Dynamic Satellite Surveys

03021

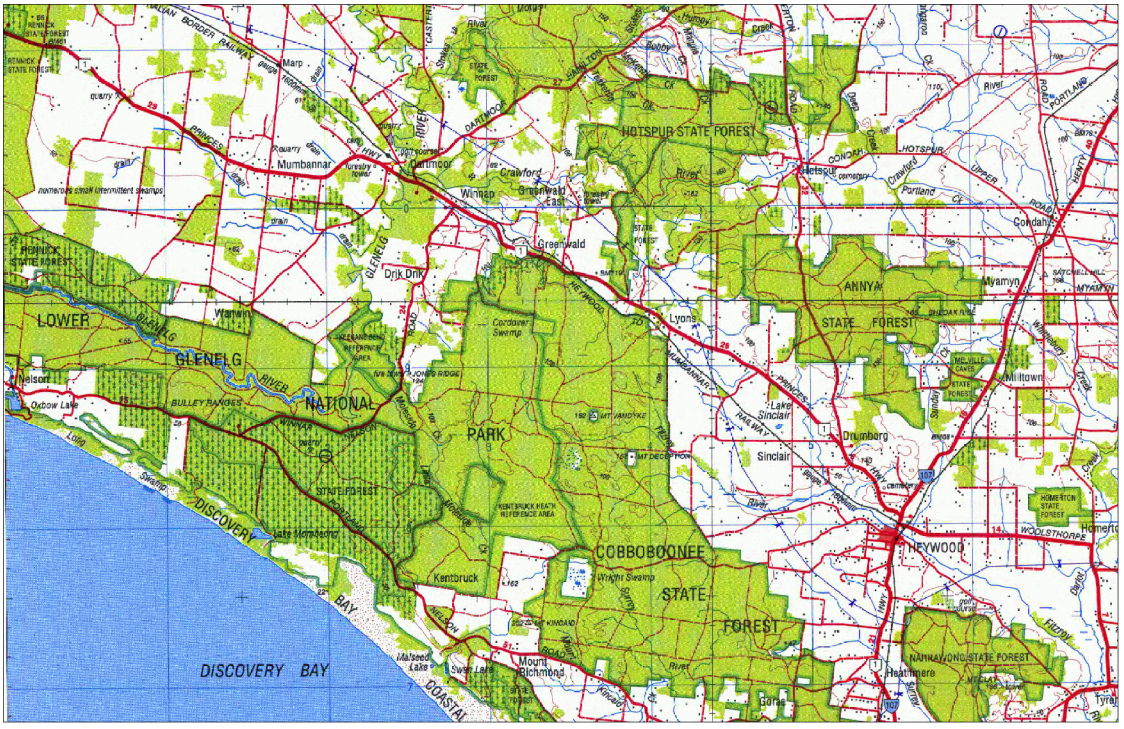
Final Operations Report
on the

2003 Nelson 3D Seismic Survey

for

TRACE ENERGY SERVICES Pty Ltd
and
ESSENTIAL PETROLEUM RESOURCES LIMITED

April/May 2003



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INTRODUCTION

The following report covers the **2003 Nelson 3D Seismic Survey**, performed by **Dynamic Satellite Surveys Pty Ltd** (DSS) whilst contracted to **Trace Energy Services Pty Ltd** for **Essential Petroleum Resources Limited.**

The survey operations were conducted between the 22nd of April and the 29th of May, 2003.

The survey operation covered an area around and to the east of the township of Nelson in far western Victoria. All lines were in PEP 151 and were concentrated in and around the Lower Glenelg National Park. Three lines were in a separate area further east of the main block and known as the Kentbruck area. There were 37 seismic lines in total, all chained at 25m station intervals and these are summarised below:

KENTBRUCK

Located 27km east of Nelson, Victoria.

Line	Start of Line	End of Line	Distance (kms)
146	101	476	9.375
148	101	746	16.125
167	089	284	4.875
			30.375

Main survey area.

Line	Start of Line	End of Line	Distance (kms)
101	101	650	13.725
102	085	986	22.525
103	086	190	2.600
104	094	863	19.225
105	081	450	9.225
106	130	345	5.375
107	096	168	1.800
108	115	994	21.975
109	107	341	5.850
110	112	948	20.900
111	113	389	6.900
112	099	394	7.375
113	060	377	7.925
114	101	321	5.500
115	101	296	4.875
116	101	405	7.600
117	101	259	3.950
118	111	217	2.650
119	103	148	1.125
120	101	300	4.975
121	101	346	6.125
122	105	416	7.775
123	145	927	19.550
124	113	488	9.375
125	101	298	4.925
127	101	167	1.650
129	085	427	8.550
131	101	365	6.600
133	058	215	3.925
135	101	538	10.925
137	084	321	5.925
139	068	699	15.775
201	117	130	0.325
213	101	260	3.975
		TOTAL	**281.475 kms**

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INSTRUMENTATION AND PERSONNEL

2.1 Personnel and Logistics

DSS personnel involved in the survey were as follows.

