Class VI Injection Well Application

Contains proprietary business information.

Attachment 01: Narrative

40 CFR 146.82(A)

Dragon Project
Tazewell County, Illinois

22 November 2024

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List of Acronyms and Abbreviations

2D	two-dimensional
3D	three-dimensional
25Cr	25-Chrome
25Cr80	25 Chrome, minimum yield strength of 80,000 pounds per square inch
ACZ	above confining zone
ADM	Archer Daniels Midland
Al	aluminum
AoR	Area of Review
APT	annulus pressure test
BHP	bottomhole pressure
CAA	Clean Air Act
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
CGP	Construction General Permit
CO_2	carbon dioxide
CWA	Clean Water Act
DOE	Department of Energy
DRG ACZ1	Dragon Above Confining Zone Monitoring Well 1
DRG OBS1	Dragon Deep Observation Well 1
DRG MA1	Dragon Mahomet Aquifer Monitoring Well 1
DRG INJ1	Dragon Injection Well 1
EPA	Environmental Protection Agency
EPSG	European Petroleum Survey Group
ERRP	Emergency and Remedial Response Plan
FEMA	Federal Emergency Management Agency

fbgl	feet below ground level
fbsl	feet below sea level
GSDT	Geologic Sequestration Data Tool
IBDP	Illinois Basin–Decatur Project
IEc	Industrial Economics
IL-ICCS	Illinois Industrial CCS Project (run by ADM)
IPaC	Information for Planning and Consultation
ktpa	kilotonnes per annum
MAIP	maximum allowable injection pressure
mD	millidarcy
MD	measured depth
Mt	million tonnes
N/A	not applicable
NOV	National Oilwell Varco
NPDES	National Pollution Discharge Elimination System
NRI	Nationwide Rivers Inventory
O&G	oil and gas
PBI	proprietary business information
PNL	pulsed neutron logging
PISC	Post-injection Site Care and Site Closure
SRT	step rate test
TBD	to be determined
TCS	total closure stress
TDS	total dissolved solids
UIC	Underground Injection Control
US	United States
USGS	United States Geological Survey
USDW	underground source of drinking water
USFWS	US Fish and Wildlife Service
XRD	x-ray diffraction

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

1.1 Project Contact Information

Project Name: Dragon

Project Operator: Vault Dragon CCS LP

Project Contact: Scott Jordan, Project Manager
Vault Dragon CCS LP
1125-17th Street, Suite 1275
Denver, Colorado 80202
Email: dragon@vault4401.com
Phone: 713-930-4401

Project Location: Tazewell County, Illinois

Dragon Injection Well 1 (DRG INJ1) Location:
Latitude: 40.45742° N
Longitude: 89.74468° W

1.2 Project Background

The objective of the Dragon Project is to effectively capture carbon dioxide (CO_2) produced at a nearby ethanol facility, and safely and permanently sequester approximately 9 million tonnes (Mt) of CO_2 over 12 years in the Mt. Simon Sandstone. One well is expected to be sufficient for injection of the project's intended mass flow rate of 750 kilotonnes per annum (ktpa) of CO_2 into the Mt. Simon Sandstone. This Underground Injection Control (UIC) Class VI application describes and supports this effort in accordance with the United States (US) Environmental Protection Agency's (EPA's) Class VI regulations in Title 40 of the Code of Federal Regulations (40 CFR 146.81).

Vault Dragon CCS LP will be the owner, operator, and permit holder for the injection well DRG INJ1 and the transport pipeline. Neither an injection depth waiver nor an aquifer exemption expansion is being requested for this project.

The target injection formation, the Lower 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. Other strata, including the Davis Member of the Franconia Formation, Oneota Formation, Shakopee Formation, Maquoketa Group, and New Albany Shale, will serve as additional confining zones.

Figure 1 and Figure 2 show the locations of the four primary wells associated with the project and the project area of review (AoR): Dragon Deep Observation Well 1 (DRG OBS1), Dragon

Mahomet Aquifer Monitoring Well 1 (DRG MA1), Dragon Above Confining Zone Monitoring Well 1 (DRG ACZ1), and DRG INJ1. Table 1 shows the coordinates, depth, and intended use for each well.

Within the AoR there are no State or Federal EPA approved subsurface clean-up sites, mines, quarries, or State, Tribal, or Territory boundaries. Surface bodies of water within the AoR include a perennial stream, the Mackinaw River, intermittent waterways (Hickory Grove Ditch, Breedlove Ditch, Meeker Ditch, and North Quiver Ditch) and small wetlands. Information on oil and gas (O&G) wells and water wells within the AoR can be found in Section 4.1 of Attachment 02: AoR and Corrective Action Plan, (2024).

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 (Attachment 05: Pre-operational Testing Program, 2024). 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.

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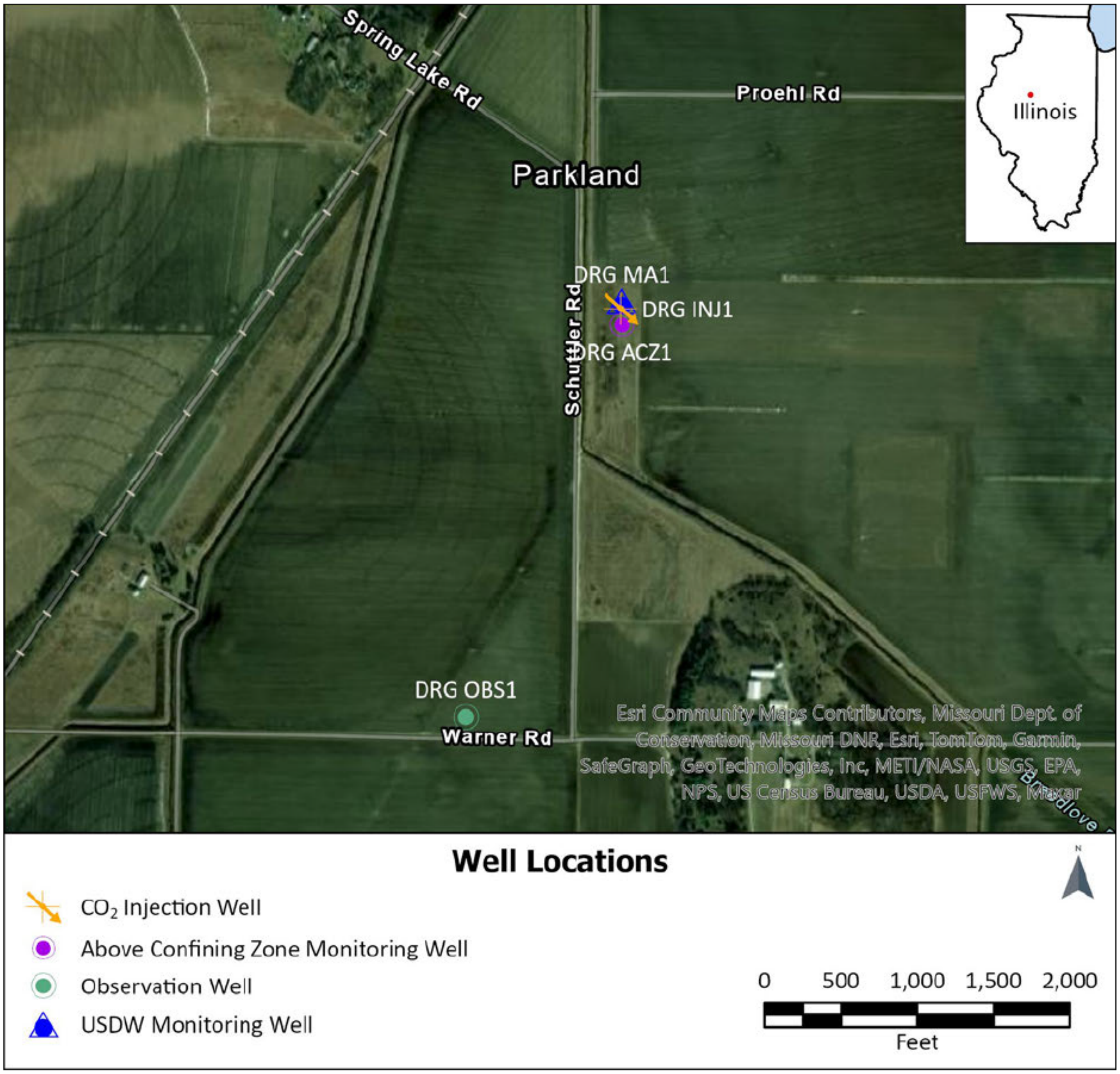

Figure 2: Proposed locations of injection, deep observation, above confining zone monitoring, and Mahomet Aquifer monitoring wells for the Dragon Project. Map base adapted from Esri.

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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
Emergency Dispatch – Police, Fire, or Medical Emergency	911
Tazewell County Sheriff's Office	309-346-4141
Pekin Police Department, Pekin, Illinois	309-346-3132
Illinois State Police Troop 4	309-833-4046
Forman Fire Department, Manito, Illinois	309-968-6902
Cincinnati Fire Protection District, Pekin, Illinois	309-348-3579
Peoria Area EMS, Peoria, Illinois	309-655-2113
Forman Ambulance, Manito, Illinois	309-968-6902
Environmental Services Contractors to be determined (TBD)	TBD
US EPA Region UIC Supervisor Class VI Wells/Carbon Sequestration/Climate Change	312-353-7648 (UIC Supervisor) 312-353-3944 (Class VI UIC Wells/Carbon Sequestration)
EPA National Response Center (24 hours)	1-800-424-8802
Illinois Emergency Management Agency	217-782-7860 (24-hour Response)
Illinois Department of Natural Resources O&G Resource Management	217-782-6302

1.4 Summary of Other Permits Required

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

Table 3: Permits required for the Dragon Project.

Program	Permit(s) Required
Hazardous Waste Management program under Resource Conservation and Recovery Act	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 the Clean Water Act (CWA)	NPDES Construction General Permit (CGP); NPDES program administered by the state of Illinois.
Prevention of Significant Deterioration program under the Clean Air Act (CAA)	N/A, not a major source
Nonattainment program under CAA	N/A, Tazewell County is currently in attainment for all criteria pollutants
National Emission Standards for Hazardous Air Pollutants 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)	
Illinois Safety and Aid for the Environment (SAFE) CCS Act	Sequestration Permit
Illinois Environmental Protection Agency	CGP

1.5 Landowners within the AoR

A list of names and addresses of all owners of record of land within the AoR of the Dragon Project can be found in **PBI** 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.

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

The Dragon Project, located in Tazewell County of central Illinois, is within the intracratonic Illinois Basin that extends beneath much of Illinois, western Indiana, and western Kentucky (Figure 3). The Illinois Basin is comprised of Cambrian to Permian strata that reach a maximum thickness of nearly 23,000 feet in its southern portion (Collinson et al., 1988) and over 4,500 feet at the Dragon Project site. The Illinois Basin has been the focus of extensive research into geological carbon sequestration for over two decades through the Midwest Regional Carbon Sequestration Partnership (Wickstrom, 2005; Battelle, 2011; Greenberg, 2021) and the US Department of Energy (DOE) sponsored CarbonSAFE program (Leetaru et al., 2019; Whittaker, 2019; Korose, 2022; Whittaker and Carman, 2022). In addition, the Illinois Industrial Carbon Capture and Storage Project (IL-ICCS) is an active carbon commercial sequestration project taking place at the Archer Daniels Midland (ADM) ethanol facility at Decatur, IL, approximately 60 miles southeast of the proposed location for the Dragon Project (Figure 3). The IL-ICCS project storage complex uses the Cambrian Mt. Simon Sandstone and Eau Claire Silt as the injection zone, and the overlying Eau Claire Shale as the primary confining zone (Gollakota and McDonald, 2014; Figure 4). The Dragon Project proposes to use the same formations for the storage complex. Due to the continuous lateral extent of the Cambro-Ordovician strata in the Illinois Basin and the proximity of the Dragon Project site to IL-ICCS, the IL-ICCS project will be used as an analog for the Dragon Project. Data collected during the Pre-operational Testing Program (Attachment 05) will be used to validate this hypothesis.

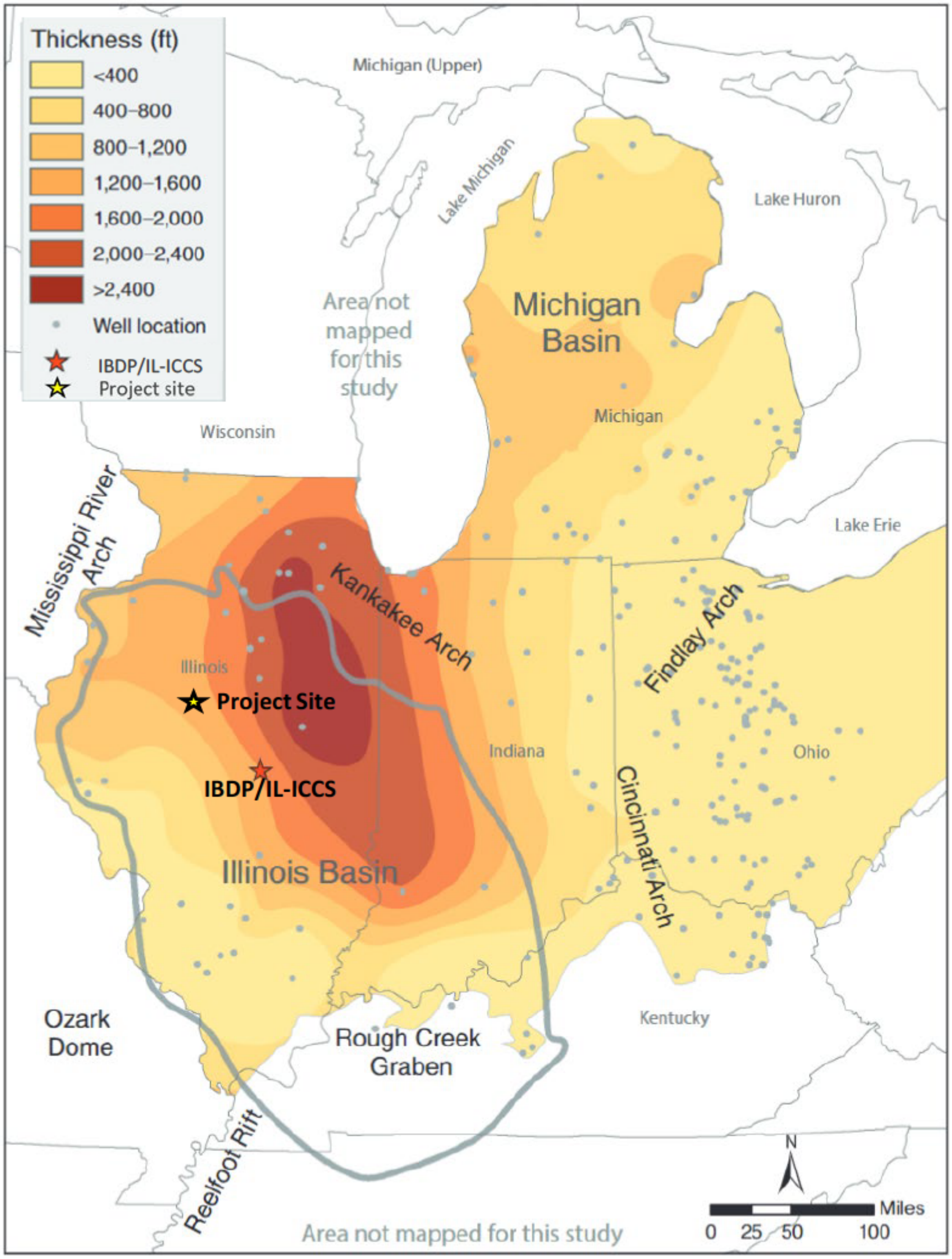

Figure 3: Mt. Simon Sandstone isopach map (feet) with the Illinois Basin extent, major structural features, and the Dragon Project site shown by yellow star. The location of the Illinois Basin–Decatur Project (IBDP) and IL-ICCS project are shown by the red star. Modified from Medina and Rupp, (2012).

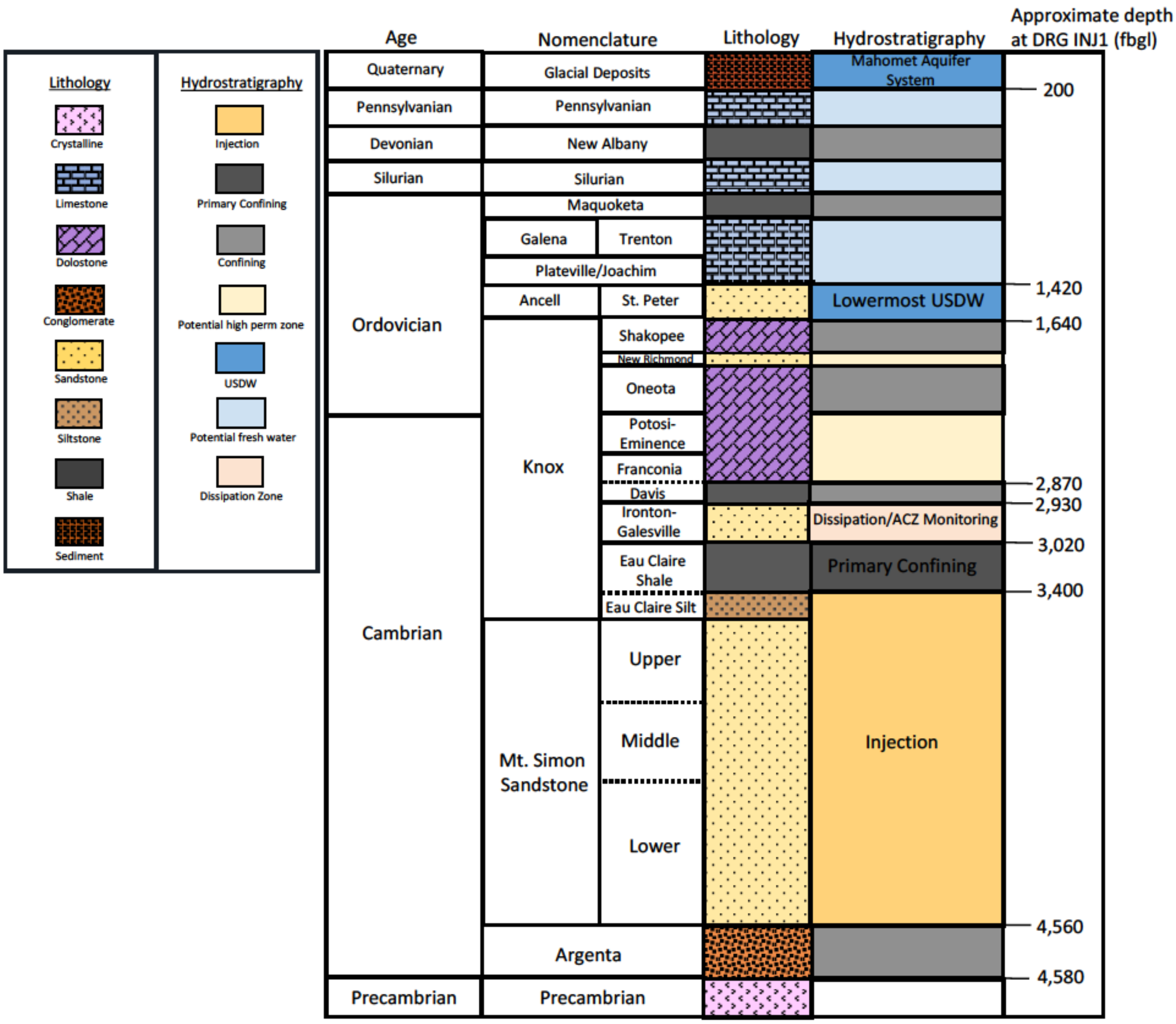

Figure 4: Dragon Project site-specific stratigraphic column with age, nomenclature, generalized lithology, hydrostratigraphy, and approximate depth in feet below ground level (fbgl).

[redacted]

The Illinois Basin began to form in the late Precambrian to early Cambrian during the breakup of the supercontinent Rodinia (Braile et al., 1986; Kolata and Nelson, 1990, 1990, 1997). The basin is bounded to the northwest by the Mississippi River Arch, to the north - northeast by the Kankakee Arch, and to the east by the Cincinnati Arch (Figure 3). The Reelfoot Rift and Rough Creek Graben are significant features within the southern portion of the basin related to processes linked to basin subsidence and are where the thickest accumulation of sediments exist in the basin (Kolata, 2010). It is noteworthy, however, that the depocenter for Cambrian sediments was more northerly as shown by the greatest thickness of the Mt. Simon Sandstone in Figure 3. Paleozoic sedimentary strata of the basin unconformably overlie the Precambrian Basement, which is broadly composed of felsic intrusives and volcanics of the Eastern Granite-Rhyolite Province (Figure 5; Bradbury and Atherton, 1965; Bickford et al., 1986; Atekwana, 1996; Lidiak, 1996; Green, 2018).

The Cambrian Mt. Simon Sandstone, Eau Claire Silt, and Eau Claire Shale are among the oldest and deepest strata in the basin (Figure 4 and Figure 5) and will serve as the injection and confining zones, respectively, for the Dragon Project. The clastic sediments of the Mt. Simon Sandstone are interpreted to have been deposited in the failed rift basin that ultimately provided up to 2,600 feet of accommodation space for Mt. Simon sediments to accumulate (Figure 3). The Mt. Simon Sandstone is underlain by the Argenta Formation that is variably present in the basin and that was, until recently, considered part of the Mt. Simon Sandstone. An erosional unconformity exists between the Argenta Formation / Mt. Simon Sandstone and the underlying Precambrian Basement.

By late Cambrian time the tectonic regime evolved from a rift to a broad embayment and the Illinois Basin was a slowly subsiding cratonic basin for the remainder of the Paleozoic (McBride and Kolata, 1999). Eustatic sea level fluctuations coupled with tectonics allowed for the accumulation of both marine and terrestrial sediments in the basin. Uplift during the Pennsylvanian to Late Cretaceous isolated the basin and created the present geometry (Figure 3; Kolata and Nelson, 1990, 1997; McBride and Kolata, 1999).

Much of the Illinois Basin was covered by a sea by the early Ordovician; this was followed by a marine regression that exposed newly deposited marine sediments to erosion and created the Middle Ordovician Knox Group unconformity. A series of transgressions and regressions and periods of both uplift and subsidence dominated the remainder of Ordovician time (Freeman, 1953).

By early to mid-Silurian time, central Illinois was close to wave-base and the surrounding sedimentary basins to the west, north, and east received large quantities of sediment (Janssens, 1968). Sea-level regression and uplift occurred during the Devonian, causing extensive erosion. A sea level transgression during the Devonian-Mississippian deposited marine shales across the region including the regionally extensive New Albany Shale (Mikulic et al., 2010) that forms a barrier to vertical fluid movement.

