Figure 2 shows general features of the Crescent Junction site.

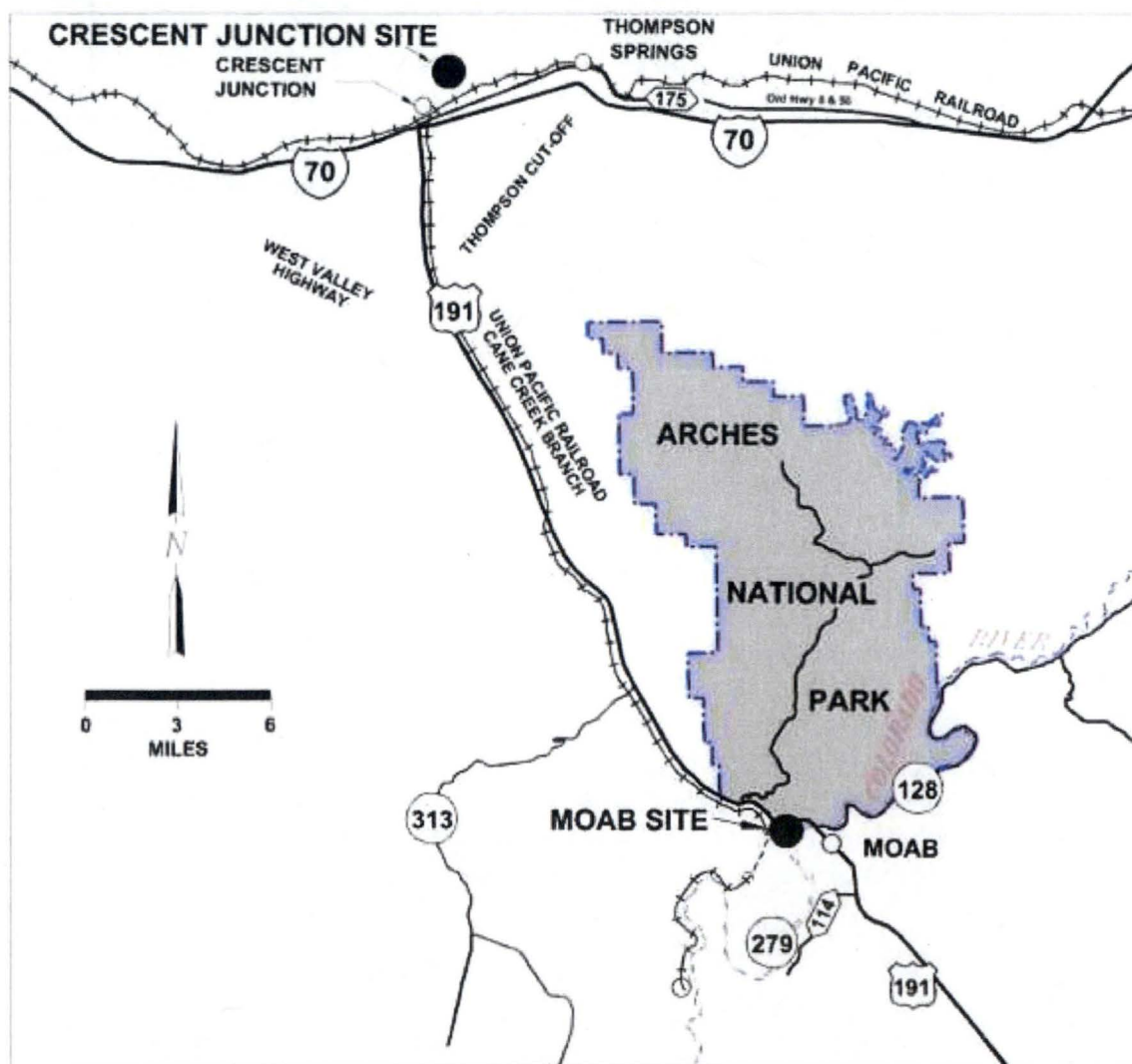


Figure 1. Location of Moab and Crescent Junction Sites

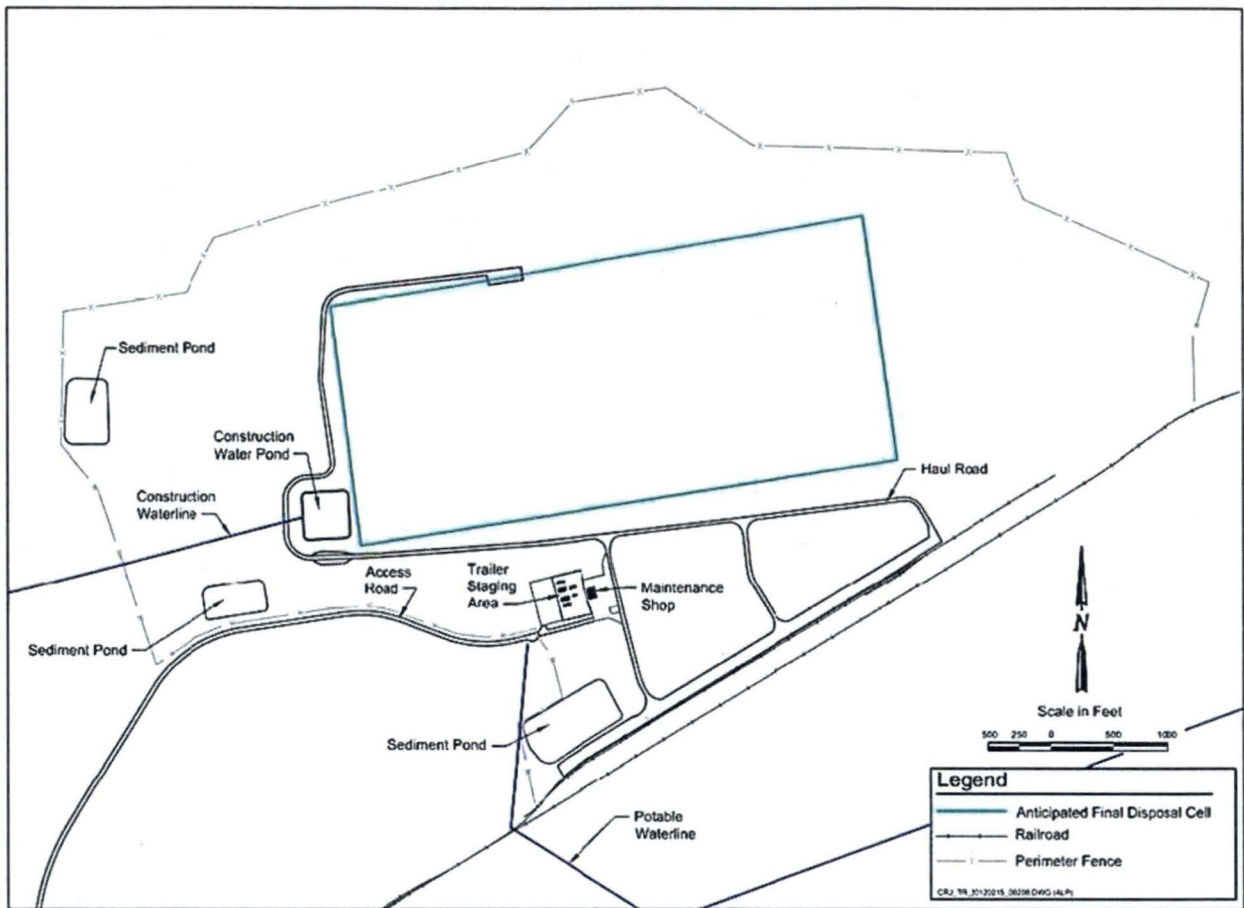


Figure 2. Crescent Junction Site Features

This Addendum documents activities performed by the RAC for the Project from October 1, 2017, through September 30, 2018.

Addendum H sections are outlined below.

- Section 2.0 summarizes the results of critical aspects of the disposal cell construction and provides tables and figures summarizing data found in Appendix A.
- Section 3.0 describes any differences in the completed design from design requirements in the RAP.
- Section 4.0 provides verification that placement of RRM and cell cover material was conducted according to RAP requirements.
- Section 5.0 is a list of references for this document.
- Appendix A includes test results to demonstrate compliance with compaction requirements.
- Appendix B contains photographs of the various stages of cell construction.

2.0 Critical Review

The Critical Review provides key technical information about the disposal cell construction. This section contains tables summarizing inspections or tests for cell excavation, embankment construction, RRM placement, and cell cover material placement as appropriate for this Report period. The tables reference criteria and material testing procedures used to verify cell excavation and placement of each type of material, performed in accordance with design specifications or drawings and with Addendum E of the RAP, and the *Remedial Action Inspection Plan* (RAIP). The distribution survey associated with each material type is also included in this section, as appropriate. Figure 3 shows the general extent of cell cover layers as of the end of this Addendum period.

Information regarding total lifts of compacted material, tests performed, and geotechnical data is summarized in Table 1. Additional geotechnical data, including proctor test result summaries, lift approval summaries, and lift approval packages, as appropriate, are located in Appendix A. A lift approval package consists of documentation of tests conducted to demonstrate the lift met requirements. A package could include lift approval forms and associated figures, slope elevation surveys, and field density tests.

Table 1. Lifts/Testing Totals

Area/ Material	Total Volume Placed (yd ³)	Total Number of Lifts Approved	Lifts Approved Using CAES	Lifts Approved Not Using CAES	Total Number of Standard Proctor Tests	Total Number of In-place Density/Moisture Tests	Total Average for All In-place Density Tests Performed (%)	Total Average CAES Passes that Meet Compaction Criteria (%)	Total Number of Soil Classifications	Total Number of Durability Tests	Total Number of Gradation Tests
Cell Perimeter Embankment	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RRM	316,385	193	193	0	2	1	93.5	99.01	N/A	N/A	N/A
Interim Cover	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Radon Barrier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Infiltration and Biointrusion Barrier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Frost Protection Layer	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-in. Cap Rock	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

CAES = Computer Aided Earthmoving System; in. = inch.

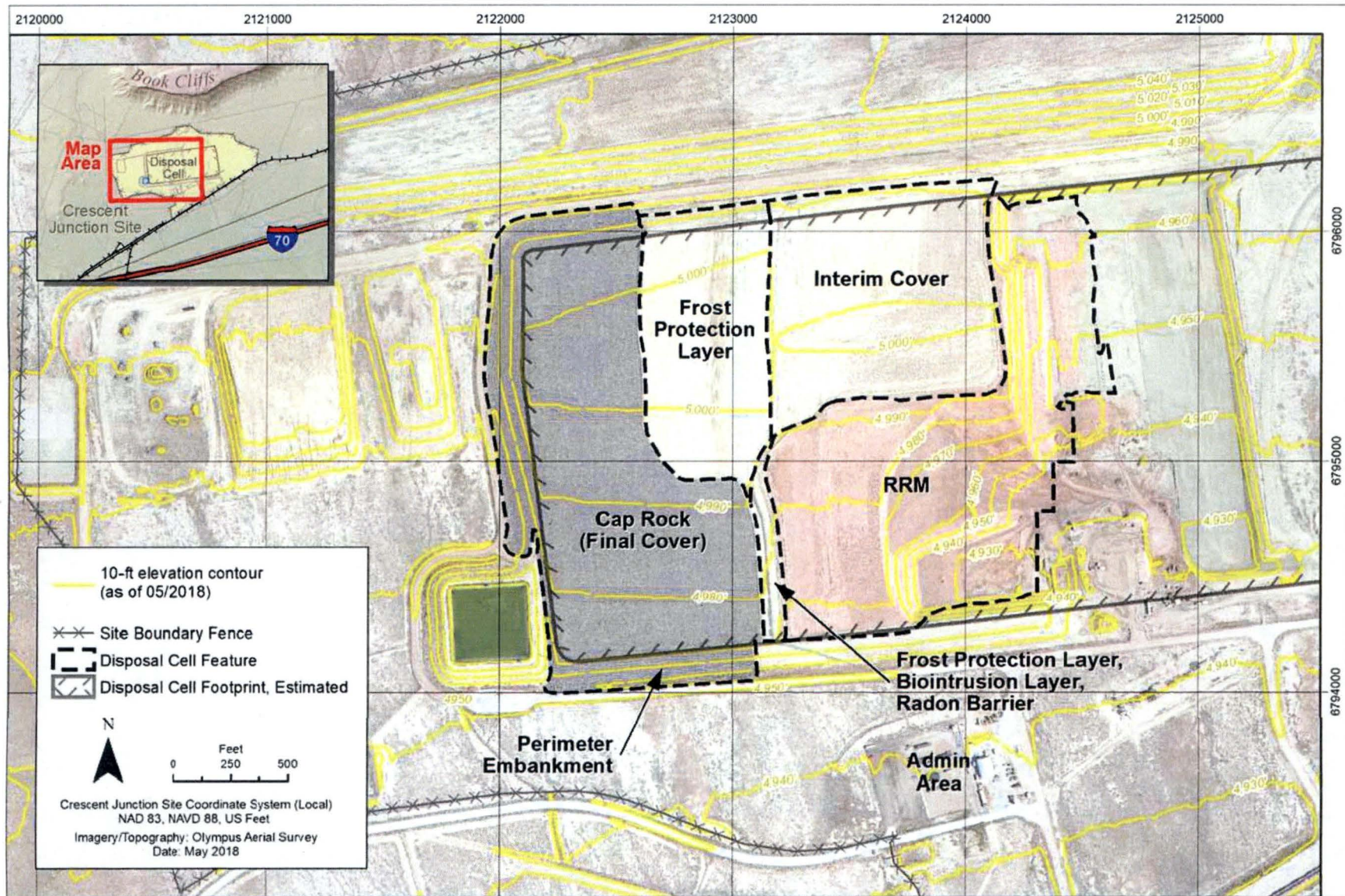


Figure 3. General Extent of Cover Layers

2.1 Cell Excavation

In August, Operations began preparing the cell floor for RRM placement by re-establishing design grade. This area was found to be below grade. One lift of Mancos Shale was tested and approved to bring the cell floor to design grade. Table 2 lists the lift, quantity placed, percent compaction, and lift thickness.

Table 2. Cell Floor Lifts

Date	Lift ID Number	Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)
8/8/18	UCF1K27180808-00	127	100	0.1

The inspection and testing summary for the disposal cell excavation can be found in Table 3.

Table 3. Cell Excavation Inspection and Testing

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
Visual Observation	The disposal cell floor is weathered Mancos Shale or low spots have been compacted with processed Mancos Shale.	N/A	6.2.3	All locations observed met criteria for Phase 2.
High-Accuracy GPS Survey	Floor and side slopes are per design plans. Final floor and side slopes survey match the coordinates and elevations in the plans. The cell floor slopes 2.3% from northwest to southeast. The cut slopes on the northern, western, and southern sides of the cell slope at 2:1 or 3:1.	Drawing E-02-C-102	6.2.1	Cell floor was checked for grade.

GPS = Global Positioning System.

2.2 Perimeter Embankment

No activities associated with the perimeter embankment were conducted during this period.

2.3 Residual Radioactive Material

2.3.1 Computer Aided Earthmoving System Performance Verification Testing

The Project used machines equipped with a Computer Aided Earthmoving System (CAES) to meet RRM compaction requirements as specified in Section 6.4.3 of the RAIP. Additional information about the CAES verification testing is provided in Section 4.3 of this Addendum. The RAIP also requires periodic verification of the CAES compaction by comparing the results to in-place, nuclear density gauge test results. Table 4 shows the results of the comparison tests performed during this Report period.

Table 4. CAES Performance Verification Testing

Lift ID Number	Test Performance Date	In-place Density Compaction (%)	Lift Area Meeting CAES Compaction Criteria (%)
UW1F24180320-00	3/22/18	93.5	99.4

2.3.2 Residual Radioactive Material Placement

RRM inspections and tests are shown in Table 5. No lifts were placed to reach the design top of waste; therefore, no buyoff surveys were conducted. The standard proctor test results summary, lift approval summaries, and one lift approval package for RRM are provided in Appendix A2.

Table 5. RRM Inspection and Testing

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
Visual Observation	At a minimum, scarify the top 1 in. of subsoil or preceding RRM lift, using a footed roller or a dozer, before placing subsequent RRM layers. Fill material is placed in continuous and planar lifts. The method of dumping and spreading RRM shall result in loose lifts. Average thickness of fill area is not to exceed 12 in. Dozers shall have a minimum ground pressure of 1,650 lb/ft ² . Compaction equipment shall be footed rollers or dozers. Footed rollers shall have a minimum weight of 45,000 lb and at least one tamping foot provided for each 110 in ² of drum surface. The length of each tamping foot from the outside surface of the drum shall be at least 6 in. After lift placement, moisture content shall be maintained until the next lift is placed. Erosion that occurs in RRM layers shall be repaired and grades re-established. If freezing or desiccation occurs, the affected soil shall be reconditioned.	Specification 31-00-20 Sections 1.3.2, 3.2.1, and 3.2.4	6.4.2	Visually verified throughout material preparation, ground preparation, and RRM placement. Documented in lift approval packages.
Laboratory Compaction Characteristics	Assessment tests shall be performed on RRM to ensure compliance with specified requirements and to develop compaction requirements for placement. Perform tests (standard proctor) in accordance with the following standards, as applicable: *ASTM D698 and D2216.	Specification 31-00-20 Section 3.1.1	6.4.3	Two tests were performed to determine compaction characteristics.
Moisture Test	Fill material is properly moisture conditioned. Acceptable moisture content is $\pm 3\%$ of optimum moisture. Perform in accordance with the following standard: *ASTM D4643.	Specification 31-00-20 Section 3.4.2	6.4.3	Moisture tests performed daily and documented in lift approval packages.

