LETTER OF NOTIFICATION FOR THE

Garver Substation Expansion

PUCO Case No. 19-0048-EL-BLN

Submitted to:

The Ohio Power Siting Board

Pursuant to OAC 4906-6

Submitted by:

Duke Energy Ohio, Inc.

January 2019

Letter of Notification

This Letter of Notification has been prepared by Duke Energy Ohio, Inc. (hereafter "Duke Energy Ohio") in accordance with Ohio Administrative Code (OAC) Section **4906-6-05** for the review of Accelerated Certificate Applications. The following section corresponds to the administrative code sections for the requirements of a Letter of Notification.

4906-06-05 ACCELERATED APPLICATION REQUIREMENTS

4906-6-05 (B): General Information

4906-6-05 (B)(1) Name, Reference Number, Brief Description, and Letter of Notification Requirement

Name of Project: **Garver Substation Expansion**

2018 LTFR Reference: The Project was included in Case No. 18-484-EL-FOR, pp. 44, 46-47, 54-56. The PJM upgrade identification number for the Project is B2830.

Brief Description of the Project:

Duke Energy Ohio proposes to expand the existing Garver Substation on the southern portion of the NTE Middletown Energy Center (MEC) power plant site, located in the City of Middletown, Butler County, Ohio. Specifically, the project is located north of Enterprise Drive and west of Cincinnati-Dayton Road. The MEC is a newly constructed natural gas fired power plant able to generate 475 megawatts of electricity, enough energy for 400,000 homes. The proposed Project area consists of approximately 2.9 acres of land disturbance of a previously constructed laydown area and includes the expansion of the existing 345kV Garver Substation to include a 138kV transmission substation. The expansion will have seventy-eight (78) low profile bus support structures, two (2) double bay A-frame transmission line take off towers, one (1) single bay A-Frame transmission line take off tower, and one (1) single bay H-frame take off tower.

Letter of Notification Requirement:

This Project qualifies as a Letter of Notification filing as it meets the requirements outlined in O.A.C. 4906-1-01, Appendix A, item (4)(b). Item (4)(b) allows the filing of a Letter of Notification for *"Constructing additions to existing electric power transmission stations or converting distribution stations to transmission stations where: There is a greater than twenty percent expansion of the fenced area."*

4906-6-05 (B)(2): Need for the Project

The Garver 138kV expansion project is a Baseline project that was part of the 2016 PJM RTEP. The need for the Garver Substation 138kV expansion is to reinforce and improve the quality of the electric service and reliability to the service area. This area includes, but is not limited to, the City of Middletown, Butler County, Ohio.

4906-6-05 (B)(3): Location of the Project Relative to Existing or Proposed Lines

The location of the Project is depicted in Attachment A: Figures 1 and 2. Figure 1 shows the general project vicinity depicted on a USGS quadrangle topographic map. Figure 2 depicts the planned substation location, ecological resources in the Project vicinity, and additional details depicted on an aerial imagery map. Attachment B depicts the Project location relative to the existing transmission lines.

4906-6-05 (B)(4): Alternatives Considered

The proposed Project will occur entirely within a previously constructed laydown area and the MEC power plant. No additional long-term impacts to adjacent properties are anticipated as a result of the Garver Substation Expansion Project. Therefore, the current alignment is the only reasonable alternative available and no alternatives were considered.

4906-6-05 (B)(5): Public Information Program

Duke Energy Ohio has worked closely with property owners during the development of the Project. Duke Energy Ohio has mailed letters, via first class mail, to affected landowners, tenants, contiguous owners, and anyone else Duke Energy Ohio determined may be affected by the Project. See Attachment C for a copy of the letter and list of recipients.

4906-6-05 (B)(6): Construction Schedule

Construction is planned to begin on March 4, 2019, contingent upon approval of this Letter of Notification. The Project is anticipated to be completed and in service by October 22, 2019.

4906-6-05 (B)(7): Area Map

Figures 1 and 2 depict the general location of the Project. Attachment A, Figure 1, depicts the general Project vicinity depicted on a USGS quadrangle topographic map. Attachment A, Figure 2, depicts the planned substation location, ecological resources in the Project

vicinity, and additional details on an aerial imagery map. Attachment B depicts the Project location relative to the existing transmission lines.

4906-6-05 (B)(8): Property Owner List

The proposed Duke Energy Ohio Garver Substation Expansion Project will be within property Duke Energy Ohio will acquire from NTE. There is an existing agreement for purchase of the property, which purchase is scheduled to close at the end of February.

Duke Energy Ohio has identified property owners within 500 feet of the project area and these owners have been notified as outlined in this response [Part 4906-6-05(B)(5)]. The adjacent property owners list and correspondence letter can be found in Appendix C.

4906-6-05 (B)(9): TECHNICAL FEATURES OF THE PROJECT

The Project involves expanding the existing yard and construction of seventy-eight (78) low-profile bus support structures, two (2) double-bay A-frame transmission line take-off towers, one (1) single-bay A-Frame transmission line take-off tower, and one (1) single-bay H-frame take-off tower. The proposed expansion area consists of approximately 2.9 acres of disturbance consisting of a previously constructed laydown area and includes the portions of the MEC facility. Structure diagrams are provided in Attachment B.

4906-6-05 (B)(9)(a): Operating Characteristics

Voltage:	345kV 138kV
Structure Type:	Seventy-eight (78) low-profile bus support structures, two (2) double-bay A-frame transmission line take-off towers, one (1) single-bay A-Frame transmission line take-off tower, and one (1) single-bay H-frame take-off tower.

Right-of-Way/Land Requirements: Duke Energy Ohio will be acquiring 2.9 acres of property from NTE. This is currently scheduled to be acquired the end of February 2019.

4906-6-05 (B)(9)(b): Electric and Magnetic Fields

Information concerning the electric and magnetic fields will not be required as the proposed Project is not within 100 feet of an occupied residence or institution.

4906-6-05 (B)(9)(c): Estimated Cost

The estimated cost for the proposed Project is approximately $17,200,000.00.

4906-6-05 (B)(10): SOCIAL AND ECOLOGICAL IMPACTS

4906-6-05 (B)(10)(a): Land Uses

The Project is located in the City of Middletown, Butler County, Ohio. The City of Middletown, which covers about 26 square miles, contained a population of 48,813 people based on 2016 census data. The land use immediately surrounding the Project area is predominantly industrial, undeveloped secondary growth forest, and agricultural.

4906-6-05 (B)(10)(b): Agricultural Land

An agricultural land vegetation assemblage does not exist within the Project area.

4906-6-05 (B)(10)(c): Archaeological or Cultural Resources

The Ohio Historic Preservation Office's (OHPO) online mapping system was consulted to identify previously recorded cultural resources within 1.6 km (1 mi) of the study area (one-mile buffer). The OHPO records check indicates that 20 archaeological sites, 14 historic structures, and 1 cemetery have been previously recorded in the one-mile buffer. The literature review indicates that three previously identified cultural resources are located within or adjacent to the Project area (33-Bu-1071, 33-Bu-1072, and 33-Bu-1181). All of the sites appear to have been entirely destroyed by construction activities and grading. Site 33-Bu-1181 is located outside the area where subsurface disturbance associated with the Project will occur; therefore, the site will not be impacted by Project activities. In addition, sites 33-Bu-1071, 33-Bu-1072, and 33-Bu-1181 have been previously determined not to meet eligibility criteria for the National Register of Historic Places.

The majority of the Project is located in areas that have been heavily disturbed by mechanical equipment. These areas are not conducive for containing intact cultural deposits. In addition, the entirety of the Project area was previously investigated for cultural resources (Marshall 2014; Jacoby 2014).

Due to the presence of heavily graded and disturbed soils, as well as the 2014 cultural survey of the entire Project area, no archaeological reconnaissance is recommended for the Project to proceed as planned.

Table 1-1 Cultural Resources in the 1.0 mile buffer

Resource Number	Resource Type	Resource Name	Address/ Location
33-BU-0123	Prehistoric Mound	N/A	Confidential
33-BU-0125	Prehistoric Mound Group	N/A	Confidential
33-BU-0399	Prehistoric Site	N/A	Confidential
33-BU-0400	Prehistoric Site	N/A	Confidential
33-BU-0401	Prehistoric Site	N/A	Confidential
33-BU-0423	Historic Isolate Site	N/A	Confidential
33-BU-0424	Prehistoric and Historic Site	N/A	Confidential
33-BU-0425	Historic Isolate Site	N/A	Confidential
33-BU-0426	Prehistoric and Historic Site	N/A	Confidential
33-BU-1069	Prehistoric Site	N/A	Confidential
33-BU-1070	Prehistoric Site	N/A	Confidential
33-BU-1071	Prehistoric Habitation Site	N/A	Confidential
33-BU-1072	Prehistoric Site	N/A	Confidential
33-BU-1073	Prehistoric Isolate Site	N/A	Confidential
33-BU-1096	Historic Site	N/A	Confidential
33-BU-1097	Historic Site	N/A	Confidential
33-BU-1181	Prehistoric Site	N/A	Confidential
33-BU-1182	Prehistoric Site	N/A	Confidential
33-WA-0488	Prehistoric Isolate Site	N/A	Confidential
33-WA-0939	Historic Site	N/A	Confidential

Table 1-1 Cultural Resources in the 1.0 mile buffer

Resource Number	Resource Type	Resource Name	Address/ Location
BUT0152408	Single Dwelling/ Barn	Ellison Harkrader House	Cincinnati-Dayton Rd
BUT0245808	Double	Combs Duplex	4805 Oxford State Rd
BUT0245908	Double	Collins Duplex	2941 Harkie St
BUT0246008	Single Dwelling	Jones House	2931 Harkie St
BUT0246108	Single Dwelling	Lanier House	2930 Harkie St
BUT0246208	Single Dwelling	Call House	2926 Harkie St
BUT0246308	Double	Gay Duplex	2925 Harkie St
BUT0246408	Single Dwelling	Crockett House	2922 Harkie St
BUT0246508	Single Dwelling	Collins House	2921 Harkie St
BUT0246608	Single Dwelling	Wilson House	2920 Harkie St
BUT0246708	Single Dwelling	O'Neill House	2914 Harkie St
BUT0246808	Single Dwelling	Carter House	2913 Harkie St
BUT0246908	Single Dwelling	Barrow House	2906 Harkie St
WAR0142705	Single Dwelling/ Barn	Snyder House	1000 N Garver Rd
OGS ID 1285	Cemetery	Saint Anthony Cemetery	0.5 mile south of Oxford State Road. East side of Cincinnati-Dayton Road/old US 25

4906-6-05 (B)(10)(d): Local, State, and Federal Requirements

No other local, state, or federal permit or other authorizations are required for the Project.

4906-6-05 (B)(10)(e): Endangered, Threatened, and Rare Species Investigation

Several sources of information were consulted to further define the potential habitat of listed species that occur within the county of the Project. Attachment A, Table 1, contains a list of the Rare, Threatened, and Endangered (RTE) species known to occur within Butler County and their potential to occur within the Study Area based on their habitat requirements and observations during the field survey.

Coordination with the U.S. Fish and Wildlife Service (USFWS) and Ohio Department of Natural Resources Division of Wildlife (ODNR-DOW) was initiated on January 14, 2019. No responses from the agencies have been received as of the date of this Letter of Notification; however, a response from the USFWS was received on November 19, 2018, which included the adjacent F7581/ F7582/F5689-138kV Garver Substation TLoop Project Area and Garver to AK Steel-138kV Project Area. A response from the ODNR-DOW was

received on January 25, 2019, which included the adjacent F7581/ F7582/F5689-138kV Garver TLoop Project Study Area. Copies of the requests and USFWS November 19, 2018 response letter and ODNR-DOW January 25, 2019 response letter are located in Attachment D.

The entire Project Area was field surveyed by Cardno, Inc., (Cardno) as part of contracted services to assess ecological impacts. This included habitat assessments to identify RTE species and their habitat, specifically Indiana Bat and Northern Long-Eared Bat roost trees. Based on Cardno's field inspection, the Project Study Area consisted of impervious, gravel surfaces. There were no trees identified within the Project Study Area.

4906-6-05 (B)(10)(f): Areas of Ecological Concern

As a part of the investigation, Duke Energy Ohio hired Cardno to conduct an investigation for areas of ecological concern. As a part of Cardno's investigation, a request was submitted to the ODNR Environmental Review Services on January 14, 2019, and U.S. Fish and Wildlife Service on January 14, 2019, to research the presence of any unique ecological sites, geological features, animal assemblages, scenic rivers, state wildlife area, nature preserves, parks or forest, national wildlife refuges, or other protected areas within one (1) mile of the Project area using the ODNR Natural Heritage Database. A copy of the ODNR request and USFWS request letters are included in Attachment D.

As a part of the field investigation and ecological assessment, Cardno conducted a wetland delineation and stream assessment of the Project area. Cardno's investigation included the approximately 14.24-acre study area around the proposed substation, access roads, and additional workspace areas. During the investigation, Cardno identified no potentially regulated waters in the study area. See Attachment E, Regulated Waters Determination Letter.

The proposed substation expansion will avoid disturbance to all streams and wetlands. Transmission lines into the substation will impact wetlands and are addressed in Case Nos 19-49-EL-BLN and 19-50-EL-BLN. No impacts to regulated waters or RTE habitat are anticipated by the substation expansion.

As a part of the investigation, Cardno identified 100-year floodplains using the FEMA National Flood Hazard Layer within the Project area. Attachment A, Figure 2, depicts the location of the 100-year floodplains in relation to the Project Area. Although all construction will take place within the 100-year floodplain of Shaker Creek, no changes in flood elevations are anticipated as the entire Project area is located within impervious areas which have been previously cleared and graded associated with the MEC. The Project is exempt from the City of Middletown floodplain requirements per Section 3.9C of the City of Middletown's Flood Damage Prevention Regulations.

4906-6-05 (B)(10)(g): Other Information

To the best of Duke Energy Ohio's knowledge, no unusual conditions exist that would result in environmental, social, health, or safety impacts. Construction and operation of the proposed Project will meet all applicable safety standards established by the Occupational Safety and Health Administration, and will be in accordance with the requirements specified in the latest revision of the National Electric Safety Code, as adopted by the Public Utilities Commission of Ohio. The Stormwater Pollution Prevention Plan (SWPPP), depicting the erosion and sediment controls for the Project, is located in Appendix E.

4906-6-07: Document of Letter of Notification Transmittal and Availability for Public Review

Copies of the Letter of Notification have been sent to governmental offices in the City of Middletown and Butler County and the MidPointe Library Middletown Public Library. As required by rule, a newspaper notice will be provided in the Cincinnati Enquirer within 7 days of filing this application.

Attachment A

Figures and Tables

SPECIES	COMMON NAME	STATE STATUS [1]	FEDERAL STATUS[2]	HABITAT[3]	BREEDING PERIOD[3]	PROBABILITY OF OCCURENCE[4]
Butler County						
MAMMAL						
Eptesicus fuscus	Big Brown Bat	SSC	---	Water, fields, forest openings, and urban and suburban areas.	August-October	None
Lasionycteris noctivagans	Silver-Haired Bat	SCC	---	Prefer mature northern forests with ponds and streams nearby. It roosts in trees during the summer and winter.	August-October	None
Lasiurus borealis	Red Bat	SSC	---	Solitary and prefer to roost in trees, shrubs, and clusters of weeds in the summer. They change roost sites every couple of days and often roost closer to the ground. They overwinter in trees and tree cavities.	August-October	None
Lasiurus cinereus	Hoary Bat	SSC	---	Migratory tree bat species travel north in the summer and back south in the winter. They migrate varying distances using landmarks and magnetic cues to direct themselves, and instead of hibernating in caves, they often hibernate in trees or leaf litter.	August-October	None
Microtus ochrogaster	Prairie Vole	SSC	---	Eastern deciduous forests. They live on the forest floor in the thick layers of leaves and loose soil.	April-October	Low
Microtus pinetorum	Woodland Vole	SSC	---	Eastern deciduous forests. They live on the forest floor in the thick layers of leaves and loose soil.	April-October	Low
Myotis lucifugus	Little Brown Bat	SSC	---	Water, fields, forest openings, and urban and suburban areas.	August-October	None
Myotis septentrionalis	Northern Long-Eared Bat	SSC	T	Wooded and Semi wooded areas, mainly along streams. Maternity colonies are around hollow trees.	August-October	None
Myotis sodalis	Indiana Bat	SE	LE	Wooded and Semi wooded areas, mainly along streams. Maternity colonies are around hollow trees.	August-October	None
Perimyotis subflavus	Tri-Colored Bat	SSC	---	Open forest areas that are near a source of water.	August-October	None
Peromyscus maniculatus	Deer Mouse	SSC	---	Forests, grasslands, brushlands, agricultural fields and deserts.	n/a	Low-Moderate
Synaptomys cooperi	Southern Bog Lemming	SSC	---	Low, damp bogs and meadows with heavy vegetation growth	April-September	None
Taxidea taxus	Badger	SSC	---	Grassland species, specifically favoring habitats with short grass, such as fields and pastures.	June-September	None
BIRD						
Colinus virginianus	Northern Bobwhite	SSC	---	Forest edge	February-October	None
Dolichonyx oryzivorus	Bobolink	SSC	---	Grassy hayfields and pastures, clover/alfalfa hayfields, wet prairies, and the grassy margins of marshes. Fallow fields composed of grasses and weeds also provide suitable nesting habitats.	May-June	None

Seiurus noveboracensis	Northern Waterthursh	SSC	---	Swampy woodlands.	n/a	None
FISH						
Esox masquinongy	Muskellunge	SCC	---	Heavily vegetated lakes with lots of tree stumps and bays. Prime stream muskellunge habitat is generally considered to be long pools (at least 0.2 miles in length) with a minimum depth of at least three to four feet and an abundance of submerged woody structure.	April-Early May	None
Moxostoma carinatum	River Redhorse	SSC	---	Found in only the largest rivers of the Ohio and Lake Erie drainage systems. They are typically found in deep pools with moderate current over bedrock or gravel substrate.	April-May	None
INVERTEBRATE						
Alasmidonta marginata	Elktoe	SSC	---	Medium to large size streams but is most common in smaller streams with moderately fast current and riffles. Fine gravel mixed with sand is preferred substrate.	June-July	None
Gomphus externus	Plains Clubtail	E	---	Found near large, slow, muddy streams and rivers.	May-Late July	None
Orconectes (Rhoadesius) sloanii	Sloan's Crayfish	T	---	Headwater and small inland streams	August-October	None
Truncilla donaciformis	Fawnsfoot	T	---	Prefers large rivers or the lower reaches of medium-sized streams. It is most commonly found in sand or gravel.	April-May	None
Truncilla truncata	Deertoe	SSC	---	Habitats of firm sand or gravel substrates in rivers and lakes with a moderately swift current, but has been observed occasionally in smaller streams	August-July	None
Villosa fabalis	Rayed Bean	E	E	Smaller, headwater creeks, but are sometimes found in large rivers and wave-washed areas of glacial lakes	n/a	None
REPTILE						
Clemmys guttata	Spotted Turtle	T	---	Shallow, sluggish waters of ditches, small streams, marshes, bogs, and pond edges, especially where vegetation is abundant.	April-May	None
Regina septemvittata	Queensnake	SSC	---	Prairie fens, wet meadows, wet prairies and associated open and wooded wetlands	February-March, May, August-September	None
Sistrurus catenatus	Eastern Massasauga	E	T	Wet prairies, sedge meadows, and early successional fields. Preferred wetland habitats are marshes and fens.	April-May	None
AMPHIBIAN						
Eurycea lucifuga	Cave Salamander	E	---	In and around caves, seeps, springs, and small forested limestone creeks associated with groundwater. Rock crevices or under rocks, logs, or other debris.	December-February	None
Acris crepitans crepitans	Eastern Cricket Frog	SSC	---	The shores of sparesly vegetated permanent ponds and streams.	April-June	None
PLANT						

Arabis pycnocarpa var. adpressipilis	Southern Hairy Rock Cress	P	---	Variable habitat from part-shade, open woods to sunny, open prairie.	n/a	None
Arabis pycnocarpa va. Pycnocarpa	Western Hairy Rock Cress	X	---	Meadows, meadow slopes, juniper hills, pastures, rocky outcrops, roadsides.	n/a	None
Bromus kalmia	Prairie Brome	P	---	Open upland woodlands, mesic to dry-mesic prairie, and grassy fens.	n/a	None
Carex mesochorea	Midland Sedge	T	---	Well-drained openings and clearings, oak woods and borders, fields.	n/a	None
Carex timida	Timid Sedge	T	---	Wet/marshy areas, sedge meadows, forests, and prairies.	n/a	None
Cyperus acuminatus	Pale Umbrella-sedge	P	---	Open, wet, sandy habitats. Sores, seepages and fields.	n/a	None
Echinodorus berteroi	Burhead	P	---	Muddy shores and shallow water of lakes, ponds, slow-moving streams, and ditches. Also in swamp woods and river bottoms.	n/a	None
Ribes missouriense	Missouri Gooseberry	ST	---	Mesic to dry open woodlands, savannas, woodland borders, thickets, power line clearances and small meadows and wooded areas, abandoned fields, and partially shaded fence rows.	n/a	None
Salix caroliniana	Carolina Willow	P	---	Wetland areas such as streams, swamps, marshes and retention ponds.	n/a	None
Silene nivea	Snowy Campion	E	---	Forested river valley.	n/a	None
Viburnum molle	Soft-leaved Arrow-wood	T	---	Dry, rocky woods, grassland, shores of rivers or lakes.	n/a	None

1. STATE STATUS - X = extirpated, E = endangered, T = threatened, R = rare, SSC = special concern, WL = watch list, SG = significant, ** = no status but rarity warrants concern

Ohio Department of Natural Resources, Division of Wildlife Website - http://wildlife.ohiodnr.gov/portals/wildlife/pdfs/publications/information/pub356.pdf (March 2016).