Name	Qualification	Duties
Ron Weekes	B. Applied Science (Surveying) W.A.I.T.	Supervising surveyor, data processing, report.
Mike Borthwick	Certificate in Hydrographic Surveying (RNZN)	Chaining, surveying.
Mark Lefebvre	B. Applied Science (Surveying), R.M.I.T.	Chaining, surveying.
Tony Morcom	B. Geomatics (Surveying), University of Melbourne	Chaining, surveying.
Denis Williams	B. App. Sc. (Surveying) B. Information Technology Q. U. T.	Chaining, auditing, training.
Rob Heyer	DSS Operations Manager	Chaining, logistics.
Gregory Birrell		Chaining.
Renae Turner		Chaining.

Personnel and equipment logistics were supported by the DSS Yeppoon office. Two rental vehicles were driven to Nelson from Melbourne and the DSS Hilux was driven to Nelson from Yeppoon.

Survey operations were based at the Sun Valley Eco Farm, 2.5km east of Nelson on the Nelson - Portland Road. This provided accommodation and ample vehicle/equipment storage space. The farm was also the location of the DSS survey site office.

No time was lost due to wet weather although a few days were damp.

2.2 Equipment

Equipment provided by DSS and used on this project.

	Description	Qty
Vehicles	Toyota Hilux - DSS	1
	Toyota Landcruiser Trayback - Hired	2
GPS receivers	NovAtel RT20 c/w VHF Telemetry	4
	NovAtel 2151 c/w VHF Telemetry	1
	Garmin 72 hand held GPS receiver	1
Computers	Dell Inspiron 5000	2
	GRiD 386 Field PCs	6
Software	GravNav / GravNet GPS post-processing - Waypoint Consultancy	1
	Nav98 field software - DSS	Ver4.0
	MIB2001 for Windows - DSS	Ver4.0.3
	TransIt 2000 - DSS	Ver2.04
Printer	Sharp AL-840 printer/copier	1
Survey Instruments	Rapid Elevation Meter - DSS	2
	Geodimeter 600 Total Station.	1
Miscellaneous	Necessary standard surveying equipment	
	Sundry office and transport equipment	
	Field and Office Consumables	

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SURVEY REFERENCE SYSTEMS

3.1 Geodetic Datum

The Geocentric Datum of Australia 1994 (GDA94) is based on the Geodetic Reference System 1980 (GRS80) model described by the following parameters.

Datum:	GDA94 (Geocentric Datum of Australia 1994)
Spheroid:	GRS 1980
Reference Frame:	ITRF92(International Terrestrial Reference Frame)
Semi-Major Axis Length:	6 378 137.0
Inverse Flattening:	298.257222101
The Unit of Measure:	International Metre

3.2 Map Projection

Final rectangular coordinates were based on the Map Grid of Australia 1994 (MGA 94). Parameters for this projection are as follows.

Projection:	Universal Transverse Mercator (MGA Zone 54)
Latitude of Origin:	0°
Central Meridian (CM):	141° E
Scale Factor at CM:	0.9996
False Easting:	500 000
False Northing:	10 000 000
The Unit of Measure:	International Metre

3.3 Height Datum

All elevations obtained relative to WGS 84 (World Geodetic System) have been reduced to the Australian Height Datum (AHD) using the AUSGEOID98 Geoid - Spheroid separation model to determine the geoid-ellipsoid separation (N) for the particular area.

GPS observations are made on the WGS84 datum. The height associated with this datum is an ellipsoidal height (h). The Australian Height Datum (AHD), the height datum associated with MGA94, is an orthometric height which is measured as the height above mean sea level, or the geoid (H).

The function that defines the relationship between the ellipsoid and orthometric heights is:

H = h - N

Or

AHD = (WGS84)Ht - (Geoid / Ellipsoid Separation)

AUSGEOID98 is the third in a series of national geoid models produced for Australia by the Australian Surveying and Land Information Group (AUSLIG). The geoid-ellipsoid data is prepared for the Australian region from:

- EGM96 Global Geopotential Model;
- 1996 Australian Gravity DataBase, from the Australian Geological Survey Organisation (AGSO);
- AUSLIG / AGSO GEODATA nine-second digital elevation model;
- Satellite altimeter - derived free air gravity anomalies offshore;
- Theories, techniques and software developed by Associate Professor Will Featherstone, Curtin University of Technology[1].

AUSGEOID98 N values were obtained using the GrafNet Version 6.03 software, distributed by Waypoint. Consulting Inc.

[1] Johnston, G.M., Featherstone, W.E. (1998) AUSGEOID98: A New Gravimetric Model for Australia

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SURVEY CONTROL

The datum point for this survey was PM42 (C520-8) which is a zero order horizontal and third order vertical government control mark located near Nelson. This mark has the following coordinates.

