Dwyer Engineering LLC

Crescent Junction Disposal Site
Alternative Final Cover System Post-Construction Monitoring Plan

Stephen F Dwyer, PhD, PE

2021

Submitted to North Wind Portage

Crescent Junction Disposal Site

Alternative Final Cover System
Post-Construction Monitoring Plan
60% Draft Submittal

DRAFT FOR REVIEW ONLY

PREPARED FOR:

North Wind Portage
Crescent Junction UMTRA Project Site
15 CR 223
Thompson Springs, UT 84540

PREPARED BY:

Dwyer Engineering LLC
Stephen F Dwyer, PhD, PE
1813 Stagecoach Rd. SE
Albuquerque, NM 87123

60% Report Date: August 15, 2021

Revision 00

EXECUTIVE SUMMARY

The Crescent Junction uranium tailings impoundment has been closed with an evapotranspiration (ET) cover composed of compacted cover soil overlain by a rock/soil admixture. This Post-Construction Monitoring Plan addresses post-closure care and monitoring for the U.S. Department of Energy (DOE) Crescent Junction, Utah, Uranium Mill Tailings Impoundment Closure System. This monitoring plan identifies post-closure care and monitoring requirements and activities for the Crescent Junction closure site. This monitoring is planned to be performed until the site is transferred to the DOE Environmental Management (EM) Office of Legacy Management (LM) portfolio. A tentative inspection and reporting schedule is also included.

The Alternative Final Cover System project located at the Crescent Junction Disposal Site consisted of the design and construction of a replacement cover for the impoundment. The cover system is a vegetated soil cover referred to as an ET cover (Crescent Junction Disposal Site, Alternative Final Cover System, Dwyer Engineering 2021). Details of the cover system design are in the construction drawings (Dwyer Engineering 2021), specifications (Dwyer Engineering 2021), and calculations included in the Design Report (Crescent Junction Disposal Site, Alternative Final Cover System 60% Design, Dwyer Engineering 2021).

DRAFT FOR REVIEW ONLY

CONTENTS

EXECUTIVE SUMMARY III
1.0 PURPOSE 1
2.0 SITE ELEMENTS MONITORED 2
2.1 ET COVER 2
2.1.1 Biointrusion Monitoring 2
2.2 STORM WATER CONTROL SYSTEMS 2
2.3 FENCING 3
2.4 EROSION AND SEDIMENTATION CONTROL 3
2.5 REVEGETATION OF DISTURBED AREAS 3
2.6 SITE ACCESS 4
3.0 COMMUNICATION/REPORTING REQUIREMENTS 5
4.0 REFERENCES 7
ATTACHMENT 1. POST-CONSTRUCTION MONITORING CHECKLIST 8
ATTACHMENT 2. EXAMPLES OF INSPECTION ISSUES 15

DRAFT FOR REVIEW ONLY

ACRONYMS

CFR	Code of Federal Regulations
DOE	United States Department of Energy
EM	Environmental Management
ET	Evapotranspiration
FCD	Federal Cleanup Director
LM	Legacy Management
NUREG	Nuclear Regulatory Commission Report

DRAFT FOR REVIEW ONLY

1.0 PURPOSE

The Crescent Junction, Utah, Uranium Mill Tailings Impoundment Closure System site elements will be inspected as outlined below during the post-closure monitoring period prior to acceptance of the project into the DOE EM LM portfolio. The long-term effectiveness of the final closure of the Crescent Junction Disposal Site should be for 1000 years, but not less than 200 years (40 CFR 192.02). The final cover system must provide reasonable assurance that releases of radon-222 from residual radioactive material to the atmosphere will not exceed an average release rate of 20 picocuries per square meter per second (40 CFR 192.02). The cover system and closure site should minimize erosion and provide long-term stable slopes (NUREG 1623).

The final cover system and erosion and sedimentation control measures shall be inspected quarterly during the initial 5-year monitoring period (or until transferred to DOE EM LM portfolio if sooner than 5-year period) to assess the general condition of the closure system and identify any maintenance or repair issues that may arise. The quarterly inspection schedule is intended to monitor the site and quickly correct any issues identified in the closure. After the initial 5-year monitoring, inspections are intended on an annual basis thereafter until transferred to the DOE EM LM portfolio. In addition to the quarterly inspections, if the site experiences a precipitation event that exceeds 1 inch in any given hour (the 100-year, 1-hour design storm event for Thompson Springs, Utah, is 1.47 in./hr.); the site shall also be inspected for any potential damage that may have occurred due to the storm.