Subsidence and uplift continued to the end of the Paleozoic Era, and erosion and nondeposition prevailed 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, including the Mahomet Aquifer which is a designated sole source aquifer in central Illinois.

2.2 Regional Stratigraphy

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

Geophysical logs from regional wells were used to build the static model (Figure 6). The regional continuity of the Paleozoic strata in the vicinity of the project site [40 CFR 146.82(a)(3)(i)] is demonstrated through cross sections of the site model (Figure 5 and Figure 7). Quaternary glacial sediments overlie the bedrock (Figure 4) and are discussed 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 Illinois, Indiana, Kentucky, and Ohio was compiled. The well logs were interpreted and used to develop a static geomodel for the project site.

Within 50 miles of the Dragon Project site, two wells penetrate the Precambrian Basement and over 100 wells penetrate the Upper Mt. Simon Sandstone, all of which were used to assess the site-specific geology. Additional wells penetrate the Mt. Simon Sandstone outside of the 50-mile radius (Figure 6). The closest wells that penetrate into the Mt. Simon Sandstone and have well log data are located within the Hudson gas storage field, approximately 45 miles east of the project site (Figure 6). This field, along with the Lake Bloomington, Lexington, and Manlove gas storage fields, utilizes the Upper Mt. Simon Sandstone as a gas storage reservoir. Most wells do not penetrate into the Lower Mt. Simon Sandstone, were drilled in the 1970s, and remain active. The Furrow #2 and FutureGen wells penetrate through the entire Mt. Simon Sandstone into the Precambrian Basement and are located approximately 46 and 48 miles from the project site (Figure 6).

[redacted]

[redacted]

2.2.1 Precambrian Basement Complex

The project site overlies granite, rhyolite, trachyte, and quartzite of the Eastern Granite-Rhyolite Province of the Precambrian Basement (Denison et al., 1984). These basement rocks are of extensional tectonic origin and contribute to the source of Early Cambrian siliciclastic strata in the Illinois Basin (Bickford et al., 1986). Figure 8 shows the Precambrian Basement deepens from approximately 3,000 feet below sea level (fbsl) in the northwest of the map area and deepens to 6,600 fbsl in the southeast where basin structure becomes more complex. The formations within the storage complex similarly deepen to the southeast toward the center of the Illinois Basin as described following sections.

2.2.2 Argenta Formation (Below Injection Zone) (Cambrian)

The Precambrian surface represents a 900-million-year depositional hiatus before Cambrian sediments of the Argenta Formation were deposited forming an unconformable contact. The Argenta strata are of variable thickness (Figure 5 and Figure 7), in part due to Precambrian topography, and locally the Argenta Formation onlaps against the Precambrian Basement as observed in Figure 5. The Argenta Formation is also in unconformable contact with the overlying Mt. Simon Sandstone (Leetaru, 2015). Until recently the Argenta was considered to be part of the Lower Mt. Simon Sandstone but work by the Illinois State Geological Survey (Freiburg, 2015) suggests it is a pre-Mt. Simon sedimentary unit. The Argenta Formation is composed of shallow-marine, shoreface to fan-delta sandstone and conglomerate with some interbedded mudstone. Conglomerates are dominantly clast supported and exhibit inverse and normal graded bedding, as well as planar and cross-beds. Bioturbation is abundant in some sandstone intervals, which suggests a Lower to Middle Cambrian age for this formation, and it was likely deposited during a marine transgression associated with thermal subsidence (Freiburg, 2015).

The elevation map of the Argenta shows that the formation deepens to 6,400 fbsl in the southeast portion of the mapped area (Figure 9). The Argenta Formation is not present due to non-deposition to the west of the Dragon Project (Figure 10). It thickens to more than 300 feet to the east and is prognosed to be 21 feet thick at the project site.

[redacted]

[redacted]

[redacted]

2.2.3 Mt. Simon Sandstone (Injection Zone) (Cambrian)

The Cambro-Ordovician Sauk sequence unconformably overlies the Argenta Formation and includes the Mt. Simon Sandstone, the Eau Claire Silt, the Eau Claire Shale, and the Knox Group (Figure 4, Figure 5, and Figure 7). Specific to this project, the Mt. Simon Sandstone and Eau Claire Silt serve as the injection zone and the Eau Claire Shale is the primary confining zone. The Lower Mt. Simon Sandstone will be perforated and is the target injection interval for the Dragon Project.

The Mt. Simon Sandstone is a transgressive terrestrial to shallow marine sequence that is a laterally extensive deposit in the Illinois Basin and throughout the Midwest (Kolata and Nelson, 1990). It is thickest in northeastern and east-central Illinois (Figure 3; Leetaru and McBride, 2009). Mt. Simon sedimentology was impacted by a wide range of depositional environments including shallow marine, deltaic, fluvial, eolian, and coastal (Janssens, 1973; Baranoski, 2007; Saeed and Evans, 2012; Freiburg et al., 2016). Fine to coarse-grained, poorly sorted, arkosic and quartz sandstone primarily compose the Mt. Simon Sandstone. Typically, the Mt. Simon Sandstone is subdivided into Lower, Middle, and Upper intervals, with the Lower Mt. Simon Sandstone containing basal arkosic strata. For this project, the arkosic zone is included within the base of the Lower Mt. Simon Sandstone (Figure 4).

The Mt. Simon Sandstone has been the focus of considerable research into carbon sequestration in the Illinois Basin through a number of US DOE funded projects including the Regional Carbon Sequestration Partnerships (Greenberg, 2021) and the CarbonSAFE program (Leetaru et al., 2019; Korose, 2022; Whittaker and Carman, 2022). It has also been demonstrated as an effective sequestration formation through an active carbon sequestration project (IL-ICCS) at the ADM facility in Decatur, IL (Patrick Engineering, 2021).

The Lower Mt. Simon Sandstone is the target injection interval for the Dragon Project. These beds are dominantly medium- to fine-grained cross-bedded to ripple-laminated subarkosic arenite (Freiburg et al., 2014). In the center of the Illinois Basin, the base of the Lower Mt. Simon Sandstone is composed of planar-bedded sandstone and conglomerate composed of subarkosic to arkosic arenite, arkosic wacke and mudstone. This arkosic zone thins toward the basin margin. Grading upwards, the Mt. Simon Sandstone contains mixed eolian and fluvial deposits to marine tidal deposits in its upper portions. Porosity in the Lower Mt. Simon Sandstone is largely a result of diagenesis including dissolution of feldspars and coating of grains by clay (illite) that restricts formation of porosity occluding cements. The dominant diagenetic cement is quartz, and the presence of authigenic quartz decreases in the Lower Mt. Simon units as compared to the Middle and Upper intervals (Freiburg et al., 2016). The Upper Mt. Simon Sandstone also exhibits good reservoir characteristics and is used for natural gas storage in several locations in the Illinois Basin including the sites shown in Figure 6.

The elevation map of the Lower Mt. Simon Sandstone, which represents the top of the planned injection zone, is shown in Figure 11 and displays how the zone deepens from [redacted] in the northwest to [redacted] in the southeast toward the basin center. The thickness of the Lower Mt. Simon Sandstone injection zone presented in Figure 12 shows the continuity of the unit across a wide region as well as the increase in unit thickness to [redacted] feet the northwest. The elevation map of the top of the Upper Mt. Simon Sandstone is presented in Figure 13 and shows the zone deepening to [redacted] the southeast.

[redacted]

[redacted]

[redacted]

2.2.4 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 that is part of the injection zone and directly overlies the Mt. Simon Sandstone and the finer-grained Eau Claire Shale that will serve as the primary confining zone (Figure 4, Figure 5, and Figure 7). The Eau Claire Silt is the basal unit of the Knox Group and is prognosed to be [redacted] feet thick at the project site (Kolata, 2010). The Eau Claire Silt 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 parts of the Midwest (Willman et al., 1975). Regionally, the Eau Claire Silt and Eau Claire Shale form a thick succession of fine-grained strata that is present across much of the Illinois Basin and deepens from [redacted] in the northwest portion of the mapped area to [redacted] toward the basin center to the southeast (Figure 14). The regional thickness of the Eau Claire Shale increases to the south and east of the project site, as shown in Figure 15. The Eau Claire Shale is expected to be [redacted] feet thick at the project site (Figure 15).

The Eau Claire Silt and Eau Claire Shale exhibit a range of mineralogical and textural features across the Illinois Basin, and Neufelder et al., (2012) report five lithofacies found in seven Illinois Basin cores: 1) sandstone, 2) clean siltstone, 3) muddy siltstone, 4) silty mudstone, and 5) shale. Lahann et al., (2014) additionally evaluated the sealing properties of the Eau Claire Silt and Eau Claire Shale, and determined that the finer-grained facies, such as mudstones and shale would restrict vertical entry of CO_2 into the rocks.

Figure 16 shows core and well log porosity and permeability data from four Illinois Basin wells that penetrated both the Eau Claire Silt and Eau Claire Shale, and these data were divided into the five lithofacies listed above. In general, the coarser grained lithofacies have higher porosities and associated permeabilities, and the finer grained, clay-rich lithofacies have lower values, though there is considerable scatter in this data.

At the ADM facility, ADM CCS1 was drilled as part of the Illinois Basin–Decatur Project (IBDP) (Greenberg, 2021). It is approximately 60 miles southeast of the Dragon Project site (Figure 3), and at this location the Eau Claire Shale is 462 feet thick, and the Eau Claire Silt is 36 feet thick. These strata grade from highly laminated shale to silty shale to clayey limestone. The shale and muddy siltstone layers isolate the clayey limestone from the injection zone (Leetaru and Freiburg, 2014). The characteristics of the Eau Claire Shale around the Dragon Project site are described in more detail in Section 2.6 *Injection and Confining Zone Details*.

[redacted]

DRG INJ1

[redacted]

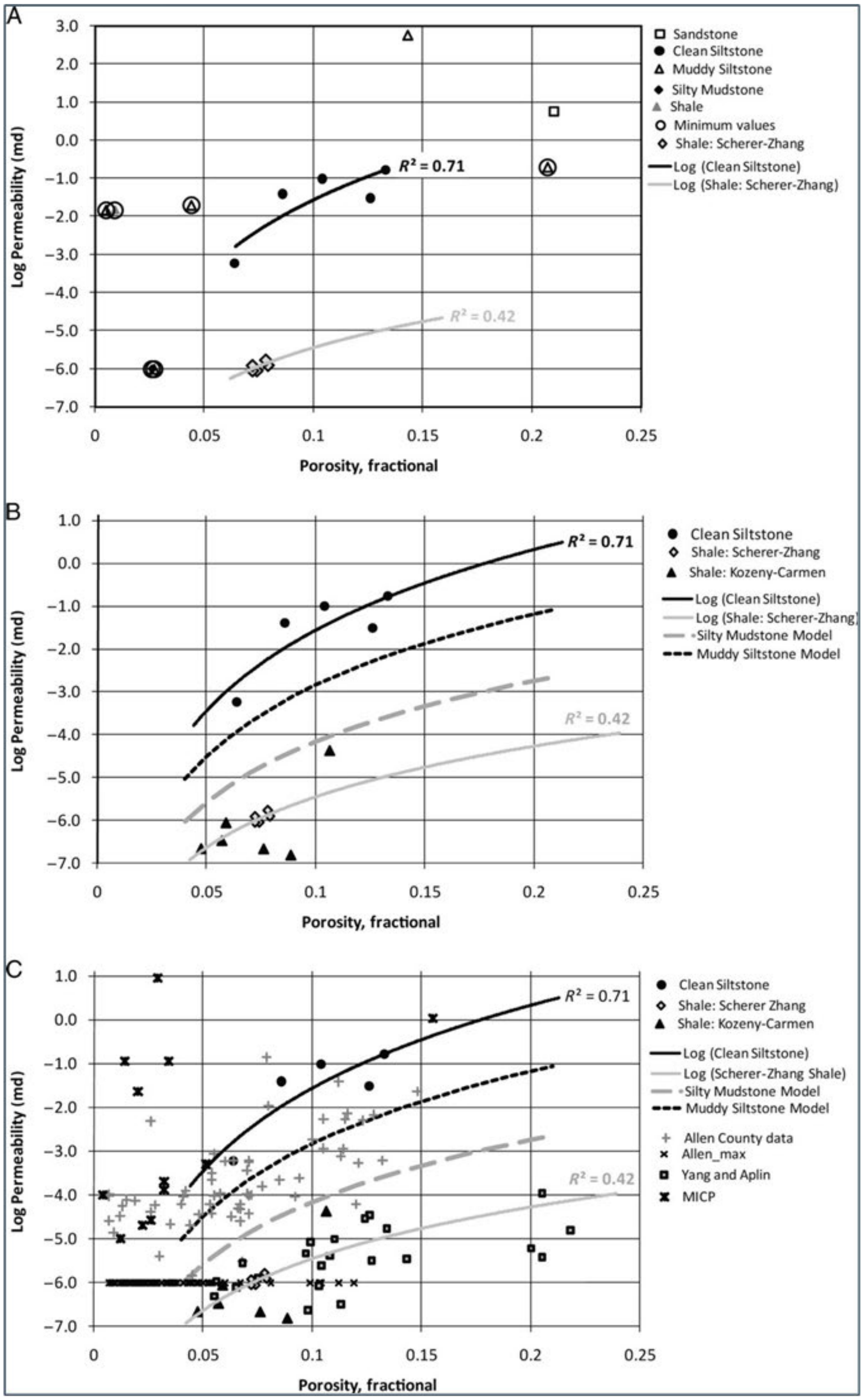

Figure 16: Porosity-permeability models for the Eau Claire Silt and Eau Claire Shale lithofacies modified from Neufelder et al., 2012. (A) Cross plot of conventionally derived core porosity and permeability with regression lines for the clean silt lithofacies. (B) Cross plot of traditional core porosity and calculated permeability with regression lines for the clean silt, muddy siltstone, and silty mudstone lithofacies. (C) Cross plot of traditional core porosity and calculated permeability for clean silt, muddy silt, and shale lithofacies.

2.2.5 Ironton-Galesville Sandstones (Dissipation Zone/ACZ Monitoring Zone) (Cambrian)

The Eau Claire Shale is conformably overlain by the Ironton-Galesville Sandstones, which are also part of the Knox Group, and will serve as the dissipation/ above confining zone (ACZ) monitoring zone for the Dragon Project (Figure 4). The Ironton Formation is a fine to coarse grained, poorly sorted silty sandstone. The underlying Galesville Formation is a fine to medium grained, well sorted sandstone and, in the lower part, fossiliferous (Emrich, 1966). Due to the gradational nature of the Ironton and Galesville Formations, it is difficult to distinguish between these formations in well data, and they are undifferentiated for this project.

These sandstones were derived from pre-existing sedimentary rocks, sourced from the northern Michigan Highlands (Emrich, 1966) and deposited on a broad, shallow shelf with clastic deposition in the north and carbonate deposition in the south. During this time, clastic deposition dominated in the northern portion of the Illinois Basin and carbonate deposition increased eastward toward the Kankakee and Cincinnati Arches, as such, these strata grade to fine-grained silty sandstones and dolomitic shale to the east in Indiana. The underlying well-sorted Galesville Sandstone is slightly finer-grained than the Ironton Sandstone and is only present in the northern portion of Indiana (Emrich, 1966).

2.2.6 Davis Member (Confining Zone) (Cambrian)

The Davis Member of the Franconia Formation overlies the Ironton-Galesville Sandstones and is composed of a number of carbonate and clastic lithologies, including: 1) brownish gray, silty, glauconitic dolomite with oolites, 2) yellowish gray, feldspathic siltstone with dolomite and glauconite, 3) dark gray, calcareous shale, and 4) gray limestone with interbedded shale, siltstone, and sandstone (Figure 4). They are interpreted to have been deposited in a shallow marine environment (Willman et al., 1975).

2.2.7 Franconia Formation (Cambrian)

The Davis Member of the Franconia Formation is conformably overlain by the upper strata of the Franconia Formation (Figure 4), which consist of glauconitic, argillaceous sandstone and dolomite, and underlies the relatively clean dolomite of the Potosi Formation. In extreme northern Illinois, the Franconia Formation primarily consists of gray to pink, fossiliferous, glauconitic, silty, argillaceous, fine-grained, dolomitic sandstone with some interbedded red and green shale (Willman and Templeton, 1951). It becomes increasingly shaly to the south, and the uppermost part grades to silty and sandy dolomite. In north-central Illinois, these two units are separated by a wedge of fine-grained, glauconitic, dolomitic sandstone, which is absent in central and southern Illinois where the silty, shaly sandstone of the Davis Formation is directly overlain by relatively pure dolomite. Because of its diminishing amounts of sand, shale, and glauconite, the upper part of the Franconia Formation is difficult to differentiate from the overlying Potosi Formation dolomite (Willman et al., 1975). For this project, the Potosi and Franconia Formations will not be differentiated.

2.2.8 Potosi and Eminence Formations (Cambrian)

The Potosi Formation of the Knox Group overlies the Franconia Formation and consists of crystalline, clean to slightly argillaceous, brown to pinkish-gray dolomite (Figure 4; Willman et al., 1975). The Eminence Formation is also composed of dolomite and overlies the Potosi Formation. Due to the similar nature of the Potosi and Eminence formations (Droste and Patton, 1985), these strata are not differentiated for this project (Figure 4).

The Potosi Formation exists in much of the Illinois Basin, except in the north where it has been eroded (Willman and Templeton, 1951). This rock is sandy at the base and the glauconite content increases upward. Drusy quartz sometimes covers the surfaces of small to large cavities within the rock, which is a defining characteristic in both outcrops and core samples, and portions of this formation have relatively high permeability due to karst dissolution features (e.g., large vugs) and can be zones of lost circulation during drilling throughout the Illinois Basin (Willman et al., 1975).

Lasemi and Khorasgani (2024) interpret the widespread porous zones to have developed from rising basinal and hydrothermal fluids. Cavern reservoirs in the Potosi Formation are laterally extensive, stacked, and have relatively low bulk density and caliper log excursions. Associated mineral assemblages (i.e., saddle dolomite and Mississippi Valley-type ore deposits) suggest that regional karstification occurred by the flow of basement-sourced hypogenic/hydrothermal fluid that flowed through basement-rooted faults and associated folds and fractures. Lasemi and Khorasgani (2024) state that the thick dolomite strata of the Eminence and Oneota formations overlying Potosi paleokarst features can serve as effective seals.

2.2.9 Oneota Formation (Confining Zone) (Ordovician)

The Oneota Formation consists of crystalline, light gray to brownish gray, cherty dolomite with minor amounts of sand and thin shaly beds at the base (Figure 4). The rock is generally white to pinkish gray with some sandy and oolitic layers. The chert occurs in layers, lenses, isolated nodules, and irregularly shaped bodies that have a distinctive branching habit (Willman et al., 1975).

2.2.10 New Richmond Sandstone (Ordovician)

The New Richmond Sandstone overlies the Oneota Formation, is locally unconformable, and grades upwards and laterally into the Shakopee Formation in the Illinois Basin (Willman et al., 1975). The sandstone is gray, fine to medium grained, subrounded to rounded, friable, moderately-well sorted, with cross beds, ripple marks, and interbedded sandy dolomite with oolitic chert. The characteristics of the sandy dolomite intervals are similar to those of the overlying basal section of the Shakopee Formation (Willman and Payne, 1943).

2.2.11 Shakopee Formation (Confining Zone) (Ordovician)

The Shakopee Formation is the uppermost interval of the Knox Group and consists of argillaceous to pure, crystalline dolomite with some thin beds of medium-grained, cross-bedded sandstone, medium-grained dolomite, green to light gray shale, and buff siltstone. It contains oolitic, partly sandy chert in discontinuous bands and isolated nodules, conglomerate beds, ripple marks, and mud cracks, and bentonite layers are present in a quarry in northern Illinois (Willman and Templeton, 1951; Figure 4).

2.2.12 St. Peter Sandstone (Lowermost USDW) (Ordovician)

The Knox Group is overlain by the St. Peter Sandstone (Figure 4), which consists of fine to medium, well sorted, rounded, frosted quartz sand grains that are friable or weakly cemented with horizontal to low-angle cross beds. The St. Peter Sandstone is an exceptionally pure quartz sandstone and was deposited in a near-shore environment (Lamar, 1928; Willman and Payne, 1943; Buschbach, 1964). It has three members:1) the Kress Member at the base (chert, sand, clay, and shale), 2) the Tonti Sandstone Member, and 3) the Starved Rock Sandstone Member (Willman et al., 1975).

The St. Peter Sandstone is one of the major aquifers in Illinois and is the lowermost underground source of drinking water (USDW) in the project area. A USDW may supply public water systems or contains a sufficient quantity of groundwater to supply a public water system; and is not an exempted aquifer. The St. Peter Sandstone USDW is discussed in detail in Section 2.9.3 *Determination of Lowermost USDW*.

2.2.13 Joachim Dolomite (Ordovician)

The St. Peter Sandstone is overlain by the Joachim Dolomite (Figure 4), which can be differentiated into six members regionally within the basin. This rock is generally light gray, argillaceous, silty, or sandy dolomite, and also contains beds of relatively pure dolomite, sandstone, limestone, shale, and chert. Dolomitic algal domes are also found within the Joachim Dolomite. Layers of anhydrite exist in the subsurface but are dissolved where the Joachim Dolomite crops out. The general absence of marine fossils and existence of algal domes suggests that the Joachim Dolomite was deposited in a shallow, closed basin, and mud cracks and ripples occur in some beds. The Joachim Dolomite contains more clastic material than the overlying Platteville Group, and these two formations are not differentiated for this project (Willman et al., 1975).

2.2.14 Platteville Group (Ordovician)

The blue-gray, mottled limestone of the laterally continuous Platteville Group overlies the Joachim Dolomite. A diastem divides the Platteville Group into the lower Pecatonica Formation, which is a persistent dolomite, and the overlying Plattin Subgroup limestone (Buschbach, 1964; Willman et al., 1975).

2.2.15 Galena Group/ Trenton Limestone (Ordovician)

Overlying the Platteville Group is the Trenton Limestone of the Galena Group (Figure 4). The Galena Group has three major facies:1) fine-grained limestone in northwestern Illinois, 2) dolomite, and 3) a calcarenite in southern Illinois. In most of northern Illinois, the group is entirely dolomite and the lower part grades into a limestone to the south. Still farther south, the limestone interval is truncated so that the group is entirely calcarenite and calcarenitic limestone (Willman et al., 1975).

