5.0 PRE-OPERATIONAL TESTING PLAN

40 CFR 146.82(a)(8), 146.87

CASS SEQUESTRATION

Facility Information

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Well name: [redacted]

Well location: CASS COUNTY, INDIANA
[redacted]

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5.0 Pre-Operational Testing Program

5.1 Introduction

The pre-operational formation testing program describes how Cass Sequestration, LLC ("Cass Sequestration") will meet the testing requirements of 40 CFR 146.87 and well construction requirements of 40 CFR 146.86.

The requirements of 40 CFR 146.87 include verification of formation depths, thickness, mineralogy, lithology, porosity, permeability, and geomechanical information of the Mt. Simon storage formation and overlying Eau Claire confining formation prior to injection well construction. These pre injection baseline data are also used as a reference to identify samples collected during injection operation that may result from the injection of CO_2.

At the Cass Sequestration site, a stratigraphic test well (STW), Logansport #1 test well [redacted] was drilled at the proposed injection well location to provide the site-specific subsurface data required by 40 CFR 146.87 and to support subsequent geostatistical model building and CO_2 injection simulation. The well was spudded on October 2nd 2024, and reached a total depth of [redacted] on October 24th 2024. After all required data had been acquired, the well was shut-in, secured, and the rig was released on October 30th, 2024. The STW was drilled and completed in such a way that it can be converted to the injection well. Construction details of the converted injection well can be found in Permit Section 4 - Injection Well Construction Plan.

An overview of the project site is presented in **Figure 5-1** which shows the location of the proposed injection well, the Area Of Review (AoR) and local infrastructure.

Data collected in the STW includes extensive [redacted] which has been incorporated into the static earth and dynamic models (Permit Section 2 – AoR and Corrective Action Plan) from which the AoR is derived. **Figure 5-2** summarizes the type of data acquired. A list of final graphic files associated with these data is shown in **Appendix A** and the files themselves have been uploaded to the GSDT as part of this permit application.

