GALLATIN FOSSIL PLANT

Tennessee Valley Authority
welcomes you to

Gallatin Fossil Plant
Public Open House

GALLATIN FOSSIL PLANT

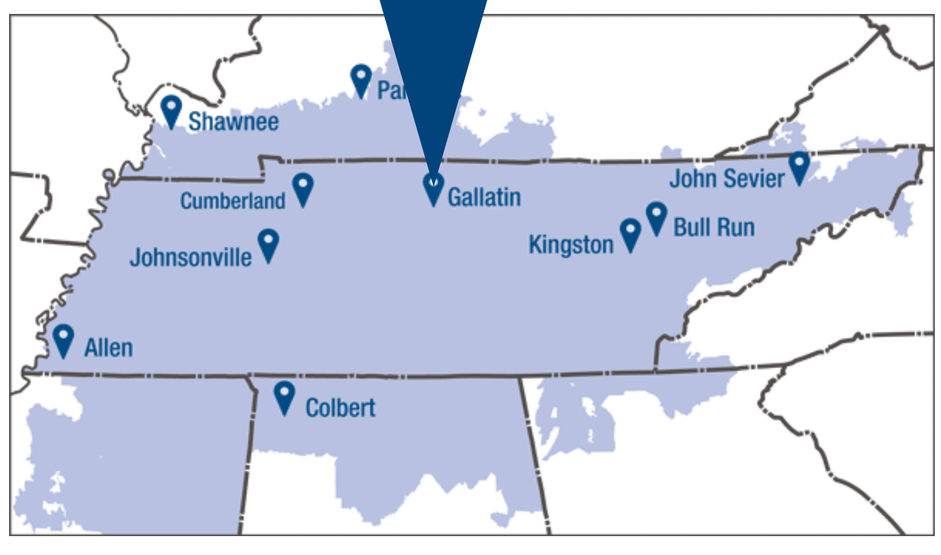
Units

- Bottom Ash Pond
- Middle Pond A
- Ash Pond A
- Ash Pond E
- Stilling Ponds
- Non-Registered Site (NRS) (closed)
- North Rail Loop (NRL) Landfill (lined CCR landfill)

Legend

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

NOTE: Aerial image dated February 2017



Facility Overview

1956-1959	Date of commissioning
1,950	Facility size (acres)
13,767,000	Cubic yards of coal combustion residuals (CCR)
976	Megawatts of output
565,000	Number of homes powered
70	Acres of CCR units closed
435	Acres of CCR units to be closed

GALLATIN FOSSIL PLANT

COAL COMBUSTION RESIDUALS

What are coal combustion residuals?

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

At Gallatin these residuals include fly ash, bottom ash, and dry FGD scrubber material which are collected separately from different areas of the facility.

Bottom ash and fly ash are generated in the boiler. Fly ash is collected in a baghouse, while bottom ash is collected from the boiler. Dry FGD scrubber material is generated by the dry FGD scrubber air quality controls completed in 2015. As of 2019, all CCR generated at Gallatin are disposed of in a lined landfill that began operation in 2016.

Dry FGD Scrubber Material

Bottom Ash/Slag

Fly Ash

GALLATIN FOSSIL PLANT

COAL COMBUSTION RESIDUALS ENVIRONMENTAL INVESTIGATION

What is the Environmental Investigation Plan?

The State of Tennessee (State), the Tennessee Department of Environment and Conservation (TDEC) and the Tennessee Valley Authority (TVA) agreed for TVA to conduct an environmental investigation at Gallatin, which began on July 18, 2016. The environmental investigation includes:

- A hydrogeologic characterization informed by surface geophysical surveys
- Development of current conditions groundwater elevation maps
- Development of groundwater elevation maps for anticipated future conditions
- A private water well survey and water supply well sampling
- Establish a permanent groundwater monitoring network including background wells
- A characterization of native soils
- An evaluation of seeps
- An evaluation of impoundment slope stability
- An assessment of coal combustion residuals material quantity
- An assessment of coal combustion residuals chemical and physical properties
- An evaluation of the Cumberland River sediment and benthic invertebrates
- An evaluation of the Cumberland River water quality
- An evaluation of the Cumberland River fish community and bioaccumulation
- An evaluation of groundwater discharge to the Cumberland River
- An inventory of karst features
- A dye trace study
- A hydrogeologic water balance for the ash ponds
- An evaluation of potential off-site sources of groundwater contamination

At the conclusion of the environmental investigation, TVA will submit a final Environmental Assessment Report (EAR) to TDEC. This report will present the results of the investigation, including the extent to which coal combustion residuals have contaminated the soil, surface water, and groundwater at GAF. The report will also support development of an appropriate corrective action plan at GAF if corrective actions are necessary. TVA has already submitted a draft report on the results of the environmental investigations conducted so far, and TVA will produce a final version of the report when the additional environmental investigation activities conclude.

What TVA is doing independent of the Environmental Investigation

Gallatin has on-going environmental studies independent of the Environmental Investigation. To learn more, please visit the following link:

https://www.tva.gov/Energy/Our-Power-System/Coal/Gallatin-Fossil-Plant

GALLATIN FOSSIL PLANT

ENVIRONMENTAL INVESTIGATION PROCESS

Environmental Investigation Plan (EIP)

Revision Cycle
Address TDEC Comments

Implement EIP
Began July 2016

Draft Environmental Assessment Report (EAR)
April 28, 2017

Additional EIP Studies
Began December 2017

Implement Corrective Action

TDEC Approval of CARA Plan

Official Public Comment Period

Corrective Action and Risk Assessment Plan

EAR

GALLATIN FOSSIL PLANT

ENVIRONMENTAL INVESTIGATIONS

FOCUS AREA	EXISTING INFORMATION	EIP ACTIVITIES
Slope Stability	• Routine visual monitoring and instrumentation monitoring • Existing analyses meet industry standards • Existing drilling and laboratory data support new analyses	• New analyses (for some units) for normal and earthquake conditions • Compared existing models to new data • If needed, updated models and reanalyzed • Compared 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 1953	• Reviewed existing surveys, drawings, and borings • Developed three-dimensional models of CCR units • Updated three-dimensional models with new boring data and water levels • Confirmed CCR volumes
CCR Chemcial and Physical Properties	• Chemical characterization previously completed in 2013 and 2016 • Physical characterization previously completed in 2012	• Collected CCR material samples from borings in units • Collected pore water samples from temporary wells in units • Analyzed samples for CCR constituents • Analyzed samples for physical properties
Hydrogeologic Investigation	• Monitoring well network in place for CCR Rule and state permitting requirements	• Completed a hydrogeologic characterization of the GAF • Drilled borings, performed borehole geophysics and reviewed tests; wells located with surface geophysics • Installed monitoring wells • Developed geologic cross sections • Developed current conditions groundwater elevation maps • Developed groundwater elevation maps for anticipated future conditions based on groundwater flow modeling
Groundwater Investigation	• Groundwater monitoring has been ongoing since 1987	• Establish permanent network of groundwater monitoring wells based on hydrogeologic investigation, private water well survey, surface geophysics, groundwater elevation map, and groundwater flow modeling for closure conditions • Identify proposed background wells for GAF to establish background groundwater quality
Private Water Well Survey	• No existing data available	• Visited 235 properties within survey area • Completed survey form with owner • If well present, requested access to sample well • Sampled private water supply wells

