

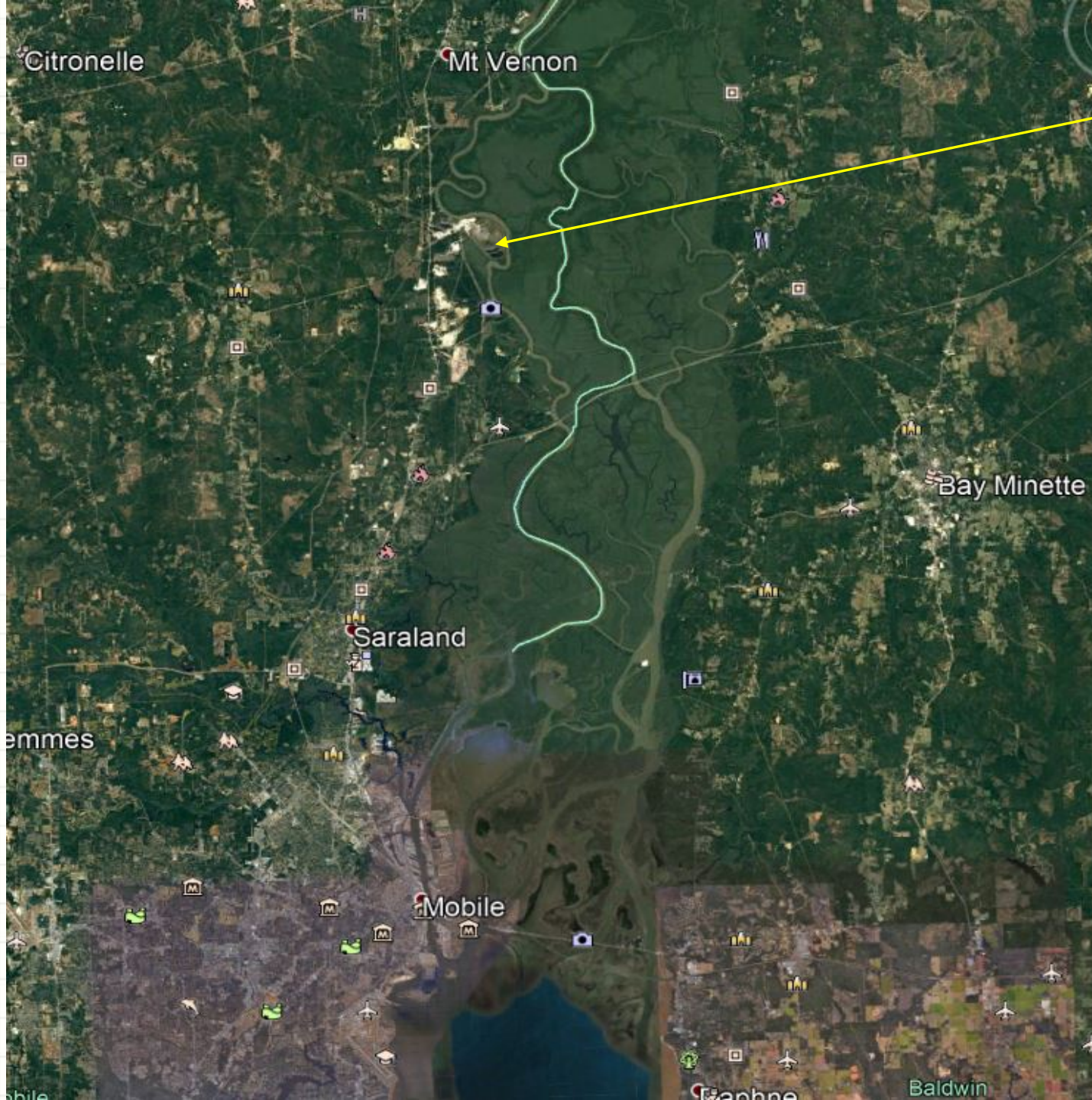
PLANT BARRY COAL ASH POND HYDROGEOLOGIC CONDITIONS SUMMARY

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Plant Barry
Ash Pond

Local and Regional Reaction to Environmental Issues

Reactions for many citizens when faced
with environmental issues are
informed by **Perception** and **Passion**



PRIMARY HYDROGEOLOGIC ISSUES RELATED TO COAL ASH POND CLOSURE

1. Isolation of the coal ash and its included contaminants.
2. Migration of the Mobile River channel.
3. Flooding and future impacts on the coal ash pond.



