DATA REPORT FOR 2D SEISMIC PALEOCHANNEL CHARACTERIZATION, SOUTH BRUCE, ONTARIO

APM-REP-01332-0388 March 2024

Geofirma Engineering Ltd.

NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Nuclear Waste Management Organization
22 St. Clair Avenue East, 4th Floor
Toronto, Ontario
M4T 2S3
Canada

Tel: 416-934-9814
Web: www.nwmo.ca

Data Report for 2D Seismic Paleochannel Characterization, South Bruce, Ontario

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Prepared for:

Nuclear Waste Management Organization
22 St. Clair Avenue East. 6th Floor
Toronto, ON, M4T 2S3

Prepared by:

GEOFIRMA ENGINEERING
1 Raymond St. Suite 200, Ottawa, Ontario K1R 1A2
613.232.2525 613.232.7149 geofirma.com

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Prepared by:	David Schieck and Randy Chodziki	
Reviewed by:	Sean Sterling and Angela Garrison	
Approved by:	Sean Sterling Sean Sterling (M.Sc., P.Eng., P.Geo.) – Project Manager - Principal	

Revision Tracking Table

Revision	Revision Release Date	Description of Modifications/Edits
R0	July 7, 2023	Initial Release
R1A	Oct 27, 2023	Revised report addressing GRG and additional NWMO comments after R0 version.
R1B	Dec 22, 2023	Revised report addressing additional NWMO comments after R1A version.
R1C	Mar 7, 2024	Revised report addressing additional NWMO comments
R1	Mar 22, 2024	Final version (R1) revised to address NWMO and GRG comments

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1 INTRODUCTION

Geofirma Engineering Ltd. (Geofirma) has been contracted by the Nuclear Waste Management Organization (NWMO) to implement several components of the NWMO Phase 2 Geoscientific Preliminary Field Investigations at the South Bruce site, near Teeswater, Ontario as part of the NWMO's Adaptive Phased Management (APM) program.

As part of this work, Geofirma completed a 2D seismic reflection study (approximately 6 linear km) that is situated within a larger 3D seismic reflection study area (approximately 15 km^2) that was also completed during the same mobilization. The 2D seismic study area is approximately 8 km^2 as shown in Figure 1, comprising three individual seismic lines, each approximately 2 km in length and spaced approximately 2 km apart along existing roadways northwest of the community of Teeswater, Ontario.

Geofirma subcontracted and supervised Echo Environmental and Geotechnical Seismic Ltd. (Echo-Geotech) to provide the geophysical technical input including design, data acquisition, data processing, and data interpretation for this portion of the project.

This technical report documents activities associated with Geofirma's 2D land-streamer seismic reflection study including data acquisition, data processing, and data interpretation. The 3D seismic reflection study is described in two separate reports (Geofirma Engineering Ltd., 2023a and 2023b).

1.1 2D Seismic Project Purpose and Objectives

This work was primarily completed to provide further understanding and interpretation within a known local infilled bedrock valley, locally known as the Wingham Valley, which extends through the South Bruce study area and is believed to be formed as a remnant river valley (paleochannel). While there are basic details of the approximate depth and extent of this buried bedrock valley, this study intends to better understand the size, shape, and depth of the ancient bedrock valley. It is important to better understand the approximate distribution of overburden thicknesses (both laterally and in depth) to provide context for any potential future infrastructure design (above or below ground) and to better understand the hydraulic connection between overburden and shallow bedrock.

This 2D seismic reflection study included a shear source and 3-component receivers were used to generate images of the subsurface in order to map in detail the buried valley, reported in Gao (2011) to have a width ranging from 750 to 1000 meters and depths reaching up to 40 meters in the vicinity of Teeswater. These data will help to interpret the depth to bedrock, lithologic soil boundaries within the buried valley, and shear velocities to describe the paleochannel characteristics.

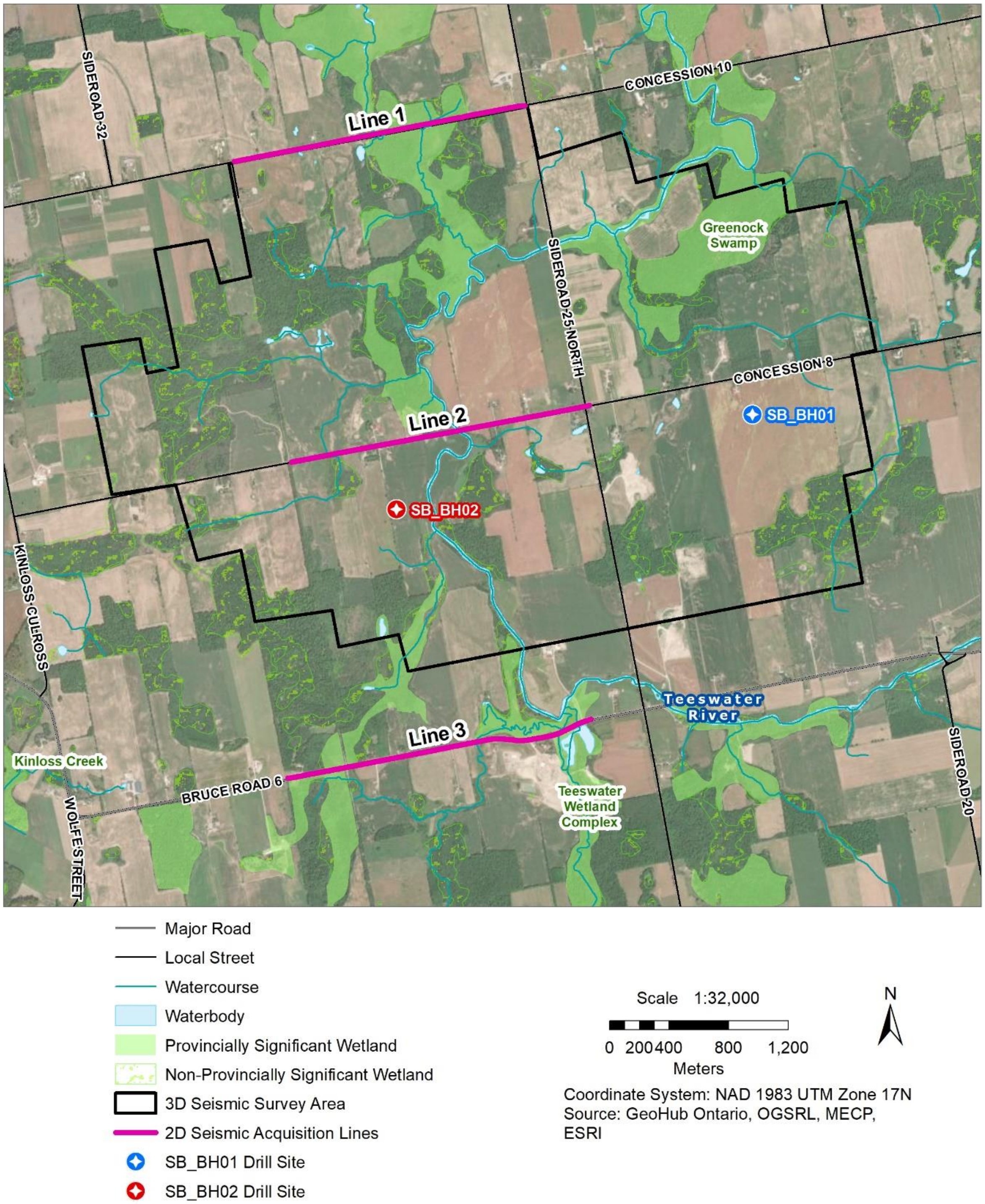


Figure 1 Locations of 2D seismic acquisition lines for the Buried Valley study

2 GEOLOGICAL BACKGROUND

2.1 Regional Geological Setting

While this study focusses on the geometry of the bedrock surface, a brief overview of the regional geology, including the Paleozoic bedrock sequence and overlying unconsolidated material, is warranted.

The Paleozoic-aged strata at the South Bruce site were deposited within the Michigan Basin northwest of the Algonquin Arch in southwestern Ontario. The Michigan Basin is a circular-shaped, carbonate-dominated, intracratonic basin that is composed primarily of shallow marine carbonates (limestone, dolostone), evaporites, and shales that were deposited while eastern North America was at tropical latitudes (Armstrong and Carter 2006, 2010). West of the Algonquin Arch, the Paleozoic strata tend to gradually dip westward towards the centre of the Michigan Basin. In the South Bruce site, this succession of Paleozoic strata rests unconformably on an erosional surface of Precambrian crystalline basement rocks (at approximately 900 m below ground surface) of the Grenville Province, a tectonic subdivision of the Canadian Shield.

The Paleozoic bedrock near the South Bruce site is overlain by a variable thicknesses of overburden (unconsolidated) sediments (including sand, gravel, boulders, till, etc), ranging from tens of meters in average thickness and locally reaching a maximum thickness of approximately 250 m east of the Niagara Escarpment (Gao et al. 2006; Gao 2011).

2.2 Local Bedrock Valleys

Many bedrock valleys and depressions exist beneath thick surficial deposits in southern Ontario. Narrow but deep bedrock lows or gorges include the Milverton, Wingham, and Mount Forest valleys to the west and northwest of Kitchener. The Mount Forest, Wingham, and Milverton valleys are rectilinear to slightly curved gorges with widths ranging from 2 to 4 km and depths of 40 to 70 m trending to the southeast across the Algonquin Arch as detailed by Gao (2011). Gao extracted depth-to-bedrock information from water-well, petroleum and geotechnical drill records as well as published geological maps (Gao et al., 2006).

One of these paleochannels or buried valleys (Wingham Valley) was known to exist within the South Bruce site and this study will help to better determine its geometry by using seismic shear wave (S-wave) reflection techniques. A map of the thalweg, which is a line connecting the lowest points along a river valley, based on the work by Gao (2011) was used as a guide for the location of the three East-West oriented 2D seismic acquisition lines acquired at the site.

Drilling results from the two nearby deep boreholes (SB_BH01 and SB_BH02), drilled as part of the Phase 2 Preliminary Field Investigations by NWMO during 2021-2022, found that overburden thicknesses range from 20 to 35 meters below ground surface (mBGS) in SB_BH01 and SB_BH02, respectively (Geofirma Engineering Ltd., 2022; Geofirma Engineering Ltd., 2023c). Similarly, a recent report published by the Ontario Geological Survey (OGS) including a data grid of overburden thickness (depth to bedrock) (Gao. 2011) indicates that the overburden thickness is very irregular within the South

Bruce site, ranging from zero in areas with outcropping bedrock to up to 64 m along the western boundary of the study area.

Based on its position, the Wingham bedrock valley is estimated to reach depths of 60 to 100 mBGS and situated within the upper 30 to 70 metres of bedrock comprising the shallow Devonian-aged rocks of the Lucas and Amherstburg formations.

3 DATA ACQUISITION/FIELD ACTIVITIES

Geofirma contracted Echo-Geotech to complete the field data acquisition of this project. The seismic reflection data acquisition phase of this project involved a series of tasks as described below. Echo-Geotech provided an ARAM24 recording system which included the central system, field station units, batteries, and geophone sensors. All geophones and recording equipment were tested to meet manufacturers' specifications. The geophone sensors used for this project were GS20Dx 10 Hz 3-component single geophones.

Echo-Geotech completed a test of several vibration sweeps on November 24, 2021 to optimize the land streamer vibration parameters for the study. The final selected vibration parameters included a 10-seconds long vibration sweep of 8-120 Hz. Several scenarios were tested including 8, 10, 12 and 24-second sweeps with increasing higher frequencies up to 160 Hz, however no useable data was observed above 120 Hz. The entire data acquisition phase of this project was completed over a 6-day period between November 25 and December 1, 2021. During this period, the weather was overcast and cold ranging from -6 to +1 °C with little to no rain or snow, therefore data acquisition was able to proceed as planned without any major delays.

3.1 Field Equipment

The seismic data acquisition equipment used for this study was owned and operated by Echo-Geotech. Table 1 provides a summary of the equipment that was used for data acquisition and field activities.

Echo-Geotech has developed and tested a low cost, non-intrusive shear source which tows a series of equally spaced (1.5 m) 72 x 3-component (3C) receivers. The 3-component receivers record two S-wave (shear) signals and one P-wave (compression) signal. The two S-wave signals include inline shear wave (SI) and crossline (horizontal to inline) shear wave (SH). The shear wave data is predominantly recorded on the crossline (SH-wave) component.

The equipment was used to acquire continuous lines of data with 0.75 m lateral sampling for SH-wave and P-wave reflections sections. The Vibroseis unit was operated to stop and shake every 3 m. The data for each sweep, all 72 X 3 components, are recorded at 0.5 milli second (ms) sample rate. The quality control data of these measurements are reviewed in the recording truck instantaneously on the display monitor. Figure 2 shows photos of the vibroseis equipment and geophone layout during data acquisition.

Production sweeps involved two SH sweeps using a horizontally vibrating plate that was oriented transverse or perpendicular to the line. Each of the two sweep sequences are 180 degrees out of phase meaning that it commenced the sweep in opposite directions. For the SH-wave records, these two sweeps were correlated and subtracted. For the P-wave (vertical component), the two sweeps were correlated and added together. By subtracting the two SH sweeps, one reduces any P-wave or vertical signal that may be present within the SH-wave data and enhances the SH sweeps which were 180 degrees out of phase, essentially boosting the signal-to-noise ratio. For the P-wave data, the addition of the two sweeps reduces the signal-to-noise ratio and, because the sweeps are generated horizontally, both sweeps are the same polarity in a vertical sense (e.g., 90 degrees or perpendicular to the sweep direction).

Table 1 Summary of Field Equipment for Data Acquisition

Component	Component Description
Aram recording system	Vibroseis electronics, Omni GPS tablet and antennae, recording computer
Vibrator Units and Electronics	Envirovibe buggy with S6 Shear vibrating pack
Support Vehicles (trucks)	Cage truck to pick-up deploy seismic streamer
Land Streamer	72 x 3C receivers spaced 1.5 m apart affixed to Kevlar strap 9 - Aram Aries remote 24 channel acquisition modules connected to 9 strings of 8, 3 component GS20Dx 10 Hz geophones
Toolbox/toolkit	Various hand tools used for troubleshooting, repairing, and maintaining geophysical recording equipment
Personal PPE	Minimum PPE for work included CSA Composite Safety steel toed boots. Additional PPE, including eye protection, gloves, CSA certified head protection, and hearing protection was used as dictated by specific work activities.

Figure 2 2D seismic data acquisition equipment. Left: Vibroseis unit and geophone streamer; Right: Detailed view of land streamer equipment (geophones are yellow)

3.2 Field Parameters

Table 2 summarizes the Land Streamer field acquisition parameters outlining the type of equipment used for source and receiver (geophone) and spacing parameters. This resulted in the acquisition of seismic data over three lines with a total length of 6089.25 m and 1942 source points. Table 3 summarizes the details of the 3 seismic lines, including number of source stations, number of common mid points and total line length.

Table 2 Field Parameters

Number of Lines	3
Total Line Length	6089.25 m
Source Spacing	3 m
Receiver Spacing	1.5 m
Total Number Source Points	1942
Average # Source Points per Line	647
Bin Size	0.75 m
Nominal Fold	18
Receiver Type	GS20DX 10 HZ 3-component
Tail Spread	72 x 3C channels, 144 traces from -4.5-111 m with offsets @1.5 m spacing
Sweep	2 sweeps x single SH Envirovibe, 180 degrees out of phase, 10-160 Hz 1.2 second sweep length
Recording parameters	3 second record length, 0.5 ms sample rate

Table 3 Line Parameters

Line	Length (m)	# Source Stations	Source Start ID	Source End ID	# common mid-points	Receiver Start ID	Receiver End ID
1	1992	642	121	767	2656	101	47620
2	2042.25	640	104	767	2723	101	47476
3	2055	660	102	767	2740	101	48916
TOTAL	***6089.25***	***1942***			***8119***		

1942 total number source points of 3 component files 3 seconds in length at 0.5 ms

Figure 3 shows the surface conditions for the 2D seismic acquisition area with contoured bedrock topography. These topographic contours are based on local domestic water well data. As shown in the image, all three seismic lines are situated along existing roads and station numbering is from east to west, extending across the inferred bedrock valley location.

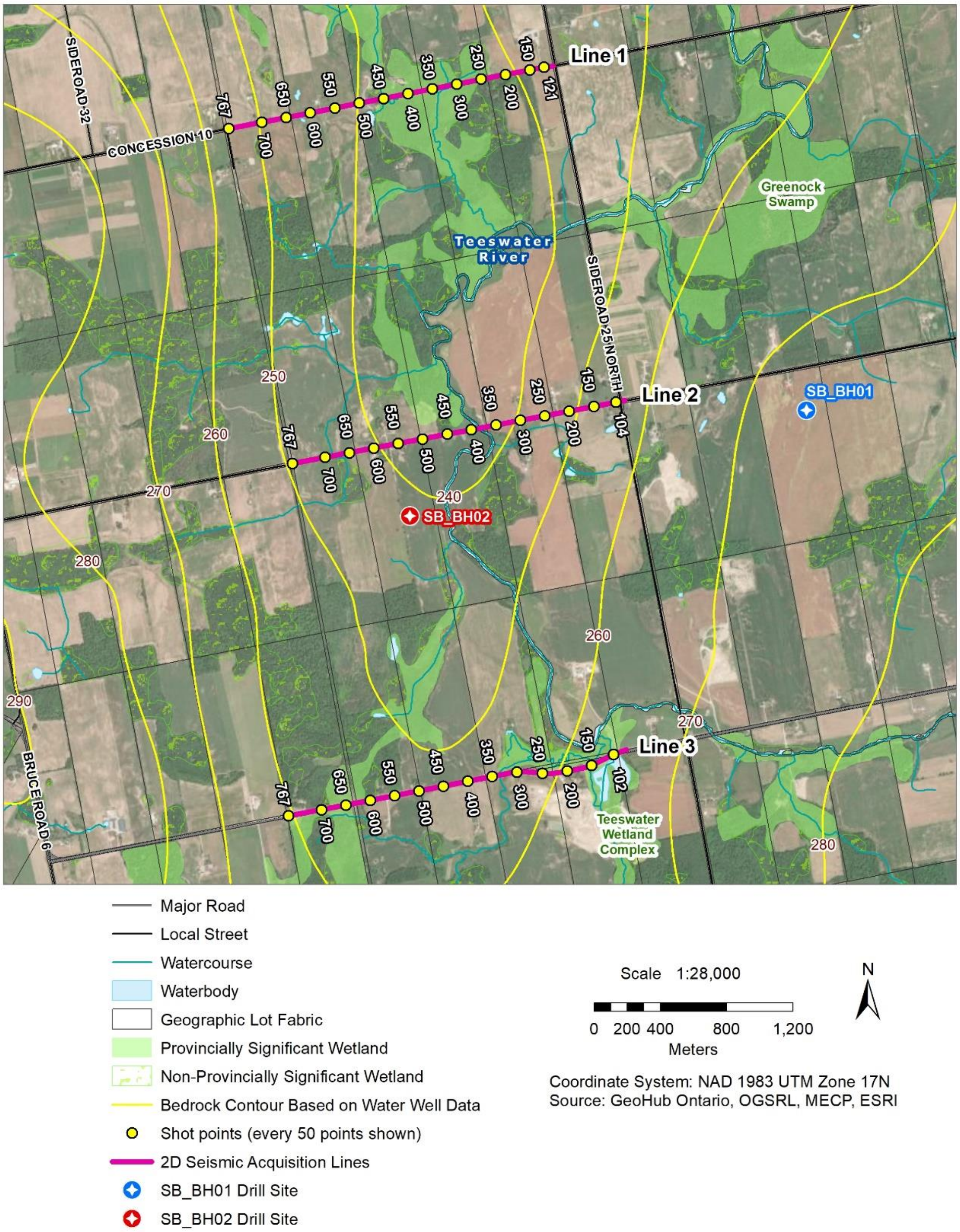


Figure 3 **2D seismic line locations and source station IDs with inferred top of bedrock elevation contours (mASL) based on water well data**

4 SEISMIC DATA PROCESSING

4.1 Preconditioning of the Data

The raw data was correlated with the reference sweep to provide correlated data as shown in Figure 4. Two-way seismic traveltime (ms) is presented in the Y-axis and Source Station ID is plotted on X-axis. These data include all 3 components of the 72 geophones for a total of 216 channels plus 6 auxiliary traces, which include the time break and correlated reference sweep. This is one of two vibrator source points that are aquired at each source station location. A second sweep (shown in Figure 5) is recorded at the same pad location but is 180 degrees out of phase (i.e., the first point is taken with vibe sweep initiated to the left of the road and the second point initiates the swep to the right). Traces 1-72 are the P-wave or vertical component, traces 73-144 are the inline shear (SI) component and the last 145-216 traces are the crossline shear (SH) component. All seismic data processing was completed by Echo-Geotech.

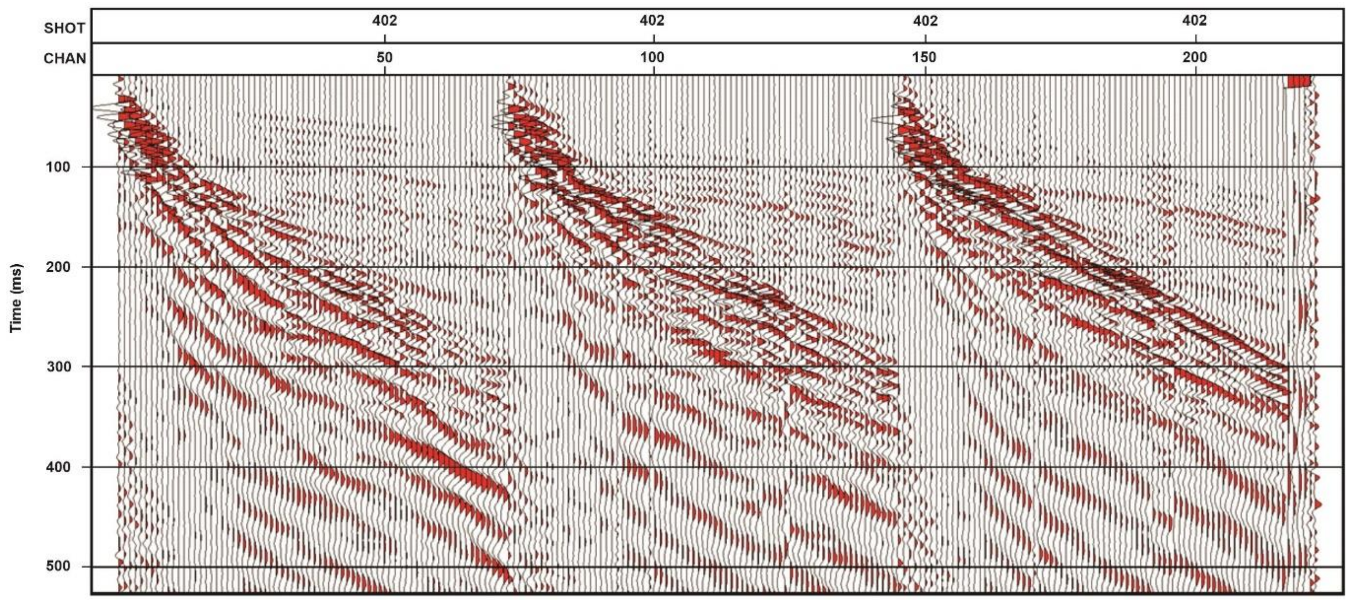


Figure 4 Sample raw correlated data point 0-phase sweep source station 402 Line 3, increasing channels 1-216 from left to right, left channels 1-72 P-wave or vertical component, middle channels 73-144 inline shear (SI) and right channels 145-216 crossline shear (SH) component

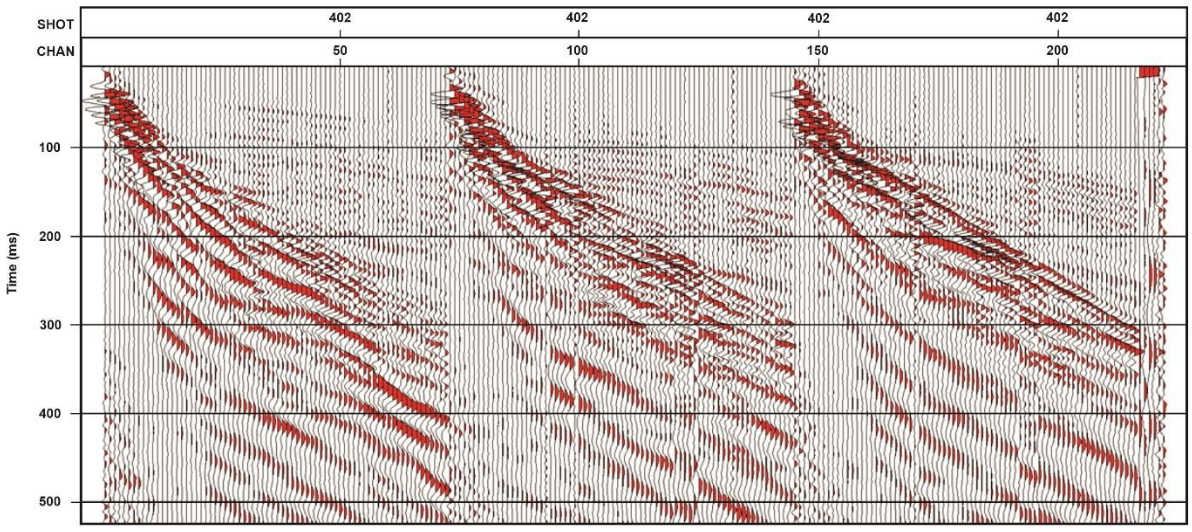


Figure 5 **Sample raw correlated data point 180-degree phase source station 402 Line 3 increasing channels 1-216 from left to right, left channels 1-72 vertical or P-wave, middle channels 73-144 inline shear wave (SI) and right channels 145-216 crossline shear wave (SH) component.**

These records were split into 6 different files, namely the 0-degree and 180-degree phase for each component. These two versions of the SH-wave component are subtracted to reduce the P-wave elements and enhance the SH-wave component as shown in Figure 6. Similarly, the P-wave or vertical component is summed to enhance the vertical component signal-to-noise ratio as shown in Figure 7. Similarly, for both of these figures, two-way seismic traveltime (ms) is presented in Y-axis and Source Station ID is plotted on X-axis.