Table 5. RRM Inspection and Testing (continued)

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
In-place Density/Moisture Test	Density tests must meet at least 90% of the material's maximum dry density in accordance with *ASTM D698. Acceptable moisture content is $\pm 3\%$ of optimum moisture. Perform in accordance with the following standards, as applicable: *ASTM D1556, D2216, D4643, and D6938.	Specification 31-00-20 Section 3.2.2	6.4.3	One test was performed with average in-place density of 93.5% of the laboratory-determined maximum dry density. No lifts were approved using in-place density/moisture tests.
Compaction by CAES	QC shall monitor CAES compaction by visually inspecting the process and reviewing the computer records for each layer of soil placed.	Specification 31-00-20 Section 3.4.1	6.4.3	193 lifts were approved using CAES.
Visual Observation	Each container of demolition debris shall be spread in a single layer (not stacked) and placed in a manner that results in a minimum of voids around the debris. Wood, concrete, and masonry: cut or break up to a maximum size of 3 ft measured in any dimension. Structural steel member, pipes, ducts, and other long items: cut into maximum lengths of 10 ft. Concrete, clay tile, and other pipes: crush concrete and clay tile pipes. Crush other pipes and ducts that are 6 in. or greater in diameter or, if crushing is impractical, cut pipes and ducts in half longitudinally. Do not crush asbestos-cement pipe. Rubber tires excavated at the site: cut into two halves around the circumference. Geo-membranes and other sheet material: cut into strips with a maximum of 4 ft wide by 4 ft long. Tree limbs with a diameter of 4 in. and larger: cut into lengths of 8 ft or less.	Specification 31-00-20 Section 3.2.5	6.4.4	Debris inspections performed during debris placement. Inspections documented in lift approval packages.

ASTM = ASTM International; in. = inches; in² = square inches; lb = pounds; lb/ft² = pounds per square foot; QC = quality control.
 *ASTM Standard titles are included in the References Section 5.0.

2.4 Interim Cover

No activities associated with the interim cover were conducted during this period.

2.5 Radon Barrier

No activities associated with this material layer were conducted during this period.

2.6 Infiltration and Biointrusion Barrier

No activities associated with this material layer were conducted during this period.

2.7 Frost Protection Layer

No activities associated with this material layer were conducted during this period.

2.8 Cap Rock and Armoring

No activities associated with this material layer were conducted during this period.

3.0 Design Assessment

The disposal cell design incorporates established design criteria, drawings and specifications, and calculations, all of which are included in the RAP and in Interim Completion Report addenda.

This section discusses design criteria changes, changes to the design of the disposal cell and associated erosion control features, fulfillment of QA requirements, and compliance with permit requirements.

3.1 Design Criteria Changes

No changes to the design criteria were made during this period.

3.2 Design Changes

No changes to the design were made during this period.

3.3 Quality Assurance Requirements

There were no QA requirements for design changes during this period.

QA activities were conducted in accordance with the *Moab UMTRA Project Quality Assurance Plan for the Remedial Action Contractor* (DOE-EM/GJRAC1766), which complies with:

- ASME NQA-1 2008 and addenda through 2009 consensus standard, "Quality Assurance Requirements for Nuclear Facility Applications."
- DOE Order (O) 226.1B, "Implementation of Department of Energy Oversight Policy."
- Title 10 Code of Federal Regulations Part 830 (10 CFR 830) Subpart A, "Nuclear Safety Management, Quality Assurance Requirements."
- DOE Office of Environmental Management EM-QA-001, "EM Quality Assurance Program."
- DOE O 414.1D, Admin Chg 1, "Quality Assurance."

3.4 Permits and Agreements

The Project is in compliance with permits and agreements applicable to the Crescent Junction site. The permits and agreements are summarized in Table 6.

Table 6. Crescent Junction Site Permits and Agreements

Agreement Number	Document Name or Description	Issuing Agency	Purpose
400-00177	Easement for Green River Pump Station	Utah Division of Forestry, Fire, and State Lands	ROW easement to construct and operate water pipeline in the Green River.
4P-082364-0	UDOT Encroachment Permit	UDOT	To construct waterline within UDOT 60-ft ROW and operate within 20-ft ROW for State Route 19 near City of Green River.
6-UT-06-F-014	Biological Opinion	U.S. Fish and Wildlife Service	U.S. Fish and Wildlife Service issued Biological Opinion for Green River Pump Station.
1-92-677	Green River Water Right	State Water Engineer	Gives DOE right to divert 323 acre-feet or ~200 gallons per minute from Green River for Crescent Junction disposal site.
DE-RO01-06GJ68009	Access Roadway Contract and Grant of Easement	Private Owner	Perpetual easement and ROW for construction of an access roadway and related utilities at the disposal site.
ESMT 463	Waterline Easement	SITLA	Easement across state land for potable waterline.
Folder No. 02392-96	Pipeline Crossing Agreement	Union Pacific Railroad	Agreement grants right to construct, maintain, and operate one underground waterline and access for phone line and 1.5-in. conduit across Union Pacific Railroad's property at mile post 533.2, Green River Subdivision.
Folder No. 02399-44	Pipeline Crossing Agreement	Union Pacific Railroad	Agreement grants right to construct, maintain, and operate one underground waterline and access for phone line and 1.25-in. conduit at mile post 0.25, Cane Creek Subdivision, Thompson Springs, for the disposal site.
Folder No. 2537-02	Industrial Track Contract	Union Pacific Railroad	Covers construction, maintenance, and operation of 5,209-ft Track A, 3,524-ft Track B, and 617-ft Track C at mile post 533.21, Green River Subdivision line.
Property No. 70-4; 189A: AEQ	Easement	UDOT	Easement for waterline across UDOT property near Floy Wash that allows 60-ft construction ROW and 20-ft permanent ROW.
Public Land Order 7697	Permanent Land Transfer	BLM	Order permanently transferred 500 acres of BLM public domain land to DOE for disposal cell.
REEMCBCDOE-3-15-0702	Real Estate License	Rocky Mountain Power	Power line extension to dump ramp.
REEMCBCDOE-6-08-0302	Waterline Easement	Grand County	Easement within County Road 175 or old Highway 6 and 50 and Hastings Lane ROWs to construct waterline within 60-ft ROW and operate within 20-ft ROW.

Table 6. Crescent Junction Site Permits and Agreements (continued)

Agreement Number	Document Name or Description	Issuing Agency	Purpose
REEMCBCDOE-6-08-0304	Waterline Easement	Private Owner	Easement across private land near the Green River to construct waterline within 60-ft ROW and operate within 20-ft ROW and pump station.
REEMCBCDOE-6-08-0308 SITLA No. 1345	Waterline Easement	SITLA	Easement to construct waterline within 60-ft ROW and operate within 20-ft ROW on three parcels of SITLA land near Green River and Crescent Junction.
REEMCBCDOE-6-08-0309	Waterline Easement	City of Green River	Easement to construct waterline within 60 ft of County Road 175 or old Highway 6 and 50 ROWs within Green River city limits and operate within 20-ft ROWs.
REEMCBCDOE-6-12-0302	Waterline Easement	Private Owner	Permanent easement across private land near Crescent Junction to construct waterline within 60-ft ROW and operate within 20-ft ROW.
REEMCBCDOE-7-15-014	Access Agreement	Private Owner	For installation and maintenance of air monitoring equipment and collection of air quality data for monitoring station MPS-0306.
REEMCBCDOE-7-15-016	Access Agreement	Private Owner	For installation and maintenance of air monitoring equipment and collection of air quality data for monitoring station MPS-0307.
Resolution 2006-2741	Grand County Council Resolution	Grand County	Approves conditional use permit for the Project.
Statewide Utility License Agreement No. 8439	Utility License	UDOT	License with state of Utah to construct waterline across UDOT property.
U.S. DOT No. 050217551021ZB	Hazardous Materials Certificate of Registration	U.S. DOT	For shippers of hazardous materials through 06/2020.
U.S. DOT-SP 14283	Special Permit	U.S. DOT	Permit to transport mill tailings from Moab site to the disposal site.
UTR359187	Storm Water Permit	Utah Division of Water Quality	To limit the discharge of pollutants from disposal cell construction activities.
UT-SES-GR-14001	MOU	Utah Dept. of Natural Resources and BLM	MOU outlines terms and conditions for helicopter use of pond for wildland fire fighting.
UTU-83354	Waterline ROW	BLM Moab Field Office	For construction of 14.5 miles of waterline on BLM land from Green River to disposal site.
UTU-83396	Utility ROW	BLM Moab Field Office	For buried telephone line at the disposal site.
UTU-83450	Utility ROW	BLM Moab Field Office	ROW for power line to the disposal site.

Table 6. Crescent Junction Site Permits and Agreements (continued)

Agreement Number	Document Name or Description	Issuing Agency	Purpose
Not assigned	Memorandum of Agreement	BLM Moab Field Office	Between DOE and BLM for management of existing uses on lands withdrawn in conjunction with the Project.
Not assigned	Water Use Agreement	Thompson Special Service District	Water use agreement among Thompson Special Service District in Grand County, Crescent Junction Properties, Inc., and DOE to install potable waterline from Thompson Springs, Utah, to the disposal site.

BLM = U.S. Bureau of Land Management; ft = feet; in. = inches; MOU = Memorandum of Understanding; ROW = right-of-way; SITLA = School and Institutional Trust Lands Administration; UDOT = Utah Department of Transportation; U.S. DOT = U.S. Department of Transportation.

4.0 Remedial Action Assessment

A description of pre-excavation site conditions, construction activities, and verifications performed at the Crescent Junction disposal site is provided in this section.

4.1 Pre-excavation Site Conditions

Pre-excavation site conditions were discussed in Addendum A of the *Moab UMTRA Project Crescent Junction Disposal Cell Interim Completion Report* (DOE-EM/GJRAC2040-A).

4.2 Cell Construction

The only cell construction activities during this period were placement of RRM.

The *Moab UMTRA Project Lift Approval Procedure* (DOE-EM/GJRAC1803) was used to ensure the material placed met the compaction criteria. Descriptions of compaction equipment used during the above cell construction activities are provided in Table 7.

Each activity performed as part of this Addendum is further described in the following subsections. Photographs representative of the cell construction activities are included in Appendix B.

4.2.1 Excavation

There were no excavation activities during this period.

4.2.2 Perimeter Embankment Construction

There were no perimeter embankment construction activities during this period.

Table 7. Descriptions of Compaction Equipment Used during Cell Construction

Compaction Equipment	Machine Weight (lb)	Equipped with CAES	Material Layer						
			RRM	Interim Cover	Radon Barrier	Infiltration and Biointrusion Barrier	Frost Protection	Perimeter Embankment	Spoils Embankment
CAT 825H Soils Compactor	69,000	X	X						
CAT D8 Bulldozer	84,850	X	X						
Komatsu 275AX Bulldozer	112,466	X	X						

CAT = Caterpillar; lb = pounds

4.2.3 Residual Radioactive Material Placement

Placement of RRM in the disposal cell continued east from where it ended, as shown in Addendum G of the *Moab UMTRA Project Crescent Junction Disposal Cell Interim Completion Report* (DOE-EM/GJ2040-G). The RRM was loaded into dump trucks and driven to the disposal area, where it was spread for compaction using a bulldozer. A Caterpillar (CAT) 825H soils compactor, CAT D8 bulldozer, and Komatsu 275AX bulldozer were used to compact the RRM in place.

4.2.4 Cover and Rock Armoring Placement

There were no cover or rock armoring activities during this period.

4.2.5 Spoils Embankment Construction

There were no spoils embankment construction activities during this period.

4.3 Soil Compaction and Testing

Initial CAES compaction setup and verification is documented in *Crescent Junction Interim Completion Report* Addendum A. The CAES compaction is periodically verified by performing in-place tests using a nuclear density gauge manufactured by Troxler Electronic Laboratories, Inc., following ASTM International (ASTM) methods and in compliance with the RAIP. The individual nuclear density tests verify the compaction achieved with the CAES is greater than or equal to the required 90 percent. The CAES compaction results compared to the nuclear density gauge are provided in Table 4.

4.4 Lift Approval

The *Lift Approval Procedure* and Addenda B and E of the RAP were followed to verify each lift met established criteria. Results of lifts are documented in lift approval packages. A sample lift approval package for RRM placed during this Report period is provided in Appendix A.

4.5 Geotechnical Testing

The RAIP describes methods and frequencies for performing tests to verify material placed in the cell meets the requirements. Geotechnical tests fall within two general categories: soils testing and aggregate testing. The *Moab UMTRA Project Moisture/Density Testing Procedure* (DOE-EM/GJRAC1783) provides requirements and methods for the proper moisture/density testing of soils placed in the cell. Only soils testing was used during this Addendum period as described below.

4.5.1 Soils Testing

Laboratory and/or field soils geotechnical tests were conducted on every lift of each material layer placed to support verification that specified compaction requirements were met. Test requirements varied depending on whether the CAES was used for demonstrating compaction. Because the soils in the RRM can vary in composition, multiple compaction curves were developed to determine the maximum dry density and optimum moisture content for that material to achieve compaction.

Results of tests conducted are shown in the standard proctor test results summary tables included in Appendix A. When multiple standard proctor tests, or "sets," were performed on RRM, the test selected to represent that soil type appears in red in the table. The tables also summarize the tests performed to determine soil type and geotechnical properties.

Moisture content testing was performed daily for each soil layer placed to verify the moisture content met the requirements before the lifts were approved. The thickness of each lift was surveyed and verified using a high-accuracy global positioning system, when practical; otherwise, manual measurements were taken.

4.5.2 Aggregate Testing

There were no aggregate testing activities during this period.

4.6 Radiological Verification

Section 5 of the Remedial Action Selection Report of the RAP, *Radon Attenuation*, identifies two primary verification criteria associated with construction of the disposal cell: radium-226 (Ra-226) measurements in RRM placed in the upper 7 feet (ft) and radon flux measurements to verify the integrity of the radon barrier. Addendum A of this Report provides an explanation of this verification process.

There were no final radiological verification activities during this period for Ra-226 measurements in the upper 7 ft of RRM or for radon flux measurements to verify the integrity of the radon barrier.

4.7 Quality Assurance Requirements

QA activities were conducted in accordance with documents identified in Section 3.3. During construction activities, surveillances and assessments were performed by the RAC to verify and ensure these activities were performed in accordance with established plans, drawings, instructions, procedures, specifications, and other applicable documents.

In addition, the Technical Assistance Contractor (TAC) supports DOE assessments of the RAC.

During the report period of this Addendum, five oversight inspections, three assessments, and four management assessments were performed (see Table 8). Corrective actions are developed to address any deficiencies identified during the assessments.

Table 8. Surveillances and Assessments Conducted during Construction

Date	Conducted By	Type	Assessment Number	Scope
10/18/2017	TAC	Oversight Inspection	N/A	Storm water oversight inspection.
01/22/2018	RAC	Management Assessment	MA-18-006	Review Radiological Control Program to evaluate established program to control contamination from leaving radiological posted areas.
02/22/2018	RAC	Management Assessment	MA-18-008	Review the Permits and Agreements Report to determine whether RAC permits and agreements are being maintained and updated in a timely fashion and in compliance with their terms and conditions.
03/21/2018	TAC	Oversight Inspection	N/A	Storm water oversight inspection.
03/31/2018	RAC	Management Assessment	MA-18-010	Review of radiological program implementation – Radiological Work Permits, Posting and Access Control, and Radiological Surveys.
04/2018	DOE	Assessment	Moab Project 2018 Annual ISMS Assessment	Verify compliance with Integrated Work Plan implementation.
05/01/2018	TAC	Assessment	DOE-18-A-016	Assessment to evaluate RRM placement and supporting geotechnical processes.
06/2018	RAC	Assessment	MB-18-A-011	Evaluate and verify proper implementation of MB-IWP/JSA-011, Disposal Cell Operations.
07/09/2018	TAC	Oversight Inspection	N/A	Storm water oversight inspection.
08/13/2018	TAC	Oversight Inspection	N/A	Storm water oversight inspection.
09/05/2018	RAC	Management Assessment	MA-18-021	Review Crescent Junction Disposal Cell QA/QC activities to ensure compliance with program requirements.
09/10/2018	TAC	Oversight Inspection	N/A	Storm water oversight inspection.

