DTE Energy

Prepared for

DTE Electric Company
One Energy Plaza
Detroit, Michigan 48226

2018 ANNUAL INSPECTION REPORT
ASH BASIN EMBANKMENT

MONROE POWER PLANT

Monroe, Michigan

Prepared by

Geosyntec consultants

engineers | scientists | innovators

3520 Green Court, Suite 275
Ann Arbor, Michigan 48105

CHE8242V

January 2019

TABLE OF CONTENTS

LIST OF APPENDICES

1. INTRODUCTION

1.1 Overview

The 2018 Annual Inspection Report (AIR) was prepared by Geosyntec Consultants (Geosyntec) for the DTE Electric Company (DTE) to summarize the results of the annual inspection of the Monroe Ash Basin (Ash Basin). The annual inspection is a part of the Inspection Monitoring and Maintenance (IMM) program for the Ash Basin. The IMM program was prepared to comply with United States Environmental Protection Agency (USEPA) Coal Combustion Residual (CCR) Rule (CCR Rule) published on April 17, 2015 (40 CFR 257.73). Under the CCR Rule, the Ash Basin is an "existing surface impoundment" and must be inspected by a qualified professional engineer on a periodic basis, not to exceed one year.

The site is located about one mile southwest of the Monroe Power Plant near Monroe, Michigan, and is bounded on the east by Lake Erie and the Plant discharge canal, on the west by Interstate Highway 75 (I-75), on the south by an agricultural field, and on the north by residential property and Plum Creek.

The Ash Basin was constructed in the early 1970s to contain a 410-acre ash basin to hold sluiced ash. The Ash Basin is constructed with a 3-1/2-mile long embankment using on-site fine grained (clay) soils that were excavated from within the footprint of the Ash Basin. Ash and water is pumped to the Ash Basin using four, above grade pipelines consisting of steel and high-density polyethylene pipes. After treatment in the Ash Basin, water flows out from the Ash Basin through a discharge structure in accordance with the facility National Pollutant Discharge Elimination System (NPDES) permit #MI0001848.

1.2 Purpose

Inspection, monitoring and maintenance of the embankment are performed by DTE pursuant to the combined monitoring and maintenance program described in IMM program (MONPP – 1301 – Rev.C) and the CCR Rule. The objective of the IMM program is to detect indications of potential slope instability in time to allow planning, design, and implementation of appropriate mitigation measures. Further, the purpose of the inspection under the CCR Rule is "…to ensure that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards." (40 CFR 257.83(b)(1)).

The purpose is accomplished through periodic visual inspection (and photo-documentation) of the embankment, monitoring of instrumentation intended to detect movement of the embankment, and review of construction and operating records since the last annual inspection.

1.3 Report Organization

The remainder of this report is organized as follows:

- Section 2 - Review of available information: a summary of various historical documents that were reviewed as part of this inspection.
- Section 3 - Inspection Results: a summary of visual observations recorded during inspections of the ash basin facility.
- Section 4 - Instrumentation Monitoring and Survey Results: a presentation of the data from subsurface instrumentation monitoring and bathometry survey of the Ash Basin.
- Section 5 - Maintenance Activities: a description of the maintenance activities performed during 2015.
- Section 6 - Evaluation: an evaluation of the results of the visual inspection and instrumentation monitoring and recommendations for corrective actions as needed.
- Section 7 - Conclusion: the overall conclusions of the annual inspection.

1.4 Terms of Reference

The annual visual inspection was performed by Mr. Omer Bozok, P.E. and Mr. David Kein, E.I.T. of Geosyntec[1], with assistance from DTE's qualified personnel.

The weekly inspections and monitoring of inclinometers were performed by DTE's qualified personnel.

This report was prepared by Mr. Omer Bozok, P.E. and Mr. David Kein E.I.T. of Geosyntec and reviewed by Mr. John Seymour, P.E. of Geosyntec.

[1] Omer Bozok, P.E. of Geosyntec is the qualified professional engineer per the requirements of §257.53 of the CCR Rule. He has been involved with Monroe Ash Basin since 2009 when the design efforts for the mitigation of the embankment started and has extensive knowledge of the site. His resume is provided in Appendix B.

2. REVIEW OF AVAILABLE INFORMATION

Geosyntec reviewed the following documents, summarized in Table 1, below.

Table 1: Documents Reviewed

Title	Documentum No.	Prepared by	Year	Content
Monroe Fly Ash Disposal Basin Technical Report	MONPP-0144-77	DTE	1977	Design, construction and operational information.
Inspection, Monitoring and Maintenance Manual	MONPP-1301-Rev. C	Geosyntec	2018	Procedures for inspection, monitoring and maintenance of various facility structures.
Safety Factor Assessment	MONPP-0120-16	Geosyntec	2016	Safety factor assessment per the CCR Rule.
Hydraulic Capacity Assessment	MONPP-0119-16	Geosyntec	2016	Hydraulic capacity assessment per the CCR Rule.
Fill Plan Alternatives – Rev. B	MONPP-0154-15	Geosyntec	2015	Pros and cons of various fill plan alternatives for the remaining life of the ash basin.
Potential Failure Mode Analysis Results – Rev. 3	MONPP-0152-15	Geosyntec	2015	Results of potential failure mode analysis.
Geotechnical Site Characterization Report	MONPP-0135-10	Geosyntec	2012	Summary of data from various site investigation studies conducted around the perimeter of the embankment.

