BULL RUN FOSSIL PLANT

Tennessee Valley Authority
welcomes you to the

Environmental Investigation Plan
Bull Run Fossil Plant

COMMUNITY INFORMATION SESSION

BULL RUN FOSSIL PLANT

EVENT GUIDE

This event is to provide information about the Environmental Investigation Plan (EIP) for the Bull Run Fossil Plant. We welcome your feedback and comments on the EIP.

The following acronyms appear frequently on the boards:

- Environmental Investigation Plan (EIP)
- Environmental Assessment Report (EAR)
- Coal Combustion Residuals (CCR)
- Tennessee Valley Authority (TVA)
- Tennessee Department of Environment and Conservation (TDEC)
- Sampling and Analysis Plan (SAP)
- Environmental Protection Agency (EPA)

The information boards are color-coded according to the technical focus area they cover in the EIP. For instance, if they contain general information regarding the EIP process, the information board will be color-coded in blue.

General Information

Below are the main areas of technical focus in the EIP, divided by study area. More information on the activities within each area has been provided at the stations around the room.

The evaluation of existing site data serves as the foundation to support the additional studies planned for each focus area.

Geotechnical	Civil/Mapping Activities	Hydrogeologic	Environmental
• Exploratory Drilling	• Coal Combustion Residuals Material Quantity	• Hydrogeologic Investigation	• Benthic Investigation
• Slope Stability		• Groundwater Investigation	• Surface Stream Investigation
		• Water Use Survey	• Fish Tissue Investigation
		• Background Soil Investigation	• Seepage Investigation
			• CCR Material Characteristics

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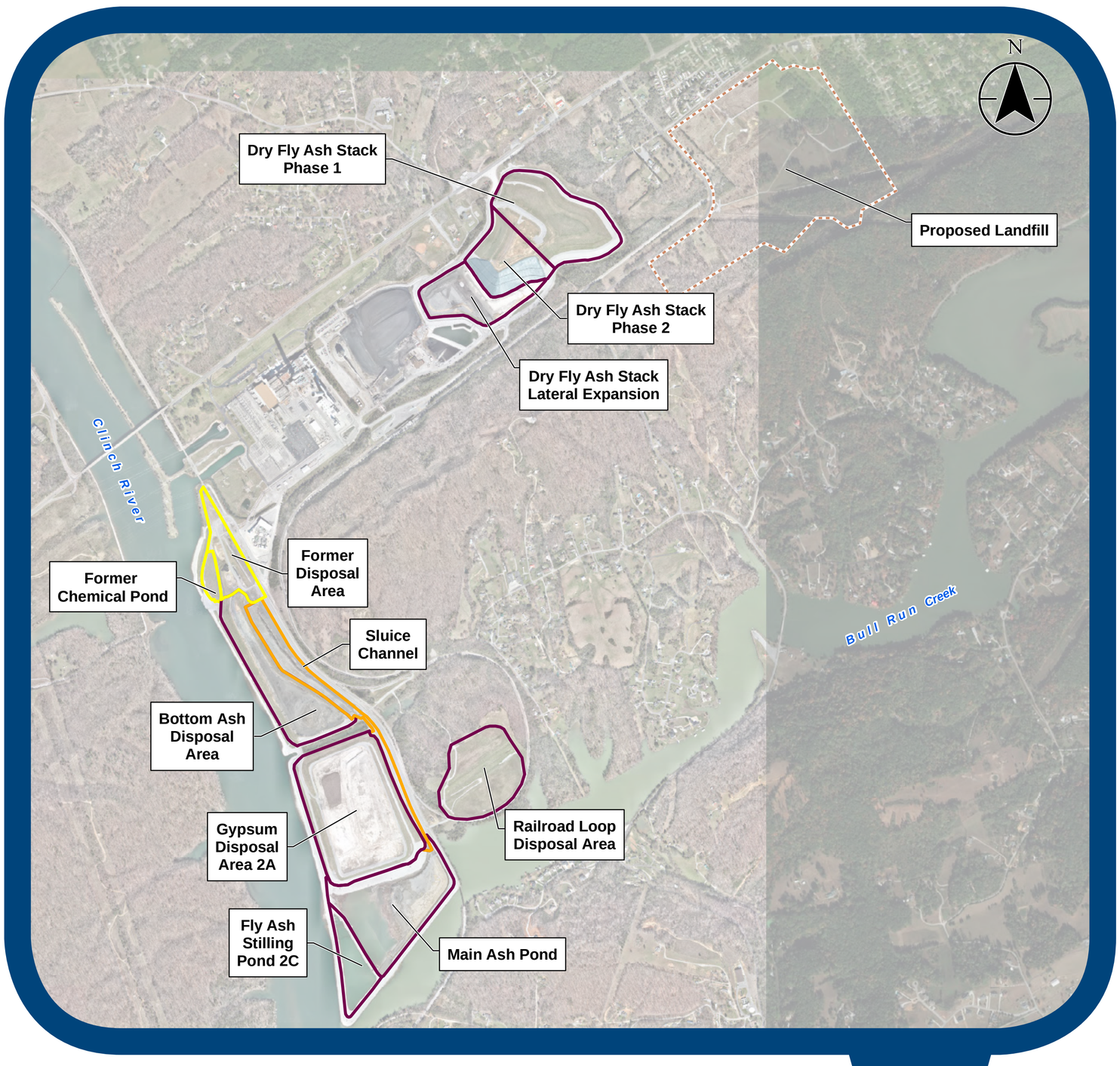
TDEC Order CCR Units:

- Dry Fly Ash Stack Phase 1 (Closed)
- Dry Fly Ash Stack Phase 2
- Dry Fly Ash Stack Lateral Expansion
- Bottom Ash Disposal Area
- Railroad Loop Disposal Area (Closed)
- Gypsum Disposal Area 2A
- Fly Ash Stilling Pond 2C
- Main Ash Pond



Facility Overview

1967 Generator goes into operation (**largest** in the **world** in the volume of steam produced at the time)

6 billion kilowatt-hours of electricity/year

Enough to supply **400,000** homes

13 times best heat rate (a measure of efficiency) of any plant in the United States

7,300 tons of coal burned daily

TVA's only single-unit, coal-fired plant

BULL RUN FOSSIL PLANT

COAL COMBUSTION RESIDUALS COMPLIANCE ORDER

What is the TDEC Order and why was it put in place?

On August 6, 2015, the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 to the Tennessee Valley Authority (TVA) for Coal Combustion Residuals (CCR) compliance pursuant to the provisions of Tennessee's solid waste management and disposal laws.

This order establishes a transparent, comprehensive process to investigate, assess, and remedy any unacceptable risks resulting from the management and disposal of CCR at TVA coal-fired power plants within the state:

Plant	Comment Period
Cumberland	April 12 to May 25
John Sevier	July 25 to September 7
Kingston	August 15 to September 28
Watts Bar	September 5 to October 19
Bull Run	September 19 to November 2
Johnsonville	September 26 to November 9
Allen	October 15 to November 28

What are coal combustion residuals?

Coal combustion residuals, commonly known as coal ash, are created when power plants burn coal to produce electricity.

These residuals include fly ash, bottom ash/slag, and gypsum, and are collected separately from different areas of the facility.

Fly ash originates from the flue gas electrostatic precipitators, bottom ash from the boilers, and gypsum from the sulfur dioxide scrubbers.

What is the EIP?

What it is and why we do it

TDEC has requested certain information about Bull Run's CCR management.

What TVA has already done

TVA has ongoing programs and monitoring that can help answer TDEC's questions.

Proposed EIP Activities

The Environmental Investigation Plan (EIP) lays out the proposed investigation TVA will conduct to provide additional information that TDEC has requested.

Did you know…

For over 50 years, Bull Run has been awarded the distinction of being one of the most energy-efficient coal-fired power plants in the nation.

Bottom Ash/Slag

Gypsum

Fly Ash

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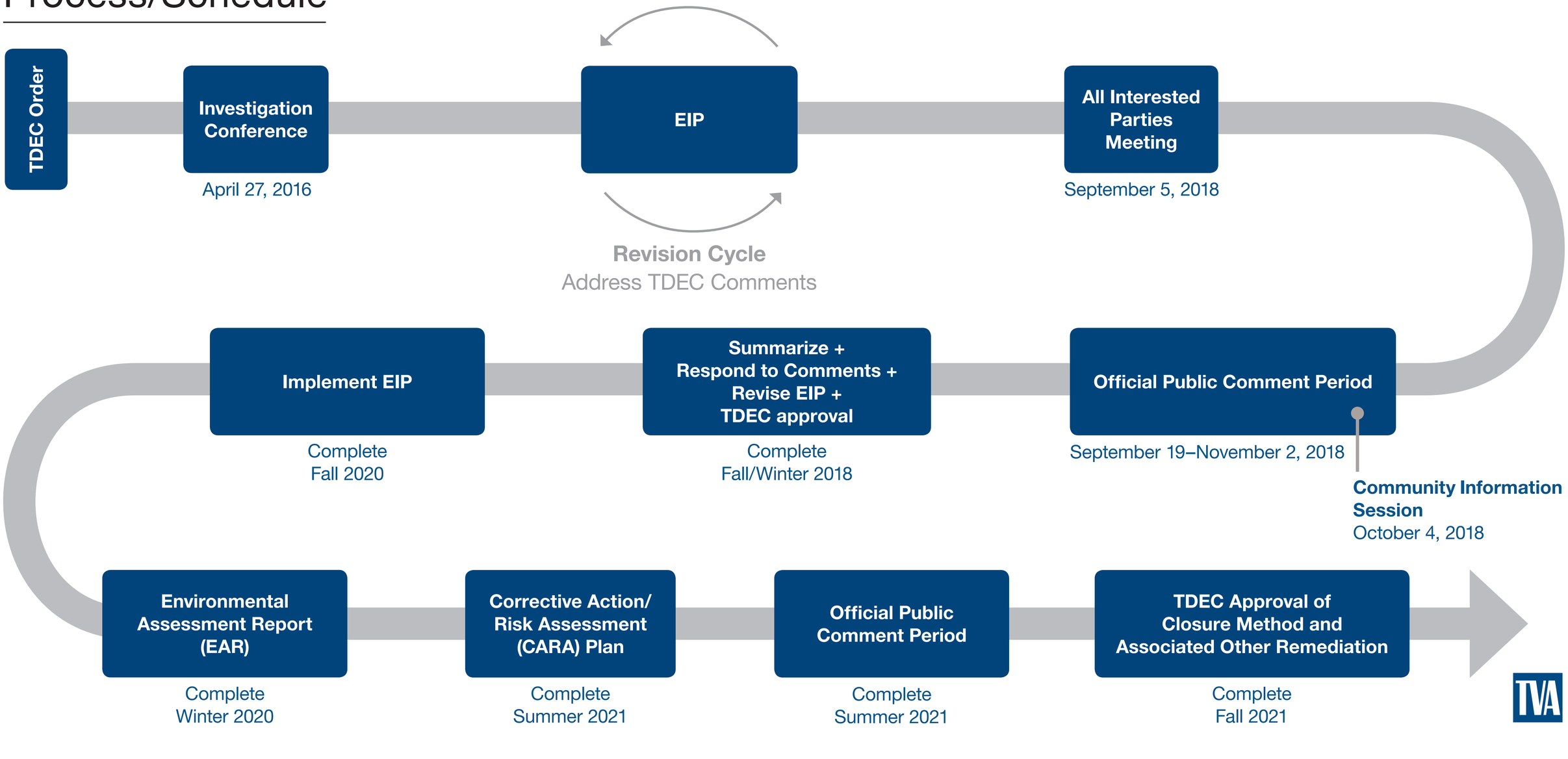
ENVIRONMENTAL INVESTIGATION PLAN

Process/Schedule



BULL RUN FOSSIL PLANT

ACTIVITIES MATRIX

FOCUS AREA	EXISTING INFORMATION	PROPOSED EIP ACTIVITIES
Exploratory Drilling	• Performed as required for specific projects • Over 550 existing borings and over 165 water level instruments	• Geotechnical drilling and soil/rock sampling • Install water level instruments • Laboratory testing
Slope Stability	• Routine visual monitoring and instrumentation monitoring • Existing analyses (available for some units) meet industry standards • Existing drilling and laboratory data support new analyses	• New analyses (for some units) for normal and earthquake conditions • Compare existing models to new data • If needed, update models and reanalyze • Compare slope stability results to acceptance criteria
Coal Combustion Residuals (CCR) Material Quantity	• As built/record drawings • Aerial surveys performed for specific projects • Drilled borings history beginning in 1959	• Review existing surveys, drawing, and borings • Develop three-dimensional models of CCR units • Update three-dimensional models with new boring data and water levels • Confirm CCR volumes
Hydrogeologic Investigation	• Monitoring well network in place for CCR Rule and state permitting requirements	• Install 9 pilot holes to be converted to piezometers • Install 9 pilot holes to be converted to monitoring wells
Groundwater Investigation	• Groundwater monitoring has been ongoing since 1981	• Bimonthly groundwater sampling for 1 year (6 events)
Water Use Survey	• Previous surveys in 1999 and 2014	• Update previous studies by reviewing State database and water supply information for Claxton
Background Soil Investigation	• Background soil data previously collected during 2009	• Test additional background soil locations for CCR Parameters • Visually inspect accessible rock and residuum outcrops in the vicinity of the Plant in an attempt to determine if naturally occurring sources of metallic ore minerals are present in the area • Review existing data for comparative analysis

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ACTIVITIES MATRIX

FOCUS AREA	EXISTING INFORMATION	PROPOSED EIP ACTIVITIES
Benthic Investigation (sediment, benthic macroinvertebrate and mayfly sampling)	• Conducted sediment sampling of Melton Hill Reservoir in association with TVA's Reservoir Ecological Health Monitoring Program from 1991 to 2016 • Performed 34 sampling events under the program • Collected samples and performed total analyses for 14 different metals • Benthic invertebrate community sampling completed in 2010, 2011, 2014 and 2016	• Collect sediment, benthic macroinvertebrate, and mayfly samples • Analyze sediment samples for CCR constituents and percentage of ash • Analyze benthic macroinvertebrate samples for community composition • Analyze mayfly samples for CCR metals constituents • Report on analytical assessment
Surface Stream Investigation	• Performed surface water sampling at Bull Run Outfalls 001, 002, and IMP 004 in accordance with NPDES Permit TN0005410 • Conducted heavy metal monitoring at the West Knox District Intake between 2006 and 2012 as required by NPDES Permit TN0005410	• Collect water samples • Analyze samples for CCR Parameters • Conduct comparative analysis against upstream samples and existing surface data • Report on analytical assessment
Fish Tissue Investigation	• Reservoir Fish Assemblage assessments in Clinch River since 2001 • No evidence of adverse environmental impact • No samples analyzed to assess impacts from CCR parameters	• Capture target fish species at sampling locations • Remove and transport fish tissue samples to laboratory • Analyze tissue samples for CCR constituents • Comparative analysis against upstream samples • Report on analytical assessment
Seepage Investigation	• Conducted seep inspections in accordance with Seep Action Plan: – Quarterly for potential seepage areas – Monthly for active seepage areas until remediated • Annual seep inspection report submitted to TDEC	• Conduct seepage investigation to identify active seeps • Collect soil and water samples at identified seeps • Analyze samples for CCR constituents • Comparative analysis against background soils • Report on analytical assessment
CCR Material Characteristics	• Total metals, leachability analysis of fly ash and bottom ash conducted 1995 • Total metals, leachability analysis of fly ash and bottom ash conducted 2002 • Total metals, leachability analysis of fly ash, bottom ash, and gypsum conducted 2013	• Collect CCR material samples from borings in units • Collect pore water samples from temporary wells in units • Analyze samples for CCR constituents • Comparative analysis against existing data • Report on analytical assessment

BULL RUN FOSSIL PLANT

HISTORIC TIMELINE

1962

Construction begins on Bull Run Fossil Plant (BRF), which will become TVA's only single-generator coal-fired power plant

It will require over 300 miles of piping to move steam that is over 1000°F at over 248 atmospheres of pressure!