REVIEWED DOCUMENTS

Alabama Power Company Plant Barry 2017 and 2018

Annual Groundwater Monitoring and Corrective Action Reports

Alabama Power Ash Pond History of Construction Report

Alabama Power Initial Safety Factor Assessment

Alabama Power Assessment of Corrective Measures 2019

Mobile Baykeeper Pollution Report: Coal Ash at Alabama Power's Plant Barry

Available well records for the Buck, Alabama area

Geologic Maps

Groundwater Availability Reports

Topographic maps and aerial imagery



Primary Hydrogeologic Issues

- Hydrogeologic Isolation of Coal Ash and Chemical Constituents



Geologic Map



Coal Ash Pond Monitoring Wells



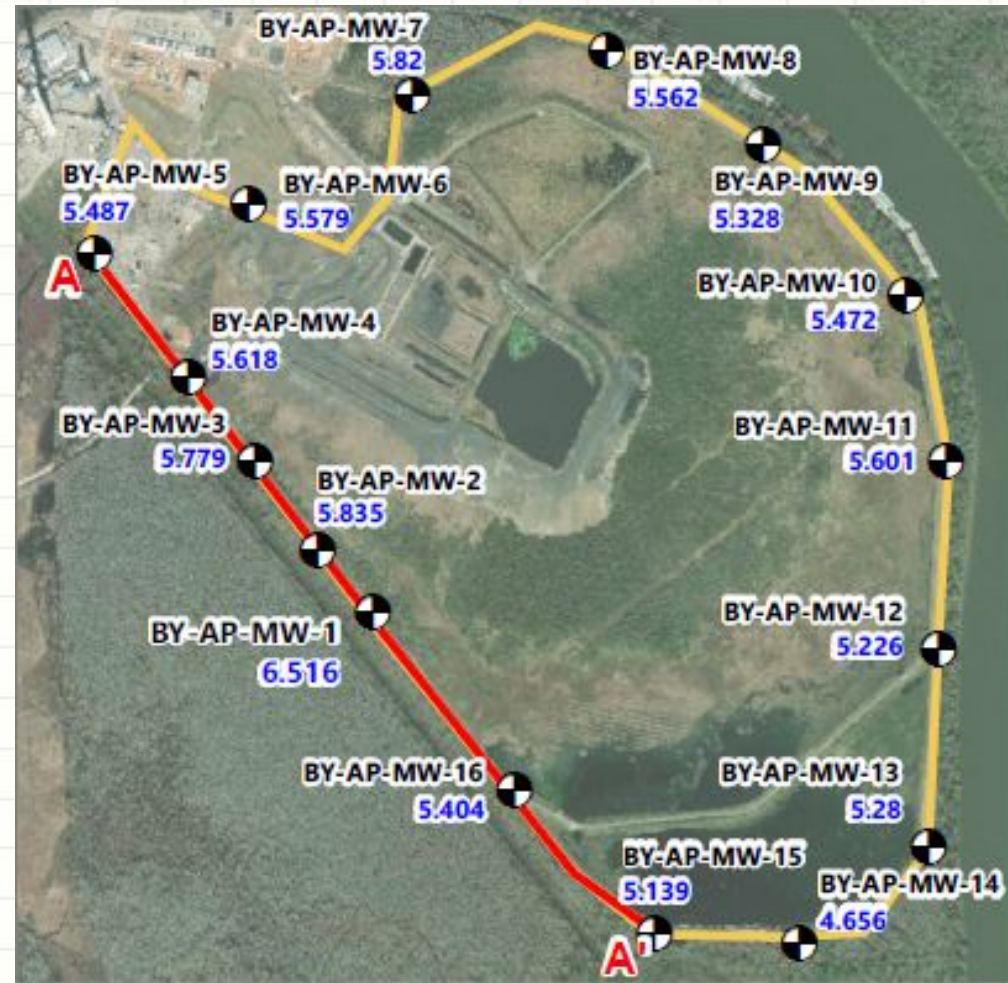


Vertical Isolation

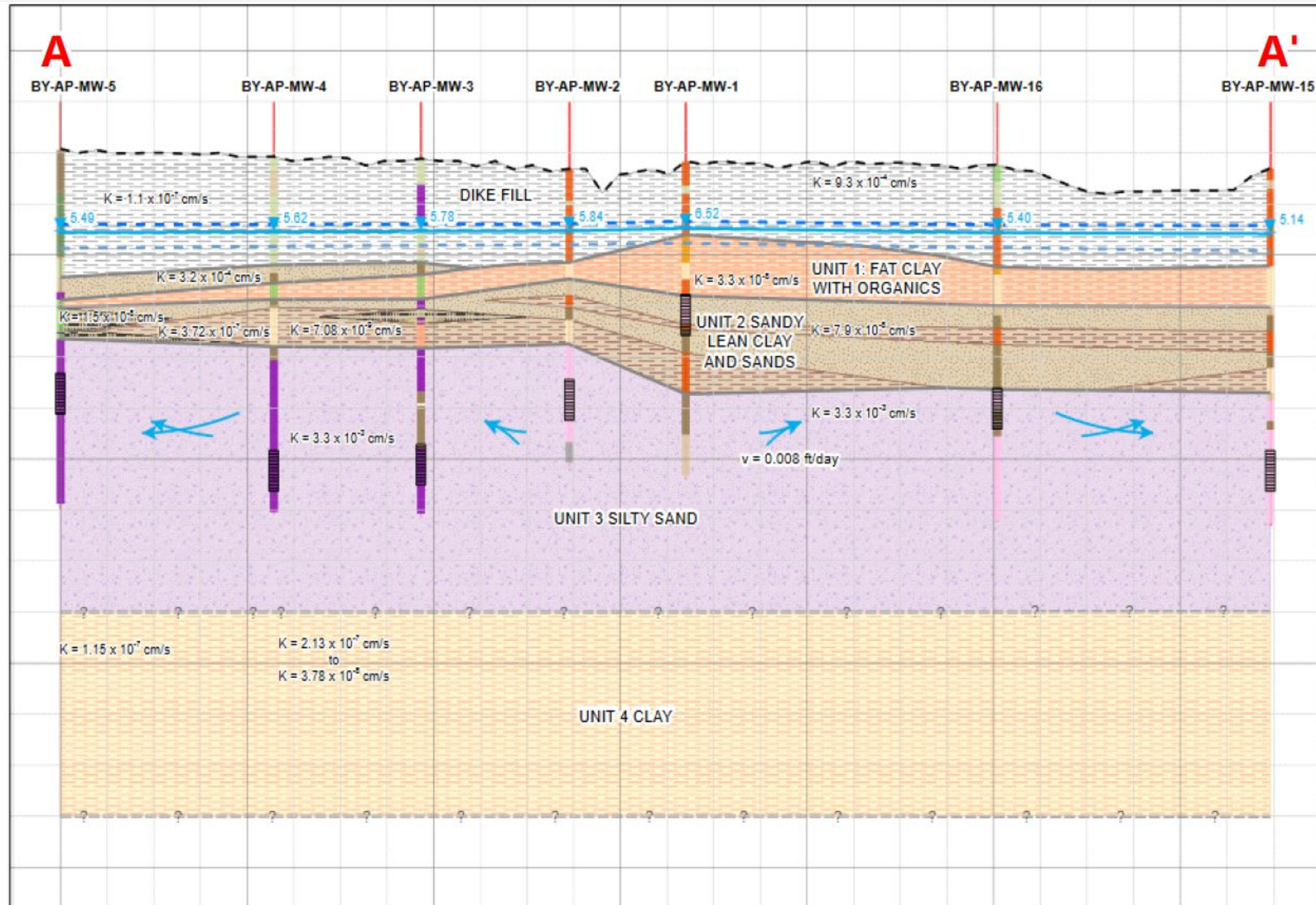
Are the clay layers underlying the ash pond homogeneous, impervious, and continuous?



LINE OF CROSS SECTION



Hydrogeologic Cross Section





Are the clay layers underlying the ash pond homogeneous, impervious, and continuous?

No. The clay layers are not homogeneous. There are massive clay layers, but in some areas the unit contains silt and fine-grained sand.

Overall, average permeability is 10^{-7}

The clay unit is continuous but varies in thickness from 4 to 28 feet and is lithologically variable.

Conclusion: The clay unit forms an effective aquiclude.



If clay layers underlying the ash pond form an effective aquiclude, why have coal ash contaminants been found?

During the most recent compliance sampling event (May 2019), arsenic and cobalt exceeded their respective groundwater protection standards.

For arsenic the standard is the MCL (drinking water standard).
For cobalt the standard is the statistically calculated background concentration.

Arsenic exceeded the MCL of 0.01 mg/L and concentrations at the site ranged between Non-Detect (<0.005 mg/L) and a maximum concentration of 0.0671 mg/L.

Cobalt exceeded the background concentration of 0.01794 mg/L and the concentrations at the site ranged between Non-detect (<0.005 mg/L) and a maximum concentration of 0.0343 mg/L.



How will the in-place closure plan address contaminant movement into the Alluvial aquifer?

One of the primary tasks in the ash pond closure plan is to dewater the ash. This will accomplish two important goals:

- 1) Mobilization of chemical constituents occurs in water. Mobilization will not occur in dry ash.
- 2) Dewatering the ash and removing free water in the pond will reduce the hydraulic head in the pond, thereby reducing the downward pressure and the means for introduction of contaminants into the alluvial aquifer.

