

June 16, 2022

Tennessee Valley Authority
1101 Market Street
Chattanooga
Tennessee, 37402-2801

**Subject: Engineer's Certification of Seismic Impact Zones Location Restriction Demonstration
North Rail Loop Landfill Cell 2
Tennessee Valley Authority Gallatin Fossil Plant
Gallatin, Tennessee**

1.0 PURPOSE

The purpose of this document is to certify that the Tennessee Valley Authority (TVA) Gallatin Fossil Plant (GAF) North Rail Loop (NRL) Landfill Cell 2 is in compliance with the seismic impact zones location restriction requirements specified in 40 CFR § 257.63 of the United States Environmental Protection Agency (USEPA) Coal Combustion Residuals Rule (CCR Rule). Cell 2 is defined by the CCR Rule as a lateral expansion of the existing NRL Landfill (Cell 1). Presented below is the background, summary of findings, and certification.

2.0 BACKGROUND

In accordance with 40 CFR § 257.63(a), all new and existing CCR impoundments, new CCR landfills, and lateral expansions of units must not be located in seismic impact zones unless the owner or operator demonstrates that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit such that all structural components including liners, leachate collection and removal systems, and surface water control systems, are able to resist the maximum horizontal acceleration in lithified earth material for the site.

3.0 SUMMARY OF FINDINGS

A Location Restriction Demonstration (Demonstration) has been prepared and is provided in **Attachment A**. The Demonstration shows that the NRL Landfill Cell 2 meets the requirements set forth in 40 CFR § 257.63(a).

4.0 CERTIFICATION

I, David E. Skeggs, being a Professional Engineer in good standing in the State of Tennessee, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with the accepted practice of engineering; that the information contained herein is accurate as of the date of my signature below; and that the North Rail Loop Landfill Cell 2 meets the requirements of 40 CFR § 257.63(a).

SIGNATURE: _____



David E. Skeggs, PE

DATE: June 16, 2022

ADDRESS: 5438 Wade Park Boulevard
Suite 200
Raleigh, NC 27607

TELEPHONE: 919-461-1100

ATTACHMENTS: A – Seismic Impact Zones Location Restriction Demonstration



Attachment A
Seismic Impact Zones Location Restriction
Demonstration

TVA GALLATIN FOSSIL PLANT – SUMNER COUNTY, TENNESSEE

SEISMIC IMPACT ZONES
LOCATION RESTRICTION DEMONSTRATION
40 CFR § 257.63
NORTH RAIL LOOP
LANDFILL CELL 2

Prepared for



Tennessee Valley Authority
1101 Market St.
Chattanooga, TN 37402-2801

Revision 1
June 16, 2022

Prepared by

AECOM
5438 Wade Park Boulevard, Suite 200
Raleigh, NC 27607
919-461-1100



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Figure 3. Rail Loop Geologic Map

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REVISION HISTORY

Revision	Revision Date	Description
0	09/10/2021	Initial Issue
1	06/16/2022	Revised Issue – Revised Figure 3 to provide updated geologic map of the site



1.0 INTRODUCTION

1.1 OBJECTIVE

This Location Restriction Demonstration (Demonstration) has been prepared for the North Rail Loop (NRL) Landfill Cell 2, which is a lateral expansion of the existing NRL Coal Combustion Residuals (CCR) Landfill (Cell 1), located at the Tennessee Valley Authority's (TVA) Gallatin Fossil Plant (GAF) in Sumner County, Tennessee.

The purpose of this Demonstration is to document compliance with the seismic impact zones location restriction requirements set forth in 40 CFR § 257.63 of the United States Environmental Protection Agency (USEPA) CCR Rule.

1.2 CCR RULE REQUIREMENTS – 40 CFR § 257.63

§ 257.63 Seismic impact zones

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(c) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (c)(1) or (2) of this section.

(1) For an existing CCR surface impoundment, the owner or operator must complete the demonstration no later than October 17, 2018.

(2) For a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit, the owner or operator must complete the demonstration no later than the date of initial receipt of CCR in the CCR unit.