1967

BRF begins producing power using the biggest boiler ever built in the USA to generate the largest volume of steam in the world. At its peak, it provides electricity for about 400,000 homes a year.

1981

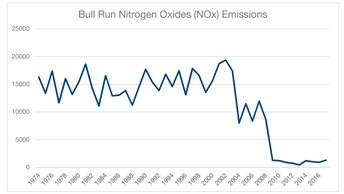
New ash disposal area (the Rail Loop) opens

1995-2017

BRF starts a 22-year long run of being named one of the 10 most efiicient power plants in the USA, including being named the most efficient plant 13 times

2003

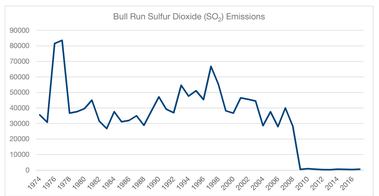
Selective catalytic reduction (SCR) system installed, reducing NO_x emissions by **90%**



2005-2008

Flue gas desulfurization (FGD) system installed, reducing SO_2 emissions by **95%**

Over $5.4 billion has been spent so far in updating all of TVA's fossil fuel plants to produce ***cleaner energy***



2009

TVA commits up to $2 billion to convert coal ash storage at all plants to dry storage, including the 33-acre fly ash impoundment at BRF

2015

BRF stops using water to move coal ash

2017

Bull Run Fossil Plant in 2017

2018

Bull Run Draft Environmental Investigation Plan released for public comment

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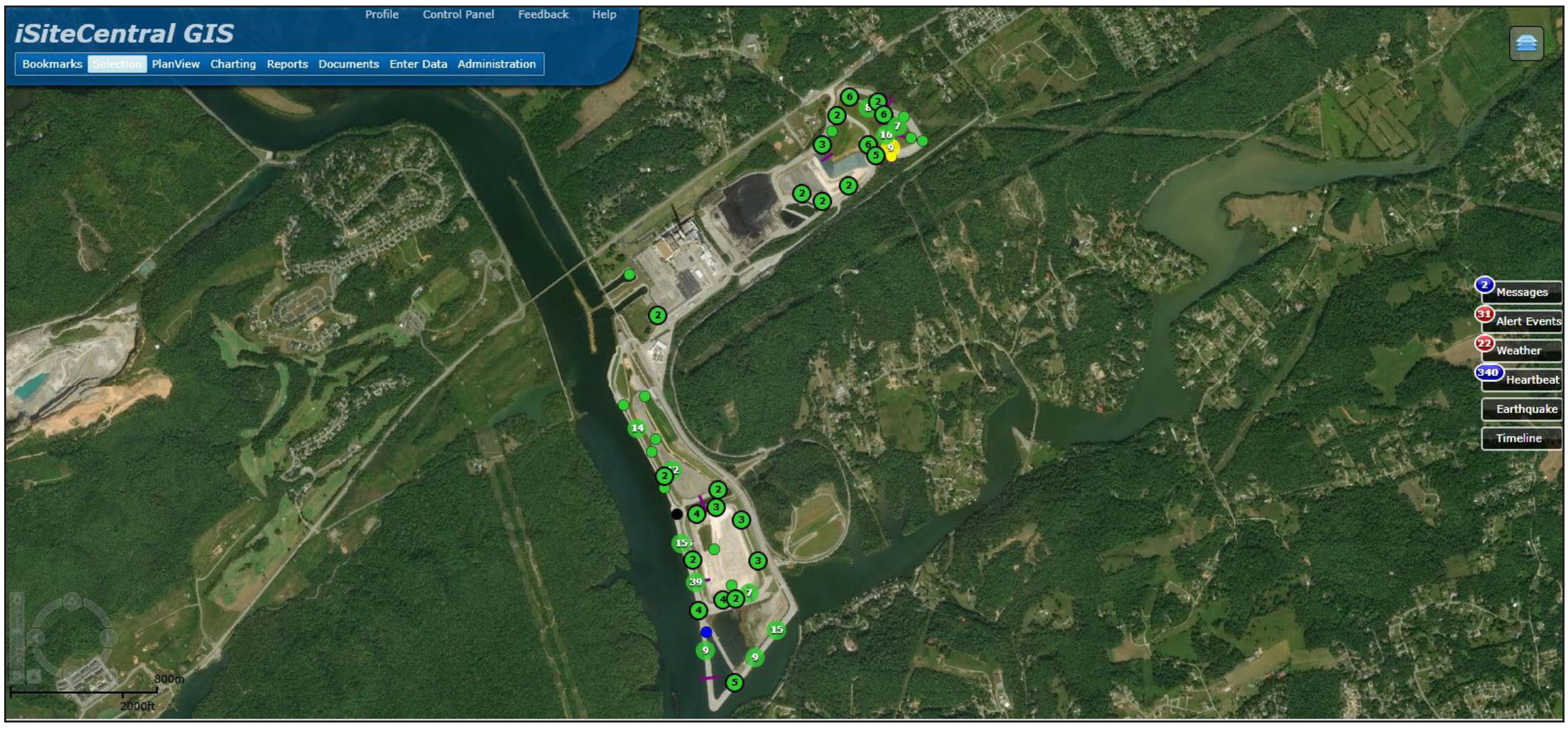
TVA'S ADVANCED TECHNOLOGY FOR IMPOUNDMENT MONITORING CENTER



Automated Instrumentation

TVA's Advanced Technology for Impoundment Monitoring (ATIM) Center

$2 million to develop the ATIM center

Only facility of its kind in the utility industry in the U.S.

Helps to **identify** and **respond** to any coal ash issues before they become an emergency

More than **11,000 real-time sensors** to monitor ash impoundments send data (24/7/365) to a centralized computer monitoring system

LED wall displays Geographic Information System (GIS) maps, weather, earthquakes, sensor data

Operations has **real-time data** or can watch what's happening at TVA impoundments via **live video**

System sends **alerts** on any irregularities

ATIM Center

BULL RUN FOSSIL PLANT

COAL COMBUSTION RESIDUALS MATERIAL QUANTITY

What it is and why we do it

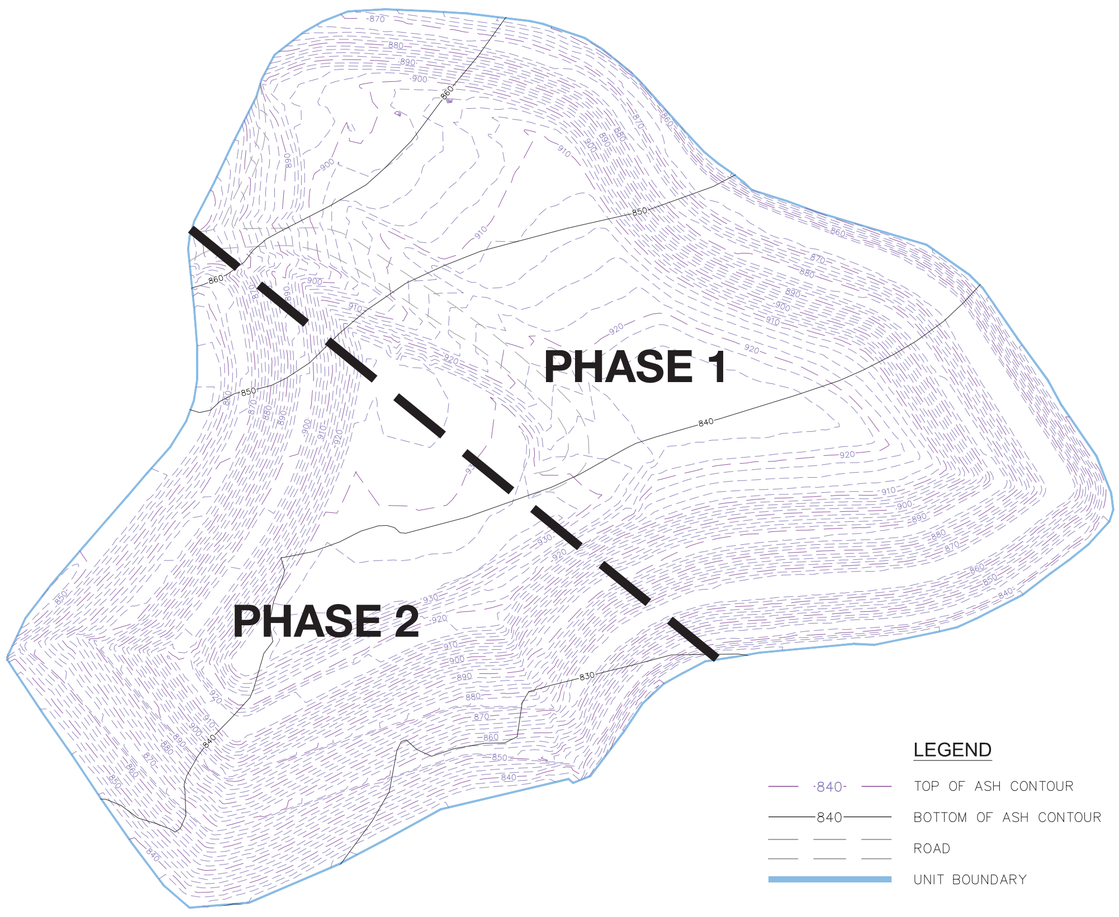
Recent surveys of the site track the location and quantity of coal combustion residuals (CCR) to aid overall site management.

What TVA has already done

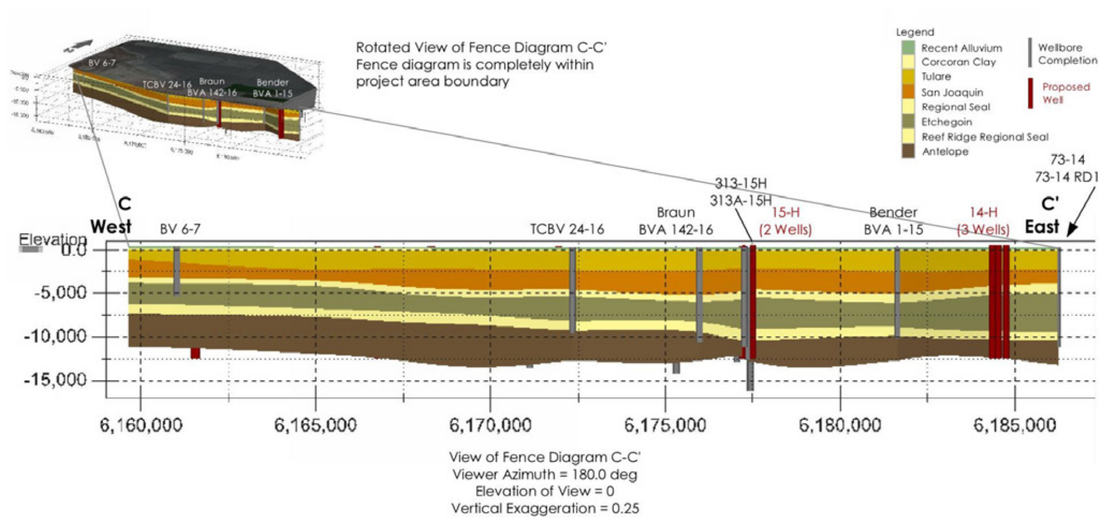
- Pre-development topographic maps
- As built/record drawings
- Aerial surveys performed for specific projects
- Drilled borings history beginning in 1959

Even before construction began, the facility had been extensively mapped. These site topographic maps, aerial surveys and construction updates are used for site management.

Site mapping is typically updated annually as well as any time significant changes are made to the layout of the site—whether that means a shift of operations from one area to another or an increase/decrease in the volumes of materials that are stored on site. These mapping updates are for both inventory management as well as site management, ensuring that the CCR units are used to their best potential.



Dry Fly Ash Stack Phase 1 and 2
(Example Topographic Map)



Example of a 3-dimensional model developed and used to calculate volumes

Proposed EIP Activities

- Review existing surveys, drawing, and borings
- Develop three-dimensional models of CCR units
- Update three-dimensional models with new boring data and water levels
- Confirm CCR volumes

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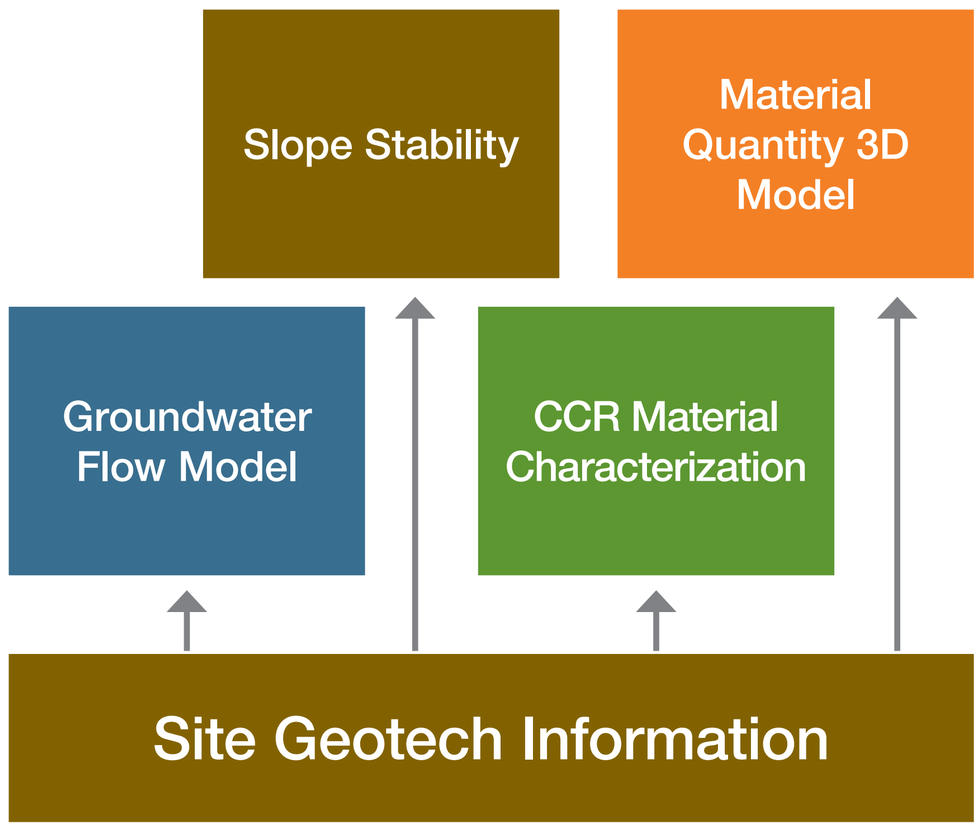
EXPLORATORY DRILLING (1 of 4)

What it is and why we do it

Exploratory drilling helps us better understand what is in and under each CCR unit.

It tells us:

- What is there: material types (CCR, soil, rock) and properties (strength, permeability, etc.)
- Where it is (material locations)
- Where the water level(s) are (material saturation)



What TVA has already done

The EIP includes an evaluation of existing geotechnical data. This includes a review of design and construction records, inspection records, field data (including 550+ borings and 165+ water level instruments), laboratory data, and engineering analyses.