Station	Easting (MGA)	Northing (MGA)	Height (AHD)	Comments
PM 42 C520-8	501689.441	5787396.971	28.731	0 hor / 3rd vert

Eight new survey points were installed for the job and these were used at different times as base reference stations for the real-time GPS survey. These new points were all linked in a closed network observed by static GPS methods.

The GPS recordings were post-processed with GRAFNET[2] and a least squares adjustment for best fit was applied.

A check point in the network was another Victorian government survey control mark, Glenelg PM50 (C520-3). The results of this tie gave a high degree of reliability to the network and are quoted below. PM50 is a 3rd order horizontal, 3rd order vertical control mark.

[2] GRAFNET Version 6.03 by Waypoint Consulting Inc, Canada

Station	Easting (MGA)	Northing(MGA)	Height (AHD)	Comments
PM 50	500998.081	5788691.600	15.069	SMES
C520-3	500998.132	5788691.584	15.061	03021
	0.051	-0.016	-0.008	Misclose

Two other survey control marks from earlier surveys done by DSS were observed during the course of this survey. These points were at the east and west ends of the job and gave a good quality control check for the control network.

Station	Easting (MGA)	Northing(MGA)	Height (AHD)	Comments
DSS 97-12	518104.21	5782537.93	60.66	DSS 1997
BAS8	518104.05	5782537.71	60.54	03021
	-0.16	-0.22	-0.12	Misclose

Station	Easting (MGA)	Northing(MGA)	Height (AHD)	Comments
DSS 01-38	497015.32	5789942.39	12.20	DSS 2001
PM718	497015.96	5789943.20	12.27	03021
	0.64	0.81	0.07	Misclose

Some of the discrepancy in these positions must be attributable to the transformation of coordinates from AMG84 to GDA/MGA. A better agreement would be expected as in the tie to PM50 if the transformation used a locally adjusted transformation. The transformation AMG-MGA varies slightly across the country and the transformation applied here for a check has used a general set of values.

The agreement in elevation is very acceptable for seismic control.

A control network diagram showing all points in the control survey can be found in **Appendix B - Control Network Diagram**. This has been taken from the Grafnet software package and also shows all GPS static baselines observed.

All ties and miscloses can be seen in **Appendix A - Control Survey and Ties.**

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MONUMENTATION

All lines were marked at a 25 metre station interval.

In most areas the lines were marked with alternating painted wooden pegs and pinflags. In these areas each peg was fully numbered with line number and station number.

In areas where disturbance from farm animals was likely, every point was marked with a numbered wooden peg and a spray mark of pink paint on the ground to facilitate recovery.

Two lines had long sections of hand cleared foot track and here the stations were marked with pinflags only. The station number was written on each pinflag

Survey control marks were placed at desirable locations for base station operation. Control marks consisted of a 1650mm steel star picket driven to refusal (approximately 0.5 metre in depth), and tagged with an aluminium plate stating the DSS job number and station name.

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METHOD OF SURVEY

6.1 Line Ranging

Line ranging was not part of the job specification for DSS on this project. The reason given was that most lines were on existing roads and tracks and therefore line ranging would not be needed. This was true for the majority of the job.

Some lines in the south-western areas were in open farm paddocks and line scouting/ranging was done ahead of survey by the line clearing/fencing crew. In more normal seasons the line of slashed vegetation would be quite obvious and easy to follow but with the current near drought conditions some paddocks have very little grass height. Although all lines had been driven by the slasher and the fencing vehicle there were places where the line could not be seen. This made it very difficult at times for the survey teams to follow the proposed line and significant time was lost in scouting ahead to ascertain correct line.

In future some more identifiable line marking such as flagging or spray painting may be necessary.

A small amount of line ranging with a hand held GPS unit was done on a couple of lines at river crossings.

6.2 Surveying and Chaining

In areas of open or low vegetation and clear overhead visibility the lines were surveyed using DSS' RT20 real-time kinematic surveying technique.

RT20 enables both position and elevation coordinates to be acquired in real-time and on the appropriate datum.

The survey method utilised phase data received from US Navy NAVSTAR Satellites to provide three-dimensional positioning. One receiver was set up as a base station at a known location while another receiver was used as a remote rover.

To obtain real-time capabilities, VHF telemetry is required between the base and the remote GPS receiver. Any number of remote receivers can be used at any given time with a base station.

NovAtel real-time kinematic methods can achieve accuracies of better than +/-0.3m in position and elevation, depending on base line length. The expected precision for locating pegged positions is better than 0.3 metre.

Initialisation of the RT20 rover GPS usually takes as little as 2-3 minutes, although this is greatly dependant on satellite geometry, availability, base line length and denseness/height of trees.

A lot of areas could not be surveyed using RT20 techniques and a variety of survey methods were employed. The National Park areas were generally heavily wooded with native vegetation and there were sections that were inaccessible by vehicle. The remainder of the project areas were in plantation pine forests with trees in blocks of varying ages/heights.