2.2.16 Maquoketa Group (Confining Zone) (Ordovician)

The shale and carbonate of the Maquoketa Group exists in most of Illinois, unconformably overlies the Galena Group, and truncates the portions of the upper half of the Galena Group in southern Illinois (Figure 4). Silurian strata locally truncate the upper half of the Maquoketa Group. Throughout most of Illinois, the Maquoketa Group consists of a lower shale unit (Scales Shale), a middle limestone (Fort Atkinson Limestone), and an upper shale (Brainard Shale) (DuBois, 1945; Gutstadt, 1958; Templeton and Willman, 1963; Buschbach, 1964). The Maquoketa Group will serve as a confining zone for this project.

2.2.17 Silurian System

The Silurian System unconformably overlies the Maquoketa Group. During this period, a shallow sea transgressed across the Illinois Basin and deposited carbonate sediments. This, in conjunction with the subsidence of the Illinois and surrounding basins, allowed prominent shelf-edge carbonate banks to develop. 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).

2.2.18 New Albany Shale (Confining Zone) (Devonian)

The New Albany Shale of Middle to Upper Devonian age unconformably overlies Silurian strata and is widely distributed across the Illinois Basin. The cumulative thickness of the organic-rich black shales is greatest near the center of the basin and thins toward the basin edge. Organic-poor, greenish-gray shales predominate in the basin center and are thickest in western and west-central Illinois. A broad transitional zone, where these organic-rich and organic-poor facies interfinger and grade laterally into one another, trends northeast-southwest across central Illinois (Cluff and Dickerson, 1982).

Sea level regressed during the Mississippian, and the Illinois Basin contained a river system that flowed southwestward across a swampy lowland, carrying mud and sand from the highlands located to the northeast. This river system formed thin, widespread deltas that prograded into the shallow sea that covered much of present-day Illinois. Because the lowland stood only slightly above sea level, slight changes in relative sea level caused great shifts in the position of the shoreline (Siever, 1951). The Mississippian strata (i.e., St. Genevieve, St. Louis, Keokuk) are more than 3,000 feet thick in some parts of Illinois (Willman et al., 1975) but are expected to be thin to absent at the project site.

2.2.19 Pennsylvanian System

The Illinois Basin continued to subside throughout the Pennsylvanian, which lead to the accumulation and preservation of about 3,000 feet of sediments in the basin. The previously described Mississippian river system persisted in flowing across a swampy lowland, carrying mud and sand from bordering highlands. These rivers formed thin, widespread deltas that coalesced into a vast coastal plain, and sediments continued to prograde into a shallow sea (Siever, 1951). At the Dragon Project site, much of the Pennsylvanian strata is limestone. During the late Pennsylvanian, a eustatic sea level regression coupled with the Alleghenian Orogeny tectonics, resulted in erosion of much Pennsylvanian and pre-Pennsylvanian strata. The bedrock at the Dragon Project site is composed of cyclothems of Pennsylvanian Carbondale Formation (Kolata et al., 2005), which will be further discussed in Section 2.9 *Hydrologic and Hydrogeologic Information*. Permian strata are not found at the Dragon Project site.

2.2.20 Quaternary Sediments

Illinois experienced numerous glacial intervals during the Quaternary Period, and glacial processes and post-glacial streams deposited up to 200 feet of sediment at and around the Dragon Project site, which is located just west of the westernmost extent of the Wisconsin end moraine (Panno et al., 2005). In Tazewell County, Kansan Stage glacial sediments of the Banner Formation infilled the pre-existing Mahomet Bedrock Valley, which locally incised the Pennsylvanian bedrock (Figure 17; Soller et al., 1999). Above the Banner Formation, numerous pre-Illinoian Stage tills (Harmattan, Hillery, and Tilton Tills of the Banner Formation) and Illinoian Stage tills (Vandalia and Radnor Till of the Glasford Formation), along with some interbedded sand and gravel lenses, separate the Banner Formation from the surficial Wisconsinan Stage Mason Group. The Henry Formation of the Mason Group composes the surface sediment at the project site (Kolata et al., 2005).

The Mahomet Sand Member of the Banner Formation comprises the Mahomet Aquifer (Figure 17), which Roadcap et al. (2011) and Locke et al. (2018) describe as being composed of the lowermost glacial sand and gravel deposited in the Mahomet Bedrock Valley immediately overlying bedrock that is expected to occur at about 200 fbsl. Quaternary deposits and the Mahomet Aquifer will be discussed in detail in Section 2.9 *Hydrologic and Hydrogeologic Information*.

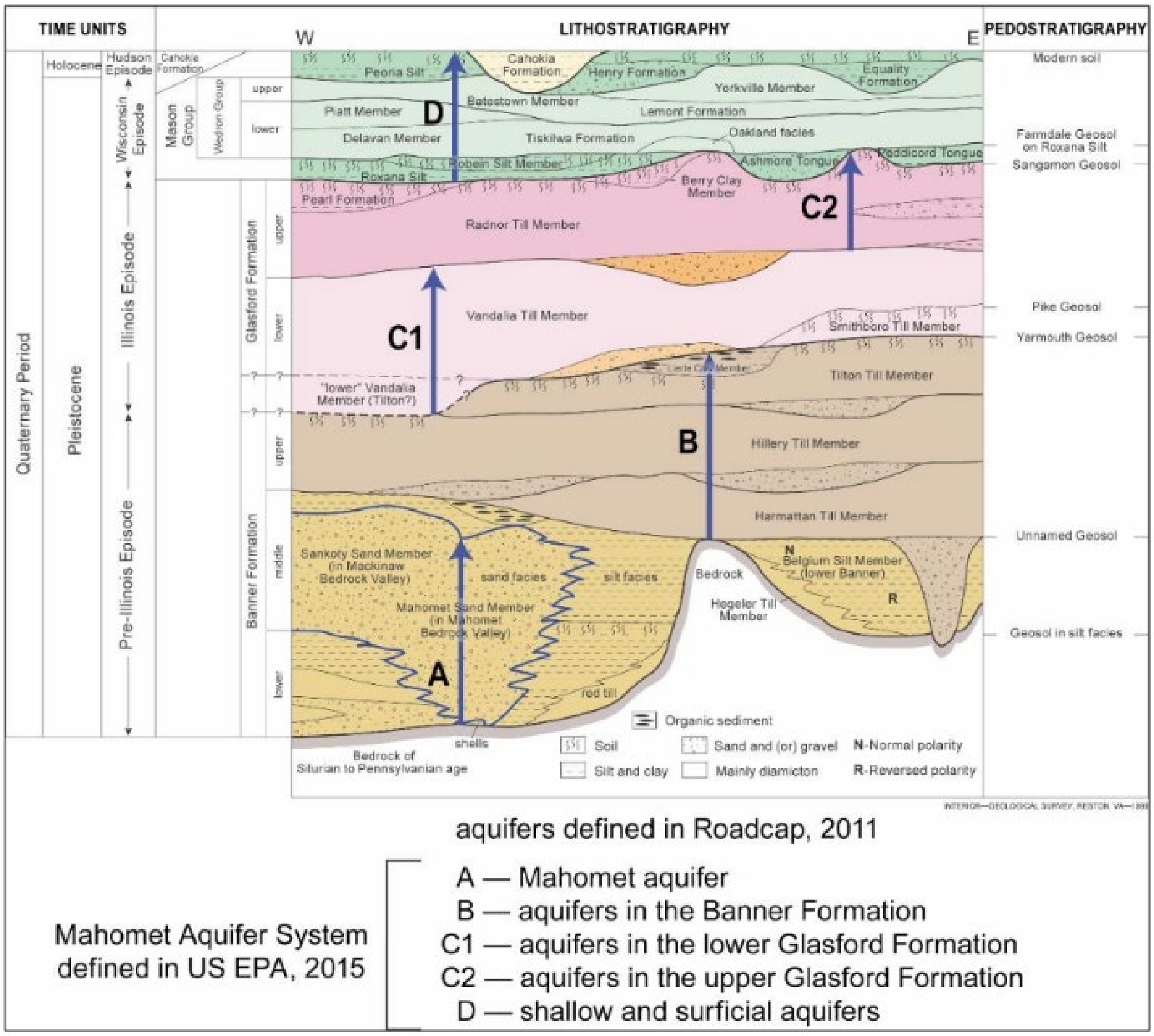

Figure 17. Stratigraphic column of glacial deposits in central Illinois (Roadcap et al., 2011; Locke et al., 2018).

2.3 Regional Structure

The Illinois Basin (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 (Denny et al., 2020).

The closest mapped structural features to the Dragon Project site are a series of subtle, parallel, east-plunging, individual folds (Bryant, Canton, Fairview, and Elmwood) that compose the larger Peoria Fold Complex on the Sangamon Arch. This arch formed by upwarping in the Silurian to Devonian periods and caused existing strata to generally dip to the east. This influenced the distribution of Silurian and Devonian carbonate strata and associated hydrocarbon reservoirs in western Illinois (Whiting and Stevenson, 1965). The named structures within the Peoria Fold Complex also have some smaller mapped but unnamed folds among the larger features (Nelson, 1995). In general, these asymmetrical folds have less than 100 feet of structural relief and the southern flanks of the folds are steeper than the northern flanks (Nelson, 1995).The Canton Syncline is the closest named structure to the project site (Figure 18). This fold is about 5 miles to the north of the project site, has a fold axis that is over 20 miles long, and structural relief ranges between 50 to 75 feet (Nelson, 1995).

The other named structures in the Peoria Fold Complex include the Bryant, Fairview, and Elmwood Synclines (Figure 18), all of which have similar orientations, lengths, and offsets. The Elmwood Syncline is the northernmost Peoria Fold Complex structure, has between 40 to 50 feet of structural relief, and becomes more asymmetrical with depth. The Bryant Syncline is the southernmost fold of the complex and is over 13 miles west-southwest of the project site (Figure 18; Nelson, 1995).

The Late Ordovician Glasford Structure is approximately nine miles north of the DRG INJ1 injection well that lies between the Canton and Fairview Synclines. It is interpreted to be an impact crater connected to an Ordovician event marked by an increase in the global rate of extraterrestrial impacts (Figure 18; Monson et al., 2019). A gravity survey suggests that this buried structure is 2.5 miles wide and samples taken from core collected in the structure show impact breccia, shatter cones, and quartz and dolomite micro-deformation. The structure is complex, with an uplifted central region that may cause Cambrian rocks to be about "1,000 feet above their normal stratigraphic position" (Monson et al., 2019). The crater is filled with a post-impact sedimentary succession of more than 1,000 feet of Ordovician through Pennsylvanian strata overlain by Quaternary sediments. Strata of the Galena Group are not deformed at the Glasford Structure, whereas strata of the Platteville Group and older are deformed, though the vertical thickness of the impacted strata is uncertain, and deformation could extend to the Precambrian Basement (Monson et al., 2019). An uplifted rim defines the furthest extent of the Glasford Impact Structure which is more than 7.5 miles north of the Dragon Project AoR.

An analog impact structure in Estonia, the Kardla Impact Structure, is also an Ordovician impact structure in Cambro-Ordovician sedimentary rock. At the Kardla Impact Structure fractures are not observed to extend horizontally further than the outer rim (Suuroja et al., 2013). As suggested by the analog Kardla Impact Structure, it is likely that fracturing will be limited to the bedrock immediately surrounding the Glasford Structure.

The most prominent structural feature in the central Illinois Basin is the La Salle Anticlinorium (Nelson, 1995), which is a large upward fold belt comprised of smaller domes, anticlines, monoclines (step-like folds), and intervening synclines (including the Clinton Syncline and Downs Anticline). It trends N-S to NE-SW and is about 200 miles (320 km) long by 80 miles (130 km) wide. Major uplift of the La Salle Anticlinorium began during the Late Mississippian and lasted throughout most of Pennsylvanian time (Kolata and Nelson, 1990). These features are more than 60 miles east of the project site and not shown in Figure 18.

The Clinton Syncline, which is more than 34 miles to the east of the project site, has a western flank that is relatively gentle compared to the eastern flank, and merges with the western limb of the Downs Anticline (Figure 18). The asymmetrical, south-plunging Downs Anticline is a component of the larger, north-south trending La Salle Anticlinorium and has a significantly steeper western flank. Several domes occur along the Downs Anticline, and borehole data shows that this fold is likely a basement structure.

High density two-dimensional (2D) seismic data acquired specifically for the Dragon Project indicates there are no significant structural features identified within the project's AoR that would impact CO_2 sequestration and containment. The 2D seismic data is discussed in detail in Section 2.5 *Faults and Fractures*. The structural features listed above are significantly removed from the project area and are not considered impactful to carbon sequestration operations.

[redacted]

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

[redacted]

[redacted]

The Lower Mt. Simon Sandstone (target injection interval) and the Eau Claire Shale (primary confining zone) both extend laterally beyond the AoR limits. This is demonstrated by the regional thickness maps (Figure 12 and Figure 15), the cross section shown in Figure 5, and 2D seismic data discussed below (Figure 20, Figure 21, Figure 22, Figure 23, Figure 24, and Figure 25).

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

2D seismic data (Figure 20, Figure 21, Figure 22, Figure 23, Figure 24, and Figure 25) acquired specifically for the Dragon Project and discussed in Section 2.5 Faults and Fractures of this document indicate the Mt. Simon Sandstone and Eau Claire strata are laterally continuous and exhibit no significant faults or structural features. One fault is observed in the seismic data that terminates within the upper part of the Middle Mt. Simon Sandstone and does not extend vertically into overlying Mt Simon strata or to the Eau Claire Shale. Other observed faults are either within the Precambrian Basement section and truncate at or below or at the Precambrian unconformity or extend into the Lower Mt. Simon Sandstone. These faults would have no impact on injection or containment (Section 2.5 *Faults and Fractures*).

The St. Peter Sandstone is the lowermost USDW present within the AoR based on regional data (Figure 4) and the top of this formation is predicted to occur at a depth of approximately [redacted] feet, with its base about [redacted] feet above the top of the primary confining zone at the Dragon Project site (Section 2.9.3 *Determination of Lowermost USDW*). There are no structural features or faults observed to intersect the St. Peter Sandstone in the AoR. As described in Section 2.1 *Regional Geology, Hydrogeology, and Local Structural Geology*, there are several confining zones within the Knox Group between the Eau Claire Shale and the St. Peter Sandstone in the AoR.

There are no O&G wells and 30 water wells within the Dragon AoR (Figure 19; ILWATER) as compiled from the Illinois Water and Related Wells website and the Illinois O&G Resources website. Shallow groundwater utilization wells in the AoR range in depth from 44 feet to 136 feet. A table with the identifying information, location, depth, and status of these wells and borings was uploaded to the Geologic Sequestration Data Tool (GSDT).

There are no existing wells that penetrate the primary confining zone in the AoR at the Dragon Project site.

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

Figure 20 shows the four 2D seismic lines that were acquired to characterize the subsurface within the Dragon Project AoR and to provide information regarding subsurface structure and stratigraphy. Three of the seismic lines fully traverse the AOR: Lines 1, 2, and RL2030. Line RL2000 is located about [redacted] west of the western edge of the AOR but is included in this discussion for additional geological context.

The two lines shown in red were part of a high resolution 2D seismic program conducted during March 2024. The data were acquired with a vibrator truck operating on county roads with a 4-120 Hz broad band sweep of 20 second duration. 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. The two lines shown in blue were acquired during an ultra high resolution 2D seismic program conducted during June 2024 using a vibrator truck with a with a 4-120 Hz broad band sweep of 20 second duration. Source and receiver spacing of 40 and 20 feet, respectively, were used and enabled high density processing.

Seismic image quality over the four seismic lines was variable. The shallower stratigraphy (Maquoketa Group to Knox Group) was generally well-imaged, but the deeper stratigraphy was more variable in image quality. This variability is believed to be caused by changes in the thickness and sediment type of the near-surface and shallow geology. Overall the seismic data quality is sufficient to confirm the continuity of the Mt. Simon Sandstone and Eau Claire Shale.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.5.1 Impact on Containment

No faults or fractures are observable within the primary confining zone at the Dragon Project site. The primary confining and injection zones do not have notable structural features. Line 2 has one fault that dies out at the upper part of the Middle Mt. Simon Sandstone but clearly does not extend up to the Eau Claire Shale (Figure 25). Other faults are either within the Precambrian Basement and truncate at or below or at the Precambrian unconformity or extend into the Lower Mt. Simon Sandstone. These faults will not impact containment.

Previously collected seismic data associated with CO_2 sequestration projects in the Illinois Basin suggests that minor faults in the Precambrian Basement and Argenta / Mt. Simon Sandstone strata are not expected to act as conduits through the primary confining zone (Greenberg, 2021) and present no endangerment to USDWs.

Vault Dragon CCS LP intends to acquire a baseline three-dimensional (3D) surface seismic survey at the Dragon Project site and any identified structural features or faults will be mapped and assessed to determine if there is any potential impact to storage or containment. The data gathered during the pre-operational phase of the project will be used for geomechanical modeling to evaluate whether any minor faults identified in the seismic data are stable or whether they could become critically stressed during the injection phase of the project (Attachment 05: Pre-operational Testing Program, 2024).

2.5.2 Tectonic Stability

The Dragon Project site is within an intraplate tectonic setting several thousands of miles distant from a plate boundary. It is located in the northern portion of the intracratonic Illinois Basin which is a tectonically stable region that has a low probability of seismic activity or earthquakes above M 2.5. See Section 2.8 *Seismic History* for detailed discussion for earthquakes near the Dragon Project site. Between 1 billion to around 600 million years ago a nascent rift began to develop in what is now southern Illinois (Kolata and Nelson, 1990) approximately 225 miles south of the Dragon Project site. The location of the failed rift is associated with the Reelfoot Reef and Rough Creek Graben within the New Madrid seismic zone (Section 2.1 *Regional Geology, Hydrogeology, and Local Structural Geology*).

There is no evidence of significant seismic activity in the region of the Dragon Project since the end of the Paleozoic Era 250 million years ago. This is supported by 2D seismic data acquired for the Dragon Project (Section 2.5 *Faults and Fractures*) that show that faults originating in the Precambrian Basement terminate in the Lower and Middle Mt. Simon Sandstone and thus have not been active since Cambrian time. Regionally, thickness changes in the Cambrian-aged Argenta and Lower Mt. Simon formations may be related to interpreted syn-depositional fault movement along the basement-involved faults. However, at the Dragon Project site, no changes in thickness of strata overlying the Mt. Simon Sandstone can be attributed to these faults, which suggests there has been little active faulting since early Cambrian time approximately 500 million years ago.

2.5.3 Addressing Uncertainty

A 3D surface seismic survey will be acquired for the project prior to submitting the Pre-Operational Narrative to evaluate injection and confining zone properties, map Precambrian Basement topography, and characterize any identifiable basin fill or basement faults. Detailed mapping and attribute analysis using this dataset is expected to confirm the lack of large-scale faulting. The 3D surface 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 proposed 50-year PISC period to provide an indirect measurement of CO_2 plume migration over time (Attachment 06: Testing and Monitoring, 2024; Attachment 08: Post-injection Site Care and Site Closure, 2024).

As detailed in Attachment 05: Pre-operational Testing Program, (2024), 4-inch core and geophysical logs, which include sonic and image logs, will be acquired while drilling the DRG INJ1 well. These will be used to assess the nature of identifiable fractures and their impact on long-term integrity of the primary confining and injection zones.

The static model will be updated with the 3D seismic data and well analyses, and a Pre-Operational Narrative will be submitted to the EPA that will provide the new data and updated static and computational models. Narrative text, maps, and cross sections related to faults and fractures will be updated with the new data.

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

2.6.1 Injection Zone and Primary Confining Zone Extent and Thickness

The Lower Mt. Simon Sandstone is the target injection interval for the Dragon Project. The entire injection zone is represented by the sedimentary succession bracketed by the base of the Lower Mt. Simon Sandstone and the top of the Eau Claire Silt (Figure 4). Within this package, the Middle Mt. Simon Sandstone typically has relatively poor reservoir quality in the central Illinois Basin and serves as a baffle to upward fluid migration. Computational modelling predicts that most of the injected CO_2 remains in the Lower Mt. Simon Sandstone (Attachment 02: AoR and Corrective Action Plan, 2024). The Upper Mt. Simon Sandstone can also have good reservoir characteristics and is used for natural gas storage within the Illinois Basin region (Figure 6). The Eau Claire Shale is the primary confining zone for the Dragon Project (Figure 4). The 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 Dragon Project site. Within the Dragon AoR, there are only minor elevation variations and no significant thinning of either the target injection interval (Lower Mt. Simon Sandstone) or primary confining zone (Eau Claire Shale). [redacted] Site specific 2D seismic data discussed in Section

2.5 *Faults and Fractures* confirms the lateral continuity and structural integrity of these strata across the AoR.

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 Eau Claire Shale primary confining zone will provide a thick, laterally extensive barrier to prevent upward migration of injection zone fluids over time.

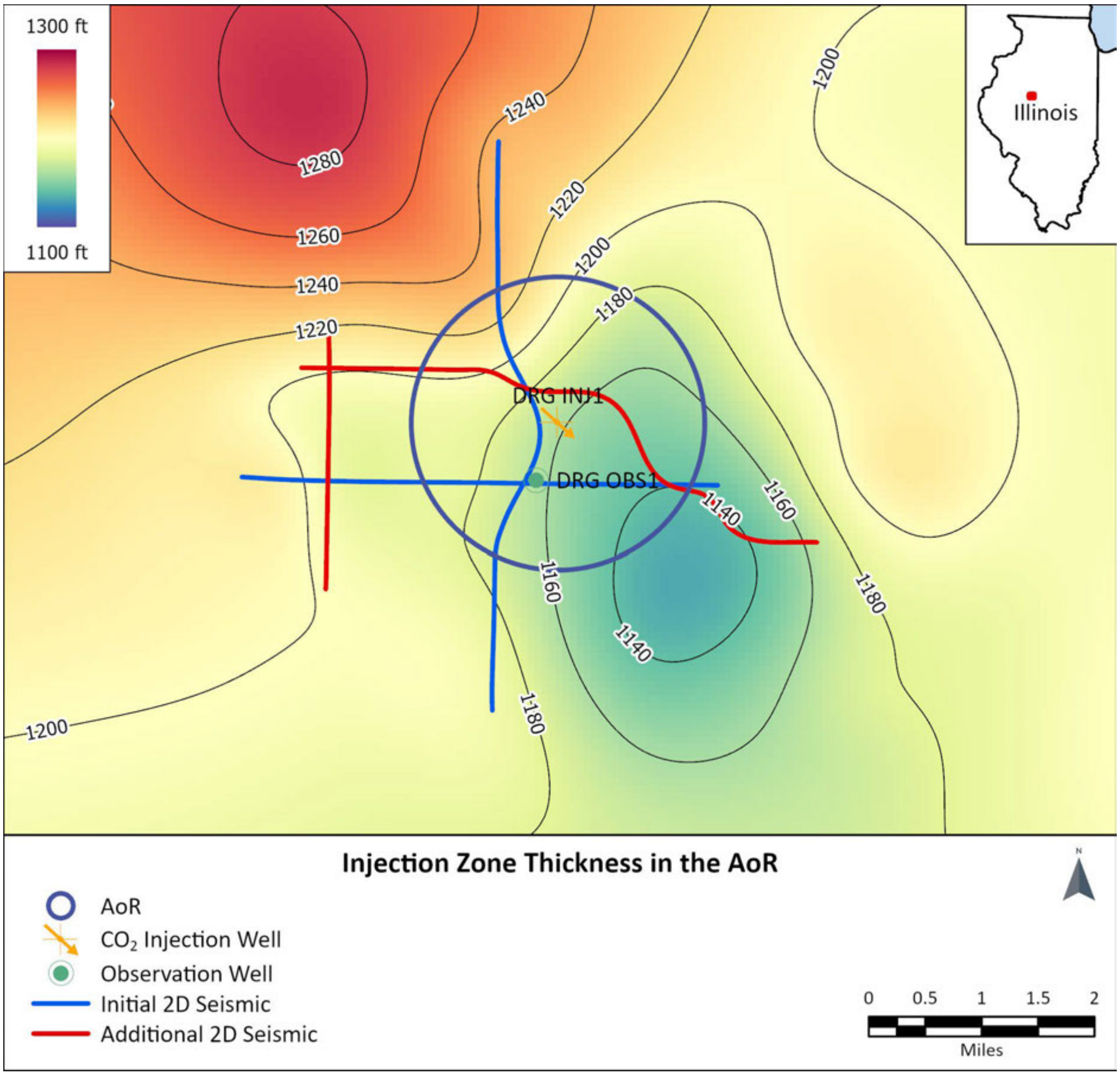

Figure 26: Thickness (feet) of the Mt. Simon Sandstone and Eau Claire Silt injection zone in the AoR.

