Class VI Injection Well Application

Contains proprietary business information.

Attachment 01: Narrative

40 CFR 146.82(A)

Aster Project
Madison County, Indiana

16 September 2024

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List of Acronyms

2D	two-dimensional
3D	three-dimensional
25Cr	25-Chrome
25Cr80	25-Chrome L80
ACZ	above confining zone
ADM	Archer Daniels Midland
Al	aluminium
AoR	Area of Review
AST ACZ1	Aster Above Confining Zone Monitor Well 1
AST INJ1	Aster Injection Well 1
AST OBS1	Aster Deep Observation Well 1
AST USDW1	Aster USDW Monitoring Well 1
BAFL	Best Available Flood Hazard Layer
CCS	carbon capture and sequestration
CCS1	Illinois Basin–Decatur Project Injection Well drilled on ADM property
CCS2	ADM Illinois Industrial CCS Project CO_2 injection well
CMP	common midpoint
CO_2	carbon dioxide
CWA	Clean Water Act
EGRP	Eastern Granite-Rhyolite Province
EPA	Environmental Protection Agency
EPSG	European Petroleum Survey Group
ERRP	Emergency and Remedial Response Plan
fbgl	feet below ground level
fbsl	feet below sea level
FEMA	Federal Emergency Management Agency
GSDT	Geologic Sequestration Data Tool
h	Thickness
IBDP	Illinois Basin–Decatur Project
IDNR	Indiana Division of Natural Resources
IEc	Industrial Economics
IL-ICCS	Illinois Industrial CCS Project (run by ADM)
IPaC	Information for Planning and Consultation
k	permeability
ktpa	kilotonnes per annum
MAIP	Maximum Allowable Injection Pressure
MBTA	Migratory Bird Treaty Act
mD	millidarcy
mg/L	milligrams per liter
MICP	mercury injection capillary pressure
MRCSP	Midwest Regional Carbon Sequestration Partnership
Mt	million tonnes
Mtpa	million tonnes per annum

Mw	moment magnitude
N/A	not applicable
NPDES	National Pollutant Discharge Elimination System
O&G	oil and gas
PBI	proprietary business information
PISC	Post-injection Site Care and Site Closure
SE	state endangered
Si	silicon
ST	state threatened
SRT	step rate test
SWP3	Stormwater Pollution Prevention Plan
T&E	threatened or endangered
TBD	to be determined
TDS	total dissolved solids
UIC	Underground Injection Control
US	United States
USDW	Underground Source of Drinking Water
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
XRD	x-ray diffraction

1. Project Background and Contact Information [40 CFR 146.82(a)(1)]

1.1 Project Contact Information

Project Name: Aster

Project Operator: Vault GSL CCS Holdings LP

Project Contact: Jennifer Jacobs, Project Manager
Vault GSL CCS Holdings LP
1125-17th Street, Suite 1275
Denver, Colorado 80202
Email: jenn@vault4401.com
Phone: 713-930-4401

Aster Project Injection Well 1 (AST INJ1) Location:
Madison County, Indiana
Latitude: 40.30026°
Longitude: -85.65565°

1.2 Project Background

The objective of the Aster Project is to permanently sequester carbon dioxide (CO_2). The area of review (AoR) and location of wells are shown in Figure 1 and Figure 2.

Vault GSL CCS Holdings LP will be the owner, operator, and permit holder for the AST INJ1. Vault GSL CCS Holdings LP will also be the owner and operator of the transport pipeline. Neither an injection depth waiver nor an aquifer exemption expansion is being requested for this project. Based on the maximum anticipated annual volume of 359 kilotonnes per annum (ktpa) of CO_2 over a period of 12 years, the total mass of injected CO_2 is anticipated to be approximately 4.31 million tonnes (Mt).

The Mt. Simon Sandstone is of sufficient depth and temperature at the site to maintain the injected CO_2 in a supercritical state. The Mt. Simon Sandstone has served as a suitable injection interval for Class I, II and VI wells in the region for multiple decades. The primary confining zone is the Eau Claire Shale interval of the Eau Claire Formation. Other strata including the Davis Formation, the Ancell Group, and the Maquoketa Group will serve as secondary confining zones.

Figure 1 and Figure 2 show the locations of the four primary wells associated with the project: Aster Deep Observation Well 1 (AST OBS1), Aster underground source of drinking water (USDW) Monitoring Well 1 (AST USDW1), Aster Above Confining Zone Monitoring Well 1 (AST ACZ1), and AST INJ1. Table 1 shows the coordinates, depth, and intended use for each well.

Within the AoR there are no deep stratigraphic boreholes, State or Federal Environmental Protection Agency (EPA) approved subsurface clean-up sites, mines, quarries, or State, Tribal, or Territory boundaries. Surface bodies of water within the AoR include Star Creek, Pisgah Run, and unnamed tributaries. Information on oil and gas wells (O&G) and water wells within the AoR can be found in Section 4.1 of Attachment 02: AoR and Corrective Action Plan, (2024).

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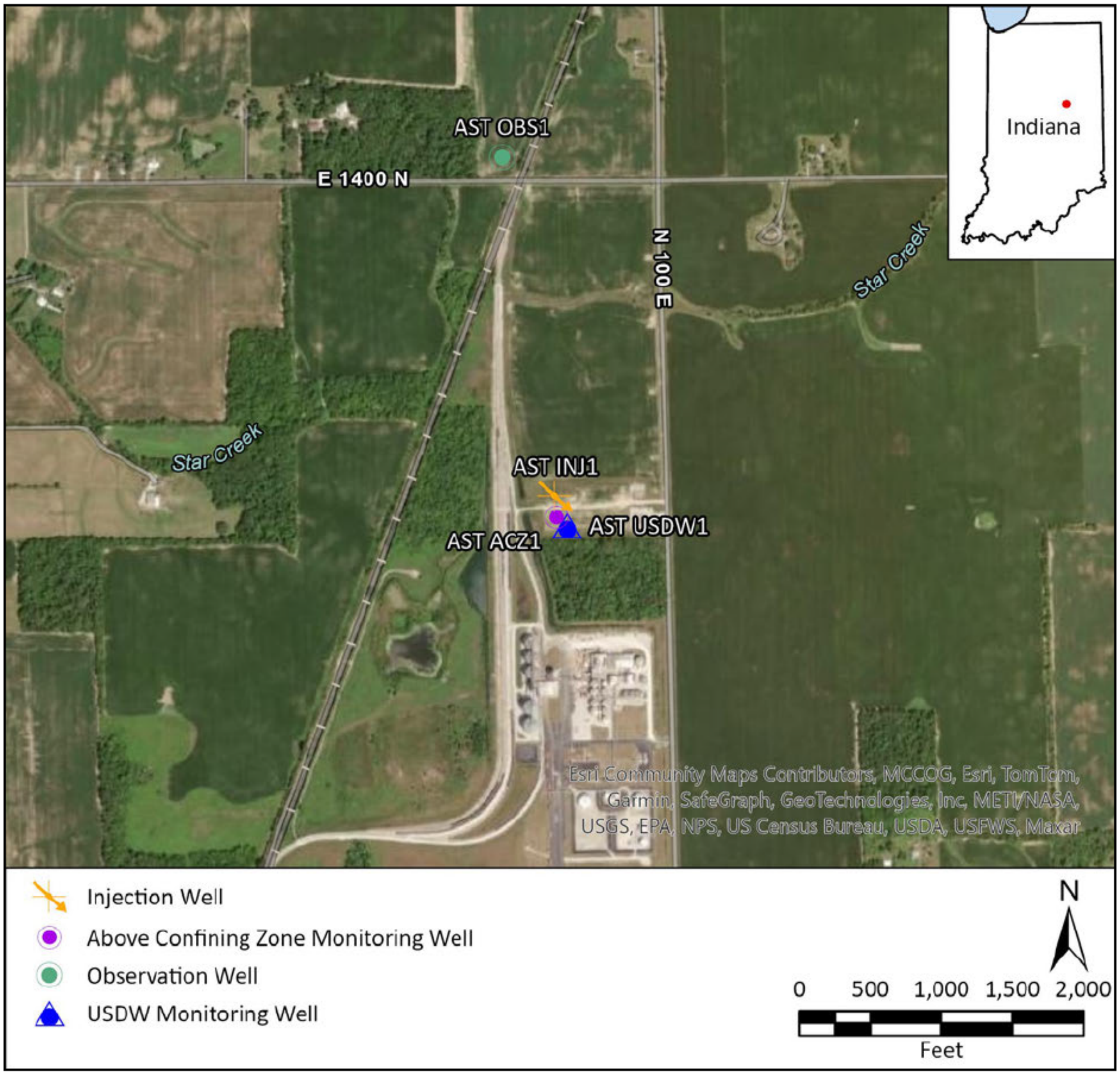

Figure 2: Proposed locations of the injection, deep observation, above confining zone monitoring, and the lowermost USDW monitoring wells for the Aster Project. Map adapted from Esri.

[redacted]

The objective of the Aster Project is to effectively capture CO_2 produced at a nearby ethanol facility, and safely and permanently sequester approximately 4.31 Mt of CO_2 over 12 years in the Mt. Simon Sandstone. One well is expected to be required for injection of the project's intended mass flow rate of 359 ktpa of CO_2 into the Mt. Simon Sandstone. The Aster Project has been designed to operate for 12 years at a capacity of 359 ktpa of CO_2. This Underground Injection Control (UIC) Class VI application describes and supports this effort.

Project execution will begin with the drilling and completion of several wells including the CO_2 injection well (Figure 2, Table 1). Additional site-specific data will be collected as the wells are drilled and completed. The data gathered will be processed and analyzed to confirm or re-assess the project modeling efforts and current understanding. As necessary, additional data sets will be collected and analyzed.

1.3 Local, State, and Federal Emergency Contacts [40 CFR 146.82(a)(20)]

Table 2 provides emergency contact information in the event of an emergency at the project site.

Table 2: Local, state, and federal emergency contacts

Agency	Phone Number
Police, Fire, or Medical Emergency	911
Alexandria Fire Department	765-724-2195
Madison County Sheriff's Department	765-642-0221
Alexandria Police Department	765-724-3222
Indiana State Police District 51	800-527-4752 or 765-778-2121
Environmental services contractor to be determined (TBD)	TBD
UIC Program Director (Region 5)	312-353-7648
EPA Region 5 UIC Class VI Wells/Carbon Sequestration	312-353-3944
EPA National Response Center (24 hours)	800-424-8802
Indiana Department of Natural Resources	317-232-4200

1.4 Summary of Other Permits Required

Table 3 provides a summary of permits required for the Aster Project.

Table 3. Permits required for the Aster Project.

Program	Permit(s) Required
Hazardous Waste Management program under Resource Conservation and Recovery Act (RCRA)	Not applicable (N/A), non-hazardous waste
UIC program under Safe Drinking Water Act	Class VI UIC permit
National Pollutant Discharge Elimination System (NPDES) program under Clean Water Act (CWA)	Stormwater Pollution Prevention Plan (SWP3) prior to construction; NPDES programs administered by state of Indiana.
Prevention of Significant Deterioration (PSD) program under Clean Air Act (CAA)	N/A, not a major source
Nonattainment program under CAA	N/A, Madison County is in attainment for all criteria pollutants
National Emission Standards for Hazardous Air Pollutants (NESHAPS) preconstruction approval under the CAA	N/A, non-hazardous pollutants
Ocean dumping permits under Marine Protection Research and Sanctuaries Act	N/A, onshore project with no proposed ocean dumping
Section 404 of CWA	N/A, activities outside of waters of the US
State or Other relevant environmental permits, including state permits 40 CFR 144.31 (e)(6)(ix)	
Indiana Department of Natural Resources (IDNR) Oil & Gas Resource Management	Carbon Sequestration Project Permit upon issuance of a UIC Class VI permit
Indiana Department of Environmental Management Office of Water Quality Construction Stormwater General Permit	SWP3 prior to land disturbance

1.5 Landowners within the AoR

A list of names and addresses of all owners of record of land within the AoR of the Aster Project can be found in Appendix A – List of Landowners Within the AoR.

2. Site Characterization [49 CFR 126.82(a)(2), (3), (5) and (6)]

Unless otherwise stated, all depths are in reference to feet below ground level (fbgl).

2.1 Regional Geology, Hydrogeology, and Local Structural Geology [40 CFR 146.82(a)(3)(vi)]

The Aster Project, located in northern Madison County of east-central Indiana, is within the Arches Province which is a structural high extending beneath eastern Indiana, western Ohio, and central Kentucky (Figure 3). Three separate arches, the Kankakee, Cincinnati, and Findlay arches, comprise the larger Arches Province, and the structural relief of the arches and associated platforms is the result of differential subsidence of the Illinois Basin to west, the Michigan Basin to the north, and the Appalachian basin to the east. The Arches Province is comprised of Cambrian to Mississippian strata that reach a maximum thickness of nearly 5,000 feet in portions of Indiana (Rupp, 1991).

The Mt. Simon Sandstone and the Arches Province has been the focus of research into geological carbon sequestration due to the intersection of reservoir thickness, permeability, and depth. Previously conducted simulation work on the Mt. Simon Sandstone in the Arches Province concluded that large-scale injection into the Mt. Simon Sandstone reservoir may be achieved in the region (Sminchak, 2012). The Mt. Simon Sandstone has served as a suitable injection interval in the province for Class I and II wells (BP Lima and AK Steel wells; Figure 3) for multiple decades, with the Eau Claire Shale acting as the confining zone (Sminchak, 2012). In the adjacent Illinois Basin, the Mt. Simon Sandstone has been thoroughly investigated for carbon sequestration potential for over two decades through the Midwest Regional Carbon Sequestration Partnership's (MRCSP's) Illinois Basin–Decatur Project (IBDP) (Figure 3; Wickstrom et al., 2005; Greenberg, 2021) and the CarbonSAFE program (Leetaru et al., 2019; Korose, 2022; Whittaker, 2022; Whittaker and Carman, 2022), both funded by the U.S. Department of Energy.

The Illinois Industrial Carbon Capture and Storage Project (IL-ICCS) is an active commercial carbon sequestration project taking place at the Archer Daniels Midland (ADM) ethanol facility in Decatur, IL, funded, in part, through the American Recovery and Reinvestment Act. The IBDP demonstration project also drilled an injection well (CCS1) on ADM property that has provided a rich source of data around carbon storage in the Mt. Simon Sandstone (Greenberg, 2021). The IBDP CCS1 and IL-ICCS CCS2 CO_2 injection wells are located approximately 175 miles west of the proposed location for the Aster Project (Figure 3).

The IL-ICCS Project storage complex uses the Cambrian Mt. Simon Sandstone as the injection zone and the overlying Eau Claire Shale as the confining zone (Figure 4, Gollakota and McDonald, 2014). These same formations are proposed as the storage complex for the Aster Project.

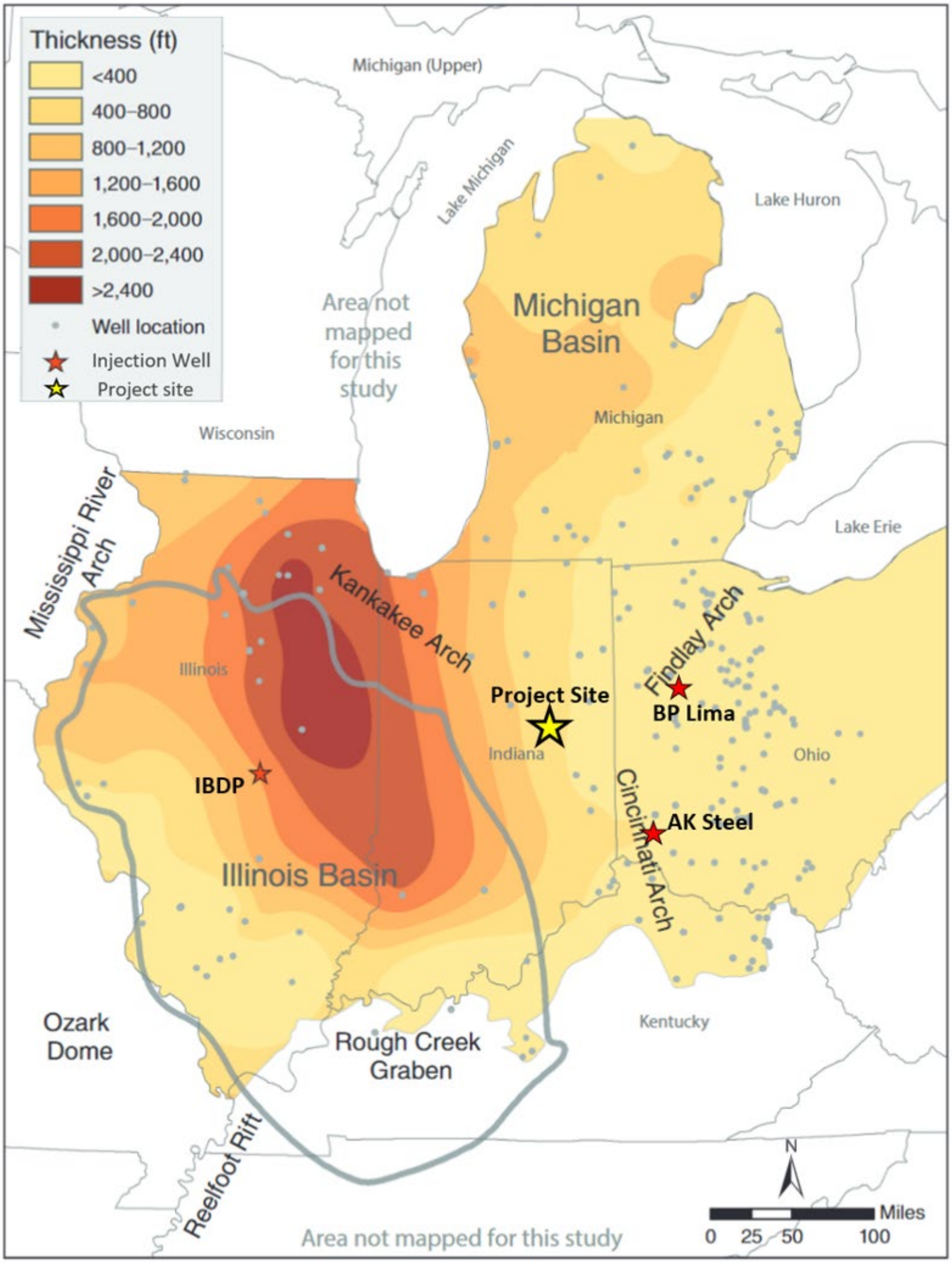

Figure 3: Mt. Simon Sandstone isopach map (feet) with major structural features of the Arches Province, the Illinois Basin extent, and the Aster Project site shown by the yellow star. The location of the IBDP and Illinois Industrial CCS Project, the AK Steel injection well, and the BP Lima injection well are also shown by red stars. Modified from (Medina and Rupp, 2012).

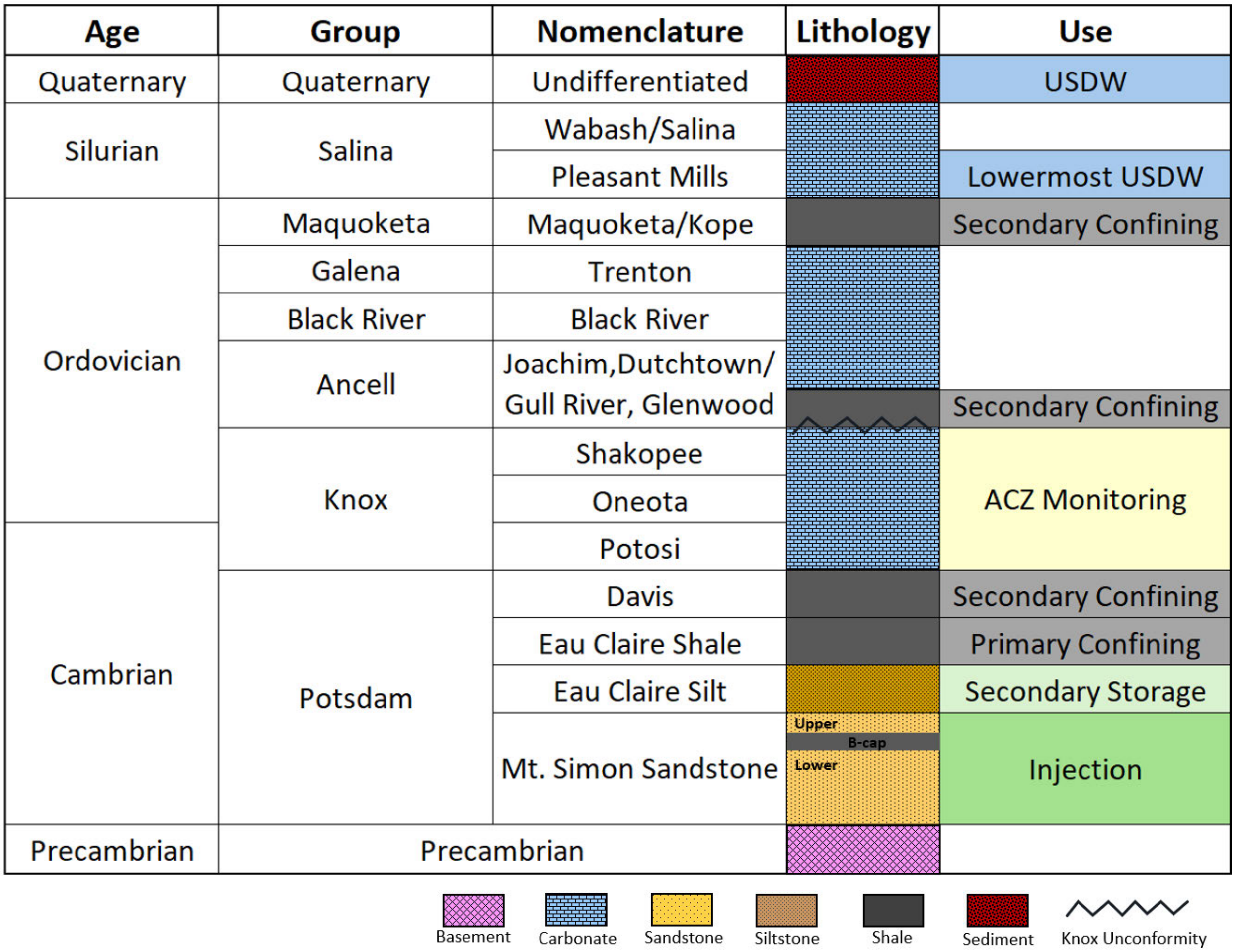

Figure 4: Aster Project site-specific stratigraphic column with age, nomenclature, generalized lithology, and zone of use.

The Arches Province evolved contemporaneously with the basins that surround the structural high (Braile et al., 1986; Kolata and Nelson, 1990, 1997; Kolata et al., 2005). The Aster Project is located on the Kankakee Arch in east-central Indiana. Eustatic sea level fluctuations coupled with tectonics allowed for the accumulation of both marine and terrestrial sediments in the study area and surrounding basins.

Paleozoic sedimentary strata of the Arches Province unconformably overlie the Precambrian basement, which is broadly composed of felsic intrusives and volcanics of the Eastern Granite-Rhyolite Province (EGRP) (Figure 4 and Figure 5; Bradbury and Atherton, 1965; Bickford et al., 1986; Atekwana, 1996; Lidiak, 1996; Green, 2018). As previously stated, over 5,000 feet of Paleozoic sedimentary rock thickness exists in the Arches Province, which is relatively thin compared to that of surrounding basins. In contrast, up to 18,000 feet of Paleozoic strata accumulated in the Reelfoot Rift and Rough Creek Graben, which are significant features within the southern portion of the Illinois Basin related to processes linked to basin subsidence (Kolata and Nimz, 2010).

[redacted]

The Cambrian Mt. Simon Sandstone and Eau Claire Shale are among the oldest and deepest strata in Indiana and will serve as the injection and confining zones, respectively, for the Aster Project. The Eau Claire Silt is between the Mt. Simon Sandstone and the Eau Claire Shale and is a secondary storage interval (Figure 4). These transgressive clastic sediments were deposited in a near shore environment fed by drainage systems, and an erosional unconformity exists between the Mt. Simon Sandstone and the underlying Precambrian Basement (Freeman, 1953; Janssens, 1973).

By late Cambrian, much of Indiana was covered by a shallow sea. This sea regressed in the Middle Ordovician creating the Knox Unconformity (Figure 4; Keith, 1984; McBride and Kolata, 1999). Indiana was near wave-base in the Middle Silurian and much sediment deposition during this time was diverted to the surrounding basins. During the Devonian, the sea regressed, and uplift occurred due to the Acadian Orogeny, allowing for non-deposition and erosion along the arches. Following this, sea level transgressed during the Devonian-Mississippian, depositing marine shales across the region. Uplift during the Pennsylvanian to Late Cretaceous separated the surrounding sedimentary basins from the Arches Province and eroded previously deposited sediment (Rupp, 1991; Kolata and Nimz, 2010).

Erosion and/or nondeposition prevailed along the arches throughout the Mesozoic and Cenozoic. During the Pleistocene Epoch, the region was covered by continental ice sheets that deposited hundreds of feet of glacial sediment in the region, some of which now serve as shallow groundwater aquifers.

2.2 Regional Stratigraphy

Figure 4 is specific stratigraphic column for the Aster Project and will be referred to throughout this narrative.