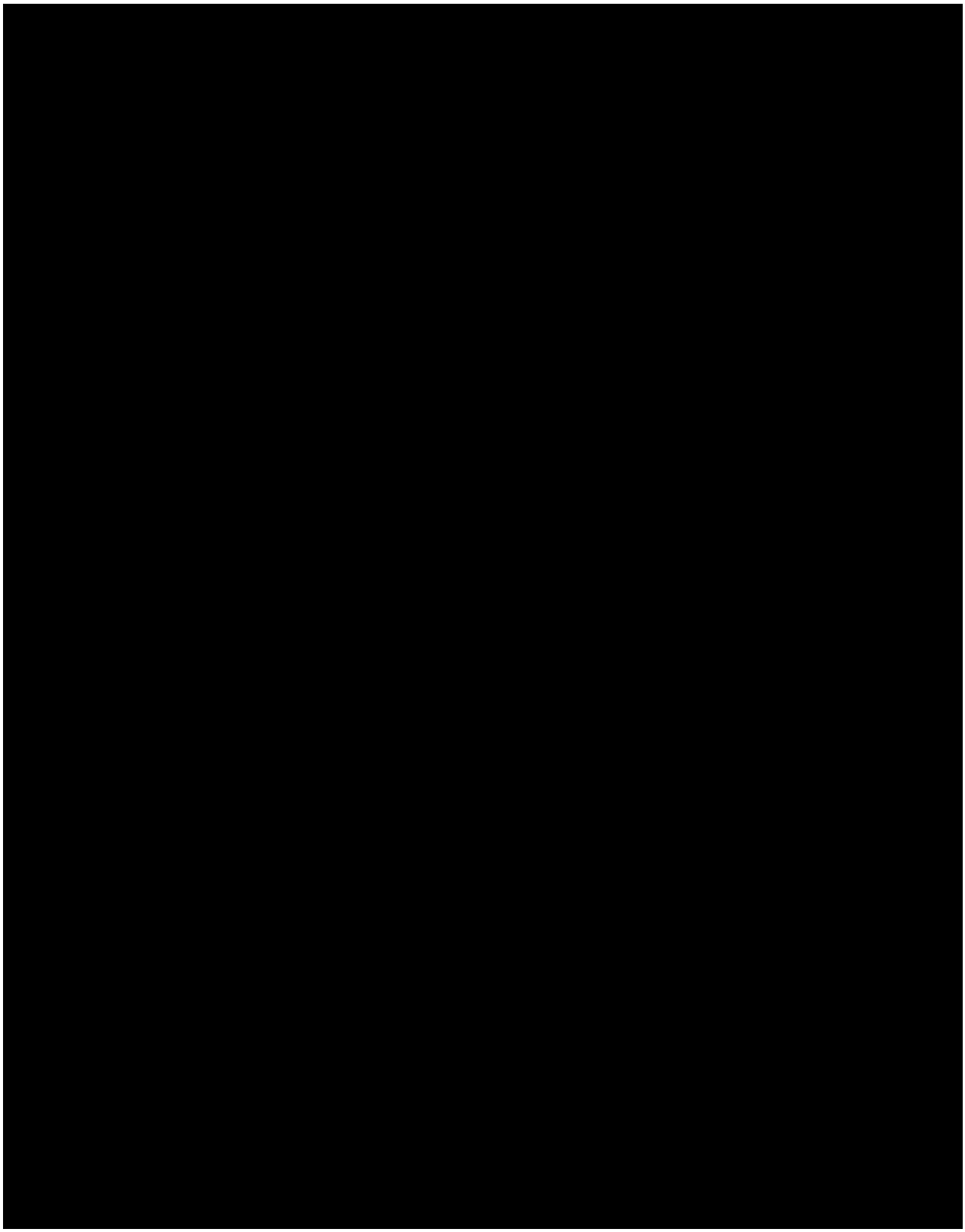

Figure 5-1: Map of Cass Sequestration project showing injection well [redacted] In Zone (IZM-1) and Above Zone (AZM-1) monitor wells, conceptual location of seismicity stations and AoR. The satellite base image is unaltered and includes all required components of 40 CFR 146.82(a)(2).