ISMS = Integrated Safety Management System; QC = quality control.

4.8 Monitoring Free Liquid Presence

Monitoring of the one existing standpipe (location shown on Figure 4) for the presence of free liquids in the disposal cell occurred in February, June, and September 2018. The monitoring results indicate the standpipe was dry during this Report period (Table 9). No additional standpipes were installed during fiscal year 2018.



Figure 4. Locations of Monitoring Wells and Standpipe

4.9 Monitoring Groundwater Presence

The four monitoring wells (locations shown on Figure 4) were checked for the presence of groundwater in February, June, and September 2018, with the results presented in Table 10. Wells 0203 and 0210 were dry throughout this Report period, while well 0202 was dry in February and June 2018. Only 0.02 ft of water was present in well 0202 in September 2018, which represents an insufficient volume required to collect a sample for analysis. This water is likely the result of condensation that accumulates inside the well.

Table 9. Monitoring Results for the Presence of Fluids in Standpipe 01

Date Monitored	Presence or Level of Fluids (ft)
02/06/18	Dry
06/27/18	Dry
09/26/18	Dry

Dry = no fluids present.

Table 10. Monitoring Results for Presence of Groundwater

Date Monitored	Monitor Well Number			
	0202	0203	0205	0210
02/06/18	Dry	Dry	DTW = 51.87 ft btoc	Dry
06/27/18	Dry	Dry	DTW = 53.17 ft btoc	Dry
09/26/18	DTW = 61.39 ft btoc	Dry	DTW = 52.36 ft btoc	Dry

Dry = no fluids present; DTW = depth to water; ft btoc = feet below top of casing.

Water was first encountered in well 0205 in late June 2015, and has been present since then. As part of the monitoring practice, a sample may be collected of any water present in sufficient quantity and submitted to a laboratory for analysis of various anions, cations, inorganics, and radionuclides. The February and June 2018 water quality data associated with samples collected from well 0205 are presented and discussed in the *Moab UMTRA Project Ground Water and Surface Water Monitoring Report January through June 2108* (DOE-EM/GJTAC2267) and the September 2018 data will presented in the *Moab UMTRA Project Ground Water and Surface Water Monitoring Report July through December 2018* (no document number available at this time).

In addition to collecting samples for analytical analysis to determine the source of the water that is present in well 0205, during this Report period three short-term recovery tests were also completed. Test results indicate the recharge rate of the water entering well 0205 ranged from 0.02 to 0.03 gallons per minute during fiscal year 2018. The test completed in June 2018 represents the lowest recharge rate (0.02 gpm) measured at this location since water was first encountered in this well. This is likely indicative of the drought conditions experienced in this region in 2018.

Data from these recovery tests and associated analytical results continue to suggest that the source water does not appear to be associated with leakage from the disposal cell, but rather surface runoff from precipitation events.

5.0 References

10 CFR 830A (Code of Federal Regulations), "Nuclear Safety Management, Quality Assurance Requirements."

ASME (American Society of Mechanical Engineers), Nuclear Quality Assurance (NQA)-1 2008 and addenda through 2009 consensus standard, "Quality Assurance Requirements for Nuclear Facility Applications (QA)."

ASTM (ASTM International) Standard D698, "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort."

ASTM (ASTM International) Standard D1556, "Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method."

ASTM (ASTM International) Standard D2216, "Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass."

ASTM (ASTM International) Standard D4643, "Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating."

ASTM (ASTM International) Standard D6938, "Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)."

DOE (U.S. Department of Energy), *Moab UMTRA Project Crescent Junction Disposal Cell Interim Completion Report Addendum A* (DOE-EM/GJRAC2040-A).

DOE (U.S. Department of Energy), *Moab UMTRA Project Crescent Junction Disposal Cell Interim Completion Report Addendum G* (DOE-EM/GJRAC2040-G).

DOE (U.S. Department of Energy), *Moab UMTRA Project Final Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at the Crescent Junction, Utah, Disposal Site, Addendum B, Remedial Action Inspection Plan* (DOE-EM/GJ1547).

DOE (U.S. Department of Energy), *Moab UMTRA Project Final Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at the Crescent Junction, Utah, Disposal Site, Addendum E, Remedial Action Inspection Plan* (DOE-EM/GJ1547).

DOE (U.S. Department of Energy), *Moab UMTRA Project Lift Approval Procedure* (DOE-EM/GJRAC1803).

DOE (U.S. Department of Energy), *Moab UMTRA Project Groundwater and Surface Water Monitoring Report July through December 2016* (DOE-EM/GJTAC2231).

DOE (U.S. Department of Energy), *Moab UMTRA Project Groundwater and Surface Water Monitoring Report January through June 2017* (DOE-EM/GJTAC2240).

DOE (U.S. Department of Energy), *Moab UMTRA Project Moisture/Density Testing Procedure* (DOE-EM/GJRAC1783).

DOE (U.S. Department of Energy), *Moab UMTRA Project Quality Assurance Plan for the Remedial Action Contractor* (DOE-EM/GJRAC1766).

DOE (U.S. Department of Energy) Office of Environmental Management, "EM Quality Assurance Program" (EM-QA-001).

DOE (U.S. Department of Energy), Order 226.1B, "Implementation of Department of Energy Oversight Policy."

DOE (U.S. Department of Energy), Order 414.1D, Admin Chg 1, "Quality Assurance."

Appendix A2.
RRM

Standard Proctor Test Results Summary
Lift Approval Summaries
Lift Approval Package

Appendix A. Construction Verification Data

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NOTE: Appendices A1 and A3 through A8 are not included as they are not relevant to the period covered in this Addendum.

Appendix A2. RRM Standard Proctor Test Results Summary

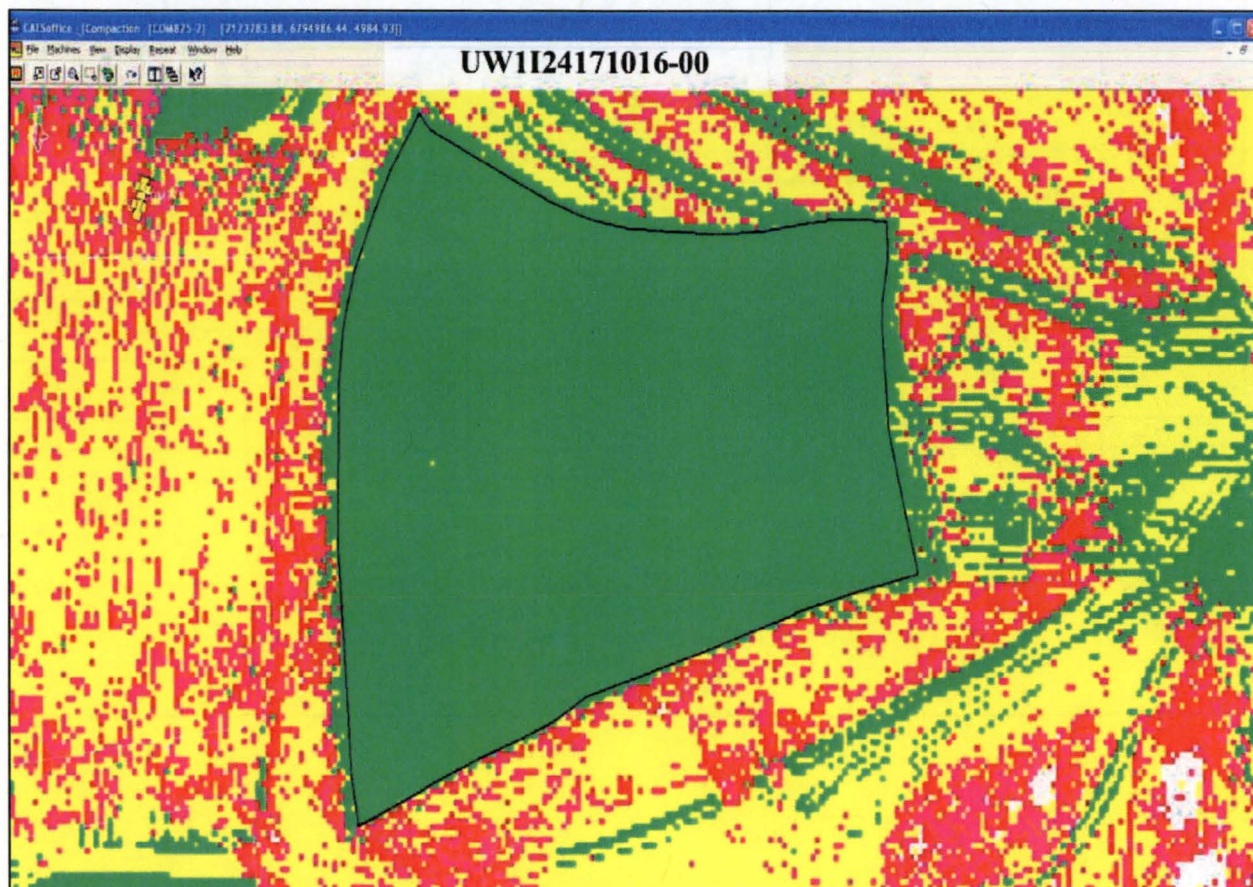
Set	Proctor ID #	Date Sampled	Date Approved	Maximum Dry Density (lb/ft ³)	Optimum Moisture Content (%)	Soils Description
SET 172	RRM 520	10/04/17	10/16/17	109.7	12.4	Sand stockpile. Red and brown sand mixed w/ clay. Approx. 2% clay
	RRM 521	10/04/17	10/16/17	109.3	11.1	Sand stockpile. Red and brown sand mixed w/ clay. Approx. 1% clay
	RRM 522	10/04/17	10/16/17	113.5	12.4	Sand stockpile. Red and brown sand mixed w/ clay. Approx. 5% clay.
Set 173	RRM 523	04/25/18	07/31/18	116.7	13.9	Grayish brown, fine to medium, subround, sand with clay.
	RRM 524	04/25/18	07/31/18	112.4	13.8	Grayish brown, fine to medium, subround, sand with clay.
	RRM 525	04/25/18	07/31/18	114.7	14.3	Grayish brown, fine to medium, subround, sand with clay.

Appendix A2. RRM Lift Approval Summaries

October 2017										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
10/02/17	UW1B18170928-00	2	2116	2,116	97.8	1.0	515	0	0	N/A
10/03/17	UW1I24170925-00	2	3294	5,410	97.7	0.9	512	0	0	N/A
10/05/17	UW1F24170928-00	1	1499	6,909	99.6	0.8	515	0	0	N/A
10/10/17	UW1I24171003-00	2	3720	10,629	99.6	1.0	521, 515	0	0	N/A
10/12/17	UW1F24171005-00	0	1633	12,262	99.6	0.9	N/A	0	0	N/A
10/12/17	UW1E30171010-00	0	663	12,925	99.9	0.7	N/A	0	0	N/A
10/16/17	UW1I24171010-00	2	3753	16,678	99.6	1.0	515	0	0	N/A
10/16/17	UW1B18171003-00	0	1905	18,583	100	0.9	N/A	0	0	N/A
10/17/17	UW1E30171012-00	0	515	19,098	99.4	0.7	N/A	0	0	N/A
10/18/17	UW1F24171017-00	1	2029	21,127	99.6	1.0	515	0	0	N/A
10/18/17	UW1B18171017-00	0	2094	23,221	99.4	0.9	N/A	0	0	N/A
10/24/17	UW1I24171016-00	1	3378	26,599	99.9	0.9	515	0	0	N/A
10/24/17	UW1F24171019-00	0	2029	28,628	99.9	1.0	N/A	0	0	N/A
10/26/17	UW1B18171024-00	1	2327	30,955	100	1.0	515	0	0	N/A
10/31/17	UW1I24171024-00	0	3966	34,921	99.3	1.0	N/A	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%)= 99.4 Total Quantity Approved (yd³) = 34,921 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 12 Quantity per Moisture Test (yd³) = 2,910 Total Average Thickness (ft)= 0.9 </p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from October 2017. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

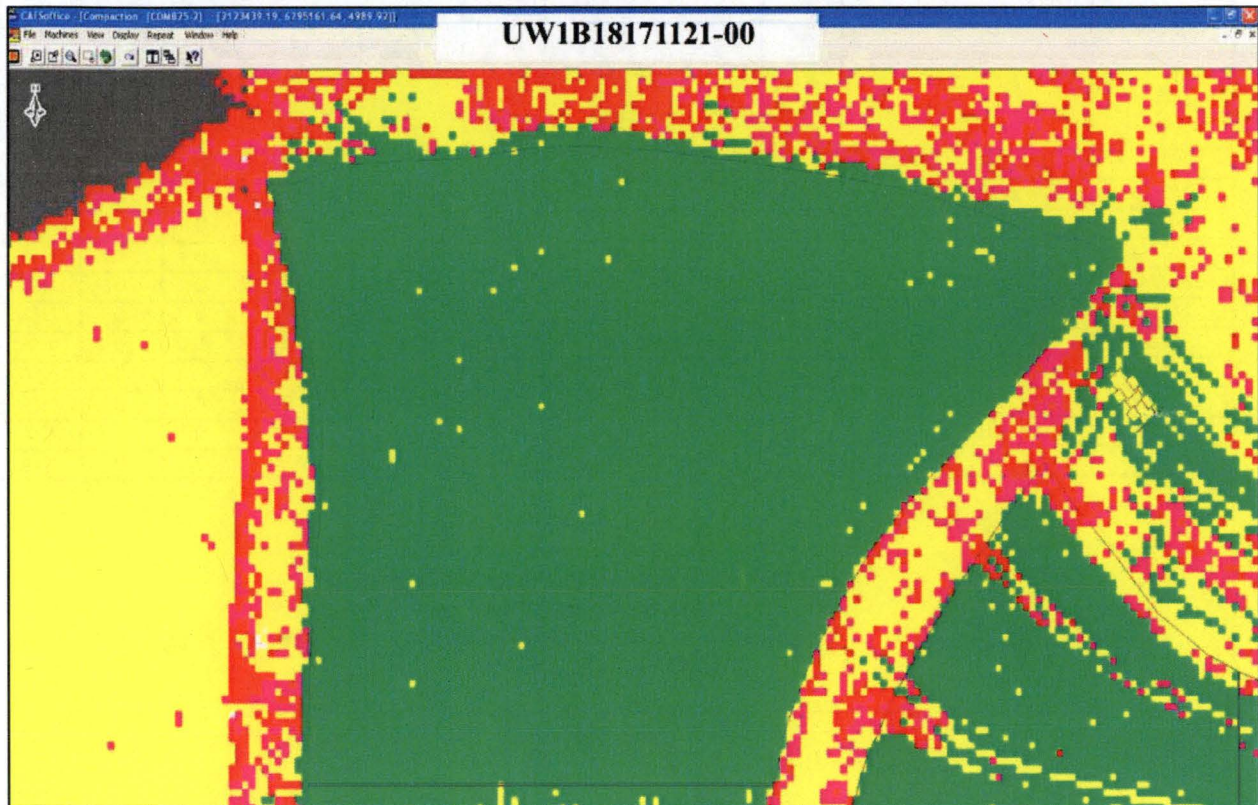


Appendix A2. RRM Lift Approval Summaries (*continued*)

November 2017										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
11/02/17	UW1F24171026-00	2	2294	2,294	99.1	0.8	515, 505	0	0	N/A
11/06/17	UW1B18171102-00	1	1985	4,279	99	0.8	515	0	0	N/A
11/07/17	UW1I24171102-00	1	3659	7,938	99.3	0.9	515	0	0	N/A
11/09/17	UW1F24171107-00	0	2279	10,217	99.2	0.9	N/A	0	0	N/A
11/15/17	UW1B18171109-00	1	2296	12,513	99.1	0.9	515	0	0	N/A
11/15/17	UW1F24171114-00	1	2026	14,539	98.6	0.8	515	0	0	N/A
11/20/17	UW1B18171116-00	0	2651	17,190	99.2	0.9	N/A	0	0	N/A
11/21/17	UW1F24171116-00	1	2283	19,473	99.2	1.0	515	0	0	N/A
11/27/17	UW1B18171121-00	1	2946	22,419	99.3	1.0	515	0	0	N/A
11/29/17	UW1F24171127-00	1	2283	24,702	98.6	1.0	505	0	0	N/A
11/30/17	UW1B18171129-00	0	2651	27,353	97.6	0.9	N/A	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%)= 98.9 Total Quantity Approved (yd³) = 27,353 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 9 Quantity per Moisture Test (yd³) = 3,039 Total Average Thickness (ft)= 0.9 </p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from November 2017. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