(3) The owner or operator has completed the demonstration required by paragraph (a) of this section when the demonstration is placed in the facility's operating record as required by § 257.105(e).

(4) An owner or operator of an existing CCR surface impoundment who fails to demonstrate compliance with the requirements of paragraph (a) of this section by the date specified in paragraph (c)(1) of this section is subject to the requirements of § 257.101(b)(1).



(5) An owner or operator of a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit who fails to make the demonstration showing compliance with the requirements of paragraph (a) of this section is prohibited from placing CCR in the CCR unit.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(e), the notification requirements specified in § 257.106(e), and the Internet requirements specified in § 257.107(e).

As required by 40 CFR § 257.63(a), TVA must demonstrate that the NRL Landfill Cell 2 is not located within a seismic impact zone, unless the specified landfill components are designed to withstand the maximum peak ground acceleration (PGA) for the site. Per 40 CFR § 257.53, a seismic impact zone is defined as “an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth’s gravitational pull (g), will exceed 0.10 g in 50 years.” This demonstration must be made prior to receiving any CCR in the NRL Landfill Cell 2 per 40 CFR § 257.63(c)(2).

1.3 METHODOLOGY

The United States Geological Survey (USGS) publishes hazard maps for various return periods, including 2 percent in 50 years. The hazard map was last updated in 2014 (USGS, 2014). This demonstration is made by reviewing the 2 percent in 50 years hazard map provided by USGS and determining if the site falls into a seismic impact zone as described above.

1.4 SITE BACKGROUND

The NRL Landfill is located on land currently owned by TVA at GAF. GAF is located at 1499 Steam Plant Road in Sumner County, on the north bank of the Cumberland River, approximately four miles southeast of the juncture of U.S. Route 31E and Tennessee State Route 109 in Gallatin. The NRL site for the disposal facility (Figure 1) is located within the GAF reservation, just north of the GAF plant and west of Steam Plant Road. Existing ground surface elevation across the disposal site ranges from approximately 470-ft to 580-ft National Geodetic Vertical Datum of 1929 (NGVD29).

2.0 REGIONAL AND SITE GEOLOGY

Middle Tennessee, where GAF is located, is occupied by the Nashville Dome, which is a large anticlinal structure with a northeast-southwest trending axis that occurs on the south end of the Cincinnati Arch. Bedrock of the Nashville Dome nearest the surface generally consists of Ordovician limestones, dolomites, and shales, while the surrounding Highland Rim region generally consists of younger (less eroded) Silurian, Devonian, and Mississippian limestones, cherts, shales, and sandstones. These sedimentary rocks are underlain by approximately 2,500-ft of Cambrian sedimentary rocks and a Precambrian igneous and metamorphic basement complex (Wilson, 1991). Regional dips for bedrock surrounding the study area are approximately 15- to 25-ft per mile (less than one degree) to the northwest (Wilson, 1991). The published regional geologic map for the Odom’s Bend area is provided in Figure 2.



A geologic map of the NRL Landfill area is provided in Figure 3. The map was created primarily from field collected data, including drilling, borehole geophysical logging, Electrical Resistivity Imaging (ERI) and seismic refraction surveys, and geologic mapping of rock outcroppings. It also takes into account information obtained from published maps and other literature sources. The bedrock stratigraphy in the area of study is, from youngest to oldest and in the order that the units are encountered from the surface:

Nashville Group	<u>Bigby-Cannon Limestone</u> – comprises the <i>Bigby</i> facies (0- to 10-ft thick), the <i>Cannon</i> facies (40- to 80-ft thick), and the <i>dove-colored</i> facies (10- to 20-ft thick).
	<u>Hermitage Formation</u> – comprises the <i>silty nodular</i> facies (0- to 5-ft thick), the <i>granular phosphatic</i> facies (10- to 20-ft thick), and the <i>laminated argillaceous</i> facies (40- to 60-ft thick).
Stones River Group	<u>Carters Limestone</u> – comprises the <i>Upper Carters</i> (10- to 20-ft thick), the <i>T-3 bentonite</i> deposit (6- to 12-inches), and the <i>Lower Carters</i> (60- to 70-ft thick).
	<u>Lebanon Limestone</u> – consists of a single facies, approximately 80- to 120-ft thick.

