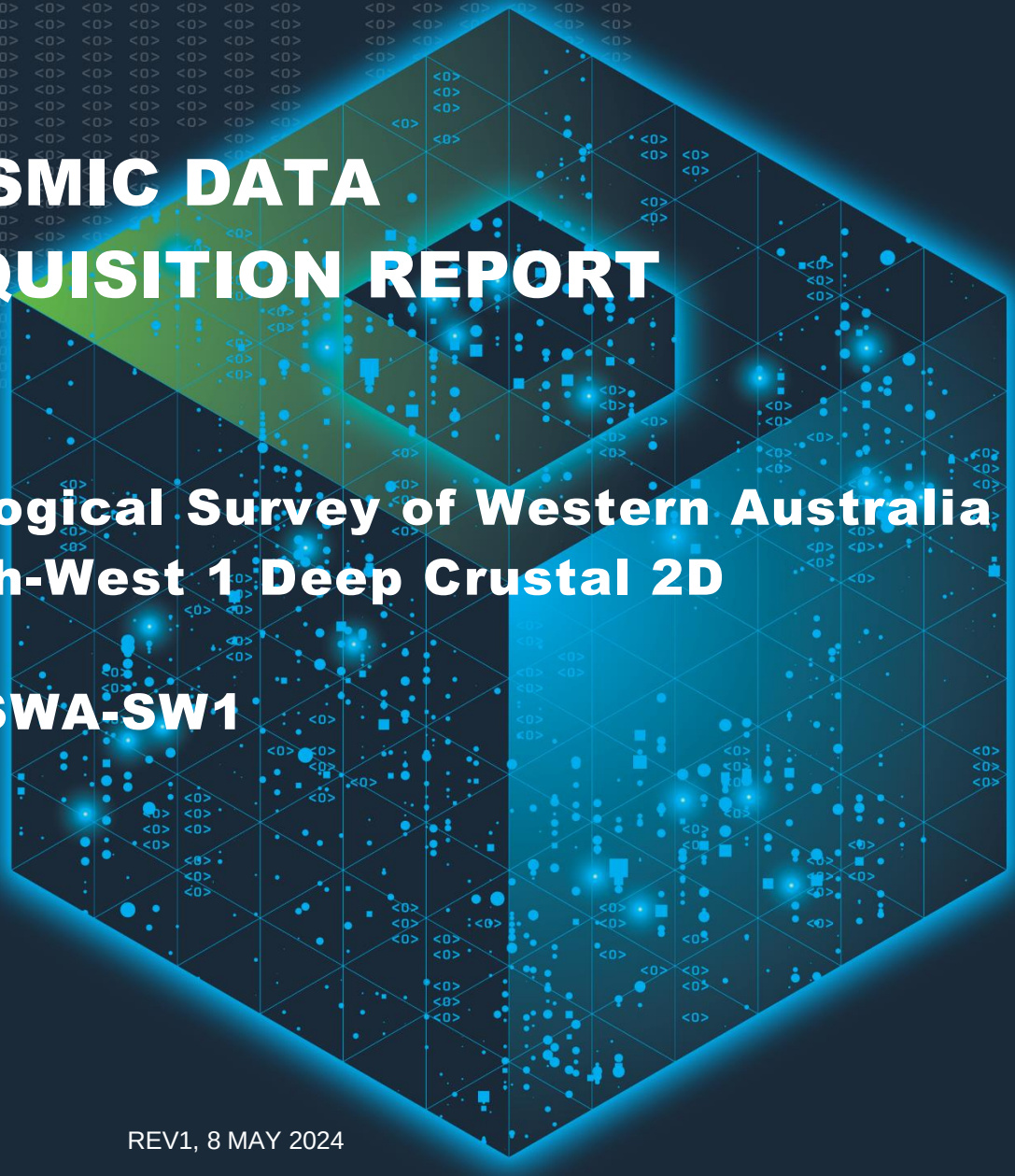
SEISMIC DATA ACQUISITION REPORT

Geological Survey of Western Australia South-West 1 Deep Crustal 2D

23GSWA-SW1



Rev, Date	REV1, 8 MAY 2024
Date:	14th November 2023
Prepared for:	GSWA
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Statement of Quality

The survey reported herein has been conducted according to the standards specified in the contract between GSWA & HiSeis, which outlined the scope and objectives of the work completed. In the absence of such contractual standards, the survey was conducted in accordance with the instructions of GSWA or by the technical operating standards of HiSeis Pty Ltd.

We implemented rigorous quality control measures throughout the survey to ensure the accuracy and reliability of data. Our team of qualified professionals, certified in relevant fields, executed the survey. Data collection and analysis were performed using INOVA software and machinery.

The survey was completed with no LTI incidents while all environmental and safety considerations were thoroughly addressed to meet GSWA, industry and legal standards.

We appreciate the collaboration with GSWA throughout this process, as the input and feedback from GSWA representatives was instrumental in the success of the survey. For more detailed information, please refer to the information provided in this report.

Marc Wilkinson
General Manager – Operations
HiSeis Pty Ltd

EXECUTIVE SUMMARY

HiSeis acquired a high-resolution 2D Land Vibroseis reflection seismic survey for the Geological Survey of Western Australia (GSWA). The project involved the 632 km-long line, 23GSWA-SW1, spanning from Cascade to Hamelin Bay along sealed and unsealed gazetted roads. GPS surveying commenced on 8/9/24. Data collection began on 17/9/23 and concluded on 30/10/23.

A segment near Nyabing underwent reacquisition from 3/2/24 to 4/2/24 due to wind noise. The original shots in this area were contaminated with wind noise particularly on the far offsets. The call was initially made to proceed with acquisition, but Brute stacks from field QC demonstrated a reduction in signal to noise ratio.

The work was carried out under agreement between the GSWA and HiSeis Pty Ltd. Under the agreement HiSeis acquired seismic data on a turnkey basis, and directly controlled surveying/positioning, data acquisition, field data processing, and internal HSE.

Acquisition of the 2D seismic dataset utilised three 60,000 lb Vibroseis source vehicles in a single array as a means of producing seismic energy at 40m source-point intervals. A 24 second sweep was used, with a frequency range of 3-96 Hz. The INOVA Quantum wireless acquisition system was used to record the data on a rolling spread of up to 3000, 5 Hz quantum nodes spaced at 10m intervals.

The surveying, and acquisition and geophysics teams were deployed with the necessary equipment, field systems, computer hardware, and processing software. Data quality was monitored daily, with seismic data uploaded and processed to generate geometry, noise QC and brute stack volumes. HiSeis' proprietary information management system was used to manage large volumes of recorded data, navigation data and, metadata.

Although the data quality of the acquired 2D seismic dataset was excellent, some stations were skipped due to restricted access within populated areas and infrastructure corridors. Throughout the project life cycle the HiSeis field crew aimed to maintain full fold coverage. Skipped source points were compensated for by taking shots at 20m intervals before and after the buffer zones and on the rare occasion one of the 3 Vibroseis in array encountered mechanical issues requiring down time. All these measures proved to be valuable in enhancing the quality of the acquired seismic data and recovering most of the dropped fold due to townships, infrastructure, and vibe down. PPV monitoring was used through all areas of infrastructure.

