CLASS VI PERMIT APPLICATION NARRATIVE

40 CFR 146.82(a)

GULF COAST SEQUESTRATION
PROJECT MINERVA

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1.0 PROJECT BACKGROUND

1.1 Project goals

Gulf Coast Sequestration (GCS) seeks to build and operate the United States premier saline sequestration asset, Project Minerva, in the Louisiana Gulf Coast. Once completed, the GCS "hub" is expected to be the largest geologic carbon capture sequestration project in the United States and one of the largest in the world, designed to permanently store more than 80 million tons of carbon in a saline aquifer. With the capacity to sequester 2,700,000 tons of CO2 annually, Project Minerva will have the same carbon offset impact as more than 600 utility-scale solar facilities or some half a million-household rooftop solar panels.

Project Minerva envisions sourcing CO_2 volumes from industrial producers of CO_2 in the Eastern Texas and Southwestern Louisiana industrial corridors. Project Minerva desires to enable the United States manufacturing and industrial base in the Texas and Louisiana Gulf Coast to continue to provide jobs and economic opportunity while minimizing the amount of CO_2 which would have been emitted into the earth's atmosphere. GCS maintains that both economic and environmental stewardship can advance in unison with an asset such as Project Minerva. GCS intends to see this vision become a reality.

1.2 Ownership

GCS is a wholly owned subsidiary of the Stream family, a multi-generational single-family office, based in Lake Charles, Louisiana. In addition to other investments, the Stream family are long-term landowners in Southwestern Louisiana, owning and operating land assets for well over a century in and near Lake Charles. The Stream family have protected and restored tens of thousands of acres of wetlands and sustainably managed thousands of acres of timber assets. The GCS sequestration "hub" is a natural fit for the Stream family.

1.3 Proposed injection mass/volume and CO_2 source

Project Minerva is designed for four wells which are spread into two project areas – 'Perry Ridge' located in southwestern Calcasieu Parish and 'South Island' located in northwestern Cameron Parish. Each of Perry Ride and South Island project areas will contain four injection wells emanating from a single surface location per project area. Four injection wells were selected to maximize access to the available pore volume of the Oligocene Frio Formation and to disperse and maximize the flow of CO_2 from the project areas. Project Minerva is designed to operate for thirty years at a nameplate capacity per annum of 2.7 million metric tons of CO_2 across all four injection wells.

CO_2 is anticipated to be sourced from industrial facilities in Southwestern Louisiana and Southeastern Texas, primarily from the Lake Charles and Beaumont industrial corridors. According to Environmental Protection Agency (EPA) Facility Level Information on GreenHouse gases Tool (FLIGHT) the total CO_2 emissions from the four counties/parishes which abut Project Minerva emitted nearly 57 million metric tons of CO_2 in 2018 (EPA FLIGHT database at https://ghgdata.epa.gov/ghgp/). The two counties in Texas are Jefferson and Orange and the two parishes in Louisiana are Cameron and Calcasieu. Project Minerva does not have a dedicated

source of CO_2 under contract but is in advanced stage discussion on offtake arrangements for CO_2 with a number of counterparties with assets in the four county/parish area discussed above.

2.0 REGIONAL GEOLOGICAL DESCRIPTION

2.1 Regional Geological Background

2.1.1 Gulf of Mexico regional geologic setting

The Gulf of Mexico is a relatively small ocean basin covering an area of more than 579,000 mi^2 (1.5 million km^2) (Ocean Exploration and Research Website, 2018). Since ~135 million years ago, the basin has been a stable geologic province characterized by the persistent subsidence of its central part, and the massive influx of clastic sediments off the North American Continent, forming thick prograding clastic wedges along its northwestern and northern margins. Sediment input has been particularly voluminous since the start of the Paleogene and is responsible extensive deformation of underlying salt and the resulting abundance of prolific hydrocarbon systems along the Gulf Coast of Louisiana and Texas (Figure 2.1 and Figure 2.2) (Foote et al., 1984). The Project Minerva interval of interest comprises >8,000 ft of dominantly clastic strata.

2.1.2 Gulf of Mexico Basin origin and early evolution

Around 200 million years ago, the super continent Pangea split into two separate and smaller supercontinents, Laurasia (which would later become North America, Europe, and Asia) and Gondwana (which would later become South America, Africa, Antarctica, and Australia). As Pangea rifted apart, a section of the fracture between the future North American and South American continental plates expanded and the resulting stretching as well as thinning of the Earth's crust created a large depression that would become the Gulf of Mexico basin (Ocean Exploration and Research Website, 2018).

2.1.3 Deposition of thick Mid Jurassic salt deposits

As spreading of new oceanic crust expanded and deepened the young Gulf of Mexico basin, between 160 and 140 million years ago (mid to late Jurassic), it was intermittently filled by seawater from the Pacific and early Atlantic, creating shallow bodies of water with restricted flow conditions. Repeated cycles of seawater flooding and evaporation resulted in the formation of extensive salt accumulations that locally attained thicknesses of 10,000 to 15,000 ft thick before flowage into the numerous pillows, massifs, and diapiric stocks that today dominate the structural fabric of much of the Gulf basin (Foote et al., 1984).

2.1.4 Dominantly carbonate deposition from late Jurassic until the late Cretaceous

Following the last major cycle of evaporitic deposition early in Late Jurassic time, the Gulf of Mexico region was flooded by open seas. Depositional environments quickly changed from evaporitic and continental to shallow and, perhaps locally, deep marine. Terrigenous sands and muds initially were deposited across the basin, and eventually they were overlain by predominantly carbonate accumulations as subsidence slowed and the supply of terrigenous clastic material waned. A carbonate depositional regime prevailed into the Early Cretaceous, during which time, broad carbonate banks composed of limestones, dolomites, and interbedded anhydrites were

constructed around the periphery of the basin. Carbonate muds accumulated in the deeper water areas between these broad banks. As reef construction and sedimentation kept pace with regional subsidence, the banks were continually built upward as their foundations sank (Foote et al., 1984).

2.1.5 Voluminous clastic sediments dominate during late Cretaceous

General uplift of the North American continent during latest Cretaceous and early Tertiary times was related to the tectonic formation of the Rocky Mountains in the western United States; this general uplift produced voluminous amounts of clastic sediment throughout the Tertiary period. Large volumes of land-derived sands and muds were deposited in successively younger wedges of off-lapping strata as the basin subsided relatively rapidly. Alternate periods of load-induced subsidence and up-building of sediments followed by less subsidence and out-building of sediments produced the multiple transgressions and regressions of depositional environments that are characteristic of the Tertiary sequence along the Louisiana and Texas Gulf Coast. Sediment supplies during Cenozoic time overwhelmed the general rate of subsidence, causing the margins to be prograded as much as 240 mi (384 km) from the edges of Cretaceous carbonate banks to the present position of the continental slopes off Texas and Louisiana (Foote et al., 1984).

Cenozoic and Mesozoic shales and dense limestones demonstrably serve as seals in producing oil and gas fields regionally. Cenozoic sedimentary units of clastic origin deposited across the Gulf Coast, such as those of interest at Project Minerva, appear as dominantly well-layered alternating sands and shales, based upon their seismic characteristics, the widely accepted depositional model and data collected from drilled wells (Foote et al., 1984).

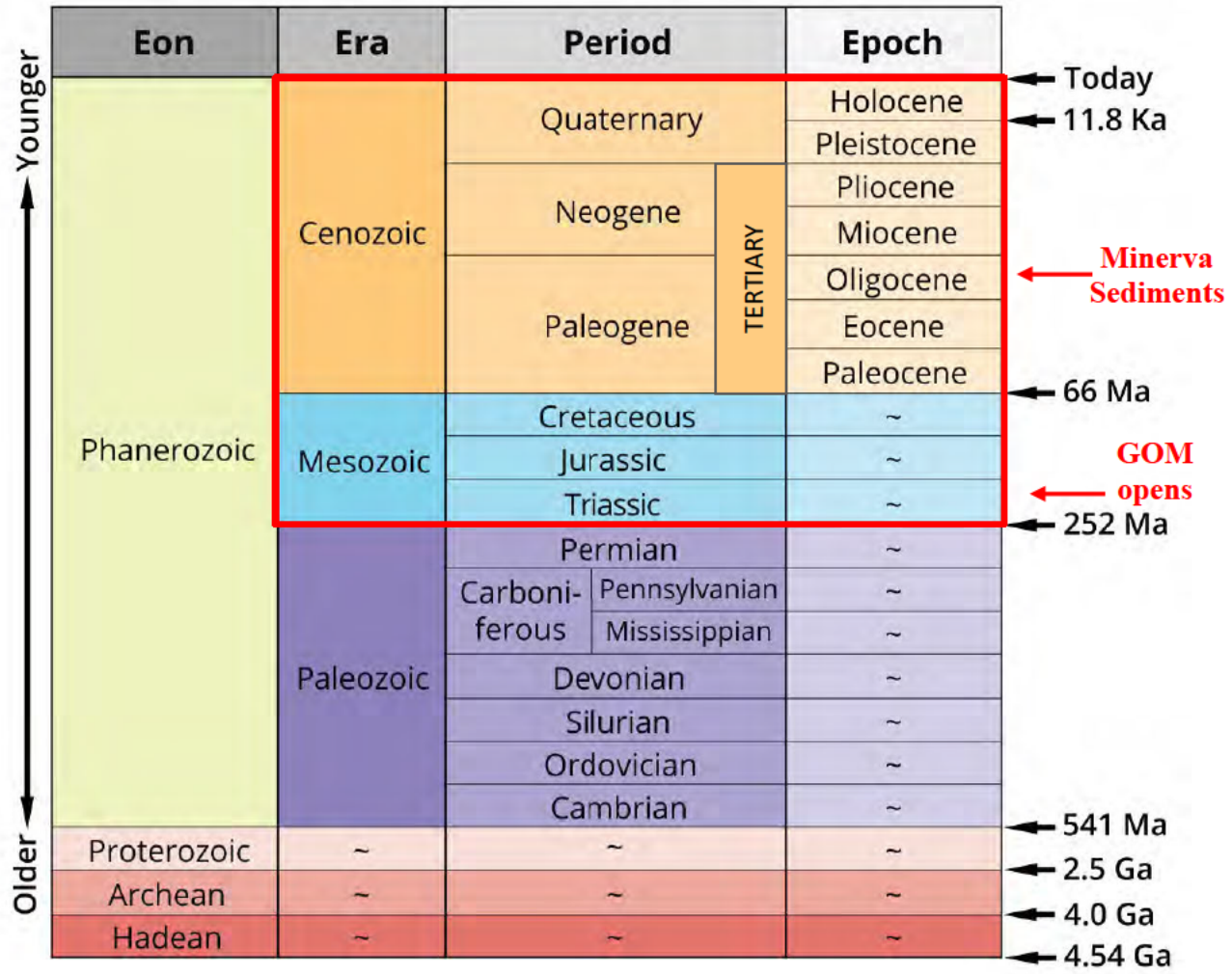
2.1.6 Pleistocene glacial sedimentation forms dominant USDW interval

The voluminous infilling of the Gulf basin during Tertiary time was followed by sediment influx of similar proportions due to the profound effects of continental Pleistocene glaciation. Sea levels rose and fell in concert with climatic conditions that controlled the retreats and advances of glacial sheets. Pleistocene sediments accumulated along the outer shelf and upper slope regions of the northern gulf margin, blanketing the Project Minerva area (Foote et al., 1984). The main underground source of drinking water (USDW) at Project Minerva, the Chicot reservoir, was deposited at this time.

