1.0 PROJECT NARRATIVE
40 CFR 146.81

CLECO DIAMOND VAULT PROJECT

Facility Information

Facility name: DIAMOND VAULT

Facility contact: [redacted]

Well name: CLDV-IW3

Well location: RAPIDES PARISH, LOUISIANA
[redacted] [redacted]

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List of Abbreviations

Abbreviation	Description
°	Degree
µm	Micrometer
13CR	Corrosion-resistant chrome
2D	Two-dimensional
3D	Three-dimensional
ACZ	Above confining zone
AoR	Area of Review
ASTM	American Society for Testing and Materials
Bbl	Barrel
BOP	Blowout preventor
BOPE	Blow out prevention equipment
C	Celsius
CBL-VDL	Cement bond log – variable density log
CCS	Carbon capture and storage
CFR	Code of Federal Regulations
CO_2	Carbon dioxide
DAS	Distributed Acoustic Sensing
DOE	Department of Energy
DOT	Department of Transportation
DRM	
DTS	Distributed Temperature Sensing
EOD	Environment of deposition
EPA	Environmental Protection Agency
ERRP	Emergency and Remedial Response Plan
F	Fahrenheit
FEMA AE	Federal Emergency Management Agency Adverse Effects
FMEA	Failure, Mode, Effect, Analysis
ft	Feet
FO	Fiber optic
gal	Gallon
GC	Gas chromatograph
H_2S	Hydrogen sulfide
ID	Identification
KCl	Potassium chloride
L	Liter
lb	Pound
LCM	Lost circulation material
LDNR	Louisiana Department of Natural Resources
LGS	Louisiana Geological Survey

m	Meter
MD	Measured depth
mD	Millidarcy
mg	Milligram
MI	Move-in
mi	Mile
MIT	Mechanical integrity test
mL	Milliliter
MMSCF	Million standard cubic feet
ms	Millisecond
MMt	Million tonnes
MVA	Monitoring, Verification, and Accounting
NACE	National Association of Corrosion Engineers
NaCl	Sodium chloride
NELAP	National Environmental Laboratory Accreditation Program
NGVD	National Geodetic Vertical Datum of 1929
NPT	National pipe thread
ORP	Oxidation-reduction potential
P&A	Plug and abandonment
PFO	Pressure fall-off
PGA	Peak ground acceleration
PISC	Post-injection site closure
PM	Project Manager
PNC	Pulsed neutron capture
POZ	Pozzolan
ppg	Pounds per gallon
ppm	Parts per million
psi	Pounds per square inch
psig	Pounds per square inch gauge
QA	Quality assurance
QC	Quality control
QASP	Quality Assurance and Surveillance Plan
QR	Quality Representative
RPD	Relative percent difference
RPN	Risk Priority Number
RU	Rig up
SCADA	Supervisory Control and Data Acquisition
SEM	Static Earth Model
SF	Safety factor
SME	Subject matter expert
SOP	Standard operating procedures
SP	Spontaneous potential
SPCC	Spill Prevention, Control, and Countermeasure
SPF	Shots per foot
STW	Stratigraphic Test Well
TD	Total depth

TDS	Total dissolved solids
TVDss	true vertical depth sub-sea
UIC	Underground Injection Control
USDW	Underground source of drinking water
USGS	United States Geological Survey
VSP	Vertical Seismic Profile

1.0 Project Narrative

1.1 Project Background and Contact Information

Cleco Power, LLC's primary goal of the Cleco Diamond Vault Project is to capture and sequester carbon dioxide (CO_2) near Boyce, Rapides Parish, Louisiana. The project is planned as a multi injection well facility with six injection wells being proposed. Three well pads will each host two injection wells targeting different injection formations: the Wilcox 1 and the Wilcox 2. Each well will be drilled from a land-based location and have an S-shaped trajectory, returning vertically above the confining layer with injection zones under Lake Rodemacher.

In compliance with Environmental Protection Agency (EPA) Underground Injection Control (UIC) Class VI regulations, each injection well will be permitted separately.

This document (and associated sections) forms the Class VI application for injection well CLDR-IW3.

An overview of the project site is presented in Figure 1-1 which shows the location of the six proposed injection wells relative to Lake Rodemacher and local infrastructure. The Area of Review (AoR) for the project is also shown. This AoR encompasses the combined pressure front at the end of injection from all injection wells.

Figure 1-2 shows the eastern well pad with CLDV-IW3 (the subject injection well of this permit application), highlighted.

The data used in the preparation of this permit application are based on extensive regionally available sources. It is anticipated that this information will be updated with data acquired from a stratigraphic test well (STW). The STW will be centrally located within the AoR and will be drilled to reduce uncertainty in the characterization of the geomechanical and hydrogeological subsurface at the project site. Extensive wireline logging, coring, fluid sampling, and formation hydrogeologic testing will be performed. These data will be incorporated into the static earth model and dynamic models (Permit Section 2) from which the AoR is derived.

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Figure 1-1: Cleco Diamond Vault Project showing proposed location of six injection wells, AoR and local infrastructure.

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Figure 1-2: Map view of eastern well pad showing location of CLDV-IW3.

1.1.1 Project Goals

In this project, Cleco Power, LLC plans to:

- Construct a capture and compression system at the Cleco Diamond Vault facility
- Build the infrastructure needed to transport CO_2 to the injection site
- Drill six injection wells and required monitoring wells to inject and monitor CO_2, respectively
- Monitor the subsurface for any potential impacts to the deepest underground source of drinking water (USDW)
- Upon completion of the injection phase of the project, verify stability of the CO_2 plume and decline of storage formation pressure to pre-injection levels, verify plume predictions made by the computational modelling, demonstrate non-endangerment of USDWs, and safely plug all injection wells and decommission associated infrastructure.

1.1.2 Partners/Collaborators

Key partners and collaborators on this project are listed in Table 1-1.

Name	Role
Cleco Power, LLC	Owner
Cleco Power, LLC	Storage Operator
Cleco Power, LLC	CO_2 Capture Operator

Table 1-1: Key project partners and collaborators.

1.1.3 Overview of the Project Timeframe

The overall timeframe of the project, including well drilling, CO_2 injection, monitoring, and closure, is anticipated to be approximately 24 years (Table 1-2). This includes:

- 1 year for permit approval
- Construction during the second year
- 12 years of CO_2 injection and monitoring
- [redacted]

	Elapsed years																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Class VI approval																								
Construct																								
Injection																								
Closure																								
Post-closure monitoring																								

Table 1-2: Project Gantt Chart

1.1.4 Proposed Injection Mass/Volume and CO_2 Source

The average annual injection rate for each of the six injection wells is shown in Table 1-3. Sensitive, C [redacted]

Prior to injection, the chemical and physical characteristics of the injectant will be confirmed using appropriate analytical methods.

Injection well name	Target injection formation	Annual CO_2 injection volume (MTPA, metric tons per annum)
CLDV-IW1	Wilcox 2	Sensitive, Confidential, or Privileged Information [redacted]
CLDV-IW2	Wilcox 1	
CLDV-IW3	Wilcox 2	
CLDV-IW4	Wilcox 1	
CLDV-IW5	Wilcox 2	
CLDV-IW6	Wilcox 1	

Table 1-3: Anticipated annual CO_2 injection volumes for all injection wells at Cleco Diamond Vault Project

1.1.5 Injection Depth Waiver or Aquifer Exemption Requested

No injection depth waiver or aquifer expansion is being sought as part of this permit application.

1.1.6 Other Administrative Information

Table 1-4 provides the administrative information for this Class VI injection well permit application as required by 40 CFR 144.31(e)(1 through 6).

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Table 1-4: General Class VI CO_2 injection well permit application information.

1.1.7 Site Classification

The Diamond Vault facility is located at Cleco's Brame Energy Center. The primary business at this location is the generation of electricity for distribution to the public. The Division of Corporate Finance code associated with this service is SIC 4911. This code is located under Office of Energy & Transportation and categorized with the Industrial Title of Electric Services.

1.2 Site Characterization

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

The Cleco Diamond Vault facility is located northwest of the town of Boyce in Rapides Parish, Louisiana. The facility sits within the Western Gulf Coastal Plain in central Louisiana on the northern flank of the Gulf Coast Basin and at the southern end of the Mississippi Embayment (Figure 1-3). This region has favorable geology for carbon storage in porous and permeable deep saline formations interstratified with low porosity and low permeability caprocks. In the Gulf of

Mexico Basin and throughout the Gulf Coast, deposition of Jurassic to Holocene-age sedimentary rocks began due to the breakup of Pangea and associated crustal extension and expansion of the seafloor during the Mesozoic (Roberts-Ashby et al., 2014). Over 15,000 ft of sediments in the study area thicken and gently dip from north to south towards the Gulf of Mexico. The deep saline storage reservoirs and caprocks at and near the Cleco site are comprised of Cenozoic-age sandstone and shale.

The site is bordered by the Sabine Uplift, North Louisiana Salt Basin, and La Salle Arch to the north and the South Louisiana Salt Basin to the south (Figure 1-3). Other structural elements include salt domes in the salt basin regions north and south of the site and the Angelina Caldwell Flexure, which extends from central Texas into Louisiana (Dennen and Hackley, 2012). The study area is located on the stable shelf north of the Wilcox expanded fault zone, where growth faults are present due to the deposition of large volumes of sediment on an unstable shelf margin. No regional faults are mapped in the immediate Cleco site location.

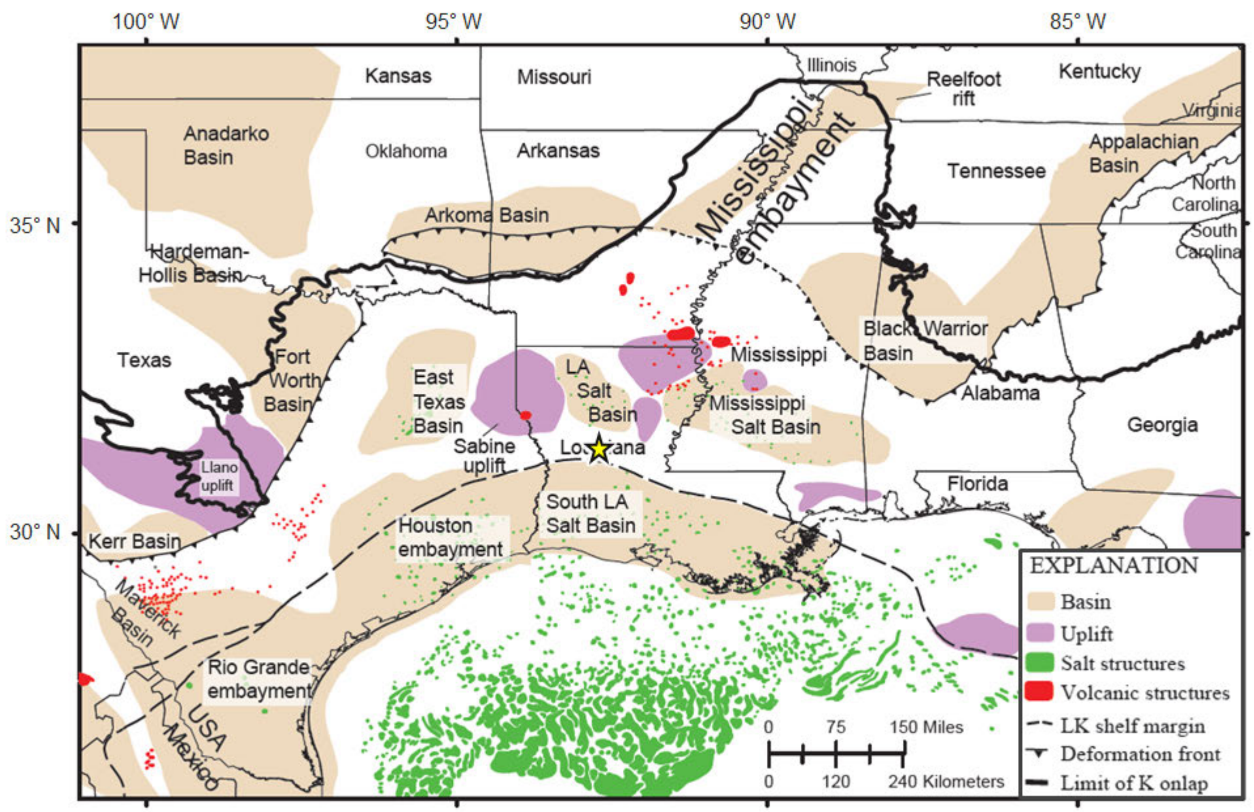

Figure 1-3: Map of northern Gulf Coast Basin structural features including basins, uplifts, and other structural features. The Cleco Diamond Vault site is denoted by the yellow star in central Louisiana. Abbreviations: K, Cretaceous; LK, Lower Cretaceous; LA, Louisiana. Modified from Warwick (2017).

The region has favorable geology for carbon storage in the clastic rocks of the Paleocene- to Eocene-age Wilcox Group and the Carrizo Sandstone. The primary storage reservoir identified at the Cleco Diamond Vault facility is the Wilcox Group, which is a 3,500-foot-thick sequence of clastic rocks with dominate lithologies of sandstone and shale (Carlson and Van Biersel, 2009; Warwick, 2017). Storage capacity within the Wilcox Group is found within the pore space of coarse-grained, quartz-rich sediments (Dutton et al., 2015). Regionally, the Wilcox Group is often divided into two units, which are separated at the base of a regionally extensive shale in the upper zone, the Big Shale (Galloway, 1968; Tye, 1991). In this project, the upper Wilcox unit is referred to as the Wilcox 1, and the lower Wilcox unit is referred to as the Wilcox 2.

The primary caprock is the regional and laterally extensive Cane River Shale, which sits atop the Carrizo Sandstone and below the Sparta Sandstone. This shale is clay-rich and composed of small clay particles that are tightly packed preventing supercritical CO_2 flow vertically into shallower formations. The Midway Group, the lower confining unit, underlies the Wilcox Group and is expected to be at a depth of approximately 7,500 ft below surface at the Cleco Diamond Vault site. The stratigraphic column in Figure 1-4 shows the study area's stratigraphic succession, highlighting the primary storage reservoir (Wilcox 2) and the confining unit (Cane River). The depth to the top of the Wilcox 2 at the Cleco Diamond Vault site is approximately 5,600 ft below surface, which meets the depth criteria required to sustain a supercritical phase of the injected CO_2 at the site.

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Figure 1-4: Stratigraphic column with lithology and hydrostratigraphy for the Cleco Diamond Vault site. Estimated depths are based on structural model surfaces at the location of the CLDV-IW3 well.

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

At the Cleco Diamond Vault site location and surrounding area, there is no evidence of subsurface faults or structural features that would impact the integrity of the confining zones. Thus, there is low containment risk for interference of injected CO_2 with the shallower USDWs. The deepest USDW at the Cleco Diamond Vault facility is the Oligocene-age Catahoula Formation, which is found at an estimated depth of 660 ft in the CLDV-IW3 well. The top of the Cane River confining zone is 3,713 ft below surface, which is 2,627 ft below the base of the Catahoula Formation in the CLDV-IW3 well. The exact spatial relationship between the lowermost USDW and the injection and confining zones will be confirmed during the drilling of

STW. Additionally, the Cook Mountain Formation, the Jackson Group, and the Vicksburg Group serve as secondary confining zones between the primary confining zone and the lowermost USDW. The depths of these secondary confining zones in the CLDV-IW3 well are labeled on the stratigraphic column in Figure 1-4.

The formations found in the subsurface of the Cleco Diamond Vault facility are locally correlative and laterally extensive across the region. This was evaluated and confirmed through regional reports, cross sections and maps, and well and seismic data correlations throughout the immediate site location and surrounding area. Regional structure and thickness maps for these units and further detail about data types used can be found in Section 1.2.4 Major geologic units and their stratigraphic relationships are depicted in the regional cross section shown in Figure 1-5, where the Cleco Diamond Vault site location is denoted with a yellow star.

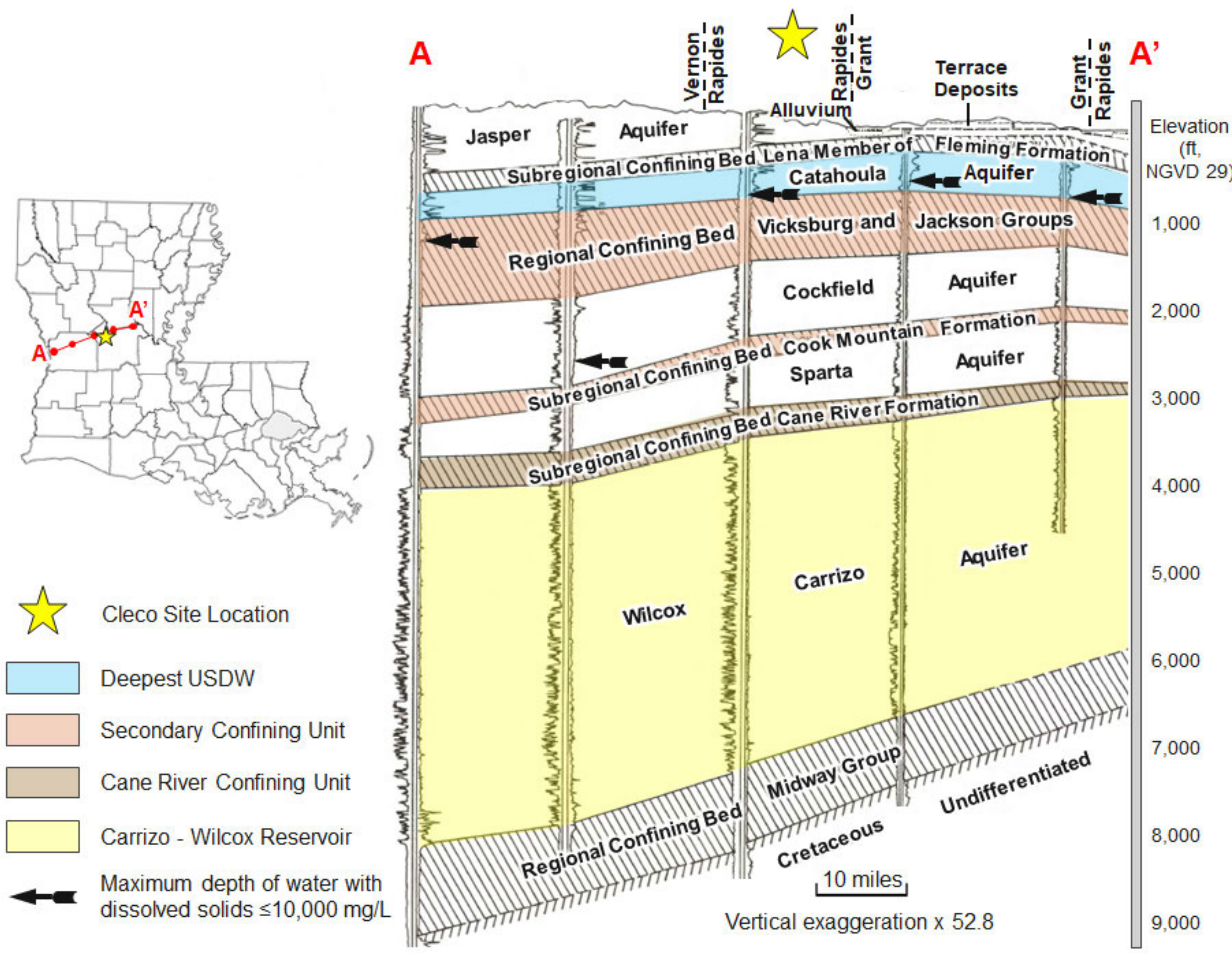

Figure 1-5: Geologic cross section from west to east Louisiana featuring the structural configuration of subsurface strata that contains the target injection zone and caprock, as well as the deepest USDW. Modified from Whiteman and Martin, 1984.

A map of the AoR, existing wells within the AoR, and proposed injection wells is shown above in Figure 1-1. The Cleco Diamond Vault facility has a total of 23 shallow groundwater monitoring wells on site. These wells are part of an established groundwater monitoring system around the various ash and metal ponds in the facility. These wells vary in depth from 50 to 300 ft and are used to test for various parameters such as pH, conductivity, chloride, sulfate, arsenic, among others in shallow groundwater aquifers such as the Carnahan Bayou Aquifer. Additionally, an air monitoring program is in place at the Cleco Diamond Vault site.