Sweep testing was completed prior to commencement of acquisition, 3 different sweeps were tested, and it was agreed with GSWA representatives to use the tried and tested Weibull base sweep for the 2D survey.

The survey was completed without any lost time injuries (LTIs).

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1 2D ACQUISITION

1.1 SUMMARY

The 23GSWA-SW1 2D reflection seismic survey was designed for deep crustal mapping over the south-west of Western Australia. The purpose of the surveys is to image the crustal architecture in the project areas, and the structure, geometry, and relationships between the various geological domains from the surface to below the Moho. Acquisition commenced on the 17th of September 2023 and concluded on the 30th of October 2023.

1.2 SURVEY LOCATION

Commencing in Cascade, located 630 km south-east of Perth the acquisition program progressed west and finished in Hamelin Bay, 300 km south of Perth. A total of 632 line km of 2D seismic data was acquired gazetted roads. Roads were predominantly sealed, with only 180km of unsealed rural road. The blue line in Figure 1-1 illustrates the extend of the 2D line.

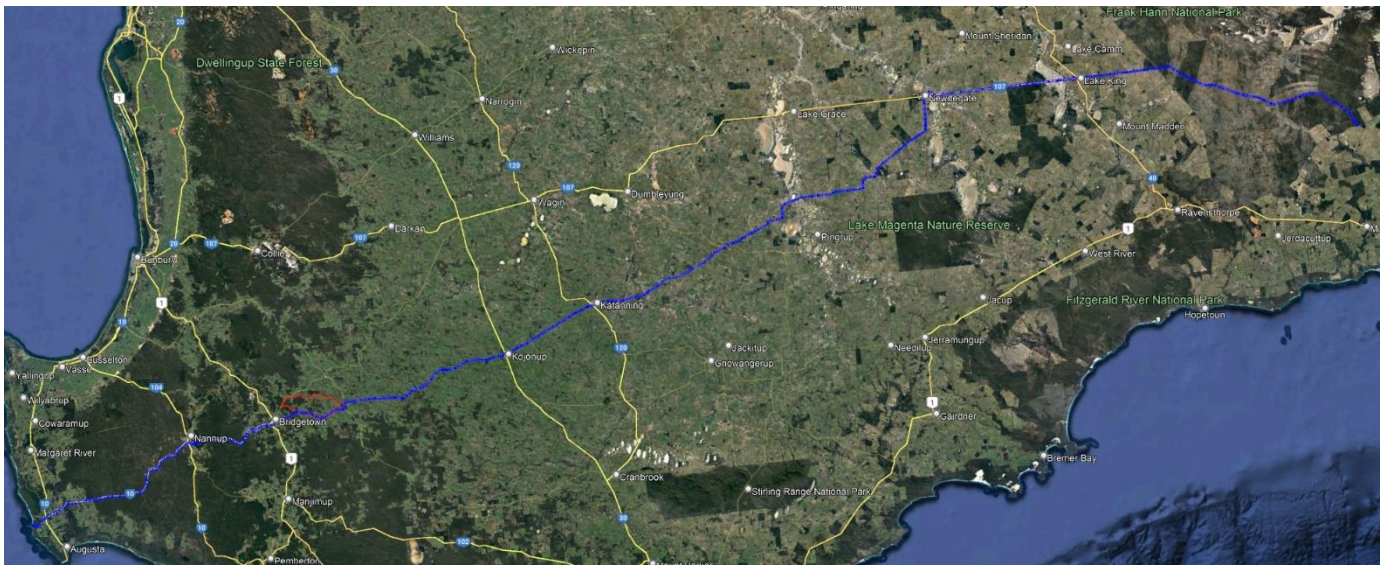

Figure 1-1 : Location of GSWA southwest line 1

1.3 ACQUISITION

A moving patch of no less 1600 receiver stations were used while shooting the 2D with a further 1200 receiver stations deployed and rolling. The shooting patch consisted of an 8000 m active patch either side of the 3-vibe array. Due to the nature of the wireless equipment, all geophones deployed were collecting data. All Vibroseis points (VPs) were acquired with a triple (3-vibes shooting simultaneously) 24 second sweep plus a 20 second listening time using the Weibull base 3-96 Hz sweep as used with previous GA 2D surveys. The 3-vibe array collected VPs at either 40 m shot station intervals, or at 20 m intervals where infill shots were required. The final shot count for the survey was 15 951.

The nominal survey parameters were as follows:

Table 1-1: Acquisition parameters

2D Acquisition Parameters	
Total Survey Size	632.727 km
Total Number of Receiver stations	63 088
Active Receiver Spread	2400 minimum
Receiver station spacing	10 m
Total Number of Source Points	15 951 including killed stations (Culverts, roads etc)
Source Point Spacing	40 m with 20 m infill shots around buffer areas
Nominal Fold	~200
Max offset	8000 m, all in-line live

Technical Specifications as of 09/11/2023

Job:23GSWA- SW1 2D

Technical Survey Specifications:

Collect in System: MGA

Datum: GDA 2020

Zone: 50

Equipment Line lengths	632.727 km
Total number of source points	15951 – Skips
Number of Receiver Stations	63088 – Skips
Sample Interval	2 ms
Record Length	20 s
Nominal Fold	Radial offset patch of 8 km
Format	**SEG Y (REV 0)** to USB hard-drive in field.
Source	INOVA AHV-IV (60000 lb)
Source Array	3 x AHV IV in a single fleet
Source Number	1
Recording Filters:	
Low-cut	3 Hz
Hi-cut	0.8 Nyquist set to 219 Hz
Notch	Out
Diversity Stack	Yes
Source Parameters:	
Source Spacing	40 m and 20m for makeup shots.
Sweep Frequency	3 – 96Hz
Sweep Number	1
Sweep Length	24 secs + 20s listen time
Sweep Type -	Weibull
Source Array	3 Vibroseis
Start Taper	500 ms
End Taper	600 ms
Maximum Source Gaps	As required for safety/access
Receiver Parameters: QUANTUM	
Group Spacing	10 m
Geophone Type	Quantum 5Hz (PS-5GR)
Case	land
Frequency	5 Hz
Geophones per Group	**One (1)**

Figure 1-2: Vibe array

Figure 1-3 : PPV monitoring through townships.

1.4 STATISTICS

The below statistics cover the 23GSWA-SW1 2D seismic survey

Table 1-2: 2D survey statistics

2D Survey Statistics	
Total Receivers	3000 Quantum Nodes (Within the active patch)
Source Points (acquired)	15 951
Days to Acquire (shooting days only)	34 days including 1 day of sweep testing
Average shots per day (shooting days only excluding weather standby)	469

The images below denote the shot statistics for the survey.