The regional continuity of the Paleozoic strata in the vicinity of the project site [40 CFR 146.82(a)(3)(i)] is demonstrated through geophysical logs of regional wells (Figure 6) and cross sections of the site model (Figure 5 and Figure 7). Quaternary glacial sediments overlie the bedrock (Figure 4) and are discussed further in Section 2.9 *Hydrologic and Hydrogeologic Information*.

To develop a comprehensive understanding of the site-specific geology for this project, a database of publicly available geophysical well logs from Indiana, Illinois, Kentucky, and Ohio was compiled. The well logs were interpreted and used to develop a static model for the project site.

Within 50 miles of the Aster Project, six wells penetrate the Precambrian basement, and nine wells penetrate the Mt. Simon Sandstone, all of which were used to assess the site-specific geology. Figure 6 shows the closest wells to the Aster Project that penetrate into the Mt. Simon Sandstone, the nearest of which is over 12 miles northeast of the project site. The Royal Center Gas Storage field began development in 1957 and is located approximately 60 miles to the northwest of the project site. This field utilizes a structural closure associated with the Royal

Center Fault to store natural gas in both the Trenton Limestone and the Mt. Simon Sandstone (Figure 6, Keller, 1998).

The Aster Project site is located within the Trenton Gas Field, which began development in the late 19th century and still has hundreds of active wells that produce natural gas from the Trenton Limestone in east-central Indiana (IDNR).

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2.2.1 Precambrian Basement Complex

The Precambrian basement complex that underlies the project site is comprised of granite, rhyolite, trachyte, and quartzite of the EGRP (Green, 2018). These basement rocks are of extensional tectonic origin (Figure 4) and contribute to the source of Early Cambrian siliciclastic strata (Bickford et al., 1986). Figure 8 shows that the Precambrian Basement deepens from approximately 2,300 feet below sea level (fbsl) in the east of the map area to more than 3,100 fbsl in the northwest portion of the map.

A boundary between the EGRP and the Eastern Continental Rift Basin (ECRB, Figure 9) exists east of the project site. In portions of the Arches Province, the ECRB contains sandstones of the Middle Run Formation and intrabasinal volcanic rocks. The Middle Run Formation was first recognized in the Ohio Department of Natural Resources (ODNR), Division of Geological Survey (DGS) DGS #2627 core located in Warren County approximately 100 miles southeast of the project. Sediments of the Middle Run Formation were deposited in a rift-basin during the Neoproterozoic, and seismic, magnetic, and gravity data suggest a genetic relationship between the Midcontinent Rift System, the Fort Wayne rift basin, and flanking marginal, clastic rift basins that contain the Middle Run Formation (Dickas et al., 1992; Drahovzal et al., 1992; Baranoski et al., 2009). This formation has been identified in portions of Ohio, Kentucky, and Indiana, but it is not expected at the Aster Project site. However, this is uncertain due to the project site proximity to wells that penetrate the Middle Run Formation (Figure 9, Drahovzal et al., 1992).

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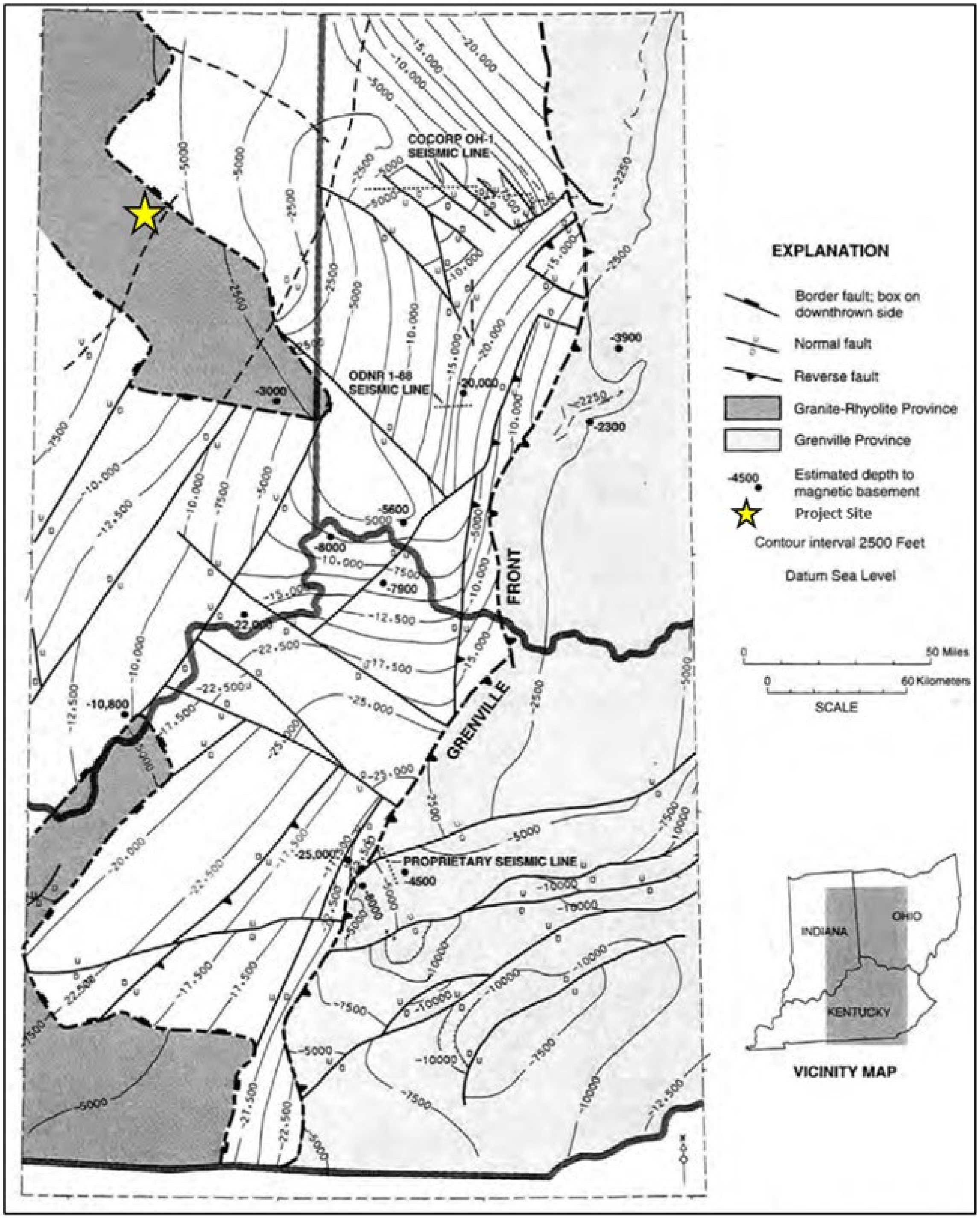

Figure 9: Elevation map of the Precambrian basement in the Arches Province and surrounding areas. Shaded areas indicate the EGRP. Border fault boundaries are shown. The Aster Project site is in the EGRP, and the Middle Run Formation is not expected at the project site. Modified from Drahovzal et al. (1992).

2.2.2 Mt. Simon Sandstone/Injection Zone (Cambrian)

The Potsdam Supergroup of the Cambro-Ordovician Sauk sequence unconformably overlies the Precambrian Basement and at the Aster Project site and includes the Mt. Simon Sandstone, the Eau Claire Silt, the Eau Claire Shale, and the Davis Formation (Figure 4 and Figure 5). The Cambrian Ironton-Galesville Sandstones and the Franconia Formation are also part of the Potsdam Supergroup in northwestern Indiana but are not present at the project site. Specific to this project, the Mt. Simon Sandstone is the target for the injection and storage zone, the Eau Claire Silt is a secondary storage zone, and the Eau Claire Shale (above the Eau Claire Silt) is the primary confining zone.

The Mt. Simon Sandstone is a transgressive terrestrial to shallow marine sequence that is a laterally extensive deposit throughout the Arches Province, the Illinois Basin, and the Michigan Basin (Rupp, 1991; Leetaru and McBride, 2009). It is thickest in northeastern and east-central Illinois and thins eastward into Indiana (Figure 3;. Mt. Simon Sandstone sedimentology was impacted by a wide range of depositional environments including shallow marine, deltaic, fluvial, eolian, and coastal (Janssens, 1973; Baranoski, 2007; Bowen et al., 2011; Saeed and Evans, 2012; Freiburg et al., 2016). Fine to coarse-grained, poorly sorted, quartz and arkosic sandstone primarily compose the Mt. Simon Sandstone in the Midwest (Bowen et al., 2011).

In Indiana, the Mt. Simon Sandstone is composed of a variety of lithofacies that include conglomerate, sandstone, and shale and porosity variations are related both to depositional heterogeneities and diagenesis (Bowen et al., 2011). In the adjacent Illinois Basin, the Mt. Simon Sandstone is subdivided into Lower, Middle, and Upper intervals, with the Lower Mt. Simon Sandstone containing an arkosic basal zone. Where the Mt. Simon Sandstone is thinner in northern Indiana, the “B-cap” (described below) is located near the top of the Mt. Simon Sandstone (Figure 4; Bowen et al., 2011). For this project, the B-cap separates the Lower Mt. Simon from the Upper Mt. Simon, though it is important to note that these subdivisions are not necessarily the stratigraphic equivalent of the Lower and Upper Mt. Simon intervals in the Illinois Basin (Figure 4).

As previously mentioned, the Mt. Simon Sandstone has been the focus of numerous studies and has served as the injection interval in the Arches Province for Class I and II wells for multiple decades, with the Eau Claire Shale acting as the confining zone (INEOS Nitriles, 2016; Cleveland-Cliffs Steel Corporation, 2021). The Mt. Simon Sandstone is also the injection interval in the adjacent Illinois Basin through a number of US DOE funded projects including the US DOE Regional Carbon Sequestration Partnerships’ IBDP’s CCS1 well (Greenberg, 2021) and the CarbonSAFE program (Leetaru et al., 2019; Korose, 2022; Whittaker and Carman, 2022).

As stated above, within the Mt. Simon Sandstone is a layer of interbedded mudstone and siltstone known as the “B-cap” which extends across much of northern Indiana and is interpreted to have been deposited in flood-plain to tidal environments (Bowen et al., 2011). The B-cap is a relatively fine-grained, lower porosity interval and is anticipated to exist at the Aster Project site. It is typically observed in the upper portion of the Mt. Simon succession and, for this project, Mt.

Simon strata above B-cap are referred to as Upper Mt. Simon Sandstone and strata below, Lower Mt. Simon Sandstone (Figure 4).

The elevation map of the Mt. Simon Sandstone, which represents the top of the planned injection zone (Figure 10), shows the continuity of the unit across a wide region and that it deepens to more than 2,400 fbsl in the west and toward the Illinois Basin. Figure 11 shows the thickness of the Mt. Simon Sandstone increases from less than 300 feet east of the project site to over 900 feet in the northwest. In the area of the Aster Project the thickness Mt. Simon Sandstone is expected to be approximately 680 feet.

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2.2.3 Eau Claire Shale/Primary Confining Zone (Cambrian)

For the purposes of this project, the Eau Claire Formation is divided into a basal Eau Claire Silt secondary storage interval that directly overlies the Mt. Simon Sandstone and a finer-grained Eau Claire Shale that will serve as the primary confining zone at the Aster Project site (Figure 4, Figure 5, and Figure 7). Regionally, the entire Eau Claire Formation is a thick succession of fine-grained strata present across much of Indiana and surrounding areas and deepens to more than 1,600 fbsl to the southwest portion of the mapped area in Figure 12. The Eau Claire Silt has some interbedded very fine-grained sandstone that forms a gradational contact with the underlying Mt. Simon Sandstone and is sometimes referred to as the Elmhurst Member of the Eau Claire Formation in the Illinois Basin. The Eau Claire Silt is expected to be approximately [redacted] feet thick at the Aster Project site and is a secondary storage zone (Figure 4). The regional thickness map of the confining Eau Claire Shale (Figure 13) above the Eau Claire Silt indicates that the shale as is expected to be between [redacted] feet thick at the Aster Project site.

In core from the Class I UIC AK Steel well in southwestern Ohio (approximately 90 miles to the southeast; Figure 3), the Eau Claire Silt contains beds of silt and fine to medium-grained quartz sandstone, pyrite, and mica. The silt grades upward to a gray, micaceous, glauconitic shale with some slightly more calcareous beds (Cleveland-Cliffs Steel Corporation, 2021).

The BP Lima well is located over 85 miles east-northeast of the project site and is used as a Class I UIC well, with the Mt. Simon Sandstone serving as the injection zone and the Eau Claire Shale serving as the primary confining zone . At this well, the Eau Claire Silt storage interval is approximately 150 feet thick and grades upwards into more than 300 feet of lower porosity shale of the confining Eau Claire Shale (INEOS Nitriles, 2016). The Eau Claire Shale serves as an effective seal for carbon storage in the IBDP and IL-ICCS projects 175 miles to the west in the Illinois Basin (Leetaru and Freiburg, 2014).

[redacted]

[redacted]

2.2.4 Davis Formation/Secondary Confining Zone (Cambrian)

The Eau Claire Shale is overlain by the Davis Formation, which is a sequence of shale, siltstone, limestone, and dolomite of the Potsdam Supergroup in western Indiana. In north-central Indiana, Davis-equivalent rocks are the relatively coarser-grained undifferentiated Ironton-Galesville Sandstone and the Franconia Formation (Figure 4; . Due to the project site proximity to the facies transition in north-central Indiana and the thin nature of these rocks, the shaley unit at the top of the package is interpreted to be shale of the Davis Formation and the underlying coarser sandstones are the undifferentiated Franconia Formation/Ironton Sandstone-Galesville Sandstone, which are not expected at the project site. The Davis Formation will serve as a potential confining zone and contains four primary facies: 1) gray oolitic dolomite, 2) yellowish-gray feldspathic siltstone, 3) dark gray calcareous shale, and 4) gray limestone with interbedded siltstone and sandstone. This formation is interpreted to have been deposited in a shallow marine environment (Becker et al., 1978).

2.2.5 Knox Supergroup (Potosi Dolomite/Oneota Dolomite/Shakopee Dolomite/Above Confining Zone Monitoring Zone) (Cambro-Ordovician)

The Cambrian Potosi Dolomite conformably overlies the Davis Formation and is the basal unit of the Knox Supergroup in Indiana (Figure 4). It consists of crystalline gray-brown dolomite with thin shale and siltstone interbeds and glauconite and chert are locally present (Rupp, 1991). Drusy quartz sometimes covers the surfaces of small to large cavities within the rock, and portions of this formation have relatively high permeability (Willman et al., 1975). These intervals within the Potosi Dolomite that exhibit karst dissolution features can be zones of lost circulation in the Midwest (Droste and Patton, 1985).

The Ordovician Oneota Dolomite is the middle member of the Knox Supergroup and consists of crystalline, light gray to brownish gray cherty dolomite (Figure 4). Sandy and thin, green shaly beds occur with greater frequency at the base of the dolomite. The rock is interpreted to have been deposited in a peritidal environment and grades upward to the overlying finer-grained Shakopee Dolomite (Droste and Patton, 1985; Rupp, 1991).

In Indiana, the Shakopee Formation is the top interval of the Knox Supergroup and is composed of dolomite with interbedded shale and sandstone. Grain-size and content generally increases upward. Like the Oneota Dolomite, the Shakopee Dolomite is gray-brown and cherty. The chert occurs in discontinuous bands and isolated nodules (Willman et al., 1975; Droste and Patton, 1985; Rupp, 1991).

The transition from passive margin deposition to a convergent boundary created the Knox Unconformity and associated karst topography. The unconformity separates the passive margin Knox Supergroup carbonates from the unconformably overlying interbedded clastics and carbonates of the Ancell Group (Figure 4; Droste and Patton, 1985; Drahovzal et al., 1992).

The Knox Supergroup is expected to have porous, permeable intervals beneath the Knox Unconformity. Geophysical logs acquired as part of the Pre-Operational Testing Program will be used to further identify a porous and permeable interval within the Knox Supergroup for an above confining zone monitoring zone (Attachment 05: Pre-operational Testing Program, 2024).

2.2.6 Ancell Group (Joachim Dolomite and Dutchtown/Gull River/Glenwood Formation/Secondary Confining Zone) (Ordovician)

The Ancell Group can be differentiated into several members throughout in the Midwest, including the Joachim Dolomite and the undifferentiated Dutchtown /Gull River/Glenwood Formations, and the relatively finer-grained basal interval is a secondary confining zone for this project (Figure 4). These rocks were deposited in a shallow sea that transgressed following the uplift associated with the Knox Unconformity and are generally composed of a range of clastic sediment with interbedded dolomite (Droste and Patton, 1985).

2.2.7 Black River Group (Ordovician)

The micritic to finely crystalline limestone of the Black River Group was deposited in subtidal to intertidal conditions (Drahovzal et al., 1992). This formation consists of lithographic limestone with sandstone, dolomite, chert, and brown shales. The lower section of the Black River Group contains lenses of fine-grained brown dolomite, and bentonites at the top of the group are evidence that the Taconic Orogeny was increasing in intensity to the east (Drahovzal et al., 1992).

2.2.8 Trenton Limestone (Ordovician)

Deepening of the sea resulted in the deposition of the basal, subtidal, and open-shelf facies of the Ordovician Trenton Limestone of the Galena Group. As a result of the subsidence of the proto-Appalachian Basin and the early stages of the Taconic Orogeny, the end of deposition of the basal Trenton facies is marked by a change in depositional strike. This caused shallowing of the sea to the northwest and the deposition of the thick carbonate platform facies of the Trenton Limestone.

The Trenton Limestone exists throughout the subsurface of Indiana except in the southeastern part of the state, where the limestone interval is truncated so that the rock is entirely calcarenite and calcarenitic limestone. The Trenton Limestone also becomes increasingly dolomitic in northern Indiana. Near faults and highly fractured areas, the Trenton Limestone is completely dolomitized and may have both fracture and vuggy porosity (Gray, 1972; Willman et al., 1975; Droste and Shaver, 1983; Sullivan, 1995).

The Aster Project site is located within the Trenton Gas Field of east-central Indiana. This field was explored and developed between 1889 and 1910 and was the largest natural gas discovery up to that time. Reservoir porosity occurs in dolomitized, vuggy, and fractured dolomite. By 1910, the Trenton Gas Field was depleted partially due to wasteful production methods (IDNR).

2.2.9 Maquoketa Group/Secondary Confining Zone (Ordovician)

The shale and carbonates of the Maquoketa Group are a clastic wedge that exists across Indiana, most of the Arches Province and Illinois Basin and conformably overlies the Trenton Limestone at the Aster Project site (Figure 4). Silurian strata locally truncate the upper portion of the Maquoketa Group, which thins westward across Indiana. Within the Maquoketa Group, the Kope Formation is the lower basal shale overlying the Trenton Limestone in eastern Indiana and is the equivalent to the Utica Shale in the Appalachian Basin (Gutstadt, 1958). The carbonate content is greatest in the upper part of the group (DuBois, 1945; Gutstadt, 1958), and it will serve as a secondary confining zone for this project.

2.2.10 Silurian System/Lowermost USDW (Pleasant Mills Formation, Wabash Formation, Salina Group)

The Silurian Pleasant Mills Formation and the Wabash Formation/Salina Group comprise the Silurian System at the Aster Project site and unconformably overly the Maquoketa Group. The limestone of the Pleasant Mills Formation is the basal Silurian unit and is the lowermost underground source of drinking water (USDW) at the project site (Figure 4; Fitzwater and Dunkman, 2007). During the Silurian, a shallow sea transgressed across the Arches Province, depositing carbonate and evaporite sediment. This, in conjunction with the subsidence of the surrounding basins, allowed prominent shelf-edge carbonate banks to develop in Indiana. At the end of the Silurian, eustatic fluctuations, cratonic uplift, and local tectonic events caused sea level to regress. This ended sedimentation, exposing, and eroding the Silurian strata for millions of years (Mikulic et al., 2010).

2.3 Regional Structure

The region around and including Indiana (Figure 3) has been affected by three major tectonic episodes during the Phanerozoic Eon, including Rodinia-related rifting; widespread compressional (reverse) faulting during the assembly of the supercontinent Pangea in the late Paleozoic; and extensional (normal) faulting during the Mesozoic related to Pangea's breakup (Drahovzal et al., 1992; Denny et al., 2020).

Major structural features in Indiana consist of the Kankakee Arch, the Cincinnati Arch, the eastern portion of the Illinois Basin, and the southern portion of the Michigan Basin (Figure 3). The Cincinnati Arch is a broad uplift that separates the Illinois Basin to the west and the Appalachian Basin to the east. At the Indiana/Ohio boundary, the Cincinnati Arch bifurcates into two separate arches, the Kankakee Arch to the west and the Findlay Arch to the east, and this region of the Midwest is called the Arches Province. The project site is in the middle of the Arches Province where the Cincinnati Arch splits into the two separate arches and is closest to the crest of the Kankakee Arch (Figure 3).

The Kankakee Arch extends across northern Illinois and northern Indiana and separates the Michigan Basin to the northeast from the Illinois Basin to the southwest. The crest of the arch is broad, flat, and up to 75 miles wide. The Findlay Arch trends northeast-southwest and extends across the northwestern corner of Ohio and separates the Michigan Basin from the Appalachian Basin (Figure 3).

The closest mapped structural features to the Aster Project site are the normal, northeast-trending Fortville, Sharpsville, Auglaize, and Royal Center Faults (8 miles southwest, 21 miles west-northwest, 46 miles east, and 60 miles northwest, respectively; Figure 14; Gray and Steinmetz, 2015). The Fortville Fault is a northeast-trending normal fault that extends for nearly 50 miles in central Indiana. The hanging-wall is on the southeast of the fault and up to 80 feet of displacement is observed in Trenton Gas Field wells 8 to 15 miles southwest of the project site (Figure 14; Indiana Department of Transportation, 2021). North of the gas fields, displacement along the Fortville Fault decreases significantly (Indiana Department of Transportation, 2021) and there is little to no displacement observed in Trenton strata from wells on either side of the projected fault trace several miles north of the gas fields or at the latitude of the Aster Project site. Figure 15 and Figure 16 show detailed structure and thickness maps constructed from wells that penetrate the top of the Trenton Limestone in the Trenton Gas Field, respectively. These maps show that there is no offset or thickness changes in the Trenton Limestone surrounding the Fortville Fault at the project site. Two-dimensional (2D) seismic data collected specifically for the Aster Project extended west over the projected trace of the fault (Figure 14) and found no indications of the Fortville Fault being present in the Precambrian basement or at any stratigraphic layer in the vicinity of the Aster Project site. Faults are observed in the Precambrian basement located to the east of the project site as described in Section 2.5 *Faults and Fractures*.

As mentioned in Section 2.2 *Regional Stratigraphy*, the Royal Center Gas Storage is 60 miles northwest of the project site field and began development in 1957. This field utilizes a structural closure associated with the normal Royal Center Fault to store natural gas in both the Trenton Limestone and the Mt. Simon Sandstone (Figure 6; Wickstrom et al., 1993; Mroz et al., 1997).

The Auglaize Fault is mapped to terminate in western Ohio, associated with the Eastern Continental Rift Basin basement (rift-fill volcanics and sediments) and not exposed at the surface. The extent and offset along this feature are also questionable due to data constraints, and it is not interpreted to have been active during the Paleozoic (Wickstrom et al., 1993; Baranoski et al., 2009).

The Wabash Valley Fault System 200 miles southwest of the site is composed of high-angle normal faults that die out with depth (Nelson, 1995; Leetaru and McBride, 2009). The Kentland Impact Structure, 100 miles west-northwest of the Aster Project site, is a circular dome with an associated deformed area that is approximately eight miles in diameter. This deeply eroded structure is characterized by shatter cones, deformed bedrock, localized faults, and vertical contacts among normally horizontal strata. There is also an unnamed fault with unknown offset in the northeast corner of the mapped area in

High density 2D seismic data acquired specifically for the Aster Project indicates there are no significant structural features identified within the project's AoR that would impact CO_2 sequestration and containment. The Fortville Fault is not discernible in the seismic data. Faults are observed in the Precambrian Basement to the east of the project site, which terminate at the Precambrian surface or within the lowermost Mt. Simon Sandstone. No displacement of

Phanerozoic strata is associated with these faults, and they do not impact the primary confining zone of the Eau Claire Shale. The 2D seismic data are discussed in detail in Section 2.5 *Faults and Fractures*.

[redacted]

[redacted]

[redacted]

2.4 Maps and Cross Sections of the AoR [40 CFR 146.82(a)(2), 146.82(a)(3)(i)]

[redacted]

[redacted]

The Mt. Simon Sandstone is the injection zone, the Eau Claire Silt is the secondary storage zone, and the Eau Claire Shale is the confining zone. All extend laterally beyond the AoR limits. This is demonstrated by the regional thickness maps (Figure 11 and Figure 13), the cross section shown in Figure 5, as well as the 2D seismic data discussed in Section 2.5 *Faults and Fractures* (Figure 18, Figure 19, Figure 20, Figure 21, and Figure 22).

Strata of the Mt. Simon Sandstone and Eau Claire Shale are of consistent thickness with no evidence of stratigraphic pinch-out within the AoR. [redacted] Additionally, there is no indication that structural trapping by faults or domes could occur within the AoR.