These strata are separated by erosional unconformities. The most recognizable geologic contacts occurring in this sequence are the Hermitage/Carters contact and the Upper/Lower Carters contact. A graphical depiction of the stratigraphic column was prepared as part of the NRL Landfill Hydrogeologic Evaluation Report (HER) (URS, 2013) and is provided herein in Figure 4. A detailed discussion of the regional and site-specific geology can be found in the HER (URS, 2013).

3.0 SEISMIC IMPACT ZONES

A figure showing the location of GAF overlaying contours of PGA for a two-percent probability of exceedance in 50 years is provided in Figure 5. As shown in Figure 5, GAF is located in a zone with a PGA of 0.11-0.14g. As such, GAF is located in a seismic impact zone. Therefore, the NRL Landfill and associated structural components were designed to withstand the maximum horizontal acceleration due to the probabilistic earthquake. Supporting calculations can be found in Part F of the State Part II Permit Application (URS, 2014).

4.0 CONCLUSIONS

As noted in Section 3, GAF is located in a seismic impact zone and the NRL Landfill was designed to withstand the probabilistic earthquake such that the NRL Landfill Cell 2 meets the requirements of 40 CFR § 257.63(a).

5.0 REFERENCES

URS (2013), *TVA Gallatin Fossil Plant, Part II Permit Application, CCP Disposal Facility – North Rail Loop, Hydrogeologic Evaluation*, January 2013