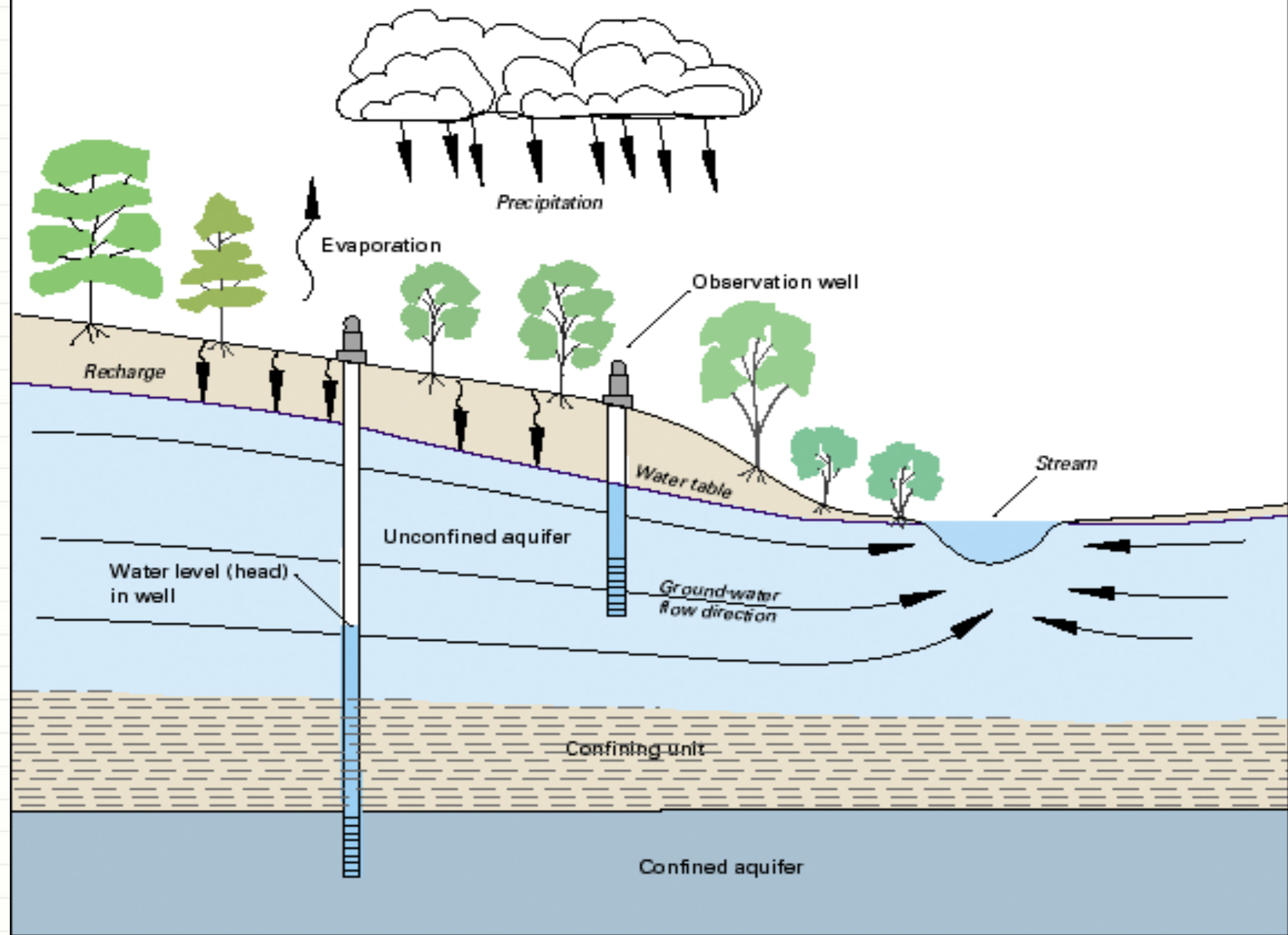




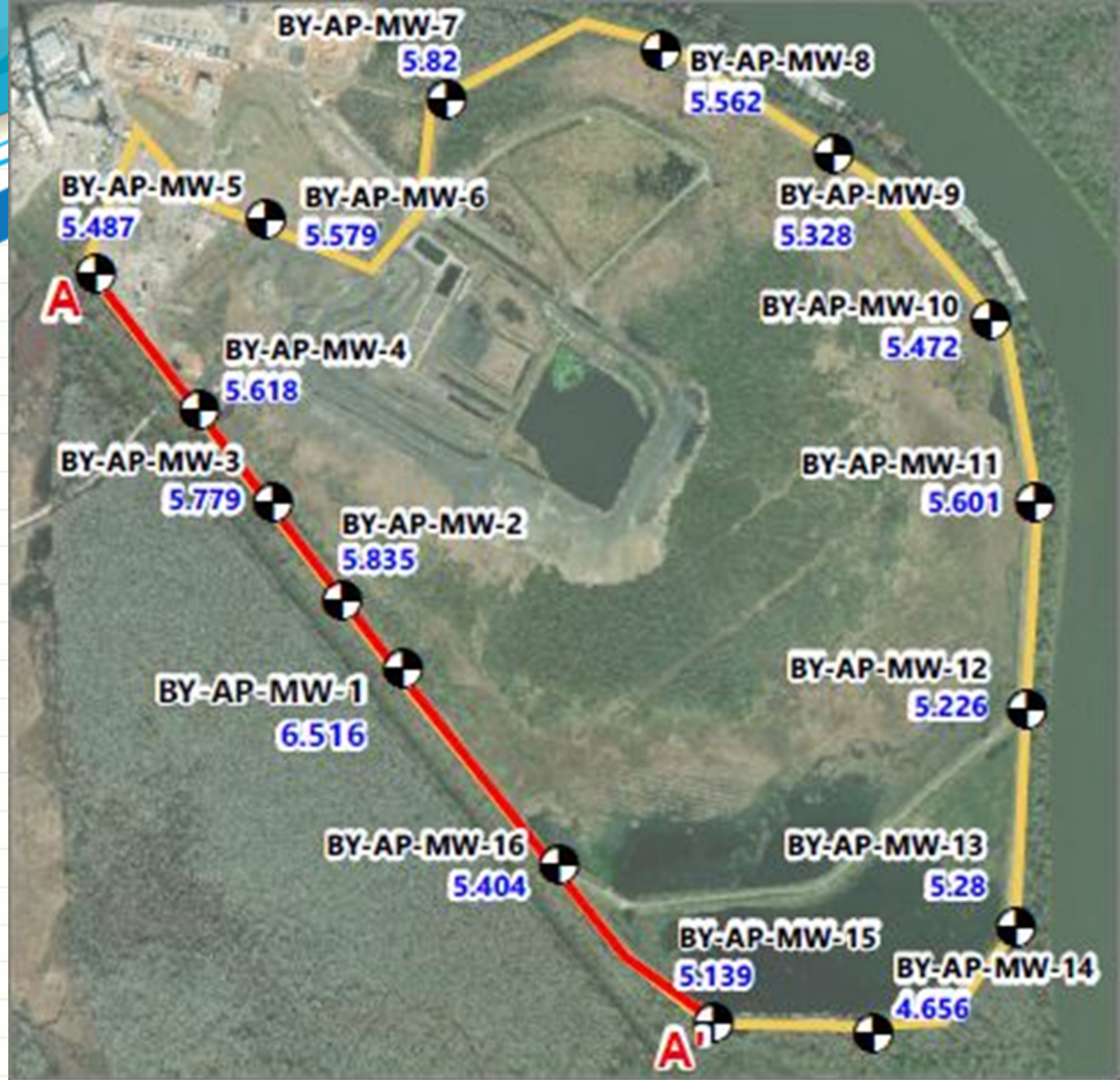
Vertical Isolation

Is the alluvial aquifer, underlying
the ash pond confined?