An inspection report shall be prepared by the inspection engineer within two weeks of each inspection. An annual Post-Construction Monitoring Report shall be prepared and submitted to DOE by February 14 of the following year. The annual report shall include all inspection reports and all monitoring performed in the prior calendar year along with any maintenance and/or repairs performed (if any) and an executive summary describing the cover's performance for the year.

Inspections of the individual site elements are discussed in Section 2. Reporting requirements are outlined in Section 3. A proposed inspection checklist is provided in Attachment 1. Examples of issues to be inspected for are contained in Attachment 2. This inspection list may be modified as the inspections progress, based on findings and comments during this process.

DRAFT FOR REVIEW ONLY

2.0 SITE ELEMENTS MONITORED

This Post-Construction Monitoring Plan covers the following elements of the Crescent Junction Disposal Site closure:

- ET cover system
- Storm water control systems, including the Run-on Diversion Wedge
- Fencing
- Erosion and sedimentation control measures
- Revegetation of disturbed areas
- Site access.

All inspections performed shall be included in the inspection reports to be compiled and included in the annual Post-Construction Monitoring Report submitted to DOE. The inspections will be performed by a qualified engineer with no less than 10 years of expertise in alternative cover systems. Inspection records and documentation of corrective actions will be retained in the project file and provided with the annual report along with an executive summary detailing the cover's performance.

2.1 ET Cover

The general integrity of the ET cover system shall be inspected. The top slope and side slopes shall be examined for potential degradation of the cover system, such as erosion (as evidenced by rilling or gullying), quality and quantity of vegetation establishment, areas of subsidence, biointrusion, cracking, slope instability, and wet areas. The overall integrity of the cover on the top slope and side slopes system shall be inspected and observations shall be recorded with digital photos in an inspection report that includes the checklist contained in Attachment 1. Any maintenance or repair issues identified in an inspection shall be repaired as soon as weather permits. Any repairs requiring additional fill shall use fill from an approved borrow source meeting requirements set forth for cover soil in the Technical Specifications (Dwyer Engineering 2021).

2.1.1 Biointrusion Monitoring

As part of each inspection, the ET cover surface will be visually monitored for significant animal burrowing. The surface layer, composed of a mixture of 33% rock to 67% soil by volume, will discourage burrowing but may not prevent it. Large woody roots of trees can provide preferential flow paths through soil covers. Significant burrowing or establishment of trees shall be reported in the attached inspection checklist. Any animal burrows larger than 3 in. in diameter shall be reported (Dwyer Engineering 2021).

2.2 Storm Water Control Systems

The general integrity of the site drainage channels and culverts shall be inspected. The channels and the transition of the channels shall be inspected for evidence of degradation, erosion, subsidence, sediment accumulation, undercutting, obstructions, slope instability, and other disturbances to the channels. The overall integrity of the drainage channels and culverts shall be

DRAFT FOR REVIEW ONLY

inspected, and observations shall be recorded using the table in Attachment 1. If any of the issues listed in Attachment 1 are observed to be significant, they are to be repaired as soon as weather permits. Any repairs requiring additional fill and/or rock shall use material from an approved borrow source. Repairs requiring additional material such as riprap shall use locally available materials that meet the design specifications (Dwyer Engineering, Technical Specifications 2021).

2.3 Fencing

Fencing is used to control access to the site. Fencing at the site includes perimeter fencing and access gates around the site. The integrity of all fencing shall be inspected. This length of fencing shall be inspected for any damage, including but not limited to: bent posts, loose posts, broken links or wire, and damaged gates. Any damage observed shall be noted in the inspection report and repaired as soon as weather permits.

2.4 Erosion and Sedimentation Control

Condition of temporary erosion measures shall be inspected for their integrity and usefulness during the time period they are deemed essential (until vegetation is established around the perimeter of the cover system – generally during the first two years only). If temporary erosion control measures are deemed to be damaged, they are to be repaired or replaced with similar materials as designated by the Engineer performing the inspection. All damage shall be noted in the inspection report along with recommend maintenance. These repairs or replacements are to be performed as soon as weather permits.