Each piece of information has been evaluated to confirm that it was collected and analyzed properly in the past. This existing data is very valuable to understand the CCR unit conditions.

What are borings

Drilled holes from which to take samples of CCR, soil, and rock

The field geologist/engineer will prepare boring logs to describe the recovered samples.

Proposed EIP Activities

- Additional borings within the interior of the CCR units
- Install temporary wells in CCR material
- Targeted borings in specific areas along unit borders
- Shallow bedrock characterization
- Laboratory testing
- Share data with hydrogeological, environmental, and civil/mapping discipline teams

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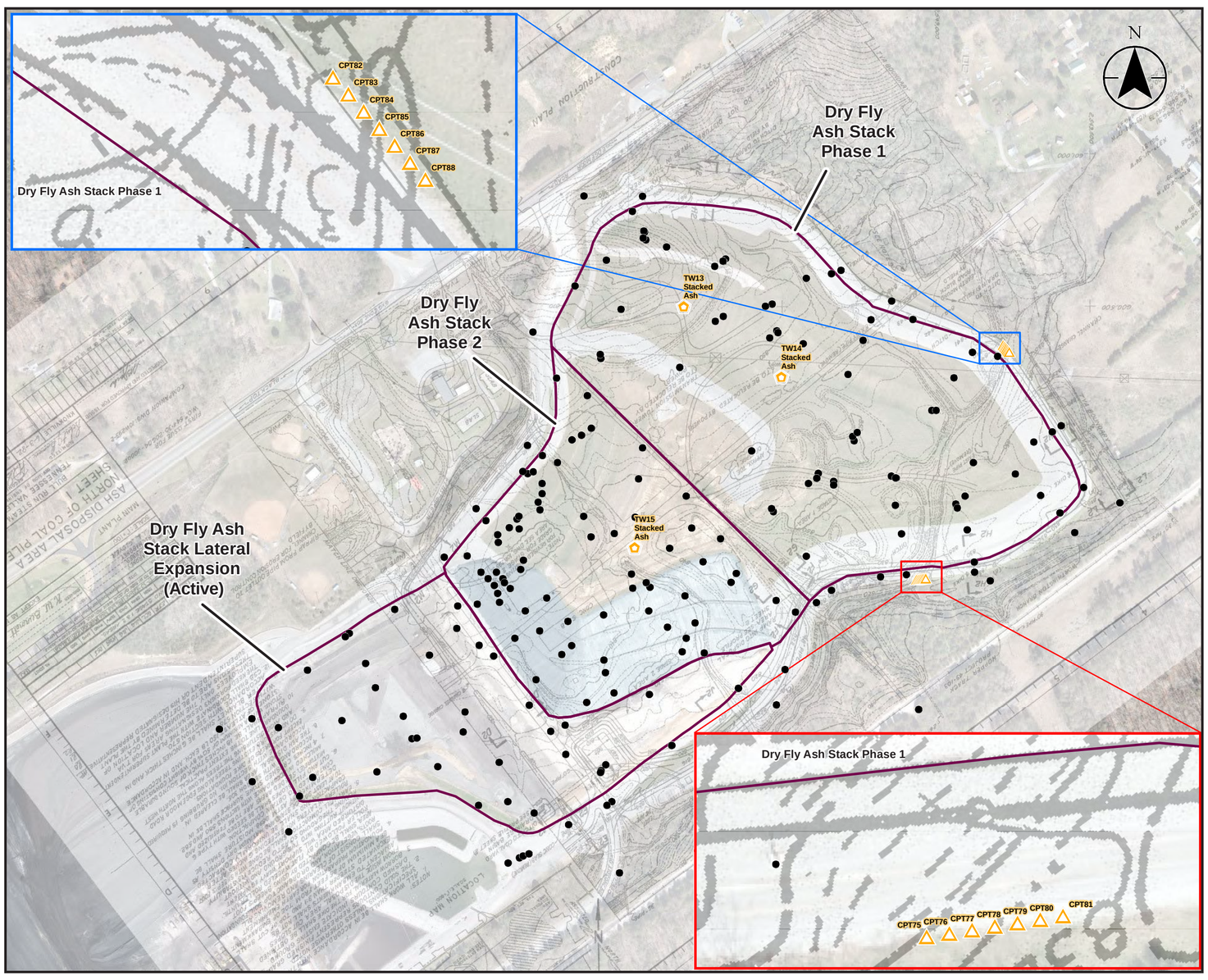
EXPLORATORY DRILLING

Where will the drilling be done?



Dry Fly Ash Stack Phases 1 and 2

3 Borings

- **3** Borings with Temporary Wells and No Rock Coring

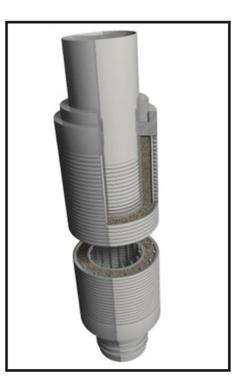
14 Cone Penetration Tests

Legend

- Proposed Cone Penetration Test
- Proposed Boring with Temporary Well (Saturation Level in CCR, Pore Water Sampling, and Geotechnical Data) (Screened Interval)
- Existing Boring
- CCR Unit Area (Approximate)

What are Water Level Instruments/Piezometers?

Sensors that measure water pressures in CCR, soil, rock



Slotted well screen

Surface protection for top of well

Slotted PVC pipe that allows water to enter at a selected depth in the boring

What are Cone Penetration Tests?

- Measure resistance to pushing cone
- Relate results to estimated engineering soil properties
- Quick, cost effective

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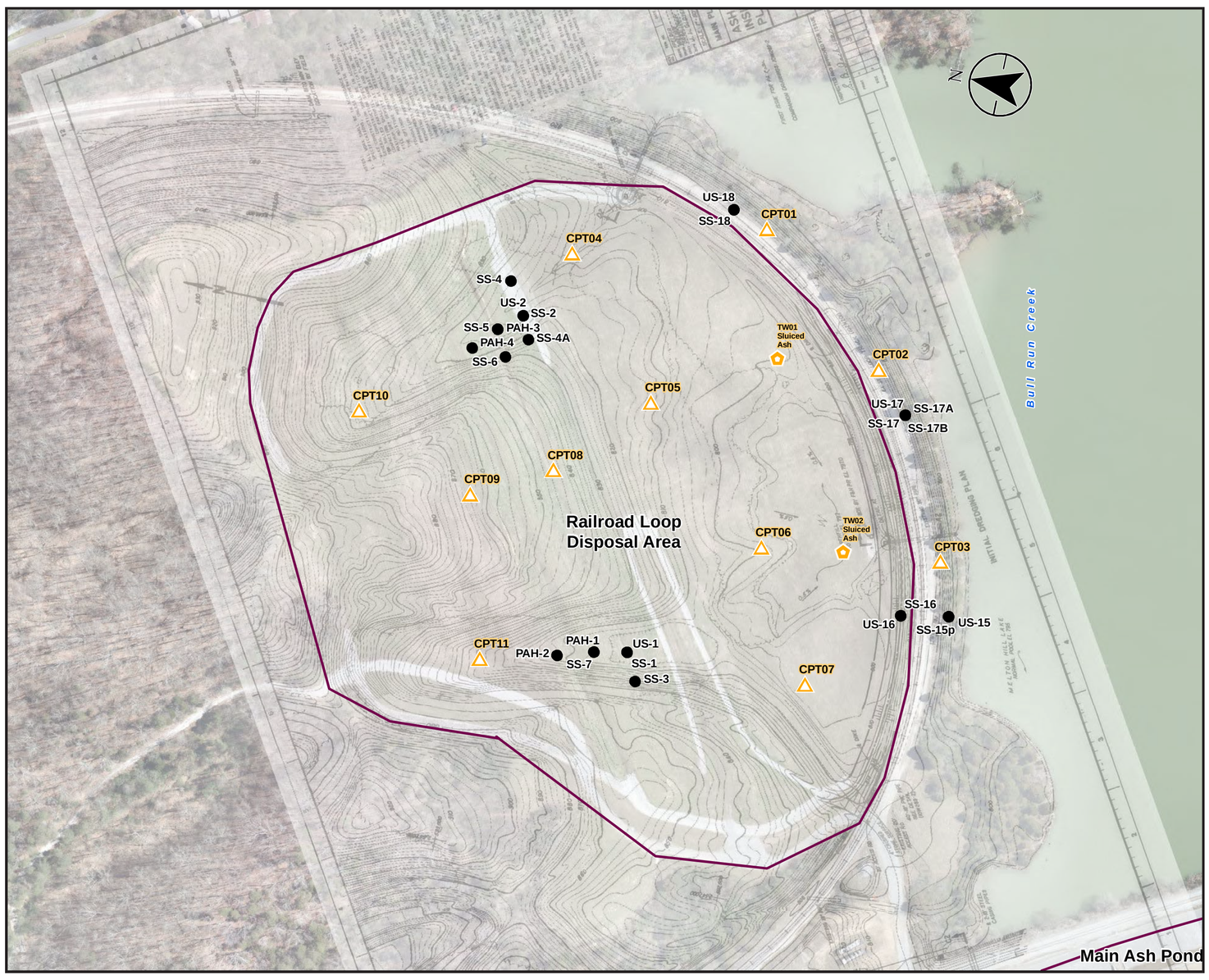
EXPLORATORY DRILLING (3 of 4)



Railroad Loop Disposal Area

2 Borings

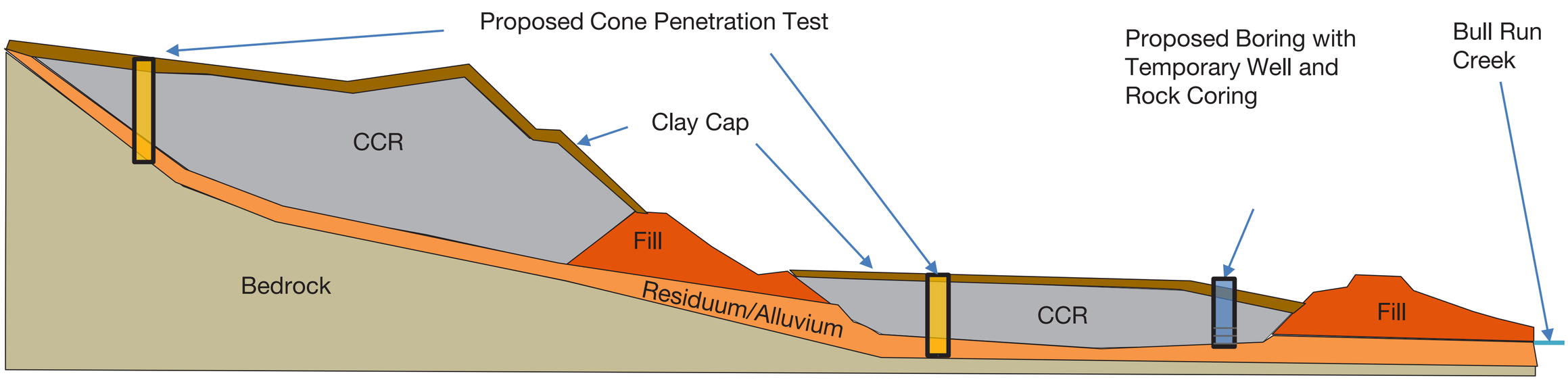
2 Borings with Temporary Wells and Rock Coring

11 Cone Penetration Tests

Legend

- Proposed Cone Penetration Test
- Proposed Boring with Temporary Well (Saturation Level in CCR, Pore Water Sampling, and Geotechnical Data) (Screened Interval)
- Existing Boring
- CCR Unit Area (Approximate)

Railroad Loop Disposal Area Proposed Borings Cross Section



Cross-section represents typical north-south geometry
(Not to scale)

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EXPLORATORY DRILLING (4 of 4)

Bottom Ash Disposal Area

3 Borings

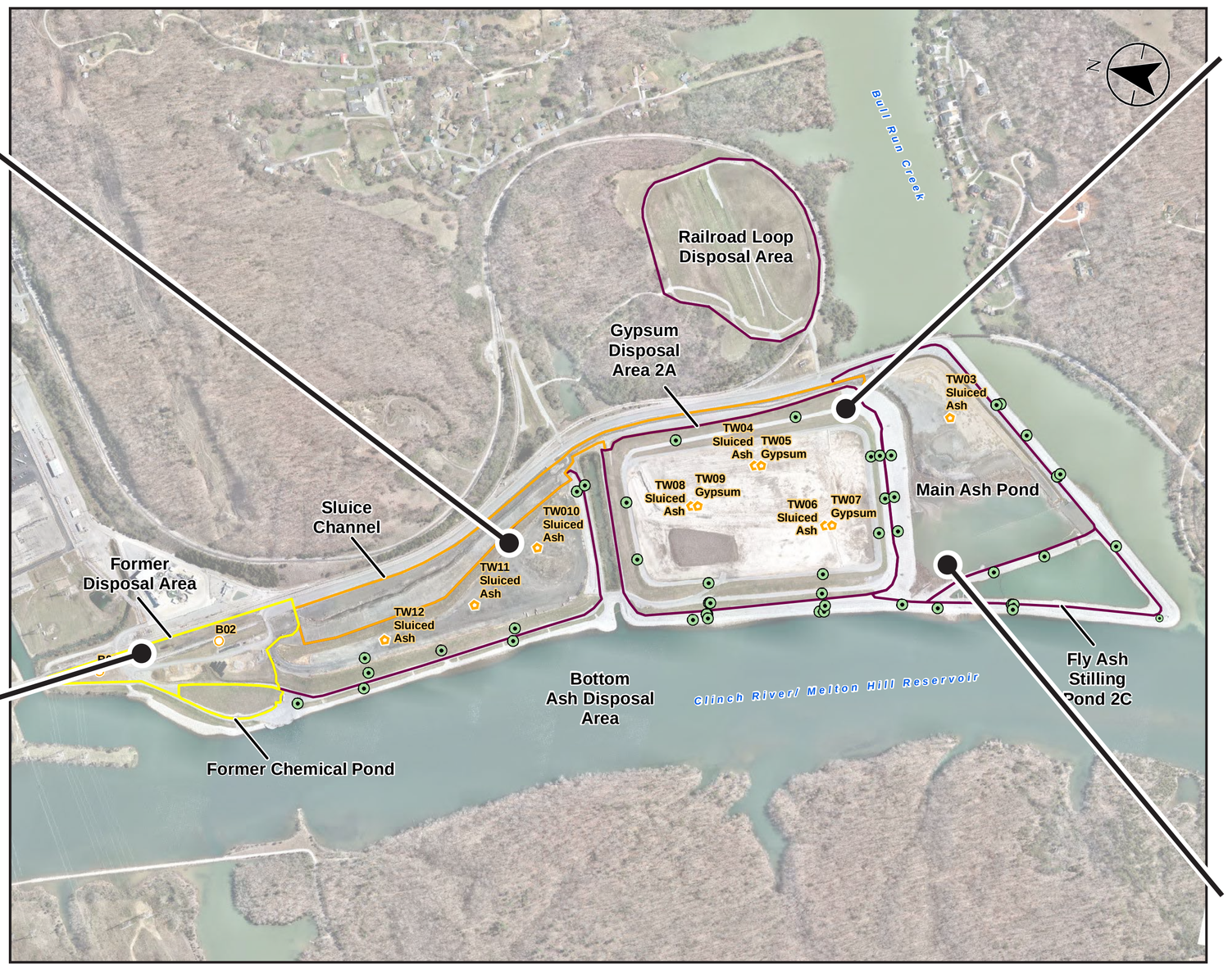
3 Borings with Temporary Wells and Rock Coring