Title	Documentum No.	Prepared by	Year	Content
2009 Construction Completion Report	MONPP-0134-09	Geosyntec	2010	Construction information for the 2009 construction.
2010 Construction Completion Report	MONPP-0113-10	Geosyntec	2011	Construction information for the 2010 construction.
2011 Construction Completion Report	MONPP-0132-11	Geosyntec	2012	Construction information for the 2011 construction.
2012 Construction Completion Report	MONPP-0129-12	Geosyntec	2013	Construction information for the 2012 construction.
2013 Construction Completion Report	MONPP-0147-12	Geosyntec	2014	Construction information for the 2013 construction.
2014 Annual Inspection Report	MONPP-0152-14	Geosyntec	2015	Summary of quarterly inspection results for 2014.
2015 through 2017 Annual Inspection Reports	Various	Geosyntec	2016 through 2018	Summary of annual inspection results from 2015 to 2017.
Overliner Construction, Phase 1- Construction Quality Assurance Report	MONPP-0155-15	Golder	2015	Construction completion document.
Dust Control Plan	MONPP CCR Fugitive Dust Plan	DTE	2015	Dust control plan.
Groundwater Monitoring System Summary Report		TRC	2017	Information on groundwater monitoring system components and details

Title	Documentum No.	Prepared by	Year	Content
Groundwater Statistical Evaluation Plan		TRC	2017	Basis for statistical evaluation for groundwater monitoring events
Annual Groundwater Monitoring Report		TRC	2018	Summary of annual groundwater monitoring results for 2018

3. VISUAL INSPECTION RESULTS

DTE performed the following visual inspections in 2018:

- Annual inspection on April 23, 2018 (provided in Appendix A); and
- Weekly inspections – ongoing.

DTE's visual inspection for the annual and weekly inspections included the embankment crest, exterior slopes of the embankment, ash discharge point, discharge structure, and discharge pipes through the embankment. Photographs of observed conditions were taken at the time of the inspection.

In addition to the annual and weekly inspections, the general condition of the site and embankment was visually inspected by DTE daily.

The embankment has been flattened from 2H:1V to 3H:1V from Station 52+00 to 60+00, and from 160+00 to 168+00 since the last annual inspection.

In general, "minimum" signs of distress were observed during the annual inspection on the embankment crest, exterior slopes of the embankment and discharge structure. These structures appeared to be in good condition except for non-optimal conditions noted below. These conditions do not represent an immediate concern for the safe operation or stability of the Ash Basin's embankment as discussed in Section 6.

1. Cracks that are one-inch wide or less were observed on the exterior slope of the embankment between stations ~121+00 and ~122+00 (Photographs 23 and 24). These areas were filled with sand-bentonite mix at the end of 2017 construction season, but cracks kept forming since filling.

2. The mid-slope stormwater ditch appeared to lose contact with adjacent soil along the downstream edge at multiple locations. In general, the upslope edge appeared to have good contact with adjacent soil (Photograph 31).

3. The down-chute at Station 26+00 has lost contact with the embankment at the upstream end (Photograph 46).

4. Erosion features were observed on the embankment and access ramps, at stations approximately 0+00, 67+00, 162+00 and 167+00 and 169+00 (Photographs 1, 3, 35, 36, 37, 43, 51, 52 and 58).

5. Localized sparse vegetation was observed on the embankment at stations approximately 100+00, 136+00 and ~148+00 (Photographs 7, 20 and 28).

6. A local depression was observed near the crest of the embankment at Station 28+00. No sign of sloughing or cracks were observed on the embankment (Photograph 44). It appears to be a tire rut.

7. The mid-slope ditch is missing a cable bolt at station ~158+00. The location has been flagged (Photograph 4).

8. Minor sloughing, approximately 6- to 8-inches in depth, and bulging was observed above the mid-slope trench at three locations between stations 141+00 and 145+00 (Photographs 9 – 16).

4. INSTRUMENTATION MONITORING AND BATHOMETRY SURVEY RESULTS

4.1 Inclinometers

4.1.1 Inclinometer Monitoring Procedures

Ten inclinometers (SIs) are currently being monitored at the embankment. The inclinometer casings were installed from the crest of the embankment to depths of approximately 45 to 50 feet below the crest. The purpose of the inclinometers is to provide a means of measuring horizontal displacement of the ground around the casing. The inclinometer readings provide values of horizontal displacement at discrete depths (at 1.6-ft intervals) in two orthogonal directions (A-axis and B-axis). Plots of horizontal displacement versus depth are generated that provide a vertical profile of the horizontal displacement experienced by the inclinometer casing at the time of the reading.

The orientation of the A-axis and B-axis are unique to the individual inclinometer casing. The positive A-axis corresponds to a direction oriented outward from the basin and approximately perpendicular to the embankment crest station baseline. The B-axis is oriented parallel to the embankment crest station baseline.

Inclinometers were installed in late 2015 and baseline readings were taken on January 1, 2016. These inclinometers continuously record measurements and were installed to replace the decommissioned inclinometers that required manual recording.