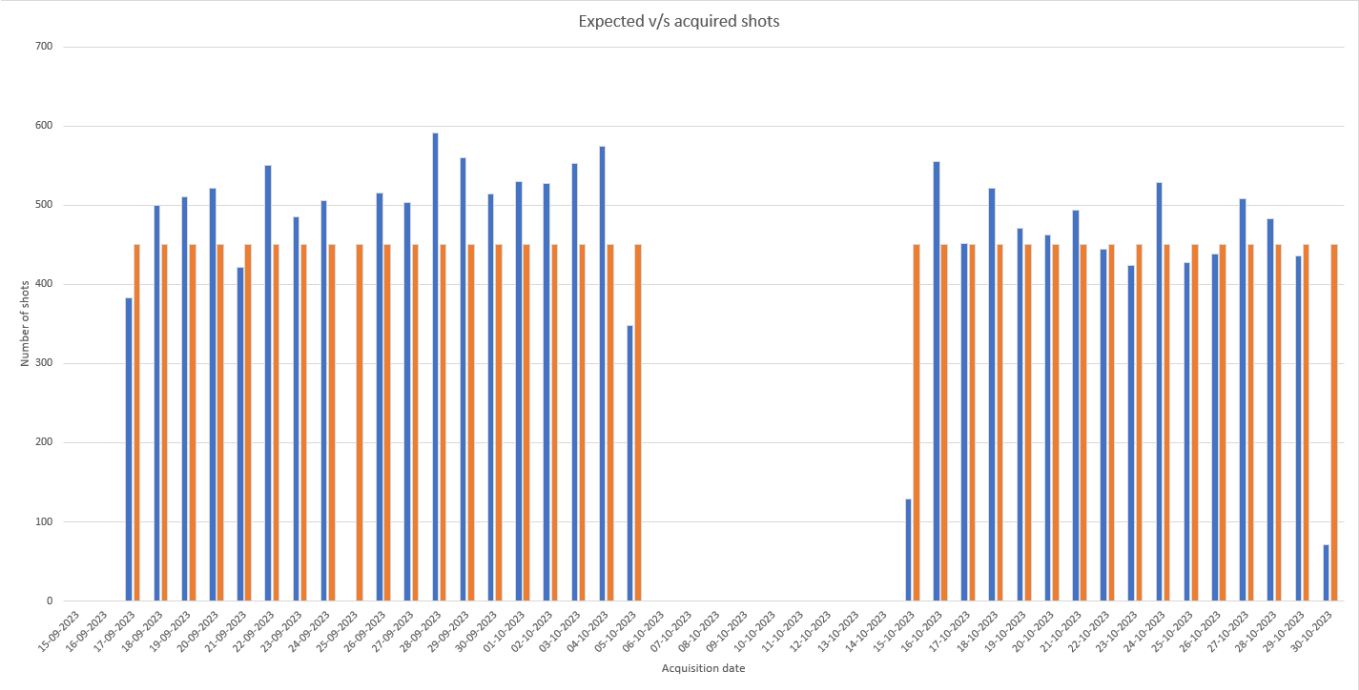

Figure 1-4 : Acquisition statistics.

Total field production time for the acquisition crew was 425.50 hours, including 296.32 recording hours. 6.12 hours downtime, 26.84 hours for spread set up and 10.49 hours for pickup and 39.72 hours of travel to and from site. Safety meeting accounted for 15.00 hours of the total time on the project.

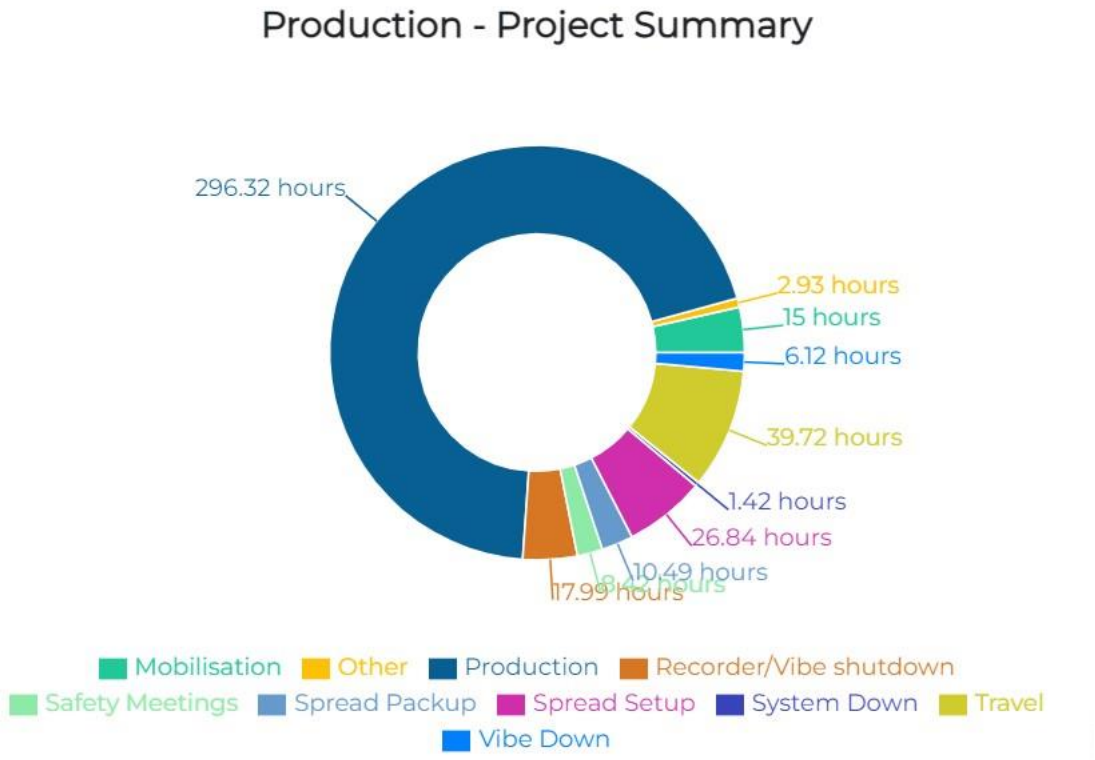

Figure 1-5 : Pie chart of hours spent on different activities for the entire project.

Date	VPs collected		Comments
15-09-2023	0	0	HiSeic acquisition crew mobilized on site
16-09-2023	0	0	Vibroseis sweep testing commenced
17-09-2023	383	450	Acquisition commenced
18-09-2023	500	450	
19-09-2023	511	450	
20-09-2023	522	450	
21-09-2023	422	450	
22-09-2023	551	450	
23-09-2023	486	450	
24-09-2023	506	450	
25-09-2023	0	450	RDO
26-09-2023	516	450	
27-09-2023	503	450	
28-09-2023	592	450	
29-09-2023	560	450	
30-09-2023	515	450	
01-10-2023	530	450	
02-10-2023	528	450	
03-10-2023	553	450	
04-10-2023	575	450	
05-10-2023	348	450	
15-10-2023	129	450	
16-10-2023	555	450	
17-10-2023	452	450	
18-10-2023	522	450	
19-10-2023	471	450	
20-10-2023	463	450	
21-10-2023	494	450	
22-10-2023	445	450	
23-10-2023	424	450	
24-10-2023	529	450	
25-10-2023	428	450	
26-10-2023	439	450	
27-10-2023	508	450	
28-10-2023	483	450	
29-10-2023	436	450	
30-10-2023	71	450	

Figure 1-6 : Collected v/s expected shots.