14 Cone Penetration Tests

Former Disposal Area

2 Borings

2 Borings with Rock Coring



Gypsum Disposal Area 2A

6 Borings

3 Borings with Temporary Wells and Rock Coring

3 Borings with Temporary Wells and No Rock Coring

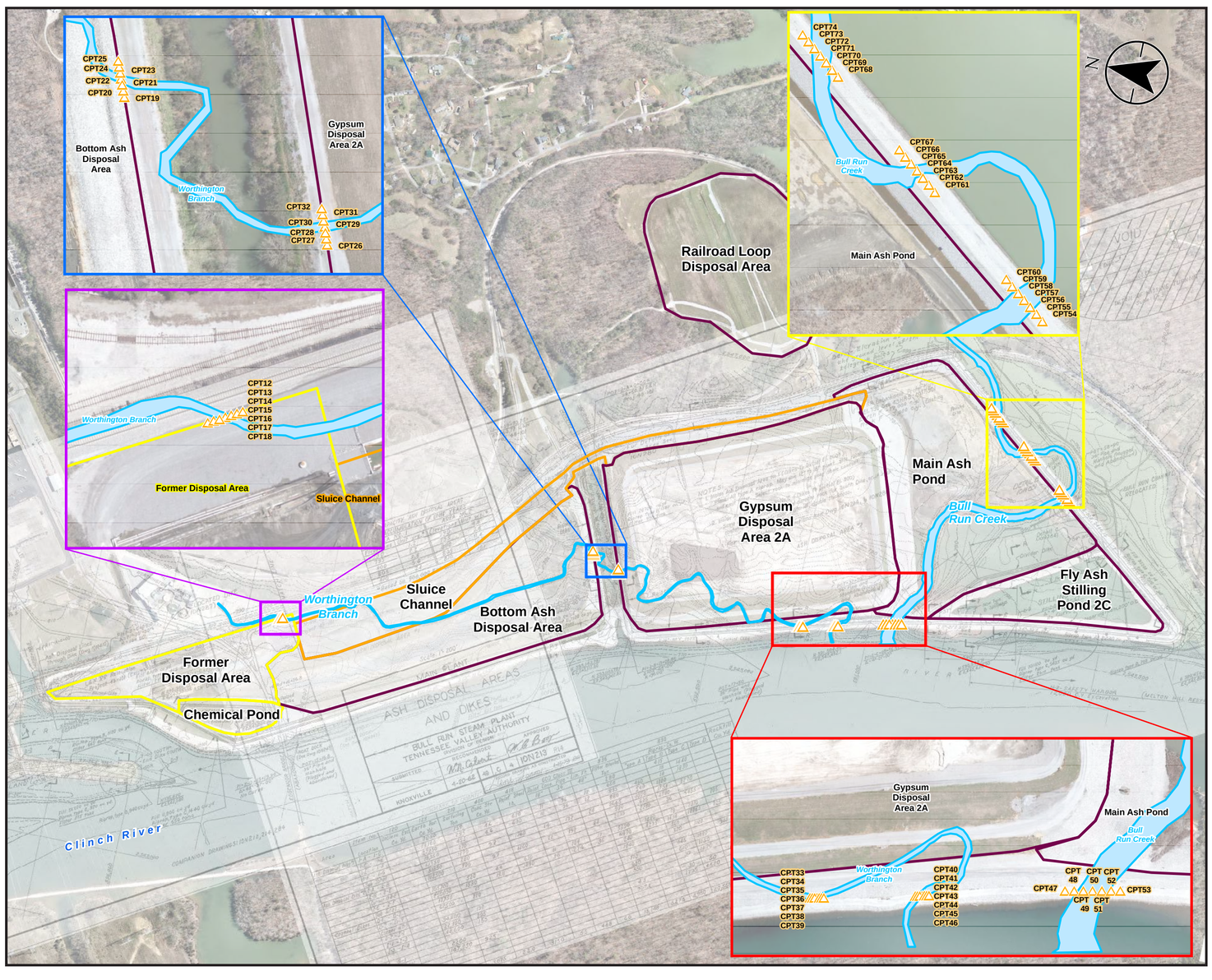
21 Cone Penetration Tests

Main Ash Pond

1 Boring

1 Boring with Temporary Well and Rock Coring

28 Cone Penetration Tests



Legend

- Proposed Geotechnical Boring
- Proposed Boring with Temporary Well (Saturation Level in CCR, Pore Water Sampling, and Geotechnical Data) (Screened Interval)
- Existing Piezometer Open Standpipe
- Proposed Cone Penetration Test
- Historic Creek Alignment
- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)

SLOPE STABILITY

What it is and why we do it

These analyses tell us if the slopes of the CCR units are stable. Multiple locations around each CCR unit are checked for stability.

Normal (long-term) conditions and earthquake conditions are evaluated.

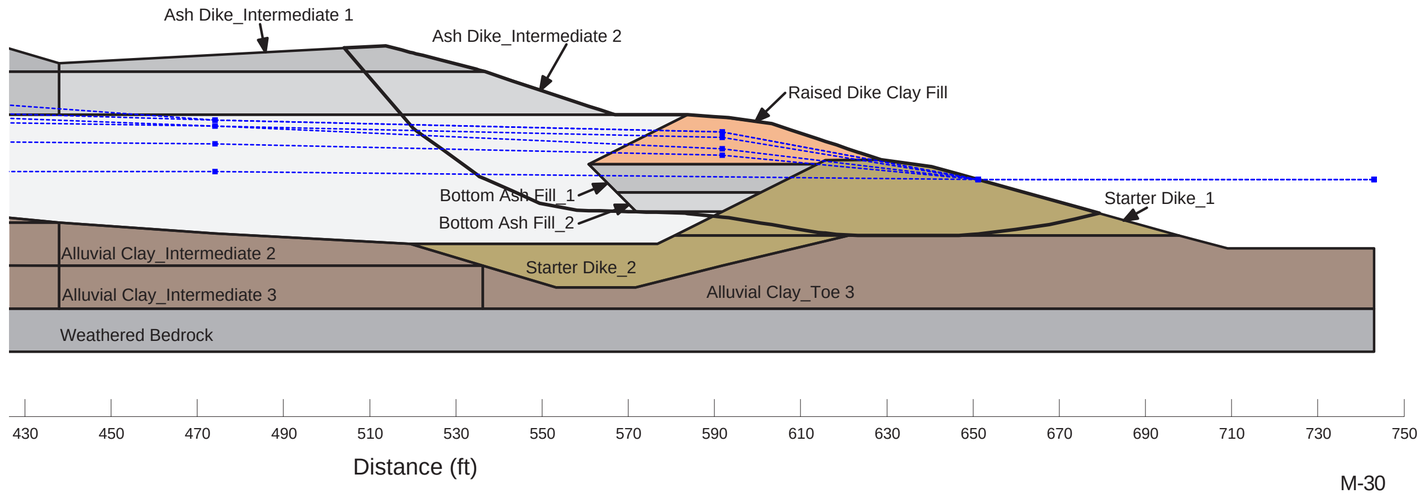
What TVA has already done

Slope stability has been analyzed many times over the years, for various conditions and at multiple units.

The existing analyses were reviewed as part of the evaluation of existing geotechnical data.

Each analysis was reviewed for adequate documentation, appropriate methods, and representative conditions.

Example of existing slope stability analysis



Inputs: Surface and subsurface geometry/zones, engineering properties, water levels/pressures, external loads

Outputs: Factor of safety against sliding

Existing and proposed analyses satisfy EIP requirements

CCR Unit	Normal	Earthquake
Bottom Ash Disposal Area	E	E
Gypsum Disposal Area 2A	E	E
Main Ash Pond	E	P
Fly Ash Stilling Pond 2C	E	P
Railroad Loop Disposal Area	P	P
Dry Fly Ash Stack Phase 1 and 2	E	P
Dry Fly Ash Stack Lateral Expansion	E/P	E/P

E = Existing analysis **P** = Proposed analysis

Proposed EIP Activities

- Compare existing models to new data from the Exploratory Drilling Sampling and Analysis Plan
  - If models are representative, no changes
  - If not, update models and reanalyze
- New analyses (for some units) for normal and earthquake conditions
- Compare slope stability results to acceptance criteria

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SLOPE STABILITY

(2 of 3)

What it is and why we do it

Slope stability is influenced by water levels and pressures (among other factors).

Monitoring water levels also supports the hydrogeologic investigation and the CCR material quantity estimate (saturated vs. unsaturated material).

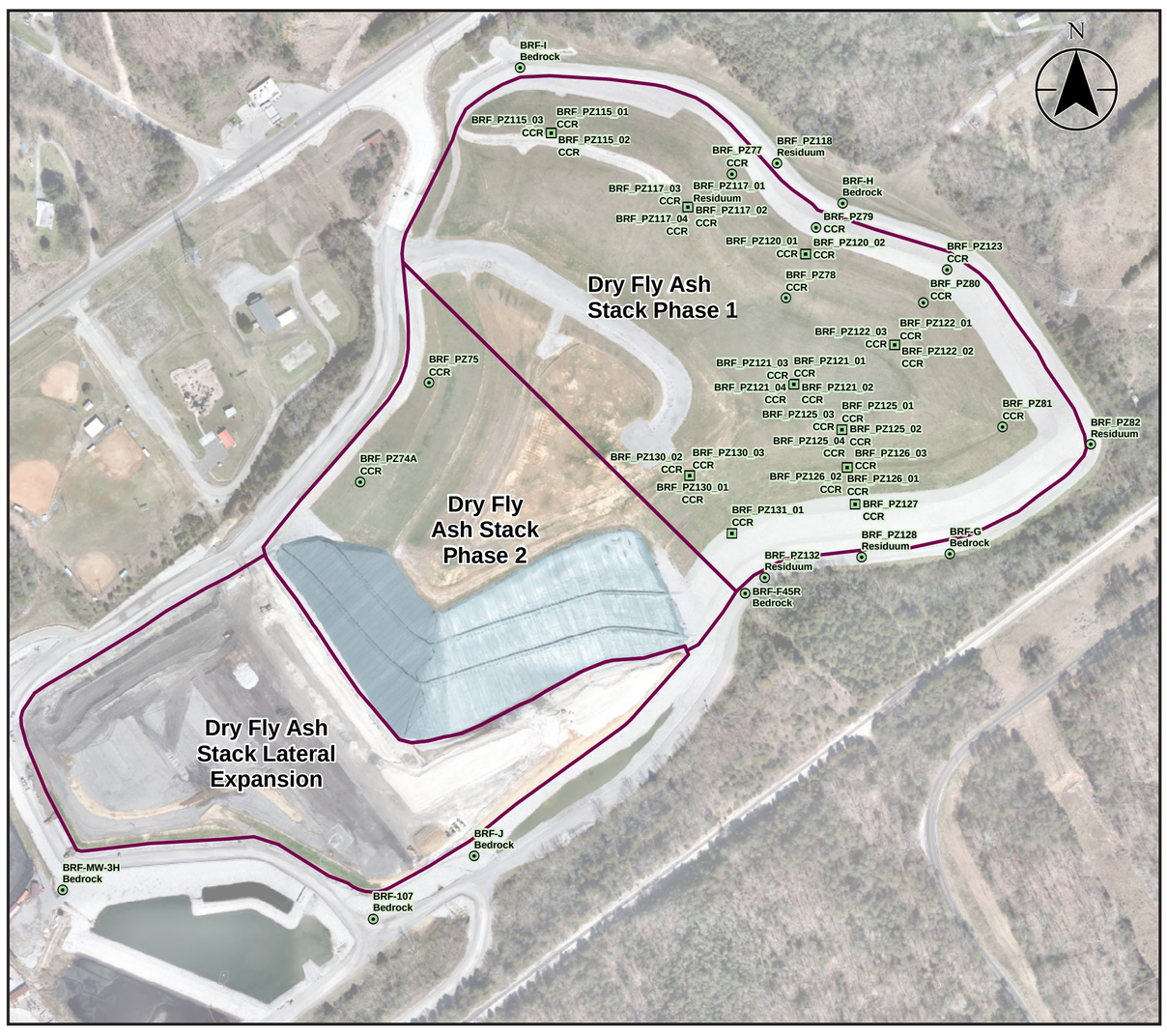
What TVA has already done

TVA has multiple types of water level instruments on site, as well as a number of monitoring wells, to track water levels in many areas. These instruments have been installed over many years, for various purposes. More than 130 water level instruments (including piezometers) are currently installed.

TVA has operated an Instrumentation Monitoring Program since 2012 that includes automated and manual readings of select piezometers. These monitoring instruments will send warnings to site personnel if water levels rise enough to start affecting slope stability.

Data are routinely assessed and correlated to rainfall, river levels, etc.

Existing instrumentation: Dry Fly Ash Stack



Legend

- Existing Piezometer Open Standpipe (Screened Interval)
- Existing Piezometer Vibrating Wire (Screened Interval)
- CCR Unit Area (Approximate)

Water level instrumentation

- New instruments are added
  - due to Exploratory Drilling Sampling and Analysis Plan
  - due to Hydrogeological Investigation Sampling and Analysis Plan (monitoring wells)

BULL RUN FOSSIL PLANT

SLOPE STABILITY

Existing instrumentation:
Bottom Ash Disposal Area, Gypsum Disposal Area 2A, Fly Ash Stilling Pond 2C, Railroad Loop Disposal Area & Main Ash Pond

Legend

- Existing Piezometer Open Standpipe (Screened Interval)
- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)

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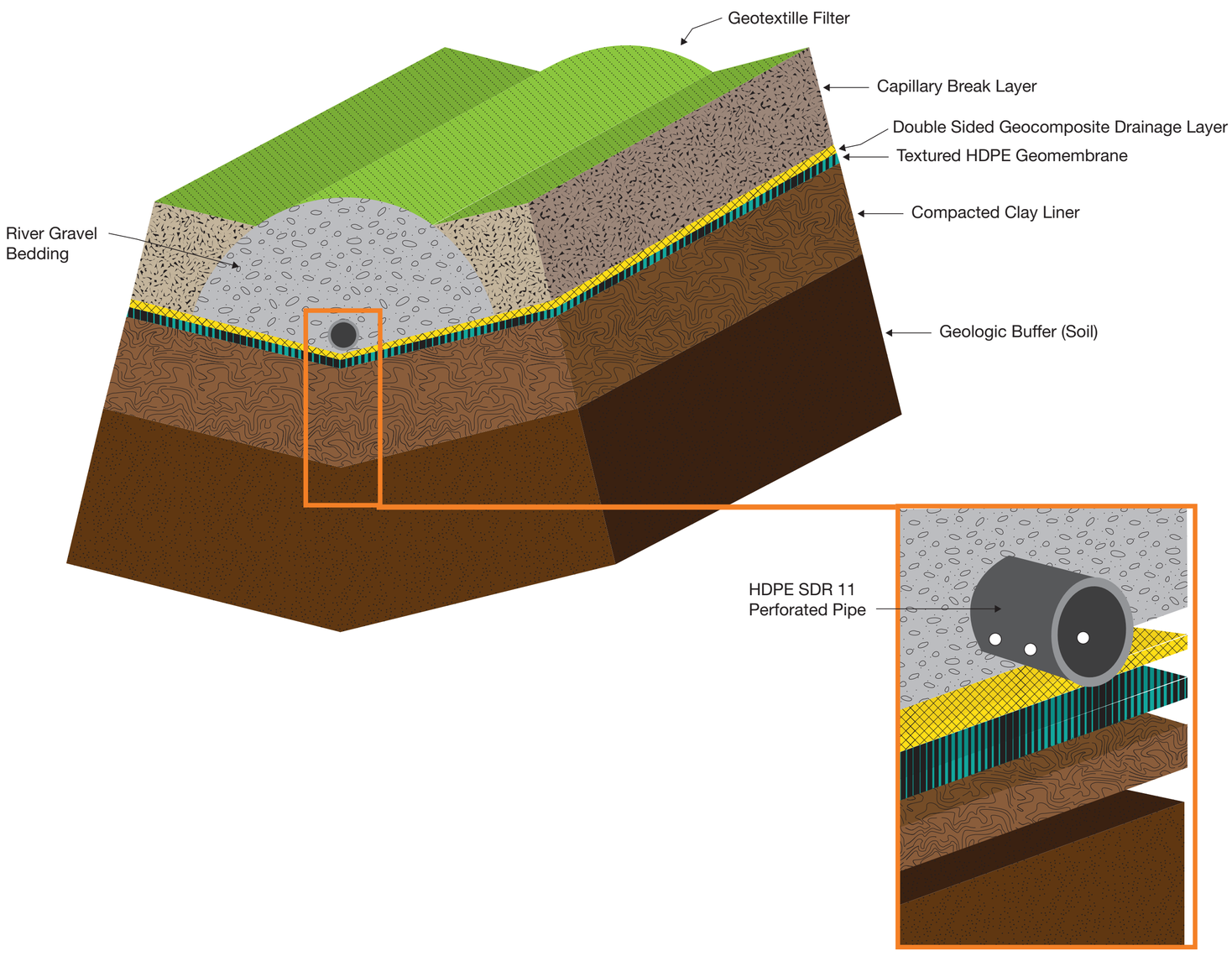
BOTTOM LINER AND LEACHATE COLLECTION SYSTEM

What it is and why we do it

The Dry Fly Ash Stack (DFAS) lateral expansion was permitted with TDEC in 2012 as a new landfill with a bottom liner and leachate collection system.