1.2.3 Faults and Fractures [40 CFR 146.82(a)(3)(ii)]

Large faults and their associated fractures have predominantly been identified in the northwestern and southern areas of Louisiana (Stevenson and McCulloh, 2001) in the North Louisiana Fault Zone and the Wilcox Fault Zone, respectively. However, the stable shelf region of central Louisiana is not known to be a heavily faulted area, and no major faults have been identified near the site location in Rapides Parish (Figure 1-6). Additionally, regional evaluations confirm the absence of salt domes in the site area, which are typically associated with faults and fractures. Therefore, no faults or fractures are expected to impact the integrity of the confining zone and the containment of injected CO_2 at the site location. This was further evaluated with multiple two-dimensional (2D) seismic lines. Three 2D seismic lines were licensed to conduct a preliminary assessment of the presence or absence of large-scale faults near the Cleco facility. This assessment found no evidence of significant faulting in the study area. This will be evaluated in more detail and confirmed by collecting image logs and whole core samples from the STW. An example of one of the licensed 2D seismic lines (80-378-185) is shown in Figure 1-7.

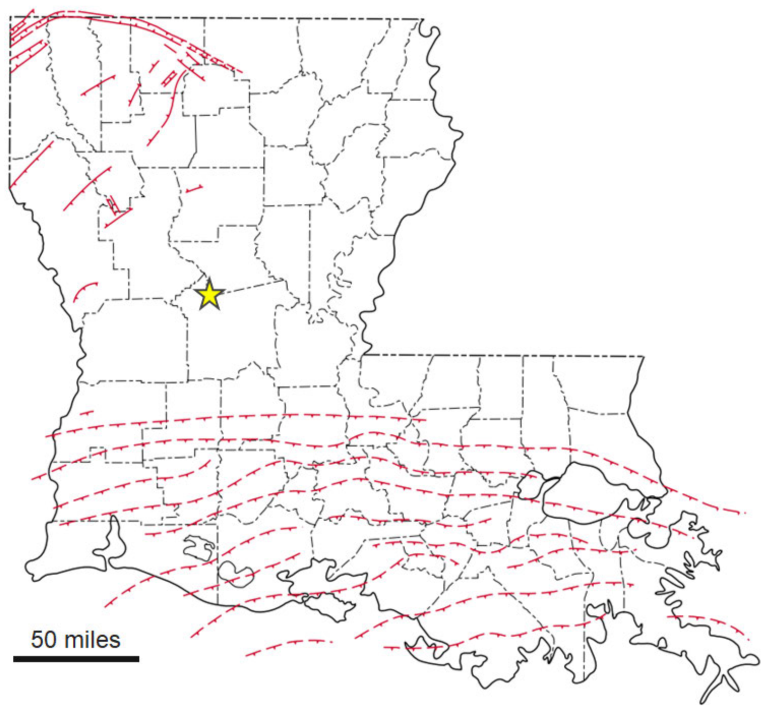

Figure 1-6: Map of major faults in Louisiana. The Cleco Diamond Vault site is denoted by the yellow star. Modified from Stevenson and McCulloh (2001).

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Figure 1-7: Example of licensed 2D seismic line (80-378-185) acquired through the study area.

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

Confining Zone: Cane River Shale

The primary caprock is the regional and laterally extensive Cane River Shale, which sits atop the Wilcox Group and Carrizo Sandstone and below the Sparta Sandstone. In the site location, the top of the Cane River is found at depths of -3063to -3550 ft true vertical depth sub-sea (TVDss), and the gross thickness ranges between 325 and 355 ft. Depth and thickness across the AoR were determined by picking formation tops from digital well log data proximal to the site. These were gridded using a convergent interpolation algorithm from Schlumberger's Petrel® and contoured in TVDss and all surface maps were quality control checked using the 2D seismic lines. Maps of the top structural surface and the thickness of the Cane River are presented in Figure 1-8.

Injection Interval: Wilcox Sandstone

For this project, the regionally extensive Wilcox Group was divided into an upper Wilcox 1 and lower Wilcox 2 based on the presence of a regional shale called the Big Shale (Galloway, 1968; Tye, 1991). In the AoR, the top of the Wilcox 2 injection zone is found at depths between 5,602 and 7,733 ft below surface, and the gross thickness ranges between 2037 and 2257 ft. Maps of the top structural surface and the thickness of the Wilcox 2 are presented in Figure 1-9. At these depths, pressure and temperature conditions are high enough to sustain a supercritical phase of the injected CO_2 at the site. The modest variation in thickness demonstrates no evidence of local formation pinch our or faulting that would affect CO_2 storage.

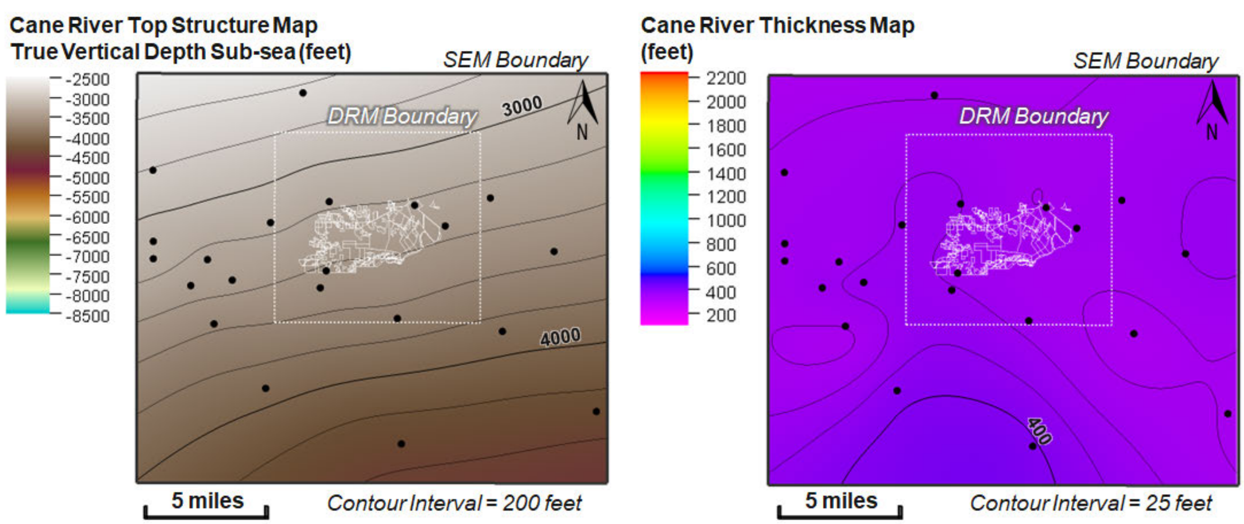


Figure 1-8: Structural map showing measured depth from the surface to the top of the Cane River (left) and Cane River formation thickness map (right) at the Cleco Diamond Vault site. Contour intervals are 200 ft and 20 ft, respectively. The black box indicates the Static Earth Model area, and the white dashed line indicates the Dynamic Reservoir Model boundary. The white outline indicates Cleco land boundaries.

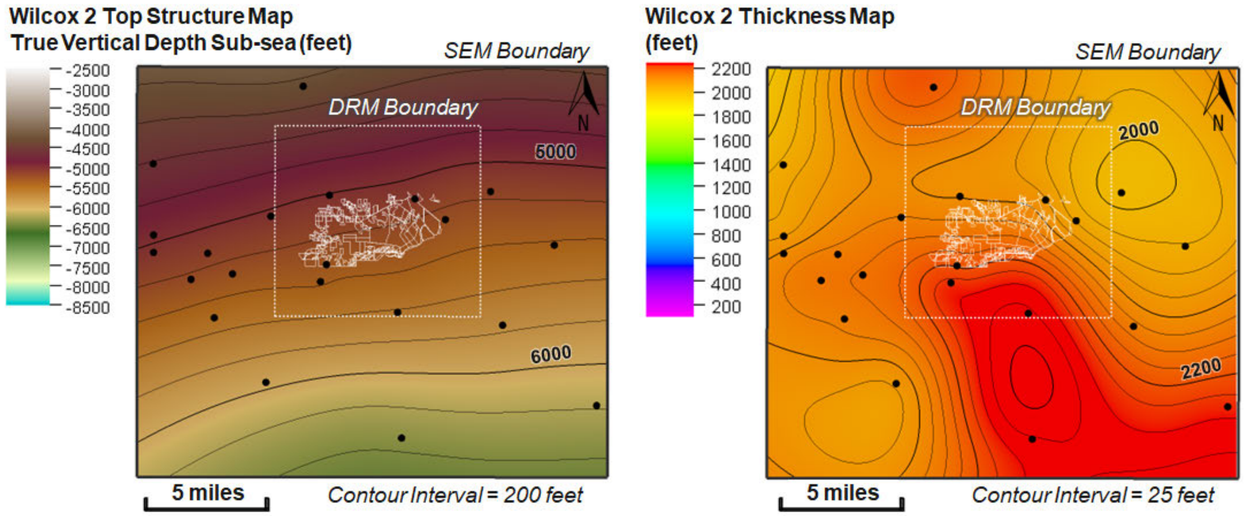


Figure 1-9: Structural map showing measured depth from the surface to the top of the Wilcox 2 (left) and Wilcox 2 formation thickness map (right) at the Cleco Diamond Vault site. Contour intervals are 200 ft and 20 ft, respectively. The black box indicates the Static Earth Model area, and the white dashed line indicates the Dynamic Reservoir Model boundary. The white outlines indicate Cleco land boundaries.

Much of the subsurface data analyzed in this study are derived from regional wells with modern wireline log data, as well as historical log data from wells proximal to the site. Twenty-five wells from across the region were acquired that provided: 1) multiple log types of interest, 2) adequate spatial and depth coverage, 3) core analysis data, and 4) checkshot or velocity survey data. Eight wells were not used to inform model properties due to poor log data quality, although they were able to be used to develop structural surfaces. Of the remaining logs, 17 supplied regional and local measurements of in-situ physical rock properties, such as porosity, at depths that captured the entirety of the target reservoir and caprock formations. One well with routine core analysis data provided two data points in the Carrizo/nine data points in the Wilcox 1/three data points in the Wilcox 2. The wireline log and core data are consistent with observations pertaining to depth, thickness, lateral extent, and lithology from the three 2-D seismic lines shown in Figure 1-10 and discussed further in Section 1.2.3. These datasets enabled the project to interpret crucial subsurface information regarding the lithology and quality of the reservoir and caprock and calculate rock properties.

Current interpretations of the injection and confining zones at the Cleco Diamond Vault site will be confirmed by routine and advanced datasets acquired from the stratigraphic test well as detailed in the Pre-operational Testing Plan. Site-specific geologic core and special core analysis will confirm porosity and permeability, mineralogy, capillary pressure, and relative permeability as specified by EPA (2012) [40 CFR 146.82(a)(3)(iii)]. Additionally, geomechanical data in the storage zone will confirm the maximum injection pressure, rock strength, and in-situ fluid pressure as specified by EPA (2012) [40 CFR 146.82(a)(3)(iv)].

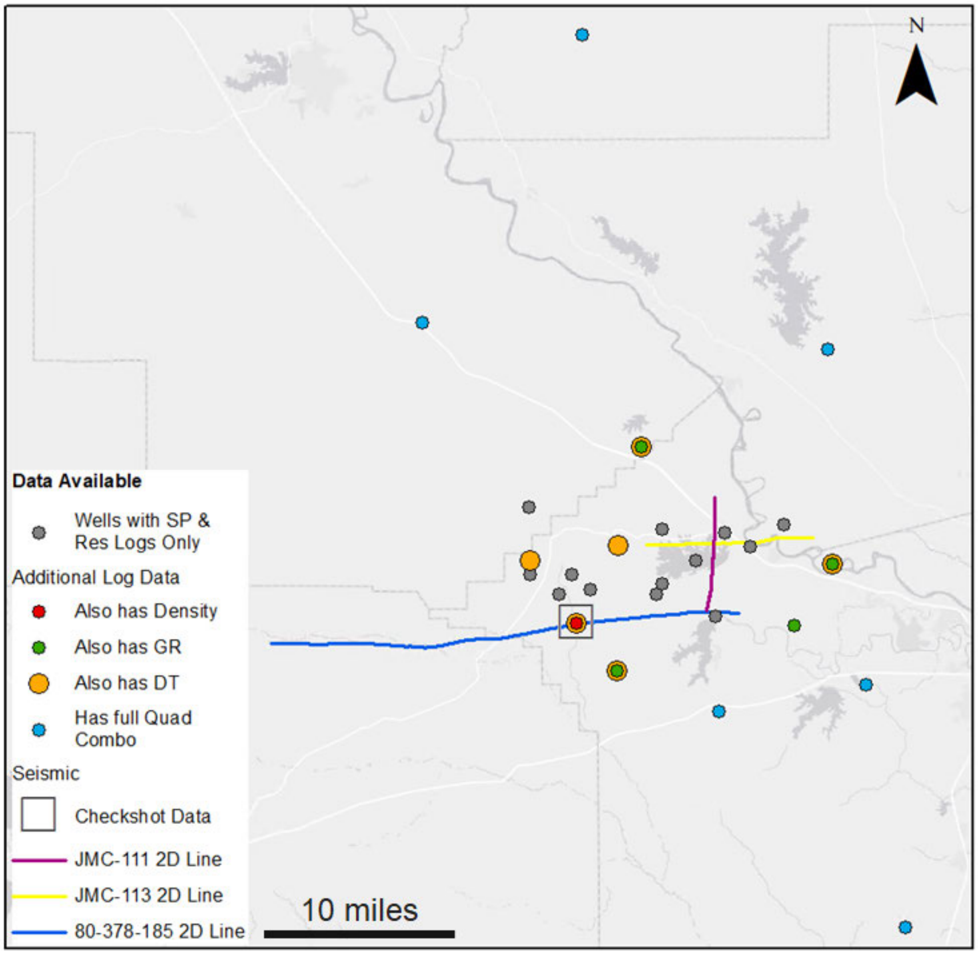


Figure 1-10: Map of the wells selected for log data analysis and location of purchased 2D seismic lines. The well highlighted in red was used to create a well-tie to tie the seismic time data to depth for integration into the model.

Sediments of the upper Cane River consist of brown clay, and the lower Cane River is composed of glauconite and glauconitic marl. At the basal contact of the Cane River and Carrizo, brown quartzose sand with minor glauconite is present. Minor constituents include carbonaceous minerals in the upper Cane River and fine quartz sand grains (Choung, 1975). An in-depth mineralogical assessment of the Cane River is necessary to evaluate the potential effects of injected CO_2 on its competence as caprock. Data and rock samples collected from the stratigraphic test well will be used to confirm that the mineral composition of the Cane River is conducive to confining CO_2.

The Wilcox Group is a heterogeneous formation composed of very fine- to coarse-grained sandstone with frequent shale interbeds (Dutton et al., 2015). The sandstones that compose the Wilcox Group are abundant in feldspars and lithics and are predominately characterized as felspathic litharenites or lithic arkoses (Loucks and Dutton, 2019). Figure 1-11 displays a ternary diagram of the composition of Wilcox Group samples collected from Louisiana and Texas.

Quartz is the most common mineral found in the rocks of the Wilcox Group, with calcite and ankerite being the next most prevalent, and numerous other minerals identified in minor volumes (Loucks and Dutton, 2019). Cementation (primarily quartz cementation) makes up 10 to 35% of the rock volume of the Wilcox Group. As with the Carrizo Sandstone, the prevalence of quartz cement in the Wilcox Group has positive implication for CO_2 injection, as quartz cemented rocks are naturally resistant to the potentially corrosive effects of long-term exposure to injected CO_2. Table 1-5 summarizes the mineralogical make-up of the Wilcox Group.

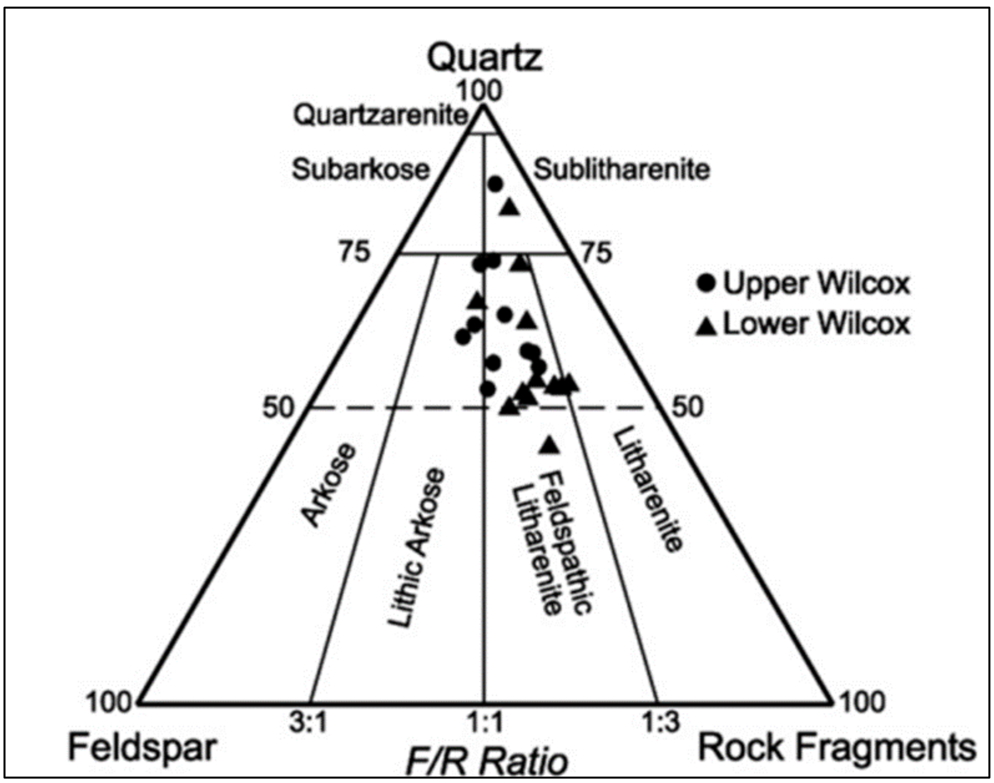


Figure 1-11: Ternary diagram displaying the compositional make up of rock samples collected from the Wilcox Group in Texas and Louisiana (Loucks and Dutton, 2019).

Wilcox Group Mineralogy	
Major Minerals	Quartz
	Calcite
	Ankerite
Minor Minerals	Albite
	Chlorite
	Dolomite
	Glauconite
	Illite
	Illite-Smectite mix
	Kaolinite
	Leucoxene
	Pyrite
	Siderite
	Sphene

Table 1-5: Mineralogical composition of rock samples collected from the Wilcox Group in Texas and Louisiana (Loucks and Dutton, 2019).

Based on the Department of Energy (DOE)-National Energy Technology Laboratory (NETL) methods for static volumetric calculations (Levine et. al, 2016), the estimated storage capacity for the Wilcox 2 within the AoR is approximately 10.3 MMt of CO_2 per mi2. Inputs for thickness and porosity were determined by calculating the average net thickness and effective porosity values across the AoR for the Wilcox 2 (1265 ft and 11%, respectively). Then, the input for the density of CO_2 was calculated using the same temperature and pressure gradients as the reservoir model, which were applied to the midpoint depth for the Wilcox 2 in the center of the AoR (approximately 6400 ft below ground surface). The initial water saturation from relative permeability was used, and storage efficiency factors were applied. The same workflow applied to the Wilcox 1 results in a storage capacity estimation of approximately 5.5 MMt of CO_2 per mi2. The Cane River has a low average porosity and permeability of 3.48% and 0.012 mD, respectively. The tight, impermeable nature and the lack of faults and fractures in this formation indicate that it will serve as an adequate confining zone.