A feature of all GPS data that was greatly utilised on this job was the reliable horizontal accuracy most of the time but vertical accuracy only in good observing conditions.

Most of the forested areas and National Park were conventionally chained using a 100m chain marked at 25m intervals. RT20 GPS was used to check the chaining (ie. ensure no station number errors were made and the distance along the line was correct) and to observe horizontal coordinates where necessary. The forests usually had places at useable intervals sufficiently clear to allow an accurate height reading to be obtained which could be used later for elevation control.

In pine forests, the tracks were usually very straight and allowed horizontal position fixing at extended locations and the intermediate points to be interpolated. The elevations had to be observe separately using the REM (Rapid Elevation Meter).

6.3 Rapid Elevation Meter (REM)

The REM was developed by DSS and consists of a Paro Scientific 1016a quartz crystal digital barometer linked to a field computer. It is used to observe elevations and does not require line-of-sight. It is accurate to 0.3m or better and is suitable for use in a vehicle or in a backpack powered by a motorcycle style 12 volt battery.

In the hand cleared sections where overhead vegetation prevented sufficiently accurate real-time readings or it would be too slow to achieve useable accuracy, static observations were recorded. This involved setting up the GPS base receiver to log phase data continuously and setting up another GPS unit to log phase data at the point to be surveyed.

Later, this data was downloaded to the office computer and post-processed to obtain an accurate elevation and horizontal position. The points surveyed using the static method were then used as control points for the REM and compass observations. All intermediate points on these sections were hand chained.

6.4 GPS Processing and Quality Control

When using RT20 and REM, all data is recorded internally in GRiD palmtop data loggers and downloaded to the office computer each evening.

The quality of the satellite data is monitored by examining the various on-screen quality control statistics produced by the software.

These checks on data integrity are in the form of standard deviation (or sigma) values for Easting, Northing and Height and for three dimensional recording are generally better than 0.2 metres.

Any recording of positions when the standard deviation values are in excess of 0.3m was highlighted to the surveyor at the time of recording, and the GPS could be re-initialised until a more accurate solution is calculated.

For two dimensional readings (horizontal only) the standard deviation on the height is ignored and the values on east and north are as low as practical after receiving a few full radio correction signals.

Checks on pre-recorded marks were observed during each days survey. These observations confirm the integrity of the GPS base receiver and the placed markers.

Static observations were post-processed using Grafnet software. Data was processed using a combination of “float” and “quick static” solutions. Satellite configuration and data quality was monitored during the field observations and processing. This software can output MGA94 coordinates and AHD elevations.

In office processing the coordinates were checked by determining point to point direction and distance.

Profile plots were examined to identify any height anomalies.

Any positions at variance with the line requirements were flagged for further investigation and re-recorded if necessary.

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DATA PRESENTATION

All line files were checked and finalised before the survey crew demobilised from the prospect.

All final data was in UTM grid coordinate format on the MGA projection (Zone 54) on the GDA94 reference spheroid. All elevations were on the Australian Height Datum (AHD71).

Files produced were:

XXX.uka	Line data in UKOOA format.
XXX.int	Line data as initially output by DSS software
intersec.crd	Line intersection coordinates
upholes.crd	Uphole coordinates
ties.crd	Ties coordinates

All files are backed up on digital disks in the Yeppoon office for future reference.

A full set of line trace diagrams were produced and passed to Trace Energy Services before survey demobilisation.

No hard copy data was provided.

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SAFETY

DSS personnel are aware of safety conditions concerning all exploration seismic surveys. The DSS “Quality Policy Statement” and “Health, Safety and Environment Policy” were adhered to at all times.

With close daily contact between DSS personnel and with the Trace Energy crew toolbox any topics of safety awareness and concern were discussed regularly.

Each vehicle was fitted with a UHF radio, shovel, fire extinguisher, first-aid kit, vehicle recovery equipment, emergency response plan and weekly vehicle maintenance check lists.

Any safety hazards that were noticed or encountered were raised at each mornings survey toolbox meeting.

On this project the only hazard that was a concern was the vehicle traffic on the main roads. There was a high daily volume of large trucks and great care was necessary when survey of the line crossed or ran along the road.

Most of the lines along the roads were able to be offset away from the carriageway in a corridor against the tree line. Some sections of road did not have a sufficiently large shoulder and speed restriction and “work in progress” signs had to be erected for survey to continue safely. All safety procedures were followed with rotating orange beacons, bright safety vests worn and road signage displayed.

No incidents were reported and no lost-time injuries occurred on the project.

