



Inspection Report

To: Nate Rozic (Keystone Generating Station)
From: Richard Southorn, P.E., P.G.
Re: Keystone Ash Disposal Site – Annual CCR Unit Inspection Report
Inspection Date: October 21, 2019
Report Date: January 16, 2020

INTRODUCTION

Title 40 Code of Federal Regulations (CFR) Part 257 addresses, in part, the management of Coal Combustion Residuals (CCR Rule, or Rule) in regulated units, including landfills. Specific to §257.84(b) of the Rule, existing and new CCR landfills must be inspected on an annual basis by a qualified professional engineer. For the Keystone-Conemaugh Projects, LLC-Keystone Generating Station, this inspection requirement applies to the existing Ash Disposal Site. In support of this obligation, Mr. Richard Southorn (a qualified professional engineer with Aptim Environmental & Infrastructure, LLC [APTIM]) conducted an on-site inspection of the Ash Disposal Site on October 21, 2019. The findings from this annual inspection are summarized in the remaining sections of this correspondence.

As required, this report will be placed in the Keystone facility's operating record per §257.105(g)(9), noticed to the State Director per §257.106(g)(7), and posted to the publicly accessible internet site per §257.107(g)(7). Placement of the prior annual inspection report into the facility's operating record was accomplished on January 16, 2019. Per §257.84(b)(4), the current report will be entered into the facility's operating record no later than January 16, 2020.

BACKGROUND

The collective Ash Disposal Site consists of the contiguous East Valley and West Valley components and is operated/maintained in accordance with Pennsylvania Department of Environmental Protection (PADEP) Solid Waste Permit No. 300837. Stage I of East Valley was constructed first and became operational in 1985. Stage I was initially constructed in the northern part of East Valley, with Stage II being later constructed in the southern half of East Valley and piggy-backed over the Stage I area. West Valley comprises Stage III of the disposal site, and it along with Stage II of East Valley, are the currently active portions. Disposal of CCR materials in West Valley began in 2002. When completed, West Valley will piggy-back over the western part of the East Valley Disposal Site. Stage IV of the disposal site (West Valley Expansion) is permitted and currently under construction. It is situated in the southern part of West Valley and represents a horizontal and vertical expansion of the Stage III area. When ultimate development conditions are reached, Stage IV will piggy-back over Stage III as well as the western limits of East Valley (Stage I and Stage II). At such time when the permitted disposal capacity has been

fully expended and final grades attained, any uncapped areas of the disposal site will be capped and closed in accordance with the approved Closure Plan.

As of the October 21, 2019 inspection, CCR materials were being placed in the active face of Stage III (West Valley). Additionally, protective bottom ash material was being placed on top of the composite liner installation in the West Valley Stage IV Expansion Area. The bottom ash is used to facilitate leachate drainage in addition to offering protection of the underlying geosynthetic materials.

With respect to the Ash Disposal Site, APTIM's evaluation has focused on the following items as outlined in §257.84(b)(1)(i-ii):

- *A review of available information regarding the status and condition of the CCR unit, including, but not limited to, files available in the operating record; and*
- *A visual inspection of the CCR unit to identify signs of distress or malfunction.*

Specific to APTIM's preparation of the annual inspection report, and per §257.84(b)(2)(i-iv), the following aspects have been addressed:

- *Any changes in geometry of the structure since the previous annual inspection;*
- *The approximate volume of CCR contained in the unit at the time of the inspection;*
- *Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit; and*
- *Any other change(s) which may have affected the stability or operation of the CCR unit since the previous annual inspection.*

OPERATING RECORDS REVIEW

Principal items reviewed as part of this year's inspection included, but were not limited to: Design Drawings, Weekly and Periodic Landfill Inspection Reports that have been completed since the 2018 Inspection, 2018 Annual Landfill Operations Report, East Valley leachate seep files and miscellaneous correspondence, and Solid Waste Permit No. 300837. During the site inspection, Mr. Southorn interviewed facility personnel (Mr. Mark Jacklin) to verify the information contained within the operating record.

Environmental Control System Overview

- i. Bottom Liner System
 - a. East Valley is underlain by a single synthetic liner system.
 - b. West Valley has a double-liner system with one component being a geosynthetic clay liner.

ii. Leachate Collection System

- a. The East Valley and West Valley leachate collection systems are represented by piping networks located above the liner system. East Valley leachate is routed to the existing Pump Station and then pumped to the station's Industrial Wastewater Treatment (IWT) plant. West Valley leachate flows by gravity directly to the IWT. Following processing at the IWT and eventually at the Final Wastewater Treatment (FWT) plant, the treated effluent is discharged in accordance with the station's National Pollutant Discharge Elimination System (NPDES) Permit.

iii. Stormwater Management

- a. "Contact" stormwater at both East Valley and West Valley is collected in the West Valley Equalization Pond to allow for solids settling and is then routed to the IWT for treatment.
- b. Non-contact stormwater at both East Valley and West Valley is routed to dedicated NPDES-permitted outfalls for direct discharge to surface water.

Summary of Landfill Construction

A protective layer of bottom ash was being spread across the composite liner in the West Valley Stage IV Expansion Area at the time of inspection. CCR disposal was occurring in the remaining active areas of West Valley Stage III. CCR disposal will move to the West Valley Stage IV Expansion Area once construction is complete and the area is certified for use.

Review of Site Operating Record

A review of the site operating record acknowledged that a leachate seep had been identified at East Valley on March 21, 2019 on the first bench near the eastern toe. The bench surface was soft and wet indicating that water had built up in the toe of the landfill at that location. The existing standpipe showed the water level about four feet above the bench ground surface. The central and northern leachate pipes were cleaned by water jetting; however, this did not resolve the situation. There was concern and evidence that the East Valley leachate collection system (installed in 1991) was not draining properly.

Accordingly, in early-April 2019 well points were installed on the first bench into the leachate collection system to draw down the water level. A cleanout was also added to the southern leachate pipe and cleaning was performed. This also did not significantly reduce the water levels in the affected toe area. In May 2019, two new piezometers were installed on the second and third benches to measure the water levels within the landfill embankment.