2.1.7 Regional structural framework

Tectonism caused by sediment loading and gravity has played a major role in contemporaneous and post-depositional deformation of Tertiary strata, however the continental margins and deep ocean basin regions of the Gulf of Mexico, are relatively stable areas (Foote et al., 1984).

During the Tertiary, large quantities of sand and mud were deposited along the margins of the Gulf of Mexico and these sediments accumulated in a series of wedges that thicken and dip gulfward. Large growth fault systems formed near the downdip edge of each sediment wedge within the area of maximum deposition; these faults developed as a result of rapid sediment loading (Swanson and Karlsen, 2009) which caused the plastic flowage of underlying Jurassic salt deposits and masses of under-consolidated Cenozoic shale (Figure 2.3). Mobilization of salt resulted in the formation ridges and troughs and extensive salt diapirism, many of which have pierced many thousands of feet of overlying strata. Regional faulting typically occurred parallel to successive shelf edges during Tertiary and Quaternary times, down-thrown towards the gulf (Foote et al., 1984). Radial faulting is common around major salt diapirs (eg. Vinton Dome).



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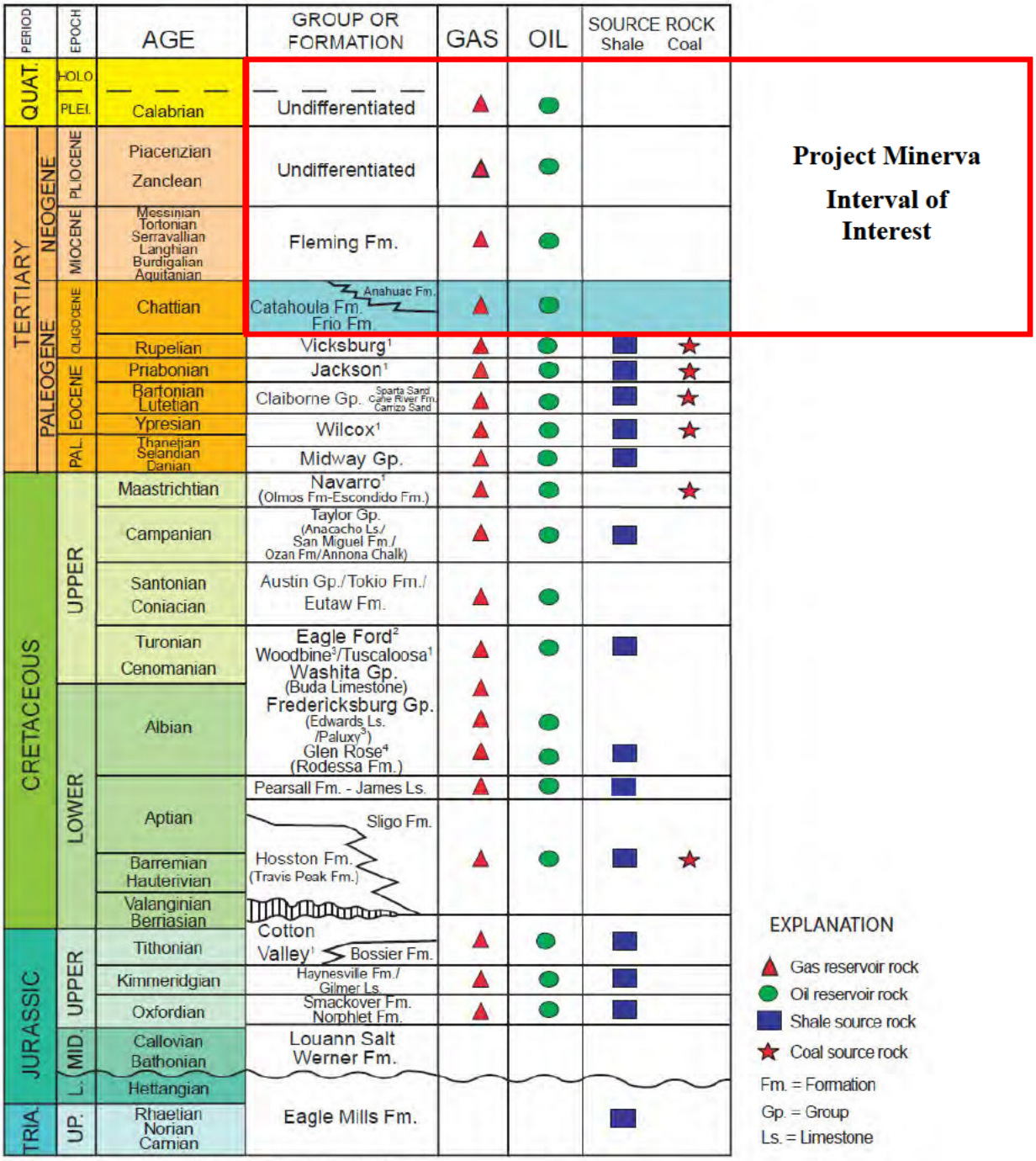

[1] Indicates classification of Group or Formation, depending on locality use.

[2] Indicates classification of Group, Formation, Clay or Shale, depending on locality use.

[3] Indicates classification of Formation or Sand, depending on locality use.

Figure 2.2 Generalized regional stratigraphic section of the northern Gulf of Mexico coastal plain, with the Frio Formation (equivalent to the Catahoula Formation in up-dip areas) and Anahuac Formation highlighted in blue. Abbreviations and symbols: Mid., Middle; Pal., Paleocene; Plei., Pleistocene; Holo., Holocene; Quat., Quaternary; wavy line, missing section; jagged line, interfingering; dashed line, uncertain. Modified from Swanson & Karlsen, 2013.

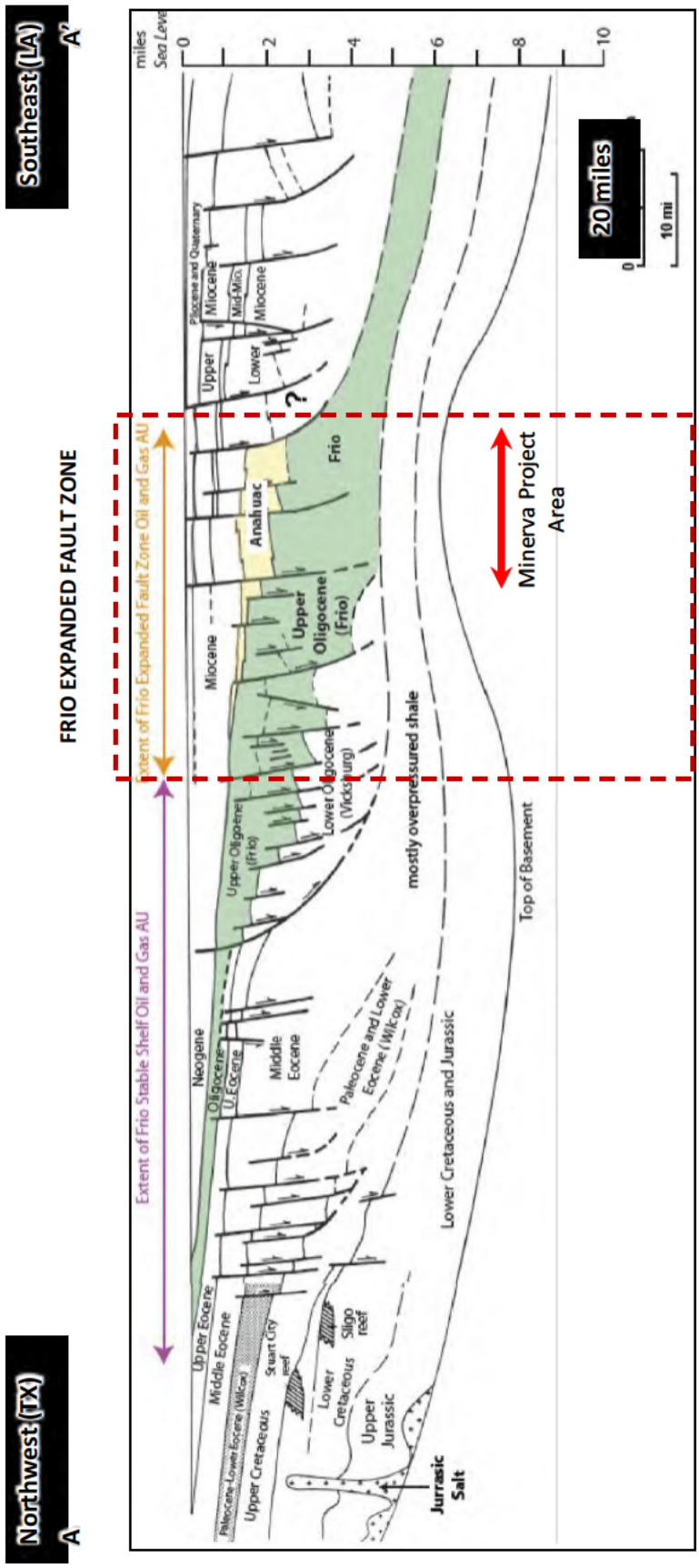

Figure 2.3 Cross section (A-A' Figure 2.4) through eastern Texas and southern Louisiana showing a schematic view of the typical structural regime stepping from the north down to the Guld of Mexico in the south. Frio and Anahuac Formations shown in yellow and green, respectively. Red Box: represents the "Frio Expanded Fault Zone", where faulting and salt dome development created significant accommodation space for thick Frio sandstones and overlying Anahuac Shale. Blue Arrows: Project Minerva sits in the southern extent of the zone, where the thickest Frio and Anahuac accumulated. Modified Swanson & Karlsen, 2013.