GALLATIN FOSSIL PLANT

ENVIRONMENTAL INVESTIGATIONS

FOCUS AREA	EXISTING INFORMATION	EIP ACTIVITIES
Karst Inventory / Dye Trace Study	• Historical maps of karst features	• Desktop study completed • Performed field reconnaissance (TVA & private properties) to develop inventory map of karst features • Injected dye into karst features, helped characterize subsurface groundwater flow paths • Dye trace study Phase 2 in planning stage
Water Balance	• We had NPDES Permit	• Compared measurements of inputs and outputs to the ash pond system
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	• Conducted seepage investigation to identify active seeps • Collected soil and water samples at identified seeps • Analyzed samples for CCR constituents • Comparative analysis against background soils • Implement Corrective Action Plan if needed
River Sediments and Benthic Invertebrates	• No previous sediment data available • TVA benthic community data available 2010-2018 • No previous benthic bioaccumulation data available	• Collected sediment cores, segmented into layers, analyzed for % ash and CCR-related chemical constituents • Collected bottom-dwelling organisms (benthic invertebrates) from coves adjacent to GAF, upstream, and downstream • Compared community structure adjacent vs. upstream / downstream • Measured bioaccumulation of CCR-related constituents
River Water Quality	• Limited USACE data available, but none near GAF	• Collected river water samples from multiple locations in the Cumberland River upstream, adjacent, and downstream of GAF • Analyzed samples for general water quality parameters and CCR-related constituents
Fish Community and Bioaccumulation	• Fish community data available 2001-2018 • Minimal previous fish bioaccumulation data available	• Caught (via electroshocking and netting), counted (by species), and released all species of fish present at locations upstream, adjacent, and downstream of GAF • Collected 6-fish composite samples of fish from locations upstream, adjacent, and downstream of GAF • Analyzed fish tissues for CCR-related constituents
Near-bottom Temperature and Conductivity	• TVA data on heated water discharge, but nothing available to identify smaller thermal anomalies	• Slowly cruised along parallel paths that track the river bank from near-shore to mid-channel, continuously monitored water temperature, conductivity, and pH at one half-meter above bottom
Aerial Imagery	• No previous aerial infared imagery available	• Collected aerial infrared imagery of the Cumberland River under summer and winter conditions

GALLATIN FOSSIL PLANT

HISTORIC TIMELINE

1953

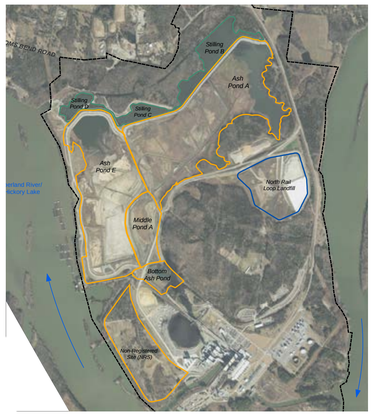
Construction begins on Gallatin Fossil Plant (GAF).

1956–1959

GAF begins producing power with all four units on-line by 1959. The Non-Registered Site (NRS) receives ash produced by GAF.

1970

Ash ponds open.



1997–1998

NRS is closed.

2009

TVA commits up to $2 billion to convert coal ash storage at all plants to dry storage.

2013–2015

At GAF, TVA invested $1 billion on the flue gas desulfurization (FGD) scrubber system, selective catalytic reduction (SCR) system, and baghouse installation.

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

2016

North Rail Loop Landfill (NRL) is constructed to receive dry FGD scrubber CCR.

2019

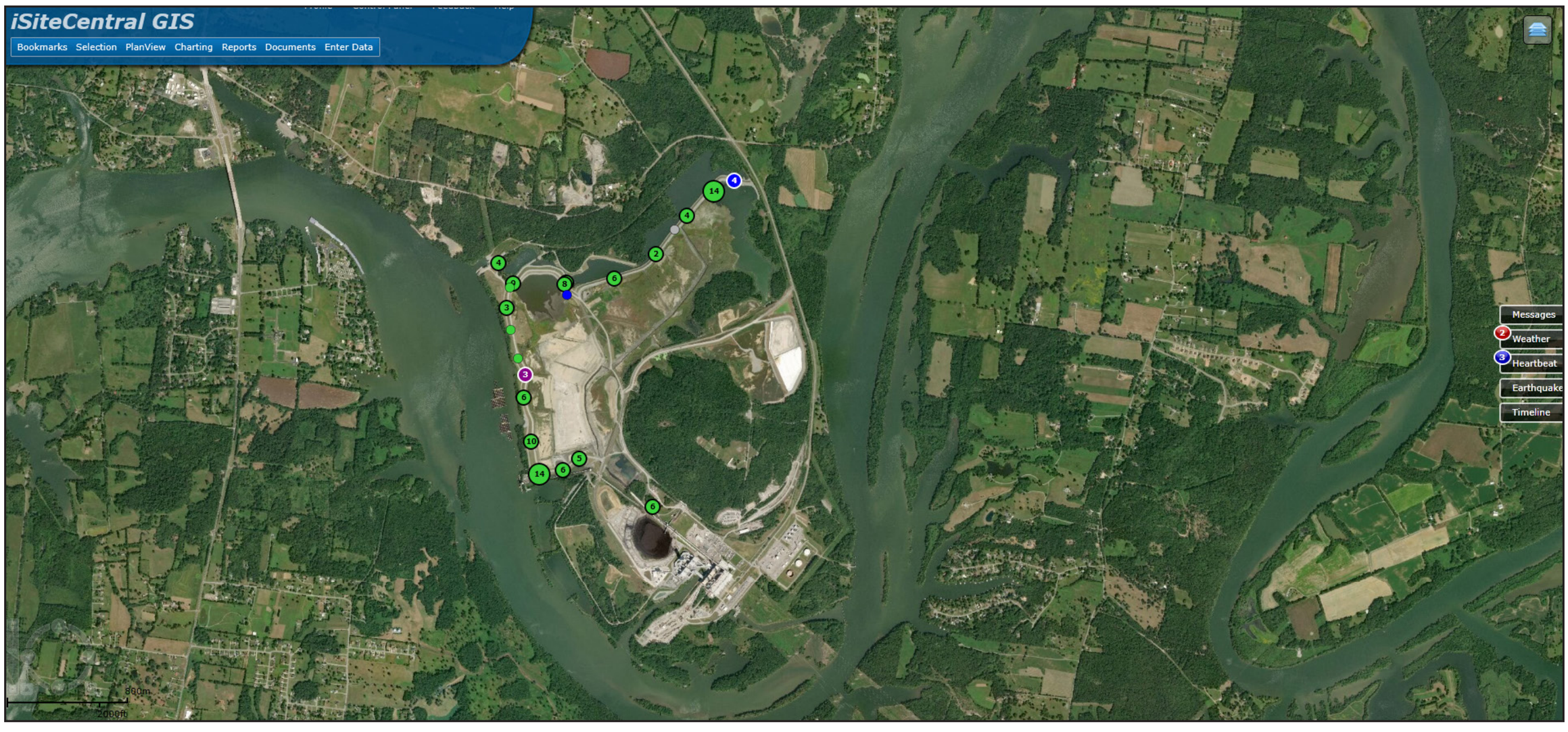
GAF stops sending CCR and process flows to ash ponds.