On July 29, 2019, two sumps were installed along the first bench to draw down the water level within the landfill embankment. The South Sump was installed over the existing NSA R-4 Central Rock Drain (Rock Drain) toward the south side of the bench, and the North Sump was installed toward the north side of the bench. The initial South Sump was not installed into the Rock Drain, which is a redundant drain to capture and convey leachate to the toe of the landfill. Therefore, a third, deeper sump (South Sump 2) was installed on August 28, 2019 immediately adjacent to the existing South Sump and into the lower portion of the Rock Drain. The sumps consist of 2-foot and 2.5-foot diameter HDPE riser pipes, and are equipped with submersible electric pumps. After operating for four weeks, the north and south submersible pumps were moved and installed within

the deeper South Sump 2, in order to draw down and maintain the water level within the landfill embankment.

GAI Consultants, Inc. (GAI) conducted a slope stability analysis along multiple landfill cross-sections in September 2019 to determine whether the seep would contribute to stability issues at East Valley. The strength parameters used in the 2019 stability analyses were based on the June 1998 revision to the original 1984 East Valley permit analysis (Permit No. 300837), previously reviewed and approved by PADEP.

Typical long-term static target factors of safety (FS) for coal combustion landfills is 1.5. Circular-deep seated analyses and block analyses along the liner system were performed to represent various potential failure modes. The calculated safety factors ranged from 1.59 to 2.07. These results indicate that, under current water levels within the landfill embankment, the landfill is expected to remain stable. GAI recommended that the water levels within the landfill continue to be measured on a weekly basis, and indicated that if water levels rise, additional stability analyses may be necessary to ensure the safety of design.

The installation of an interception trench has since been completed, and will serve as the principal component of the dedicated seep collection system. All of the field work and investigative activities conducted throughout the course of the seep mitigation efforts have been appropriately communicated to PADEP. Acknowledgement from PADEP has been received regarding the agreed upon adequacy and effectiveness of the toe seep collection system as a long-term remedy. Based on a review of available information and the 2019 Annual Inspection field reconnaissance, it is the opinion of APTIM's certifying engineer that the landfill will remain stable provided that water levels remain at or below the potentiometric surface modeled by GAI.

Review of Prior Inspections

Weekly inspections: Other than the leachate seep as noted above, a review of weekly inspections has concluded that no significant deficiencies occurred at the facility that required remedial actions.

Annual inspections: The previous annual inspection report determined that there were no deficiencies or releases, actual or potential structural weaknesses, or concern to the stability of the land form. All environmental control systems were in good operating condition and functioning as intended.

CCR Disposal

Based on information provided by Station personnel, the total in-place disposal quantity of CCR materials as of December 2018 was estimated at approximately 29,340,336 cubic yards (cy). At the end of December 2019, approximately 478,004 cy of additional materials have been disposed. Therefore, the approximate total CCR disposal quantity at the end of 2019 is 29,818,340 cy.

SITE INSPECTION

The site inspection was performed on October 21, 2019 by Mr. Southorn. The inspection focused on identification of standard geotechnical signs of distress or malfunction. Specific aspects such as slumping at the toe of slope, tensile cracking, abnormal or excessive erosion on the side slopes, slope bulging, and groundwater/surface water seepage or ponding were assessed. If

present, these readily visible signs are potential indicators of structural weakness of the CCR Landfill unit.

Visual Signs of Distress or Malfunction

As noted above, a leachate seep was observed at the toe of East Valley in March 2019. Significant activities have been completed to mitigate the seep and stability analyses have been completed to ensure that the landfill will remain stable with elevated leachate levels. As previously noted, a long-term Dewatering and Cleanout Trench has been installed longitudinally near the seep location. Based on a review of the stability analysis, APTIM concludes that geotechnical stability issues are unlikely to occur prior to the installation of the Dewatering and Cleanout Trench.

The seep area was visited during the 2019 investigation. The ground surface was found to be firm with no standing water present. Numerous piezometers and the dewatering well were observed. The dewatering well was actively drawing down leachate levels at the time of inspection. It is the opinion of APTIM's certifying engineer that the field remedies are appropriate and appear to be improving the observed conditions.

No visual signs of distress or malfunction were observed elsewhere at East Valley or West Valley during the inspection. Stormwater drainage features, slope appearance and stability, leachate conveyance mechanisms, and overall site conditions were assessed. Closed and intermediate cover areas of East Valley exhibited well established vegetation.

Review of Environmental Control Systems

Except as noted, and with no evidence to the contrary, the bottom liner systems at East Valley and West Valley are believed to be in good operating condition and functioning as intended. At the time of the inspection, conveyance systems to the IWT were operating as designed.

Review of Previously Recommended Actions

No corrective actions were required based on the findings of the 2018 Annual Inspection. Recommendations were limited to the continued operation and maintenance of the facility and maintaining access to closed portions of the landfill for inspection purposes. These recommendations were found to have been followed, based on site conditions and the review of weekly inspection logs.

CONCLUSIONS

Changes in Geometry

CCR material placement has progressed in the active disposal area of West Valley throughout this year. As of the date of this inspection, peak fill elevations in the active disposal area were at approximately 1,380 feet mean sea level.

In-Place CCR Disposal Quantities

The total permitted disposal capacity for the combined East Valley and West Valley areas is 49,926,600 cy. The approximate total CCR disposal quantity at the end of 2019 is 29,818,340 cy.

Appearance of an Actual or Potential Structural Weakness of the CCR Unit

At the time of inspection, there were no signs of distress or malfunction that would indicate actual or potential structural weakness at East Valley or West Valley.

Changes that may Affect the Stability or Operation of the CCR Unit

There have been no changes to the East Valley or West Valley areas that pose a threat or concern to the stability of the land form.

RECOMMENDATIONS

1. Continue to monitor and maintain the East Valley toe seep collection outfall pipe, piezometers and manhole as part of routine landfill inspections. As required, additional stability evaluations may need to be performed in the event that leachate levels rise above the modeled conditions.
2. Continue operation and maintenance in the active areas as currently performed.
3. Ensure adequate access to the closed portions of the landfill to maintain the ability to perform weekly visual site structural inspections.