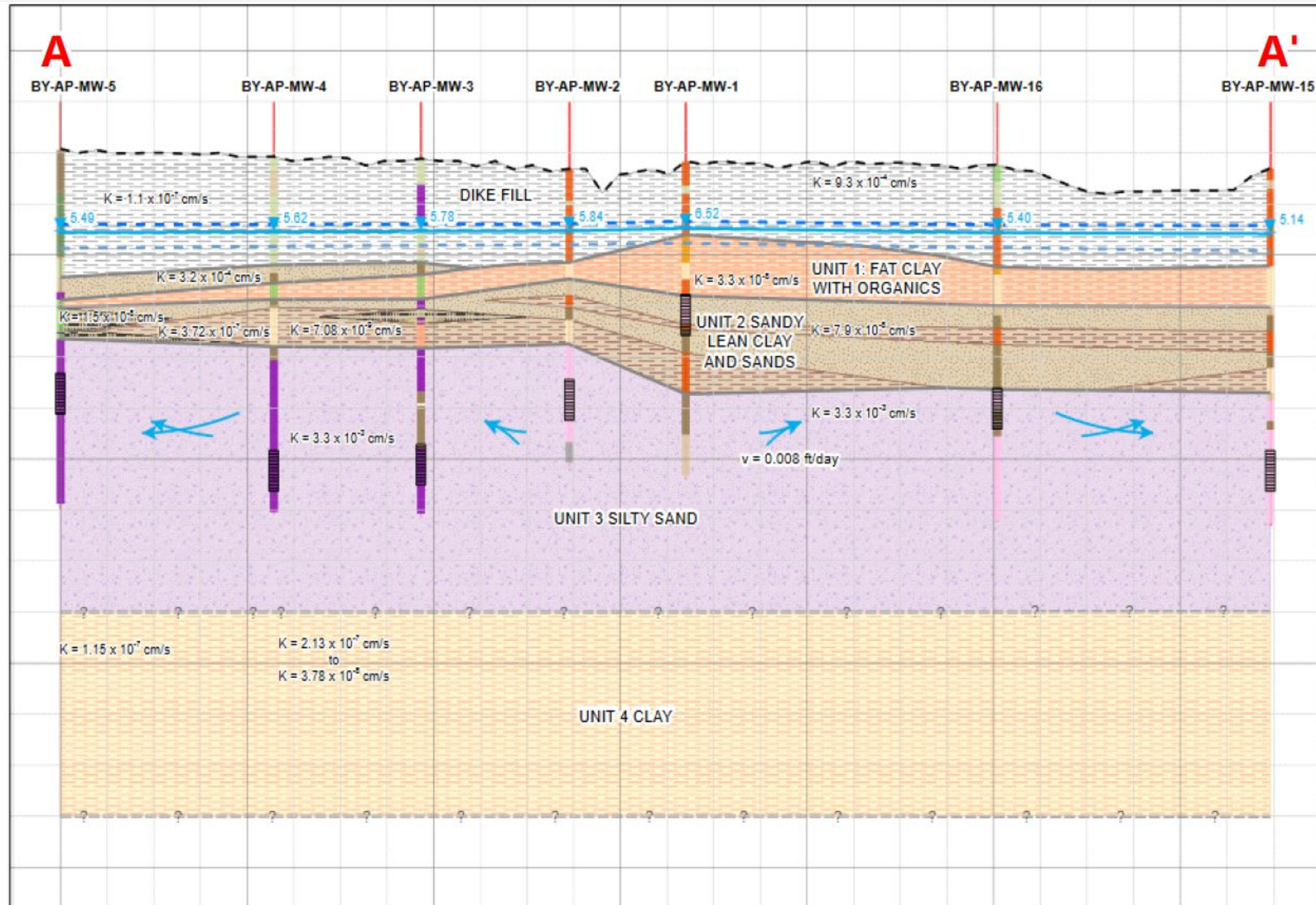




LINE OF
CROSS
SECTION



Hydrogeologic Cross Section



Hydraulic Head in Ash Pond Monitoring Wells, January 2018

Well Name	Installation Date	Northing	Easting	Ground Elevation	Top of Casing Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Purpose
BY-AP-MW-1	10/7/2015	362905.452	1811513.200	22.91	25.80	-10.304	-20.304	Downgradient
BY-AP-MW-2	10/7/2015	363375.014	1811104.860	21.10	23.89	-31.515	-41.515	Upgradient
BY-AP-MW-3	10/7/2015	364009.973	1810627.965	23.60	26.61	-46.581	-56.581	Upgradient
BY-AP-MW-4	10/7/2015	364620.885	1810128.368	24.05	26.97	-47.942	-57.942	Upgradient
BY-AP-MW-5	10/7/2015	365528.959	1809431.284	25.97	28.93	-30.023	-40.023	Downgradient
BY-AP-MW-6	10/7/2015	365906.041	1810555.372	23.78	26.69	-51.821	-61.821	Downgradient
BY-AP-MW-7	10/7/2015	366714.007	1811745.255	22.90	25.94	-53.98	-63.98	Downgradient
BY-AP-MW-8	10/7/2015	367064.508	1813172.112	25.57	28.45	-29.688	-39.688	Downgradient
BY-AP-MW-9	10/7/2015	366387.185	1814330.505	21.91	24.39	-37.082	-47.082	Downgradient
BY-AP-MW-10	10/7/2015	365296.811	1815400.957	23.61	26.89	-34.578	-44.578	Downgradient
BY-AP-MW-11	10/7/2015	364079.137	1815715.187	23.20	26.08	-37.999	-47.999	Downgradient
BY-AP-MW-12	10/7/2015	362704.953	1815677.689	21.24	23.88	-49.054	-59.054	Downgradient
BY-AP-MW-13	10/7/2015	361251.169	1815627.420	21.29	24.22	-39.29	-49.29	Downgradient
BY-AP-MW-14	10/1/2013	360520.621	1814694.666	8.89	11.74	-36.284	-46.284	Downgradient
BY-AP-MW-15	10/7/2015	360594.416	1813618.877	21.23	23.89	-48.791	-58.791	Downgradient
BY-AP-MW-16	10/7/2015	361610.794	1812571.016	22.05	25.01	-32.706	-42.706	Downgradient

Notes: 1. Northing and easting are in feet relative to the State Plane Alabama West North America Datum of 1983.