2016

TVA begins environmental investigations at Gallatin.

GALLATIN FOSSIL PLANT

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 stability issues before they become an emergency

More than **16,000 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

GALLATIN FOSSIL PLANT

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.

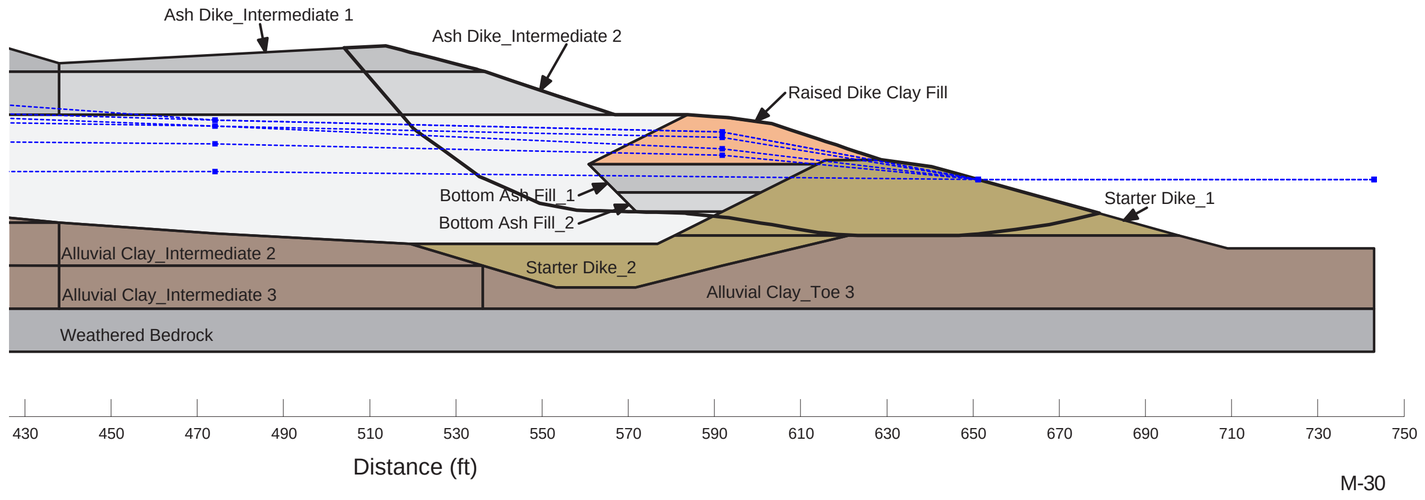
What TVA had already done

Slope stability had 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

Required analyses to satisfy EIP requirements

Unit	Normal	Earthquake
Bottom Ash Pond	E	E
Middle Pond A	E	E
Ash Pond A	E	E
Ash Pond E	E	E
Stilling Ponds	E	C
NRS	C	C

E = Existing analysis **C** = Completed analysis for EIP

Additional EIP Activities

- Completed new analyses (for some units) for normal and earthquake conditions
- Compared slope stability results to acceptance criteria

GALLATIN 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.