A landfill bottom liner is a low permeable barrier consisting of compacted clay and a geomembrane to separate the CCR materials from the groundwater. A leachate collection system consists of pipes, geocomposite drainage layers and drainage aggregates to collect rainwater that flows to the bottom of the CCR landfill.

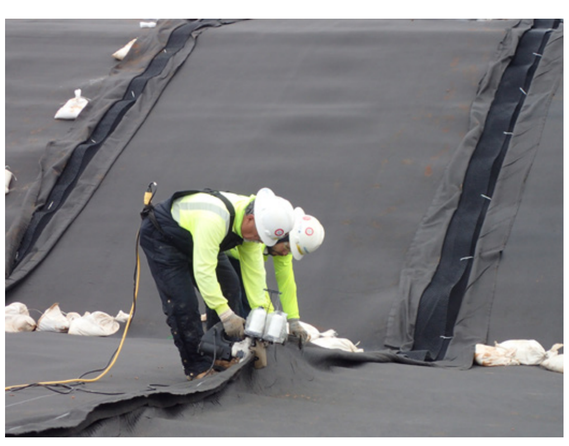
Bottom liner and leachate collection system for the Bull Run DFAS Lateral Expansion Area (Phase III)



Making the bottom liner and leachate collection system

Place geologic buffer and compacted clay liner

Place geomembrane over compacted clay liner



Install geocomposite drainage layer over geomembrane

Install capillary break layer and perforated leachate collection pipe

Install drainage stone over perforated leachate collection pipe

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HYDROGEOLOGIC INVESTIGATION

What it is and why we do it

Hydrogeologic investigations help us better understand how groundwater moves in a particular area, as well as its interaction with the surrounding soils and rocks.

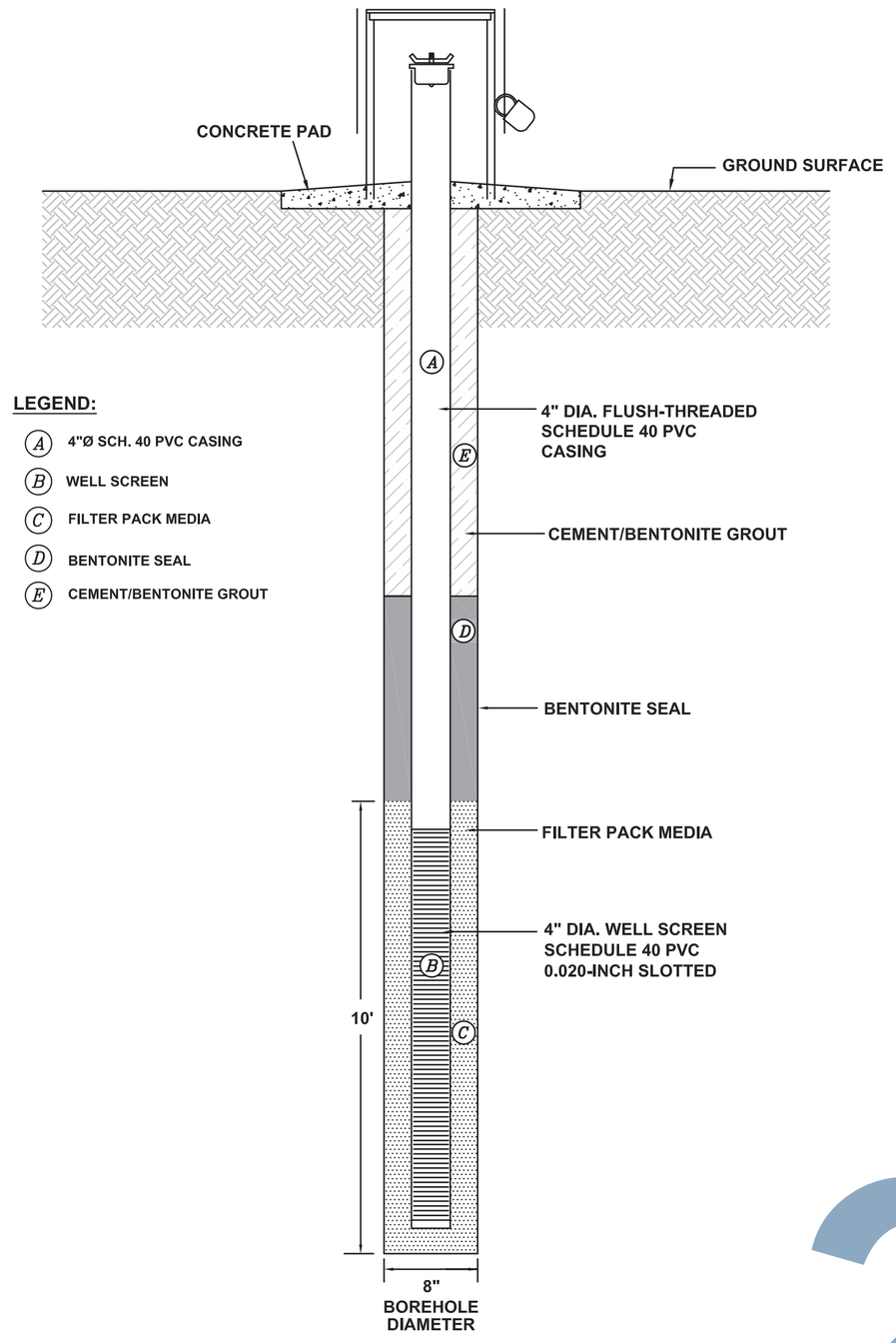
These investigations consist of installing groundwater monitoring wells to collect information about groundwater.

Background (i.e., unaffected by the Bull Run site) and downgradient wells are used to study water quality changes.

What TVA has already done

Several hydrogeologic investigations have been conducted at the Bull Run plant to monitor groundwater quality and flow direction to determine compliance with state regulations and program commitments.

Groundwater monitoring well



What is a groundwater monitoring well?
A well specially designed and installed to obtain representative groundwater quality samples and hydrogeologic information.

Proposed EIP Activities

- Additional monitoring wells and piezometers will be installed to supplement current groundwater monitoring well networks to further investigate groundwater quality and flow direction:
  - Advance 18 pilot holes to collect hydrogeological information
  - Install 15 monitoring wells
  - Install 9 piezometers
  - Report the analytical results in the Environmental Assessment Report (EAR)

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GROUNDWATER INVESTIGATION

What it is and why we do it

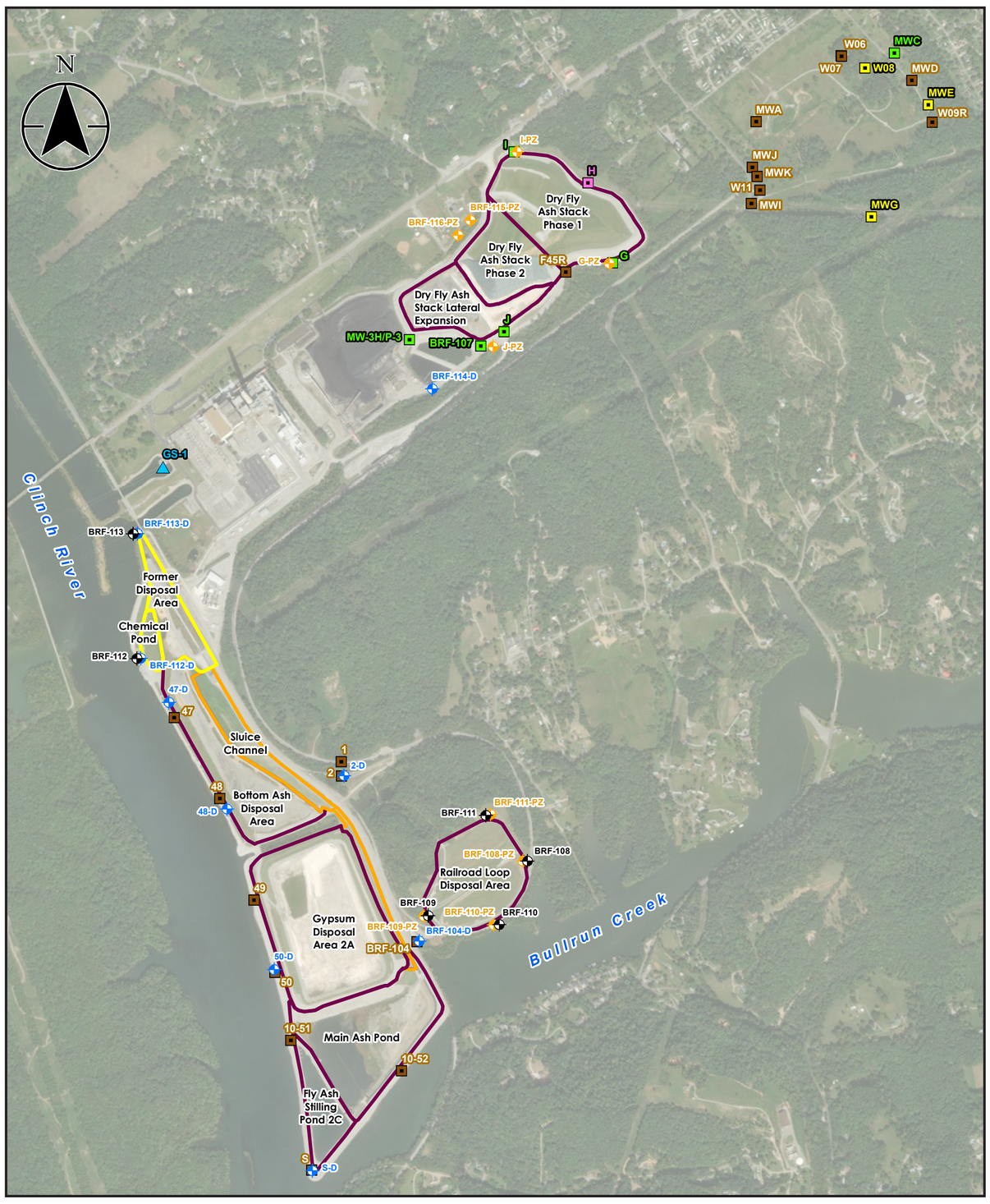
Groundwater samples are collected frequently to test for a number of quality measures. By testing groundwater regularly, TVA can track compliance with regulatory permits and requirements.

What TVA has already done

Groundwater monitoring has been occurring on the Bull Run Plant since 1981 and currently consists of 2 programs:

- State permit monitoring:
  - Bottom Ash Disposal Area
  - Gypsum Disposal Area 2A
  - Dry Fly Ash Stack Phase 1 and 2
  - Dry Fly Ash Stack Lateral Expansion
- CCR Rule monitoring:
  - Dry Fly Ash Stack Lateral Expansion
- Voluntary:
  - Main Ash Pond and Stilling Pond

Proposed groundwater well locations



Legend

- Proposed Pilot Hole to be Converted to Piezometer
- Proposed Pilot Hole to be Converted to Monitoring Well
- Proposed Monitoring Well

Existing Well

- Existing Monitoring Well (State Compliance)
- Observation Well (State Compliance)
- Existing Monitoring Well (State and CCR Rule Compliance)
- Existing Monitoring Well (Other)
- Surface Water Gauging Station
- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)

Proposed EIP Activities

- Bimonthly groundwater sampling for 1 year (6 events) from 15 new monitoring wells
- Groundwater samples will be collected from background and downgradient locations
- Provide an investigation to further understand the movement of groundwater
- Investigate how the CCR units affect groundwater movement and quality

BULL RUN FOSSIL PLANT

WATER USE SURVEY

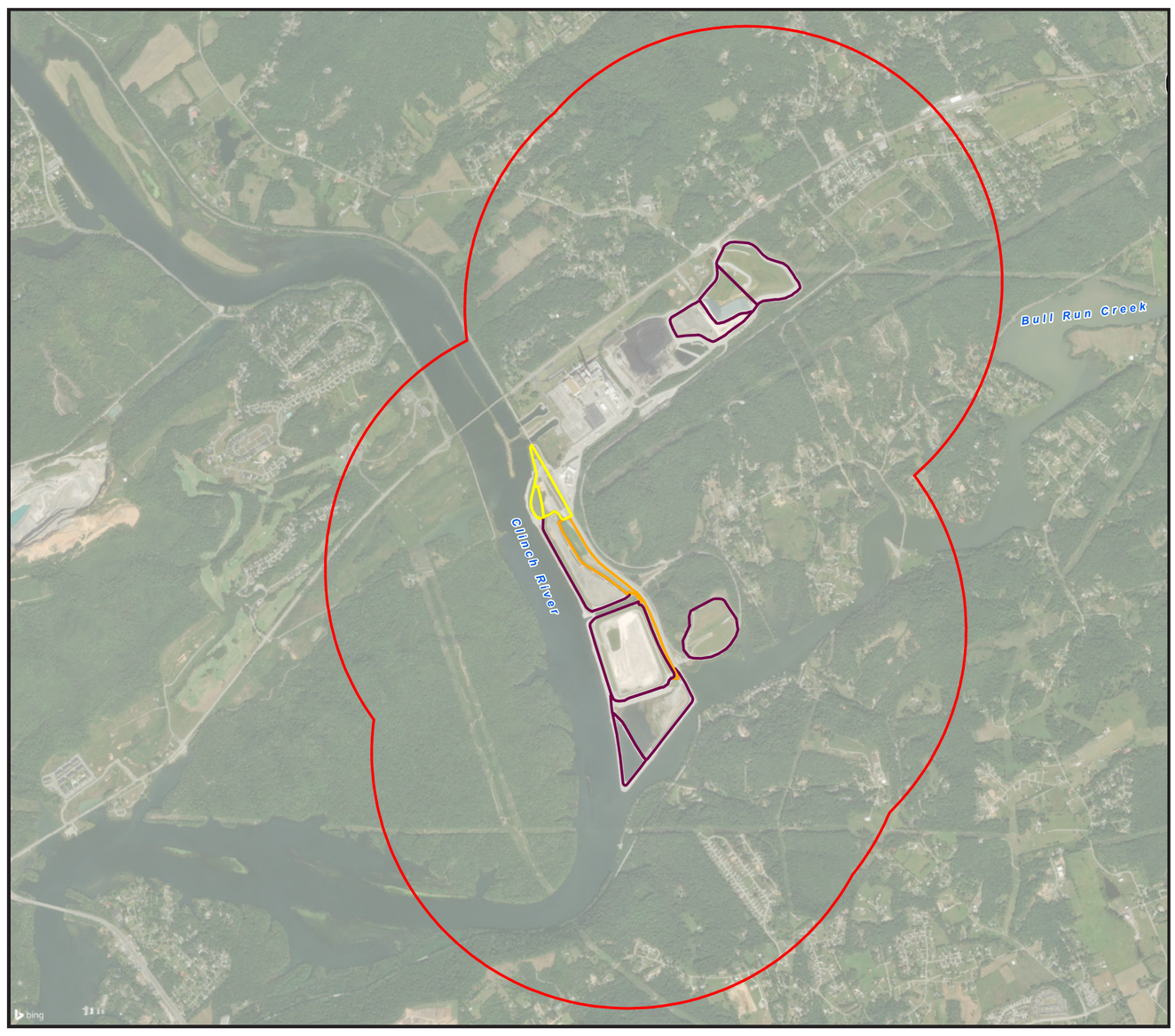
What it is and why we do it

A water use survey is a search for private water supplies (e.g. wells, springs) located within a 1-mile radius of the center of each of the CCR units within the Study Area at the Bull Run Plant. It is used to evaluate the quality of groundwater used in these private wells.