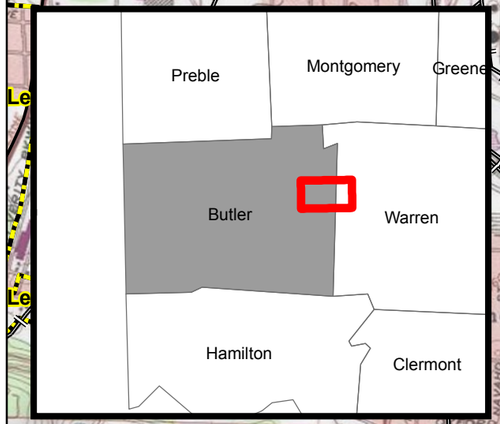
2. FEDERAL STATUS - E = endangered, T = threatened, R = rare, LELT = different listing for specific ranges or species, PE = proposed endangered , PT = proposed threatened, e/sa – appearance similar to a listed endanger species, **= not listed

United States Fish and Wildlife Service, County Distribution of Federally-Listed Threatened, Endangered, Proposed, and Candidate Species - http://www.fws.gov/midwest/endangered/lists/ohio-cty.html (January 2017).

3. Habitats and Breeding Periods described by:

a. NatureServe: An online encyclopedia of life [web application].2000. Version 1.1 Arlington, Virginia, USA: Association for Biodiversity information. Available: http://www.natureserve.org/ (Accessed January 6, 2017).
b. United States Fish and Wildlife Service Rayed Bean Fact Sheet - http://www.fws.gov/midwest/endangered/clams/rayedbean/RayedBeanFactSheet.html (January 6, 2017).
c. United States Fish and Wildlife Service Indiana Bat Fact Sheet - http://www.fws.gov/midwest/endangered/mammals/inba/index.html (January 6, 2017).
d. United States Fish and Wildlife Service Northern Long-eared Bat Fact Sheet - http://www.fws.gov/midwest/endangered/mammals/nleb/index.html (January 6, 2017).
e. United States Fish and Wildlife Service Eastern Massasauga Fact Sheet - http://www.fws.gov/midwest/endangered/mammals/inba/index.html (January 6, 2017).
f. United States Fish and Wildlife Service Running buffalo clover Fact Sheet - http://www.fws.gov/midwest/endangered/mammals/nleb/index.html (January 6, 2017).

4. Likelihood of occurrence: None, Low, Moderate, or High based on best available data and selective field observations.



Middletown

BUTLER COUNTY

GARVER SUBSTATION

GARVER SUBSTATION EXTENSION PROJECT AREA

WARREN COUNTY

Monroe

Lemon Twp.

PROJECT LOCATION

BUTLER COUNTY, OHIO

REFERENCE: USGS 7.5' TOPOGRAPHIC QUADRANGLE: MONROE, OHIO. OBTAINED VIA ESRI USA TOPO, NATIONAL GEOGRAPHIC TOPO, AND USGS, ACCESSED 01/2017.

N

0 1,000 2,000 4,000 Feet

- Existing Facility
- Interstate
- State Highway
- US Highway
- Railroad
- Municipal Boundary
- Project Area
- County Boundary

DUKE ENERGY.

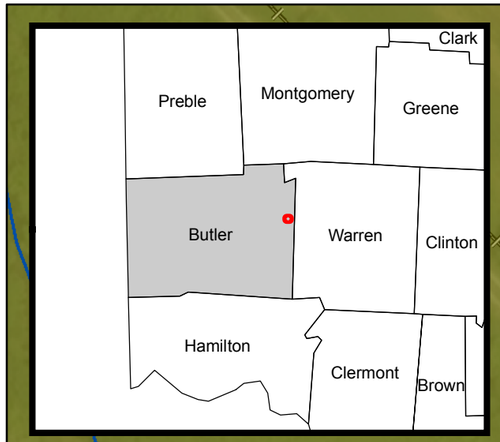
Cardno

FIGURE 1

GARVER SUBSTATION EXPANSION
OHIO POWER AND SITING BOARD
PROJECT VICINITY MAP

DRAWN BY: DKT DATE: 1/14/2019
CHECKED: CAJ APPROVED: CAJ

R:\Projects\15\156\156720M_DukeEnergy9193\M78_SOW38_Garver Distribution Lines_GIS2SAVE\GIS\MXD\LEA M78 Garver EXTENSION\M78_GarverEXT_F1_LEA_Project Vicinity Map.mxd



GARVER SUBSTATION

BUTLER COUNTY

Shaker Creek

Shaker Creek

PROJECT LOCATION

BUTLER COUNTY, OHIO

REFERENCE:
USGS 7.5' TOPOGRAPHIC QUADRANGLE: MONROE, OHIO. OBTAINED VIA ESRI USA TOPO, NATIONAL GEOGRAPHIC TOPO, AND USGS, ACCESSED 10/2018

Project Area
Existing Facility
Parcels
Municipal Boundary
County Boundary
Railroad
Local Road
Interstate
NWI Wetland
NHD Flowline
100Yr Floodplain
State Highway
US Highway

DUKE ENERGY.
Cardno

0 80 160 Feet

FIGURE 2

GARVER SUBSTATION EXPANSION
OHIO POWER AND SITING BOARD
ENVIRONMENTAL ACCESS PLAN

DRAWN BY: DKT
CHECKED: DKT
DATE: 1/14/2019
APPROVED: MWW

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Attachment B

Site Plans

LEGEND:

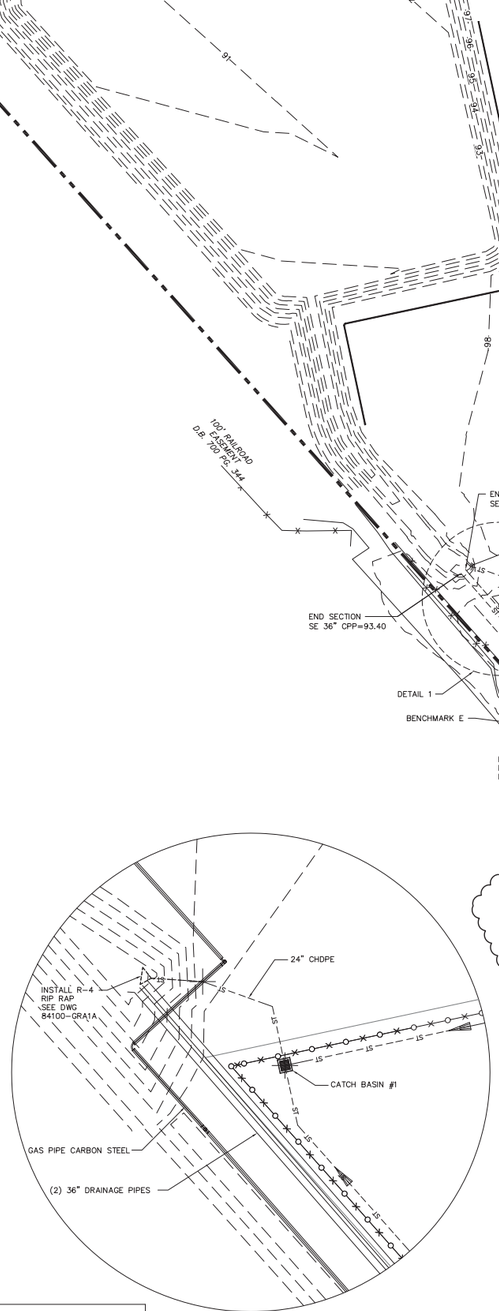
- 620 — CONTOUR (EXISTING)
- 620 — CONTOUR (REGRADED)
- 620 — CONTOUR (NEW)
- SUBSTATION FENCE (SPEC. SECTION 32 01 00)
- EXISTING SWITCHYARD FENCE
- BASELINE
- B.L.M. — PERMANENT BASELINE MONUMENT
- PROPERTY LINE
- EDGE OF PAVEMENT
- G — GAS PIPE
- ST — STROMWATER PIPE
- OE — OVERHEAD ELECTRIC LINE
- W — WATER PIPE
- BENCH MARK "2"
- UNDERGROUND UTILITY EASEMENT

NOTES & SPECIFICATIONS:

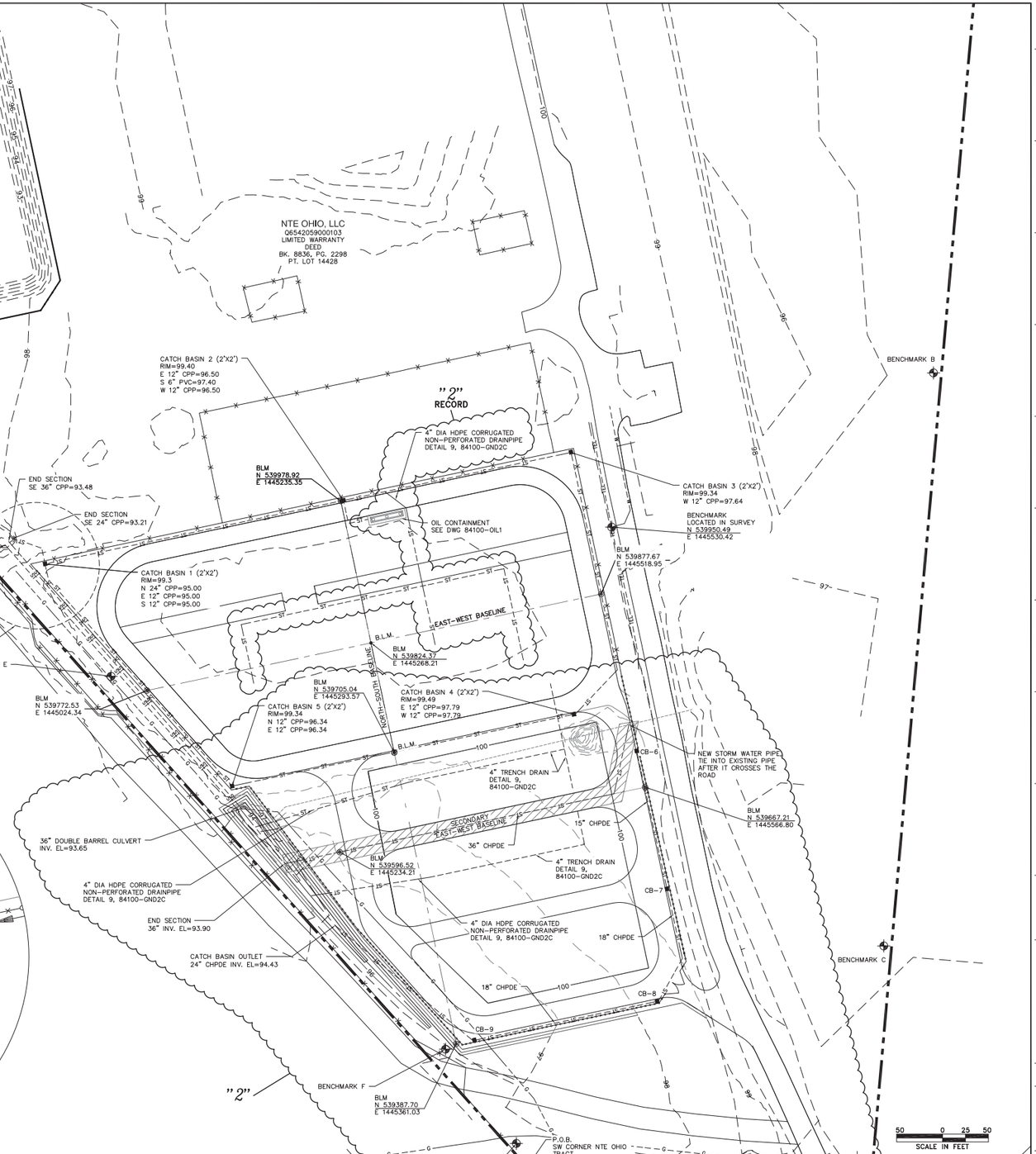
1. DUKE ENERGY WILL ESTABLISH SURVEYING CONTROL BASELINES AND INSTALL MARKERS FOR GRADING AND/OR CONSTRUCTION AS SHOWN. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OF THE ADDITIONAL SURVEYING CONTROLS.
2. SOIL BORINGS PERFORMED BY: TTL ASSOCIATES, INC.
   1915 NORTH 12TH STREET
   TOLEDO, OHIO 43604
   PROJECT: T1072TS1
   DATED: MAY 29, 2014
3. ALL CONTOURS AND SPOT ELEVATIONS INDICATE TOP OF SUBGRADE, ADD 6" TO OBTAIN TOP OF FINISHED SURFACING WITHIN SUBSTATION YARD AND TO A MINIMUM DISTANCE OF 4'-0" OUTSIDE THE FENCE. SEE PLAN FOR AGGREGATE SURFACE AREAS. SEE DUKE ENERGY SPEC. ON AGGREGATE SURFACING--SECTION 32 15 00.
4. FOR GENERAL TECHNICAL SITE REQUIREMENTS REFER TO DUKE ENERGY SPECIFICATION SECTION 01 11 00 SUMMARY OF WORK.
5. CONTRACTOR SHALL REFER TO THE SPECIFICATIONS LISTED ON THIS DRAWING FOR ADDITIONAL WORK PROCEDURE AND/OR ITEMS, NOT SPECIFICALLY INDICATED IN THESE NOTES OR ON THE DRAWINGS.
6. FOR TECHNICAL INSTALLATION REQUIREMENTS OF EARTHWORK AND STORM WATER CONTROL MEASURES REFER TO DUKE ENERGY SPECIFICATION SECTION 31 00 00 EARTHWORK.
7. FOR TECHNICAL INSTALLATION REQUIREMENTS OF THE SUBSTATION DRIVEWAY REFER TO DUKE ENERGY SPECIFICATION SECTION 32 15 00 AGGREGATE SURFACING.
8. FOR TECHNICAL INSTALLATION REQUIREMENTS OF STATION SECURITY FENCE REFER TO DUKE ENERGY SPECIFICATION SECTION 32 31 00 STATION SECURITY FENCE.
9. REFER TO THE STORM WATER PREVENTION PLAN AND DRAWING. CONTRACTOR SHALL INSTALL, MAINTAIN THE EROSION CONTROL AND MAINTAIN INSPECTION RECORDS AND AS SPECIFIED IN THE STORM WATER PREVENTION PLAN AND DRAWING.
10. NORTHING AND EASTING COORDINATES ARE BASED OFF THE OHIO SOUTH STATE PLANE COORDINATE SYSTEM.
11. VERTICAL ELEVATION ARE BASED OFF OF PLANT DATUM. TO OBTAIN PLANT DATUM ELEVATION, SUBTRACT 553.5 FEET FROM THE NAVD88 ELEVATION.
12. ALL SIDE SLOPES SHALL BE 3:1 UNLESS NOTED OTHERWISE. "2"

REFERENCES:

84100-CBL2	CABLE ROUTING PLAN OF 345KV YARD
84100-CBL3	TRENCH PLAN OF 345KV YARD
84100-FAB2	STEEL FABRICATION PLAN OF 345KV YARD
84100-FDN2	FOUNDATION PLAN OF 345KV YARD
84100-LOC1	SITE LOCATION PLAN OF 138KV & 345KV SUBSTATION
84100-SEL1	STRUCTURAL ELECTRICAL PLAN OF 138KV & 345KV YARD
84100-GRA1A	GRADING DETAILS OF 138KV & 345KV SUBSTATION
84100-GRA1B	EROSION AND SEDIMENT CONTROL PLAN 138KV SUBSTATION "2"
84100-GRA2	FENCE AND DRIVE PLAN OF 138KV & 345KV SUBSTATION
84100-GRA2A	FENCE DETAILS SHEET 1
84100-GRA2B	FENCE DETAILS SHEET 2
84100-OIL2	OIL CONTAINMENT PLAN OF 345KV SUBSTATION



DETAIL 1
SCALE: NTS



EXISTING BENCHMARK MONUMENTS					
ID NO.	STATE PLANE (NOTE 10) NORTH	STATE PLANE (NOTE 10) EAST	NAVD 88 ELEVATION	PLANT DATUM ELEVATION (NOTE 11)	REMARKS
A	540694.4424	1445778.0160	651.43	97.93	EXISTING MONUMENT
B	540118.4942	1445880.9704	651.82	98.32	EXISTING MONUMENT
C	539494.3519	1445826.8081	651.29	97.79	EXISTING MONUMENT
D	540469.4891	1444402.3532	649.39	95.89	PRELIMINARY MONUMENT
E	539787.9600	1444985.1000	654.25	100.75	PRELIMINARY MONUMENT
F	539381.8937	1445349.4457	650.67	97.17	EXISTING MONUMENT

REVISION			
2	DFT: JAC/B&V	DES/CHK: AGB,JDA/B&V	
	ENG: JDA/B&V	BM:	
	DPN/OU: T1928TS1/VSOH	FP: TOH1928	
	REVISED LEGEND. GRADED 138KV YARD. ADDED DRAINAGE SYSTEM AND TRENCH DRAINS. ADDED 138KV SUBSTATION FENCE AND GATE. ADDED NOTES AND REFERENCE. ADDED 345KV TRENCH DRAIN FOR RECORD.		
	DATE ISSUED: 09/19/18	ISSUE TYPE: FOR CONSTRUCTION	

REVISION			
1	DFT: SJS/B&V	DES/CHK: EML,GMJ/B&V	
	ENG: APB	BM:	
	DPN/OU: T1072TS1/VSOH	FP: TOH1072	
	REVISED ACCESS GATE TO 30'-0". REVISED DWG REFERENCES.		
	DATE ISSUED: 4/20/18	ISSUE TYPE: AB 262	

SEAL: JEREMY D ADAMEK E-83332 REGISTERED PROFESSIONAL ENGINEER STATE OF OHIO 19/Sep/2018

DRAFTED BY: JDL,SJS/B&V
DESIGNED/CHECKED BY: AMA,EML/B&V
ENGINEER: SJW/B&V,AMF,BJW
DETAIL PROJECT NO/OPERATING UNIT: T1072TS1/VSOH
RM/FUNDING PROJECT: /TOH1072
DATE ISSUED: 8/8/16

☐ PRELIMINARY ☐ APPROVAL
☐ AS BUILT
DATE _____
NAME _____

DUKE ENERGY.