2D seismic data (Figure 18, Figure 19, Figure 20, Figure 21, Figure 22,) acquired specifically for the Aster Project, and discussed in Section 2.5 *Faults and Fractures*, also indicate the Mt. Simon Sandstone and Eau Claire strata are laterally continuous and there are no structural features in the AoR that will impact storage and containment. The ductile nature of the Eau Claire Shale and lack of structural features indicate the confining zone has excellent characteristics for CO_2 sequestration at the Aster Project site. No potential conduits for injection zone fluids to migrate out of the Mt. Simon Sandstone injection zone were identified in the AoR of the Aster Project.

The base of the Pleasant Mills Formation/top of the Maquoketa Group is the lowermost USDW present within the AoR. The top of the USDW is prognosed at [redacted] feet depth, and its base is more than [redacted] feet above the top of the Eau Claire confining zone at the Aster Project site. There are no structural features or faults observed to intersect the Silurian strata in the AoR. As described in Section 2.1 *Regional Geology, Hydrogeology, and Local Structural Geology* there are several secondary confining zones between the Eau Claire Shale and the Silurian strata in the AoR.

There are 22 O&G wells within the Aster Project AoR according to the Indiana Department of Natural Resources public database. The latest water well data search indicates that 32 groundwater wells are located within the Aster Project AoR that have a maximum depth of 300 feet (Indiana DNR; Indiana DNR, Division of Water).

No existing well in the AoR penetrates the confining strata of the Eau Claire Shale.

2.5 Faults and Fractures [40 CFR 146.82(A)(3)(ii)]

A high density 2D seismic acquisition program conducted in February 2024 acquired and processed approximately [redacted] miles of seismic data at the Aster Project site to provide information regarding subsurface structure and stratigraphy (Figure 18). In addition, [redacted] miles of existing 2D seismic data near the project site was purchased. Lines were acquired to enable accurate delineation of subsurface features. A vibrator truck operating on roads with a 4-120 Hz broad band sweep of 24 second duration acquired these data. Source spacing of 80 feet and receiver spacing of 40 feet were used to enable high density processing to identify both shallow and deep subsurface features. In addition to acquiring new seismic data, five miles of 2D seismic data were purchased. This data was acquired in 2023 with a similar acquisition design and merged with [redacted] miles of new data to form Line C.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.5.1 Impact on Containment and Tectonic Stability

Previously collected seismic data associated with CO_2 sequestration projects in Indiana and the Illinois Basin suggest that minor faults in the Precambrian and Mt. Simon Sandstone strata are not expected to act as conduits through the confining zone (Greenberg, 2021) and that they present negligible endangerment to USDWs.

A future baseline three-dimensional (3D) surface seismic survey will be conducted at the Aster Project site prior to injection. This survey will evaluate injection and confining zone properties and map Precambrian basement topography. It will be used to identify any subsurface structural features or faults that may potentially be present and assess their potential impact to storage or containment. The 3D seismic survey will be designed to obtain full fold data over the predicted extent of the CO_2 plume after 12 years of injection and the 50 year Post-injection Site Care and Site Closure (PISC) period (Attachment 06: Testing and Monitoring, 2024).

The data gathered during the pre-operational phase of the project will be used for geomechanical modeling to evaluate the influence of regional stresses on any minor faults identified in the 3D surface seismic data. The Pre-Operational Testing Program details the geophysical log and core data that will be acquired to evaluate the nature of any identifiable fractures and their impact on long-term integrity of the confining zone (Attachment 05: Pre-operational Testing Program, 2024).

Faults originating in the Precambrian basement and terminating in the basal units of the Mt. Simon Sandstone have not been active since Cambrian time. Regionally, thickness changes in the Cambrian-aged Mt. Simon Sandstone may be related to interpreted syn-depositional fault movement along the basement-involved faults, but at the Aster Project site changes in thickness of strata overlying the Mt. Simon Sandstone are not attributed to these faults, suggesting there has been little active faulting since early Cambrian time.

In the area of the Aster Project in Indiana, earthquakes above M 2.5 are rare. See Section 2.8 *Seismic History*.

2.6 Injection and Confining Zone Details [40 CFR 146.82 (a)(3)(iii)]

2.6.1 Injection Zone and Confining Zone Extent and Thickness

The Mt. Simon Sandstone is the injection zone for the Aster Project. The overlying Eau Claire Silt provides additional storage capacity as a secondary storage zone (Section 2.2 *Regional Stratigraphy*) although direct injection will not be performed into this unit. Computational simulation indicates most of the injected CO_2 will remain in the Mt. Simon Sandstone as described in (Attachment 02: AoR and Corrective Action Plan, 2024).

The Eau Claire Shale, above the Eau Claire Silt is the confining zone for the Aster Project (Figure 4). Regional characteristics of the injection and confining zones are also described in Section 2.2 *Regional Stratigraphy*.

Available public data were collected and integrated to develop site-specific subsurface maps, petrophysical relationships, and a static model of the Aster Project site. Geophysical well logs and the local 2D seismic data were used to generate thickness maps for the Mt. Simon Sandstone injection interval (Figure 23), the Eau Claire Silt storage zone (Figure 24), and the Eau Claire Shale primary confining zone above the Eau Claire Silt (Figure 25).

Within the Aster Project AoR, there are only minor elevation variations and no significant thinning of the injection, storage (Eau Claire Silt and Mt. Simon Sandstone), or confining zone (Eau Claire Shale). [redacted]

CO_2 plume development is expected to be controlled dominantly by sedimentological heterogeneities within the injection zone, as structural features will have minimal influence on CO_2 plume development at this site. The fine-grained, low porosity B-cap unit within the Mt. Simon Sandstone will act as a baffle to vertical migration of CO_2 injected into the Lower Mt. Simon Sandstone beds. The Eau Claire Shale primary confining zone will provide a thick, laterally extensive barrier to prevent upward migration of injection zone fluids over time.

[redacted]

[redacted]

[redacted]

2.6.2 Porosity and Permeability

Public log and core information from four wells north of the project site provide significant data for petrophysical characterization of the injection and confining zones (Figure 26). Additional wells are available that penetrate into or through the Mt. Simon Sandstone and inform the understanding of regional geological characteristics. These wells are variously located at gas storage sites, UIC Class I and VI sites, stratigraphic test wells, and hydrocarbon wells and include data such as well logs, core, and fluid injection data from the Mt. Simon Sandstone, Eau Claire Silt, and Eau Claire Shale.

The Shady Lane well is approximately 24 miles northeast of the project site and is the closest geologic analog for the storage system though it does not penetrate the entire thickness of the Mt. Simon Sandstone and into the Precambrian Basement (Figure 26 and Figure 27), The Hudson #1 well is approximately 45 miles north-northwest of the site and also serves as a geologic analog for the complete storage system ,as it penetrates the Precambrian Basement (Figure 26 and Figure 28). These wells are discussed in more detail in Section 2.7.2 *Petrophysics*.

[redacted]

2.6.3 Mt. Simon Sandstone

[redacted]

Reservoir quality of both the Upper and Lower Mt. Simon Sandstone is similar in northern Indiana. Bowen et al. (2011) state that reservoir quality does not have a simple relationship with depth and varies both laterally and vertically depending on depositional facies, mineralogy, and diagenesis. Enhanced reservoir quality in the Mt. Simon Sandstone is often observed through depositional heterogeneities and secondary porosity development resulting from diagenetic dissolution of feldspar grains (Leetaru and McBride, 2009; Bowen et al., 2011; Medina and Rupp, 2012; Freiburg et al., 2016; Leetaru et al., 2019). Primary depositional flow barriers within the Mt. Simon Sandstone consist of isolated overbank and tidal mudstones including the B-cap.

Bowen et al. (2011) concluded that porosity types in the Mt. Simon Sandstone range from intergranular porosity, elongate and oversized pores, fracture porosity, and dissolution porosity. In contrast, quartz and feldspar overgrowth cement, iron-bearing illitic clays, kaolinite, and iron oxides greatly reduce porosity in the Mt. Simon Sandstone (Bowen et al., 2011). Sminchak (2012) examined geophysical well logs, rock samples, drilling logs, and geotechnical tests collected from the Mt. Simon Sandstone in the Arches Province, with a focus on porosity and permeability analyses, and concluded that large-scale injection of CO_2 into the Mt. Simon Sandstone in the Arches Province is possible with proper design, operation, and monitoring.

Additional site-specific information regarding the injection zone will be acquired when the project wells are drilled through the pre-operational testing program and will include, but are not limited to, well logging, fluid sampling, and core acquisition and analysis.

The baseline 3D surface seismic data will be calibrated to the well data and may be used for inversion analysis. This will allow the project to characterize variations in injection zone porosity and lithology away from the project wells over the imaging area of the 3D surface seismic data volume.

[redacted]

[redacted]

[redacted]

2.6.4 Eau Claire Shale

[redacted]

Sminchak (2012) compiled data on depositional fabrics, mineralogy, and petrophysical characteristics to assess the sealing potential of the Eau Claire Shale in the Arches Province. More than 300 porosity and permeability core data points were evaluated and many of the tests were below detection limits for permeability. This study determined that the Eau Claire Shale will act as an effective confining interval in the Arches Province. As the Eau Claire Shale regionally exhibits effective seal characteristics, it is expected to be a thick, competent confining zone for the underlying Mt. Simon Sandstone injection zone at the Aster Project site.

Well logs, core analyses, and seismic data collected as part of the pre-operational testing program will be used to further characterize the porosity and permeability of the confining zone (Attachment 05: Pre-operational Testing Program, 2024). Capillary pressure and permeability will be measured as part of the Eau Claire Shale core analysis reported in (Attachment 05: Pre-operational Testing Program, 2024).

2.6.5 Davis Formation

The Davis Formation is a thin, fine-grained unit at the top of the Cambrian Potsdam Supergroup in north-central Indiana and will serve as a secondary confining zone for the Aster Project (Figure 4). This shale is laterally gradational with the Franconia, Ironton, and Galesville Sandstones in portions of northern Indiana. At the nearby Shady Lane well, the Davis Formation is 84 feet thick and has average porosity and permeability of 1.2 % and 0.0 mD.

2.6.6 Ancell Group

The Ancell Group will serve as a secondary confining zone and unconformably overlies the Knox Group (Figure 4). This rock was deposited in a shallow sea that transgressed following the uplift associated with the Knox Unconformity and is generally composed of a range of upward coarsening-upward fine-grained clastic sediment with interbedded dolomite (Droste and Patton, 1985). The finer-grained clastics at the base of the Ancell Group are expected to be approximately 43 feet thick at the Aster Project site.

2.6.7 Maquoketa Group

The Maquoketa Group is anticipated to be approximately 359 feet thick at the Aster Project site and regionally serves as a seal for hydrocarbons in the underlying Trenton Limestone. Young (1992) indicates the Maquoketa Group is a low permeability groundwater-confining unit throughout the Midwest. Core from Kentucky reveals that the rock is a black, fissile shale dominated by clay minerals and has both sufficiently low permeability and high compressive strength to serve as confining zone for an underlying CO_2 injection zone. In the Decatur area of the central Illinois Basin, the Maquoketa Group contains higher fractions of quartz and carbonate minerals relative to clays and is thinly laminated with low effective porosity (<3%) and permeability (<9.86 x10 $^{-12}$ cm^2 [1 mD]) (Zaluski, 2014).

2.7 Geomechanical and Petrophysical Information [40 CFR 146.82 (a)(3)(iv)]

2.7.1 Geomechanics

A 27-layer geomechanical model was constructed to test the integrity of the confining zone at the Aster Project site. Average values of pore volume compressibility, Young's Modulus, Poisson's Ratio, and bulk compressibility were calculated for the Eau Claire Shale, the Eau Claire Silt, and the Mt. Simon Sandstone using data from the BP Lima well (Figure 3, Figure 29 and Table 5). Average values of total closure stress (TCS) and pore pressure used in the geomechanical model are shown in Table 6. The large difference between the TCS and the pore pressure indicates that there is a sufficient buffer that will allow a significant injection rate to occur without opening existing fractures.

Figure 29 displays the calculated geomechanical properties computed on 0.5-foot intervals for the BP Lima well using petrophysical data and calibrated with geomechanical data from well tests. The geomechanical properties derived from the calibrated sonic and density logs include Vp/Vs ratio, Biot's constant, bulk and shear moduli, Poisson's ratio, and Young's Modulus. The calculated values of TCS were compared to actual values from well tests from the BP Lima wells and were found to be in good agreement.

Shales are ductile and can accommodate high levels of strain without brittle failure. Mechanical tests using core from the Eau Claire Shale collected at the BP Lima wells demonstrate a low Young's modulus and a high Poisson's ratio which indicate a ductile shale [40 CFR 146.82(a)(3)(iv)]. This core and well test data informed the log calculations of the geomechanical properties shown in Figure 29. These geomechanical data were used to model the Eau Claire Shale confining zone integrity at the Aster Project site with an anticipated injection rate of 359 ktpa into the Mt Simon Sandstone. The pressure gradient from the geomechanical modeling indicates a pore pressure of 1,103 psi in the Eau Claire Shale (Table 6: PBI Average values of TCS calculated from the BP Lima well (Figure 29) were used in addition to pore pressure estimates as input for the geomechanical model. Middle depth is the measured depth to the middle of the respective formation used to calculate TCS and pore pressure.). Currently, estimates of in situ pressure in the confining zone at the Aster Project have been derived from BP Lima. Site specific data on pressure in the Eau Claire Formation will be obtained as part of the Pre-operational Testing Plan (Attachment 05: Pre-operational Testing Program, 2024).

[redacted]

[redacted]

[redacted]

During the pre-operational phase of the project, a variety of site-specific data from the confining and injection zones will be acquired in the project wells to support further geomechanical modeling (Attachment 05: Pre-operational Testing Program, 2024). These data include:

- Caliper, sonic, and image logs,
- Triaxial testing to establish geomechanical parameters such as rock strength, Young's Modulus, Poisson's Ratio, and fracture gradient,
- SRTs.

2.7.2 Petrophysics

Petrophysical analysis of the Mt. Simon Sandstone, the Eau Claire Silt, and the Eau Claire Shale was performed using four wells in the general region of the Aster Project site (Figure 26 and Table 7). The petrophysical analyses were completed to evaluate the characteristics of the confining, storage and injection zones (Figure 30, Figure 31, Figure 32, Figure 33, and Figure 34). For the analyses, log ASCII standard (LAS) files and routine core analyses data were acquired from the Indiana Geological & Water Survey, the Illinois State Geological Survey, and the Ohio State Geological Survey. Geophysical well logs, core plugs, and well test data were used to calibrate the petrophysical calculations to derive effective porosity and permeability (Figure 31, Figure 32, Figure 33, and Figure 34). These analyses will be re-visited once the project acquires site-specific well logs and core data in the project wells (Attachment 05: Pre-operational Testing Program, 2024).

Table 7: Well logs used for petrophysical analysis. Log abbreviations can be found at the beginning of this document.

Well Name	UWI	Well Logs
Shady Lane	13053537870000	Gamma ray, spontaneous potential, density, density sandstone porosity, neutron sandstone porosity, photoelectric factor, density correction, deep resistivity, deep resistivity, medium resistivity, density limestone porosity, neutron limestone porosity, density dolomite porosity, neutron dolomite porosity
Pfeil	13049700400000	Gamma ray, deep resistivity, neutron porosity, core porosity, core permeability
Leuenberger	13003702210000	Gamma ray, caliper, neutron sandstone porosity, medium resistivity, neutron limestone porosity, neutron porosity, core porosity, core permeability
Hudson	13169290240000	Gamma ray, spontaneous potential, sonic, deep resistivity, deep resistivity, neutron porosity

Core and log data were also calibrated to well test data that is publicly available from the BP Lima well in western Ohio (Figure 3). Cross plots and histograms were made using these data which enabled more thorough analysis of wells without core data (Figure 30, Figure 31, and Figure 32). These results were incorporated into the development of a static geologic model (Attachment 02: AoR and Corrective Action Plan, 2024).

Pre-processing work on the raw log data, which included depth shifting, unit conversion, and synthetic log generation, was performed prior to the petrophysical calculations. Gamma, neutron porosity, sonic, PE, and density logs were used to derive the petrophysical properties for the four wells, which included:

- Effective Porosity,
- Permeability,
- Mineralogy (where data quality was reliable),
    - Volume Shale (VSH_V),
    - Volume Quartz (Quartz_V),
    - Volume Limestone (Limestone_V),
    - Volume Dolomite (Dolomite_V),
    - Volume Sphalerite (Sphalerite_V),
    - Precambrian (Basalt_V),
    - Bound Water (BVW_V).

Table 8 and Table 9 summarize petrophysical values determined from geophysical well logs and calibrated using data from core and reservoir testing for the Mt. Simon Sandstone, Eau Claire Silt, and Eau Claire Shale, respectively. The Shady Lane well is closest to the Aster project site and has the highest Mt. Simon Sandstone average porosity and permeability values, though it is important to note that this well does not penetrate the true thickness of the Lower Mt. Simon Sandstone. The Pfeil and Leuenberger wells have relatively lower values (Table 8 and Table 9).

Facies modeling was performed on the four petrophysical wells and is reported in Section 1.1.1 of Attachment 02: AoR and Corrective Action Plan, (2024). Effective porosity (PHIE) and mineralogy logs were used to define three porosity cutoffs for the sandstone (relatively higher porosity), siltstone, and shale facies (relatively lower porosity). Individual variograms for each facies were developed and the facies were then each distributed throughout the static model.

For the four petrophysical wells, effective porosity/permeability cross plots (Figure 30), effective porosity histograms (Figure 31), and permeability histograms (Figure 32) indicate that the Upper and Lower Mt. Simon Sandstone intervals have the highest porosity and permeability values. The petrophysical and core data show that the Mt. Simon Sandstone is primarily composed of quartz sandstone with some thin interbedded shale and siltstone layers and demonstrates that the Lower and Upper Mt. Simon Sandstone intervals have similar reservoir quality.

The Eau Claire Shale primary confining zone above the Eau Claire Silt has significantly lower effective porosity and permeability values and higher shale content compared to the underlying Mt. Simon Sandstone, which is primarily composed of quartz sandstone (Figure 30, Figure 31, Figure 32, Figure 33, Figure 34, Attachment 02: AoR and Corrective Action Plan, 2024).

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[redacted]

2.8 *Seismic History [40 CFR 146.82(a)(3)(v)]*

Based on Federal Emergency Management Agency (FEMA) classification the Aster Project site has a very small probability of experiencing damaging earthquake effects. The site is 275 miles northeast of the Strongest Shaking Zone E associated with the New Madrid Seismic Zone (Figure 35).

The site is also 45 miles west of the Moderate Shaking Zone associated with the Anna Seismic Zone in western Ohio. It is hypothesized that this seismic zone is associated with the Eastern Continental Rift Zone (Figure 35, Dart and Hansen, 2008).

All earthquakes since 1800 having a magnitude of 2.5 or greater and within a 100-mile radius of the Aster Project site are shown in Figure 36 and listed in Table 10. The largest earthquake within this 100-mile radius occurred in 1937, approximately 73 miles east, with a magnitude of 5.4 moment magnitude (Mw). The most recent earthquake (2.9 Mw) occurred on December 9, 2023, approximately 82 miles east of the project. No earthquakes have been recorded with an epicenter in the project AoR (USGS).

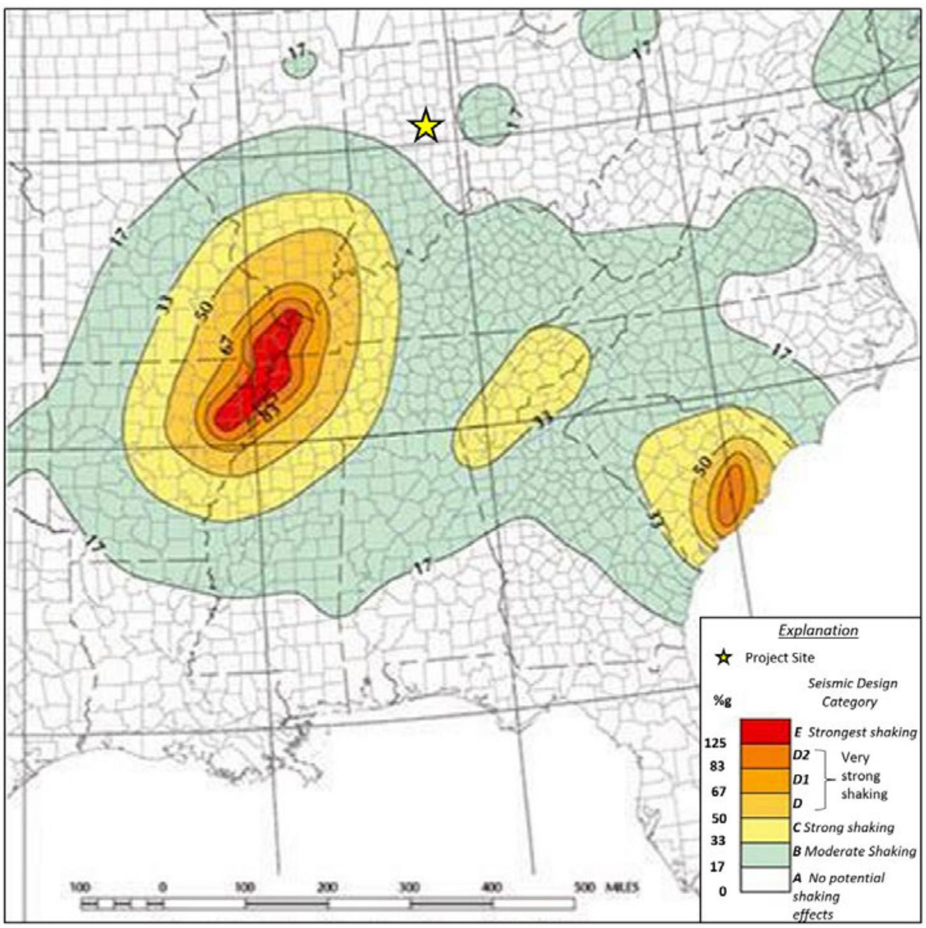

Figure 35: FEMA Earthquake Hazard Map shows that the project site (yellow star) is located in the lowest earthquake hazard category A. The New Madrid Seismic Zone is in Zone E.

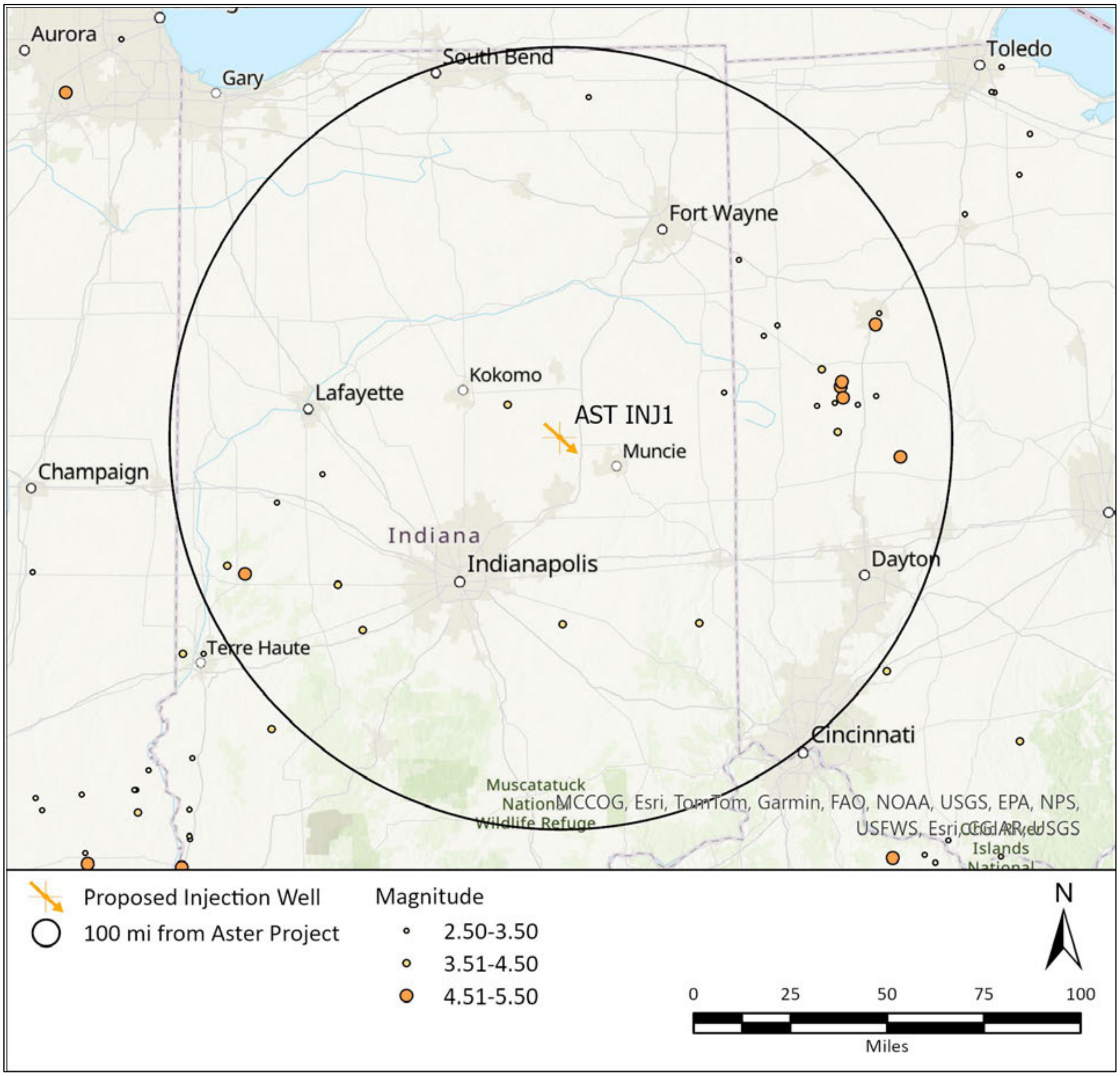

Figure 36: Map of earthquake epicenters with 2.5 or greater magnitude that occurred between 1 January 1800 to 3 May 2024 within 100 miles (black circle) of the Aster Project AoR (USGS, 2024).