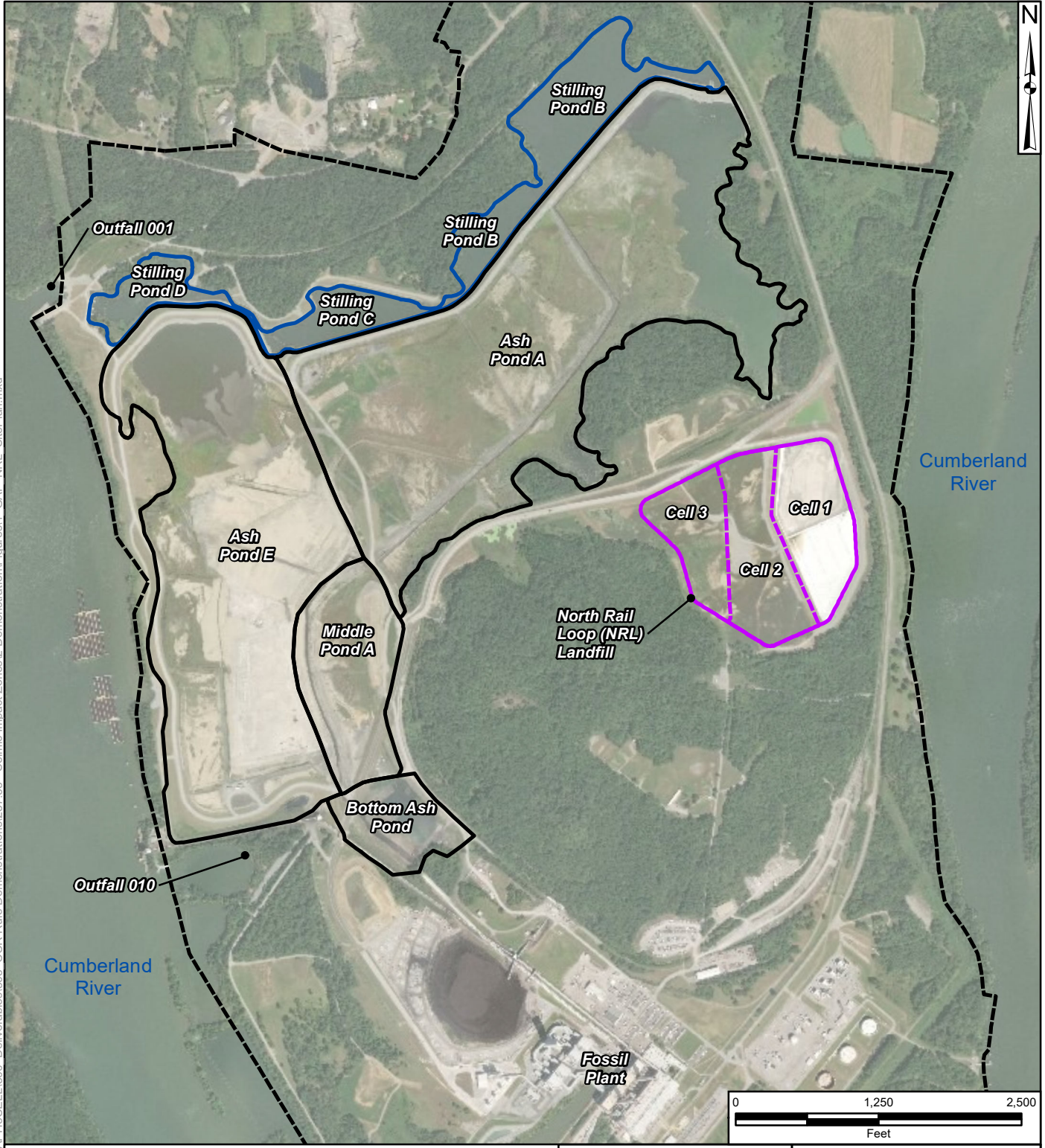


URS (2014), *Part II Permit Application, CCP Disposal Facility – North Rail Loop Site, Engineering Plans and Narratives, Vol 3 – Design Calculations*, June 2014.

United States Geological Survey (2014), *Seismic Hazard Maps & Site-Specific Data, United States – Lower 48*, accessed via:
<https://earthquake.usgs.gov/hazards/hazmaps/conterminous/index.php#2014>

Wilson Jr., C.W., (1991). *The Geology of Nashville, Tennessee. TDEC, Division of Geology, Bulletin 52, Second Edition.*