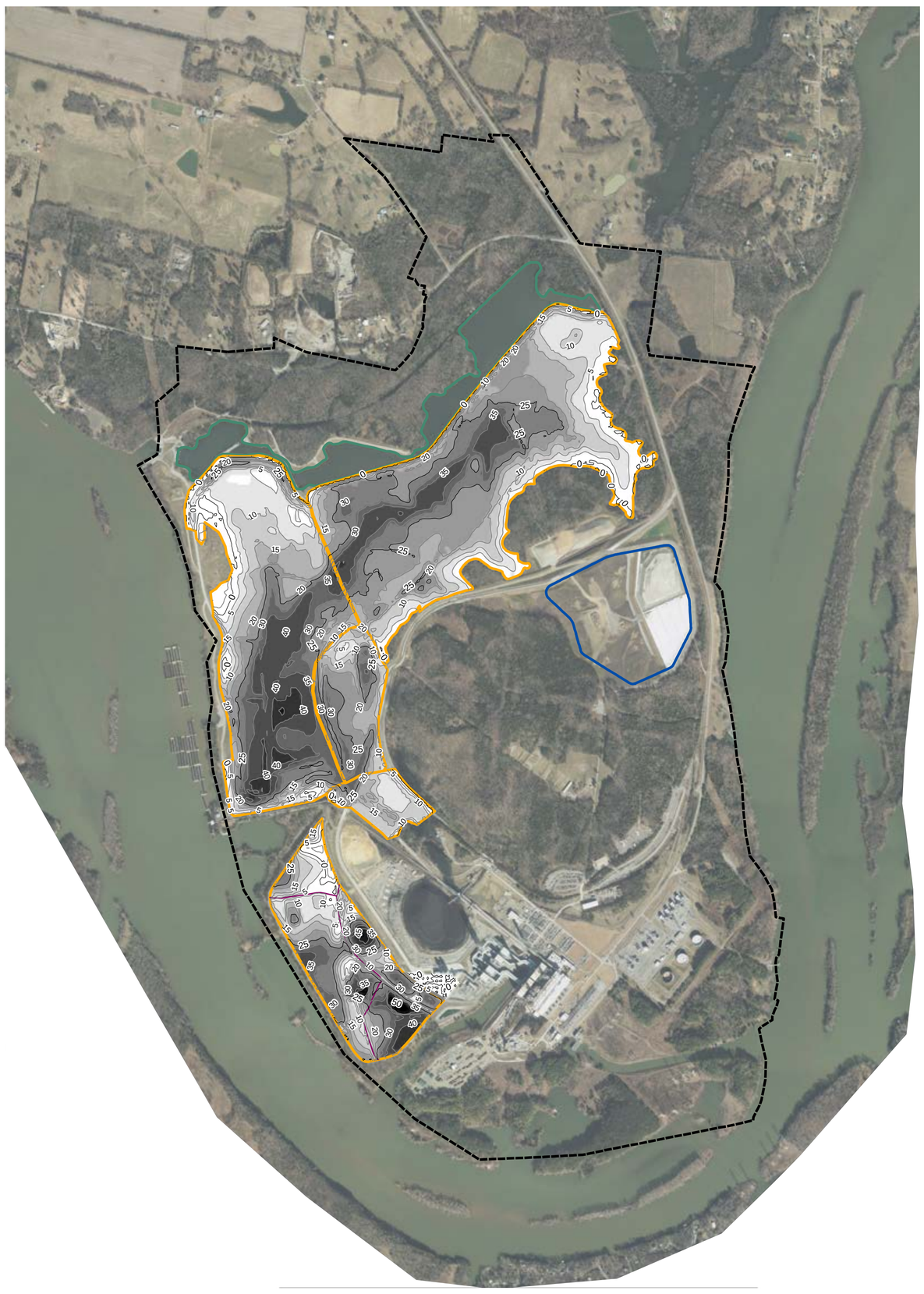
What TVA had already done

- Pre-development topographic maps
- As built/record drawings
- Aerial surveys performed for specific projects
- Drilled borings history beginning in 1953

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.

CCR Map (Location/Depth)



Additional EIP Activities

- Reviewed existing surveys, drawing, and borings
- Developed three-dimensional models of CCR units
- Updated three-dimensional models with new boring data and water levels
- Confirmed CCR volumes

GALLATIN FOSSIL PLANT

COAL COMBUSTION RESIDUALS MATERIAL CHARACTERISTICS

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.

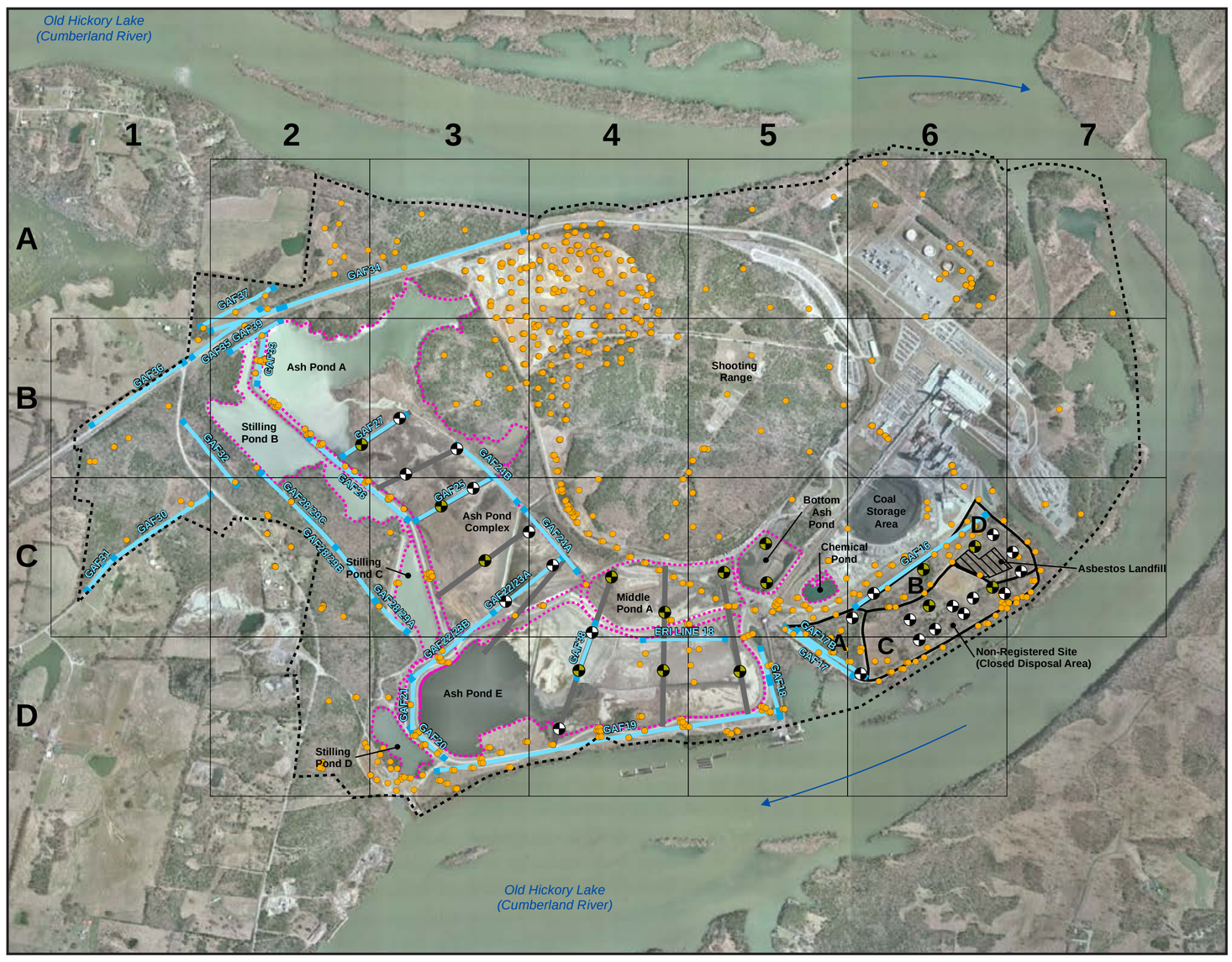
What TVA had done

Comprehensive studies were conducted in 2012, 2013, and 2016 to characterize the CCR.

The ash material sampled included: Fly Ash and Bottom Ash.