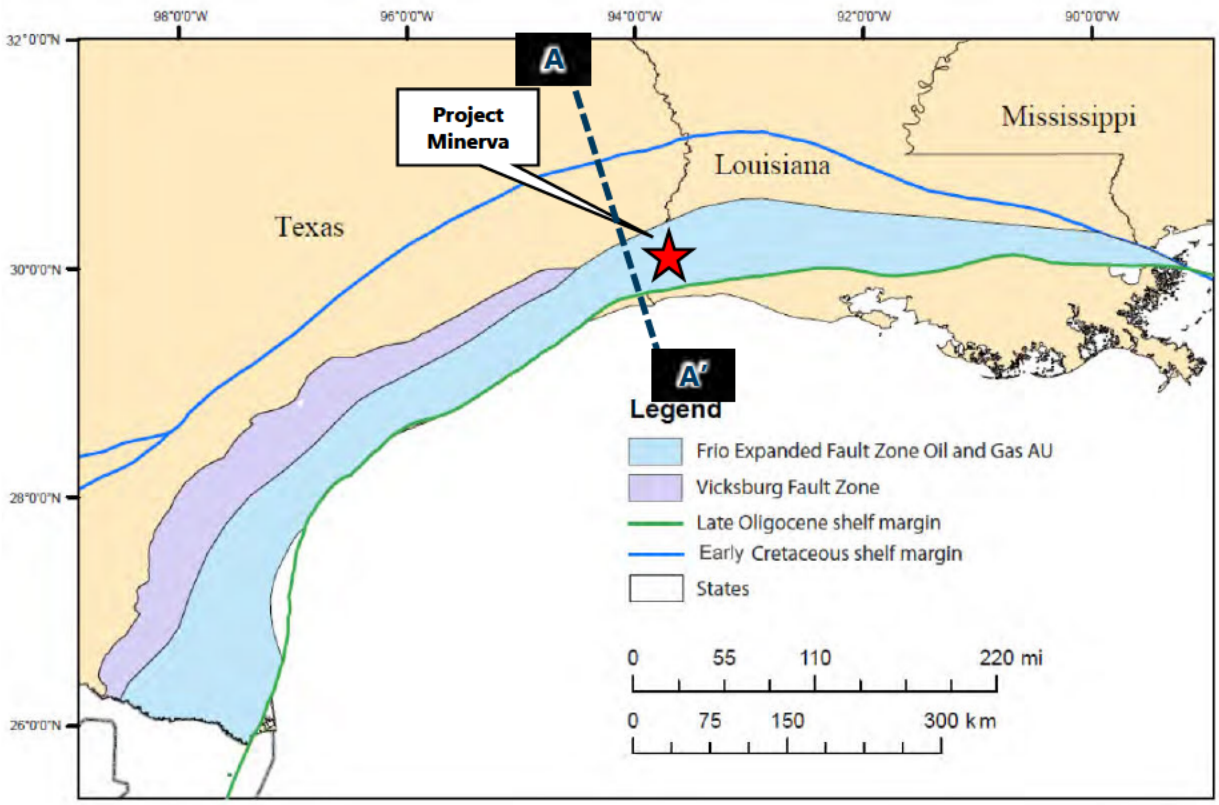

Figure 2.4 Frio Expanded Fault Zone. Modified from Swanson and Karlsen (2009)

2.2 Geological background of the Oligocene and Miocene (Interval of Interest)

2.2.1 Interval of interest overview

Project Minerva is primarily interested in the Late Oligocene Frio Formation (sandstone-rich Injection Zone) and Anahuac Formation (shale-rich Confining Zone). Attention has also been paid to the Miocene interval (clastic-/shale-rich Secondary Confining Zone) and the Quaternary interval (glacial sediments and regional potable water aquifers) (Figure 2.2 and Figure 2.5).

2.2.2 Regional geological setting of Project Minerva

Project Minerva lies within the "Frio Expanded Fault Zone", where large-scale regional fault movement generated accommodation space for thick, clastic Frio reservoir sandstones, and a subsequent transgressive sealing shale (Anahuac Formation) (Figure 2.2 and Figure 2.3). Regional structure dips to the south and is dominated by deep-seated "fault zones" (bands / complexes of closely aligned faults) generally dipping towards the Gulf, driven by gravity sliding along underlying salt and shales. Simplified fault zones are shown on regional maps where 3D seismic is not available for detailed analysis. Salt dome features are visible as structural highs typically surrounded by radial faulting (Figure 2.6).

2.2.3 Oligocene Deposition

During the Oligocene four sediment-dispersal axes dominated the Gulf margin (Figure 2.7). The Houston, and central Mississippi deltas, provided a source of coarse-grained sediment at Project Minerva (Swanson & Karlsen, 2009). Oligocene sediments were deposited along the Gulf Coast basin as cyclic depositional units, which represent transgressive and regressive stages of deposition. These depositional cycles were caused by variations in sediment supply and subsidence. Oligocene deposits are subdivided according to depositional cycles (Figure 2.5) (Foote et al., 1984).

1. Lower Oligocene (Vicksburg) represents a transgressive phase (mainly shale and some sandstone lenses) and underlies our interval of interest
2. Middle Oligocene (Frio) represents a regressive phase (sandstones interbedded with marine shales)
3. Upper Oligocene (Anahuac) represents transgression (marine shales and thin sandstones)

2.2.4 Frio Formation

The Middle Oligocene Frio Formation is a very thick sequence of regressive sediments that were deposited rapidly in alluvial, lagoonal and inner-neritic environments, forming a major progradational wedge along the Gulf. Non-marine sands were deposited in constantly shifting deltas and are interbedded with marine shales that were deposited during periods of local transgression. The massive/stacked Frio sands seen at Project Minerva are likely related to thick accumulations in shorezone of strand plain and deltaic environments. Locally, lenses of Frio sandstone may shale-out along strike into the Frio shales (Foote et al., 1984). Regionally, the extent of the Frio Sandstone trend is defined to the north (southern Beauregard Parish) by transition into fine-grained, mix-load dominated fluvial sediments, and to the south (offshore Gulf of

Mexico) by large-scale fault-related juxtaposition against thick, fine-grained formations in the overlying Neogene. (Swanson et al., 2013).

2.2.5 Hackberry Trend

A transgressive, deep water shale and sandstone unit referred to as the "Hackberry" occurs in the middle to lower part of the Frio Formation. Oligocene turbidite sands were deposited in nearshore and deep marine environments, in a relatively confined area of southern Louisiana and Texas where deltas prograded directly into deeper waters (Figure 2.7 and Figure 2.10) (Foote et al., 1984). The Hackberry interval appears in the middle to lower Frio Formation and is characterized by thick shales punctuated by incised submarine channel sandstones.

2.2.6 Anahuac Formation

The Frio Formation is regionally overlain by late Oligocene, the Anahuac Formation, a transgressive marine shale containing sandstone, carbonate bank, and carbonate reef deposits. The Anahuac Formation occurs in the subsurface of Texas, Louisiana, and southwestern Mississippi (Figure 2.12). Three depositional systems have been proposed in south-central and southwestern Louisiana: proximal deltaic, distal deltaic, and slope environments (Swanson et al., 2013).

The Anahuac Formation strata of southwestern Louisiana and Texas typically consist of light- to dark-greenish-gray calcareous shale that is interbedded with thin beds of locally calcareous sandstone and limestones. In western and central parts of Louisiana (Project Minerva area) the interval mostly comprises shales with lesser sandstones, while limestones and calcareous clastics dominate in Anahuac eastern Louisiana and the eastern Gulf of Mexico, where clastic influx was minimal (Swanson et al., 2013).

2.2.7 Miocene Deposition

At the end of Oligocene time, the depocenters shifted northeastward into southern Louisiana where the ancestral Mississippi River began to supply large quantities of sand, silt, and mud. In each Miocene depocenter, sediments were deposited on deltas and further distributed gulfward and laterally across broad shelf areas by marine currents Progradation of coastal depositional environments dominated throughout Upper Miocene and Pliocene times and represent persistent and laterally uniform sedimentary environments. In southern Louisiana depocenters, Miocene deposits exceed 20,000 ft in thickness and comprise prolific source beds, reservoir rocks, structural-stratigraphic traps, and reservoir seals (Foote et al., 1984).