There were no deficiencies or releases identified during the annual inspection that required the owner or operator to perform corrective actions as required under §257.84(b)(5).

PROFESSIONAL ENGINEER'S CERTIFICATION

In accordance with §257.84(b) of the Rule, I hereby certify based on a review of available information within the facility's operating records and observations from my personal on-site inspection (including the photographs contained in Attachment 2), that the Keystone Ash Disposal Site does not exhibit any appearances of actual/potential structural weakness that would be disruptive to the normal operations of the East Valley and West Valley CCR Units. Both units are being operated and maintained consistent with recognized and generally accepted good engineering standards and practices.

Certified by:


Date: JAN 16, 2020



Richard Southorn, P.E., P.G.

Professional Engineer Registration No. PE085411

Aptim Environmental & Infrastructure, LLC

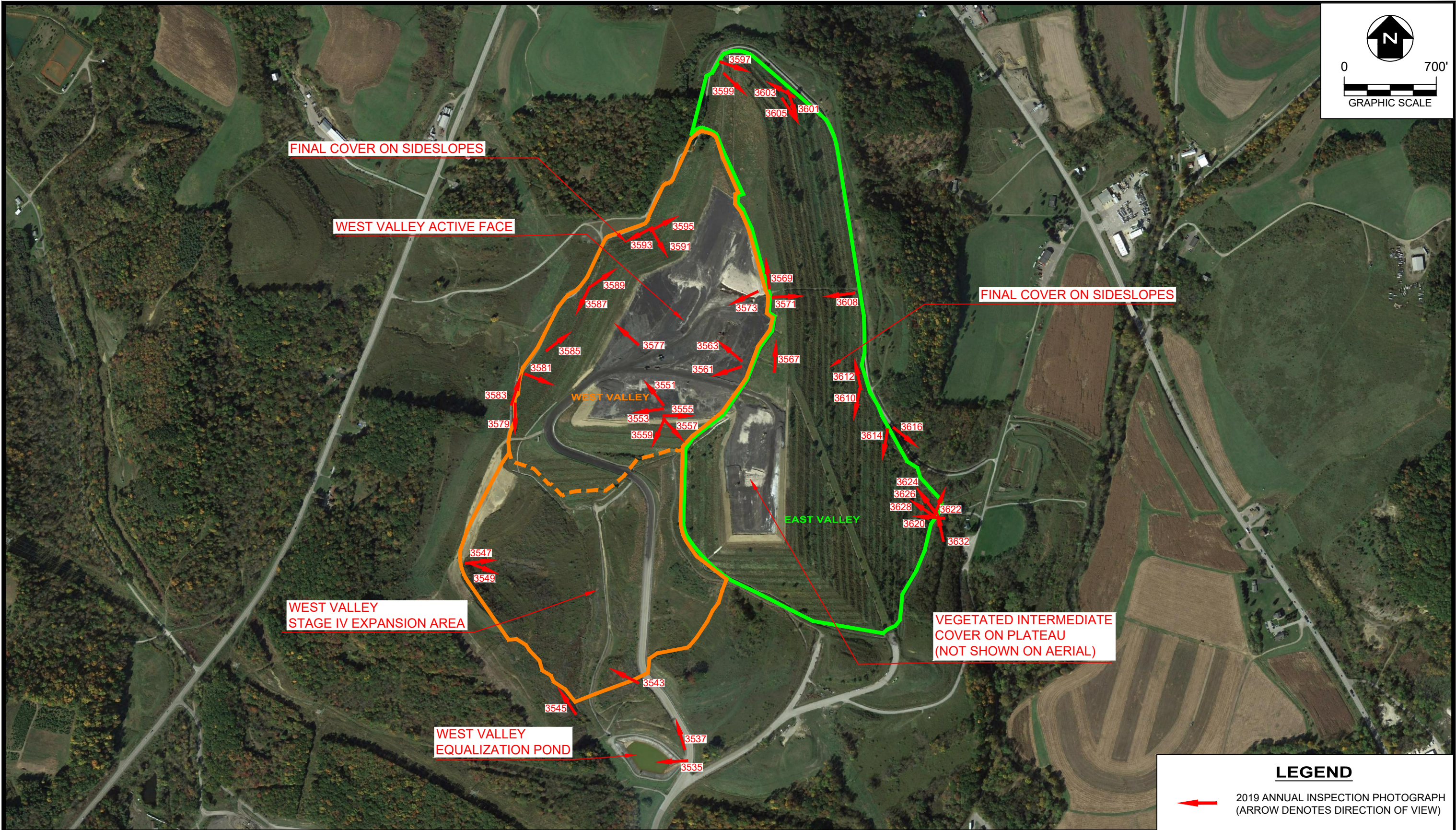
ATTACHMENTS

1. Site Map
2. Inspection Photo Log

REFERENCES

1. Residual Waste Major Permit Modification, Keystone Station Disposal Site, July 1996.
2. 2018 Keystone Generating Station Annual Landfill Operations Report.
3. Leachate seep documentation in Operating Record.
4. Weekly and Periodic Landfill Inspection Reports Nov 2018 – Oct 2019.
5. 40 Code of Federal Regulations, Part 257.


Attachment 1
Site Map



LEGEND

 2019 ANNUAL INSPECTION PHOTOGRAPH
(ARROW DENOTES DIRECTION OF VIEW)

REV. NO.	DATE	DESCRIPTION



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KEYSTONE GENERATING STATION SHELOCTA, PENNSYLVANIA			
PHOTOGRAPH LOCATION MAP			
DRAWN BY:	BWM	APPROVED BY:	RDS
PROJ. NO.:	631004162	DATE:	JANUARY 2020

Attachment 2
Photo Log

Image: 3535
Date: 10/21/2019
Time: 10:48 AM
Direction: West

Description:

West Valley Equalization Pond. Well maintained. Minor sediment buildup in pond.



Image: 3537
Date: 10/21/2019
Time: 10:48 AM
Direction: Northeast

Description:

Contact water ditch lined with revetment matting. Free of obstructions.