Condition of permanent erosion control measures shall be inspected. These include the cover system surface admixture, drainage channels, diversion wedge, and riprap protecting the perimeter of the impoundment. Any degradation or damage shall be noted in the inspection reports along with recommended repair or maintenance for each occurrence. These repairs or maintenance items are to be performed as soon as weather permits.

Condition of perimeter drains shall be inspected for presence of sediments, breaches, presence of vegetation or debris, etc. Sediments, vegetation, or debris retarding storm water runoff will be removed as needed. Breaches shall be repaired using the appropriate materials.

2.5 Revegetation of Disturbed Areas

Vegetation is a key aspect of the ET cover. Revegetation of all disturbed areas including the ET cover will be inspected for success based on type of vegetation, percent bare area, and size of native vegetation seeded during the cover installation. These values will be recorded by the Inspection Engineer in each inspection report. Furthermore, the vegetation will be monitored for continued robustness to ensure there are no unintended stresses on it. Digital photos will be taken during each inspection and included in the quarterly report to monitor the maturation and success of the vegetation. Should problems with vegetation be identified by the Engineer, the problem will be noted along with a recommended repair or further evaluation recommendations.

DRAFT FOR REVIEW ONLY

2.6 Site Access

Continued access to the site will be inspected. Access shall be made available for any maintenance or repairs required, as noted during the inspections.

DRAFT FOR REVIEW ONLY

3.0 COMMUNICATION/REPORTING REQUIREMENTS

An annual Post-Construction Monitoring Report shall be submitted to the DOE until the site is adopted by the DOE EM-LM. These reports shall include all inspection reports as well as any recommended maintenance or repairs inclusive of documentation that the recommended repair was properly performed.

Attachment 1 provides a Post-Construction Monitoring Checklist for guidance during the inspections. Digital photos of key elements shall be included in each inspection report in addition to a summary of the condition of the site and any changes, damage, or other issues, along with any maintenance or repairs recommended. The annual Post-Construction Monitoring Report shall include an executive summary summarizing the condition and performance of the cover. It shall also include, at a minimum, the following information for each reporting period:

- Summary of the condition of each site element identified.
- Photographs of the site features taken at the locations.
- Summary of all findings.
- Summary of all changes or repairs made to the site (if any), indicating consultation with DOE and/or the Design Engineer and approval of those changes, when necessary.
- Summary of any applicable contacts or discussions with representatives of the local community, public interest groups, or government agencies.
- Summary of all problems or potential problems encountered (if any).
- Summary of actions taken and being taken to rectify problems (if any).
- Changes in project personnel (if any).
- Copies of inspection reports and any other relevant records.

Each inspection report shall include a list of any recommended maintenance or repairs based on findings from the recent inspection (if any). Subsequent inspection reports shall include a follow-up review of previous maintenance or repairs performed, verifying their effectiveness at addressing the issue (if any). Examples of maintenance or repairs needed may include:

- Localized areas of the cover where vegetation is deemed to be inadequate. Reseeding or further investigation may be required.
- Localized erosion, including formation of grills/gullies, will require repair and potential redesign to address the situation.
- Localized differential settlement that has created, or may create, ponding will require repairs by adding additional soil in depressed area and reseeding.
- Excessive or large burrowing. Large burrow holes can be filled with soil; excessive burrowing may adversely affect the cover performance and should be addressed in addition to repairs to the cover system.

Included in each inspection report are areas of concern to be closely monitored on subsequent inspections (if any). These may include localized vegetation distress, settlement, erosion,

DRAFT FOR REVIEW ONLY

cracking, an unexpected increase cover moisture, etc. These issues on a case-by-case basis may trigger a more in-depth review. Any of these issues will be included in the inspection report.

A project file containing records of all inspections, monitoring, and maintenance performed shall be maintained by DOE Environmental Management Grand Junction Field Office. The annual Post-Construction Monitoring Report will be prepared and provided to the DOE prior to February 14 of each subsequent year.

The name, address, and telephone number for the individual to contact during the post-closure period is as follows:

Russell McCallister, Federal Cleanup Director (FCD)
US Department of Energy – Grand Junction Field Office
200 Grand Ave., Suite 500
Grand Junction, CO 81501
Ph: 970-257–2115
Email: Russell.McCallister@emcbc.doe.gov

DRAFT FOR REVIEW ONLY

4.0 REFERENCES

1. Dwyer Engineering, 2021, Alternative Final Cover System 60% Design Report, Crescent Junction Disposal Site, prepared by Dwyer Engineering LLC, August 2021.
2. Dwyer Engineering, 2021, Technical Drawings for Crescent Junction Disposal Site UMTRA Final Cover System, prepared by Dwyer Engineering LLC, August 2021.
3. Dwyer Engineering, 2021, Technical Specifications for Crescent Junction Disposal Site UMTRA Final Cover System, prepared by Dwyer Engineering LLC, August 2021.