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

Proposed Temporary Wells



Legend

- Historical Boring Location
- Proposed DPT Location
- Proposed DPT/Temporary Monitoring Well Location
- Geophysical Survey Line Used for Selection of Drilling Location
- Temporary Road
- Estimated Pond Extents
- NRS Boundary Cell Dividers
- 2000' Grid
- TVA Gallatin Boundary

Additional EIP Activities

- Collected CCR material samples from borings in units
- Collected pore water samples from temporary wells in units
- Analyzed samples for CCR constituents
- Analyzed samples for physical properties
- Report the analytical results in the Environmental Assessment Report (EAR)

GALLATIN FOSSIL PLANT

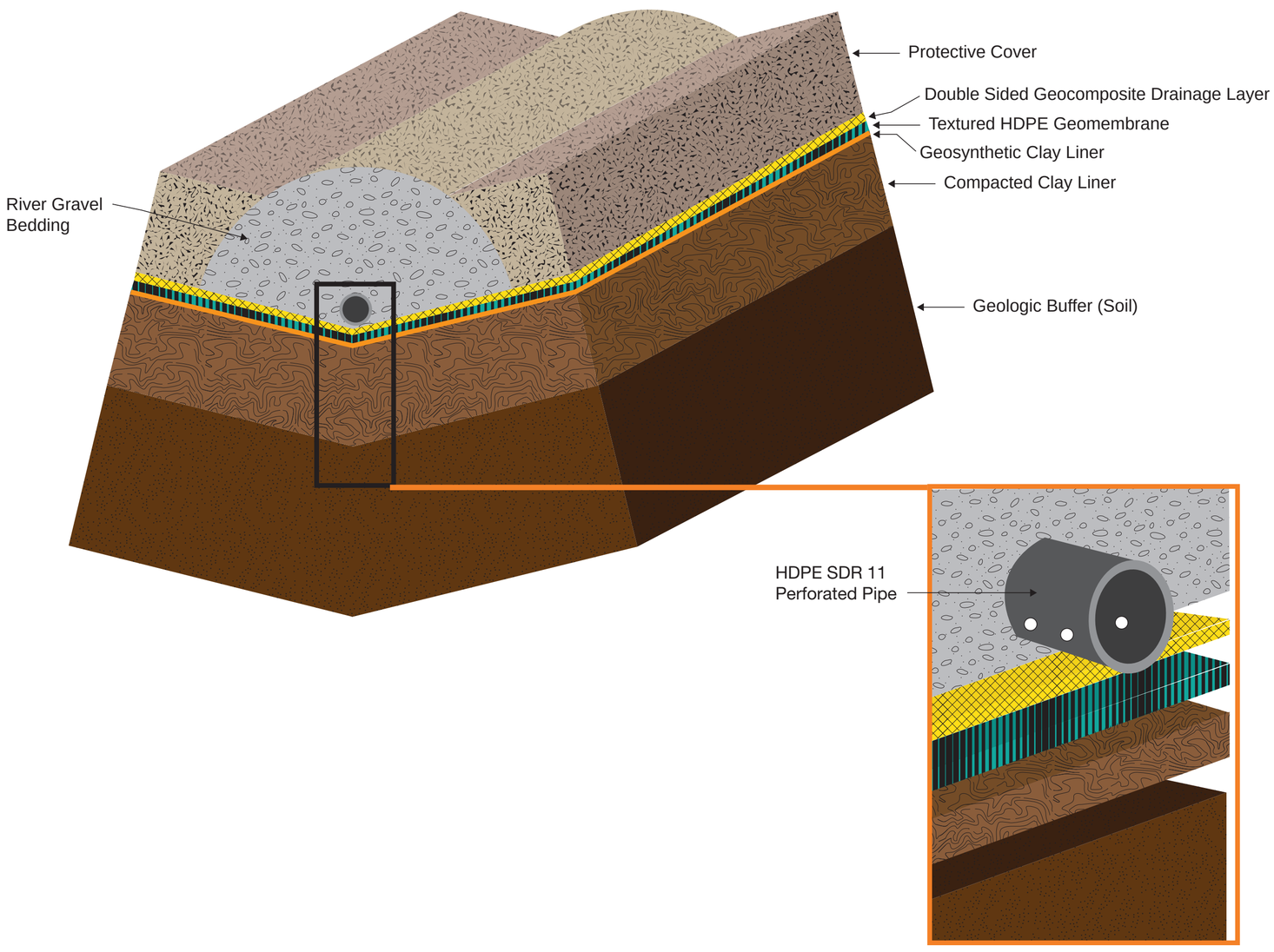
NORTH RAIL LOOP LANDFILL

What it is and why we do it

The North Rail Loop Landfill was permitted with TDEC in 2014 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, geosynthetic clay liner, 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 Gallatin North Rail Loop Landfill



Making the bottom liner and leachate collection system

Place geologic buffer and compacted clay liner

Place geosynthetic clay liner over compacted clay liner

Install geomembrane over geosynthetic clay liner

Install geocomposite drainage layer over geomembrane

Install protective ash cover layer and perforated leachate collection pipe

Aerial photo of landfill

GALLATIN FOSSIL PLANT

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.

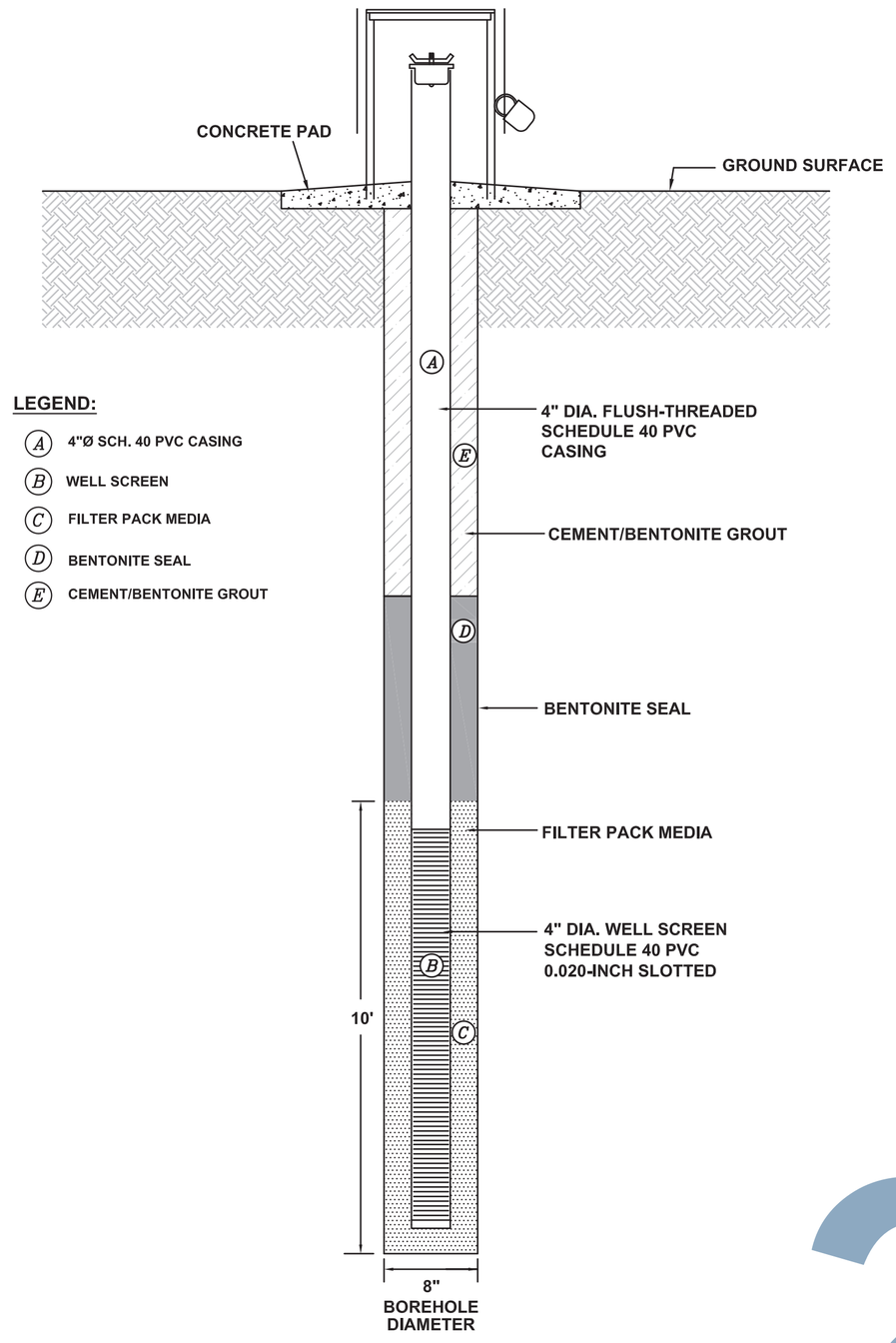
These investigations consist of installing groundwater monitoring wells to collect information about groundwater.