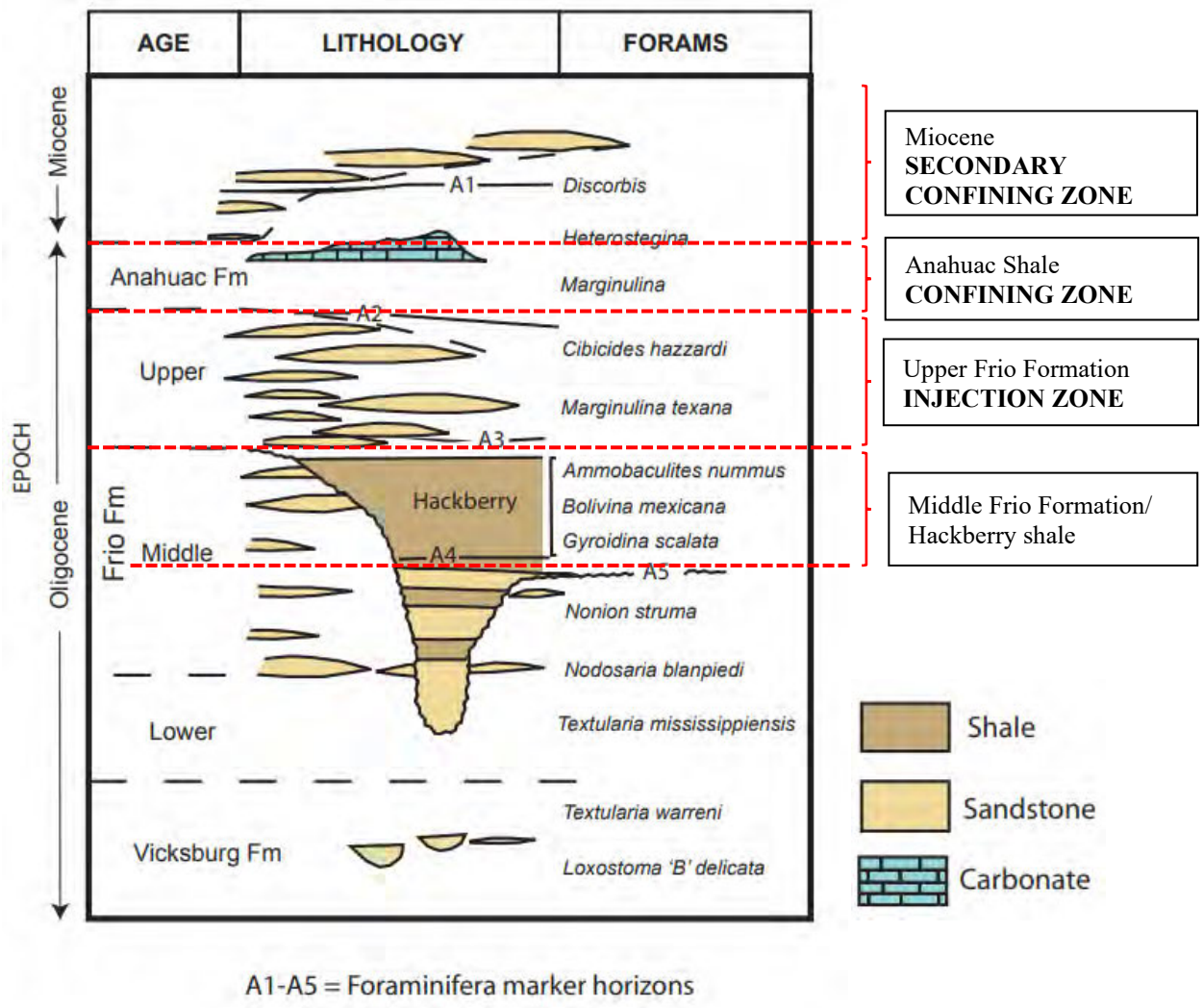

Figure 2.5 Schematic stratigraphic column illustrating the relative position of the Confining and Injection Zones.

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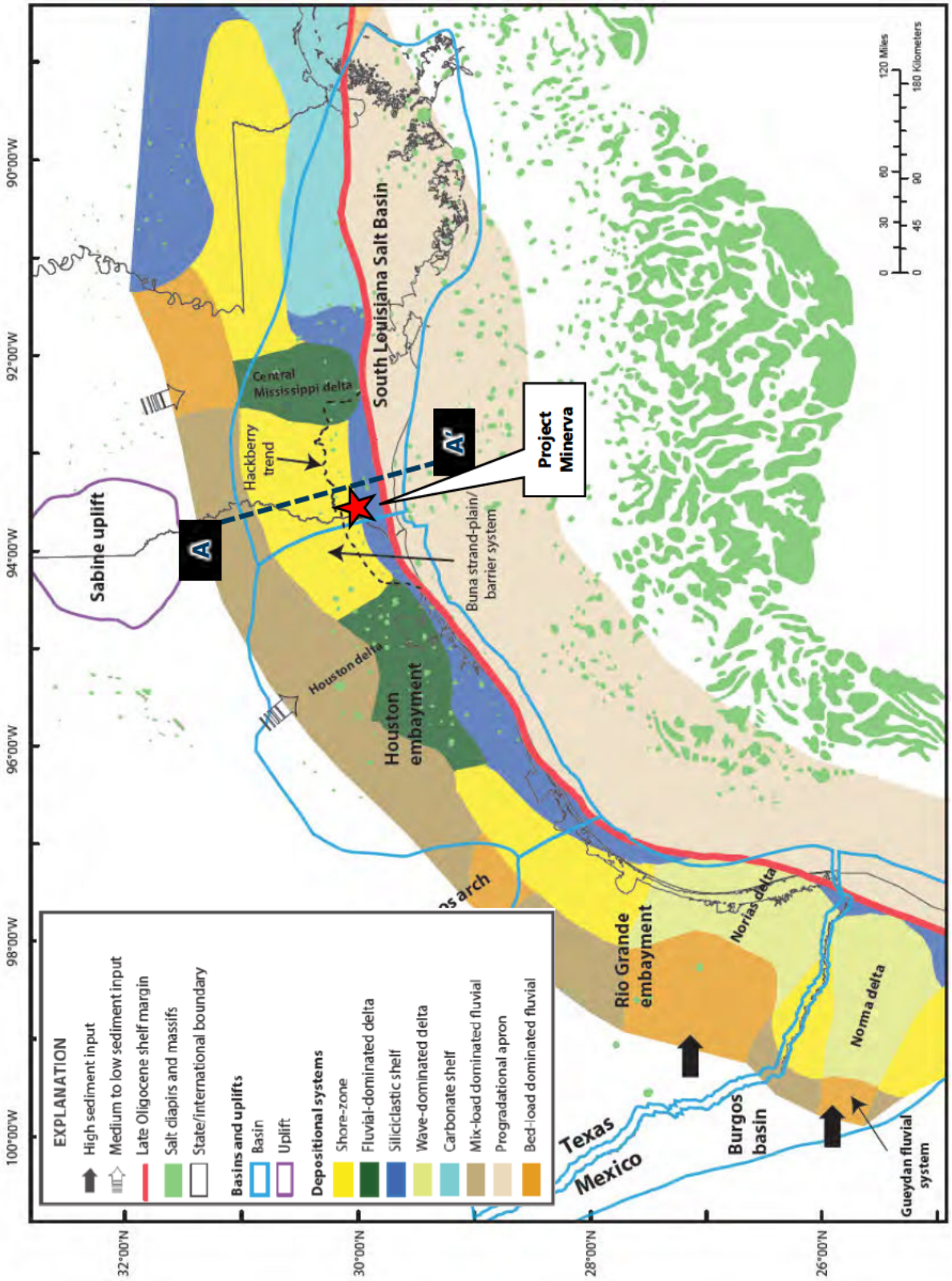

Figure 2.7 Regional depositional model for the late Oligocene Frio Formation (Project Minerva Site highlighted with red star). Principal sediment sources, basins and uplift, and depositional systems shown. Cross section line refers to Figure 2.8. Modified from Swanson & Karlsen, 2013.

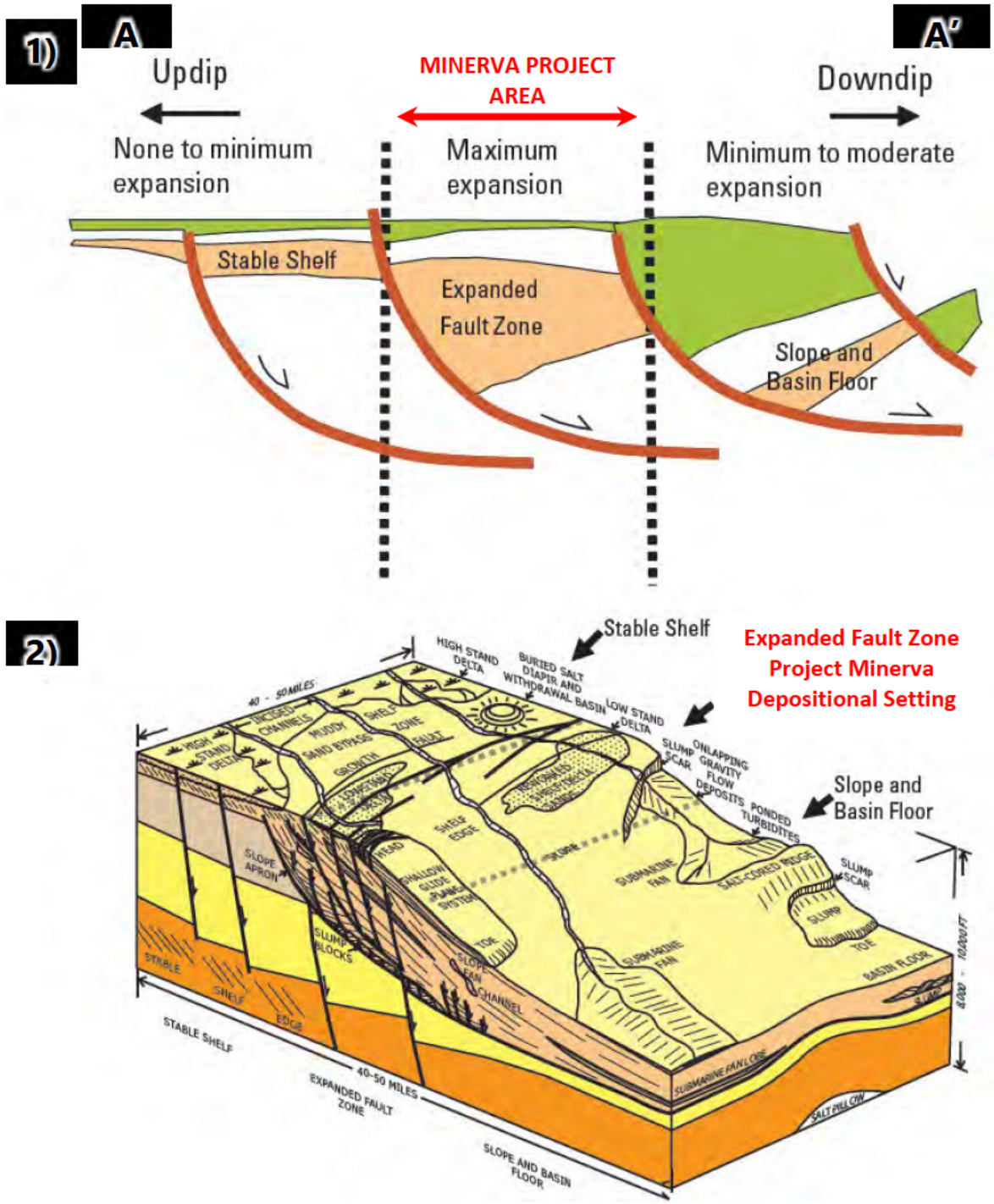

Figure 2.8 Geologic model of the Gulf Coast. Cross section line shown in Figure 2.7 A) Diagram showing stable shelf, expanded fault, and slope and basin floor zones, and B) Generalized diagram with structural and depositional systems associated with each zone. Frio sandstone deposition at Minerva occured within the "Expanded Fault Zone", with dominantly fluvial/shorezone stacked sandstones forming the reservoir interval of interest. Modified from Swanson & Karlsen, 2013