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CHRONOLOGICAL SUMMARY

DATE	OPERATIONS
22nd April	Ron Weekes mobilised from Sydney to Melbourne. Picked up rental vehicle and drove to Nelson.
23rd April	Ron Weekes meet with Andy Brett, Ray Willox and Roger Blake. Discuss job, look over plans. Drive several areas of interest/concern.
24th April	Office work on total line lengths. Prepare line files. Reconnoitre lines north of river.
25th April	Meet Head Ranger of Lower Glenelg National Park - discuss proposed work. Locate existing survey control to be used for estalishing new control points.
26th April	Collect survey pegs from supply in Penola. Commence static GPS control survey. Establish four new control points east of Nelson.
27th April	Complete control survey loop. Commenced chain and survey of line 46 (later 146) in Kentbruck area. Line 146 0.125km
28th April	Chain 2 kilometres of line but REM required because of vegetation cover preventing 3D real-time survey. Rob Heyer arrived from Yeppoon with survey equipment.

DATE	OPERATIONS
29th April	Mike Borthwick and Tony Morcom mobilised from Yeppoon. Line 146 and 167 surveyed to limits of private property boundaries. No access beyond due to locked gates and stock restrictions. Lines 146 and 167. 11.775km
30th April	Chain and survey of first lines in main area started. Possible underground pipeline checked with Ray Willox and cleared. Brief showers during day. Lines 110 and 122. 15.300km
1st May	Two chaining crews working. Approx 12.5km of line chained but requiring REM survey for elevation. Lines 108 and 137. 4.925km.
2nd May	Mark Lefebvre mobilised to site from Melbourne. Ron Weekes scouted lines north of the river checking for slashing or clearing requirements. Tony Morcom had a full day of REM survey. Chainman Greg Birrell commenced work. Lines 108, 123, 137 and 139. 18.825km
3rd May	Two chaining crews operating all day. One REM surveyor all day. Lines 116, 129, 131 and 133. 10.900km
4th May	Two chaining crews and one REM all day. All crews working on north side of river. Lines 116, 129, 131, 135 and 139 12.675km
5th May	Two chaining crews and one REM all day. Lines 120, 122 and 139 - north side of river. 14.325km.
6th May	Two chaining crews and one REM all day. Chaining crews finish day back on south side of river. Lines 108, 118, 120 and 139. 17.100km

DATE	OPERATIONS
7st May	One chaining crew, one GPS surveyor and one REM surveyor. Rob Heyer demobilised from site.in morning. Survey of three new lines in Kentbruck completed and the full extent of lines 146 and 167 completed. Lines 112, 146, 148, 167 and 171. 19.125km
8th May	One chaining crew and two crews doing a combination of GPS and REM surveys. Some problems with satellite signals in the afternoon but DSS gear all checks ok. Lines 108, 112, 114, 129 and 169. 17.050km
9th May	One chaining crew all day and one for half a day. Two GPS surveyors installing and recording new control late in the afternoon. Lines 106, 110, 114 and 125. 14.650km
10th May	One chaining crew all day and one for half a day. Work commenced on long hand cleared section of line 135. One surveyor scouted a river crossing for hand clearing. Trace crew all on site this morning. Lines 110 and 123. 11.650km
11th May	One chaining crew all day and one for half a day. One REM surveyor for half a day. Mike Borthwick out on break at 14:00. Lines 106, 113 and 135. 6.575km
12th May	One chaining crew all day. One REM surveyor all day on hand cleared line using a backpack. Lines 133 and 135. 4.025km
13th May	One chaining crew all day. Chainman returned to town at 10:00 due to illness. Denis Williams DSS Survey Manager here for training of field crews and internal audit. Does chainmans job for the rest of the day. One REM surveyor (backpack) for 3 hours on line 129 then GPS surveyor for rest of the day. Lines 111, 113, 115, 129 and 139. 12.250km

DATE	OPERATIONS
14th May	One chaining crew for 3 hours then GPS surveyor for remainder of day. Denis Williams helps out as chainman in the morning. One GPS surveyor all day. 14:30 Ray Willox informed surveyors of threat to pegs on lines 129, 131 and 137 by pine harvesting operations. Pegs moved to opposite side of track 15:00 - 16:00. Lines 101, 102, 110 and 115. 15.500km
15th May	Two survey crews doing mix of GPS and chaining all day. Denis Williams chainman for the morning. He then demobilised from site at 15:00. Ron Weekes out to Kentbruck to mark three uphole locations before crew depeg the lines. New chainman commenced work at 7:00. Lines 107, 108, 111 and 113. 4.925km
16th May	Two GPS surveyors for half a day. One REM surveyor half a day, one chaining crew half a day. Chainman left field at 13:00 for medical reasons. Ron Weekes attended Cross Cultural Seminar in Portland for Aboriginal Heritage clearance on site. Lines 101, 103, 108 and 115. 9.925km
17th May	One GPS surveyor all day One REM surveyor all day. Lies 101, 109, 111, 113 and 121. 13.15km
18th May	Two GPS surveyors all day. Rain showers during afternoon. Lines 101 and 105. 8.225km
19th May	Two GPS surveyors all day. Rain showers during the day. Ron Weekes inspected and marked location of heritage site on line 104. Extent is stations 529 to 548 - a total of 475m. Ron Weekes marked ten proposed uphole locations ready for drillers tomorrow. Lines 102, 109 and 117. 16.325km