2. Elevations are in feet relative to the North American Vertical Datum of 1988.

Well	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16
Head	13.97	33.98	48.89	49.98	31.8	53.45	55.7	31.01	38.17	35.84	39.51	50.24	40.46	36.89	49.97	34.64



Vertical Isolation

Is the alluvial aquifer, underlying
the ash pond confined?

All 16 monitoring wells constructed in the alluvial aquifer have positive hydraulic heads from 13.97 to 55.7 feet.

Conclusion: Clay layers underlying the ash pond form an effective confining unit.

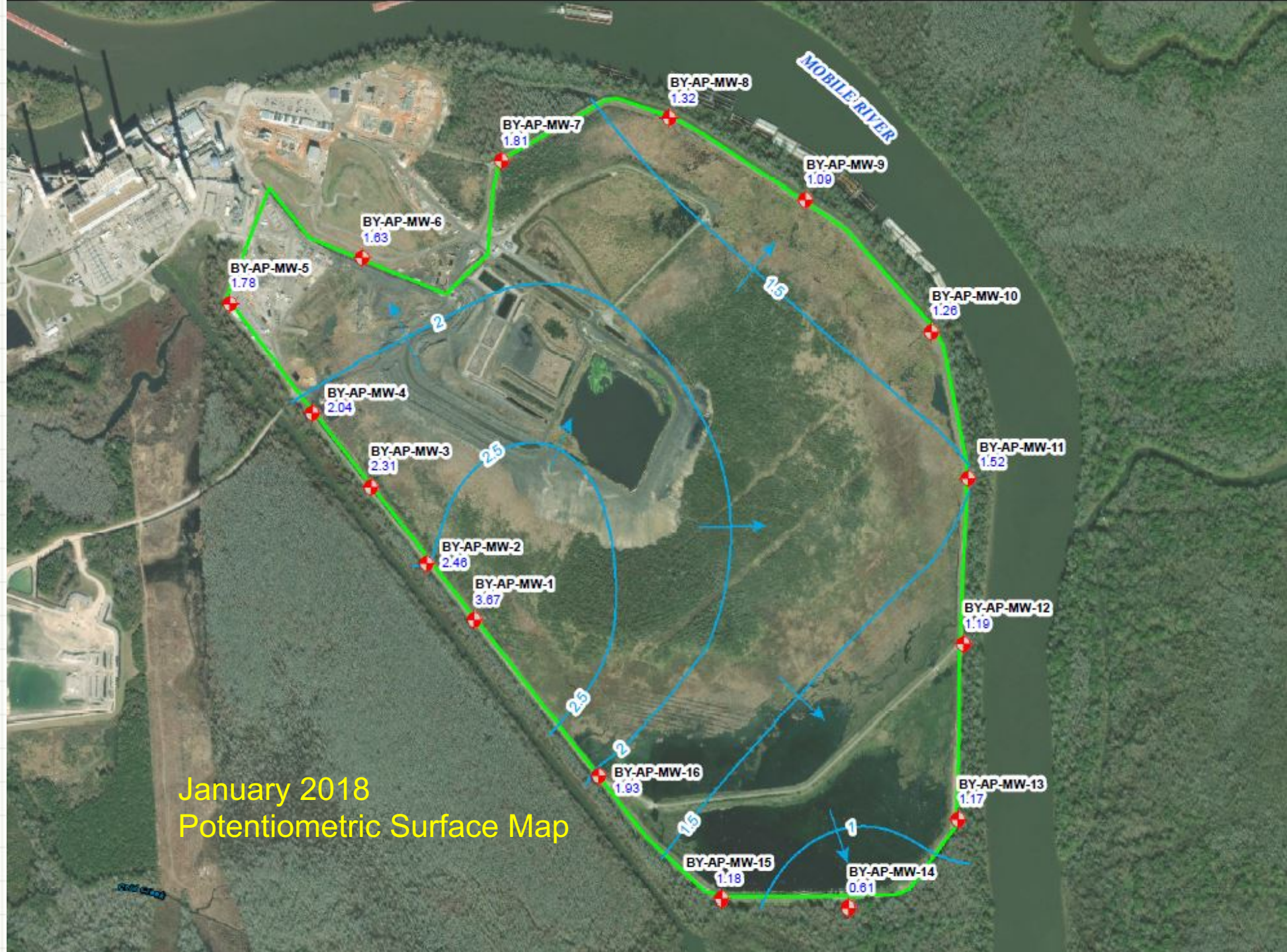


Horizontal Isolation

What is the direction of groundwater flow in the Plant Barry area and what impact does the Mobile River have on groundwater flow?

If contaminants get into the alluvial aquifer, where will they go and is there any possibility that contaminants will move into the Miocene aquifer?