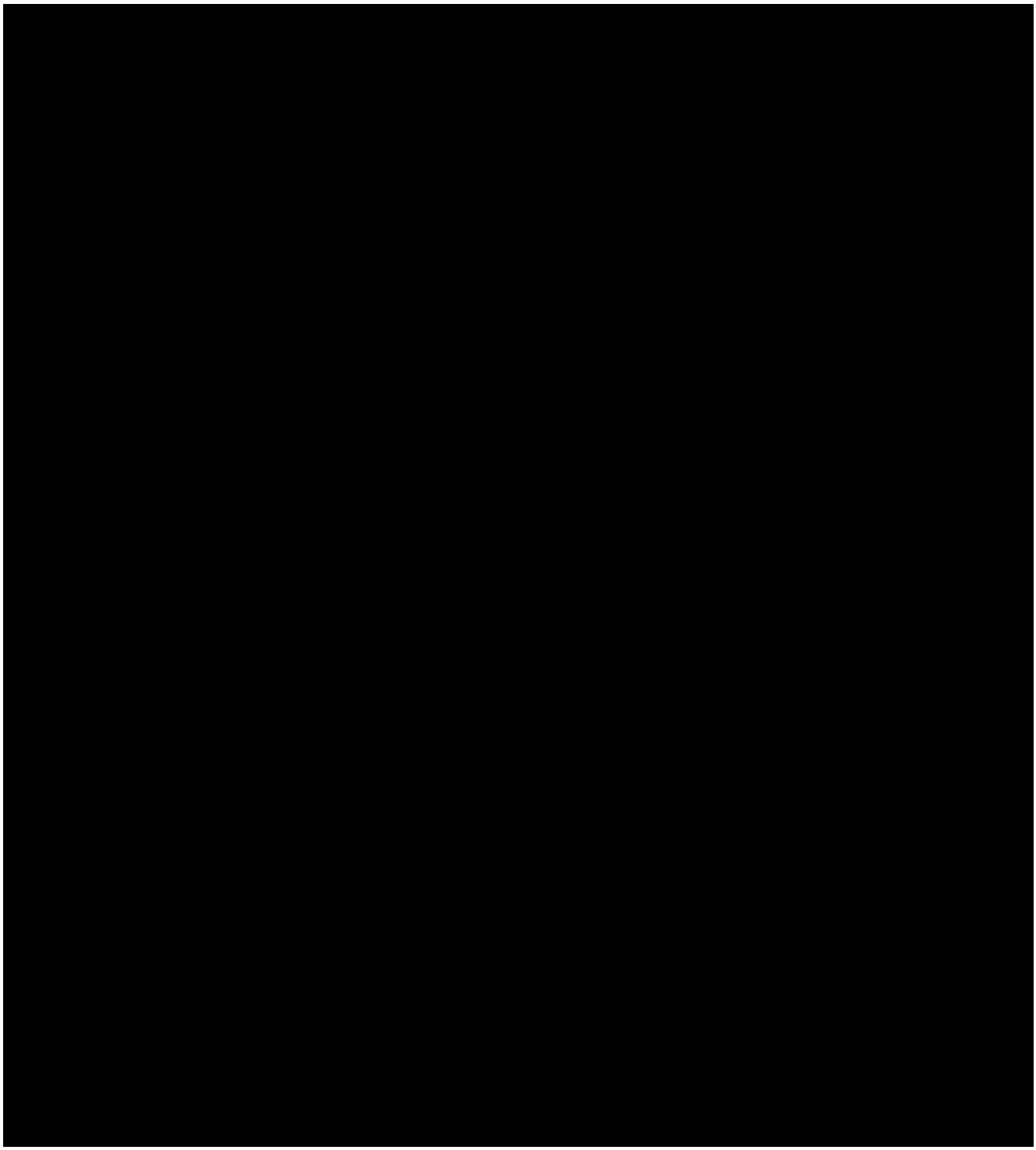

Figure 5-2: Schematic summary illustrating data collected in STW (Logansport #1).

5.2 Pre-Operational Testing During Injection Well Installation (40 CFR 146.87 (a))

5.2.1 Deviation Surveys (40 CFR 146.87 (a)(1))

Deviation surveys were obtained as the STW was drilled to determine the wellbore path from the surface to the total depth (TD) of the well. The well was drilled with measurement while drilling (MWD) equipment (inclusive of downhole motor) allowing the wellbore deviation to be corrected as necessary. [redacted]

5.2.2 Well Logging: Surface Section (40 CFR 146.87 (a)(2))

During drilling of the STW, open hole well logs were acquired prior to setting surface casing as well as after surface casing was set and cemented (Table 5-1). Open hole logs included [redacted] **Table 5-1** summarizes the well logs that were acquired before and after surface casing was set and the purpose of each well log.

The cased hole well logs were acquired after the surface casing had been set and cemented. Cement integrity was evaluated through a basic cement bond log – variable density log (CBL-VDL) without pressure and with a gamma ray tool for depth correlation. The depth interval over which these data were acquired is shown in **Figure 5-2**. A list of final graphic files associated with these data is shown in **Appendix A** and the files themselves have been uploaded to the GSDT as part of this permit application.

Table 5-1: Summary of wireline logs, associated parameters of logging tools and graphical files run before and after surface casing during drilling of STW.

5.2.3 Well Logging: Secondary Surface Section (40 CFR 146.87 (a)(2))

During drilling of the STW, open hole well logs were acquired after the second surface section of the well was drilled to characterize the deeper geology of this interval before casing and cementing were installed. Open hole logs included [redacted] **Table 5-2** summarizes the well logs that were acquired in the intermediate well section and the purpose of each well log.

After the second surface casing string was cemented, logs were acquired to evaluate the cement integrity. Cement integrity was evaluated through an un-pressurized CBL-VDL run with a gamma ray tool for depth correlation. The depth interval over which these data were acquired is shown in **Figure 5-2**. A list of final graphic files associated with these data is shown in **Appendix A** and the files themselves have been uploaded to the GSDT as part of this permit application.

Table 5-2: Summary of wireline logs and associated parameters of logging tools run before and after secondary surface casing during drilling of STW.

5.2.4 Well Logging: Open hole Section (40 CFR 146.87 (a)(3))

During drilling of the STW, well logs were acquired in the open hole section of the well to characterize the deeper geology at the site. Open hole logs included [redacted]. **Table 5-3** summarizes the well logs that were acquired in the open hole deep section, well logs that will be acquired in the cased hole deep section, and the purpose of each well log.

Upon conversion of the STW to an injection well, the production casing will be cemented and logs will be acquired to evaluate cement quality and provide baseline data for external well integrity. Cement quality will be evaluated through a CBL-VDL log. If further investigation becomes necessary an advanced ultrasonic logging tool will be run. The depth interval over which these data were acquired is shown in **Figure 5-2**. A list of final graphic files associated with these data is shown in **Appendix A** and the files themselves have been uploaded to the GSDT as part of this permit application

Table 5-3: Summary of wireline logs, associated parameters of logging tools and graphical files, that were run in the open hole.