4.1.2 Characterization of Displacement versus Depth Profile Plots

The horizontal displacement versus depth profiles are summarized below for the readings from the time of the annual inspection (April 2018). These conditions do not represent an immediate concern for the safe operation or stability of the ash basin embankment as discussed in Section 6.

4.1.2.1 *Station 11+50 Inclinometer*

- A-axis direction
  - Maximum cumulative displacement magnitude and direction: +0.3 inches at three feet below ground surface.
- B-axis direction
  - Maximum cumulative displacement magnitude and direction: -0.14 inches at six feet below ground surface.

4.1.2.2 *Station 34+00 Inclinometer*

- A-axis direction
  - Maximum cumulative displacement magnitude and direction: -0.18 inches at the ground surface.
- B-axis direction
  - Maximum cumulative displacement magnitude and direction: -0.12 inches at the ground surface.

4.1.2.3 *Station 56+00 Inclinometer*

- A-axis direction
  - Maximum cumulative displacement magnitude and direction: +0.1 inches at ten feet below ground surface.
- B-axis direction
  - Maximum cumulative displacement magnitude and direction: -0.27 inches at seven feet below ground surface.

4.1.2.4 *Station 65+50 Inclinometer*

- A-axis direction
  - Maximum cumulative displacement magnitude and direction: +0.14 inches twenty-five feet below the ground surface.
- B-axis direction
  - Maximum cumulative displacement magnitude and direction: +0.15 inches twenty-two feet below the ground surface.

4.1.2.5 *Station 77+00 Inclinometer*

- A-axis direction
  - Maximum cumulative displacement magnitude and direction: +0.18 inches at the ground surface.
- B-axis direction
  - Maximum cumulative displacement magnitude and direction: -0.18 inches at the ground surface.

4.1.2.6 *Station 118+00 Inclinometer*

- A-axis direction

  - Maximum cumulative displacement magnitude and direction: +0.4 inches at the ground surface.
- B-axis direction
  - Maximum cumulative displacement magnitude and direction: -0.2 inches three feet below the ground surface.

4.1.2.7 *Station 133+00 Inclinometer*

- A-axis direction
  - Maximum cumulative displacement magnitude and direction: +1.4 inches at the ground surface.
- B-axis direction
  - Maximum cumulative displacement magnitude and direction: -0.4 inches at sixteen feet below ground surface.

4.1.2.8 *Station 142+00 Inclinometer*

- A-axis direction
  - Maximum cumulative displacement magnitude and direction: +0.2 inches at the ground surface.
- B-axis direction
  - Maximum cumulative displacement magnitude and direction: -0.17 inches at the ground surface.

4.1.2.9 *Station 162+50 Inclinometer*

- A-axis direction
  - Maximum cumulative displacement magnitude and direction: +1.6 inches at the ground surface.
- B-axis direction
  - Maximum cumulative displacement magnitude and direction: -0.18 inches at two feet below ground surface.

4.1.2.10 *Station 178+00 Inclinometer*

- A-axis direction
  - Maximum cumulative displacement magnitude and direction: +0.25 inches at the ground surface.
- B-axis direction

- Maximum cumulative displacement magnitude and direction: -0.2 inches 23 feet below ground surface.

4.2 Bathymetric Survey Results

The bathymetric survey of the Ash Basin was performed by DTE survey crew in June of 2018. The following were observed or estimated based on the survey results.

1) Water level at the time of survey was at elevation 608.3 ft[2], which is lower than the maximum operation water level of 609 ft.

2) Approximately 70 percent of the Ash Basin footprint is filled with ash above the water level.

3) The maximum water depth is approximately 36.9 ft. The top of ash at this location is at approximate elevation 571.4 ft.

4) The maximum ash thickness is approximately 50 ft, measured from the top of ash at approximate elevation 613 ft to the bottom of the Ash Basin, which is at approximate elevation 563.4 ft. The minimum thickness of ash is approximately 8 ft.

5) At the time of the bathymetry measurements:

    a. the remaining storage capacity of the Ash Basin is approximately 3.4 million cubic yards.

    b. approximately 24.5 million cubic yards of ash is deposited in the Ash Basin.

    c. approximately 690 million gallons of water is impounded in the Ash Basin.

[2] Elevations referred to in this report are based on National Geodetic Vertical Datum of 1929 (NGVD29).

5. MAINTENANCE ACTIVITIES PERFORMED IN 2018

The following maintenance activities were performed since the last inspection:

- Restored sloughed soils at the southeast corner of the Ash Basin Embankment;
- Flattened sections of the embankment from 2H:1V to 3H:1V;
- Relocated the discharge point of Line 5 to "outfall 5 location" per February 2017 draft fill plan; and
- Maintained the access roads around the site.

6. EVALUATION

6.1 Visual Inspection

Non-optimal conditions noted from the 2018 annual inspection are discussed below:

- Cracks one-inch wide or less were observed on the exterior slope of the embankment between Station ~121+00 and ~122+00, these cracks do not represent an immediate concern for global stability of the Ash Basin embankment; these cracks should be monitored on a regular basis at a frequency of once every 30 days (maximum).

- A local depression that was observed near the crest of the embankment at Station ~28+00 does not represent an immediate concern for the safe operation or stability of the Ash Basin embankment.