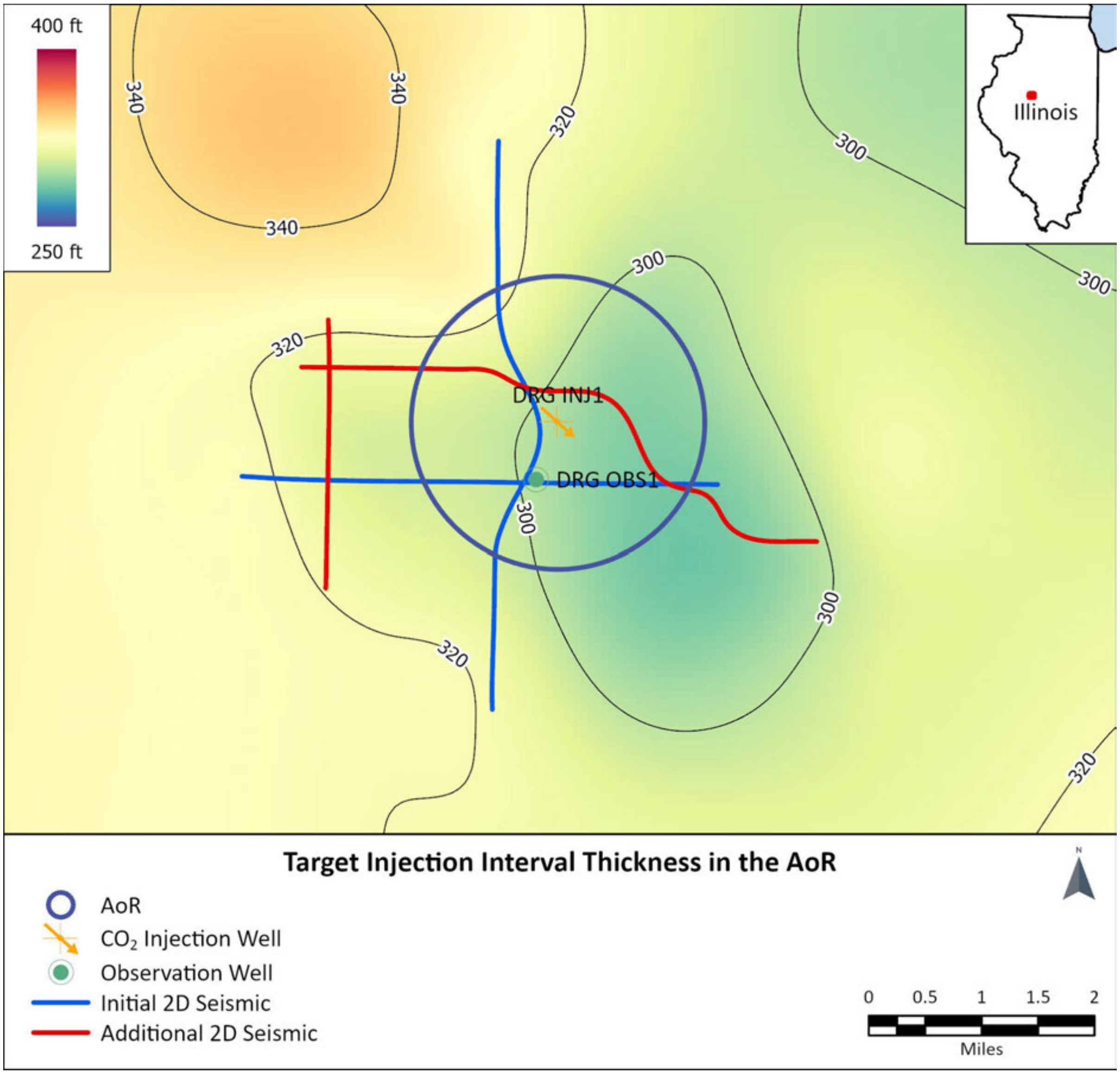

Figure 27: Thickness (feet) of the Lower Mt. Simon Sandstone target injection interval in the AoR.

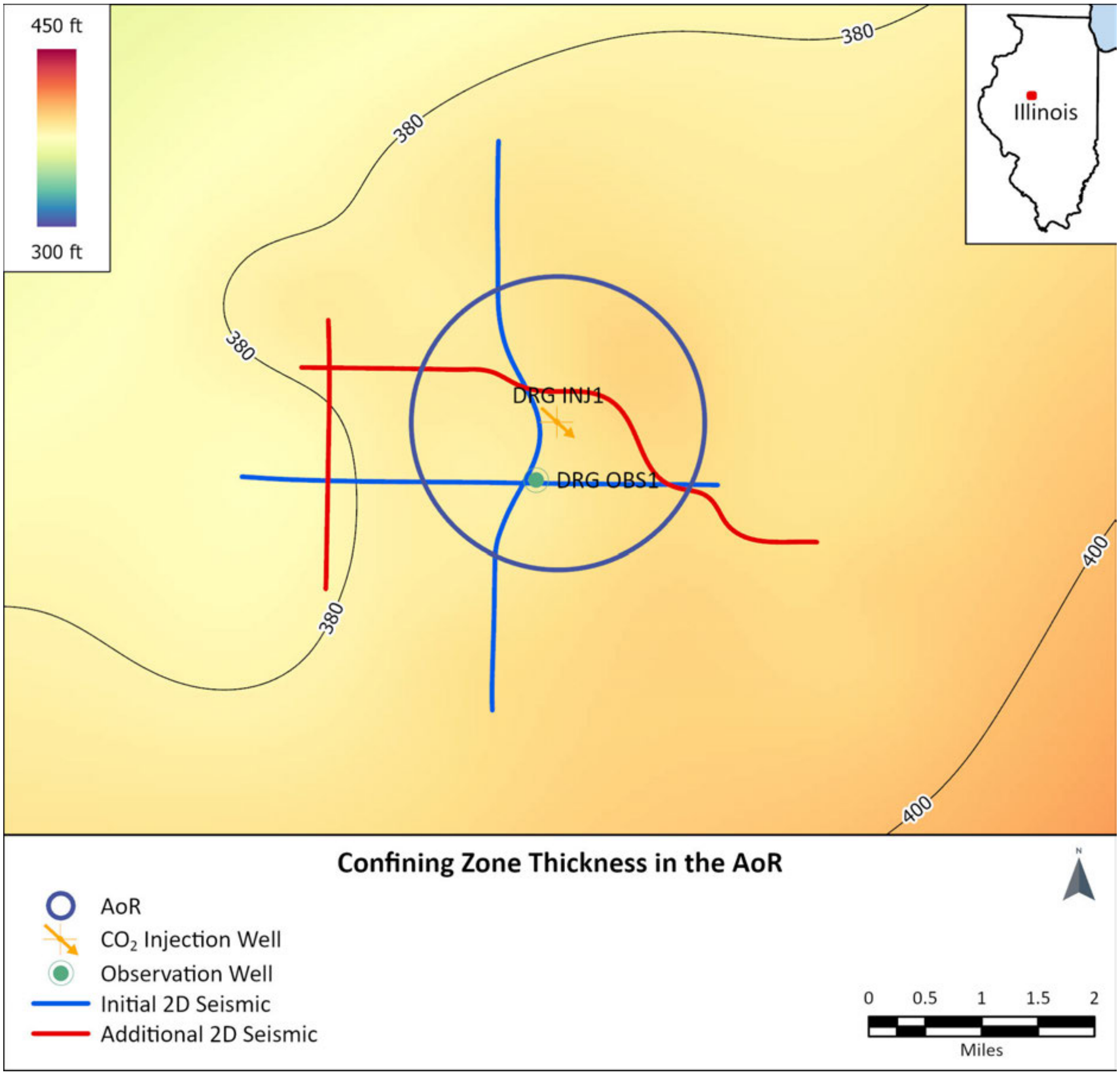

Figure 28: Thickness of the Eau Claire Shale primary confining zone in the AoR.

2.6.2 Porosity and Permeability

Public log and core information from seven wells in Illinois provide significant data to characterize the injection and primary confining zones at the Dragon Project site. Available wells that penetrate the Mt. Simon Sandstone or deeper are from gas storage sites, UIC Class VI sites, and structure test wells that have well logs, core, and fluid injection data from the Mt. Simon Sandstone and Eau Claire Shale (Figure 29). The Furrow #2 well is located approximately 45 miles east-northeast of the project site and represents the closest analog for the injection and primary confining intervals. However, due to core and other data sets collected at the ADM CCS1 well and the similar geology between ADM CCS 1 and Furrow #2, ADM CCS 1 will also be used as a porosity and permeability analog for the injection and primary confining zones. Mt. Simon Sandstone average porosity and permeability values from the seven offset wells in central Illinois are presented in Table 4.

[redacted]

2.6.3 Mt. Simon Sandstone (Injection Zone)

[redacted]

The Upper Mt. Simon Sandstone may exhibit good reservoir characteristics particularly in thin, tidal flat channel sands such as are utilized for natural gas storage in the basin (Morse and Leetaru, 2005). The Upper Mt. Simon Sandstone is heterogeneous with interbedded shale and has regional log-derived porosity and permeability averages of 8.5% and 5.4 mD, respectively, although more porous and permeable units are present (Leetaru et al., 2019).

At the ADM CCS1 well, the entire Lower Mt. Simon Sandstone interval is reported to have a mean well log porosity of 16.6% and permeability values as high as 400 mD (Leetaru et al., 2019). The average effective porosities and intrinsic permeabilities for various depth intervals within the Mt. Simon Sandstone and Argenta Formation were reported by Patrick Engineering (2011). These data are also shown on the ADM CCS 1 well log, were calculated by integrating geophysical logs/core/well test data, and then used to divide the Eau Claire, Mt. Simon Sandstone, and Argenta Formation into seven sub-intervals based on lithologic and porosity trends (Table 4 and Figure 30). The ADM CCS1 data show that the Lower Mt. Simon Sandstone has the best reservoir quality. The highest reported average porosity and permeability values (21.8%, 107 mD) are found within the basal arkose interval. The Upper Mt. Simon Sandstone has relatively high average values (10.8%, 19.4 mD) compared to the underlying Middle Mt. Simon Sandstone interval (8.7%, 10.2 mD) (Table 4 and Figure 30).

[redacted]

[redacted]

Site specific information from 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, core acquisition and analysis, and injectivity testing (Attachment 05: Pre-operational Testing Program, 2024).

The baseline 3D surface seismic data will be calibrated to the well data and 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.

2.6.4 Eau Claire Shale (Primary Confining Zone)

[redacted]

2.6.5 Ironton-Galesville Sandstone (Dissipation Zone / ACZ Monitoring Zone)

The Ironton-Galesville Sandstones are not differentiated and together will serve as the ACZ Monitoring Zone and as a potential dissipation interval (Section 2.2.5 *Ironton-Galesville Sandstones*). At the Furrow #2 well, the Ironton-Galesville Sandstones are 208 feet thick with average porosity and permeability values of 10% and 20 mD.

2.6.6 *Davis Member (Confining Zone)*

The Davis Member of the Franconia Formation is a fine-grained shaley unit at the base of the Franconia Formation in north-central Indiana and will serve as a confining zone for the Dragon Project (Section 2.2.6 *Davis Member*). The Davis Member lithology is primarily interbedded shallow marine carbonates and shale. At the Furrow #2 well, the Davis Member is 57 feet thick and has average porosity and permeability of 0.5% and 0 mD. This shale is prognosed to be 61 feet thick at the project site.

2.6.7 Addressing Uncertainty

Vault Dragon CCS LP will collect a 3D surface seismic survey and conduct a comprehensive core and logging program at the DRG INJ1 well that will be summarized as part of the Pre-Operational Narrative (Attachment 05: Pre-operational Testing Program, 2024). This information will be used to create a seismic-to-well tie, and updates will be made to the static model as needed. The high-density seismic data and the local well data will provide information to update the injection and confining zone's depth, thickness and continuity while reducing uncertainty within the AoR and larger model domain.

DRG INJ1 well results, including cores and logs (Attachment 05: Pre-operational Testing Program, 2024), will provide direct lithological and petrophysical data for the injection and confining zones at the site. Porosity and permeability measurements from core and calibrated logs will be used to validate the static model properties and updates will be made as needed (Attachment 02: AoR and Corrective Action Plan, 2024).

The site static model will be updated with depths, thicknesses, and reservoir properties including capillary pressure measurements acquired from DRG INJ1, and used to update the computational models and reduce uncertainty at the Dragon Project site. A revised Pre-Operational Narrative will be submitted to the EPA that will provide the new data and updated static and computational models, as well as the verification or re-evaluation of the project AoR.

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

2.7.1 Geomechanics

A 32-layer geomechanical model was constructed to test the integrity of the confining zone at the Dragon Project site. Average values of Young's Modulus, Poisson's Ratio, and bulk compressibility were calculated for the modeled geologic zones using data from the ADM CCS1 well (Figure 3, Figure 7, and Figure 30). Average values of total closure stress (TCS) and pore pressure used in the geomechanical model are shown in Table 5. The large difference between the TCS and the pore pressure indicates that there is a significant buffer that will allow for sufficient injection rate to occur without opening existing fractures.

Figure 31 is a log with the calculated geomechanics properties calculated at 0.5-foot intervals and calibrated with geomechanical data from step rate tests (SRT). The calculated values of TCS were compared to actual values from SRT from the ADM CCS1 and were found to be in good agreement. These geomechanical data were then used to model the Eau Claire Shale confining zone integrity with an anticipated injection rate of 750 ktpa into the Lower Mt. Simon Sandstone for the Dragon Project.

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[redacted]

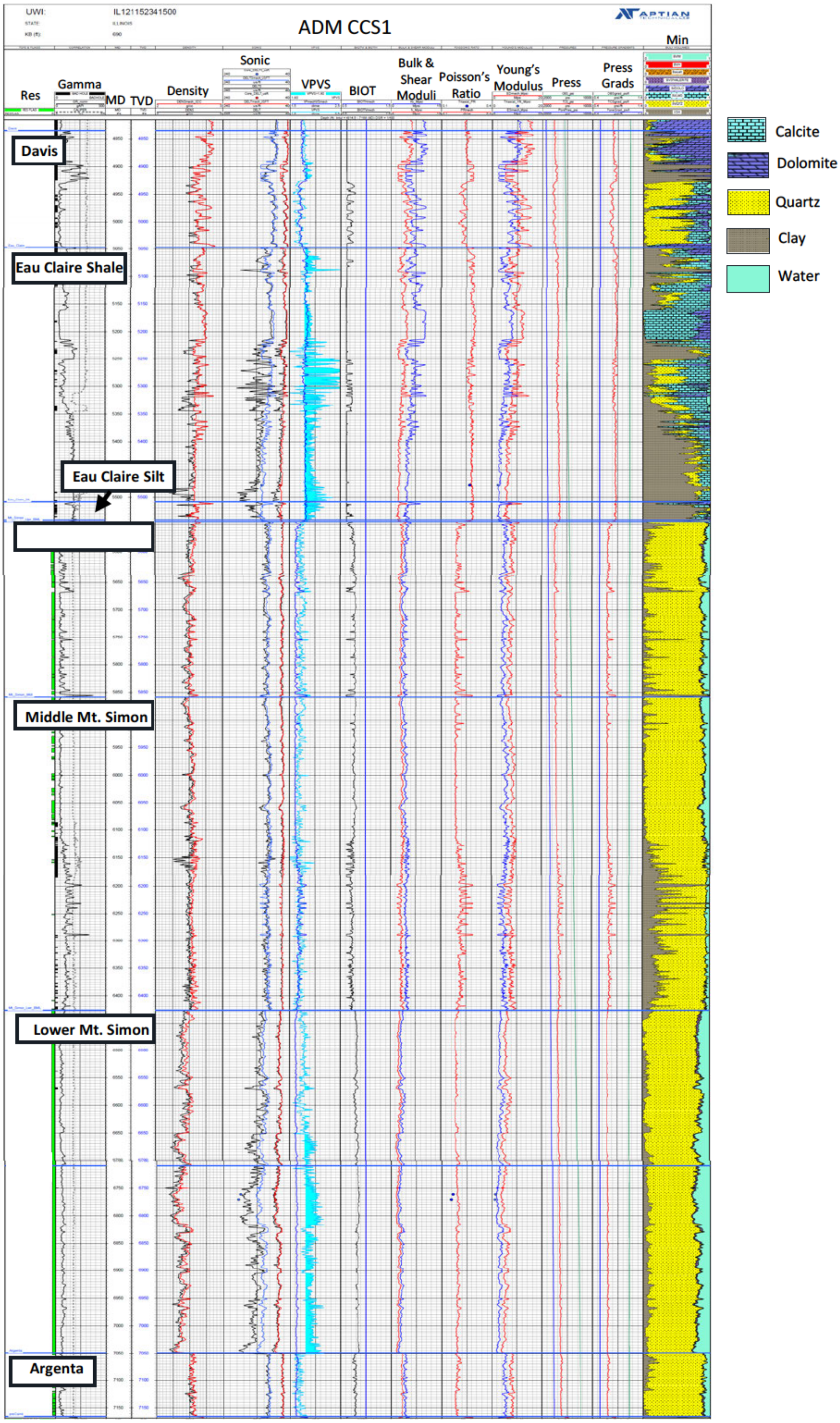

Figure 31. Geomechanical parameters calculated from the ADM CCS1 well (12115234150000). Res=reservoir, VPVS=compressional to shear wave velocity ratio, BIOT=Biot's Factor, Press=pressure, Grads=gradient, Min=mineralogy.

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. Information on the core testing that will provide ductility information for the injection and confining zones are provided in (Attachment 05: Pre-operational Testing Program, 2024). These data include:

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

2.7.2 Petrophysics

Petrophysical analysis of the Precambrian Basement, Mt. Simon Sandstone, Eau Claire Silt, and Eau Claire Shale were completed using data from seven wells in the general region of the Dragon Project site (Figure 29; Table 7). The petrophysical analyses were used to evaluate the characteristics of the confining and injection zones (Figure 32, Figure 33, Figure 34, Figure 35, and Figure 36). For the analyses, log ascii standard (LAS) files and routine core data was acquired from the Illinois State Geological Survey, Illinois O&G Resources Map (ILOIL), and other public data sources. Geophysical well logs, core plugs, and well test data were used to calibrate the petrophysical calculations to derive effective porosity and permeability. 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).

[redacted]

Core and log data were calibrated to well test data that was publicly available from the IBDP dataset (2022), Sandia Technologies, (2013) and the T.R. McMillen #2 well. Cross plots and histograms were made using this data which enabled better analysis of wells which did not have core data and improved the geologic model (Figure 32, Figure 33, and Figure 34).

Pre-processing work on the raw log data, including 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 seven 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 and Eau Claire Shale, respectively. The petrophysical values are incorporated into the static model for the Dragon Project site (Attachment 02: AoR and Corrective Action Plan, 2024). The average Mt. Simon Sandstone porosity and permeability values range from 11% to 13% and 21 mD to 50 mD Of the wells evaluated, ADM CCS1 and T.R. McMillen #2 have the highest Mt. Simon Sandstone average porosity and permeability values whereas Furrow #2 has the lowest values (Figure 35; Figure 36; Table 8).

Facies modeling was performed on the seven 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 cut-offs for sandstone (relatively higher porosity), silty sandstone, and shale facies (relatively lower porosity). Individual variograms for each facies were developed, and the facies were then distributed throughout the static model. For the petrophysical wells, effective porosity/permeability cross plots (Figure 32), effective porosity histograms (Figure 33), and permeability histograms (Figure 34) indicate that the Upper and Lower Mt. Simon Sandstone intervals are primarily composed of quartz with some interbedded shale layers (Figure 35 and Figure 36) and have the highest porosity and permeability values. The Middle Mt. Simon has slightly poorer reservoir quality. The Eau Claire Shale primary confining zone has significantly lower effective porosity and permeability values and higher shale content compared to the underlying Mt. Simon Sandstone (Figure 32; Figure 33; Figure 34; Figure 35; Figure 36; Table 9 Attachment 02: AoR and Corrective Action Plan, 2024).

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2.7.3 Addressing Uncertainty

The comprehensive core and logging program for DRG INJ1 is designed to provide geomechanical data that will reduce uncertainty at the Dragon Project site (Attachment 05: Pre-operational Testing Program, 2024). Triaxial compression and rock compressibility tests will be performed to characterize Young's modulus, Poisson's ratio, rock strength, compressibility, and ductility. These calculations will be incorporated into existing geomechanical analyses and updates will be made as needed.

As previously stated in Section 2.5.3, sonic and image logs from DRG INJ1 will be used to characterize fractures at the Dragon Project site. Additionally, step-rate tests will be performed to inform fracture opening pressure, fracture propagation pressure, and fracture closure pressure. These test and logs will be used to update primary stress fields and fracture gradient calculations at the Dragon Project site, and a Pre-Operational Narrative will be submitted to the EPA that will provide the new data and updated static and computational models

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

Based on Federal Emergency Management Agency (FEMA) classification, the Dragon Project site has a very small probability of experiencing damaging earthquake effects. The site is more than 215 miles north of the strongest shaking Zone E associated with the New Madrid Seismic Zone (Figure 37).