What TVA has already done

Water use surveys were conducted in 1999 and 2014. The purpose of the water use survey is to provide an understanding of local groundwater quality.

1-mile unit buffer



Legend

- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)
- 1 Mile Buffer from Center of CCR Units

Proposed EIP Activities

- Update previous studies by reviewing State database and water supply information
- Perform a door-to-door water use survey
- Record water use data and GPS locations of identified water wells and springs
- Conduct sampling for CCR parameters and compare to United States Environmental Protection Agency drinking water standards
- Test water for potential impacts from CCR constituents
- Results will be provided in the Environmental Assessment Report (EAR)

BULL RUN FOSSIL PLANT

BACKGROUND SOIL INVESTIGATION

What it is and why we do it

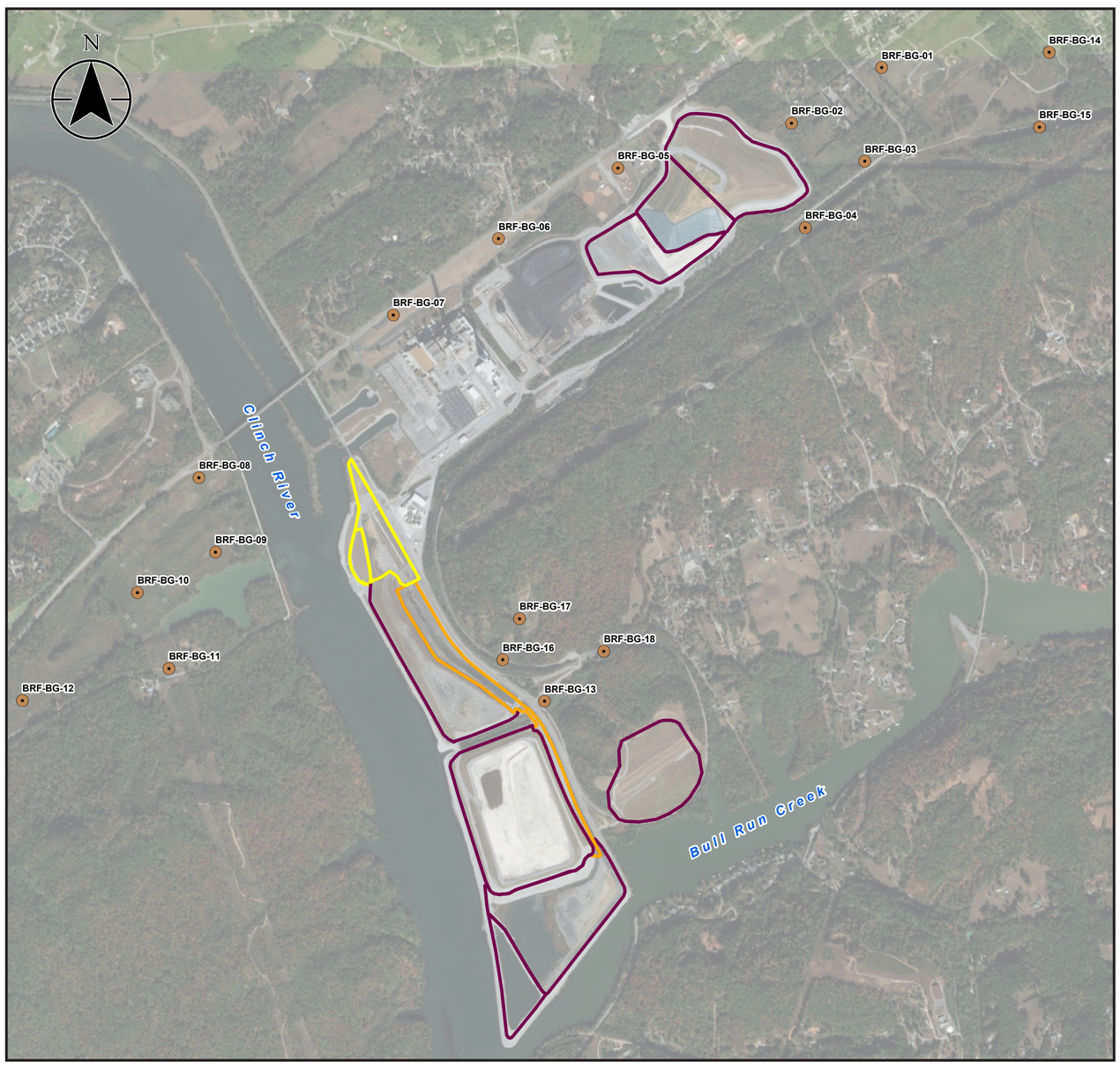
The constituents found in CCR are also found in nature. This investigation would determine CCR constituent levels in background soils.

These background levels can be compared to other site soils to determine if concentrations are higher than natural levels. They can also be used to determine if CCR constituents are naturally occurring in native soils.

What TVA has already done

Background soil data previously collected during 2009.

Proposed soil sampling locations



Legend

- Proposed Background Soil Sample Location
- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)

Proposed EIP Activities

- Test additional background sampling locations for CCR Parameters
- Visually inspect accessible rock and residuum outcrops in the vicinity of the Plant in an attempt to determine if naturally occurring sources of metallic ore minerals are present in the area
- Review existing data for comparative analysis

BULL RUN FOSSIL PLANT

BENTHIC INVESTIGATION–BIOLOGICAL STUDIES

What it is and why we do it

The Clinch River and Bull Run Creek are evaluated to compare the health of aquatic wildlife upstream and downstream of the plant.

These evaluations have two parts:

- Testing mayfly adults and nymphs to see if CCR constituents are in their tissues
- Counting the types and numbers of different benthic macroinvertebrates in rivers and streams adjacent to the site

What TVA has already done

- From 1991 to 2016, sediment sampling of the Melton Hill Reservoir has been conducted in association with TVA's Reservoir Ecological Health Monitoring Program. Seventeen sampling events at both mile marker CRM 24.0 mile marker CRM 45.0 have been performed under the program. Samples have been collected and analyses performed for fourteen different metals.
- Benthic invertebrate community sampling completed in 2010, 2011, 2014, and 2016.

What are benthic macroinvertebrates?

Aquatic organisms that live in and on the sediment substrate.

Why do we study them?

They are an important part of the local food chain, and are good indicators of changes in the environment.

Examples of benthic macroinvertebrates

Nymphs are immature mayflies found in the sediment.

Proposed EIP Activities

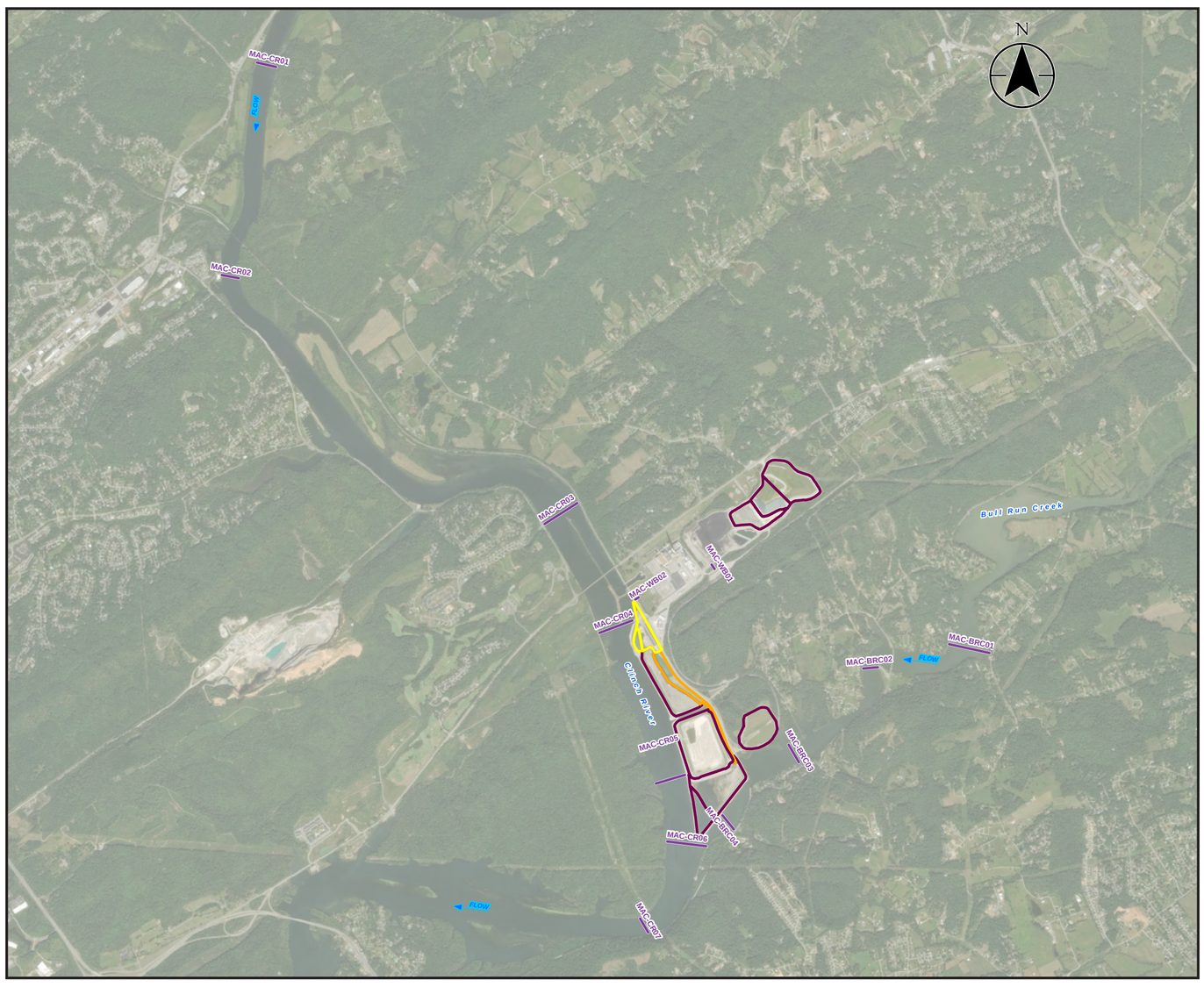
- Collect benthic macroinvertebrate and mayfly samples
- Analyze benthic macroinvertebrate samples for community composition
- Analyze mayfly samples for CCR metals constituents
- Report the analytical results in the Environmental Assessment Report (EAR)

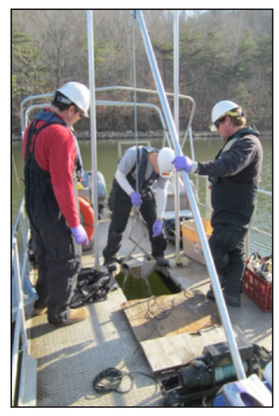
BULL RUN FOSSIL PLANT

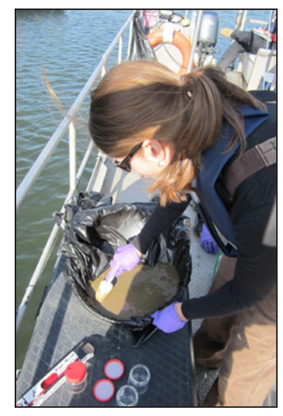
BENTHIC INVESTIGATION–BIOLOGICAL STUDIES

Where will the sampling be done?

Benthic macroinvertebrates sampling







Legend

- Transect
- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)

Mayfly sampling: adult mayflies & mayfly nymphs

Legend

- Mayfly Sample Location
- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)

BULL RUN FOSSIL PLANT

BENTHIC INVESTIGATION– SEDIMENT STUDIES

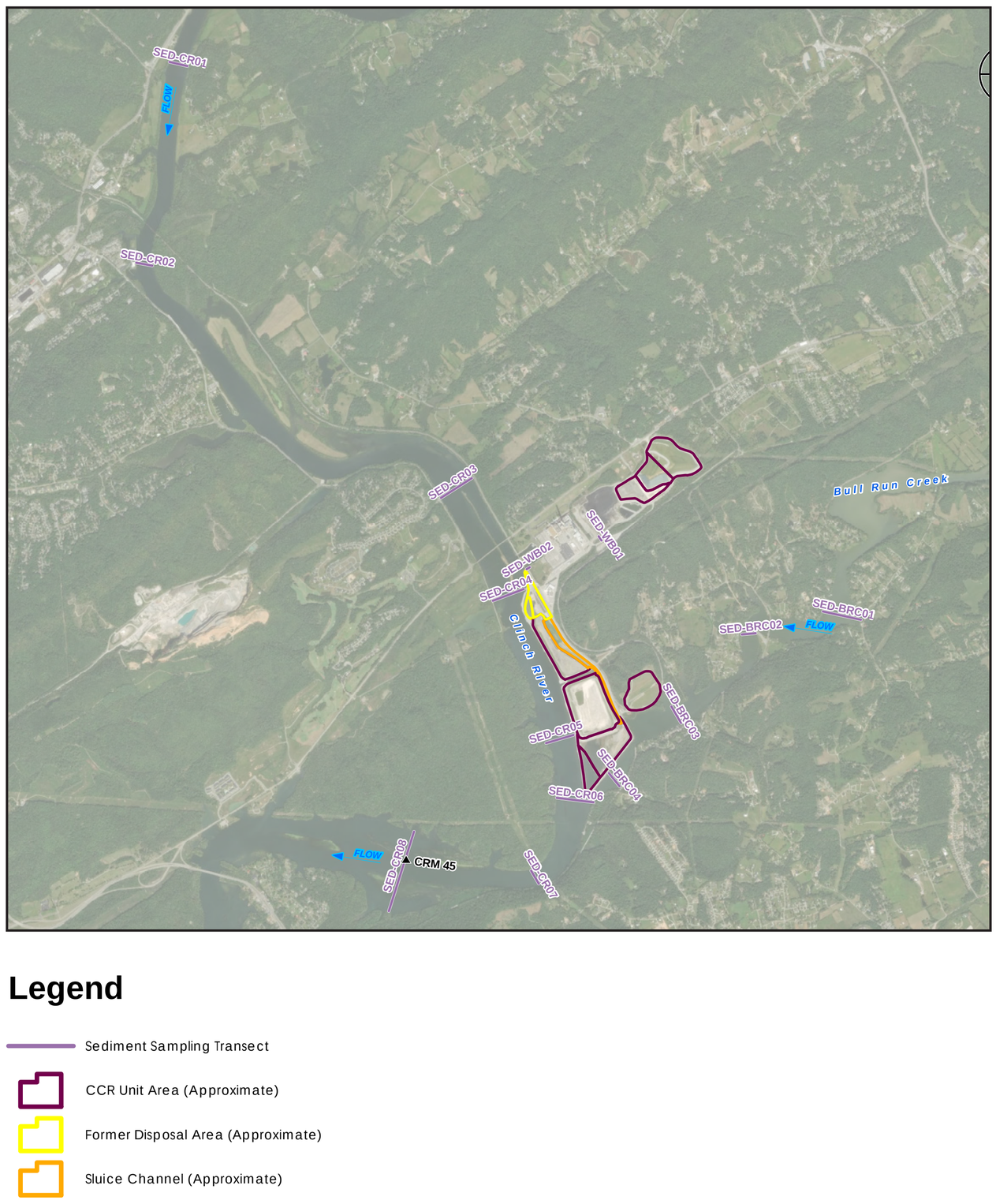
What it is and why we do it

Sediment samples are taken from the river bottom to determine whether CCR material and/or constituents have migrated from the site to Clinch River, Bull Run Creek, and other surface waters.