FIGURES

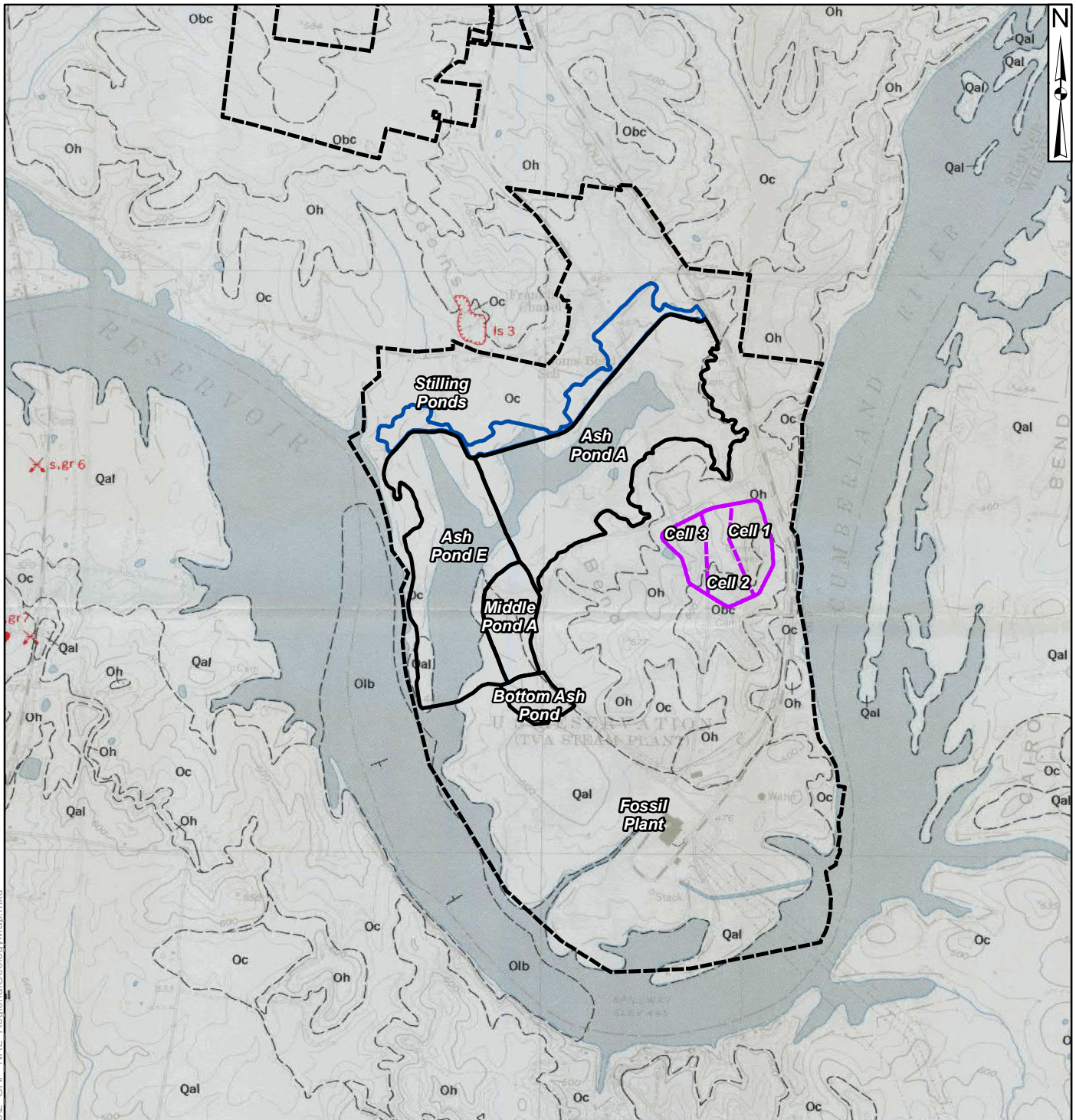


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- LEGEND**
- CCR Management Units
 - North Rail Loop (NRL) Landfill
 - Stilling Ponds
 - TVA Gallatin Fossil Plant Property Boundary

AECOM		Figure 1	
SITE LOCATION MAP			
DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
J.COLLEY	D.SKEGGS	-	REV. 1
GALLATIN FOSSIL PLANT TENNESSEE VALLEY AUTHORITY			
DATE:	DEPT:		
MAR 2020	FOSSIL AND HYDRO ENGINEERING		

NOTE: Aerial image dated February 2017



NOT TO SCALE

LEGEND

- CCR Management Units
- North Rail Loop (NRL) Landfill
- Stilling Ponds
- TVA Gallatin Fossil Plant Property Boundary (Approximate)

	Contact, dashed where approximate		
	Strike and dip of beds		gr Gravel
	Active quarry or pit		ls Limestone
	Abandoned quarry		s Sand
	Abandoned pit		
	Map numbers refer to descriptions in Mineral Resources Summary		

	Qal	Alluvial Deposits
	Ocy	Catheys Formation
	Obc	Bigby-Cannon Limestone
	Oh	Hermitage Formation
	Oc	Carters Limestone
	Olb	Lebanon Limestone