Image: 3543
Date: 10/21/2019
Time: 10:52 AM
Direction: Northwest

Description:

Bottom ash being spread over West Valley Expansion Area as protective cover over bottom liner system.



Image: 3545
Date: 10/21/2019
Time: 10:53 AM
Direction: Northwest

Description:

Stormwater run-on control ditch near limits of construction in West Valley Expansion Area.



Image: 3547
Date: 10/21/2019
Time: 10:55 AM
Direction: East

Description:

Overview of West Valley Expansion Area. The bottom liner has been covered with a protective layer of bottom ash.

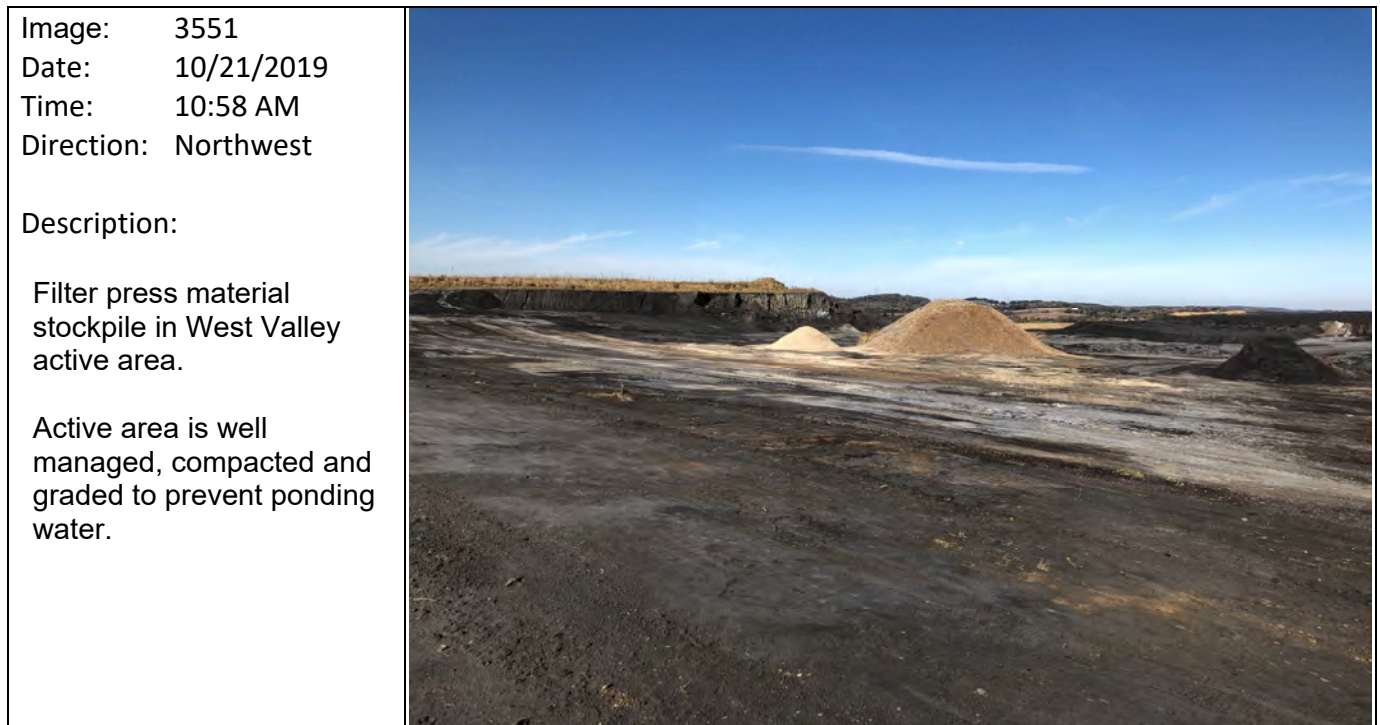


Image: 3549
Date: 10/21/2019
Time: 10:55 AM
Direction: East

Description:

West Valley Expansion Area.





