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Denbury Carbon Solutions, LLC

## Testing and Monitoring Plan

Draco Storage Facility, Allen, Beauregard, and Vernon Parishes, Louisiana

Denbury 

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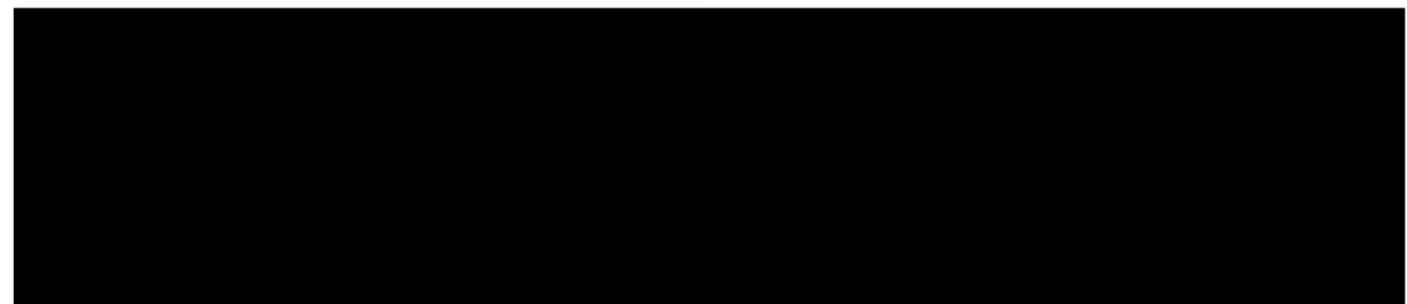
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## ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition

CO <sub>2</sub>	Carbon Dioxide
Cr	Chromium
CRDS	Cavity Ring-Down Spectroscopy
Cu	Copper
δ <sup>13</sup> C	Lower Carbon Isotope
DIC	Dissolved Inorganic Carbon
DO	Dissolved Oxygen
DRO	Diesel Range Organics
ERRP	Emergency and Remedial Response Plan
Fe	Iron
Fl	Flerovium
Ft	feet
GC	Gas Chromatograph
g/cc	Grams per Cubic Centimeter
GRO	Gasoline Range Organics
H	Hydrogen
Hg	Mercury
H <sub>2</sub> S	Hydrogen Sulfide
IRMS	Isotope Ratio Mass Spectrometry
IZM	In-Zone Monitor
K	Potassium
LAC	Louisiana Administrative Code
LDNR	Louisiana Department of Natural Resources
Li	Lithium
LLC	Limited Liability Company
mBq/L	Megabecquerel per Liter
µg/L	Microgram per Liter

Mg	Magnesium
mg/L	Milligram per Liter
Mn	Manganese
MS	Mass Spectrometry
mS/cm	Millisiemens per Centimeter
MSD	Mass Spectrometry Detector
mV	Millivolts
N <sub>2</sub>	Nitrogen (gaseous)
Na	Sodium
N/A	Not Applicable
NAD27	North American Datum of 1927
Ni	Nickle
NO	Nitric Oxide
NO <sub>2</sub>	Nitrogen Dioxide
NO <sub>3</sub>	Nitrate
O <sub>2</sub>	Oxygen (gaseous)
ORO	Oil Range Organics
ORP	Oxidation Reduction Potential
Pb	Lead
pCi/L	Picocuries per Liter of Air
pH	Potential of Hydrogen
PISC	Post-Injection Site Care and Site Closure
P/T	Pressure and temperature
PM	Preventive Maintenance
PNL	Pulsed Neutron Log
ppmV	Parts per Million Volume
psi	Pounds per Square Inch

QA	Quality Assurance
QASP	Quality Assurance and Surveillance Plan
QC	Quality Control
Ra	Radium
RGA	Refinery Gas Analyzer
Rn	Radon
RST	Reservoir Saturation Tool
Sb	Antimony
Se	Selenium
SN	Serial Number
SO <sub>2</sub>	Sulfur Dioxide
SO <sub>4</sub>	Sulfate
SOP	Standard Operating Procedure
Sr	Strontium
SRT	Step Rate Test
SU	Standard Unit
TBD	To be Determined
Tl	Thallium
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbon
TVD	True Vertical Depth
U	Uranium
UIC	Underground Injection Control
USDW	Underground Source of Drinking Water
USEPA	United States Environmental Protection Agency
USIT	Ultrasonic Imager Tool
VMP	Vapor Monitoring Points

VOC	Volatile Organic Compound
Zn	Zinc
3D	3 Dimensional
4D	4 Dimensional

## 1.0 FACILITY INFORMATION

Facility Name: Draco Storage Facility

Facility Location: [REDACTED]

Mailing Address: 5851 Legacy Circle, Suite 1200  
Plano, Texas 75024

Well Location(s) [REDACTED]

This Testing and Monitoring Plan describes how Denbury Carbon Solutions, LLC (Denbury) will monitor the Draco Storage Facility site pursuant to USEPA 40 CFR §146.90 and LAC 43: XVII §3625.A. In addition to demonstrating that the well is operating as planned, the carbon dioxide (CO<sub>2</sub>) plume and pressure front are moving as predicted, and that there is no endangerment to underground source of drinking water (USDW), the monitoring data will be used to validate and adjust the geological models used to predict the distribution of CO<sub>2</sub> within the storage zone to support Area of Review (AoR) reevaluations and a non-endangerment demonstration.

## 2.0 OVERALL STRATEGY AND APPROACH FOR TESTING AND MONITORING

This Testing and Monitoring Plan for the Draco Storage Facility includes an analysis of the injected CO<sub>2</sub>, periodic testing of the injection well, a corrosion-monitoring plan for the CO<sub>2</sub> injection well components, a monitoring plan for the operational parameters of the CO<sub>2</sub> injection system, and a leak detection plan to monitor for potential movement of CO<sub>2</sub> outside of the storage reservoir. As such, this plan simultaneously meets the permit requirements for three required monitoring activities:

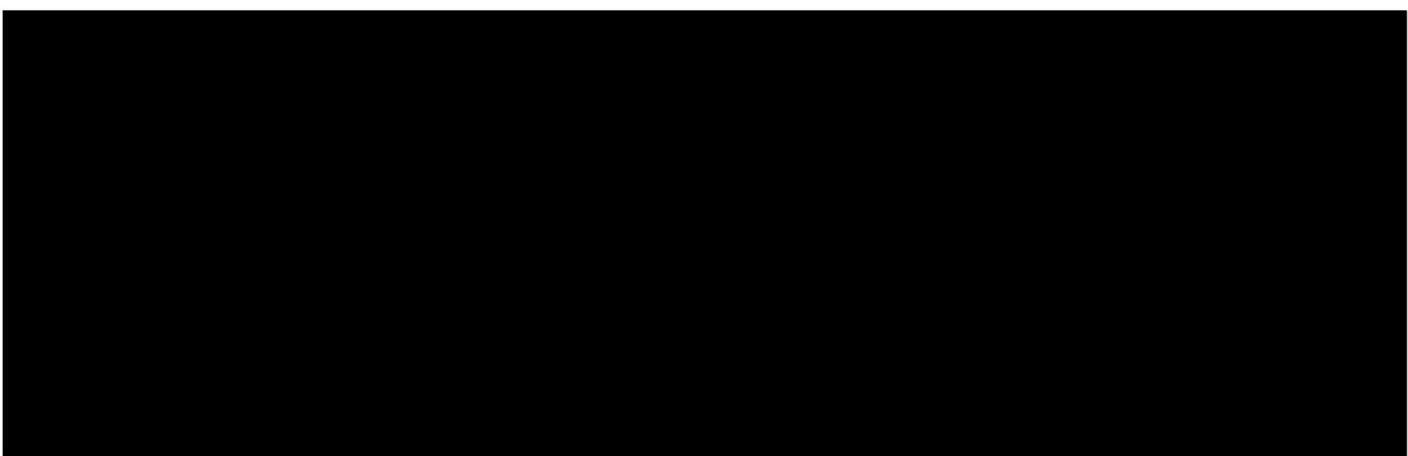
- 1) Corrosion monitoring and prevention;
- 2) Near-surface leak detection and monitoring; and
- 3) Subsurface leak detection and monitoring.