DRAFT FOR REVIEW ONLY

Attachment 1. Post-Construction Monitoring Checklist

DRAFT FOR REVIEW ONLY

Post-Construction Monitoring Checklist for the Crescent Junction Disposal Site Closure

Site Name: Crescent Junction Disposal Site	Date of Inspection:
City: Thompson Springs	Weather:
State: Utah	Temperature:
Agency: Department of Energy	Site Map:
Inspector:	Note: Indicate the location of any deficiency noted below on the site map
ET Cover – Top Slope	**Remarks**
1. Settlement (Low Spots): Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Surface Cracks: Yes ( ) No ( ) Length: Width: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
3. Erosion: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
4. Biointrusion Holes: Yes ( ) No ( ) Areal Extent: Depth: Suspected Cause (Rodent or Other): Repairs Necessary Yes ( ) No ( ) If yes, explain	
5. Vegetation Condition: General Condition progressing as expected: Yes ( ) No ( ) If no, explain Issues Observed: Yes ( ) No ( ) If yes, explain Repairs Necessary: Yes ( ) No ( ) If yes, explain	
6. Rill/Gully: Yes ( ) No ( ) Areal Extent: Height: Suspected Cause Repairs Necessary Yes ( ) No ( ) If yes, explain	
7. Wet Areas: Yes ( ) No ( ) Ponding: Yes ( ) No ( ) Areal Extent:	

DRAFT FOR REVIEW ONLY

Seeps: Yes ( ) No ( ) Areal Extent: Estimated Flow Rate: Soft Subgrade: Yes ( ) No ( ) Areal Extent: Repairs Necessary Yes ( ) No ( ) If yes, explain	
8. Slope Instability: Yes ( ) No ( ) Slides: Yes ( ) No ( ) Areal Extent: Probable Slide Interface: Suspected Cause: Exposed Cover Components: Repairs Necessary Yes ( ) No ( ) If yes, explain	
9. Surface Rock/Soil admixture: General Condition progressing as expected: Yes ( ) No ( ) Issues Observed: Yes ( ) No ( ) If yes, explain Repairs Necessary: Yes ( ) No ( ) If yes, explain Areal Extent: Suspected Cause: Repairs Necessary Yes ( ) No ( ) If yes, explain	
ET Cover – Side Slopes	
1. Settlement (Low Spots) : Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Cracks: Yes ( ) No ( ) Length: Width: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
3. Erosion: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
4. Biointrusion Holes: Yes ( ) No ( ) Areal Extent: Depth: Suspected Cause (Rodent or Other): Repairs Necessary Yes ( ) No ( ) If yes, explain	
5. Vegetation Condition: General Condition progressing as expected: Yes ( ) No ( ) If no, explain Issues Observed: Yes ( ) No ( ) If yes, explain Repairs Necessary: Yes ( ) No ( ) If yes, explain	

DRAFT FOR REVIEW ONLY

6. Rill/Gully: Yes ( ) No ( ) Areal Extent: Height: Suspected Cause: Repairs Necessary Yes ( ) No ( ) If yes, explain	
7. Wet Areas: Yes ( ) No ( ) Ponding: Yes ( ) No ( ) Areal Extent: Seeps: Yes ( ) No ( ) Areal Extent: Estimated Flow Rate: Soft Subgrade: Yes ( ) No ( ) Areal Extent: Repairs Necessary Yes ( ) No ( ) If yes, explain	
8. Slope Instability: Yes ( ) No ( ) Slides: Yes ( ) No ( ) Areal Extent: Probable Slide Interface: Suspected Cause: Exposed Cover Components: Repairs Necessary Yes ( ) No ( ) If yes, explain	
9. Surface Rock/Soil admixture: General Condition progressing as expected: Yes ( ) No ( ) Issues Observed: Yes ( ) No ( ) If yes, explain Repairs Necessary: Yes ( ) No ( ) If yes, explain Areal Extent: Suspected Cause: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Rip Rap Lined Drainage Channels	
1. Settlement: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Material Degradation: Yes ( ) No ( ) Material Type: Areal Extent: Degree of Degradation: Repairs Necessary Yes ( ) No ( ) If yes, explain	
3. Erosion: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
4. Undercutting: Yes ( ) No ( ) Areal Extent: Depth:	

