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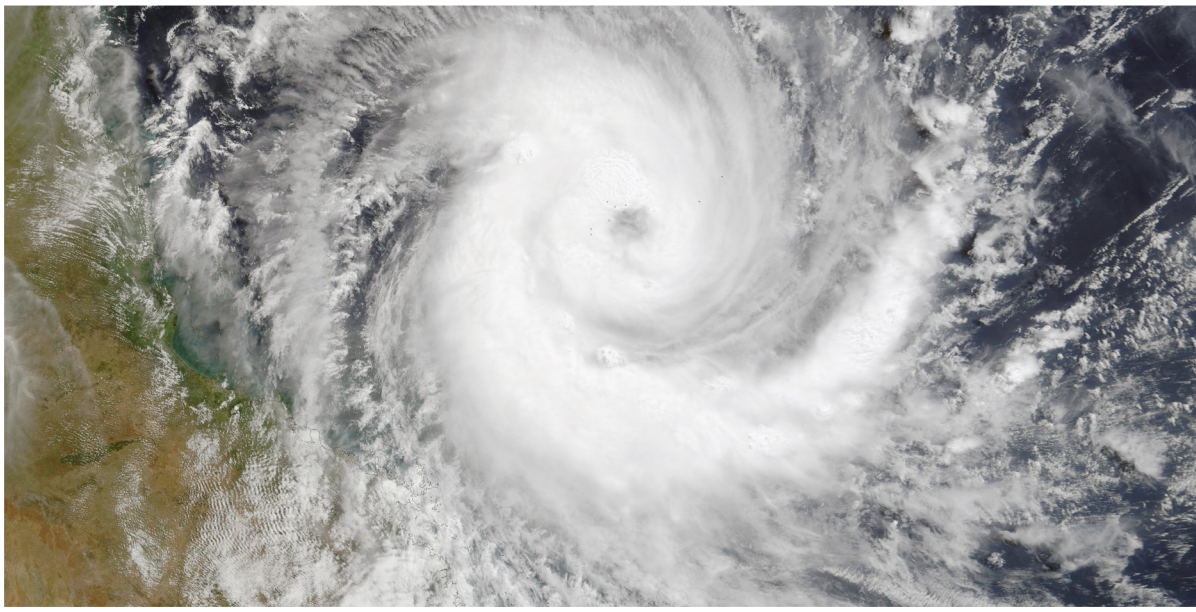

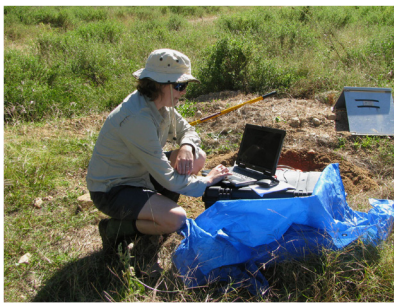

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Determination of GDA94 coordinates for eighty-four stations of GPSnet in Victoria using the October 2012 GPS data set

G. Hu, J. Dawson

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Expiry of this Report

5 years after authorisation date.

Abbreviations

AFN	Australian Fiducial Network
ARGN	Australian Regional GNSS Network
CORS	Continuously Operating Reference Station(s)
GDA94	Geocentric Datum Australia 1994
GNSS	Global Navigation Satellite System(s)
GPS	Global Positioning System
GRS80	Geodetic Reference System 1980
IGS	International GNSS Service
ITRF	International Terrestrial Reference Frame
ITRF92	International Terrestrial Reference Frame 1992
ITRF2008	International Terrestrial Reference Frame 2008

Introduction

An application dated 11 February 2013 for verification of a reference standard of measurement under Regulation 12 of the National Measurement Regulations 1999 was received from Department of Environment and Primary Industries, for verification of GDA94 position on their owned or managed station monument. This report documents the processing and analysis of GPS data observed by the Department of Environment and Primary Industries during a 7-day period for eighty-four stations to satisfy the position verification requirements.

Measurand

Station position, at the time of measurement and stated instrumentation, of a GPS monument with respect to the Geocentric Datum of Australia (GDA94) referred to the GRS80 ellipsoid being in the ITRF92 reference frame at the epoch 1994.0.

Measurand Traceability

Measurement traceability was ensured by comparing the computed solution against the recognised value standard for position of the Australian Fiducial Network stations. Additionally, the computed solution was checked against the ITRF based solutions computed by the IGS and the individual global analysis centres of the IGS. The validity and traceability of the entire GPS system was ensured via its link to the global Satellite Laser Ranging (SLR) and Very Long Baseline Interferometry (VLBI) observing networks through the ITRF. The validity and traceability of our internal computation processes were ensured by undertaking standard benchmark analysis prior to this analysis.