GRA FILENAME: 84100gra1.dwg

TITLE: GRADING PLAN 138KV & 345KV SUBSTATION

LOCATION: GARVER SUBSTATION

SCALE:	SCALE FACTOR:	STA NO.	REV:	DWG NO:
1"=50'	1	75	2	84100-GRA1

09/19/18 14:43:37 KDU/B&V

Last Plot Date:9/19/2018 2:44 PM

Attachment C

Property Owner Notification Letter And Recipient List

Parcel Number	Owner	Mail Address	Mail City, State, Zip
Q6542059000002	AK STEEL CORP	9227 CENTRE POINTE DR	WEST CHESTER OH 45069 4822
Q6542059000103	NTE OHIO LLC	24 CATHEDRAL PL Suite 300	SAINT AUGUSTINE FL 32084
Q6542059000017	PENNSYLVANIA LINES LLC	110 FRANKLIN RD SE	ROANOKE VA 24042 0028
Q6542059000001	PRECISION STRIP INC	86 S OHIO ST P O BOX 10	MINSTER OH 45865
Q6542059000006	AK STEEL CORP	9227 CENTRE POINTE DR	WEST CHESTER OH 45069 4822
Q6542059000019	AK STEEL CORP	9227 CENTRE POINTE DR	WEST CHESTER OH 45069 4822
Q6542059000042	K P PROPERTIES OF OHIO LLC	11300 LONGWATER CHASE CT	FT MYERS FL 33908
Q6542059000025	PRECISION STRIP INC	86 S OHIO ST P O BOX 10	MINSTER OH 45865 9999
Q6542059000003	NTE OHIO LLC	24 CATHEDRAL PL Suite 300	SAINT AUGUSTINE FL 32084
Q6542060000019	AK STEEL CORP	9227 CENTRE POINTE DR	WEST CHESTER OH 45069 4822
Q6542059000004	NTE OHIO LLC	24 CATHEDRAL PL Suite 300	SAINT AUGUSTINE FL 32084
Q6542059000035	CITY OF MIDDLETOWN	1 DONHAM PLZ	MIDDLETOWN OH 45042 1901
Q6542060000003	AK STEEL CORP	9227 CENTRE POINTE DR	WEST CHESTER OH 45069 4822
Q6542059000007	A K ASSET MANAGEMENT CO	9227 CENTRE POINTE DR	WEST CHESTER OH 45069 4822
Q6542060000020	PRECISION STRIP INC	86 S OHIO ST P O BOX 10	MINSTER OH 45865 9999
Q6542059000036	COMPARTIR LLC	15435 NE 92ND ST	REDMOND WA 98052

Transmission – Public Engagement
EX552 | 315 Main Street
Cincinnati, OH 45202
duke-energy.com

January 25, 2019

Re: Important information about a Duke Energy reliability project in Butler County – Garver Substation expansion and new transmission line installation

Dear Property Owner:

Reliability is a responsibility that Duke Energy takes very seriously. To keep that commitment, we are upgrading the power transmission system in your community, which will provide continued reliability of your area's electric service.

Duke Energy will begin work this spring on expanding the Garver Substation, located at 3431 Cincinnati Dayton Road in Middletown, Ohio. The fence will be expanding on Duke Energy property to measure approximately 410 feet by 329 feet (see map enclosure). The expansion will accommodate equipment for the addition of three existing 138-kilovolt (kV) transmission lines into the substation to support the area's growing energy needs. The substation presently has two 345-kV transmission lines to support this industrial area.

Construction on this project will begin on March 4. The construction for the three existing 138-kV transmission lines will involve the replacement of a lattice tower and six wood utility poles with steel poles. Eleven additional steel poles will be installed to route the new transmission lines into the 138-kV section of the substation. The poles have a height of 60 to 115 feet above ground. The base of the poles increases in diameter according to pole height, which makes the poles stronger and more reliable.

As part of our energy reliability enhancement program, Duke Energy – like other utility companies around the nation – is utilizing steel poles as its new standard for transmission projects.

We expect to have all substation upgrades complete by December 2019.

Installing substation infrastructure is similar to a typical construction site, with numerous crews, trucks and equipment. T his construction may include:

Concrete work – Concrete footings and foundations will be poured. Expect to see large trucks with a concrete mixer in the right of way.

Steel erection and civil construction – The substation galvanized steel framework is installed. The steel supports electric control equipment and the transmission lines that connect the substation to the regional energy grid.

Equipment testing – The new equipment is extensively tested to make sure that the facility's operation will be safe and reliable for customers.

Energized and site restoration – Once the substation is energized, all disturbed or exposed areas outside the substation fence will be restored.

Post-construction operation – Most substations are not staffed once they're in operation. Technicians may make regular visits for routine maintenance and monitoring.

A new 1.2-mile 138-kV transmission line will connect from the Garver Substation to the AK Steel Substation, located at 1801 Crawford Street in Middletown (outlined in map enclosure). Pre-construction activities, including staking and vegetation clearing for the new transmission line, are expected to begin in spring, and construction is planned for summer 2019.

Construction for the new transmission line will include the installation of 22 steel transmission poles. The poles have a height of 60 to 105 feet above ground. The project also will include building approximately 600 feet of 7.2-kV distribution line to feed equipment at the AK Steel Substation. The completion of the line construction is expected in January 2020.

Generally, project neighbors can anticipate seeing skilled contractors and trade workers in the project area during daylight hours. Work zones may be established to provide safety for our crews and for the public. At times, a road may be blocked temporarily as we set up equipment. Drivers are advised to be cautious and slow down as they approach crews and their equipment.

Upon completion of the project, all construction materials and debris will be removed, and the right of way will be restored as closely as possible to its original condition.

Demand for energy has grown in Southwest Ohio, and Duke Energy is committed to providing dependable, cost-effective and reliable electric service to our customers. For additional questions, please call us toll-free at 888.827.5116, or email your questions and comments to MidwestTransmission@duke-energy.com.

Sincerely,

Chris Gruber
Duke Energy Project Manager

State Parcel Identification Number (PIN):

Every year, the Duke Energy Foundation funds more than $2 million in charitable grants, matching gifts and volunteer grants in Ohio and Kentucky, supporting the environment, communities and K-12 education.

Transmission – Public Engagement
EX552 | 315 Main Street
Cincinnati, OH 45202
duke-energy.com

January 29, 2019

Re: Important information about a Duke Energy reliability project in Butler County – Garver Substation expansion and new transmission line installation

Dear Property Owner:

Duke Energy Ohio, Inc. (Duke Energy) is proposing an electric transmission project in your area. This project will allow for the expansion of the Garver Substation, located at 3431 Cincinnati Dayton Road, in Middletown, Ohio. This project will provide space for equipment to route one new and three existing 138-kilovolt (kV) transmission lines into the substation to support the area's growing energy needs.

The fence will be expanding on Duke Energy property to measure approximately 410 feet by 329 feet. A map of the project area is included in this letter. Preconstruction activities including vegetation clearing for the substation expansion will begin this spring.

A Letter of Notification to construct, operate and maintain this facility is now pending before the Ohio Power Siting Board (OPSB) in Columbus, Ohio. Interested persons may participate in the process by filing comments in the docket, or by seeking permission to formally intervene in the case. You may also request notification of the filing documents in the case by signing up with the OPSB for electronic notice of filings, or by sending a letter to the OPSB to indicate your interest. The case may be found on the OPSB's website, identified as Case No. 19-0048-EL-BLN. The OPSB can be reached by email at **contactOPSB@puc.state.oh.us**, by phone 866.270.6772, or by mail addressed to: The Ohio Power Siting Board, 180 East Broad Street, Columbus, OH 43215.

A copy of the application is available for public inspection at the main office of Duke Energy Ohio, 139 E. Fourth Street, Cincinnati, Ohio 45202. It also is available on the Duke Energy Ohio website: **https://www.duke-energy.com/our-company/about-us/electric-transmission-projects**, and on the Ohio Power Siting Board's website: **www.opsb.ohio.gov.** Thank you for working with us as we move forward with this important project to meet your energy needs.

Sincerely,

Duke Energy Ohio, Inc.

Attachment D

Agency Coordination Letters

Ohio Department of Natural Resources

MIKE DEWINE, GOVERNOR MARY MERTZ, DIRECTOR

Office of Real Estate
Paul R. Baldridge, Chief
2045 Morse Road – Bldg. E-2
Columbus, OH 43229
Phone: (614) 265-6649
Fax: (614) 267-4764

January 25, 2019

Danielle Thompson
Cardno
11121 Canal road
Cincinnati, Ohio 45241

Re: 18-1317; Duke Energy F7581, F7582, F5689 - 138kV Garver Substation

Project: The proposed project involves the removal and replacement of approximately 0.49 miles of existing transmission line (3 lines total) as well as create approximately 0.59 miles of new transmission line.

Location: The proposed project is located in Middletown, Butler County, Ohio.

The Ohio Department of Natural Resources (ODNR) has completed a review of the above referenced project. These comments were generated by an inter-disciplinary review within the Department. These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the National Environmental Policy Act, the Coastal Zone Management Act, Ohio Revised Code and other applicable laws and regulations. These comments are also based on ODNR's experience as the state natural resource management agency and do not supersede or replace the regulatory authority of any local, state or federal agency nor relieve the applicant of the obligation to comply with any local, state or federal laws or regulations.

Natural Heritage Database: The Natural Heritage Database has no records at or within a one-mile radius of the project area.

A review of the Ohio Natural Heritage Database indicates there are no other records of state endangered or threatened plants or animals within the project area. There are also no records of state potentially threatened plants, special interest or species of concern animals, or any federally listed species. In addition, we are unaware of any unique ecological sites, geologic features, animal assemblages, scenic rivers, state wildlife areas, state nature preserves, state or national parks, state or national forests, national wildlife refuges, or other protected natural areas within the project area. The review was performed on the project area you specified in your request as well as an additional one-mile radius. Records searched date from 1980.

Please note that Ohio has not been completely surveyed and we rely on receiving information from many sources. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area. Although all types of plant communities have been surveyed, we only maintain records on the highest quality areas.

Fish and Wildlife: The Division of Wildlife (DOW) has the following comments.

The DOW recommends that impacts to streams, wetlands and other water resources be avoided and minimized to the fullest extent possible, and that best management practices be utilized to minimize erosion and sedimentation.

The project is within the range of the Indiana bat (*Myotis sodalis*), a state endangered and federally endangered species. The following species of trees have relatively high value as potential Indiana bat roost trees to include: shagbark hickory (*Carya ovata*), shellbark hickory (*Carya laciniosa*), bitternut hickory (*Carya cordiformis*), black ash (*Fraxinus nigra*), green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), shingle oak (*Quercus imbricaria*), northern red oak (*Quercus rubra*), slippery elm (*Ulmus rubra*), American elm (*Ulmus americana*), eastern cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), sassafras (*Sassafras albidum*), post oak (*Quercus stellata*), and white oak (*Quercus alba*). Indiana bat roost trees consists of trees that include dead and dying trees with exfoliating bark, crevices, or cavities in upland areas or riparian corridors and living trees with exfoliating bark, cavities, or hollow areas formed from broken branches or tops. However, Indiana bats are also dependent on the forest structure surrounding roost trees. If suitable habitat occurs within the project area, the DOW recommends trees be conserved. If suitable habitat occurs within the project area and trees must be cut, the DOW recommends cutting occur between October 1 and March 31. If suitable trees must be cut during the summer months, the DOW recommends a net survey be conducted between June 1 and August 15, prior to any cutting. Net surveys should incorporate either nine net nights per square 0.5 kilometer of project area, or four net nights per kilometer for linear projects. If no tree removal is proposed, this project is not likely to impact this species.

The project is within the range of the rayed bean (*Villosa fabalis*), a state endangered and federally endangered mussel, and the fawnsfoot (*Truncilla donaciformis*), a state threatened mussel. Due to the location, and that there is no in-water work proposed in a perennial stream, this project is not likely to impact these species.

The project is within the range of the Kirtland's snake (*Clonophis kirtlandii*), a state threatened species. This secretive species prefers wet fields and meadows. Due to the location and the type of habitat present at the project site, and within the vicinity of the project area, this project is not likely to impact this species.

The project is within the range of the cave salamander (*Eurycea lucifuga*), a state endangered species. Due to the location, the type of habitat present at the project site and within the vicinity of the project area, and the type of work proposed, this project is not likely to impact this species.

The project is within the range of the upland sandpiper (*Bartramia longicauda*), a state endangered bird. Nesting upland sandpipers utilize dry grasslands including native grasslands, seeded grasslands, grazed and ungrazed pasture, hayfields, and grasslands established through the Conservation Reserve Program (CRP). If this type of habitat will be impacted, construction should be avoided in this habitat during the species' nesting period of April 15 to July 31. If this type of habitat will not be impacted, this project is not likely to impact this species.

The project is within the range of the Sloan's crayfish (*Orconectes sloanii*), a state threatened species. Due to the location, and that there is no in-water work proposed, this project is not likely to impact this species.

Due to the potential of impacts to federally listed species, as well as to state listed species, we recommend that this project be coordinated with the U.S. Fish & Wildlife Service.

Water Resources: The Division of Water Resources has the following comment.

The local floodplain administrator should be contacted concerning the possible need for any floodplain permits or approvals for this project. Your local floodplain administrator contact information can be found at the website below.

http://water.ohiodnr.gov/portals/soilwater/pdf/floodplain/Floodplain%20Manager%20Community%20Contact%20List_8_16.pdf

ODNR appreciates the opportunity to provide these comments. Please contact Sarah Tebbe, Environmental Specialist, at (614) 265-6397 or Sarah.Tebbe@dnr.state.oh.us if you have questions about these comments or need additional information.

John Kessler
Environmental Services Administrator

Cori Jansing

From: susan_zimmermann@fws.gov on behalf of Ohio, FW3 <ohio@fws.gov>
Sent: Monday, November 19, 2018 12:00 PM
To: Danielle Thompson
Cc: nathan.reardon@dnr.state.oh.us; kate.parsons@dnr.state.oh.us
Subject: Duke Energy F581/F7582/F5689 - 138 kV Garver Substation, Cincinnati, Hamilton Co.

UNITED STATES DEPARTMENT OF THE INTERIOR
U.S. Fish and Wildlife Service
Ecological Services Office
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993 / Fax (614) 416-8994

TAILS# 03E15000-2019-TA-0297

Dear Ms. Thompson,

We have received your recent correspondence requesting information about the subject proposal. There are no federal wilderness areas, wildlife refuges or designated critical habitat within the vicinity of the project area. The following comments and recommendations will assist you in fulfilling the requirements for consultation under section 7 of the Endangered Species Act of 1973, as amended (ESA).

The U.S. Fish and Wildlife Service (Service) recommends that proposed developments avoid and minimize water quality impacts and impacts to high quality fish and wildlife habitat (e.g., forests, streams, wetlands). Additionally, natural buffers around streams and wetlands should be preserved to enhance beneficial functions. If streams or wetlands will be impacted, the Corps of Engineers should be contacted to determine whether a Clean Water Act section 404 permit is required. Best management practices should be used to minimize erosion, especially on slopes. All disturbed areas should be mulched and revegetated with native plant species. Prevention of non-native, invasive plant establishment is critical in maintaining high quality habitats.

FEDERALLY LISTED SPECIES COMMENTS: All projects in the State of Ohio lie within the range of the federally endangered **Indiana bat** (*Myotis sodalis*) and the federally threatened **northern long-eared bat** (*Myotis septentrionalis*). In Ohio, presence of the Indiana bat and northern long-eared bat is assumed wherever suitable habitat occurs unless a presence/absence survey has been performed to document absence. Suitable summer habitat for Indiana bats and northern long-eared bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥3 inches diameter at breast height (dbh) that have any exfoliating bark, cracks, crevices, hollows and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat. Northern long-eared bats have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat. In the winter, Indiana bats and northern long-eared bats hibernate in caves and abandoned mines.

Should the proposed site contain trees ≥3 inches dbh, we recommend that trees be saved wherever possible. If any caves or abandoned mines may be disturbed, further coordination with this office is requested to determine if fall or spring portal surveys are warranted. If no caves or abandoned mines are present and trees ≥3 inches dbh cannot be avoided, we recommend that removal of any trees ≥3 inches dbh only occur between October 1 and March 31. Seasonal clearing is being recommended to avoid adverse effects to Indiana bats and northern long-eared bats. While incidental take of northern long-eared bats from most tree clearing is exempted by a 4(d) rule (see http://www.fws.gov/midwest/endangered/mammals/nleb/index.html), incidental take of Indiana bats is still prohibited without a project-specific exemption. Thus, seasonal clearing is recommended where Indiana bats are assumed present.

If implementation of this seasonal tree cutting recommendation is not possible, summer surveys may be conducted to document the presence or probable absence of Indiana bats within the project area during the summer. If a summer survey documents probable absence of Indiana bats, the 4(d) rule for the northern long-eared bat could be applied. Surveys must be conducted by an approved surveyor and be designed and conducted in coordination with the Endangered Species Coordinator for this office. Surveyors must have a valid federal permit. Please note that in Ohio summer mist net surveys may only be conducted between June 1 and August 15.

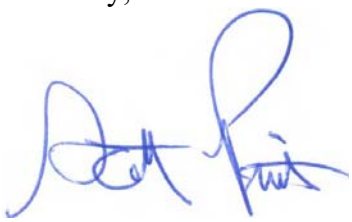
If there is a federal nexus for the project (e.g., federal funding provided, federal permits required to construct), no tree clearing should occur on any portion of the project area until consultation under section 7 of the ESA, between the Service and the federal action agency, is completed. We recommend that the federal action agency submit a determination of effects to this office, relative to the Indiana bat and northern long-eared bat, for our review and concurrence.

Due to the project type, size, and location, we do not anticipate adverse effects to any other federally endangered, threatened, proposed, or candidate species. Should the project design change, or during the term of this action, additional information on listed or proposed species or their critical habitat become available, or if new information reveals effects of the action that were not previously considered, consultation with the Service should be initiated to assess any potential impacts.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the ESA, and are consistent with the intent of the National Environmental Policy Act of 1969 and the Service's Mitigation Policy. This letter provides technical assistance only and does not serve as a completed section 7 consultation document. We recommend that the project be coordinated with the Ohio Department of Natural Resources due to the potential for the project to affect state listed species and/or state lands. Contact John Kessler, Environmental Services Administrator, at (614) 265-6621 or at john.kessler@dnr.state.oh.us.

If you have questions, or if we can be of further assistance in this matter, please contact our office at (614) 416-8993 or ohio@fws.gov.

Sincerely,



Scott Pruitt
Acting Field Office Supervisor

cc: Nathan Reardon, ODNR-DOW
Kate Parsons, ODNR-DOW

January 14, 2019

Cardno

11121 Canal Road
Cincinnati, Ohio 45241
USA

Phone 513 489 2402
Fax 513 489 2404

Mr. John Kessler
Ohio Department of Natural Resources
Office of Real Estate
2045 Morse Road, Building E-2
Columbus, OH 43230

RE: Duke Energy T1072TS1 Garver Substation New Build
Rare, Threatened, and Endangered Species Consultation
Middletown, Butler County, Ohio

Dear Mr. Kessler:

Duke Energy (Duke) is proposing to build a new substation facility within the previously constructed laydown area for the now built Middletown Energy Center Power Plant (MEC), encompassing a total study corridor of approximately 21.09 acres. A field investigation of the study corridor was conducted on December 12, 2018.

The project study area is located in Middletown, Butler County, Ohio. The location of the proposed Project is depicted on the attached Cincinnati East and Cincinnati West (OH) USGS 7.5-minute topographic map excerpt (Figure 1).

Cardno was contracted by Duke to perform a boundary delineation and assessment of regulated waters, including wetlands, streams, ditches, and/or other federally regulated open waters, rare, threatened, endangered, and special habitat located within the proposed 1.18 miles of existing 100-ft wide ROW. The project study area was dominated by fallow field, scrub shrub, secondary growth forest, forested wetland, and emergent wetland vegetation assemblages. Cardno botanists and ecologists conducted a habitat assessment to identify the presence of regulated waters, and potential Indiana bat (*Myotis sodalis*), Northern long-eared bat (*Myotis septentrionalis*), and Running Buffalo Clover *(Trifolium stoloniferum)* habitat.

In accordance with the ODNR-DOW Environmental Review coordination requirements; the Project study area and its habitat characteristics has been summarized for you below.

1. Location data including latitude and longitude of the project area, site address, and county.

3439 Cincinnati Dayton Rd, Middletown (Butler County), OH 45044
Initiates and Terminates: 39.46755, -84.35276

2. A detailed project description, including layout of any new construction.

The proposed Duke Energy T1072TS1 Garver Substation New Build Project is necessary in order to maintain the integrity of existing Duke structures to ensure adequate power supplies to current and future utility customers in the area. The project is also needed to ensure safety within the existing easements and remain in compliance with current transmission line standards. The Garver Substation will be within the MEC.

Construction will be accomplished largely through the use of bucket trucks with truck-mounted augers for structure installation and other construction vehicles transporting cable spools to install the transmission cable within the substation. Excavation will be restricted to the locations where electric transmission poles will occur. Earth moving activities are anticipated to be minimal. The extent of access disturbance can vary widely dependent upon many factors, including density and type of surface, vegetative cover, weather conditions, and the type of vehicles moving over the area.

Project construction is expected to begin in April 2019.

3. A detailed description of onsite habitat, including the size, location, and quality of streams, wetlands, forested areas, and other natural areas, and proposed impacts.

The proposed Duke Energy T1072TS1 Garver Substation New Build Project is linear in scope and will take place entirely within the MEC (Figure 1 & 2). There are no regulated waters identified within the project's Study Area. Specific attention was given to the presence of habitat suitable for federally endangered and threatened species – specifically, the Indiana bat (*Myotis sodalis),* the Northern Long-Eared bat (*Myotis septentrionalis),* and Running Buffalo Clover *(Trifolium stoloniferum).* To evaluate the potential habitat for rare, threatened, and endangered species a general site reconnaissance of the project study area was performed by Cardno botanists and ecologists. The result of these habitat assessments can be found below.