AECOM **Figure 2**

REGIONAL GEOLOGIC MAP

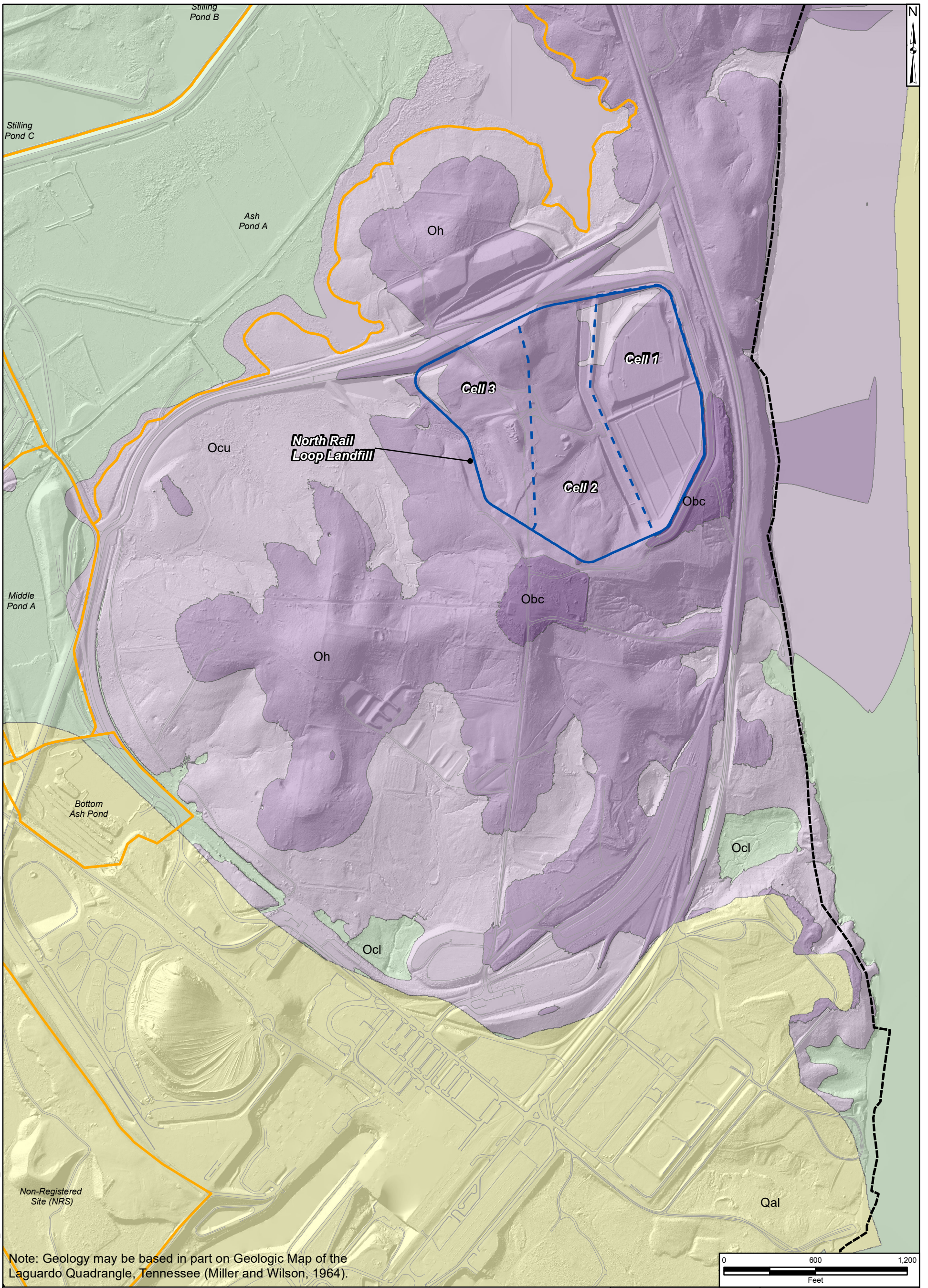
DRAWN BY: J.COLLEY	REVIEWED BY: D.SKEGGS	APPROVED BY: -	REVISION NUMBER: REV. 1
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**GALLATIN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY**

DATE: JULY 2020	DEPT: FOSSIL AND HYDRO ENGINEERING
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NOTE: Laguardo Quadrangle Geologic Map from the State of Tennessee Department of Conservation Division of Geology dated 1964.



Note: Geology may be based in part on Geologic Map of the Laguardo Quadrangle, Tennessee (Miller and Wilson, 1964).