Table 10: Events 2.5 or greater magnitude from 1800 to 3 May 2024 with epicenters within 100 miles (USGS, 2024).

Date	Latitude	Longitude	Depth	Magnitude	Place
12/9/2023	40.43220	-84.10840	6.79	2.90	5 km W of Jackson Center, Ohio
10/31/2023	40.17450	-86.82270	6.13	2.50	7 km ESE of Linden, Indiana
6/17/2021	39.83050	-87.28667	6.26	3.82	Illinois-Indiana border region
6/12/2015	40.95500	-84.76200	5.00	2.60	6 km NW of Convoy, Ohio
1/26/2012	41.57600	-85.49000	4.70	3.00	5 km NE of Topeka, Indiana
12/30/2010	40.43000	-85.91400	5.00	3.80	6 km SE of Greentown, Indiana
9/30/2008	40.41000	-84.31000	5.00	2.80	5 km SW of Kettlersville, Ohio
8/15/2006	40.71000	-84.11000	5.00	2.50	3 km NE of Fort Shawnee, Ohio
5/12/2006	40.74000	-84.08000	5.00	2.80	2 km E of Lima, Ohio
9/12/2004	39.60433	-85.66150	2.40	3.80	4 km NW of Manilla, Indiana
1/30/2004	40.67000	-84.65000	5.00	2.50	2 km S of Rockford, Ohio
4/14/2000	39.76000	-86.75000	5.00	3.60	4 km NW of Heritage Lake, Indiana
4/4/1994	40.40000	-84.40000	5.00	2.90	2 km WNW of Minster, Ohio
12/20/1990	39.59000	-86.63000	5.00	3.70	5 km S of Stilesville, Indiana
12/17/1990	40.06800	-87.04400	10.00	3.20	Illinois-Indiana border region
4/17/1990	40.46000	-84.85200	5.00	3.00	8 km NW of Fort Recovery, Ohio
7/12/1986	40.53700	-84.37100	10.00	4.50	1 km ESE of Saint Marys, Ohio
6/17/1977	40.70700	-84.58200	5.00	3.20	5 km ENE of Rockford, Ohio
3/9/1937	40.47000	-84.28000	3.00	5.40	Give me
3/2/1937	40.48800	-84.27300	2.00	5.00	3 km E of New Knoxville, Ohio
9/20/1931	40.42900	-84.27000	5.00	4.70	1 km SSW of Kettlersville, Ohio
9/30/1930	40.30000	-84.30000	0.00	4.20	5 km E of Newport, Ohio
9/27/1909	39.80000	-87.20000	0.00	5.10	4 km NNE of Rockville, Indiana
9/19/1884	40.70000	-84.10000	0.00	4.80	Near Lima, Ohio
2/9/1882	40.40000	-84.20000	0.00	3.10	Near Anna, Ohio
6/18/1875	40.20000	-84.00000	0.00	4.70	Western Ohio
1/27/1812	39.60000	-85.00000	0.00	4.20	Eastern Indiana, NW of Cincinnati, OH

2.9 Hydrologic and Hydrogeologic Information [40 CFR 146.82(a)(3)(vi), 146.82(a)(5)]

The following sections provide information regarding available drinking water resources and delineation of the lowermost USDW, which is the Silurian Pleasant Mills Formation directly overlying the Maquoketa Group at the project site (Figure 4). Water well, monitoring well, and dry well records were collected for the project AoR from the Indiana Geological Survey. A total of 32 shallow water wells are located within the AoR. Attachment 02: AoR and Corrective Action Plan, (2024) includes a detailed discussion of the number and locations of the groundwater wells within the AoR.

2.9.1 Near Surface Aquifers

The study site is located in the White and West Fork White River Basin near the boundary with the Upper Wabash River Basin (Figure 37, Martin et al., 2016). Both the Upper Wabash River Basin and the White and West Fork White River Basin are part of the greater Wabash River Basin network, which drains rural, agricultural land and communities across much of Indiana and is a tributary to the Ohio River. Streamflow from the White and West Fork White River Basins drains into the Wabash River in southwestern Indiana (Figure 37, Schrader et al., 2002).

During the Pleistocene Epoch, Indiana experienced several glacial intervals, and glacial deposits overly bedrock and affect surface hydrology and aquifers in the region with up to 500 feet of till and valley fill in certain areas of the state. The Aster Project AoR is within glacial tills associated with the Huron-Erie Glacial Lobe of the larger Laurentide Ice Sheet; specifically, it is near the contact of the clay-loams of the Wisconsinan Lagro Formation and loam till of the Trafalgar Formation (Figure 38, Wayne, 1958). This area has flat to gently rolling topography created by glaciers and is composed of various glacial deposits and Pleistocene fill. At the project site, approximately 50 feet of unconsolidated glacial till, drift and moraine deposits of the Lagro and Trafalgar Formations is expected (Figure 39) which directly overlie the Silurian-aged carbonates of the Wabash Formation bedrock (Figure 40). The average ground elevation within the AoR is approximately 875 feet above mean sea level.

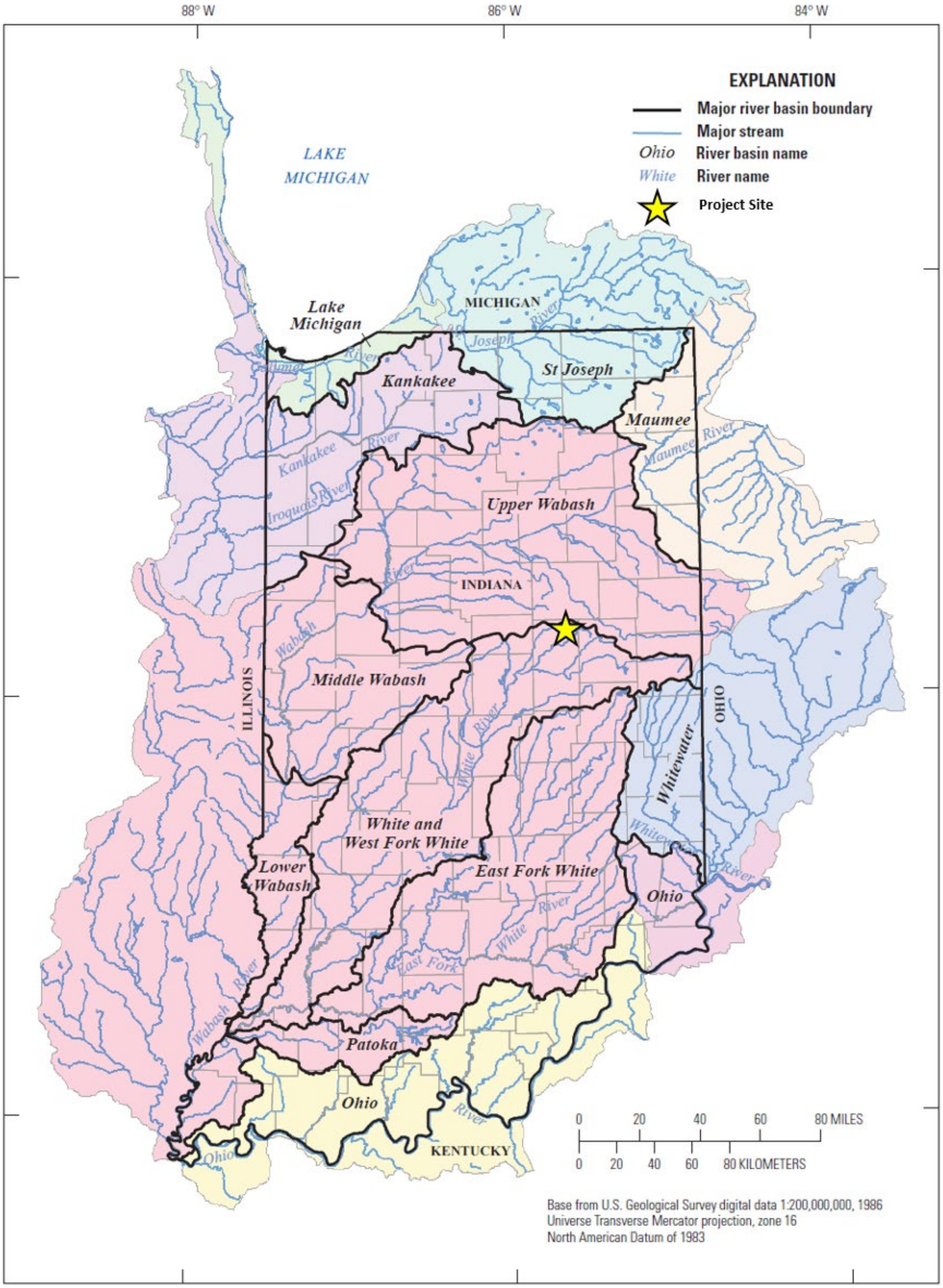

Figure 37: Map of Indiana river basins including the Upper Wabash and the White and West Fork White Basins. From Martin et al, (2016).

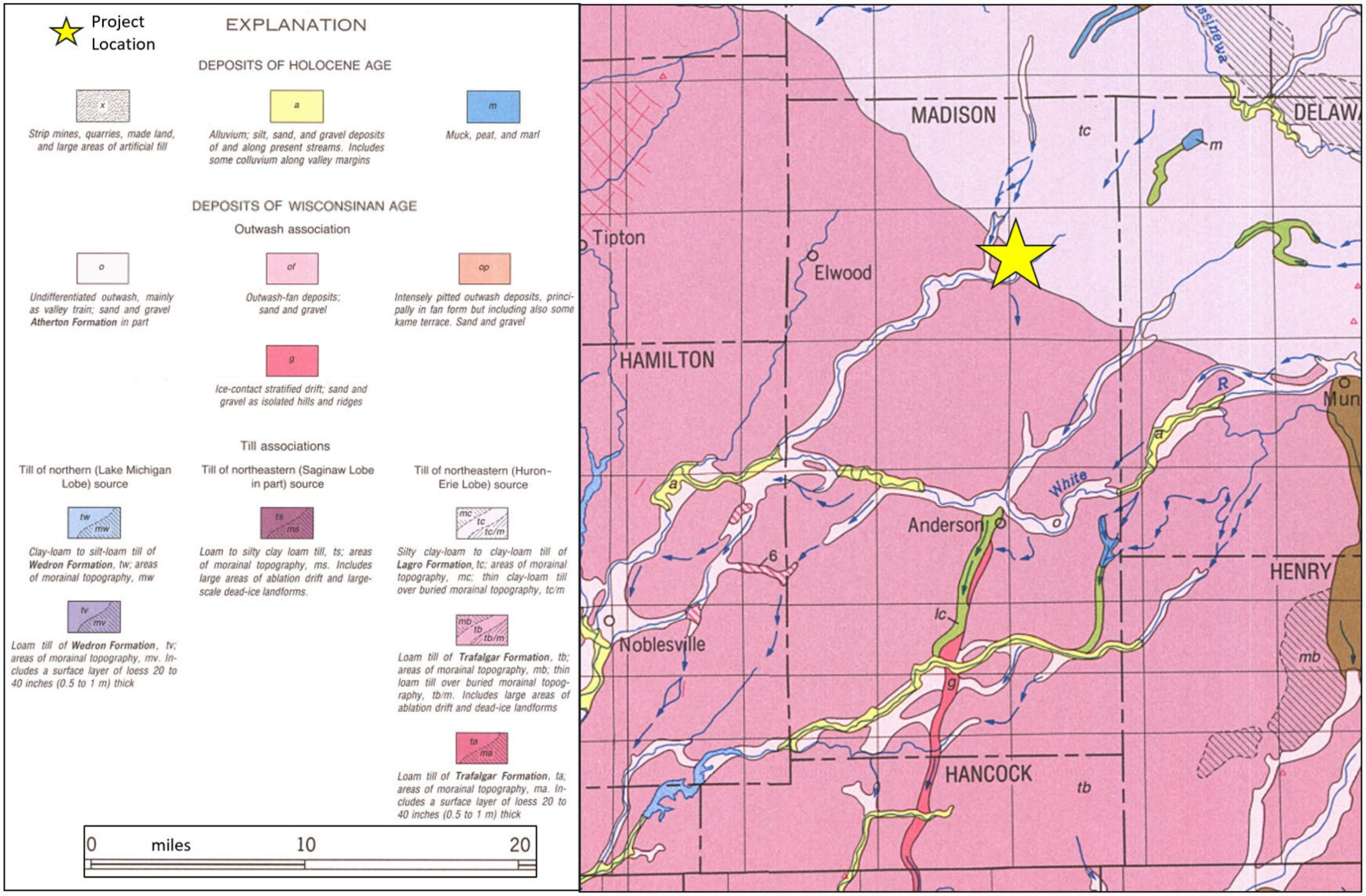

Figure 38: Map of Indiana glacial deposits shows that the Aster Project site is located on glacial deposits composed of both the Lagro and Trafalgar Formations (Wayne, 1958; Gray, 1989)

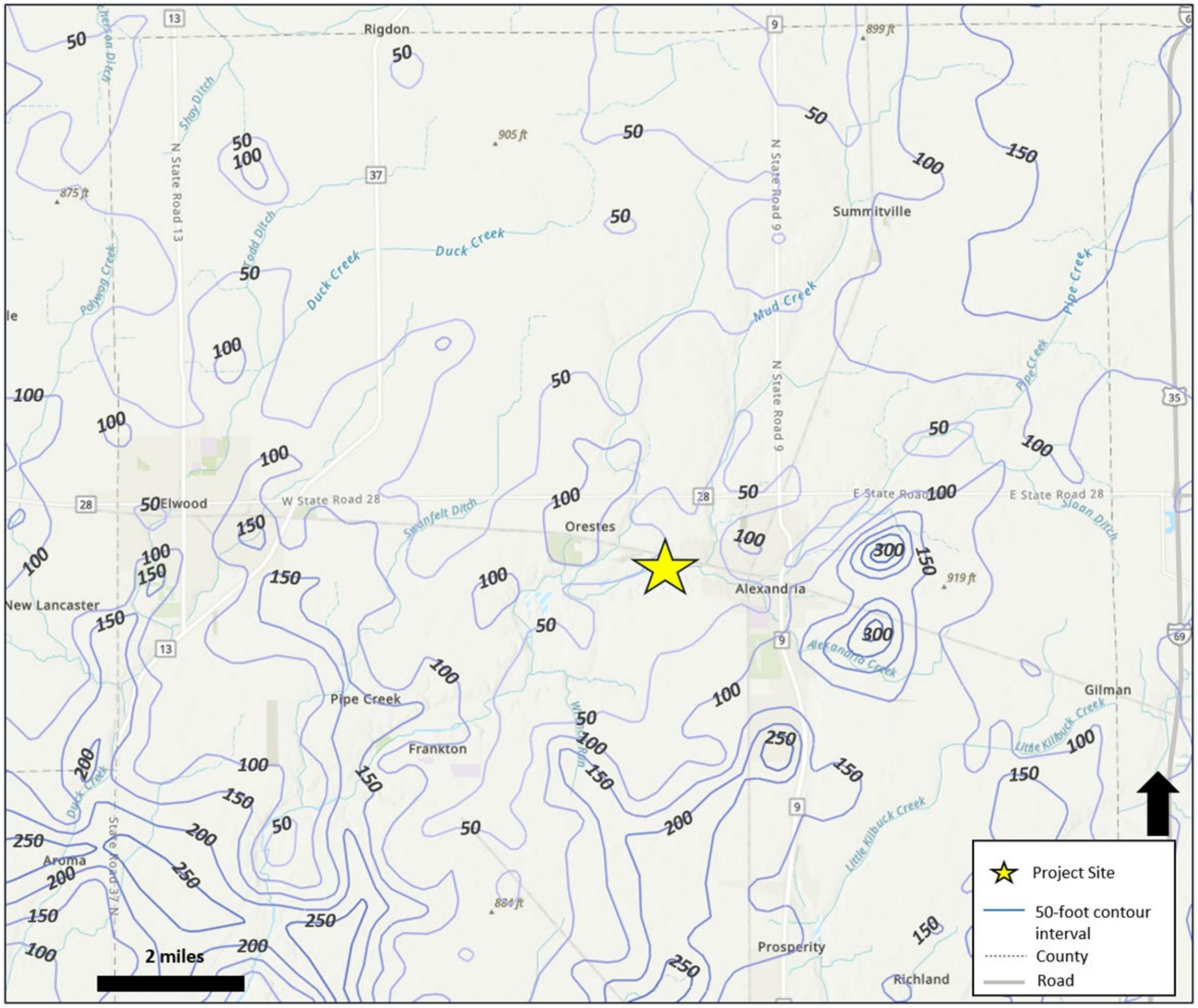

Figure 39: Map of glacial drift thickness in feet. At the project site, approximately 50 feet of glacial drift are expected. Modified from Indiana Geographic Information Office, (2024).

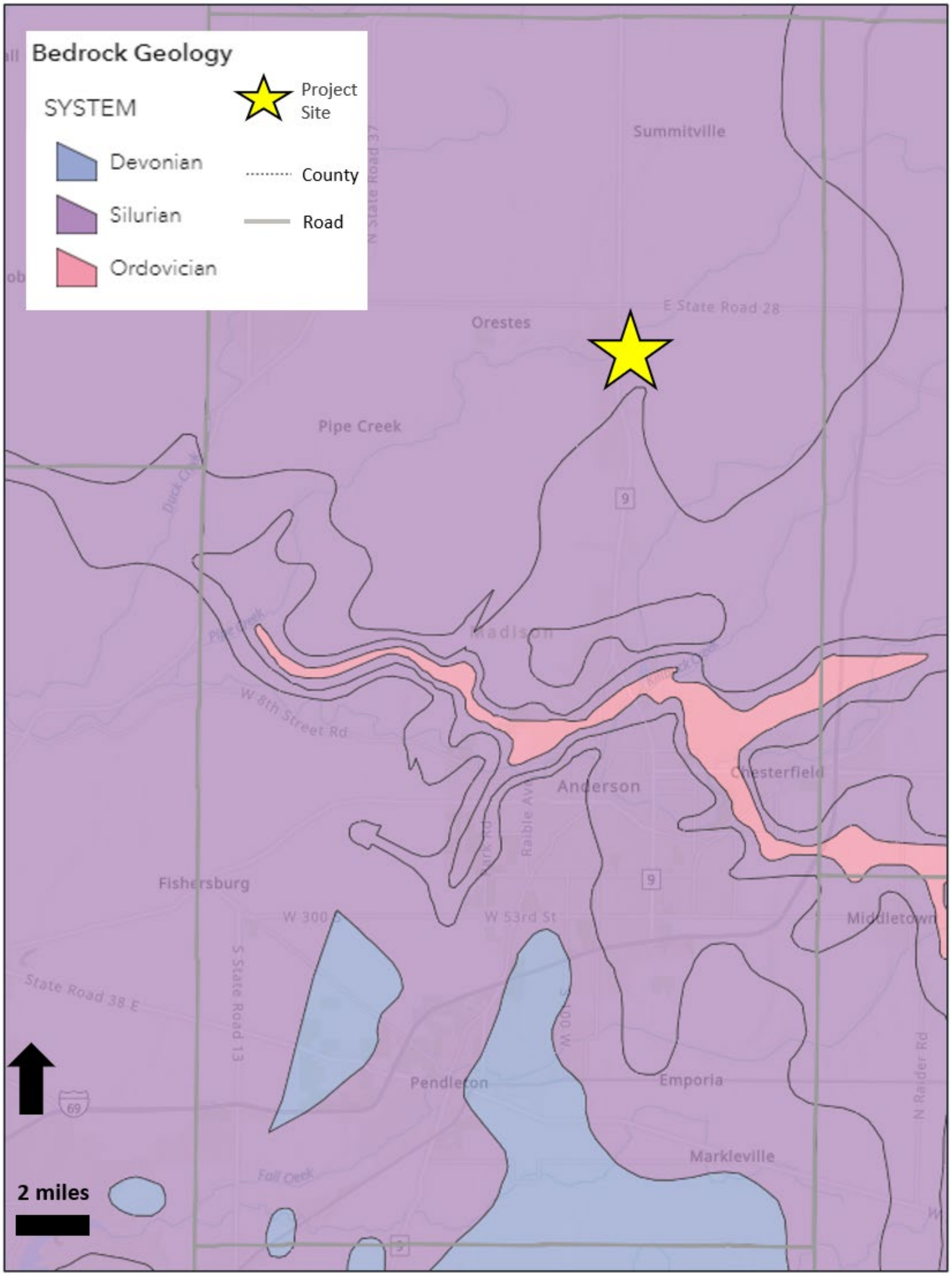

Figure 40: Bedrock geology underlying unconsolidated glacial deposits.
The Aster Project site, indicated by the yellow star, is located above the Silurian Wabash Formation bedrock.
Modified from Indiana Geographic Information Office, 2024).

2.9.2 Local Hydrology

There are several sources of groundwater in northern Madison County, Indiana:

1) The consolidated Silurian Carbonate Aquifer System,
2) The unconsolidated aquifer systems of various tills and till veneers associated with the Bluffton/New Castle/Till Veneer Complex, which in turn are part of the Lagro and Trafalgar Formations, and
3) Unconsolidated outwash and gravel deposits of the White River and Tributary System (Dean 2010a, 2010b).

Extracted groundwater is primarily used as a public water supply, but it is also used for agriculture and industry in Madison County. Specifically, the area within and surrounding the Aster Project site utilizes unconsolidated aquifers and Silurian carbonate bedrock. Devonian carbonates are a groundwater source in southern Madison County but, due to the thin or not existent nature of Devonian bedrock near the project site, it is not a groundwater source in northern Madison County. The Ordovician Maquoketa Group bedrock aquifer is utilized in southern Madison County where it is exposed at the surface but is not considered a groundwater source in the northern portion of the county (Figure 41).

The thickness of unconsolidated glacial deposits in Madison County ranges from zero to over 350 feet, and this variability is attributed to the deposition of glacial material over an undulating bedrock surface (Scott, 2010). Approximately half of the Madison County water wells are completed in these sediments. The till portion of the Bluffton/New Castle/Till Veneer Complex has the most limited ground water resources in the area, and the sand/gravel fraction of the complex generally meets the needs of most domestic and some high-capacity users in the county (Dean, 2010a). Wells producing from this aquifer system are typically 50 to 105 feet deep (Dean, 2010b). Approximately 50 feet of unconsolidated glacial till, drift and moraine deposits are expected at the project site (Figure 39).

The project site is underlain by approximately 250 feet of the Silurian Wabash Formation and Pleasant Mills Formation. Approximately 50 feet of till veneer and glacial deposits of the Bluffton/New Castle/Till and the Till Veneer aquifer systems are above the Silurian bedrock (Figure 38, Figure 39, Figure 40, and Figure 42). Reported depths of wells producing water from the Silurian/Devonian carbonates in Madison County typically range from 30 to 132 feet. Approximately half of the water wells in the county are completed within the bedrock, and the carbonate aquifers are most productive within 100 feet from top of the bedrock surface. In Madison County, groundwater in the Silurian carbonate aquifer is recharged by percolation of precipitation through overlying glacial deposits. Regional groundwater flow in the Silurian aquifer is down-dip to the west (Fenelon et al., 1994; 40 CFR 146.82(a)(5)). Locally, groundwater flow can be directed toward registered groundwater withdrawal facilities within Madison County (Dean, 2010a).

As stated in Section 2.2.9 *Maquoketa Group/Secondary Confining Zone*, the Maquoketa Group consists mostly of organic-rich black shale and organic-poor gray shale. Few wells are reported to produce water from this shale in Madison County due to the availability of unconsolidated aquifers in the area, and depths of water wells producing from this formation range from 170 to 270 feet. The Maquoketa Group is accessed for water in the southern half of Madison County but not near the project site. As such, the base of the bottom of the Pleasant Mills Formation immediately overlying the Maquoketa Group is considered the lowermost USDW for the Aster Project. The US Geological Survey (USGS) cross section shows that unconsolidated glacial deposits and Silurian carbonate bedrock are the primary aquifers for the area (Figure 43).