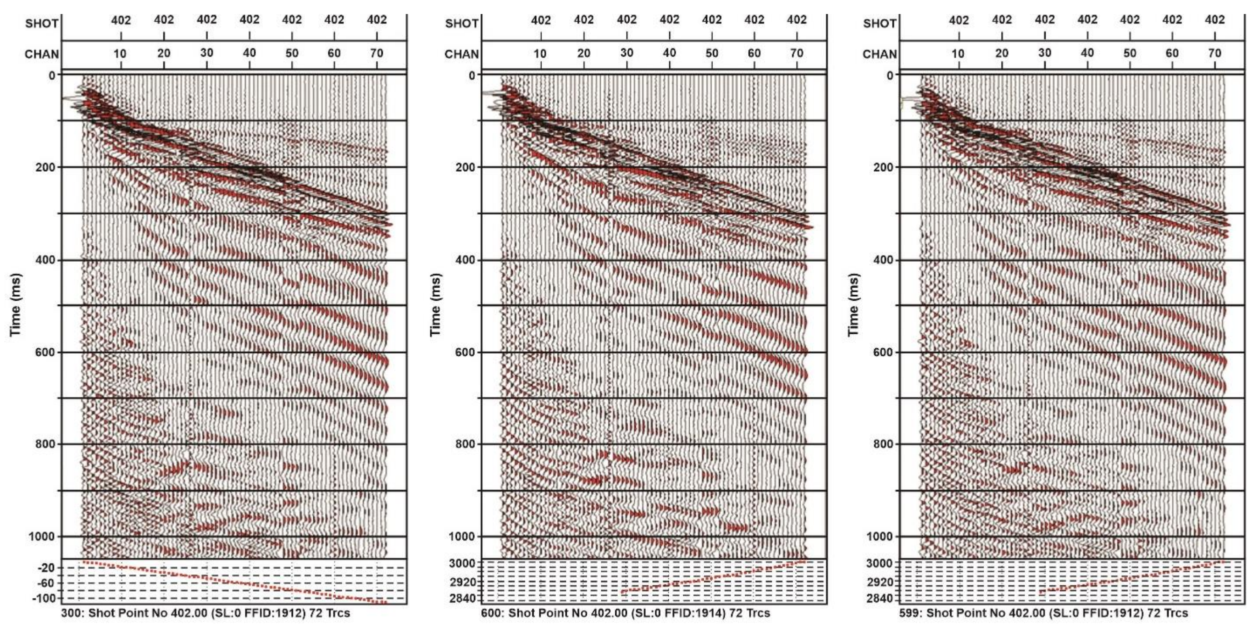


Figure 6 **SH component source station 402 from Line 3. Left plot is result of subtracting the middle plot (0 degrees Phase) from the right-hand plot (180 degrees Phase).**

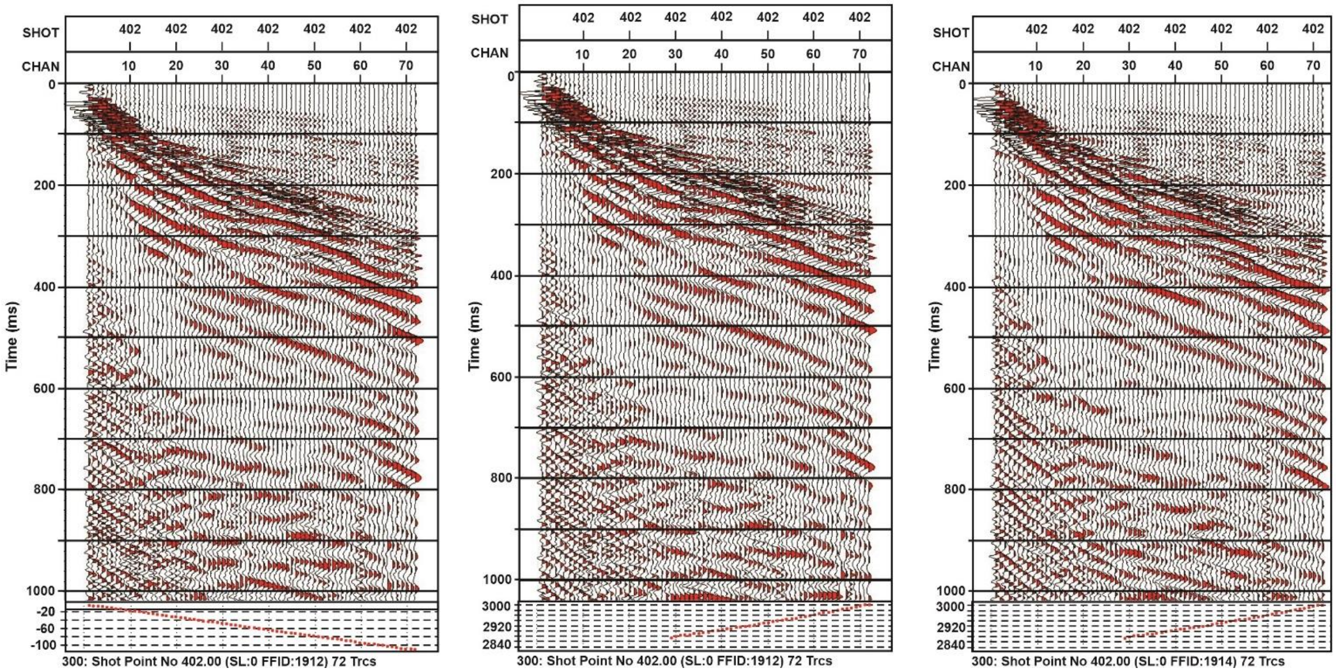


Figure 7 P-wave component source station 402 Line 3. Left plot is combined by adding the middle plot (0 degrees Phase) and the right-hand plot (180 degrees Phase).

4.2 Processing Workflow

The processing workflow completed by Echo-Geotech is summarized in the following six steps:

Step 1: Reformatting and separating the data. This initial step involves reformatting the raw data acquisition from the field for the processing software and separating it into the different components for processing the SH and P wave components. This involves several tasks, including:

- Demultiplex/reformat the data to be ready for processing
- Isolate the SH and P components
- Add or subtract SH and P wave records to increase the signal-to-noise ratio of the data

Step 2: Creating a geometry for the lines. Applying surface bin and trace coordinates to organize the data so it can be organized in different displays during the processing and provide the final coordinates (station numbers and XYZ coordinates) for the processed lines.

Step 3: Data signal-to-noise ratio enhancement. Noise removal techniques are applied to increase S/N and enhance the quality of the seismic gathers. This involves several tasks, including:

- Trace editing – to remove or scale bad traces
- Ensemble balance – ensures consistency between traces
- F-K filter – Removes the noise of low velocity ground roll
- Gain Recovery – recover low amplitude signal (exponential scaling 1^p, p=1.25)

- Zero phase Deconvolution – recovers a consistent phase to the data (operator length 60ms, Pre-whitening 0.01)

Step 4: Flattening reflection for stacking. This step is completed before stacking and helps determine the velocities for stacking and migrating the data. This also increases the signal-to-noise ratio of the final image. This involves several tasks, including:

- Velocity picking – Using Semblance to pick velocities for Normal Move Out (NMO)/Stacking velocities
- F-K filter – A linear & erratic noise suppression filter
- Common Depth Point (CDP) trim statics to correct for not correctly flattened events (Sliding 100ms window with a bandpass filter 10/15-55/60
- Picking of mute pairs for stacking [(d,t) 18.9,19.5 34,88 72,259 111,371]
- Second pass of CDP trim statics (weighted model)

Step 5: FX deconvolution for further noise suppression (Levinson-Durbin 5trace, 50trace, 100ms design window)

Step 6: Stacking and Migration. Stacking is the first stage with an image that shows a subsurface profile. Migration puts reflection information that may be in the wrong location back to its correct spot, creating a cleaner, more geologically correct image. This involves several tasks, including:

- Stacked data to produce a cross section
- Filter and Gain control for better imaging
    - Applied bandpass filter 15/25-90/110
    - Automatic gain control (AGC) of 150ms
- Post-Stack Finite Difference Migration to place reflections in the proper location (100% stacking velocities)

Figure 8 and Figure 9 show the results of applying steps 1-6 on the crossline shear wave (SH) and compressional wave (P-wave), respectively.

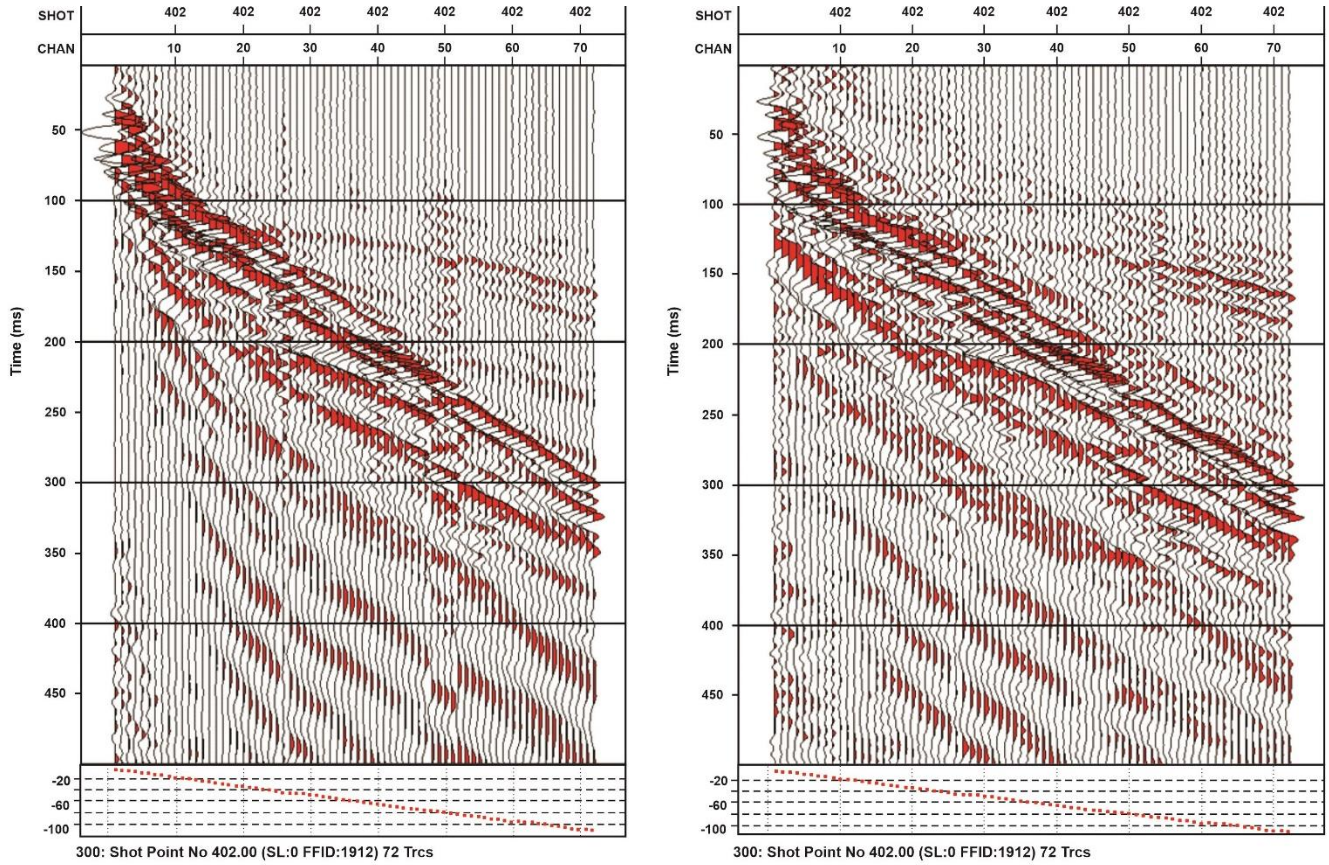


Figure 8 Line 3 SH component pre-conditioned seismic data on the left and results of steps 1-6 on the right

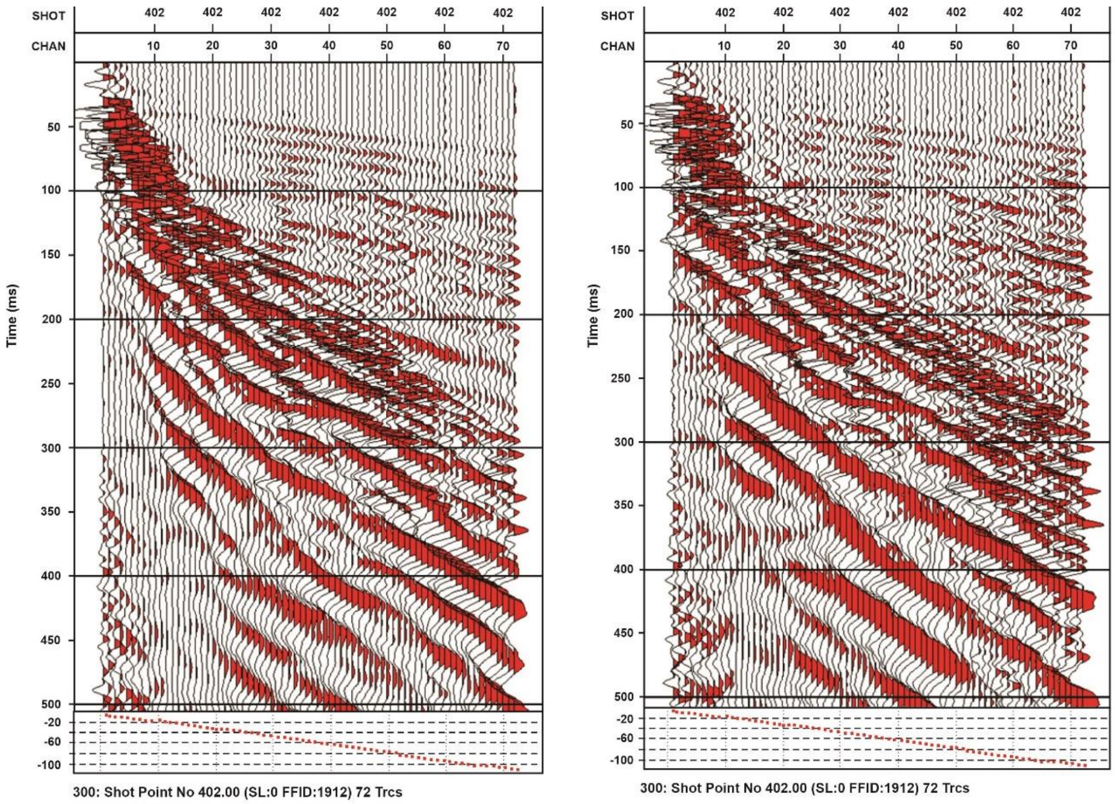


Figure 9 Source station 402 Line 3 P-wave component pre-conditioned data on the left and results of steps 1-6 on the right

Interactive velocity analysis (Step 4) is performed on the filtered, scaled and deconvolved source records by rearranging them into common midpoint gathers and combining 5 adjacent gathers into a super gather arranged by offset. Semblance analysis is the process of applying a range of velocities to these super gathers and stacking laterally across them to create a time versus velocity plot shown in Figure 10A. An interactive program is used to pick optimal velocities that are used to generate common-midpoint stacks of these data along the line, every 50 common midpoints or 37.5 m.

These velocities are then used to create the final seismic stacks by using the processing workflow steps 5 and 6.

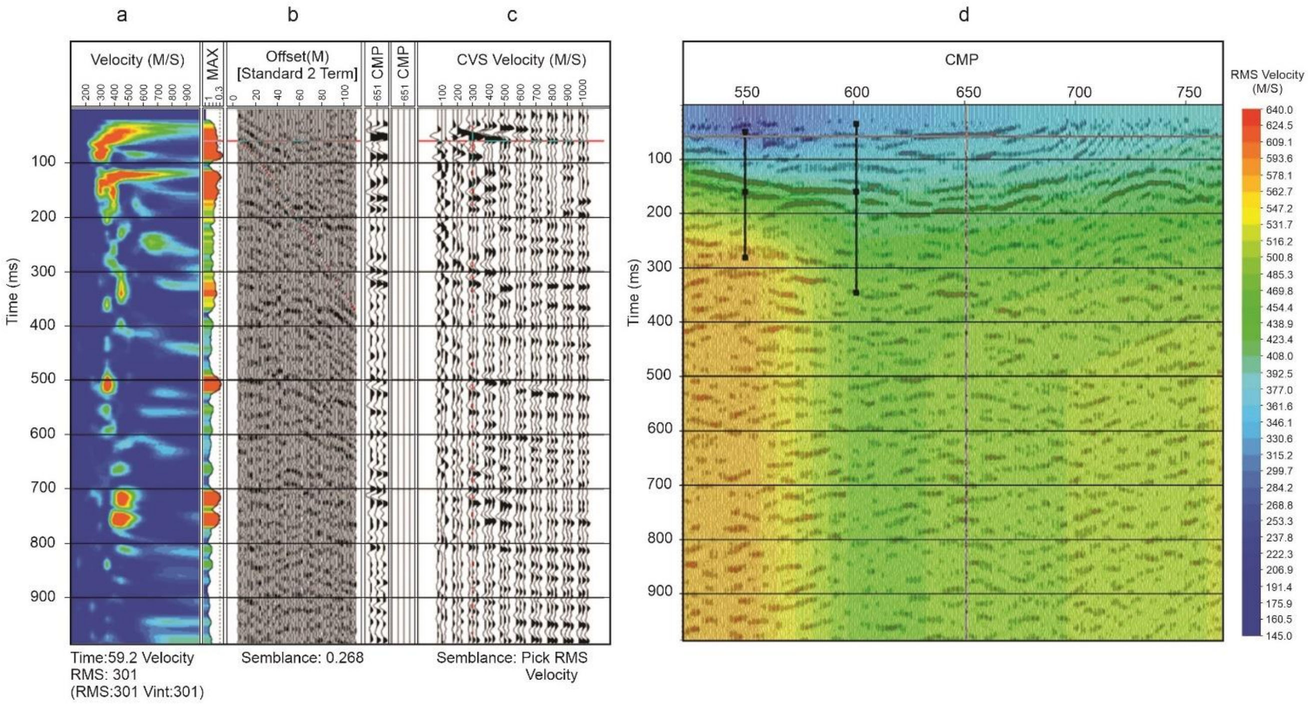


Figure 10 **Interactive semblance analysis of SH velocities Line 3. (a) semblance versus velocity, (b) common offset gather, (c) common velocity stack, and (d) brute stack with these velocities showing the location of the current gather (red vertical line).**

4.3 Final Profiles

The final processed seismic profiles are presented in Figure 11 through Figure 16 with a vertical scale in two-way traveltime (ms) and two horizontal scales including source station numbers (Source) and common midpoint (CMP) numbers (with the lowest numbers on the right). Both the SH-wave and P-wave sections are shown for comparison showing that the SH-wave sections provide superior imaging. Two images are presented in each figure, including unmigrated sections (i.e., seismic stacks) on top and migrated sections on bottom. Note the P-wave reflection sections are typically unclear for overburden characterizing unconsolidated near surface overburden when less than 40 m thick. This could be attributed to the velocities being exceptionally high, creating a narrow data window between refractions and ground roll at shallow depths. The significance of SH waves at shallow depths lies in their considerably slower velocities, ranging from 6 to 10 times slower than P waves. This results in substantial data windows for the processing flows of SH-wave reflection events, enabling the imaging of depths as shallow as 4 to 6 meters in some cases. A useful reference detailing some of these advantages of SH-wave reflections in seismic analysis is Pugin et al., 2013.

Figure 11 shows the SH-wave section for Line 1, which displays a clear representation of the bedrock contact reflections as well as other reflection events within the overburden. Two reflections are evident with improved resolution on the migrated sections. Conversely, Figure 12 shows the P-wave stack for Line 1 with reduced resolution of the subsurface.

Figure 13 depicts the SH-wave section for Line 2 showing a comparable quality to Line 1 but with improved imaging of a shallow reflection on the migrated section. Figure 14 provides the P-Wave section for Line 2 also with reduced quality imaging.

Figure 15 shows the SH-wave section for Line 3 with a strong bedrock reflection and good image quality in both the seismic stack and migrated sections. Figure 16 provides the P-wave section for Line 3 with the same reduction in imaging quality as in Lines 1 and 2.