All earthquakes since 1800 having magnitude of 2.5 or greater within a 100-mile radius of the Dragon Project site are shown in Figure 38 and listed in Table 10 (USGS, 2024). The largest earthquake within this 100-mile radius occurred in 1909 approximately 22 miles southwest with a felt-area magnitude of 4.8 mantle faulting assessment magnitude (mfa). The most recent earthquake occurred on July 15, 2024, approximately 98 miles northeast of the project site with a magnitude of 3.1 regional moment magnitude (mwr). No earthquakes have been recorded with an epicenter in the project AoR.

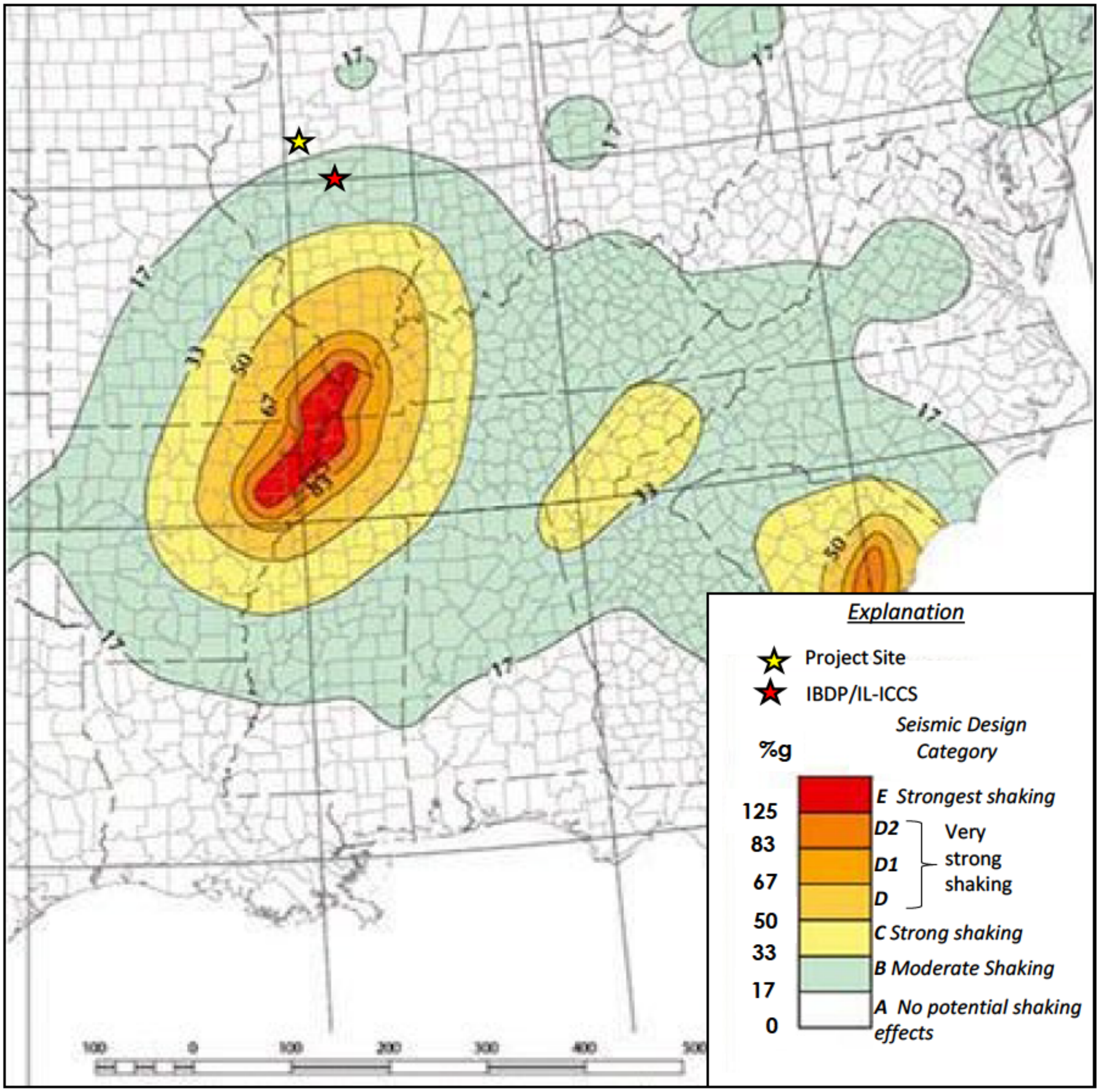

Figure 37: FEMA Earthquake Hazard Map shows that the project site (yellow star) is located in the lowest earthquake hazard category A (FEMA). The IBDP/IL-ICCS site is represented by a red star.

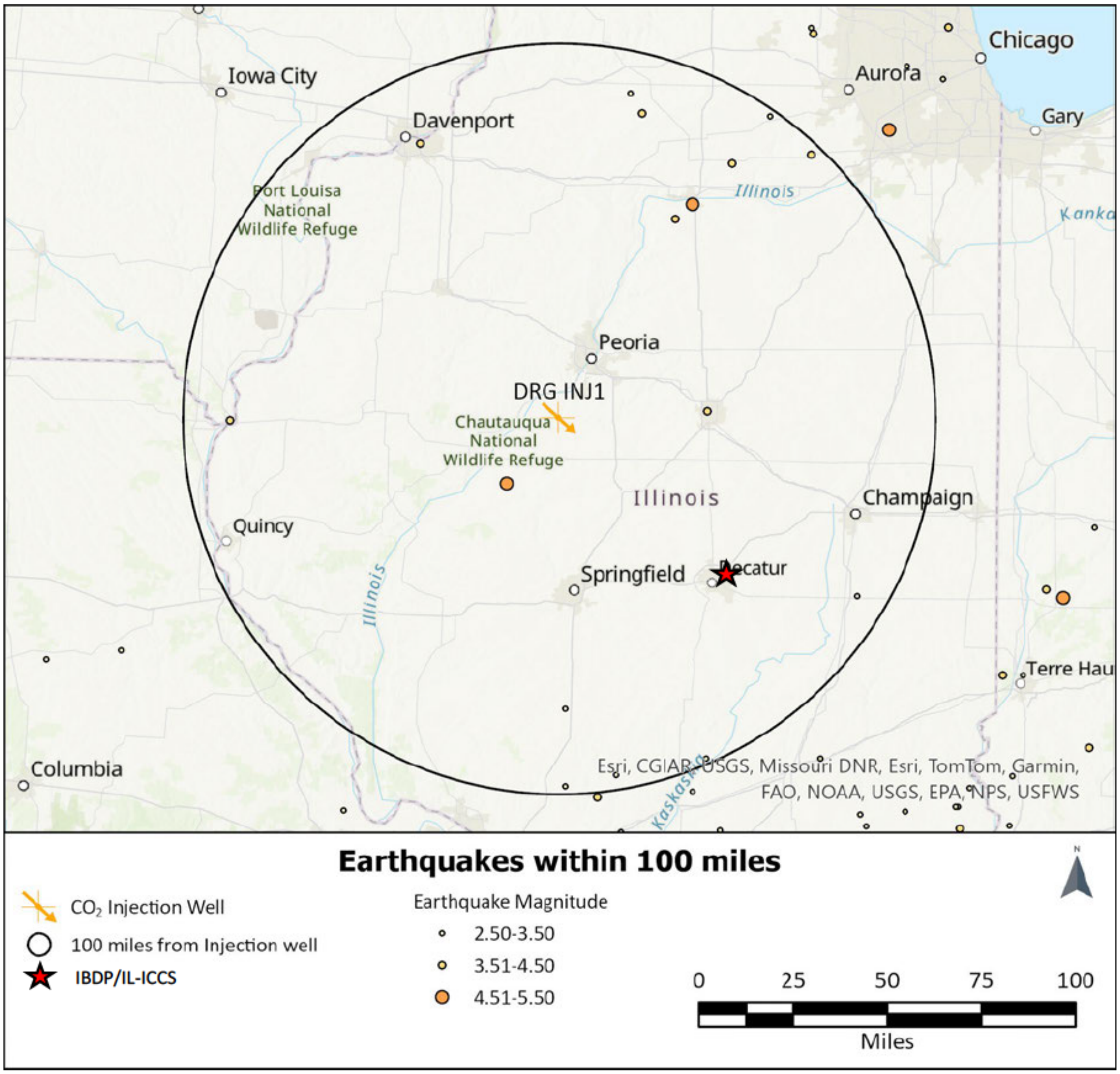

Figure 38: Map of earthquake epicenters with 2.5 or greater magnitude that occurred between 1 January 1800 and 24 September 2024 within 100 miles (black circle) of the Dragon injection well (USGS, 2024). The IBDP/IL-ICCS site is represented by a red star.

Table 10: Earthquake events 2.5 or greater magnitude from 1 January 1800 to 24 September 2024 with epicenters within 100-miles of the Dragon injection well (USGS, 2024). (mw=moment magnitude scale, mwr=regional moment magnitude, mb=body wave magnitude, md=duration magnitude, lg=surface wave magnitude, mfa=mantle faulting assessment magnitude, mb_lg=combines both body wave magnitude and surface wave magnitude.)

Date	Latitude	Longitude	Depth	Magnitude	Magnitude Type	Location
07/15/2024	41.64610	-88.71160	9.67	3.10	mwr	2 km WNW of Somonauk, Illinois
11/15/2023	41.24020	-89.18580	5.69	3.60	mb_lg	1 km SSW of Standard, Illinois
10/26/2023	39.16233	-88.96750	17.47	2.58	md	6 km SSE of Herrick, Illinois
06/28/2004	41.46000	-88.90000	10.00	4.20	mwr	12 km NW of Dayton, Illinois
09/02/1999	41.72100	-89.43300	5.00	3.50	mblg	8 km W of Amboy, Illinois
03/13/1987	39.09000	-89.41000	1.10	3.20	md	1 km W of Coffeen, Illinois
03/28/1985	39.04000	-89.66000	5.00	2.50	md	4 km SW of Walshville, Illinois
07/01/1982	39.34000	-89.67000	5.00	2.60	md	4 km SSW of Waggoner, Illinois
02/16/1978	39.80000	-88.23000	5.00	2.70	mlg	4 km E of Tuscola, Illinois
09/15/1972	41.64500	-89.36900	11.00	4.04	mw	8 km SSW of Amboy, Illinois
11/12/1934	41.50000	-90.50000	0.00	4.00	fa	1 km ESE of Moline, Illinois
01/02/1912	41.50000	-88.50000	0.00	4.50	fa	2 km NW of Lisbon, Illinois
07/19/1909	40.20000	-90.00000	0.00	4.80	fa	5 km N of Kilbourne, Illinois
04/13/1905	40.40000	-91.40000	0.00	4.00	mfa	Near Keokuk, Iowa
02/04/1883	40.50000	-89.00000	0.00	4.30	mfa	Near Bloomington, Illinois
05/27/1881	41.30000	-89.10000	0.00	4.60	mfa	Near La Salle, Illinois

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 St. Peter Sandstone, around the project site. Water well, monitoring well, and dry well records were collected for the project AoR from the Illinois State Geological Survey. A total of no shallow groundwater and two engineering test wells are located within the AoR. There are no natural springs within the AoR. The AoR and Corrective Action Plan includes a detailed discussion of the number and locations of the groundwater wells within the AoR (Attachment 02: AoR and Corrective Action Plan, 2024). A shallower USDW source, the Mahomet Aquifer (Figure 39), is located above the St. Peter Sandstone in unconsolidated Quaternary sediments.

2.9.1 Mahomet Aquifer System

The Dragon Project site is located within the Mackinaw River Basin, which is a major tributary to the Illinois River (Figure 39). These rivers primarily drain rural agricultural land in central and east-central Illinois. The average ground elevation within the AoR is around 500 feet above mean sea level (MSL).

Unconsolidated sand and gravel deposits provide much of the water supply to communities, agriculture, and industry in central Illinois, and the main source of groundwater at the Dragon Project site is the Mahomet Aquifer System. During the Pleistocene Epoch, the Illinois Basin experienced several glacial intervals with glacial processes and post-glacial streams depositing more than 500 feet of valley fill in certain areas of the state (Figure 40 and Figure 41). The Mahomet Aquifer System occurs within the Pleistocene glacial and related deposits (Section 2.2.20) that infill the pre-existing Mahomet Bedrock Valley which is locally incised in Pennsylvanian bedrock (Figure 17, Figure 39, Figure 40, Figure 41, and Figure 42; Soller et al., 1999; Roadcap et al., 2011). These glacial deposits overlie bedrock and affect surface hydrology and aquifers in the region (William H. Walker et al., 1965). At the Dragon Project site these glacial deposits are expected to be about 100 to 200 feet thick.

The Mahomet Aquifer System (Figure 17) comprises four hydrogeologic units including the shallow and surficial aquifers, aquifers in the Glasford Formation, aquifers in the upper Banner Formation, and the Mahomet Sand Member which is in the lower Banner Formation (Roadcap et al., 2011; USEPA, 2015; Locke et al., 2018). Water-bearing sands and gravels within the Glasford and Banner Formations typically occur within or between till deposits. The sand and gravel deposits of the shallow and surficial aquifers, Glasford Formation aquifers, and upper Banner Formation aquifers are typically thin, discontinuous, and of limited aerial extent and are primarily used for rural domestic water supply (Roadcap et al., 2011).

The Mahomet Aquifer is within the lowermost deposit of preglacial and glacial sand and gravel (Mahomet Sand Member) in the Banner Formation (Soller et al., 1999; Locke et al., 2018). The aquifer occurs within an east–west trending buried bedrock valley in east-central Illinois that extends into western Indiana, and flows westward at the project site (Figure 43; Kempton et al., 1991; Roadcap et al., 2011). The Mahomet Aquifer is an extensive source of high-quality, fresh groundwater in central Illinois and provides an estimated 220 million gallons of water per day to communities, agriculture, industry, and rural wells (Ammons et al., 2018). The aquifer is recharged by natural processes in the surficial glacial deposits (Panno et al., 1994; Roadcap et al., 2011; Panno and Kelly, 2020). In western Tazewell County, IL, where the Dragon Project site, the base of the Mahomet Aquifer immediately overlies the Carbondale Formation bedrock (Figure 42), which generally occurs at depths less than 200 fbgl in western Tazewell County.

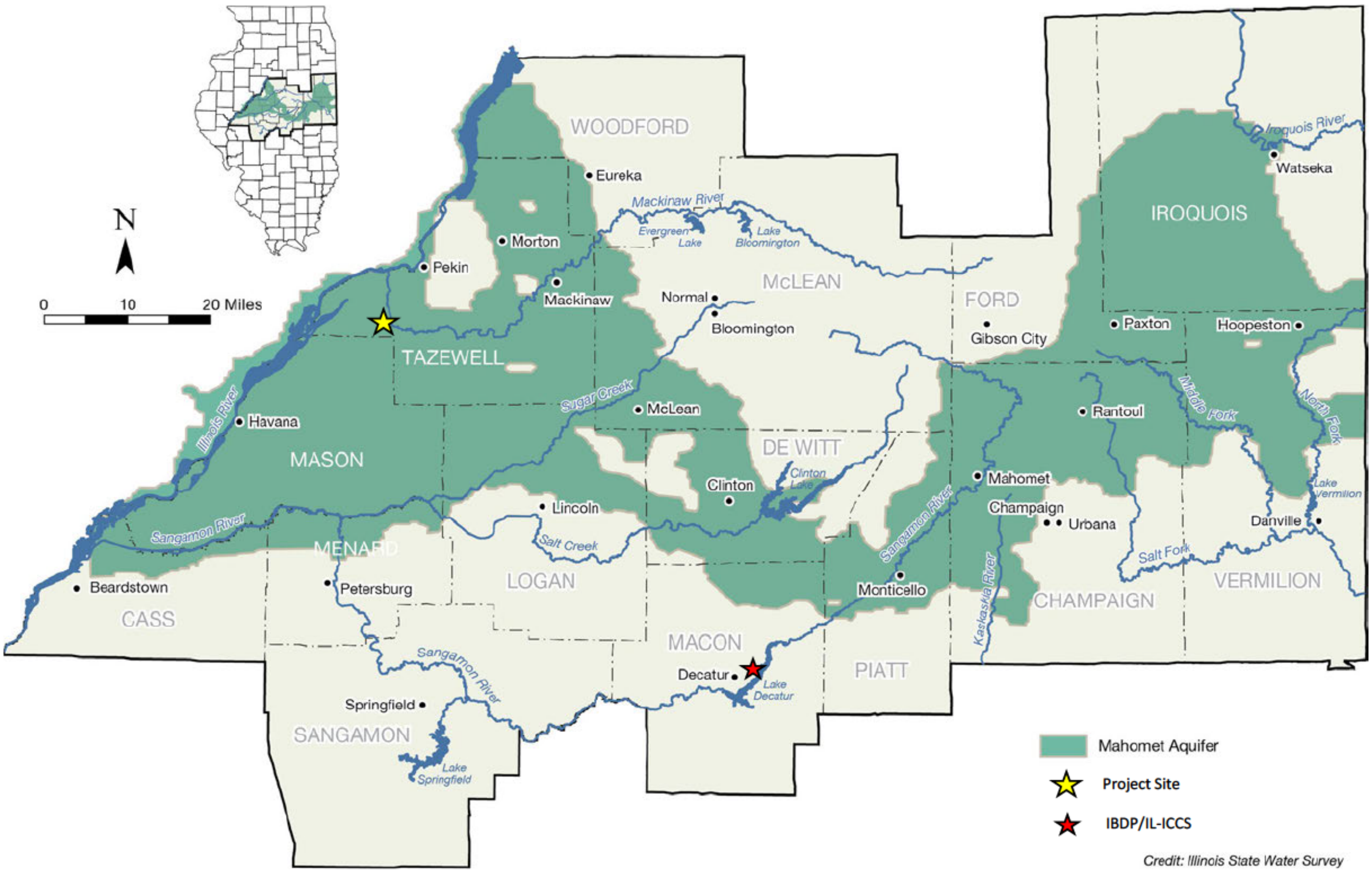

Figure 39: Map of the Mahomet Aquifer and the Mackinaw River. County names and major municipalities are labeled. Modified from Mahomet Aquifer Consortium (Ammons et al., 2018). The Dragon Project site is a yellow star and the IBDP/IL-ICCS site is represented by a red star.

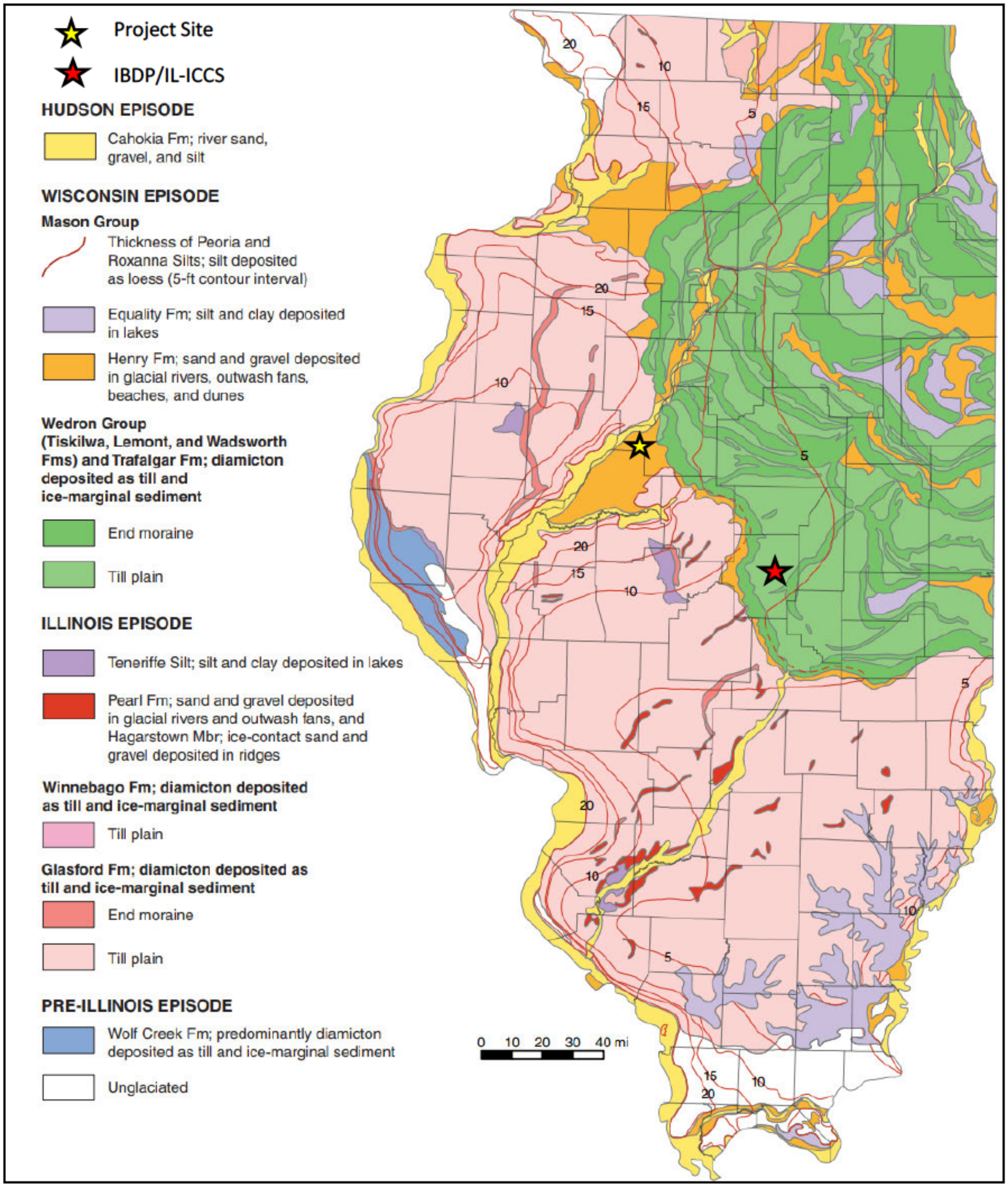

Figure 40: Quaternary deposits of Illinois map show the project site (yellow star) is located on sand and gravel of the Henry Formation of the Mason Group (Panno et al., 2005). The IBDP/IL-ICCS site is represented by the red star.