LEGEND	
	Lebanon Limestone
	Alluvium
	Bigby-Cannon Limestone
	Hermitage Formation
	Upper Carters Limestone
	Lower Carters Limestone
	CCR Management Units
	North Rail Loop (NRL) Landfill
	TVA Gallatin Fossil Plant Property Boundary

NOTE: Geologic surfaces from April 25, 2019

AECOM

Figure 3

RAIL LOOP GEOLOGIC MAP

DRAWN BY: J. COLLEY	REVIEWED BY:	APPROVED BY: D. SKEGGS	REVISION NUMBER: REV 1
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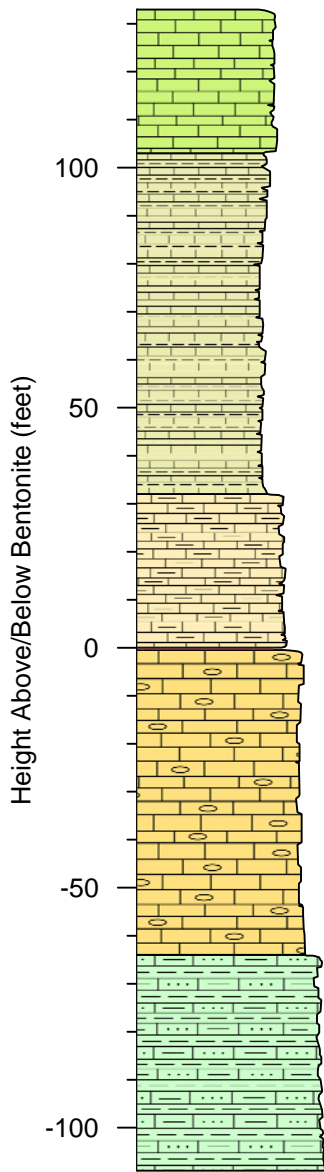
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TENNESSEE VALLEY AUTHORITY

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Figure 4

Extracted from the Hydrogeologic Evaluation Report (URS, 2013)



Bigby-Cannon Limestone

Medium to dark gray, microcrystalline to medium-grained, fossiliferous limestone, with shaly and fossil-hash beds.

Hermitage Formation

Medium to dark gray, slightly fossiliferous, very fine-grained argillaceous limestone and calcareous shale, laminated to thinly bedded.

Upper Carters Limestone

Gray to dark gray microcrystalline to medium-grained, fossiliferous limestone, with shale laminations and trace fossils.

Bentonite

Light gray to bluish-gray, fat clay; volcanic ash. Regionally identified as the T3 bentonite.

Lower Carters Limestone

Light gray and yellowish brown, fossiliferous, medium-grained limestone, with shale laminations, chert nodules and chert lenses, trace fossils, and stylolites.

Lebanon Limestone

Medium gray to olive gray, very fine to medium-grained, fossiliferous limestone, with thin shaly beds.