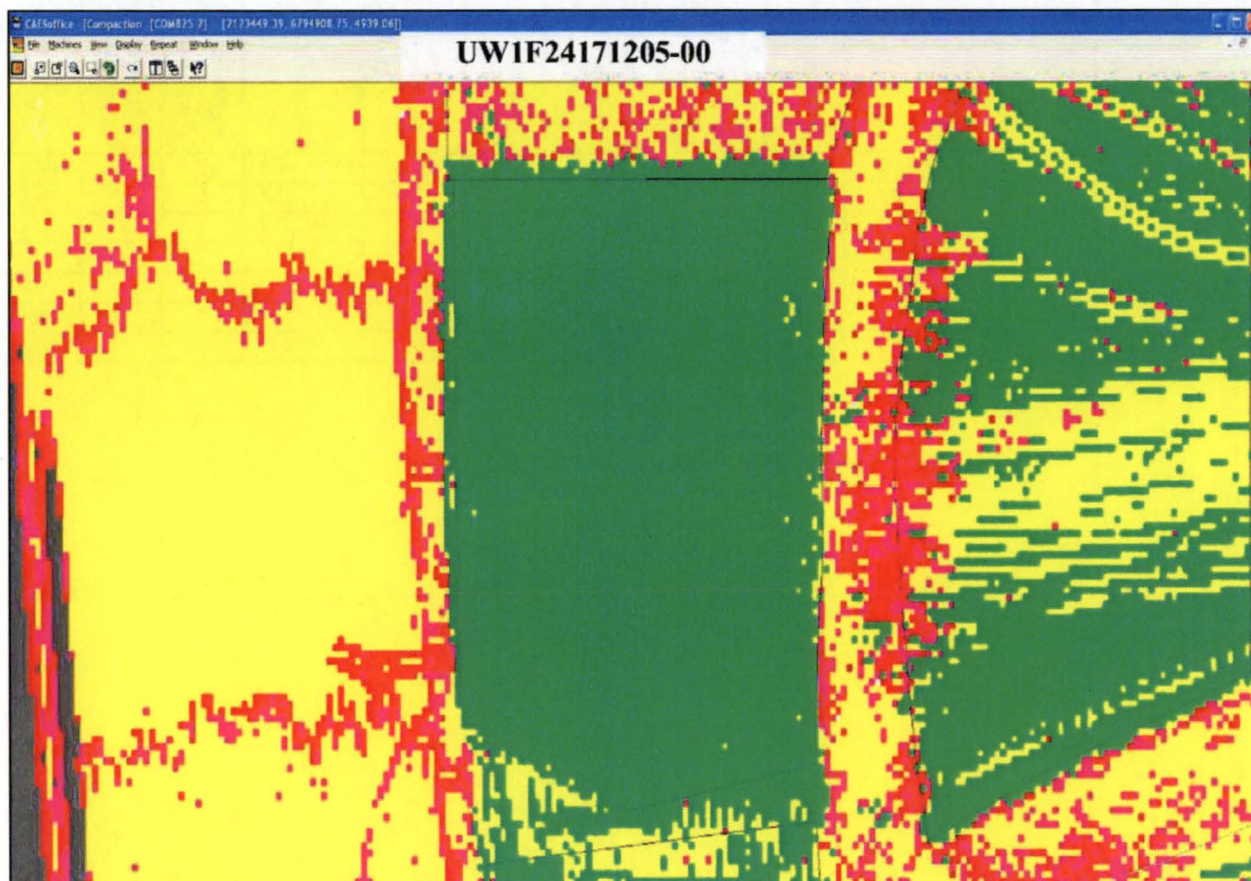


Appendix A2. RRM Lift Approval Summaries (*continued*)

December 2017										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
12/01/17	UW1F24171129-00	1	2055	2,055	98.5	0.9	517	0	0	N/A
12/05/17	UW1B18171201-00	1	2434	4,489	99.7	0.8	517	0	0	N/A
12/05/17	UW1F24171205-00	1	1924	6,413	98.8	0.9	517	0	0	N/A
12/07/17	UW1B18171205-00	2	2130	8,543	99.2	0.9	517, 488	0	0	N/A
12/07/17	UW1F24171207-00	1	337	8,880	99.6	0.9	488	0	0	N/A
12/11/17	UW1B18171207-00	1	1118	9,998	98.5	1.0	488	0	0	N/A
12/12/17	UW1B18171212-00	1	895	10,893	99.3	0.8	517	0	0	N/A
12/13/17	UW1K21171207-00	2	1672	12,565	99.7	1.0	488, 517	0	0	N/A
12/14/17	UW1I24171212-00	2	2261	14,826	98.9	0.9	488, 517	0	0	N/A
12/19/17	UW1K21171214-00	2	1505	16,331	100	0.9	488	0	0	N/A
12/20/17	UW1I24171219-00	1	2548	18,879	99.3	1.0	488	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%)= 99.2 Total Quantity Approved (yd³) = 18,879 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 15 Quantity per Moisture Test (yd³) = 1,259 Total Average Thickness (ft)= 0.9 </p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from December 2017. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

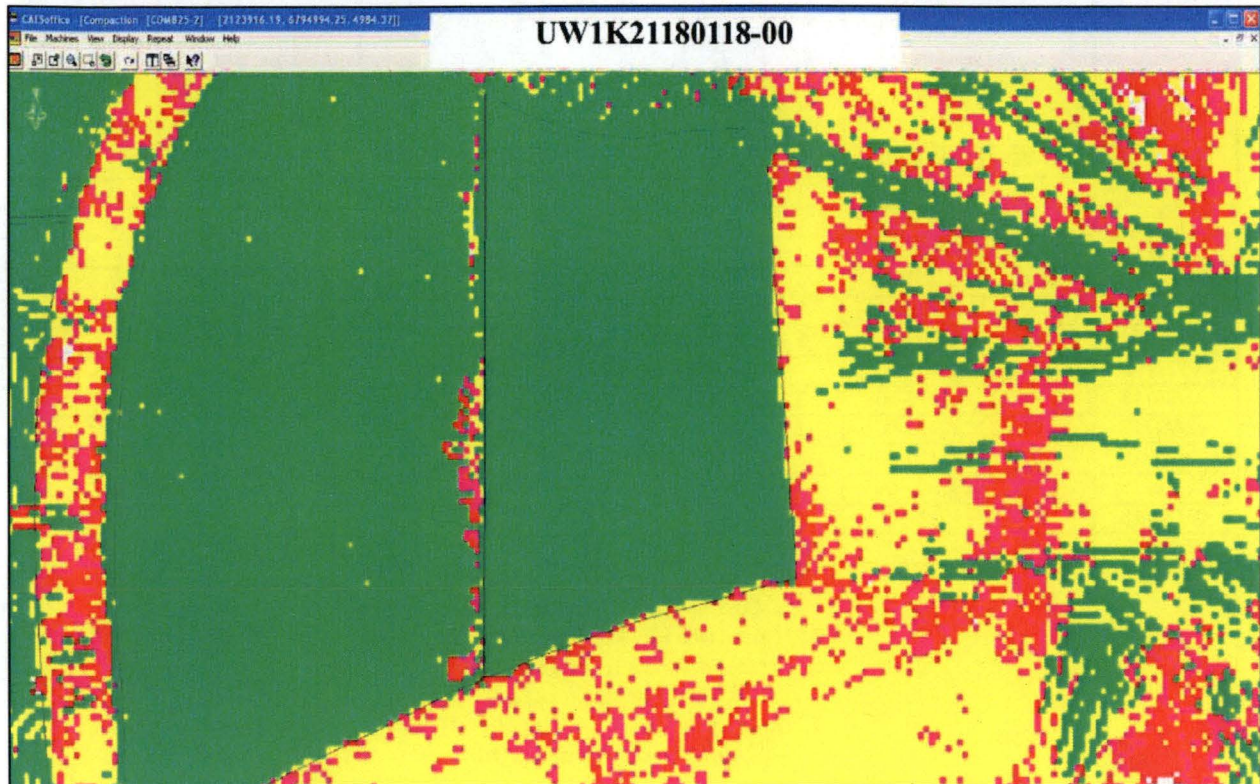


Appendix A2. RRM Lift Approval Summaries (*continued*)

January 2018										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
01/08/18	UW1K21171220-00	2	1368	1,368	99.8	0.8	517, 488	0	0	N/A
01/11/18	UW1I24180109-00	3	2659	4,027	99.5	1.0	517, 488	0	0	N/A
01/15/18	UW1K21180111-00	2	1504	5,531	98.9	0.9	488, 517	0	0	N/A
01/17/18	UW1I24180111-00	2	2826	8,357	99.3	1.0	488	0	0	N/A
01/22/18	UW1K21180118-00	1	1671	10,028	98.9	1.0	488	0	0	N/A
01/25/18	UW1A16180103-00	2	1771	11,799	99.4	1.0	521, 517	0	0	N/A
01/30/18	UW1I24180123-00	2	2826	14,625	98.7	1.0	488	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%)= 99.2 Total Quantity Approved (yd³) = 14,625 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 14 Quantity per Moisture Test (yd³) = 1,045 Total Average Thickness (ft)= 1.0 </p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from January 2018. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

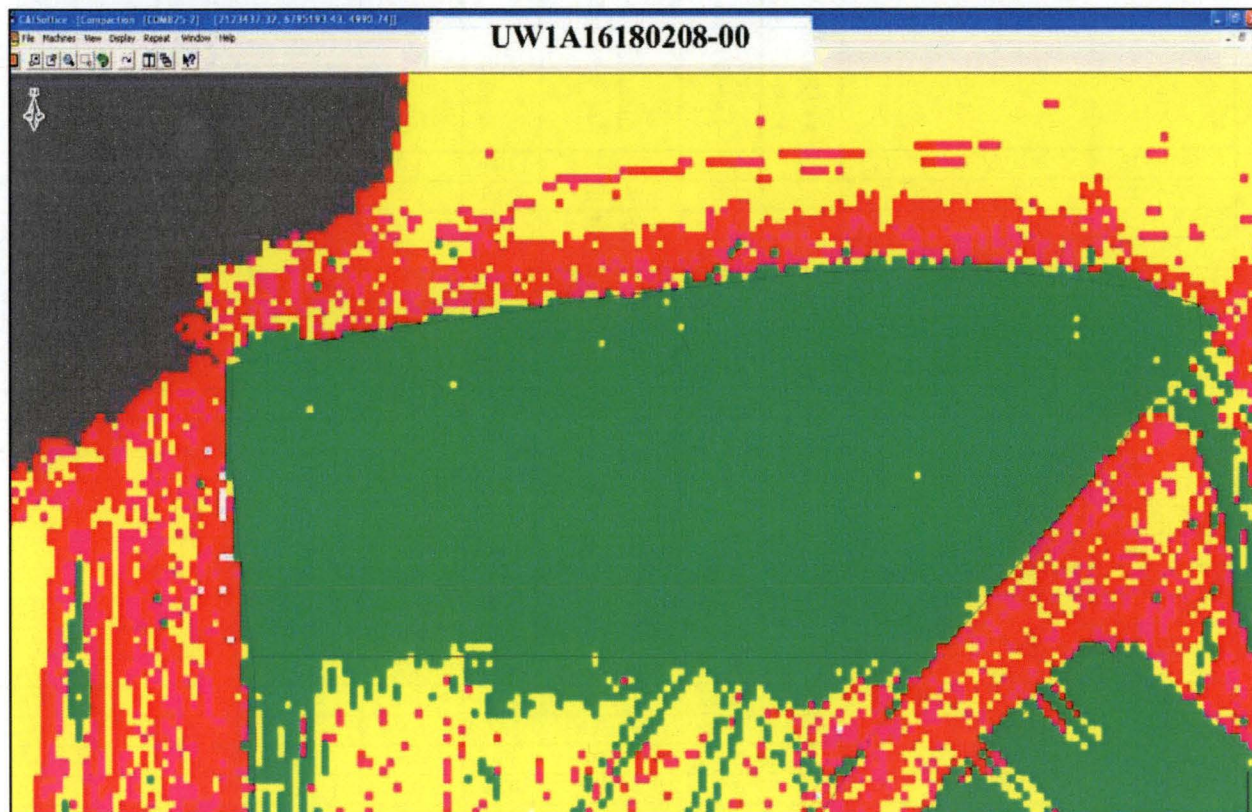


Appendix A2. RRM Lift Approval Summaries (continued)

February 2018										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
02/01/18	UW1K21180130-00	1	1589	1,589	99	0.9	488	0	0	N/A
02/01/18	UW1B18180201-00	1	1173	2,762	99.6	0.9	521	0	0	N/A
02/05/18	UW1F24180201-00	1	1870	4,632	100	1.0	521	0	0	N/A
02/08/18	UW1E30180206-00	1	1437	6,069	99.2	1.0	521	0	0	N/A
02/08/18	UW1A31180206-00	1	2051	8,120	98.8	1.0	521	0	0	N/A
02/08/18	UW1I24180207-00	1	3018	11,138	99.7	1.0	488	0	0	N/A
02/15/18	UW1A16180208-00	1	1444	12,582	98.9	0.7	521	0	0	N/A
02/20/18	UW1B18180208-00	3	1408	13,990	99.9	1.0	520, 521	0	0	N/A
02/20/18	UW1F24180215-00	2	1715	15,705	100	0.9	520, 521	0	0	N/A
02/22/18	UW1A31180221-00	1	2054	17,759	98.7	1.0	521	0	0	N/A
02/22/18	UW1E30180215-00	2	1320	19,079	99.5	0.9	520, 521	0	0	N/A
02/28/18	UW1A16180221-00	2	2117	21,196	99.6	1.0	522, 521	0	0	N/A
02/28/18	UW1B18180227-00	1	1380	22,576	99.5	1.0	522	0	0	N/A
02/28/18	UW1F24180227-00	1	1706	24,282	99.9	0.9	522	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%)= 99.5 Total Quantity Approved (yd³) = 24,282 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 19 Quantity per Moisture Test (yd³) = 1,278 Total Average Thickness (ft)= 0.9 </p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from February 2018. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

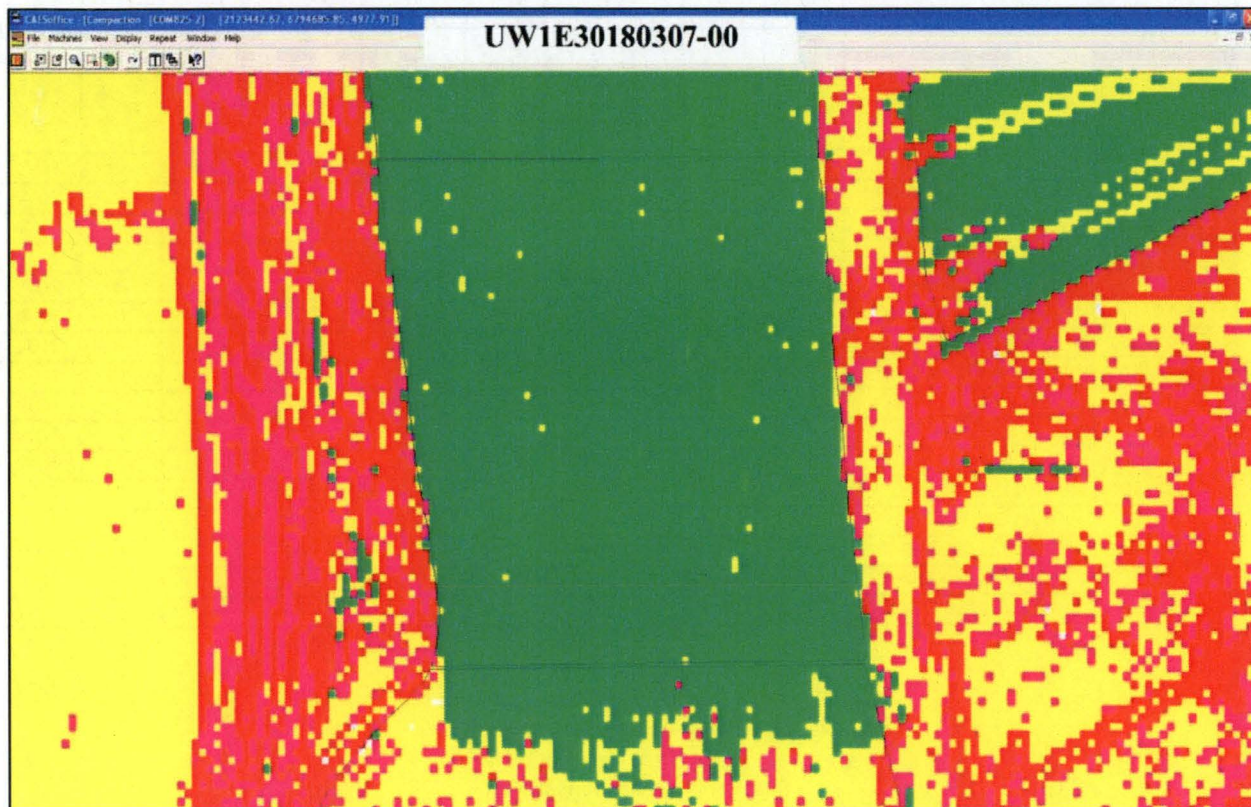


Appendix A2. RRM Lift Approval Summaries (continued)