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

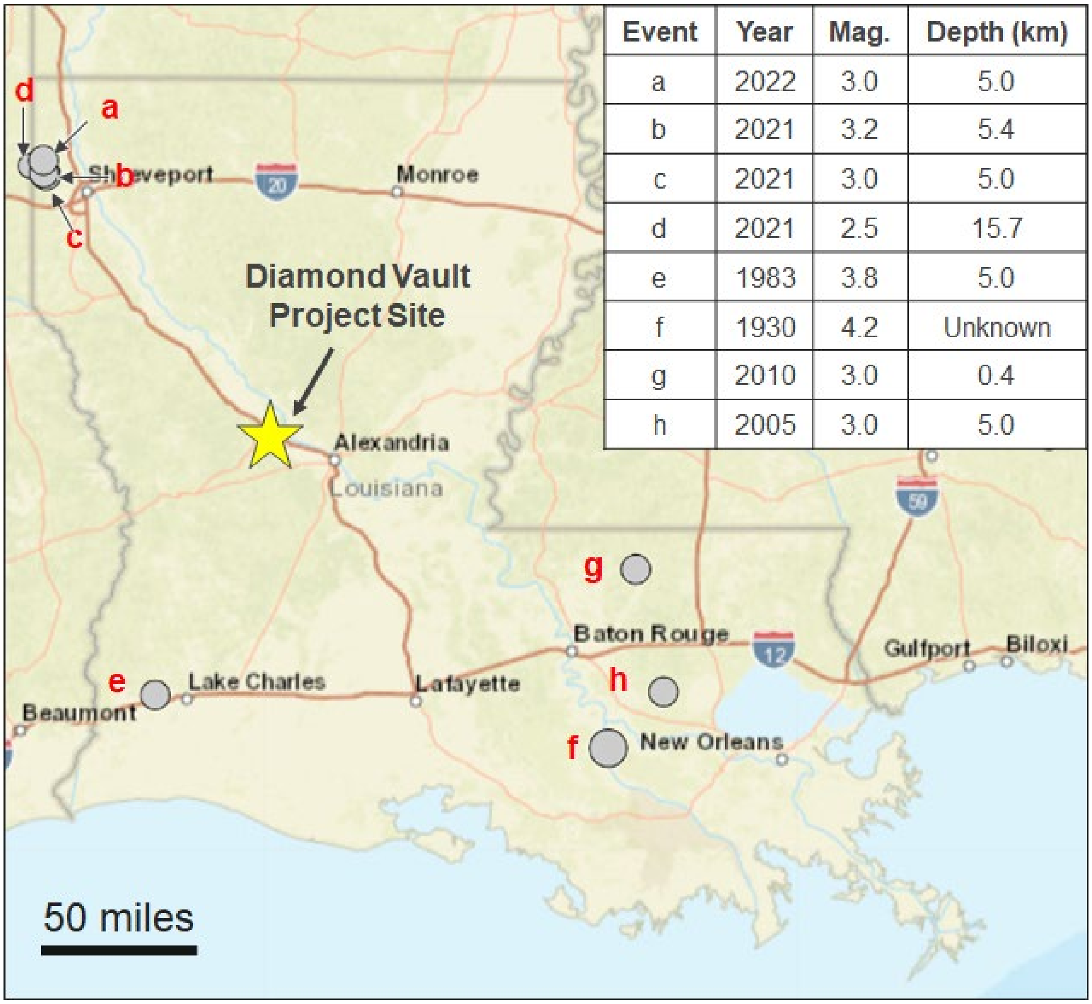
Petrophysical analysis was conducted to integrate available log data in the study area, generate the porosity log curves used to populate the static earth model (SEM), and determine the storage reservoir properties. The logs compiled as part of the data collection effort, detailed in Section 1.2.4, were first edited, and normalized as part of the quality control procedure to eliminate erroneous data points, correct for varying signal intensities, and establish consistent readings between wells. A lithologic log representing the fraction of clay with depth, Vclay, was generated and integrated with core data and routine porosity logs to calculate refined porosity curves, and subsequently, permeability curves. The permeability log was further refined by rock type after modeling hydraulic facies, or zones of rock that have comparable properties controlling fluid flow.

Additional geomechanical and petrophysical properties will be evaluated and confirmed through well tests, wireline logs, and laboratory analyses of core samples from the STW. Geomechanical properties of the target and confining zone will be confirmed from minifrac test analysis and dipole sonic logs. The geomechanical integrity of the confining zone is confirmed if its fracture pressure exceeds the target zone's. Data will be collected in the STW using wireline logging tools such as the dipole sonic to determine elastic rock properties such as Young's modulus, stresses and Poisson's ratio which will be used as an accuracy check for the minifrac data in case of any operational issues during testing.

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

The seismic history for the area was characterized using publicly available data from the United States Geological Survey (USGS) and the Louisiana Geological Survey (LGS). Louisiana is largely a seismically inactive state in which earthquakes have historically occurred with low frequency and magnitude. Extensive faulting is present in the northwestern and southern areas of Louisiana. However, these faults are primarily growth faults associated with sediment loading and are not seismically active. No recorded earthquakes in Louisiana have been definitively attributed to any of the mapped fault systems in the state (Stevenson and McCulloh, 2001). Eight earthquakes have been recorded in Louisiana in the last 100 years (1923–2023); only two were greater than 3.5 M, and none occurred within 80 miles of the project site (Figure 1-12). Of these earthquakes, all have occurred at depths of 5 km or greater, apart from one that occurred at a shallower depth of 0.4 km. Additionally, one occurred in 1930 in which the depth is unknown (USGS, 2023).

The absence of recorded earthquakes near the Cleco Diamond Vault project site is consistent with the regional seismic hazard map published by the USGS (2014), which designates central Louisiana as a low-risk area for seismic activity. There is a 2% probability that the level of horizontal shaking, or peak ground acceleration (PGA), due to seismic activity will exceed 4 to 8% of the acceleration due to gravity within 50 years (Figure 1-13).



Event	Year	Mag.	Depth (km)
a	2022	3.0	5.0
b	2021	3.2	5.4
c	2021	3.0	5.0
d	2021	2.5	15.7
e	1983	3.8	5.0
f	1930	4.2	Unknown
g	2010	3.0	0.4
h	2005	3.0	5.0

Figure 1-12: Earthquakes in Louisiana greater than or equal to 2.5 magnitude since 1900 (modified from USGS, 2023).

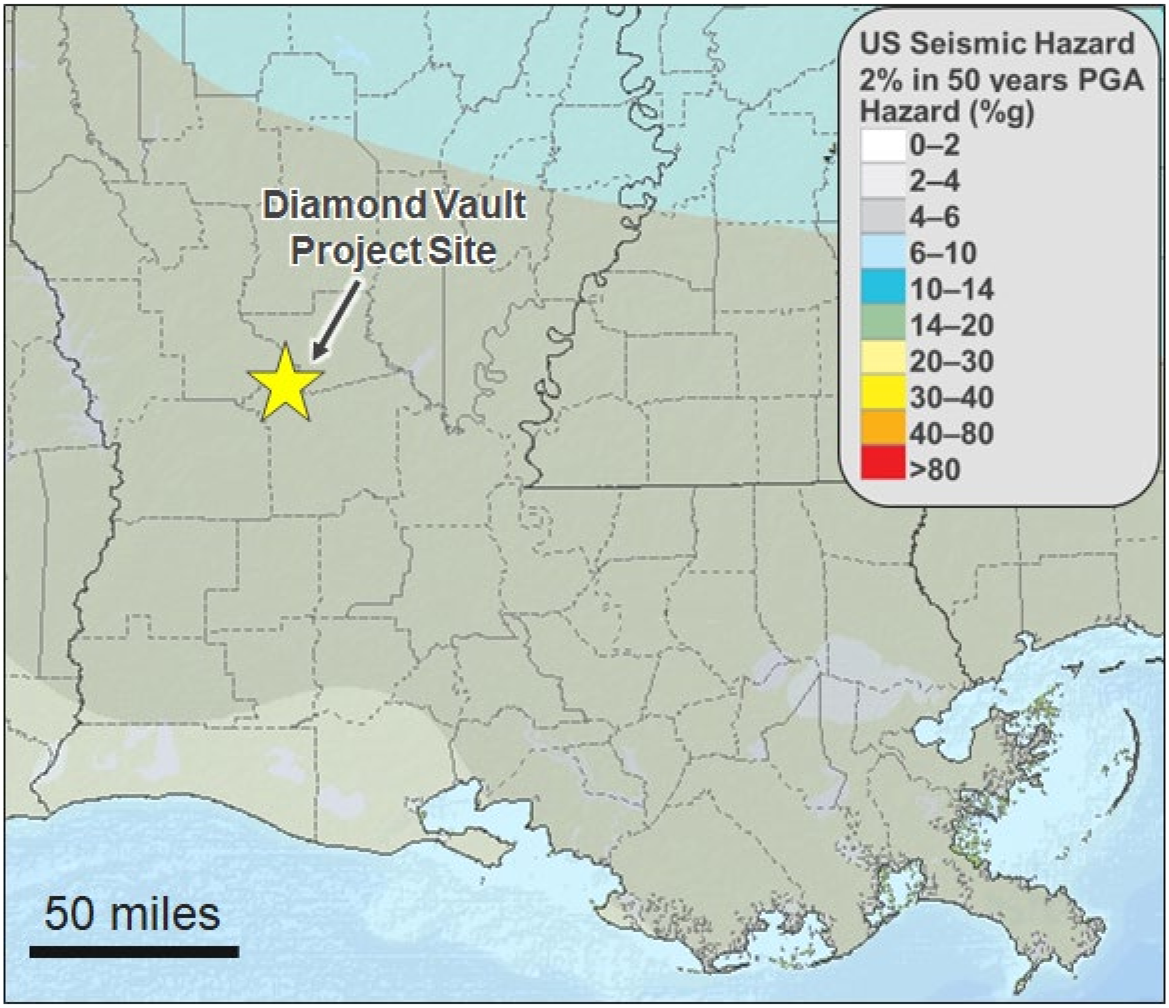


Figure 1-13: 2014 regional seismic hazard map for Louisiana (USGS, 2014).

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

To further understand the subsurface underlying the Cleco Diamond Vault site, an assessment of the local hydraulic and hydrogeologic conditions was completed. This included a review of the hydrostratigraphy, groundwater flow direction, and salinity of shallow and deep aquifers in Rapides Parish, Louisiana. This assessment benefited from the work of Tomaszewski (2009), which reviewed the hydrogeology, including water quality, of Rapides Parish. This work used a cutoff of 250 mg/L chloride concentration to determine the freshwater-saltwater interface (as opposed to 10,000 mg/L total dissolved solids [TDS] cutoff for the lowest USDW interface), as shown in the subsequent maps.

Table 1-6 and Figure1-14 display the shallow subsurface hydrostratigraphy of Rapides Parish, Louisiana. Regionally, there are seven aquifers containing freshwater (USDWs) in Rapides Parish, as well as three confining units that separate them into four groups (Tomaszewski, 2009).

Each of these aquifers occur in rocks composed of clastic sediments of varying sizes (clay, silt, sand, gravel) with the sand/sandstone beds of the formations being most amenable to freshwater production. The confining layers separating the aquifer systems are composed primarily of clay and silt, rendering them impermeable (Tomaszewski, 2009).

The spatial distribution of these seven aquifers varies throughout the Parish. Locally, there are five aquifers present in the subsurface beneath the Cleco project site: the Red River Alluvial, the Chicot Aquifer System, the Upland Terrace Aquifer, the Carnahan Bayou Aquifer, and the Catahoula Aquifer (Figures 1-15, 1-16, and 1-17). The Red River Alluvial aquifer is a predominately freshwater aquifer that extends roughly through the middle of Rapides Parish in a northwest to southeast direction. Its depth varies across Rapides Parish, ranging in elevation from 0 to 80 ft above the National Geodetic Vertical Datum of 1929 (NGVD), and it is at or near its shallowest points near the Cleco Diamond Vault site. Groundwater movement in the Red River Alluvial aquifer varies locally, however in general the waters that comprise the aquifer generally flow in an eastward direction. The Chicot and Upland Terrace aquifers merge in southwestern Rapides Parish and are treated as one large freshwater aquifer. Groundwater flow in the Chicot and Upland Terrace Aquifers is complex and flows in multiple directions throughout the Parish, generally in the direction of a nearby surface water stream. Considerable variation exists in altitude of the Chicot and Upland Terrance aquifers, as it varies in elevation from 80 ft above to 40 ft below NGVD and is about 40 ft above NGVD near the Cleco Diamond Vault site. The Carnahan Bayou Aquifer is the most extensive of the six regional aquifers, encompassing all of Rapides Parish. Water quality varies considerably in the Carnahan Bayou Aquifer, with most of the aquifer being comprised of saltwater or mixed saltwater and freshwater. Despite this, a significant portion of the Carnahan Bayou aquifer contains freshwater, notably in northern Rapides Parish. The surface of the Carnahan Bayou aquifer ranges in elevation from roughly 100 ft above NGVD to 200 ft below NGVD and is locally approximately 0 ft above NGVD near the Cleco site. Groundwater flow in the Carnahan Bayou aquifer is related to groundwater withdrawal and usage and trends towards the cities of Alexandria and Pineville and the Kisatchie well field.

System	Series	Formation		Lithology	Hydrogeologic Unit	
Quaternary	Pleistocene	Red River alluvial deposits		Clay, silty clay, sand, gravel	Red River Alluvial Aquifer	
		Northern Louisiana terrace deposits		Clay, silty clay, sand, gravel	Upland Terrace Aquifer	
		Unnamed Pleistocene deposit		Sand, gravel	Chicot Aquifer System	
Tertiary	Pliocene	Fleming Formation	Blounts Creek Member	Sand, silt, clay interbeds	Evangeline Aquifer	
			Castor Creek Member	Silt, clay	Castor Creek confining unit	
	Miocene		Williamson Creek Member	Sand, clay interbeds	Jasper Aquifer System	Williamson Creek Aquifer
			Dough Hills Member	Silt, clay		Dough Hills confining unit
			Carnahan Bayou Member	Sand, clay interbeds		Carnahan Bayou Aquifer
			Lena Member	Silt, clay	Lena confining unit	
		Catahoula Formation		Sandstone	Catahoula Aquifer	

Table 1-6: Shallow water aquifer stratigraphy of Rapides Parish, LA. Blue shading indicates a freshwater aquifer, mixed blue and red shading indicates a mixed saltwater and freshwater aquifer, gray shading indicates a confining unit, and the red shading indicates a saline aquifer (modified from Tomaszewski, 2009).

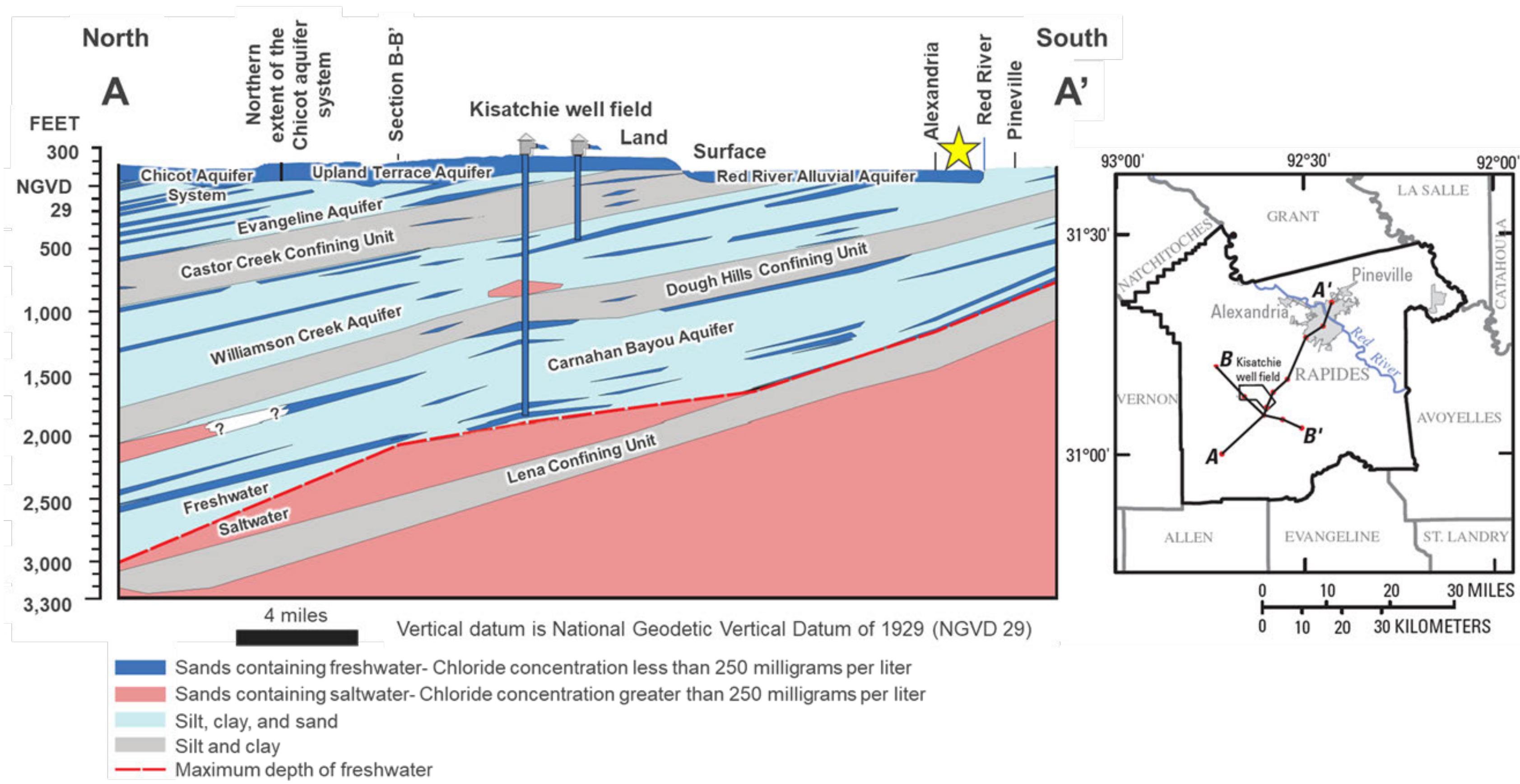


Figure 1-14: Hydrogeologic stratigraphic cross section of Rapides Parish, LA
(modified from Tomaszewski, 2009)

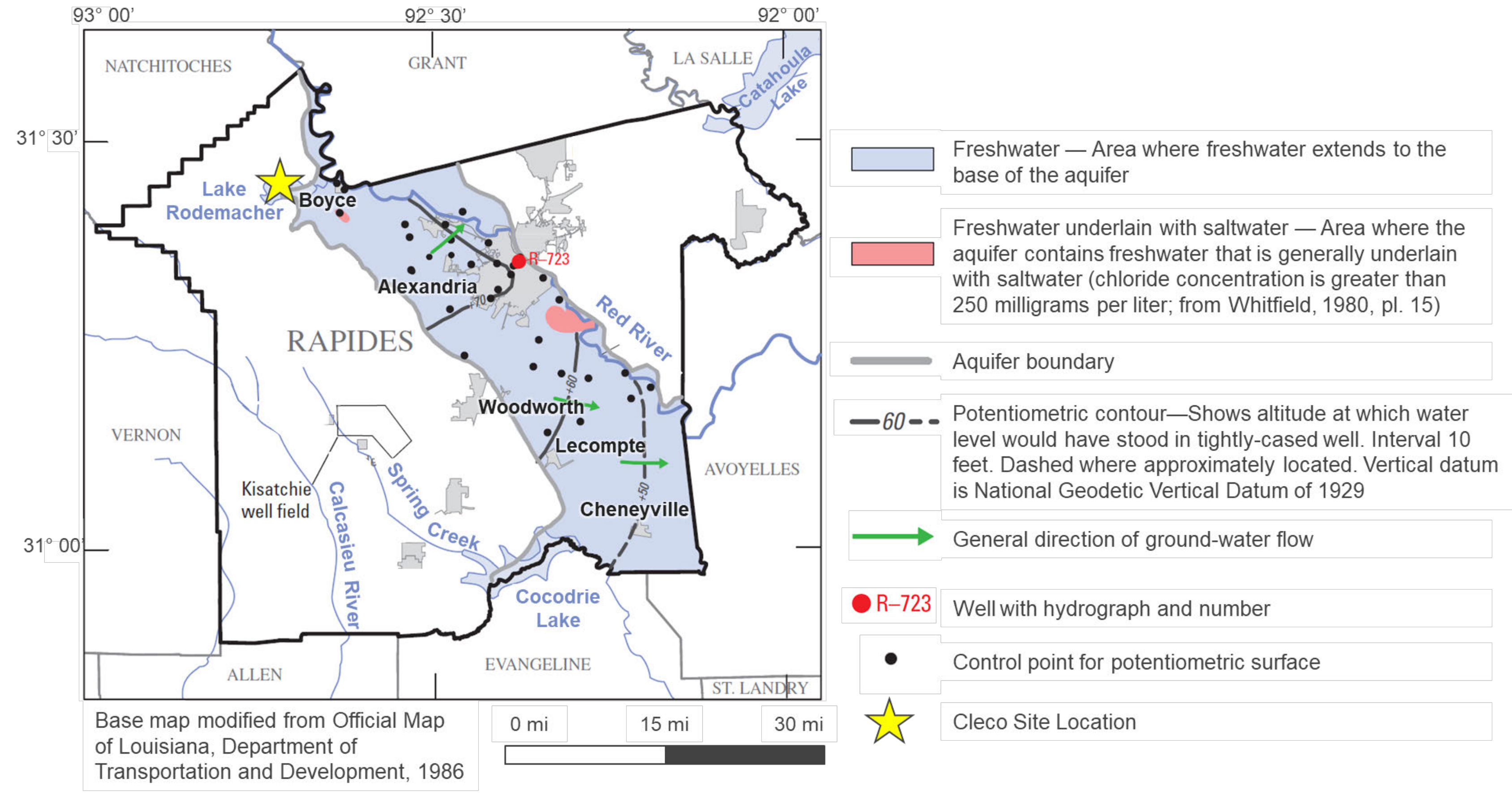


Figure 1-15: Map displaying the spatial extent and general direction of groundwater flow of the Red River Alluvial Aquifer in Rapides, Parish LA (modified from Tomaszewski, 2009).