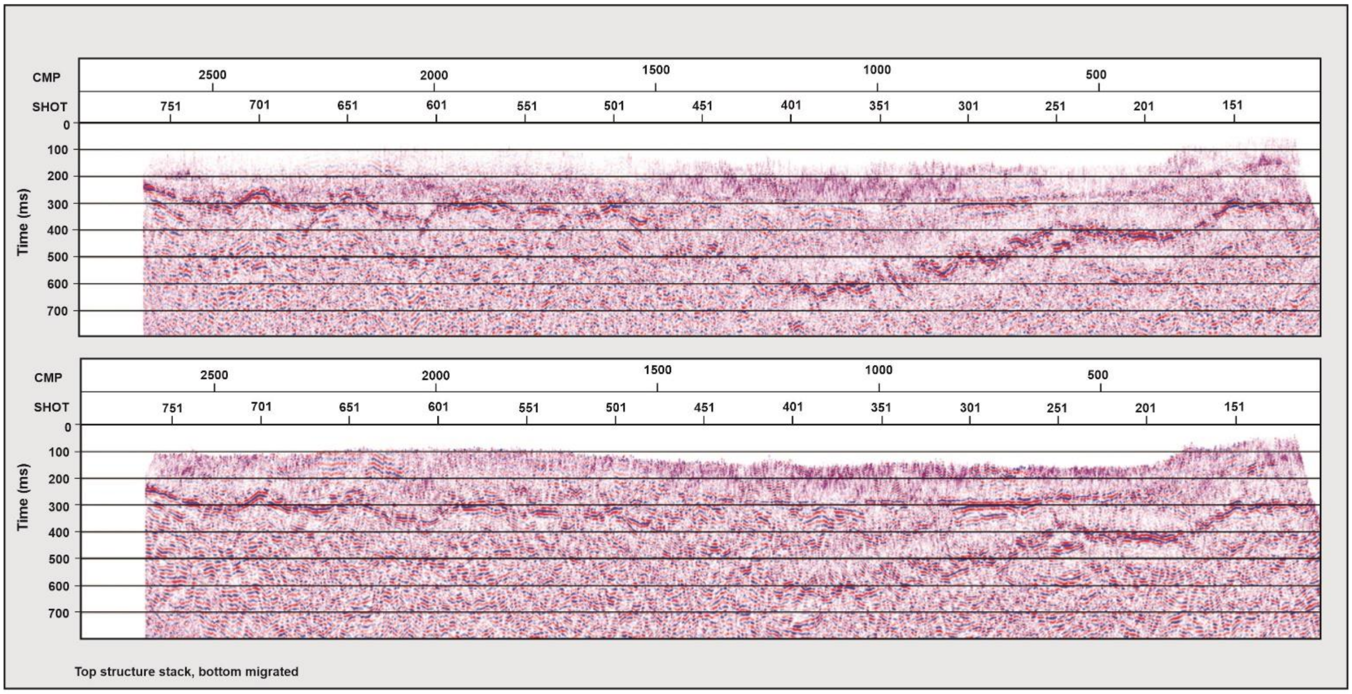


Figure 11 Line 1 SH-wave reflection section. Top: unmigrated section (seismic stacks); Bottom: migrated section.

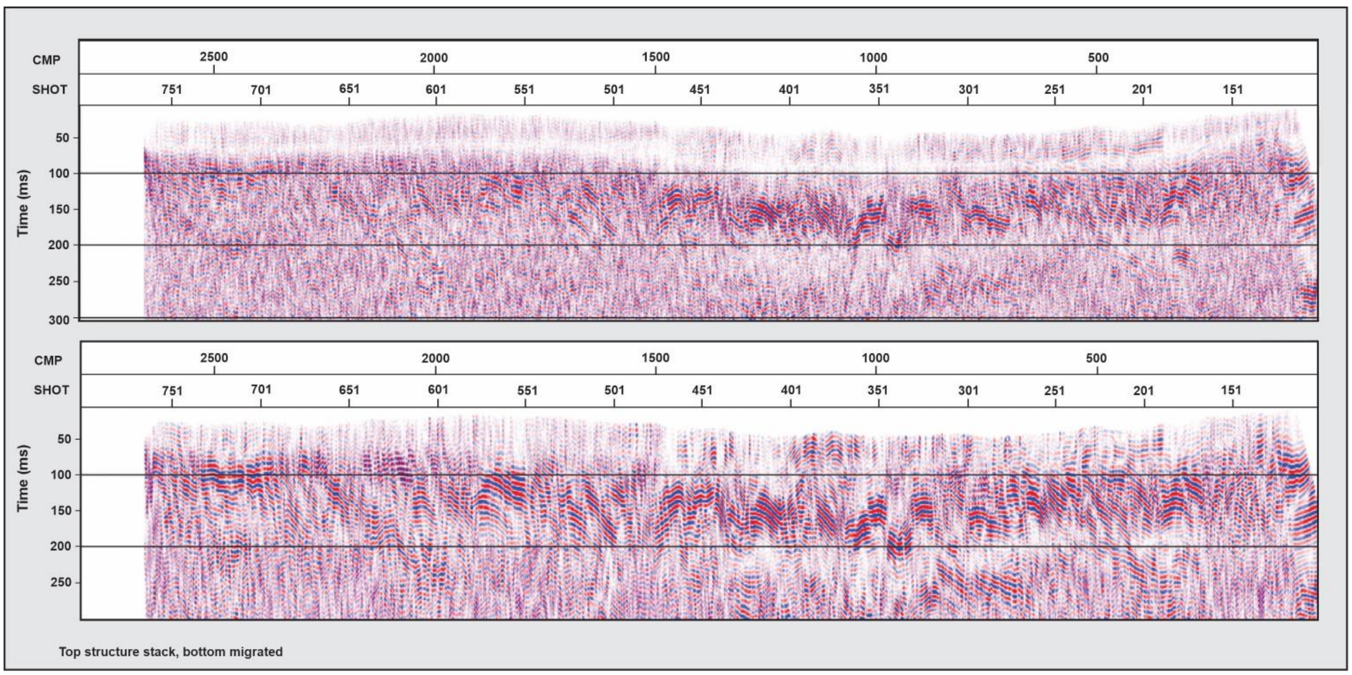


Figure 12 Line 1 P-wave reflection section. Top: unmigrated section (seismic stacks); Bottom: migrated section.

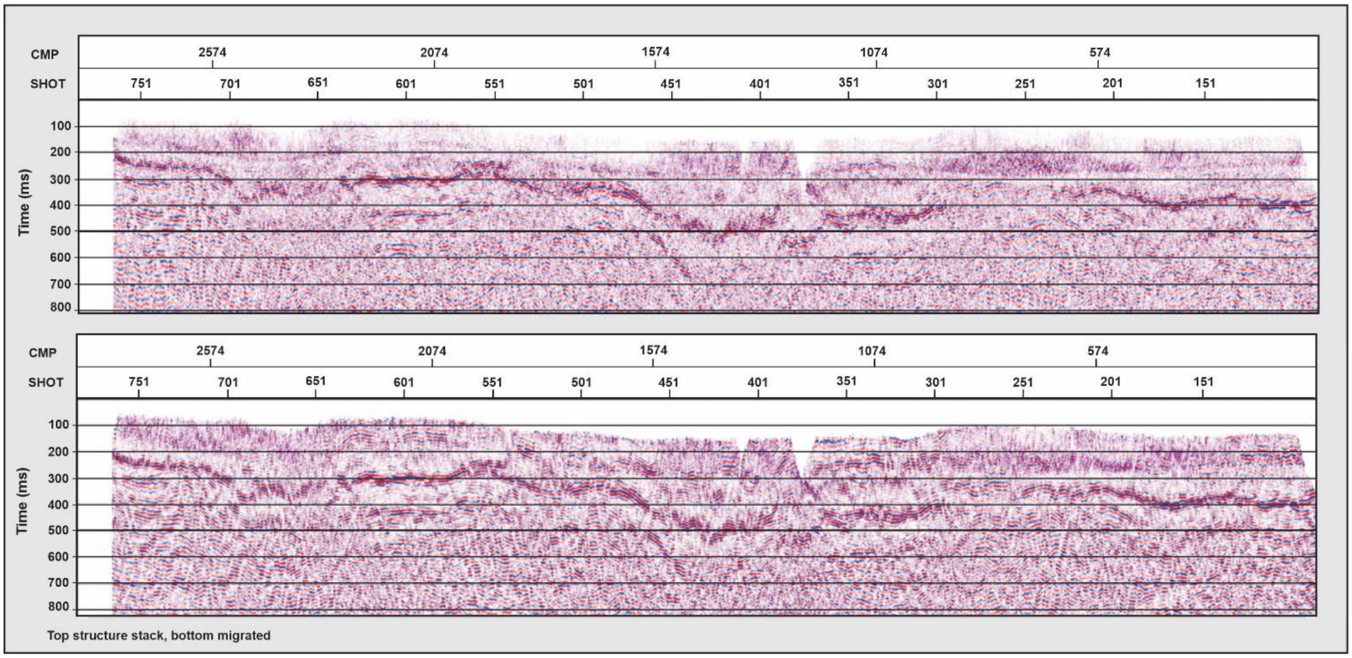


Figure 13 Line 2 SH-wave reflection section. Top: unmigrated section (seismic stacks); Bottom: migrated section.

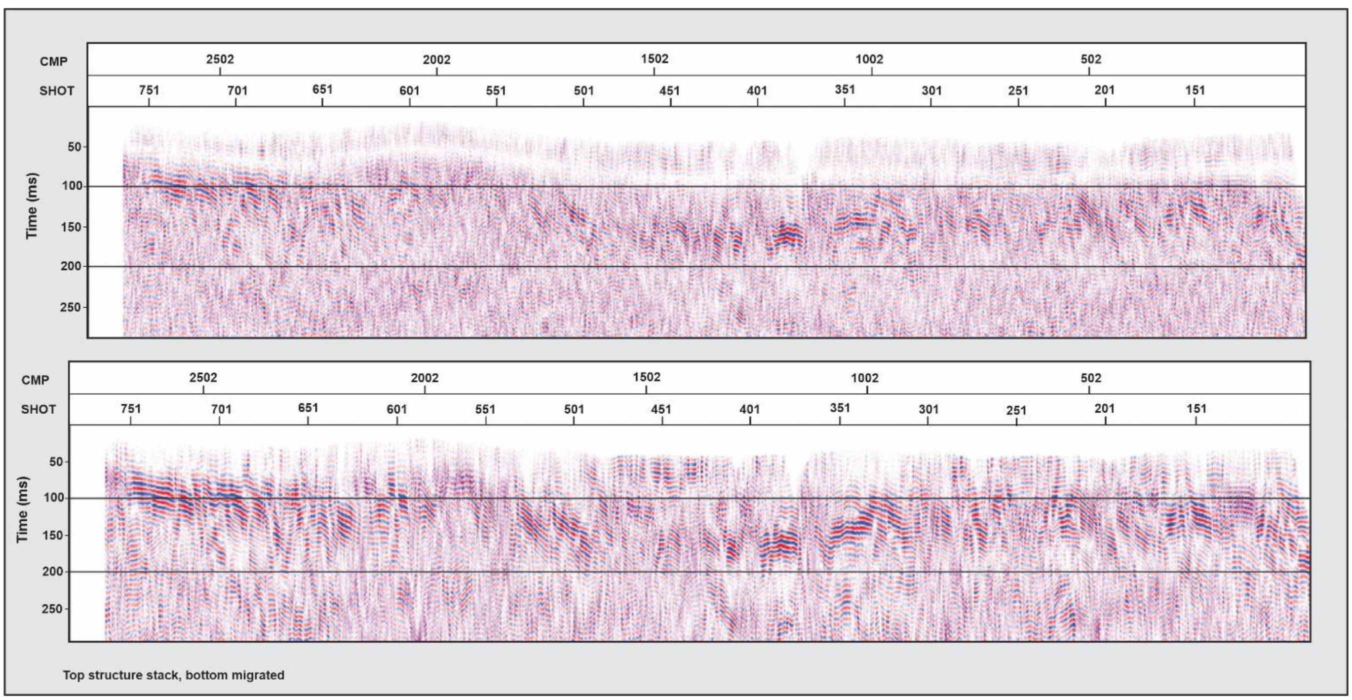


Figure 14 Line 2 P-wave reflection section. Top: unmigrated section (seismic stacks); Bottom: migrated section.

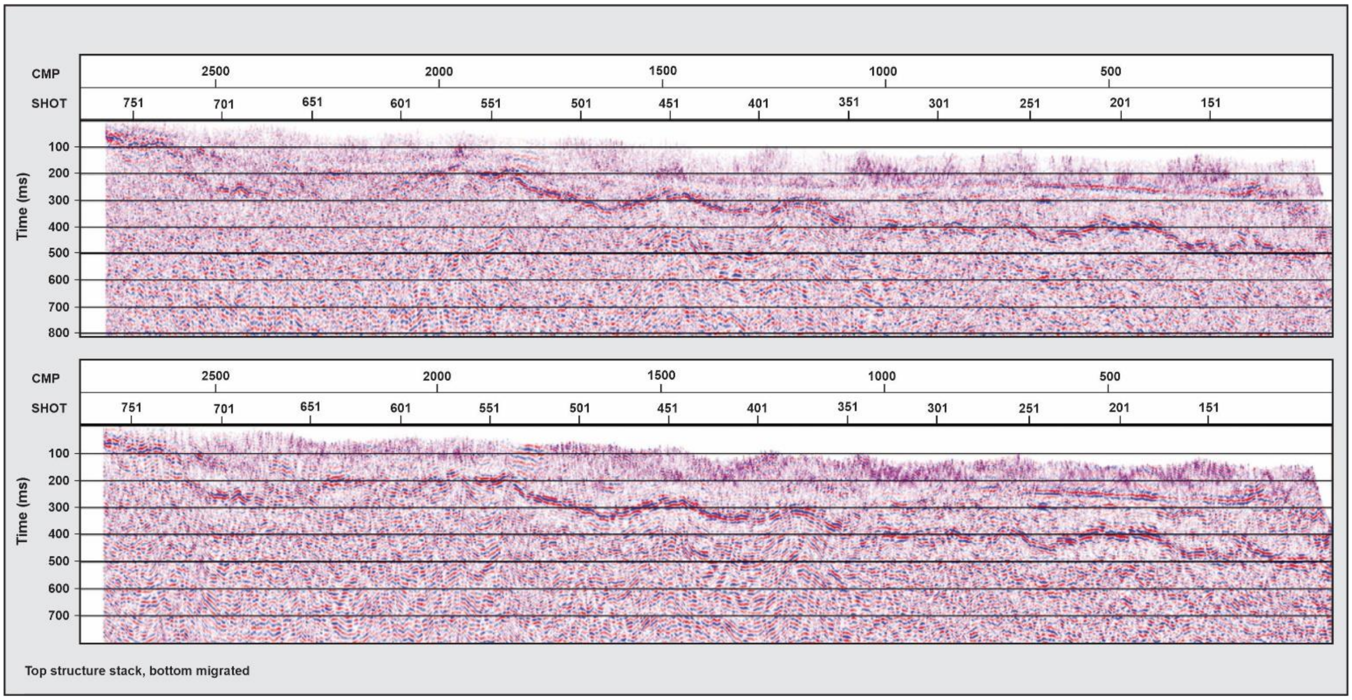


Figure 15 Line 3 SH-wave reflection section. Top: unmigrated section (seismic stacks); Bottom: migrated section.

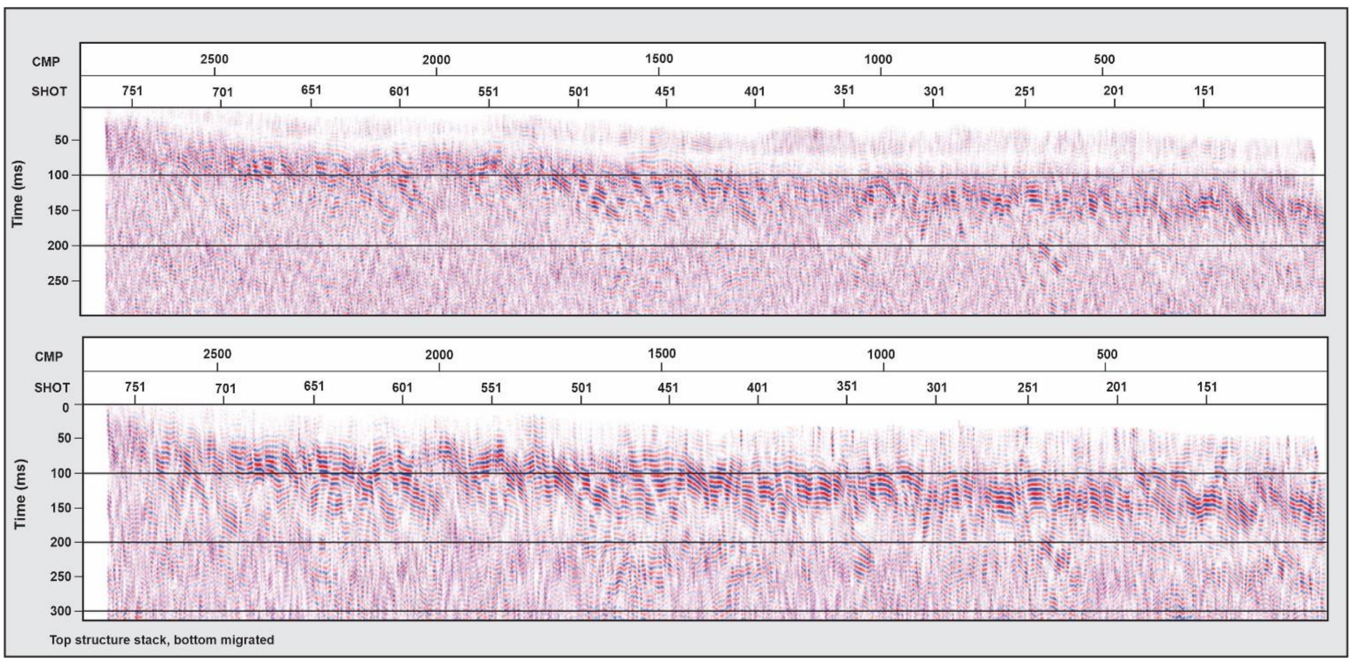


Figure 16 Line 3 P-wave reflection section. Top: unmigrated section (seismic stacks); Bottom: migrated section.

5 SEISMIC DATA INTERPRETATION

Seismic data interpretation for the purpose of creating stratigraphic bedrock surfaces involves a combination of processes whereby known depth to bedrock and key stratigraphic markers within nearby boreholes are used to guide the picks of these same features on the seismic reflectivity sections. It is important to understand that the interpretation of the 2D seismic data collected as part of this study is based entirely on the three individual seismic lines as shown in Figure 3, and then this data is interpolated in between the lines using water well records to provide gridded surfaces over the entire interpretation area.

5.1 Overview of Workflow

The SH-wave migrated sections were used in the interpretation of the bedrock and a shallow reflection layer thought to be till as the P-wave sections did not provide a consistent reflection for interpretation.

A general workflow for the interpretation of the depth to bedrock was followed:

- Loading of the 2D Land Streamer into WinPICS
- Picking of the Bedrock on the Land Streamer data
- Gridding of the picked horizon
- Estimating an average velocity field based on the wells
- Gridding of the depth below surface based on the average velocity and horizon grids

There was no well velocity data for a direct tie of the bedrock available at the time of interpretation.

5.2 Bedrock Interpretation

5.2.1 Top of Bedrock Using Available Borehole Data

Data reported from nearby boreholes were used to interpret and generate a top-of-bedrock surface within the 2D study area, which was then used in the time-to-depth conversion discussed further in Section 6.1. The available borehole data used to create the bedrock surface layer for this study included:

- Six boreholes (SB-MW02 through SB-MW07) recently drilled as part of a shallow well drilling program (Geofirma Engineering Ltd., 2023d) summarized in Table 4;
- Shallow information from two deep boreholes (SB-BH01 and SB-BH02) recently drilled as part of a deep bedrock drilling program summarized in Table 5; and,
- 28 nearby historical domestic water wells as reported by the Ontario Ministry of Environment, Conservation and Parks (MECP) Water Well Information System (WWIS) and summarized in Table 6.

Figure 17 shows the resulting interpreted bedrock surface using these existing borehole data. A digital elevation model was created using the survey data obtained as part of the 3D seismic survey conducted in December 2021, the elevations along the paleochannel lines and the Geofirma borehole elevations.

The gridding was conducted using the DGI algorithm within the WinPICS software as detailed in Section 6.1 below.

Table 4 Depth to top of bedrock from six nearby shallow monitoring wells recently drilled as part of NWMO study

ID	Top of Bedrock (mBGS)	Ground Surface Elevation (mASL)	Bedrock Elevation (mASL)	Overburden Materials	UTM Coordinates			
					Datum	Zone	Easting	Northing
SB_MW02	12.55	291.75	279.20	Sand / clay / gravel	NAD83	17	478826	4874053
SB_MW03	11.25	282.35	271.10	Clay / gravel	NAD83	17	474260	4873064
SB_MW04	19.43	284.43	265.00	Sand / gravel	NAD83	17	469539	4872679
SB_MW05	22.92	277.92	255.00	Sand / gravel / silt	NAD83	17	472436	4873781
SB_MW06	30.64	286.46	255.82	Sand / silt	NAD83	17	470981	4873864
SB_MW07	17.46	301.96	284.50	Sand / silt	NAD83	17	469539	4872679

Table 5 Depth to Top of Bedrock from the Deep Boreholes Recently Drilled as Part of NWMO Study

ID	Top of Bedrock (mBGS)	Ground Surface Elevation (mASL)	Bedrock Elevation (mASL)	UTM Coordinates			
				Datum	Zone	Easting	Northing
SB_BH01	19.61	291.50	271.89	NAD83	17	473711	4873187
SB_BH02	34.60	294.26	259.66	NAD83	17	471318	4872548

Table 6 Depth to Top of Bedrock from Nearby Wells Data (MECP and OGS Data)

MECP Well ID	Easting UTM17	Northing UTM17	Data Source[1]	Derived Ground Surface Elevation (mASL)[2]	Ground Surface Elevation from DEM[3]	Difference in Ground Surface Elevation from Derived vs DEM	Overburden Thickness OGS[1]	Overburden Thickness from MECP[1]	Difference in overburden Thickness between OGS[1] vs MECP[1]	Best estimate Top of Bedrock Elevation (mASL)
1401057	473949	4871460	OGS/MECP	292.40	295.96	-3.56	11.47	17.40	-5.93	275.00
1401064	473589	4873275	MECP	287.14	291.76	-4.62	19.59	22.90	-3.31	264.24
1401065*	470215	4872675	MECP	305.10	306.54	-1.44	38.43	11.60	26.83	293.50
1401068	473864	4873525	MECP	286.64	289.00	-2.36	15.62	11.30	4.32	275.34
1401073	473713	4875034	MECP	280.74	274.11	6.63	12.56	10.40	2.16	270.34
1401074	470090	4874575	OGS/MECP	291.11	287.23	3.88	21.62	21.90	-0.28	269.21
1405193	471265	4874576	OGS/MECP	286.21	286.68	-0.47	49.33	52.70	-3.37	233.51
1405385	471765	4873125	OGS/MECP	278.51	280.27	-1.76	44.50	51.20	-6.70	227.31
1406388	473914	4871475	OGS/MECP	292.38	295.96	-3.58	11.87	18.30	-6.43	274.08
1406722	473314	4873300	OGS/MECP	288.75	291.39	-2.64	16.18	19.20	-3.02	269.55
1407090	473124	4873482	OGS/MECP	282.41	281.51	0.90	15.59	16.20	-0.61	266.21
1408738	472142	4874446	MECP	281.49	285.15	-3.66	44.74	31.10	13.64	250.39
1408935	472291	4871568	MECP	278.85	279.37	-0.52	23.47	30.20	-6.73	248.65
1409203	471886	4873633	MECP	280.25	282.57	-2.32	44.39	NA		235.86
1409983	472235	4874405	MECP	276.74	277.16	-0.42	42.34	34.10	8.24	242.64
1410803	472779	4873062	MECP	281.16	283.66	-2.50	24.76	13.10	11.66	268.06
7047231	473357	4873515	MECP	282.39	282.65	-0.26	14.78	22.90	-8.12	259.49
7112319	473443	4873081	MECP	286.04	288.44	-2.40	19.82	NA		266.22
7112320	471683	4871465	MECP	283.66	285.11	-1.45	32.45	NA		251.21

MECP Well ID	Easting UTM17	Northing UTM17	Data Source[1]	Derived Ground Surface Elevation (mASL)[2]	Ground Surface Elevation from DEM[3]	Difference in Ground Surface Elevation from Derived vs DEM	Overburden Thickness OGS[1]	Overburden Thickness from MECP[1]	Difference in overburden Thickness between OGS[1] vs MECP[1]	Best estimate Top of Bedrock Elevation (mASL)
7182215	470778	4875059	MECP	288.91	294.51	-5.60	44.47	NA		244.44
7184536	473515	4873673	MECP	282.13	283.99	-1.86	16.80	NA		265.33
7192155	473937	4873669	MECP	281.85	283.25	-1.40	15.34	6.70	8.64	275.15
7243770	472296	4871580	MECP	279.23	279.63	-0.40	23.55	NA		255.68
7245533	471087	4875161	MECP	279.82	280.46	-0.64	45.35	NA		234.47
7309376	473950	4871471	MECP	292.46	295.62	-3.16	11.64	NA		280.82
7314952	471906	4872484	MECP	281.75	280.44	1.31	41.17	NA		240.58
7314953	472373	4872147	MECP	283.62	284.07	-0.45	29.55	NA		254.07
7314954	472252	4872585	MECP	281.21	284.77	-3.56	35.73	NA		245.48
7356284	472203	4873269	MECP	277.95	282.98	-5.03	39.27	19.50	19.77	258.45

Notes:

- Data highlighted is considered to be best estimate for ground surface elevation, overburden thickness, and top of bedrock elevation for each MECP well..
- The depth to bedrock at well 1401065 was excluded from the depth conversion due to lower confidence it is representative of nearby conditions and in favour of numerous other wells in the nearby vicinity.
- NA: information was not available.
- “1”: MECP = Ontario Ministry of Environment, Conservation and Parks Water Well Information System (WWIS), OGS = Ontario Geological Survey Miscellaneous Data Release Data (MRD) 207 (Gao et al, 2006).
- “2”: Derived ground surface elevation in units of metres above seal level (mASL) is a raster surface created for this study using surveyed ground surface elevations collected during the 3D seismic study (December 2021), the elevations along the 2D seismic survey lines as part of this study, survey data from recently drilled boreholes by Geofirma as part of other NWMO studies in the South Bruce Area (summarized in Tables 4 and 5).
- “3”: DEM = Digital Elevation Model produced by the Ontario Ministry of Natural Resources (2008).