March 2018										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
03/06/18	UW1E30180301-00	1	1447	1,447	100	1.0	521	0	0	N/A
03/06/18	UW1A31180301-00	1	1835	3,282	99.9	0.9	521	0	0	N/A
03/08/18	UW1A16180306-00	1	2696	5,978	100	1.0	521	0	0	N/A
03/08/18	UW1B18180306-00	1	1371	7,349	99.4	1.0	521	0	0	N/A
03/08/18	UW1F24180306-00	2	1872	9,221	99	1.0	520, 522	0	0	N/A
03/08/18	UW1E30180307-00	2	1447	10,668	98.6	1.0	521, 522	0	0	N/A
03/13/18	UW1A31180308-00	1	1835	12,503	100	0.9	521	0	0	N/A
03/14/18	UW1A16180308-00	2	2426	14,929	99.2	0.9	521	0	0	N/A
03/14/18	UW1B18180313-00	1	1234	16,163	99.5	0.9	521	0	0	N/A
03/14/18	UW1F24180313-00	1	1872	18,035	99.4	1.0	521	0	0	N/A
03/19/18	UW1E30180313-00	2	1013	19,048	99.7	0.7	521	0	0	N/A
03/19/18	UW1A31180315-00	1	1835	20,883	98.6	0.9	521	0	0	N/A
03/20/18	UW1B18180320-00	1	1371	22,254	97.6	1.0	521	0	0	N/A
03/20/18	UW1A16180315-00	2	2157	24,411	98.1	0.8	521	0	0	N/A
03/22/18	UW1F24180320-00	2	1685	26,096	99.7	0.9	521	1	0	93.5
03/22/18	UW1E30180321-00	1	1302	27,398	99.4	0.9	521	0	0	N/A
03/22/18	UW1A31180321-00	1	1835	29,233	99.2	0.9	521	0	0	N/A
03/27/18	UW1A16180322-00	2	1412	30,645	99.9	0.7	521	0	0	N/A
03/27/18	UW1B18180326-00	1	1351	31,996	99.6	1.0	521	0	0	N/A
03/28/18	UW1F24180327-00	1	1699	33,695	98.6	0.9	521	0	0	N/A
03/29/18	UW1E30180327-00	1	1311	35,006	99.4	0.9	521	0	0	N/A
03/29/18	UW1A31180327-00	2	1427	36,433	99.8	0.7	521	0	0	N/A
03/29/18	UW1A16180328-00	1	1626	38,059	100	0.9	521	0	0	N/A
03/29/18	UW1B18180329-00	1	1227	39,286	100	0.9	521	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%)= 99.4 Total Quantity Approved (yd³) = 39,286 Total # of Nuclear Density Gauge Tests = 1 Total # of Moisture Tests = 32 Quantity per Moisture Test (yd³) = 1,228 Total Average Thickness (ft)= 0.9 </p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from March 2018. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

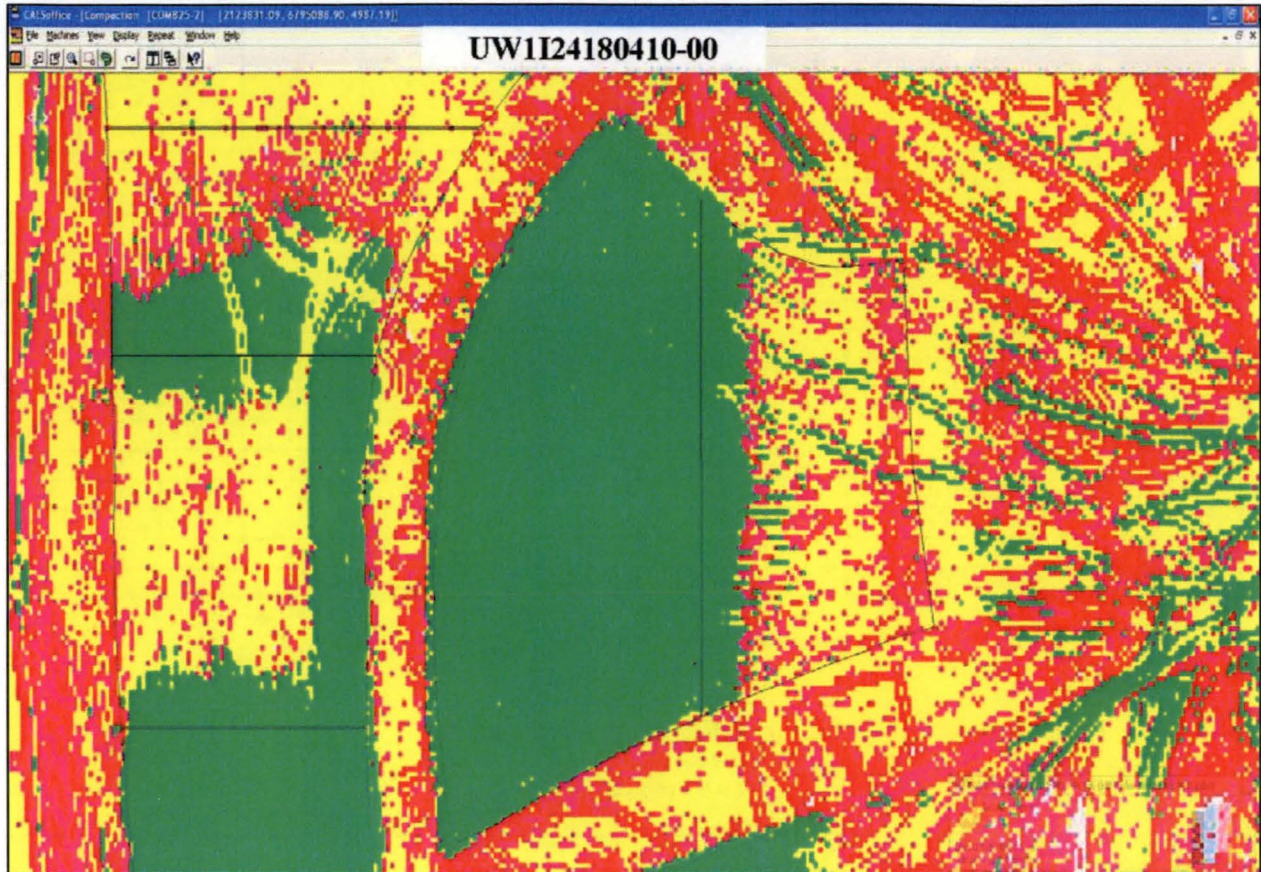


Appendix A2. RRM Lift Approval Summaries (continued)

April 2018										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
04/04/18	UW1E30180403-00	1	1438	1,438	99.5	1.0	521	0	0	N/A
04/04/18	UW1K21180404-00	1	0	1,438	97.5	0.0	517	0	0	N/A
04/05/18	UW1I24180404-00	1	0	1,438	99.2	0.0	517	0	0	N/A
04/09/18	UW1I28180405-00	1	767	2,205	99.8	0.7	488	0	0	N/A
04/10/18	UW1I28180409-00	1	986	3,191	99.4	0.9	517	0	0	N/A
04/10/18	UW1K21180405-00	1	1155	4,346	99.1	0.7	488	0	0	N/A
04/12/18	UW1I24180410-00	1	2716	7,062	99.8	0.9	488	0	0	N/A
04/12/18	UW1K21180410-00	1	1320	8,382	99.2	0.8	488	0	0	N/A
04/17/18	UW1I24180412-00	1	2574	10,956	98.3	0.8	488	0	0	N/A
04/18/18	UW1I28180417-00	1	1007	11,963	98.6	0.9	488	0	0	N/A
04/19/18	UW1K21180417-00	1	1294	13,257	98.9	0.8	488	0	0	N/A
04/19/18	UW1I24180417-00	2	2574	15,831	98.6	0.8	488, 489	0	0	N/A
04/24/18	UW1I24180424-00	1	2574	18,405	99.5	0.8	488	0	0	N/A
04/24/18	UW1K21180419-00	1	1294	19,699	99.3	0.8	489	0	0	N/A
04/26/18	UW1K21180424-00	1	1362	21,061	99.6	0.9	488	0	0	N/A
04/26/18	UW1I28180424-00	2	1007	22,068	99.9	0.9	488	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%) = 99.1 Total Quantity Approved (yd³) = 22,068 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 18 Quantity per Moisture Test (yd³) = 1,226 Total Average Thickness (ft) = 0.7 </p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from April 2018. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

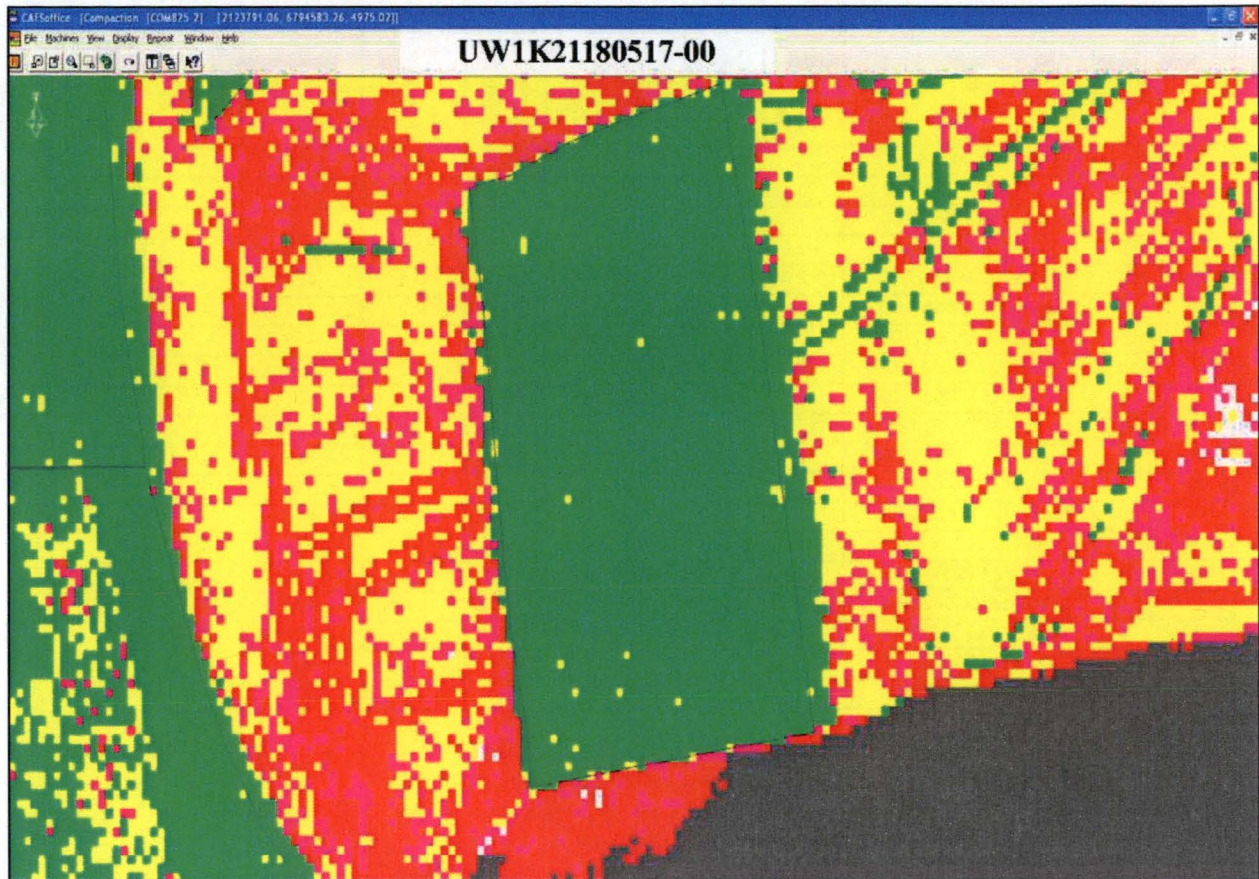


Appendix A2. RRM Lift Approval Summaries (continued)

May 2018										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
05/01/18	UW1I28180501-00	1	1022	1,022	99.1	0.9	488	0	0	N/A
05/08/18	UW1I24180426-00	1	3052	4,074	98.6	0.9	488	0	0	N/A
05/08/18	UW1I28180501-01	1	1362	5,436	99.2	0.9	488	0	0	N/A
05/10/18	UW1I28180510-00	1	997	6,433	99	0.9	488	0	0	N/A
05/10/18	UW1K21180508-00	1	1508	7,941	99.7	1.0	488	0	0	N/A
05/10/18	UW1I24180508-00	2	3125	11,066	99.6	0.9	488	0	0	N/A
05/15/18	UW1K21180510-00	1	1357	12,423	99.6	0.9	488	0	0	N/A
05/17/18	UW1I24180515-00	1	3125	15,548	99.7	0.9	488	0	0	N/A
05/17/18	UW1K21180515-00	2	1357	16,905	98.2	0.9	488, 489	0	0	N/A
05/22/18	UW1K21180522-00	1	1403	18,308	99	0.9	488	0	0	N/A
05/22/18	UW1I24180517-00	1	3125	21,433	99.2	0.9	489	0	0	N/A
05/22/18	UW1I28180517-00	1	931	22,364	99.8	0.9	489	0	0	N/A
05/24/18	UW1I24180522-00	1	3343	25,707	98.8	0.9	488	0	0	N/A
05/24/18	UW1K21180524-00	1	1247	26,954	98.4	0.8	488	0	0	N/A
05/31/18	UW1I24180524-00	1	3343	30,297	97.7	0.9	489	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%)= 99.0 Total Quantity Approved (yd³) = 30,297 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 17 Quantity per Moisture Test (yd³) = 1,782 Total Average Thickness (ft)= 0.9 </p>										

Appendix A2. RRM Lift Approval Summaries *continued*)

CAES compaction screen example from May 2018. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

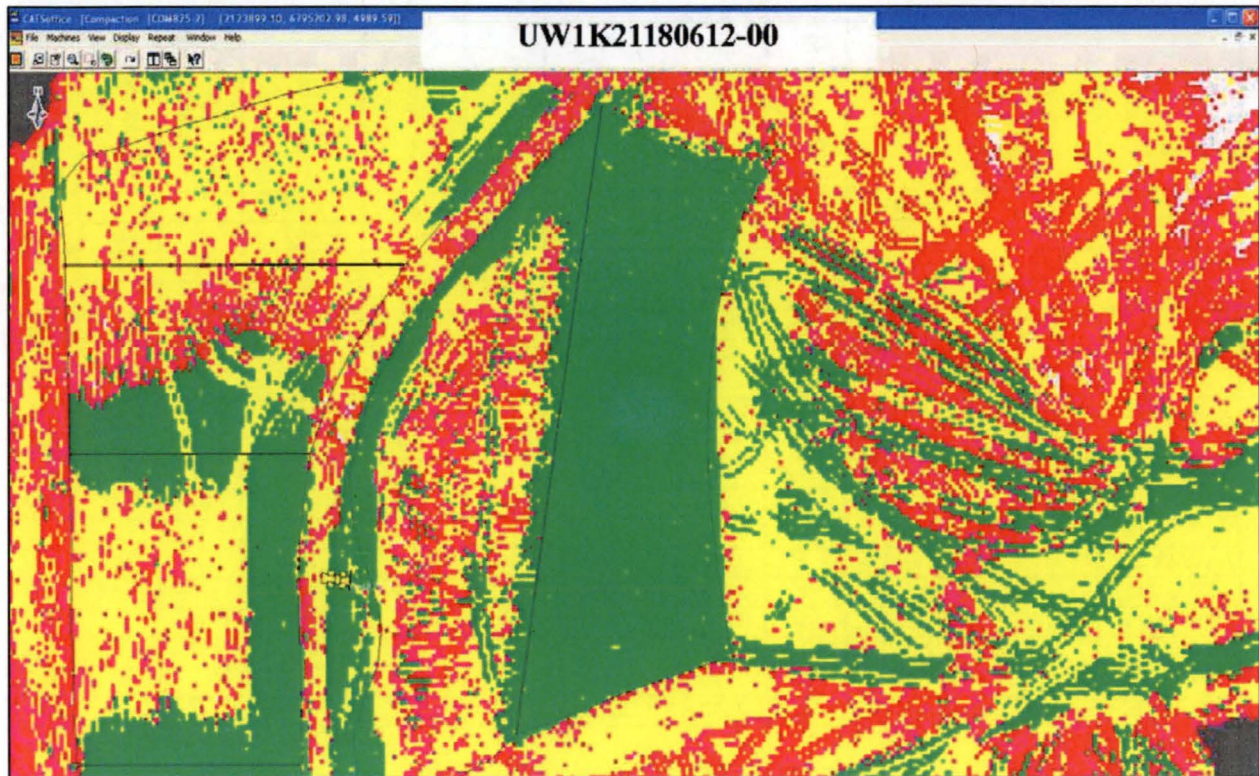


Appendix A2. RRM Lift Approval Summaries (continued)