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

What TVA had already done

Several hydrogeologic investigations have been conducted at the Gallatin 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.

Additional EIP Activities

- Additional monitoring wells and piezometers installed to supplement current groundwater monitoring well networks to further investigate groundwater quality and flow direction:
  - A total of 163 monitoring wells exist today (on-site and on private property)
  - Water levels are gauged monthly

GALLATIN FOSSIL PLANT

GROUNDWATER INVESTIGATION

What it is and why we do it

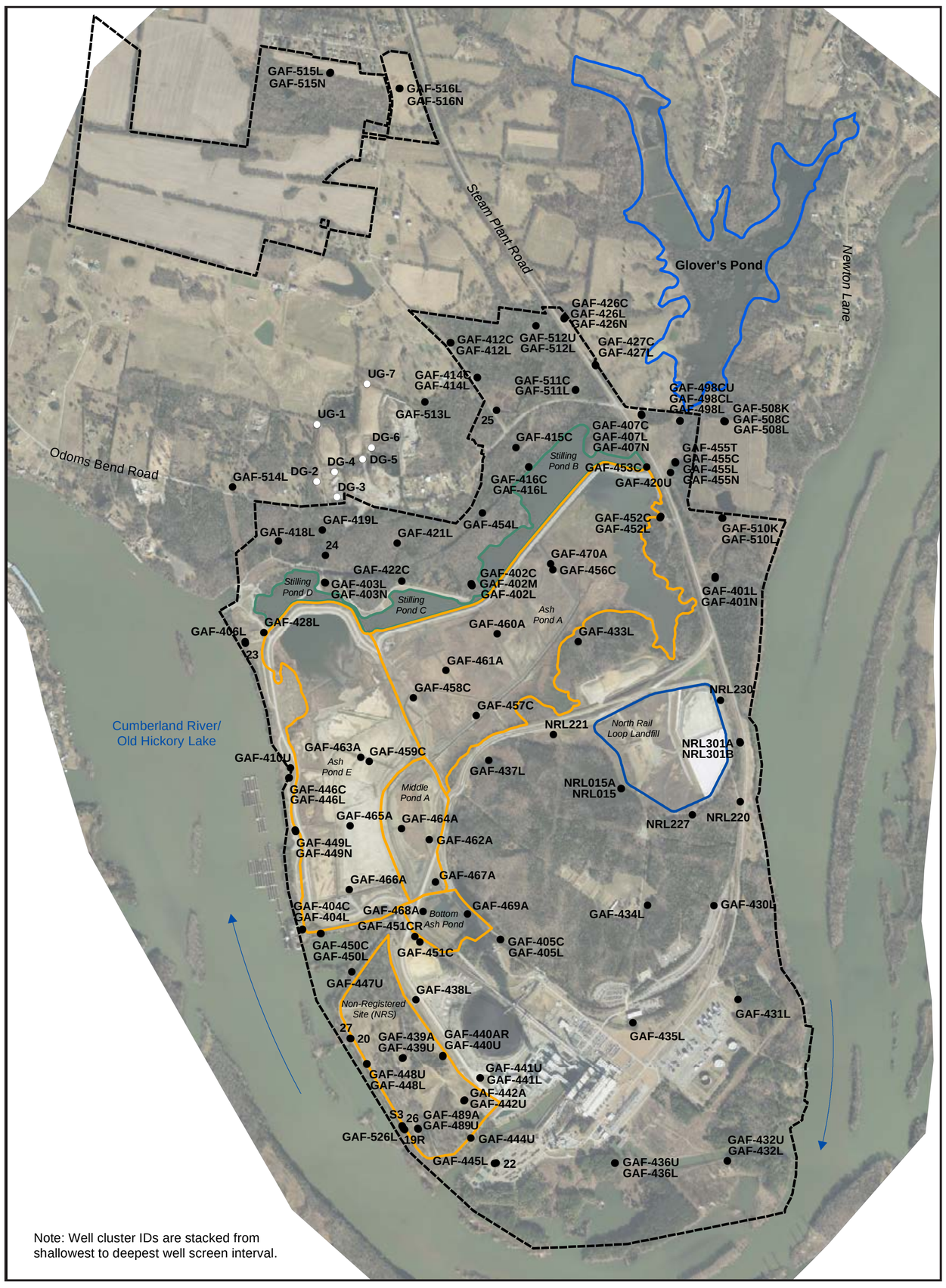
Groundwater samples are collected frequently to test for a number of quality measures. By testing groundwater regularly, TVA can track compliance with regulatory permits and requirements.