Impervious Surfaces
The Study Area is within the MEC which is composed of impervious surfaces. Although a formal study was not part of this scope, there was no potential habitat for listed species identified within this habitat.

4. Proposed impacts (i.e. in-water work or tree clearing)

No in-water work or tree clearing will take place. Excavation will be restricted to the locations, within the MEC, where electric transmission poles will occur.

5. Proposed Best Management Practices

Best management practices will be followed for all potential stormwater impacts or runoff areas. These will include the use of fiber roll to collect any runoff/sediment. A Storm Water Pollution Prevention Plan (SWPPP) will be prepared prior to project construction, and if needed, an NPDES permit will also be obtained.

Conclusion

Based on the physical site characteristics, the site does not contain any habitat for the federally endangered Indiana and NLE bat based on the project study area's composition and intensity of surrounding land use.

We are requesting a review by your office and a written response regarding effects on state listed threatened and/or endangered species and their critical habitat within the vicinity of the project area. Enclosed for your review are the project location map, aerial map, proposed site plan, and GIS Shapefiles.

If you have any questions concerning this request or would like additional information, please do not hesitate to contact me at (440) 343-1148 or Kaitlin.Hillier@Cardno.com.

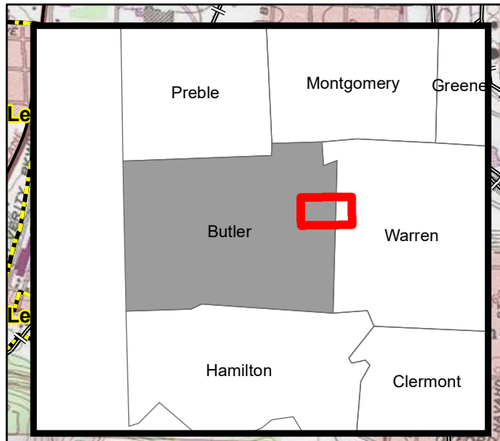
Sincerely,

Kaitlin Hillier
Staff Scientist for Cardno, Inc.

Enc: USGS map, Aerial Map, Site Plans, GIS Shapefile

Attachments

USGS Map
Aerial Location Map
Site Plans



Middletown

GARVER SUBSTATION PROJECT AREA

GARVER SUBSTATION

BUTLER COUNTY

WARREN COUNTY

Monroe

Lemon Twp.

PROJECT LOCATION

BUTLER COUNTY, OHIO

REFERENCE: USGS 7.5' TOPOGRAPHIC QUADRANGLE: MONROE, OHIO. OBTAINED VIA ESRI USA TOPO, NATIONAL GEOGRAPHIC TOPO, AND USGS, ACCESSED 01/2017.

N

0 1,000 2,000 4,000 Feet

Existing Facility
AOI
Interstate
State Highway
US Highway
Railroad
Municipal Boundary
County Boundary

DUKE ENERGY

Cardno

FIGURE 1
LINE ENVIRONMENTAL ASSESSMENT
GARVER SUBSTATION 138 kV YARD
DUKE ENERGY
PROJECT VICINITY MAP

DRAWN BY: DKT DATE: 1/14/2019
CHECKED: CAJ APPROVED: CAJ

R:\Projects\15\156\156720M_DukeEnergy9193\M78_SOW38_Garver Distribution Lines_GIS2SAVE\GIS\MXD\LEA Garver Subst Distr Lines\M99_GarverSubstDistrLines_F1_LEA_Project Vicinity Map.mxd

PROJECT LOCATION

BUTLER COUNTY, OHIO

REFERENCE:
USGS 7.5' TOPOGRAPHIC QUADRANGLE: MONROE, OHIO. OBTAINED VIA ESRI USA TOPO, NATIONAL GEOGRAPHIC TOPO, AND USGS, ACCESSED 10/2018

- Existing Facility
- AOI
- Interstate
- County Boundary
- Railroad
- Local Road
- State Highway
- US Highway

DUKE ENERGY®

Cardno

0 100 200 Feet

LINE ENVIRONMENTAL ASSESSMENT
GARVER SUBSTATION 138 kV YARD
DUKE ENERGY
AERIAL

DRAWN BY: DKT
CHECKED: DKT
DATE: 1/14/2019
APPROVED: MWW

R:\Projects\15\156\156720M_DukeEnergy9193\M78_SOW38_Garver Distribution Lines_GIS2SAVE\GIS\MXD\LEA Garver Subst Distr Lines\M99_GarverSubstDistrLines_F0_LEA_AERIAL.mxd

LEGEND:

- 620 — CONTOUR (EXISTING)
- 620 — CONTOUR (REGRADED)
- 620 — CONTOUR (NEW)
- SUBSTATION FENCE (SPEC. SECTION 32 01 00)
- EXISTING SWITCHYARD FENCE
- BASELINE
- B.L.M. — PERMANENT BASELINE MONUMENT
- PROPERTY LINE
- EDGE OF PAVEMENT
- G — GAS PIPE
- ST — STROMWATER PIPE
- OE — OVERHEAD ELECTRIC LINE
- W — WATER PIPE
- BENCH MARK "2"
- UNDERGROUND UTILITY EASEMENT

NOTES & SPECIFICATIONS:

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2. SOIL BORINGS PERFORMED BY: TTL ASSOCIATES, INC.
   1915 NORTH 12TH STREET
   TOLEDO, OHIO 43604
   PROJECT: T1072TS1
   DATED: MAY 29, 2014
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10. NORTHING AND EASTING COORDINATES ARE BASED OFF THE OHIO SOUTH STATE PLANE COORDINATE SYSTEM.
11. VERTICAL ELEVATION ARE BASED OFF OF PLANT DATUM. TO OBTAIN PLANT DATUM ELEVATION, SUBTRACT 553.5 FEET FROM THE NAVD88 ELEVATION.
12. ALL SIDE SLOPES SHALL BE 3:1 UNLESS NOTED OTHERWISE. "2"

REFERENCES:

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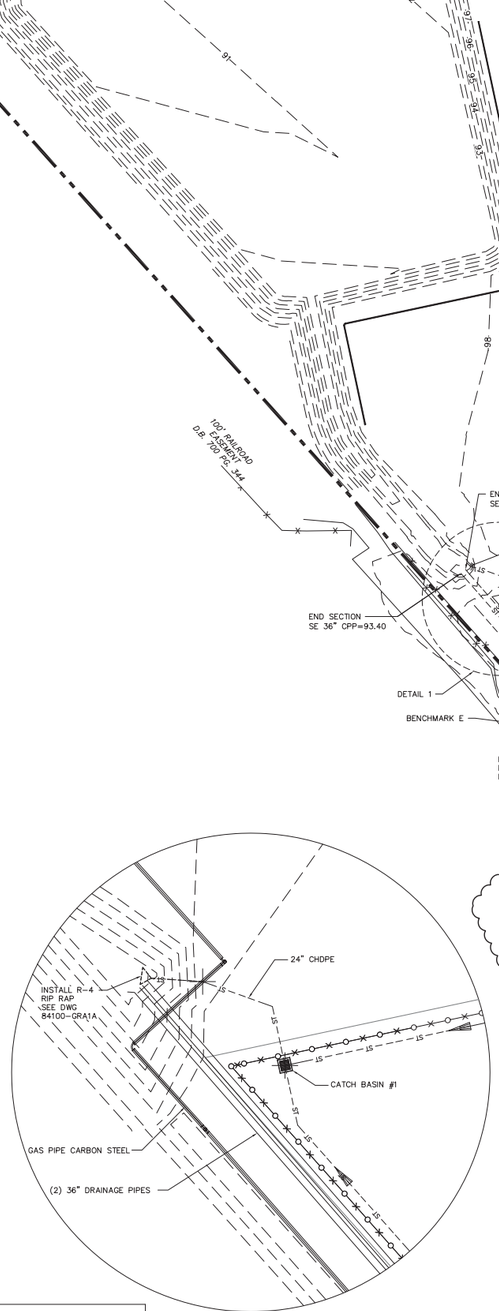
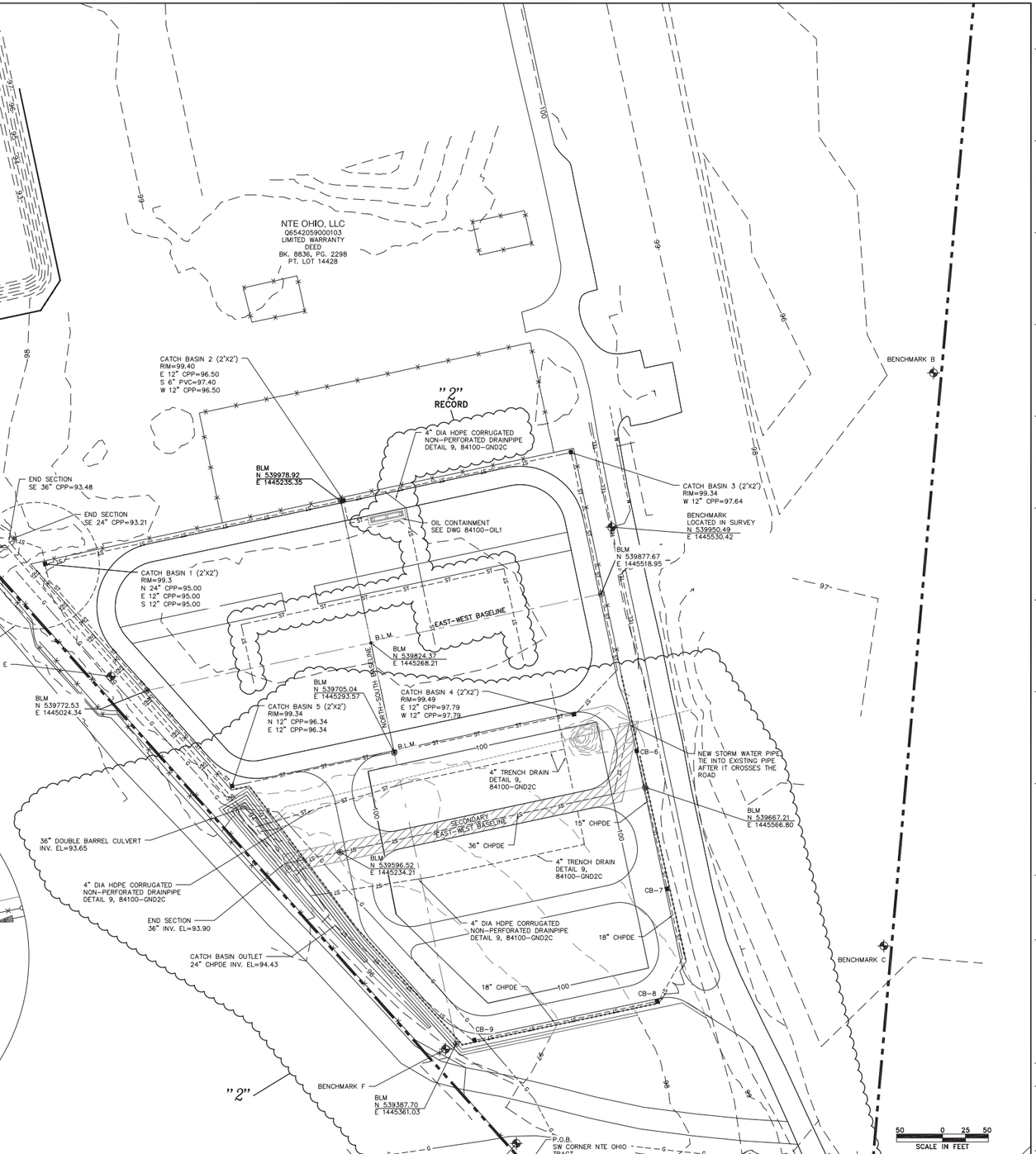
84100-CBL3	TRENCH PLAN OF 345KV YARD
84100-FAB2	STEEL FABRICATION PLAN OF 345KV YARD
84100-FDN2	FOUNDATION PLAN OF 345KV YARD
84100-LOC1	SITE LOCATION PLAN OF 138KV & 345KV SUBSTATION
84100-SEL1	STRUCTURAL ELECTRICAL PLAN OF 138KV & 345KV YARD
84100-GRA1A	GRADING DETAILS OF 138KV & 345KV SUBSTATION
84100-GRA1B	EROSION AND SEDIMENT CONTROL PLAN 138KV SUBSTATION "2"
84100-GRA2	FENCE AND DRIVE PLAN OF 138KV & 345KV SUBSTATION
84100-GRA2A	FENCE DETAILS SHEET 1
84100-GRA2B	FENCE DETAILS SHEET 2
84100-OIL2	OIL CONTAINMENT PLAN OF 345KV SUBSTATION



DETAIL 1
SCALE: NTS



EXISTING BENCHMARK MONUMENTS					
ID NO.	STATE PLANE (NOTE 10) NORTH	STATE PLANE (NOTE 10) EAST	NAVD 88 ELEVATION	PLANT DATUM ELEVATION (NOTE 11)	REMARKS
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B	540118.4942	1445880.9704	651.82	98.32	EXISTING MONUMENT
C	539494.3519	1445826.8081	651.29	97.79	EXISTING MONUMENT
D	540469.4891	1444402.3532	649.39	95.89	PRELIMINARY MONUMENT
E	539787.9600	1444985.1000	654.25	100.75	PRELIMINARY MONUMENT
F	539381.8937	1445349.4457	650.67	97.17	EXISTING MONUMENT

REVISION			
2	DFT: JAC/B&V	DES/CHK: AGB,JDA/B&V	
	ENG: JDA/B&V	BM:	
	DPN/OU: T1928TS1/VSOH	FP: TOH1928	
	REVISED LEGEND. GRADED 138KV YARD. ADDED DRAINAGE SYSTEM AND TRENCH DRAINS. ADDED 138KV SUBSTATION FENCE AND GATE. ADDED NOTES AND REFERENCE. ADDED 345KV TRENCH DRAIN FOR RECORD.		
	DATE ISSUED: 09/19/18	ISSUE TYPE: FOR CONSTRUCTION	

REVISION			
1	DFT: SJS/B&V	DES/CHK: EML,GMJ/B&V	
	ENG: APB	BM:	
	DPN/OU: T1072TS1/VSOH	FP: TOH1072	
	REVISED ACCESS GATE TO 30'-0". REVISED DWG REFERENCES.		
	DATE ISSUED: 4/20/18	ISSUE TYPE: AB 262	

SEAL: JEREMY D ADAMEK E-83332 REGISTERED PROFESSIONAL ENGINEER STATE OF OHIO 19/Sep/2018

DRAFTED BY: JDL,SJS/B&V
DESIGNED/CHECKED BY: AMA,EML/B&V
ENGINEER: SJW/B&V,AMF,BJW
DETAIL PROJECT NO/OPERATING UNIT: T1072TS1/VSOH
RM/FUNDING PROJECT: /TOH1072
DATE ISSUED: 8/8/16

☐ PRELIMINARY ☐ APPROVAL
☐ AS BUILT
DATE _____
NAME _____

DUKE ENERGY.

GRA FILENAME: 84100gra1.dwg

TITLE: GRADING PLAN 138KV & 345KV SUBSTATION

LOCATION: GARVER SUBSTATION

SCALE:	SCALE FACTOR:	STA NO.	REV:	DWG NO:
1"=50'	1	75	2	84100-GRA1

09/19/18 14:43:37 KDU/B&V

Last Plot Date:9/19/2018 2:44 PM

January 14, 2019

Dan Everson
Field Office Supervisor
U.S. Fish and Wildlife Service
4625 Morse Rd Suite 104
Columbus, OH, 43230

Cardno

11121 Canal Road
Cincinnati, Ohio 45241
USA

Phone 513 489 2402
Fax 513 489 2404

www.cardno.com

RE: Duke Energy T1072TS1 Garver Substation New Build
Threatened and Endangered Species Consultation
Middletown, Butler County, Ohio
(Lat. 39.46755; Long. -84.35276)

Dear Mr. Everson:

Duke Energy (Duke) is proposing to build a new substation facility within the previously constructed laydown area for the now built Middletown Energy Center Power Plant (MEC), encompassing a total study corridor of approximately 21.09 acres. A field investigation of the study corridor was conducted on December 12, 2018.

The project study area is located in Middletown, Butler County, Ohio. The location of the proposed Project is depicted on the attached Cincinnati East and Cincinnati West (OH) USGS 7.5-minute topographic map excerpt (Figure 1).

Cardno was contracted by Duke to perform a boundary delineation and assessment of regulated waters, including wetlands, streams, ditches, and/or other federally regulated open waters, rare, threatened, endangered, and special habitat located within the proposed 1.18 miles of existing 100-ft wide ROW. The project study area was dominated by fallow field, scrub shrub, secondary growth forest, forested wetland, and emergent wetland vegetation assemblages. Cardno botanists and ecologists conducted a habitat assessment to identify the presence of regulated waters, and potential Indiana bat (*Myotis sodalis*), Northern long-eared bat (*Myotis septentrionalis*), and Running Buffalo Clover *(Trifolium stoloniferum)* habitat.

In accordance with the USFWS Section 7 ESA coordination requirements the Project study area and its habitat characteristics has been summarized for you below.

1. Location data including latitude and longitude of the project area, site address, and county.

3439 Cincinnati Dayton Rd, Middletown (Butler County), OH 45044
Initiates and Terminates: 39.46755, -84.35276

2. A detailed project description, including layout of any new construction.

The proposed Duke Energy T1072TS1 Garver Substation New Build Project is necessary in order to maintain the integrity of existing Duke structures to ensure adequate power supplies to current and future utility customers in the area. The project is also needed to ensure safety within the existing easements and remain in compliance with current transmission line standards. The Garver Substation will be within the MEC.

Construction will be accomplished largely through the use of bucket trucks with truck-mounted augers for structure installation and other construction vehicles transporting cable spools to install the transmission cable within the substation. Excavation will be restricted to the locations where electric transmission poles will occur. Earth moving activities are anticipated to be minimal. The extent of access disturbance can vary widely dependent upon many factors, including density and type of surface, vegetative cover, weather conditions, and the type of vehicles moving over the area.

Project construction is expected to begin in April 2019.

3. A detailed description of onsite habitat, including the size, location, and quality of streams, wetlands, forested areas, and other natural areas, and proposed impacts.

The proposed Duke Energy T1072TS1 Garver Substation New Build Project is linear in scope and will take place entirely within the MEC (Figure 1 & 2). There are no regulated waters identified within the project's Study Area. Specific attention was given to the presence of habitat suitable for federally endangered and threatened species – specifically, the Indiana bat (*Myotis sodalis),* the Northern Long-Eared bat (*Myotis septentrionalis),* and Running Buffalo Clover *(Trifolium stoloniferum).* To evaluate the potential habitat for rare, threatened, and endangered species a general site reconnaissance of the project study area was performed by Cardno botanists and ecologists. The result of these habitat assessments can be found below.

<u>Impervious Surfaces</u>
The Study Area is within the MEC which is composed of impervious surfaces. Although a formal study was not part of this scope, there was no potential habitat for listed species identified within this habitat.

4. A description of the forested habitat onsite, including type of forest, and presence of dead trees, split branches or trunks, and exfoliating bark, and proposed impacts.

There is no forested habitat within the Study Area.

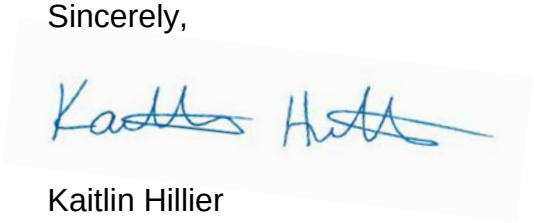
5. Conclusion

Based on the physical site characteristics, the site does not contain any habitat for the federally endangered Indiana and Northern Long Eared bat based on the Study Area's composition and intensity of surrounding land use.

We are requesting a review by your office and a written response regarding effects on federally listed threatened and/or endangered species and their critical habitat within the vicinity of the project area. Enclosed for your review are the project location map, aerial map, proposed site plan, and GIS Shapefile.

If you have any questions concerning this request or would like additional information, please do not hesitate to contact me at (440) 343-1148 or Kaitlin.Hillier@Cardno.com.