January 2018
Potentiometric Surface Map

Horizontal Isolation

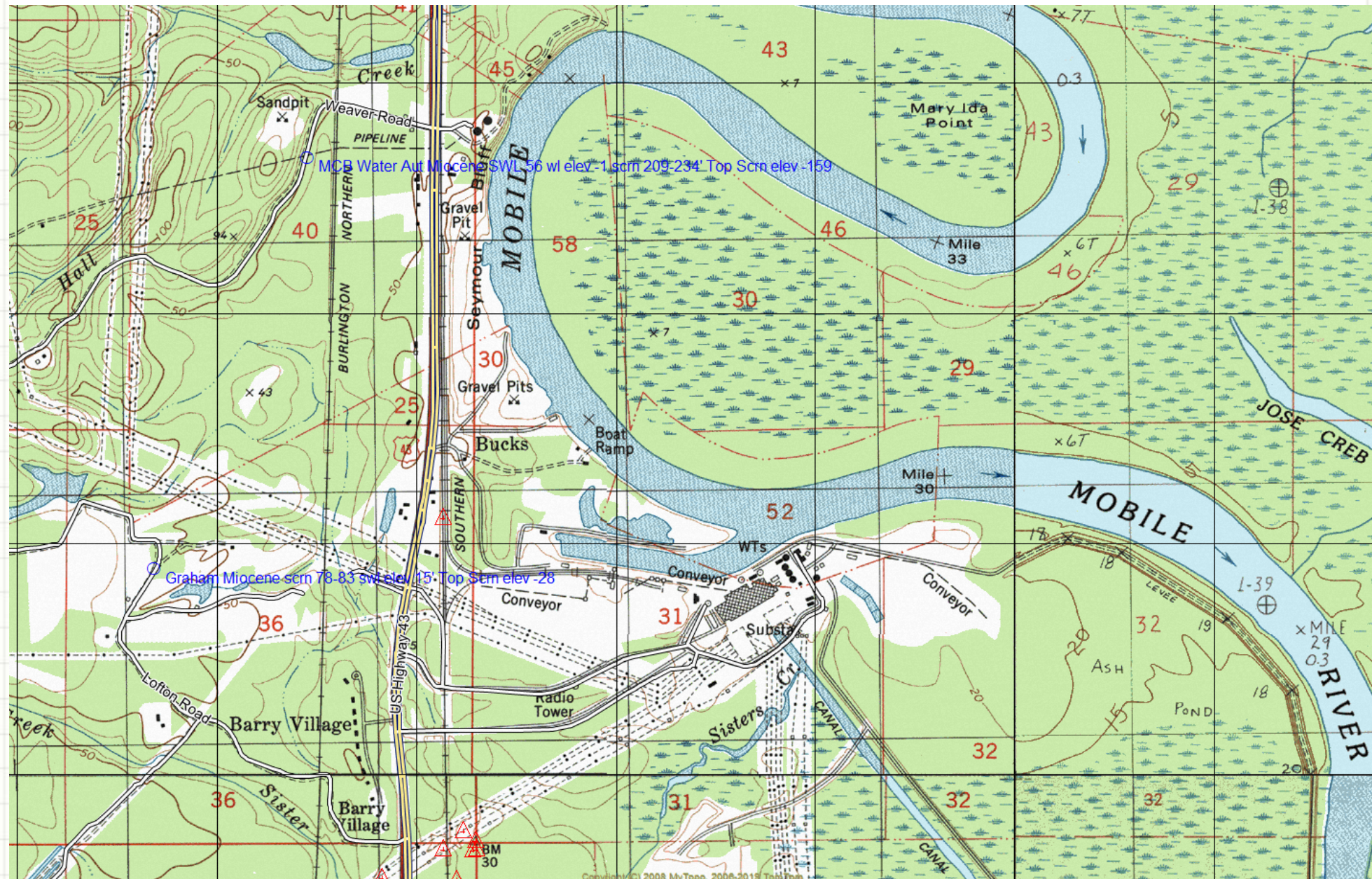
All regional groundwater flow (Alluvial and upper Miocene aquifers) in the Plant Barry/Bucks area is eastward to the Mobile River.

The hydraulic gradient in the alluvial aquifer in the ash pond area is 0.0003, which is extremely flat, meaning that groundwater movement is slow. Groundwater flow velocity calculated for the site is 2.92 feet per year towards the Mobile River.

Contaminants in the alluvial aquifer will eventually flow into the Mobile River.



Area Water –Supply Wells



Horizontal Isolation

Horizontal movement of the coal ash and its chemical constituents at ground surface is dependent on the dike around the pond. This is an engineered structure and was not evaluated in this assessment.



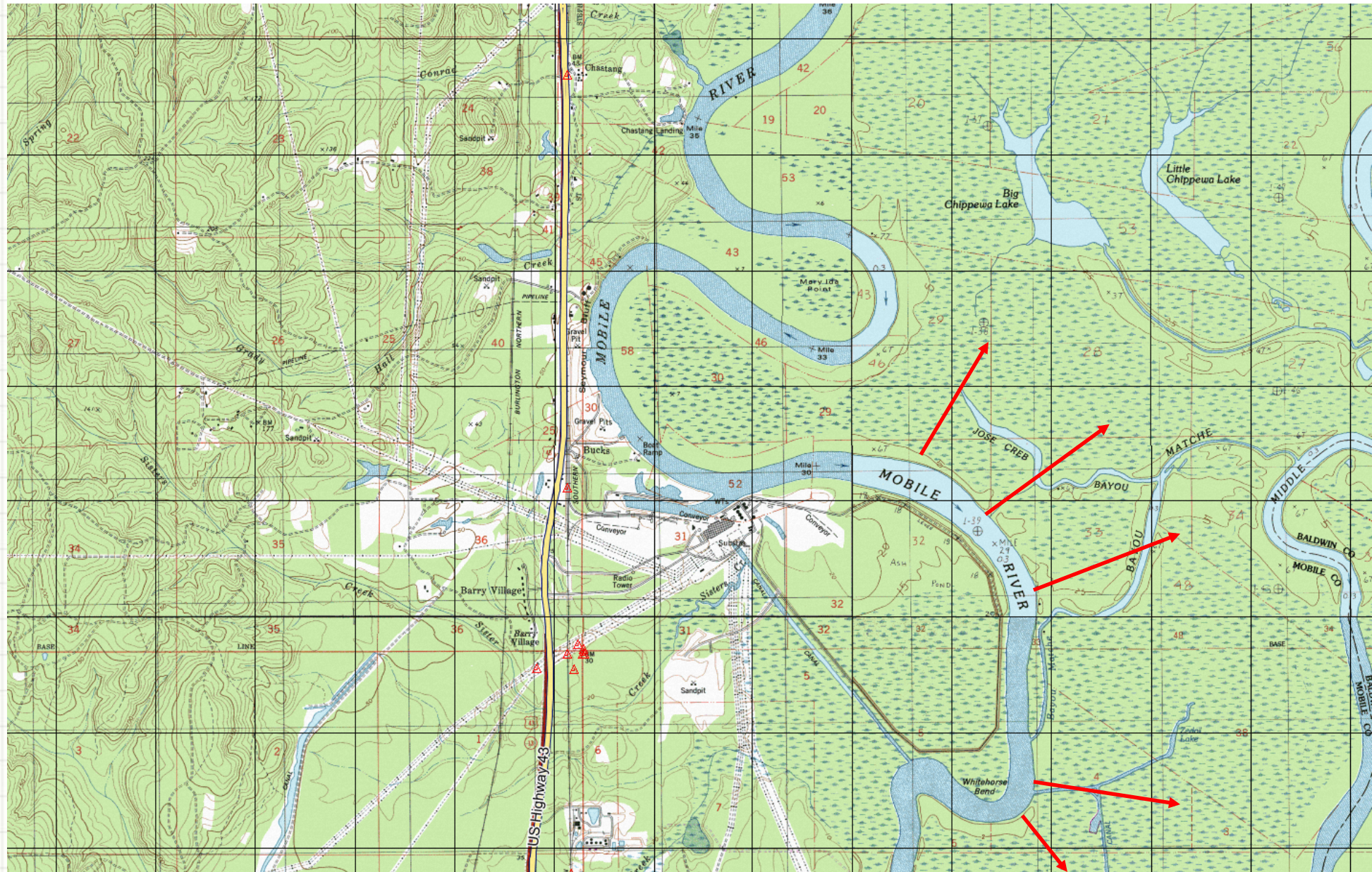


Mobile River Channel Migration

What is the potential for the Mobile River channel to relocate through Plant Barry and the coal ash pond?