DATE	OPERATIONS
20th May	One GPS surveyor all day. The other surveyor did REM for 3.5 hours and GPS for 7 hours. Showers during the day. Chained line awaiting REM building up because of windy weather. Lines 109 and 119. 1.850km
21st May	Two GPS surveyors all day. One working with backpack on short line sections. No REM today due to windy weather. Ron Weekes marked eight proposed uphole locations. Line 121. 2.050km
22nd May	Two surveyors doing REM all day. Lines 102, 104, 105, 109 and 129. 24.475km
23rd May	One chaining crew all day with new chainman. One REM surveyor for half a day. Tony Morcom left site at 13:00 for weekend break. Lines 108 and 109. 5.625km
24th May	Priority switch to last three lines north of the river. Chaining crew all day. REM surveyor for half a day. Lines 129 and 135. 4.900km.
25th May	One chaining crew all day. Work commenced on hand cut line 213. One REM surveyor for half a day. Lines 121 and 127. 4.525km.
26th May	One chaining crew all day on hand cut line 213. One GPS surveyor for half a day and one REM surveyor for half a day. Tony Morcom back at work 7:00 Lines 102 and 105. 3.250km.
27th May	REM surveyor for most of day completing line 213. One chaining crew all day completing various lines. One km section chained and surveyed past Henke #1. All field survey of lines completed. Lines 102, 105, 139, 201 and 213. 4.575km

DATE	OPERATIONS
28th May	Tony Morcom demobilised from site at 10:00 in DSS Hilux. Mark Lefebvre in office drawing up outstanding chaining diagrams. Ron Weekes in office finalising data and commencing report.
29th May	Mark Lefebvre resurveyed stations 112 to 129 on line 110 on request for relocation by Sam Coniglio. Mark demobilised at 15:30. Ron Weekes continued work on the final report.
30th May	Ron Weekes completed the draft of the final report.
31st May	Ron Weekes demobilised from site in the morning.
June	Final Operations Report completed.

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OPERATIONAL ASPECTS

Approximately one third of the total area was open and allowed full three dimensional GPS survey to be done (RT20). The rest of the area was either native forest in National Park or pine forest plantation of varying ages and heights.

The areas of young pines were normally good for GPS but often the lines had tall pines bordering one side and this often restricted the satellite signal. The majority of the job was surveyed using a combination of GPS and chaining with elevations by REM.

The weather was very favourable for surveying considering the season and only minor disruption occurred to work because of rain. Wind delayed the use of the REM several times as the barometric system works well in stable atmospheric conditions. The presence of slow moving high pressure systems was very favourable for accurate REM work.

The accommodation and office arrangement for the DSS team was excellent with plenty of weather proof space for vehicles, equipment and consumables. The fact that the survey office was 2.5km out of town was not an inconvenience for anyone as communication between survey, the crew, and the client representative was very easy and regular.

Ray Willox and his team provided good line clearing and permitting services and no problems of significance occurred.

The survey of lines progressed very well in part due to DSS providing extra personnel at the start to allow the build up of a good lead on the crew. DSS always had sufficient vehicles and equipment for the task and the support from the Yeppoon office ensured the work progressed smoothly. There was only one instance of the seismic crew being close to needing a line before the pegs were in the ground and as usual this was due to a late forced change of plan. No delays were caused to any part of the project.

All services for the job were available at Mt. Gambier, 35km away.

The job was centred around Nelson and so travel times were quite minimal for a project of this size. The main issue for travel was the only two crossings of the Glenelg River being at Nelson and Dartmoor.

From an operational perspective the only major issue of concern for survey crews was the high volume of fast truck traffic on the main roads and occasionally in the pine plantations. Some waste pine log burning off was in progress in the northern part of the job but this caused little interference to survey.

Cultural heritage was an issue on one section of one line and this had already been inspected by Essential Petroleum and local indigenous representatives. The marking of this section, line 104 stn 529 - 548, was accomplished very quickly with no disruption to survey.

All upholes were marked and some changed by Ron Weekes and so no production time was lost by the regular field crews.

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CONCLUSIONS AND RECOMMENDATIONS

For DSS, this project has gone extremely well and this has been due to a combination of good effort and good fortune. Good effort by all participants in the project, not just DSS, has meant a good rapport between all working groups which avoided problems being major issues.

As stated earlier, Ray Willox and his team provided good line clearing and permitting services and no problems of significance occurred. The hand clearing of lines through the national park and access to river crossings were well done within the restrictions allowable. Regeneration of the vegetation should be swift and little evidence of seismic passing through will be left behind.

For survey, the only problem was the open paddocks where the slasher passing left no path to follow because of the very short grass. This then caused lost time with the surveyor having to scout ahead to find the correct line before restarting chaining and survey. Some means to prevent this should be discussed before future projects.