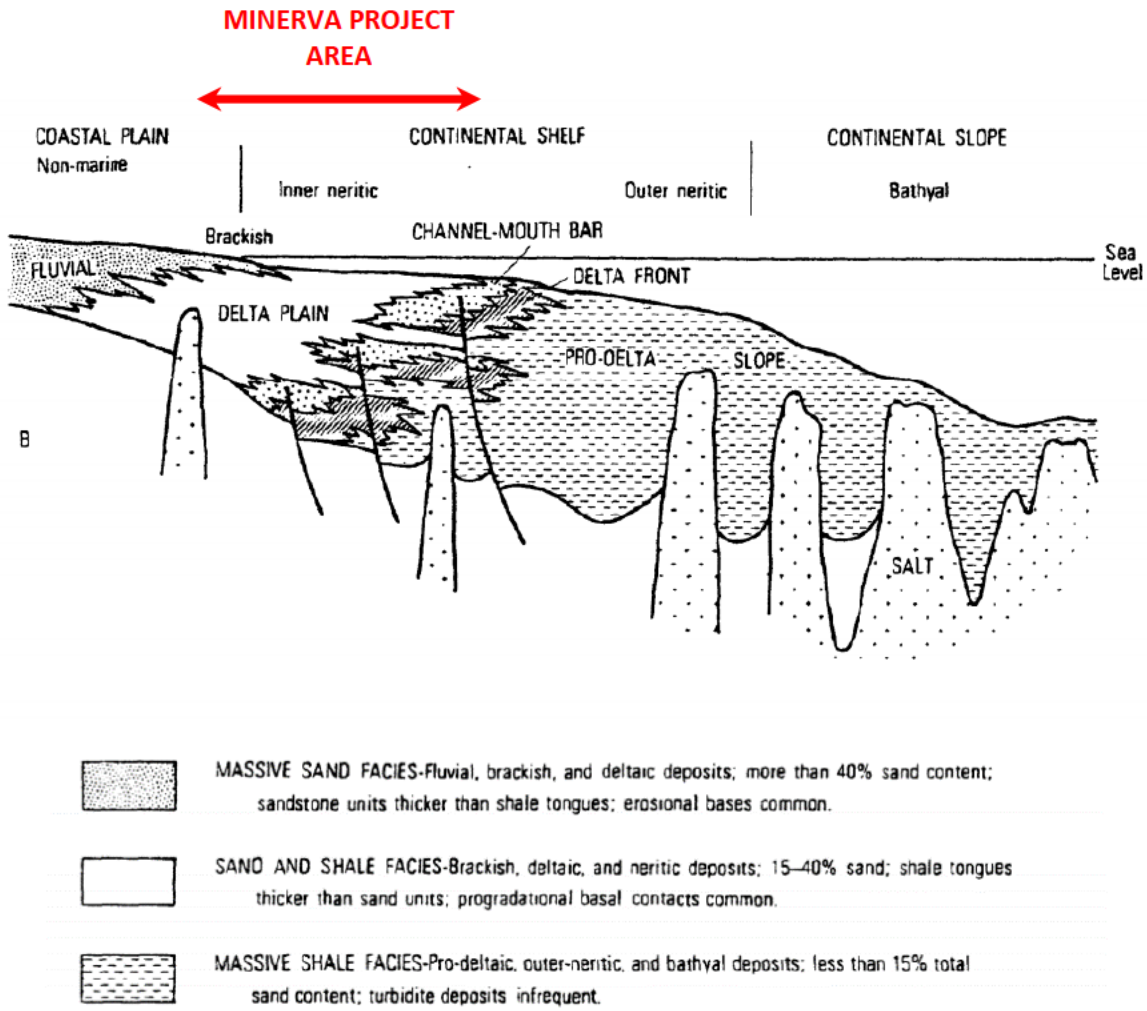

Figure 2.9 Schematic cross section of depositional facies during the Oligocene along the Gulf Coast

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4.0 PROJECT AREA SPECIFIC DESCRIPTION OF THE GEOLOGY OF THE AOR

4.1.1 Project Minerva Geological System Overview

Project Minerva benefits from an ideal geological system involving the late Oligocene Frio Formation reservoir sealed by the overlying Anahuac shale interval, in a broad syncline structure created by the interplay of regional fault zones and salt diapirs. Secondary sealing is provided by a shale-rich Miocene (Figure 4.1). Significant separation exists between the top of the Frio Formation and the deepest mapped USDW. See Figure 4.2 for a schematic cross section of the system.

4.1.1.1 Injection Zone – High Net-to-Gross Upper Frio Formation

The Frio Formation comprises a thick series of stacked, laterally extensive, high net-to-gross deltaic and marginal-marine sandstones. It is a proven high quality reservoir interval (>8% porosity) and is one of the largest hydrocarbon producers from the Paleogene in the Gulf of Mexico.

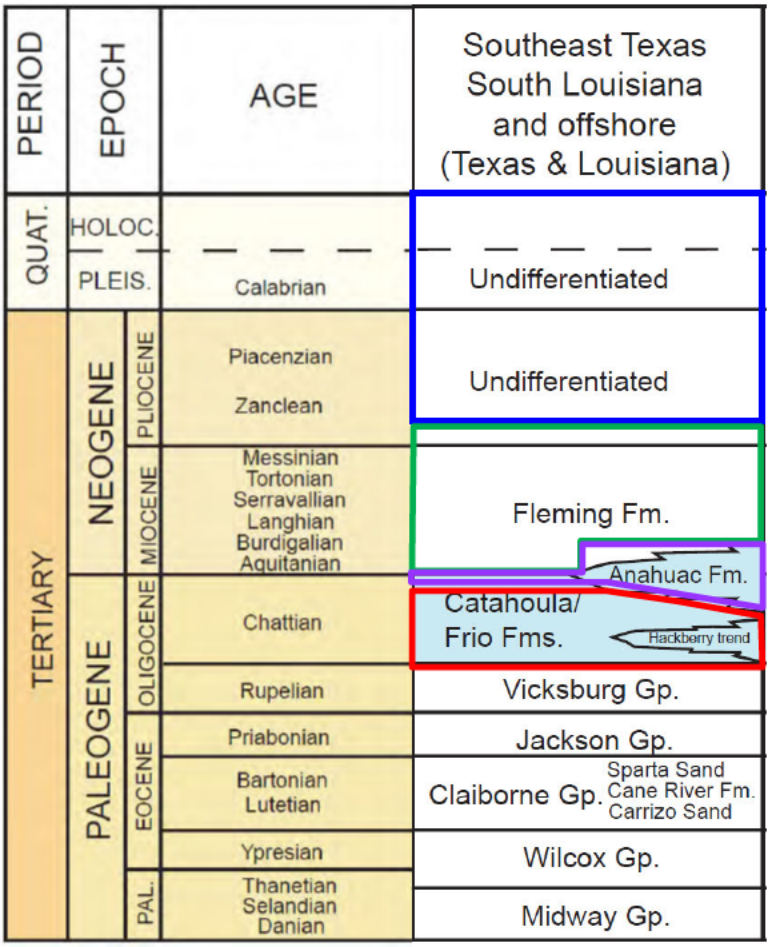
At Project Minerva, the Frio Formation comprises three distinct zones – Upper, Middle and Lower – clearly visible in geophysical log data (Figure 4.3). The Upper and Middle zones contain the highest quality and most prolific reservoir sandstone intervals. Both the Upper and Middle Frio intervals have been extensively developed in in southwest Louisiana, however, at Project Minerva, the Upper Frio is sparsely drilled and water-wet.

4.1.1.2 Confining Zone – Low Permeability Anahuac Shale

Progradation of shore-zone (Frio Formation) depositional systems across Project Minerva in the early Oligocene was followed by sustained systems tract retreat during the late Oligocene. The shale-rich retrogradational systems tract (Confining Zone) that overlies and seals the Injection Zone is known regionally as the Anahuac Formation. It typically comprises thick (average 750ft), low vertical permeability (~10^{-6} mD), fine-grained, open-marine deposits, light- to dark-greenish-gray calcareous shale that is interbedded with thin beds of locally calcareous sandstone and limestones. Regionally extensive deposition occurred in proximal deltaic, distal deltaic, and slope environments and completely covers the Project Minerva area (Swanson et al., 2013).

4.1.1.3 Secondary Confining Zone and USDW– Miocene Overburden

The Miocene in the Louisiana coast is one of the thickest wedges of terrigenous clastic sediments fed by a complex river system in the northern Gulf of Mexico. In the Early Miocene, active salt tectonics restricted deposition to the shelf with the salt reinforcing the prograding slope, thereby trapping sediments on the shelf (Coker, 2006). This resulted in more than 7,000ft of Miocene strata (>1,100 feet net impermeable shale) being deposited across the Project Minerva site. Extensive shales within this interval act as secondary confinement of the Frio reservoir and the interval provides significant vertical separation of the USDW (Figure 4.2)



Approx. USDW
Pliocene and younger formations

Secondary Confining Zone
Fleming Formation: thick interbedded shales, siltstones and sandstones. >7,000ft vertical separation from Frio Formation in project area

Confining Zone
Anahuac Shale >750ft

Injection Zone
Upper Frio Formation; Catahoula Formation represents up-dip equivalent to the Frio (north of project area); Hackberry channel trend (Middle Frio) variably present across project area.