June 2018										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
06/05/18	UW1K21180605-00	1	1247	1,247	98.8	0.8	489	0	0	N/A
06/05/18	UW1I28180531-00	1	931	2,178	98.6	0.9	489	0	0	N/A
06/07/18	UW1I24180605-00	1	2971	5,149	98.6	0.8	489	0	0	N/A
06/07/18	UW1I28180605-00	2	948	6,097	97.7	0.9	489, 488	0	0	N/A
06/12/18	UW1K21180607-00	2	2068	8,165	98.9	0.9	488	0	0	N/A
06/14/18	UW1I24180607-00	3	2079	10,244	98.8	0.8	488, 489	0	0	N/A
06/14/18	UW1I28180612-00	2	842	11,086	98.7	0.8	489	0	0	N/A
06/14/18	UW1K21180612-00	2	2068	13,154	99.2	0.9	488, 489	0	0	N/A
06/19/18	UW1I24180614-00	1	1819	14,973	98.8	0.7	488	0	0	N/A
06/19/18	UW1I28180614-00	3	948	15,921	99.1	0.9	488, 489	0	0	N/A
06/21/18	UW1I28180621-00	1	842	16,763	99.1	0.8	489	0	0	N/A
06/21/18	UW1K21180619-00	1	1838	18,601	98.7	0.8	488	0	0	N/A
06/21/18	UW1I24180621-00	1	1559	20,160	98.4	0.6	489	0	0	N/A
06/26/18	UW1K21180621-00	2	1549	21,709	99.5	1.0	488, 489	0	0	N/A
06/26/18	UW1I24180626-00	1	916	22,625	99.6	0.9	488	0	0	N/A
06/26/18	UW1I28180626-00	1	821	23,446	98.8	0.8	488	0	0	N/A
06/28/18	UW1K21180626-00	1	1394	24,840	99.3	0.9	488	0	0	N/A
06/28/18	UW1I24180628-00	1	815	25,655	99.6	0.8	488	0	0	N/A
06/28/18	UW1I28180628-00	1	924	26,579	100	0.9	488	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%)= 99.0 Total Quantity Approved (yd³) = 26,579 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 28 Quantity per Moisture Test (yd³) = 949 Total Average Thickness (ft)= 0.8 </p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from June 2018. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

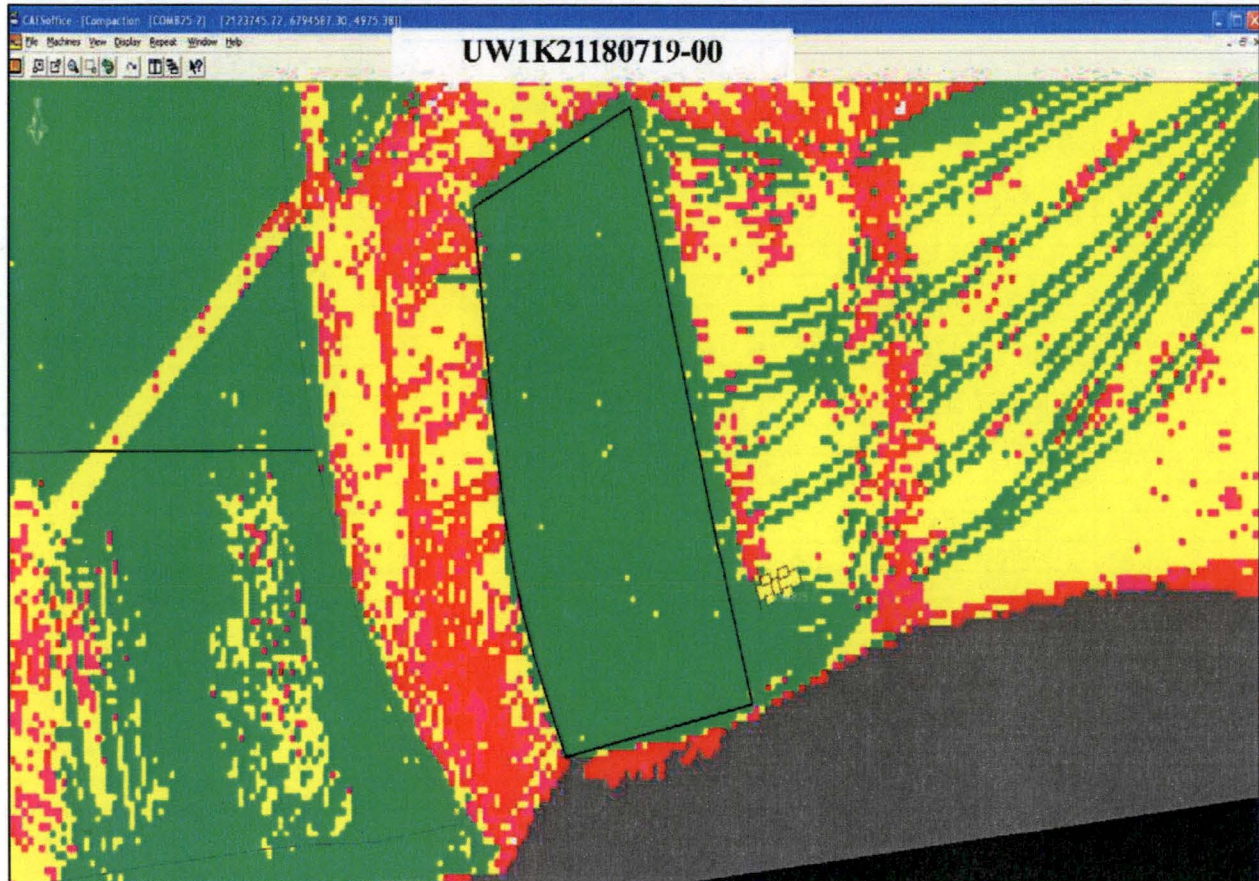


Appendix A2. RRM Lift Approval Summaries (*continued*)

July 2018										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
07/03/18	UW1I24180628-01	1	355	355	99.8	0.7	488	0	0	N/A
07/03/18	UW1I28180702-00	1	813	1,168	98.8	0.8	469	0	0	N/A
07/03/18	UW1K21180628-00	1	910	2,078	99	0.9	488	0	0	N/A
07/03/18	UW1I24180703-00	1	1122	3,200	98.2	0.9	469	0	0	N/A
07/10/18	UW1I28180703-00	1	828	4,028	99.3	1.0	469	0	0	N/A
07/10/18	UW1I24180710-00	1	620	4,648	99.9	0.9	488	0	0	N/A
07/10/18	UW1I28018710-00	1	837	5,485	100	1.0	488	0	0	N/A
07/16/18	UW1K21180710-00	2	2550	8,035	100	1.0	488	0	0	N/A
07/17/18	UW1I24180712-00	1	794	8,829	100	1.0	488	0	0	N/A
07/17/18	UW1I28180712-00	1	1461	10,290	99.9	1.0	488	0	0	N/A
07/19/18	UW1K21180717-00	1	2251	12,541	99.1	0.9	488	0	0	N/A
07/19/18	UW1I24180719-00	1	1633	14,174	99.6	0.8	488	0	0	N/A
07/23/18	UW1I28180719-00	1	668	14,842	100	0.8	488	0	0	N/A
07/24/18	UW1K21180719-00	1	1225	16,067	99.9	0.5	488	0	0	N/A
07/25/18	UW1I24180724-00	1	1927	17,994	99.9	0.9	488	0	0	N/A
07/25/18	UW1I28180724-00	1	622	18,616	99.9	0.6	488	0	0	N/A
07/26/18	UW1K21180726-00	1	2451	21,067	99.4	1.0	488	0	0	N/A
07/31/18	UW1I24180726-00	1	2142	23,209	99.6	1.0	488	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%)= 99.6 Total Quantity Approved (yd³) = 23,209 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 19 Quantity per Moisture Test (yd³) = 1,222 Total Average Thickness (ft)= 0.9 </p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from July 2018. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

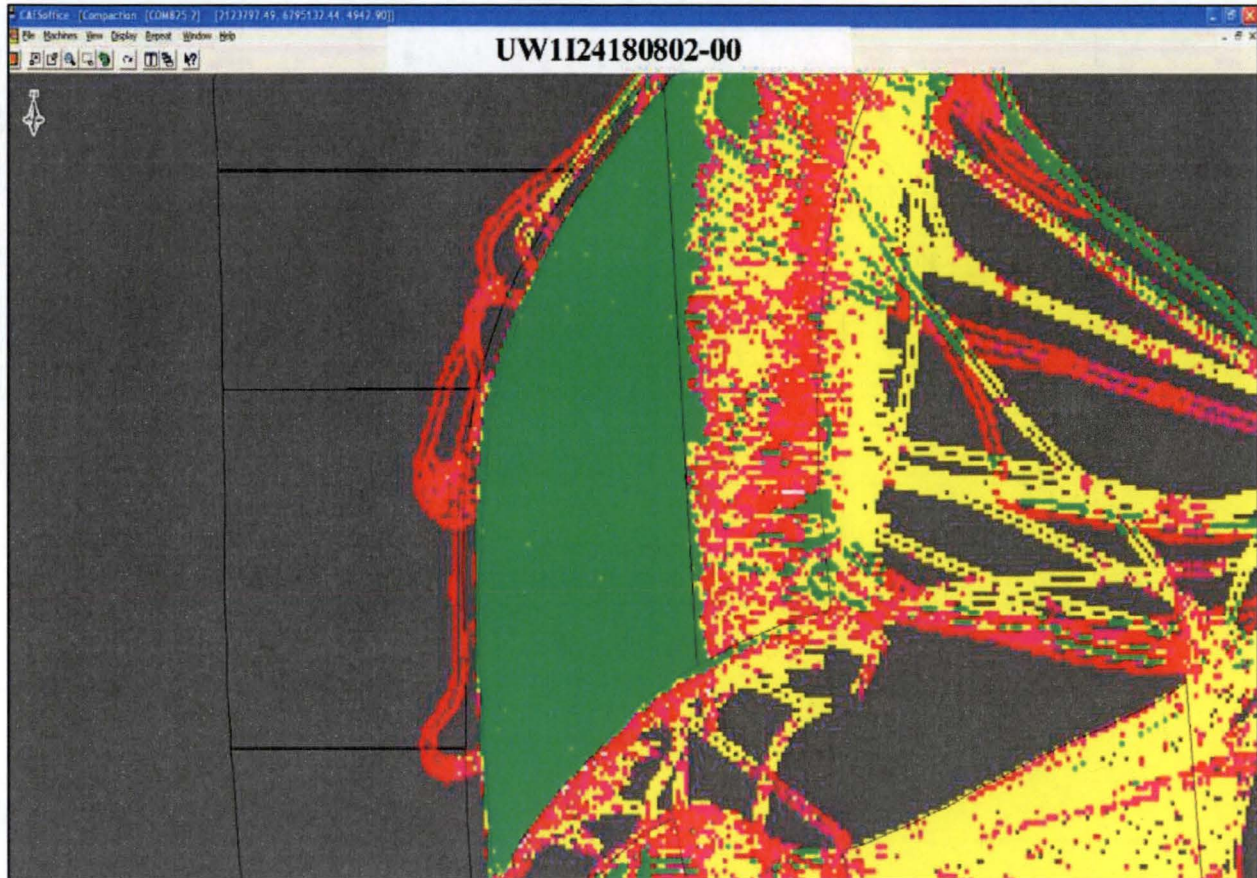


Appendix A2. RRM Lift Approval Summaries (continued)

August 2018										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
08/01/18	UW1I28180726-00	1	932	932	99.9	0.9	488	0	0	N/A
08/02/18	UW1K21180731-00	1	2451	3,383	99.7	1.0	488	0	0	N/A
08/06/18	UW1I24180802-00	1	2345	5,728	99.9	1.0	488	0	0	N/A
08/07/18	UW1K21180802-00	1	1811	7,539	99.9	0.8	488	0	0	N/A
08/08/18	UW1I24180807-00	1	2110	9,649	99.8	0.9	419	0	0	N/A
08/09/18	UW1K21180807-00	2	2137	11,786	100	0.9	419	0	0	N/A
08/13/18	UW1I28180809-00	1	755	12,541	99.4	0.8	419	0	0	N/A
08/14/18	UW1K21180814-00	1	947	13,488	99.9	0.8	419	0	0	N/A
08/14/18	UW1I24180809-00	1	1646	15,134	99.8	0.8	419	0	0	N/A
08/15/18	UW1K27180814-00	1	1139	16,273	100	0.9	419	0	0	N/A
08/15/18	UW1M26180814-00	1	1262	17,535	100	0.9	419	0	0	N/A
08/16/18	UW1I28180814-00	1	850	18,385	100	0.9	419	0	0	N/A
08/16/18	UW1M26180816-00	1	1184	19,569	100	0.9	419	0	0	N/A
08/16/18	UW1K27180816-00	1	1266	20,835	100	1.0	419	0	0	N/A
08/21/18	UW1I28180826-00	1	829	21,664	95.6	0.9	419	0	0	N/A
08/21/18	UW1M26180821-00	1	1315	22,979	98.2	1.0	419	0	0	N/A
08/21/18	UW1K27180821-00	1	1250	24,229	99.5	0.9	419	0	0	N/A
08/23/18	UW1I28180821-00	1	737	24,966	99.5	0.8	419	0	0	N/A
08/23/18	UW1K27180823-00	1	1250	26,216	99.3	0.9	419	0	0	N/A
08/23/18	UW1M26180823-00	1	1184	27,400	99.4	0.9	419	0	0	N/A
08/27/18	UW1K27180827-00	1	1111	28,511	99.3	0.8	419	0	0	N/A
08/27/18	UW1M26180823-01	1	1052	29,563	98.4	0.8	419	0	0	N/A
08/28/18	UW1I28180827-00	1	645	30,208	99	0.7	419	0	0	N/A
08/28/18	UW1M26180828-00	1	921	31,129	99.4	0.7	419	0	0	N/A
08/28/18	UW1K27180828-00	1	1111	32,240	99.6	0.8	419	0	0	N/A
08/29/18	UW1M26180828-01	1	1052	33,292	98.2	0.8	419	0	0	N/A
08/30/18	UW1M26180830-00	1	921	34,213	99.9	0.7	419	0	0	N/A
08/30/18	UW1K27180829-00	1	1389	35,602	99.2	1.0	488	0	0	N/A
08/30/18	UW1I28180830-00	1	645	36,247	95.6	0.7	488	0	0	N/A
<p style="text-align: center;">Average CAES Screen Passing Pixels (%)= 99.3 Total Quantity Approved (yd³) = 36,247 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 30 Quantity per Moisture Test (yd³) = 1,208 Total Average Thickness (ft)= 0.9</p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from August 2018. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.

