

TLS Report PNR1z – Final Report					
Author		Seismologist	File Name:		TLS_finalreport_29.10.20_PNR1z
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Version	Section	Revision Information		Date	Reviser
0.1	All	Draft Publication			Senior Geoscientist

*Documents are reviewed as per proposed review date, or sooner if a significant change to the operation has taken place, to ensure relevance to the systems and process that they define.*

## Event Summary

During injection operations of cumulative stage 11 at sleeve 32 for the hydraulic stimulation of PNR1z, a seismicity related traffic light system red light threshold was exceeded. The seismic event had a local magnitude of 1.0 ML (reported by BGS as 1.1ML). The seismic event hypocenter shown in the map and x-section by the blue dot, was roughly 362.4 m from the injection point.

## Event Classification

Green Event	Amber Light	Red Light	Trailing Event (<=0.5ML)	Trailing Event (>0.5ML)
		<b>X</b>		

## Event Details

Magnitude (ML)	Date	Time (24hr) BST	Sleeve Injection Location
<b>1.0</b>	<b>29/10/2018</b>	<b>11:30:39</b>	<b>32</b>

## Hypocenter Information

X [mEast] BNG	Y [mNorth] BNG	Z [mTVDGL]	Distance to Nearest Injection Point (m)
<b>336429</b>	<b>432988</b>	<b>-2262</b>	<b>362.4</b>

## Error / Uncertainties

P Trace Quality	S Trace Quality	Trace Quality	Min Ellipsoid size (m)	Mid Ellipsoid size (m)	Max Ellipsoid size (m)
<b>1</b>	<b>0.7</b>	<b>0.8</b>	<b>183.3</b>	<b>227.6</b>	<b>698.4</b>

## Ground Motion & Well Integrity

Max PPV (mm/sec)	Average PPV (mm/sec)	Fit to GMPE (mm/sec)	Annular Pressure Change (psi)
<b>1.16</b>	<b>0.23</b>	<b>0.8mm</b>	<b>0</b>

## Injection Information

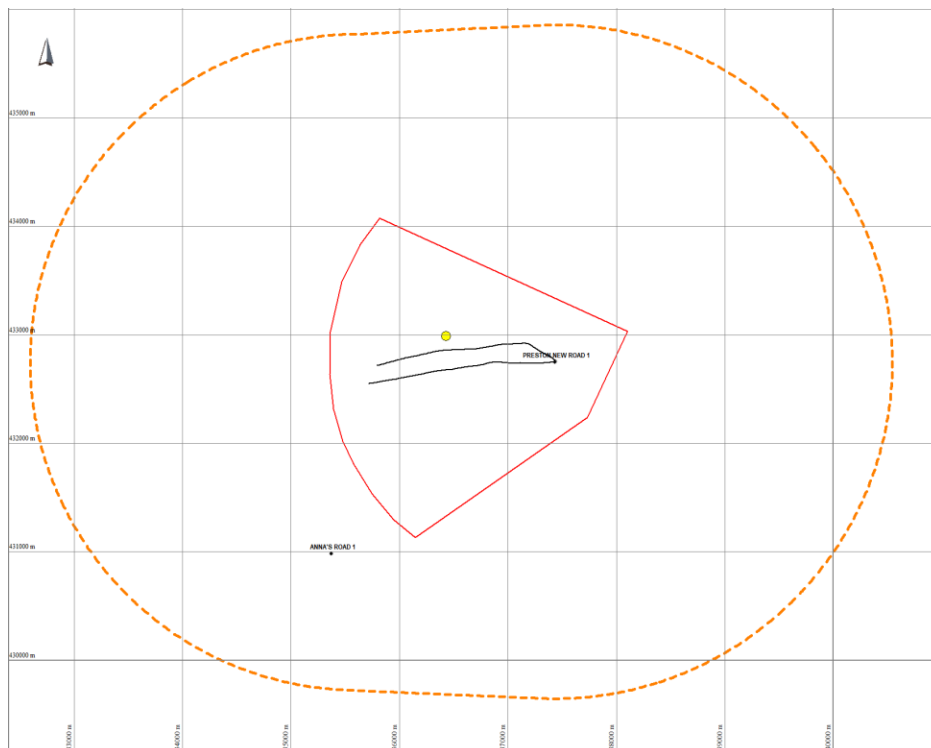
Sleeve	Fluid Volume Injected (m³)	Proppant Volume Injected (tonnes)	Average Rate (m³/min)	Max Treatment Pressure (surface) (psi)	Average Treatment Pressure (surface) (psi)
32	120.1	4.8	4.0	6612	5626