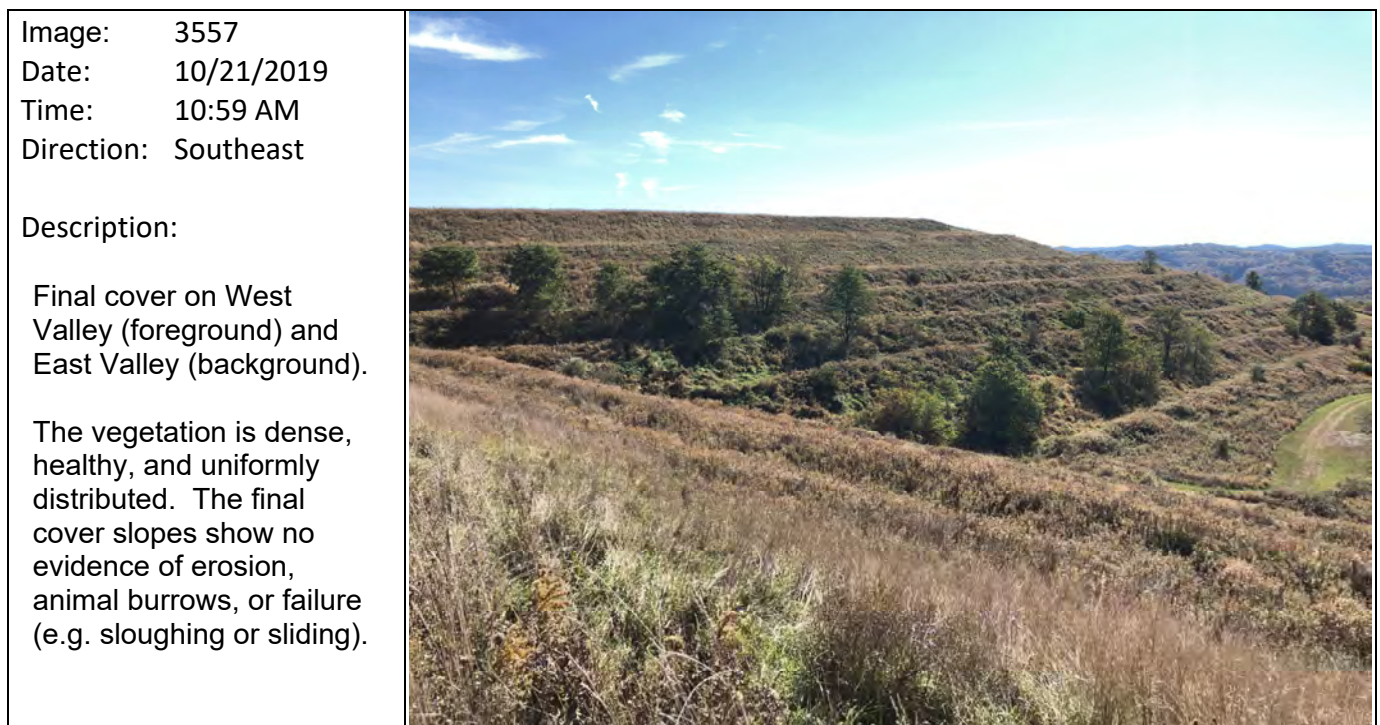


Image: 3559
 Date: 10/21/2019
 Time: 10:59 AM
 Direction: Southwest

Description:

Southern view between East Valley and West Valley Expansion Area from active area.



Image: 3561
 Date: 10/21/2019
 Time: 11:02 AM
 Direction: Southwest

Description:

West Valley active area. Compacted and graded to prevent ponding water.



Project: Keystone 2019 Annual Inspection

Project No.: 631004162

Photographer: Richard Southorn

Image: 3563
Date: 10/21/2019
Time: 11:02 AM
Direction: Northwest

Description:

Gypsum pile in background of West Valley active area. The active area in the foreground is well compacted and graded to prevent ponding water.



Image: 3567
Date: 10/21/2019
Time: 11:03 AM
Direction: North

Description:

Final cover installed on East Valley sideslope. The vegetation is dense, healthy, and uniformly distributed. The final cover slopes show no evidence of erosion, animal burrows, or failure (e.g. sloughing or sliding).



Image: 3569
Date: 10/21/2019
Time: 11:05 AM
Direction: North

Description:

Recently installed final cover soils that will be vegetated and stabilized. Survey staking is used to ensure construction follows the permitted design.



Image: 3571
Date: 10/21/2019
Time: 11:05 AM
Direction: East

Description:

A non-contact stormwater channel that is lined with revetment mat. The channel is generally free of obstructions (minor dirt clods only) and appears in good condition.



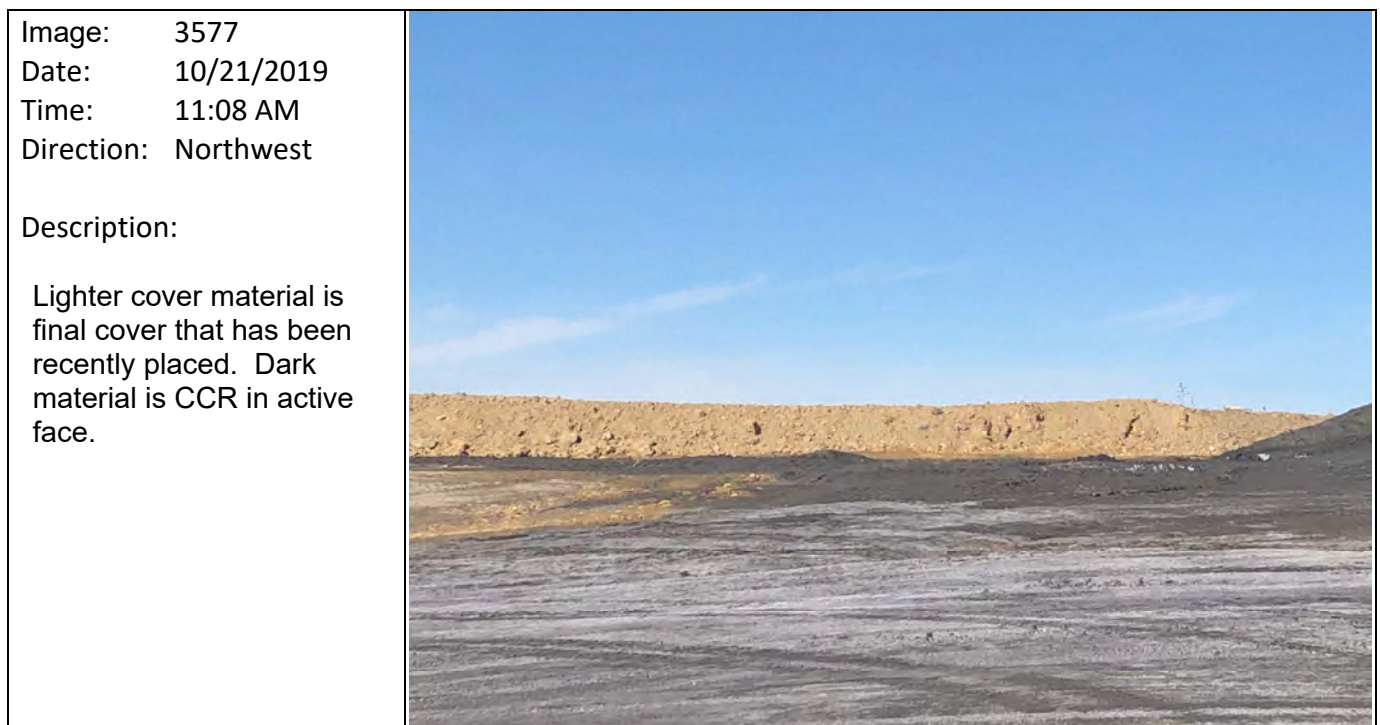


Image: 3579
Date: 10/21/2019
Time: 11:10 AM
Direction: South

Description:

A West Valley non-contact stormwater channel that is lined with revetment mat. The channel is free of obstructions and appears in good condition.