Sincerely,

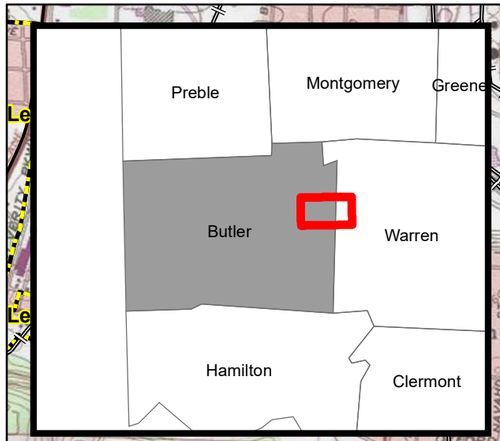


Kaitlin Hillier
Staff Scientist
for Cardno, Inc.

Enc: USGS map, Aerial Map, Site Plans

ATTACHMENTS:

PROJECT LOCATION MAP
PROJECT AERIAL MAP
SITE PLANS



Middletown

GARVER SUBSTATION PROJECT AREA

GARVER SUBSTATION

BUTLER COUNTY

WARREN COUNTY

Monroe

Lemon Twp.

PROJECT LOCATION

BUTLER COUNTY, OHIO

REFERENCE: USGS 7.5' TOPOGRAPHIC QUADRANGLE: MONROE, OHIO. OBTAINED VIA ESRI USA TOPO, NATIONAL GEOGRAPHIC TOPO, AND USGS, ACCESSED 01/2017.

N

0 1,000 2,000 4,000 Feet

Existing Facility
AOI
Interstate
State Highway
US Highway
Railroad
Municipal Boundary
County Boundary

DUKE ENERGY

Cardno

FIGURE 1
LINE ENVIRONMENTAL ASSESSMENT
GARVER SUBSTATION 138 kV YARD
DUKE ENERGY
PROJECT VICINITY MAP

DRAWN BY: DKT DATE: 1/14/2019
CHECKED: CAJ APPROVED: CAJ

R:\Projects\15\156\156720M_DukeEnergy9193\M78_SOW38_Garver Distribution Lines_GIS2SAVE\GIS\MXD\LEA Garver Subst Distr Lines\M99_GarverSubstDistrLines_F1_LEA_Project Vicinity Map.mxd

PROJECT LOCATION

BUTLER COUNTY, OHIO

REFERENCE:
USGS 7.5' TOPOGRAPHIC QUADRANGLE: MONROE, OHIO. OBTAINED VIA ESRI USA TOPO, NATIONAL GEOGRAPHIC TOPO, AND USGS, ACCESSED 10/2018

- Existing Facility
- AOI
- Interstate
- County Boundary
- Railroad
- Local Road
- State Highway
- US Highway

DUKE ENERGY®

Cardno

0 100 200 Feet

LINE ENVIRONMENTAL ASSESSMENT
GARVER SUBSTATION 138 kV YARD
DUKE ENERGY
AERIAL

DRAWN BY: DKT
CHECKED: DKT
DATE: 1/14/2019
APPROVED: MWW

R:\Projects\15\156\156720M_DukeEnergy9193\M78_SOW38_Garver Distribution Lines_GIS2SAVE\GIS\MXD\LEA Garver Subst Distr Lines\M99_GarverSubstDistrLines_F0_LEA_AERIAL.mxd

LEGEND:

- 620 — CONTOUR (EXISTING)
- 620 — CONTOUR (REGRADED)
- 620 — CONTOUR (NEW)
- SUBSTATION FENCE (SPEC. SECTION 32 01 00)
- EXISTING SWITCHYARD FENCE
- BASELINE
- B.L.M. — PERMANENT BASELINE MONUMENT
- PROPERTY LINE
- EDGE OF PAVEMENT
- G — GAS PIPE
- ST — STROMWATER PIPE
- OE — OVERHEAD ELECTRIC LINE
- W — WATER PIPE
- BENCH MARK "2"
- UNDERGROUND UTILITY EASEMENT

NOTES & SPECIFICATIONS:

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   1915 NORTH 12TH STREET
   TOLEDO, OHIO 43604
   PROJECT: T1072TS1
   DATED: MAY 29, 2014
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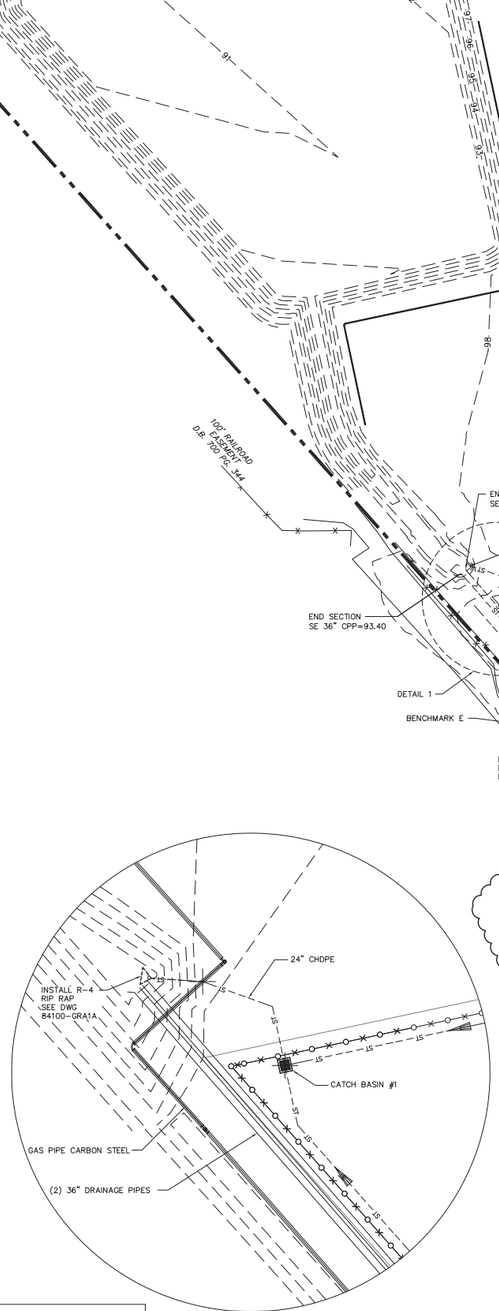
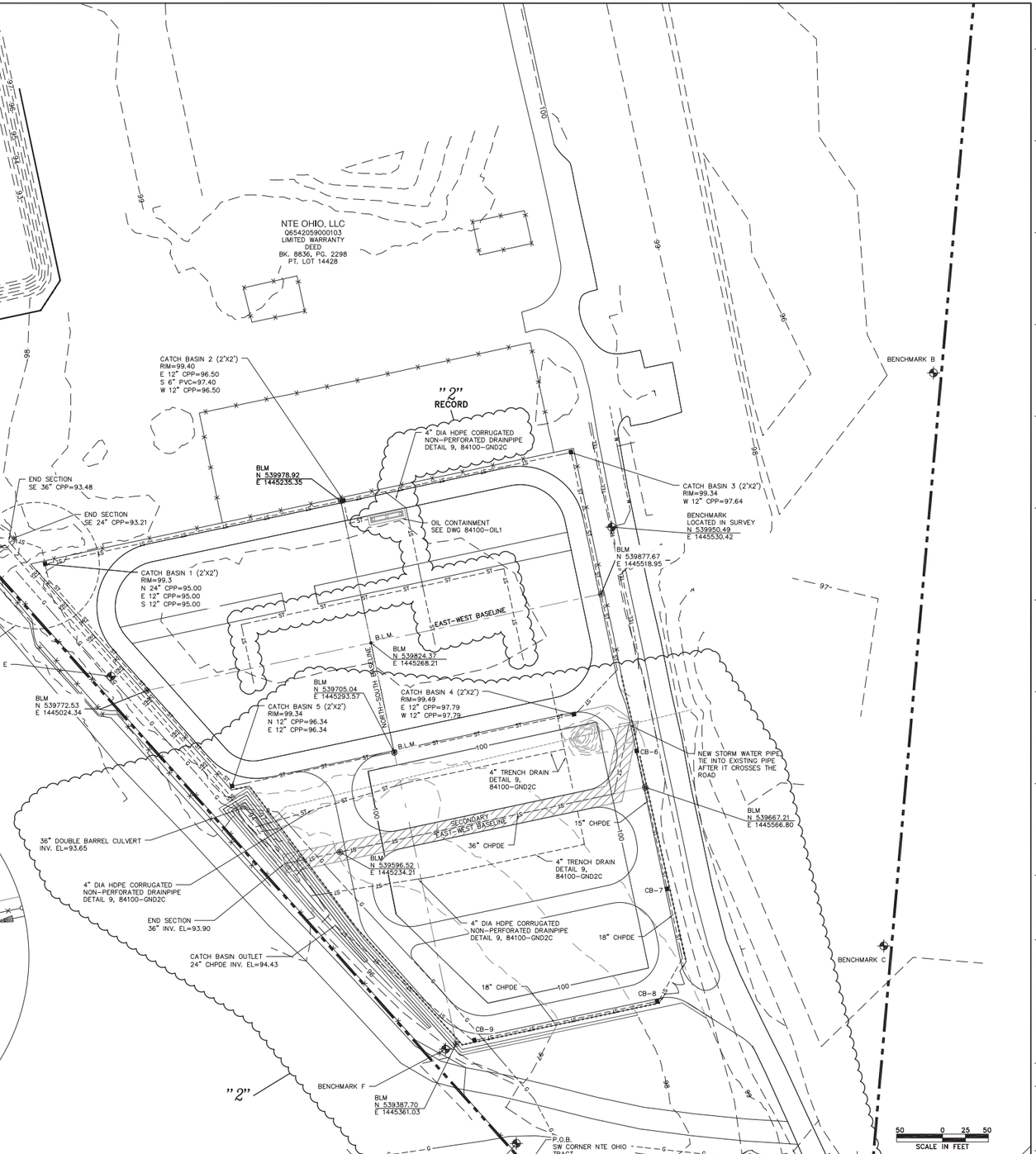
84100-GRA1A	GRADING DETAILS OF 138KV & 345KV SUBSTATION
84100-GRA1B	EROSION AND SEDIMENT CONTROL PLAN 138KV SUBSTATION "2"
84100-GRA2	FENCE AND DRIVE PLAN OF 138KV & 345KV SUBSTATION
84100-GRA2A	FENCE DETAILS SHEET 1
84100-GRA2B	FENCE DETAILS SHEET 2
84100-OIL2	OIL CONTAINMENT PLAN OF 345KV SUBSTATION



DETAIL 1
SCALE: NTS



EXISTING BENCHMARK MONUMENTS					
ID NO.	STATE PLANE (NOTE 10) NORTH	STATE PLANE (NOTE 10) EAST	NAVD 88 ELEVATION	PLANT DATUM ELEVATION (NOTE 11)	REMARKS
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F	539381.8937	1445349.4457	650.67	97.17	EXISTING MONUMENT

REVISION			
2	DFT: JAC/B&V	DES/CHK: AGB,JDA/B&V	
	ENG: JDA/B&V	BM:	
	DPN/OU: T1928TS1/VSOH	FP: TOH1928	
	REVISED LEGEND. GRADED 138KV YARD. ADDED DRAINAGE SYSTEM AND TRENCH DRAINS. ADDED 138KV SUBSTATION FENCE AND GATE. ADDED NOTES AND REFERENCE. ADDED 345KV TRENCH DRAIN FOR RECORD.		
	DATE ISSUED: 09/19/18	ISSUE TYPE: FOR CONSTRUCTION	

REVISION			
1	DFT: SJS/B&V	DES/CHK: EML,GMJ/B&V	
	ENG: APB	BM:	
	DPN/OU: T1072TS1/VSOH	FP: TOH1072	
	REVISED ACCESS GATE TO 30'-0". REVISED DWG REFERENCES.		
	DATE ISSUED: 4/20/18	ISSUE TYPE: AB 262	

SEAL: JEREMY D ADAMEK E-83332 REGISTERED PROFESSIONAL ENGINEER STATE OF OHIO 19/Sep/2018

DRAFTED BY: JDL,SJS/B&V
DESIGNED/CHECKED BY: AMA,EML/B&V
ENGINEER: SJW/B&V,AMF,BJW
DETAIL PROJECT NO/OPERATING UNIT: T1072TS1/VSOH
RM/FUNDING PROJECT: /TOH1072
DATE ISSUED: 8/8/16

☐ PRELIMINARY ☐ APPROVAL
☐ AS BUILT
DATE _____
NAME _____

DUKE ENERGY.

GRA FILENAME: 84100gra1.dwg

TITLE: GRADING PLAN 138KV & 345KV SUBSTATION

LOCATION: GARVER SUBSTATION

SCALE:	SCALE FACTOR:	STA NO.	REV:	DWG NO:
1"=50'	1	75	2	84100-GRA1

09/19/18 14:43:37 KDU/B&V

Last Plot Date:9/19/2018 2:44 PM

Attachment E

Regulated Waters Determination Letter

January 14, 2019

Cardno

11121 Canal Road
Cincinnati, Ohio 45241
USA

Phone 513 489 2402
Fax 513 489 2404

www.cardno.com

Kate Keck
Duke Energy
139 E. 4th Street
Cincinnati, OH 45202

Subject: ***Regulated Waters Determination***
Duke Energy Ohio T1072TS1 Garver Substation Expansion
Middletown, Butler County, OH

Dear Ms Keck:

Cardno has completed a site visit (regulated waters determination) in support of the Duke Energy T1072TS1 Garver Substation Expansion Project (herein "the Project") located off Cincinnati Dayton Road in Middletown, Butler County, Ohio.

Methods and Summary

Cardno visited the proposed new T1072TS1 Garver Substation Expansion site on December 12, 2018. Cardno performed an abbreviated ecological survey (regulated waters reconnaissance) and rapid assessment regarding the presence/absence of potentially jurisdictional resources and to assess whether the existing site contains wetlands, streams or other potentially regulated 'Waters of the U.S.'. No streams, open water bodies, or wetlands were identified on the Project site during the site investigation.

Summary of Findings

Cardno inspected the proposed T1072TS1 Garver Substation Expansion Project study area on December 12, 2018. The study area included approximately 14.24 acres, predominately comprised of impervious surfaces.

Recommendations

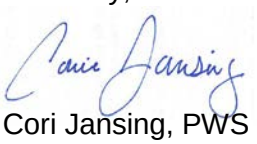
No streams, open water bodies, or wetlands were identified at the Project site during the site visit.

While this report represents our best professional judgment based on our knowledge and experience, it is important to note that the Huntington District of the U.S. Army Corps of Engineers has final discretionary authority over all jurisdictional determinations of 'waters

of the U.S.' including all wetlands and streams in this region. This correspondence shall be considered confidential for internal and site planning purposes only.

Thank you for this opportunity to provide regulated waters consultation in support of this Project. Please contact me if you have any comments or questions regarding these findings or recommendations.

Sincerely,



Cori Jansing, PWS
Regulatory Specialist, Botanist
Cardno, Inc.
Phone: 513-833-6392
Email: cori.jansing@cardno.com

Exhibit 1: Figures

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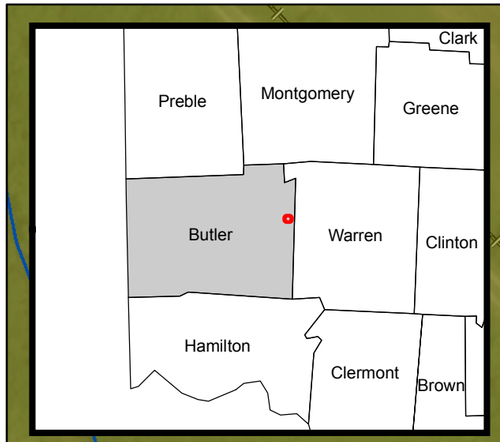


GARVER SUBSTATION

BUTLER COUNTY

Shaker Creek

Shaker Creek

PROJECT LOCATION

BUTLER COUNTY, OHIO

REFERENCE:
USGS 7.5' TOPOGRAPHIC QUADRANGLE: MONROE, OHIO. OBTAINED VIA ESRI USA TOPO, NATIONAL GEOGRAPHIC TOPO, AND USGS, ACCESSED 10/2018

Project Area
Existing Facility
Parcels
Municipal Boundary
County Boundary
Railroad
Local Road
Interstate
NWI Wetland
NHD Flowline
100Yr Floodplain
State Highway
US Highway

DUKE ENERGY.
Cardno

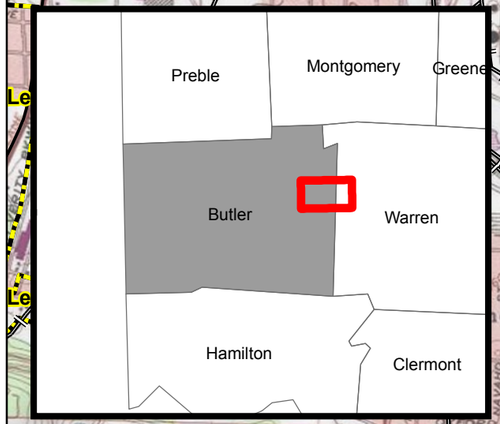
0 80 160 Feet

FIGURE 2

GARVER SUBSTATION EXPANSION
REGULATED WATERS DETERMINATION
AERIAL MAP

DRAWN BY: DKT
CHECKED: DKT
DATE: 1/14/2019
APPROVED: MWW

R:\Projects\15\156\156720M_DukeEnergy9193\M78_SOW38_Garver Distribution Lines_GIS2SAVE\GIS\MXD\LEA M78 Garver EXTENSION\M78_GarverEXT_F2_LEA_Environmental Access Plan_KEYMAP.mxd



Middletown

BUTLER COUNTY

GARVER SUBSTATION

GARVER SUBSTATION EXPANSION PROJECT AREA

WARREN COUNTY

Monroe

Lemon Twp.

PROJECT LOCATION

BUTLER COUNTY, OHIO

REFERENCE: USGS 7.5' TOPOGRAPHIC QUADRANGLE: MONROE, OHIO. OBTAINED VIA ESRI USA TOPO, NATIONAL GEOGRAPHIC TOPO, AND USGS, ACCESSED 01/2017.

N

0 1,000 2,000 4,000 Feet

- Existing Facility
- Interstate
- State Highway
- US Highway
- Railroad
- Municipal Boundary
- Project Area
- County Boundary

DUKE ENERGY.

Cardno

FIGURE 1

GARVER SUBSTATION EXPANSION
REGULATED WATERS DETERMINATION
PROJECT VICINITY MAP

DRAWN BY: DKT DATE: 1/14/2019
CHECKED: CAJ APPROVED: CAJ

R:\Projects\15\156\156720M_DukeEnergy9193\M78_SOW38_Garver Distribution Lines_GIS2SAVE\GIS\MXD\LEA M78 Garver EXTENSION\M78_GarverEXT_F1_LEA_Project Vicinity Map.mxd

Attachment F

Stormwater Pollution Prevention Plan

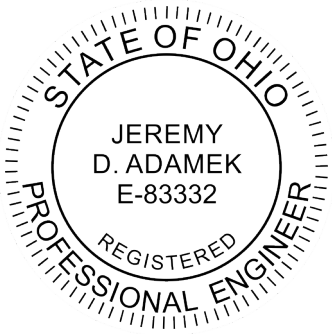
REV 0

138KV YARD STORMWATER DESIGN

Garver Substation

B&V PROJECT NO. 195924
B&V FILE NO. 51.0530.1095.01

PREPARED FOR



15/Nov/2018

Duke Energy

20 SEPTEMBER 2018

Table of Contents

Attachments

1.0 References

1. Manual of Design for Public Improvements, City of Middletown, Ohio, March 2007.
2. United States Department of Agriculture (USDA). “Urban Hydrology for Small Watersheds, TR-55.” Technical Release 55, June 1986.
3. Ohio Department of Natural Resources. “Rainwater and Land Development: Ohio’s Standards for Stormwater Management, Land Development, and Urban Stream Protection (2006, 3rd Edition).
4. NOAA’s National Weather Service (2018). *Precipitation Frequency Data Server (PFDS)*. Location: Middletown, Ohio, USA.

2.0 Design Basis

Garver Substation is a new substation site located off Cincinnati Dayton Road at the south end of the Middletown Energy Center (MEC) in Middletown, Ohio. The project includes building a new substation facility on the previously constructed laydown area for the now built MEC power plant. Sargent & Lundy previously designed the stormwater conveyance system for the MEC power plant, shown in Attachment 5. The area that the substation will be constructed on has already been designed as an aggregate surface with a runoff coefficient value of 0.75. This matches Black & Veatch design philosophy, so there will not be additional excess water drainage into the previously designed ditch by Sargent & Lundy.