The very favourable weather for this season was a bonus to all field crews and a good team effort meant a good result. The combination of survey techniques employed by DSS allowed good production rates. Better than expected GPS coverage in the native forests was a definite plus.

The reasons for the better than normal coverage are unclear but is suspected that the dry weather has reduced the moisture content of the tree foliage and alled a better signal penetration. The tall pines were still a problem with high signal loss unlike the native forest.

Survey control was found in a local zero order horizontal and third order vertical station. PM42 near the main beach was perfectly placed to be used as a base station and to provide the datum point of the survey. The project was observed in the GDA/MGA and AHD datums.

There were no safety incidents on the project.

Ron Weekes

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APPENDICES

Control Survey and Ties

Coordinates are MGA94 Zone 54, CM 141°
Elevations are AHD, using the AusGeoid98 N Value Model

SURVEY DATUM:

Station	Easting (MGA)	Northing (MGA)	Height (AHD)	Comments
PM 42 C520-8	501689.441	5787396.971	28.731	0 hor / 3rd vert

BASE STATIONS:

Station	Easting (MGA)	Northing(MGA)	Height (AHD)	Comments
DON1	497064.864	5791747.490	32.175	Border road
NORTH	501157.183	5793539.052	33.756	North Nelson Rd
PARK1	511327.661	5788985.563	70.062	Off line 108
PARK2	528059.001	5779153.209	143.746	Off line 146
PINE1	507515.065	5787879.985	57.071	Johnsons Rd
PINE2	516472.026	5786569.607	38.881	Airstrip Rd
PINE3	500933.843	5796501.176	51.118	Behind deer farm

TIES:

Station	Easting (MGA)	Northing(MGA)	Height (AHD)	Comments
PM 50	500998.081	5788691.600	15.069	SMES
C520-3	500998.132	5788691.584	15.061	03021
	0.051	-0.016	-0.008	Misclose

Ties continued

Station	Easting (MGA)	Northing(MGA)	Height (AHD)	Comments
97-12	518104.21	5782537.93	60.66	DSS 1997
BAS8	518104.05	5782537.71	60.54	03021
	-0.16	-0.22	-0.12	Misclose

Station	Easting (MGA)	Northing(MGA)	Height (AHD)	Comments
01-38	497015.32	5789942.39	12.20	DSS 2001
PM718	497015.96	5789943.20	12.27	03021 RT20
	0.64	0.81	0.07	Misclose

Station	Easting (MGA)	Northing(MGA)	Height (AHD)	Comments
PM 39	500767.574	5790269.736	9.464	SMES
C519-15	500767.44	5790269.42	9.14	03021 RT20
	-0.134	-0.316	-0.324	Misclose

Control Network Diagram

Final Line Summary

Final Line Summary

Line	BOL	EOL	No. of Stns	Line length (km)	No. of Stns programmed 02/05/03	Non-existent Stns and reason
101	101101	101650	549	13.725	465	275-279 line return
102	102085	102986	901	22.525	876	091-096 river
103	103086	103190	104	2.6	115	
104	104094	104863	769	19.225	763	
105	105081	105450	369	9.225	275	205-209 river
106	106130	106345	215	5.375	222	
107	107096	107168	72	1.8	81	
108	108115	108994	879	21.975	818	
109	109107	109341	234	5.85	227	291-295 river
110	110112	110948	836	20.9	771	259-263 bridge
111	111113	111389	276	6.9	275	
112	112099	112394	295	7.375	294	
113	113060	113377	317	7.925	281	No stn # gap for line return
114	114101	114321	220	5.5	221	
115	115101	115296	195	4.875	150	
116	116101	116405	304	7.6	305	
117	117101	117259	158	3.95	103	
118	118111	118217	106	2.65	117	
119	119103	119148	45	1.125	48	
120	120101	120300	199	4.975	180	
121	121101	121346	245	6.125	229	265-268 river
122	122105	122416	311	7.775	316	No stn # gap for river
123	123145	123927	782	19.55	716	
124	124113	124488	375	9.375	388	
125	125101	125298	197	4.925	153	
127	127101	127167	66	1.65	65	
129	129085	129427	342	8.55	328	331-335 river
131	131101	131365	264	6.6	291	
133	133058	133215	157	3.925	151	
135	135101	135538	437	10.925	369	440-444 river
137	137084	137321	237	5.925	221	
139	139068	139699	631	15.775	597	371-381 line return, 647-654 river
146	146101	146476	375	9.375		

Line	BOL	EOL	No. of Stns	Line length (km)	No. of Stns programmed 02/05/03	Non-existent Stns and reason
167	167089	167284	195	4.875		
201	201117	201130	13	0.325		
213	213101	213260	159	3.975		
						Total dead stns = 59
		Total	**12302**	**311.85**		

Kentbruck Section **Final Station Total = 12243**

Stns	**Kms**
1215	30.375

Upholes Listing

Upholes Listing

Coordinates are MGA94 Zone 54, CM 141°
Elevations are AHD, using the AusGeoid98 N Value Model