Image: 3581
Date: 10/21/2019
Time: 11:10 AM
Direction: Southeast

Description:

A leachate cleanout present within the West Valley final cover.



Image: 3583
Date: 10/21/2019
Time: 11:10 AM
Direction: Northeast

Description:

Perimeter road and final cover on sideslopes of West Valley. The vegetation is dense, healthy, and uniformly distributed. The final cover slopes show no evidence of erosion, animal burrows, or failure (e.g. sloughing or sliding).



Image: 3585
Date: 10/21/2019
Time: 11:10 AM
Direction: Northeast

Description:

Final cover on sideslopes of West Valley. The vegetation is dense, healthy, and uniformly distributed. The final cover slopes show no evidence of erosion, animal burrows, or failure (e.g. sloughing or sliding).



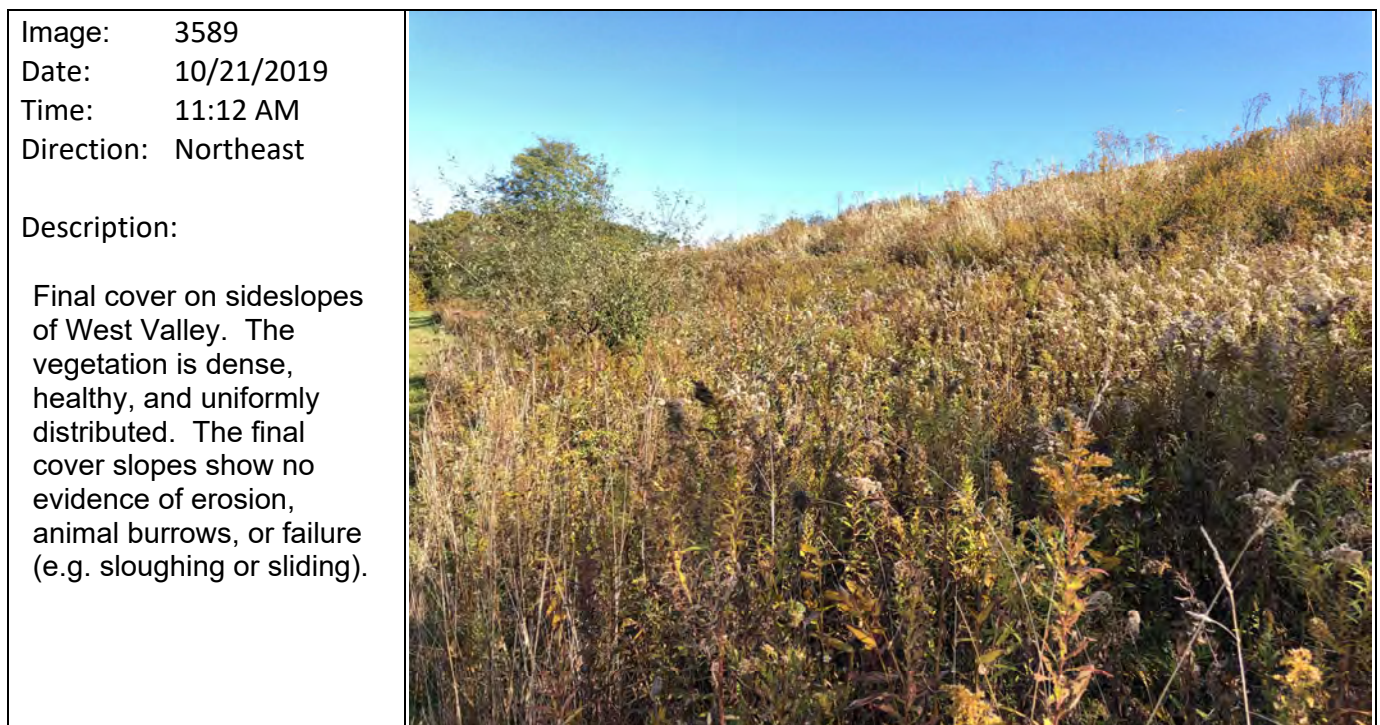


Image: 3591
Date: 10/21/2019
Time: 11:13 AM
Direction: Southeast

Description:

West Valley Edge-of-Liner marker in foreground and leachate cleanout access in background.



Image: 3593
Date: 10/21/2019
Time: 11:14 AM
Direction: Southwest

Description:

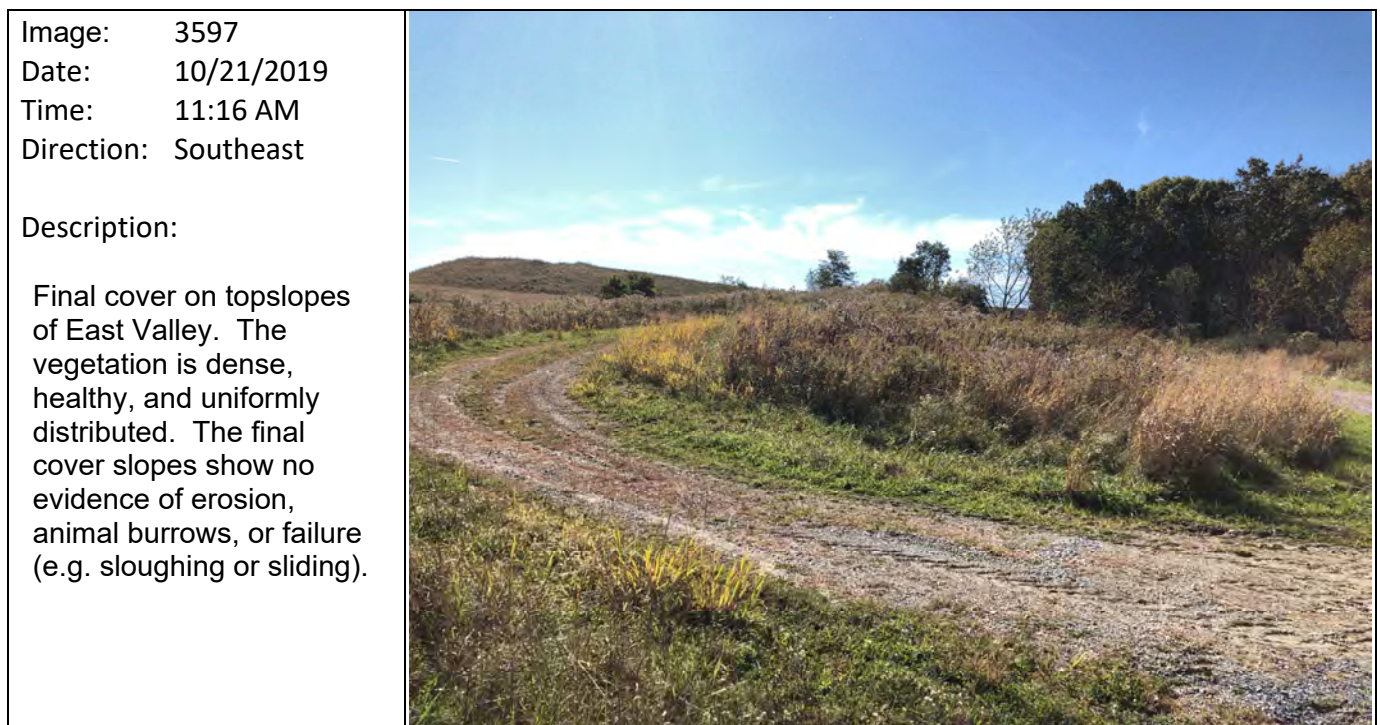
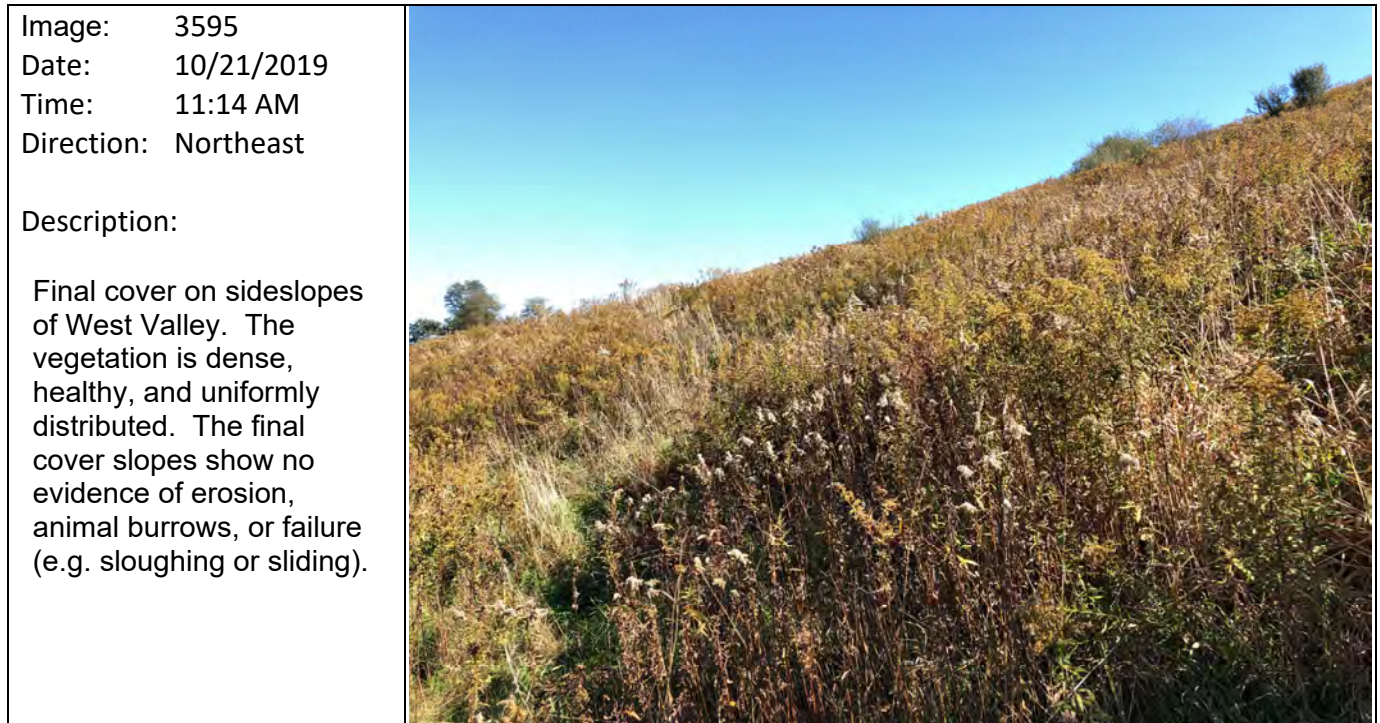
Final cover on sideslopes of West Valley. The vegetation is dense, healthy, and uniformly distributed. The final cover slopes show no evidence of erosion, animal burrows, or failure (e.g. sloughing or sliding).



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Project No.: 631004162

Photographer: Richard Southorn



Project: Keystone 2019 Annual Inspection

Project No.: 631004162

Photographer: Richard Southorn

Image: 3599
Date: 10/21/2019
Time: 11:16 AM
Direction: Southeast

Description:

Final cover on topslopes of East Valley. The vegetation is dense, healthy, and uniformly distributed. The final cover slopes show no evidence of erosion, animal burrows, or failure (e.g. sloughing or sliding).



Image: 3601
Date: 10/21/2019
Time: 11:17 AM
Direction: South

Description:

Final cover on sideslopes of East Valley. The vegetation is dense, healthy, and uniformly distributed. The final cover slopes show no evidence of erosion, animal burrows, or failure (e.g. sloughing or sliding).



Project: Keystone 2019 Annual Inspection

Project No.: 631004162

Photographer: Richard Southorn

Image: 3603
Date: 10/21/2019
Time: 11:18 AM
Direction: Northwest

Description:

Final cover on sideslopes of East Valley. The vegetation is dense, healthy, and uniformly distributed. The final cover slopes show no evidence of erosion, animal burrows, or failure (e.g. sloughing or sliding).