DRAFT FOR REVIEW ONLY

Repairs Necessary Yes ( ) No ( ) If yes, explain	
5. Obstructions: Yes ( ) No ( ) Type: Areal Extent: Size: Repairs Necessary Yes ( ) No ( ) If yes, explain	
6. Slope Instability: Yes ( ) No ( ) Type: Areal Extent: Repairs Necessary Yes ( ) No ( ) If yes, explain	
7. Siltation: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
8. Drop Inlet Structures: Working Properly Yes ( ) No ( ) Condition: Extent of Damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Fencing	
1. Fence: bent posts: Yes ( ) No ( ) loose posts: Yes ( ) No ( ) broken links or wire: Yes ( ) No ( ) damaged gates: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Temporary Erosion & Sedimentation Control Measures (if any)	
1. Erosion Control Blanket, etc.: Functional Yes ( ) No ( ) if no, describe locations Damaged Blanket: Yes ( ) No ( ) Other damage: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Permanent Erosion & Sedimentation Control Measures	
1. Rip Rap Reinforced Side Slope: Functional Yes ( ) No ( ) if no, describe locations Damage or degradation: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Rock Check Dams: Functional Yes ( ) No ( ) if no, describe locations Damage, displaced rock, or other damage: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	

DRAFT FOR REVIEW ONLY

3. Diversion wedge: Functional Yes ( ) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
4. Drainage Channels adjacent to Wedge: Functional Yes ( ) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
5. Other: Functional Yes ( ) No ( ) if no, describe locations Damage or degradation: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Site Access	
1. Access Restrictions: Yes ( ) No ( ) Description: Repairs Necessary Yes ( ) No ( ) If yes, explain	
General	
1. Vandalism: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Land Use Change: Yes ( ) No ( ) Description: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Summary of Recommended Maintenance and/or Repairs	
1. Maintenance / Repairs Necessary Yes ( ) No ( ) If yes, explain	
Other	