- Isolated problems with the mid-slope ditch bedding (i.e. pea stone and underlying soil) washing out were observed at down-chute at Station 26+00. The observed problems do not represent an immediate concern for the safe operation or stability of the Ash Basin embankment. However, this down-chute should be fixed in accordance with IMM Manual.

- The gap between mid-slope ditch flap and adjacent ground was observed at various sections along the embankment. These gaps do not represent an immediate concern for the safe operation or stability of the Ash Basin. However, gaps on the upstream side of the mid-slope ditch should be filled in accordance with IMM Manual to direct storm water into the mid-slope ditch. Furthermore, detailed inspection of mid-slope ditch cables should be performed, and missing cable bolts should be replaced.

- Erosion rills do not represent an immediate concern for the safe operation or stability of the Ash Basin embankment. However, they should be maintained within a year in accordance with IMM Manual.

- Sparse vegetation does not represent an immediate concern for the safe operation or stability of the ash basin embankment.

6.2 Inclinometer Monitoring

The maximum cumulative displacement for all the inclinometers is 1.6 inches at the ground surface at Station 162+50. There is no evidence of movement of the embankment at the monitored locations that would suggest a global instability of the embankment.

7. CONCLUSION AND CERTIFICATION

The annual visual inspection did not identify evidence of structural weakness or instability.

Based on the annual inspection results and review of the available data, the Monroe Ash Basin facility was designed, constructed, operated and maintained with generally accepted good engineering standards.

Certified by:

Date 1/9/2019

Omer Bozok, P.E. Michigan License Number 6201062700
Project Engineer

APPENDIX A

2018 ANNUAL INSPECTION FORMS AND PHOTOS

MONROE ASH BASIN 2018 ANNUAL INSPECTION

Name of Surface Impoundment: Monroe Power Plant Ash Basin
Surface Impoundment ID Number:
Owner: DTE Electric Company
Operator:
Site Conditions: Wet

Qualified Engineer: Omer Bozok P.E.
Date: 4/24/2018 **Time:** 8 am to 1 pm
Weather: Raining, High 40s
Precipitation (since last inspection): 1 in.

I. Crest

1. Are there any appearances of actual or potential structural weaknesses (ruts, holes, erosion, cracking, slides, depressions, undesired vegetation etc.)? Provide approximate size and location.)

In general, the crest is in good condition, no cracks or ruts and pot holes were observed.

2. Are there any significant changes since last inspection? None.

II. Embankment Slopes

1. Are there any appearances of actual or potential structural weaknesses (ruts, holes, erosion, cracking, sloughs, depressions, bulges, undesired vegetation etc.)? (Provide approximate size and location/station.

Up to one-inch wide crack was observed on the upper half of the embankment between stations 121 and 122. (Photographs 23 and 24). These cracks were flagged.
Erosion rills were observed on the embankment, at stations approximately 0, 67, 162, 167 and 169 (Photographs 1, 3, 35, 36, 37, 43, 51, 52 and 58).
Minor soughing, 6 to 8 inches in depth, and bulges were observed on the embankment at discrete locations between stations approximately 1141 and 145 (Photographs 9-16).
A localized depression was observed on the embankment near the crest at station approximately 28 (Photograph 44), appeared to be a tire rut.
Localized areas of sparse vegetation were observed on the embankment at stations approximately 100, 136, and 148 (Photographs 7, 20, and 28).

2. Are there any visible wet areas on the downstream slope? None.

3. Are there any significant changes since the last inspection?
The embankment has been flattened from 2H:1V to 3H:1V from Station 52+00 to 60+00, and from 160+00 to 168+00 since the last annual inspection.

III. Surface Impoundment Conditions

1. Is the in-flow piping to the surface impoundment flowing freely to open water? X Yes ___ No
If 'No', describe (type of debris, reason for obstruction, etc.)
Line 1, 3 and 6 were inspected. Line 5 was not located.

2. What is the water level in the surface impoundment today?
Maximum Pool Level / Datum 609 ft / NGVD29 Pool Level is 608.5 ft

3. Is there excessive CCR build-up above the water surface that could lead to overtopping?

There is CCR above the water level, however discharge lines 1 and 3 directly discharge into open water. Therefore, overtopping is considered unlikely.
Line 5 was not located, however, it is our understanding that line 5 outfall is near open water, therefore overtopping is considered unlikely.

4. Are there any significant changes since the last inspection? None.

DTE Energy

MONROE ASH BASIN 2018 ANNUAL INSPECTION

IV. Discharge Structure and Channel

1. Are there any cracks or breaks in concrete or steel parts of the discharge structure, or obstructions to water flow (If 'Yes' report the location and severity).

No.

2. Are there signs of slope distress or seepage on the slope between the inlet and outlet structures or turbidity in the outflow?

None.

3. Is the weir at the downstream of discharge channel in working condition? *If 'No', describe the issue.*

Yes.

VI. Slurry Piping

1. Are there any breaks or leaks along the embankment? ___ Yes X No

If 'Yes', describe (the line #, location, severity, etc.)