2 NYABING RE-ACQUISITION

2.1 SUMMARY

Elevated levels of wind noise were reported during 2 days of shooting near the town of Nyabing between 1/10/23 and 2/10/23. It was initially decided to proceed with acquisition during these days. However, after field QC and early production processing it was decided the impact of the wind noise on the data warranted re-acquisition between stations 39711 and 40383.

Re-acquisition commenced on the 1st of February 2024 and concluded on the 4th of February 2024. The re-acquired data positioned receivers in the same locations as the original acquisition, but with source stations offset by 20m resulting in a double density patch

2.2 SURVEY LOCATION

The reshoot location commenced 30km east of Nyabing and concluded 13km to the west. The crew's accommodation was in Lake Grace.

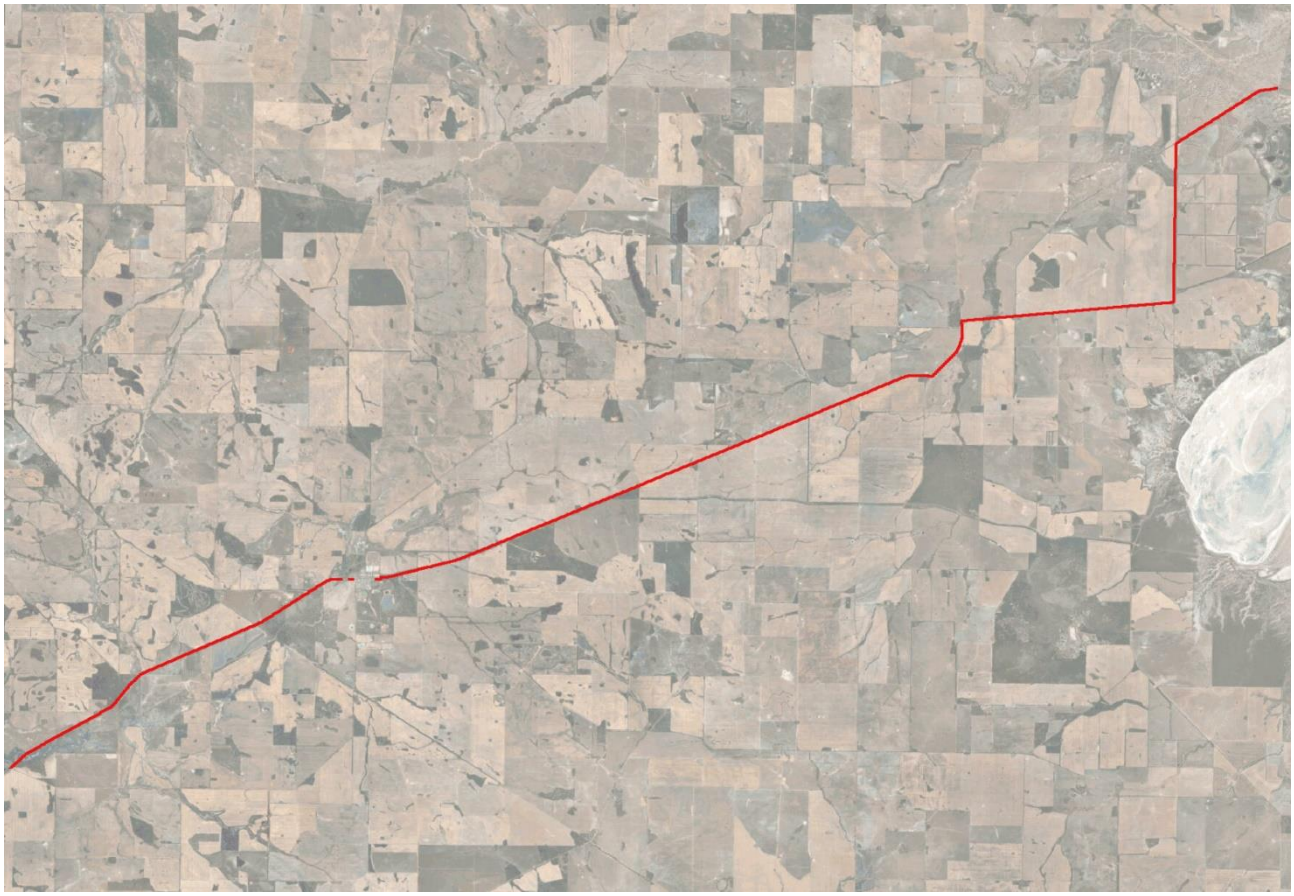

Figure 2-1. Reshoot location

2.3 ACQUISITION

A moving patch of no less 1600 receiver stations were used while shooting the 2D with a further 1200 receiver stations deployed. The shooting patch consisted of an 8000 m active patch either side of the 3-vibe array. Due to the nature of the wireless equipment, all geophones deployed were collecting data. All Vibroseis points (VPs) were acquired with a triple (3-vibes shooting simultaneously) 24 second sweep plus a 20 second listening time using the Weibull base 3-96 Hz sweep as used with previous GA 2D surveys. The 3-vibe array collected VPs at either 40 m shot station intervals, or at 20m intervals where infill shots were required.

59 km of nodes were deployed from station 35 317 to station 41 185. A total of 59 km was deployed to ensure there was an 8km offset from the vibe starting point and finishing point. The 3 vibes acquired 42.6 km in total from station 36 119 to station 40 383. Acquisition ran smoothly without technical or mechanical issue for the duration of the project. Winds were forecast to become moderate to strong on the afternoon of Saturday 3rd the wind was monitored using the Kestral wind monitor in multiple locations on the active spread at 2.20 pm wind gusts were reaching 23 km/h, it was decided to retrieve 80 nodes from different offsets to check for wind noise. Minor wind noise was showing in the data therefore it was decided to halt production for the remainder of the day with winds building. Production was completed on Sunday morning in light winds, all nodes were retrieved and download. A total of 1055 source points were acquired.