The Mobile River at Plant Barry

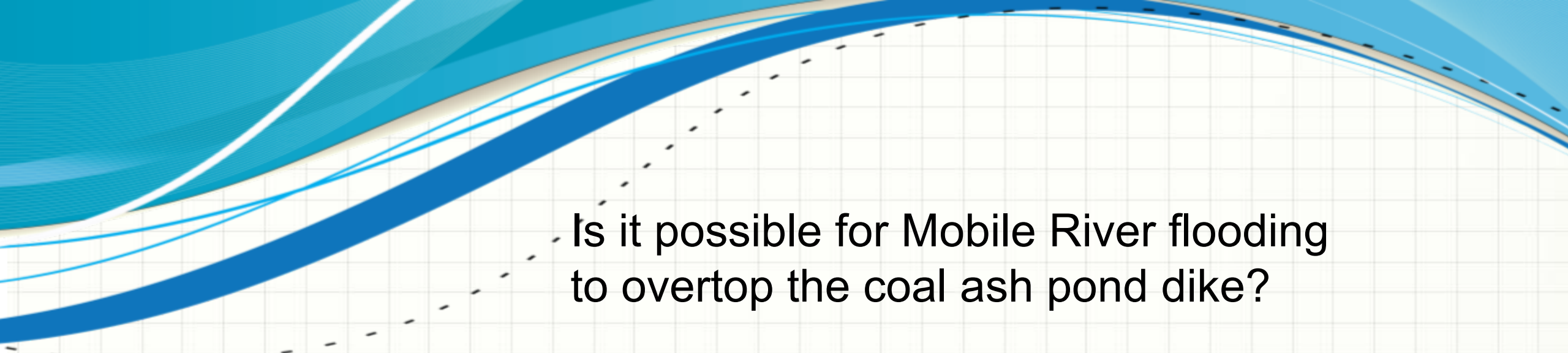


Mobile River Channel Migration

What is the potential for the Mobile River channel to relocate through Plant Barry and the coal ash pond?

Conclusion: The potential for a meander cut-off at Plant Barry is not realistic. The ash pond is located on a point bar. Therefore, the channel is migrating eastward away from the facility.





Is it possible for Mobile River flooding to overtop the coal ash pond dike?

Alabama Power reports:

The dike around the coal ash pond was constructed to withstand a 1,000 year-24-hour rainfall event at the facility.

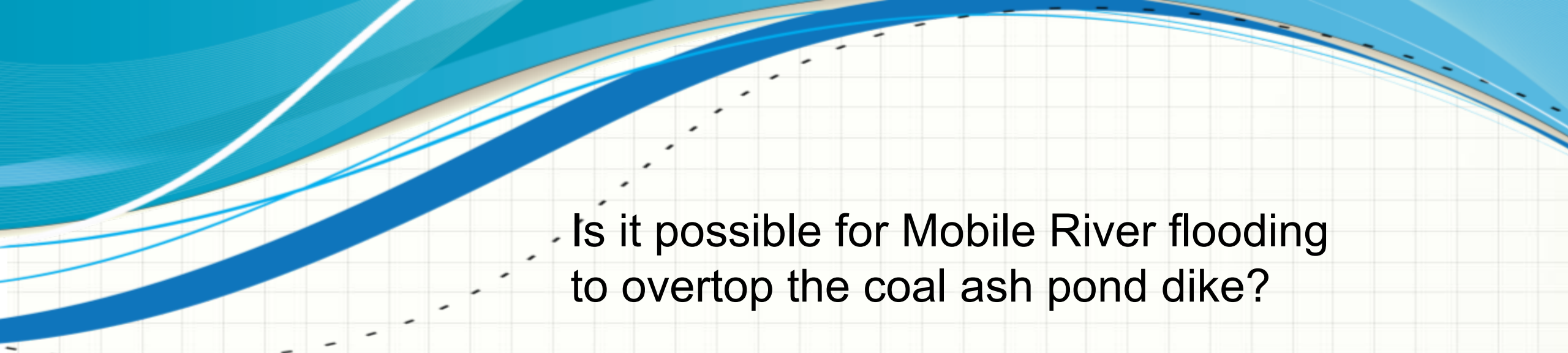
The dike was constructed to an elevation of 21.5 feet.

The 100-year flood elevation is 16 feet.

The flood of record was 18.19 feet in 1961.

Combinations of future climate factors, including rising sea level, a major upstream flood, and a severe tropical storm could cause a catastrophic flood event on the Mobile River that could inundate the coal ash pond.





Is it possible for Mobile River flooding to overtop the coal ash pond dike?

Conclusion: A catastrophic level flood event on the Mobile River at the coal ash pond site has not been simulated. Whether the coal ash is excavated and relocated or capped in place, the impacts of a flood of this magnitude during the next 20 to 30 years should be considered and impacts on an encapsulation structure for an indefinite time period should be a part of an in-place closure plan.

Cook Hydrogeology and the MBNEP Science Advisory Committee has recommended to Alabama Power that simulations of various major flood scenarios is warranted.



WHAT IF THE COAL ASH IS EXCAVATED AND MOVED TO AN UPLAND LANDFILL?

It must be isolated from the
surrounding environment.