A combination of the above monitoring efforts will be used to verify that the geologic storage project is operating as permitted and is protecting the USDW. An overview of these individual monitoring efforts is

provided in [REDACTED] along with the storage site component monitored by each method. A regular assessment and adaptation of the monitoring program (i.e., a minimum of every 5 years) will be conducted to ensure that it remains appropriate for the site and is adequately tracking the injected CO<sub>2</sub>, thereby providing an accurate assessment of the performance of the surface/subsurface equipment and subsurface storage complex containing the stored CO<sub>2</sub>. [REDACTED]

Additional details of the individual efforts of the monitoring program are provided in the remainder of this document.

[REDACTED]



## **2.1 QUALITY ASSURANCE AND SURVEILLANCE PROCEDURES**

A Quality Assurance and Surveillance Plan (QASP) for all testing and monitoring activities, pursuant to USEPA 40 CFR §146.90(k) and LAC 43: XVII §3625.A.11, is provided in the Appendix A of this Testing and Monitoring Plan.

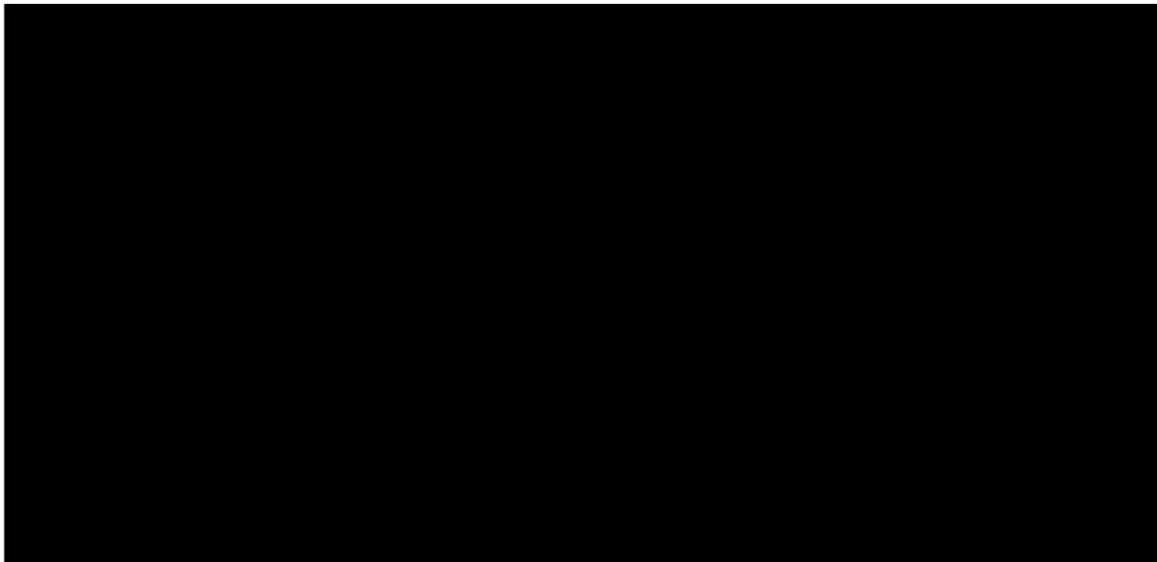
## **2.2 REPORTING PROCEDURES**

Denbury will report the results of all testing and monitoring activities to the USEPA in compliance with the requirements under USEPA 40 CFR §146.91 and LAC 43: XVII §3629.A.

## **3.0 ANALYSIS OF INJECTED CO<sub>2</sub> AND INJECTION WELL TESTING**

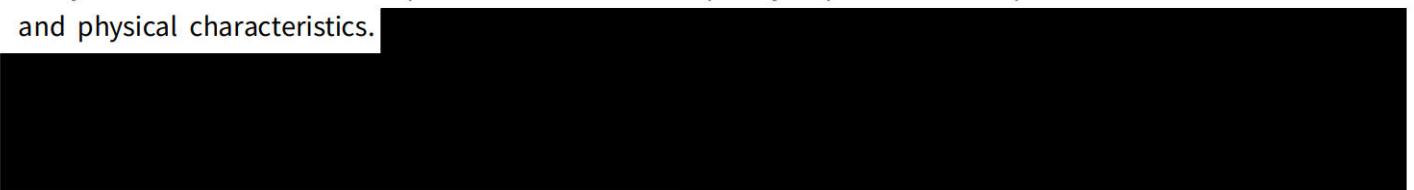
### **3.1 CO<sub>2</sub> ANALYSIS**

Prior to injection, Denbury will determine the chemical and physical characteristics of the CO<sub>2</sub> stream using appropriate analytical methods as described in the attached QASP document.

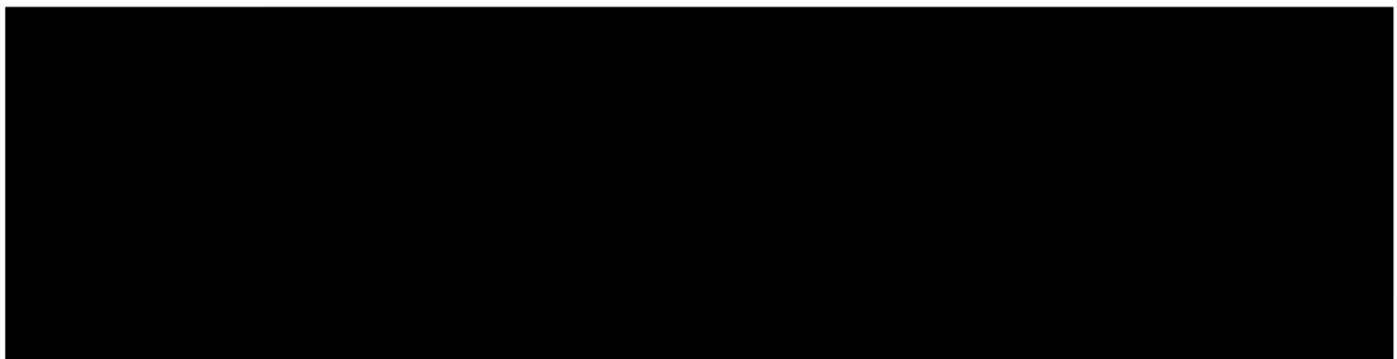


### **3.1.1 Analysis Parameters**

According to the requirements of USEPA 40 CFR §146.90 and LAC 43: XVII §3625.A of the Class VI UIC Regulation, analysis of the CO<sub>2</sub> stream is required with sufficient frequency to provide data representative of its chemical and physical characteristics.