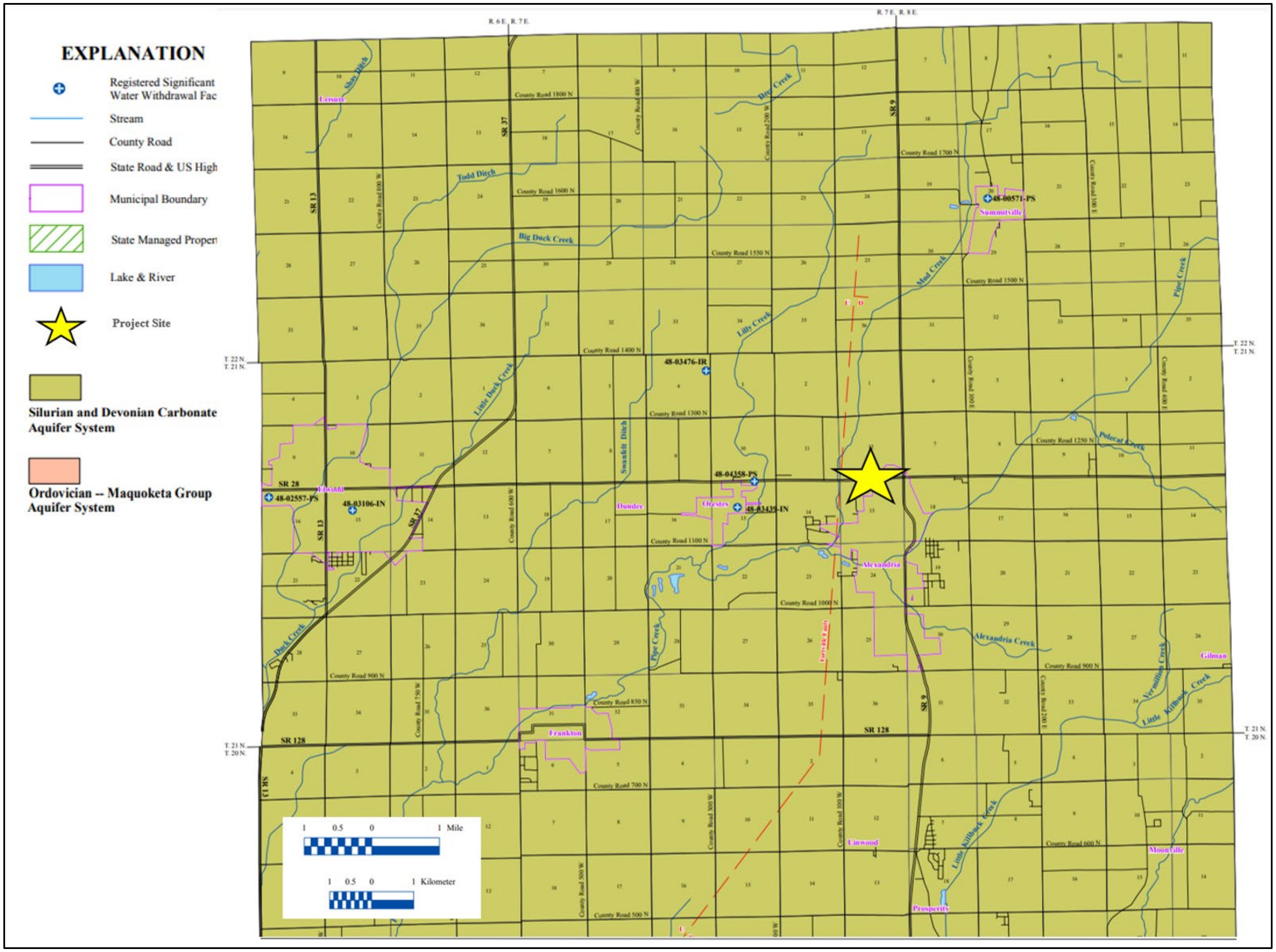

Figure 41: Bedrock aquifer map of northern Madison County. Modified from Dean (2010a).

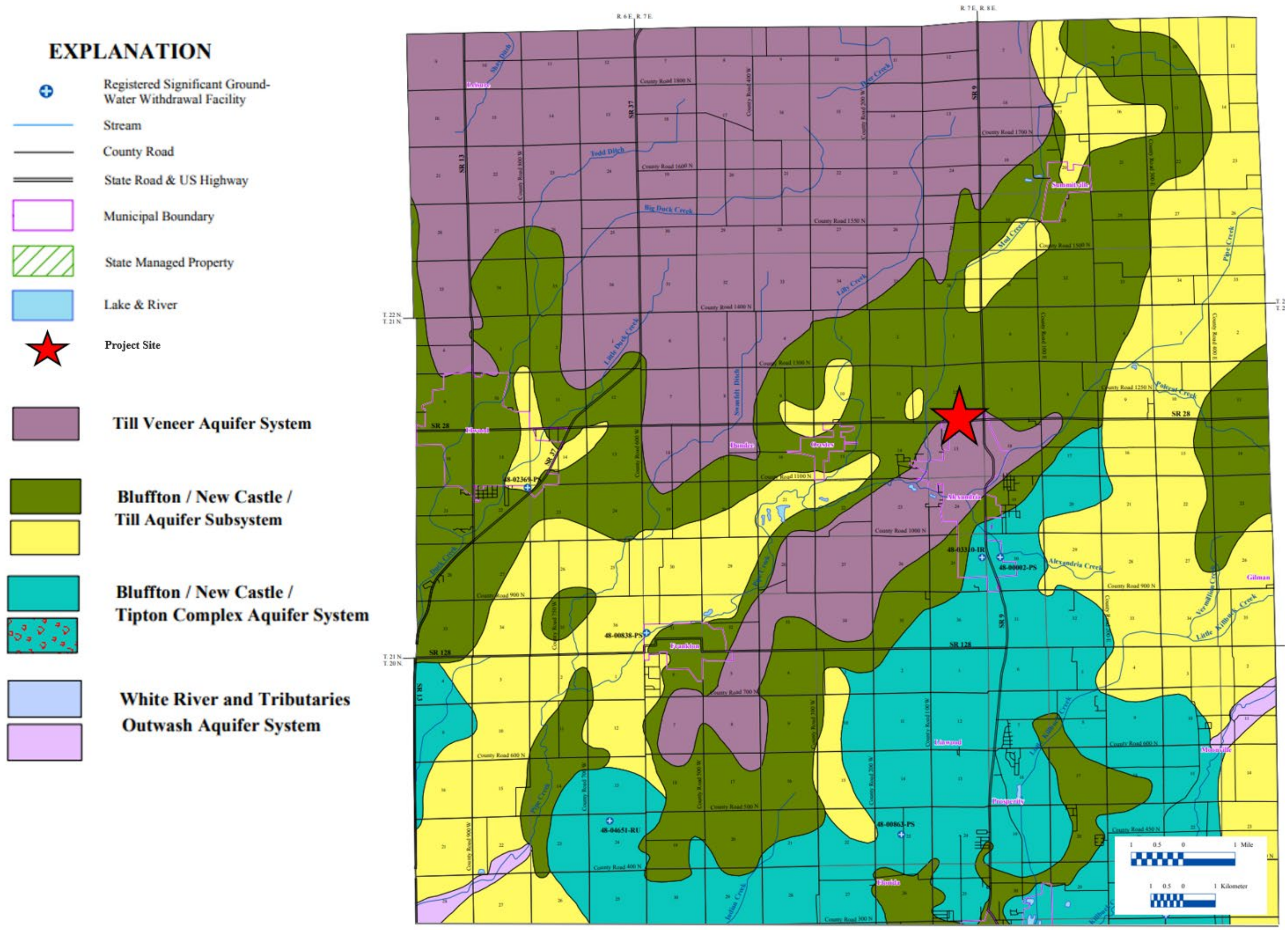

Figure 42: Unconsolidated aquifer map of Madison County. Modified from Dean, (2010b).

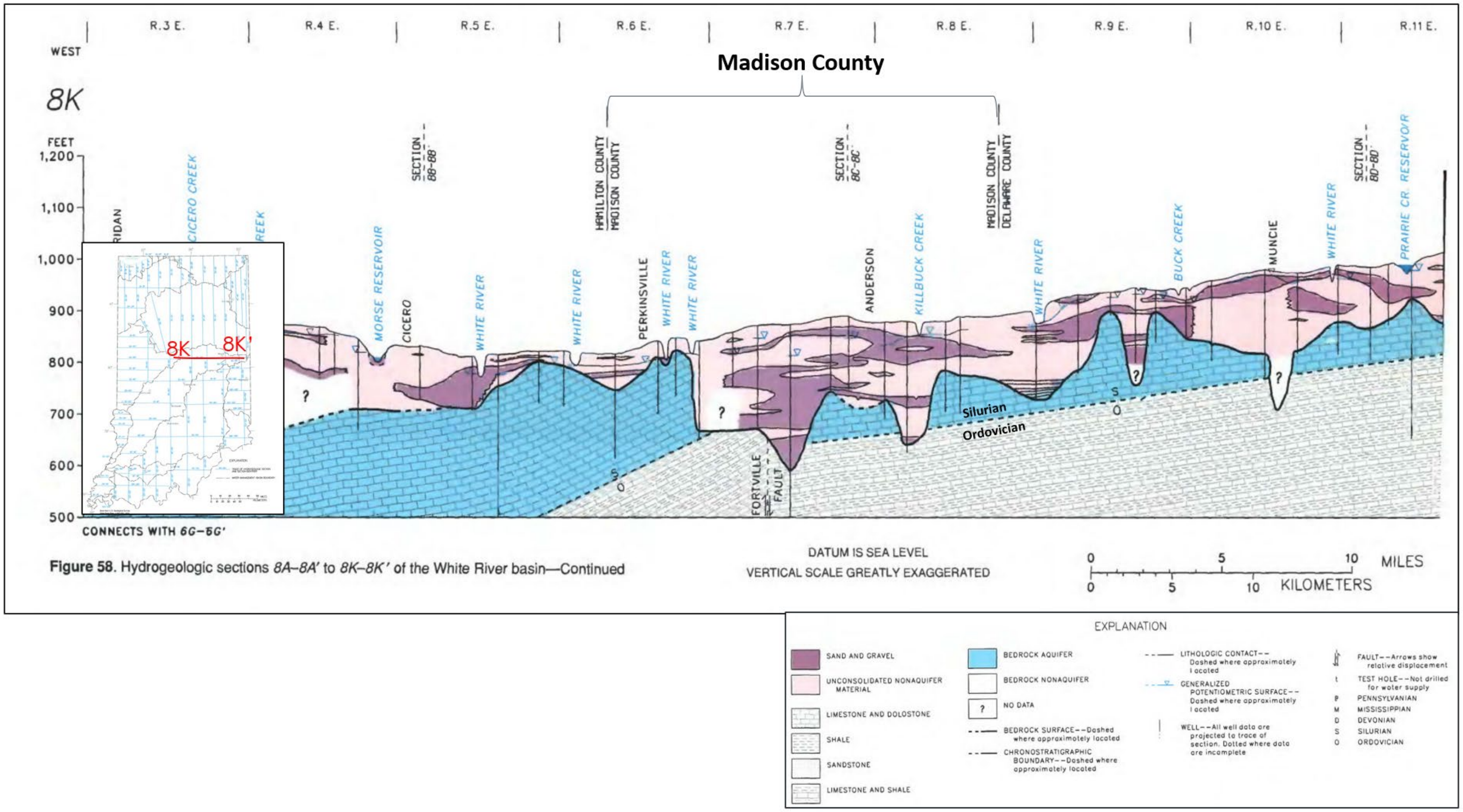

Figure 43: West-east hydrogeologic cross section through Madison County. Modified from Fenelon et al., (1994).

2.9.3 Determination of Lowermost USDW

A USDW is defined by the EPA as an aquifer that (40 CFR 146.3):

- Supplies any public water system
- Contains a sufficient quantity of groundwater to supply a public water system; and
  - Currently supplies drinking water for human consumption, or
  - Contains fewer than 10,000 milligrams per liter (mg/L) total dissolved solids (TDS),
- Which is not an exempted aquifer.

The Silurian Pleasant Mills Formation is the lowermost USDW in northern Madison County. For the purposes of this project, the lowermost USDW will be mapped as the top of the Upper Ordovician Maquoketa Group/base of the Pleasant Mill Formation (Figure 4).

Schrader et al. (2002) presented analyses of groundwater in the White and West Fork White River Basins, including northern Madison County, from both unconsolidated sediment and the Silurian bedrock aquifer. Generally, the bedrock aquifers have higher TDS values compared to the overlying unconsolidated deposits, though specific values for the Silurian bedrock aquifer system were not reported, and TDS values vary based on the bedrock mineralogy and groundwater residence times. TDS values from the unconsolidated and bedrock aquifers in northern Madison County range between 500-800 mg/L (Schrader et al., 2002).

The St. Peter Sandstone is a potable aquifer in northwestern Indiana. However, this formation does not exist at the Aster Project site. The Mt. Simon Sandstone is considered a 'high capacity' aquifer system in Wisconsin, Iowa, and northern Illinois, where it is relatively shallow and accessed for groundwater withdrawal. However, TDS in the Mt. Simon Sandstone increases southward throughout Indiana, and it is not suitable as a drinking or agricultural water source in the east-central portion of the state (Mehnert and Weberling, 2014). Based on regional data, the Mt. Simon Sandstone injection and storage zone formation water TDS is expected to be about 150,000 mg/L at the Aster Project site (Figure 44).

Hydraulic flow simulations and modeling by Gupta (1993) show that in central Indiana regional groundwater flow in the Mt. Simon Sandstone is westward towards regions of lower hydraulic head; 40 CFR 146.82(a)(5)). This flow is influenced by the broad-scale arches as described in Section 2.1 *Regional Geology, Hydrogeology, and Local Structural Geology* toward the center of the Illinois Basin to the west (Lloyd and Lyke, 1995; Gupta, 1993).

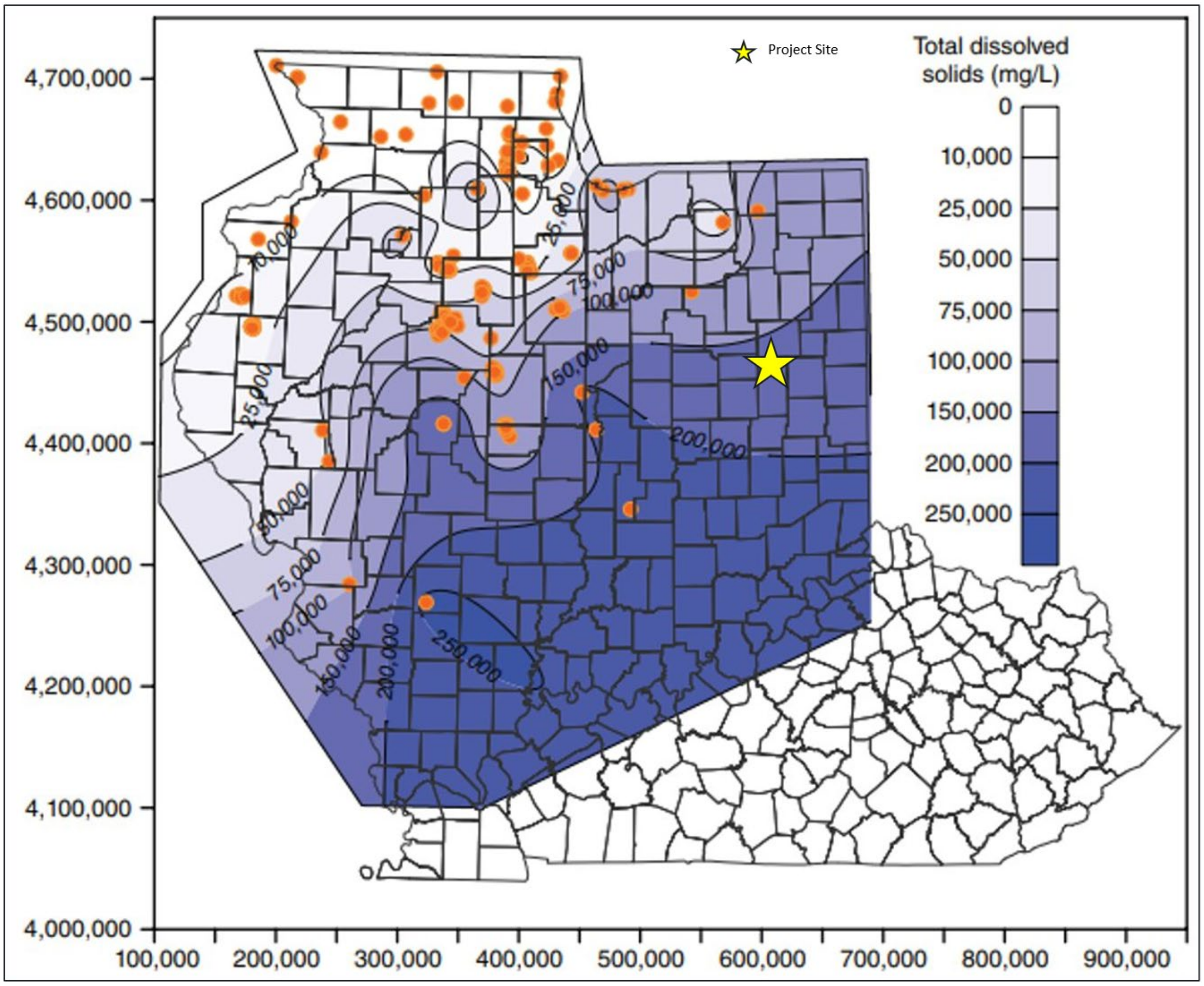

Figure 44: Map of TDS concentration contours in the Mt. Simon Sandstone formation water. The project site is represented with a yellow star and sample locations are shown by orange circles. (Modified from Mehnert and Weberling, 2014).

2.9.4 Topographic Description

[redacted]

The site has an elevation of approximately 875 feet above sea level. It is part of the Central Till Plain Physiographic Province, which is where the sediment of the Bluffton, Iroquois, New Castle, and Tipton Tills intermingle. This region is characterized by flat or gently sloping topography with glacial deposits overlying bedrock (Gray, 2000).

The land within the project AoR is considered an area of minimal flood hazard as established by FEMA. A FEMA Zone A flood hazard (1% chance of annual flooding) is located approximately 0.5 miles west of the AST INJ1 site along Star Creek (Figure 45, FEMA).

Indiana DNR has developed a Best Available Flood Hazard Layer (BAFL) with additional studies reviewed and approved by the Division of Water. Although the data has not been submitted to FEMA for inclusion in the Flood Insurance Rate Maps or National Flood Hazard Layer, the data is useful for planning and development purposes. The BAFL indicates a Zone A flood hazard risk extending further along Star Creek within the project AoR. All project wells are located outside of the BAFL flood hazard risk area as indicated in (Figure 45, IDNR).

[redacted]

2.10 Geochemistry [40 CFR 146.82(a)(6)]

2.10.1 Data Sources, Analyses

There has been extensive research into the regional understanding of the geochemistry of fluids and lithology of strata within the Arches Province and surrounding areas from numerous studies by Saeed and Evans (2012), Sminchak (2012), and the Illinois State Geological Survey as well as detailed work at carbon capture and sequestration (CCS) projects in the Illinois Basin including the IBDP (Greenberg et al., 2022), IL-ICCS (Gollakota and McDonald, 2014; Whittaker and Carman, 2022), and CarbonSAFE Illinois – Macon County (Whittaker and Carman, 2022). Although local variations will exist, there is confidence in the bulk lithology and mineralogy of rock and geochemistry of formation fluids in injection zone and confining zone at the Aster Project site. Formation fluids, full-diameter rock core, and side-wall core samples have been collected and analyzed by the projects identified above.

Attachment 05: Pre-operational Testing Program, (2024) details the data that will be acquired in AST OBS1 and AST INJ1 that may be used to support future geochemical evaluation. The mineralogy of the injection zone and confining zone will be determined through a combination of core analysis and well logging. Well log data will also be acquired through the lowermost USDW and above confining zone (ACZ) monitoring zone to assist in establishing the mineralogy of these formations. Fluid samples will be collected and analyzed from Silurian strata above the Maquoketa Group (Pleasant Mills, the lowermost USDW), the above confining zone interval (a porous and permeable interval within the Knox Supergroup), and the injection zone (Mt. Simon Sandstone).

The Testing and Monitoring Plan details the parameters and analytes that will be used to establish baseline conditions for these formations as well as during the injection phase of the project (Attachment 06: Testing and Monitoring, 2024). The aqueous geochemistry data gathered during the pre-operational phase of the project will also be used to support any future geochemical modeling work. Geochemical modeling will likely focus on reactions in the injection zone and any reactions in the confining zone that may impact long-term containment and endangerment of USDWs.

2.10.2 Fluid Geochemistry

Many fluid samples have been collected from the Mt. Simon Sandstone in the Midwest (Locke et al., 2013). To fulfil the requirements for UIC Class I or VI permits for the IBDP and IL-ICCS projects, the Illinois State Geological Survey has collected fluid samples since 2011 from both the Mt. Simon Sandstone and St. Peter Sandstone from these sites at Decatur, IL about 175 miles west-southwest of the Aster Project site. Mt. Simon Sandstone fluids are of the Na-Ca-Cl type with Cl/Br ratios typically ranging 165±15 (Panno et al., 2013). The general range of TDS measured for fluids from Mt. Simon Sandstone at the Decatur, IL, sites is from 150,000 - 200,000 mg/L and the salinity at the Aster Project site is expected to be around 150,000 mg/L (Figure 44).

2.10.3 Solid-Phase Geochemistry

The mineralogy of the Mt. Simon Sandstone has been regionally characterized in the Midwest Region by numerous studies (Bowen et al., 2011; Saeed and Evans, 2012; Carroll et al., 2013; Freiburg et al., 2014; Davila et al., 2020; Shao et al., 2020) that indicate it is dominated by quartz with lesser amounts of feldspar, authigenic clay, and detrital clay minerals. The clay-sized fraction of minerals usually present in the Mt. Simon Sandstone are a small percentage (1 to 3% by volume). In Indiana, the formation is primarily quartz arenite (up to 95%). Some intervals of the Mt. Simon Sandstone contain abundant detrital and early authigenic K-feldspar (up to 40% by volume), clay minerals (illite, kaolinite, and chlorite up to 3% by volume), and iron oxide (up to 2% by volume). Trace detrital grains include zircon, rutile, and chromite. The distribution of the mineral components of the Mt. Simon Sandstone across the Arches Province and the Illinois Basin is relatively consistent (i.e., Bowen et al., 2011; Freiburg et al., 2014).

2.10.4 Geochemical Reactions and Modeling

The Mt. Simon Sandstone mineralogy is similar in the Arches Province and the Illinois Basin (Bowen et al., 2011; Saeed and Evans, 2012; Carroll et al., 2013; Freiburg et al., 2014; Davila et al., 2020; Shao et al., 2020) and regional fluid chemistry trends within the Mt. Simon Sandstone have been documented (Locke et al., 2013; Panno et al., 2013). As such, laboratory batch studies on geochemical reactions conducted using samples from the IBDP site can be used as an analog. These studies use Mt. Simon Sandstone, Eau Claire Silt, and Eau Claire Shale samples collected at the IBDP wells to investigate the geochemical interaction of rock, brine, and CO_2 (Carroll et al., 2013; Yoksoulian et al., 2014). The experiments were conducted under relevant reservoir conditions to identify the reaction mechanisms, kinetics, and solid-phase products that would be likely to occur when rock and brine are exposed to injected CO_2. The results of batch studies were also used to constrain the conceptual geochemical model, calibrate mean parameter values, and quantify parameter uncertainty in reactive-transport simulations.

The batch reactor experiments with Mt. Simon Sandstone generally indicated that limited dissolution of rock minerals occurs (Carroll et al., 2013; Yoksoulian et al., 2014; Shao et al., 2020). A decrease in pH occurs quickly in these experiments after CO_2 is introduced because of its dissolution into the brine and dissociation of carbonic acid. Reaction of the Mt. Simon Sandstone can be characterized by an increase in dissolved silicon (Si) and aluminium (Al) after the reaction, suggesting the dissolution of aluminosilicate minerals, such as feldspar and clay minerals.

The amount of mineral dissolution is limited, however, as the mass of Al that dissolved from the solid phase into aqueous phase accounted for less than 0.3% of total Al in the rock samples. The liquid to solid ratios in batch experiments were much higher than aquifer conditions suggesting that under aquifer conditions less than 0.002% of Al would be mobilized. Results from x-ray diffraction (XRD) analyses demonstrated the bulk mineral composition remained unchanged for all sandstone samples after reaction (1 to 4 months), indicating that the influence of rock-brine-CO_2 interaction on bulk rock composition was negligible.

Batch experiments introducing CO_2 to crushed Eau Claire Shale indicated mineral dissolution from Eau Claire samples were more significant than Mt. Simon Sandstone samples. This is likely, in part, due to the processing of rock samples to small fragments that increased the reactive surface area, thus accelerating mineral dissolution of Eau Claire Shale. The Eau Claire Shale, however, is a highly laminated, fissile shale to silty shale with the shaliest section near the base (above the Eau Claire Silt) and advective flow from the Mt. Simon Sandstone into the Eau Claire Shale is expected to be insignificant (Roy et al., 2014). Modeling of ionic diffusion into the Eau Claire Shale has also shown this to be insignificant (Roy et al., 2014).

Numerical simulations with PHREEQC 2.17.0 geochemical code (Carroll et al., 2013) suggested that the geochemical alteration of the Mt. Simon Sandstone and Eau Claire Shale can be modeled by incongruent dissolution of annite, illite, K-feldspar, and formation of montmorillonite, amorphous silica, and kaolinite. However, the formation of these secondary minerals was not confirmed with available characterization techniques.

Potential geochemical reactions at the Aster Project site were also modeled using Computer Modelling Group (CMG) Generalized Equation Model (GEM). A 27 layer model was constructed, and the four main expected mineral components and their percentages used in the model are based on Mt. Simon Sandstone core from VW#1 (Leetaru and Freiburg, 2014):

- Quartz (70 %).
- K-feldspar (20%).
- Illite (5%); and
- Illite-smectite (5%).