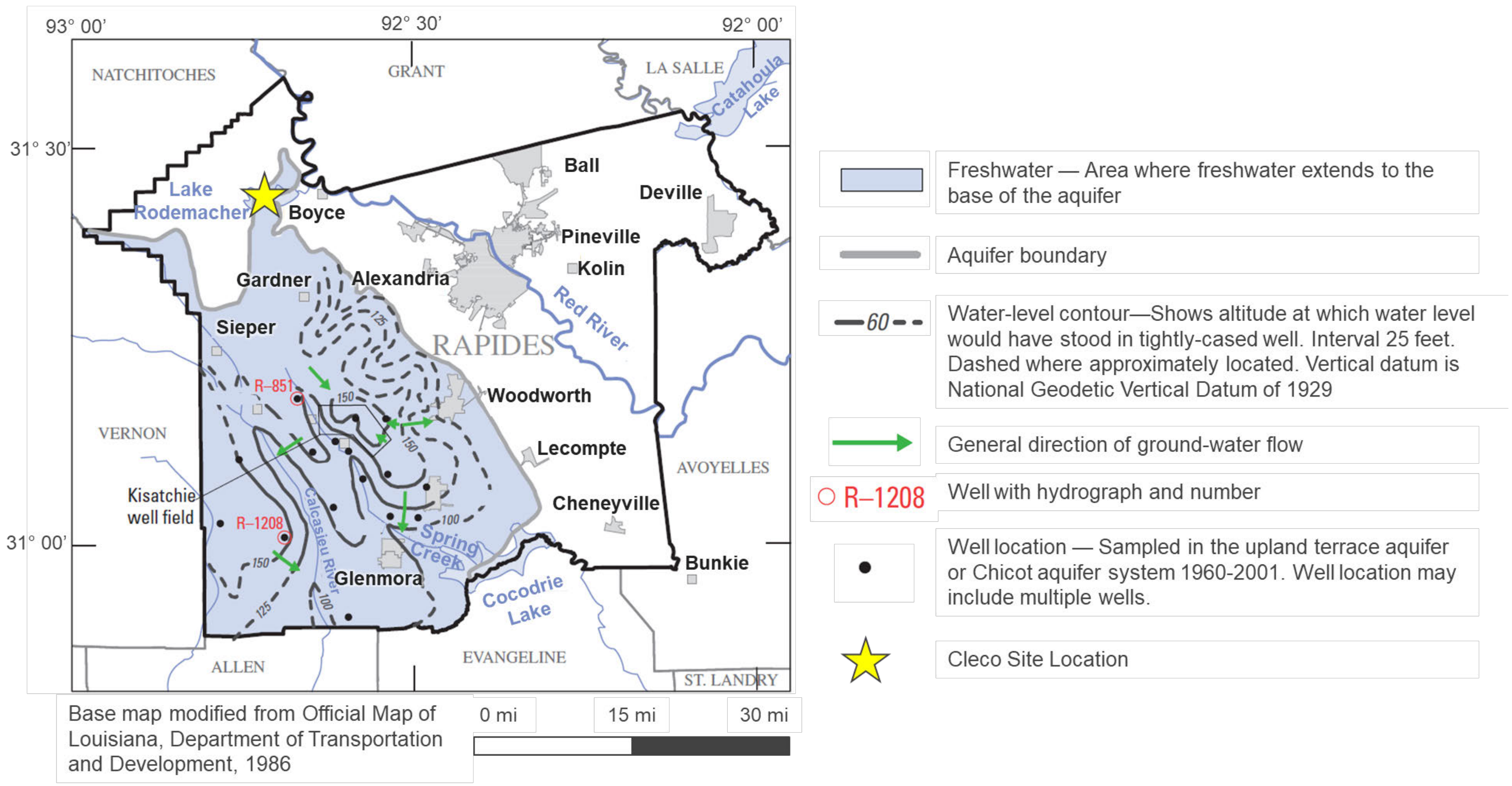


Figure 1-16: Map displaying the spatial extent and general direction of groundwater flow of the Chicot Aquifer in Rapides, Parish LA (modified from Tomaszewski, 2009).

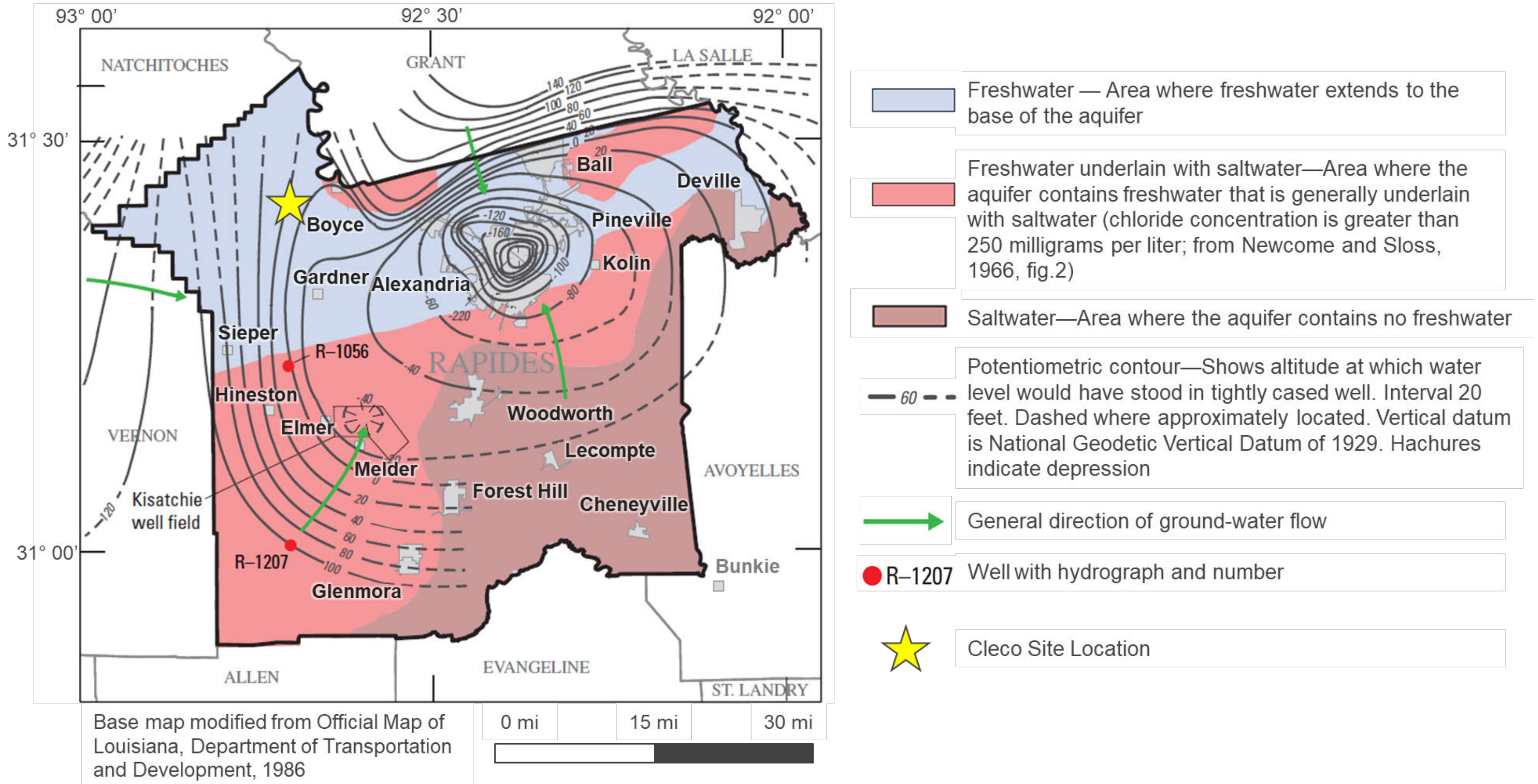


Figure 1-17: Map displaying the spatial extent and general direction of groundwater flow of the Carnahan Bayou Aquifer in Rapides, Parish LA (modified from Tomaszewski, 2009).

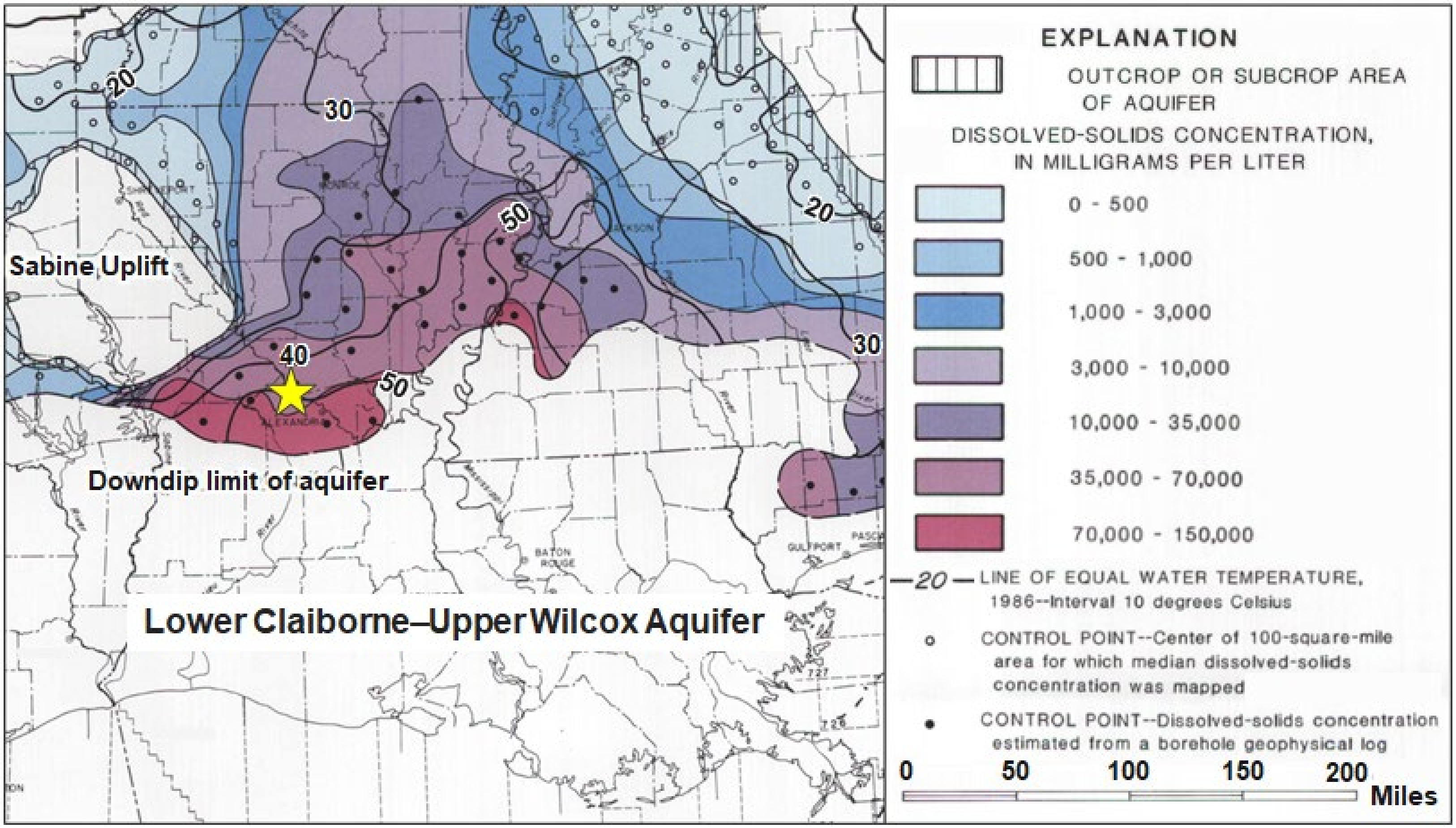


Figure 1-18: Total dissolved solids (salinity) concentration map for the Carrizo Sandstone and Wilcox Group in Louisiana (modified from Pettijohn et. al, 1988). Colors indicate TDS concentrations. The Cleco study area, highlighted by the yellow star, has TDS concentrations of approximately 70,000 mg/L for the Carrizo and Wilcox.

In addition to reviewing shallow subsurface freshwater aquifers in Rapides Parish, it was also necessary to review the salinity levels of the potential saline reservoir injection targets. Saline reservoirs in Louisiana were researched by Pettijohn et al. (1988) in their work focusing on the aquifers and hydrogeology of the Tertiary System in the Gulf of Mexico Coastal Plain. This work included the creation of a map detailing the salinity of the reservoirs within the Wilcox and Claiborne Groups. This map indicates the salinity of these units becomes increasingly saline towards the southern portions of Louisiana, as well as with increasing depth, with the Carrizo and Wilcox mapped as having TDS values of approximately 70,000 parts per million (ppm) (Figure 1-18). Additional to this map, salinity calculations were derived from well logs in the immediate vicinity of the Cleco property to confirm TDS values found in literature (Figure 1-19). These maps, along with well log calculated salinity, support that water in the target storage formations is sufficiently saline in the study area to permit CO_2 storage projects.

Local log data shows a range of salinities, which is likely due to the vintage of the resistivity logs (Figure 1-19) and thus likely a measurement error. However, all wells show salinities significantly greater than 10,000 ppm for each injection zone, which is the regulatory lower limit. Calculated salinity values are consistent with regional literature (Carlson and Van Biersel, 2009; Pettijohn et al, 1988). These apparent water resistivity (Rwa)-derived salinity values should be considered a minimum salinity. Local mapping of greater than 70,000 ppm is highly likely for each zone.

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Figure 1-19: Calculated log salinity of the Wilcox 2 in the area in thousands of ppm, colored by unique well.

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

Regional geochemical data provide insights into the reservoir water salinity (TDS) of the Carrizo Formation, Wilcox Group, and multiple overlying USDWs at the project site. However, site specific geochemistry data are not currently available due to a lack of subsurface water samples. The acquisition of these data will be completed during the installation of an onsite STW. Water samples will be collected for aqueous and solid-phase geochemical data through analysis of major cations and anions, trace metals, and general geochemical properties (i.e., pH, TDS, alkalinity, etc.). These analyses will be used to determine:

- The deepest USDW at the project site
- Baseline geochemical data for the project site that can be used to evaluate the migration of CO_2 and brine waters at the site
- Current geochemical equilibrium conditions to evaluate the saturation relationship between the dissolved and solid-phase minerals at the site
- Geochemical reactions that may occur from the injection of CO_2

The analysis of onsite geochemical properties in the subsurface reservoirs above and within the injection zones will confirm the intervals identified for CO_2 storage meet the criteria outlined for Class VI permit approval.

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

No surface air and/or soil gas data were collected at the Cleco site location.

1.2.10 Site Suitability [40 CFR 146.83]

An extensive set of subsurface data have been analyzed at the Cleco Diamond Vault site to support the evaluation of site suitability. The integration of well logs, 2D seismic, and regional maps and cross sections confirm the lateral extent of the target reservoir and confining zone, as well as the absence of faulting and structural features at the site location and surrounding area that would impact the integrity of the confining zone. Therefore, the containment risk is low, and no secondary confinement zone is necessary for USDW protection. Additional well and rock data collected from a site characterization well will provide further geomechanical data to support the integrity of the confining zone.

The Cleco Diamond Vault site location is also suitable for CO_2 sequestration due to its favorable target reservoir lithologies. The Wilcox 1 and 2 are composed of sandstones with interbedded shales. The sandstones have a predominantly felspathic and lithic mineralogy and are categorized as felspathic litharenites or lithic arkoses (Loucks and Dutton, 2019). The most common mineral in the sandstones of the Wilcox 1 and 2 is quartz followed by calcite and ankerite, as well as numerous accessory minerals present in minor volumes (Loucks and Dutton, 2019). Additionally, quartz cementation makes up 10 to 35% of the rock volume of the Wilcox 1 and 2. The prevalence of quartz cement has positive implications for CO_2 injection because quartz-cemented rocks are naturally resistant to the potentially corrosive effects of long-term exposure to injected CO_2. Furthermore, although neither the CO_2 stream nor formation waters are expected to be highly corrosive, the injection well materials that come in contact with the CO_2 stream and/or reservoir brines will be constructed of corrosion-resistant materials, such as 13CR steel, or similar. For example, the casing string across the Wilcox 1 and 2, the packer, and deep portion of the tubing with be constructed with corrosion-resistant materials.

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The target reservoirs for injection (Wilcox 1 and 2) are fluvial deltaic in origin. Their resulting geometries are influenced by the orientation of the main sediment source during deposition, which ultimately influences the direction of plume migration for the injected CO_2. The main sediment source during Wilcox deposition was the Holly Springs Delta. This had a north-northeast orientation and later migrated eastward. The geometries were integrated into the SEM to provide depositionally-informed anisotropy, which resulted in north and north-east trending channel bodies. This orientation and geometry, as well as a subtle southern depositional dip, will influence the resulting plume shape and migration during injection (Figure 1-20).

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Figure 1-20: Environment of deposition property for each injection zone showing fluvial-dominated environments in the Wilcox 1, and Wilcox 2. View is of the top layer of each zone.

1.3 Permit Section 2.0: AoR and Corrective Action

The AoR and Corrective Action Plan are submitted to meet the requirements of Plan 40 CFR 146.82(a)(13), 146.84(b) and 40 CFR 146.84(c).

The plan describes the computational modeling approach and results. The objective of the computational modeling is to track the CO_2 plume size and shape, area of pressure buildup, and determine an AoR for CO_2 injection at the Cleco Diamond Vault project site. The SEM is a three-dimensional (3D) geocellular model that represents the porosity and permeability of different stratigraphic formations, most notably, the intended CO_2 storage formation and overlying confining layer. This type of model was selected as it offers the best options for quantifying, representing, and visualizing the subsurface geologic interpretations for the site. The purpose of this model is to represent available pore volume and enable the estimation of CO_2 storage capacity. Primarily, this geologic model serves as the framework (in terms of delineating zones, surfaces, permeability, and porosity) for computational modeling of CO_2 injection.

The computational modeling to simulate CO_2 injection into the saline aquifer was performed using a 3D multiphase flow simulator CMG-GEM 2016 version (CMG-GEM, 2016). In addition to the geological framework imported from the SEM, additional parameters, such as relative permeability data, initial conditions, phase behavior model, and well and perforation parameters, were added to the computational model to complete the dynamic modeling. CMG-GEM is an equation-of-state based compositional simulator that models the phase behavior of brine and CO_2 plumes during the injection and post-injection phases of a project. Multiple phases were accounted for in the computational model including aqueous, gas, and supercritical phases.