What TVA had already done

Groundwater monitoring has been occurring on the Gallatin Plant since 1987 and currently consists of 2 programs:

- State permit monitoring:
  - North Rail Loop (NRL) Landfill (lined CCR landfill)
  - Non-Registered Site (NRS) (Closed)
- Federal Coal Combustion Residuals (CCR) Rule monitoring:
  - Bottom Ash Pond, Middle Pond A, Ash Pond A, Ash Pond E
  - North Rail Loop Landfill

Monitoring Well Locations



Note: Well cluster IDs are stacked from shallowest to deepest well screen interval.

Legend

- Monitoring Well Location
- Non-TVA Monitoring Well Location
- TVA Gallatin Fossil Plant Property Boundary (Approximate)
- CCR Management Units
- North Rail Loop (NRL) Landfill
- Glover's Pond
- Stilling Ponds
- Cumberland River Direction of Flow

Additional EIP Activities

- Groundwater samples collected from background and downgradient locations
- Groundwater samples collected per Environmental Investigation Plan (EIP) schedule, Federal Coal Combustion Residuals (CCR) rule requirements, and state compliance requirements
- Analytical results to be reported in the Environmental Assessment Report (EAR)

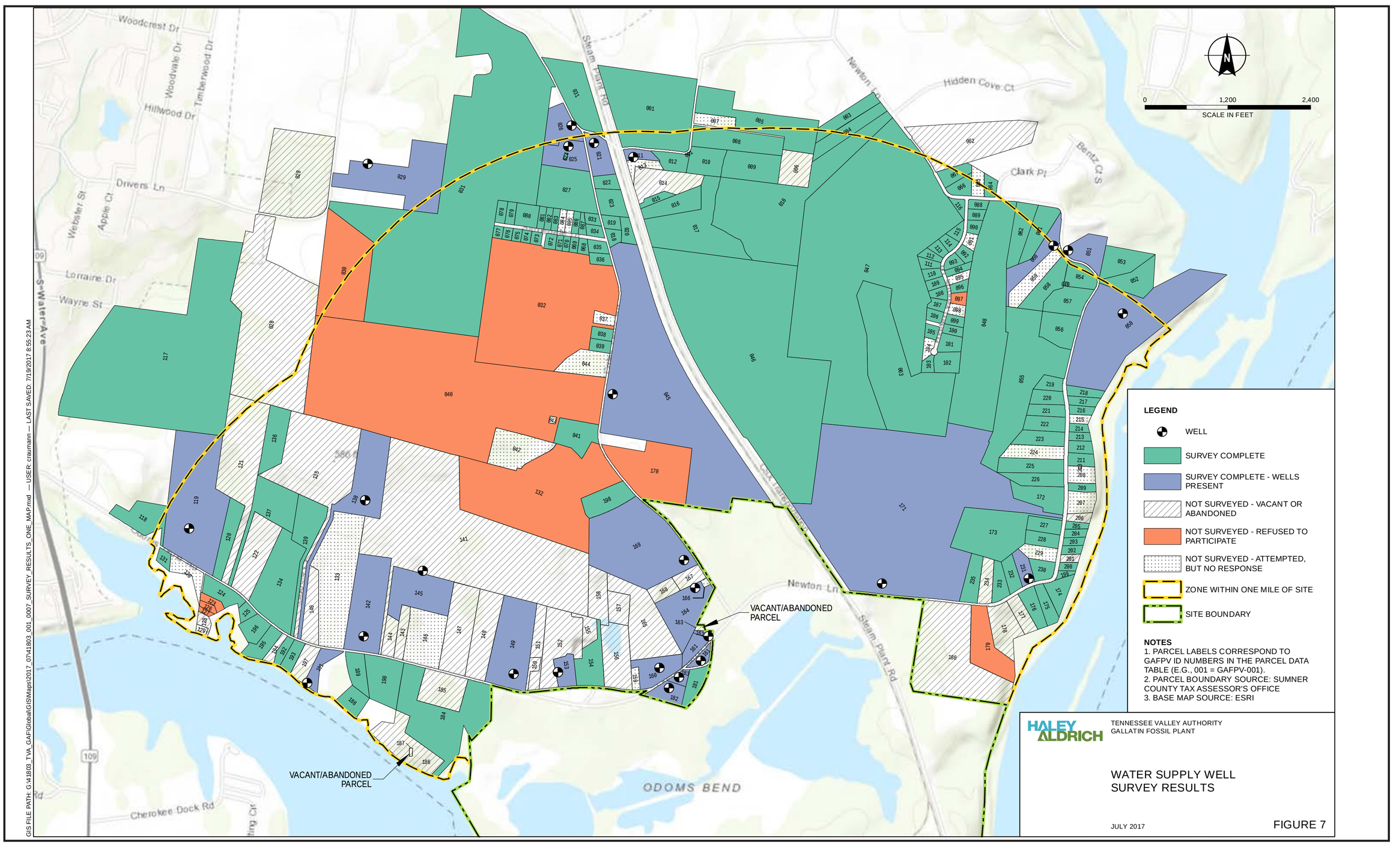
GALLATIN FOSSIL PLANT

PRIVATE WATER WELL 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 north of the Gallatin Fossil Plant. It is used to evaluate the quality of groundwater used in these private wells.

Private Water Well Survey Area



Additional EIP Activities

- Performed a door-to-door survey for private water wells (235 properties surveyed)
- Recorded water use data
- Conducted sampling for CCR constituents and compared to United States Environmental Protection Agency drinking water standards
- Results will be provided in the Environmental Assessment Report (EAR)