The modeling results indicate that potassium (K) feldspar precipitates and smectite dissolves over the 12-year injection period (Figure 46). There is little reaction with quartz or illite. Mineralization is negligible after 100 years post injection (50-year PISC and 50-years post-PISC period) and any change (reduction) in porosity is negligible during the injection period.

[redacted]

The geochemical modeling also predicted the main CO_2 trapping mechanisms. Figure 47 displays the evolution of the main trapping mechanisms during injection, PISC, and 50-years post-PISC periods. Initially, a large percentage of the CO_2 is structurally trapped. As the fluids gravity segregate, the amount of residual (immobile) gas increases. Dissolution of CO_2 into brine also begins at a slow rate. Dissociation of dissolved CO_2 into aqueous ions also occurs but only accounts for a small percentage of the trapping. Mineralization is negligible during this time period, as it is a slow process that generally takes hundreds or thousands of years to become a significant trapping mechanism. Table 11 indicates the trapping mechanisms and percentage of CO_2 trapped 100-years post-injection at the Aster Project site.

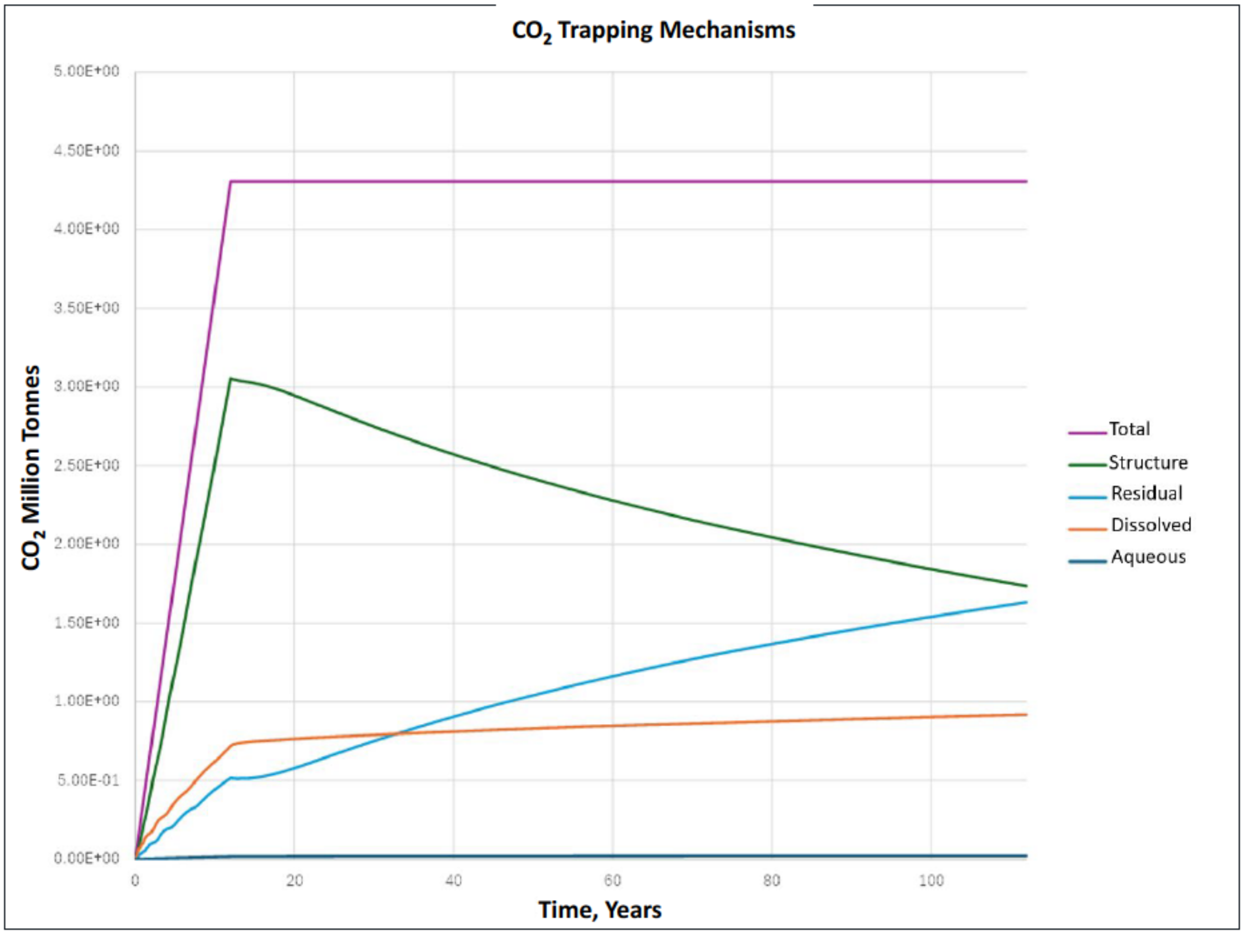

Figure 47: Graph of the relationships and evolution of CO_2 trapping mechanisms during 12 years of CO_2 injection followed by a 50-year PISC period and 50-years post-PISC at the Aster Project site.

[redacted]

2.11 Other Information (Including Surface Air and/or Soil Gas Data, if Applicable)

Attachment 05: Pre-operational Testing Program, (2024) presents the data that will be collected in order to determine and verify the depth, thickness, mineralogy, lithology, porosity, permeability, and geomechanical information of the injection zone, confining zone, and other relevant geologic formations via petrophysical logging and analysis, and core acquisition and testing. In addition, baseline 3D surface seismic data will be acquired during the pre-injection phase of the project to assist in the characterization of the injection zone and confining zone rock properties away from the project wells.

Currently, the project does not plan to acquire baseline atmospheric or soil gas data nor are there plans to pursue atmospheric or soil gas monitoring during the injection phase of the project.

2.12 Site Suitability *[40 CFR 146.83]*

2.12.1 Summary

The Mt. Simon Sandstone at the Aster Project site meets all requirements necessary to serve as a competent injection zone, and the site can sequester 359 ktpa of CO_2 over a 12-year period (approximately 4.31 Mt total) based on the geologic evaluation, static modeling, and computational modeling results (Attachment 02: AoR and Corrective Action Plan, 2024). The Eau Claire Shale at the project site has sufficient thickness, continuity, and low porosity and permeability to be a competent confining zone for the proposed volume of CO_2. The IBDP and ongoing commercial IL-ICCS project near Decatur, IL have each provided significant data that supports that the Mt. Simon/Eau Claire storage complex is highly suitable for long-term carbon sequestration.

Table 12 summarizes the properties of the Mt. Simon Sandstone that contribute to its suitability as an injection zone.

[redacted]

CO_2 plume development will likely be controlled by heterogeneities within the injection zone, and these heterogeneities will be characterized using a combination of well log, core, and 3D surface seismic data (Attachment 05: Pre-operational Testing Program, 2024). The AoR and Corrective Action Plan includes discussion of the capacity estimates for the injection zone (Attachment 02: AoR and Corrective Action Plan, 2024).

After extensive review of the publicly available well data, no wells penetrate the Eau Claire Shale confining zone within the AoR. The closest well (IGS ID 133725) that penetrates the Eau Claire Shale is a dry abandoned well with a TD of 3,167 fbgl located more than 12 miles from the injection well (*IGWS ID 133725*, 1982).

FEMA classifies the project site to have a very small probability of experiencing damaging earthquake effects and a low probability of experiencing annual flooding.

2.12.2 Primary Seal

[redacted]

2.12.3 Lowermost USDW

The base of the Silurian Pleasant Mills Formation overlying the Ordovician Maquoketa Group is the lowermost USDW at the project site and is expected to be more than 2,000 feet above the top of the Eau Claire Shale confining zone.

2.12.4 Secondary Confinement Strata

There are several secondary confining beds between the lowermost USDW and the Eau Claire Shale primary confining zone, including the Davis Formation, the basal portion of the Ancell Group, and the Maquoketa Group, which will prevent fluids from reaching the lowermost USDW should they migrate past the primary confining zone.

2.12.5 Structural Integrity

2D seismic data acquired for the project indicate there are no faults or fractures, or other natural conduits, which can be identified within the AoR that would allow injection zone fluid migration beyond the confining zone.

2.12.6 Capacity and Storage

The AoR and Corrective Action Plan show that the Mt. Simon Sandstone at the Aster Project Site storage location has the capacity and hydrogeologic characteristics necessary to store 359 ktpa of CO_2 over a period of 12-years (4.31 Mt total).

Computational modeling was used to simulate multiphase (brine and CO_2) flow in the subsurface and considered the injection zone geologic and hydrogeologic characteristics. The modeling included one injection well within the sequestration site and resulting AoR. CO_2 trapping mechanisms modeled include structural/stratigraphic trapping, residual phase trapping, and solubility trapping. The model showed that in the post-injection phase and beyond, the pressure front dissipates rapidly, and the CO_2 plume stabilizes and remains confined to the injection zone (Attachment 02: AoR and Corrective Action Plan, 2024).

2.12.7 Injection Zone and Compatibility with the Injectate

Studies using laboratory experiments and reactive transport modeling of the Mt. Simon Sandstone from the Illinois Basin suggest that there is minimal reactivity of the rock with brine and CO_2. experiments using Mt. Simon Sandstone core samples. These experiments suggest minor dissolution of aluminosilicate minerals such as feldspar and clay may occur, but the bulk of the mineralogy (i.e., quartz) is effectively inert. Results from XRD analyses indicated the bulk mineral composition remained unchanged for all sandstone samples after reaction and indicates that the influence of rock-brine-CO_2 interaction on bulk rock composition was negligible. Computational modeling indicates that smectite dissolution and K-feldspar precipitation may occur in the first 100 years of the project, but it would take hundreds of years to see any impact of mineral trapping.

The well casing, tubing, and cement used through the confining zone and injection zone will be CO_2 resistant (Attachment 04: Injection Well Construction Plan, 2024).

3. AoR and Corrective Action

Computational modeling has delineated the AoR for the Aster Project shown in Figure 1. The AoR and Corrective Action module (Attachment 02: AoR and Corrective Action Plan, 2024) provides a detailed summary of the modeling parameters. After a thorough review of all identified wells in the region, it has been determined that there are no wells within the AoR that penetrate the confining zone, and there are no requirements for corrective action [40 CFR 146.82(c)(2)]. The closest well (Light Norman R #1-17) that penetrates the Eau Claire Shale is a dry abandoned well with a TD of 3,167 fbgl located more than 12 miles from the injection well (IGWS).

During AoR re-evaluations, the position of any additional wells will be assessed, and the requirement for corrective action will be addressed according to the results of the re-evaluation [40 CFR 146.82(c)(1-3)].

Further detail on the corrective action(s) is provided in the AoR and Corrective Action document (Attachment 02: AoR and Corrective Action Plan, 2024).

AoR and Corrective Action GSDT Submissions
GSDT Module: AoR and Corrective Action ***Tab(s):*** All applicable tabs Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Tabulation of all wells within AoR that penetrate confining zone ***[40 CFR 146.82(a)(4)]*** ☒ AoR and Corrective Action Plan *[40 CFR 146.82(a)(13) and 146.84(b)]* ☒ Computational modeling details ***[40 CFR 146.84(c)]***

4. Financial Responsibility

The financial assurance estimation for the project was divided into four components:

1) Corrective Action,
2) Injection Well Plugging and Abandonment,
3) Post-injection Site Care and Closure, and
4) the Emergency and Remedial Response Plan (ERRP).

[redacted]

Internal estimates and external vendor quotes were used to assemble the estimates for the first three components. All appropriate quotes that were provided from vendors are provided with the submittal documentation. The cost estimate for the ERRP was developed in tandem with Industrial Economics (IEc). Their full report is provided with the Financial Assurance Plan (Attachment 03: Financial Assurance Plan, 2024).

Financial Responsibility GSDT Submissions
GSDT Module: Financial Responsibility Demonstration ***Tab(s):*** Cost Estimate tab and all applicable financial instrument tabs Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Demonstration of financial responsibility ***[40 CFR 146.82(a)(14) and 146.85]***

5. Injection Well Construction

The injection well (AST INJ1) proposed in this application will be constructed as a new well that will terminate in the Precambrian basement. The Mt. Simon Sandstone, the injection zone for the project, is a thick sandstone which directly overlies the Precambrian basement. The Eau Claire Shale, which overlies the Mt. Simon Sandstone, is approximately 481 feet thick and serves as the primary confining zone for the project.

Vault GSL CCS Holdings LP plans to drill the deep monitoring well (AST OBS1) into the Precambrian basement in order to collect characterization data at the top of the basement. AST INJ1 will also be drilled into the Precambrian basement in order to identify the top of the basement. AST INJ1 will also be used to collect most of the pre-operational testing data for the project.

Vault GSL CCS Holdings LP intends to use materials for the construction (casing, cement, etc.) that are verified by independent third-party sources as suitable for the worst-case corrosive and operational loads expected to occur during the life of the project (AMPP, 2023). This suitability is discussed further in Section 5.5 *Construction Materials Suitability*. All work will be performed in accordance with guidance documents, approved work plans, and reporting timelines as approved by the EPA. AST INJ1 will be constructed with multiple casing strings. Each string will be smaller in diameter than the previous string and cemented to surface to provide multiple layers of protection for USDWs.

The wellhead will use appropriately sized components and materials of construction based on the build of the wellbore. The wellhead will vary depending on whether the intermediate casing contingency section is needed or not. Following installation of the long string casing and cement, the casing shoe will be drilled out and the well will be drilled out to the basement to collect characterization data. Once the basement characterization data has been collected, the open basement sections of both wells will be plugged back to the injection zone using CO_2-resistant cement. This will be performed as part of the completion of the well.

This section of the document summarizes the methods and materials to be used for the construction of the injection well. Schematics of the well that illustrate its construction and wellhead are provided in Attachment 04: Injection Well Construction Plan (2024). Please note that these schematics are not meant to portray final products and are subject to change pending availability of materials listed and the completion of well installation.

5.1 Proposed Stimulation Program [40 CFR 146.82(a)(9)]

It is not anticipated that an initial stimulation will need to be performed on the well after its completion.

Intermediate stimulations during the life of the project may be required based on well conditions and performance. For instance, near-wellbore salt precipitation may cause a reduction in well performance. The requirements and methods of stimulation will be identified through the evaluation of well performance over time. The necessary notification will be provided to the EPA prior to any field mobilization. Within this notification, detail on the proposed procedure, equipment, and chemicals to be used will be provided.

A list of some of the common remediation techniques that may be deployed in the future has been listed below. Note this list is not exhaustive and additional technologies or treatments may be used.

- Matrix acid stimulation,
- Coil tubing chemical stimulation,
- Coil tubing mechanical stimulation,
- Coil tubing stimulation with a salt water flush,
- Perforations.

All treatments will be performed at pressures under the fracture pressure of the Mt. Simon Sandstone in order to prevent the development of fractures and to ensure that containment is maintained. Calculations to determine safe working pressures during stimulation operations will be determined prior to any work and be strictly enforced while stimulation operations are carried out.

Potential additives to stimulations may include but are not limited to dilute concentration hydrochloric (HCl) acid, dilute mud acid (HCl and hydrofluoric acids), citric acid, scale reducer, defoamers, or saline solution (potassium chloride or other non-reactive mineral solution). Prior to the use of any acids, additives, or other stimulation fluid, analysis of the drill cuttings and/or core may be performed to ensure compatibility between any solutions and the Mt. Simon Sandstone.

5.2 Construction Procedures [40 CFR 146.82(a)(12)]

Multiple strings of carbon steel and 25-Chrome (25Cr), specifically 25-Chrome L80 (25Cr80), casing will be installed and cemented in place to protect the USDWs and other strata overlying the injection zone. Fluids will be injected into the Mt. Simon Sandstone using internally coated carbon steel tubing landed in a nickel or chrome-coated packer. The Mt. Simon Sandstone will be accessed for injection through [redacted] within the Lower Mt. Simon Sandstone.

The injection well is designed such that monitoring equipment is located in a manner that makes it easily accessible and retrievable should failure occur. Downhole gauges are currently planned to be landed in a mandrel above the packer. The lines from these gauges will be run back up the casing-tubing annulus through a port in the wellhead. The mandrel and port will be properly rated for the anticipated pressure loading to be experienced downhole and at the wellhead.

Table 13 provides a summary of the openhole sections of the injection well construction. Vault GSL CCS Holdings LP may elect to utilize an intermediate hole section and intermediate casing to mitigate the potential for lost circulation pending operational results from drilling AST OBS1.

[redacted]

A high-level procedure is provided below. A detailed procedure will be provided prior to any field activities.

[redacted]

Should a lost circulation zone be encountered while drilling, all attempts will be made to successfully cure the loss circulation. Should those efforts be unsuccessful, a contingency intermediate casing string will be installed. These efforts would take place between steps 6 and 7 above. Further details on the casing and cementing for this string are provided in Section 5.3 *Casing and Cementing*. Schematics for the design are provided in (Attachment 04: Injection Well Construction Plan, 2024).

Specifications on the tools, equipment, casing, cement, and other things are provided in more detail in the following sections. All materials of construction are designed to API standards and are intentionally chosen to maximize protection from corrosive loading. Each item is suitably rated for the corrosive and pressure loading it will experience.

5.3 Casing and Cementing

5.3.1 Casing

Table 14 and Table 15 display the safety factors and safety factor loads based on the proposed well design. It is noted that a standard 80% derating factor for new pipe was applied prior to any analyses. This implies there is an additional 1.20 safety factor on top of those displayed in Table 14. The safety factor is determined by dividing the pipe rating by the calculated load. Additionally, material and specification derating based on tensile loading has also been considered for the collapse analysis. For purposes of this application, three scenarios were considered for the casing analysis.

The burst analysis scenario considers the impact of the plug bump and preset holding pressure following the full pumping of cement. Note that the preset holding pressure is typically 500 psi over the hydrostatic pressure required to pump the cement or 80% of the burst rating of the pipe, whichever is less.

The collapse analysis scenario considers the impact of having a full column of cement on the annulus side of the casing following the bleeding off of pressure utilized to hold the plug in place following the full pumping of cement. Note that this analysis includes the derating of the collapse rating of the pipe when in tension.

The tensile analysis scenario considers the impact of a 100,000-pound overpull on the casing string. Overpull is defined as the pulling weight less the weight of the pipe. Note that this scenario will typically occur prior to any cement being pumped and hydrostatic differences in fluid have not been considered.

The tubing burst analysis consisted of analyzing the burst loading during injection operations at the surface, where the tubing-annulus differential is at its greatest. The point that was utilized for the analysis was the Maximum Allowable Injection Pressure (MAIP) at surface. Details on the determination of this pressure are provided in Section 7.1.1 *Determination of Maximum Injection Pressure*.

The tubing collapse analysis consisted of estimating the collapse loading during a modeled annulus pressure test (APT), which will be run during static (in this case 0 wellhead pressure) conditions with 1,500 psi on the annulus. In this scenario the maximum collapse load will be experienced at the packer.

The tensile analysis on the tubing was performed in a similar manner as the casing, with the exception of the analyzed tensile load being a 75,000-pound overpull.

The resulting safety factor from these analyses are presented in Table 14. In addition to these analyses, operational, cyclic, and temperature loading analyses were performed. These are discussed in greater detail in Section 5.5 *Construction Materials Suitability*. Table 16 displays the setting depths and specifications of the casing to be used for the well. All casing conforms with API specifications. Table 17 shows the design parameters of the casing and tubing to be used for the well.

Details on the cement program are provided in Section 5.3.2 *Cementing*. All cement used conforms with API standards. Corrosion resistant cement will be used from the bottom of the long string in the Mt Simon Sandstone to above the top of the Eau Claire Shale.

Mechanical integrity will be demonstrated as part of the initial completion, and as needed during injection operations as discussed in Attachment 05: Pre-operational Testing Program, (2024) and Attachment 06: Testing and Monitoring, (2024).

All materials for the construction will be suitable for the anticipated loading and are not anticipated to decrease in suitability over time.

Table 14: Casing safety factors for design.

Burst	Collapse	Tensile
1.2	1.2	1.5

[redacted]

[redacted]

[redacted]

5.3.2 Cementing

Table 18 provides a summary of the cement systems that will be used on the casing strings during the injection well construction. This table also provides details on the systems for the contingency intermediate string. All cement systems used will conform with API standards where applicable. Note that the excess cement pumped is subject to change pending field results.

Cement will be pumped with the following excess:

- Surface: 100% open-hole excess
- Intermediate (contingency): 50% open-hole excess
- Long string: 30% open-hole excess

Vault GSL CCS Holdings LP plans to use CO_2 resistant cement for the lower portion of the long string section. One CO_2 resistant cement option is EverCRETE CO_2-resistant cement system from SLB. These systems are stable in extreme acidic conditions, highly resistant to the CO_2 stream and formation fluids in the Mt. Simon Sandstone, and of sufficient quality to maintain integrity over the design life of the injection well. Note that if the EverCRETE system is not used, an equivalent alternative will be.

[redacted]

The surface casing cement system will provide the required isolation of the lowermost USDW from the drilling process for the remainder of the well installation and serve as an additional layer of protection to prevent contamination from the CO_2 or formation fluids from the Mt. Simon Sandstone. The lowermost USDW is currently anticipated to be the Pleasant Mills Formation, with the base considered to be the top of the directly underlying Maquoketa Group.

The intermediate casing cement system, if used, will provide isolation from any potential lost circulation zone, and serve as an additional layer of protection to prevent upward migration of CO_2 or injection zone fluids.

The long string cement system will provide the primary isolation for injected CO_2 or injection zone fluids from formations above the injection zone.

The quality of the bond between the cement, casing, and borehole for all hole sections, will be verified by the cased hole logs that will be run after each string of casing is cemented in place (Attachment 05: Pre-operational Testing Program, 2024).

5.4 Tubing and Packer Specifications

The tubing will be internally coated 4-inch L80 pipe designed for CO_2 service. An example of a CO_2 service coating is National Oilwell Varco (NOV) Tuboscope™, TK-15XT, which is used in CO_2 floods for enhanced oil recovery (EOR). Material specifications and suitability for use were determined from material provided by NOV (*Tuboscope Coatings Spec Sheet*, 2022).

The injection packer will use CO_2 resistant materials for the CO_2-wet surfaces. An example of this type of packer is the Baker Hughes' Signature F™ Injection packer system. The packer can be used with either a retrievable or permanent configuration and will be made of 25Cr or a nickel alloy to resist corrosion effects of the CO_2 stream (Baker Hughes, 2021).

Tubing and packer setting depths and materials of construction are detailed in Table 19.

[redacted]

5.5 *Construction Materials Suitability*

This section discusses the application of the design ratings to ensure the suitability of the construction materials for this project in addition to the analyses performed in Section 5.3 *Casing and Cementing*.

Consistent with Section 5.3 *Casing and Cementing*, all tubulars have been derated to 80% of their initial ratings. All comparative evaluations detailed in this section are in reference to these derated values.

The injection packer to be used will have a differential rating of 10,000 psi and a max load rating of 80,000 pound-force.

5.5.1 Temperature

[redacted]

5.5.2 Injection Pressure

[redacted]

[redacted]

5.5.3 Annulus Pressure

[redacted]

5.5.4 Formation Pressure

[redacted]

[redacted]

5.5.5 Tensile Loading

[redacted]

5.5.6 Cyclic Loading

[redacted]

[redacted]

5.5.7 Corrosion Loading

[redacted]

5.5.8 Operational Considerations

Permanent downhole gauges will be used to monitor pressure and temperature at the packer. These gauges will be located in a gauge mandrel above the packer and will transmit data through a wire that is run up the annulus to the surface SCADA system. This mandrel and port will be properly rated for the anticipated pressure loading to be experienced downhole and at the wellhead.

Tubulars have been designed such that logging tools and other equipment that are needed for routine annual monitoring will be able to pass through with no restrictions.

6. Pre-operational Logging and Testing

Details on the Pre-operational Testing Program are provided in the relevant section of this permit application (Attachment 05: Pre-operational Testing Program, 2024).

Pre-Operational Logging and Testing GSDT Submissions
GSDT Module: Pre-Operational Testing ***Tab(s):*** Welcome tab Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Proposed pre-operational testing program ***[40 CFR 146.82(a)(8) and 146.87]***

7. Well Operation

This section is meant to provide a brief overview of the well operation conditions. The operational parameters for AST INJ1 provided in Table 20 will be monitored continuously.

[redacted]

7.1 Operational Procedures [40 CFR 146.82(a)(10)]

Table 21 displays the parameters that will be used during injection operations. Details on the methods of calculations and inputs for these values are provided in Section 7.1.1 *Determination of Maximum Injection Pressure*. Values provided in this table are designed to stay below the critical fracture pressure and manage the pressure loading experienced during operations in order to protect equipment. It is not anticipated that significant deviation from these values will occur during the life of the project.

[redacted]

7.1.1 Determination of Maximum Injection Pressure

[redacted]

[redacted]

The annular pressure operations will be performed as follows:

1. When the well is started up, annulus pressure will be allowed to rise to 500 psi. At this point, the pressure will be bled off until the pressure reaches 100 psi.
2. This process will be repeated until the annulus liquid comes to thermal equilibrium.
3. Pressure will then be monitored as the injection operations continue. Pressure will be allowed to fluctuate freely during steady state injection.
4. Pressure alarm set points will be at:
    a. 1,250 psi for the high alarm
    b. 1,500 psi for the high-high emergency shut down
    c. 0 psi for the low alarm
    d. -5 psi for the low-low emergency shut down.
5. Should a high or low alarm occur, the occurrence will be noted in daily logs.
6. Should a shut-down event occur, the well will be shut-in, and the cause of the shut-down event will be investigated by the operator.