Modeling multiphase flow processes in porous media, with all components as described above, enables:

- Estimation of pressure buildup in the storage formation – confining layer system
- CO_2 phase behavior at storage reservoir condition
- CO_2 saturation to determine plume extent in the storage formation (Wilcox 2 Sandstone)
- Ensure confining layer sealing capabilities

The estimated CO_2 saturation map and pressure buildup from modeling multiphase flow processes will predict CO_2 movement during the injection and post injection periods and delineate the AoR.

1.4 Permit Section 3.0: Financial Responsibility

The Financial Responsibility Plan is submitted to meet the requirements of 40 CFR 146.82(a)(14) and 146.85.

1.5 Permit Section 4.0: Injection Well Construction

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

No completion stimulation is planned at this time because the reservoir quality is expected to be adequate for the planned injection volumes. While there are no plans for reservoir stimulation, it may be required to enhance the injectivity of the injection zone. The goal of stimulation is to increase the connectivity between the reservoir and the wellbore and allow for the injectate to be more readily injected into the reservoir. This can be accomplished through several technologies (chemical, electro-hydraulic, propellants) and the best course of action will be determined once the reservoir issues have been diagnosed.

A stimulation plan will be submitted to the UIC Program Director at least 30 days prior to the proposed stimulation (40 CFR 146.91 (d)(2). The stimulation plan will include the technology to be utilized and the procedure for executing the stimulation. The plan would demonstrate that the technology will not fracture the confining zone or otherwise allow injection fluids or formation fluids to endanger identified USDWs (40 CFR 146.88(a). Any changes or clarifications requested by the UIC Program Director to the stimulation plan will be discussed and implemented.

1.5.2 Construction Procedures [40 CFR 146.2(a)(12)]

A newly drilled injection well (CLDV-IW3) will be constructed at the Cleco Diamond Vault facility near Boyce, Louisiana, to meet the requirements of 40 CFR 146.86.

1.5.3 Casing and Cementing

The well will be designed using carbon steel for the casing and tubulars that are not expected to be in contact with a mixture of the injectate (CO_2) and water. That is, the conductor, surface, and intermediate casing sections will all be carbon steel. The deep casing string will be constructed with corrosion-resistant chrome (13CR) across the reservoir and caprock to total depth (TD) and carbon steel from above the caprock to surface. This section of the wellbore is expected to have intermittent exposure to CO_2-formation water mixed fluids especially in the initial phases of injection and intermittently when well workovers are performed throughout the life of the project. Although the expected water content of the injectate stream will be less than 50 ppm, the injection tubing string and flow-wetted injection tree components will be composed of corrosion-resistant materials.

Table 1-7 summarizes the casing program for the injection well and Table 1-8 summarizes the cement program. All casing strings will be cemented to surface and any changes to the final well design will be discussed with the UIC Director or representative.

The deepest USDW will be confirmed from the fluid sampling program in the STW. Surface casing will be set through the deepest USDW, and the long string casing will provide an additional layer of protection to the USDW.

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Table 1-7: Casing details.

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Table 1-8: Cement program for the CO_2 injection well.

After the well has been completed, a cement bond log – variable density log (CBL-VDL) and advanced ultrasonic cement evaluation log will be run of the entire depth of the long casing string shortly after completion of the injection well to confirm that the casing string was properly cemented. A baseline temperature measurement will also be acquired from surface to TD to provide initial temperature conditions over the well.

The annular fluid will be a dilute salt solution such as potassium chloride (KCl), sodium chloride (NaCl), or similar. The fluid will be mixed on site from dry salt and good quality (clean) fresh water, or it will be acquired pre-mixed. The fluid will also be filtered to ensure that solids do not interfere with the packer or other components of the annular protection system. The likely density of the annular fluid will be approximately 9.2 pounds per gallon (ppg). Final choice of the type of fluid will depend on availability and wellbore conditions.

1.6 Permit Section 5.0: Pre-Operational Logging and Testing

The Pre-Operational Logging and Testing Plan is submitted to meet the requirements of 40 CFR 146.82(a)(8) and 40 CFR 146.87.

This plan describes the pre-operational formation testing program implemented to characterize the chemical and physical features of the injection zone and confining zone at the Cleco Diamond Vault Project. The data set from STW will form the base of the pre-operational data set. A thorough logging and testing plan will be completed including wireline logging, side wall cores and whole core, fluid sampling and injection testing.

1.7 Permit Section 6.0: Well Operations

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

This section describes the source of the CO_2 that will be delivered to the storage site, its chemical and physical properties, flow rate, and the anticipated pressure and temperature of the CO_2 at the pipeline outlet. In addition, this section provides the monitoring that will be performed on the injection well to confirm that it does not provide a conduit from the storage formation to above confining zone water sources, USDW sources, or the surface.

The design basis of this project is to capture and inject the CO_2 produced at the Cleco Diamond Vault facility. The maximum injection volumes for this project are detailed in Table 1-3 and the planned injection phase of this project is 12 years. The operational parameters of the injection well will be determined using data derived from the STW.

Monitoring of the injection well parameters will be performed to ensure proper operation and compliance with 40 CFR 146.90(b). The wellhead injection pressure will be used to confirm that storage formation pressures remain below the regulated limit while the storage formation pressure will be measured with downhole pressure gauges. The mass injection rate will be continuously monitored to ensure the rate remains below the regulated limit. The annular pressure and temperature will be measured continuously to maintain compliance with the EPA Class VI permit and to monitor the internal mechanical integrity of the well. All monitoring will take place at the locations and frequencies shown in Table 1-9. The operation monitoring data will be connected to the main facility through a supervisory control and data acquisition (SCADA) system.

In addition to the annular monitoring system to evaluate the internal mechanical integrity of the well, a mechanical integrity test will be performed on the well after the tubing has been placed in the well and the packer has been set. External mechanical integrity will be monitored on an annual basis via temperature measurements over the entire depth of the well.

Parameter	Device(s)	Location	Min. Sampling Frequency	Min. Recording Frequency
CO_2 stream pressure (wellhead)	Pressure Gauge	Wellhead	Every 1 min.	Every 1 min.
Mass injection rate	Coriolis Meter	Wellhead	Every 10 sec.	Every 10 sec.
Annular pressure	Pressure Gauge	Wellhead	Every 1 min.	Every 1 min
Annulus fluid volume	Volume	Wellhead	Every 1 min.	Every 1 min
CO_2 stream temperature	Thermocouple	Wellhead	Every 1 min.	Every 1 min.

Notes:

- Sampling frequency refers to how often the monitoring device obtains data from the well for a particular parameter. For example, a recording device might sample a pressure transducer monitoring injection pressure once every two seconds and save this value in memory.
- Recording frequency refers to how often the sampled information gets recorded to digital format (such as a computer hard drive). For example, the data from the injection pressure transducer might be recorded to a hard drive once every minute.

Table 1-9: Sampling devices, locations, and frequencies for continuous monitoring.

1.7.2 Proposed Carbon Dioxide Stream [40 CFR 146.82(a)(7)(iii) and (iv)]

The injection stream will be monitored during the baseline and operational phases of the project (Permit Section 7.2). Prior to the start of the injection phase, the CO_2 stream will be sampled for analysis during regular plant operations to obtain representative CO_2 samples that will serve as a baseline dataset. Once the injection phase commences, samples of the CO_2 injection stream will be collected from the CO_2 delivery pipeline for analysis every three months.

1.8 Permit Section 7.0: Testing and Monitoring

The Testing and Monitoring Plan describes how Cleco Power, LLC will monitor the site pursuant to 40 CFR 146.82(a)(15) and 146.90.

The Testing and Monitoring Plan has been developed in conjunction with the project risk assessment to reduce the risks associated with CO_2 injection into the subsurface. Goals of the monitoring strategy include:

- Meeting the regulatory requirements of 40 CFR 146.90
- Protecting USDWs
- Ensuring that the injection well is operating as planned
- Providing data to validate and calibrate the geological and dynamic models used to predict the distribution of CO_2 within the injection zone
- Support AoR re-evaluations over the course of the project

The Testing and Monitoring Plan will be adaptive over time in that the plan can be adjusted to respond:

- As project risks evolve over the course of the project
- If significant differences between the monitoring data and predicted dynamic modeling results are identified
- If key monitoring techniques indicate anomalous results related to well integrity or the loss of containment

Figure 1-1 illustrates the modeled AoR over the 12-year injection period.

The Testing and Monitoring Plan will outline several direct and indirect technologies used throughout the injection and PISC phases of the project that will monitor:

- Daily activities of the injection operations
- Development of the CO_2 and pressure plumes in the storage formation over time
- Well integrity
- CO_2 or brine containment within the injection reservoir
- Groundwater quality in multiple aquifers, including the deepest and the deepest water-bearing formation above the caprock

Injection operations will be monitored through a range of continuous, daily, and quarterly techniques as detailed in the Well Operations Plan (Permit Section 6.0). Table 1-11 summarizes the proposed testing and monitoring plan for the project.

The well integrity of the injection and deep monitoring wells will be monitored using a range of internal and external mechanical integrity evaluation methods. Initially, a mechanical integrity test (MIT) will be performed on the injection well following the well completion to confirm internal integrity as per the Pre-Operations Testing Plan, Permit Section 5, (40 CFR 146.82(a)(8), 146.87). External mechanical integrity will be confirmed through annual temperature logging and compared to baseline temperature logging data to identify any deflections from the temperature gradient that could indicate fluid flow behind the casing (40 CFR 146.90 (e)).

Pressure fall-off tests (PFOs) will be conducted in the injection formation in the injection well when they are drilled to establish the hydrogeologic characteristics of the storage formation (Pre-Operational Testing Plan, Permit Section 5). During the injection phase of the project, a PFO will be conducted in the injection well at least once every five years.

Three above confining wells (ACZ) wells will be drilled as part of the Testing and Monitoring Plan for the project (Figure 7-1). These wells will be drilled to the top of the confining zone and will be adjacent to the injection wells to monitor the aquifers above the confining layer (Figure 7-3). These wells will be used for pressure and temperature monitoring as well as periodic fluid sampling in the deepest USDW. Potential CO_2 or brine migration into the deepest USDW will be initially identified through pressure changes in the formation and will be confirmed through

aqueous geochemistry data and analysis of stable isotopes (Permit Section 5). The shallow groundwater monitoring program will consist of a network of wells within the AoR.
Several indirect monitoring techniques will be deployed to monitor the development of the CO_2 plume and the associated pressure front through the injection and post-injection project phases (40 CFR 146.90 (g)). These techniques include distributed temperature sensing (DTS), Pulsed Neutron Capture (PNC) logging and time-lapse distributed acoustic sensing (DAS) borehole seismic.

The deep monitoring wells and the above confining zone wells will be equipped with fiber optic cable for monitoring the well temperature profile using DTS, in real time in the casing-tubing annulus in the deepest USDW, the containment layer and storage formation in the pre-operational, injection, and PISC phases of the project (40 CFR 146.90 (g)). Downhole pressure and temperature sensors in the deep monitoring wells and the above confining zone wells will also be used to measure pressure and temperature variations in the deepest USDW, the containment layer and the storage formation in the pre-operational, injection, and PISC phases of the project (40 CFR 146.90 (g)). These gauges will record data samples every minute and will be retrieved on a quarterly basis for data download. The deep monitor wells will also be used to collect fluid samples from the storage formation to monitor for changes in the water chemistry over time and verify when the leading edge of the CO_2 plume reaches the well.

PNC logs will be acquired annually in the deep monitoring wells and ACZ wells to identify the intervals and concentration of CO_2 across the injection zone and primary confining zone. This pressure and PNC log data will also be used to calibrate the dynamic modeling over the injection and PISC phases of the project.

The fiber optic cable deployed in the deep monitoring wells and the above confining zone wells will be used to acquire time-lapse borehole seismic vertical seismic profile (VSP) data using distributed acoustic sensing (DAS). These data will be used to qualitatively monitor the CO_2 plume development and calibrate the computational modeling results over time. The time-lapse borehole seismic VSP data will also be used to verify CO_2 containment within the injection formation. A robust deterministic seismic forward modeling project will be undertaken to demonstrate that this technique can successfully detect subsurface changes associated with CO_2 injection at this site (Section 7.8.5).

Background seismic activity will be monitored continuously using a site-specific seismicity monitoring network designed to optimize the accuracy of the event locations and event magnitudes (Section 8.3). The location of individual stations within this network can be adjusted as required in response to monitoring results or future AoR re-evaluations.

Monitoring Activity	**Baseline Data Frequency**	**Injection Phase Frequency**	**Location**	**Formation top / Depth Range (ft, MD)**
Assurance Monitoring:				
Shallow Groundwater Sampling	Quarterly	Quarterly	AoR Groundwater well network[1]	Producing zone
Isotope Analysis	Biannually	Annually	AoR Groundwater well network[1]	0 – TD
Operational Monitoring:				
CO_2 Stream Analysis	NA	Quarterly	CO_2 Delivery Pipeline	NA
Corrosion Coupon Analysis	NA	Quarterly	CO_2 Delivery Pipeline	NA
Injection Pressure	NA	Continuous	Injection Wellhead	Surface
Mass Injection Rate	NA	Continuous	Injection Wellhead	Surface
Injection Volume (Calculated)	NA	Continuous	Storage Formation	Surface
Annular Pressure	NA	Continuous	Injection Well	Surface
Annular Fluid Volume	NA	Continuous	Injection Well	Surface
Temperature Measurement	Once	Annually	Injection Well	0 – TD
PFO Tests	Once	Every 5 years	Injection Well	Surface

Monitoring Activity	Baseline Data Frequency	Injection Phase Frequency	Location	Formation top / Depth Range (ft, MD)
Verification Monitoring:				
Fluid Sampling				
Deepest USDW	Twice	Annually	ACZ well	TBD
Top confining zone	Twice	Annually	ACZ well	TBD
Injection zone	Twice	Annually	Deep monitor well[2]	TBD
Isotope Analysis	Twice	Annually	ACZ Well	All samples
Pressure Sensors	3 months prior to injection			
Deepest USDW	Continuous	Continuous	ACZ Well	TBD
Top confining zone	Continuous	Continuous	ACZ Well	TBD
Injection zone	Continuous	Continuous	Deep monitor well	TBD
Temperature Sensors (DTS)	3 months prior to injection			
Deepest USDW	Continuous	Continuous	ACZ Well	TBD
Top confining zone	Continuous	Continuous	ACZ Well	TBD
Injection zone	Continuous	Continuous	Deep monitor well	TBD
PNC Logging Deepest USDW Top confining zone Injection zone	Once	Annually	Deep Monitor well ACZ Well	TBD TBD
Microseismic Monitoring	6 months prior to injection	Continuous	Surface stations	TBD
Time-lapse Borehole Seismic VSP Data	Once	Every 5 years and as required	Surface	

[1] Groundwater well network incorporating selected wells from existing network and additional, new groundwater wells to provide coverage across AoR

[2] In-zone fluid sampling will be discontinued once CO2 breakthrough occurs at the well

Table 1-10: General schedule and spatial extent for the testing and monitoring activities for the Cleco Diamond Vault Project.

1.9 Permit Section 8.0: Injection Well Plugging

The Injection Well Plugging Plan describes how Cleco Power, LLC will plug the injection well pursuant to 40 CFR 146.82(a)(16) and 146.92.

A Notice of Intent to plug the well will be submitted to the EPA at least 60 days prior to the plugging operations (40 CFR 146.92 (c)). After the project has verified that there are no external well integrity issues, the well will be flushed with buffer fluid to remove any fluids or particulates that may be present in the well. The injection well casing will be plugged with cement to ensure that it does not provide a conduit outside the injection zone. Table 1-11 shows the intervals that will be plugged as well as the materials and methods that will be used to plug the intervals.

Sensitive, Confidential, or Privileged Information

[redacted]

Table 1-11: Intervals to be plugged and materials/methods used (40 CFR 146.92 (b)(2 – 4)).

Sensitive, Confidential, or Privileged Information

[redacted]

Sensitive, Confidential, or Privileged Information [redacted]

1.10 Permit Section 9.0: Post-Injection Site Care (PISC) and Site Closure

The PISC and Site Closure Plan describes the activities that Cleco Power, LLC will perform to meet the requirements of 40 CFR 146.82(a)(18) and 146.93(c).

Cleco Power, LLC will monitor groundwater quality and track the position of the CO_2 plume and pressure front for 10 years after the cessation of injection, which is the anticipated timeline for CO_2 plume and pressure front stabilization.

Based on the modeling of the pressure front as part of the AoR delineation, pressure at the injection well is expected to decrease to pre-injection levels in less than 10 years. Additional information on the projected post-injection pressure declines and differentials is presented in the permit application and the AoR and Corrective Action Plan (Permit Section 2.0).

1.11 Permit Section 10.0: Emergency and Remedial Response

The Emergency and Remedial Response Plan (ERRP) is submitted to meet the requirements of Plan 40 CFR 146.82(a)(19) and 146.94(a).

The ERRP provides actions that Cleco Power, LLC will take in the event of an emergency and to address movement of CO_2 or formation fluid that may endanger an USDW during the construction, operation, or PISC periods.

If evidence indicates that the injected CO_2 stream, formation fluids, and/or associated pressure front may cause an endangerment to a USDW, the following actions must be performed:

1. Initiate shutdown plan for the injection well.
2. Take all steps reasonably necessary to identify and characterize any release or migration.
3. Notify the permitting agency/UIC of the emergency event within 24 hours.
4. Implement applicable portions of the approved ERRP.

Where the phrase “initiate shutdown plan” is used, the following protocol will be employed: Cleco Power, LLC will immediately cease injection. However, in some circumstances, Cleco Power, LLC will, in consultation with the UIC Director, determine if a gradual cessation of injection is appropriate. If a non-emergency shutdown of the CO_2 injection system is required, the operator will complete the shutdown in a stepwise approach to prevent over-pressure situations and/or damage to the equipment. Efforts will also be made to maintain the CO_2 in the injection stream in a supercritical phase to prevent special operations during the restart of the system. Also, override of certain relays may be required to properly and safely shutdown the system.

1.12 Injection Depth Waiver and Aquifer Exemption Expansion

Cleco Power, LLC is not applying for a depth waiver or an aquifer exemption.

1.13 Other Information – Environmental Justice Baseline Analysis

Cleco Power, LLC have completed an Environmental Justice Baseline Analysis for the Cleco Diamond Vault Project. The report is included in Appendix A.

Per the requirements by the state of Louisiana and the Louisiana Department of Natural Resources (LDNR) this project will comply with the requirements of the "IT Decision" including answering and submitting the 5 "IT Questions" for the Cleco Diamond Vault site. The questions to be answered are included in Appendix B.

1.14 Other Permits

It will be necessary to have additional permits throughout the lifecycle of the project. Here is a list of the existing and expected permits:

LPDES permit LA0008036 for NPDES Discharges under the Clean Water Act

PSD Permti PSD-LA-711(M-3) for Prevention of Significant Deterioration program under the Clean Air Act

UIC-25 Stratigraphic Test Class-V Well Permit- In Progress

No other permits are necessary

Appendix A – Environmental Justice Baseline Analysis

Prepared for
Cleco Power, LLC
Cleco Corporate Holdings LLC

Prepared by
Ramboll US Consulting, Inc.
Baton Rouge, LA

Project Number
1690029667

Date
March 2023

Environmental Justice Baseline Analysis for Project Diamond Vault

PROJECT DIAMOND VAULT
LENA, LOUISIANA

RAMBOLL

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ATTACHMENT

Attachment 1. EJScreen Reports for the 1-Mile and 3-Mile Study Areas

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1. INTRODUCTION

Cleco Power, LLC (Cleco) is pleased to present the following environmental justice (EJ) baseline assessment to be used in permitting efforts related to Project Diamond Vault ("the project") a proposed carbon capture and sequestration (CCS) initiative at Cleco's Brame Energy Center (BEC) located in Lena, Louisiana. The purpose of the EJ baseline assessment is to develop an understanding of potential EJ related concerns for the surrounding communities that could arise as part of the project and inform future mitigation and outreach efforts. This EJ baseline assessment, which was prepared by Ramboll US Consulting, Inc. (Ramboll), was performed utilizing the United States Environmental Protection Agency (USEPA) Environmental Justice Screening and Mapping Tool (EJScreen), Version 2.1 (October 2022),[1] and is intended to provide an overview of EJ related baseline conditions for use in permitting efforts for Project Diamond Vault.