What TVA has already done

From 1991 to 2016, sediment sampling of the Melton Hill Reservoir has been conducted in association with TVA's Reservoir Ecological Health Monitoring Program. Seventeen sampling events at both mile marker CRM 24.0 mile marker CRM 45.0 have been performed under the program. Samples have been collected and analyses performed for fourteen different metals.

Sediment sample locations



Proposed EIP Activities

- Collect sediment samples
- Analyze sediment samples for CCR constituents and percentage of ash
- Report the analytical results in the Environmental Assessment Report (EAR)

BULL RUN FOSSIL PLANT

SURFACE STREAM INVESTIGATION

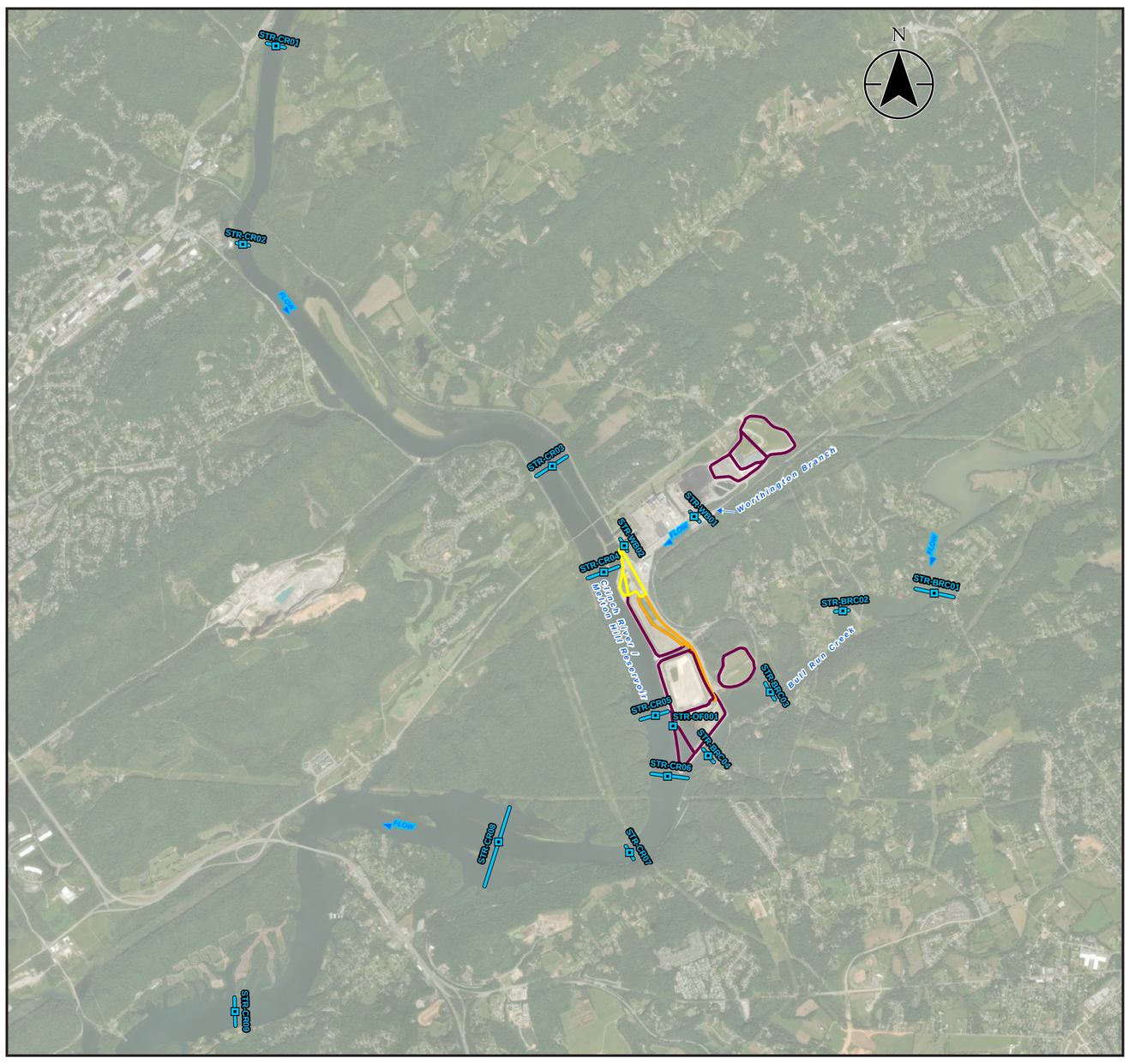
What it is and why we do it

Surface stream sampling is performed both upstream and downstream to determine if CCR materials and/or constituents have migrated from the site to adjacent water bodies.

What TVA has already done

- Surface water sampling has been performed at Bull Run Outfalls 001, 002, and IMP 004 in accordance with NPDES Permit TN0005410
- TVA conducted heavy metal monitoring at the West Knox District Intake on a semi-annual basis from 2006 through 2012
- Annual monitoring is also in current permit

Surface water sample locations



Legend

- Surface Stream Sample Location
- Hydrolab Transect
- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)

Proposed EIP Activities

- Collect water samples
- Analyze samples for CCR Parameters
- Conduct comparative analysis against upstream samples and existing surface data
- Report the analytical results in the Environmental Assessment Report (EAR)

BULL RUN FOSSIL PLANT

FISH TISSUE INVESTIGATION

What it is and why we do it

Fish are captured using electrofishing and gill netting, and tissue samples are taken.

These tissue samples are used to test the levels of CCR constituents in fish.

What TVA has already done

- Reservoir Fish Assemblage assessments in Clinch River since 2001
- Summary of Fish Assemblage study results completed in 2017
  - Addressed condition of fish populations/communities upstream and downstream of the Bull Run Plant
  - Upstream and downstream results similar
  - No evidence of adverse environmental impact
- Fish tissue samples analyzed for various metals and other constituents

Fish sampling locations

Legend

- Fish Sample Location
- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)

Electroshock fishing

Proposed EIP Activities

- Capture target fish species at sampling locations
- Remove and transport fish tissue samples to laboratory
- Analyze tissue samples for CCR constituents
- Comparative analysis against upstream samples
- Report the analytical results in the Environmental Assessment Report (EAR)

BULL RUN FOSSIL PLANT

SEEPAGE INVESTIGATION

What it is and why we do it

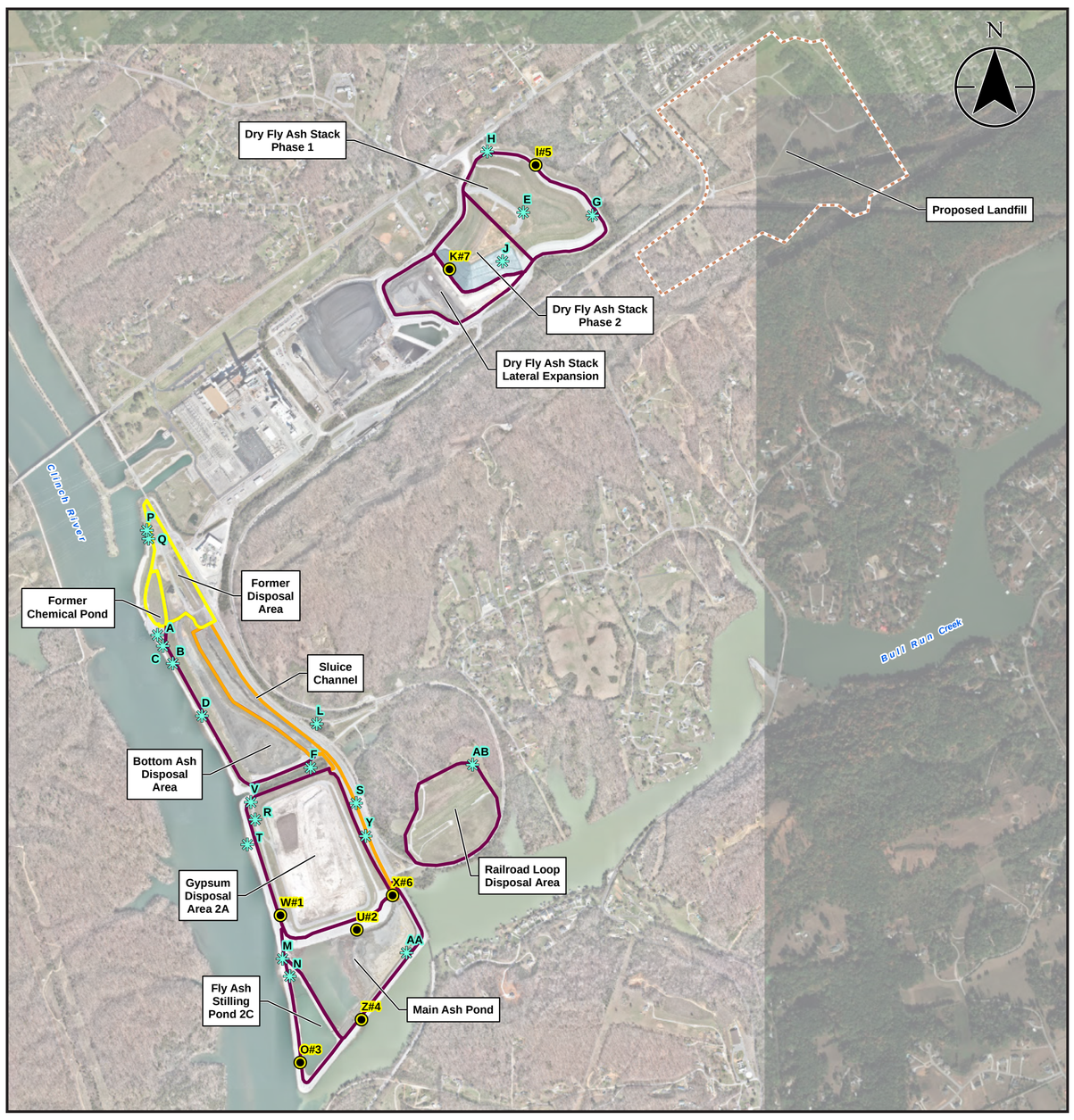
Dikes on the property are checked frequently to identify active seeps.

The soils and water at active seep areas are tested for CCR constituent levels.

What TVA has already done

- Conduct seep inspections in accordance with Seep Action Plan:
  - Quarterly for potential seepage areas
  - Monthly for active seepage areas until remediated
- Annual seep inspection report submitted to TDEC

Historic seep locations



Legend

- Historic Seep (Map ID)
- Area of Concern (AOC) (MapID/AOC #)
- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)
- Proposed Landfill (Approximate)

Proposed EIP Activities

- Conduct seepage investigation to identify active seeps
- Collect soil and water samples at identified seeps
- Analyze samples for CCR constituents
- Comparative analysis against background soils
- Report the analytical results in the Environmental Assessment Report (EAR)

BULL RUN FOSSIL PLANT

COAL COMBUSTION RESIDUALS MATERIAL CHARACTERISTICS (1 OF 2)

What it is and why we do it

The different CCR materials on site are tested for levels and types of chemical constituents. This helps us understand whether they leach from (or leave) the ash and enter the water in the CCR units.

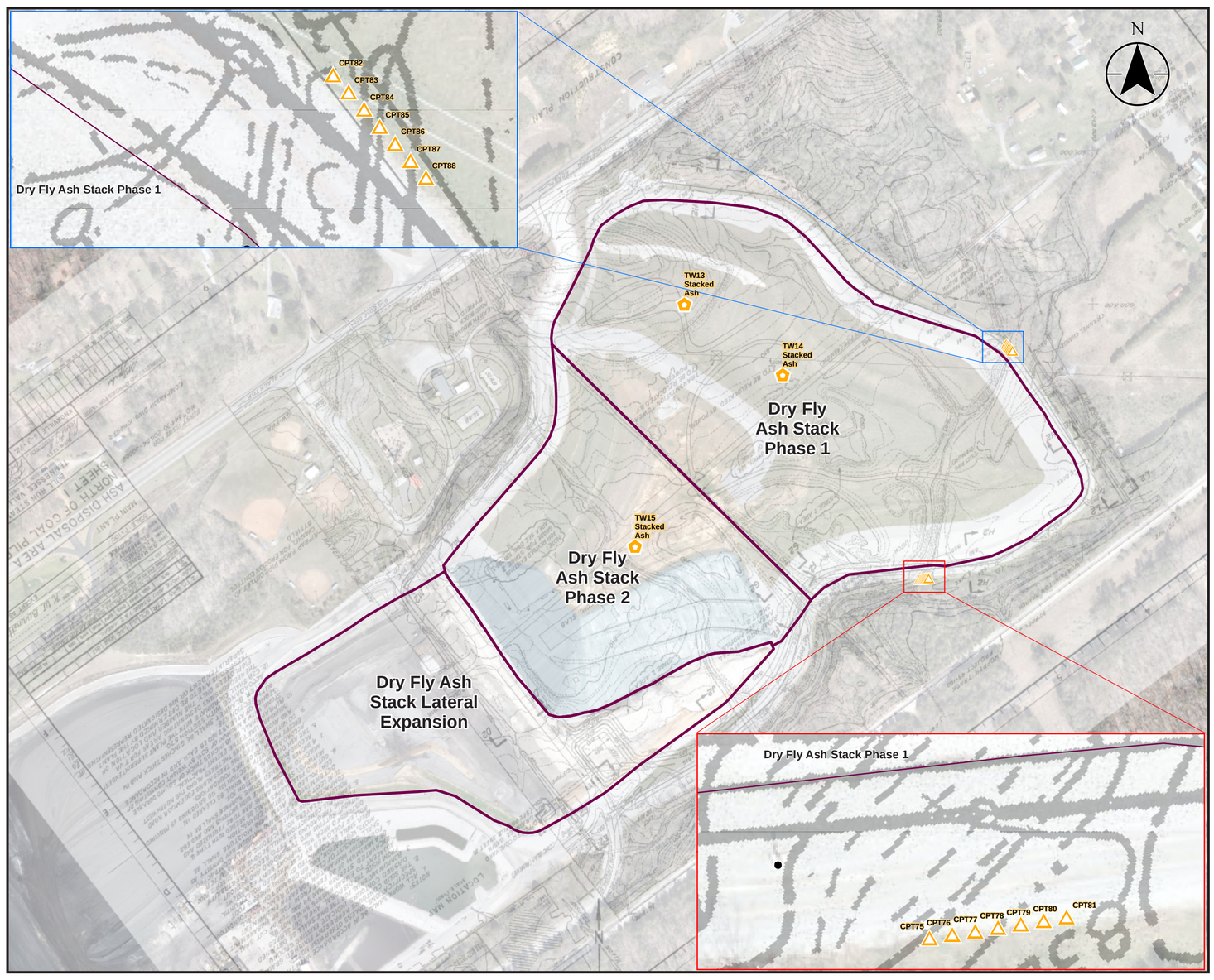
What TVA has already done

Comprehensive studies were conducted in 1995, 2002, and 2013 to characterize the CCR ash.