This method of monitoring annulus pressure will allow for detection of the following potential problems:

- A tubing to casing leak
- A packer leak
- A casing to formation leak
- A wellhead leak

Any time the annulus is blown down and fluid is removed, the volume of fluid removed from the annulus will be measured.

7.1.3 Potential Future Variation in Operational Parameters

Aster Project does not anticipate any variations from the current operational parameters outlined in Section 7.1 *Operational Procedures*. Should variations occur which would necessitate any changes to those parameters, EPA Region 5 would be consulted prior to making any such changes.

7.2 Proposed CO_2 Stream [40 CFR 146.82(a)(7)(iii) and (iv)]

The CO_2 injection stream will be sourced from the POET ethanol production facility located in Madison County, Indiana and is anticipated to have the fluid composition as shown in Table 22. Vault GSL CCS Holdings LP will analyze the CO_2 stream during the injection phase of the project to provide data representative of its chemical characteristics and to meet the requirements of 40 CFR 146.90 (a). Details on the testing and monitoring of the CO_2 stream are provided in Attachment 06: Testing and Monitoring (2024). Additional details on technical standards, QA/QC policy, sample collection and storage policies, and analytical methods are provided in the Quality Assurance and Surveillance Plan (Attachment 10: Quality Assurance and Surveillance Plan, 2024).

The CO_2 stream produced from the POET ethanol production facility will be of high purity based on the nature of the ethanol fermentation process. The CO_2 stream from ethanol fermentation typically exceeds 99 % CO_2 (mole basis), with minor impurities including common atmospheric gases (ex: O_2, N_2) and H_2O. The stream will be dehydrated to a low water content prior to entering the flowline for injection.

Quarterly sampling and analysis of the CO_2 injection stream will be performed to track the composition of the stream.

[redacted]

8. Testing and Monitoring

Testing and Monitoring GSDT Submissions
GSDT Module: Project Plan Submissions **Tab(s):** Testing and Monitoring tab Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Testing and Monitoring Plan [40 CFR 146.82(a)(15) and 146.90]

This section is meant to provide a brief overview of the Testing and Monitoring Plan. Further details on this plan are provided in Attachment 07: Testing and Monitoring (2024).

The Aster Project uses a risk-based Testing and Monitoring Plan that includes operational, verification, and assurance monitoring components that meet the regulatory requirements of 40

CFR 146.90. This Testing and Monitoring Plan is based on experience gained from other approved Class VI projects, as well as geologic evaluation and computational modeling.

Goals of the monitoring strategy include, but are not limited to:

- Fulfillment of the regulatory requirements of 40 CFR 146.90,
- Protection of USDWs,
- Risk mitigation over the life of the project,
- Confirmation that AST INJ1 is operating as planned while maintaining mechanical integrity,
- Acquisition of data to validate and calibrate the models used to predict the distribution of CO_2 within the injection zone, and
- Support AoR re-evaluations over the course of the project.

The Testing and Monitoring Plan will be adaptive over time, and is subject to alteration should one of the following potential scenarios occur:

- Project risks evolve over the course of the project outside of those envisioned at the beginning of the project,
- Significant differences between the monitoring data and predicted computational modeling results are identified,
- Key monitoring techniques indicate anomalous results related to well integrity or the loss of containment.

The monitoring activities fall within three categories based on project objectives: operational, verification, and assurance monitoring:

- ***Operational monitoring*** focuses on day-to-day injection operations such as system performance.
- ***Verification monitoring*** confirms that the injected CO_2 remains contained within the selected storage zone. The CO_2 plume and pressure front development are tracked over time to provide data for model calibration. Integration of verification monitoring data into project models allows the project to demonstrate conformance between the computational modeling and the testing and monitoring data collected during the operations and post injection phases of the project's lifecycle.
- ***Assurance monitoring*** is performed at surface and near-surface (i.e., soil, shallow groundwater, USDWs, etc.) to monitor for any changes from baseline sample data that might indicate CO_2 or injection zone fluid migration towards surface.

The three monitoring categories encompass:

- Well operations,
- Containment,
- Non-endangerment of USDWs,
- Capacity,
- Injectivity,
- Injection pressure, and
- Conformance.

Table 23 provides of summary of the general monitoring strategy with subcategories.

[redacted]

9. Injection Well Plugging

During the PISC period, the injection well will be permanently plugged and abandoned (Attachment 08: Post-injection Site Care and Site Closure, 2024). Details on the methods of these operations are provided in Attachment 08: Injection Well Plugging Plan (2024). The methods and procedures presented in the attachment are consistent with industry standards and the requirements detailed in 40 CFR 146.92. All materials to be used for the plugging and abandonment are suitable for the anticipated corrosive loading below the top of the Eau Claire Shale. Above the top of the Eau Claire Shale, the materials are standard construction materials and will conform to the API specifications.

Injection Well Plugging GSDT Submissions
GSDT Module: Project Plan Submissions ***Tab(s):*** Injection Well Plugging tab Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Injection Well Plugging Plan [40 CFR 146.82(a)(16) and 146.92(b)]

10. Post-injection Site Care and Closure

The requested documents listed below have been included in the file submission (Attachment 08: Post-injection Site Care and Site Closure, 2024). These documents address the rule requirements for the EPA citations. The Aster Project is not requesting an alternative PISC timeframe.

PISC and Site Closure GSDT Submissions
GSDT Module: Project Plan Submissions ***Tab(s):*** PISC and Site Closure tab Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ PISC and Site Closure Plan [40 CFR 146.82(a)(17) and 146.93(a)]
GSDT Module: Alternative PISC Timeframe Demonstration ***Tab(s):*** All tabs (only if an alternative PISC timeframe is requested) Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☐ Alternative PISC timeframe demonstration ***[40 CFR 146.82(a)(18) and 146.93(c)]***

11. Emergency and Remedial Response

The requested documents listed below have been included in the file submission (Attachment 09: Emergency and Remedial Response Plan, 2024). These documents address the rule requirements for the above EPA citations.

Emergency and Remedial Response GSDT Submissions
GSDT Module: Project Plan Submissions ***Tab(s):*** Emergency and Remedial Response tab Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Emergency and Remedial Response Plan *[40 CFR 146.82(a)(19) and 146.94(a)]*

12. Injection Depth Waiver and Aquifer Exemption Expansion

The Aster Project does not intend to apply for a Depth Waiver or Aquifer Exemption. As such, no supplemental documents have been filed.

Injection Depth Waiver and Aquifer Exemption Expansion GSDT Submissions
GSDT Module: Injection Depth Waivers and Aquifer Exemption Expansions ***Tab(s):*** All applicable tabs Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☐ Injection Depth Waiver supplemental report ***[40 CFR 146.82(d) and 146.95(a)]*** ☐ Aquifer exemption expansion request and data ***[40 CFR 146.4(d) and 144.7(d)]***

13. Optional Additional Project Information

A review of the National Wild and Scenic River System database indicates that no designated wild and scenic rivers exist in Indiana. The Aster Project, located in northern Madison County, Indiana, will not impact any designated wild and scenic rivers (National Information Services Center and National Park Service, 2023; National Wild and Scenic Rivers System.).

A review of Nationwide Rivers Inventory (NRI) river segments was undertaken because NRI river segments are potential candidates for inclusion in the National Wild and Scenic River System. The NRI identifies a large tributary of the Wabash River; White River, West Fork; in southern Madison County, Indiana to have outstandingly remarkable value for fish, historic, wildlife, and other. The White River, West Fork does not extend into the Aster Project AoR in northern Madison County, so the project will not impact this NRI river (National Park Service).

Indiana's Scenic River System has designated three streams for inclusion in the Natural, Scenic and Recreational River System. None of the Indiana Scenic River System designated streams occur within Madison County, so no impacts to Scenic River System streams will occur (Indiana DNR, State Parks, 2022).

There are no National Register Historic Districts or National Register Historic Sites within the Aster Project AoR. The nearest historic site is located over 2.8 miles north of AST INJ1 (National Park Service).

Indiana Historic Sites and Structures Inventory (IHSSI) County Survey Program identifies one historic site, a farm, within the Aster Project AoR and is over 0.5 mile from the proposed injection well so the project will not impact this site. The Cemetery Registry indicates one cemetery, Mt. Pisgah Cemetery, located within the AoR approximately 0.8 miles southeast of the injection well. It is not expected that the cemetery will be impacted by the project (Indiana DNR, Historic Preservation & Archaeology, 2021).

The Aster Project well site will be located on private land previously disturbed by agriculture. A cursory desktop review indicates archaeological sites and previously conducted surveys within the AoR (Atwell, 2024). However, there are no known archaeological sites in the immediate vicinity of the well pad location.

On June 7, 2024, a review of the US Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) system identified threatened or endangered, candidate, or proposed species potentially affected by the Aster Project (Table 24).

Table 24: Threatened or endangered, candidate, or proposed species potentially affected by the Aster Project (USFWS, 2024)

Name	Federal Status	Critical Habitat
Indiana Bat	Endangered	Proposed location does not overlap critical habitat.
Northern Long-eared Bat	Endangered	No critical habitat designated.
Tricolored Bat	Proposed Endangered	No critical habitat designated.
Whooping Crane	Experimental non-essential	No critical habitat designated.
Monarch Butterfly	Candidate	No critical habitat designated.

The IPaC information page for the Northern Long-eared Bat and Tricolored Bat indicates those species only need to be considered for projects that include wind turbine operations, which is not the case for the Aster Project. The AoR does not overlap critical habitat for identified species so potential effects to habitat are not expected to be analyzed (USFWS, 2024).

IPaC indicates no documented cases of eagles being present within the AoR. Eagles are protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act

(MBTA). There are no migratory birds of conservation concern, under the MBTA, expected to occur in the AoR (USFWS, 2024).

There is potential to encounter threatened or endangered (T&E) flora or fauna for Madison County within the project AoR. The Indiana County Endangered, Threatened and Rare Species List for Madison County includes the T&E flora and fauna listed in Table 25. State special concern, state significant, and state rare species also exist within Madison County but are not included in this discussion (IDNR, 2024). Habitat assessments may be needed to identify potential suitable habitat for state-listed species within the AoR.

The Aster Project is located in inland Indiana, far from coastal zones, thus project activities will not affect any coastal zones.

Table 25: Threatened and endangered flora and fauna of Madison County, Indiana

Species Name	Common Name	State Status
Mollusk: Bivalvia (Mussels)		
Epioblasma rangiana	northern riffleshell	State endangered (SE)
Plethobasus cyphyus	sheepnose	SE
Pleurobema clava	clubshell	SE
Theliderma cylindrica	rabbitsfoot	SE
Villosa fabalis	rayed bean	SE
Reptile		
Clonophis kirtlandii	Kirtland's snake	SE
Bird		
Botaurus lentiginosus	American Bittern	SE
Lanius ludovicianus	loggerhead shrike	SE
Nycticorax nycticorax	Black-crowned Night-heron	SE
Rallus elegans	King Rail	SE
Vermivora chrysoptera	Golden-winged Warbler	SE
Vascular Plant		
Deschampsia cespitosa	tufted hairgrass	State threatened (ST)
Eriophorum gracile var. gracile	slender cotton-grass	ST
Hypericum pyramidatum	great St. John's-wort	ST
Juglans cinerea	butternut	ST
Lithospermum parviflorum	shaggy false-gromwell	SE
Magnolia acuminata	cucumber magnolia	SE
Poa paludigena	bog bluegrass	ST
Spiranthes lucida	shining ladies'-tresses	ST

14. References

AMPP, 2023, Guideline for Materials Selection and Corrosion Control for CO2 Transport and Injection, AMPP Guide 21532–2023.

Atekwana, E. A., 1996, Precambrian basement beneath the central Midcontinent United States as interpreted from potential field imagery, *in* B. A. van der Pluijm, and P. A. Catacosinos, eds., Basement and basins of eastern North America: Geological Society of America (GSA), p. 33–44, doi:10.1130/0-8137-2308-6.33.

Attachment 02: AoR and Corrective Action Plan, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Attachment 03: Financial Assurance Plan, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Attachment 04: Injection Well Construction Plan, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Attachment 05: Pre-operational Testing Program, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Attachment 06: Testing and Monitoring, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Attachment 07: Injection Well Plugging Plan, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Attachment 08: Post-injection Site Care and Site Closure, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Attachment 09: Emergency and Remedial Response Plan, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Attachment 10: Quality Assurance and Surveillance Plan, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Atwell, 2024, Critical Issues Analysis - POET Alexandria Pipeline Project, Madison and Delaware Counties, Indiana, Atwell Project No. 24001390.

Baker Hughes, 2021, Signature Series F Retainer Production Packer Brochure: Baker Hughes Company.

Baranoski, M. T., 2007, Is the Cambrian Mount Simon a regional “blanket sandstone” across Ohio? AAPG Annual Convention and Exhibition.

Baranoski, M. T., S. L. Dean, J. L. Wicks, and V. M. Brown, 2009, Unconformity-bounded seismic reflection sequences define Grenville-age rift system and foreland basins beneath the Phanerozoic in Ohio: Geosphere, v. 5, no. 2, p. 140–151, doi:10.1130/GES00202.1.

Becker, L. E., A. J. Hreha, and T. A. Dawson, 1978, Pre-Knox (Cambrian) stratigraphy in Indiana: State of Indiana Department of Natural Resources Geological Survey Bulletin, v. v. 57, p. 1–72.

Bickford, M. E., W. R. Van, and I. Zietz, 1986, Proterozoic history of the midcontinent region of North America: Geology, v. 14, no. 6, p. 492–496, doi:10.1130/0091-7613(1986)14<492:PHOTMR>2.0.CO;2.

Bowen, B. B., R. I. Ochoa, N. D. Wilkens, J. Brophy, T. R. Lovell, N. Fischietto, C. R. Medina, and J. A. Rupp, 2011, Depositional and diagenetic variability within the Cambrian Mount Simon Sandstone: Implications for carbon dioxide sequestration: Environmental Geosciences, v. 18, no. 2, p. 69–89, doi:10.1306/eg.07271010012.

Bradbury, J. C., and E. Atherton, 1965, The Precambrian Basement of Illinois, Circular 382: Illinois State Geological Survey, 13 p.

Braile, L. W., W. J. Hinze, G. R. Keller, E. G. Lidiak, and J. L. Sexton, 1986, Tectonic development of the New Madrid rift complex, Mississippi embayment, North America: Tectonophysics, v. 131, no. 1, p. 1–21, doi:10.1016/0040-1951(86)90265-9.

Carroll, S., W. McNab, Z. Dai, and S. Torres, 2013, Reactivity of Mt. Simon Sandstone and the Eau Claire Shale under CO2 storage conditions: Environment Science Technology, p. 252–261.

Cleveland-Cliffs Steel Corporation, 2021, Underground Injection Control Permit to Operate Class I Hazardous Well; Ohio Permit UIC 05-09-001-PTO-I, Ohio Permit UIC 05-09-001-PTO-I: Ohio Environmental Protection Agency Division of Drinking and Ground Waters.

Dart, R. L., and M. C. Hansen, 2008, Earthquakes in Ohio and Vicinity 1776-2007: U.S. Geological Survey, Open-File Report 2008-1221.

Davila, G., L. Dalton, D. M. Crandall, C. Garing, C. J. Werth, and J. L. Druhan, 2020, Reactive alteration of a Mt. Simon Sandstone due to CO2-rich brine displacement: Geochimica et Cosmochimica Acta, v. 271, p. 227–247.

Dean, S. H., 2010a, Bedrock Aquifer Systems of Madison County, Indiana: Indiana Department of Natural Resources, Division of Water, Aquifer Systems Map.

Dean, S. H., 2010b, Unconsolidated Aquifer Systems of Madison County, Indiana: Indiana Department of Natural Resources, Division of Water, Aquifer Systems Map.

Denny, F. B., W. J. Nelson, J. R. Breeden, and R. C. Lillie, 2020, Mines in the Illinois portion of the Illinois-Kentucky Fluorspar District: Circular no. 604.

Dickas, A. B., M. G. Mudrey Jr., R. W. Ojakangas, and D. L. Shrake, 1992, A possible southeastern extension of the Midcontinent Rift System located in Ohio: Tectonics, v. 11, no. 6, p. 1406–1414, doi:10.1029/91TC02903.

Drahovzal, J. A., D. C. Harris, L. H. Wickstrom, D. Walker, M. T. Baranoski, B. Keith, and L. C. Furer, 1992, THE EAST CONTINENT RIFT BASIN: A NEW DISCOVERY, Special Report 18: Kentucky Geological Survey, Series XI.

Droste, J. B., and J. B. Patton, 1985, Lithostratigraphy of the Sauk Sequence: Bloomington: Indiana Geological Survey, Occasional Paper, v. 47, p. 24.

Droste, J. B., and R. H. Shaver, 1983, Atlas of Early and Middle Paleozoic paleogeography of the southern Great Lakes area: Bloomington: Indiana Department of Natural Resources, Indiana Geological Survey.

DuBois, E. P., 1945, Subsurface relations of the Maquoketa and" Trenton" formations in Illinois: Illinois State Geological Survey Report of Investigations 105.

FEMA, n.d., National Flood Hazard Layer: <https://www.fema.gov/flood-maps/national-flood-hazard-layer> (accessed April 27, 2023).

Fenelon, J. M., K. E. Bobay, T. K. Greeman, M. E. Hoover, D. A. Cohen, K. K. Fowler, M. C. Woodfield, and J. M. and Durbin, 1994, Hydrogeologic Atlas of Aquifers in Indiana, USGS Numbered Series 92–4142: Reston, VA, U.S. Geological Survey, Water-Resources Investigations Report, doi:10.3133/wri924142.

Fitzwater, S. A., and A. G. Dunkman, 2007, Unconsolidated Aquifer Systems of Wabash County, Indiana: Indiana Department of Natural Resources, Division of Water, Aquifer Systems Map.

Freeman, L., 1953, Regional subsurface stratigraphy of the Cambrian and Ordovician in Kentucky and vicinity: Kentucky Geological Survey, 12,352 p.

Freiburg, J. T., D. G. Morse, H. E. Leetaru, R. P. Hoss, and Q. Yan, 2014, A Depositional and Diagenetic Characterization of the Mt. Simon Sandstone at the Illinois Basin-Decatur Project Carbon Capture and Storage Site, Decatur, Illinois, USA, Circular 584: Illinois State Geological Survey, Prairie Research Institute, University of Illinois, 73 p.

Freiburg, J. T., R. W. Ritzi, and K. S. Kehoe, 2016, Depositional and diagenetic controls on anomalously high porosity within a deeply buried CO2 storage reservoir—The Cambrian Mt. Simon Sandstone, Illinois Basin, USA: International Journal of Greenhouse Gas Control, v. 55, p. 42–54, doi:10.1016/j.ijggc.2016.11.005.

Gollakota, S, and S. McDonald, 2014, Commercial-scale CCS Project in Decatur, Illinois - Construction Status and Operational Plans for Demonstration: Energy Procedia, p. 5986–5993.

Gollakota, S., and S. McDonald, 2014, Commercial-scale CCS Project in Decatur, Illinois–Construction Status and Operational Plans for Demonstration, *in* Energy Procedia, Austin, Texas: Energy Procedia, p. 5986–5993.

Gray, 1989, Deposits of Holocene Age.

Gray, H. H., 1972, Lithostratigraphy of the Maquoketa Group (Ordovician) in Indiana: Bloomington, Ind, State of Indiana. Geological Survey. Special report 7, 31 p.

Gray, H. H., 2000, Physiographic Divisions of Indiana, Special Report 61: Bloomington, Indiana, Indiana Geological Survey.

Gray, W. E., and J. C. Steinmetz, 2015, Map showing known faults and historic earthquake epicenters having magnitude 3.0 and larger in Indiana: Bloomington, IN, Indiana Geological Survey, Miscellaneous Map.

Green, M. R., 2018, Geophysical Exploration of the Upper Crust Underlying North-Central Indiana: New Insight into the Eastern Granite-Rhyolite Province: Wright State University.

Greenberg, S. E., 2021, Illinois Basin-Decatur Project Final Report: An Assessment of Geologic Carbon Sequestration Options in the Illinois Basin: Phase III: United States Department of Energy.

Greenberg, S., S. Whittaker, and K. O'Brien, 2022, Carbon Capture, Utilization, and Storage in Illinois: Prairie Research Institute, 94 p.

Gupta, N., 1993, Geologic and fluid-density controls on the hydrodynamics of the Mt. Simon Sandstone and overlying geologic units in Ohio and surrounding states: The Ohio State University, 266 p.

Gutstadt, A. M., 1958, Cambrian and Ordovician stratigraphy and oil and gas possibilities in Indiana: Indiana Department of Conservation Geological Survey Bulletin, v. 14, p. 103.

Hester, N. C., J. R. Hill, T. Fleck, P. Gerth, C. Smith, H. Stephenson, and B. Keith, 1998, Underground Storage of Natural Gas in Indiana, Special Report 59: Bloomington, Indiana, Indiana Geological Survey.

IDNR, n.d., Best Available Flood Hazard Layer: Indiana Department of Natural Resources, Division of Water.

IDNR, 2024, Indiana Endangered Threatened & Rare Species List - Madison County.

IDNR, n.d., Oil and Gas in Indiana: <https://www.in.gov/dnr/oil-and-gas/files/og-OilGas_in_Indiana.pdf> (accessed May 13, 2024, b).

IDNR Water Well Locations, n.d., Water well records: Indiana DNR, Division of Water.

IGWS, n.d., Indiana Geological & Water Survey (IGWS) Petroleum Data Management System (PADMS) Well Record Tables: https://legacy.igws.indiana.edu/pdms/WellSearch.cfm, Indiana Geological & Water Survey (IGWS).

Indiana Well Permit Number 42054 (IGWS ID 133725), 1982, Permit Number 42054: Indiana Geological & Water Survey.

Indiana Department of Transportation, 2021, Chapter 2 Geology and Pedology in Geotechnical Design Manual, *in* Geotechnical Design Manual: p. 1–26.

Indiana DNR, n.d., Indiana Oil and Gas Well Records Viewer: <https://experience.arcgis.com/experience/3c355ac677984daf99c1453bb6477831/#data_s=id%3AdataSource_7-18c174b1b08-layer-49%3A12614%2Cid%3AdataSource_7-18c34dbdf73-layer-49%3A90930%2B90931%2B90932%2B90933%2B90934%2B90935%2B90936%2B90937%2B90938%2Cid%3AdataSource_7-18c176c5618-layer-50%3A12783%2B15963> (accessed January 12, 2024).

Indiana DNR, Historic Preservation & Archaeology, 2021, Indiana State Historic Architectural and Archaeological Research Database (SHAARD) & Indiana Historic Buildings, Bridges, and Cemeteries (IHBBC) Map: <https://www.in.gov/dnr/historic-preservation/county-survey-program/shaard-database/>.

Indiana DNR, State Parks, 2022, Indiana Natural, Scenic and Recreational River System: <https://www.in.gov/dnr/state-parks/recreation/water-trails/scenic-river-system/>.

Indiana Geographic Information Office, 2024, Surficial Unconsolidated Thickness Contours.

IndianaMap GIO, 2022, Structural Features.

INEOS Nitriles, 2016, Underground Injection Control Permit to Operate Class I Hazardous Well; Ohio Permit UIC 03-02-005-PTO-I, Ohio Permit UIC 03-02-005-PTO-I: Ohio Environmental Protection Agency Division of Drinking and Ground Waters.

Janssens, A., 1973, Stratigraphy of the Cambrian and lower Ordovician in Ohio,1973 Ohio Div: Geol. Survey Bull, v. 64.

Keith, B. D., 1984, Reawakening Trenton in Indiana: Oil Gas J.; (United States), v. 79:8.

Kolata, D. R., C. C. C. Abert, C. S. McGarry, S. Medlin, and B. J. Stiff, 2005, Bedrock Geology of Illinois: Champaign, Illinois, Illinois State Geological Survey, Illinois Map 14.

Kolata, D. R., and W. J. Nelson, 1997, Role of the Reelfoot Rift/Rough Creek Graben in the evolution of the Illinois Basin: Middle Proterozoic to Cambrian rifting, central North America, v. 312, p. 287–298.

Kolata, D. R., and W. J. Nelson, 1990, Tectonic History of the Illinois Basin, *in* Interior Cratonic Basins: American Association of Petroleum Geologists, doi:10.1306/M51530C19.

Kolata, D. R., and C. K. Nimz (eds.), 2010, Geology of Illinois: Illinois State Geological Survey.

Korose, C., 2022, Wabash CarbonSAFE, Final Report, Final Report, DE-FE0031626-FINAL, 1874030: DE-FE0031626-FINAL, 1874030 p., doi:10.2172/1874030.

Lahann, R., J. Rupp, and C. Medina, 2014, An evaluation of the seal capacity and CO2 retention properties of the Eau Claire Formation (Cambrian): Environmental Geosciences, v. 21, no. 3, p. 83–106, doi:10.1306/eg.05011414003.

Leetaru, H., C. Blakley, C. Carman, D. Garner, and C. Korose, 2019, Carbon Storage Assurance Facility Enterprise (CarbonSAFE): Integrated CCS Pre-Feasibility CarbonSAFE Illinois East Sub-Basin Final Report, Final Report, DOE-FE0029445, 1576199: Prairie Research Institute, DOE-FE0029445, 1576199 p., doi:10.2172/1576199.