DRAFT FOR REVIEW ONLY

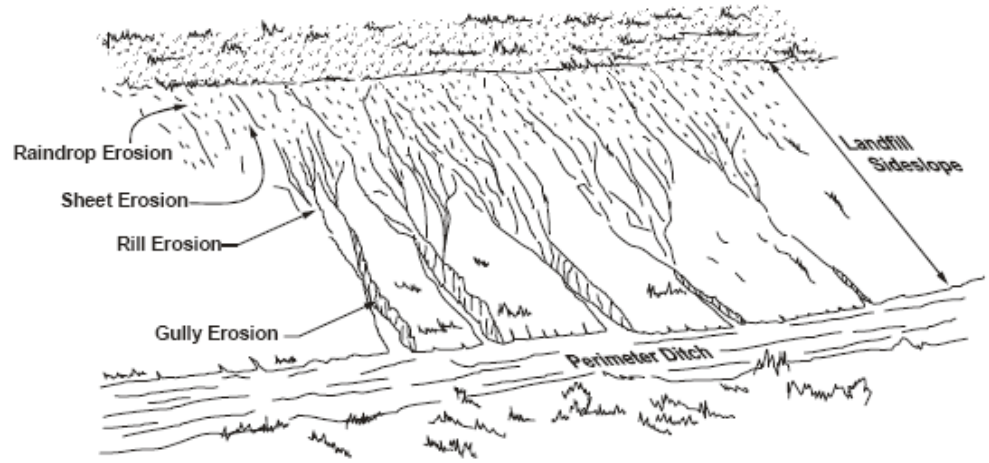
1. Describe	

DRAFT FOR REVIEW ONLY

Attachment 2. Examples of Inspection Issues

DRAFT FOR REVIEW ONLY

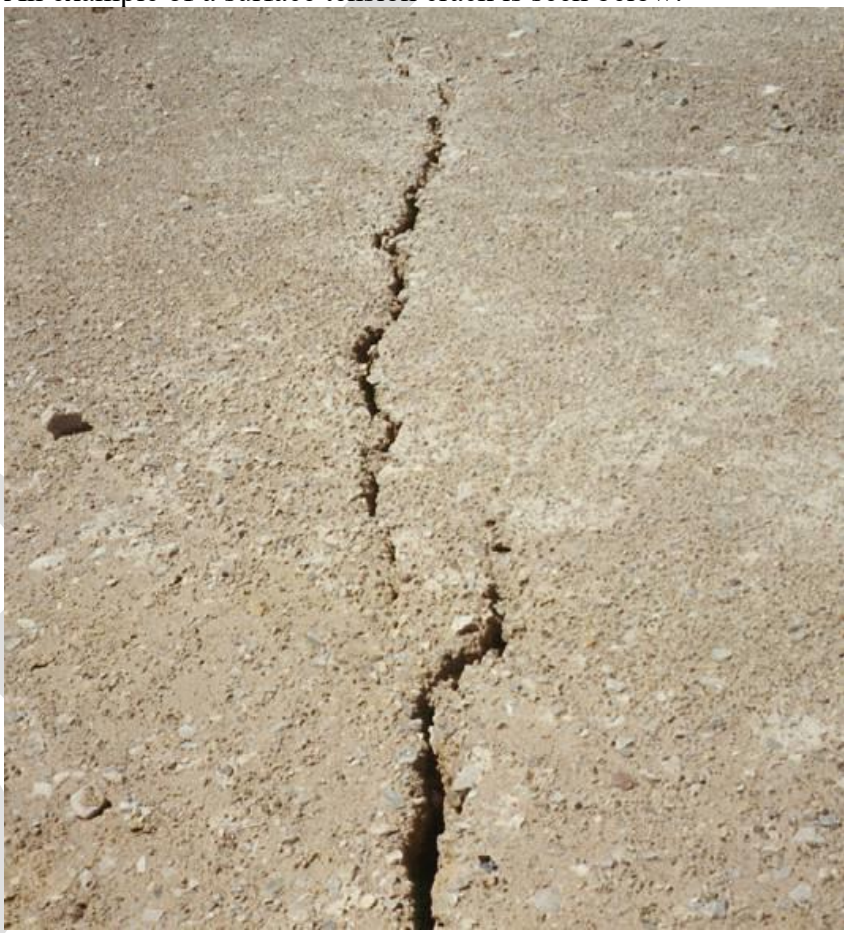
The following are examples of inspection issues to be identified and described during each inspection.

Maintenance Issue	Monitoring Indications	Maintenance of Issue[1]
EROSION	Erosion can appear in excessive sheet erosion or in rill and gully formation.	
a. Sheet	Loss of cover soil and collection of sediments at or near base of slopes.	Incorporate further temporary or permanent erosion protection methods to prevent future erosion of the cover soils. If it is determined that excessive cover soils have been eroded, additional cover soil will also be added. Reseed affected areas.
b. Rill/Gully	Rill formation in areas of concentrated surface water runoff flows. Gully formation is advanced rill development.	Evaluate surface water runoff controls in place and adjust as required. Replace all eroded soils and compact to meet specification of placed soils for the affected area. Reseed affected areas.

DRAFT

Maintenance Issue	Monitoring Indications	Maintenance of Issue[1]
SETTLEMENT	Differential settlement can create ponding that in turn leads to increased infiltration, cover flux, and eventually contaminant transfer.	An example of ponding on a cover is seen below:
a. Ponding	Localized sediment deposits within the cover system, localized excessive vegetation, vegetation variance such as salt cedar or other plants that would only appear if there was excess moisture available.	All ponded areas should be filled with a mixture of soil and rock meeting the specifications of the given cover surface admixture. These soils will be placed consistent with the original specifications for the given cover soils. After the area has been graded to the desired final grade with positive drainage, the area will be reseeded with a native seed mix matching that originally specified for the cover.
b. Surface Cracking	Surface tension cracks, particularly cracks perpendicular to surface water flow.	Surface cracks that appear due to differential settlement can be exaggerated in arid climates where soils tend to form surface crusts. These cracks lead to localized saturated flow through the cover or preferential flow. These cracks will be excavated to just beyond their full depth. The soils will then be replaced in the area to match the original placement specifications for the cover soil. After the crack has been completely repaired physically and the areas matches the adjacent grades, the disturbed area will be reseeded with a native seed mix to match that originally specified for the cover system.