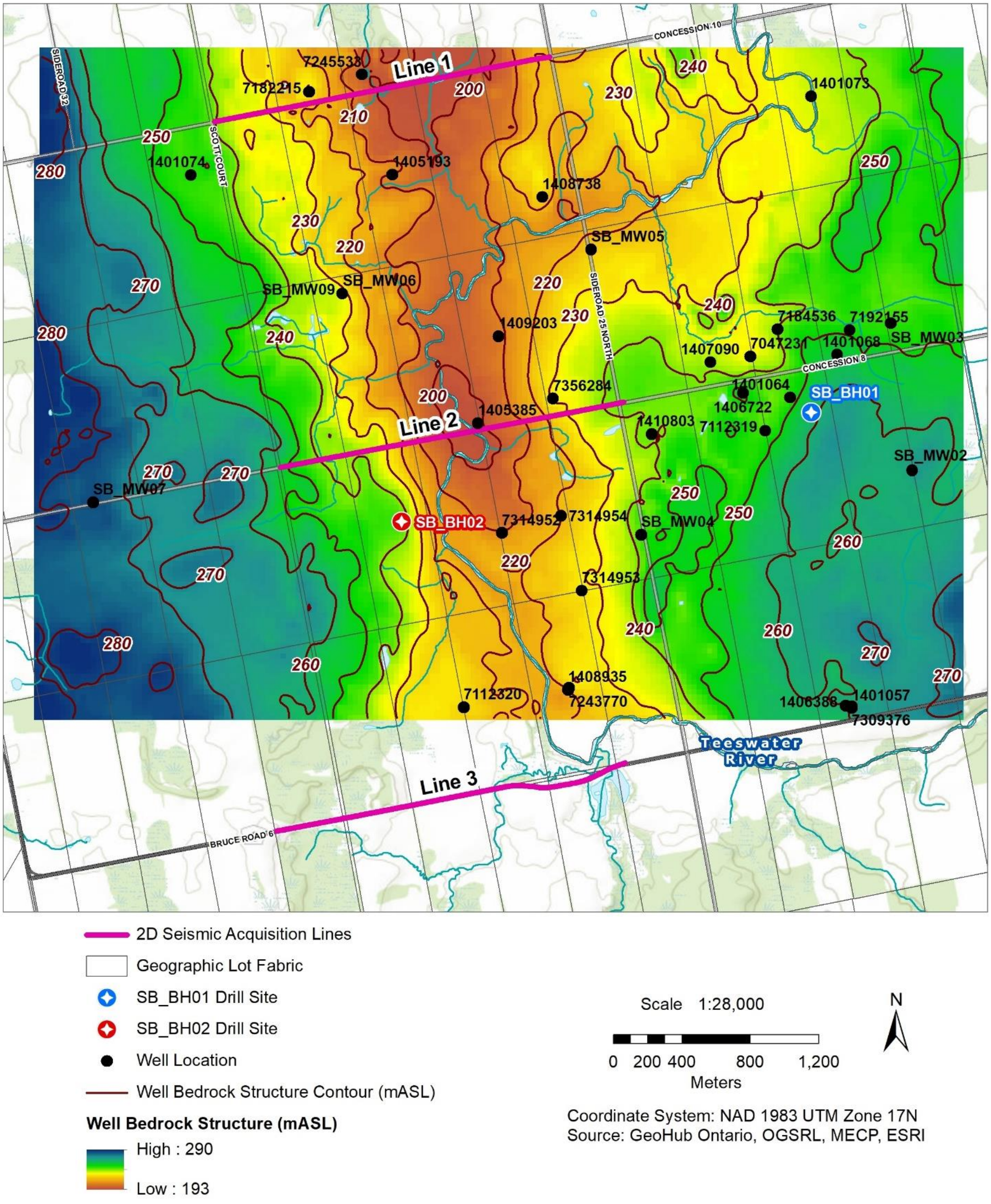


Figure 17 **Interpreted bedrock surface contour map using available borehole information expressed as elevation in units of mASL**

5.2.2 Top of Bedrock Interpreted from 2D Land Streamer Data

The top of bedrock was interpreted from the 2D land streamer data to be a strong reflection on the SH-wave reflectivity section, which is interpreted as an unconformity (Figure 18). The interpreted top of bedrock was picked on the SH-wave migrated sections using a guided method that snapped to the largest peak in a localized area. Also shown in Figure 18 is a shallow layer the represents a change in reflectivity. Resulting time picks from the 3 SH-wave migrated sections were then gridded using the DGI method (see section 6.1 for details) with 60 m x 60 m bins (Figure 19). This time grid can be converted to a depth grid once suitable velocities are determined for the conversion. Two-way seismic traveltime (ms) is presented in the Y-axis and Source Station ID is plotted on the X-axis.

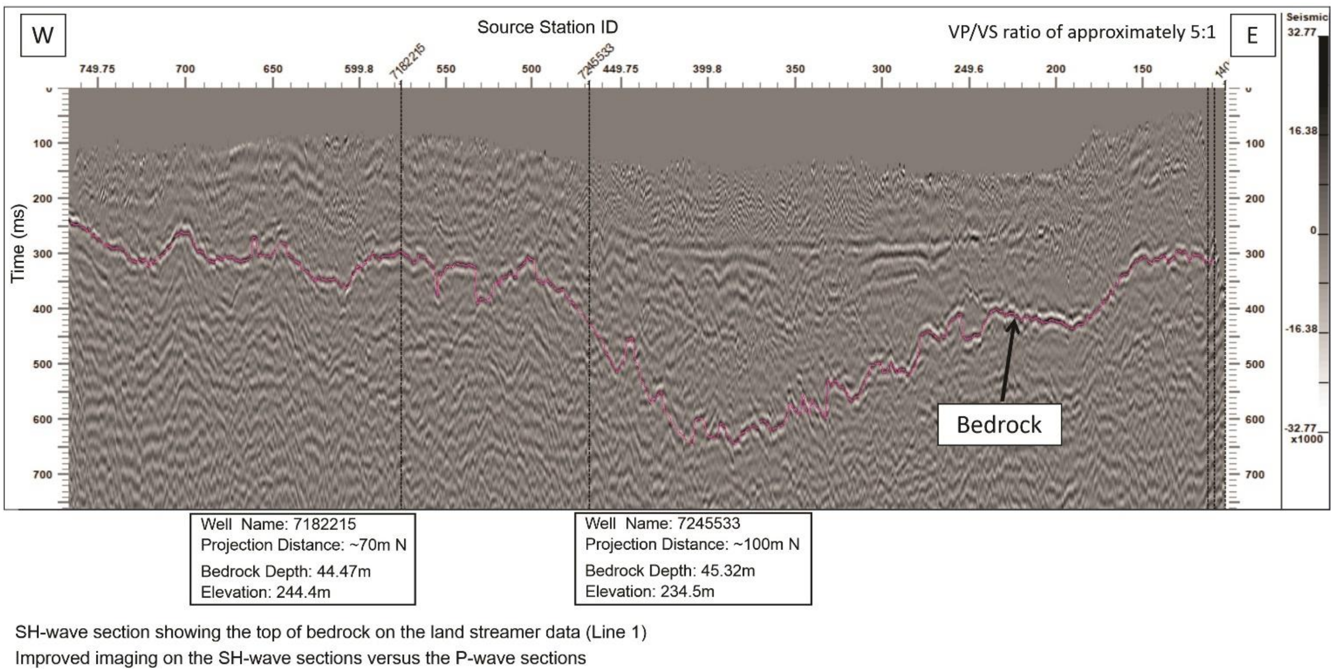


Figure 18 SH-wave migrated stack of Line 1 profile. Showing interpreted bedrock surface and shallow reflection using the land streamer data.

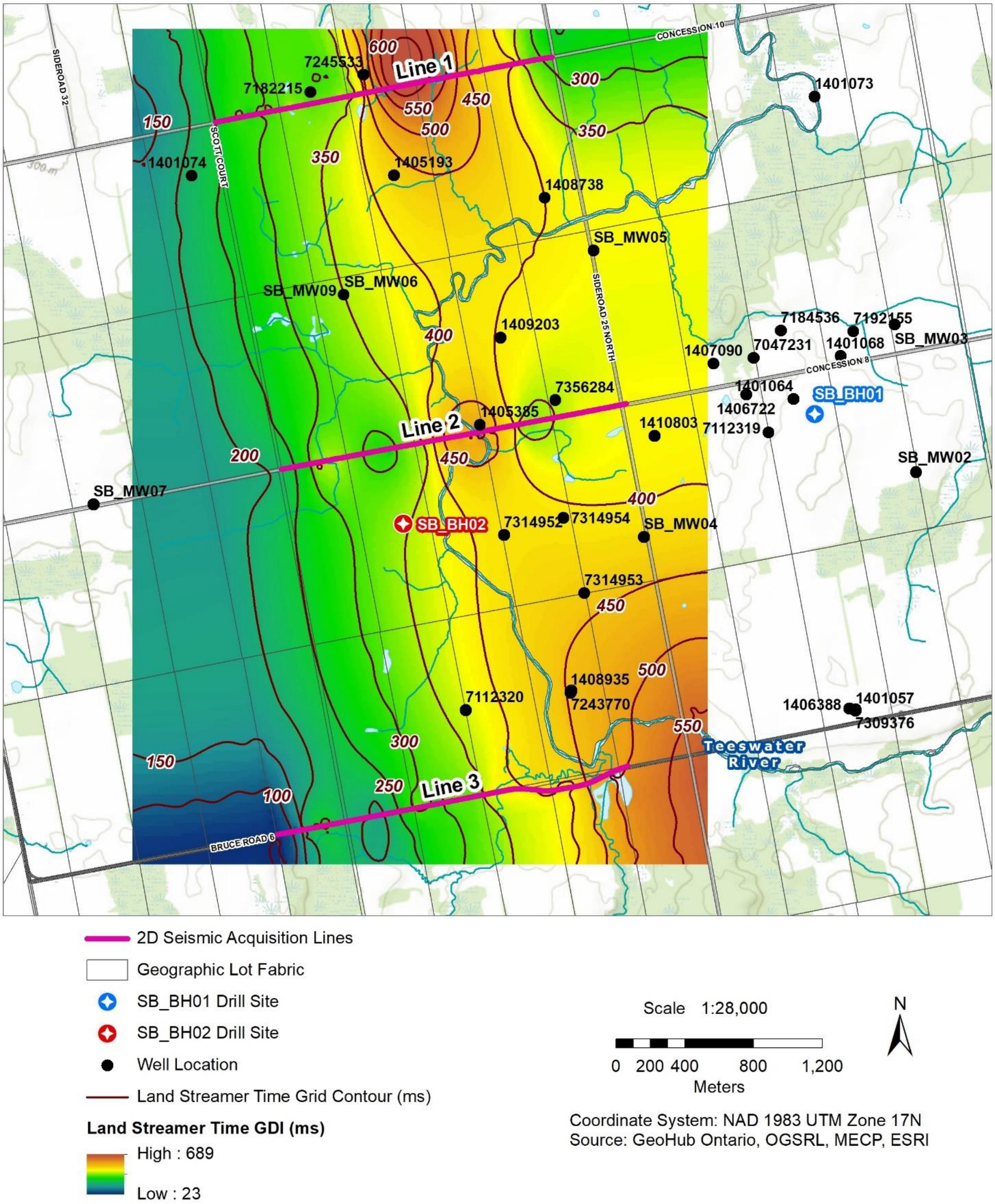


Figure 19 **Top of bedrock surface contour map expressed as two-way seismic traveltime (ms) based on gridded Land Streamer Data**

6 SEISMIC DATA DEPTH CONVERSION

6.1 Methodology

In order to present seismic data expressed in depth as opposed to data in time, an average velocity map for depth-conversion purposes has been completed. This method involved a series of steps, including:

a) Extracting seismic traveltime picks along the bedrock seismic reflection from the gridded time horizon

Time picks along the bedrock contact were extracted at the location of nearby wells (Section 5.2.1), using the gridded time horizon from the seismic section (DGI method on 60 m x 60 m bins for the land streamer data discussed in Section 5.2.2). The DGI gridding method honors input data closely and uses the WinPICS proprietary SGL (Surface Gridding Library) to produce surfaces from widely varying data input points. Assuming the gridded time horizon represents the actual seismic time of the bedrock contact away from the seismic lines (in areas where boreholes do exist), the XY coordinates of boreholes were used to extract the seismic time at the point of borehole, and the time surface intersection.

b) Calculating average shear wave velocity at existing borehole locations

The average shear wave velocity was calculated using the reported depth to bedrock at each existing borehole location and the corresponding picked time from step a. Extrapolated times were used for wells outside the time gridded horizon. The well depth is referenced to typical oil and gas drilling rig kelly bushing or KB in the formula; and seismic processing datums respectively. Below is the expression used for the estimation of average velocity.

$$\text{Ave Vel} = \frac{\text{Depth - KB + (Seismic Datum Elevation)}}{\text{(0.5*Seismic Time/1000)}}$$

c) Creating an average shear wave velocity grid

The resulting average shear wave velocities at each existing borehole were used to create an average velocity grid of the bedrock contact calculated on a 60m x 60m bin grid using the DGI gridding algorithm (chosen to gently smooth the velocities). A final shear-wave velocity grid was produced using all the wells excluding water well 1401065. Due to depth discrepancies that did not match the known geology from nearby NWMO wells, it was decided that this well would be excluded from the depth conversion with the DGI gridding method. Figure 20 shows the final shear-wave velocity grid used for depth conversion based on the 2D Land Streamer data. Note that there are bull's-eyes visible in the velocity map generated. These were not to be further addressed due to the limited control resulting from sparse data in those regions.

d) Time-to-depth conversion of seismic reflectivity sections

The average velocity grid is used to perform the time to depth conversion of reflectivity images using standard functions within WinPICS software. These functions use the velocity grid to output seismic sections in depth.

There was no shallow velocity information in the boreholes to improve the velocity field for time-to-depth conversion. The processing or stacking velocities are picked to optimally stack the data but in cases of dipping or structural variations these vertically varying velocity functions are inaccurate and could not be used for depth conversion. Hence, the assumption was made that vertical changes in velocity are practically nonexistent. Therefore, shallow layers above the bedrock, including topographic elevations, may be inaccurately portrayed in terms of depth. While this approach accurately locates the bedrock reflection at depth within the seismic reflectivity images, the depth of shallow reflections might be inaccurate due to the method relying on the assumption of lateral velocity variations solely at the bedrock contact. In other words, it employs the same velocities vertically for the time-to-depth conversion of seismic sections. The resulting depths, relative to the processing datum of 310 m, are depicted in Figure 21.

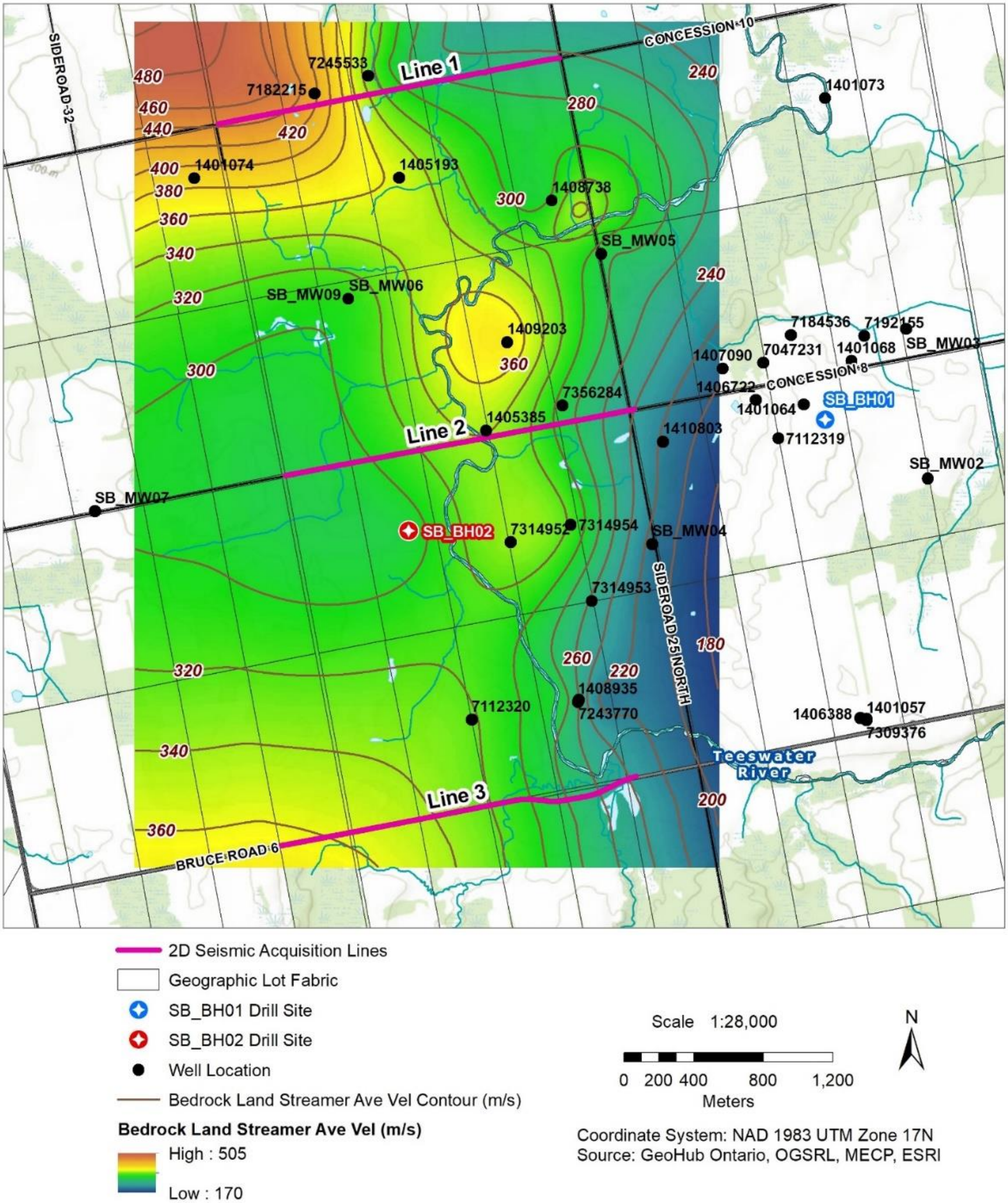


Figure 20 Final shear-wave velocity grid used for depth conversion.