VII. Repairs, Maintenance, Action Items

2. Has this inspection identified any need for repair or maintenance? If 'Yes', describe and state the urgency of maintenance. "Urgent" for maintenance that should be conducted as soon as possible, "Moderate" for maintenance that should be conducted within three months, and "Not Urgent" for maintenance that can be conducted in a year. X Yes ___ No

See Section 6.1 of the Report.

VIII. Photography

Photographs can be taken of notable features. List of photographs:

	Location	Direction of Photo	Description
1	SEE ATTACHED PHOTO LOG.		
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 1

Date: 4/24/2018

Direction: NW

Comments: Photo taken at Station ~167+00. Erosion blankets have been disrupted by wind. Erosion gully visible on channel side slope.

Photograph ID: 2

Date: 4/24/2018

Direction: SW

Comments: Photo taken at Station ~166+00. The embankment appears to have uniform slopes without signs of distress between Stations ~167+00 and ~160+00.

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 3 **Date: 4/24/2018** **Direction: SE** **Comments: Photo taken at Station ~162+00. Minor erosion rills where erosion blankets have been disturbed.**	

Photograph ID: 4 **Date: 4/24/2018** **Direction: NE** **Comments: Photo taken at Station ~158+00. Missing cable bolt on mid-slope ditch. Location has been flagged.**	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 5 **Date: 4/24/2018** **Direction: SW** **Comments: Photo taken at Station ~157+00. Mid-slope ditch is linear, and the embankment appears to have uniform slopes without signs of distress.**	

Photograph ID: 6 **Date: 4/24/2018** **Direction: NE** **Comments: Photo taken at Station ~154+00. Mid-slope ditch is linear, and the embankment appears to have uniform slopes without signs of distress.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 7 **Date: 4/24/2018** **Direction: W** **Comments: Photo taken at Station ~148+00. Area of sparse vegetation observed on the embankment above the mid-slope ditch.**	

Photograph ID: 8 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~147+00. Embankment between stations 147+00 and 140+00 have uniform slopes without signs of distress, except for localized areas detailed in following photos.**	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 9 **Date: 4/24/2018** **Direction: N** **Comments: Photo taken at Station ~143+00. 25-feet area of 6 to 8-inch deep slough above mid-slope trench.**	

Photograph ID: 10 **Date: 4/24/2018** **Direction: SE** **Comments: Photo taken at Station ~142+50. 25-feet area of 6 to 8-inch deep slough above mid-slope trench.**	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 11 **Date: 4/24/2018** **Direction: SE** **Comments: Photo taken at Station ~142+00. 25-foot area of 6 to 8-inch deep slough above mid-slope trench.**	

Photograph ID: 12 **Date: 4/24/2018** **Direction: NE** **Comments: Photo taken at Station ~141+00. 15-foot area of 6 to 8-inch deep slough above mid-slope trench.**	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 13 **Date: 4/24/2018** **Direction: NE** **Comments: Photo taken at Station ~141+00. 15-foot area of 6- to 8-inch deep slough above mid-slope trench.**	

Photograph ID: 14 **Date: 4/24/2018** **Direction: NE** **Comments: Photo taken at Station ~140+50. 25-foot area of 6- to 8-inch deep slough above mid-slope trench.**	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 15 **Date: 4/24/2018** **Direction: NE** **Comments: Photo taken at Station ~140+50. 25-foot area of 6- to 8-inch deep slough above mid-slope trench.**	

Photograph ID: 16 **Date: 4/24/2018** **Direction: SW** **Comments: Photo taken at Station ~140+50. 25-foot area of 6- to 8 inch deep slough above mid-slope ditch.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 17 **Date: 4/24/2018** **Direction: NE** **Comments: Photo taken at Station ~139+00. General view of SE corner.**	

Photograph ID: 18 **Date: 4/24/2018** **Direction: N** **Comments: Photo taken at Station ~139+00. No obstruction was noticed for the pump house discharge channel within the ash basin.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 19 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~137+00. The embankment appears to have uniform slopes without signs of distress.**	

Photograph ID: 20 **Date: 4/24/2018** **Direction: SE** **Comments: Photo taken at Station ~136+00. Area of sparse vegetation observed on the embankment.**	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 21 **Date: 4/24/2018** **Direction: NE** **Comments: Photo taken at Station ~136+50. Area of exposed geo-cells observed on the embankment.**	

Photograph ID: 22 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~143+00. Cracks filled with bentonite-sand mixture show no signs of further opening.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 23 **Date: 4/24/2018** **Direction: SE** **Comments: Photo taken at Station ~122+00. 20-foot-long crack along the embankment that was previously filled with bentonite-sand mixture that is showing further signs of movement.**	

Photograph ID: 24 **Date: 4/24/2018** **Direction: SE** **Comments: Photo taken at Station ~122+00. 20-foot-long crack along the embankment that was previously filled with bentonite-sand mixture that is showing further signs of movement.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 25 **Date: 4/24/2018** **Direction: NE** **Comments: Photo taken at Station ~115+00. Discharge Location for lines 1, 3 and 6.**	

Photograph ID: 26 **Date: 4/24/2018** **Direction: SW** **Comments: Photo taken at Station ~113+00. The erosion rills that were observed in 2017 appeared to be mitigated.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 27 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~98+00. The embankment appears to have uniform slopes without signs of distress.**	