DRAFT

Maintenance Issue	Monitoring Indications	Maintenance of Issue[1]
		An example of a surface tension crack is seen below: 

Maintenance Issue	Monitoring Indications	Maintenance of Issue[1]
VEGETATION		
a. Establishment	Inadequate vegetation establishment	If areas within the cover systems have failed to establish adequate vegetation, the cover soils will be evaluated for adequate nutrients or excessive salt content. If the soils are found to have inadequate nutrients, amendments will be provided and mixed into the soils. If excessive salts are found in the soils, the salts will be evaluated as to whether they potentially migrated up through the cover from underlying source material, or the cover soil used had excessive salts. If the salts are deemed to have migrated up through the cover soils, the soils will be excavated and replaced with a capillary barrier system meeting the specifications for original placement of a capillary barrier system. If the salts are deemed to have come from borrow soils that are high in such salts as calcium carbonate or other naturally occurring salts, the localized soils will be replaced with soils that meet the original cover soils material and placement specifications from accepted borrow areas.
b. Distress	Localized plant distress	Examine the cover soils for potential salt migration from underlying source materials into cover soils. The soils will be excavated and tested for excessive salts. An example of localized plant distress due to salt migration up through the cover (in this case due to burrowing animals excavating and depositing the salt on the surface) is seen below:

DRAFT

Maintenance Issue	Monitoring Indications	Maintenance of Issue[1]
SLOPE STABILITY	Slope failures are commonly accompanied by surface cracks.	 Slope failures can be caused by a variety of events and circumstances. The areas of concern for slope failure are the steeper side slopes. In this case, failure will likely occur either by significant differential settlement of fill materials or loss of strength due to localized saturated soils and excessive seepage generally near the toe of the slope. These areas will be inspected for early warning signs of any potential slope failures. An example of a slope failure due to excessive seepage is seen below with the surface crack above the slope that has begun to slide:

Maintenance Issue	Monitoring Indications	Maintenance of Issue[1]
		Should any surface cracking or localized saturation presumably due to excessive seepage be identified, this area will be evaluated for redesign to stabilize the slope.
HUMAN INTRUSION	Vandalism	Human intrusion at the site is not expected since this is a remote site in a fenced and protected area. However, if any vandalism or damaged due to human intrusion is identified, the areas will be repaired to meet the original design and specifications for the affected area(s).
BIOINTRUSION		Biointrusion is a natural part of cover systems and burrowing is possible on the cover system. However, excessive biointrusion that affects the ability of the cover to function properly will be identified and maintained as required.
a. Burrowing animal/insects	Burrow holes, ant hills are all considered biointrusion due to animals and insects.	Small amounts of burrowing by mammals and insects are actually good for a cover system. It allows for ventilation and provides soil turnover. However, excessive burrowing can harm a cover system. Furthermore, bringing excessive source materials to the surface can also be a problem. These issues will be monitored and maintained as required.

DRAFT

Maintenance Issue	Monitoring Indications	Maintenance of Issue[1]
		An example of localized problems where source materials were brought to the surface from biointrusion is seen below. Excessive burrowing in a local area can create excessive preferential flow. This type of burrowing will be maintained by excavating the affected areas and replacing the soil to meet original cover soil placement specifications. The disturbed area will then be reseeded with native vegetation as originally specified for the given cover system. An example of excessive burrowing in a localized area is seen below:

Maintenance Issue	Monitoring Indications	Maintenance of Issue[1]
b. Plants	Root intrusion into source materials.	Biointrusion due to vegetation generally comes from plant roots growing into source material. This issue will be monitored for and maintained as required.
DRAINAGE	Cover draining to designed surface water management facilities	Cover system final grades and surface water management facilities have been designed to control runoff. Should drainage from a cover system not be directed toward appropriate surface water control facilities, the affected area will be regraded to rectify the situation. The affected area will then be reseeded with native vegetation to match that originally specified for the given cover system.

Maintenance Issue	Monitoring Indications	Maintenance of Issue[1]
WASTE OR SOURCE MATERIAL MIGRATION	Salt deposits on surface of cover or vegetation distress	Excavate cover material and replace with clean material to prevent further waste/source material migration if salts have moved vertically up through the cover soils. The affected area will then be reseeded with native vegetation to match that originally specified for the given cover system.

1 If a significant maintenance issue is identified, the designated FCD representative will be alerted by the inspection personnel to discuss maintenance, possible redesign, or other possible fixes of the problem.

DRAFT