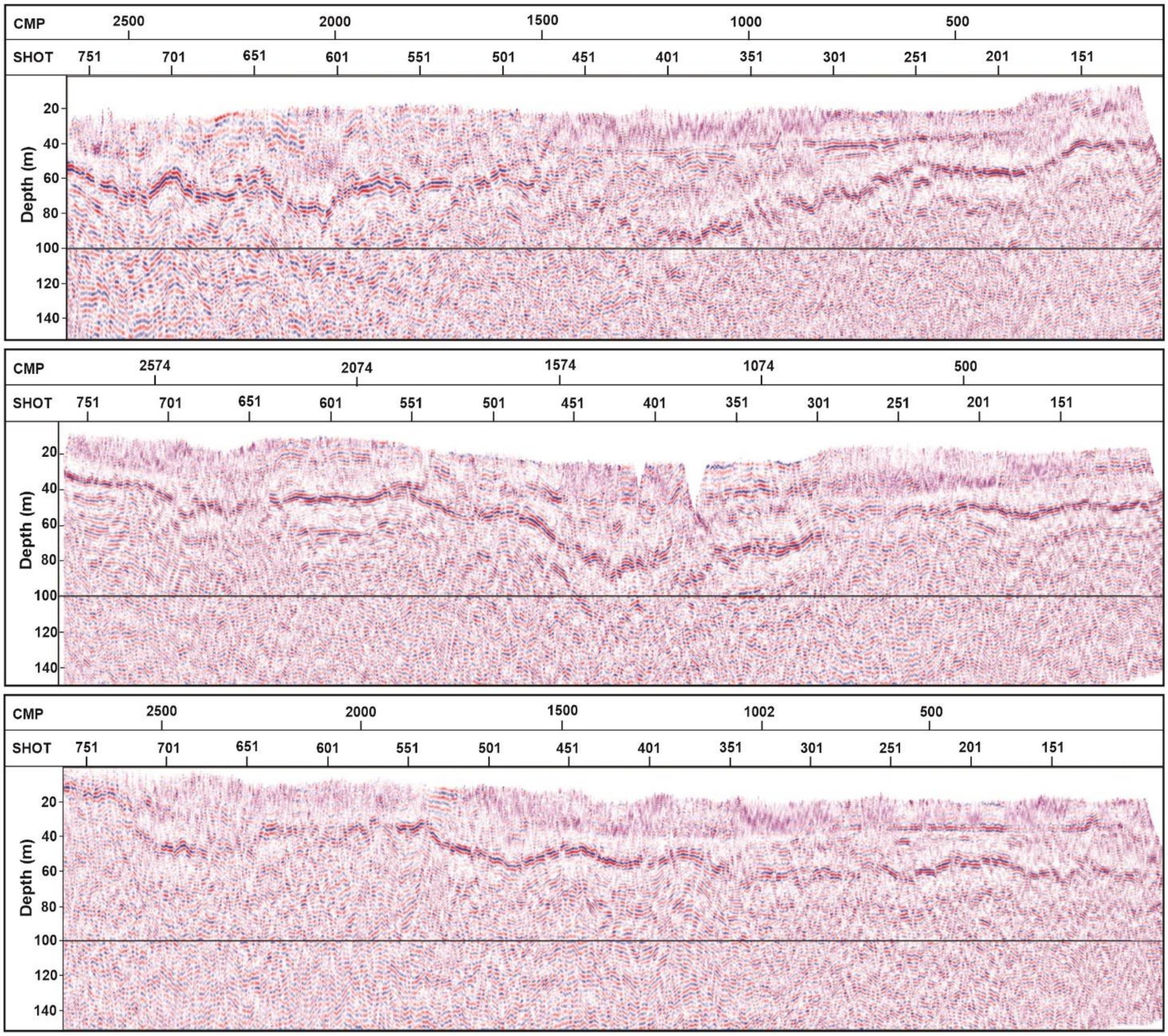
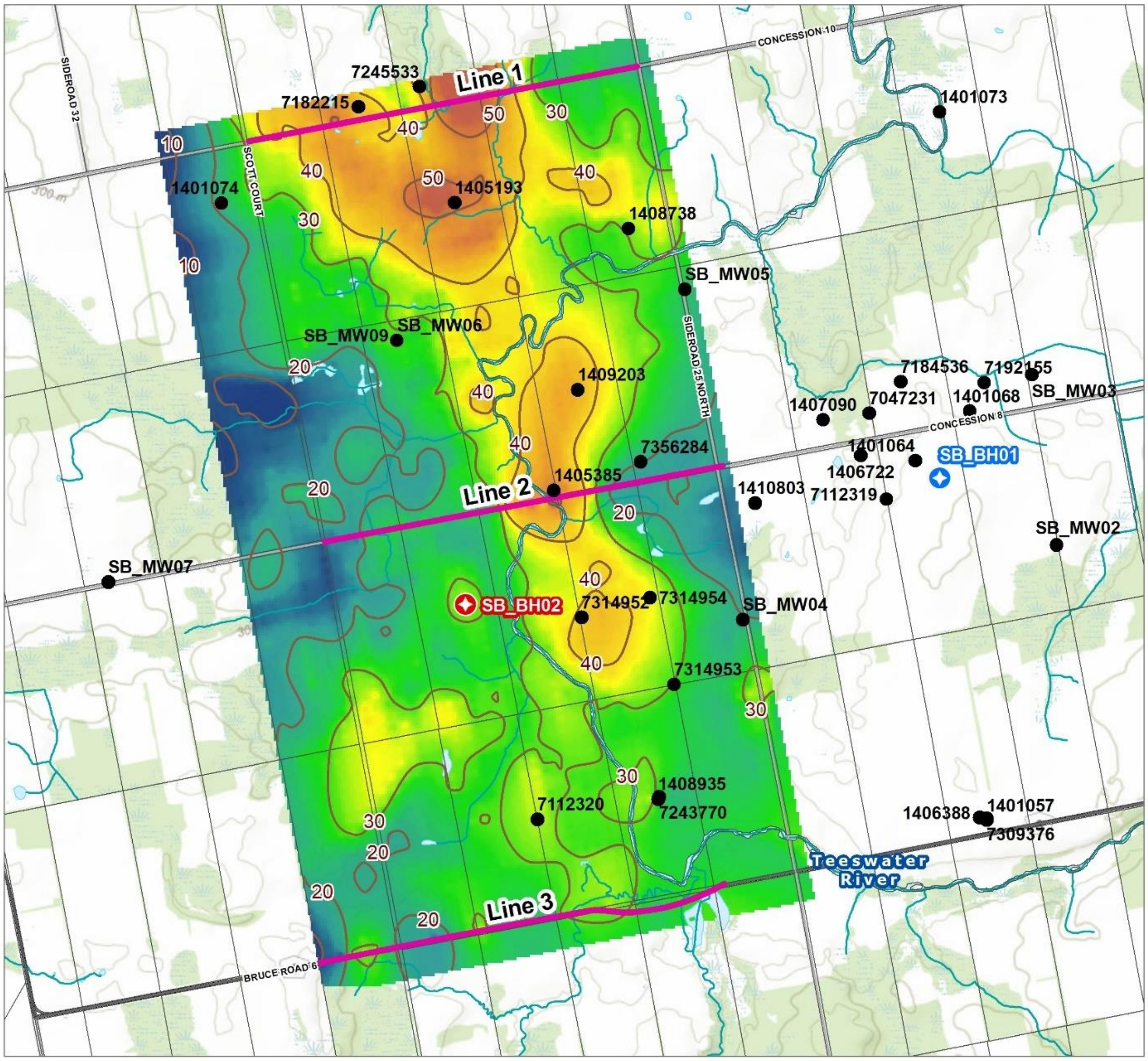


Figure 21 **Depth-converted seismic sections (depths are relative to the processing datum of 310m elevation above mean sea level) Top: Line 1; Middle: Line 2; Bottom: Line 3.**

6.2 Bedrock Surface derived from Land Streamer interpretation and Borehole Data

Using the time and velocity information displayed in Figure 19 and Figure 20, respectively, along with borehole data, we produce a top of bedrock surface expressed as depth below ground surface (mBGS), shown in Figure 22. This contour map shows the paleochannel widening and deepening to the north. The land streamer and borehole data resulted in a map with high lateral resolution in the shooting direction showing a narrower deep cut with lateral benches such as the example near MW-05 that follows a local tributary. The overall trend of the paleochannel appears to closely follow local surface water features as evidenced by a northwest to southeast orientation with a slight change to follow a more eastward trend starting approximately 500 m north of Line 3.



2D Seismic Acquisition Lines
Geographic Lot Fabric
SB_BH01 Drill Site
SB_BH02 Drill Site
Well Location
Land Streamer Bedrock Depth Contour (mBGS)

Land Streamer Bedrock Depth (mBGS)
High : 62
Low : 5

Scale 1:28,000
0 200 400 800 1,200
Meters

N

Coordinate System: NAD 1983 UTM Zone 17N
Source: GeoHub Ontario, OGSRL, MECP, ESRI

Figure 22 Top of bedrock contour map expressed as depth (mBGS) created using 2D seismic land streamer data and incorporating known depth to bedrock at nearby existing boreholes.

6.3 Comparison of the updated paleochannel location to previous interpretations

As mentioned in Section 1, the bedrock valley in the project area was previously known to exist and is locally referred to as the Wingham Valley. The Ontario Geological Survey (OGS) map portrayed in Figure 23, show the approximate projected location of this bedrock valley based on interpreted local borehole data (black dashed line).

The interpreted location of the paleochannel based on the land streamer data compares favorably with OGS maps in the north of the project area but deviates in the south to suggest an alternative trend of the paleochannel. Ultimately, due to the higher resolution and quality of the dataset used as part of this seismic study, the interpreted position of the paleochannel using the land streamer data is considered to be more accurate than its location shown on the OGS map.

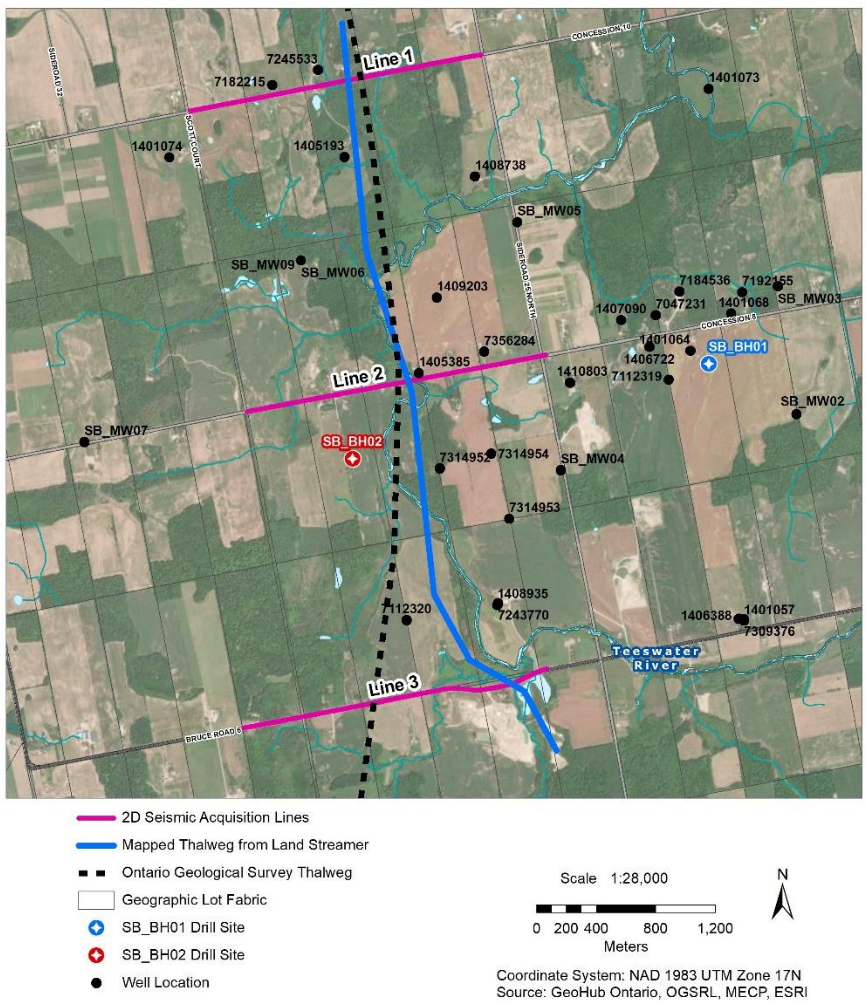


Figure 23 **Interpreted trend for the paleochannel derived from the 2D seismic land streamer data (blue line) compared to the Ontario Geological Survey (OGS) interpreted paleochannel trend (black dashed line).**

7 CONCLUSION

Geofirma completed the data acquisition of three 2D seismic lines (approximately 2 km in length, each) spaced approximately 2 km apart at the South Bruce site to better understand the depth to bedrock, lithologic soil boundaries within the buried valley, and shear velocities to describe the paleochannel geometry locally known as the Wingham Valley. This report presents and compares the differences between the interpreted top of bedrock surface over the paleochannel using nearby borehole data, and 2D seismic land streamer data. The imaging provided by this seismic technique successfully mapped the paleochannel throughout the project area.

Providing more information than the groundwater wells alone, the land streamer SH-wave data provided better definition of the paleochannel edges and the overlying unconsolidated material (overburden). The interpreted location of the paleochannel based on the 2D land streamer data was compared with existing interpretations of its location as reported by the Ontario Geological Survey (OGS) on maps. The interpreted location of the paleochannel based on the land streamer data compares favorably with OGS maps in the north of the project area but deviates in the south to suggest an alternative trend of the paleochannel towards the south-east instead of the OGS mapped trend towards the south-southwest. Due to the higher resolution and quality of the land streamer data, the interpreted paleochannel position within this study area is more accurate compared to the location mapped by the OGS.

While the land streamer SH-wave data has provided valuable insights into the paleochannel characteristics at the South Bruce site, it is important to acknowledge the inherent uncertainties associated with this technique. One limitation arises from the sparse control information provided by the existing groundwater wells used to establish time to depth conversion. The accuracy of the interpretation is intricately linked to the available well data, and the limited coverage may introduce uncertainties in the depth-to-bedrock estimations and the interpretation of the bedrock surface. Additional efforts may aim to better characterize lateral and vertical shear wave velocity distributions to enhance the time to depth conversion, ultimately refining the geometry of the paleochannel in the study area.

8 REFERENCES

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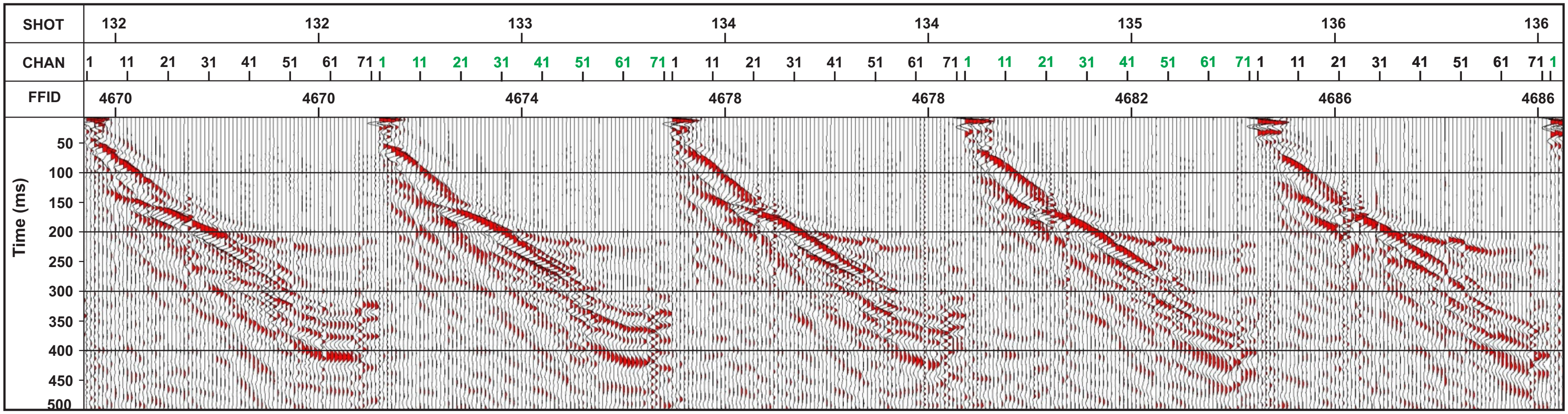
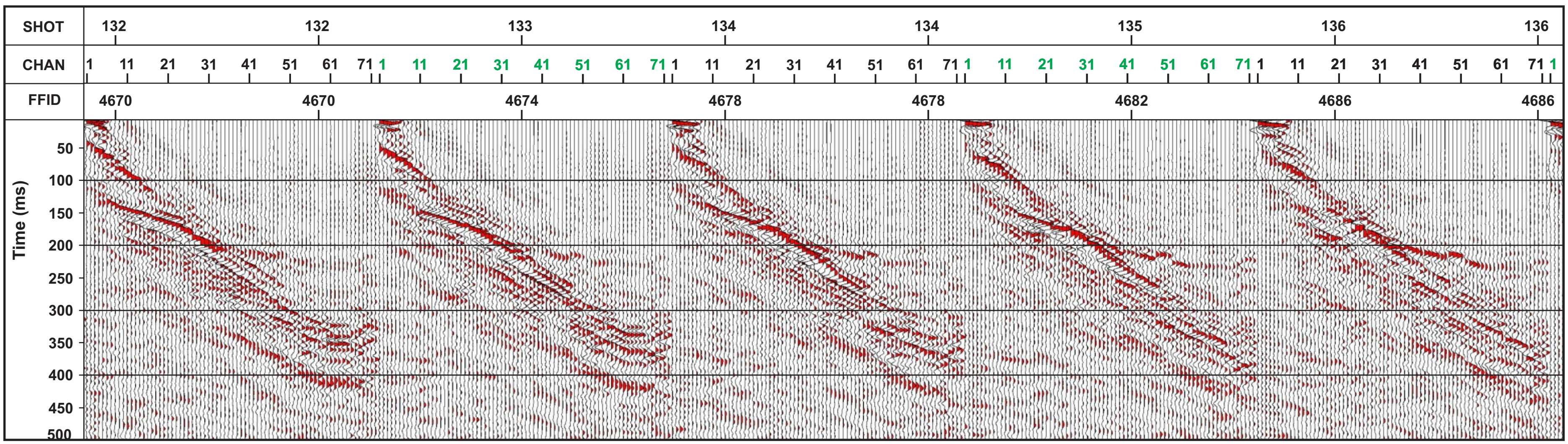
Appendix A

Examples of Raw Seismic Data

A) SH Wave - Raw Scaled Data East End of Line 1



B) SH Wave - Processed Data East End of Line 1



SH Wave - Line 1 - East End
Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization

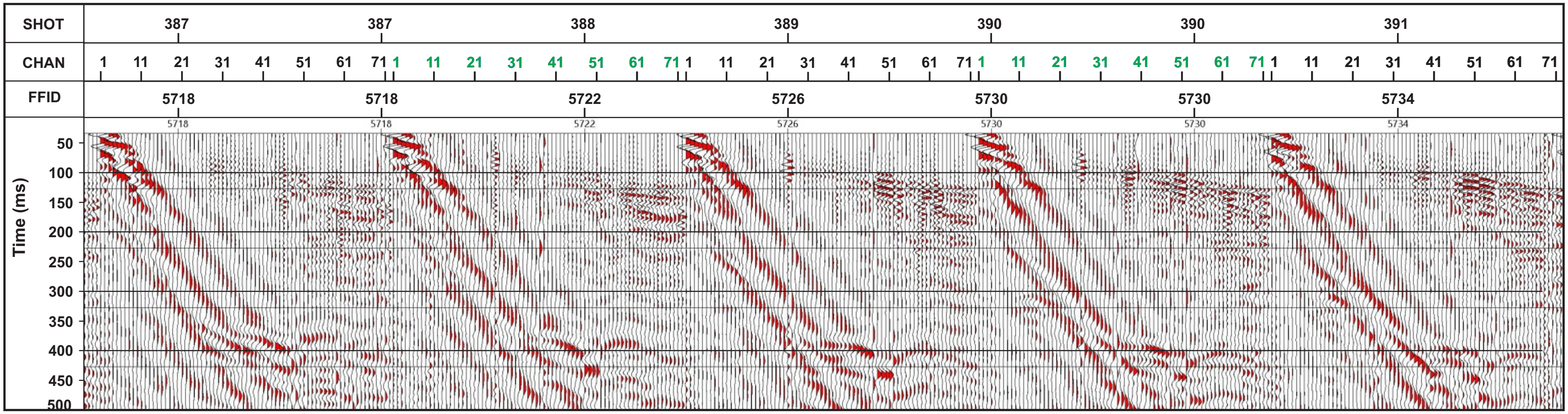
Prepared by: ADG
Reviewed by: SNS
Date: Apr 12, 2023

FIGURE A.1

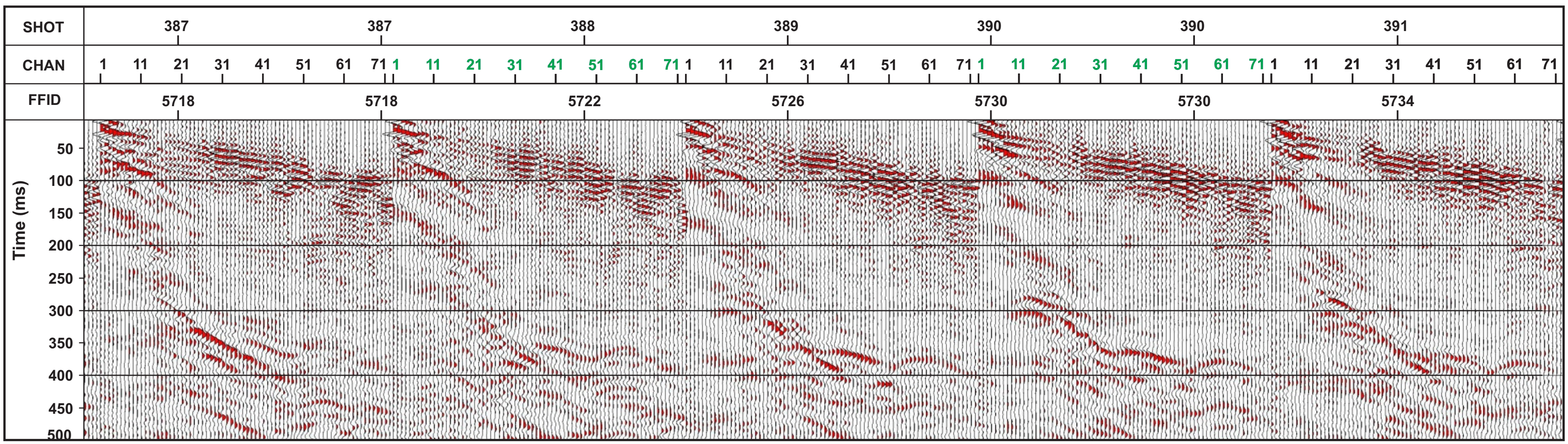
Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A01_SHWave_Line1_East.cdr"

GEOFIRMA ENGINEERING

A) SH Wave - Raw Scaled Data Middle of Line 1



B) SH Wave - Processed Data Middle of Line 1



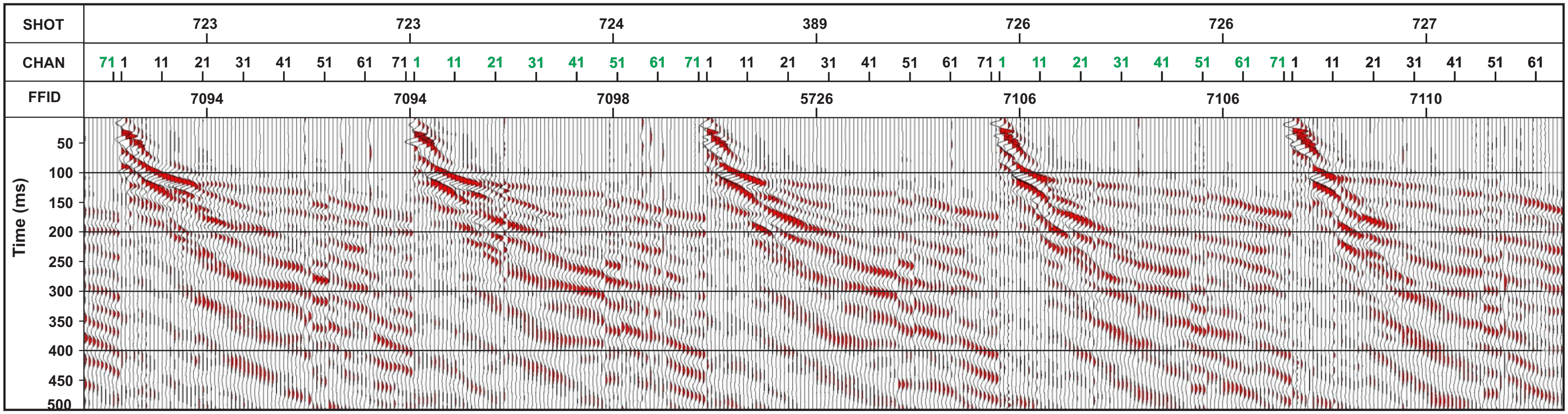
SH Wave - Line 1 - Middle
Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization

FIGURE A.2

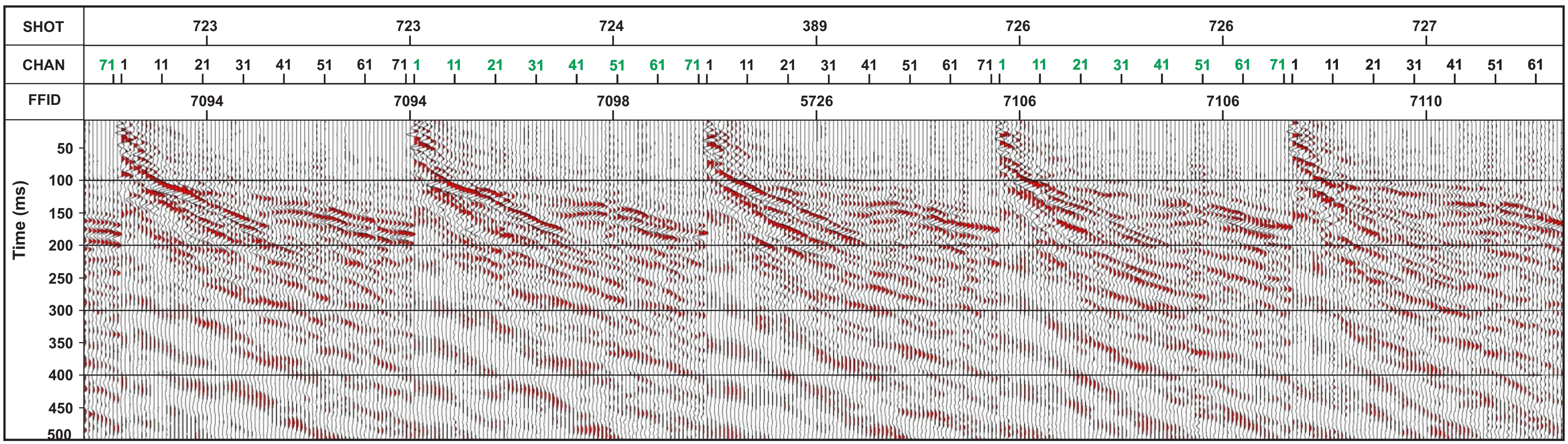
Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A02_SHWave_Line1_Middle.cdr"