The purpose of this calculation is to design catch basins within the substation to carry stormwater into the previously designed ditch to ensure proper flow into the existing pond. Stormwater ditches were designed by Sargent & Lundy. The total site drainage area was delineated with Bluebeam (Attachment 2). It consists of only aggregate surfacing, and the drainage area leading to the catch basins and yard storm pipes is approximately 1.76 acres. The existing contours on-site show a general drainage pattern from east to west. Next, the runoff coefficient was carried over from the Sargent & Lundy calculation.

Because the flow paths to the catch basins are short, a minimum time of concentration of 5 minutes was utilized. The rainfall intensity was taken from the NOAA website (Ref. 4). The precipitation intensity that corresponds with a minimum time of concentration of 5 minutes is 7.74 in/hr.

Post development will be the same as the predevelopment conditions at the site due to the existing construction laydown area being gravel in material. The purpose of this calculation is to ensure that the substation will drain into the ditch to be carried into the pond, which has already been designed by Sargent & Lundy and is sufficient per B&V philosophy. Riprap will not be needed at the outlet culvert, because the outlet velocity is less than 5 fps (Ref. 1, Attachment 4).

3.0 Conclusions

The drainage areas into the catch basins are show below. The delineated areas for each catch

basin can be found in Attachment 2.

Table 1 - Drainage Area		
Catch Basin	Area (sq ft)	Area (acre)
CB-6	23,652	0.54
CB-7	26,209	0.60
CB-8	10,149	0.23
CB-9	16,486	0.38
Total:	76,496	1.76

Table 2 shows the peak flow rates at each pipe.

Table 2 - Pipe Peak Flow Rate				
Pipe	Runoff Coefficient	Intensity (in/hr)	Area (acres)	Q (cfs)
P-1	0.75	7.74	0.54	3.15
P-2	0.75	7.74	1.14	6.64
P-3	0.75	7.74	1.38	8.00
P-4	0.75	7.74	1.76	10.19

Table 3 shows the required sizes of culverts to carry the flowrates from the catch basins. View the drawings in Attachment 2 for locations of pipes.

Table 3 - Pipe Flow Table				
Pipe	Slope (ft/ft)	Diameter (in)	Discharge Capacity (cfs)	Discharge, 25 YR (cfs)
P-1	0.0025	15	3.50	3.15
P-2	0.0050	18	8.05	6.64
P-3	0.0050	18	8.05	8.00
P-4	0.0025	24	12.25	10.19

Attachment 1
Analysis

4.1 Stormwater Flow Design

The City of Middletown requires that a Water Quality Volume or Water Quality Flow calculation be completed (Ref. 1). The area that the substation is sitting on has been previously designed as a construction laydown area, which consists of sloping to a ditch that flows into (2) 36" culverts. The purpose of this calculation is to design catch basins within the substation to carry water into the previously designed ditch to ensure proper flow into the existing pond. Attachment 5 is the calculation performed by Sargent & Lundy that illustrates that the pond has been sized correctly, and the culvert carrying the stormwater from the substation (previously construction laydown) is sufficient.

4.1.1 Determine Drainage Area

Bluebeam was utilized to delineate the drainage areas of the substation site flowing to each catch basin, as shown in Attachment 2. The drainage area consists of aggregate, and will remain that way after construction.

Drainage Area		
Catch Basin	Area (sq ft)	Area (acre)
CB-6	23,652	0.54
CB-7	26,209	0.60
CB-8	10,149	0.23
CB-9	16,486	0.38
Total:	76,496	1.76

The total area contributing to the catch basins and yard storm pipes is 1.76 acres.

4.1.2 Runoff Coefficient

The Sargent & Lundy calculation utilized a runoff coefficient of 0.75 for aggregate surfaces. This will be used to maintain continuity, and it is in-line with Black & Veatch typical runoff coefficient values for aggregate.

$$C = 0.75$$

4.1.3 Time of Concentration

Because the flow paths are short for each catch basin, a minimum time of concentration of 5 minutes will be used. This was also used for the calculation completed by Sargent & Lundy (Attachment 5).

$$T_c = 5 \text{ mins}$$

4.1.4 Rainfall Intensity

The rainfall precipitation intensity was taken from the NOAA website (Ref. 4) that corresponds with a time of concentration of 5 minutes.

$$I = 7.74 \text{ in/hr}$$

4.1.5 Calculate Peak Flow Rate

Flow rate from stormwater runoff will be calculated using the Rational Method.

$$Q = CiA$$

Q = peak flow rate, cfs
C = runoff coefficient
i = rainfall intensity, in/hr
A = area, acres

Catch Basin Peak Flow Rate				
Catch Basin	Runoff Coefficient	Intensity (in/hr)	Area (acres)	Q (cfs)
CB-6	0.75	7.74	0.54	3.15
CB-7	0.75	7.74	0.60	3.49
CB-8	0.75	7.74	0.23	1.35
CB-9	0.75	7.74	0.38	2.20

Pipe Peak Flow Rate				
Pipe	Runoff Coefficient	Intensity (in/hr)	Area (acres)	Q (cfs)
P-1	0.75	7.74	0.54	3.15
P-2	0.75	7.74	1.14	6.64
P-3	0.75	7.74	1.38	8.00
P-4	0.75	7.74	1.76	10.19

4.1.6 Size the Yard Storm Pipes

FlowMaster V8i was used to size the yard storm pipes. Pipe capacities were designed for the 25-year storm. The yard storm pipes were designed with respect to full flow capacity. They were sized to ensure that the full-flow capacity exceeded the actual discharge.

Yard Storm Pipe Table				
Pipes	Beginning Invert Elev. (ft)	Ending Invert Elev. (ft)	Length (ft)	Slope (ft/ft)
P-1	96.78	96.40	150	0.0025
P-2	96.40	95.75	130	0.0050
P-3	95.75	94.75	200	0.0050
P-4	94.75	94.25	198	0.0025

Pipe Flow Table				
Pipe	Slope (ft/ft)	Diameter (in)	Discharge Capacity (cfs)	Discharge, 25 YR (cfs)
P-1	0.0025	15	3.50	3.15
P-2	0.0050	18	8.05	6.64
P-3	0.0050	18	8.05	8.00
P-4	0.0025	24	12.25	10.19

Attachment 2
Drawings

LEGEND:

- 620 — CONTOUR (EXISTING)
- 620 — CONTOUR (REGRADED)
- 620 — CONTOUR (NEW)
- SUBSTATION FENCE (SPEC. SECTION 32 01 00)
- EXISTING SWITCHYARD FENCE
- BASELINE
- B.L.M. — PERMANENT BASELINE MONUMENT
- PROPERTY LINE
- EDGE OF PAVEMENT
- G — GAS PIPE
- ST — STROMWATER PIPE
- OE — OVERHEAD ELECTRIC LINE
- W — WATER PIPE
- BENCH MARK
- UNDERGROUND UTILITY EASEMENT

"2"

NOTES & SPECIFICATIONS:

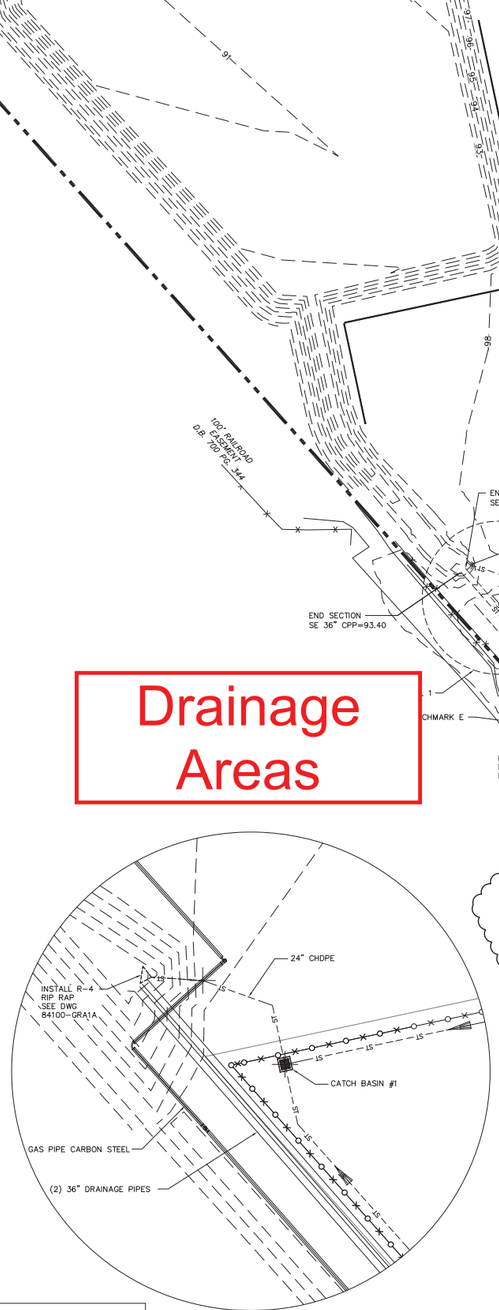
1. DUKE ENERGY WILL ESTABLISH SURVEYING CONTROL BASELINES AND INSTALL MARKERS FOR GRADING AND/OR CONSTRUCTION AS SHOWN. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OF THE ADDITIONAL SURVEYING CONTROLS.
2. SOIL BORINGS PERFORMED BY: TTL ASSOCIATES, INC.
   1915 NORTH 12TH STREET
   TOLEDO, OHIO 43604
   PROJECT: T1072TS1
   DATED: MAY 29, 2014
3. ALL CONTOURS AND SPOT ELEVATIONS INDICATE TOP OF SUBGRADE, ADD 6" TO OBTAIN TOP OF FINISHED SURFACING WITHIN SUBSTATION YARD AND TO A MINIMUM DISTANCE OF 4'-0" OUTSIDE THE FENCE. SEE PLAN FOR AGGREGATE SURFACE AREAS. SEE DUKE ENERGY SPEC. ON AGGREGATE SURFACING-SECTION 32 15 00.
4. FOR GENERAL TECHNICAL SITE REQUIREMENTS REFER TO DUKE ENERGY SPECIFICATION SECTION 01 11 00 SUMMARY OF WORK.
5. CONTRACTOR SHALL REFER TO THE SPECIFICATIONS LISTED ON THIS DRAWING FOR ADDITIONAL WORK PROCEDURE AND/OR ITEMS, NOT SPECIFICALLY INDICATED IN THESE NOTES OR ON THE DRAWINGS.
6. FOR TECHNICAL INSTALLATION REQUIREMENTS OF EARTHWORK AND STORM WATER CONTROL MEASURES REFER TO DUKE ENERGY SPECIFICATION SECTION 31 00 00 EARTHWORK.
7. FOR TECHNICAL INSTALLATION REQUIREMENTS OF THE SUBSTATION DRIVEWAY REFER TO DUKE ENERGY SPECIFICATION SECTION 32 15 00 AGGREGATE SURFACING.
8. FOR TECHNICAL INSTALLATION REQUIREMENTS OF STATION SECURITY FENCE REFER TO DUKE ENERGY SPECIFICATION SECTION 32 31 00 STATION SECURITY FENCE.
9. REFER TO THE STORM WATER PREVENTION PLAN AND DRAWING. CONTRACTOR SHALL INSTALL, MAINTAIN THE EROSION CONTROL AND MAINTAIN INSPECTION RECORDS AND AS SPECIFIED IN THE STORM WATER PREVENTION PLAN AND DRAWING.
10. NORTHING AND EASTING COORDINATES ARE BASED OFF THE OHIO SOUTH STATE PLANE COORDINATE SYSTEM.
11. VERTICAL ELEVATION ARE BASED OFF OF PLANT DATUM. TO OBTAIN PLANT DATUM ELEVATION, SUBTRACT 553.5 FEET FROM THE NAVD88 ELEVATION.
12. ALL SIDE SLOPES SHALL BE 3:1 UNLESS NOTED OTHERWISE. "2"

REFERENCES:

84100-CBL2	CABLE ROUTING PLAN OF 345KV YARD
84100-CBL3	TRENCH PLAN OF 345KV YARD
84100-FAB2	STEEL FABRICATION PLAN OF 345KV YARD
84100-FDN2	FOUNDATION PLAN OF 345KV YARD
84100-LOC1	SITE LOCATION PLAN OF 138KV & 345KV SUBSTATION
84100-SEL1	STRUCTURAL ELECTRICAL PLAN OF 138KV & 345KV YARD
84100-GRA1A	GRADING DETAILS OF 138KV & 345KV SUBSTATION
84100-GRA1B	EROSION AND SEDIMENT CONTROL PLAN 138KV SUBSTATION
84100-GRA2	FENCE AND DRIVE PLAN OF 138KV & 345KV SUBSTATION
84100-GRA2A	FENCE DETAILS SHEET 1
84100-GRA2B	FENCE DETAILS SHEET 2
84100-OIL2	OIL CONTAINMENT PLAN OF 345KV SUBSTATION

"2"

Drainage Areas



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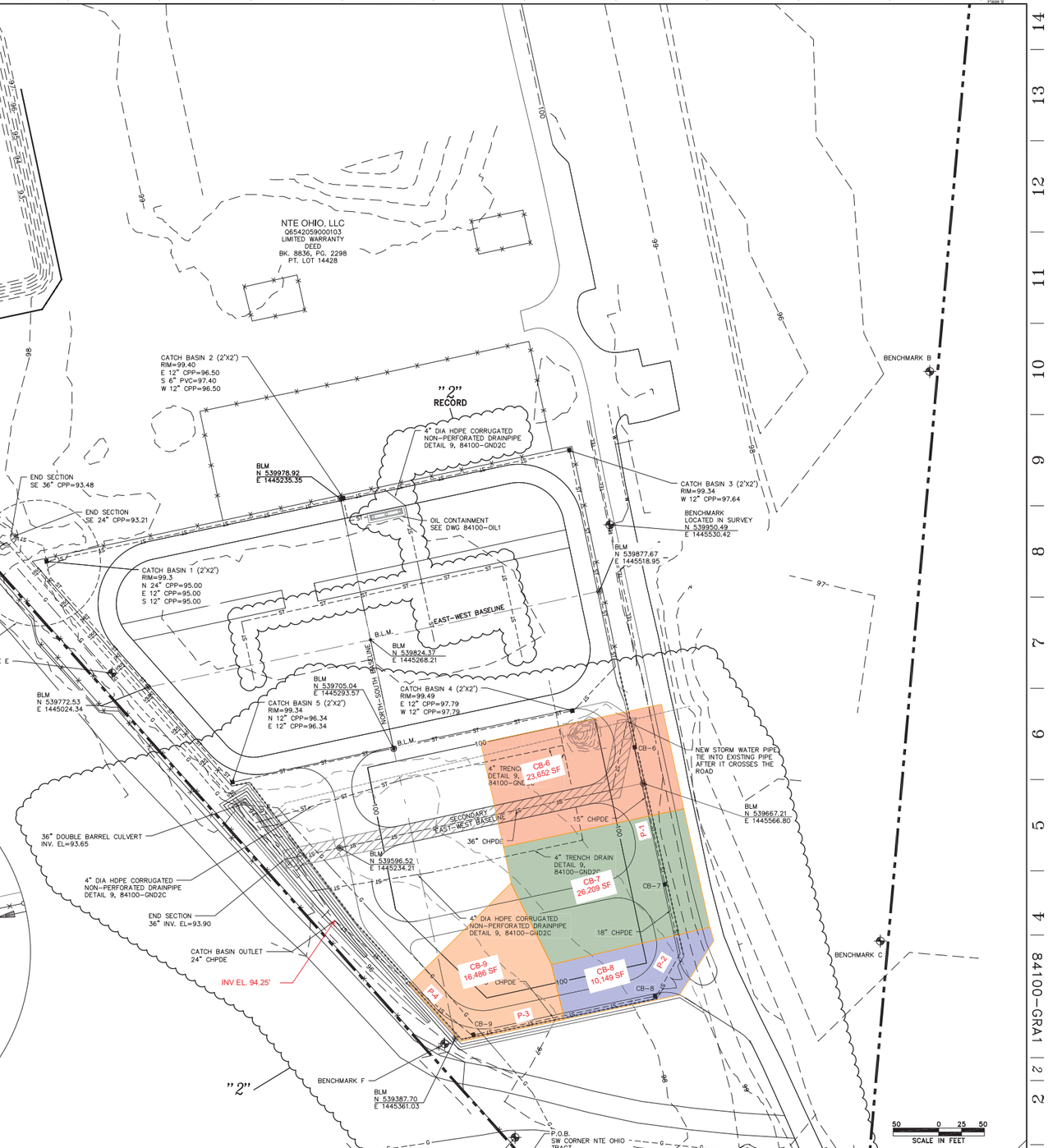
SCALE: NTS



EXISTING BENCHMARK MONUMENTS					
ID NO.	STATE PLANE (NOTE 10) NORTH	STATE PLANE (NOTE 10) EAST	NAVD 88 ELEVATION	PLANT DATUM ELEVATION (NOTE 11)	REMARKS
A	540694.4424	1445778.0160	651.43	97.93	EXISTING MONUMENT
B	540118.4942	1445880.9704	651.82	98.32	EXISTING MONUMENT
C	539494.3519	1445826.8081	651.29	97.79	EXISTING MONUMENT
D	540469.4891	1444402.3532	649.39	95.89	PRELIMINARY MONUMENT
E	539787.9600	1444985.1000	654.25	100.75	PRELIMINARY MONUMENT
F	539381.8937	1445349.4457	650.67	97.17	EXISTING MONUMENT

REVISION		
2	DFT: JAC/B&V; DES/CHK: AGB,JDA/B&V; ENG: JDA/B&V; BM: ; DPN/DU: T1928TS1/VSOH; FP: TOH1928	REVISED LEGEND. GRADED 138KV YARD. ADDED DRAINAGE SYSTEM AND TRENCH DRAINS. ADDED 138KV SUBSTATION FENCE AND GATE. ADDED NOTES AND REFERENCE. ADDED 345KV TRENCH DRAIN FOR RECORD. DATE ISSUED: 09/13/18; ISSUE TYPE: FOR CONSTRUCTION
1	DFT: SJS/B&V; DES/CHK: EML,GMJ/B&V; ENG: APB; BM: ; DPN/DU: T1072TS1/VSOH; FP: TOH1072	REVISED ACCESS GATE TO 30'-0". REVISED DWG REFERENCES. DATE ISSUED: 4/20/18; ISSUE TYPE: AB 262

SEAL:

DRAFTED BY: JDL,SJS/B&V
DESIGNED/CHECKED BY: AMA,EML/B&V
ENGINEER: SJW/B&V,AMF,BJW
DETAIL PROJECT NO/OPERATING UNIT: T1072TS1/VSOH
RM/FUNDING PROJECT: /TOH1072
DATE ISSUED: 8/8/16

☐ PRELIMINARY
☐ APPROVAL
☐ AS BUILT
DATE _____
NAME _____

DUKE ENERGY.