Measurand Uncertainty

Position uncertainties were calculated in accordance with the principles of the ISO Guide to the Expression of Uncertainty in Measurement (1995), with an interval estimated to have a confidence level of 95% at the time of verification. The combined standard uncertainty was converted to an expanded uncertainty using a coverage factor, *k*, of 2.

Type A uncertainty sources were evaluated by adopting an *a priori* sigma of **0.001** metre for the precision (1 sigma) of the L1-frequency, one-way, phase observation, at zenith. The corresponding uncertainties of all parameters were determined, by standard error propagation theory, in the least-squares estimation process used in the GPS analysis. Since the formal (internal) precision estimates of GPS solutions are well known to be optimistic, a factor of **10** (i.e. variance scale factor of 100) was subsequently applied to the variance-covariance matrix of the computed GDA94 coordinates.

Type B uncertainty sources, which in practice contribute to position uncertainty, cannot be estimated from the statistical analysis of short-period (i.e. 7-day) observations; these include environmental effects, such as long-period station loading (deformation) processes. Table 1 shows the major type B uncertainty sources for GPS analysis.

Table 1 Type B uncertainty sources (95% C.L.) for position, determined from GPS, and the total uncertainty, assuming the normal distribution of the uncertainty sources, high degrees of freedom and a coverage factor, k, of 2.

Uncertainty Source	Position Uncertainty Horizontal (mm)	Position Uncertainty Vertical (mm)
Antenna phase centre	3	10
Monument stability	1	1
Other sources including un-modelled crustal loading, satellite orbit variations, atmosphere, tectonics, signal multi-path	6	10

GPS Data

GPS RINEX data was supplied for spanning a 7-day period from 07 October 2012 to 13 October 2012 (day of year 281 to 287) for the eighty-four stations of GPSnet in Victoria. Figure 1 shows the locations of the stations. The AFN/ARGN/IGS network sites used in the GPS data processing are also plotted in Figure 1. Table 2 lists the GPS receiver and antenna type used in the GPS data processing for each of the AFN/ARGN/IGS network sites. The GPS receiver and antenna types at the GPSnet sites in Victoria are listed in Table 3. An antenna height of 0.000 m to the Antenna Reference Point (ARP) has been adopted for the stations of GPSnet in Victoria for the GPS data processing. The ARP is the reference point as defined by IGS and the RINEX specifications. Table 4 lists the GPS antenna heights to the Antenna Reference Point (ARP) used in the GPS data processing for the AFN/ARGN/IGS stations.

GPS Data Irregularities

The updated data set and meta data on 11 December 2013 have been adopted for the GPS data processing. Note that data of the site ALBU was invalid since the antenna was changed after submitting the data.