### **3.1.2 Sampling Method**



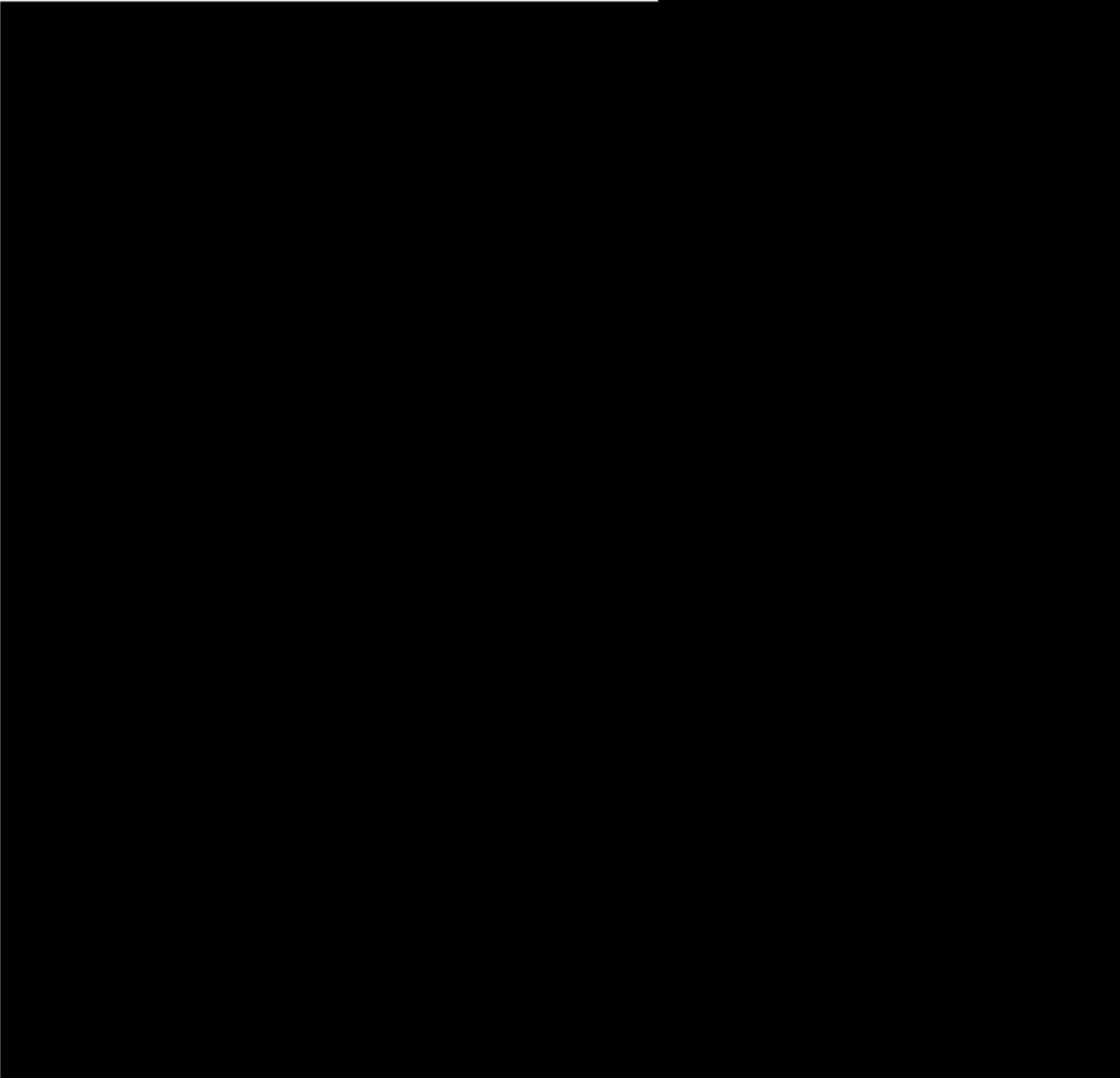
## **3.2 INJECTION WELL INTEGRITY TESTS**

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## 4.0 CONTINUOUS RECORDING OF OPERATIONAL PARAMETERS

Denbury will ensure operation of continuous recording devices and alarms and automatic shut-off systems as required by USEPA 40 CFR §146.88(e) and LAC 43: XVII §3621.A.6



#### 4.1 CONTINUOUS RECORDING AT METER STATION

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[REDACTED]

#### 4.2 CONTINUOUS RECORDING AT WELLHEAD

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[REDACTED]

#### 4.3 CONTINUOUS RECORDING DOWNHOLE

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[REDACTED]

### 5.0 CORROSION MONITORING AND PREVENTION PLAN

The purpose of the Corrosion Monitoring and Prevention Plan is to monitor the corrosion of injection well components during the operational phase of the project to ensure that the well will meet the minimum standards for material strength and performance.

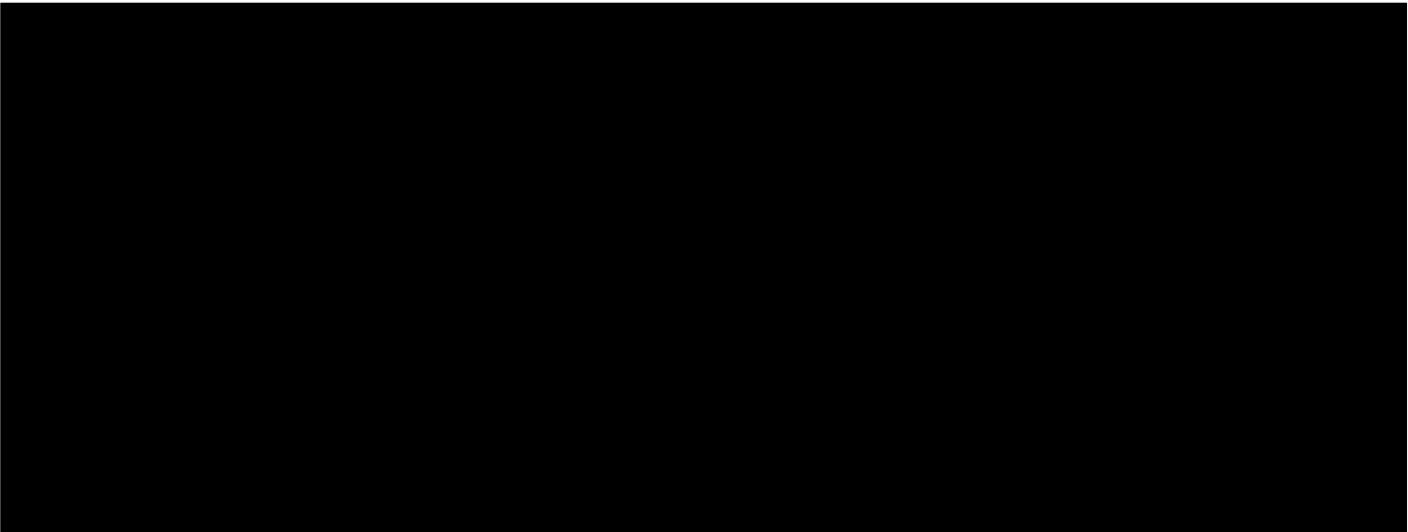
#### 5.1 CORROSION MONITORING

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Denbury will ensure safe and reliable operations of injection well components through a Corrosion Prevention and Monitoring Plan.