2.4 STATISTICS

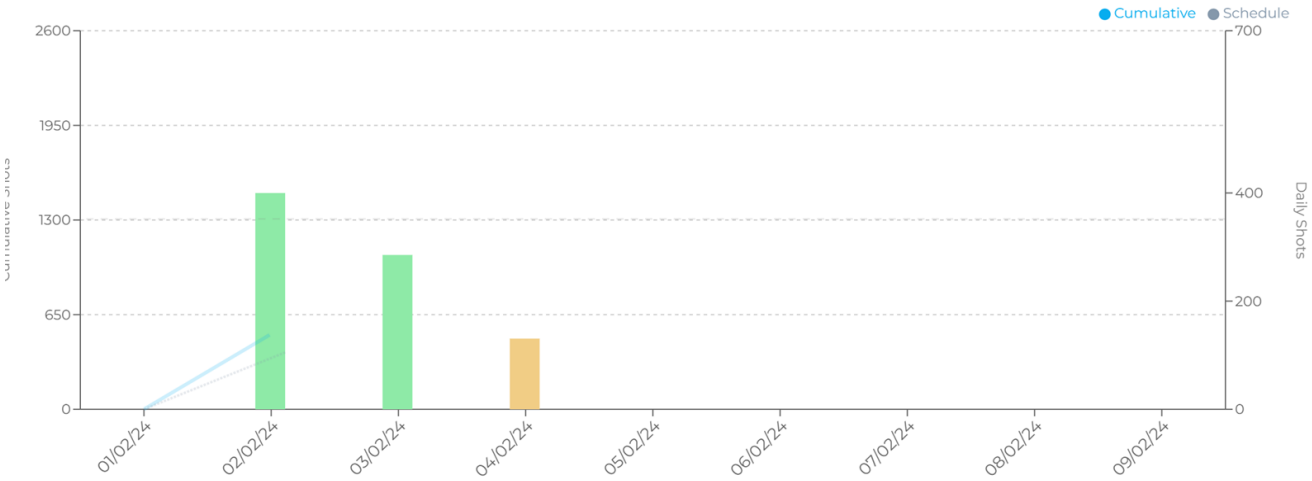

Figure 2-2. Reshoot statistics

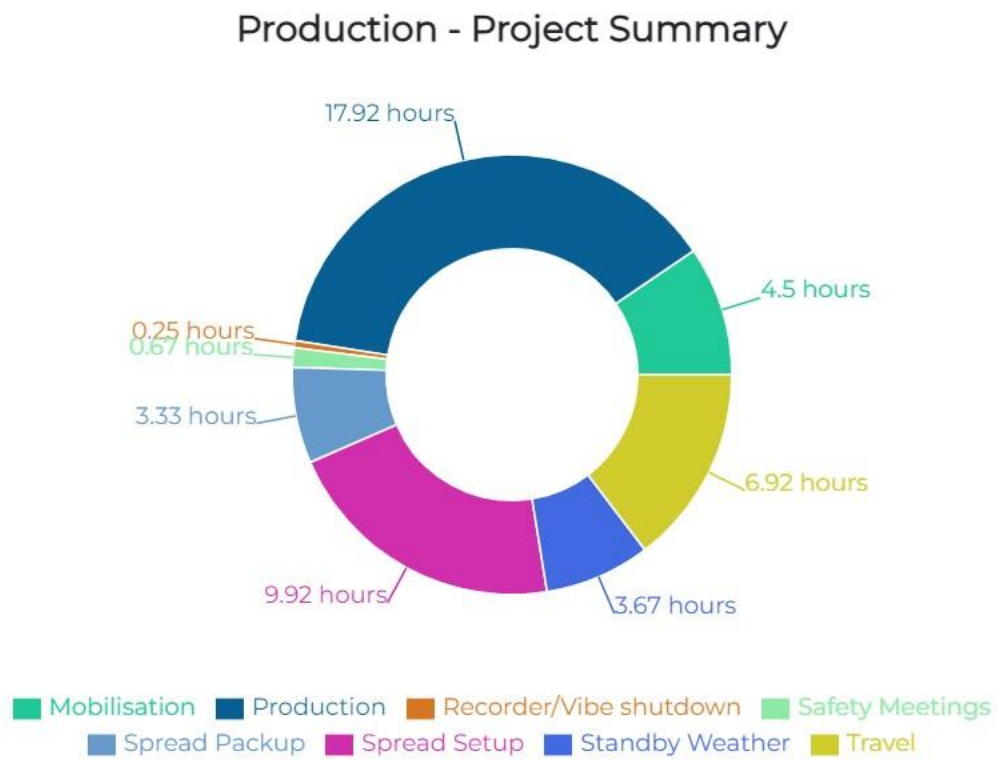

Figure 2-3. Reshoot production summary

3 OPERATIONAL COMMENTS

3.1 LOGISTICS

The survey crew arrived at Lake Grace to start the eastern end of SW1 on the 8th of September 2023.

The acquisition crew arrived in Lake King and commenced layout on the 15th of September 2023. Nodes were deployed for sweep testing which was completed on the 16th of September, the Weibull base sweep was chosen, and production began on the 17th of September.

An 8 day R&R break was taken from the 6th of October to the 14th of October. The crew returned to Katanning on the 15th of October to resume acquisition, and completed the survey on the 5th of November.

3.2 EQUIPMENT DAMAGE

Over the course of the survey period there were 5 Quantum nodes which went missing, believed to be taken by members of the public. Several nodes were damaged due to being driven over by vehicles.

3.3 TERRAIN

The terrain throughout the survey area is gently undulating as it follows the sealed and unsealed roads in good condition. From Bridgetown to 20 km west of Nannup, terrain was thick with tree cover and large rolling hills causing comms issues between the recorder and the Vibroseis, on numerous occasions through this area, the recorder was required to tail the 3-vibe array as to have clear comms with the array. Surface elevation ranged between 2 m to 404 m above mean sea level.

23GSWA-SW1 2D seismic field operations covered 632 km, encountering numerous townships and areas of farming infrastructure requiring buffer zones with no shooting allowed. Infill shots at 20 m were used leading in and out of these areas in an attempt to maintain good fold coverage. There were also a substantial number of bridges, driveways, and culverts in which nodes could not be placed so these stations were killed.

Data acquisition progressed under close consultation with GSWA representatives to ensure that all environmental, health and safety requirements were adhered to. Good planning, detailed and precise practice of procedures, and strict following of policies from all parties involved resulted in the best outcome given the ground conditions.

3.4 WEATHER

The weather for most of the project was ideal for acquisition with light to moderate winds and clear to overcast skies. On the 1st and 2nd of October there were two notably wind affected days, nodes were retrieved from far offsets to analyze data. It was agreed with the client representative to proceed with production.

3.5 CREW ACCOMMODATION

The HiSeis crew stayed in multiple locations for the project. Based on a production prediction of an average of 18 km per day, accommodation was booked in advance to reflect the timeline. At times there was up to 130 km to travel to site. This was due to the large distances between work area and nearest townships. Hotels, roadhouses, Airbnbs, and campgrounds were all utilized to accommodate the crew.

First swing:

Lake King – 15/09 – 23/09

Lake Grace – 23/09 – 03/10

Katanning – 03/10 – 06/10

Second swing:

Katanning/Kojinup – 15/10 – 19/10

Bridgetown – 19/10 – 23/10

Nannup – 23/10 – 28/10

Augusta – 28/10 – 30/10

Figure 3-1 : An example of camping facilities.