Figure 4.1 Figure 4.1 Stratigraphic section of the Tertiary and younger strata in the Northern Gulf of Mexico coastal plain. Modified from Sharon & Karlsen, 2013)

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Date/Time	Latitude	Longitude	Depth (km)	Magnitude	Event ID	Place/Location
2020-03-23T06:52:42.892Z	31.94070	-94.44260	5	2.5	us70008ee1	6km NW of Timpson, Texas
2019-07-27T04:01:03.081Z	31.84680	-94.42260	5	2.6	us60004y6h	6km SSW of Timpson, Texas
2019-01-20T11:32:03.040Z	31.47030	-94.13540	5	3.3	us2000j6m0	7km SSW of San Augustine, Texas
2018-09-12T04:35:06.180Z	31.89210	-94.38740	5	2.5	us2000hd8u	1km SSE of Timpson, Texas
2018-09-04T15:06:46.490Z	31.96130	-94.43430	5	3.5	us2000h85v	7km NNW of Timpson, Texas
2014-10-03T04:52:32.650Z	31.67610	-94.05540	5	3.1	usb000sie0	16km NNE of San Augustine, Texas
2013-09-02T23:51:15.460Z	31.90950	-94.42790	4.69	4.3	usb000jfgm	3km WNW of Timpson, Texas
2013-09-02T21:52:38.940Z	31.96560	-94.52610	4.75	4.2	usb000jfey	14km WNW of Timpson, Texas
2013-05-31T10:01:17.070Z	31.86000	-94.33200	5	2.9	usp000k11q	eastern Texas
2013-03-11T15:22:37.220Z	27.87500	-92.04300	10	2.9	us2013mqa8	212km SW of Dulac, Louisiana
2013-01-31T21:20:33.480Z	31.93900	-94.46600	5	2.8	usc000ezjq	13km WNW of Timpson, Texas
2013-01-29T12:31:33.140Z	31.86600	-94.38900	5	2.8	usc000exeh	3km S of Timpson, Texas
2013-01-25T07:01:19.840Z	31.84400	-94.30000	5	4.1	usc000ev85	11km SE of Timpson, Texas
2012-12-22T17:55:12.990Z	31.90500	-94.41400	5	2.6	usp000jx9c	eastern Texas
2012-12-07T19:38:37.790Z	31.87300	-94.40100	5	2.8	usp000jwmu	eastern Texas
2012-05-26T05:58:27.220Z	31.87800	-94.39400	5	2.5	usp000jkxz	eastern Texas
2012-05-20T18:28:34.620Z	31.90400	-94.45800	5	2.7	usp000jkpw	eastern Texas
2012-05-17T08:12:00.990Z	31.92600	-94.36900	5	4.8	usp000jkhb	eastern Texas
2012-05-10T15:15:38.840Z	31.96400	-94.46500	7	3.9	usp000jk92	eastern Texas
2010-08-02T04:34:29.350Z	30.81500	-90.85400	0.4	3	usp000hhbw	14km E of Clinton, Louisiana
2005-12-20T00:52:20.510Z	30.25800	-90.70800	5	3	usp000e6fr	Louisiana
1983-10-16T19:40:50.830Z	30.24300	-93.39300	5	3.8	usp0001z1h	Louisiana-Texas border region
1981-11-06T12:36:40.460Z	32.02100	-95.26200	5	3.2	usp0001gu9	northern Texas
1981-06-09T01:46:33.120Z	32.14200	-94.39900	5	3	usp0001e27	northern Texas
1930-10-19T12:17:00.000Z	30.00000	-91.00000		4.2	ushis853	Louisiana
1891-01-08T06:00:00.000Z	31.70000	-95.20000		3.8	ushis291	eastern Texas

Table 4.1 List of earthquakes within 300 km of Project Minerva. Note event closest to Project Minerva is event ID 'usp0001gu9 at a depth of 5 km, which is at basement level rather than fault reactivation in shallower stratigraphy.

4.2.4.2 Seismic Risk - Texas

In Texas, the regions at greatest risk for seismicity are in West Texas, where earthquakes of magnitude of about 6 occurred in 1931 and 1995, and in the Panhandle area, where at least six earthquakes with magnitude above 4 have occurred since 1900. Earthquakes of similar magnitude may occur again in these areas. Geologically, some features of the Panhandle are similar to the Missouri-Tennessee area, however, large continental quakes are extraordinarily rare (occurring less often than once per 500 years in any particular place). Within the twentieth century there have been more than 100 earthquakes large enough to be felt in Texas; their epicenters occur in 40 of Texas's 257 counties. Four of these earthquakes have had magnitudes between 5 and 6, making them large enough to be felt over a wide area and produce significant damage near their epicenters.

In four regions within Texas there have been historical earthquakes that indicate potential earthquake hazard. Two of the regions, near El Paso and in the Panhandle, have had earthquakes with magnitudes of about 5.5-6.0 occurring every 50-100 years, with even larger earthquakes possible. In northeastern Texas the greatest hazard is from very large earthquakes (magnitude 7 or above), which might occur outside of Texas, particularly in Oklahoma or Missouri-Tennessee. In south-central Texas and along the Gulf Coast the hazard is generally low, however, small

earthquakes can occur there, including some that are triggered by oil or gas production. Elsewhere in Texas, earthquakes are exceedingly rare. However, the hazard level is not zero anywhere in Texas; small earthquakes remain possible.

A series of moderate earthquakes in the Texas - Louisiana border region near Hemphill started on April 23, 1964. Epicenters were determined on April 23, 24, 27, and 28. There were numerous additional shocks reported felt at Pineland, Hemphill, and Milam. The only damage reported was from the magnitude 4.4 earthquake on April 28 - wallpaper and plaster cracked at Hemphill. The magnitude of the other epicenters changed from 3.4 to 3.7. Shocks were also felt at Pineland on April 30 and May 7. On June 2, three more shocks were reported in the same area. The strongest was measured at magnitude 4.2; intensities did not exceed IV. Another moderate earthquake on August 16 awakened several people at Hemphill and there were some reports of cracked plaster. The shock was also felt at Bronson, Geneva, Milam, and Pineland.

Finally, there is some risk to Texas from earthquakes that may occur outside of the state. Large earthquakes similar to the 1811-1812 Missouri-Tennessee earthquakes would probably damage some structures in North Texas that aren't designed to withstand earthquakes. There is also potential hazard in the Panhandle area from earthquakes that may occur in Oklahoma.

In the Project Minerva area, the likelihood of an earthquake caused by natural forces or fluid injection is considered remote. Injection of carbon dioxide at Project Minerva is expected to be at comparatively low pressures and take place into deep, high porosity-high permeability formations that are extensive over a broad area that is not subject to natural earthquakes. Therefore, the probability of an earthquake of sufficient intensity to damage the injection system, injection well, or the confining layer is very low.

4.2.4.3 Induced Seismicity

Seismicity related to fluid injection normally results from activity involving high pressures and large volumes, such as those associated with high-pressure water flood projects for enhanced oil recovery. This seismicity is caused by increased pore pressure, which reduces frictional resistance and allows the rock to fail. Fluid withdrawal has caused land subsidence and earthquakes due to dewatering and differential compaction of the sediments. Earthquakes of magnitude 3.4 to 4.3 on the Richter scale appear to have been caused by fluid withdrawal near some oil fields in east Texas (Davis et al., 1987), such as Sour Lake, Mexia, and Wortham Fields.

Since 2010, the occurrence of earthquakes with a magnitude greater than 3.0 have increased from 20 events per a year (1967-2000) to over 100 events per a year (2010-2013) in the central and eastern US region (Ellsworth, 2013). The increased rate of occurrence in previously inactive seismic areas has been correlated with the increased use of injection wells located near faults. Fluid injection induced earthquakes are most likely caused by the increased pore pressure from injection operations which have reduced effective stress of faults leading to failure. This mechanism has been used to explain the best-known cases of injection-induced seismicity which was first studied in the Rocky Mountain Arsenal near Denver. New case studies have increased with the use of wastewater injection wells associated with hydraulic fracking. In many sites, smaller seismic occurrences have shown to be precursors to larger events. More data has become available since the Rocky Mountain study in the 1960’s, leading to a better understanding of factors and processes associated with induced-seismicity.

One of the most notable regional cases of induced seismicity associated with injection wells occurred in Youngstown, Ohio. In 2011, 12 low-magnitude seismic events occurred along a previously unknown fault line (Ohio Department of Natural Resources, 2012). These events occurred less than a mile from Class II injection well Northstar I. Previously, the area was seismically inactive, with earthquakes beginning a few months after the injection of wastewater. The injectable pressure at Northstar I was increased twice over 6 months (Ohio Department of Natural Resources, 2012) and may have reduced the effective stress on a fault. After the well was shut down by the Ohio Department of Natural Resources, the seismic activity declined. As a result of this case, seismic monitoring prior to injection and after injection has become common in Class II sites.

A case study in the Dallas-Fort Worth area tied small seismic events to a Class II injection well. 11 hypocenters have been observed at a focal depth of 4.4 km and 0.5 km from a deep saltwater disposal (SWD) well (Frohlich et al., 2010). Injection at this well began 8 weeks prior to the first recorded seismic event. A northeast trending fault is located approximately at the same location of the DFW focus (Frohlich et al., 2010). As a result of fluid injection into the disposal well, the stress upon the fault had been reduced and thus reactivated the fault (Frohlich et al., 2010). All of the seismic events associated with the DFW focus are small magnitude events (less than 3.3) and occurred very shortly after initial injection.

In Oklahoma, one of the largest earthquakes in the state's history may have been a result of wastewater injection at a Class II disposal site. In 2011, Prague, Oklahoma was the location of a 5.7 magnitude earthquake that was followed by thousands of smaller aftershocks. Wastewater had been pumped continuously into an old oil well for 17 years. As the pore spaces filled, the wellhead pressure was increased to continually inject the wastewater. This reduced the effective stress upon the Wilzetta fault located 650 meters from the well (Keranen et al., 2013). The fluid was injected into the same sedimentary strata at which 83% of the aftershocks originated (Keranen et al., 2013). In this case, the seismic event occurred years after the initial injection phase. Since the area was considered low risk seismically, there is no data on smaller earthquakes that may have proceeded the event in 2011.

In north-central Arkansas, multiple earthquakes have been triggered because of a Class II injection well. Since the operation of the disposal well in 2009, the site has experienced an increase from 2 events in 2008 to 157 events in 2011 (Horton, 2012). It was also tied to the discovery of a new vertical fault. 98% of earthquakes within this area occurred within 6 km of one of three waste disposal sites (Horton, 2012). The depth of the earthquake foci occurred between 6.7 and 7.6 km. Injection of fluid occurred at a depth of 2.6 km. At this disposal site, and E-W trending (Enders Fault) cut into the aquifer in which the fluid was injected and then acted as a conduit to the new fault at the depth of 6.7 to 7.6 km (Horton, 2012). The disposal wells were shut down in 2011 by the Arkansas Oil and Gas Commission. The rate and size of the earthquakes steadily decreased following the shutdown of the wells (Horton, 2012).

In Texas there are at least two known examples of previously seismically inactive areas becoming seismically active after major injection programs began. One site is located in the Central Basin Platform, near Kermit, and the other is in the Midland Basin near Snyder. In both cases, large scale, high pressure, oil field related, water flooding projects were under way, and earthquakes with a magnitude of over 4.0 on the Richter scale were recorded. Historically, induced earthquakes in Texas have not exceeded 4.6 magnitudes (Frohlich et al., 2010). Factors for an induced earthquake are limited to the distance a well is located from a fault, the stress state of the fault, and

a sufficient quantity of fluids from the injection well at a high enough pressure and enough time to cause movement along the fault (Ohio Department of Natural resources, 2012). A hydraulic conduit from the injection zone to a fault may also induce earthquakes (Ellsworth, 2013). The largest injection-induced events are associated with faulting that is deeper than the injection interval, suggesting that the increased pressure into the basement increases the potential for inducing earthquakes (Ellsworth, 2013). In all in cases, faults have been reactivated at or in close proximity of Class II injection sites. In some cases, previously unknown faults have been discovered. No induced earthquakes have been known or are postulated to have been caused by Class I injection operations (Davis et al., 1987).