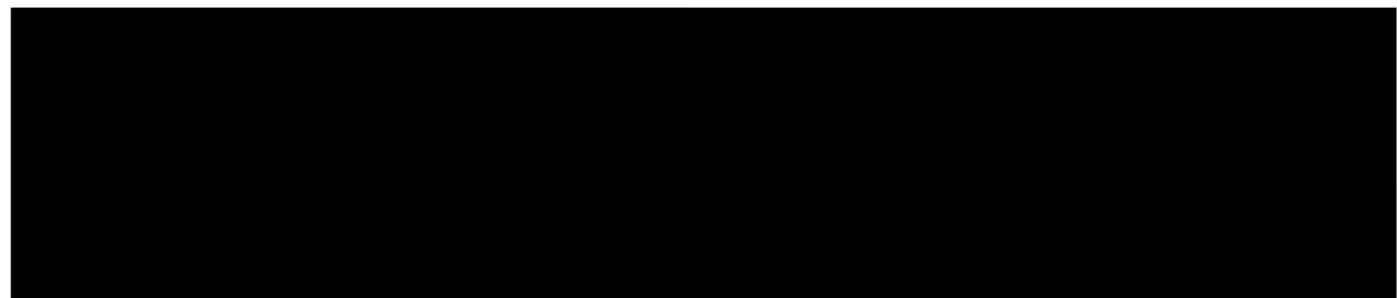
[REDACTED]

Denbury will implement a mechanical integrity program to investigate and mitigate any potential damage mechanisms before a pressure boundary failure occurs.