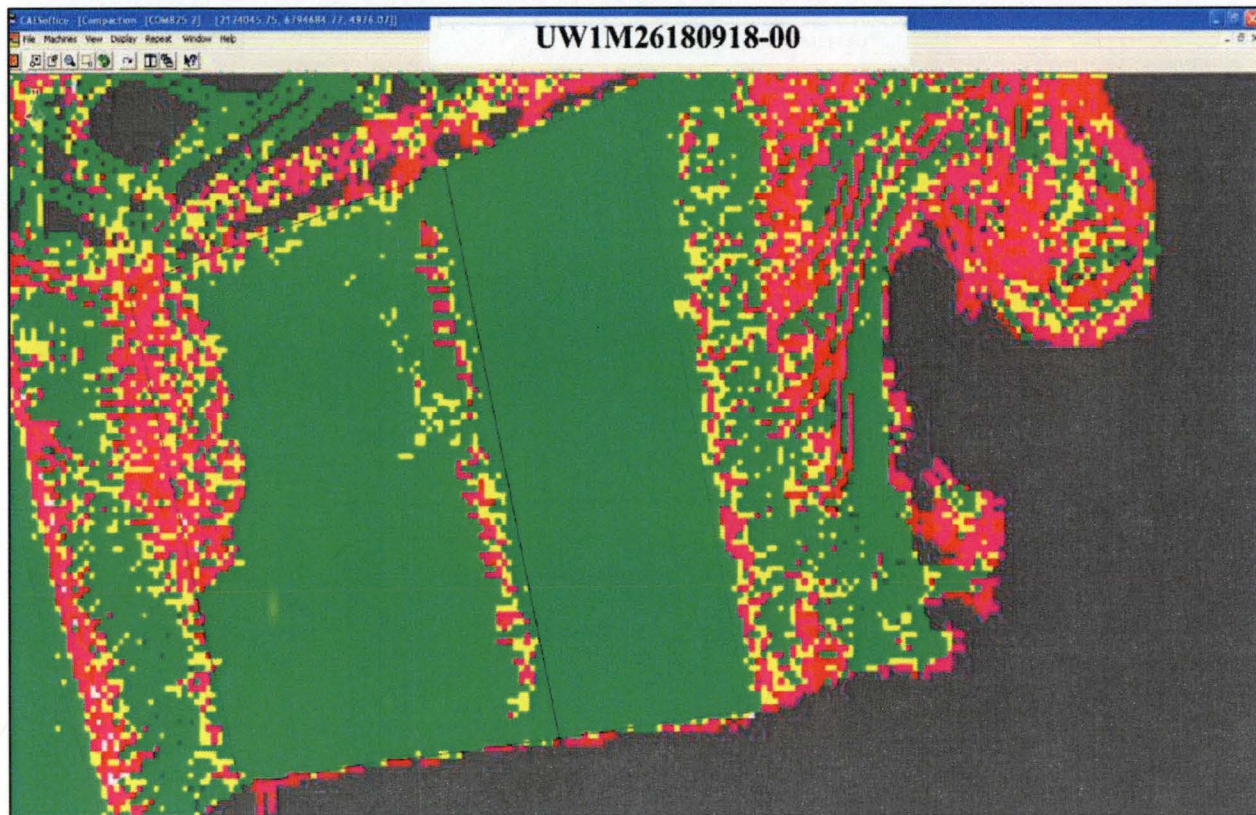


Appendix A2. RRM Lift Approval Summaries (continued)

September 2018										
Date	Lift ID #	# of Passing Moisture Tests	Quantity Approved (yd ³)	Cumulative Quantity Approved (yd ³)	CAES Screen Passing Pixels (%)	Average Thickness (ft)	Proctor ID #	# of Nuclear Density Gauge Verifications	# of Sandcone Verifications	Verified Compaction (%)
09/05/18	UW1K27180830-00	1	1111	1,111	99.2	0.8	419	0	0	N/A
09/05/18	UW1R02180904-00	1	0	1,111	99.8	N/A	505	0	0	N/A
09/06/18	UW1M26180905-00	1	1205	2,316	99.9	0.8	419	0	0	N/A
09/06/18	UW1K27180905-00	1	1526	3,842	99.9	0.9	419	0	0	N/A
09/13/18	UW1K27180911-00	1	1526	5,368	100	0.9	419	0	0	N/A
09/13/18	UW1M26180911-00	1	1506	6,874	100	1.0	419	0	0	N/A
09/18/18	UW1M26180913-00	1	1356	8,230	99.3	0.9	419	0	0	N/A
09/19/18	UW1K27180913-00	2	1845	10,075	99.4	1.0	419	0	0	N/A
09/19/18	UW1M26180918-00	1	864	10,939	100	0.7	419	0	0	N/A
09/20/18	UW1K27180920-00	1	1661	12,600	99.9	0.9	419	0	0	N/A
09/25/18	UW1M26180924-00	1	1235	13,835	100	1.0	419	0	0	N/A
09/25/18	UW1K27180924-00	2	1845	15,680	100	1.0	419	0	0	N/A
09/26/18	UW1M26180925-00	1	1120	16,800	99.6	0.9	419	0	0	N/A
09/27/18	UW1K27180925-00	1	1839	18,639	99.8	0.9	419	0	0	N/A
<p style="text-align: center;"> Average CAES Screen Passing Pixels (%)= 99.8 Total Quantity Approved (yd³) = 18,639 Total # of Nuclear Density Gauge Tests = 0 Total # of Moisture Tests = 16 Quantity per Moisture Test (yd³) = 1,165 Total Average Thickness (ft)= 3.9 </p>										

Appendix A2. RRM Lift Approval Summaries (*continued*)

CAES compaction screen example from September 2018. There are compaction screens for each lift approved on record. The number of passing pixels reported refers to the percentage of the lift which has green pixels. A green pixel verifies that the minimum of six wheel passes with the compactor has been recorded.



Appendix A2. RRM Lift Approval Package

LIFT APPROVAL FORM

PROJECT: <u>Moab UMTRA</u>		OTHER: _____	
NW CORNER		DATE: <u>5/1/2018</u>	

See attached for lift map

<u>P 1</u>			
EW:	<u>X</u>	=	
NS:	<u>X</u>	=	
<u>P 2</u>			
EW:	<u>X</u>	=	
NS:	<u>X</u>	=	
<u>P 3</u> N			
EW:	<u>X</u>	=	
NS:	<u>X</u>	=	
<u>P 4</u>			
EW:	<u>X</u>	=	
NS:	<u>X</u>	=	
<u>P 5</u>			
EW:	<u>X</u>	=	
NS:	<u>X</u>	=	
Page 2 attached: <u>Y</u> <u>N</u>			

IDENTIFY LOTS ABOVE

LIFT ID: <u>UW1128180501-00</u>	NW CORNER: <u>6794577 N. 2123798 E.</u>
Uncompacted Thickness: <u>0.9</u>	Compacted Thickness: <u>N/A</u>
NW CORNER of debris placement: <u>N/A</u>	EW Dimension: <u>N/A</u>
Lift Area (ft ²): <u>30,647</u>	Lift Volume (yd ³): <u>1,022</u>

Debris Insp. By: N/A Date: N/A Time: N/A

NS Dimension: N/A

Comments: QC verified lift area was scarified prior to placement. QC performed the dailt moisture for 05/01/2018 on this lift with satisfactory results.

Attached Forms: Grid Slope x Compaction Macro x Print Screen x Moisture/ Density x

KEYING IN NOTES: ☒ N ☐ E ☐ S ☐ W Satisfactory. MOISTURE/ DENSITY TESTS ID # (S): 1

LIFT APPROVED BY: Cory J Vetere/ *[Signature]* DATE: 5/1/2018 TIME: 1433

[Signature] 05/22/2018
QA/QC APPROVAL DATE

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Appendix A2. RRM Lift Approval Package (continued)

Slope Elevation Survey

[illegible]

Appendix A2. RRM Lift Approval Package (continued)

% >=6	99.1%
Elevation Avg	4932.2
Total >=6	2825
Total Lines	2851

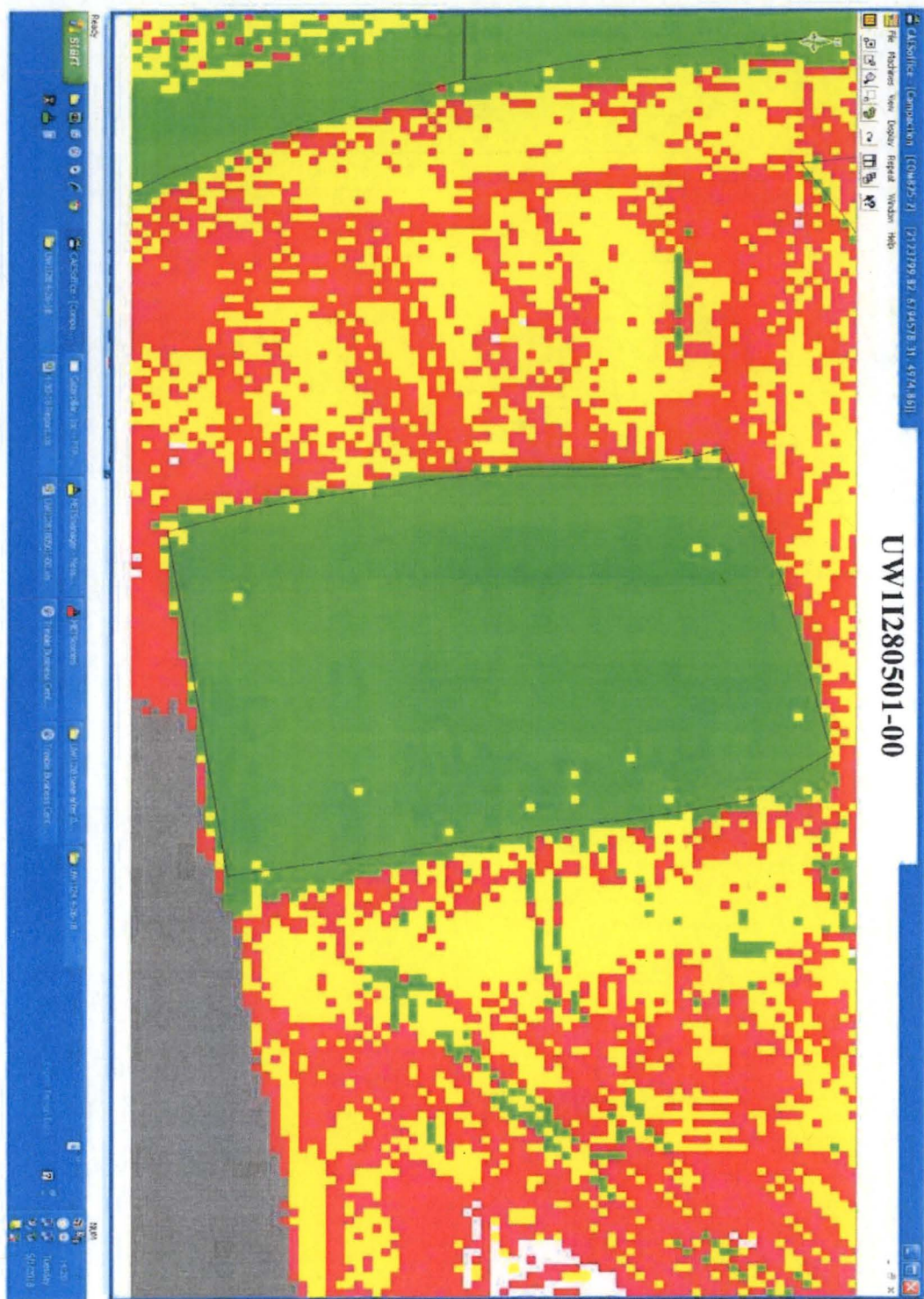
<h1>Pass</h1>	Minimum Number of Machine Passes
	3

Lift ID: UW1126180501-00

Northing	Easting	Elevation	# of Passes	Passes >=6	Count	
6794574	2123800	4935.5	8	1	1	Lift Height
6794578	2123800	4935.6	1		1	6"
6794558	2123803	4935.0	7		1	
6794561	2123803	4935.0	6		1	Thick Lift Threshold
6794564	2123803	4935.2	7		1	1' 0"
6794568	2123803	4935.1	8	1	1	
6794571	2123803	4935.1	6		1	Last Lift Elevation
6794574	2123803	4934.9	7		1	N/A
6794578	2123803	4935.4	5		1	
6794509	2123807	4933.8	8	1	1	Min. # of Wheel Passes
6794512	2123807	4933.8	8	1	1	6
6794515	2123807	4933.9	8	1	1	
6794519	2123807	4934.1	8	1	1	
6794522	2123807	4934.2	8	1	1	
6794525	2123807	4934.2	8	1	1	
6794528	2123807	4934.4	8	1	1	
6794532	2123807	4934.5	8	1	1	
6794535	2123807	4934.6	8	1	1	
6794538	2123807	4934.7	8	1	1	
6794542	2123807	4934.9	8	1	1	
6794545	2123807	4934.9	8	1	1	
6794548	2123807	4935.0	8	1	1	
6794551	2123807	4935.0	8	1	1	
6794555	2123807	4935.0	8	1	1	
6794558	2123807	4934.9	8	1	1	
6794561	2123807	4934.9	8	1	1	
6794564	2123807	4935.0	8	1	1	
6794568	2123807	4935.0	8	1	1	
6794571	2123807	4935.0	8	1	1	
6794574	2123807	4935.0	8	1	1	
6794578	2123807	4934.8	8	1	1	
6794581	2123807	4935.3	6		1	
6794479	2123810	4932.9	8	1	1	
6794482	2123810	4933.0	8	1	1	
6794486	2123810	4933.2	8	1	1	
6794489	2123810	4933.2	8	1	1	
6794492	2123810	4933.3	8	1	1	
6794496	2123810	4933.4	8	1	1	
6794499	2123810	4933.5	8	1	1	
6794502	2123810	4933.6	8	1	1	
6794505	2123810	4933.7	8	1	1	
6794509	2123810	4933.7	8	1	1	
6794512	2123810	4933.8	8	1	1	
6794515	2123810	4933.9	8	1	1	

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Appendix A2. RRM Lift Approval Package (*continued*)



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Appendix A2. RRM Lift Approval Package (continued)

FIELD DENSITY TEST

PROJECT: <u>Moab UMTRA Project</u>		OTHER: _____	
LIFT IDENTIFICATION: <u>UW1128180501-00</u>		DATE: <u>5/1/2018</u>	
TEST ID NUMBER(S): <u>I</u>			
TEST LOCATION: <u>Lift Area</u>		TEST METHOD: <u>N/A</u> D1556 <u>N/A</u> D6938	

<p>ASTM D6938 (DENSITY DETERMINATION)</p> <p>Make/Model _____ Gauge Serial # _____</p> <p>Last Calibration Date: <u>N/A</u></p> <p>Daily Standard Counts:</p> <p>Density _____ Moisture _____</p> <p>Method A (Direct Transmission) or Method B (Backscatter)</p> <p>Depth Setting _____ (inches) A Count Time _____ (minutes)</p> <p>Moisture Count _____ Density Count _____</p> <p>Wet Density (ρ_m) _____ (lbs/ft³) Dry Density _____ (lbs/ft³)</p> <p>Moisture Density _____ (lbs/ft³) Moisture Fraction _____ (%)</p>	<p>ASTM D1556 (DENSITY DETERMINATION)</p> <p>Testing Apparatus _____ Calibrated Vol. (lbs/ft³) _____</p> <p>Bulk Density of sand (ρ_s) _____ g/cm³ _____ lbs/ft³</p> <p>Mass of Sand to Fill Cone & Plate (M_2) _____ g</p> <p>Mass of bottle & cone before filling _____ g</p> <p>Mass of bottle & cone after filling _____ g</p> <p>Mass of sand to fill cone, plate, & hole (M_3) _____ g</p> <p>Mass of sand to fill hole _____ g</p> <p>Mass of wet soil in container _____ g</p> <p>Mass of container _____ g</p> <p>Mass of wet soil (M_4) _____ g</p> <p>Test Hole Volume _____ cm³</p> <p>$V = (M_1 - M_2) / \rho_s$</p> <p>Dry Mass of soil _____ g</p> <p>$M_d = 100 M_4 / (w + 100)$</p> <p>Wet Density _____ lbs/ft³</p> <p>$\rho_m = (M_3 / V) \times 62.43$</p> <p>Dry Density _____ g/cm³</p> <p>$\rho_d = M_d / V$</p> <p>Dry Unit Weight _____ lbs/ft³</p> <p>$\gamma_d = \rho_d \times 62.43$</p>
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<p>MOISTURE DETERMINATION</p> <p>ASTM D4643</p> <p>Container ID <u>102</u></p> <p>Scale Serial # <u>14714971</u> Last Calibration Date: <u>10/6/17</u></p>	
<p>Mass of container & wet specimen (M_{cms}) <u>506.2</u> g</p> <p>Mass of container & dry specimen (M_{cbs}) <u>459.1</u> g</p> <p>Mass of water (M_w) <u>47.1</u> g</p> <p>$M_w = M_{cms} - M_{cbs}$</p> <p>Mass of container (M_c) <u>218.4</u> g</p> <p>Mass of dry specimen (M_s) <u>240.7</u> g</p> <p>$M_s = M_{cbs} - M_c$</p> <p>Moisture content (w) <u>19.6</u> %</p> <p>$w = (M_w / M_s) \times 100$</p>	<p>Dry Density (ρ_d) = $(100 \times \rho_m) / (100 + w)$</p> <p>$\rho_d = (100 \times \text{####}) / (100 + 19.6) = 0.0$ lbs/ft³</p> <p>Note: Wet Density from ASTM D1556 (g) values precedence over ASTM D6938 (ρ_m)</p> <p>Percent Compaction = $\rho_d / \gamma_{dmax} \times 100$</p> <p>$0.0 / 105.1 \times 100 = 0.0$ %</p>

<p>Comments:</p> <p>Represents 100% of lift area Microwave oven power setting on HIGH. Initial time setting of 3 minutes and subsequent incremental drying periods of 1 minute until a change of 0.1 % or less of the initial wet mass of the soil.</p>	<p>Soil Description: <u>Greyish brown very fine to medium well graded subround clay.</u></p> <p>Proctor ID: <u>RRM # 488</u></p> <p>Standard Proctor (ASTM D698)</p> <p>Maximum Dry Density (γ_{dmax}) <u>105.1</u> (lbs/ft³)</p> <p>Optimum Moisture (w_{opt}) <u>19.2</u> (%)</p> <p>Required Moisture: <u>16.2</u> % to <u>22.2</u> %</p> <p>Required Percent Compaction: <u>90.0</u> (%)</p>
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<p>TEST RESULTS:</p> <p><input checked="" type="checkbox"/> Pass Date: <u>5/1/18</u></p> <p><input type="checkbox"/> Failed Moisture</p> <p><input type="checkbox"/> Failed Compaction Time: <u>0937</u></p> <p>By: <u>Cory J Vetere</u> (print) <u>[Signature]</u> (signature)</p>	
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<p>QA/QC APPROVAL: <u>[Signature]</u></p>	<p>DATE: <u>05-22-2018</u></p>
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Appendix B.
Photographs