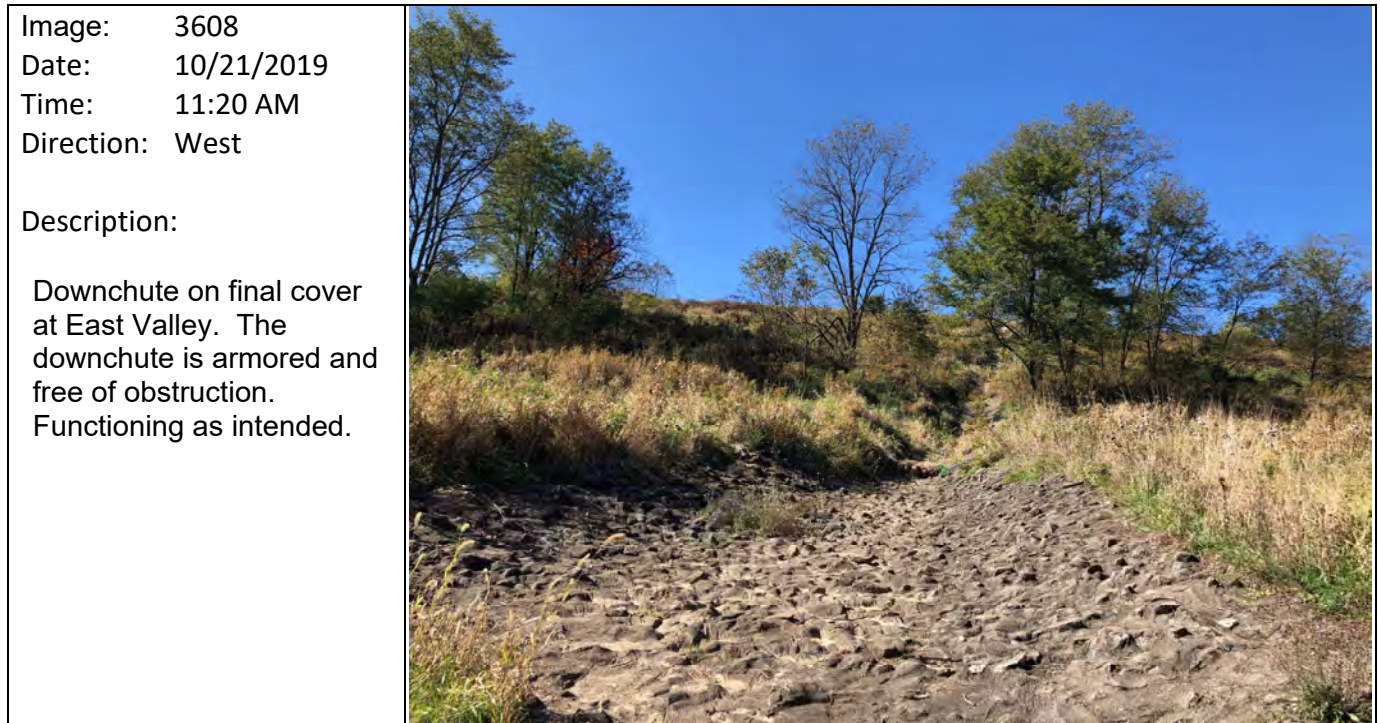


Image: 3605
Date: 10/21/2019
Time: 11:18 AM
Direction: Southeast

Description:

Final cover and terrace berm on sideslopes of East Valley. The vegetation is dense, healthy, and uniformly distributed. The final cover slopes show no evidence of erosion, animal burrows, or failure (e.g. sloughing or sliding).





Project: Keystone 2019 Annual Inspection

Project No.: 631004162

Photographer: Richard Southorn

Image: 3612
Date: 10/21/2019
Time: 11:22 AM
Direction: North

Description:

Final cover terrace on sideslopes of East Valley. The vegetation is dense, healthy, and uniformly distributed. The final cover slopes show no evidence of erosion, animal burrows, or failure (e.g. sloughing or sliding).



Image: 3614
Date: 10/21/2019
Time: 11:23 AM
Direction: South

Description:

Woody vegetation on sideslopes of East Valley final cover. The final cover slopes show no evidence of erosion, animal burrows, or failure (e.g. sloughing or sliding).



Image: 3616
Date: 10/21/2019
Time: 11:23 AM
Direction: Southeast

Description:

Non-contact stormwater channel looking downslope at East Valley. Armored and functioning as intended.



Image: 3620
Date: 10/21/2019
Time: 11:26 AM
Direction: West

Description:

East Valley leachate collection structure (routes to Pump Station and then to IWT facility).



Image: 3622
Date: 10/21/2019
Time: 11:27 AM
Direction: North

Description: Temporary contact water conveyance pipe to allow access to East Valley sideslope area where contact water (leachate) was observed seeping out of landfill sideslope.



Image: 3624
Date: 10/21/2019
Time: 11:28 AM
Direction: Northwest

Description: Contact water had been observed seeping out of East Valley slope during routine CCR inspections. An extraction well was installed through sideslope to just above base liner in black corrugated pipe. Contact water has been actively pumped down and directed to leachate. White pipes are piezometers to gauge depth of contact water. An interceptor trench will be installed.



Image: 3626
Date: 10/21/2019
Time: 11:28 AM
Direction: Northwest

Description:

Piezometers are used to ensure that contact water level remains at acceptable levels and are used to gauge the success of the temporary pumping until the contact water interceptor trench is installed at East Valley.



Image: 3628
Date: 10/21/2019
Time: 11:29 AM
Direction: Northwest

Description:

Temporary leachate extraction well at East Valley. Leachate is pumped from within the landfill and discharged to the contact water system.



Project: Keystone 2019 Annual Inspection**Project No.: 631004162****Photographer: Richard Southorn**

Image: 3632
Date: 10/21/2019
Time: 11:31 AM
Direction: North

Description:

Discharge location for contact water from temporary leachate extraction well at East Valley. This structure routes to the Pump Station and then to the IWT facility.