1.1 Project Diamond Vault

Cleco is part of the larger Cleco Corporate Holdings LLC, which is a holding company in the energy sector that predominantly operates in Louisiana under Cleco Cajun, LLC and Cleco Power, LLC (Cleco). Cleco is a regulated electric public utility that serves approximately 290,000 customers across Louisiana. As part of ongoing efforts to optimize its operation, Cleco is in the process of developing Project Diamond Vault ("the project"), a new carbon capture facility at the Brame Energy Center in Rapides Parish, Louisiana with the aim of reducing carbon dioxide emissions through CCS technology.

CCS is deemed to be an effective solution for reducing carbon dioxide (CO_2) emissions[2]. Project Diamond Vault is a proposed CCS installation, which will be located at the BEC's Madison Unit 3 (**Figure 1**), one of the three electricity generating units (EGU) at the BEC. When constructed, the project is anticipated to reduce Madison Unit 3's CO_2 emissions by 95% by storing the CO_2 in geological features underneath the BEC. Cleco currently proposes a 12-year injection period with 7 total wells that can store up to 4.6 million ton per year (MMt/yr) of CO_2. The project was publicly announced on April 11, 2022 and is expected to begin construction in the second half of 2025.[3]

The project is located on Lake Rodemacher in Lena, LA near the community of Boyce, LA and the larger nearby city of Alexandria, LA. The BEC is located off Interstate 49 which connects the larger cities of Shreveport, LA and Lafayette, LA. While the Madison Unit 3 EGU is located on a peninsula on the northeast corner of Lake Rodemacher, Cleco's property spans the perimeter of the lake (**Figure 1**). More information on the demographics of the project area are provided as part of Section 2.

The proposed wells that are part of the project fall into the category of USEPA Class VI wells, and therefore the project must follow the requirements for Class VI permit applications. Louisiana Department of Natural Resources (LDNR) has submitted a Class VI primacy application as of May 2021 and has been granted access to several Class VI permit applications.[4] However, the permit application authority still remains with USEPA in the state of Louisiana. Both USEPA and LDNR have recommended an initial environmental justice (EJ) assessment for Class VI permit applications that includes nearby

[1] US Environmental Protection Agency (USEPA). EJScreen: Environmental Justice Screening and Mapping Tool (version 2.10). Oct 11, 2022. Available at: https://ejscreen.epa.gov/mapper/

[2] US Environmental Protection Agency (USEPA). Available at: https://19january2017snapshot.epa.gov/climatechange/carbon-dioxide-capture-and-sequestration-overview_.html

[3] Cleco. 2022. Diamond Vault FAQs. Available at: https://www.cleco.com/diamondvaultfaq

[4] LDNR. 2021. Class VI USEPA Primacy Application. Available at: http://www.dnr.louisiana.gov/assets/OC/im_div/uic_sec/ClassVIPrimacyApplicationstamped.pdf

communities and the 12-year modeled Area of Review (AoR). A map showing the AoR in relation to the BEC is shown in **Figure 1**.

1.2 Process Description

A general overview of the CCS process used in the project is shown in **Figure 2** and described here.[5] In the proposed CCS process, the flue gas with CO_2 emitted from the Madison 3 EGU is diverted into a carbon capture system where it is first cooled before entering an absorber tower. In the absorber tower, flue gas with CO_2 is combined with an amine-based solvent that separates the CO_2 and the flue gas. Flue gas without CO_2 is emitted directly to the atmosphere from the absorber tower. The amine-based solvent with CO_2 is then heated allowing for the separation of CO_2 and the amine-based solvent. CO_2 is then compressed, dehydrated, and sent to the injection site where it is transported to the underground storage location. The amine-based solvent is cooled and can be reused in the absorber tower.

While CCS initiatives involve reducing CO_2 emissions by injecting CO_2 underground, it is important to consider potential environmental effects of the project's construction and operations. As part of an initial review of air quality permitting options, previous analysis identified that Project Diamond Vault has the potential to increase emissions of volatile organic compounds (VOCs) (specifically formaldehyde and amines).[6] Because CCS involves the injection of CO_2 underground there have been concerns about the effects to local ecosystems and drinking water; however, USEPA guidance states that "*proper site* selection *and careful monitoring are important factors in minimizing and identifying any potential impacts to drinking water, human health, and ecosystems.*"[7] Developing an understanding of the local community near a project is a good first step in better understanding local demographic, socioeconomic, and environmental conditions.

1.3 Baseline EJ Approach

The following is a proactively conducted EJ Baseline Assessment providing an overview of baseline, pre-project conditions at the BEC. Cleco recognizes the importance of understanding the existing environmental conditions and demographics of the area surrounding Project Diamond Vault to ensure that proper outreach efforts are conducted, and the potential environmental effects on the surrounding communities are considered. The following includes a baseline screening of the project area using the USEPA EJ Screening tool (EJScreen) and details the results from screening. An additional discussion of potential variables of concern supplemented with additional analyses is also provided.

[5] Cleco. 2022. Diamond Vault: Scientific Technology. Available at: https://www.cleco.com/docs/default-source/diamond-vault/cleco-diamond-vault-scientific-process.pdf

[6] Ramboll. 2023. Review of Carbon Capture Air Permitting Options: Brame Energy Center-Madison Unit 3.

[7] US Environmental Protection Agency (USEPA). 2016. Carbon Dioxide Capture and Sequestration: Storage Safety and Security. Available at: https://19january2017snapshot.epa.gov/climatechange/carbon-dioxide-capture-and-sequestration-storage-safety-and-security_.html

1.4 Project Diamond Vault Public Engagement Strategy

Cleco has developed and initiated a public engagement strategy that will serve as a roadmap for the Cleco communications department to effectively conduct meaningful public engagement and document their engagement practices in a manner that is consistent with current available guidance[8].

This public engagement and communication strategy is adapted from the World Resources Institute Carbon Capture and Storage and Community Engagement Spectrum of Community Engagement Approaches.[9] The overarching goal of this recommended process is to use a flexible, collaborative, and iterative process to inform, consult and negotiate with all stakeholders in order to reach consensus so that Project Diamond Vault can move forward with public and stakeholder support. Additionally, the strategy is intended to increase outreach and opportunities for meaningful engagement with EJ or disproportionately impacted (DI) communities as identified from the US EPA EJScreen[10].

The best possible outcome from the public engagement process is that a comprehensive outreach strategy was implemented that solicited input from all affected stakeholders and that stakeholders were afforded a meaningful opportunity to provide feedback that was then considered as part of the project design and operational measures. At the conclusion of the initial community engagement process, public comments and outcomes will be documented in a Community Engagement Report. The initial report can be included with permit applications and/or be shared publicly to provide transparency and inform the public. Periodic public engagement and outreach will be ongoing throughout all phases of the project to keep the public updated and to answer any new questions that may arise.

---

[8] EPA. 2011. "Geologic Sequestration of Carbon Dioxide – UIC Quick Reference Guide, Additional Considerations for UIC Program Directors on the Public Participation Requirements for Class VI Injection Wells" Available at: https://www.epa.gov/uic/quick-reference-guides-class-vi-program-implementation

[9] CCS and Community Engagement, World Resources Institute. Available at: https://files.wri.org/d8/s3fs-public/pdf/ccs_and_community_engagement.pdf

[10] US Environmental Protection Agency Environmental Justice Mapping Tool, Version 2.1. Available at: https://ejscreen.epa.gov/mapper/

2. ENVIRONMENTAL JUSTICE BASELINE ASSESSMENT

An environmental justice baseline assessment was performed as a first step to ensure that any adverse environmental effects on communities of color and/or low-income communities, can be avoided to the maximum extent possible. This assessment was performed utilizing the USEPA's EJ Screening and Mapping Tool (EJScreen), Version 2.1 (October 2022).[1]

This section is organized as follows:

- Section 2.1 provides an overview of environmental justice and relevant federal policies guiding this analysis; and
- Section 2.2 summarizes the results of the baseline EJ assessment.

2.1 Definition of Environmental Justice and Applicable regulations

Currently, there are no specific regulatory frameworks or guidance documents issued from the USEPA or LDNR to permittees defining the requirements of an environmental justice analysis for this Class VI permitting effort. The following federal policy summary is provided as a general framework guiding the consideration of environmental justice.

In 1994, in response to growing concern that minority[11] and low-income populations bear a disproportionate amount of adverse health and environmental effects, President Clinton issued Executive Order 12898 on environmental justice formally focusing federal agency attention on this issue. Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* requires federal agencies to assess the potential for their actions to have disproportionately high and adverse environmental and health impacts on minority and low-income populations, and directs them to develop strategies for implementing environmental justice.

The USEPA defines "environmental justice" as follows:[12]

> *The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.*

The USEPA defines "fair treatment" as follows:[8]

> *No group of people, including a racial, ethnic, or a socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.*

[11] To utilize more inclusive language, for the remainder of this assessment the terms "people of color" or "communities of color" are used instead of the term "minority;" the USEPA has also adopted similar phrasing updates in EJScreen 2.1.

[12] USEPA. 1998. Final Guidance for Incorporating Environmental Justice Concerns in USEPA's NEPA Compliance Analyses. Available at: https://www.epa.gov/sites/default/files/2015-02/documents/ej_guidance_nepa_epa0498.pdf

The USEPA defines "meaningful involvement" as follows:[8]

1) Potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health;
2) The public's contribution can influence the regulatory agency's decision;
3) The concerns of all participants involved will be considered in the decision-making process; and,
4) The decision-makers seek out and facilitate the involvement of those potentially affected.

USEPA documents including *Principles for Addressing Environmental Justice in Air Permitting,*[13] and *Additional Tools for UIC Program Directors Incorporating Environmental Justice Considerations into the Class VI Injection Well Permitting Process,*[14] provide suggested direction to guide federal, state, and local permitting programs that can inform this EJ analysis process. Additional guides, *Environmental Justice and Civil Rights in Permitting Frequency Asked Questions*[15] and *USEPA Legal Tools to Advance Environmental Justice*[16] provide additional direction, specifically addressing questions related to permitting processes and cumulative impacts analysis. On a state level, the LDNR Class VI USEPA primacy application encourages EJ review in the pre-permitting stage and requires it as part of the permit application process.[4] At a minimum, LDNR mandates the submission of an EJ report to identify any geographic parts of the project's Area of Review (AoR) encompassing EJ communities based on USEPA EJScreen criteria which is why it is important to consider the AoR in EJ analysis. This environmental justice analysis takes into account these and other guidance documents and provides an environmental justice perspective of the potential environmental effects of the proposed project being evaluated in this EJ analysis.

In this analysis, impacts are defined as adverse or beneficial health or environmental effects of the BEC on the surrounding community. This includes cumulative impacts on the surrounding community that could result when any impacts from the BEC combine with other impacts. Disproportionate impacts are defined as adverse impacts borne disproportionately on the basis of race, color, or national origin.

2.2 Baseline Environmental Justice Assessment

This section presents a screening-level review of the baseline conditions, burdens, and vulnerabilities for the community in the area surrounding the BEC using EJScreen (Version 2.1, released October 2022).[6] EJScreen is the most widely used federal assessment tool for evaluating potential impacts to communities facing EJ-related concerns. It provides a nationally consistent dataset and approach for combining environmental and demographic socioeconomic indicators used to assess potential exposure in vulnerable communities. In this analysis, the results of the tool were used to identify potential baseline environmental concerns present in the community that warrant additional review

[13] USEPA. 2022. Principles for Addressing Environmental Justice in Air Permitting. Memorandum from Joseph Goffman, Principal Deputy Assistant Administrator, Office of Air and Radiation, to Air and Radiation Division Directions, USEPA Regions I-X. December 22, 2022.

[14] USEPA. 2011. Additional Tools for UIC Program Directors Incorporating Environmental Justice Considerations into the Class VI Injection Well Permitting Process. Available at: https://www.epa.gov/sites/default/files/2015-07/documents/epa816r11002.pdf

[15] USEPA. 2022. Environmental Justice and Civil Rights in Permitting Frequency Asked Questions. Office of General Counsel. August 2022.

[16] USEPA. 2022. EPA Legal Tools to Advance Environmental Justice. Office of General Counsel. May 2022.

and guide further assessment of whether the project might contribute to adverse and disproportionate impacts.

2.2.1 Overview of EJScreen

EJScreen calculates 12 "Environmental Justice Indexes (EJ Indexes)" - one for each of the 12 individual environmental indicators of concern - where the EJ Index is a percentile ranking between a census tract and two comparison populations: state and US. Each EJ Index is published at both state and US comparison levels within the standard reports (**Attachment 1**) exportable from the tool.

As recommended by USEPA, the 80th percentile was used as a starting point for the purpose of identifying geographic areas in the US that may warrant further consideration, analysis, or outreach.[17] That is, if any of the EJ Indexes are at or above the 80th percentile, then further review may be appropriate. This basis is consistent with that used by the Louisiana Department of Environmental Quality (LDEQ) for air permitting actions[18,19] where the 80th percentile is used as the threshold for assessing the need for further evaluation. In this analysis, EJ Indexes equal to or greater than the 80th percentile among either of the two comparison populations are discussed to assess the potential for disproportionate impacts.

An EJ Index for a particular environmental indicator (e.g., $PM_{2.5}$ or Air Toxics Cancer Risk) combines the following information for the user-specified study area:

- the environmental indicator percentile for a Census block group,
- a demographic index for a Census block group, consisting of percent low-income population[20] and percent people of color, and
- population size for block group.

The EJ Index results are intended to represent the average resident within the study area; however, the data used to calculate the index are based on a combination of Census tract- and Census block group-levels, which can be larger geographic areas than the user-defined study area. In this way, the EJ Indexes represent the closest approximation to the average resident in the study area but are estimates only, with some imprecision.

2.2.2 Study Area Definition

Figure 1 shows the 82.93 square mile study area for this EJ baseline analysis, which is defined as a 3-mile radius buffer around the boundary of the BEC. Use of a 3-mile radius is supported by EJ technical documentation and is large enough to encompass multiple census blocks and relevant communities near the BEC.

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[17] USEPA. 2022. EJSCREEN Technical Documentation. Available at: https://www.epa.gov/sites/default/files/2021-04/documents/ejscreen_technical_document.pdf; EPA. 2019. EJSCREEN Technical Documentation. EJSCREEN Technical Documentation. Available at: https://www.regulations.gov/document/EPA-R09-OAR-2021-0249-0057 (note: both guides remain relevant as the 2022 update does not provide the comprehensive level of information that the 2019 version includes).

[18] LDEQ. June 3, 2022. Basis for Decision, Magnolia Power LLC – Magnolia Power Generating Station Unit 1, AI No. 222431. LDEQ-EDMS Document 13323744, see discussion of "EJSCREEN," on page 22.

[19] LDEQ. April 29, 2022. Basis for Decision, Indorama Ventures Olefins, LLC – Westlake Ethylene Plant, AI No. 5337. LDEQ-EDMS Document 13275727, see discussion of "EJSCREEN," on page 22.

[20] The low-income population metric is developed using a threshold of two times the federal poverty level.

As an alternate point of comparison, a study area defined by a 1-mile radius was also evaluated. Comparisons across different study area sizes may suggest significant differences are present in environmental vulnerabilities though this is not necessarily an accurate interpretation. The EJScreen technical guide indicates, "...EJ index values are often very uncertain at block group resolution. Therefore, modest differences in percentile scores between block groups or small buffers should not be interpreted as meaningful because of the uncertainties in demographic and environmental data at the block group level." [21]

The 3-mile study area includes a boundary around the Cleco BEC property (see **Figure 1** and the EJScreen Reports in **Attachment 1**). The smaller, 1-mile study area was around the same boundary. The 1-mile radius is comprised of Census tracts 22043020300, 22079010500, and 22079010600. The same Census tracts are included within the 3-mile study area along with a small portion of tract 22079010700.[22] The 3-mile study includes the entirety of the AoR while the 1-mile study area does not.

The EJScreen analysis based on the 3-mile study area is more representative and relevant for characterizing the environmental justice vulnerability of the communities surrounding the BEC than the 1-mile study area based on the following rationale:

- The 3-mile study area covers 82.93 square miles and an approximate population of 2,302 and incorporates the nearest communities in Boyce, LA. The 1-mile study area does not provide adequate coverage of neighboring communities further away from the BEC covering only 29.30 square miles and an approximate population of 217.
- USEPA cautions on the use of smaller study areas (e.g., less than one mile) with smaller population counts due to uncertainties in the spatial resolution of the Census and environmental datasets that are used in EJScreen. The 1-mile study area population count of 217 may introduce uncertainties due to the small sample size.
- The entirety of the project's modeled 12-year AoR is included in the 3-mile study area but not the 1-mile study area.

This environmental justice analysis will focus on the EJScreen results for the 3-mile study area. However, the EJScreen report for both the 3- and 1-mile study areas are included in **Attachment 1**.

2.2.3 Screening Results and Discussion

EJ Indexes

The demographic index and population count are combined with each of the 12 individual environmental indicators to yield 12 EJ Indexes. An EJ Index is higher for Census block groups where the demographic index is higher, i.e. where there are more people living with low income and/or a higher percentage of people of color. As discussed previously, EJ Indexes equal to or greater than the 80th percentile, when compared with state or US populations are highlighted in this analysis. **Table 1** provides a summary of the three EJ Indexes exceeding the 80th percentile among the state or US for the 3-mile study area. The complete EJScreen results are provided in **Attachment 1**.

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[21] USEPA. 2019. EJSCREEN Technical Documentation. Available at: https://www.regulations.gov/document/EPA-R09-OAR-2021-0249-0057

[22] The 1-mile radius is comprised of Block groups 220790105011, 220430203001, and 220790106001. The same Block groups are included within the 3-mile study area along with 20790105012, 220790107021 and 220790106002.

Table 1. EJ Indexes Exceeding the 80th Percentile		
EJ Indexes > 80th Percentile	**State Percentile***	**US Percentile***
Area: 82.93 square miles; Population: 2,302		
EJ Index for Air Toxics Respiratory HI	61	80
EJ Index for Particulate Matter 2.5	79	83
EJ Index for Wastewater Discharge	80	83
Notes: HI = hazard index *These values represent baseline and do not take into account any potential impact from the proposed project.		

The EJ Indexes representing the Air Toxics Respiratory Hazard Index (HI), $PM_{2.5}$, and Wastewater Discharge exceed the 80th percentile in the state and/or US comparison populations. These percentiles do not necessarily indicate health concerns but rather the need to review site-specific data or perform additional analysis for the study area. In addition to the percentiles, USEPA also suggests considering the following:

- if and to what extent the environmental data show values above relevant health-based or regulatory thresholds,
- the significance of said thresholds, severity of health or impacts of environmental concern, and,
- the degree of any disparity amongst various groups exposed to environmental pollutants.

Environmental Indicators for Baseline Assessment

EJScreen evaluates 12 environmental indicators that range from estimates of human health risk to proxies for potential exposure such as proximity to hazardous waste sites. These indicators are presented without consideration of the socioeconomic/demographic indicators. The environmental indicators associated with the EJ Indexes exceeding the 80th percentile as highlighted in **Table 1**, are presented in **Table 2**. Additionally, the Air Toxics Cancer Risk is added to the table for two reasons: the EJ index of 77th percentile on a national scale is close to the 80th percentile, and the proposed project does expect potential emissions increases of air toxics. Thus, understanding the baseline environmental indicator percentiles can inform project planning. A discussion of each environmental indicator of interest is included in sections below.

Table 2. Baseline Environmental Indicators of Interest for the Study Area			
Environmental Indicators of Interest	**Environmental Indicator Value***	**State Percentile***	**US Percentile***
Area: 82.93 square miles; Population: 2,302			
Air Toxics Cancer Risk (lifetime risk per million)	30	52	80-90th
Air Toxics Respiratory HI (unitless)	0.44	73	80-90th
Particulate Matter 2.5 (μg/m^3)	9.44	68	74

Table 2. Baseline Environmental Indicators of Interest for the Study Area			
Wastewater Discharge (toxicity-weighted concentration/meter distance)	0.013	79	71

Notes:
HI = hazard index
μg/m^3 = microgram per cubic meter
*These values represent baseline and do not take into account any potential impact from the proposed project.