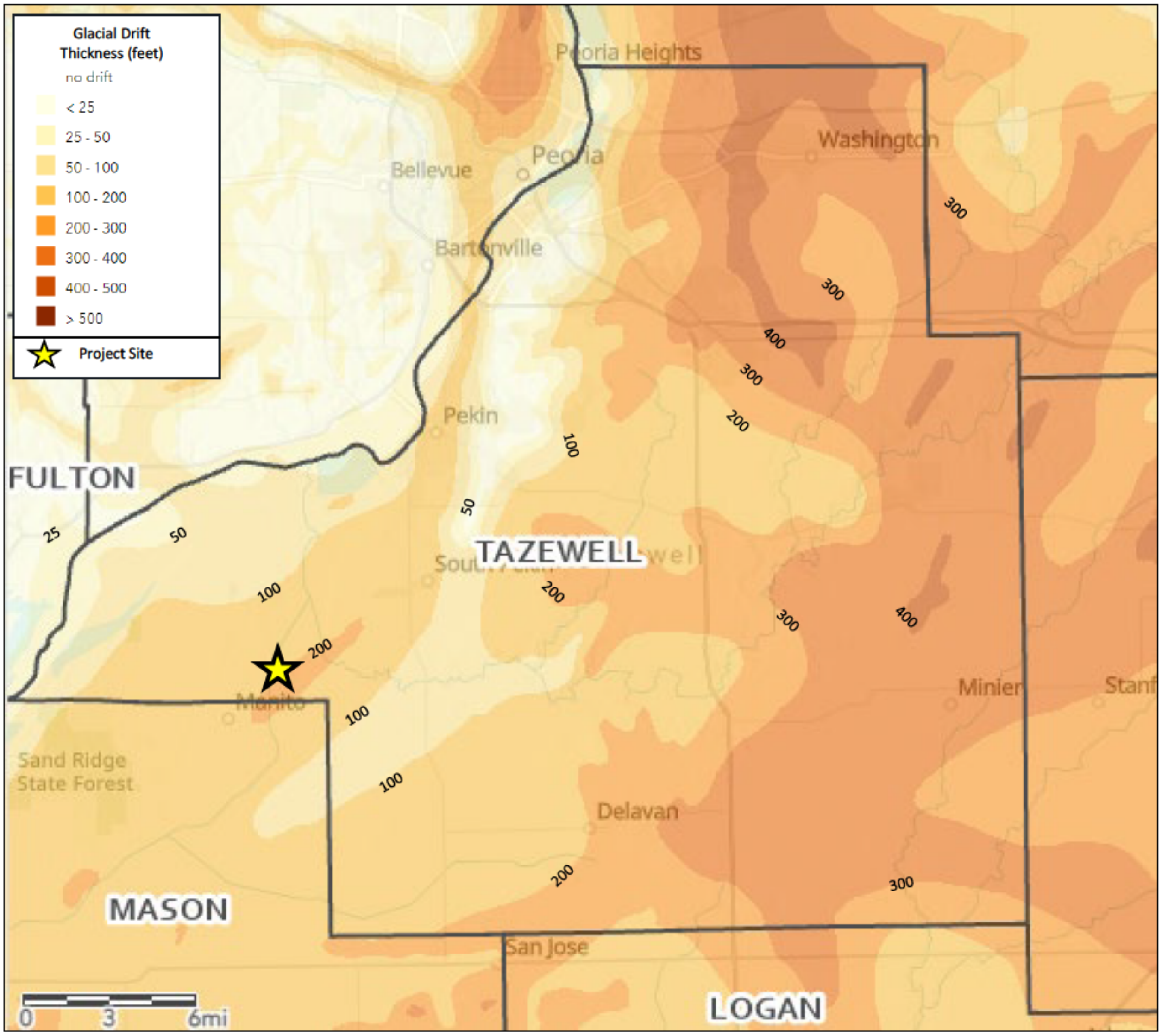

Figure 41: Map of glacial drift thickness in feet. At the project site (yellow star), 200 feet of glacial drift are expected.

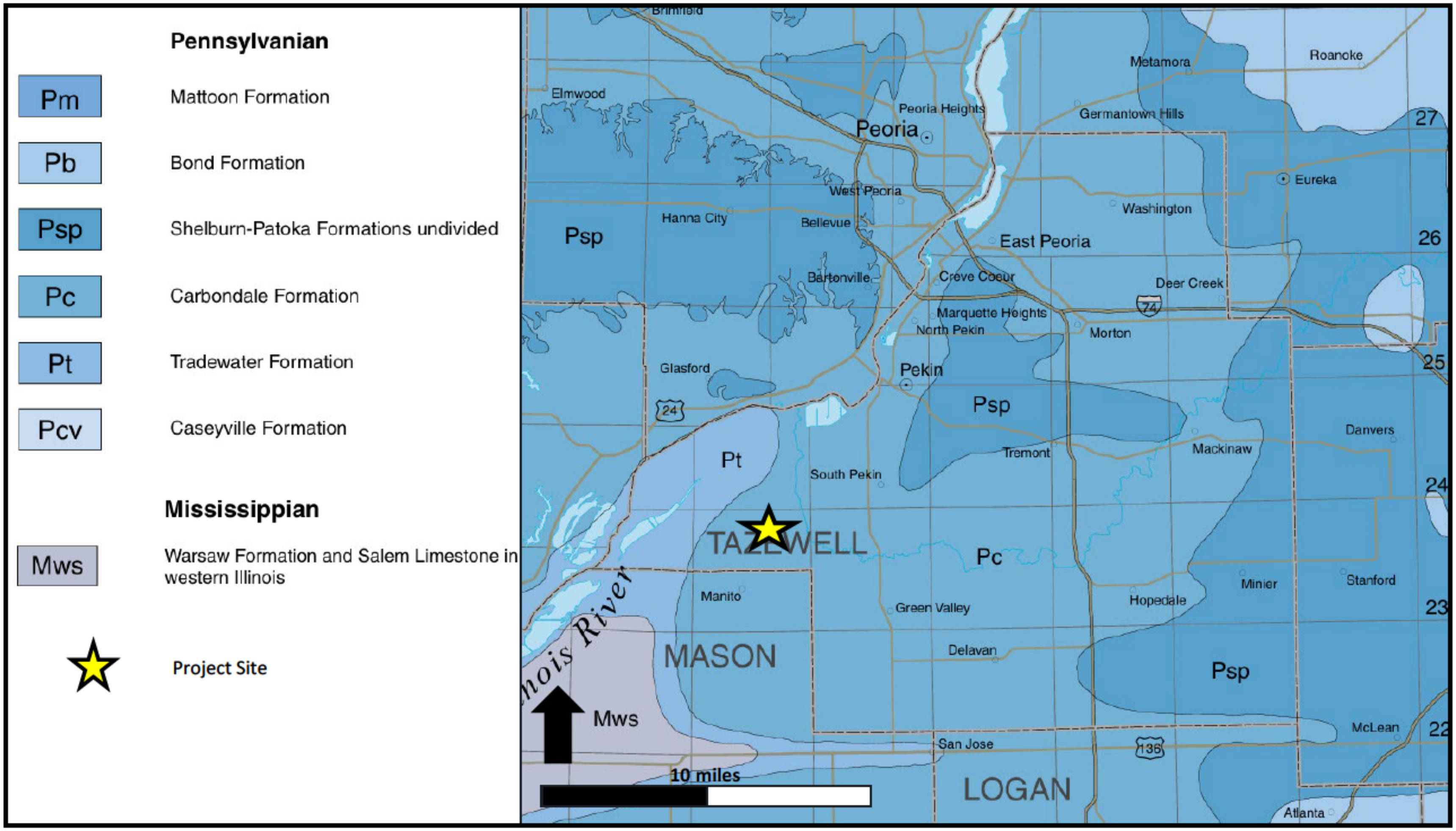

Figure 42: Bedrock geology underlying the Mahomet Aquifer. Modified from Kolata et al., (2005).

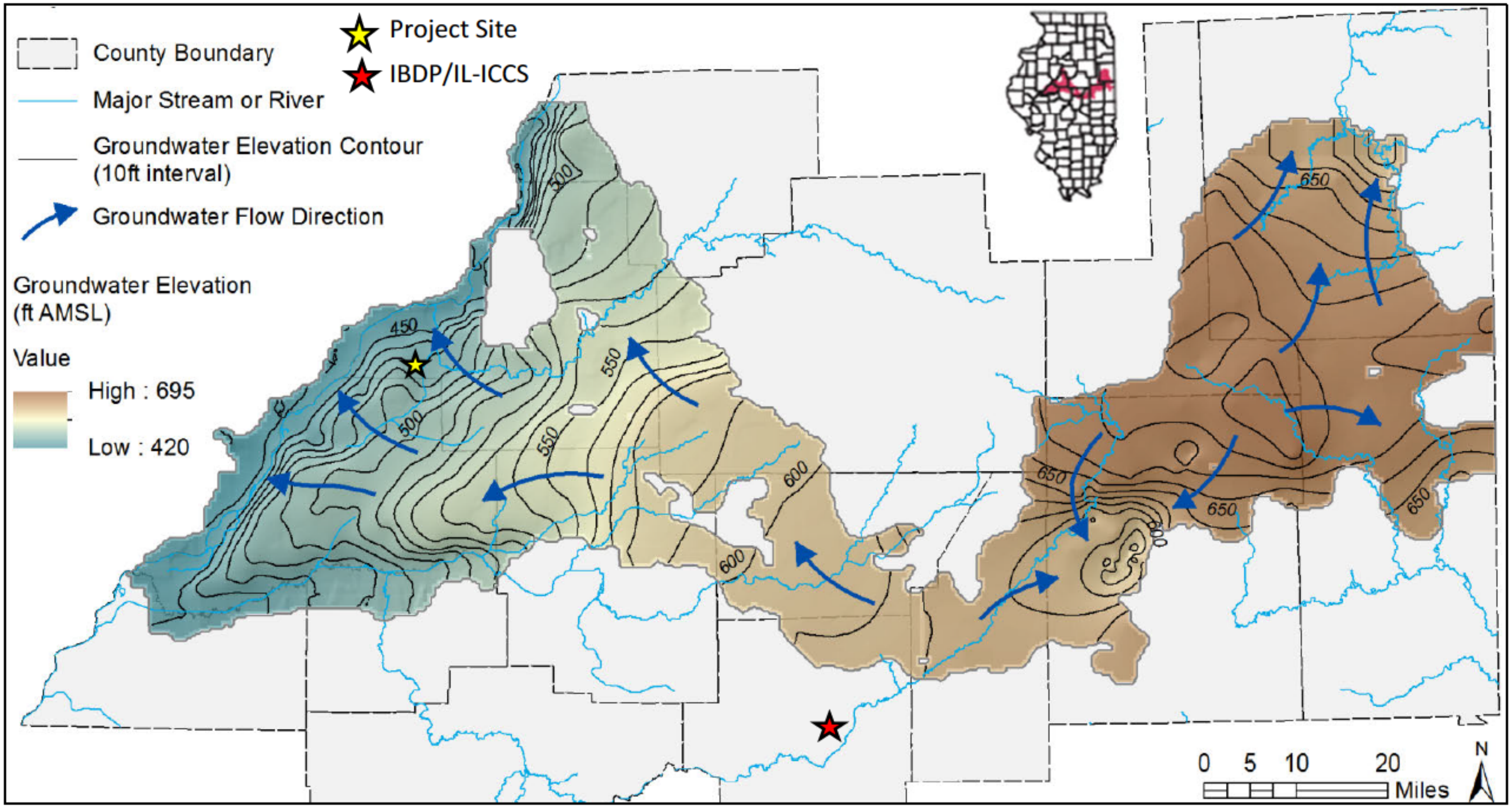

Figure 43: Map of the Mahomet Aquifer with groundwater elevation in feet above mean sea level (AMSL) contours and flow direction. Modified from Roadcap et al., (2011).

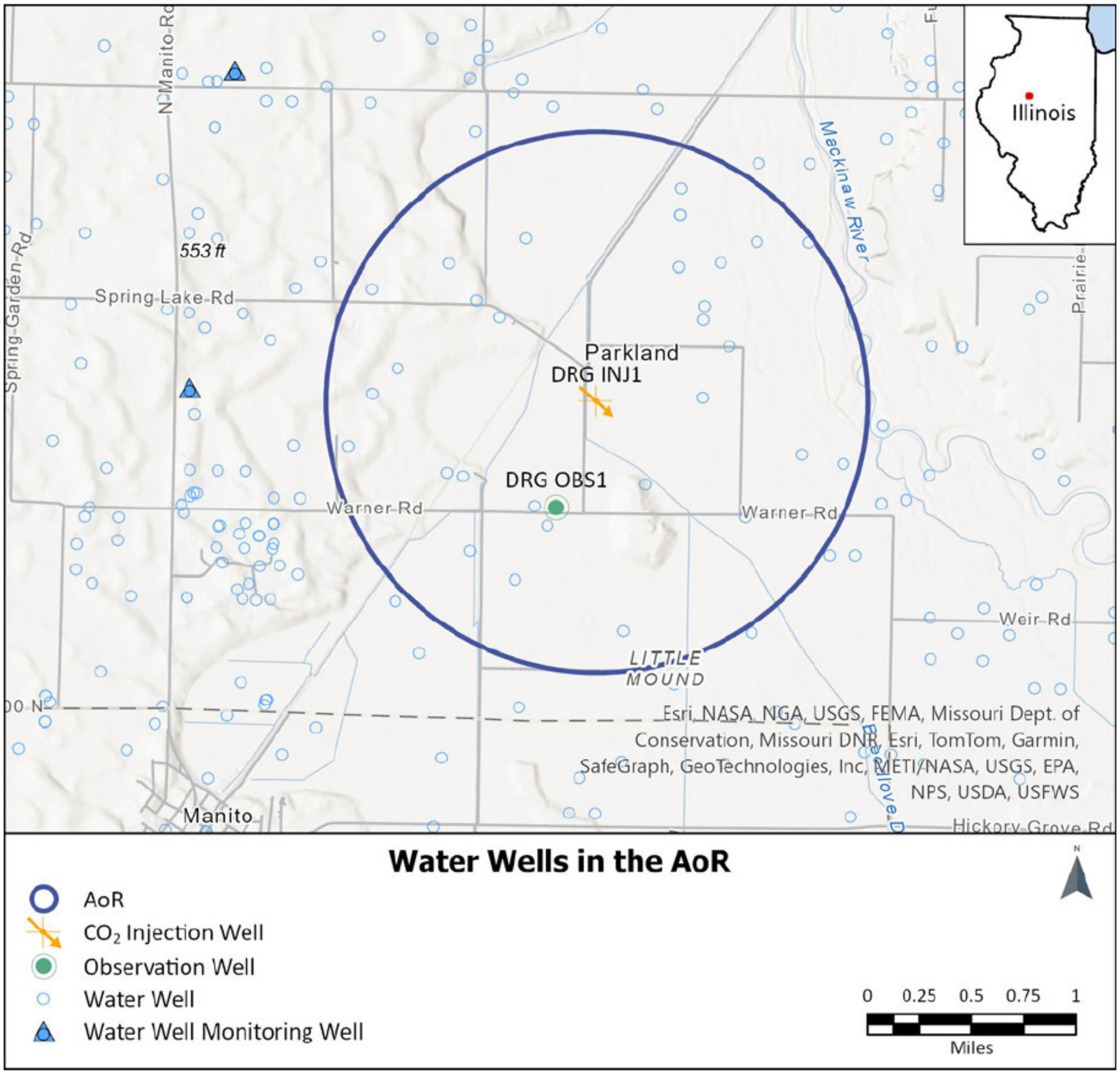

Figure 44: Map of groundwater utilization wells within the AoR. There are no injection wells, producing wells, abandoned wells, plugged wells, dry holes, deep stratigraphic boreholes, quarries, or mines located within the AoR.

2.9.2 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 mg/l total dissolved solids (TDS),
- Is not an exempted aquifer.

Figure 45 displays that the St. Peter Sandstone formation water at the Dragon Project site is expected to have a TDS concentration of around 2,200 mg/l (Figure 45, Attachment 02: AoR and Corrective Action Plan, 2024), which is less than the EPA 10,000 mg/l TDS threshold (Young, 1992). The St. Peter Sandstone is prognosed to occur between 1,416 and 1,627 fbgl at the Dragon Project site. The bottom of the St. Peter Sandstone is estimated to be more than 1,300 feet above the top of the Eau Claire Shale primary confining zone at the project site. The thickness of the St. Peter Sandstone at the Dragon Project site is estimated to be 211 feet at the project site. There are no water wells that utilize the St. Peter Sandstone within the AoR.

The St. Peter Sandstone is a widespread, near-shore quartz arenite (Lamar, 1928; Willman and Payne, 1943; Buschbach, 1964) and is part of the larger St. Peter Sandstone-Prairie du Chien-Jordan regional aquifer system that is located across the Midwest United States (Young, 1992). Regionally, the formations of the Cambro-Ordovician aquifer system in the Illinois Basin and throughout the Midwest United States, including the St. Peter Sandstone, flow southward, though localized flow patterns may vary (Wilson, 2012).

2.9.3 Non-USDWs

The Mt. Simon Sandstone is part of the same larger Cambro-Ordovician aquifer system as the St. Peter Sandstone. It is considered a 'high capacity' aquifer system in Wisconsin, Iowa, and northern Illinois, where it is relatively shallow and accessed for groundwater withdrawal. TDS in the Mt. Simon Sandstone Aquifer increases southward throughout Illinois, and it is not suitable as a drinking or agricultural water source in central Illinois (Figure 47, Mehnert and Weberling, 2014). It is expected the TDS of the Mt. Simon Sandstone at the project site is about 60,000 mg/L. Isotopic data also suggest that the Mt. Simon Sandstone brine originated as connate seawater that mixed with meteoric water and was also influenced by evaporite dissolution (Labotka et al., 2015).

Water in the Mt. Simon Sandstone generally flows southward in the northern portion of the Illinois Basin (Wilson, 2012). Regional hydraulic flow simulations and modeling by Gupta (1993) show that groundwater in the Mt. Simon Sandstone flows towards regions of lower hydraulic head. This flow is influenced by the broad-scale arches that surround the basin (Section 2.1 *Regional Geology, Hydrogeology, and Local Structural Geology*).

The Ironton-Galesville Sandstones are part of the Cambro-Ordovician aquifer in northern Illinois, and in area of the ADM CCS1 well, brines of the Ironton-Galesville are greater than

63,000 mg/l (Labotka et al., 2015). In general, the Silurian through Pennsylvanian-aged rock in central Illinois are not USDW's, as they either have poor water quality or serve as aquitards (Young, 1992).

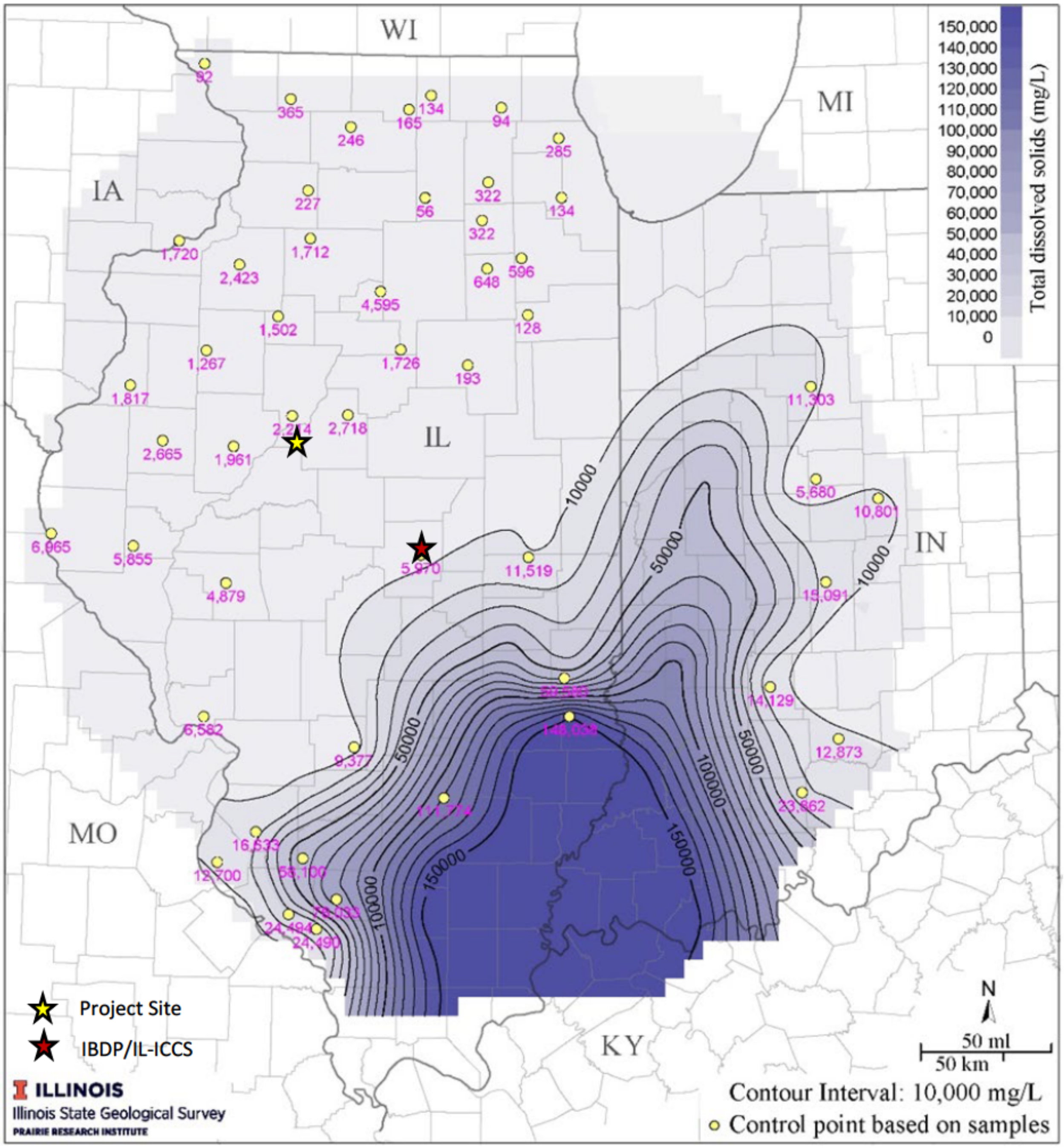

Figure 45: Map of the St. Peter Sandstone TDS. The project site is represented with a yellow star, sample locations are shown by yellow circles, and the IBDP/IL-ICCS site is represented by the red star. This is unpublished work by the Illinois State Geological Survey (Whittaker, 2021).