3.6 COMMUNICATIONS

Communication between HiSeis and GSWA was conducted via:

- Mobile phones
- Starlink satellite internet
- UHF radio

Land based operational communications were conducted via vehicle two-way, hand-held UHF radios, and whatsapp groups to communicate with line crew due to the large work area. This worked exceptionally well for group notifications as most of the survey area had reasonable cell phone reception. All vehicles were fitted with UHF radios to ensure we were able to communicate with all other contractors that operated in and around the site. Traffic management controllers used multiple UHF radio channels to communicate with HiSeis personnel and channel 40 to communicate with heavy vehicles in the area.

Starlink high speed satellite internet was used in the recorder and to transfer data back to the Perth team for QC.

3.7 ADMINISTRATION

Most crew administration tasks were handled through the HiSeis main office in Subiaco by the Project Manager, Project Administrator, and the GIS Manager; all other administrative needs of the crew were managed by the Party Managers on site. All field personnel completed HiSeis Crew HSE inductions prior to arrival on site.

3.8 PERMITTING AND PUBLIC RELATIONS

Main Roads permits, Public Relations, stakeholders' interactions, and land access activities were handled by HiSeis and GSWA. Email and phone contact was established prior to HiSeis crew entering stakeholders' properties. All crew were briefed on public interactions and notices explaining the scope of work were placed in all vehicles to hand out to members of the public upon request.

4 RECORDING SYSTEM

Data collection saw the use of INOVA's Quantum IX1 wireless seismic acquisition system. The Quantum nodal system operates autonomously and is ideal for the operational conditions experienced on the GSWA – SW1 project. It is rugged and has a compact design allowing for deployment in challenging terrain and dense vegetation. Furthermore, the Quantum system is built with wireless technology and has advanced QC tools that provided crew with the ability to communicate with field stations and obtain valuable nodal information such as the hardware status of field stations, memory usage, battery voltage, GPS performance, and sensor operations wirelessly.

Once deployed, the node acquires GPS signal for timing and positioning which operated efficiently in the mostly thin vegetation and tree canopy experienced on SW1. Each of the nodes were programmed at the T3 (transcriber) with a configuration file. Once the wireless node was placed by field crew on previously surveyed locations, the node would commence a series of internal tests (BITS) before it starts continuous recording until the node is retrieved. QC and troubleshooting can be done at any time whilst the node is deployed and awake. After collection, the data from the node is downloaded in the T3 and then erased so that it is ready for the next deployment.

The Quantum system offered an efficient means for collecting seismic data over the acquisition project area.

Given the chosen Weibull base 3-96Hz sweep, the Quantum nodes equipped with the 5 Hz (PS-5GR) geophone element were ideal for recording the low frequencies produced by the source.

Table 4-1: Recording parameters

Field System Recording Parameters	
Instrument	iX1 (Nodal)
Tape Format	SEGY Rev. 0
Filters	Hi Cut 205 Hz
Sample Rate	2 ms
Correlated Record Length	20 000 ms
Node recording time	24 hrs/day (6 am – 6 pm)

Table 4-2: 2D receiver parameters

2D Receivers	
Receiver Group Interval	10 m in-line interval
Geophones	Quantum 5 Hz (PS-5GR) Geophone Element
Array	10 m single point sensor

5 SEISMIC SOURCES

5.1 INOVA AHV-IV 60 0000 LB VIBROSEIS

The INOVA AHV-IV Vibroseis unit operates through the oscillation of a servo-hydraulic controlled 60,000 lb peak-force mass and baseplate ensemble. These units are designed to produce predominantly P-wave seismic energy over a variable sweep profile, defined by the operator.

For this 2D survey, 3 x AHV-IV vibrators were used simultaneously on a single source station to produce seismic energy.

5.2 SWEEP PROFILE

Sweep testing was conducted prior to the start of acquisition. Receivers were laid out at 20m intervals from station 10001 to 11401 (14 km). A 3-vibroseis array was used to test out the various sweeps across the laid line with a radial patch of 8 km one after the other till the end of the test line was reached. The nodes were then replaced and run through the transcriber to extract the test data from them.

The data from the nodes was then sent to the HiSeis office in Perth to generate brute stacks and conduct a sweep analysis following which, a sweep would be chosen for production.

The sweep test parameters have been listed below:

Table 5-1: Standard sweep definition

Test Sweeps			
Weibull Base sweep	3-96 Hz	500ms start and end taper.	Stored sweep
Weibull Mid Dwell sweep	3-96 Hz	500ms start and end taper.	Stored sweep
Linear sweep 1	3-96 Hz	500ms start and end taper.	Stored sweep
Linear sweep 2	3-60 Hz	1000ms start and 500ms end taper.	Stored sweep

After analysing the data from the sweep tests, GSWA decided to go with the Weibull base sweep. Therefore, 2D dataset acquired at GSWA was done so with the following source sweep parameters:

Table 5-2: Standard sweep definition

Sweep Definition 2D	
Vibrators	INOVA AHV-IV (PLS 362) 60, 000 lb
Electronics	INOVA VibPro HD
Sweep Frequency Range	3 – 96 Hz (Weibull base sweep)
Sweep Duration	24 second
Sweep Type	Custom Weibull
Tapers	Start taper – 500ms, End taper – 600ms.
Vibrator Array	3 vibes shooting in array (Single fleet)
Operating Force	70%
Phase Locking	Ground force
Amplitude Control	Peak-to-peak

6 SURVEYING

Surveying of all receiver points was completed by subcontracted surveying company GSS. Surveying involved the surveyor and assistant, flagging and collecting receiver coordinates within an accuracy of 10cm along pre-designed survey lines. These personnel were also responsible for reconnaissance and reporting of obstacles and obstructions to typical survey design and plans. Coordinates were collected using Leica GS18, GS15 and GS14 survey equipment with 4 individual rovers connected to base station.

Please see accompanying Survey Report for more information.

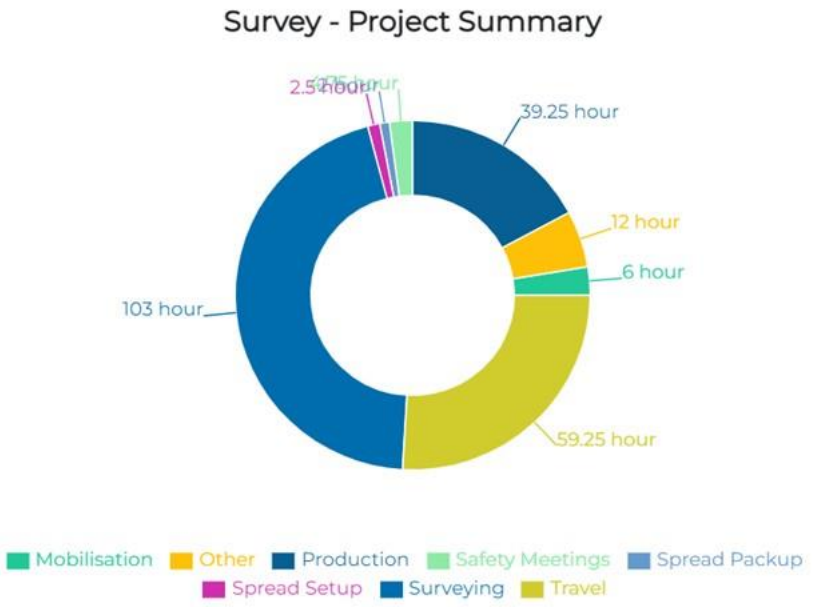

Figure 6-1 : Breakdown of Surveyors hours on the 23GSWA-SW1 2D Project.