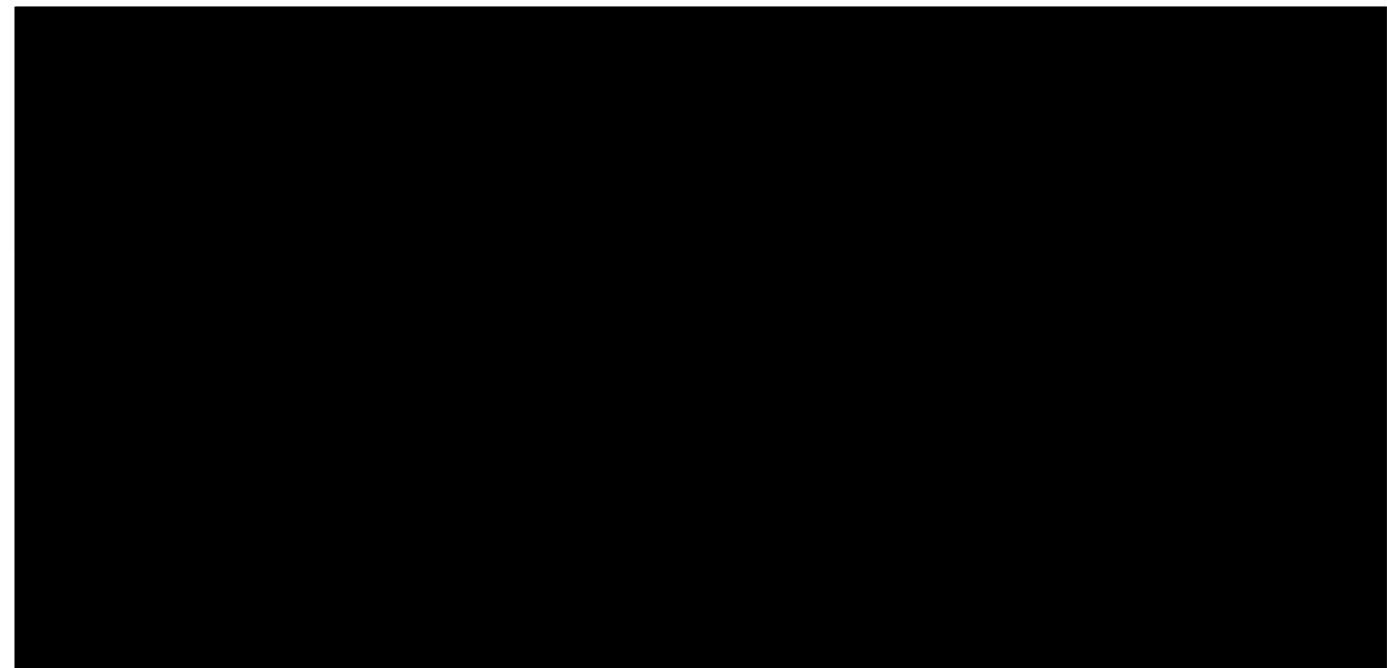


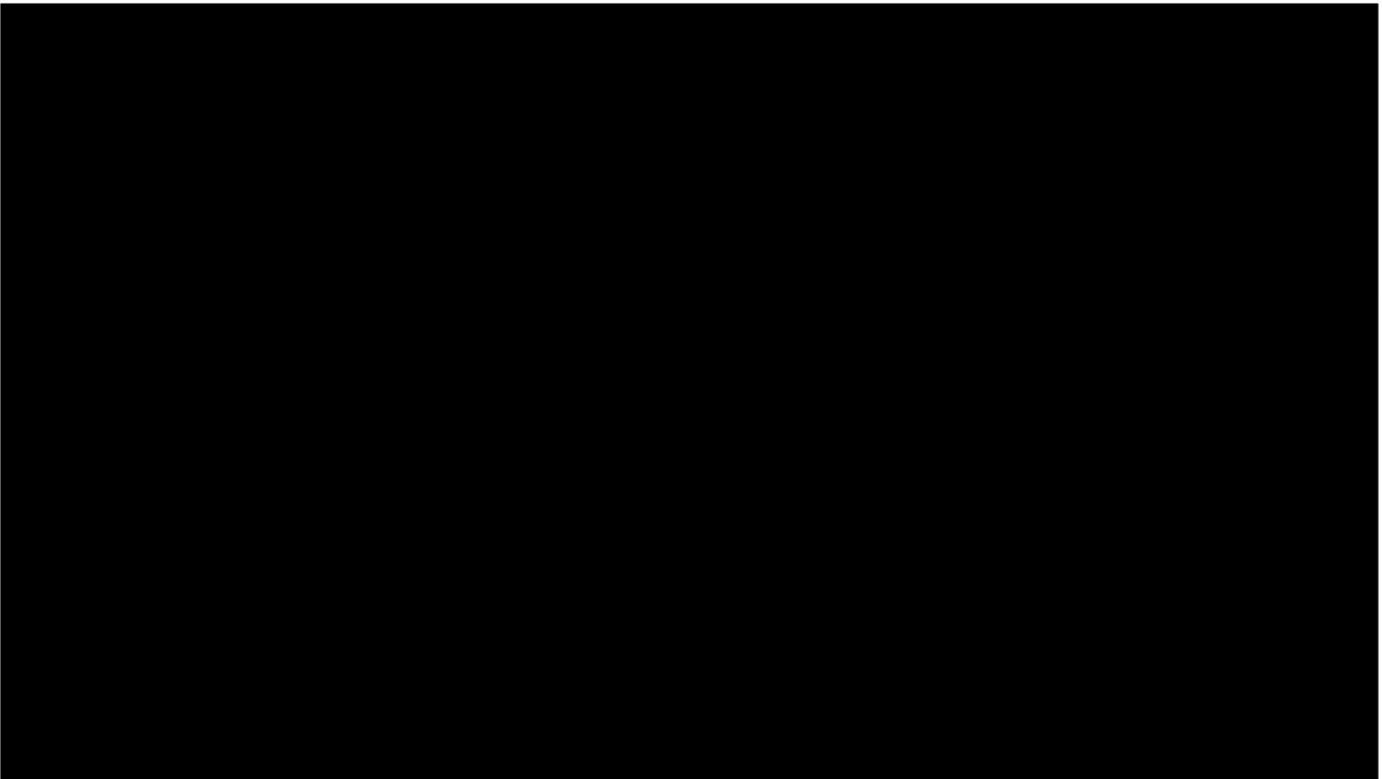
## 5.2 CORROSION PREVENTION

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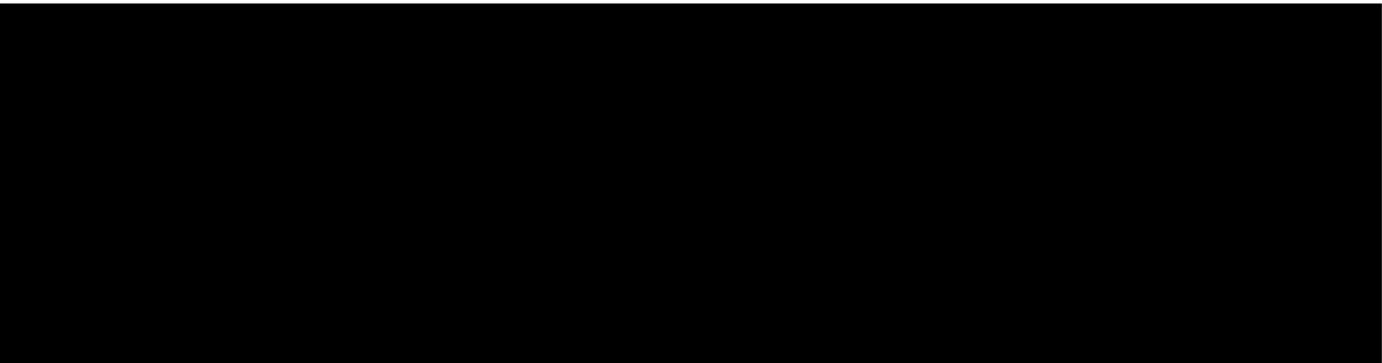