Turkey Trot Landfill

Fairford

Calvert

43

45

Citronelle

Mt Vernon

Movico

43

Chastang

45

Bucks

Barry Village

Gulfcrest



All Landfills Leak, and Our Health and Environment Pay the Toxic Price

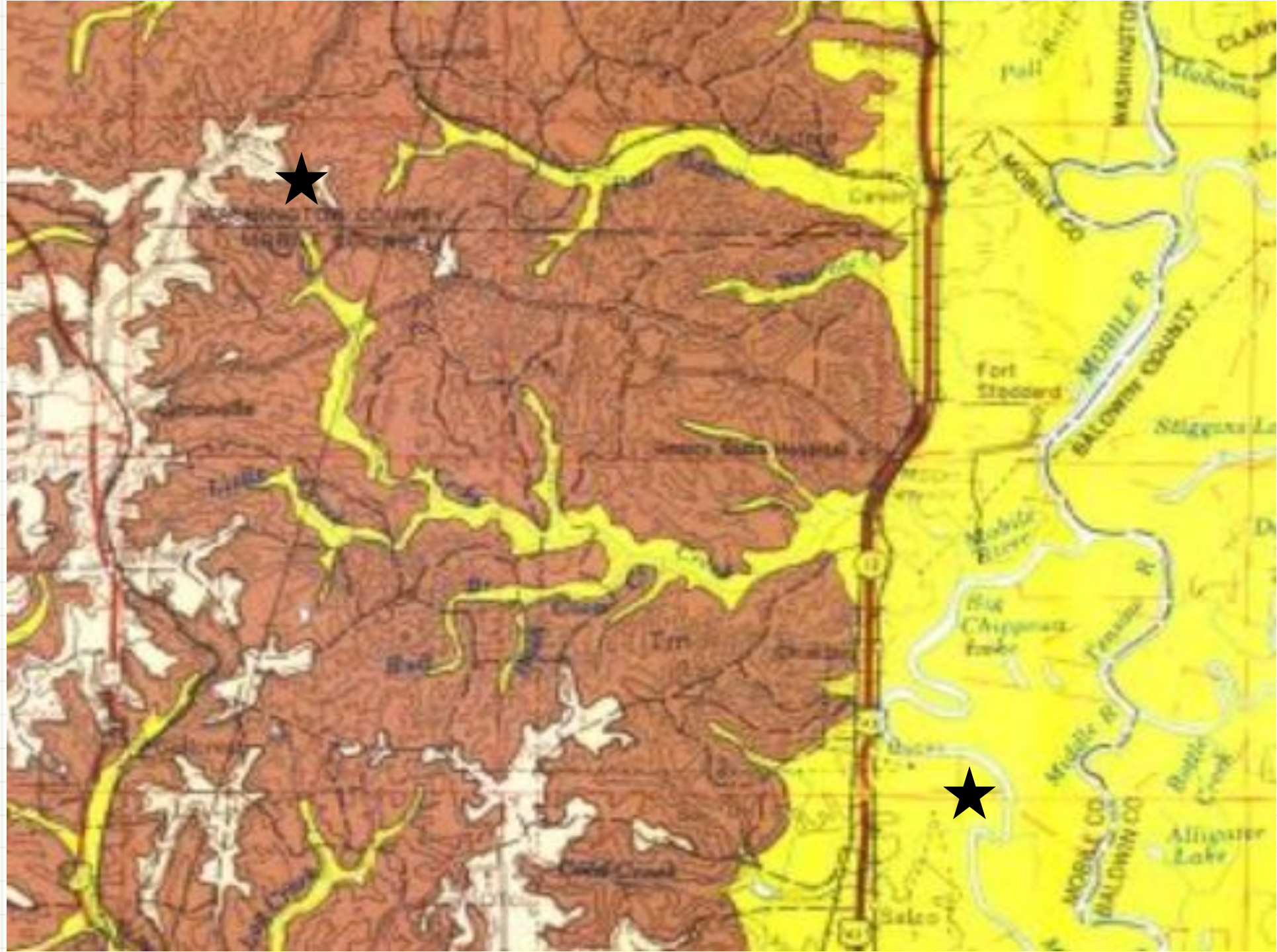
Despite state and federal regulation, landfills leach harmful chemicals into the ground and water supply

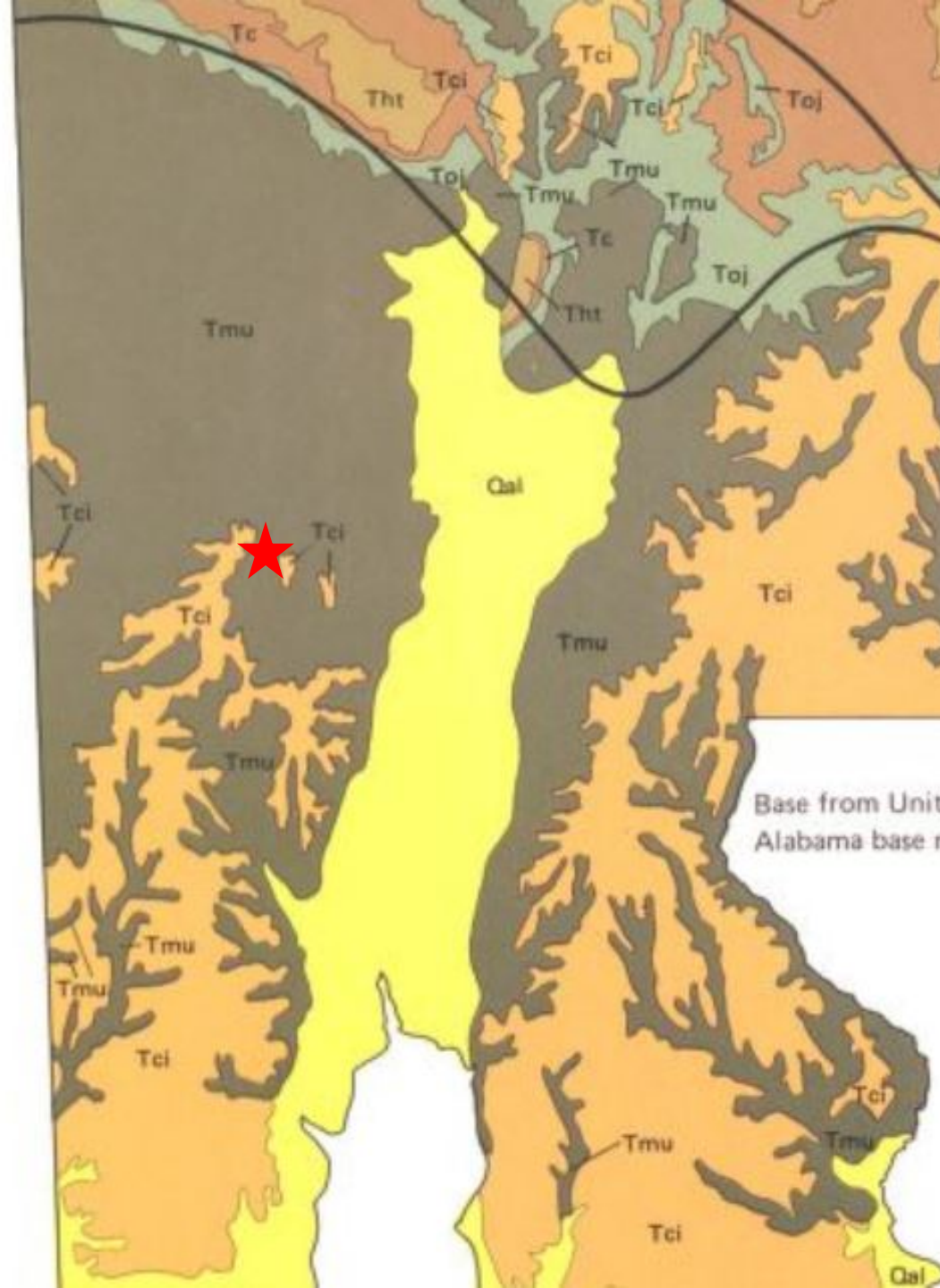
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Rain and snow get into them while they're open and accepting waste (which can be for years). And even after the cell is sealed, the plastic caps develop holes over time, letting in more rain and snow.

The water that gets into landfill cells picks up contaminants from the waste and becomes "leachate."







Miocene Aquifer Recharge Area



CONCLUSIONS

- If we could do it over, we wouldn't want the Plant Barry ash pond in its current location.
- The ash must be isolated from the surrounding environment in the best way possible, but there is no perfect solution.
- We all have a stake in the decision as to how the ash will be isolated. That decision must be based on the best science and engineering.
- From a hydrogeologic perspective, capping in place is a viable option that is dependent on engineered structures for long-term containment.