7 HEALTH, SAFETY AND ENVIRONMENT (HSE)

This section describes the procedures, activities, and statistics related to HSE (Health, Safety, and Environment) for the GSWA – SW1 2D Seismic Survey. Throughout the project's duration, HSE played a vital role in reducing hazards and risks. HSE plans, risk assessments, emergency response plans, daily Toolbox meetings, and weekly safety meetings were conducted with the goal of minimizing project-related risks to a reasonably practicable level.

Furthermore, crew inductions, onsite orientations, and training were provided to all personnel and client representatives, any site visitors. Incident reports and safety statistics were systematically compiled for in-depth analysis. The results of these assessments were reported in daily, weekly, and monthly reports. Additionally, this information was utilized at the crew level to further enhance the project's safety standards.

7.1 HSE STATISTICS

Crew safety is a core value for HiSeis. At no point during any survey has HiSeis put production before the safety of its personnel, and the GSWA – SW1 2D project was no different.

HiSeis and GSWA staff collaborated closely to ensure the survey was coordinated and executed in a safe manner with the highlight being 28,226 hours of work with ZERO LTI's.

Table 6-7-1: HSE Statistics

HSE Statistics	
Total Person Hours	28226
HSE Incidents	0
Lost Time Injuries	0
Total Safety Meetings	34
Breath Tests	816
Risk Assessments (JHA/Take 5's)	615
Pre-starts	578
Formal HiSeis Safety Observations	10

7.2 INDUCTIONS AND TRAINING

7.2.1 Inductions

Inductions and orientations were conducted for all HiSeis personnel and visitors. The site orientation consisted of a general walk through the HiSeis/GSWA office locations and laydown yard where the harvester trailer, technical and mechanical workshops were located. Information was relayed regarding where the HSE notice board and HiSeis corporate policies were posted, emergency assembly areas and fire extinguisher locations.

All HiSeis and Traffic management personnel were informed of HSE requirements and updated as the project progressed.

- HiSeis HSE and Policies
- HSE Project Plan and Emergency Response Plan
- Hazard Reporting and Assessing Risks
- Emergency Resources
- Communication
- Journey Management
- Weed & Seed, Land and Fauna Interaction Logging
- Incident Reporting
- Asking for Help

7.2.2 Take 5's

HiSeis uses the Take 5 system as one means to identify, communicate, and control new hazards. This system was very successful and Take 5's was discussed daily at the toolbox meetings. This ensured that everyone was aware of new hazards as they were identified and advised of what control measures were put in place to control them.

All Take 5s were documented and added to the HiSeis WHS system. Action points arising from the documents would be issued a priority rating, assigned to a department, given a target date for close, and reviewed on a regular basis to ensure that all action points were followed up on and subsequently closed out.

There was a total of 615 Take 5's submitted during the project. The need for accurate and timely hazard reporting was reinforced at every opportunity. It was emphasised to the Crew to report all Unsafe Acts, Unsafe Conditions, Near Misses, Environmental Hazards – all of which were relayed to the crew at the next day's toolbox meeting. The Take 5's can be anonymous with only the date and department being required for reporting purposes.

7.3 HAZARDS

7.3.1 Traffic management/ Working on public roads.

Given the diverse conditions of the survey area, constant interactions with public vehicles were managed by traffic management controllers broken up into 3 teams.

1. 1 – 2 x TMC crew with node deployment.
2. 1 x TMC crew with nodes retrieval
3. 1 x crew of up to 5 TMC crew working with the vibes. Lane closures were required from Bridgetown to Nannup.

Land transport was the number one hazard to all personnel working on the project. There were no reported road traffic accidents for the duration of the survey.

The vehicles used on the crew included:

- 11 Toyota Hilux Utes
- 2 Isuzu MR trucks
- 2 HV trucks

7.3.2 Vehicle Maintenance

HiSeis staff were responsible for completing the daily vehicle inspection checklist each morning. These checklists documented vehicular deficiencies, vehicle kilometers, and driver details. A weekly mechanical and safety equipment exceptions list was compiled by the Journey Manager and distributed to the mechanic and HSE departments for resolution. If a deficiency was deemed to be a safety issue, the vehicle was taken off the road until it was repaired or had its safety equipment restored.

7.3.3 Journey management

Journey Management was critical for crew especially when mobilizing to/from Perth/Margaret River and when working on the spread. The JESI journey management app was utilized by HiSeis to safely manage and track personnel movements.

7.3.4 Working in heat / wet conditions

One of the most common hazards for the seismic crews was working outdoor with elements such as heat and wet weather. As the climate warmed up, the risk of heat illnesses increased, hydration was a regular topic at the daily toolbox meeting. Management ensured that the crew was aware of the importance of drinking plenty of water in addition to supplying hydrolyte supplements to replenish electrolytes. Information on heat stress management and the recognition of its signs / symptoms was reviewed on more than one occasion.

Each vehicle was outfitted with water containers ranging from 5 – 40 liters depending on the type of vehicle and number of crew members it supported. In addition, crew members utilized smaller 1 liter water containers and personal sport bottles that were topped up from the larger containers.

7.3.5 Snakes and Wildlife

Due to the location of the survey area, poisonous snakes known to inhabit the region were a concern. Over the course of the project several snake sightings occurred in various locations along the survey area. For this reason, the need for increased attention and awareness was raised at the toolbox meetings. First aid training was given to members of the crew so that the team would know how to attend to a snake bite victim. Snake bite kits and first aid kits were distributed to the crew and were also standard safety equipment within each vehicle. There were no occurrences of snake bites during the survey.

Another concern was the presence of livestock, kangaroos and other fauna that posed a threat to transportation on primary roads, service roads and access tracks throughout the survey area. The vehicle fleet is outfitted with bull-bars, daytime running lights, and the crew was restricted to daytime only operations to help reduce the exposure to wildlife.

Figure 7-1 : Snake spotted on the seismic spread.

7.4 HSE MANAGEMENT

The HSE Management System on this project was derived from the HiSeis inductions, safety management processes. A specific HSE Plan was written for the GSWA – SW1 2D seismic survey. The HSE Plan was developed with input from the crew for all HSE documentation, hazards, risks, and emergency response plans. The project specific HSE Plan was signed off by the HiSeis Operations Manager, Project Manager, and Senior Crew Manager.