## 6.0 SUBSURFACE LEAK DETECTION AND MONITORING PLAN





## 7.0 NEAR-SURFACE TO USDW MONITORING





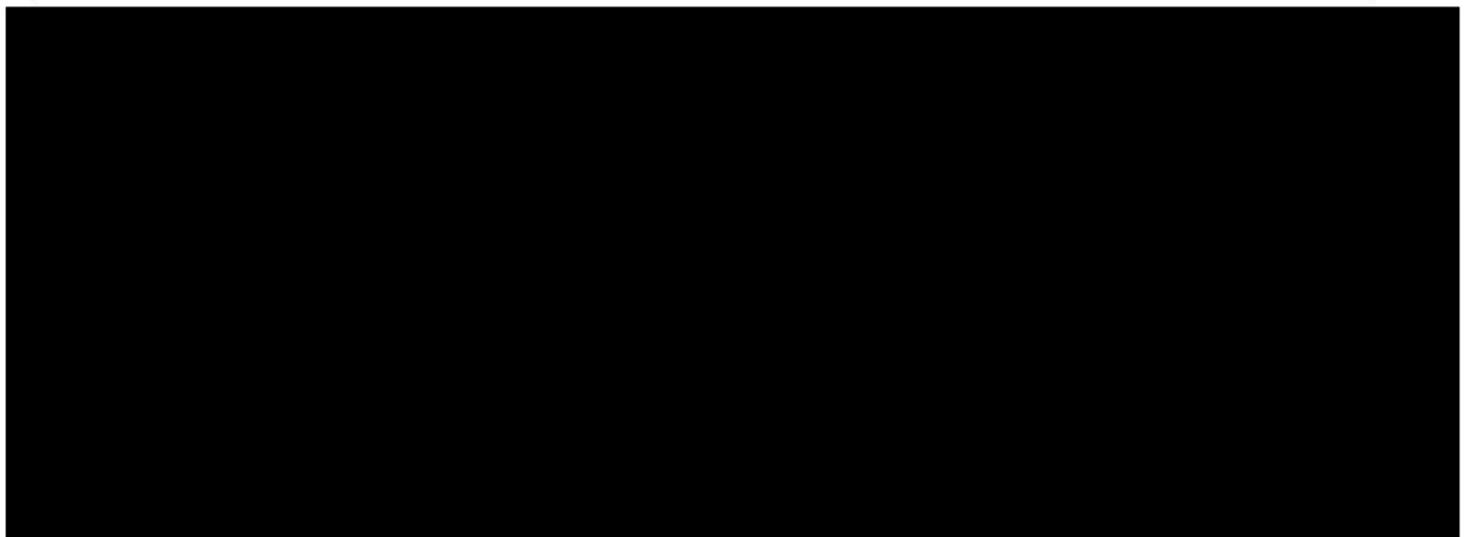




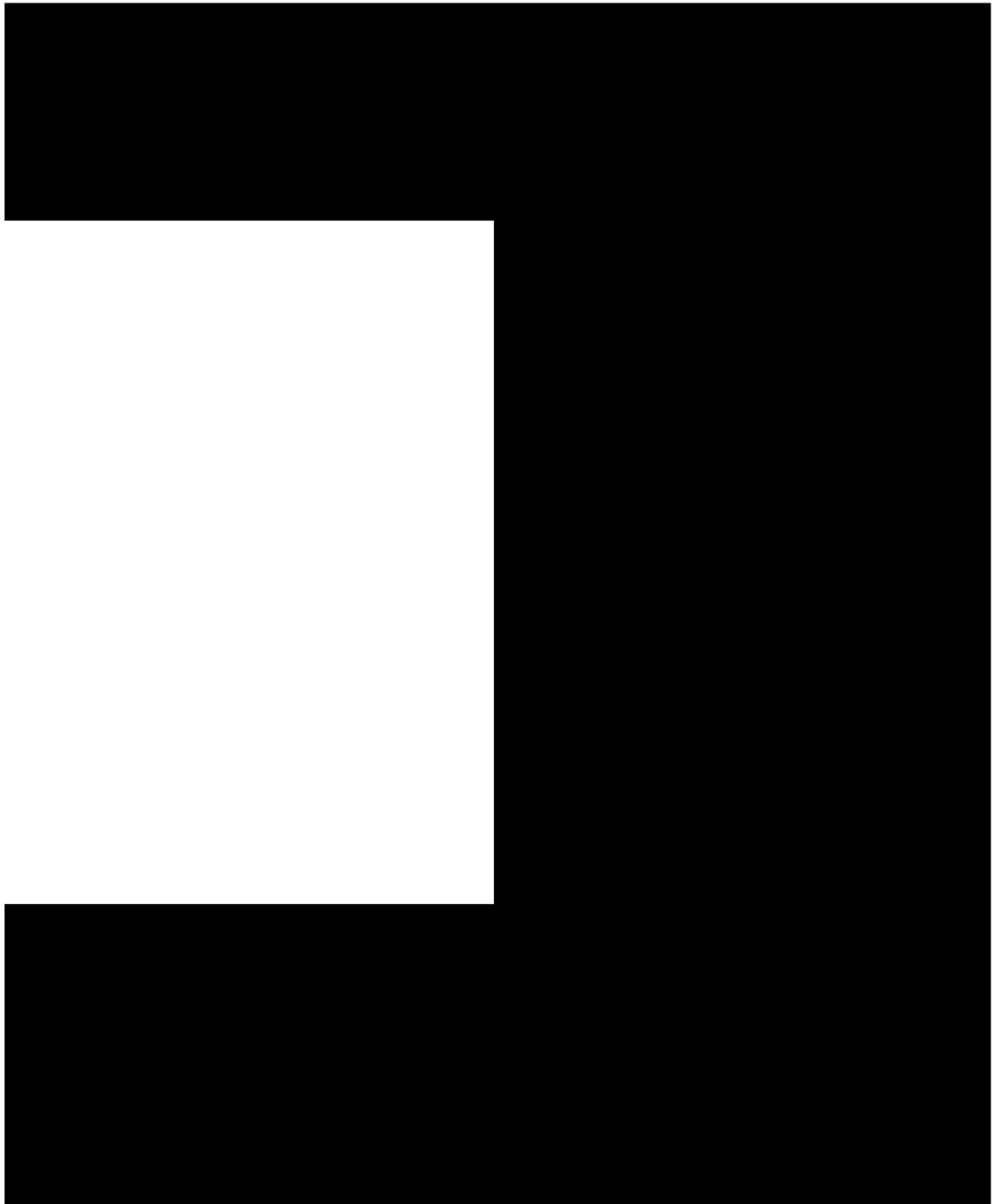


## **8.1 GROUNDWATER MONITORING**

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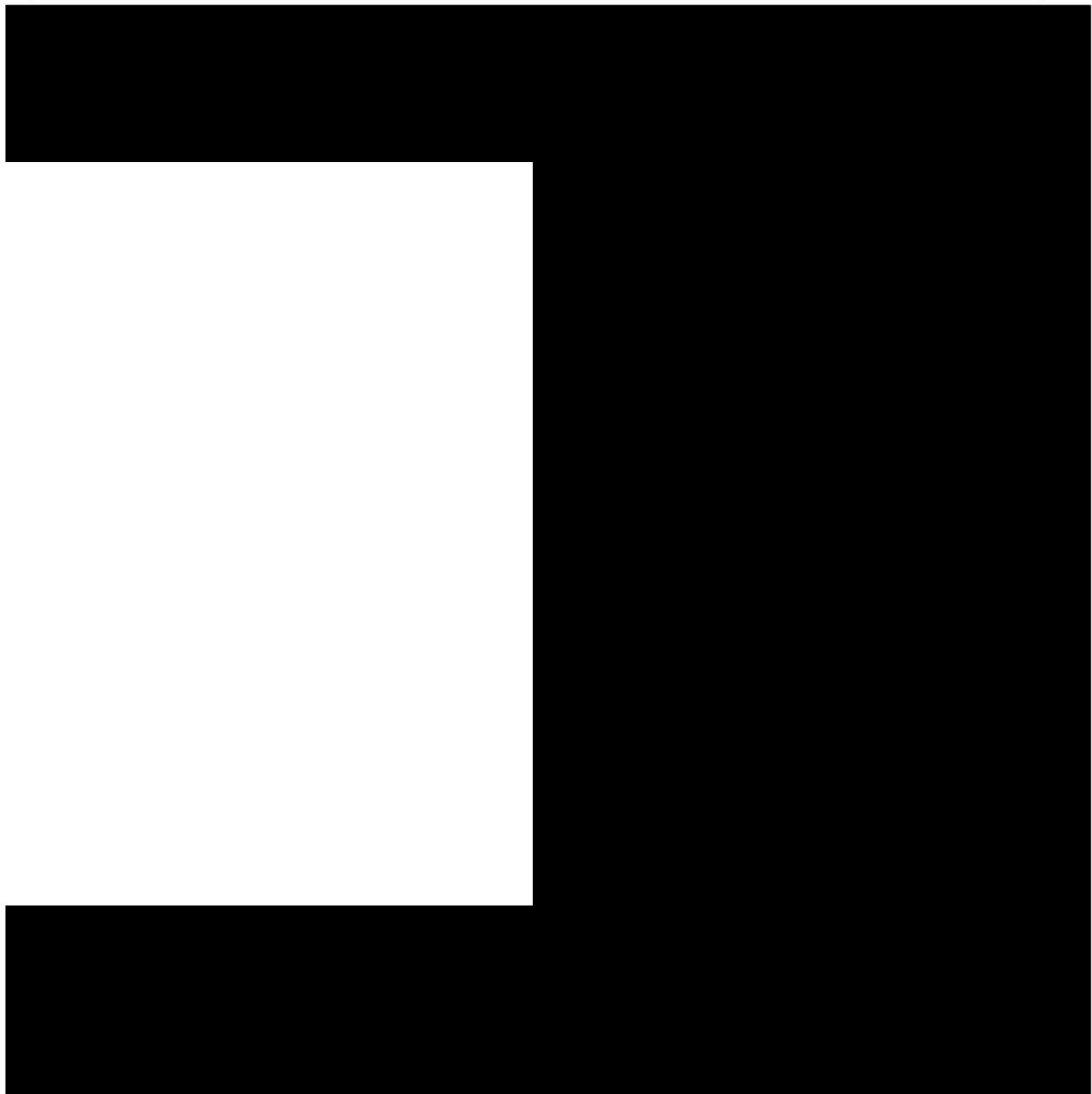






## 8.2 SOIL GAS MONITORING

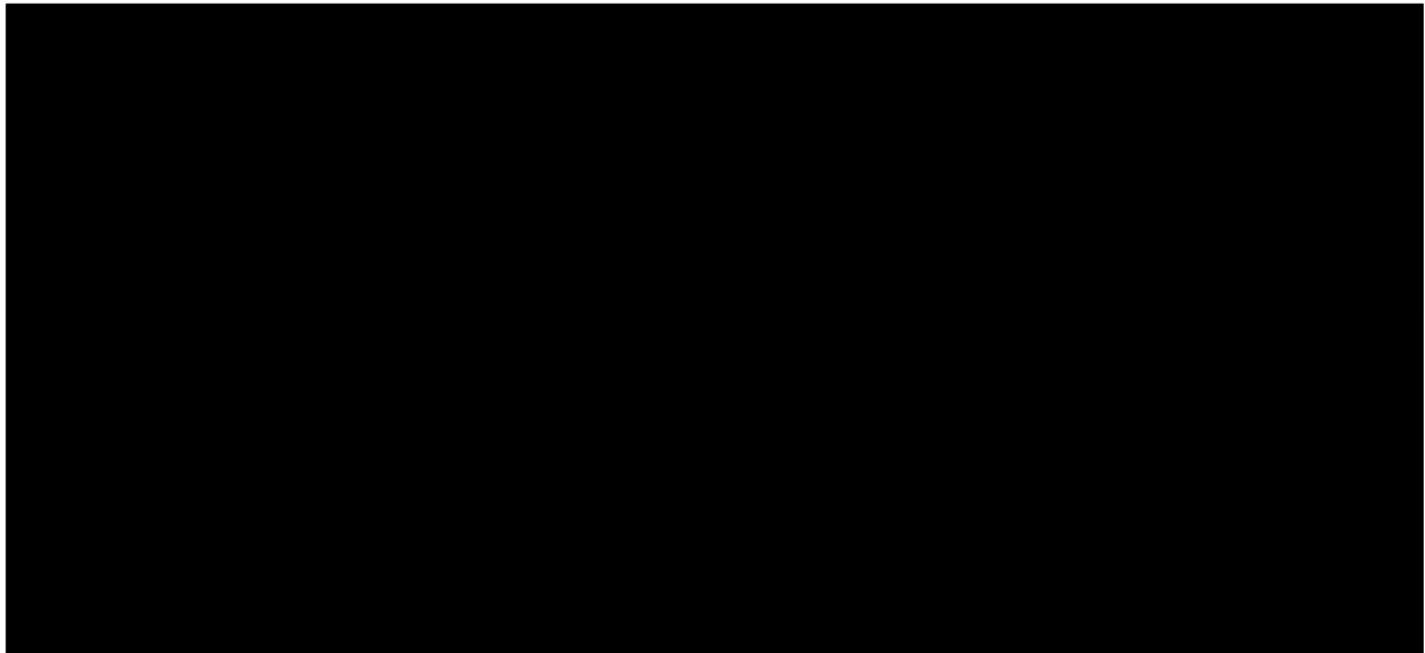
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## 8.0 BASELINE MONITORING PLAN