Air Toxics Cancer Risk
The air toxics cancer risk indicator provides a numerical estimate of the probability of "excess lifetime cancer" in terms of cases of cancer per million people. Excess lifetime cancer relates to the potential for developing cancer over the course of a lifetime, apart from the existing background cancer rate. The EJ Index for air toxics cancer risk (53rd in state, 77th in US) did not exceed the 80th percentile. However, the environmental indicator for this EJ index (cancer risk of 30 per million) fell within the 80-90th percentile and is therefore further discussed in this baseline assessment.

The significance of the cancer risk indicator value is assessed through comparison of the estimated excess lifetime cancer risk to USEPA's acceptable range for cancer risk of 1 in one million to 100 in one million. This range reflects a de minimis or negligible increased cancer risk level above background cancer risk, which is approximately 400,000 in one million, or 1 in 2.5 people, based on 2017-2019 data.[23] USEPA's risk assessment methodology applied in calculating cancer and noncancer risks incorporates multiple factors representing a reasonable maximum exposure and applies toxicity values for each chemical that are modified by uncertainty and sensitivity factors that account for and are protective of sensitive subpopulations.[24] If estimated cancer risks are within or lower than this range, cancer risk is considered negligible. If cancer risks are greater than USEPA's acceptable risk range, then additional analysis is recommended. Typically, this includes refining data inputs and assumptions to reflect "site-specific" conditions.[25]

The EJScreen air toxics cancer risk indicator presented above is based on USEPA 2017 AirToxScreen[26] (Air Toxics Screening Assessment). The USEPA AirToxScreen can provide health risks at the census tract level based on pollution source and it is developed based on National Emission Inventory and other emission data at the census tract level. The AirToxScreen cancer risk provides a conservative assumption for upper-bound cancer risk level for an individual breathing air toxics for 70 years. A Census tract is comprised of Census block groups and is oftentimes a larger geographic area than the 3-mile study area. Therefore, risks provided for the Census tract may reflect risks associated with emissions from facilities that are distant from the BEC. In addition, EJScreen uses 2017 AirToxScreen

[23] This range is derived from the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300), which states that "acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using the information on the relationship between dose and response." For reference, the nomenclature used by the EPA, 10^{-4} and 10^{-6}, is equivalent to the terms '1 in one million to 100 in one million.' Available at: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-J/part-300

[24] National Cancer Institute, Surveillance, Epidemiology, and End Results Program https://seer.cancer.gov/statfacts/html/all.html.

[25] EPA. 1989. Risk assessment guidance for Superfund Volume I, Human health evaluation manual (Part A), Interim Final. EPA/540/1-89/002. Available at: https://www.epa.gov/risk/risk-assessment-guidance-superfund-rags-part

[26] USEPA. 2022. Air Toxics Screening Assessment. Available at: https://www.epa.gov/AirToxScreen

information for any Census tract that intersects with the study area (i.e., Census tracts 22043020300, 22079010500, 2079010600, and 22079010700 in **Figure 3**, which can also result in ascribing air toxics cancer risks to the study area that are not necessarily representative. For example, only a small portion of tract 22079010700 is included in the study area, but these results nevertheless influence the total cancer risk estimate calculated in EJScreen.

The recently published 2019 AirToxScreen[27] results are available for the Census tracts within which the study area lies (i.e., Census tracts 22043020300, 22079010500, 2079010600, and 2079010700), though these results have not yet been incorporated into the EJScreen tool. The BEC lies within Census tract 2079010600, with a small portion of Census tracts 22043020300, 22079010500, and 2079010700 also included within the 3-mile study area. 2019 AirToxScreen results were reviewed, to understand potential changes in baseline air toxics cancer risks that are incorporated in more recent versions of AirToxScreen but not yet reflected in EJScreen, which relies on the 2017 AirToxScreen results.

With respect to Census tract 2079010600, where the BEC is located, the 2019 AirToxScreen air toxic cancer risk result of 31 in one million shows a slight decrease compared to the 2017 results of 33 in one million; although, the relative contributions from the air toxics, including acetaldehyde, carbon tetrachloride, and formaldehyde remained similar to 2017 (see **Table 3**). A similar trend is observed for other census three tracts where the total air toxics cancer risk in 2019 was lower than 2017, while the relative contributions from the air toxics remained identical to 2017.

Table 3. Baseline Cancer Risk Reported in AirToxScreen 2017 & 2019 in Vicinity of the BEC

AirToxScreen Version	Cancer Risk (per million people)	Cancer Risk Contribution by Chemical (%)[a]		
		Acetaldehyde	Carbon Tetrachloride	Formaldehyde
Census Tract 22043020300[b]				
2017	32	10	10	70
2019	30	10	10	69
Census Tract 22079010500[c]				
2017	33	9	9	67
2019	30	9	10	67
Census Tract 22079010600[d]				
2017	33	10	9	70
2019	31	10	10	69
Census Tract 22079010700[e]				
2017	32	10	9	68

[27] USEPA. 2022. 2019 AirToxScreen Mapping Tool. Available at: https://www.epa.gov/AirToxScreen/2019-airtoxscreen, accessed January 20, 2023. The 2019 AirToxScreen used the 2017 National Emissions Inventory (NEI) as a starting point and updated these data for 2019 from comments provided by state, local and tribal agencies during the AirToxScreen review.

Table 3. Baseline Cancer Risk Reported in AirToxScreen 2017 & 2019 in Vicinity of the BEC				
AirToxScreen Version	**Cancer Risk** (per million people)	**Cancer Risk Contribution by Chemical (%)**[a]		
		Acetaldehyde	**Carbon Tetrachloride**	**Formaldehyde**
2019	30	10	10	69

Notes:

a. The BEC does not and will not contribute to existing emissions of carbon tetrachloride.
b. The cancer risk estimates are based on Census Tract 22043020300, which is overlapping with the study area.
c. The cancer risk estimates are based on Census Tract 22079010500, which is overlapping with the study area.
d. The cancer risk estimates are based on Census Tract 22079010600, where the BEC is located.
e. The cancer risk estimates are based on Census Tract 22079010700, which is overlapping with the study area.

The emissions from 2017 AirToxScreen[28] for facilities located within 25 miles of the BEC are presented in **Table 4**, sorted by formaldehyde (i.e., the primary risk-driving chemical) emissions in descending order. As shown in this table, formaldehyde and acetaldehyde emissions from the BEC are one to two orders of magnitude lower than the major emitters in the region and are much lower than most of the surrounding facilities that emit these two chemicals. In addition, the BEC does not emit carbon tetrachloride. The emissions for the risk-driving chemicals from these major regional emitters have a significant impact on the ambient air concentrations and health risks in the Census tracts overlapping with the study area, especially the regional facilities clustered near the City of Alexandria located upwind of the BEC. The locations of facilities within 25 miles of the BEC emitting more than 0.1 tons per year of risk-driving chemicals (i.e., formaldehyde, acetaldehyde, and carbon tetrachloride) are shown in **Figure 3**.

Table 4. List of Facilities Emitting Cancer Risk or Respiratory HI Driving Chemicals in the Vicinity of Study Area						
Facility Name	**Census Tract ID**	**Emissions from 2017 AirToxScreen (ton per year)**				**Distance to the BEC (mile)**
		Acetal-dehyde	**Acrolein**	**Carbon Tetrachloride**	**Formal-dehyde**	
Martco, L.L.C. - Chopin Mill [a]	22069000900	1.1E+00	1.9E-02	0.0E+00	1.1E+01	11
Procter & Gamble Manufacturing Co [a, b]	22079011300	6.5E-05	0.0E+00	0.0E+00	4.8E+00	18
Hexion Specialty Chemicals Inc - Adhesive & Resin Division [a, b]	22079012700	0.0E+00	0.0E+00	0.0E+00	9.3E-01	19
Alexandria City of - DG Hunter Generating Station [a,b]	22079013900	1.3E+00	7.9E-01	5.7E-03	8.8E-01	16
Texas Gas Transmission LLC - Pineville Compressor Station [a, b]	22079013200	2.9E-02	4.6E-03	0.0E+00	5.1E-01	24
Boise Cascade Wood Products - Alexandria Engineered Wood Prod [c]	22079010600	1.0E-02	0.0E+00	0.0E+00	4.7E-01	0.6

Table 4. List of Facilities Emitting Cancer Risk or Respiratory HI Driving Chemicals in the Vicinity of Study Area						
Facility Name	Census Tract ID	Emissions from 2017 AirToxScreen (ton per year)				Distance to the BEC (mile)
		Acetal-dehyde	Acrolein	Carbon Tetrachloride	Formal-dehyde	
CLECO Power LLC - Brame Energy Center [c]	22079010600	7.9E-03	0.0E+00	0.0E+00	1.5E-01	0

Notes:

a. Within 25 miles of the BEC
b. Within or near the City of Alexandria
c. Within the Cleco BEC Property Boundary

Air Toxics Respiratory HI

The EJ Index for air toxics respiratory HI is a measure of estimated noncancer health impacts specific to the respiratory system. The environmental indicator for this EJ Index is an HI value of 0.44 (73rd percentile in state and 80-90th percentile in US). USEPA uses a risk management threshold HI of 1 to assess potential noncancer health impacts, wherein HIs less than 1 indicate exposures are below levels of concern. The HI of 0.44 reported for the 3-mile study area is below USEPA's threshold of 1, which indicates no potential for adverse noncancer health impacts.

The air toxics noncancer HI indicator value presented in EJScreen is based on USEPA's AirToxScreen 2017.[16,28] As with the cancer risk estimate provided in AirToxScreen, the noncancer HI value provided in EJScreen is associated with all Census tracts within which the project study area lies (i.e., Census tracts 22043020300, 22079010500, 22079010600, and 22079010700 as shown in **Figure 4**) and may reflect noncancer hazards associated with emissions from facilities that are distant from the BEC and may not accurately reflect hazards in the vicinity of the facility.

The 2017 AirToxScreen HI value of 0.44-0.45 in the corresponding census tracts represents an upper-bound baseline hazard level and is largely attributable to emissions of formaldehyde (39-45%), acetaldehyde (34-37%), acrolein (16-17%.) According to the 2017 AirToxScreen data, the BEC emits 0.008 and 0.15 tons of acetaldehyde and formaldehyde, respectively while it does not emit any acrolein. Compared to 2017 HI values, the 2019 AirToxScreen results for Census tracts 22043020300, 22079010500, 22079010600, and 22079010700 have trended downward and remained below USEPA's risk management threshold HI of 1, with HIs of 0.37 and 0.39, respectively. Relative contributions of acrolein to the HI have decreased between 2017 and 2019, but relative contributions of acetaldehyde and formaldehyde to the HI have increased for all Census tracts (see **Table 5**).

As shown in **Table 4**, acetaldehyde and formaldehyde emissions from the BEC are one to two orders of magnitude lower than the major emitters in the region and are much lower than most of the surrounding facilities that emit these two chemicals. In addition, the BEC does not emit acrolein. The emissions of the respiratory HI-driving chemicals from these major regional emitters have a significant impact on the ambient air concentrations and health risks in the Census tracts overlapping with the study area, especially the regional facilities clustered near the City of Alexandria located upwind of the

[28] Although EJScreen currently only uses results from 2017 AirToxScreen, results from more recent versions of AirToxScreen (i.e., 2018 AirToxScreen and 2019 AirToxScreen) which use the 2017 NEI data as a starting point but were updated for 2018 or 2019 based on comments provided by agencies during the AirToxScreen review are also publicly available for individual Census tracts and are referenced in this document.

BEC. The locations of facilities within 25 miles of the BEC emitting more than 0.1 tons per year of HI-driving chemicals (i.e., formaldehyde, acetaldehyde, and acrolein) are shown in **Figure 4**.

Table 5. Baseline Air Toxic Respiratory HI Reported in AirToxScreen 2017 & 2019 in Vicinity of the BEC

AirToxScreen Version	HI	Air Toxic Respiratory HI Contribution by Chemical (%)[a]		
		Acetaldehyde	Acrolein	Formaldehyde
Census Tract 22043020300[b]				
2017	0.44	37	16	40
2019	0.37	40	8	45
Census Tract 22079010500[c]				
2017	0.44	34	17	39
2019	0.37	37	10	43
Census Tract 22079010600[d]				
2017	0.45	37	16	40
2019	0.39	40	9	44
Census Tract 22079010700[e]				
2017	0.44	35	17	40
2019	0.37	36	9	40

Notes:

a. BEC does not and will not contribute to existing emissions of acrolein.
b. The air toxic respiratory HI estimates are based on Census Tract 22043020300, which is overlapping with the study area.
c. The air toxic respiratory HI estimates are based on Census Tract 22079010500, which is overlapping with the study area.
d. The air toxic respiratory HI estimates are based on Census Tract 22079010600, where the BEC is located.
e. The air toxic respiratory HI estimates are based on Census Tract 22079010700, which is overlapping with the study area.

HI = hazard index

$PM_{2.5}$

The EJ index for $PM_{2.5}$ (79th percentile in state and 83rd percentile in US) is based on an estimated 2018 $PM_{2.5}$ annual average concentration of 9.44 microgram per cubic meter (μg/m³).[29] The annual $PM_{2.5}$ concentration of 9.44 μg/m³ provided in the EJScreen tool for the 3-mile study area is derived from a 2018 analysis using the tool's downscaler method.[30] USEPA's model uses monitored data and

[29] USEPA. 2023. Overview of Environmental Indicators in EJScreen. Available at: https://www.epa.gov/ejscreen/overview-environmental-indicators-ejscreen

[30] EJScreen estimates PM2.5 data using a combination of monitoring data and Community Multiscale Air Quality (CMAQ) modeling. The additional methodology is discussed in EPA Report EPA-454/S-15-001.

community-scale model data to develop a relationship between observed concentrations from monitors and modeled concentrations to predict concentrations in unmonitored regions. When evaluated in the absence of the demographic index, this environmental indicator is ranked below the 80th percentile on both a state and national scale. Comparing the annual average $PM_{2.5}$ concentration of 9.44 µg/m^3 to the current NAAQS value of 12 µg/m^3 demonstrates compliance with current NAAQS standard.[31] Furthermore, the most recent annual $PM_{2.5}$ design value, which describes the air quality status of a given area, for Rapides Parish is 7.4 µg/m^3, which is well under current NAAQS standard.[32]

Wastewater Discharge

The EJ Index for wastewater discharge ranked above the 80th percentile; however, the environmental indicator for wastewater discharge evaluated in the absence of the demographic index was below the 80th percentile on both a state and national scale. This indicator takes into account the proximity of the average resident to a stream or river reach receiving Louisiana Pollutant Discharge Elimination System (LPDES) loadings reported to the Toxic Release Inventory (TRI). This discharge information is used in USEPA's Risk Screening Environmental Indicators (RSEI)[33] model that combines information on chemical concentrations, fate and transport factors, weighted toxicity values, and other factors to allow users to perform comparative analyses of specific facilities, industries, or geographies. EJScreen relies on RSEI modeled outputs to generate a toxicity-weighted stream concentration for segments within 500 meters of the study area, divided by distance between the study area and stream segment.

The environmental indicator value of wastewater discharge in the study area is 0.013, which is one to two orders of magnitude lower than the state average value (0.37) and the US average (12). Despite the very low environmental indicator value for the study area relative to the state and US comparison populations, the percentiles for this environmental indicator in the study area range between the 71st to 79th percentiles between the two comparison populations, and the EJ Index for wastewater discharge is at or greater than the 80th percentile threshold (80th percentile in state and 83rd percentile in US, see **Table 1**).

In an email from USEPA responding to questions about the EJScreen wastewater indicator posed by LDEQ for an analysis associated with a permitting action for a facility owned by Entergy Louisiana, USEPA explained that the high percentiles of this EJ Index and the underlying environmental indicator are due to:

> 1) A 3-kilometer (km) cutoff around stream segments for processing, which results in a large number of block group values being set to zero (for Louisiana, 29% of block groups have a wastewater discharge indicator of zero), and
>
> 2) the data having a logarithmic distribution, with most values being very small, so even a very low environmental indicator value for wastewater discharge ends up being high on the distribution curve.[34]

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[31] USEPA. 2022. NAAQS Table. Available at: https://www.epa.gov/criteria-air-pollutants/naaqs-table

[32] USEPA. 2022. Air Quality Design Values. Available at: https://www.epa.gov/air-trends/air-quality-design-values

[33] USEPA. 2023. Risk-Screening Environmental Indicators Model. Available at: https://www.epa.gov/rsei

[34] 2022. LDEQ. Basis of Decision, Entergy Louisiana, Michoud Electric Generating Plant and New Orleans Power Station, Permit No. LA0004324. https://edms.deq.louisiana.gov/app/doc/view?doc=12303187, accessed October 31, 2022. On August 4, 2020 email from USEPA, questions raised regarding low wastewater treatment metric resulting in elevated EJ Index, "The numbers look odd for 2 reasons. First, the data has a logarithmic distribution,

Given the low environmental indicator value for wastewater discharge relative to state and US averages, the high percentiles for this EJ Index may not accurately represent the baseline wastewater discharge condition in the study area surrounding the BEC. Instead, the very low environmental indicator value for wastewater discharge demonstrates that the baseline wastewater discharge condition in the study area does not pose an environmental justice concern for the communities surrounding the BEC.

Socioeconomic/Demographic Indicators

EJScreen evaluates seven socioeconomic/demographic indicators that represent the social vulnerability characteristics of a population that does not have equitable access to environmental protections afforded to other populations. These factors are listed in the EJScreen standard report (**Attachment 1**). EJScreen calculates a demographic index of 49% for the study area, as compared to the state of Louisiana's average of 41% and the US average of 35%. The demographic index is at the 64^{th} percentile when compared to the rest of the state. No socioeconomic/demographic indicators ranked at or greater than the 80^{th} percentile in the state or US comparison populations.

with most values being very small, so this example ends up being high on the distribution curve even though it is a fairly small number. This characteristic is then reinforced because there is a 3 km cutoff around stream segments for the processing. This results in a large number of block group values being set to Zero. For Louisiana, 29% of block groups have a Wastewater Discharge Indicator of Zero."

3. CONCLUSION AND SUMMARY

This baseline EJ analysis was performed to develop an understanding of potential EJ related concerns that could arise during project scoping and inform future mitigation and outreach efforts. Among the 12 EJ Indexes calculated by USEPA's EJScreen tool for the study area surrounding the BEC, three ranked above or equal to the 80th percentile threshold used by USEPA and LDNR to assess the need for further evaluation: air toxics respiratory HI, $PM_{2.5}$, and wastewater discharge. Another EJ Index of interest was air toxics cancer risk that exceeded the 75th percentile. Although the EJ Index for air toxics cancer risk did not exceed the 80th percentile, the environmental indicator for cancer risk was in the 80th-90th percentile for the US when evaluated without demographic indicators. Based on the EJScreen report, additional analysis of the three EJ Indexes, which exceeded the 80th percentile and air toxics cancer risk was performed. This analysis is summarized as follows:

- Air Toxics Cancer Risk: Risks calculated by EJScreen and AirToxScreen for the study area were within the USEPA's acceptable risk management ranges.
    - EJScreen reported a 2017 cancer risk value of 30 per million, which is within the 1 to 100 per million risk management range established by USEPA.
    - AirToxScreen reported 2017 cancer risks of 32-33 per million and 2019 cancer risks of 30-31 per million, which are within the 1 to 100 per million risk management range established by USEPA.
- Air Toxics Respiratory HI: Hazard indexes calculated by EJScreen and AirToxScreen for the study area were below EPA's acceptable risk management threshold.
    - EJScreen reported a 2017 air toxics respiratory HI of 0.44 for the study area, which is below USEPA's risk management threshold of 1.
    - AirToxScreen reported 2017 HI values of 0.44-0.45 and 2019 HI values of 0.37-0.39, which are below USEPA's risk management threshold of 1.
- Particulate Matter 2.5 ($PM_{2.5}$): The concentration of $PM_{2.5}$ calculated by EJScreen for the study area was 9.44 µg/m3.
    - When evaluated in the absence of demographic indicators, the environmental indicator did not exceed the 80th percentile.
    - While the $PM_{2.5}$ concentration was estimated, the resulting value falls below the annual $PM_{2.5}$ NAAQS and is not currently a pollutant of concern for the community.
- Wastewater Discharge: The wastewater discharge environmental indicator value calculated by EJScreen for the study area was 0.013.
    - The environmental indicator value is smaller than the state average of 0.37 and the US average of 12.
    - When evaluated in the absence of demographic indicators, the environmental indicator did not exceed the 80th percentile.