Photograph ID: 28 **Date: 4/24/2018** **Direction: E** **Comments: Photo taken at Station ~100+00. Localized area of uneven, sparse vegetation observed on the embankment.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 29 **Date: 4/24/2018** **Direction: NE** **Comments: Photo Taken at Station ~86+00. Mid-slope ditch is linear, and the embankment appears to have uniform slopes without signs of distress.**	

Photograph ID: 30 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~87+00. In general, vegetation was observed to be washed out at each down-chute location.**	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 31 **Date: 4/24/2018** **Direction: SW** **Comments: Photo taken at Station ~86+00. In general, mid-slope ditch appears to be snug against the embankment and in good condition. There are small localized areas where a gap is visible.**	

Photograph ID: 32 **Date: 4/24/2018** **Direction: NE** **Comments: Photo Taken at Station ~78+00. Mid-slope ditch is linear, and the embankment appears to have uniform slopes without signs of distress.**	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 33 **Date: 4/24/2018** **Direction: SW** **Comments: Photo Taken at Station ~78+00. Mid-slope ditch is linear, and the embankment appears to have uniform slopes without signs of distress.**	

Photograph ID: 34 **Date: 4/24/2018** **Direction: SW** **Comments: Photo Taken at Station ~69+00. Mid-slope ditch is linear, and the embankment appears to have uniform slopes without signs of distress.**	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 35 **Date: 4/24/2018** **Direction: E** **Comments: Photo Taken at Station ~67+00. The embankment appears to have uniform slopes with signs of erosion rills in the aggregate.**	

Photograph ID: 36 **Date: 4/24/2018** **Direction: N** **Comments: Photo Taken at Station ~67+00. Signs of erosion rills in the aggregate.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 37 **Date: 4/24/2018** **Direction: S** **Comments: Photo Taken at Station ~67+00. Signs of erosion rills in the aggregate.**	

Photograph ID: 38 **Date: 4/24/2018** **Direction: W** **Comments: Photo take at Station ~63+00. Cracks filled with bentonite-sand mixture from Station ~60+00 to 65+00 show no signs of further opening.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 39 **Date: 4/24/2018** **Direction: E** **Comments: Photo take at Station ~65+00. Cracks filled with bentonite-sand mixture from Station ~60+00 to 65+00 show no signs of further opening. Flags mark the areas that were filled last year.**	

Photograph ID: 40 **Date: 4/24/2018** **Direction: E** **Comments: Photo taken at Station ~60+00. The embankment appears to have uniform slopes without signs of distress.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 41 **Date: 4/24/2018** **Direction: SW** **Comments: Photo taken at Station ~34+00. The embankment appears to have uniform slopes without signs of distress.**	

Photograph ID: 42 **Date: 4/24/2018** **Direction: NE** **Comments: Photo taken at Station ~34+00. The embankment appears to have uniform slopes without signs of distress.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 43 **Date: 4/24/2018** **Direction: SE** **Comments: Photo taken at Station ~30+00. Signs of erosion rills.**	

Photograph ID: 44 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~28+00. Localized depression observed at the crest, which appeared to be a tire rut. No bulging observed.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 45 **Date: 4/24/2018** **Direction: SE** **Comments: Photo taken at Station ~28+00. Mid-slope ditch is linear and the embankment appears to have uniform slopes without signs of distress.**	

Photograph ID: 46 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~26+00. Gap observed between embankment and mid-slope ditch. Sediment buildup in down-chute.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 47 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~14+00. Mid-slope ditch is linear, and the embankment appears to have uniform slopes without signs of distress.**	

Photograph ID: 48 **Date: 4/24/2018** **Direction: E** **Comments: Photo taken at Station ~14+00. The embankment appears to have uniform slopes without signs of distress.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 49 **Date: 4/24/2018** **Direction: SE** **Comments: Photo taken at Station ~16+00. The crest appears to be in good condition without signs of depressions.**	

Photograph ID: 50 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~16+00. The crest appears to be in good condition without signs of depressions.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 51 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~0+00. Minor signs of erosion rills beneath trestle structure.**	

Photograph ID: 52 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~0+00. Minor signs of erosion rills beneath trestle structure.**	

GEOSYNTEC CONSULTANTS
Photographic Record

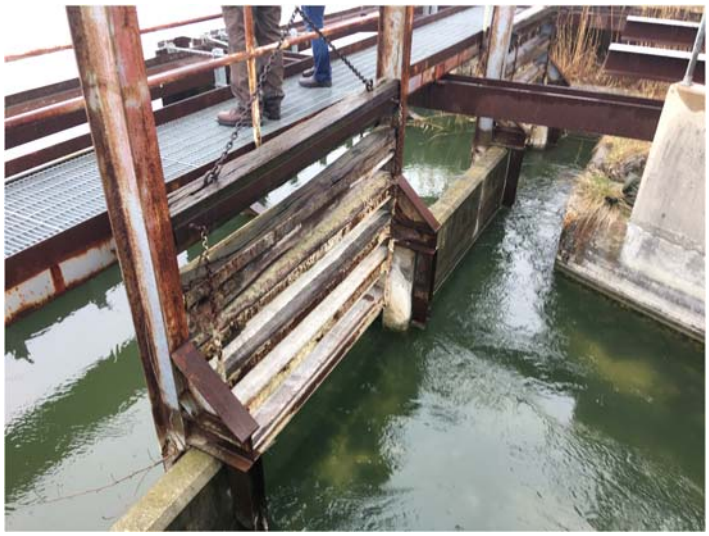
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