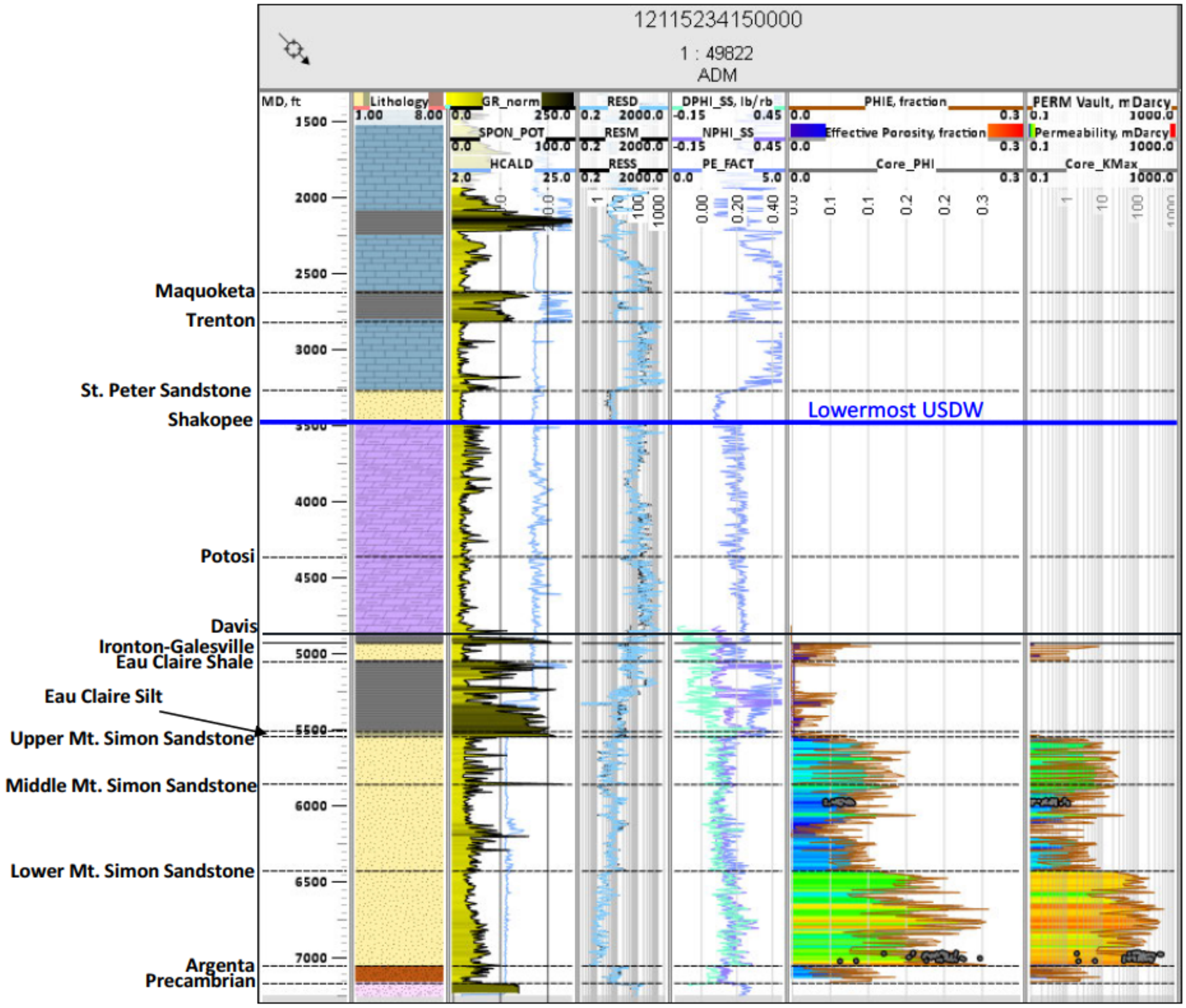

Figure 46: ADM CCS1 (121152341500) well logs that show that the lowermost USDW occurs in the St. Peter Sandstone at 3,469 feet MD. (in feet). Gamma=gamma ray, RES= resistivity, PHI= porosity, DELT=sonic, DENS=density, Zone=stratigraphic zone, PHIE=effective porosity (%), Perm=permeability (mD), and Min=mineralogy.

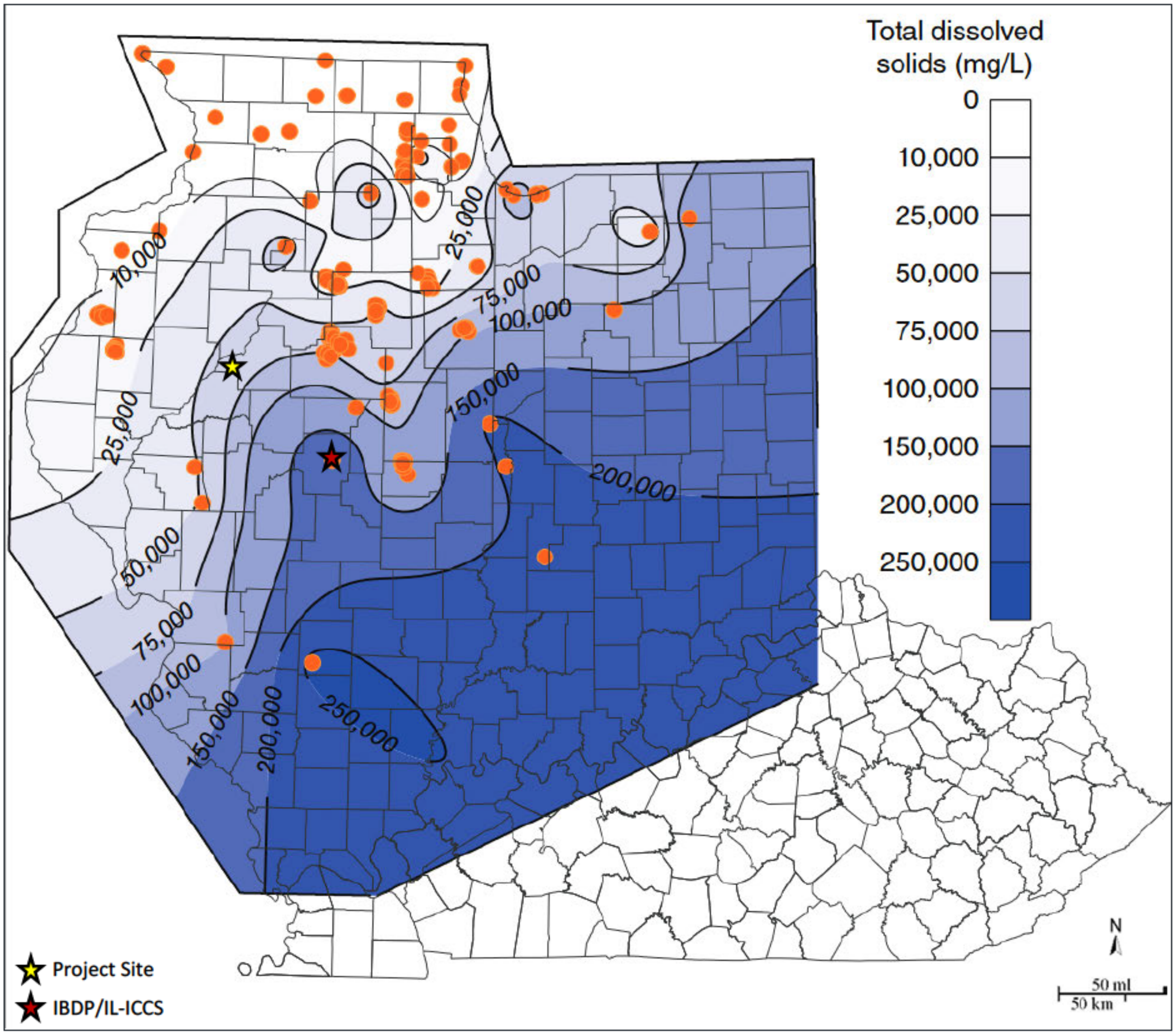

Figure 47: Map of TDS concentration contours in the Mt. Simon Sandstone formation brine. The project site is represented with a yellow star, sample locations are shown by orange circles, and the IBDP/IL-ICCS site is represented by the red star. Modified from Mehnert and Weberling, (2014.)

2.9.4 Topographic Description

[redacted] It is part of the Till Plains Physiographic Province, which is characterized by generally flat or gently sloping topography with glacial deposits overlying bedrock. The Dragon Project AoR and associated project wells are located in a Zone A flood hazard (1% chance of annual flooding) as established by FEMA (Figure 48; FEMA). Surface bodies of water within the AoR include a perennial stream, the Mackinaw River, intermittent waterways (Hickory Grove Ditch, Breedlove Ditch, Meeker Ditch, and North Quiver Ditch) and small wetlands.

2.9.5 Addressing Uncertainty

Within the project AoR, there are 30 shallow water wells less than 200 feet depth that were primarily drilled into the shallow glacial deposits (Figure 44). According to drillers logs, these wells terminate in sand, sand and gravel, or gravel at depths between 44 and 136 feet. Due to the complexity of glacial geology, the Mahomet Aquifer System hydrogeologic units present and the depth to the top of the Mahomet Aquifer is poorly constrained at the Dragon project site. To reduce the uncertainty of the depth to the Mahomet Aquifer and the St. Peters Sandstone, and which hydrogeologic units are present within the AoR and their relative thicknesses, the lithology will be logged during the drilling of the DRG MA1 well and a Pre-Operational Narrative will be submitted to the EPA that will provide the new data and updated static and computational models.

[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 most strata within the Illinois Basin from numerous studies by the Illinois State Geological Survey as well as detailed work at carbon capture and sequestration (CCS) projects in to the south of the Dragon Project site including the IBDP (Greenberg, 2021), IL-ICCS (Gollakota and McDonald, 2014), and CarbonSAFE Illinois – Macon County (Whittaker and Carman, 2022). Although local variations will exist, there is high confidence in the bulk lithology and mineralogy of rock and geochemistry of formation fluids in injection zone, confining zone, and USDW in the Dragon Project AoR. Formation fluids, full-diameter rock core, and side-wall core samples have been collected and analyzed by the projects identified above.

The Pre-Operational Testing Program details the data that will be acquired in DRG OBS1 and DRG INJ1 that may be used to support future geochemical evaluation (Attachment 05: Pre-operational Testing Program, 2024). 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 ACZ monitoring zone to assist in establishing the mineralogy of these formations. Fluid samples will also be collected and analyzed from the St. Peter Sandstone (lowermost USDW), the Ironton-Galesville Sandstones (ACZ), and the Mt. Simon Sandstone (injection zone).

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 may also be used to support 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 central Illinois Basin (e.g., Locke et al., 2013; Labotka et al., 2015). 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 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 to 200,000 mg/L. The salinity at the Dragon Project site is expected to be around 60,000 mg/L (Figure 47).

The St. Peter Sandstone is the lowermost USDW at the Decatur sites and fluid samples had TDS values around 4,500 to 6,000 mg/L. Panno et al., (2018) indicates the salinity of St. Peter

Sandstone trends lower as the formation becomes shallower to the north of Decatur and salinities at the Dragon Project site are expected to be less than 2,500 mg/L.

2.10.3 Solid-Phase Geochemistry

The mineralogy of the Mt. Simon Sandstone has been regionally characterized by numerous studies (Carroll et al., 2013; Freiburg et al., 2014; Yoksoulian et al., 2014; Davila et al., 2020; Shao et al., 2020) that indicate that it is dominated by quartz (63-95%) with lesser amounts of feldspar (2 to 22%), authigenic clay, and detrital clay minerals (Freiburg et al., 2014). The clay-sized fraction of minerals usually present in the Mt. Simon Sandstone are a very small percentage (1 to 3% by volume). The comparison of the clay mineral components of the Mt. Simon Sandstone in central Illinois is consistent among wells and are predominantly illite, montmorillonite, fine mica, and minor kaolinite.

2.10.4 Geochemical Reactions and Modeling

Laboratory batch studies have been conducted using rock samples collected from the Mt. Simon Sandstone, Eau Claire Silt, and Eau Claire Shale at the IBDP wells to investigate the geochemical interaction of rock, brine, and CO_2 (Carroll et al., 2013; Yoksoulian et al., 2014; Shao et al., 2020). The experiments were conducted under relevant reservoir conditions to identify the reaction mechanisms, kinetics, and solid-phase products that are 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 will occur (Carroll et al., 2013; Yoksoulian et al., 2014; Shao et al., 2020). A decrease of 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 aluminum (Al) after 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 indicated 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 Shale samples were more significant than Mt. Simon Sandstone samples (Carroll et al., 2013; Shao et al., 2020). 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 rock. The Eau Claire Shale, however, is a highly laminated, fissile shale to silty shale with the shaliest section near the base (just above the Eau Claire Silt) and advective flow from the Mt. Simon Sandstone into the Eau Claire Silt and 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 were not confirmed with available characterization techniques.

Potential geochemical reactions at the Dragon Project site were also modeled using Computer Modelling Group (CMG) Generalized Equation Model (GEM). A 32 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 the IBDP Verification Well #1 (Leetaru and Freiburg, 2014):

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

The modeling results indicate that K-feldspar precipitates and smectite dissolves over the 12-year injection period (Figure 49). There is little reaction with quartz or illite. A very small amount of mineralization is predicted to occur in this timeframe and any change (reduction) in porosity is negligible during the injection period.

The geochemical modeling also predicted the main CO_2 trapping mechanisms. Figure 50 displays the evolution of the main trapping mechanisms during injection, PISC, and post-PISC periods. Initially, a large percentage of the CO_2 is structurally trapped. As the fluid's gravity segregate, the amount of residual phase trapping increases. Dissolution of CO_2 into brine also increases but at a slower rate. Dissociation of dissolved CO_2 into aqueous ions also occurs but only accounts for a small percentage of the trapping. Mineralization 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-year post-injection at the Dragon Project site.

[redacted]

[redacted]

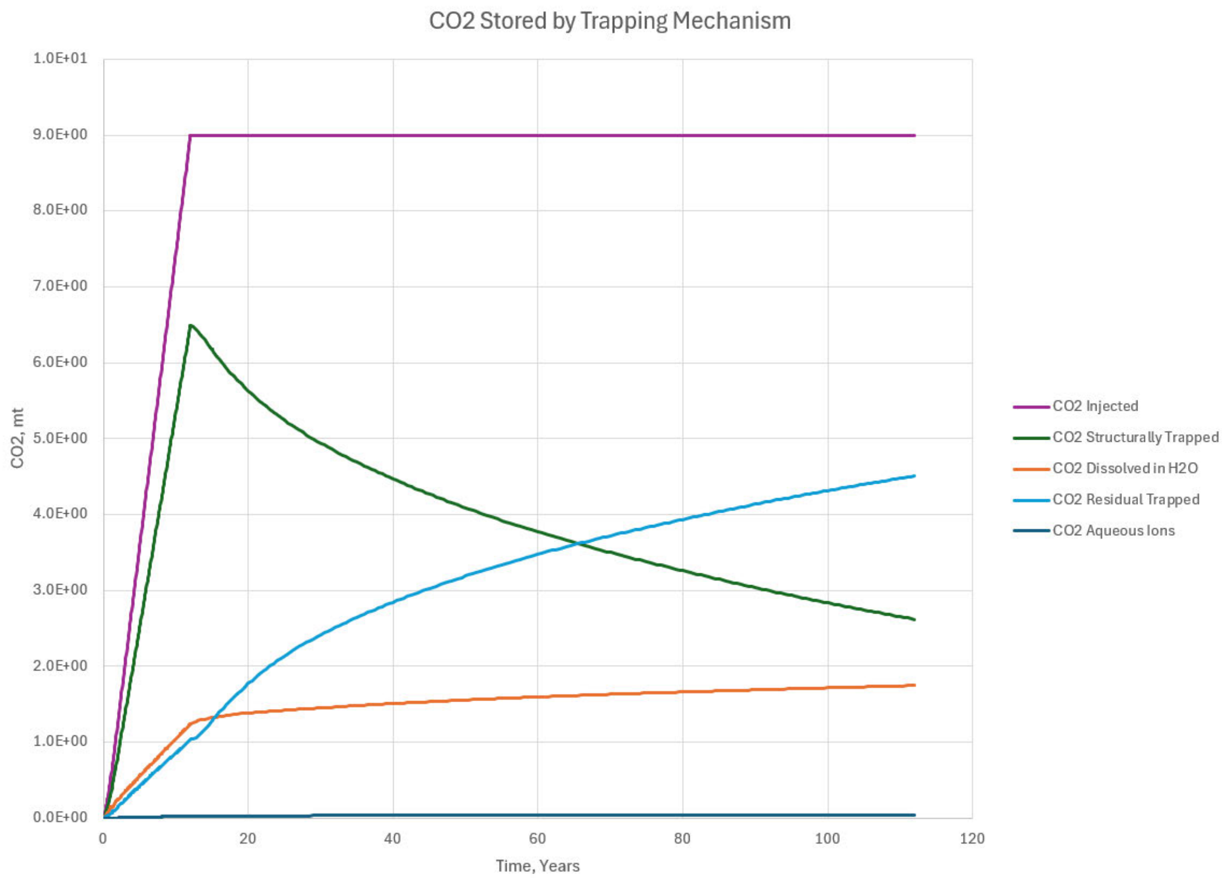

Figure 50. Graph of the relationships and evolution of CO_2 trapping mechanism during 30 years of CO_2 injection followed by a 50-year PISC period at the Dragon Project site.

2.10.5 Addressing Uncertainty

An extensive dataset, including cores and logging, will be collected at DRG INJ1 (Attachment 05: Pre-operational Testing Program, 2024) to characterize the mineralogy of the injection and confining zones, prior to submitting the permit to inject. If this data indicates the current geochemical baseline model is inaccurate for the sediments at the Dragon Project site, Vault Dragon CCS LP will rerun geochemical modeling using the updated dataset and run sensitivity analyses to address the discrepancies in data, and a and a Pre-Operational Narrative will be submitted to the EPA that will provide the new data and updated modeling.

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

The Pre-Operational Formation Testing Program presents the data that will be collected 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 (Attachment 05: Pre-operational Testing Program, 2024). In addition, baseline 3D surface seismic data will be acquired during the pre-construction phase of the project to assist in characterizing injection zone and confining zone rock characteristics away from DRG INJ1 and DRG OBS1.

Plans to acquire baseline atmospheric and soil gas data and plans to pursue atmospheric and soil gas monitoring during the injection phase of the project are being considered in response to state level requirements.

2.12 Site Suitability [40 CFR 146.83]

2.12.1 Summary

The Mt. Simon Sandstone at the Dragon Project site meets all requirements necessary to serve as a competent storage formation and can sequester an estimated 9 Mt of CO_2 over 12 years as evident through geologic evaluation, static modeling, computational modeling results, and AoR delineation reported in 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 that support it to be an effective primary confining zone.

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

[redacted]

The Eau Claire Silt is expected to be [redacted] thick at the Dragon Project site. Although it is considered part of the injection zone, its contribution to storage will be minimal. CO_2 plume development will likely be controlled by heterogeneities within the Lower Mt. Simon Sandstone, 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).

There are no wells within the AoR that penetrate the confining zone. The closest well penetration of the confining zone is the Bates well, which is located approximately 24 miles east of the AoR (S&P Global; ILOIL).

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 Confining Zone

[redacted]

2.12.3 Lowermost USDW

The St. Peter Sandstone is the lowermost USDW at the project site. The base of the St. Peter Sandstone is expected to be 1,392 feet above the top of the Eau Claire Shale primary confining zone.

2.12.4 Additional Confinement Strata

The Davis Member of the Franconia Formation, the Oneota Formation, and the Shakopee Formation are all additional confining beds between the Eau Claire Shale primary confining zone and the lowermost USDW (St. Peter Sandstone) and will prevent injection zone fluids from reaching the lowermost USDW should they migrate past the primary confining zone. The Maquoketa Group and New Albany Shale are additional confining zones between the lowermost USDW and the Mahomet Aquifer.

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 that would allow injection zone fluid migration beyond the confining zone. A future baseline 3D surface seismic survey at the Dragon Project site will further reduce uncertainty associated with formation thickness/depth and potential structural features.

2.12.6 Capacity and Storage

The AoR and Corrective Action Plan shows that the Mt. Simon Sandstone at the Dragon Project site has the capacity and hydrogeologic characteristics necessary to store an estimated 9 Mt.

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 computational modelling included one injection well within the sequestration site and resulting AoR. Major CO_2 trapping mechanisms modeled include structural/stratigraphic trapping, residual phase trapping, solubility trapping, and mineral trapping. The computational model demonstrates that the pressure front will dissipate rapidly in the PISC phase of the project, and the CO_2 plume movement stabilizes and will be confined to the injection reservoir.

2.12.7 Injection Zone and Compatibility with the Injectate

Studies using laboratory experiments and reactive modeling of the Mt. Simon Sandstone from the Illinois Basin suggest that there is minimal reactivity of the rock with brine and CO_2 (Carroll et al., 2013; Yoksoulian et al., 2014; Shao et al., 2020). Experiments using Mt. Simon Sandstone core samples suggest minor dissolution of aluminosilicate minerals, such as feldspar and clay minerals 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, indicating 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 as described in detail in Section 5 *Injection Well Construction* of this document and in Attachment 04: Injection Well Construction Plan, 2024.

2.12.8 Addressing Uncertainty

Vault Dragon CCS LP has proposed a comprehensive core and logging program at the Dragon Project site in the Pre-Operational Testing Plan (Attachment 05; 2024) as well as a 3D seismic survey to address uncertainties prior to injection operations. The purpose of acquiring this data is to validate current understanding of subsurface conditions and site suitability while providing details for modeling and confinement. Should data collected be contrary to current understanding, Vault Dragon CCS LP will update appropriate models and material, and a Pre-Operational Narrative will be submitted to the EPA that will provide the new data and updated static and reservoir models, prior to submitting the permit to inject.

3. AoR and Corrective Action

The AoR for the Dragon Project is shown in Figure 1.

The AoR and Corrective Action module provides a detailed summary of the modeling parameters (Attachment 02: AoR and Corrective Action Plan, 2024). 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 is no requirement for corrective action.

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 and have been provided in the Financial Assurance Plan (Attachment 03: Financial Assurance Plan, 2024). The cost estimate for the ERRP was developed in tandem with Industrial Economics (IEc). Their full report has been provided with the Financial Assurance Plan .

Further detail is provided in the Financial Assurance section of this permit application (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 (DRG INJ1) proposed in this application will be constructed as a new well. The Mt. Simon Sandstone, the targeted injection zone for the project, is a thick sandstone which directly overlies the Argenta Formation. The Eau Claire Shale, which overlies the Mt. Simon Sandstone, is approximately 387 feet thick and serves as the primary confining zone for the project.

Vault Dragon CCS LP plans to drill the deep monitoring well (DRG OBS1) into the Precambrian Basement. DRG INJ1 will also be drilled into the Precambrian Basement in order to identify the depth to the top of basement. DRG INJ1 will be used to collect most of the pre-operational testing data for the project (Attachment 05: Pre-operational Testing Program, 2024).