Prepared by: ADG
Reviewed by: SNS
Date: Apr 12, 2023

A) SH Wave - Raw Scaled Data West End of Line 1



B) SH Wave - Processed Data West End of Line 1



SH Wave - Line 1 - West End Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization		Prepared by: ADG Reviewed by: SNS Date: Apr 12, 2023
FIGURE A.3	Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A03_SHWave_Line1_West.cdr"	

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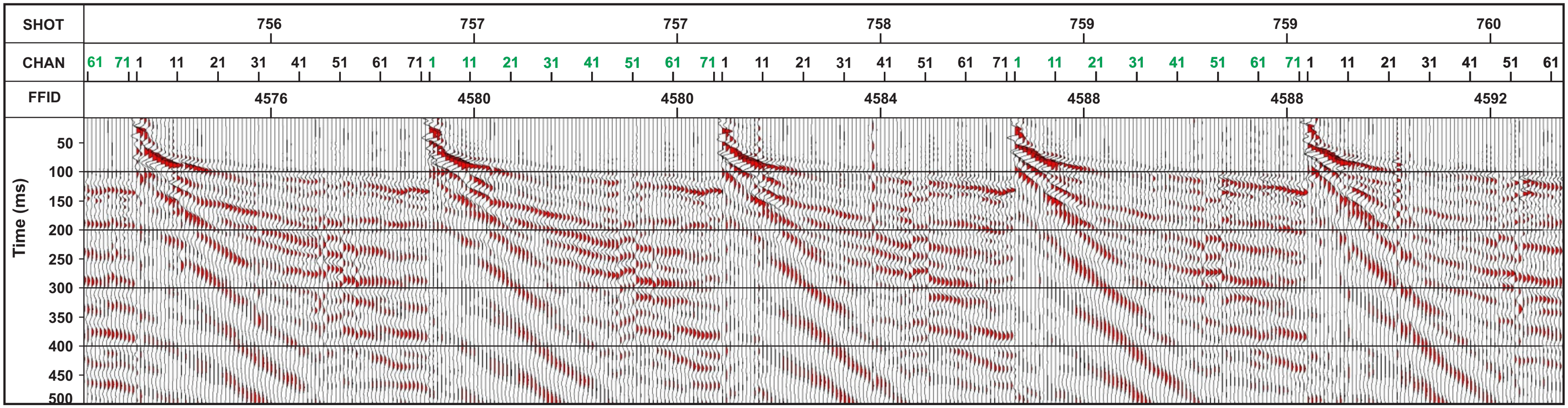
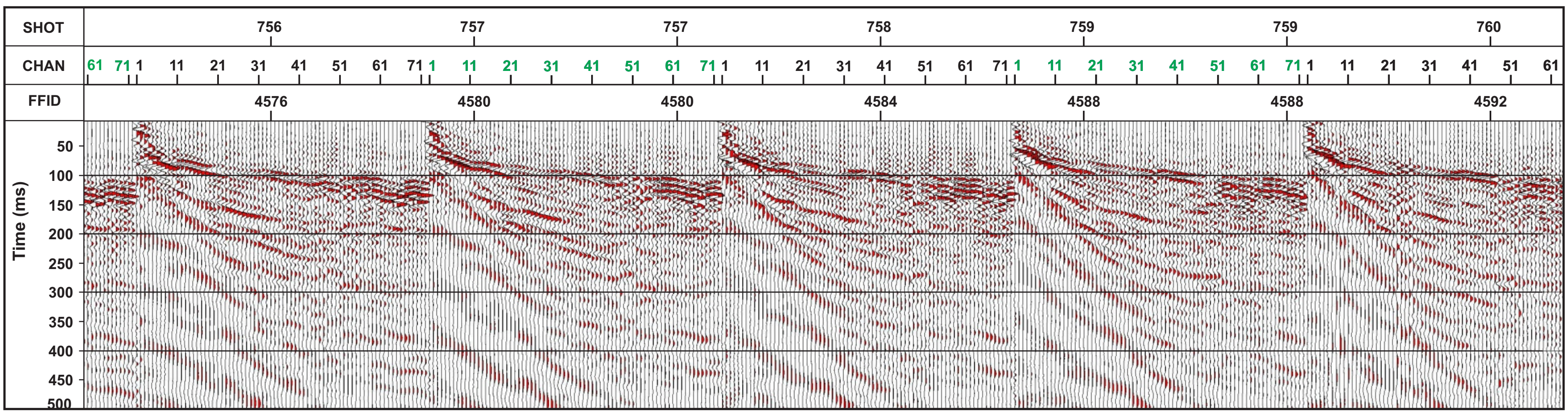
A) SH Wave - Raw Scaled Data East End of Line 2



B) SH Wave - Processed Data East End of Line 2



SH Wave - Line 2 - East End
Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization

FIGURE A.4

Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A04_SHWave_Line2_East.cdr"

Prepared by: ADG
Reviewed by: SNS
Date: Apr 12, 2023

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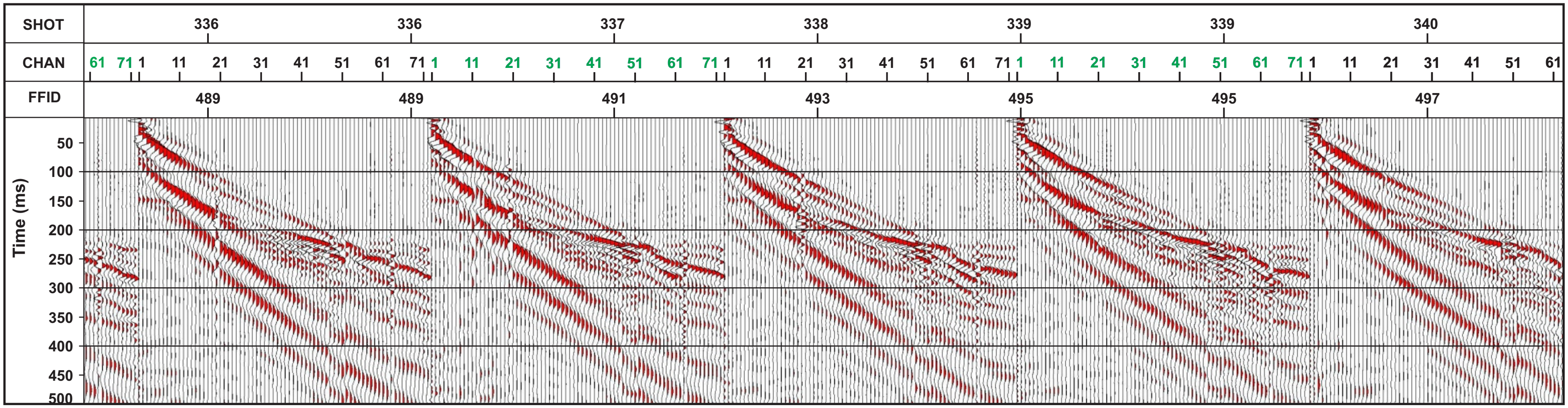
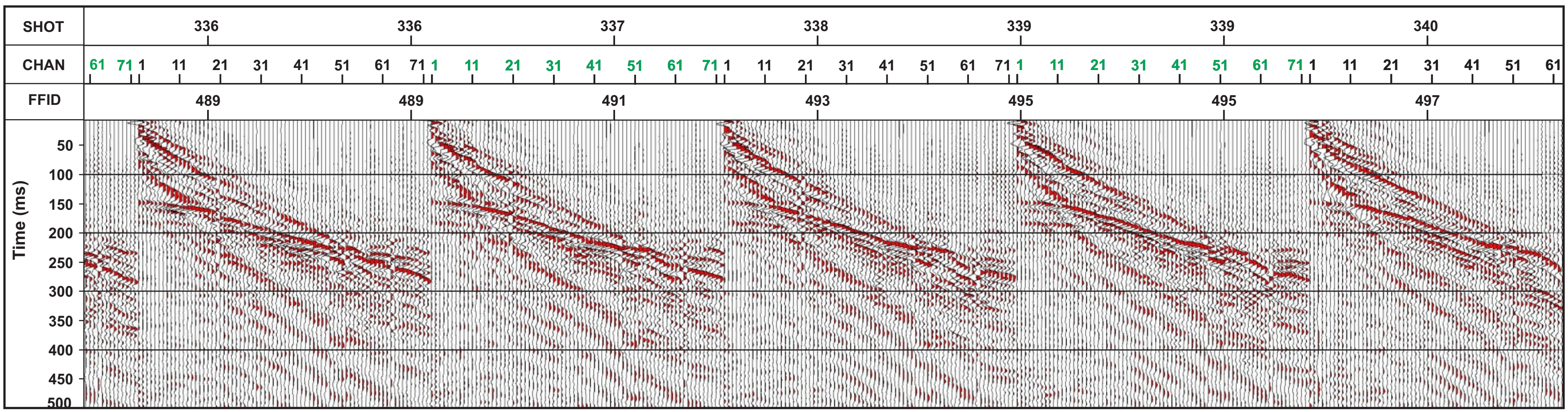
A) SH Wave - Raw Scaled Data Middle of Line 2

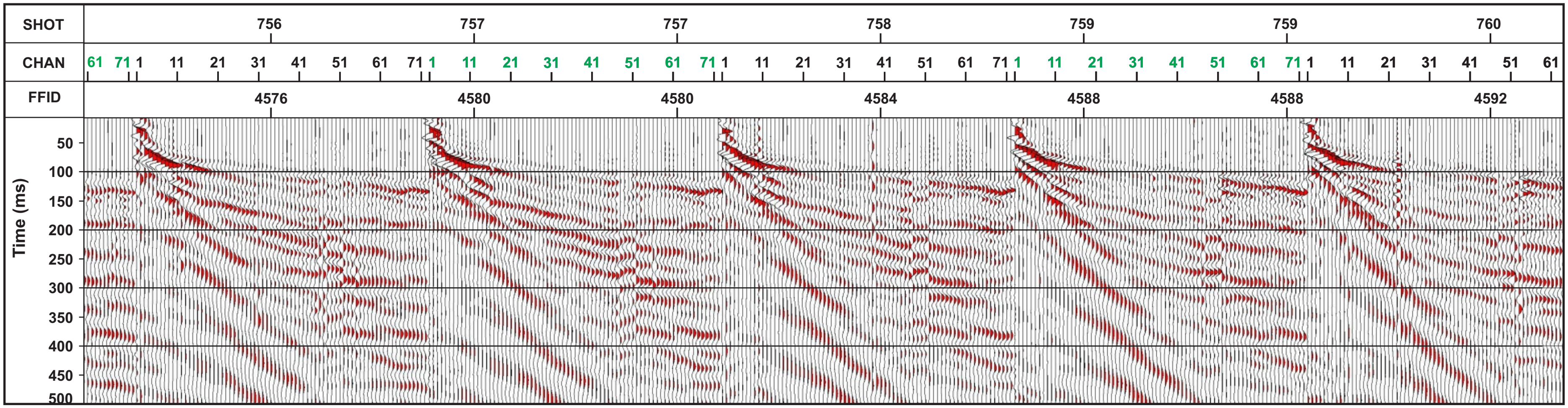


B) SH Wave - Processed Data Middle of Line 2

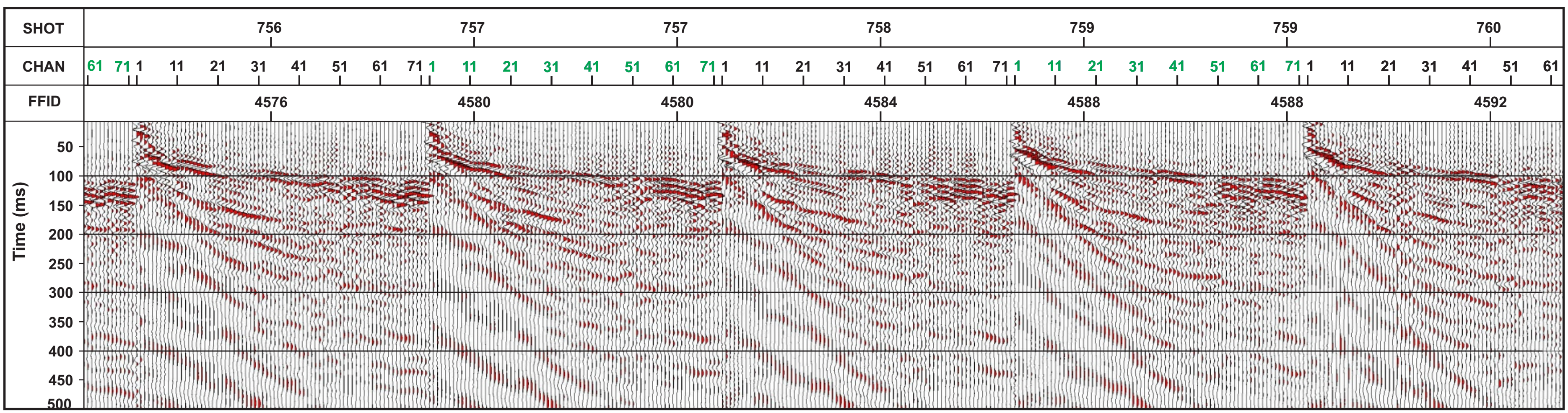


SH Wave - Line 2 - Middle Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization	Prepared by: ADG Reviewed by: SNS Date: Apr 12, 2023
FIGURE A.5	Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A05_SHWave_Line2_Middle.cdr"

A) SH Wave - Raw Scaled Data West End of Line 2



B) SH Wave - Processed Data West End of Line 2



SH Wave - Line 2 - West End
Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization

FIGURE A.6

Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A06_SHWave_Line2_West.cdr"

Prepared by: ADG
Reviewed by: SNS
Date: Apr 12, 2023

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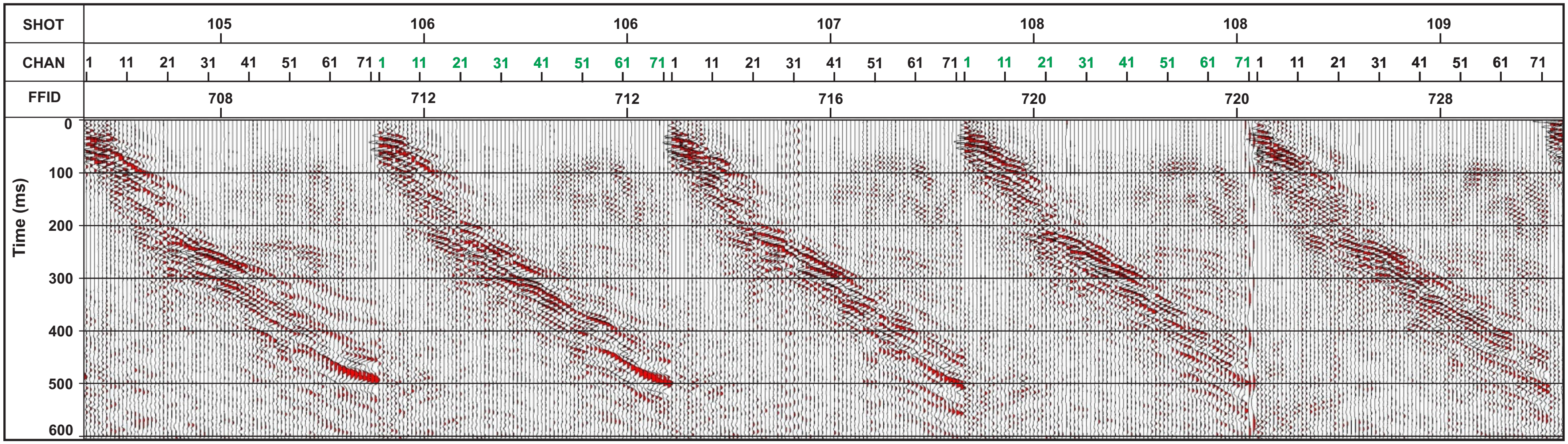
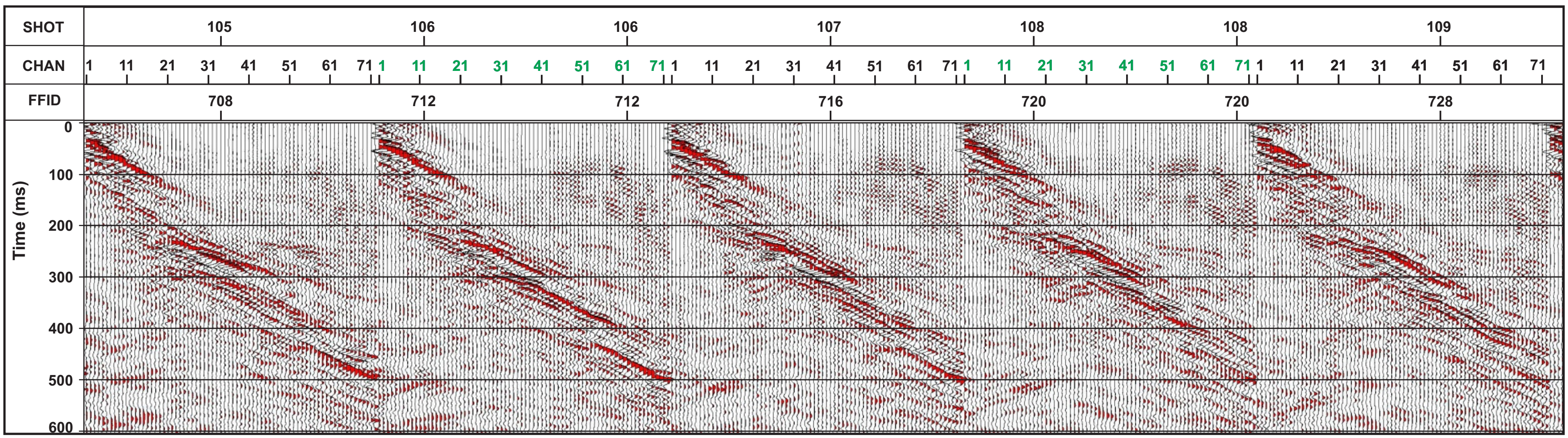
A) SH Wave - Raw Scaled Data East End of Line 3



B) SH Wave - Processed Data East End of Line 3



SH Wave - Line 3 - East End Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization		Prepared by: ADG Reviewed by: SNS Date: Apr 12, 2023
FIGURE A.7	Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A07_SHWave_Line3_East.cdr"	

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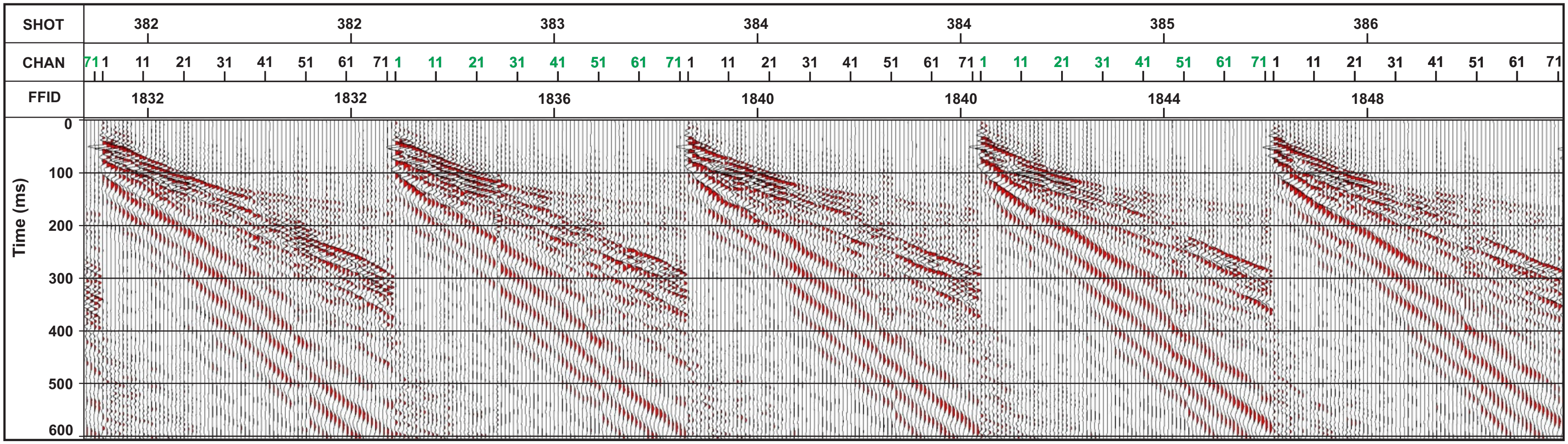
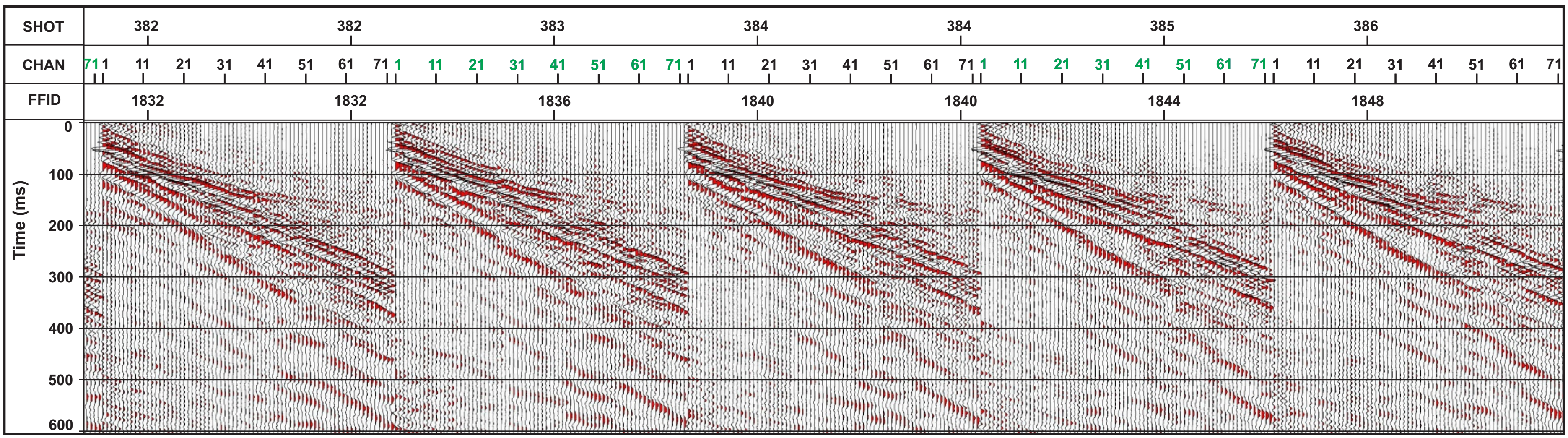
A) SH Wave - Raw Scaled Data Middle of Line 3