RAIL LOOP CCP LANDFILL PROJECT

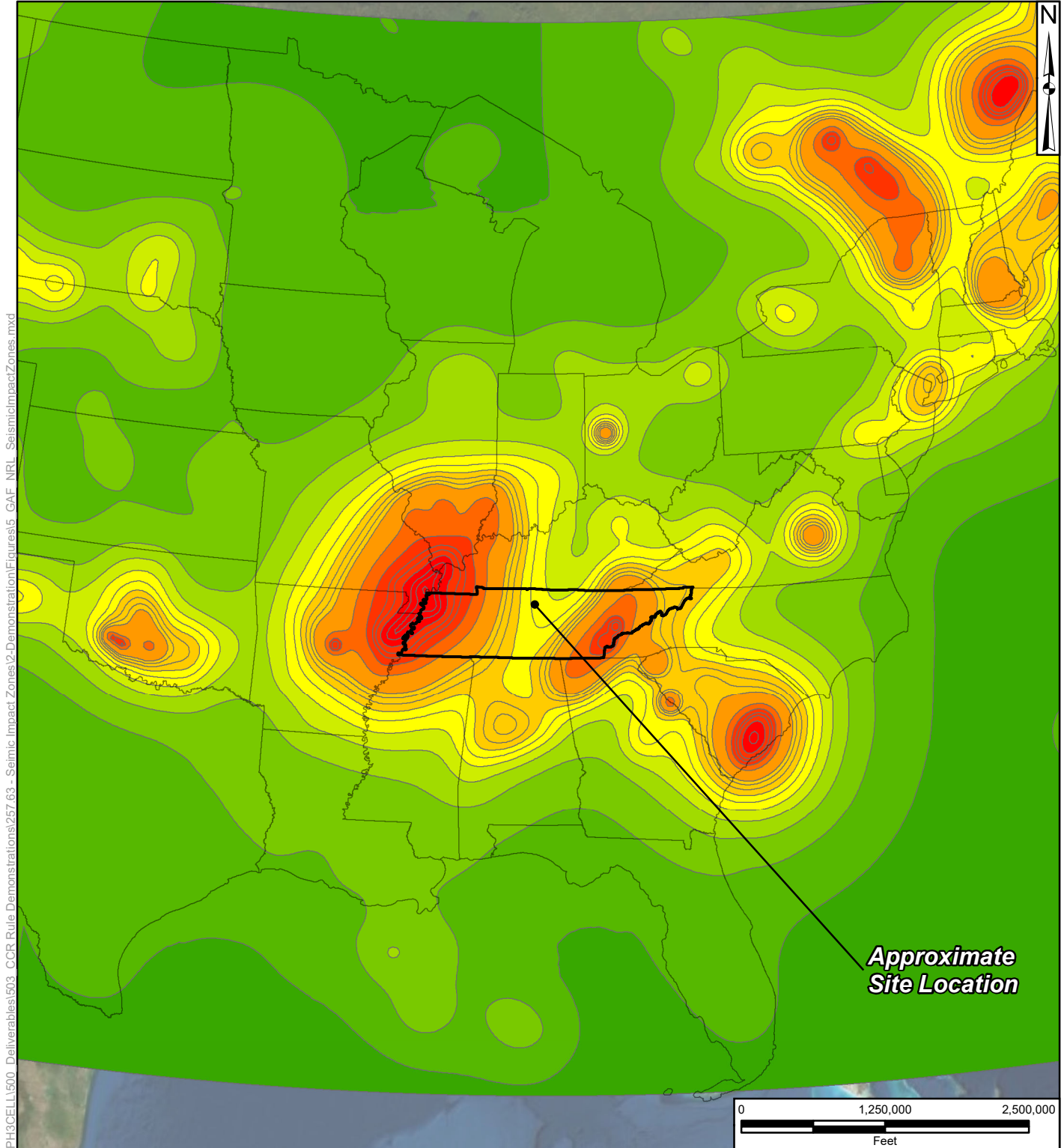
STRATIGRAPHIC COLUMN

DESIGNED BY: JRW	DRAWN BY: JRW	CHECKED BY: PFF	SUPERVISED BY: VEK	REVIEWED BY:	ISSUED BY:	APPROVED BY:
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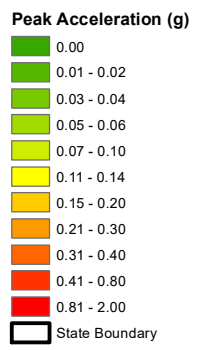


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Golden Grapher	DATE 11/08/2012				FIGURE 4-4
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Note:
 [1] Peak accelerations obtained from United States Geological Survey, Seismic Hazard Maps & Site Specific Data Website, <https://earthquake.usgs.gov/hazards/hazmaps/conterminous/index.php#2014>

AECOM		Figure 5	
TWO-PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS MAP OF PEAK GROUND ACCELERATION			
DRAWN BY: J.COLLEY	REVIEWED BY: D.SKEGGS	APPROVED BY: -	REVISION NUMBER: REV. 1
GALLATIN FOSSIL PLANT TENNESSEE VALLEY AUTHORITY			
DATE: NOV 2019	DEPT: FOSSIL AND HYDRO ENGINEERING		