7.4.1 HSE Management Process

Crew safety is a driven as a 'top-down' approach – from the HiSeis CEO to the GM of Operations, down to the Project Manager, through to the Senior Crew Managers and finally to the individual workers.

The Safe Work System refers to the identification, assessment, control, and recovery from hazards. These steps are essential to the safe working of every crew where every incident is, in effect, a failure of the process. The risks that hazards presented were managed on this crew by sound policies, good procedures, good work instructions, and systematic planning, implementation, and monitoring activities.

7.4.2 Safe Work Procedures

The HSE Plan covers all relevant work procedures for this crew. New work procedures for the crew needed to be developed to ensure safe operations for the GSWA southwest line. Work procedures were developed based upon identifying hazards, assessing the risks, and placing controls to ensure a safe system of work. Sub-contractor work procedures had to be reviewed for suitability and ensure

their work interfaced well with HiSeis work.

7.5 HSE COMMUNICATION

HSE Policies, Corporate, Regional, Country and Crew Organograms, Safety Alerts, various meeting minutes, crew rosters, and general issues were communicated through the HiSeis online WHS system, Epicentre daily reports, and meetings.

7.5.1 Toolbox Meetings

A total of 34 toolbox meetings were held during the survey and were an effective way to exchange information between the crew and managers. Each morning before the start of field operations, a general toolbox meeting was held with all crew members in attendance to discuss any safety concerns from the previous day. Take 5 cards were reviewed and discussed along with the previous day's operational information being exchanged.

There was good participation from the crew during these meetings, which allowed for open discussion on related safety points and subsequent suggestions for improvements. A random crew member was selected each day to speak on a safety related topic the following day to ensure the crew was actively participating in the meetings.

7.6 ENVIRONMENT

7.6.1 Environment Impact Minimisation

Throughout the duration of the project, a joint effort was made to minimize environmental impacts along the survey area. Some of the strategies used were:

- Coordinating with GSWA representative to have clear plans on each day's activities.
- Reviewing each laydown area to ensure that no waste or equipment was left behind.
- Working within the buffer zones along the seismic line.
- Minimising emissions by keeping motorised equipment maintained.
- Pre plotting of bridges, culverts, and other infrastructure.
- Abiding by and being familiar with sensitive fauna and flora.
- Avoiding wildlife interaction.
- Organising the shooting plan to minimise acquisition impact on roads.

8 KEY PERFOMANCE INDICATORS

Throughout the entirety of the seismic survey project, HiSeis maintained a high standard of safety and communication with GSWA. HiSeis is proud not only of meeting but also exceeding predicted acquisition goals for the seismic survey project. Notably, the team achieved an outstanding 99.34% trace yield which is significant in the pursuit of obtaining the best data possible. Despite the challenges posed by the terrain, working on public roads and operational complexities, HiSeis consistently delivered an impressive average of 469 shots per day. Furthermore, the company's commitment to diversity and inclusion was evident, with a notable 25% of the workforce consisting of female employees. HiSeis' dedication to excellence extended to issue resolution, where a flawless 100% resolution rate was achieved. These exceptional results underscore HiSeis' unwavering commitment to delivering high-quality seismic survey services while exceeding client expectations.

9 APPENDIX

9.1 SEGY HEADERS – FIELD SHOTS

See accompanying INOVA trace header specifications document.

INOVA Disk Tape and Tape Image Formats 7D.pdf

9.2 DELIVERABLES

Table 9-1. Deliverables

Item #	File name	Description
1.	Correlated shot gathers	SEGY
2.	Uncorrelated shot gathers	SEGY
3.	Passive data – 1 minute records	SEGY
4.	Sweep tests – correlated shots and brute stacks	SEGY
5.	Source and receiver locations in ASCII format (SPS).	ASCII
6.	Observers logs	XLS
7.	Sweep files	SEGY
8.	Correlated shot gathers - reshoot	SEGY
9.	Uncorrelated shot gathers - reshoot	SEGY
10.	Passive data – 1 minute records - reshoot	SEGY
11.	Source and receiver locations in ASCII format (SPS) - reshoot	ASCII

9.3 QUNATUM NODE SPECIFICATIONS

INOVA®

QUANTUM®

FEATURES

- All-in-one single component recording unit
- Lightweight node weighing only 650g
- 50 days typical, 24 Hr operation
- Local 16 GB data storage
- Optional HyperQ long range wireless QC using technology

GENERAL SPECIFICATIONS

No. of Analog Channels:	1
Data Storage Capacity:	16 GB non-volatile flash memory
Integrated Battery:	Rechargeable Li-ion
Battery Life:	50 days typical, 24 Hr operation
	42 days typical, 24 Hr operation (with HyperQ)
Wireless Communication:	Bluetooth LE, Optional HyperQ
GPS:	L1-GPS /QZSS, GLONASS,
	BeiDou, Galileo
Timing Accuracy:	+-5 µs
Sensor:	Vertical 5Hz or 10Hz
	high-sensitivity geophone
Charging Temperature:	+5 °C to + 40°C
Operating Temperature:	-40 °C to +70 °C
Water Immersion:	IP68

PHYSICAL

Size:	10.9 cm x 9.8 cm x 10.7cm
	(Excl. spike) (4.4" x 3.9" x 4.2")
Weight:	0.65 kg (1.43lbs) incl internal battery
	and geophone

ANALOG SPECIFICATIONS

A/D Converter:	24-bit
Sample Rates:	1 ms, 2 ms, or 4 ms
Gains:	0 dB, 6dB[1], 12 dB, 18dB[1], 24dB[1]
Maximum Input Signal (RMS):	3.535 V @ 0 dB , 1.768 V @ 6 dB
	0.884 V @ 12 dB, 0.442 V @18dB
	0.221 V @ 24 dB
Equivalent Input Noise* (RMS):	1.408 µV @ 0 dB
	0.712 µV @ 6 dB, 0.368 µV @ 12 dB
	0.202 µV @ 18 dB, 0.132 µV @ 24dB
Instantaneous Dynamic Range*:	128 dB @ 0 dB,128 dB @ 6 dB
	128 dB @ 12 dB,127dB @ 18 dB
	124 dB @ 24 dB
System Dynamic Range*:	148 dB
Total Harmonic Distortion:	<0.1% with 10Hz HS phone
	<0.2% with 5Hz HS phone
Channel Matching:	Better than 1%
Anti-Alias Filter:	3dB @ 0.876 *f* N (Nyquist)
Filter Options:	Minimum and Zero Phase

AUTOMATED TESTS

Unit temperature, sensor tilt, system equivalent input noise, sensor noise, dynamic range, geophone DC resistance, THD, natural frequency, damping, sensitivity

[1] Gain option when operating in hybrid with G3i® HD

*Typical specifications @ 2 ms @ 25°C

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Figure 9-1. Quantum node specifications

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