Vault Dragon CCS LP intends to use materials for the construction of the project wells (casing, cement, etc.) that are verified by independent third-party sources as suitable for the worst-case corrosive and operational loading expected to occur during the life of the project (AMPP, 2023). This suitability is discussed further in Section 5.5 *Construction Material* Suitability. All work will be performed in accordance with guidance documents, approved work plans, and reporting timelines as approved by the EPA. DRG 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 design will vary depending on whether the intermediate casing contingency section is needed or not. Once the open hole data has been collected in the long string segment of the well, casing will be run with sufficient rat hole and cemented in place. The well will be plugged back with cement above the top of the Argenta ensuring that the CO_2 will not be directly injected into the basement or the Argenta Formation. Following installation of the long string casing and cement, perforations will be made into the casing to access the Mt. Simon Sandstone for injection.

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). Well schematics are subject to change pending finalization of completion design.

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

Well stimulation is not expected to be required after initial completion, other than to clean out the perforations made in the long string casing.

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 that may be stimulated using a hot water flush to dissolve and remove the precipitated salt.

The requirements and methods of stimulation will be identified through the evaluation of well performance over time. The EPA will be notified prior to any field mobilization and will include details on the proposed procedure, equipment, and chemicals to be used.

A list of common remediation techniques that may be deployed is listed below. 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 saltwater flush,
- Perforations.

All treatments will be performed at or below 90% of the fracture pressure of the Mt. Simon Sandstone 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 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 will 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 casing consisting of carbon steel and 25-Chrome L80 (25Cr80) will be installed and cemented in place across the entire length of the well to protect the USDWs and other strata overlying the injection zone. 25Cr80 casing will be installed across the entire injection zone and the bottom of the confining zone to maximize protection from the injected fluids. These fluids will be injected into the Mt. Simon Sandstone using internally coated carbon steel tubing landed in a nickel or chrome-coated packer. The Lower Mt. Simon Sandstone will be accessed through [redacted].

The injection well has been designed such that monitoring equipment will accessible and retrievable should failure occur. Downhole gauges are 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. This 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 open hole sections of the injection well construction. Vault Dragon CCS LP may elect to utilize an intermediate hole section, and intermediate casing to mitigate the potential for lost circulation pending operational results from drilling DRG OBS1.

Should a lost circulation zone be encountered while drilling, all attempts will be made to successfully cure the lost circulation. Should these efforts be unsuccessful, an intermediate casing string will be installed. These efforts would take place within Step 6. 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).

[redacted]

A high-level procedure for the well installation is provided below. A more detailed schedule and procedure will be provided to the EPA prior to spudding the well.

[redacted]

[redacted]

Specifications on the tools, equipment, casing, cement, and other equipment or materials required to install the well 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, operational, and installation loading. Each item is suitably rated for the loading it will experience.

5.3 Casing and Cementing

5.3.1 Casing

Table 14 and Table 15 display the design safety factors and safety factor loads based on the proposed well design. The safety factor is determined by dividing the pipe rating by the calculated load. It is noted that a standard 80% derating factor for new pipe is applied prior to any analyses. 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: burst analysis scenario, collapse analysis scenario, and tensile analysis scenario.

The burst analysis scenario considers the impact of the plug bump and predetermined holding pressure following the full pumping of cement. 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 used for the analysis was the maximum allowable injection pressure (MAIP) at surface (Section 7.1.1). Note that the 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 a full column of cement in the annulus following the bleed-off of the pressure utilized to hold the plug in place at the conclusion of the cement job. The tubing collapse analysis includes the estimation of the collapse loading during a modeled annulus pressure test (APT) that will be run during static (or zero wellhead pressure) conditions with 1,500 psi of pressure on the annulus. In this scenario, the maximum collapse load will be experienced at the packer. Note that this analysis includes the derating of the collapse rating of the pipe when in tension.

The tensile analysis scenario evaluates 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. The tensile analysis on the tubing was performed in a similar manner as the casing with the exception of the tensile loading used a 60,000-pound overpull. Note that this scenario will typically occur prior to any cement being pumped, and hydrostatic differences in fluid have not been considered.

The resulting safety factors from these analyses are presented in Table 14. In addition, operational, cyclic, and temperature loading analyses were performed that are discussed in greater detail in Section 5.5 *Construction Material Suitability*.

Table 16 displays the setting depths and specifications of the casing to be used for the well. All of the casing conforms with API specifications as detailed in API 5CT, (2023). 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 will conform with API standards. Corrosion resistant cement will be used from the bottom of the long string casing 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 Formation Testing Program, (2024) and Attachment 07: 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.

[redacted]

[redacted]

[redacted]

[redacted]

5.3.2 Cementing

Table 18 provides a summary of the cement systems that will be used during the construction of the injection well; this includes the systems for the contingency intermediate string. All cement systems used will conform with API standards where applicable.

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

Note that the excess cement pumped will be subject to change pending field results.

The Dragon Project plans to use CO_2-resistant cement for the lower portion of the long string section. An example of a CO_2-resistant cement system is EverCRETE from SLB, and either EverCRETE or an equivalent alternative system will be used. These cement systems are stable in extreme acidic conditions, are 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.

[redacted]

The surface casing cement system will provide the isolation for the Mahomet Aquifer System from the drilling process for the remainder of the well installation. The surface cement will serve as an additional layer of protection from potential upward migration of deeper fluids.

The intermediate casing cement system, if required, will provide isolation from any potential lost circulation zone, and serve as an additional layer of protection from potential upward migration of injection zone fluids. The lowermost USDW is the St. Peter Formation that would be covered by the intermediate casing.

The long string cement system will provide the primary isolation of USDWs from any potential migration of injection zone fluids 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

The tubing will be internally coated 4.5-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. 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 25-Chrome (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 Additional Design Considerations

This section discusses the application of the design ratings to ensure the suitability of the construction materials for this project in addition to the analysis 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 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

Attachment 05: Pre-operational Testing Program, (2024) provides the details of the Pre-operational Testing Program for the project.

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 provides a brief overview of the well operation conditions. The operational parameters for DRG 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*. Injection pressures will remain below 90% of the 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

Dragon Project does not anticipate any variations from the current operational parameters outlined in Section 7.1. 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 an ethanol production facility located in Tazewell County, Illinois and is anticipated to have the fluid composition as shown in Table 22.

Vault Dragon CCS 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). Quarterly sampling and analysis of the CO_2 injection stream will be performed to track the composition of the stream. 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 Attachment 10: Quality Assurance and Surveillance Plan (2024).

The CO_2 stream produced from an 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 pipeline to the injection well.

[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 06: Testing and Monitoring (2024).

The Dragon 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 DRG INJ1 is operating as planned while maintaining mechanical integrity,
- Acquisition of data to validate and calibrate the models used to predict the distribution of carbon dioxide (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 a 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). The methods and procedures presented in Attachment 07: Injection Well Plugging Plan (2024)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 Dragon 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

Vault Dragon CCS LP does not intend to apply for a depth waiver or aquifer exemption for the Dragon Project. 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

The National Wild and Scenic River System database indicates that no designated wild and scenic rivers exist in Tazewell County, Illinois. Within the state of Illinois, a 17.1 mile segment of the Middle Fork Vermilion River in Vermilion County is the only designated national wild and scenic river (National Information Services Center and National Park Service, 2023; National Wild and Scenic Rivers System).

The Mackinaw River, a Nationwide Rivers Inventory (NRI) river, runs along the eastern edge of the AoR. The Mackinaw River possesses outstandingly remarkable recreational values for the area (National Park Service). A review of NRI river segments was undertaken because NRI river segments are potential candidates for inclusion in the National Wild and Scenic River System.

The Dragon Project is located inland Illinois, far from coastal zones, therefore project activities will not affect any coastal zones. There are no National Register Historic Districts, National Register Historic Sites, or Illinois State Historic Sites within the Dragon Project AoR (IHPD; National Park Service). The Dragon Project well site will be located on private land previously disturbed by agriculture. No archaeological surveys have been conducted for the Dragon Project.

On October 16, 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 Dragon Project (Table 24).

Table 24: Federal threatened or endangered, candidate, or proposed species potentially affected by the Dragon Project (USFWS, 2024)

Name	Federal Status	Critical Habitat
Indiana Bat	Endangered	Project location does not overlap critical habitat
Tricolored Bat	Proposed Endangered	No critical habitat designated
Whooping Crane	Experimental non-essential	No critical habitat designated
Monarch Butterfly	Candidate	No critical habitat designated
Western Regal Fritillary	Proposed threatened	No critical habitat designated
Decurrent False Aster	Threatened	No critical habitat designated
Eastern Prairie Fringed Orchid	Threatened	No critical habitat designated
Lakeside Daisy	Threatened	No critical habitat designated

IPaC indicates bald eagles are likely present in the Dragon Project area. Bald eagles are protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Migratory birds of particular concern that may be present in the AoR include the USFWS Birds of Conservation Concern listed in Table 25.

Table 25: Migratory birds of conservation concern potentially affected by the Dragon Project (USFWS, 2024). BCC=Birds of Conservation Concern, BCR=Bird Conservation Regions.

Name	Level of Concern	Breeding Season
American Golden-plover	BCC Rangewide[1]	Breeds elsewhere
Bald Eagle	Non-BCC Vulnerable[2]	Breeds Oct 15 to Aug 31
Black-billed Cuckoo	BCC Rangewide	Breeds May 15 to Oct 10
Bobolink	BCC Rangewide	Breeds May 20 to Jul 31
Chimney Swift	BCC Rangewide	Breeds Mar 15 to Aug 25
Grasshopper Sparrow	BCC Bird Conservation Regions (BCR)[3]	Breeds Jun 1 to Aug 20
Lesser Yellowlegs	BCC Rangewide	Breeds elsewhere
Pectoral Sandpiper	BCC Rangewide	Breeds elsewhere
Prothonotary Warbler	BCC Rangewide	Breeds Apr 1 to Jul 31
Red-headed Woodpecker	BCC Rangewide	Breeds May 10 to Sep 10
Semipalmated Sandpiper	BCC - BCR	Breeds elsewhere
Short-billed Dowitcher	BCC Rangewide	Breeds elsewhere
Wood Thrush	BCC Rangewide	Breeds May 10 to Aug 31

[1] BCC Rangewide birds are of concern throughout their range anywhere within the USA.
[2] Non-BCC Vulnerable birds are not BCC species in the project area but are listed because of Eagle Act requirements.
[3] BCC-BCR birds are of concern only in particular BCRs in the continental USA.

There is potential to encounter threatened or endangered (T&E) flora or fauna within the project AoR. The Illinois Threatened and Endangered Species by County includes 31 T&E species within Tazewell County (Table 26, Illinois Natural Heritage Database, 2024).

Table 26: State threatened and endangered flora and fauna of Tazewell County, Illinois (Illinois Natural Heritage Database, 2024). LE=Listed as endangered, LT=Listed as threatened.

Species Name	Common Name	State Status
Acipenser fulvescens	Lake Sturgeon	LE
Antrostomus carolinensis	Chuck-will's-widow	LT
Asio flammeus	Short-eared Owl	LE
Aster furcatus	Forked Aster	LT
Astragalus tennesseensis	Tennessee Milk Vetch	LE
Besseya bullii	Kittentails	LT
Boltonia decurrens	Decurrent False Aster	LT
Circus hudsonius	Northern Harrier	LE
Corydalis aurea	Golden Corydalis	LE
Cypripedium parviflorum	Small Yellow Lady's Slipper	LE
Elliptio crassidens	Elephant-ear	LE
Fundulus dispar	Starhead Topminnow	LT
Heterodon nasicus	Plains Hog-nosed Snake	LT
Kinosternon flavescens	Yellow Mud Turtle	LE
Lanius ludovicianus	Loggerhead Shrike	LE
Lepomis miniatus	Redspotted Sunfish	LT
Lethenteron appendix	American Brook Lamprey	LT
Moxostoma carinatum	River Redhorse	LT
Necturus maculosus	Mudpuppy	LT
Notropis chalybaeus	Ironcolor Shiner	LT
Nycticorax nycticorax	Black-crowned Night-Heron	LE
Orobanche ludoviciana	Broomrape	LT
Pandion haliaetus	Osprey	LT
Plantago cordata	Heart-leaved Plantain	LE
Poa wolfii	Wolf's Bluegrass	LE
Polanisia jamesii	James' Clammyweed	LE
Pseudacris illinoensis	Illinois Chorus Frog	LT
Reginaia ebenus	Ebonyshell	LE
Setophaga cerulea	Cerulean Warbler	LT
Terrapene ornata	Ornate Box Turtle	LT
Tetraneuris herbacea	Lakeside Daisy	LE

14. References

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

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

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

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

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

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

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

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

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

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

Parcel_ID	Owner	Address	City, State, Zip
08-15-11-100-007	Frank William & Jennifer	9171 Spring Lake Road	Manito, IL 61546
08-15-15-400-002	Indian Mound Farms #2 LLC	9787 Meyer Farm Ln	Manito, IL 61546
08-15-14-100-002	Knollhoff Farms LLC	% Mary Ann Brownstein 3414 Hancock Bridge Pkwy	Fort Myers, FL 33903
08-15-01-400-001	Friedrich Robert D & Vergie K	11586 Friedrich Rd	Green Valley, IL 61534
08-15-03-400-005	Becker Scott J & Charissa A	8950 Springlake Rd	Manito, IL 61546-0000
08-15-02-100-003	Herrman Verne N Jr	3918 Springfield Rd Po Box 195	Groveland, IL 61535
08-15-02-300-005	Herrman Margaret	Po Box 195	Groveland, IL 61535-0195
08-15-02-300-006	Becker Scott J & Charissa A	8950 Spring Lake Rd	Manito, IL 61546-0000
08-15-03-200-002	Herrman Charles D Testamentary Trust	11174 Herrman Rd	Manito, IL 61546
08-15-02-100-001	Mack Riv/Levee/Drain 1	% Bagley & Miller Box 699 6 S 4th St Ste 2	Pekin, IL 61555-0669
08-15-13-200-001	Becker Kenneth	8479 Townline Road	Manito, IL 61546-0000
08-15-14-400-001	Meyer Matt L	9787 Meyer Farms Ln	Manito, IL 61546-0000
08-15-14-300-002	Indian Mound Farms Llc	9787 Meyer Farms Ln	Manito, IL 61546
08-15-11-102-001	Janus Chester J Jr	9654 Parkland Rd	Manito, IL 61546-0000
08-15-11-100-003	Atkinson Rebecca A & Jonathan	9661 Parkland Rd	Manito, IL 61546
08-15-11-100-002	Janus Catherine A Chester J Jr & Rebecca A	9654 Parkland Rd	Manito, IL 61546-0000
08-15-11-100-004	Janus Catherine A Chester J Jr & Rebecca A	9654 Parkland Rd	Manito, IL 61546-0000
08-15-11-101-002	Janus Catherine A Chester J Jr & Rebecca A	9654 Parkland Rd	Manito, IL 61546-0000
08-15-11-101-003	Janus Catherine A Chester J Jr & Rebecca A	9654 Parkland Rd	Manito, IL 61546-0000
08-15-11-100-015	Frank Brian	7356 Mason Rd	Manito, IL 61546-0000
08-15-12-100-004	Meyer David B	12120 Towerline Rd	Pekin, IL 61554
08-15-12-100-003	Proehl Jason W	9701 Warner Rd	Manito, IL 61546
08-15-12-100-009	Thompson Scott	9404 Proehl Rd	Manito, IL 61546
08-15-11-200-002	Meyer David B	12120 Towerline Rd	Pekin, IL 61554
08-15-11-400-003	Proehl Jason W	9701 Warner Rd	Manito, IL 61546
08-15-12-100-007	Proehl Dorothy Trustee	Po Box 34	Groveland, IL 61535-0000
08-15-12-300-001	Proehl J D & Nancy	9776 Warner Rd	Manito, IL 61546-0000
08-15-12-300-002	Proehl J D & Nancy	9776 Warner Rd	Manito, IL 61546-0000

Parcel_ID	Owner	Address	City, State, Zip
08-15-12-400-002	Proehl J D & Nancy	9776 Warner Rd	Manito, IL 61546-0000
08-15-01-300-009	Proehl Dorothy	PO Box 34	Groveland, IL 61535-0000
08-15-12-100-005	Proehl Dorothy Trustee	PO Box 34	Groveland, IL 61535-0000
08-15-12-100-005	Proehl Dorothy Trustee	PO Box 34	Groveland, IL 61535-0000
08-15-12-200-001	Friedrich Robert D & Vergie K	11586 Friedrich Rd	Green Valley, IL 61534-0000
08-15-01-300-012	Waldrop Kelly	10314 Schuttler Rd	Manito, IL 61546
08-15-01-300-007	Schacherbauer Ryan L	10322 Schuttler Rd	Manito, IL 61546-0000
08-15-01-300-013	Schuttler Walter L Trustee	22130 Green River Rd	Colona, IL 61241
08-15-02-200-002	Waibel William S Trust	Waibel William S Trustee 1906 W Courtside Dr	Peoria, IL 61614-1264
08-15-02-200-003	Waibel William S Trust	Waibel William S Trustee 1906 W Courtside Dr	Peoria, IL 61614-1264
08-15-02-300-004	Indian Mound Farms LLC	9787 Meyer Farms Ln	Manito, IL 61546
08-15-02-400-003	Proehl Dorothy A Trustee	PO Box 34	Groveland, IL 61535-0000
08-15-02-400-004	Mackinaw River Levee Drainage District 1 River Levee	PO Box 669	Pekin, IL 61555-0669
08-15-02-400-005	Herrman Verne N Jr	PO Box 195	Groveland Il 61535-0000
08-15-02-502-002	Illinois & Midland Railroad	200 Meridian Centre Suite 300	Rochester, NY 14618
08-15-11-200-001	Proehl Dorothy Trustee	PO Box 34	Groveland, IL 61535-0000
08-15-11-300-005	Indian Mound Farms LLC	9787 Meyer Farms Ln	Manito, IL 61546
08-15-01-100-004	Waibel William S Trust	Waibel William S Trustee 1906 W Courtside Dr	Peoria, IL 61614-1264
08-15-02-300-002	Becker Scott	8950 Spring Lake Rd	Manito, IL 61546-0000
08-15-02-400-001	Herrman Verne N Jr	3918 Springfield Rd Po Box 195	Groveland, IL 61535
08-15-10-200-003	Prather Wayne F	8561 Spring Lake Rd	Manito, IL 61546-0000
08-15-10-200-004	Prather Wayne F & Marlisa G	8561 Spring Lake Rd	Manito, IL 61546
08-15-03-400-003	Becker Scott & Charissa	8950 Spring Lake Rd	Manito, IL 61546-0000
08-15-11-101-001	Buley Connie	9358 Spring Lake Rd	Manito, IL 61546-0000
08-15-03-300-002	Becker Brian K & Scott	8810 Townline Rd	Manito, IL 61546
08-15-03-400-004	Indian Mound Farms LLC	9787 Meyer Farms Ln	Manito, IL 61546
08-15-10-100-001	Ziegenbein Carol J & Donald E Trustees	7727 Springlake Rd	Manito, IL 61546-0000
08-15-10-100-002	Duval Danny L Trustee	9845 Wagonseller Rd	Green Valley, IL 61534

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08-15-10-200-002	Frank Brian	7356 Mason Rd	Manito, IL 61546-0000
08-15-10-200-006	Becker Brian K & Scott	8810 Townline Rd	Manito, IL 61546
08-15-11-100-009	Becker Scott J	8950 Spring Lake Rd	Manito, IL 61546-0000
08-15-11-100-010	Indian Mound Farms LLC	9787 Meyer Farms Ln	Manito, IL 61546
08-15-11-100-011	Frank Brian	7356 Mason Rd	Manito, IL 61546-0000
08-15-11-100-012	Becker Scott	8950 Spring Lake Rd	Manito, IL 61546-0000
08-15-11-100-013	Frank William & Jennifer	9171 Spring Lake Road	Manito, IL 61546
08-15-11-100-014	Indian Mound Farms LLC	9787 Meyer Farms Ln	Manito, IL 61546
08-15-11-502-004	Illinois & Midland Railroad	200 Meridian Centre Suite 300	Rochester, NY 14618
08-15-10-300-005	Kammeyer Scott	9150 Timber Rd	Manito, IL 61546-0000
08-15-10-300-003	Little Jerry & Wanda E	9374 Timber Rd	Manito, IL 61546-0000
08-15-10-300-002	Duval Danny L Trustee	9845 Wagonseller Rd	Green Valley, IL 61534
08-15-02-100-006	Herrman Charles Testamentary Trust	11174 Herrman Rd	Manito, IL 61546
08-15-02-200-001	Hilst Martha K	% Hilst Kenneth 11926 Hilst Rd	Green Valley, IL 61534
08-15-03-200-005	Herrman James A & Marlene F Co-Trustees	8745 Townline Rd	Manito, IL 61546
08-15-01-100-003	Hilst Martha K	% Hilst Kenneth 11926 Hilst Rd	Green Valley, IL 61534
08-15-10-300-004	Jacobson Peter & Karen	8250 Warner Rd	Manito, IL 61546-0000
08-15-10-400-003	Indian Mound Farms LLC	9787 Meyer Farms Ln	Manito, IL 61546
08-15-14-200-008	Proehl Jason W & Amanda M	9701 Warner Rd	Manito, IL 61546-0000
08-15-11-400-002	Proehl J D & Nancy	9776 Warner Rd	Manito, IL 61546
08-15-14-200-005	Woodley Anne C & Craig M	9979 Warner Rd	Manito, IL 61546-0000
08-15-10-300-001	Ziegenbein Carol J & Donald E Trustees	7727 Springlake Rd	Manito, IL 61546-0000
08-15-10-400-002	Proehl J D	9776 Warner Rd	Manito, IL 61546-0000
08-15-11-300-004	Indian Mound Farms LLC	9787 Meyer Farms Ln	Manito, IL 61546
08-15-12-400-004	Proehl J D & Nancy	9776 Warner Rd	Manito, IL 61546-0000
08-15-12-400-006	Proehl JD & Nancy	9776 Warner Rd	Manito, IL 61546-0000
08-15-13-100-001	Becker Kenneth	8479 Townline Road	Manito, IL 61546-0000
08-15-14-200-007	Proehl J D & Nancy M	9776 Warner Rd	Manito, IL 61546-0000
08-15-15-100-002	Proehl J D	9776 Warner Rd	Manito, IL 61546-0000

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08-15-15-100-004	Proehl J.D & Nancy M	9776 Warner Rd	Manito, IL 61546
08-15-15-300-005	Willett John O	12414 Deer Ridge Rd	Culpeper, VA 22701-0000
08-15-12-400-005	Proehl J D & Nancy	9776 Warner Rd	Manito, IL 61546-0000
08-15-14-200-003	Proehl J D & Nancy M	9776 Warner Rd	Manito, IL 61546-0000
08-15-15-100-003	Proehl James David	9776 Warner Rd	Manito, IL 61546-0000
08-15-13-300-002	Indian Mound Farms #2 LLC	9787 Meyer Farm Ln	Manito, IL 61546

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