The potential for induced seismicity at Project Minerva can be evaluated using the very conservative "zero-cohesion Mohr-Coulomb failure criterion," recommended by the U.S. Geological Survey (Wesson and Nicholson, 1987). This method is based on the following equation:

$$P_{crit} = \frac{S_v(3\alpha - 1)}{2} \qquad (1)$$

where:

P_{crit} = the critical injection zone fluid pressure required to initiate slippage along faults and fractures

S_V = the total overburden stress (which represents the maximum principal stress in the Gulf Coast region)

α = the ratio of the minimum principal stress (horizontal in the Gulf Coast region) to the maximum principal stress (overburden stress)

Inherent in Equation (1) are a number of conservative assumptions, guaranteed to produce a worst-case lower bound to the critical fluid pressure for inducing seismicity. These are:

1) It neglects the cohesive strength of the sediments

2) It assumes that a fault or fracture is oriented at the worst possible angle

3) It assumes a worst-case value of 0.6 for the coefficient of friction of the rock (see Figure 4 of Wesson and Nicholson, 1987)

For present purposes, Equation (1) can be expressed in a more convenient form by introducing the so-called matrix stress ratio (Ki) (Matthews and Kelly, 1967; Eaton, 1969), which is defined as the ratio of the minimum to the maximum "effective" principal stresses. Effective principal stress is equal to actual principal stress minus fluid pore pressure (p_o). Thus:

$$K_i = \frac{\alpha S_v - p_o}{S_v - p_o} \qquad (2)$$

Substituting Equation (2) into Equation (1) yields:

$$\Delta P_{crit} = \left(\frac{3K_i - 1}{2}\right)\left(S_v - p_o\right) \quad (3)$$

where ΔP_{crit} is the critical injection zone pressure build-up required to induce seismicity, with:

$$P_{crit} = p_o + \Delta P_{crit} \quad (4)$$

Equation (3) will be used to evaluate induced seismicity at Project Minerva.

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4.6.1 ***Water Wells and Data Sets***

Water well data was gathered from the online database of the Louisiana Department of Natural Resources (LADNR), specifically the online GIS website SONRIS (*https://www.sonris.com/)*. For the Texas portion of the search area, water well data was gathered from files maintained by the Texas Water Development Board (TWDB) (*https://www.twdb.texas.gov/)*. The data was combined into a digital GIS format to merge the two data sets.

A water well search was performed through SONRIS (Louisiana) and the TWDB (Texas). Primary water well locations present within the AoR (red boundary) of the Project Minerva site are shown on Figure 4.36. All water wells within the AoR are located within Louisiana. A total of 9 water wells in the determined Area of Review are tabulated in Table 4.3. These wells extend from depths of 90 feet to 400 feet into the 200-Foot sand in the Chicot Aquifer. No wells are in the deeper aquifers of the Evangeline or Jasper (Figure 4.37). Five of these water wells are plugged and abandoned wells that supplied water from rigs, 2 are current active supply for rigs, and 2 are currently used for domestic purposes. Additionally, to be conservative, a 5-mile buffer around the AoR (larger blue boundary) was searched for additional water data. These tabulated data are

contained in **A.4.2 Project Narrative Appendices (Hydrogeology Report)**. To the west of the AoR (in Texas), there are 119 water wells contained within the 5-mile buffer from the Project Minerva site. These wells range in depth from 10 feet to 990 feet, with the average well depth of 627 feet. Primary use is for domestic and industrial purpose. All water is withdrawn from the Chicot aquifer, with the 500-Foot sand as the main supply. No water is withdrawn from the deeper Evangeline aquifer for public use.

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4.6.2 Regional Hydrogeology

The regional aquifer system is called the Gulf Coast Aquifer system and stretches from Texas, across Louisiana, Mississippi, and Alabama, and includes the western most portion of Florida. Miocene and younger formations contain usable quality water (<3,000 milligrams per liter (mg/L) TDS) and potentially usable quality water (<10,000 mg/L TDS), which is defined as base of lowermost USDW within this system. These aquifer systems regionally crop out in bands parallel to the coast and consists of units that dip and thicken towards the southeast. Baker (1979) describes four major hydrogeologic units that comprise the Gulf Coast Aquifer System in the Texas and Louisiana region. In ascending order, the four units are (see Figure 4.37):

- Jasper aquifer
- Burkeville confining system
- Evangeline aquifer
- Chicot aquifer

The Burkeville confining system hydrologically separates the Evangeline aquifer from the underlying Jasper aquifer. However, the Chicot and Evangeline aquifers are thought to be hydrologically connected. The Chicot Aquifer System is the main regional aquifer system that provides the usable groundwater for southwestern Louisiana. The Chicot aquifer system is largely composed of one, major undifferentiated sand, that splits down dip. These Pleistocene-aged sands are predominately comprised of unconsolidated to loosely consolidated gravels and coarse graded sands.

A regional stratigraphic section (A-A') parallel to dip from Baker (1979) depicting the aquifers in the regional area of Southeast, Texas is contained in Figure 4.38.

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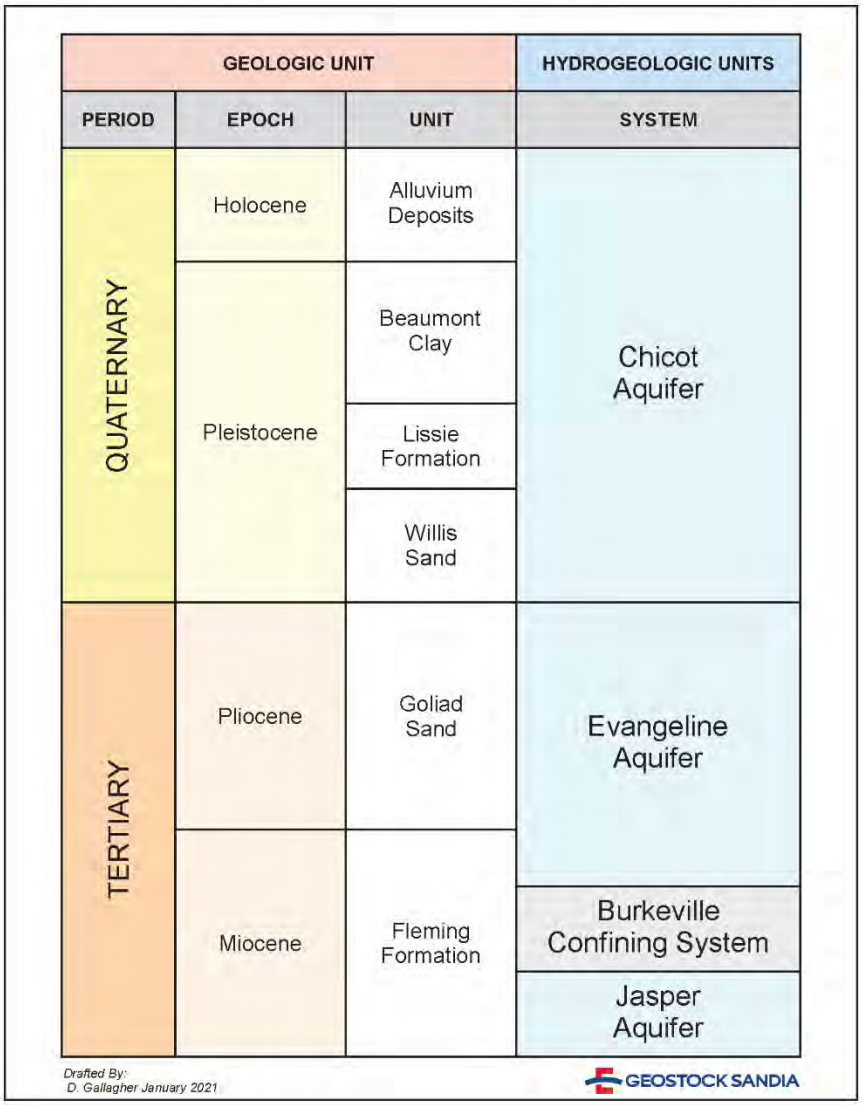

Figure 4.37 Regional hydrostratigraphic column for southeastern Texas and southwestern Louisiana.

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*4.6.3 **Regional Groundwater Flow***

Groundwater moves through aquifer systems from areas of high hydraulic head to areas of lower hydraulic head. Regional uses from industry and the public water systems have some impacts on diverting the direction of flow.

The Chicot regional flow is in the direction of development. Major development of groundwater occurs around the Lake Charles area. In Cameron Parish, due to aquifer development, the direction of groundwater flow is primarily north and northeast (Lovelace et al, 2004).

A map of the potentiometric surface for the Chicot aquifer (Figure 4.39) shows the direction of groundwater flow. Lovelace et al. (2004) indicated that the flow direction is towards major pumping areas such as Lake Charles in Calcasieu Parish and the northern part of Acadia Parish and south Evangeline Parish, where there is heavy pumping for industrial and irrigation uses. Control points and wells in the analysis are located on Table 4.3.9. The direction of flow of groundwater is downgradient at 90 degrees to the potentiometric contours at right angles. An additional issue from pumping and heavy groundwater usage is the upwards coning of saltwater that can occur as response to freshwater withdrawal. The result is higher salinity waters being pulled upwards as pumping increases in aquifers that are hydraulically connected. Along the coast in the southwestern and southern portion of Louisiana, saltwater is being gradually pulled inland (northwards) due to over pumping of groundwater aquifers for industry and agriculture, especially during the peak rice irrigation and aquaculture harvesting seasons. Two regional cross sections (Figure 4.40) extending across Calcasieu Parish show that the southern portion of the parish is impacted by saltwater encroachment in the Chicot aquifer (and by default the Evangeline) from the Gulf of Mexico. Increasing chloride concentrations between 1968 and 1984 indicated that a northwards or upward movement of the freshwater-saltwater interface in areas east and south of Lake Charles.