GALLATIN FOSSIL PLANT

KARST INVENTORY / DYE TRACE STUDY

What it is and why we do it

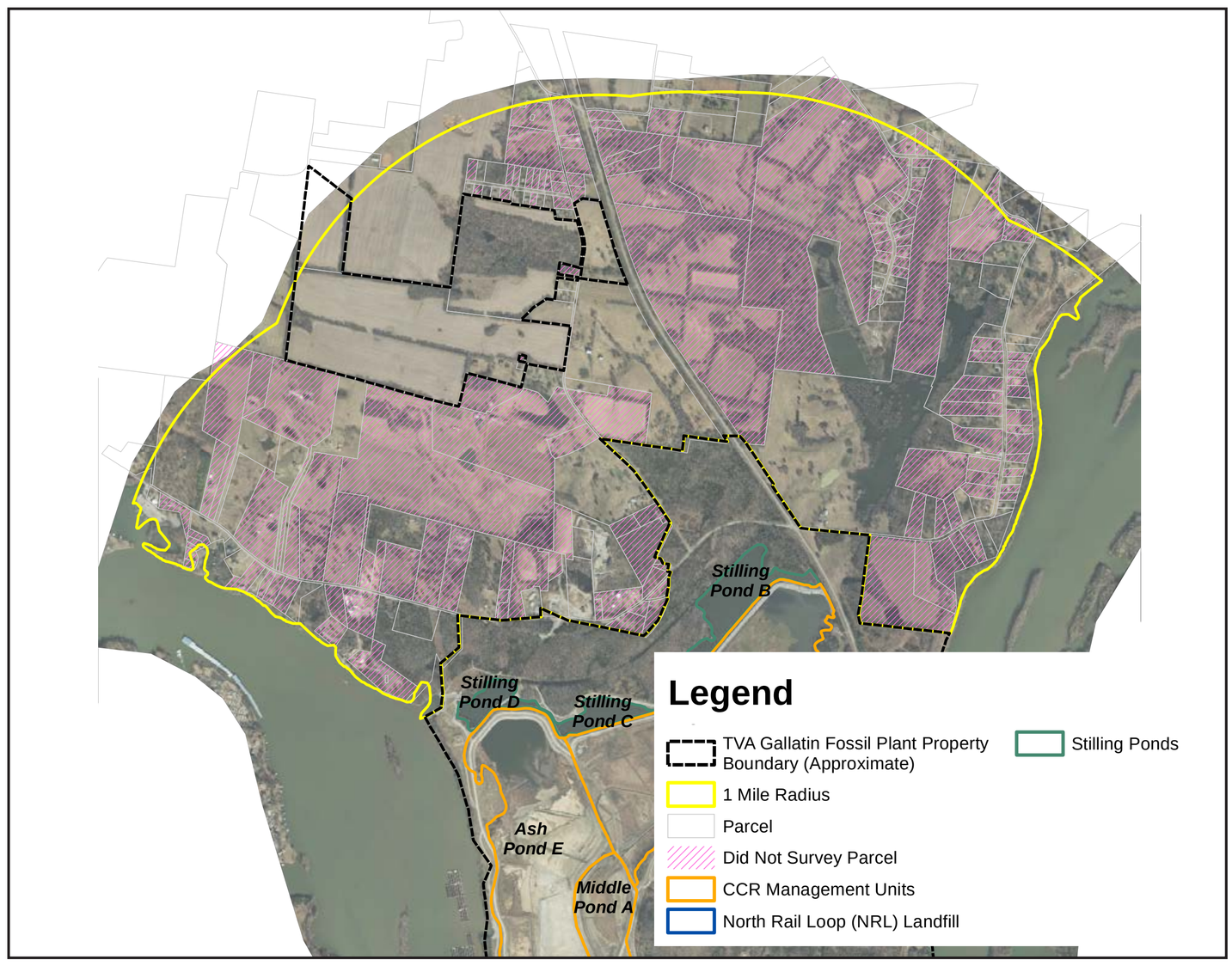
A karst inventory is a search for karst features including sinkholes, swallets, karst windows, caves, springs and sinking creeks or streams on TVA's Gallatin Fossil Plant property and within a 1-mile radius north of the Plant.

A dye trace study involved the introduction of dye into subsurface drainage pathways and monitoring where the dye flows.

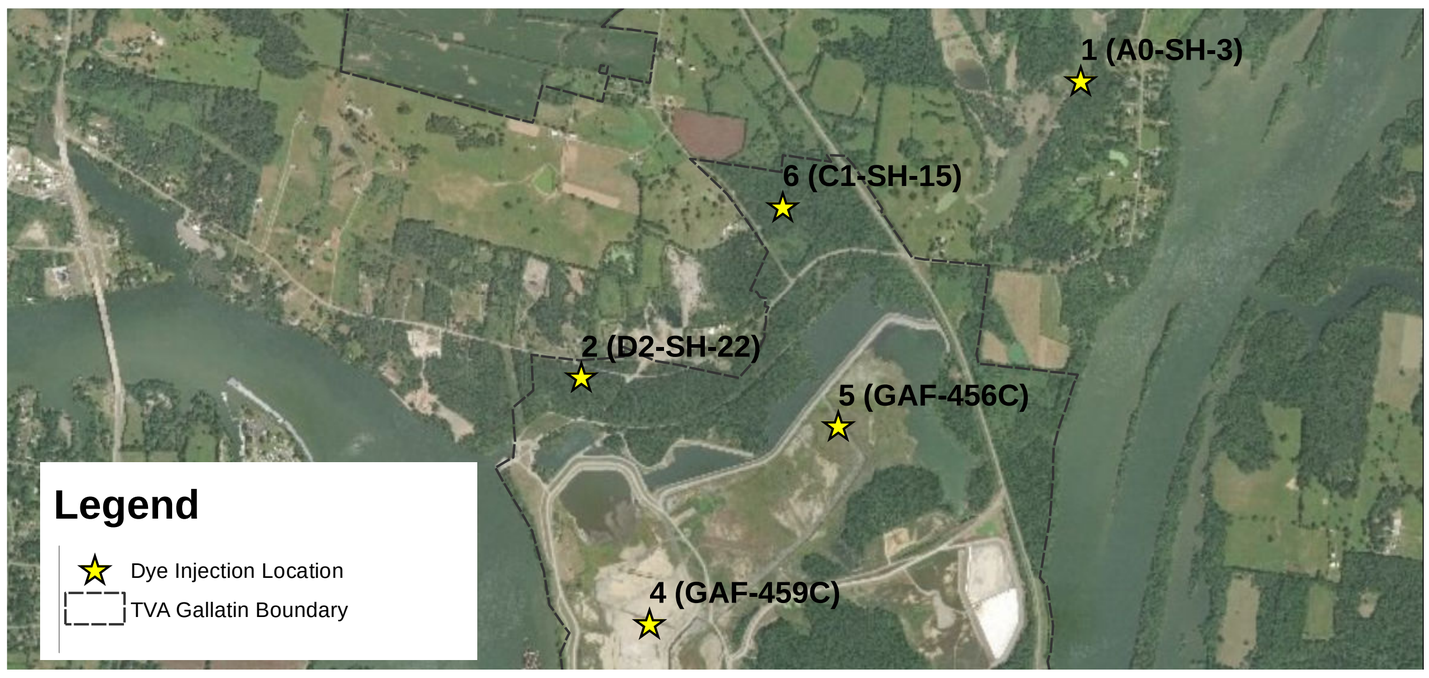
The Phase 1 dye trace study was conducted to identify potential locations of groundwater discharge or springs.

Phase 2 currently being planned.

Karst Inventory Survey Area



Phase 1 Dye Injection Locations



Additional EIP Activities

- Desktop study completed
- Performed field reconnaissance (TVA & private properties) to develop inventory map of Karst features
- Dye trace study Phase 1 completed
- Dye trace study Phase 2 in planning stage
- Results will be provided in the Environmental Assessment Report (EAR)