Leetaru, H. E., and J. T. Freiburg, 2014, Litho-facies and reservoir characterization of the Mt Simon Sandstone at the Illinois Basin–Decatur Project: Greenhouse Gases: Science and Technology, v. 4, no. 5, p. 580–595, doi:10.1002/ghg.1453.

Leetaru, H. E., and J. H. McBride, 2009, Reservoir uncertainty, Precambrian topography, and carbon sequestration in the Mt. Simon Sandstone, Illinois Basin: Environmental Geosciences, v. 16, no. 4, p. 235–243, doi:10.1306/eg.04210909006.

Lidiak, E. G., 1996, Geochemistry of subsurface Proterozoic rocks in the eastern Midcontinent of the United States: Further evidence for a within-plate tectonic setting, *in* B. A. van der Pluijm, and P. A. Catacosinos, eds., Basement and basins of eastern North America: Geological Society of America, p. 0, doi:10.1130/0-8137-2308-6.45.

Lloyd, O. B., and W. L. Lyke, 1995, Ground Water Atlas of the United States: Segment 10, Illinois, Indiana, Kentucky, Ohio, Tennessee, Hydrologic Investigations Atlas 730-K: Reston, VA, U.S. Geological Survey, K1–K30 p., doi:10.3133/ha730K.

Locke, R., D. Larssen, W. Salden, C. Patterson, J. Kirksey, A. Iranmanesh, B. Wimmer, and I. Krapac, 2013, Preinjection Reservoir Fluid Characterization at a CCS Demonstration Site: Illinois Basin – Decatur Project, USA: Energy Procedia, v. 37, p. 6424–6433, doi:10.1016/j.egypro.2013.06.572.

Martin, G., K. Fowler, and L. Arihood, 2016, Estimating Selected Low-Flow Frequency Statistics and Harmonic-Mean Flows for Ungaged, Unregulated Streams in Indiana: USGS, no. 2016–5102, p. 59.

McBride, J. H., and D. R. Kolata, 1999, Upper crust beneath the central Illinois basin, United States: GSA Bulletin, v. 111, no. 3, p. 375–394, doi:10.1130/0016-7606(1999)111<0375:UCBTCI>2.3.CO;2.

Medina, C. R., and J. A. Rupp, 2012, Reservoir characterization and lithostratigraphic division of the Mount Simon Sandstone (Cambrian): Implications for estimations of geologic sequestration storage capacity: Environmental Geosciences, v. 19, no. No. 1, p. 1–15, doi:10.1306/eg.07011111005.

Mehnert, E., and P. Weberling, 2014, Groundwater Salinity Within the Mt. Simon Sandstone in Illinois and Indiana, 582: Illinois State Geological Survey, Prairie Research Institute, University of Illinois, Circular, 31 p.

Mikulic, D. G., J. Kluessendorf, and R. D. Norby, 2010, Chapter 8: Silurian System and Lower Devonian Series (Tippecanoe II Subsequence), *in* Geology of Illinois: Illinois State Geological Survey, p. 158–166.

Mroz, T. H., J. Crismon, T. Fasnacht, S. Schaffer, and E. Majer, 1997, A geological and geophysical assessment of the Royal Center Gas Storage Field in north-central Indiana, a joint NIPSCO, DOE and GRI case study, Article DOE/FETC/C--98/7295: Gas Research Inst., Chicago, IL (United States): <https://digital.library.unt.edu/ark:/67531/metadc711807/m1/1/> (accessed January 11, 2024).

National Information Services Center, and National Park Service, 2023, National Wild and Scenic Rivers System Map: Harpers Ferry Center, National Wild and Scenic Rivers System, originally published in September 2018.

National Park Service, n.d., National Register of Historic Places Database and Research: <https://www.nps.gov/subjects/nationalregister/database-research.htm>.

National Park Service, n.d., Nationwide Rivers Inventory: <https://www.nps.gov/maps/full.html?mapId=8adbe798-0d7e-40fb-bd48-225513d64977>.

National Wild and Scenic Rivers System, n.d., Find a River: <https://www.rivers.gov/find-a-river>.

Nelson, W. J., 1995, Structural features in Illinois, Bulletin 100: Champaign, Illinois, Illinois State Geological Survey, 144 p.

Neufelder, R. J., B. B. Bowen, R. W. Lahann, and J. A. Rupp, 2012, Lithologic, mineralogical, and petrophysical characteristics of the Eau Claire Formation: Complexities of a carbon storage system seal: Environmental Geosciences, v. 19, no. 3, p. 81–104, doi:10.1306/eg.02081211014.

Panno, S. V., K. C. Hackley, R. A. Locke, I. G. Krapac, B. Wimmer, A. Iranmanesh, and W. R. Kelly, 2013, Formation waters from Cambrian-age strata, Illinois Basin, USA: Constraints on their origin and evolution: Geochimica et Cosmochimica Acta, v. 122, p. 184–197, doi:10.1016/j.gca.2013.08.021.

Patrick Engineering, 2011, UIC Permit Application IL-ICCS Project, CCS2.

Roy, W. R., E. Mehnert, P. M. Berger, J. R. Damico, and R. T. Okwen, 2014, Transport modeling at multiple scales for the Illinois Basin – Decatur Project: Greenhouse Gases: Science and Technology, v. 4, no. 5, p. 645–661, doi:10.1002/ghg.1424.

Rupp, J. A., 1991, Structure and isopach maps of the Paleozoic rocks of Indiana, Special Report 48: Bloomington, Ind, Indiana Department of Natural Resources, Geological Survey, 106 p.

Saeed, A., and J. E. Evans, 2012, Subsurface Facies Analysis of the Late Cambrian Mt. Simon Sandstone in Western Ohio (Midcontinent North America), 2: Open Journal of Geology, v. 2, no. 2, p. 35–47, doi:10.4236/ojg.2012.22004.

Schrader, G., R. Spaeth, B. Herring, G. Grove, R. Meier, and J. E. Editor: Beaty, 2002, Ground-water Resources in the White and West Fork White River Basin, Indiana, Water Resource Assessment 2002–6: Indiana Department of Natural Resources, Division of Water.

Shao, H., J. T. Freiburg, P. M. Berger, A. H. Taylor, H. F. Cohen, and R. A. Locke, 2020, Mobilization of trace metals from caprock and formation rocks at the Illinois Basin – Decatur Project demonstration site under geological carbon dioxide sequestration conditions: Chemical Geology, v. 550, p. 119758, doi:10.1016/j.chemgeo.2020.119758.

Sminchak, J., 2012, SIMULATION FRAMEWORK FOR REGIONAL GEOLOGIC CO2 STORAGE ALONG ARCHES PROVINCE OF MIDWESTERN UNITED STATES: United States, Battelle Memorial Institute, Columbus, OH (United States), doi:10.2172/1110321.

Sullivan, D. M., 1995, Natural gas fields of Indiana, Special Report 51: Indiana Geological & Water Survey, doi:10.5967/qmds-0e75.

Tuboscope - NOV Wellbore Technologies, 2017, TK-15XT: National Oilwell Varco.

Tuboscope Coatings Spec Sheet, 2022: National Oilwell Varco.

USFWS, 2024, IPaC: Information for Planning and Consultation Resource List, Aster Project.

USGS, 2024, USGS Earthquake Catalog Search: <https://earthquake.usgs.gov/earthquakes/search/> (accessed May 4, 2023).

Wayne, W. J., 1958, Glacial geology of Indiana: Indiana Geological Survey Atlas Map 10.

Whittaker, S., 2022, Illinois Storage Corridor, *in* NETL, ed.: NETL Annual Review Meeting 2022.

Whittaker, S., and C. Carman, 2022, CarbonSAFE Illinois - Macon County Final Report.

Wickstrom, L. H. et al., 2005, Characterization of Geologic Sequestration Opportunities in the MRCSP Region Phase I, Open-File Report 2005–1: Midwest Regional Carbon Sequestration Partnership (MRCSP).

Wickstrom, R. D., L. H. Stieglitz, and J. D. Gray, 1993, Stratigraphy, structure, and production history of the Trenton Limestone (Ordovician) and adjacent strata in northwestern Ohio: Ohio Geological Survey Report of Investigation 14.

Willman, H. B., E. Atherton, T. C. Buschbach, C. W. Collinson, J. C. Frye, M. E. Hopkins, J. A. Lineback, and J. A. Simon, 1975, Handbook of Illinois stratigraphy, Bulletin 95: Urbana, Illinois, Illinois State Geological Survey, 262 p.

Yoksoulian, L., P. M. Berger, J. T. Freiburg, and S. M. and Butler, 2014, Geochemical investigations of CO2-brine-rock interactions of the Knox Group in the Illinois Basin: US Department of Energy.

Young, H. L., 1992, Summary of ground-water hydrology of the Cambrian-Ordovician aquifer system in the northern Midwest, United States, USGS Numbered Series 1405-A: U.S. Geological Survey, Professional Paper, 67 p., doi:10.3133/pp1405A.

Zaluski, W., 2014, Maquoketa Shale Caprock Integrity Evaluation: U.S. DOE Report number DIE/FE0002068-9.

15. PBI Appendix A – List of Landowners Within the AoR

Parcel_Id	Owner	Address	City, State, Zip
48-02-36-400-002.000-008	Allen Donald J & Carole S	42 W County Road 1400 N	Alexandria IN 46001-8938
48-06-05-200-001.000-021	Allman Amy	8 Albright Place	Delmar NY 12054-0000
48-06-05-200-002.000-021	Allman Amy	8 Albright Pl	Delmar NY 12054-0000
48-06-05-200-003.000-021	Allman Amy	8 Albright Place	Delmar NY 12054-0000
48-06-05-300-004.000-021	Allman Amy	8 Albright Place	Delmar NY 12054-0000
48-06-05-300-003.000-021	Allman Amy	8 Albright Place	Delmar NY 12054-0000
48-06-06-900-002.000-021	Allman Amy	8 Albright Pl	Delmar NY 12054-0000
48-06-05-100-002.000-021	Allman Amy	8 Albright Place	Delmar NY 12054-0000
48-06-07-200-004.000-021	Allman Amy	8 Albright Pl	Delmar NY 12054-0000
48-01-32-300-003.000-036	Allman Amy	8 Albright Pl	Delmar NY 12054-0000
48-01-31-400-005.000-036	Allman Amy	8 Albright Pl	Delmar NY 12054-0000
48-01-31-400-002.000-036	Allman Amy	8 Albright Pl	Delmar NY 12054-0000
48-05-01-100-005.000-021	Amick Brandon T	23 W County Road 1400 N	Alexandria IN 46001-0000
48-01-31-300-010.000-036	Amos James Scott & Denice J/T R/S	149 E County Road 1450 N	Summitville IN 46070-9310
48-01-32-200-001.000-036	Apperson Thelma J 10-6-00	14614 N County Road 100 E	Summitville IN 46070-9650
48-01-31-200-003.000-036	Bair Jerry D & Peggy J	1484 E County Road 1500 N	Summitville IN 46070-9347
48-02-36-400-005.000-008	Barnes Brady A	90 W County Road 1400 N	Alexandria IN 46001-0000
48-05-01-400-013.000-021	Behm Olga M & Michael E	13075 N State Road 9	Alexandria IN 46001-0000
48-06-06-200-001.000-021	Bingham Farms LLC	21625 Cammack Rd	Noblesville IN 46062-0000
48-06-07-800-002.000-021	Black Craig Michael	2806 E 1100 N	Alexandria IN 46001-8489
48-01-31-300-009.000-036	Blanco Michelle R.	14364 N. State Road 9	Summitville IN 46070-0000

Parcel_Id	Owner	Address	City, State, Zip
48-06-08-100-011.000-021	Blankenbaker Dennis H & Amy S	12974 N County Road 175 E	Alexandria IN 46001-0000
48-01-32-400-001.000-036	Bott Ronnie R & Brittney A	1548 E 1400 N	Alexandria IN 46001-0000
48-05-01-400-001.000-021	Cooper Cindi R	13287 N State Road 9	Alexandria IN 46001-8933
48-06-05-400-003.000-021	Craib Paul A & Kristi J	1482 E County Road 1300 N	Alexandria IN 46001-8820
48-06-07-400-003.000-021	Davis Frank R & Kathy A	12471 N County Road 100 E	Alexandria IN 46001-8825
48-02-36-400-009.000-008	Dishroon Laina & Ryan Inglis J/T R/S	14219 N State Road 9	Summitville IN 46070-0000
48-05-01-100-013.000-021	Dixon Cody G.	13655 North State Road 9	Alexandria IN 46001-0000
48-06-07-100-001.000-021	Draper J Max & Nancy J	3031 E County Road 1250 N	Alexandria IN 46001-8803
48-06-06-300-001.000-021	Draper J Max & Nancy J	3031 E County Road 1250 N	Alexandria IN 46001-0000
48-06-06-200-003.000-021	Eash Wilbur H & Diana E Eash	13586 N State Road 9	Alexandria IN 46001-0000
48-06-06-300-003.000-021	Edwards Elizabeth A & Richard Loyd J/T R/S	13444 N State Road 9	Alexandria IN 46001-0000
48-06-06-300-002.000-021	Edwards Elizabeth A & Richard Loyd J/T R/S	13444 N State Road 9	Alexandria IN 46001-0000
48-01-31-300-006.000-036	Faulkenberg Jeffrey L & Sondra L	14114 N State Road 9	Summitville IN 46070-9628
48-01-31-300-005.000-036	Fromholz Thomas L	Po Box 2959	Sanford FL 32772-0000
48-01-31-300-008.000-036	Fromholz Thomas L	Po Box 2959	Sanford FL 32772-0000
48-01-31-400-003.000-036	Fromholz Thomas L	Po Box 2959	Sanford FL 32772-0000
48-01-31-300-004.000-036	Fromholz Thomas L	424 E County Road 1400 N	Summitville IN 46070-9383
48-01-31-400-001.000-036	Fromholz Thomas L	536 E County Road 1400 N	Summitville IN 46070-9382
48-01-31-700-001.000-036	Fromholz Thomas L	Po Box 2959	Sanford FL 32772-0000
48-01-31-300-003.000-036	Fromholz Thomas Lee	100 E 1400 N	Summitville IN 46070-0000
48-01-31-100-004.000-036	Furnish Gary K	658 E County Road 1450 N	Summitville IN 46070-0000
48-01-31-100-003.000-036	Furnish Gary K 5-9-00	658 E County Road 1450 N	Summitville IN 46070-0000

Parcel_Id	Owner	Address	City, State, Zip
48-06-05-400-002.000-021	Fye Blake	1572 E County Road 1300 N	Alexandria IN 46001-0000
48-05-01-100-011.000-021	Goings Marcia A	413 W 11th St Apt D29	Alexandria IN 46001-8315
48-05-01-100-014.000-021	Goings Marcia A & D Dion	413 W 11th St Apt D29	Alexandria IN 46001-0000
48-01-31-300-011.000-036	Goltz Ronald E & Susan L	143 E County Road 1450 N	Summitville IN 46070-9387
48-05-01-400-011.000-021	Guilkey Daniel L & Donna M	13037 N State Road 9	Alexandria IN 46001-8836
48-05-01-400-010.000-021	Haas Thomas Darrin & Michelle Ann	208 W. County Road 1300 N	Alexandria IN 46001-0000
48-01-31-200-002.000-036	Hawkins Faith Leanne	482 E 1450 N	Summitville IN 46070-0000
48-01-31-200-001.000-036	Hawkins Faith Leanne	482 E 1450 N	Summitville IN 46070-0000
48-06-06-200-002.000-021	Hobbs Christopher Michael And Jessica	13852 N State Road 9	Alexandria IN 46001-0000
48-06-06-200-007.000-021	Hobbs Christopher Michael And Jessica	13852 N State Road 9	Alexandria IN 46001-0000
48-06-06-200-006.000-021	Hobbs Christopher Michael And Jessica	13852 N State Road 9	Alexandria IN 46001-0000
48-01-31-300-001.000-036	Hockersmith Terry L &	276 E County Road 1400 N	Summitville IN 46070-9385
48-06-06-300-005.000-021	Hudson Derrick A & Nika M	13226 N State Road 9	Alexandria IN 46001-0000
48-01-32-200-002.000-036	Inglis Adam D.	14658 N County Road 100 E.	Summitville IN 46070-0000
48-01-32-300-002.000-036	Jk Land Holdings LLC &	2174 E 1550 N	Summitville IN 46070-0000
48-01-32-200-003.000-036	Jk Land Holdings LLC &	2174 E 1550 N	Summitville IN 46070-0000
48-06-06-200-005.000-021	Johnson Angel M	13522 N State Road 9	Alexandria IN 46001-8935
48-06-05-400-008.000-021	Johnson Danny L	11296 N County Road 200 E	Alexandria IN 46001-9052
48-02-36-400-007.000-008	Johnson Jerry R L/E & Rex & Jane Ann Johnson	31 Ems T34d Lane	Leesburg IN 46538-0000
48-05-01-100-012.000-021	Justus Bradley	209 N Walnut St	Alexandria IN 46001-0000
48-06-05-300-001.000-021	Keeley Jason A	1276 E County Road 1300 N	Alexandria IN 46001-0000

Parcel_Id	Owner	Address	City, State, Zip
48-06-05-100-001.000-021	Keesling Robert B & Gina L	13849 N County Road 200 E	Alexandria IN 46001-8974
48-06-07-100-004.000-021	Kemp James M	541 E County Road 1300 N	Alexandria IN 46001-0000
48-06-07-200-001.000-021	Lewis Robert & Madonna	451 E 1300 N	Alexandria IN 46001-8956
48-06-07-200-003.000-021	Love Rudy James	12826 N State Road 9	Alexandria IN 46001-0000
48-01-32-200-004.000-036	Lp Bair Farms LLC	14900 N County Road 100 E	Summitville IN 46070-0000
48-05-01-100-009.000-021	M Jewell LLC	213 E 4th St	Alexandria IN 46001-0000
48-05-01-100-010.000-021	M Jewell LLC	213 E 4th St	Alexandria IN 46001-0000
48-06-06-200-999.002-021	Madison County	16 E 9th St	Anderson IN 46016-0000
48-01-31-400-007.000-036	Mason Judd A & Nancy J	89 Ems B43 Ln	Leesburg IN 46538-0000
48-01-31-300-013.000-036	Meyer Robbie W & Michelle L	226 E County Road 1400 N	Summitville IN 46070-9385
48-06-05-400-005.000-021	Miller Zachary D Self-Settled Special Needs Trust	1235 North Loop West Ste 205	Houston TX 77008-0000
48-05-01-400-009.000-021	Mitchener James L Ii & Karen G	13143 N State Road 9	Alexandria IN 46001-0000
48-06-08-200-002.000-021	Monroe Twp	202 W Washington St	Alexandria IN 46001-1812
48-06-08-200-001.000-021	Montgomery Annetta G	12527 N 100 E	Alexandria IN 46001-8824
48-06-08-300-008.000-021	Montgomery Ted L	12527 N 100 E	Alexandria IN 46001-8824
48-06-07-100-006.000-021	Montgomery Ted L & Annette G	12527 N County Road 100 E	Alexandria IN 46001-8824
48-05-12-100-006.000-021	Morehead Carole A	12933 N State Road 9	Alexandria IN 46001-8931
48-05-12-100-007.000-021	Morehead Carole A	12933 N State Road 9	Alexandria IN 46001-8931
48-05-12-100-005.000-021	Morehead James P & Heather	12879 N State Road 9	Alexandria IN 46001-8930
48-05-12-100-010.000-021	Morehead Kenneth Harold & Kathleen Anne Morehead T	97 W County Road 1300 N	Alexandria IN 46001-8955

Parcel_Id	Owner	Address	City, State, Zip
48-05-12-100-009.000-021	Morehead Kenneth Harold & Kathleen Anne Morehead T	97 W County Road 1300 N	Alexandria IN 46001-8955
48-05-01-400-012.000-021	Overman David E & Kelle G	76 W 1300 N	Alexandria IN 46001-0000
48-06-07-200-002.000-021	Par A Dice Farms Inc	3031 E County Road 1250 N	Alexandria IN 46001-8803
48-06-07-200-013.000-021	Par-A-Dice Farms Inc	3031 E County Road 1250 N	Alexandria IN 46001-0000
48-06-07-200-009.000-021	Parr Max A	12614 N State Road 9	Alexandria IN 46001-8928
48-06-07-600-001.000-021	Pennsylvania Lines LLC	Po Box 209	Norfolk VA 23510-0000
48-01-32-600-001.000-036	Pennsylvania Lines LLC	Po Box 209	Norfolk VA 23510-0000
48-01-31-400-004.000-036	Pennsylvania Lines LLC	Po Box 209	Norfolk VA 23510-0000
48-06-06-900-001.000-021	Pennsylvania Lines LLC/O Norfolk Southern Corp	Po Box 209	Norfolk VA 23510-0000
48-06-07-800-001.000-021	Petty Brian P & Brittany N 1/2 &	2433 E. County Road 1250 N.	Alexandria IN 46001-0000
48-06-08-100-012.000-021	Petty Brian P & Brittany N 1/2 &	2433 E. County Road 1250 N.	Alexandria IN 46001-0000
48-06-05-400-006.000-021	Phelps Pyrtle & Janice S	1800 E County Road 1300 N	Alexandria IN 46001-8818
48-06-06-200-004.000-021	Phillips Christopher A	13566 N State Road 9	Alexandria IN 46001-0000
48-06-06-900-001.000-022	Poet Biorefining - Alexandria, LLC	Attn: Accounts Payable	Sioux Falls SD 57104-0000
48-01-31-300-007.000-036	Rector Zachery R & Kaitlyn M	14222 N State Road 9	Summitville IN 46070-0000
48-02-36-400-003.000-008	Remington William Lee & Martha	132 W County Road 1400 N	Alexandria IN 46001-8939
48-01-31-100-011.000-036	Retherford Joseph L.	912 E. County Road 1450 N.	Summitville IN 46070-0000
48-01-31-100-002.000-036	Retherford Larry	814 E County Road 1450 N	Summitville IN 46070-9392
48-01-31-100-012.000-036	Retherford Larry	814 E County Road 1450 N	Summitville IN 46070-9392
48-06-05-800-002.000-021	Richardson Paul D & Karen S	3199 W County Road 1100 N	Alexandria IN 46001-2811
48-01-31-100-001.000-036	Roberts Roger A & Rita	686 E 1450 N	Summitville IN 46070-9391

Parcel_Id	Owner	Address	City, State, Zip
48-05-01-100-001.000-021	Schildmeier Ronald E & Nancy S	197 W County Road 1400 N	Alexandria IN 46001-8939
48-05-01-100-003.000-021	Schildmeier Ronald E & Nancy S	197 W County Road 1400 N	Alexandria IN 46001-8939
48-01-31-300-015.000-036	Schoonover Ben	362 E County Road 1400 N	Summitville IN 46070-0000
48-01-31-300-014.000-036	Schoonover Ben	362 E County Road 1400 N	Summitville IN 46070-0000
48-05-01-100-004.000-021	Sidwell Jaymes E	99 W County Road 1400 N	Alexandria IN 46001-0000
48-06-06-300-004.000-021	Small Town USA Apples & More LLC	15265 N County Road 100 E	Summitville IN 46070-0000
48-05-01-400-004.000-021	Smith Annetta Kay &	720 N County Road 500 W	Anderson IN 46011-0000
48-05-01-400-002.000-021	Smith Annetta Kay &	720 N County Road 500 W	Anderson IN 46011-0000
48-05-01-400-003.000-021	Smith Joseph D & Alison D	13377 N State Road 9	Alexandria IN 46001-0000
48-06-05-300-002.000-021	Tanner Gordan C & Melissa A Revoc T/R	1318 E 1300 N	Alexandria IN 46001-8821
48-01-31-300-002.000-036	Thomas Gerald A	248 E County Road 1400 N	Summitville IN 46070-9385
48-06-07-100-003.000-021	Thomas Marcia J	Po Box 2194	Columbus IN 47202-0000
48-06-07-200-014.000-021	Thomas Marcia J	Po Box 2194	Columbus IN 47202-0000
48-06-05-400-004.000-021	Turner Ronnie V & Linda S	1616 E County Road 1300 N	Alexandria IN 46001-0000
48-06-07-100-001.000-022	Ultimate Ethanol LLC	Attn: Accounts Payable	Sioux Falls SD 57104-0000
48-01-31-100-006.000-036	Van Buren Township	Po Box 397	Summitville IN 46070-3970
48-01-31-100-007.000-036	Van Buren Twp	Po Box 397	Summitville IN 46070-3970
48-01-31-100-008.000-036	Van Buren Twp	Po Box 397	Summitville IN 46070-3970
48-01-31-200-004.000-036	Waterman Darlene Credit Shelter Trust	1275 E. County Road 650 N.	Alexandria IN 46001-0000
48-06-05-100-003.000-021	Watsons Of Minneapolis Properties LLC	11811 Pendleton Pike	Indianapolis IN 46236-3910
48-01-32-800-001.000-036	Watson's Of Minneapolis Properties LLC	11811 Pendleton Pike	Indianapolis IN 46236-0000
48-01-31-400-006.000-036	Wilson Tim E	557 E 1450 N	Summitville IN 46070-0000

Parcel_Id	Owner	Address	City, State, Zip
48-01-32-300-001.000-036	Wise Helen S L/E	1206 E 1400 N	Alexandria IN 46001-8971

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