B) SH Wave - Processed Data Middle of Line 3



SH Wave - Line 3 - Middle
Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization

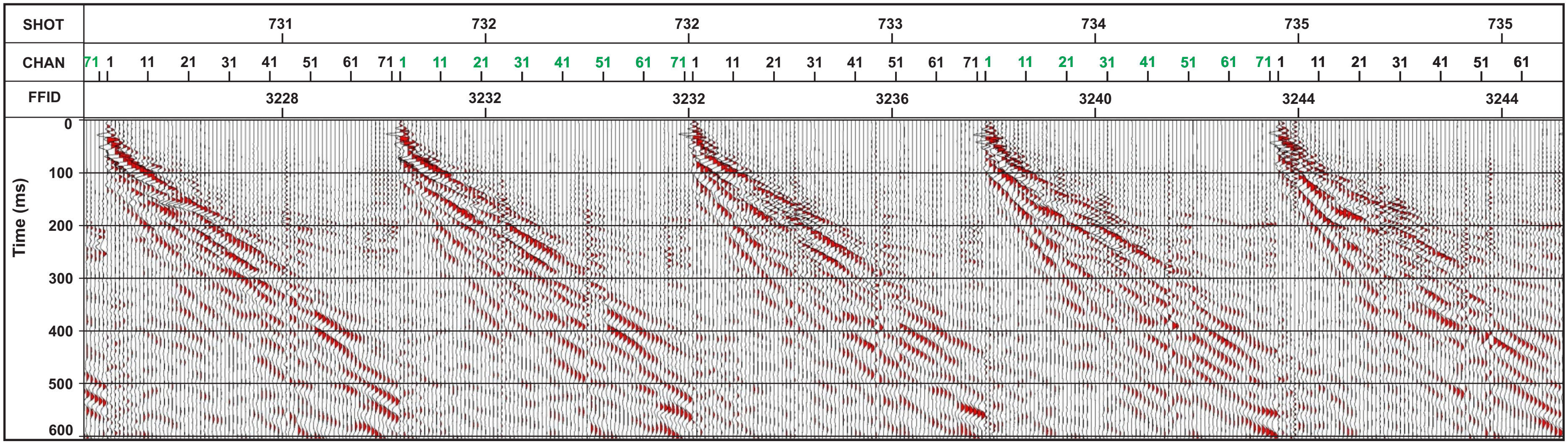
FIGURE A.8

Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A08_SHWave_Line3_Middle.cdr"

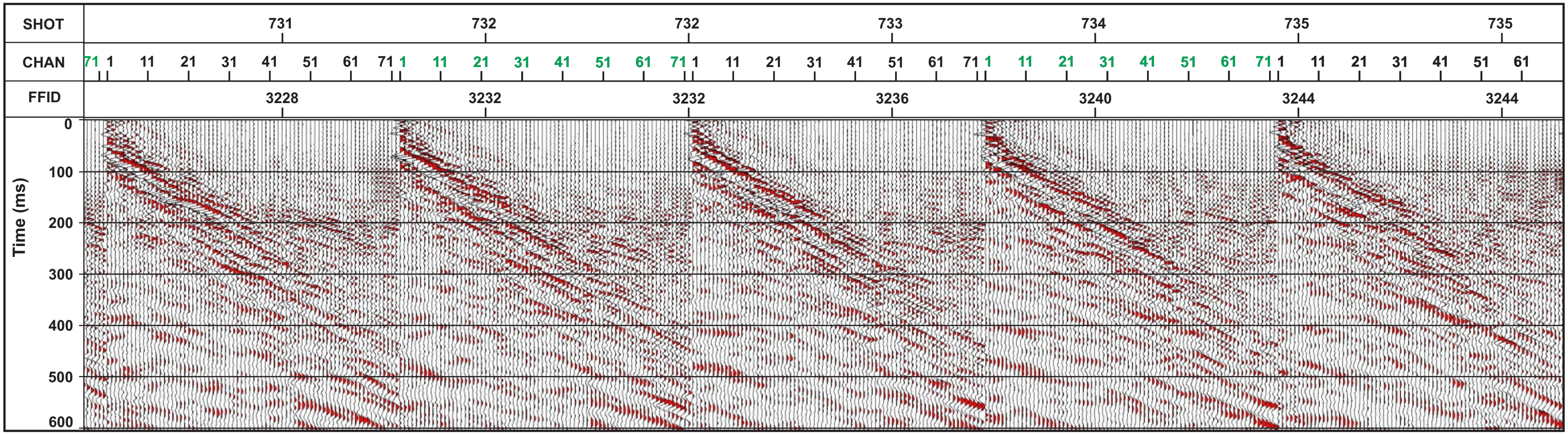
Prepared by: ADG
Reviewed by: SNS
Date: Apr 12, 2023

GEOFIRMA ENGINEERING

A) SH Wave - Raw Scaled Data West End of Line 3



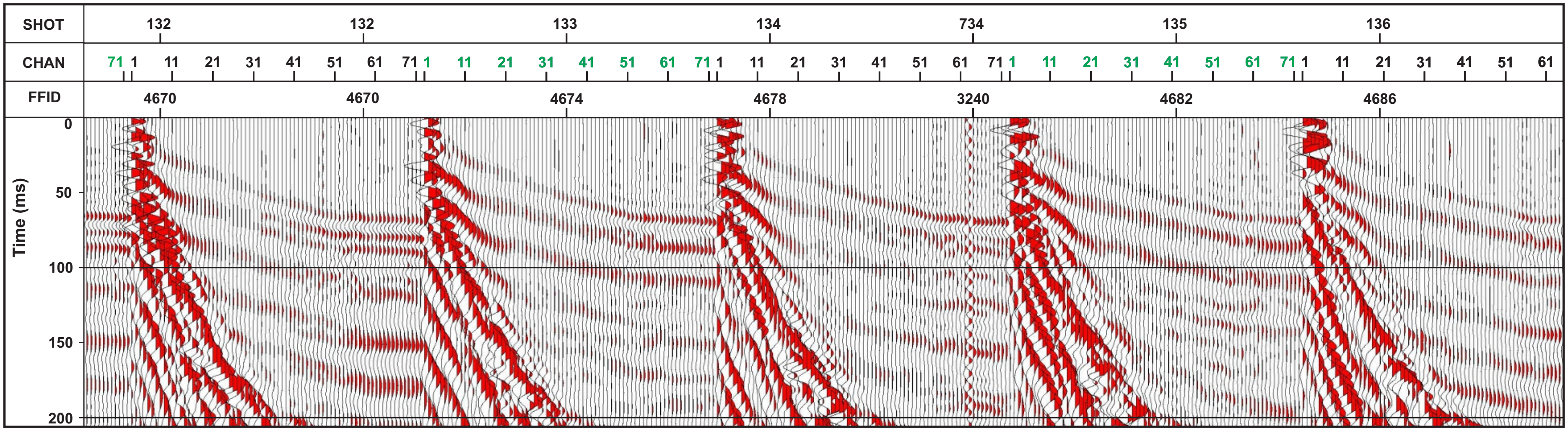
B) SH Wave - Processed Data West End of Line 3



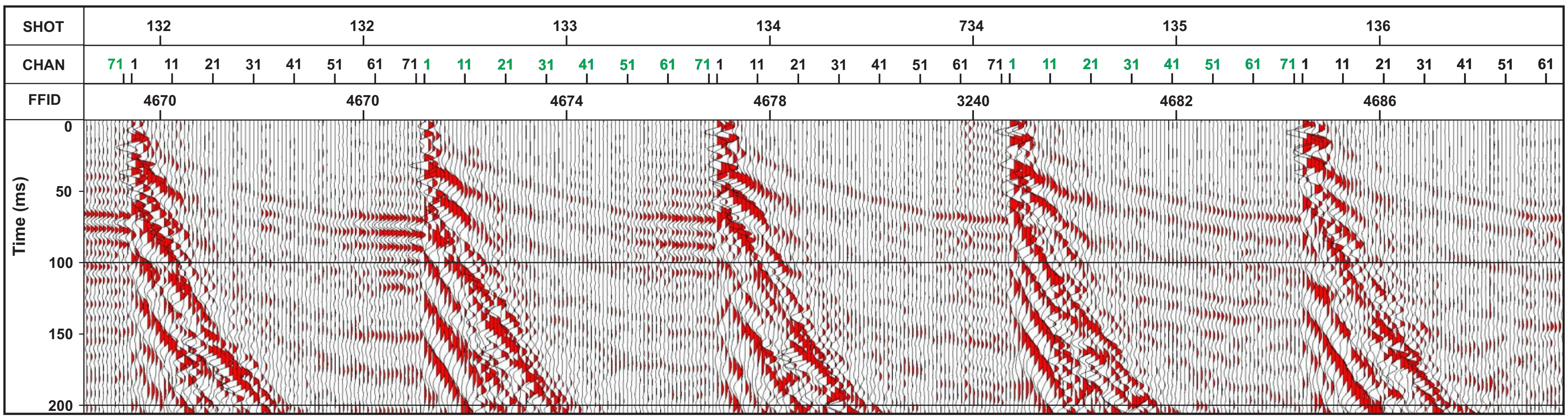
SH Wave - Line 3 - West End Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization	Prepared by: ADG Reviewed by: SNS Date: Apr 12, 2023
FIGURE A.9	Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A09_SHWave_Line3_West.cdr"

GEOFIRMA ENGINEERING

A) P Wave - Raw Scaled Data East End of Line 1



B) P Wave - Processed Data East End of Line 1



P Wave - Line 1 - East End
Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization

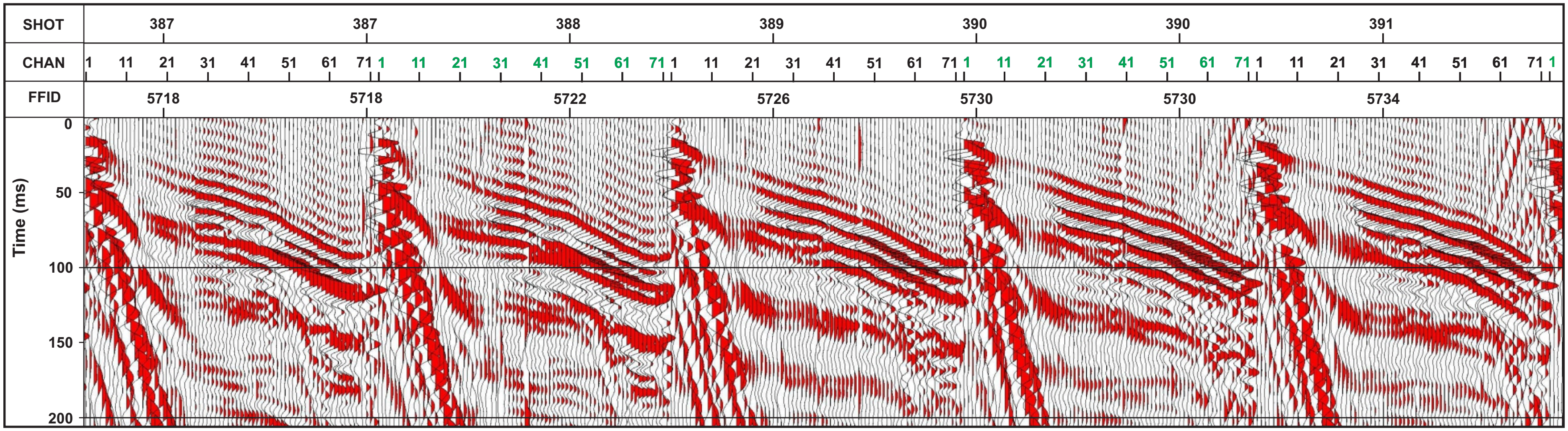
FIGURE A.10

Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A10_PWave_Line1_East.cdr"

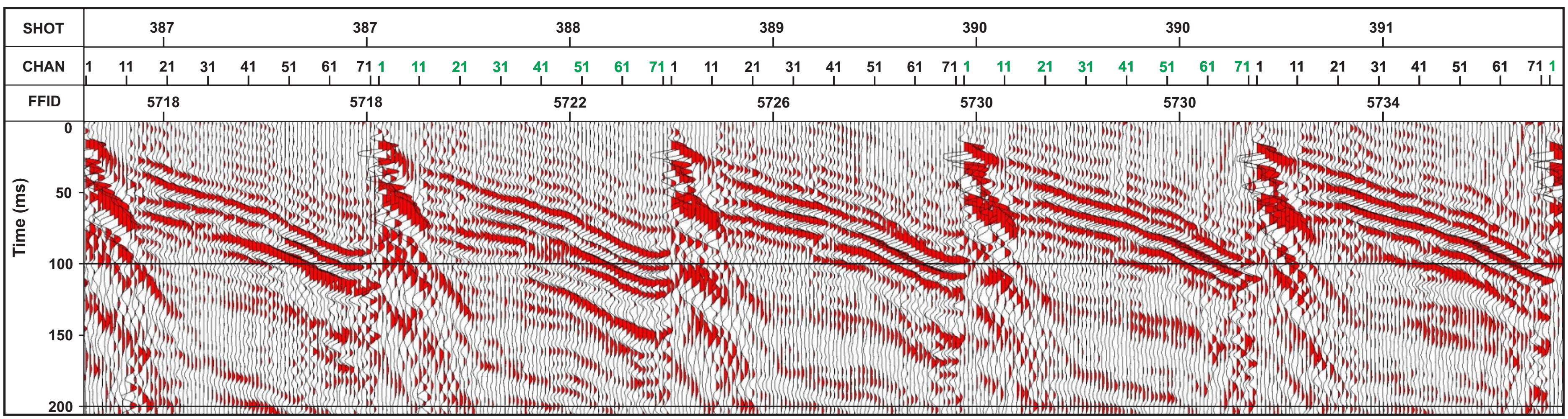
Prepared by: ADG
Reviewed by: SNS
Date: Apr 12, 2023

GEOFIRMA ENGINEERING

A) P Wave - Raw Scaled Data Middle of Line 1



B) P Wave - Processed Data Middle of Line 1



P Wave - Line 1 - Middle
Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization

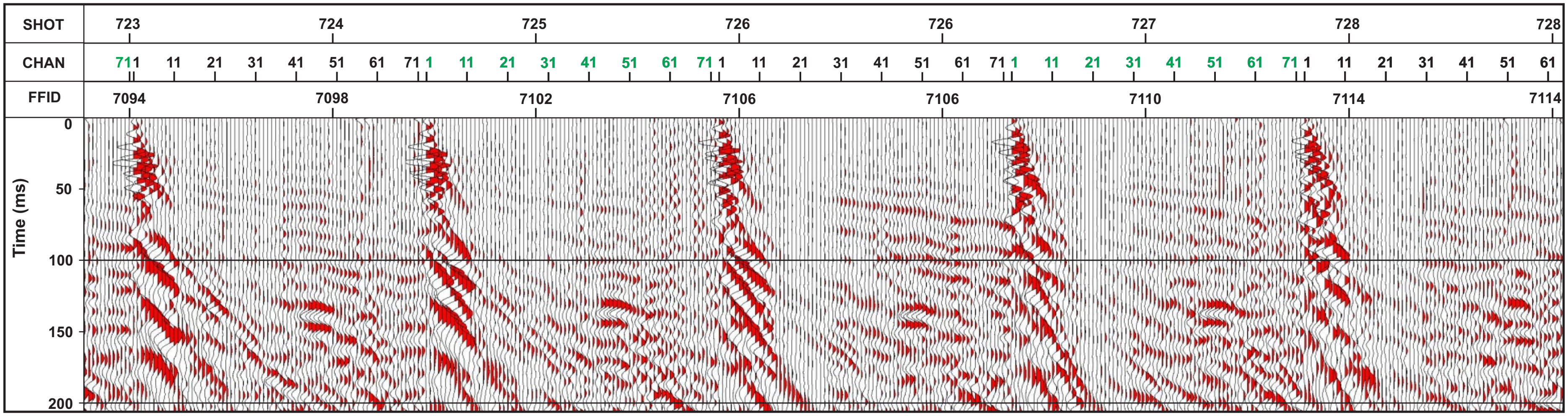
FIGURE A.11

Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A11_PWave_Line1_Middle.cdr"

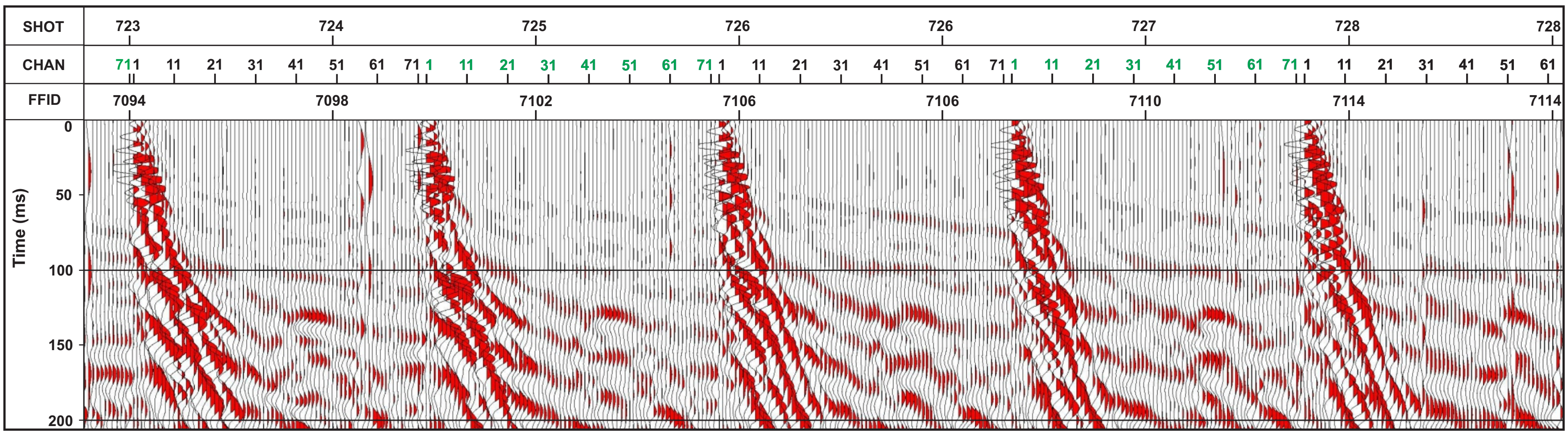
Prepared by: ADG
Reviewed by: SNS
Date: Apr 12, 2023

GEOFIRMA ENGINEERING

A) P Wave - Raw Scaled Data West End of Line 1



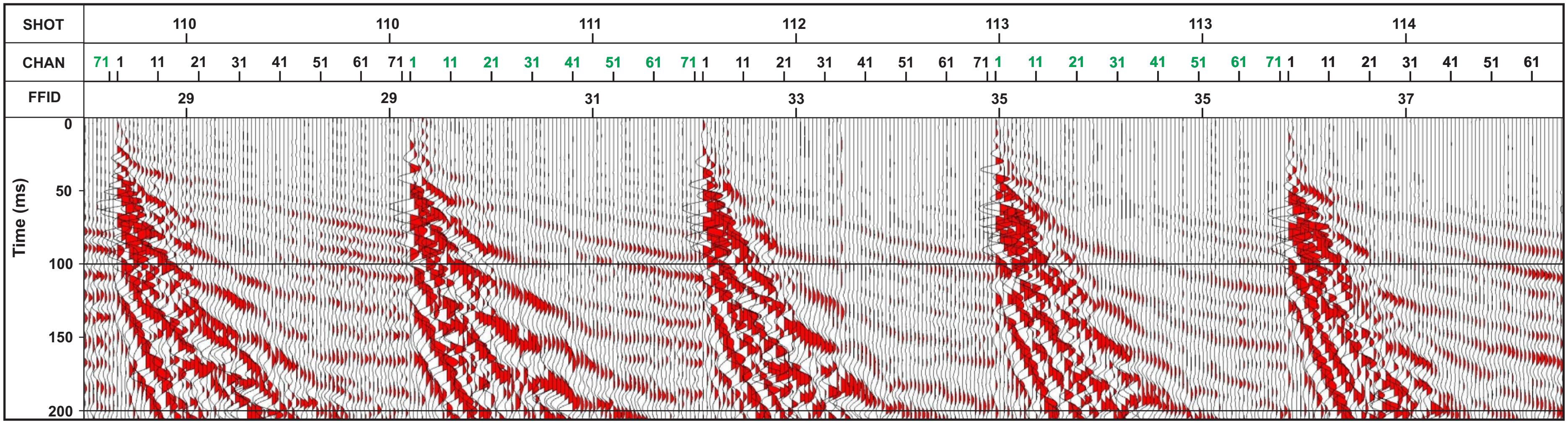
B) P Wave - Processed Data West End of Line 1



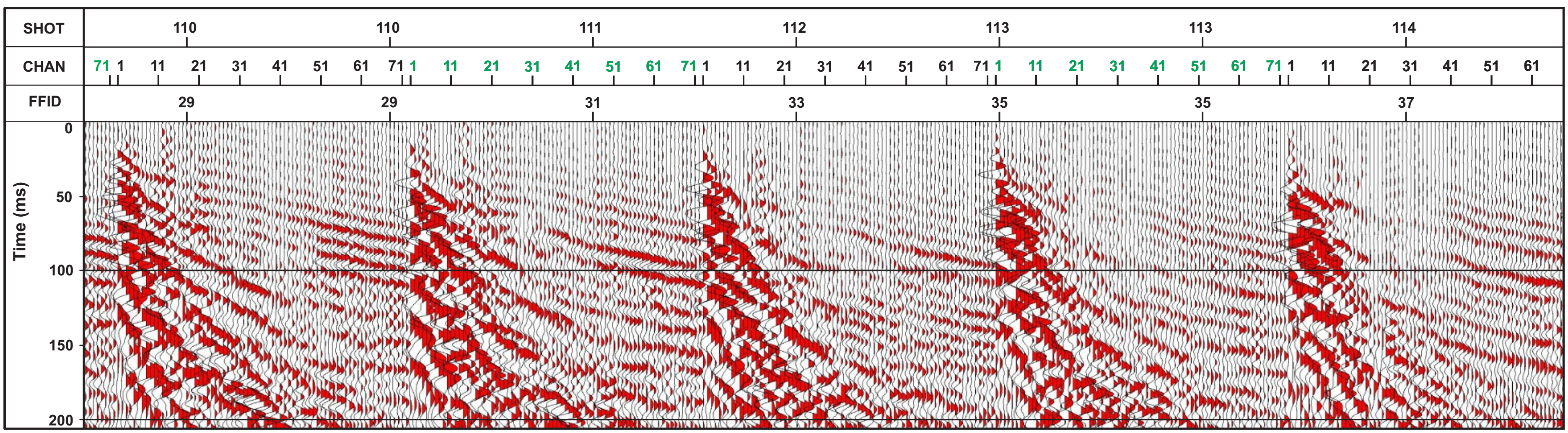
P Wave - Line 1 - West End Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization		Prepared by: ADG Reviewed by: SNS Date: Apr 12, 2023
FIGURE A.12	Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A12_PWave_Line1_West.cdr"	