Stage (cumulative)	Fluid Volume Injected (m³) (cumulative)	Proppant Volume Injected (tonnes) (cumulative)	Flow Back (m³) (cumulative)
11	2389.7	148.8	242.17

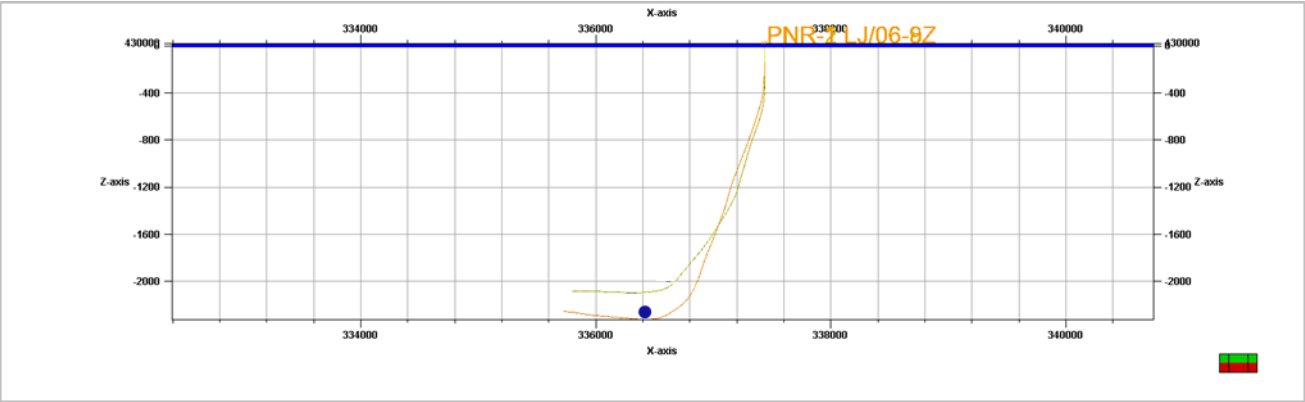
#### Forward Injection Schedule / Additional Mitigation

Waiting Time (hr)	Next Stage	Proposed Volume (m³)	Mini Frac	Additional Mitigation
18	12	400	Yes	Move to another sleeve to be decided following overnight microseismic response.

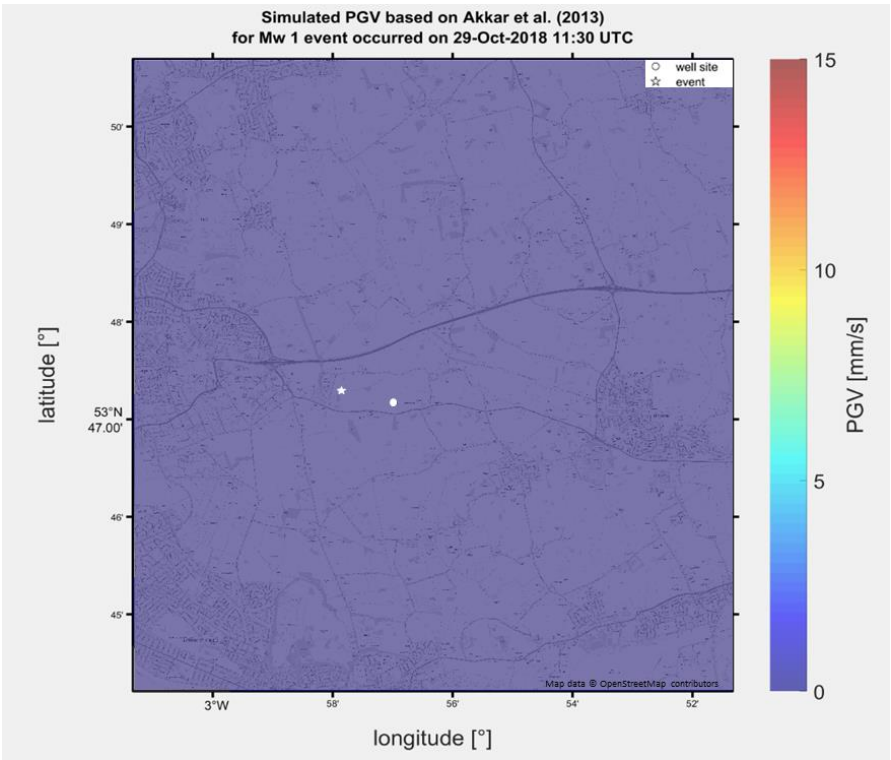
#### Map from above



Cross Section Looking North



PPV Shake Map



The location of the sensor sites has been redacted on the basis of commercial confidentiality and public safety

## PPV Attenuation Curve