In conclusion, EJ Indexes at or near the 80th percentile in the 3-mile study area corresponded to environmental indicators that did not exceed the 80th percentile or that were within or below thresholds established by the USEPA. Future analysis as Project Diamond Vault progresses can focus on using these baseline results to prioritize environmental benefits and mitigation efforts for local communities.

FIGURES

Sensitive, Confidential, or Privileged Information

[redacted]

PROJECT: 1690029667 | DATED: 16-Mar-23 | DESIGNER: NA

Y:\Cleco\Baseline EJ\Figure 2 - Diamond Vault Concept.pdf

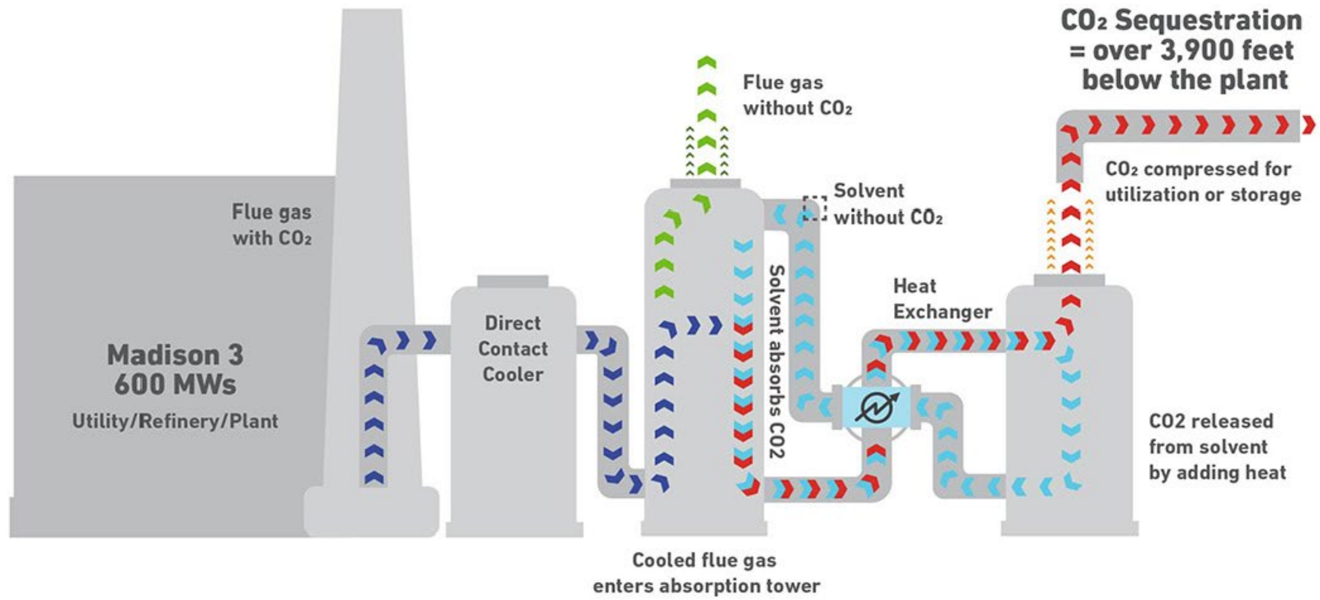


Figure Credits: Cleco Corporate Holdings LLC

PROPOSED PROJECT DIAMOND VAULT CARBON CAPTURE AND SEQUESTRATION PROCESS

Cleco Power, LLC.
Brame Energy Center

FIGURE 2

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

Sensitive, Confidential, or Privileged Information

[redacted]

Sensitive, Confidential, or Privileged Information

[redacted]

ATTACHMENT

EJScreen Report (Version 2.1)

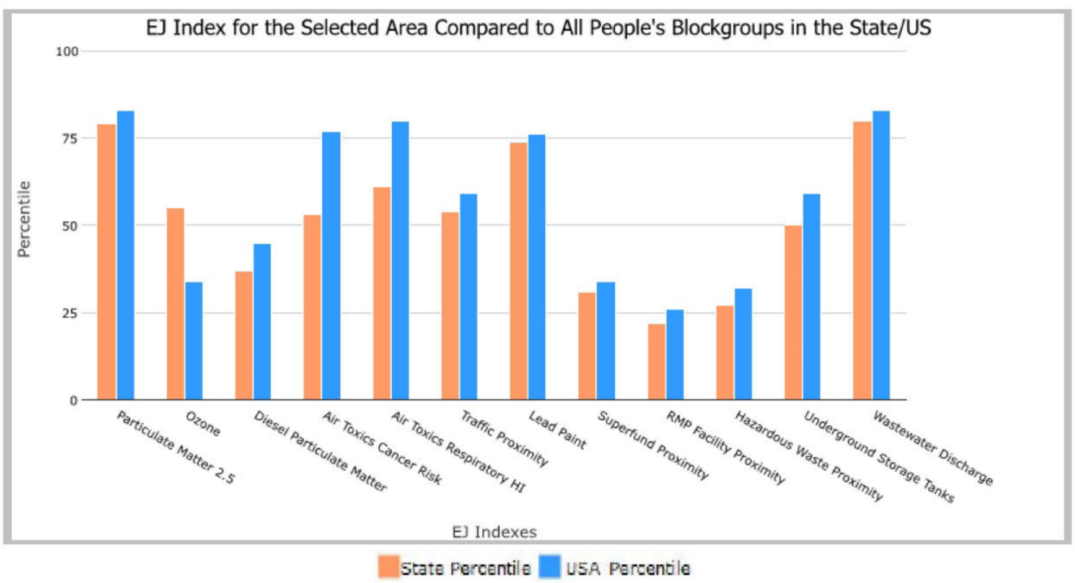
3 miles Ring around the Area, LOUISIANA, EPA Region 6

Approximate Population: 2,302

Input Area (sq. miles): 82.93

Cleco Brame Property

Selected Variables	State Percentile	USA Percentile
Environmental Justice Indexes		
EJ Index for Particulate Matter 2.5	79	83
EJ Index for Ozone	55	34
EJ Index for Diesel Particulate Matter*	37	45
EJ Index for Air Toxics Cancer Risk*	53	77
EJ Index for Air Toxics Respiratory HI*	61	80
EJ Index for Traffic Proximity	54	59
EJ Index for Lead Paint	74	76
EJ Index for Superfund Proximity	31	34
EJ Index for RMP Facility Proximity	22	26
EJ Index for Hazardous Waste Proximity	27	32
EJ Index for Underground Storage Tanks	50	59
EJ Index for Wastewater Discharge	80	83



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

February 01, 2023 1/3

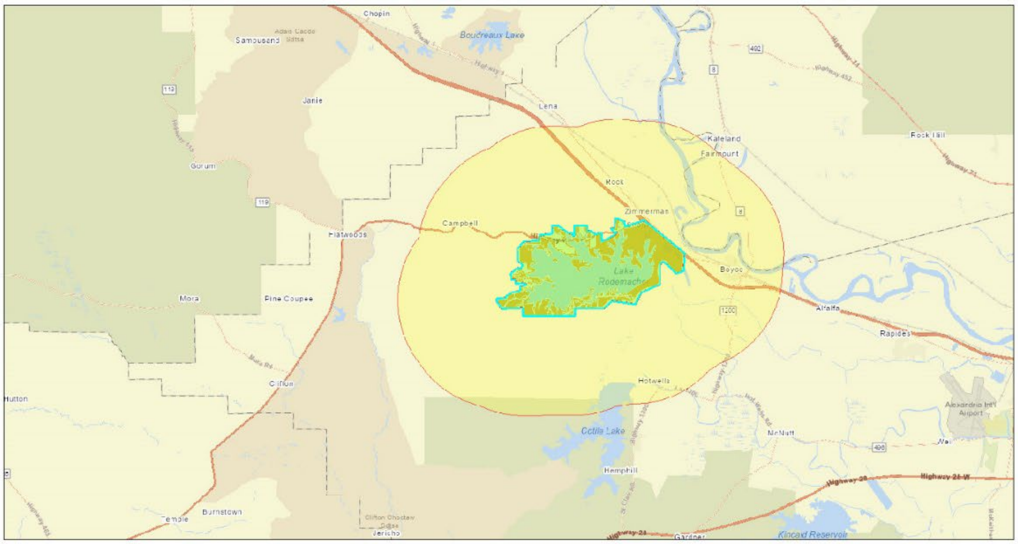
EJScreen Report (Version 2.1)

3 miles Ring around the Area, LOUISIANA, EPA Region 6

Approximate Population: 2,302

Input Area (sq. miles): 82.93

Cleco Brame Property



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

EPA United States Environmental Protection Agency

EJScreen Report (Version 2.1)

3 miles Ring around the Area, LOUISIANA, EPA Region 6

Approximate Population: 2,302

Input Area (sq. miles): 82.93

Cleco Brame Property

Selected Variables	Value	State Avg.	%ile in State	USA Avg.	%ile in USA
Pollution and Sources					
Particulate Matter 2.5 ($\mu g/m^3$)	9.44	9.2	68	8.67	74
Ozone (ppb)	36	37	35	42.5	14
Diesel Particulate Matter* ($\mu g/m^3$)	0.111	0.297	15	0.294	<50th
Air Toxics Cancer Risk* (lifetime risk per million)	30	40	52	28	80-90th
Air Toxics Respiratory HI*	0.44	0.45	73	0.36	80-90th
Traffic Proximity (daily traffic count/distance to road)	98	640	35	760	33
Lead Paint (% Pre-1960 Housing)	0.26	0.2	69	0.27	54
Superfund Proximity (site count/km distance)	0.017	0.076	16	0.13	14
RMP Facility Proximity (facility count/km distance)	0.066	0.96	9	0.77	9
Hazardous Waste Proximity (facility count/km distance)	0.064	1.4	12	2.2	12
Underground Storage Tanks (count/km^2)	0.18	2.2	30	3.9	31
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.013	0.37	79	12	71
Socioeconomic Indicators					
Demographic Index	49%	41%	64	35%	73
People of Color	50%	42%	62	40%	67
Low Income	47%	38%	62	30%	77
Unemployment Rate	5%	7%	56	5%	60
Limited English Speaking Households	1%	2%	76	5%	57
Less Than High School Education	14%	14%	57	12%	69
Under Age 5	7%	7%	66	6%	70
Over Age 64	14%	15%	49	16%	44

*Diesel particular matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

For additional information, see: www.epa.gov/environmentaljustice

EJScreen is a screening tool for pre-decisional use only. It can help identify areas that may warrant additional consideration, analysis, or outreach. It does not provide a basis for decision-making, but it may help identify potential areas of EJ concern. Users should keep in mind that screening tools are subject to substantial uncertainty in their demographic and environmental data, particularly when looking at small geographic areas. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJScreen documentation for discussion of these issues before using reports. This screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location. EJScreen outputs should be supplemented with additional information and local knowledge before taking any action to address potential EJ concerns.

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EJScreen Report (Version 2.1)

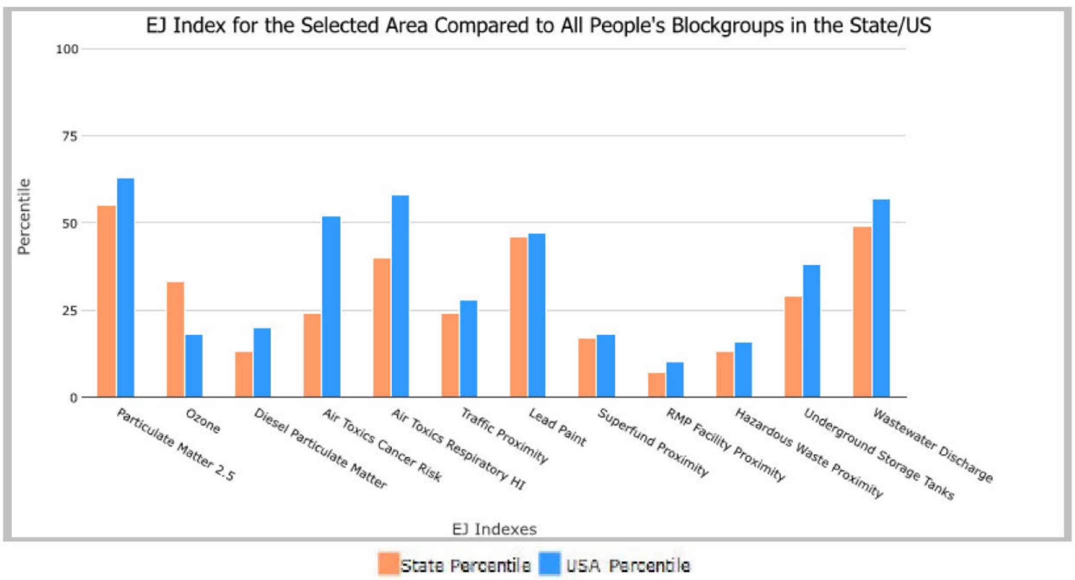
1 mile Ring around the Area, LOUISIANA, EPA Region 6

Approximate Population: 217

Input Area (sq. miles): 29.30

Cleco Brame Property

Selected Variables	State Percentile	USA Percentile
Environmental Justice Indexes		
EJ Index for Particulate Matter 2.5	55	63
EJ Index for Ozone	33	18
EJ Index for Diesel Particulate Matter*	13	20
EJ Index for Air Toxics Cancer Risk*	24	52
EJ Index for Air Toxics Respiratory HI*	40	58
EJ Index for Traffic Proximity	24	28
EJ Index for Lead Paint	46	47
EJ Index for Superfund Proximity	17	18
EJ Index for RMP Facility Proximity	7	10
EJ Index for Hazardous Waste Proximity	13	16
EJ Index for Underground Storage Tanks	29	38
EJ Index for Wastewater Discharge	49	57



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

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EPA United States Environmental Protection Agency

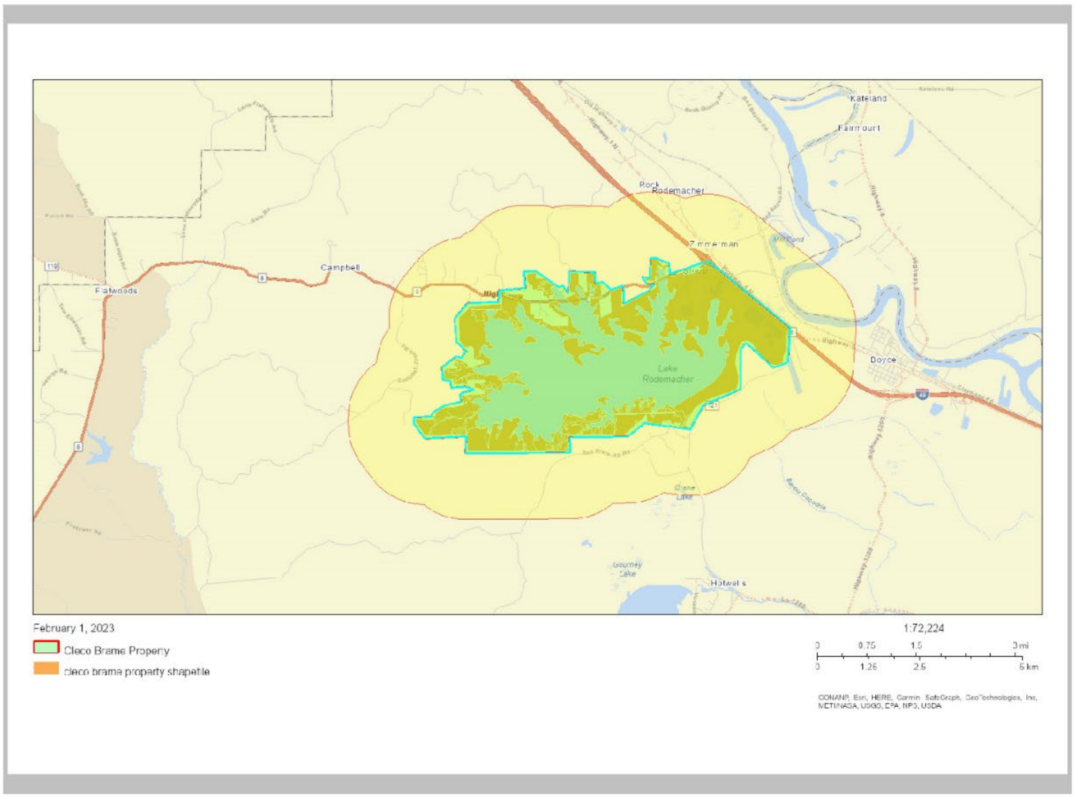
EJScreen Report (Version 2.1)

1 mile Ring around the Area, LOUISIANA, EPA Region 6

Approximate Population: 217

Input Area (sq. miles): 29.30

Cleco Brame Property



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

EJScreen Report (Version 2.1)

1 mile Ring around the Area, LOUISIANA, EPA Region 6

Approximate Population: 217

Input Area (sq. miles): 29.30

Cleco Brame Property

Selected Variables	Value	State Avg.	%ile in State	USA Avg.	%ile in USA
Pollution and Sources					
Particulate Matter 2.5 ($\mu g/m^3$)	9.42	9.2	65	8.67	74
Ozone (ppb)	36	37	34	42.5	14
Diesel Particulate Matter* ($\mu g/m^3$)	0.0868	0.297	5	0.294	<50th
Air Toxics Cancer Risk* (lifetime risk per million)	30	40	52	28	80-90th
Air Toxics Respiratory HI*	0.49	0.45	86	0.36	90-95th
Traffic Proximity (daily traffic count/distance to road)	32	640	20	760	18
Lead Paint (% Pre-1960 Housing)	0.15	0.2	54	0.27	42
Superfund Proximity (site count/km distance)	0.017	0.076	16	0.13	13
RMP Facility Proximity (facility count/km distance)	0.045	0.96	3	0.77	5
Hazardous Waste Proximity (facility count/km distance)	0.052	1.4	9	2.2	9
Underground Storage Tanks (count/km^2)	0.07	2.2	22	3.9	26
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.0042	0.37	61	12	62
Socioeconomic Indicators					
Demographic Index	25%	41%	31	35%	42
People of Color	19%	42%	33	40%	38
Low Income	30%	38%	38	30%	54
Unemployment Rate	6%	7%	62	5%	67
Limited English Speaking Households	0%	2%	76	5%	0
Less Than High School Education	17%	14%	64	12%	76
Under Age 5	2%	7%	27	6%	21
Over Age 64	22%	15%	76	16%	74

*Diesel particular matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

For additional information, see: www.epa.gov/environmentaljustice

Appendix B – The “IT Decision” – Response to Five Questions

Per the requirements by the state of Louisiana and the Louisiana Department of Natural Resources (LDNR) this project will comply with the requirements of the “IT Decision” including answering and submitting the 5 “IT Questions” for the Cleco Diamond Vault site. The questions to be answered are as follows:

1. Have the potential and real adverse environmental effects of the proposed facility been avoided to the maximum extent possible?
2. Does a cost benefit analysis of the environmental impact costs balanced against the social and economic benefits of the proposed facility demonstrate that the latter outweighs the former?
3. Are there alternative projects which would offer more protection to the environment than the proposed facility without unduly curtailing non-environmental benefits?
4. Are there alternative sites which would offer more protection than the proposed facility site without unduly curtailing non-environmental benefits?
5. Are there mitigating measures which would offer more protection to the environment than the facility as proposed, without unduly curtailing non-environmental benefits?

These questions and requirements will be resolved in detail. Thoughtful answers to these questions are being developed in conjunction with an air permit by Cleco’s environmental consultant. Upon completion, this information will be added to future revisions of this permit.

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