Number	Line/Station	Easting	Northing	Height	Comments
UH01	146433	530612.2	5777173.6	156.90	
UH02	167125	525897.1	5776057.8	127.64	
UH03	146137	525248.8	5780451.5	51.31	
UH04	124442	521038.2	5786009.0	30.80	
UH05	124246	516431.9	5786734.0	33.33	EOL 110
UH06	124130	513884.2	5788100.3	31.11	EOL 137
UH07	123300	513844.0	5783997.7	39.32	EOL 116
UH08	135190	511104.1	5785157.8	36.91	X LINE 116
UH09	125146	506972.7	5786203.5	14.45	X LINE 123
UH10	108651	507362.3	5789952.0	49.86	X LINE 125
UH11	113172	503693.5	5787751.3	24.00	X LINE 115
UH12	113344	502357.7	5790061.2	28.85	
UH13	103109	498265.6	5788976.4	5.05	X LINE 101
UH14	101401	497041.2	5791452.5	15.33	
UH15	102311	499534.7	5796203.1	23.05	X LINE 105
UH16	105362	499571.0	5798523.2	34.56	
UH17	117215	504239.0	5796686.8	25.76	Fahley #2
UH18	121346	506813.8	5795315.8	20.76	X LINE 102
UH19	102781	510195.0	5793391.8	25.85	X LINE 129
UH20	139448+12	515369.6	5793814.0	31.50	
UH21	139336	516800.1	5793704.4	34.85	Henke #1
UH22	109340	501435.4	5795776.4	21.40	X LINE 102
UH23	102870	512348.2	5792853.6	24.70	

Line Intersection Listing

Line Intersection Listing

Coordinates are MGA94 Zone 54, CM 141°
Elevations are AHD, using the AusGeoid98 N Value Model

Not all line intersections were clear as many lines started/ended at a line rather than crossing it.

Line/Station		X Line/Station		Easting	Northing	Height
146	/146433+07	171	/171167+24	530618.13	5777170.90	156.92
146	/146196+08	169	/169290+17	526631.12	5780527.26	108.06
148	/148231+22	167	/167139+20	526018.78	5776382.11	127.17
110	/110853+03	123	/123219+09	514270.95	5785931.33	38.72
110	/110789+08	137	/137241+10	512775.23	5786455.51	29.42
123	/123443+11	137	/137086+18	512128.75	5782655.33	17.28
131	/131153+25	116	/116153+05	509184.80	5785922.83	13.80
116	/116213+06	133	/133152+06	510120.19	5785475.25	27.24
116	/116271+05	135	/135178+18	511062.67	5784879.11	28.58
116	/116327+21	137	/137167+17	512441.57	5784650.39	39.62
125	/125145+18	123	/123728+21	506971.79	5786196.03	14.39
108	/108650+19	125	/125297+15	507356.28	5789952.80	49.48
110	/110729+10	135	/135264+03	511388.60	5786985.10	44.52
110	/110593+21	129	/129170+07	508280.02	5787730.25	49.49
110	/110545+09	125	/125217+09	507115.73	5787961.51	38.17
123	/123683+18	129	/129086+12	507953.87	5785667.26	6.89
108	/108816+02	131	/131288+25	510110.70	5788731.91	47.10
110	/110853+03	123	/123219+09	514270.95	5785931.33	38.72
108	/108916+20	135	/135366+14	512308.13	5789037.37	30.64
114	/114280+22	135	/135398+05	512352.07	5789781.01	28.22
108	/108698+18	129	/129252+24	508537.57	5789778.93	29.31
113	/113171+14	115	/115147+04	503704.86	5787751.22	24.85
110	/110339+09	113	/113291+08	502211.16	5788754.98	6.40
110	/110406+06	115	/115188+17	503848.04	5788593.27	29.02
110	/110303+18	111	/111292+12	501359.30	5788581.84	4.57
108	/108431+03	113	/113350+14	502363.29	5790223.67	18.76
102	/102293+06	105	/105252+03	499095.31	5796262.46	26.63
102	/102391+06	109	/109340+06	501432.98	5795782.36	21.16
108	/108364+18	109	/109107+20	500749.93	5790254.65	8.73
107	/107132+14	110	/110212+10	499346.50	5789419.19	21.60
101	/101159+01	107	/107101+10	499558.79	5788750.22	2.80
101	/101213+17	103	/103109+05	498266.39	5788980.97	5.34
101	/101338+16	110	/110114+09	497066.33	5789906.65	11.95
101	/101648+14	102	/102177+03	497102.90	5796333.80	22.89
102	/102619+08	121	/121345+13	506810.70	5795304.73	21.18
103	/103145+21	110	/110167+09	498365.44	5789885.57	18.92

Line Trace Diagrams

Photographs

Cultural Heritage Line Checking - Line 104
Lower Glenelg National Park

On Line 105 - Glenelg River

Line 201 - Section of hand carry

PM 42 - Primary Station