[redacted]

[redacted]

4.6.4 Local Hydrogeology

The Project Minerva site is located [redacted]. Hydrostratigraphic units of importance range in age from Miocene to recent-aged strata and include in ascending order: (1) Lagarto, (2) Goliad, (3) Willis, (4) Lissie (which is subdivided into the Montgomery and Bentley formations), (5) Beaumont Formation, and (6) Holocene/Recent sediments (Figure 4.37). Within this stratigraphic section are the two main aquifers of local interest, which are the Chicot aquifer and the Evangeline aquifer. The base of the lowermost USDW is located approximately at the base of the Chicot aquifer 700-Foot Sand or at the top portion of the Evangeline aquifer.

Within the local project area, the Evangeline aquifer predominantly contains saline ground water (greater than 10,000 mg/l TDS). Upper and lower boundaries to the Chicot include the Goliad Formation and the upper part of the Lagarto Formation, respectively. The Evangeline and Chicot aquifers are usually separated by confining clay, however, when this clay is absent, the geologic boundary between the two aquifers is indistinguishable. In general, the Evangeline aquifer tends to have greater sand to clay ratio with individual sand beds up to several tens of feet thick. Because the Evangeline aquifer is mostly saline within the Project Minerva area, it is not considered a USDW and is not used for groundwater in Calcasieu Parish.

The shallower Chicot aquifer contains upper and lower members separated by clay beds. The upper member of the Chicot aquifer consists of a basal sand overlain by clay and is actually part of both the Lissie Formation and the Beaumont Formation. Elevated chloride content prevents the lowermost member of the Chicot aquifer from being a source of potable water the southern portion of Calcasieu Parish. The Chicot Aquifer System is the main local aquifer system for the Project Minerva area and is the target of the majority of water wells within the AoR and 5 mile AoR buffer.

4.7 Detailed description of Geochemistry

A data collection program will be designed and implemented to fully characterize mineralogy in the Injection and Confining Zones. Based on regional analogues (eg. BEG pilot injection program) no compatibility issues are predicted.

Geochemical modelling was confined to the dissolution of CO_2 into the formation fluids.

The principal chemical reaction we wish to model in Reveal was the dissolution of CO_2 into the formation brine and its dissociation into H^+ and CO_3^{2-}.

CO_2 (supercritical phase) <-> CO_2 (aqueous phase)

CO_2 (aqueous phase) + H_2O <-> H_2CO_3 (aqueous phase)

H_2CO_3 <-> $2H^+ + CO_3^{2-}$ (a weak acid)

Only a small fraction of the dissolved CO_2 exists as the acid H_2CO_3, the equilibrium constant being equal to 1.3E-3 typically. The time scale to form H_2CO_3 is of the order of seconds. Other possible geochemical reactions are not considered in the current study.

To specify this reaction, we defined the following species in the Reveal/PHREEQC model:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

6.0 DESCRIPTION OF AOR AND CORRECTIVE ACTION PLAN

6.1 Description of the files submitted for the AOR and the Corrective Action plan

The fully completed AoR and Corrective Action Plan Report has been submitted via the GSDT in 'Confidential Business Information' form. All Tabs that require input data within the module have also been completed and submitted via the GSDT.

The report covers in detail the computational modelling approach to the delineation of the Area of Review (AoR), the Corrective Action Plan relating to existing well penetrations within the AoR and the Reevaluation Schedule for AoR delineation once operations commence. A thorough review of the hydrogeology was also supplied as an appendix to the main report, along with a comprehensive bibliography of references utilized during the AoR modelling execution and reporting phase.

The AoR and Corrective Action Plan Report satisfies rule requirements *40 CFR 146.82(a)(13), 146.84(b) and 146.84(c).*

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)]***

7.0 DESCRIPTION OF FINANCIAL RESPONSIBILITY

7.1 Description of the files submitted for the financial responsibility.

The Financial Responsibility submission is currently being prepared and will be filed via the GSDT when it is complete.

The Financial Responsibility submission will satisfy rule requirements *40 CFR 146.82(a)(14) and 146.85).*

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]***

[redacted]

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[redacted]

[redacted]

9.0 DESCRIPTION OF PRE-OPERATIONAL LOGGING AND TESTING PLAN

9.1 Description of the documents that are submitted to the GSDT

The Pre-Operational Logging and Testing Plan submission is currently being prepared and will be filled be filed via the GSDT when it is complete.

The Pre-Operational Logging and Testing Plan submission satisfies rule requirements. *40 CFR 146.82(a)(8) and 146.87*

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]***

10.0 DESCRIPTION OF WELL OPERATION PLAN

The Well Operation Plan submission will be submitted when the CO_2 streams have been identified for the nameplate capacity of Project Minerva.

10.1 Operational Procedures

The Operational Procedures [40 CFR 146.82(a)(10)] submission is currently being prepared and an update to this report will be filed via the GSDT when it is complete.

10.2 Description of the proposed Carbon Dioxide Stream

The Description of the proposed Carbon Dioxide Stream [40 CFR 146.82(a)(7)(iii) and (iv)] submission is currently being prepared and will be filed via the GSDT when it is complete.

11.0 DESCRIPTION OF TESTING AND MONITORING PLAN

11.1 Description of the documents that are submitted to the GSDT

The Testing and Monitoring Plan Report has been submitted via the GSDT in 'Confidential Business Information' form. All tabs that require input data within the module have also been completed and submitted via the GSDT. A 'Confidential Business Information' version has been submitted to Region VI of EPA as well.

The report covers in detail the overall strategy and approach for testing and monitoring, carbon dioxide stream analysis, continuous recording of operational parameters, corrosion monitoring, above confining zone monitoring, external mechanical integrity testing, pressure fall off testing, carbon dioxide plume and pressure front tracking, environmental monitoring at the surface, sampling/analytical procedures. A Class IV well Quality Assurance and Surveillance Plan (QASP) was submitted as an appendix along with additional information relation to project management, data generation and acquisition, assessment and oversight and data validation and usability.

The Testing and Monitoring Plan Report satisfies rule requirements 40 CFR 146.82(a)(15) and 146.90.

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]***

12.0 DESCRIPTION OF INJECTION AND WELL PLUGGING PLAN

12.1 Description of the documents that are submitted to the GSDT

The Injection and Well Plugging Plan has been submitted via the GSDT in 'Confidential Business Information' form. All Tabs that require input data within the module have also been completed and submitted via the GSDT. A 'Confidential Business Information' version has been submitted to Region VI of EPA as well.

The report covers in detail the planned tests and measurements to determine the bottom hole reservoir pressure, Planned External Mechanical Integrity Test, Information on Plugs, methods used for volume calculations, notifications, permits and inspections required, plugging procedures and contingency procedures/measures.

The Injection and Well Plugging Plan satisfies rule requirements 40 CFR 146.82(a)(16) and 146.92(b).

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)]***

13.0 DESCRIPTION OF POST-INJECTION SITE CARE AND SITE CLOSURE PLAN

13.1 Description of the documents that are submitted to the GSDT

The Post Injection Site Care and Site Closure Plan (PISC) Plan has been submitted via the GSDT in 'Confidential Business Information' form. All Tabs that require input data within the module have also been completed and submitted via the GSDT. A 'Confidential Business Information' version has been submitted to Region VI of EPA as well.

The report covers in detail the pre and post injection pressure differential, post-injection monitoring plan, alternative post-injection site care timeframe, non-endangerment demonstration criteria, site closure plan and QASP.

An Alternative PISC timeframe has been proposed as part of the GSDT submission. GCS has indicated an alternative PISC timeframe of 10 years instead of the default 50 years.

The Post Injection Site Care and Site Closure Plan satisfies rule requirements 40 CFR 146.82(a)(17) and 146.93(a) and the Alternative PISC submission satisfies rule requirements 40 CFR 146.82(a)(18) and 146.93(c).

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)]***

14.0 DESCRIPTION OF EMERGENCY AND REMEDIAL RESPONSE PLAN

14.1 Description of the documents that are submitted to the GSDT

The Emergency and Remedial Response Plan has been submitted via the GSDT in 'Confidential Business Information' form. All Tabs that require input data within the module have also been completed and submitted via the GSDT. A 'Confidential Business Information' version has been submitted to Region VI of EPA as well.

The report covers in detail the local resources and infrastructure, potential risk scenarios, response personnel and equipment, emergency communications plan, a plan review and staff training and exercise procedures.

The Emergency and Remedial Response Plan Report satisfies rule requirements 40 CFR 146.82(a)(19) and 146.94(a).

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)]***

15.0 INJECTION DEPTH WAIVER AND ACQUIFER EXEPMTION EXPANSION

Not applicable as GCS is not seeking a waiver or exemption.

16.0 DESCRIPTION OF ANY ADDITIONAL INFORMATION REQUESED

16.1 Description of the documents that has been requested by the UIC Program Director

No documents have been requested by the UIC Program Director.

[redacted]

[redacted]

[redacted]

Class VI UIC Project Information Tracking

This submission is for:

Project ID: R06-LA-0002

Project Name: Project Minerva

Current Project Phase: Pre-Injection Prior to Construction

General Information

Number of proposed Class VI wells: 4

Brief description of the project: Project Minerva comprises of 4 injection wells

Facility and Owner/ Operator Information

Facility name: Minerva

Facility mailing address: 2417 Shell Beach Drive, Lake Charles, Louisiana 70601

Facility location: Latitude: -999 Longitude: -999

Up to four Standard Industrial Classification (SIC) codes for the products/services provided by the facility: CO2 sequestration

Facility located on Indian lands: No

Facility contact information

Contact person: Benajmin Heard

Contact's business phone number: 713 - 320 - 2497

Contact's business email: bheard@gcscarbon.com

Operator's name: Gulf Coast Sequestration

Operator's business address: 2417 Shell Beach Drive, Lake Charles, Louisiana 70601

Operator's business phone number: 713 - 320 - 2497

Operator's status: Private

Ownership status: Owner

Initial Permit Application

Permit Application Narrative: https://epa.velo.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0002/Phase1-PreConstruction/ProjInfo-03-26-2021-2120/A.4.1--Class--VI--Permit--Application--Narrative--GSDT.pdf

Proposed project plans, submitted with the Project Plan Submission module:

Other Required Information: https://epa.velo.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0002/Phase1-PreConstruction/ProjInfo-03-26-2021-2120/A.4.2--Class--VI--Permit--Application--Narrative--Appendices--GSDT.zip

Updated Information

Complete Submission

Authorized submission made by: Benjamin Heard

For confirmation a read-only copy of your submission will be emailed to: randrews@gcscarbon.com