5.2.5 Injection Well Mechanical Integrity Testing (40 CFR 146.87 (a)(4))

Internal and external Mechanical Integrity Testing (MIT) will be completed after the STW has been converted to the injection well.

5.2.5.1 Internal Mechanical Integrity Testing (40 CFR 146.87 (a)(4)(i))

Internal mechanical integrity refers to the internal integrity or seal within the production casing string (i.e., between the production casing string, tubing, and packer). The quality of this seal can be confirmed with a MIT and tubing-casing annular pressure monitoring. Corrosion of the tubing string can result in internal mechanical issues, and inspection of the tubing will be performed to monitor the tubing for corrosion (Permit Section 7 - Testing and Monitoring Plan).

After the packer, tubing, and downhole equipment have been installed, and the tubing/casing annulus has been filled with a corrosion-inhibiting fluid (a dilute potassium chloride [KCl] solution with additives, or equivalent), a MIT will be conducted on the annular space of the injection well to ensure that there are no leaks in the tubing, casing, or packer. [redacted] The annular pressure will be monitored for [redacted] minutes to measure pressure loss. A pressure loss of less than [redacted] of the initial value would indicate proper internal mechanical integrity. If a pressure loss greater than [redacted] is observed, the cause of the poor mechanical integrity will be identified and corrected.

Once injection commences, injection pressure, annular pressure, and annular fluid volumes will be monitored to ensure the internal well integrity and proper annular pressure is maintained (Permit Section 7 - Testing and Monitoring Plan).

5.2.5.2 External Mechanical Integrity (40 CFR 146.87 (a)(4) (ii – iv))

External mechanical integrity refers to the absence of fluid movement/leaks through channels between the long casing string and the borehole or the second surface casing string.

Generally accepted methods for evaluating external mechanical integrity include the following:

- Temperature or noise log
- Radioactive tracer logging
- Oxygen-activation logging

A baseline temperature measurement will be acquired from surface to TD of the injection well to provide initial temperature conditions over the well. Temperature measurements acquired after injection has started will be compared to this log to determine if anomalies are present in the subsequent logging events that may be attributed to external integrity issues (Permit Section 7.0 - Testing and Monitoring Plan). If the temperature measurement data suggests an issue with external

well integrity exists, an oxygen-activation log or other secondary method will be performed to evaluate external well integrity with greater sensitivity.

In addition to the baseline temperature log and a CBL-VDL will be run over the entire depth of the long casing string shortly after completion of the injection well to confirm that the casing string was properly cemented. CBL-VDLs are recorded with sonic tools that detect the bond of the casing and formation to the cement between the casing and wellbore to identify damage. In the event of inconclusive cement bond information an ultrasonic tool will be run to provide higher accuracy and resolution for cement evaluation.

5.3 Injection Well Core Program (40 CFR 146.87 (b))

[redacted] **Figure 5-2** shows the depths at which both were acquired. A description of the [redacted] collected and the corresponding information derived is detailed in Section 1.2.4 of the Project Narrative. A list of final graphic files associated with these data is shown in **Appendix A** and the files themselves have been uploaded to the GSDT as part of this permit application.

5.4 Injection Well: Fluid Sampling and Analysis (40 CFR 146.87 (b – d))

[redacted] (**Figure 5-2**). A list of final graphic files associated with these data is shown in Appendix A and the files themselves have been uploaded to the GSDT as part of this permit application. [redacted]

[redacted] Additional details on the sampling and analysis of samples collected throughout the remainder of the project are provided in the Testing and Monitoring Plan and Post-Injection Site Closure Plan (Sections 7 and 9, respectively).

5.5 Injection Well Geomechanical Testing (40 CFR 146.87 (d))

[redacted] (**Figure 5-2**), and is described in Permit Section 1.2.5 of the Project Narrative.

5.6 Injection Well Hydrogeologic Characteristics (40 CFR 146.87 (e))

Upon completion, prior to operation, the injection well will receive an injectivity test with pressure fall-off to verify the hydrogeologic characteristics of the injection zone.

5.7 Injection Well Schedule (40 CFR 146.87 (f))

Cass Sequestration will provide the Director with the opportunity to witness all logging and testing by this subpart. The owner or operator will submit a schedule of such activities to the Director 30 days prior to conducting the first test and submit any changes to the schedule 30 days prior to the next scheduled test.

Appendix A – Graphic files associated with data acquired in STW