GRA FILENAME: 84100gra1.dwg

TITLE: GRADING PLAN 138KV & 345KV SUBSTATION

LOCATION: GARVER SUBSTATION

SCALE:	SCALE FACTOR:	STA NO.	REV:	DWG NO.
1"=50'	1	75	2	84100-GRA1

LEGEND:

- 620 — CONTOUR (EXISTING)
- 620 — CONTOUR (REGRADED)
- 620 — CONTOUR (NEW)
- SUBSTATION FENCE (SPEC. SECTION 32 01 00)
- EXISTING SWITCHYARD FENCE
- BASELINE
- B.L.M. — PERMANENT BASELINE MONUMENT
- PROPERTY LINE
- EDGE OF PAVEMENT
- G — GAS PIPE
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   1915 NORTH 12TH STREET
   TOLEDO, OHIO 43604
   PROJECT: T10727S1
   DATED: MAY 29, 2014
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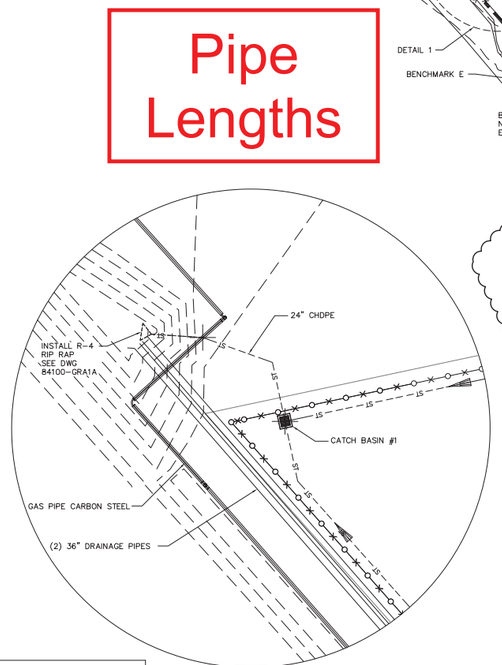
84100-SEL1	STRUCTURAL ELECTRICAL PLAN OF 138KV & 345KV YARD
84100-GRA1A	GRADING DETAILS OF 138KV & 345KV SUBSTATION
84100-GRA1B	EROSION AND SEDIMENT CONTROL PLAN 138KV SUBSTATION "2"
84100-GRA2	FENCE AND DRIVE PLAN OF 138KV & 345KV SUBSTATION
84100-GRA2A	FENCE DETAILS SHEET 1
84100-GRA2B	FENCE DETAILS SHEET 2
84100-OIL2	OIL CONTAINMENT PLAN OF 345KV SUBSTATION

Pipe Lengths



DETAIL 1
SCALE: NTS

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C	539494.3519	1445826.8081	651.29	97.79	EXISTING MONUMENT
D	540469.4891	1444402.3532	649.39	95.89	PRELIMINARY MONUMENT
E	539787.9600	1444985.1000	654.25	100.75	PRELIMINARY MONUMENT
F	539381.8937	1445349.4457	650.67	97.17	EXISTING MONUMENT

REVISION 2			
DFT: JAC/B&V	DES/CHK: AGB,JDA/B&V		
ENG: JDA/B&V	BM:		
DPN/DU: T1928TS1/VSOH	FP: TOH1928		
REVISED LEGEND. GRADED 138KV YARD. ADDED DRAINAGE SYSTEM AND TRENCH DRAINS. ADDED 138KV SUBSTATION FENCE AND GATE. ADDED NOTES AND REFERENCE. ADDED 345KV TRENCH DRAIN FOR RECORD.			
DATE ISSUED: 09/13/18	ISSUE TYPE: FOR CONSTRUCTION		

REVISION 1			
DFT: SJS/B&V	DES/CHK: EML,GMJ/B&V		
ENG: APB	BM:		
DPN/DU: T1072TS1/VSOH	FP: TOH1072		
REVISED ACCESS GATE TO 30'-0". REVISED DWG REFERENCES.			
DATE ISSUED: 4/20/18	ISSUE TYPE: AB 262		

SEAL:

DRAFTED BY: JDL,SJS/B&V
DESIGNED/CHECKED BY: AMA,EML/B&V
ENGINEER: SJW/B&V,AMF,BJW
DETAIL PROJECT NO/OPERATING UNIT: T1072TS1/VSOH
RM/FUNDING PROJECT: /TOH1072
DATE ISSUED: 8/8/16

☐ PRELIMINARY
☐ APPROVAL
☐ AS BUILT
DATE _____
NAME _____

DUKE ENERGY.

GRA FILENAME: 84100gra1.dwg

TITLE: GRADING PLAN 138KV & 345KV SUBSTATION

LOCATION: GARVER SUBSTATION

SCALE:	SCALE FACTOR:	STA NO.	REV:	DWG NO.
1"=50'	1	75	2	84100-GRA1

Attachment 3
FlowMaster Report

15" Pipe Full Flow Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.00250	ft/ft
Normal Depth	15.00	in
Diameter	15.00	in

Results

Discharge	3.50	ft³/s
Flow Area	1.23	ft²
Wetted Perimeter	3.93	ft
Hydraulic Radius	3.75	in
Top Width	0.00	ft
Critical Depth	0.75	ft
Percent Full	100.0	%
Critical Slope	0.00543	ft/ft
Velocity	2.85	ft/s
Velocity Head	0.13	ft
Specific Energy	1.38	ft
Froude Number	0.00	
Maximum Discharge	3.76	ft³/s
Discharge Full	3.50	ft³/s
Slope Full	0.00250	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

15" Pipe Full Flow Capacity

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	15.00	in
Critical Depth	0.75	ft
Channel Slope	0.00250	ft/ft
Critical Slope	0.00543	ft/ft

18" Pipe Full Flow Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.00500	ft/ft
Normal Depth	18.00	in
Diameter	18.00	in

Results

Discharge	8.05	ft³/s
Flow Area	1.77	ft²
Wetted Perimeter	4.71	ft
Hydraulic Radius	4.50	in
Top Width	0.00	ft
Critical Depth	1.10	ft
Percent Full	100.0	%
Critical Slope	0.00636	ft/ft
Velocity	4.55	ft/s
Velocity Head	0.32	ft
Specific Energy	1.82	ft
Froude Number	0.00	
Maximum Discharge	8.66	ft³/s
Discharge Full	8.05	ft³/s
Slope Full	0.00500	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

18" Pipe Full Flow Capacity

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	18.00	in
Critical Depth	1.10	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00636	ft/ft

24" Pipe Full Flow Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.00250	ft/ft
Normal Depth	24.00	in
Diameter	24.00	in

Results

Discharge	12.25	ft³/s
Flow Area	3.14	ft²
Wetted Perimeter	6.28	ft
Hydraulic Radius	6.00	in
Top Width	0.00	ft
Critical Depth	1.26	ft
Percent Full	100.0	%
Critical Slope	0.00480	ft/ft
Velocity	3.90	ft/s
Velocity Head	0.24	ft
Specific Energy	2.24	ft
Froude Number	0.00	
Maximum Discharge	13.18	ft³/s
Discharge Full	12.25	ft³/s
Slope Full	0.00250	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

24" Pipe Full Flow Capacity

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	24.00	in
Critical Depth	1.26	ft
Channel Slope	0.00250	ft/ft
Critical Slope	0.00480	ft/ft

Attachment 4
References

CULVERTS

Culverts shall be designed to carry a predetermined peak discharge without the depth of water at the entrance, or the velocity of the water at the outlet exceeding allowable limits. Use the Ohio Department of Transportation Location and Design Manual, Volume Two, Chapter 1105, and nomographs therein, as the basis for design.

The allowable headwater is the most conservative of the following:

1. 50-year 1-foot below the edge of pavement.

2. 1.5-foot below the minimum 100-year opening elevation of residence.

3. The elevation of which an upstream sewer system begins to surcharge out of the curb inlets after calculating head loss for a 10-year design storm through the sewer system with the sewer system conveying the 10-year design flow.

4. If the proposed culverts are to be installed on a zero slope, (level), for purposes of computations use:

   A. A slope of 0.002 feet/foot for concrete pipes.

   B. A slope of 0.004 feet/foot for corrugated metal pipes or pipe arches.

   C. A slope of 0.010 feet/foot for structural plate pipe or pipe arches.

5. If the mean outlet velocity is less than 5 feet/second, no slope protection is required downstream from the culvert outlet. If the mean velocity is between 5 feet/second and 18 feet second, use dumped rock channel protection as per Fig. 1107-1 of the ODOT Location and Design Manual Vol. II. If the mean outlet velocity is greater than 18 feet/second, special designed protection is required.

OPEN DITCHES

Design to handle estimated runoff for 25-year frequency storm for a minor drainage system (less than 200 acres) and 50-year for a major system so that it meets *all* of the following criteria:

1. Minimum free board of 1-foot.

2. The design flood elevation in the channel does not surcharge upstream sewer system out of curb inlets assuming sewer system conveys a 10-year design storm.

3. The 100-year flood elevation of 1.5-foot minimum below the minimum opening elevations.

4. Drainage easement includes 50-year flood area.

For drainage areas less than 400 acres, base channel design on Manning Formula ($V = 1.486/n \times R^{2/3} \times S^{1/2}$). For drainage areas greater than 400 acres, a HEC-RAS Study may be required.

MINIMUM SIDE SLOPES	GRASSED (SOD)	PAVED (CONCRETE)
Desired	4:1	4:1
Maximum	3:1	2:1

In grassed channels, require paving (or rip rap) at all channel curves and all channel junctions with other channels. Open ditches are permitted outside of the public right-of-way where a storm sewer 48-inch or larger is required to convey the design flow.

NOAA Atlas 14, Volume 2, Version 3
Location name: Middletown, Ohio, USA*
Latitude: 39.4682°, Longitude: -84.3525°
Elevation: 650.19 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

AMS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Annual exceedance probability (1/years)								
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500	1/1000
5-min	**4.82** (4.42–5.28)	**6.04** (5.52–6.60)	**6.83** (6.22–7.44)	**7.74** (7.04–8.42)	**8.40** (7.62–9.12)	**8.99** (8.14–9.77)	**9.61** (8.66–10.4)	**10.4** (9.29–11.3)	**10.9** (9.73–11.9)
10-min	**3.76** (3.44–4.12)	**4.69** (4.29–5.13)	**5.27** (4.81–5.75)	**5.92** (5.39–6.44)	**6.36** (5.78–6.92)	**6.77** (6.12–7.36)	**7.18** (6.46–7.79)	**7.63** (6.83–8.29)	**7.96** (7.09–8.65)
15-min	**3.07** (2.81–3.36)	**3.84** (3.51–4.20)	**4.32** (3.94–4.72)	**4.88** (4.44–5.30)	**5.25** (4.77–5.71)	**5.61** (5.07–6.09)	**5.95** (5.36–6.46)	**6.35** (5.68–6.90)	**6.63** (5.90–7.20)
30-min	**2.06** (1.88–2.25)	**2.63** (2.41–2.87)	**3.00** (2.74–3.28)	**3.44** (3.13–3.75)	**3.75** (3.41–4.08)	**4.05** (3.66–4.40)	**4.34** (3.91–4.72)	**4.71** (4.21–5.11)	**4.97** (4.43–5.40)
60-min	**1.26** (1.15–1.38)	**1.65** (1.51–1.80)	**1.91** (1.74–2.08)	**2.23** (2.03–2.43)	**2.47** (2.25–2.69)	**2.71** (2.45–2.94)	**2.95** (2.65–3.20)	**3.25** (2.91–3.54)	**3.49** (3.11–3.79)
2-hr	**0.738** (0.677–0.806)	**0.966** (0.886–1.05)	**1.12** (1.03–1.22)	**1.32** (1.20–1.43)	**1.47** (1.33–1.59)	**1.62** (1.46–1.75)	**1.77** (1.59–1.91)	**1.97** (1.76–2.13)	**2.13** (1.89–2.30)
3-hr	**0.523** (0.480–0.573)	**0.686** (0.628–0.751)	**0.799** (0.730–0.871)	**0.945** (0.860–1.03)	**1.06** (0.957–1.15)	**1.17** (1.06–1.27)	**1.29** (1.16–1.40)	**1.45** (1.29–1.57)	**1.57** (1.39–1.70)
6-hr	**0.313** (0.289–0.342)	**0.410** (0.377–0.446)	**0.476** (0.437–0.518)	**0.563** (0.514–0.610)	**0.630** (0.574–0.682)	**0.698** (0.632–0.754)	**0.768** (0.692–0.829)	**0.863** (0.771–0.931)	**0.938** (0.832–1.01)
12-hr	**0.184** (0.170–0.200)	**0.239** (0.220–0.260)	**0.277** (0.254–0.300)	**0.325** (0.298–0.352)	**0.362** (0.330–0.391)	**0.399** (0.363–0.431)	**0.437** (0.395–0.472)	**0.488** (0.438–0.527)	**0.528** (0.471–0.570)
24-hr	**0.107** (0.101–0.115)	**0.139** (0.131–0.148)	**0.161** (0.151–0.171)	**0.188** (0.176–0.201)	**0.209** (0.195–0.223)	**0.231** (0.215–0.245)	**0.252** (0.234–0.268)	**0.281** (0.259–0.298)	**0.303** (0.279–0.322)
2-day	**0.063** (0.059–0.067)	**0.081** (0.076–0.086)	**0.093** (0.087–0.099)	**0.109** (0.102–0.116)	**0.121** (0.113–0.128)	**0.132** (0.124–0.141)	**0.144** (0.134–0.153)	**0.160** (0.148–0.170)	**0.173** (0.159–0.183)
3-day	**0.045** (0.042–0.048)	**0.057** (0.054–0.061)	**0.066** (0.062–0.070)	**0.077** (0.072–0.082)	**0.085** (0.080–0.090)	**0.093** (0.087–0.099)	**0.102** (0.095–0.108)	**0.113** (0.104–0.119)	**0.121** (0.112–0.128)
4-day	**0.036** (0.034–0.038)	**0.046** (0.043–0.048)	**0.052** (0.049–0.056)	**0.061** (0.057–0.064)	**0.067** (0.063–0.071)	**0.074** (0.069–0.078)	**0.080** (0.075–0.085)	**0.089** (0.082–0.094)	**0.095** (0.088–0.101)
7-day	**0.024** (0.023–0.026)	**0.031** (0.029–0.032)	**0.035** (0.033–0.037)	**0.041** (0.038–0.043)	**0.045** (0.043–0.048)	**0.050** (0.047–0.053)	**0.054** (0.051–0.057)	**0.060** (0.056–0.064)	**0.065** (0.060–0.069)
10-day	**0.019** (0.018–0.020)	**0.024** (0.023–0.026)	**0.028** (0.026–0.029)	**0.032** (0.030–0.034)	**0.036** (0.033–0.038)	**0.039** (0.037–0.041)	**0.043** (0.040–0.045)	**0.047** (0.044–0.050)	**0.051** (0.047–0.054)
20-day	**0.013** (0.012–0.014)	**0.016** (0.015–0.017)	**0.018** (0.017–0.020)	**0.021** (0.020–0.022)	**0.023** (0.022–0.025)	**0.025** (0.024–0.027)	**0.027** (0.025–0.029)	**0.030** (0.028–0.031)	**0.032** (0.029–0.033)
30-day	**0.011** (0.010–0.011)	**0.013** (0.013–0.014)	**0.015** (0.014–0.016)	**0.017** (0.016–0.018)	**0.018** (0.017–0.019)	**0.020** (0.019–0.021)	**0.021** (0.020–0.022)	**0.023** (0.022–0.024)	**0.024** (0.023–0.026)
45-day	**0.009** (0.009–0.010)	**0.011** (0.011–0.012)	**0.012** (0.012–0.013)	**0.014** (0.013–0.015)	**0.015** (0.014–0.016)	**0.016** (0.015–0.017)	**0.017** (0.016–0.018)	**0.018** (0.017–0.019)	**0.019** (0.018–0.020)
60-day	**0.008** (0.008–0.009)	**0.010** (0.009–0.010)	**0.011** (0.010–0.012)	**0.012** (0.012–0.013)	**0.013** (0.013–0.014)	**0.014** (0.013–0.015)	**0.015** (0.014–0.016)	**0.016** (0.015–0.017)	**0.017** (0.016–0.018)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of annual maxima series (AMS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and annual exceedance probability) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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Attachment 5
Referenced Calculation from Sargent & Lundy

ISSUE SUMMARY
Form SOP-0402-07, Revision 11

DESIGN CONTROL SUMMARY

CLIENT: NTE Energy UNIT NO.: N/A PAGE NO.: 1

PROJECT NAME: Middletown Energy Center (MEC)

PROJECT NO.: 13390-300

CALC. NO..: C-MEC-01

S&L NUCLEAR QA PROGRAM
APPLICABLE ☐ YES ☒ NO

TITLE: Stormwater Drainage Design

EQUIPMENT NO.: N/A

IDENTIFICATION OF PAGES ADDED/REVISED/SUPERSEDED/VOIDED & REVIEW METHOD

Initial Issue for Owner's Acceptance Review
Calculation : Pages 18 (Including Issue Summary)
Attachments(14):120 Pages
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REVIEW METHOD: Detailed REV.: 0
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PREPARER: DATE:
REVIEWER: DATE:
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NOTE: PRINT AND SIGN IN THE SIGNATURE AREAS

Calculation for STORMWATER DRAINAGE DESIGN			**Calc. No.** C-MEC-01
			Rev. 0
	Safety-Related	X **Non-Safety-Related**	**Page** 2 of 18

Client NTE ENERGY	**Prepared by** N. PATEL
Project Middletown Energy Center (MEC)	**Reviewed by** M. TURNER
Project No. 13390-300 **Equip. No.** N/A	**Approved by** M. TURNER

TABLE OF CONTENTS

SECTION **DESCRIPTION** **Total Pages: 18**

Calculation for STORMWATER DRAINAGE DESIGN			**Calc. No.** C-MEC-01
			Rev. 0
	Safety-Related	X **Non-Safety-Related**	**Page** 3 of 18

Client NTE ENERGY	**Prepared by** N. PATEL
Project Middletown Energy Center (MEC)	**Reviewed by** M. TURNER
Project No. 13390-300 **Equip. No.** N/A	**Approved by** M. TURNER

1. PURPOSE & SCOPE

The purpose of this calculation is to design the stormwater drainage system for NTE Energy's proposed new power plant Middletown Energy Center (MEC) in Middletown, Ohio.

2. DESIGN INPUT

1) Proposed grading and drainage information are obtained from the following design drawings.

   Initial Grading Plans (Reference 8.1)

   Initial Grading Details (Reference 8.2)

   Storm Sewer Composite Plan (Reference 8.3)

2) Rainfall data for the site is extracted from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 (Reference 8.4, Attachment 9.1). Rainfall data is presented in Table 1.

Table 1 : Rainfall (Inches) at site for Different Duration and Recurrences Interval

Duration Minutes	Rainfall in Inches		
	10-Year	25-Year	50-Year
5	0.575	0.648	0.70
10	0.887	0.991	1.06
15	1.090	1.220	1.32
30	1.520	1.730	1.89
60	1.930	2.240	2.48
1440 (24-Hour)	3.890	4.540	5.04
See Attachment 9.1 for rainfall data of other durations and recurrence intervals			

3) All elevations in this document reference to Plant Datum.

   For MEC, elevation 100 ft in Plant Datum is equivalent to 653.5 ft North American Vertical Datum of 1988 (NAVD88)
   Elevation in NAVD 88 = Elevation in Plant Datum + 553.5 ft

4) A depth of 1 foot is provided for sediment storage at the bottom of the basin.

3. DESIGN ASSUMPTIONS

1) The minimum time of concentration of 5 minutes is assumed.

2) To calculate the peak runoff in each subarea, Rational Method is used with runoff coefficient (C) for each surface type as follows:

- For power block area and paved areas, runoff coefficient (C) value of 0.95 is used
- For Gravel surfaced areas including laydown area and switchyard area, runoff coefficient (C) value of 0.75 is used
- For grass covered areas, and wooded areas, runoff coefficient (C) value of 0.40 is used

3) To calculate the capacity of ditches and pipes using Manning's Equation, Manning's roughness coefficient (n) for different type of materials is considered as follows:

- For Gravel surfaced ditches, n value of 0.018 is used.
- For CHDPE/HDPE storm sewers and culvert pipes, conservatively, n value of 0.012 is used.
- For concrete pipes, n value of 0.013 is used.

4. METHODOLOGY & ACCEPTANCE CRITERIA

4.1 Methodology

The peak stormwater runoff is computed using the Rational Method. The peak runoff (Q) is calculated using the estimated drainage areas, the rainfall intensities for the site, and the proposed surfacing.

$$Q_{peak} = C * I * A$$

Where,
Q_{peak} = Peak flow (ft^3/s)
C = Drainage area runoff coefficient
I = Rainfall intensity (in/hr) corresponds to time of concentration
A = Drainage area (acres)

The rainfall intensity at the time of concentration is calculated using an Intensity-Duration-Frequency (IDF) table as reported in Table 1 and Attachment 9.1. In some drainage subareas,

Sargent & Lundy LLC	**Calculation for** STORMWATER DRAINAGE DESIGN		**Calc. No.** C-MEC-01
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Client NTE ENERGY	**Prepared by** N. PATEL
Project Middletown Energy Center (MEC)	**Reviewed by** M. TURNER
Project No. 13390-300 **Equip. No.** N/A	**Approved by** M. TURNER

there are multiple surface types, for which the runoff coefficient (C) is estimated using area-weighted method as follows:

$$C_W = \frac{(A_1 * C_1) + (A_2 * C_2) + \ldots + (A_n * C_n)}{\sum_{1}^{n} A_i}$$

Where,
C_W = Weighted runoff coefficient, C
A_i = Drainage subarea (acres)
C_i = Runoff coefficient for each surface type

The maximum hydraulic capacity of the drainage ditch is calculated based on the cross-sectional area (A) and slope (S) of the ditch and the Manning's roughness coefficient (n).

$$Q_{max} = \frac{1.49}{n} * A_s * R^{2/3} * S^{1/2}$$

Where,
Q_{max} = Maximum flow rate (ft^3/s)
n = Manning's roughness coefficient for ditch surface
A_s = Flow area (ft^2)
R = Hydraulic radius (ft)
S = Slope (ft/ft)

For computation of required detention volume for the stormwater detention basin, Manual of Design for Public Improvements, City of Middletown (Reference 8.5) is followed. As suggested in Reference 8.5, runoff volume calculation is performed using the methods of the Soil Conservation Service Technical Release 55 (TR-55) (Reference 8.6).