GEOFIRMA ENGINEERING

A) P Wave - Raw Scaled Data East End of Line 2



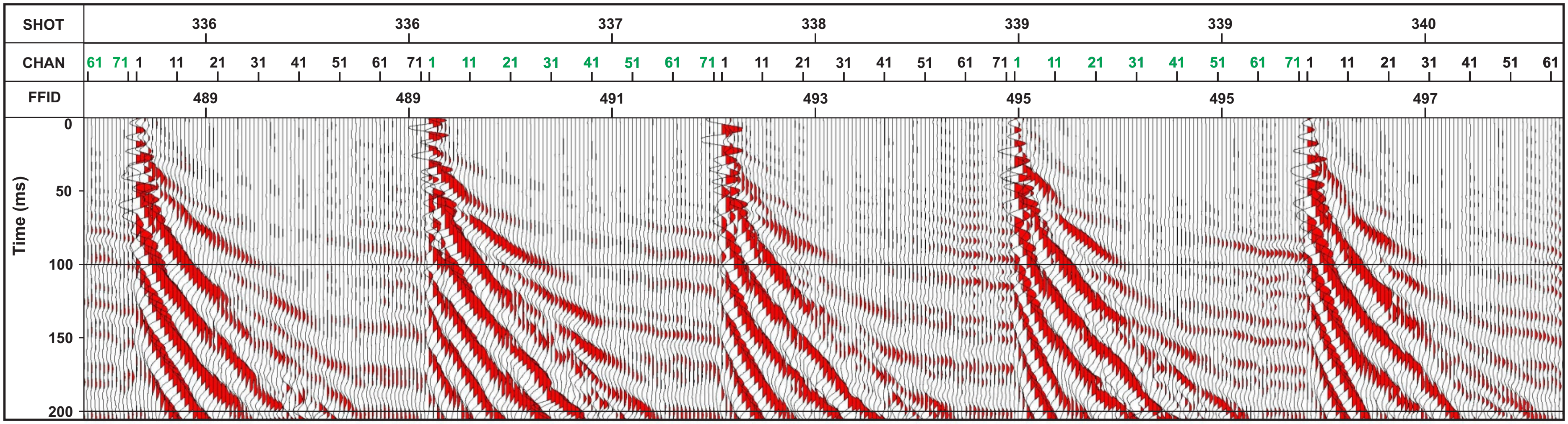
B) P Wave - Processed Data East End of Line 2



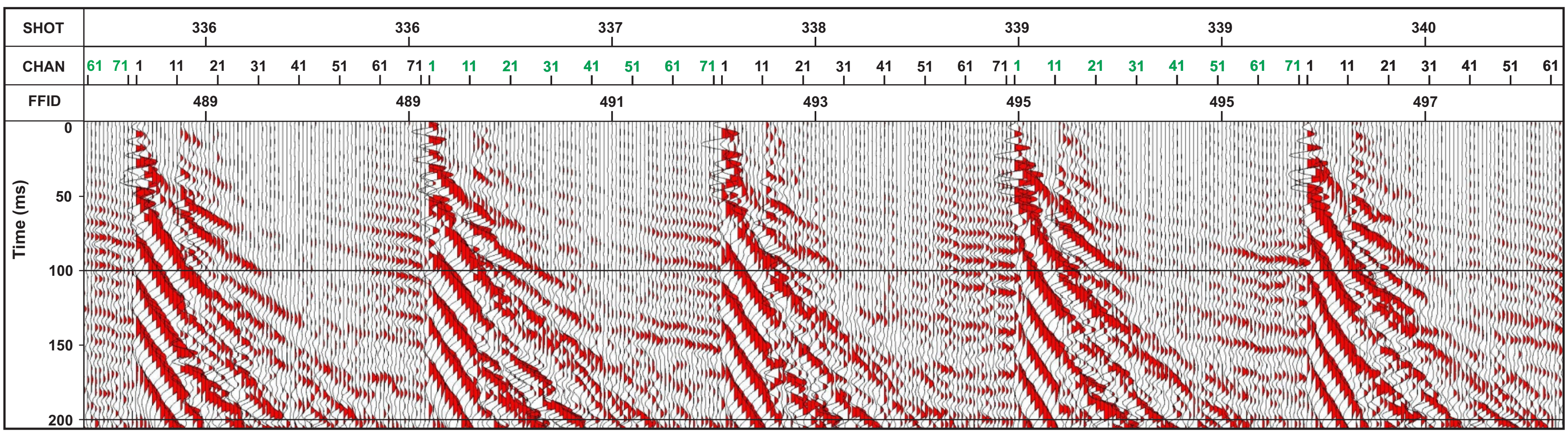
P Wave - Line 2 - East End Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization	Prepared by: ADG Reviewed by: SNS Date: Apr 12, 2023
FIGURE A.13	Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A13_PWave_Line2_East.cdr"

GEOFIRMA ENGINEERING

A) P Wave - Raw Scaled Data Middle of Line 2



B) P Wave - Processed Data Middle of Line 2



P Wave - Line 2 - Middle
Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization

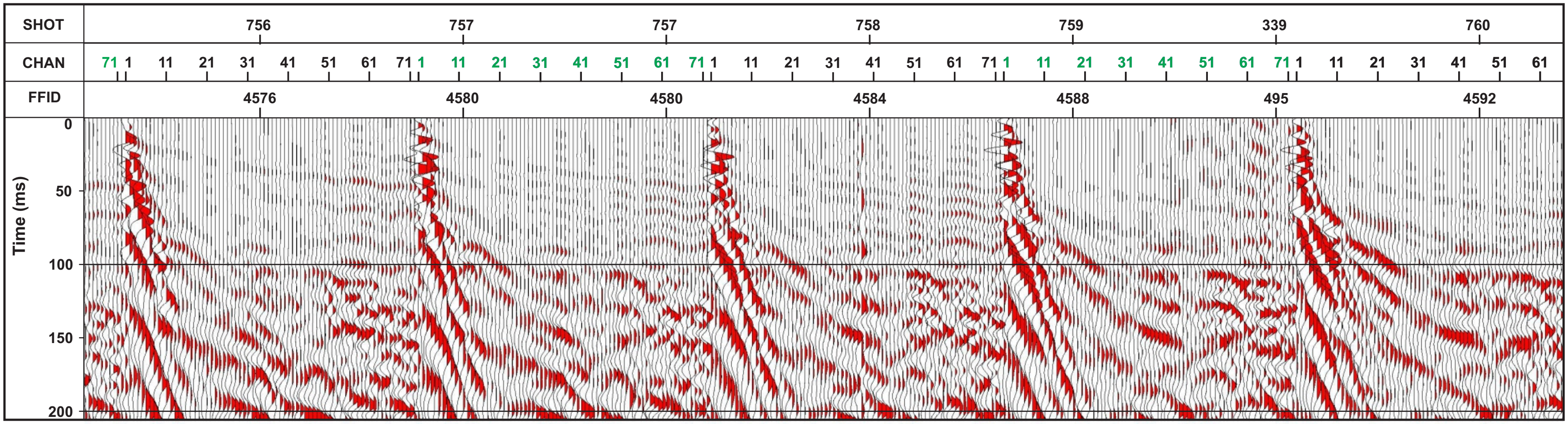
Prepared by: ADG
Reviewed by: SNS
Date: Apr 12, 2023

FIGURE A.14

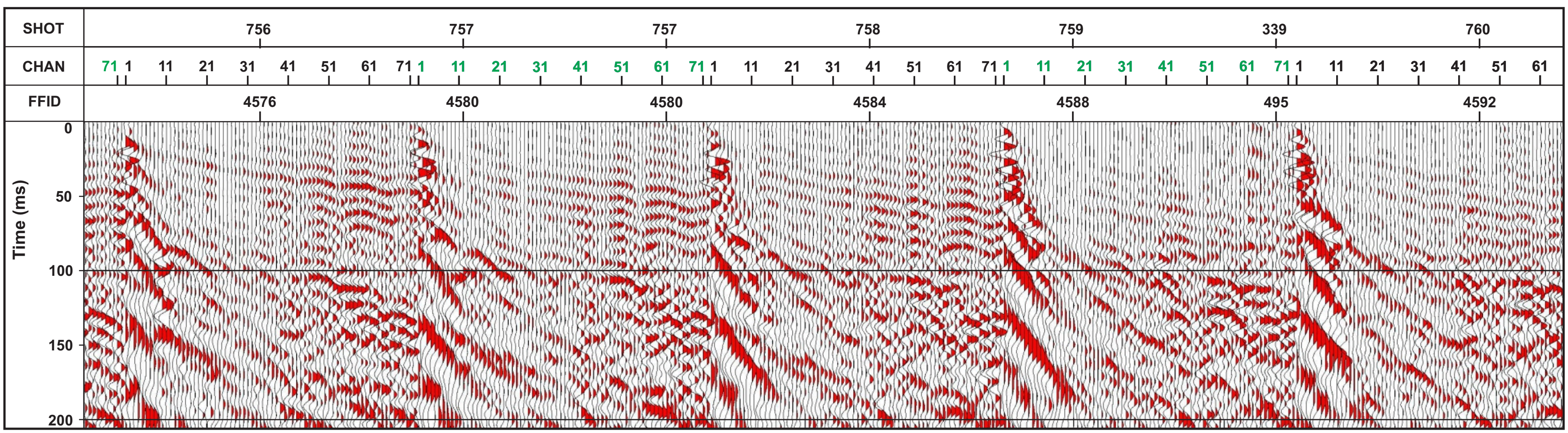
Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A14_PWave_Line2_Middle.cdr"

GEOFIRMA ENGINEERING

A) P Wave - Raw Scaled Data West End of Line 2



B) P Wave - Processed Data West End of Line 2



P Wave - Line 2 - West End
Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization

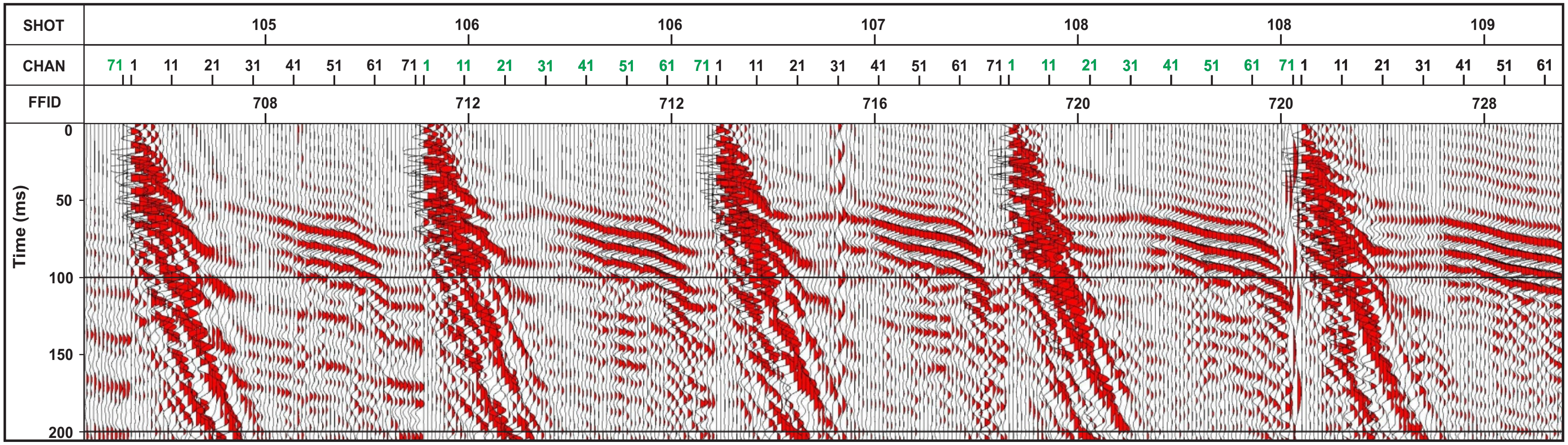
FIGURE A.15

Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A15_PWave_Line2_West.cdr"

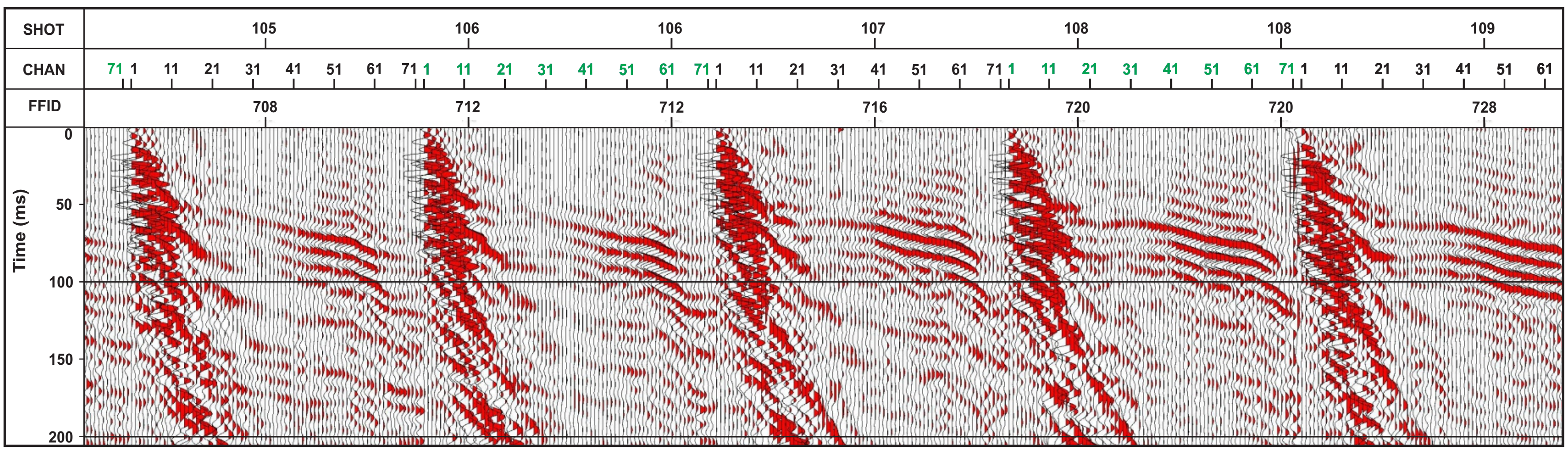
Prepared by: ADG
Reviewed by: SNS
Date: Apr 12, 2023

GEOFIRMA ENGINEERING

A) P Wave - Raw Scaled Data East End of Line 3



B) P Wave - Processed Data East End of Line 3



P Wave - Line 3 - East End
Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization

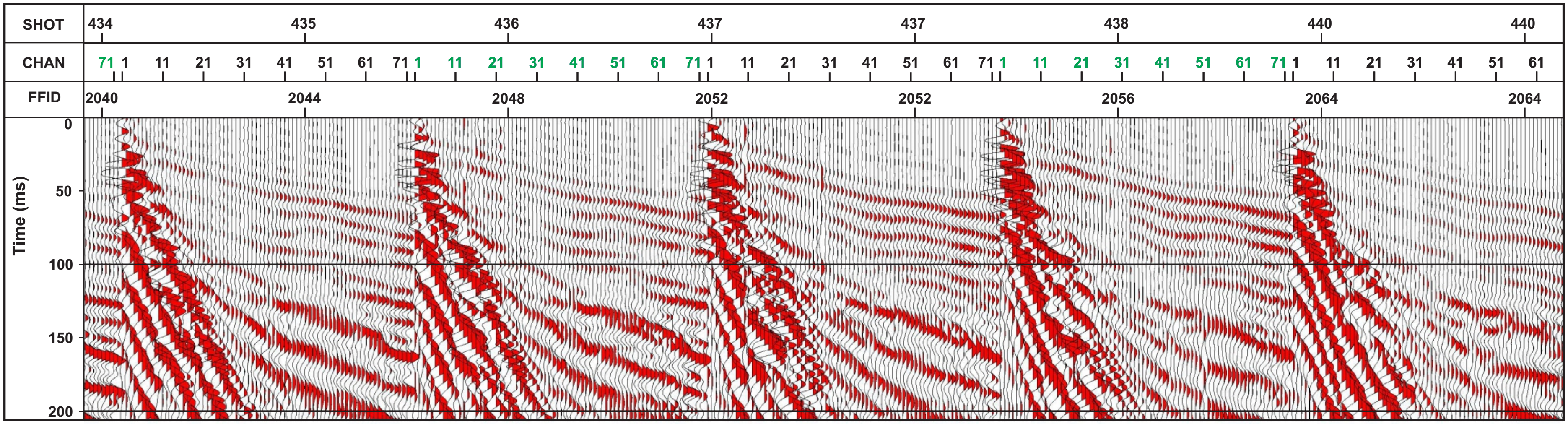
FIGURE A.16

Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A16_PWave_Line3_East.cdr"

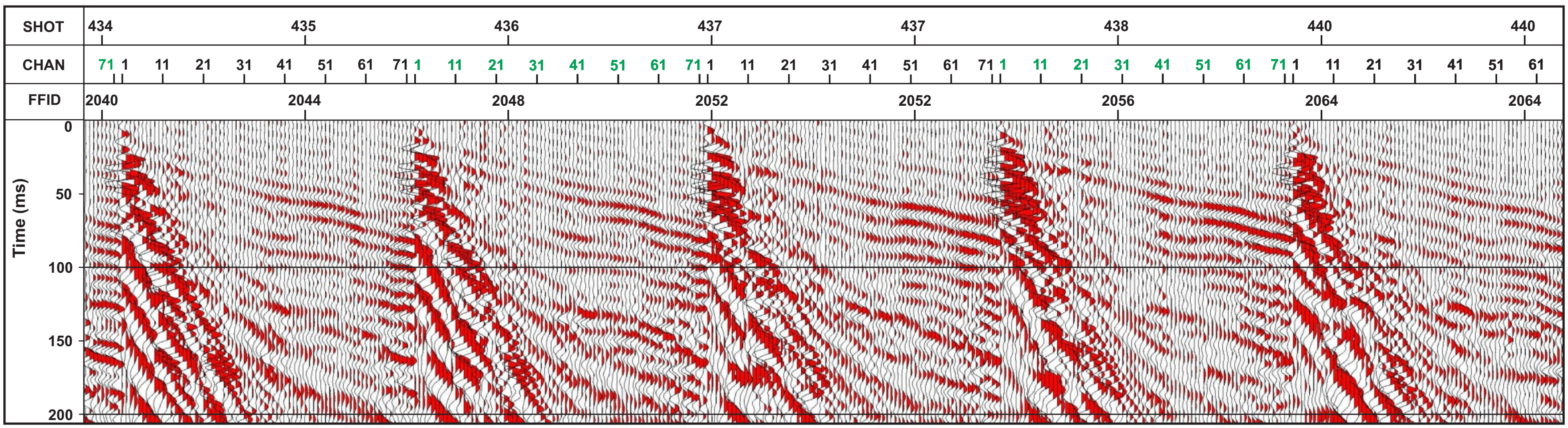
Prepared by: ADG
Reviewed by: SNS
Date: Apr 12, 2023

GEOFIRMA ENGINEERING

A) P Wave - Raw Scaled Data Middle of Line 3



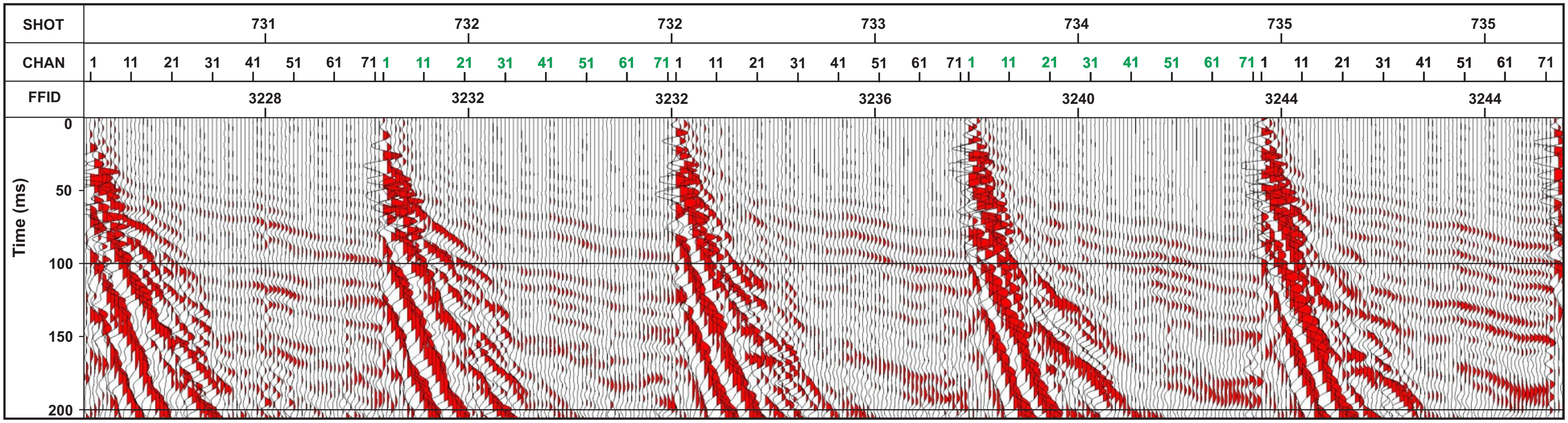
B) P Wave - Processed Data Middle of Line 3



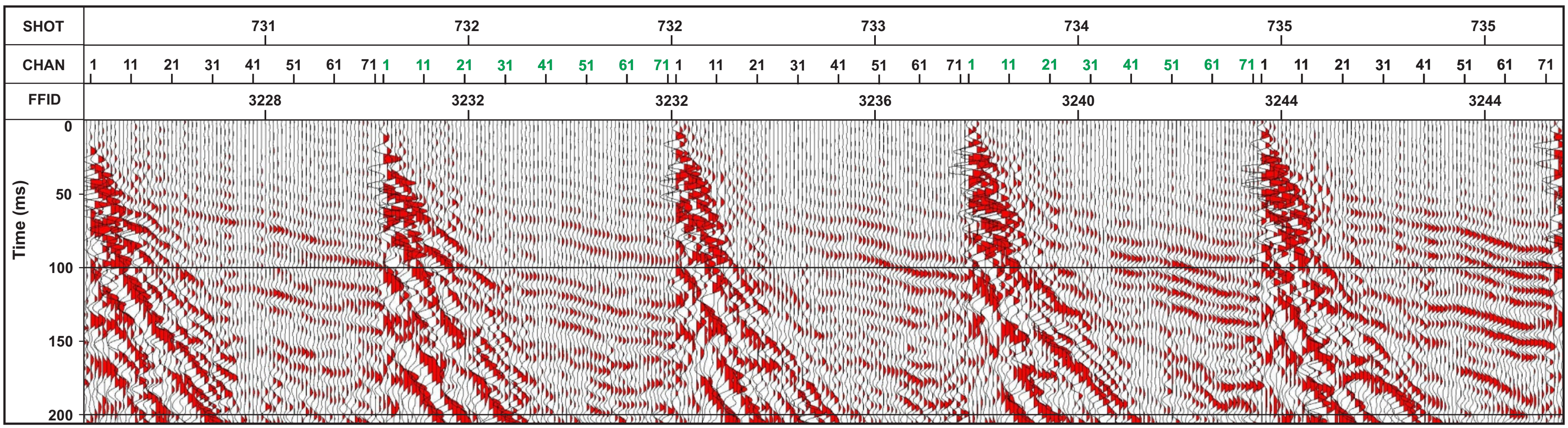
P Wave - Line 3 - Middle Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization	Prepared by: ADG Reviewed by: SNS Date: Apr 12, 2023
FIGURE A.17	Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A17_PWave_Line3_Middle.cdr"

GEOFIRMA ENGINEERING

A) P Wave - Raw Scaled Data West End of Line 3



B) P Wave - Processed Data West End of Line 3



P Wave - Line 3 - West End Phase 2 - 3D Seismic Investigation, South Bruce, Data Report for 2D Seismic Paleochannel Characterization	Prepared by: ADG Reviewed by: SNS Date: Apr 12, 2023
FIGURE A.18	Doc. No.: "P:\Projects\2021\21-210-1 NWMO - 3D Seismic South Bruce\REPORTING\2D Seismic Paleochannel Report\Working\21-210-1_2DSeismic_Appendix_A18_PWave_Line3_West.cdr"

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