Appendix B. Photographs

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Appendix B. Photographs – RRM



Photo 1. Loader Approaching Fuel Island October 2017

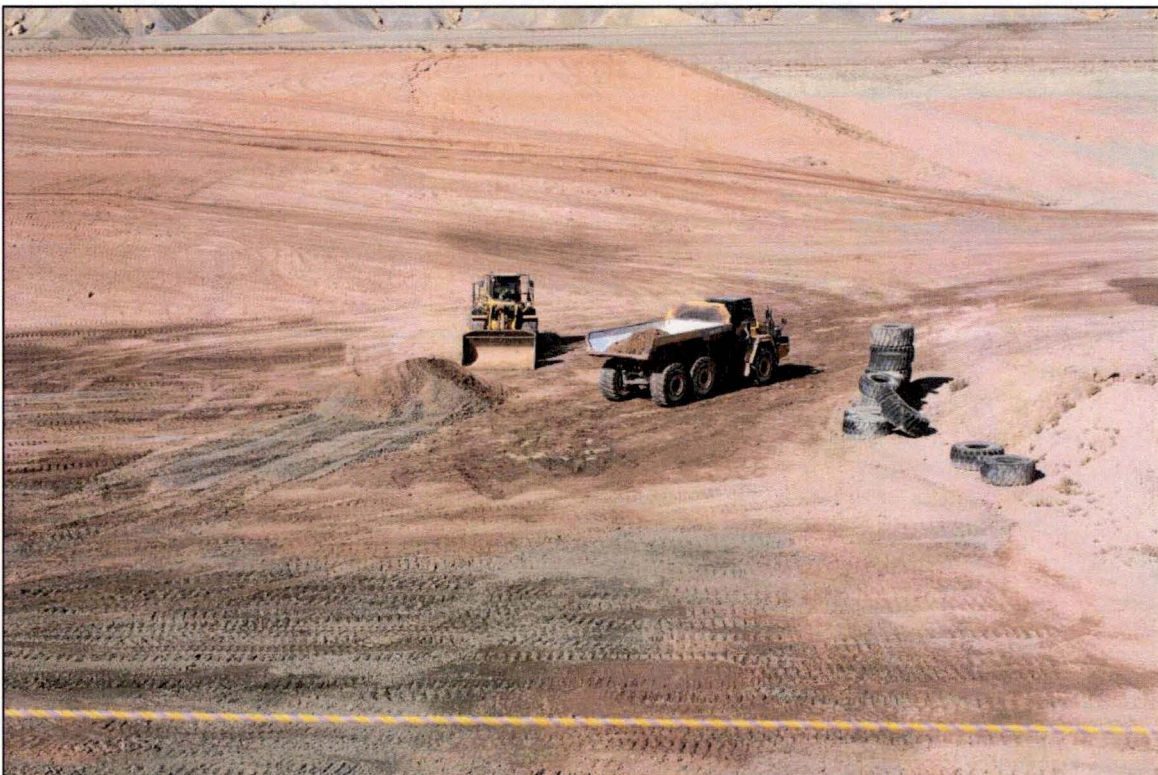


Photo 2. Loader Loading Haul Truck October 2017

Appendix B. Photographs – RRM (*continued*)



Photo 3. Multiple Disposal Cell Operations October 2017



Photo 4. Piles of Tailings on Lift Area October 2017

Appendix B. Photographs – RRM (*continued*)



Photo 5. Partial Stockpile October 2017



Photo 6. Water Wagon Operation October 2017

Appendix B. Photographs – RRM (*continued*)



Photo 7. Compaction of Lift Area November 2017



Photo 8. Dozer Placing Material November 2017

Appendix B. Photographs – RRM (*continued*)



Photo 9. Haul Truck Approaching with Load November 2017



Photo 10. Haul Truck Dumping Material November 2017

Appendix B. Photographs – RRM (*continued*)



Photo 11. Moisturized Lift Prepared for Placement of Lifts November 2017



Photo 12. Water Diversion Bar in Cell November 2017

Appendix B. Photographs – RRM (*continued*)



Photo 13. Compaction of Lift Area December 2017

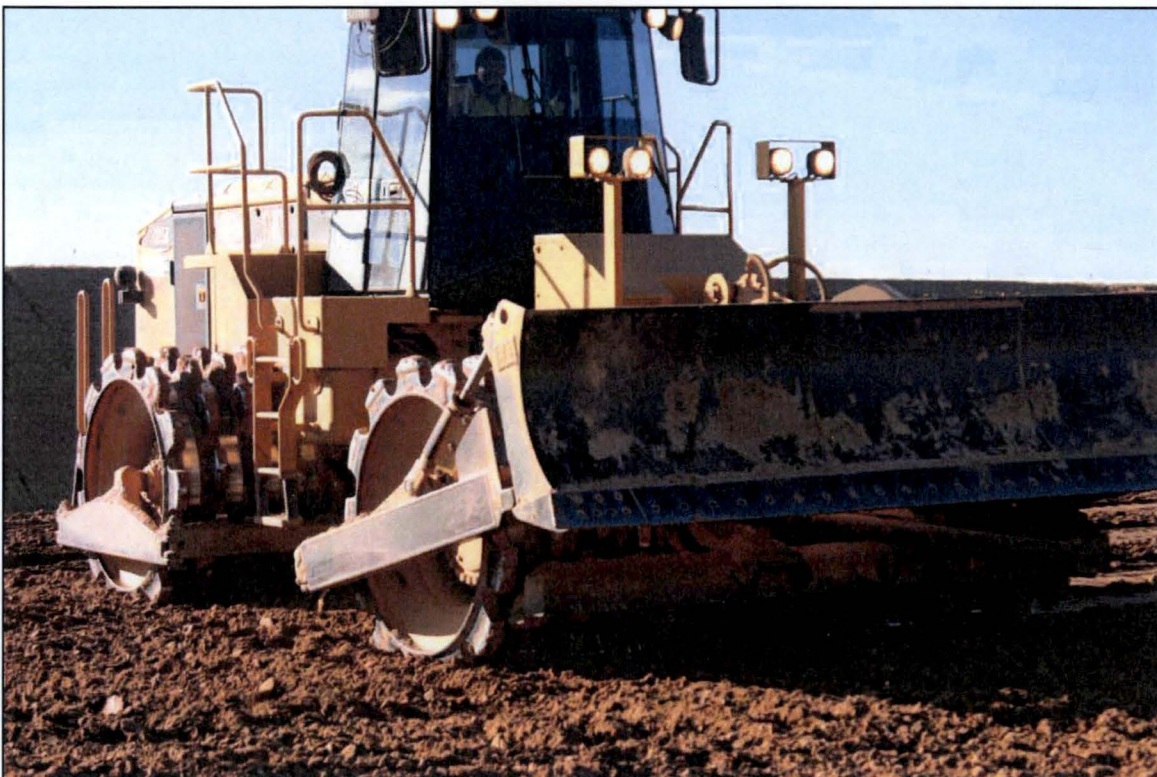


Photo 14. Compactor in Operation December 2017

Appendix B. Photographs – RRM (*continued*)



Photo 15. Dozer Pushing Material December 2017



Photo 16. Dozer Placing Material December 2017

Appendix B. Photographs – RRM (*continued*)



Photo 17. Haul Truck Hauling RRM to Lift Area December 2017



Photo 18. Truck Dumping Material on Lift Area January 2018

Appendix B. Photographs – RRM (*continued*)



Photo 19. Dozer Placing Material January 2018



Photo 20. Scarified Lift Area January 2018

Appendix B. Photographs – RRM (*continued*)



Photo 21. Compaction of Lift Area January 2018



Photo 22. Stockpiled RRM February 2018

Appendix B. Photographs – RRM (continued)



Photo 23. Bulldozer Pushing RRM for Placement February 2018



Photo 24. Sheepsfoot Scarifying Lift Area for Placement February 2018

Appendix B. Photographs – RRM (*continued*)



Photo 25. Underlying Lift Area Scarified for Placement February 2018



Photo 26. CA Loading Area at Dump Ramp March 2018

Appendix B. Photographs – RRM (*continued*)



Photo 27. Haul Truck Dumping Material March 2018



Photo 28. Dozer Placing Material on Lift Area March 2018

Appendix B. Photographs – RRM (*continued*)



Photo 29. Compaction of Lift by Compactor March 2018



Photo 30. Scarified Lift Area March 2018

Appendix B. Photographs – RRM (*continued*)



Photo 31. Moisture Density Site Preparation March 2018



Photo 32. Moisture Density Test Start March 2018

Appendix B. Photographs – RRM (*continued*)



Photo 33. Moisture Density Test in Progress March 2018



Photo 34. Water Wagon Watering Haul Routes April 2018

Appendix B. Photographs – RRM (*continued*)



Photo 35. Haul Truck Placing Load on Lift April 2018



Photo 36. Dozer Placing Material on Lift April 2018

Appendix B. Photographs – RRM (*continued*)



Photo 37. Compaction of Lift Area by Compactor April 2018



Photo 38. Placement of Material on Lift Area by Haul Truck May 2018

Appendix B. Photographs – RRM (*continued*)



Photo 39. Dozer Placing RRM May 2018



Photo 40. Compactor Compacting Lift Material May 2018

Appendix B. Photographs – RRM (*continued*)



Photo 41. Watering of Lift Area May 2018



Photo42. Haul Truck on Haul Road to Disposal Cell June 2018

Appendix B. Photographs – RRM (*continued*)



Photo 43. Loader Loading Material in Haul Truck at CA Loadout Area June 2018



Photo 44. Haul Truck Dumping RRM on Lift Area June 2018

Appendix B. Photographs – RRM (*continued*)



Photo 45. Dozer Placing RRM on Active Lift Area June 2018



Photo 46. Compaction of Lift Area by Compactor June 2018

Appendix B. Photographs – RRM (*continued*)



Photo 47. Watering of Cell Floor for Dust Control June 2018



Photo 48. Prepping Cell Floor for RRM Placement June 2018

Appendix B. Photographs – RRM (*continued*)



Photo 49. Water Truck Refilling July 2018



Photo 50. Haul Truck Preparing to Dump Material on Lift Area July 2018

Appendix B. Photographs – RRM (continued)



Photo 51. RRM Pile Placed on Lift Area July 2018



Photo 52. Placement of RRM by Dozer July 2018

Appendix B. Photographs – RRM (*continued*)



Photo 53. Compactor Compacting Material on a Lift July 2018



Photo 54. Watering Down of Lift Area August 2018

Appendix B. Photographs – RRM (continued)



Photo 55. Haul Truck Dumping RRM in Lift Area August 2018

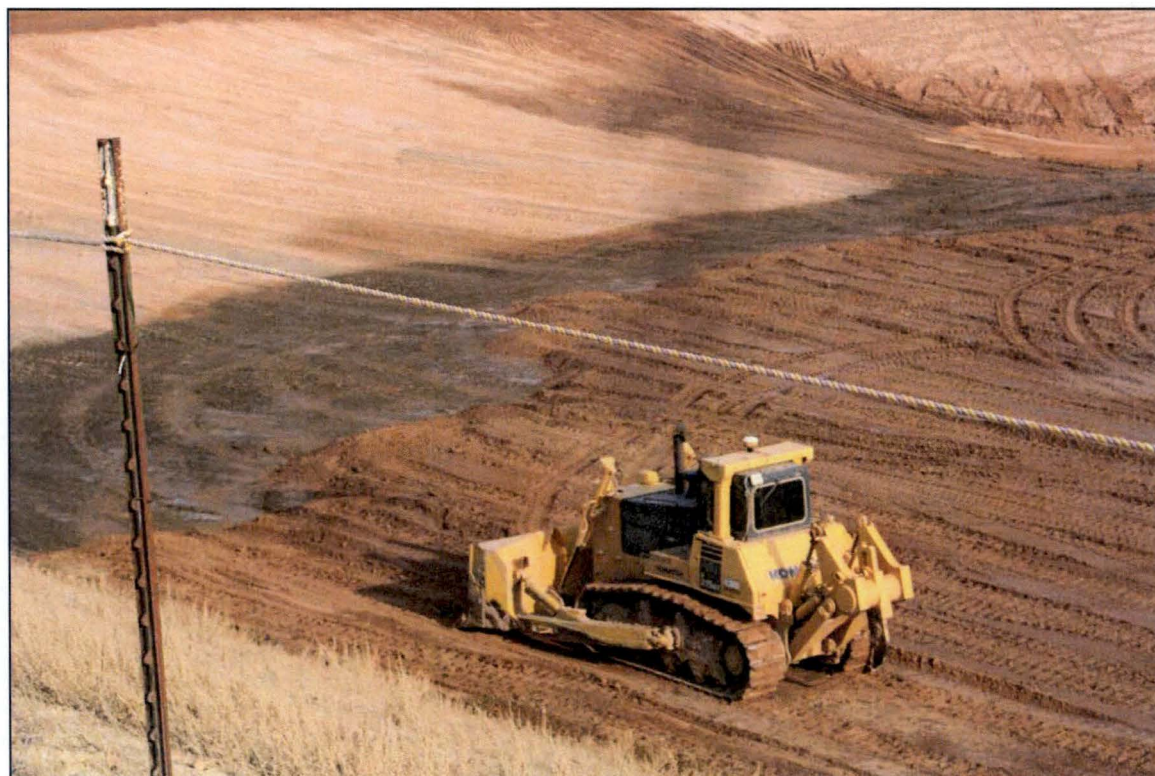


Photo 56. Dozer Placing Material on Lift Area August 2018

Appendix B. Photographs – RRM (continued)



Photo 57. Dozer Working Stockpile August 2018



Photo 58. RRM Hauled to the Lift and Placed in Piles September 2018

Appendix B. Photographs – RRM (*continued*)

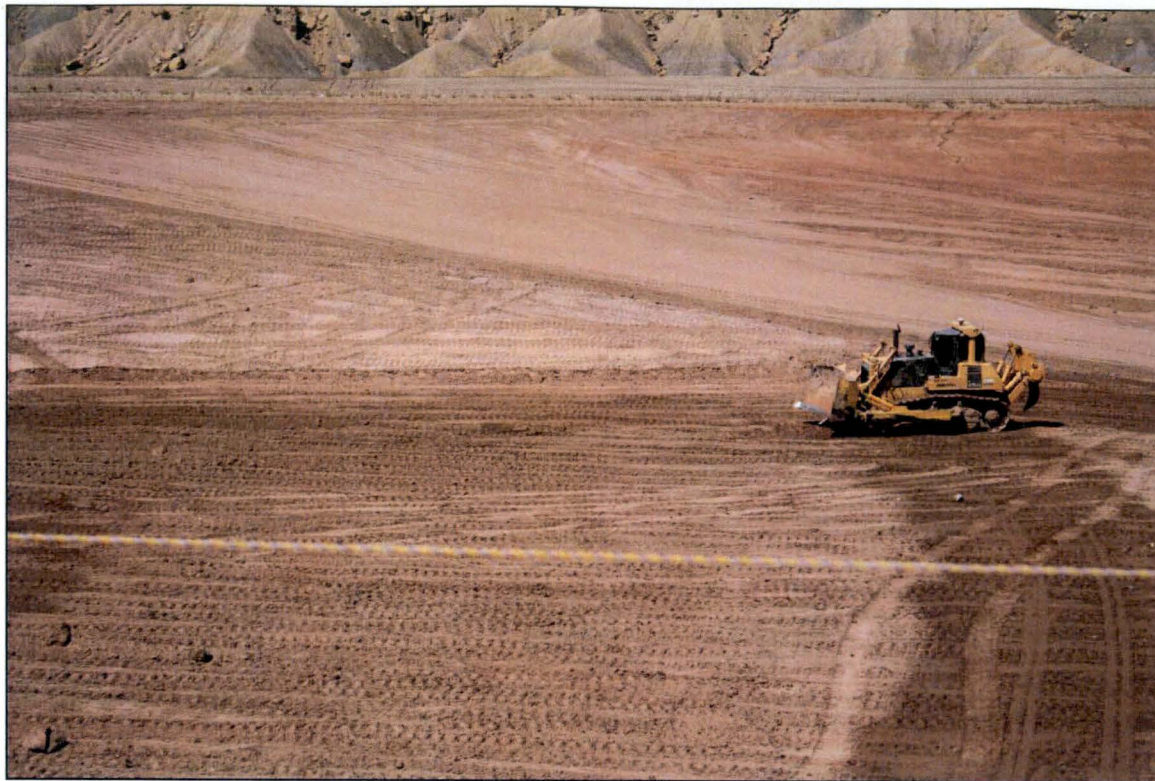


Photo 59. Dozer Placing RRM in Lift Area September 2018