For pre-developed condition, hydrologic soil group data was obtained from Natural Resources Conservation Services (NRCS) (Reference 8.7). Using the soil group and hydrologic condition, a curve number (CN) for the pre-developed condition was estimated. For the post-developed condition, weighted CN for the site based on proposed surface type is estimated. Using the weighted CN, runoff volumes for 2 to 50 year storm events for pre-developed and post-developed conditions were estimated. Stormwater detention basin was designed to provide detention volume in excess of the increase in runoff volume due to proposed site conditions. Storage routing for the 25-year storm and 50-year storm events were performed using the HEC-HMS computer program. Stormwater detention basin was designed such that the maximum

release rate for up to a 100-year return period for post-developed site condition does not exceed pre-developed maximum release rate for 10-year storm event.

4.2 Acceptance Criteria

Storm Sewers:
Storm sewer acceptance criteria is adopted from Manual of Design for Public Improvements, City of Middletown, Ohio (Reference 8.5)

- Design Hydraulic Grade Line (HGL) below crown of pipe to handle estimated runoff for 10-year storm
- Minimum sewer pipe size: 12 inch
- Minimum cover for sewer pipe: 1-foot
- Minimum mean velocity: 3.0 ft/sec
- Maximum mean velocity: 10.0 ft/sec
- Maximum manhole spacing: 350 ft

Open Ditches:

- Minimum freeboard: 1-foot
- Design discharge in ditch does not surcharge upstream sewer system above rim elevation of the structures during a 10-year design storm
- Maximum side slope for ditch 3H:1V
- Maximum velocity will be less than 5 ft/sec for aggregate surfaced ditch

Culverts:

- Head water elevation: 1-foot below the edge of pavement during 50-year storm
- Design discharge in culverts does not surcharge above rim elevation of the structures of upstream sewer system during a 10-year design storm
- No slope protection is required for outlet velocity less than 5.0 ft/sec
- For mean outlet velocity between 5.0 to 18.0 ft/sec, riprap channel protection as per Reference 8.5 shall be provided

Stormwater Detention Basin:

- Runoff volume calculations shall be performed by the methods of the Soil Conservation Service Technical Release 55 (TR-55) (Reference 8.6)

- TR-55 curve numbers for fully developed conditions shall be determined assuming Type "C" soil regardless of undeveloped soil types with the theory being that the soil characteristics of Type A and B soils more closely resembles Type C after mass grading and compaction from heavy equipment(Reference 8.5).

- The minimum time of concentration to a catch basin is 5-minutes. The post-developed time of concentration shall not be greater than the pre-developed (Reference 8.5).

- Detention basins shall be sized for post-development runoff as required to provide the greater of the 25-year volume plus one foot of free board below the emergency spillway or the 50-year storage volume at or below the emergency spillway.

- Maximum side slope of the detention basin 3H:1V (Reference 8.1)

5. COMPUTER PROGRAMS

Following S&L Verified and Validated (V&Ved) computer programs are used:

Culvert Master Version 3.03.00.04 (Reference 8.8) for Culvert analysis
Storm CAD Version 8.11.02.75 (Reference 8.9) for Storm Sewer analysis
HEC-HMS Version 3.5 (Reference 8.10) for detention basin routing analysis

All computer programs runs were performed on S&L PC # ZD9375

6. CALCULATION

6.1 Detention Basin

Pre-developed Condition:

Total site drainage area = 39.6 ac = 0.061875 sq.miles (Attachment 9.2)

Runoff Curve number for pre-developed condition CN = 68 (Reference 8.11)

Potential maximum retention S = 1000/CN – 10 (Reference 8.6)

= 1000/68 – 10 = 4.71

25-Year, 24-Hour rainfall P = 4.54 inch (Table 1)

Initial abstraction Ia = 0.2S = 0.2 x 4.71 = 0.94 inch

Runoff Q = $(P-0.2S)^2/(P+0.8S)$ (Reference 8.6)
= $(4.54 – 0.2 \times 4.71)^2/(4.54 + 0.8 \times 4.71)$
= 1.56 inches

Time of concentration for Pre-Developed condition Tc = 46 minutes (Reference 8.11)
Lag time = 0.6Tc (Reference 8.10)
= 0.6 x 46 = 27.6 minutes say 28 minutes

Total runoff volume = 39.6 ac x 1.56/12 ft = 5.15 ac-ft

Post-developed condition:

As suggested in the Middletown Design Manual (Reference 8.5) for post-development condition, runoff curve numbers corresponding to Soil Group C are used. Weighted Curve Number for the site based on different type of proposed surfacing is presented in Table 2.

Table 2: Weighted Runoff Curve Number Computation for Post-developed site

Description of area	Runoff Curve Number (CN)	Area in ac (A)	A x CN
Power Block area	95	5.2	494
Detention Basin	98	2.5	245
Switchyard- Cooling tower and balance of plant	89	15.5	1380
Undeveloped area (as per pre developed)	68	16.4	1115
Total		39.6	3234
Weighted Curve number CN = 3234/39.6 = 81.66 so use 82			

Runoff Curve number for post-developed condition CN = 82

Potential maximum retention S = 1000/CN – 10 (Reference 8.6)
= 1000/82 – 10 = 2.20

25-Year, 24-Hour rainfall from Table 1 P = 4.54 inch

Initial abstraction Ia = 0.2S = 0.2 x 2.20 = 0.44 inch

Runoff $Q = (P-0.2S)^2/(P+0.8S) = (4.54 – 0.2 \times 2.20)^2/(4.54 + 0.8 \times 2.20)$
= 2.67 inches

Time of concentration = 20 min (For the site it will be more than 20 minutes, however, conservatively 20 minutes used).

Lag time = 0.6Tc (Reference 8.10)
= 0.6 x 20 = 12 minutes

Total runoff volume = 39.6 ac x 2.67/12 ft = 8.81 ac-ft

For above data, runoff hydrograph for pre-developed and post-developed condition for different storm events were developed using HEC-HMS computer program (Reference 8.10). HEC-HMS program output showing runoff and peak discharges is presented in Attachment 9.3.

Similar to above, runoff computation for different storm events from 2-year to 100-year return period are computed and is presented in Attachment 9.4

Elevation-Area-Capacity for the detention basin developed using Reference 8.1 is presented in Table 3

Table 3: Detention Basin Elevation-Area-Capacity

Elevation	Area	Inc. Storage	Total Storage	Storage excluding Sediment storage
ft	ac	ac-ft	ac-ft	ac-ft
91.00	0.37	0.00	0.00	0.00
92.00	1.79	0.99	0.99	0.00

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Table 3: Detention Basin Elevation-Area-Capacity

Elevation	Area	Inc. Storage	Total Storage	Storage excluding Sediment storage
93.00	1.98	1.88	2.88	1.89
94.00	2.07	2.03	4.90	3.91
95.00	2.17	2.12	7.02	6.03
96.00	2.27	2.22	9.24	8.25
97.00	2.39	2.33	11.57	10.57
98.00	2.48	2.44	14.00	13.01
1-foot of sediment storage at the bottom of the detention basin is considered.				

From Attachment 9.4 detention volume for 100-year storm event = 8.11 ac-ft

Available storage volume in detention basin after 1-foot of free board = 10.57 ac-ft > required 8.11 ac-ft

From attachment 9.4, allowable release = pre-developed peak for 10-year = 27.8 cfs

To perform the routing for evaluating the maximum water surface elevation in the detention basin, HEC-HMS computer program is used. Area –Elevation characteristic of the detention basin presented in Table 3 was used as an input. Using the detention basin outlet pipe data from Reference 8.11 elevation outflow curve for the detention basin outlet was calculated.

Outlet pipe Length = 209 ft to the first manhole.
Outlet pipe diameter = 24 inch (RCP). Downstream pipe size (36 inch) is larger and invert elevation is 1.3 ft below 24 inch RCP pipe therefore free fall downstream condition is used.
Upstream invert elevation at detention basin = 644.5 ft (NAVD88) = 91.0 ft
Downstream invert elevation of outlet pipe = 643.21 ft (NAVD88) = 89.71 ft

Using the Culvert Master Computer program (Reference 8.8) with above outlet pipe data, outflow rating curve for different water levels in the detention basin was developed. Culvert Master program output is presented in Attachment 9.5. Detention basin Elevation-Outflow Rating is presented in Table 4

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Table 4 : Detention Basin Elevation-Outflow Curve

Water Level (ft)	Outflow (cfs)	Water Level (ft)	Outflow (cfs)
91.0	0.00	95.0	21.57
91.5	0.00	95.5	23.30
92.0	0.00	96.0	24.91
92.5	7.34	96.5	26.42
93.0	11.90	97.0	27.85
93.5	15.28	97.5	29.21
94.0	17.61	98.0	30.51
94.5	19.69		

Detention basin routing using HEC-HMS was performed for 2-year through 100-year storm events. HEC-HMS output is presented in Attachment 9.3

From Attachment 9.3
25-year storm event:
Maximum water level in the detention basin = 94.0 ft
Maximum outflow = 17.7 cfs < 27.8 cfs allowable
Free board = 98 ft – 94.0 ft = 4.0 ft

50-year storm event:
Maximum water level in the detention basin = 94.4 ft
Maximum outflow = 19.2 cfs < 27.8 cfs allowable
Free board = 98 ft – 94.4 ft = 3.6 ft

Provide emergency spillway at elevation 95.0 ft
100-year peak discharge (Attachment 9.3) = 161.6 cfs
Maximum head of water after 1.0 ft of freeboard = 98.0 – 95.0 – 1.0 = 2.0 ft
Length of emergency spillway is computed using broad crested weir equation.

Discharge Q = C x L x $H^{3/2}$; Q= 161.6 cfs, C=2.6 for broad crested weir, H = 2.0 ft
L= 161.6/(2.6 x $2.0^{3/2}$) = 22.0 say 25 ft
For 25 ft length of spillway head h = $[161.6/(2.6 \times 25)]^{2/3}$ = 1.8 ft
Water level = 1.8 + 95.0 = 96.8 ft
Free board = 98 ft – 96.8 ft = 1.2 ft

6.2 Storm Sewer System

For the analysis of storm sewer network, rainfall data presented in Table 1 is used.

For the tailwater level, the maximum water level in the detention basin from HEC-HMS output in Attachment 9.3 is used. Conservatively for both 10-Year and 25-year storm event tailwater elevation of 94.0 corresponds to 25-Year event is used.

Storrn CAD Computer Program (Reference 8.9) is used for the analysis.

Storm CAD program input and output is presented in Attachment 9.6

Inlet capacity and Head of water:

From Attachment 9.6, maximum flow for 25 year event = 13.5 cfs for SWCB-15 and 5.6 cfs for other structures.

Using the orifice equation Q = C_d x A_n x $(2gH)^{0.5}$ where:
Q = flow in cfs
C_d = Discharge coefficient for orifice =0.6
A_n = Net area of opening for grate excluding clogged area in ft^2
H = Head of water above the grate

Using the above formula, computation of required head is summarized in the Table 5.

Table 5 : Head of water above rim elevation at inlets

Structure	Flow Q (cfs)	Full Open Area (A) (Reference 8.13) (ft^2)	Net opening area 25% clogging (A_n) (ft^2)	Discharge Coefficient (C_d)	Head above rim (ft)
SWCB-15	13.5	9.3 (R-6672-Q)	6.97	0.6	0.16
Other inlets	5.6	2.1 (R-6672-K)	1.57	0.6	0.55

Therefore maximum depth of water at inlet above rim will be 0.55 ft

6.3 Culverts and Ditches

Schematic sketch of ditch and culvert and sewer network for east side area is presented in Attachment 9.7

Computations of water levels are performed from downstream to upstream as follows:

Based on the proposed grading and the upstream area of 19 acres, conservative time of concentration of 20 minutes is used.

From Attachment 9.1, 50-Year, 20 min rainfall = 1.51 inch, Intensity = 4.53 inch/hr

Ditch 1:
Bottom width = 2.0 ft (Reference 8.1)
Side slope = 3.0 (H:1V)
Upstream invert = 92.74 ft
Downstream invert = 92.15
Length of ditch = 260.0 ft (Attachment 9.7)
Manning's roughness coefficient = 0.018 (Conservatively used for aggregate surfaced ditch)
Upstream drainage area (Attachment 9.7) A = 2.3 + 4.4 (Duke Switchyard) + 4.5 + 4.0 + 4.05 = 19.25 ac
Weighted runoff coefficient C = ((19.25 – 4.05) x 0.75 + 4.05 x 0.4)/19.25 = 0.68
Peak discharge using rational formula (CIA)= 0.68 x 4.53 x 19.25 = 59.3 cfs
Downstream water level = water level in the detention basin 94.4 ft
Computation of water level is presented in Attachment 9.8
From Attachment 9.8, water level upstream of the ditch = 94.75 ft

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Culvert 1:
Culvert pipes 2 x 30" CHDPE

PER THE SITE SURVEY, 2X36" CULVERTS WERE INSTALLED

Manning's n for pipe = 0.012
Culvert length = 390 ft
Upstream invert = 93.5 ft
Downstream invert = 92.74 ft (Upstream invert of Ditch 1)
Upstream drainage area A = 4.5 + 4.0 + 4.05 = 12.55 ac (Duke switchyard not included)
Weighted runoff coefficient C = (8.5 x 0.75 + 4.05 x 0.4)/12.55 = 0.64
Peak discharge using rational formula (CIA)= 0.64 x 4.53 x 12.55 = 36.4 cfs
Downstream water level = 94.75 (water level at upstream end of Ditch 1)
Computation of water level is performed using Culvert Master Computer program (Reference 8.8) Culvert Master input output is presented in Attachment 9.9
From Culvert Master output in Attachment 9.9, Upstream head water level = 95.81 ft

Ditch 2:
Bottom width = 2.0 ft (Reference 8.1)
Side slope = 3.0 (H:1V)
Upstream invert = 94.5 ft
Downstream invert = 93.5 (Upstream invert of Culvert 1)
Length of ditch = 500 ft (Attachment 9.7)
Manning's roughness coefficient = 0.018 (Conservatively used for aggregate surfaced ditch)
Upstream drainage area A = 4.5 ac
Weighted runoff coefficient C = 0.75
Peak discharge using rational formula (CIA) = 0.75 x 4.53 x 4.5 = 15.3 cfs
Downstream water level = 95.81 (Head water level of Culvert 1)
Computation of water level is presented in Attachment 9.8
From Attachment 9.8, water level upstream of the Ditch 2 = 95.95 ft
Free board = 98.0 – 95.95 = 2.05 ft > required 1.0 ft

Duke Switchyard storm sewer network:
Analysis is performed for 50-year storm event to confirm upstream water level upstream of CB-1 may behave as culvert.
Downstream water level = Headwater elevation of Culvert 1 = 95.81 ft (Attachment 9.8)
Computation of water level is performed using StormCAD Computer program (Reference 8.9) StormCAD input output is presented in Attachment 9.10

7. RESULTS & CONCLUSIONS

7.1 Detention Basin

From Attachment 9.3, maximum water levels and ouflows from the detention basin for the different storm events are summarized in Table 6

Table 6: Summary of results for the detention basin

Parameter	Storm Event (Return period in Years)					
	2	5	10	25	50	100
Maximum Water Level (ft)	92.8	93.2	93.6	94.0	94.4	94.8
Peak outflow (cfs)	10.5	13.5	15.6	17.7	19.2	20.7
Peak Storage (ac-ft)	1.6	2.4	3.0	4.0	4.7	5.5

Top of elevation of the detention basin = 98.0 ft
Emergency spillway crest elevation = 95.0 ft (above 50-year water level)
Emergency spillway length = 25 ft
100-year maximum water level for emergency spillway operation = 96.8 ft
Freeboard = 1.2 ft more than required 1.0 ft

7.2 Storm Sewers

Power block area
Computer program output of stormsewer network for power block area is presented in Attachment 9.6.
From Attachment 9.6:
Minimum velocity (10 –Year) = 2.99 ft/sec ≈ 3.0 ft/sec so OK
Maximum velocity (10-Year) = 10.55 ft/sec > 10 ft/sec (Slightly higher for only one pipe, all others at or below 10 ft/sec so OK)
Minimum Cover = 1.25 ft > 1.0 ft

Switchyard area
Computer program output of stormsewer network for power block area is presented in Attachment 9.10

From Attachment 9.10:
Minimum velocity (50 –Year) = 5.6 ft/sec > 3.0 ft/sec
Maximum velocity (50-Year) = 8.5 ft/sec < 10 ft/sec
Minimum Cover = 1.5 ft > 1.0 ft except one pipe P-31 from CB-16 to CB-14;

7.3 Culverts and Ditches

From Attachment 9.8

Culvert 1:
Maximum head water elevation for 50-year storm = 95.81 ft
Freeboard = 2.19 ft > required 1 ft.
Velocity downstream = 4.3 ft/sec (Attachment 9.9), No slope protection required (Reference 8.5), however to be conservative riprap will be provided.

Ditch 1:
Water level upstream for 50-year =94.8 ft
Top of ditch elevation at upstream = 98.0 ft
Free board = 3.2 ft > 1.0 ft

Ditch 2:
Water level upstream for 50-year =95.95. ft
Top of ditch elevation at upstream = 96.0 ft
Free board = 0.05 ft < 1.0 ft

7.4 Conclusions

All ditches, culverts and storm sewers satisfy acceptance criteria presented in Section 4.2, except Ditch 2 will have free board of 0.05 ft which is less than 1 ft, however ponding of the water will be at the upstream end only and ponded area will be very small for 50-year storm event and therefore acceptable

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8. REFERENCES

8.1 S&L Drawing for Initial Grading Plan, Drawing MEC-SW-C0302 through MEC-SW-C0304, MEC-SW-C0307 Revision 2, and MEC-SW-C0305, Revision 1.

8.2 S&L Drawing for Initial Grading Details, Drawing MEC-SW-C0307 Revision 2.

8.3 S&L Drawing for Sewer Composite Plan, Drawing MEC-SW-C0501 through MEC-SW-C0502 Revision 1 and MEC-SW-C0503 through MEC-SW-C0507, Revision 0.

8.4 National Oceanic and Atmospheric Administration Atlas 14, Volume 2, Version 3. “Point Precipitation Frequency Estimates.”, Location Name: Middletown, Ohio, US.

8.5 Manual of Design for Public Improvements, City of Middletown, Ohio, March 2007

8.6 Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55), Natural Resources Conservation Services(NRCS), June 1986.

8.7 Natural Resources Conservation Services(NRCS), Web Soil Survey, Nation Cooperative Soil Survey, We site http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx accessed on 7/20/2015

8.8 Culvert Master Version 3.03.00.04 (S&L Verified and Validated Program No. 03.7.713-3.03.00.04) Status: N, Long Audit trail report is attached in Attachment 9.11

8.9 StornCAD Version 8.11.02.75 (S&L Verified and Validated Program No. 03.7.711-8.11.02.75) Status: N, Long Audit trail report is attached in Attachment 9.12

8.10 Hydrologic Engineering Center’s Hydrologic Modeling System (HEC-HMS), Version 3.5, (S&L Verified and Validated Program No. 03.7.852-3.5) Status: C, Long Audit trail report is attached in Attachment 9.13

8.11 The Kleingers Group, NTE Energy Detention Design Report, City of Middletown, Ohio, December 8, 2014 (Attachment 9.14)

8.12 Hydrologic Engineering Center’s Hydrologic Modeling System (HEC-HMS), Version 3.5, S&

8.13 Neenah Construction Casting, Neenah Foundry, Catalog, Edition 15

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9. ATTACHMENTS

9.1 Rainfall data from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 (Reference 8.4)

9.2 Site Drainage Area

9.3 HEC-HMS Computer program output showing peak discharge and runoff.

9.4 Detention Volume and Allowable Peak Release Computation sheet

9.5 Culvert Master Output for the detention basin Outlet Pipe Rating Curve

9.6 Storm CAD computer program input and output

9.7 Schematic sketch of ditch and culvert and sewer network for east side area

9.8 Computation summary sheet for ditch, culvert and sewer network for east side area

9.9 Culvert Master computer program input output for Culvert 1

9.10 Storm CAD computer program input output (Duke switch yard area)

9.11 Long Audit trail report, Culvert Master Version 3.03.00.04 (S&L Verified and Validated Program No. 03.7.713-3.03.00.04) Status: N.

9.12 Long Audit trail report, StornCAD Version 8.11.02.75 (S&L Verified and Validated Program No. 03.7.711-8.11.02.75) Status: N

9.13 Long Audit trail report, Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS), Version 3.5, (S&L Verified and Validated Program No. 03.7.852-3.5) Status: C.

9.14 The Kleingers Group, NTE Energy Detention Design Report, City of Middletown, Ohio, December 8, 2014 (Reference 8.11)