The ash material sampled included: Fly Ash, Bottom Ash, Gypsum Product.

Each sample is tested for physical and chemical characteristics, including leachability and total metals.

Proposed temporary wells and CPTs: Dry Fly Ash Stack



Legend

- Proposed Boring with Temporary Well (Saturation Level in CCR, Pore Water Sampling, and Geotechnical Data) (Screened Interval)
- Proposed Cone Penetration Test
- CCR Unit Area (Approximate)

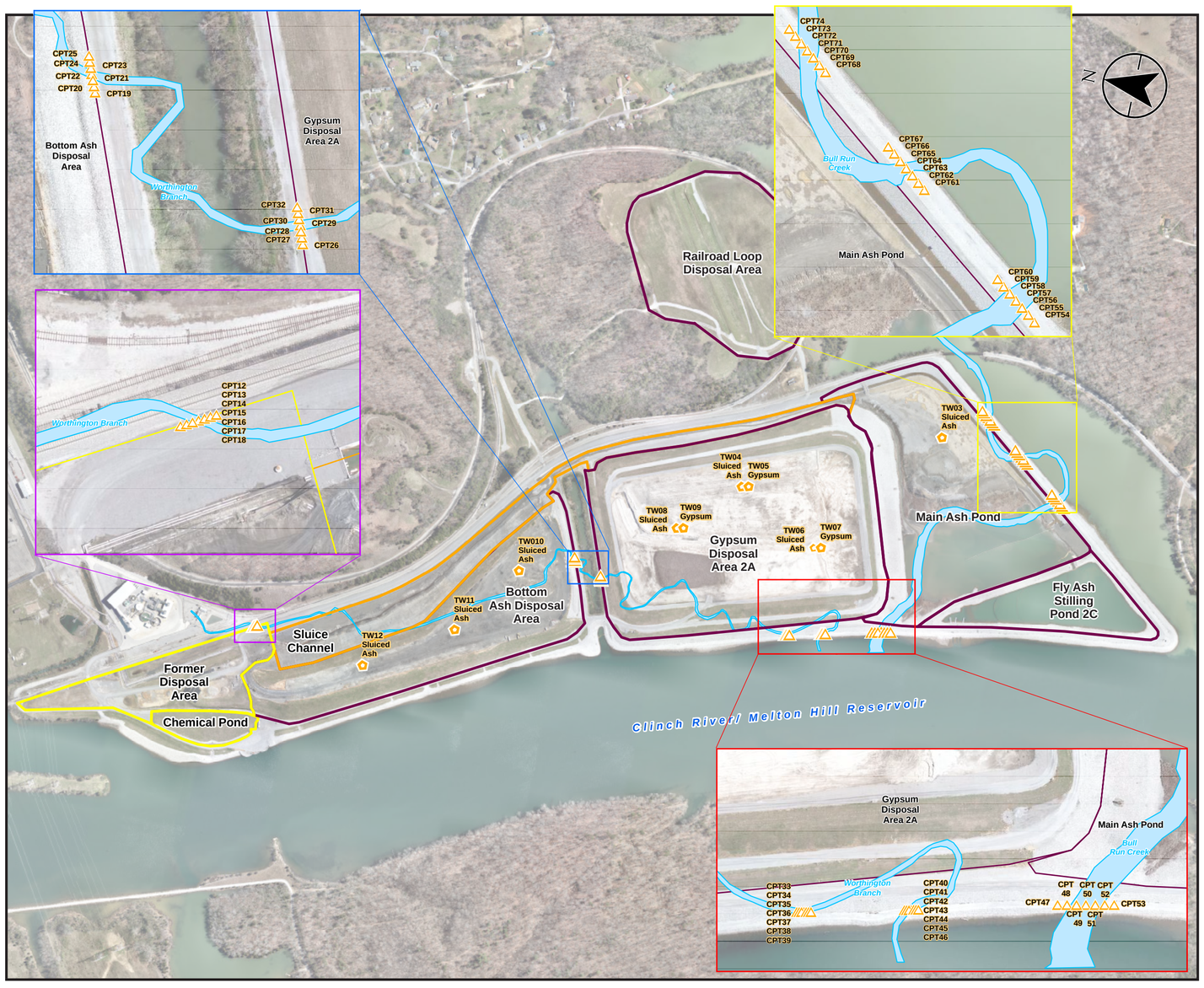
Proposed EIP Activities

- Collect CCR material samples from borings in units
- Collect pore water samples from temporary wells in units
- Analyze samples for CCR constituents
- Comparative analysis against existing data
- Report the analytical results in the Environmental Assessment Report (EAR)

BULL RUN FOSSIL PLANT

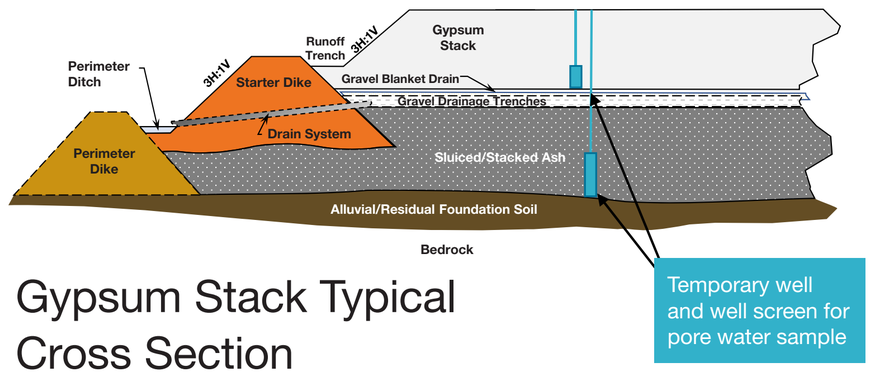
COAL COMBUSTION RESIDUALS MATERIAL CHARACTERISTICS (2 OF 2)

Proposed temporary wells and CPTs:
Bottom Ash Disposal Area, Gypsum Disposal Area 2A,
Fly Ash Stilling Pond 2C & Main Ash Pond



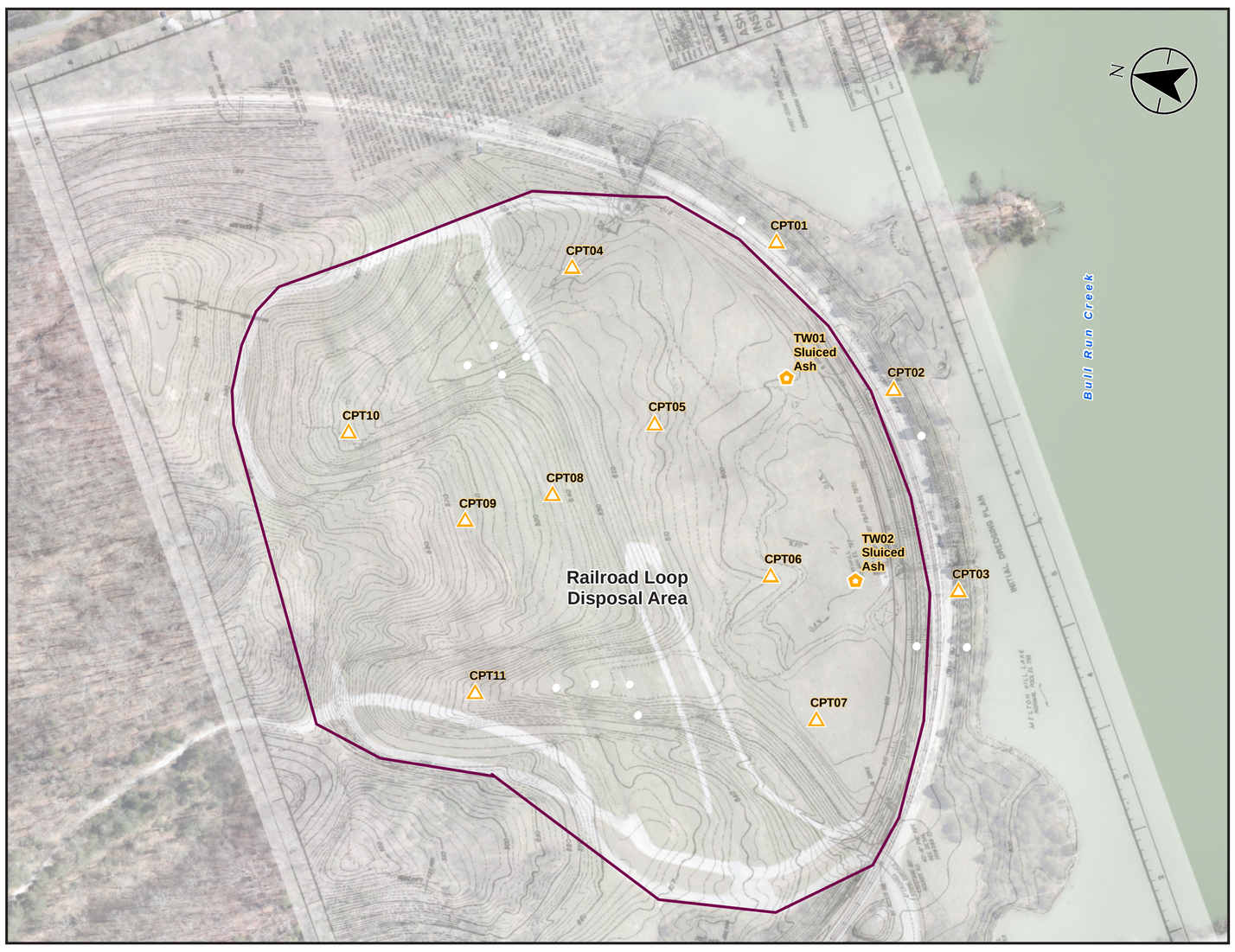
Legend

- Proposed Boring with Temporary Well (Saturation Level in CCR, Pore Water Sampling, and Geotechnical Data) (Screened Interval)
- Proposed Cone Penetration Test
- CCR Unit Area (Approximate)
- Former Disposal Area (Approximate)
- Sluice Channel (Approximate)
- Historic Creek Alignment



Gypsum Stack Typical Cross Section

Proposed temporary wells and CPTs: Railroad Loop Disposal Area



Legend

- Proposed Boring with Temporary Well (Saturation Level in CCR, Pore Water Sampling, and Geotechnical Data) (Screened Interval)
- Proposed Cone Penetration Test
- CCR Unit Area (Approximate)

Tennessee Department of Environment & Conservation
TVA Environmental Investigation Plan
Bull Run Fossil Plant

OGC15-0177 (Commissioner's Order) August 6, 2015

Order Has Two Purposes

1. Establish transparent and comprehensive process for the Investigation, assessment, and remediation of unacceptable risks, resulting from the management and disposal of coal combustion residuals (CCR) at the TVA's coal-fired power plants in Tennessee.

2. Coordination of Implementation of the federal CCR rule to insure compliance with Tennessee laws and regulations that govern the management and disposal of CCR.

TN Department of Environment & Conservation

Environmental Investigation Plan (EIP)

- The Order requires TVA to develop an EIP for each site that, when implemented, shall provide the information necessary to "*fully identify the extent of soil, surface water, and ground water contamination by CCR*"
- EIP development is an iterative process requiring review and input from TDEC
- TVA will address any comments TDEC may have, submitting additional revisions, and repeating the process until TDEC approves the EIP and schedule
- TDEC approved EIP will be presented at the AIP and issued for public comment

TN Department of Environment & Conservation

Source: TDEC All Interested Parties Meeting – September 5, 2018

Tennessee Department of Environment & Conservation
TVA Environmental Investigation Plan
Bull Run Fossil Plant

Objectives of the EIP

- Define background conditions:
  - soil
  - surface water, sediment, and aquatic life
  - groundwater
  - pre-construction site conditions (topography, hydrology)
- Determine how each unit was constructed and modified during lifetime
- Develop a thorough understanding of the geology at the site
- Define groundwater flow and chemistry at the site
- Delineate potential impacts to groundwater, soil, surface water, sediment, and aquatic life

TN Department of Environment & Conservation

Objectives of the EIP

- Characterize CCR material
  - quantity
  - chemistry
  - physical characteristics (geotechnical)
  - saturation levels
  - existing and modeled for potential closure scenarios
- Data generated will be used to develop a final Environmental Assessment Report (EAR) and ultimately, an appropriate selection of remedy for each site

TN Department of Environment & Conservation

Source: TDEC All Interested Parties Meeting – September 5, 2018

Tennessee Department of Environment & Conservation
TVA Environmental Investigation Plan
Bull Run Fossil Plant

Sampling and Analysis Plans (SAPs)

- TVA has worked with TDEC to develop and execute SAPs to develop new data where needed
- The SAPs provide detailed plans for conducting studies to obtain new data and will describe how it will be used to respond to specific information requests
- The SAPs are structured as independent documents that guide the work of the SAP execution teams
- Included as Appendices to the EIP

TN Department of Environment & Conservation

TVA BRF SAPs

- Background Soil SAP
- Exploratory Drilling SAP
- Material Quantity SAP
- CCR Material Characteristics SAP
- Hydrogeological Investigation SAP
- Groundwater Investigation SAP
- Stability SAP
- Seep SAP
- Benthic SAP
- Surface Stream SAP
- Fish Tissue SAP
- Water Use Survey

TN Department of Environment & Conservation

Source: TDEC All Interested Parties Meeting – September 5, 2018

Tennessee Department of Environment & Conservation
TVA Environmental Investigation Plan
Bull Run Fossil Plant

CCR Parameters

40 CFR Part 257 Appendix III Constituents	40 CFR Part 257 Appendix IV Constituents
Boron	Antimony
Calcium	Arsenic
Chloride	Barium
Fluoride	Beryllium
pH	Cadmium
Sulfate	Chromium
Total Dissolved Solids – Not Applicable	Cobalt
	Fluoride
	Lead
	Lithium
	Mercury
	Molybdenum
	Selenium
	Thallium
	Radium 226 and 228 Combined

TN Department of Environment & Conservation

CCR Parameters

TN Rule 0400-11-01-.04, Appendix 1 Inorganic Constituents
Copper
Nickel
Silver
Vanadium
Zinc

TN Department of Environment & Conservation

Additional Data Included in the EIP

- Appendix B – Regulatory Correspondence
- Appendix C – Exhibits
- Appendix I – Evaluation of Existing Geotechnical Data
- Appendix K – Groundwater Monitoring Data
- Appendix L – Drawings
- Appendix R – NPDES Sampling Data
- Appendix S – Historic Seep Summary
- Appendix W – Public Comments

TN Department of Environment & Conservation

Source: TDEC All Interested Parties Meeting – September 5, 2018