### 8.1 GROUNDWATER BASELINE MONITORING

#### 8.1.1 Groundwater Baseline Sampling and Analysis





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## 8.2 SOIL GAS BASELINE MONITORING

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### 8.2.1 Soil Gas Baseline Analysis

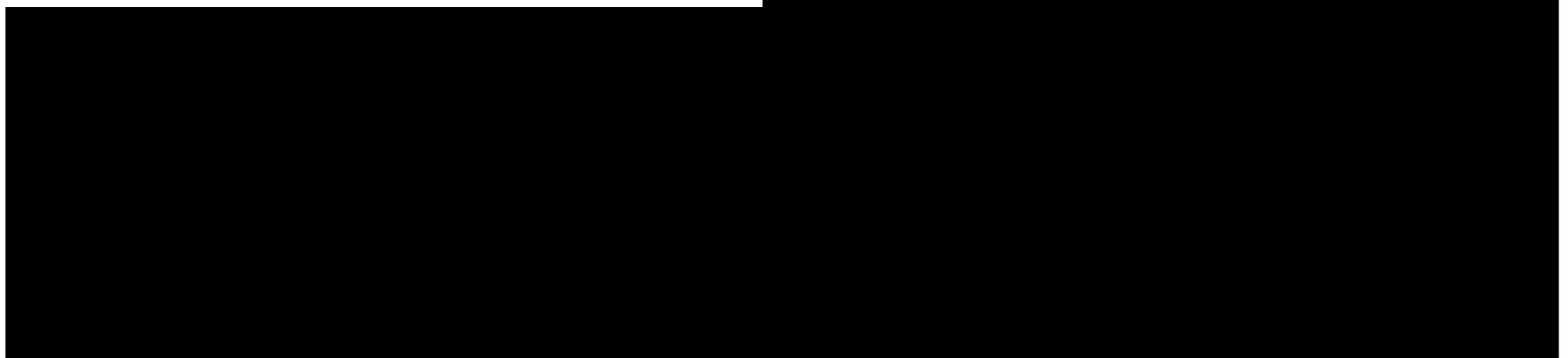
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## 9.0 SEISMIC EVENT MONITORING

## 10.0 DEEP SUBSURFACE MONITORING OF FREE-PHASE CO<sub>2</sub> PLUME AND PRESSURE FRONT

Denbury will implement direct and indirect methods to monitor the location, thickness, and distribution of the free-phase CO<sub>2</sub> plume (plume) and associated pressure (pressure) relative to the permitted storage reservoir.





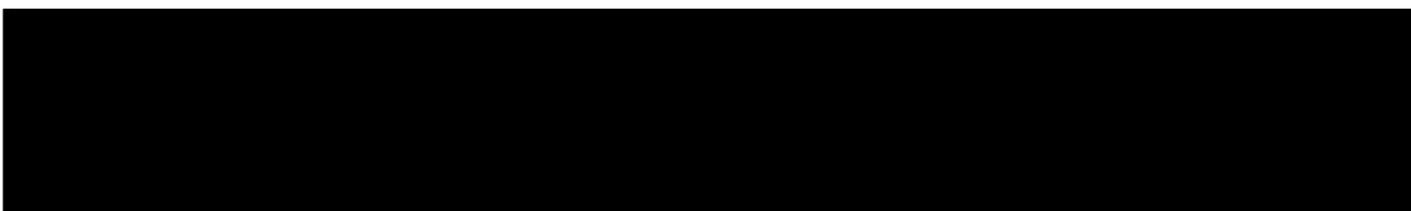




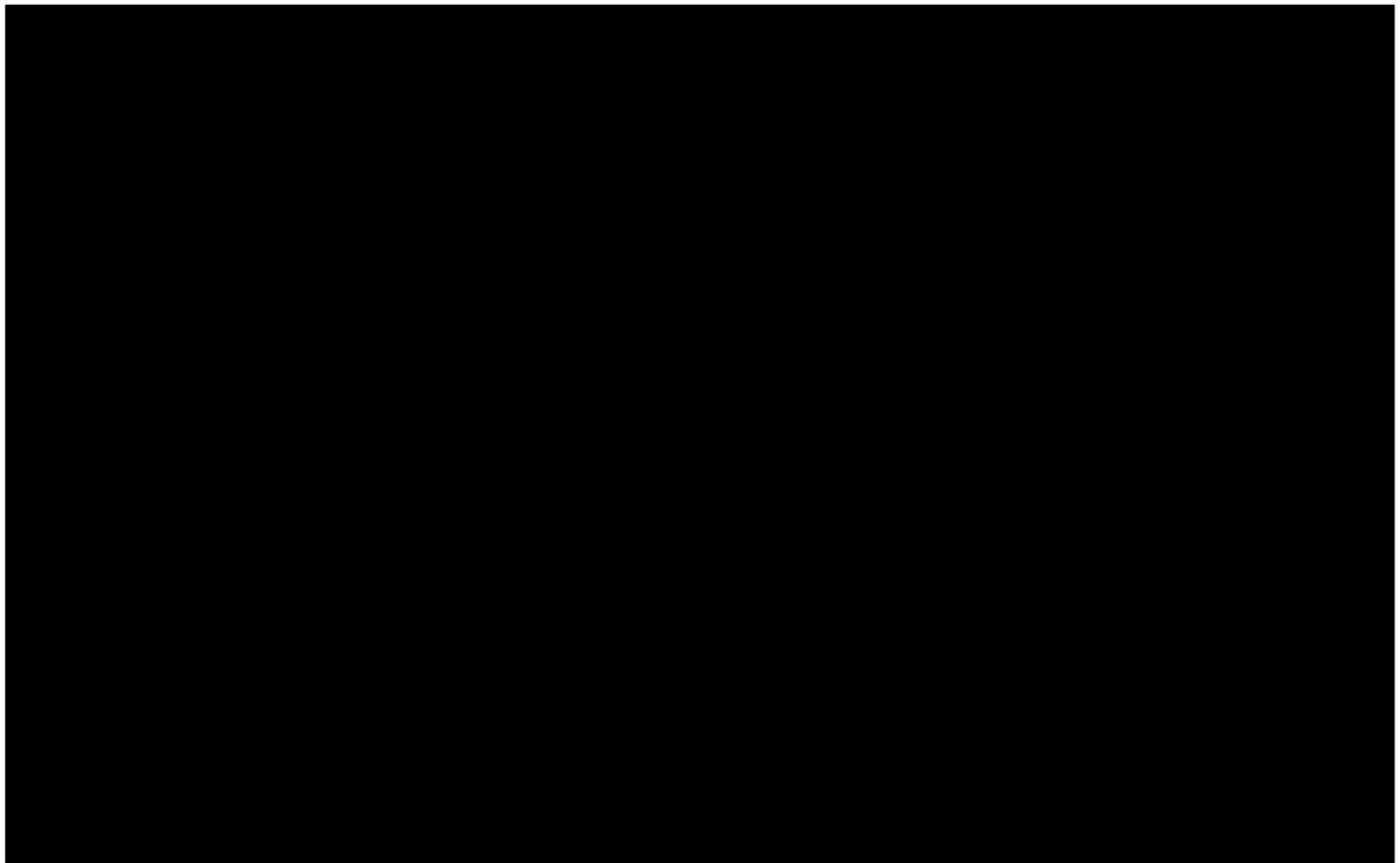
## **10.1 DIRECT TESTING AND MONITORING METHODS**