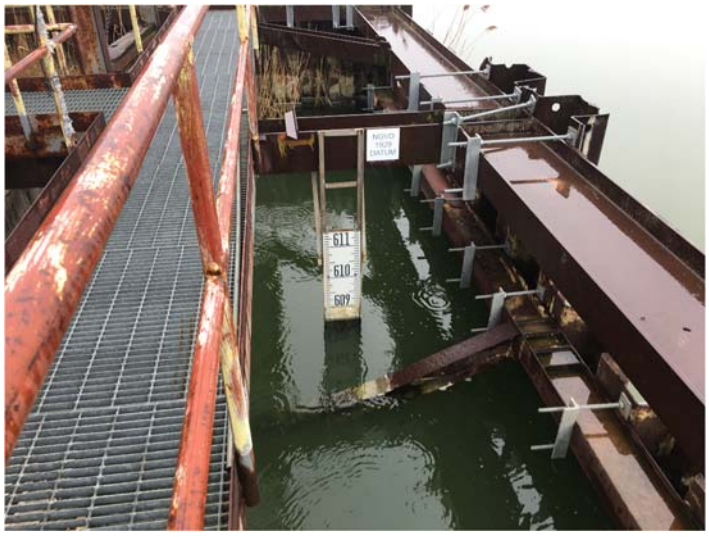
Photograph ID: 53 **Date: 4/24/2018** **Direction: E** **Comments: Photo taken at Station ~179+00. Inlet structure appears to be in good condition, without blockage.**	

Photograph ID: 54 **Date: 4/24/2018** **Direction: S** **Comments: Photo taken at Station ~179+00. Inlet structure appears to be in good condition.**	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 55 **Date: 4/24/2018** **Direction: NW** **Comments: Photo taken at Station ~179+00. All stop logs are up and not restricting flow.**	

Photograph ID: 56 **Date: 4/24/2018** **Direction: SW** **Comments: Photo taken at Station ~179+00. Water level is ~608.5 feet.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 57 **Date: 4/24/2018** **Direction: SW** **Comments: Photo taken at Station ~177+00. The embankment appears to have uniform slopes without signs of distress.**	

Photograph ID: 58 **Date: 4/24/2018** **Direction: SE** **Comments: Photo taken at Station ~169+00. Minor erosion rills visible on access ramps.**	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: DTE Electric Company	**Project Number: CHE8242**
Site Name: Monroe Power Plant Ash Basin	**Site Location: Monroe, MI**

Photograph ID: 59	
Date: 4/24/2018	
Direction: E	
Comments: Photo taken at Station ~179+00. Aerators located at the downstream end of the discharge structure appear to be in good condition.	

APPENDIX B

RESUME OF OMER BOZOK, P.E. (QUALIFIED PROFESSIONAL ENGINEER)

Geosyntec consultants

ÖMER BOZOK, P.E.[1]

EDUCATION

M.S., Geotechnical Engineering, University of Missouri, Columbia, Columbia, Missouri, 2009

B.S., Geological Engineering, Hacettepe University, Ankara, Turkey, 2007

CAREER SUMMARY

Mr. Bozok is a project engineer and has been with Geosyntec for eight years. He is responsible for managing large-scale civil projects, reviewing engineering data, writing technical reports, generating/reviewing drawings, performing geotechnical analyses and design, and managing construction quality assurance (CQA) activities.

Civil Design and Engineering

Embankment Mitigation for Fly Ash Basin, DTE Energy, *Monroe, Michigan.* The project involved design and mitigation of an existing fly ash basin embankment that is 3.5-miles long and 40-ft high. Mr. Bozok served as the project manager. Mainly, mitigation measures included flattening of the existing slopes from 2 horizontal to 1 vertical (2H:1V) slopes to 2.5H:1V with a mid-slope stormwater conveyance channel. The project was completed in five construction seasons (2009 through 2013).

The project won DTE's "Best Large Project Award" under their Major Enterprise Project group. The five-year project was completed under budget, within schedule and with no safety incidents.

Stingy Run Fly Ash Reservoir Closure, American Electric Power, *Cheshire, Ohio.* The project involved closure of an existing 300-acre fly ash pond and lowering of 100-ft tall dam. Mr. Bozok served as the project manager. The project requires approximately 4 million CY of earthwork. The scale of the project, nature of loose ash, lowering of the dam, nearby highwalls, wetlands and streams make it a challenging design project and involves collaboration between different disciplines.

Wood River West Ash Complex Closure, Vistra Energy, *East Alton, Illinois*. Mr. Bozok is the project manager and the lead civil design engineer for the project that involves closure of an existing 50-acre fly ash pond, detailed dewatering design and relocation of plant discharge pipes. The project requires approximately one million CY of earthwork. The availability of limited on-site materials, nature of loose ash, and extent of groundwater makes it a challenging project.