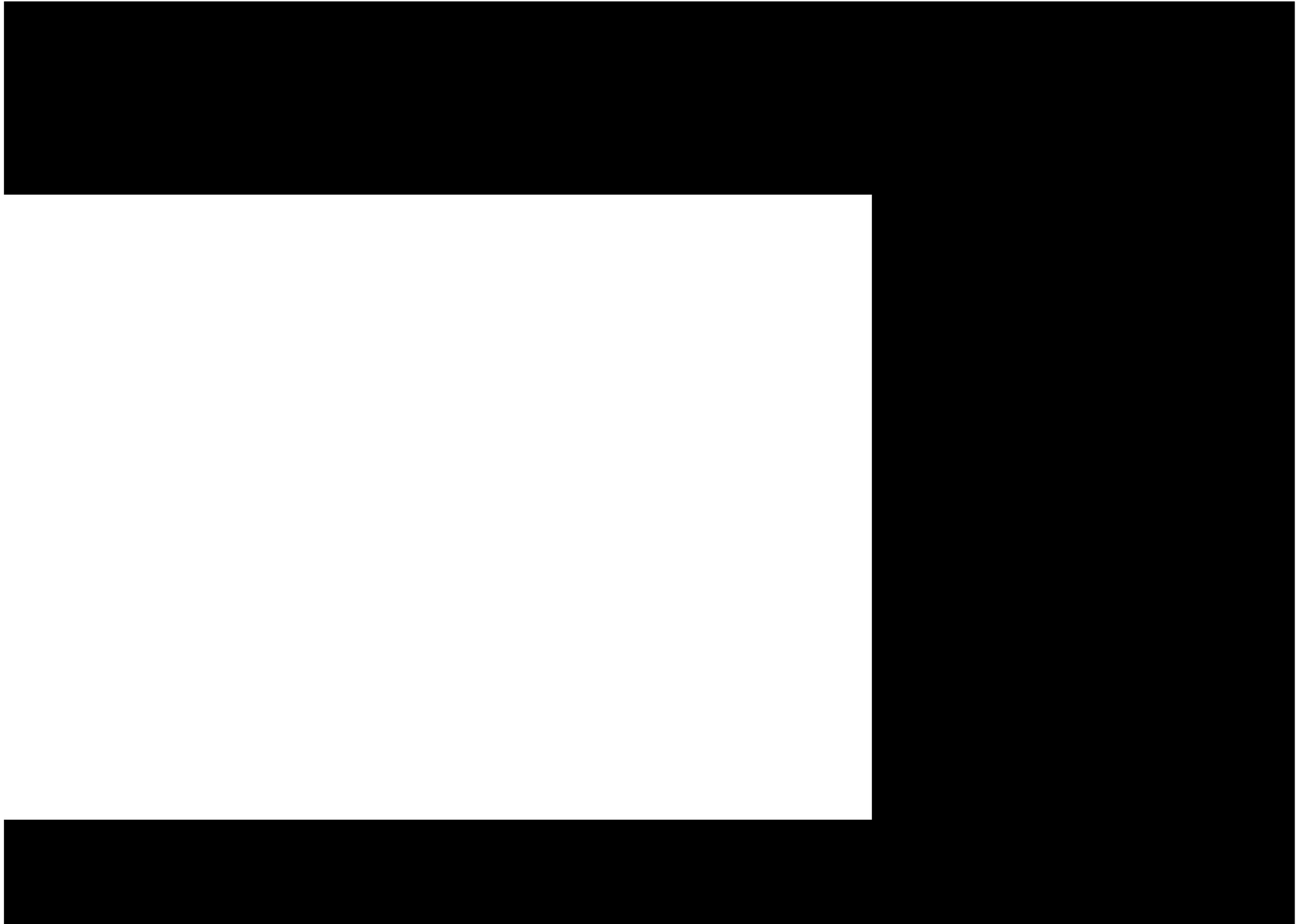


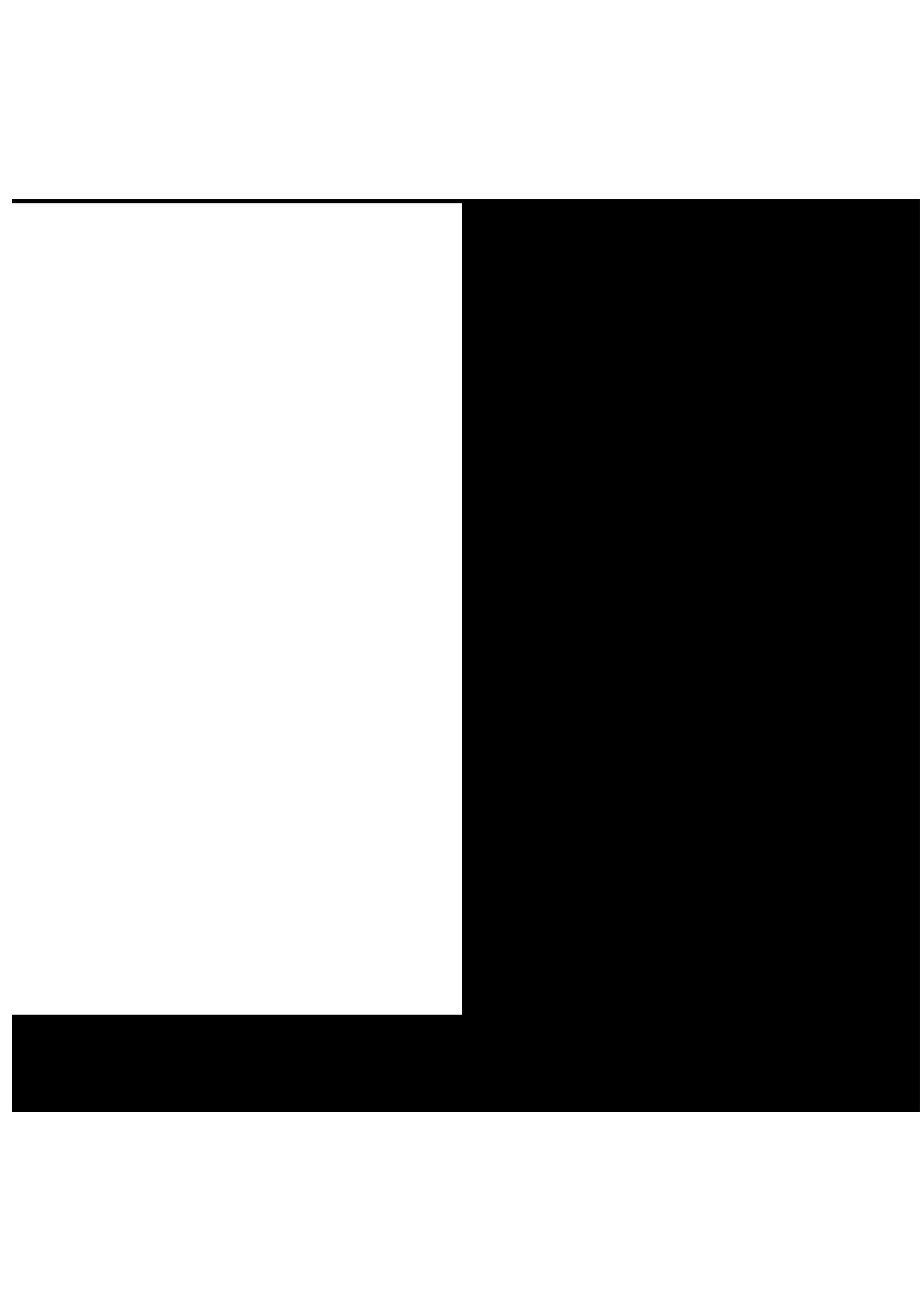
## **10.2 INDIRECT MONITORING METHODS**











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## **APPENDIX A: QUALITY ASSURANCE AND SURVEILLANCE PLAN**