MIG/DeWane Superfund Site Remedial Design, Republic Services, *Belvidere, Illinois.* Mr. Bozok was the lead design engineer for closure of a Superfund site, and managed CQA activities during construction. The project involved preparing remedial design construction drawings for an existing approximately 50-acre Superfund site to upgrade an interim cap that had been installed in 1990s. Design included: (i) construction of leachate and gas collection system consisting of approximately 4,000-ft long leachate and gas collection system trench, and underground and above ground storage tanks; (ii) augmentation of the existing clay fill cover by compacting additional clay fill; and (iii) implementation of stormwater management system.

---

[1] Licensed in Michigan and Ohio, currently working on reciprocity for Illinois.

Escanaba Ash Pond Fly Ash Removal, City of Escanaba, *Escanaba, Michigan.* The project involved closure of an existing one-acre ash pond by removal. Mr. Bozok served as the project manager and oversaw quality assurance activities for the construction.

Review of Safety Factor Assessments for Various Sites, Dynegy, *various locations.* Mr. Bozok was a key member of a team, which reviewed safety factor assessments for various high risk sites that were prepared by another consulting firm. The documents were prepared to meet the requirements of USEPA CCR rules and required diligent review before made available to the public.

Use of Instrumented Test Fill to Assess Static Liquefaction of Impounded Fly Ash for Cardinal Landfill, American Electric Power, *Brilliant, Ohio.* Mr. Bozok provided geotechnical services for a research project on static liquefaction of impounded fly ash.

Engineering Correlations for Geotechnical Parameters for Ponded Fly Ash, EPRI, *Palo Alto, California*. The project involved performing a field plate load test at an ash basin site and preparing a report summarizing findings of the study. Mr. Bozok was one of the principal investigators and managed the field investigation activities and the plate load testing.

Annual Inspection of Ash Impoundments and Landfills, DTE Energy, *various locations*. Mr. Bozok inspected Sibley Quarry Landfill and Monroe Ash Basin and prepared annual inspection reports per the requirements of USEPA CCR rules.

Documentation for USEPA CCR Rules, DTE Energy, *Monroe, Michigan*. Mr. Bozok assisted client with meeting the documentation requirements of USEPA CCR rules. The rule requires various documentation regarding the history of construction, operations and design of various structures. He directed hydraulic capacity and safety factor assessments.

Probabilistic Slope Stability Analysis for Fly Ash Basin, DTE Energy, *Monroe, Michigan.* The client was considering mitigating a portion of a 3.5-miles long and 40-ft high the embankment to improve slope stability safety factor. Mr. Bozok performed probabilistic slope stability analysis to assess the global stability and recommend mitigation measures. Mr. Bozok provided the client with a probability of failure information for the embankment and the client decided that mitigation was not necessary. This provided the client with approximately 5-million-dollar savings.

Emergency Action Plan for Fly Ash Basin, DTE Energy, *Monroe, Michigan*. Mr. Bozok prepared an Emergency Action Plan (EAP) for the Monroe Ash Basin. The Ash Basin is critically bounded on the east by Lake Erie, on the west by Interstate Highway 75 (I-75), on the north by Plum Creek, and on the south by an agricultural field. Mr. Bozok evaluated four failure scenarios at critical locations around the perimeter embankment and developed the EAP based on Federal Emergency Management Agency Guidelines for Dam Safety.

Potential Failure Mode Analysis for Fly Ash Basin, DTE Energy, *Monroe, Michigan*. Mr. Bozok worked with the client to identify potential failure modes for a 400-acre ash basin that could cause ash release. Mr. Bozok facilitated meetings with client's staff including personnel from operations, maintenance, engineering and environmental group, to rank and categorize potential failure modes. Upon, identifying medium and high risk failure modes, Mr. Bozok worked with the client to design and implement mitigation measures to lower risk levels.

Operations Plan for Fly Ash Basin, DTE Energy, *Monroe, Michigan.* Project involved installation of a continuous monitoring and alarm system for the ash basin embankment inclinometers. Mr. Bozok directed a group of field staff and instrumentation engineers to implement the program. The operations

plan provides guidelines on how to safely operate the fly ash basin, structures, provides communication procedures, and provides action criteria for surface and subsurface instrumentation.

PUBLICATIONS

Bozok, O., Sabatini, P.J., Amaya, P. (2013) "Use of Instrumented Test Fill to Assess Static Liquefaction of Impounded Fly Ash" World of Coal Ash Conference 2013, Lexington, KY

Bozok, O., Tanyu, B.F., Sabatini, P.J., Seymour, J.S. (2015) "Reliability Analysis of an Existing Ash Basin Embankment" World of Coal Ash Conference 2015, Nashville, TN

Seymour, J.S., Bozok, O., Hughes, A., Bodine, B. (2015) "Conditions of Coal Ash Embankments" World of Coal Ash Conference 2015, Nashville, TN

Sabatini, P.J., Bozok, O., Andonyadis, P., Yafrate, N. (2014) "Engineering Correlations for Geotechnical Parameters for Ponded Fly Ash", EPRI Document #3002001151, July 2014

Tanyu, B.F., Neal, W., Seymour, J.P., Bodine, D., Bozok, O. (2011) "Case Study: Stability of Two Horizontal to One Vertical Embankment" ASCE, *Geo-Frontiers Conference*, March, Dallas, Texas.