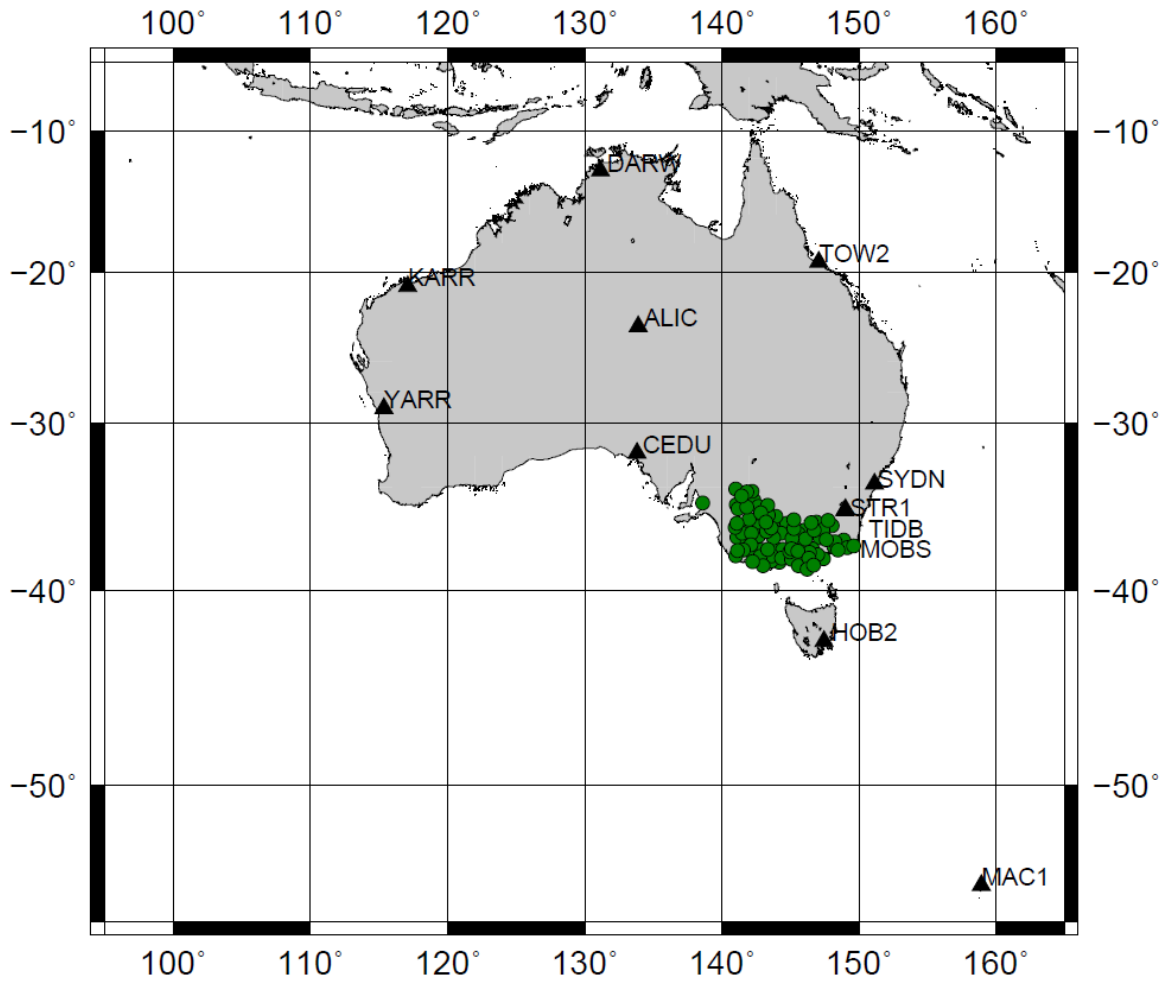

Figure 1 Stations of GPSnet in Victoria (circle) and AFN/ARGN/IGS (black triangles) stations used in GPS data processing.

Table 2 GPS receiver and antenna types for the AFN/ARGN/IGS sites.

Station	GPS receiver type	GPS antenna serial number	IGS antenna type and dome type
ALIC	LEICA GRX1200GGPRO	09370001	LEIAR25.R3 NONE
CEDU	TRIMBLE NETR8	194	AOAD/M_T AUST
DARW	GRX1200GGPRO	CR13354	ASH700936D_M NONE
HOB2	LEICA GRX1200GGPRO	203	AOAD/M_T NONE
KARR	TRIMBLE NETR8	4938353444	TRM59800.00 NONE
MAC1	LEICA GRX1200+GNSS	308	AOAD/M_T AUST
MOBS	LEICA GRX1200GGPRO	CR20020709	ASH701945C_M NONE
STR1	LEICA GRX1200GGPRO	CR620023911	ASH701945C_M NONE
SYDN	JPS E_GGD	CR519994908	ASH701945C_M NONE
TIDB	ASHTECH UZ-12	205	AOAD/M_T JPLA
TOW2	LEICA GRX1200GGPRO	09310016	LEIAR25.R3 NONE
YARR	LEICA GRX1200PRO	103314	LEIAT504 NONE

Table 3 GPS receiver and antenna types for the stations of GPSnet in Victoria.

Station	GPS receiver type	GPS antenna serial number	IGS antenna type and dome type
ADEL	Trimble NetR5	30518790	TRM55971.00 NONE
ANGL	Trimble NetR5	11909802	TRM41249.00 NONE
ANTW	Trimble NetR5	1440932115	TRM57971.00 NONE
APSL	Trimble NetR5	1440929138	TRM57971.00 NONE
BALL	Trimble NetR9	1441107493	TRM57971.00 NONE
BALM	Trimble NetR5	1441004065	TRM57971.00 NONE
BCUS	Leica GRX1200GG Pro	08090150	LEIAX1202GG NONE
BEUA	Trimble NetR5	1441004198	TRM57971.00 NONE
BIGG	Trimble NetR5	1441004019	TRM57971.00 NONE
BIRC	Trimble NetR5	1440932191	TRM57971.00 NONE
BNDC	Trimble NetR5	1440929178	TRM57971.00 NONE
BNLA	Trimble NetR9	1441112323	TRM57971.00 NONE
BOLC	Leica GRX1200+GNSS	10321034	LEIAS10 NONE
BOOL	Trimble NetR5	1440932111	TRM57971.00 NONE
BORT	Trimble NetR5	1441009481	TRM57971.00 NONE
BUCH	Trimble NetR5	1440932029	TRM57971.00 NONE
BUXT	Trimble NetR5	1440932171	TRM57971.00 NONE
CANR	Trimble NetR5	1440921023	TRM57971.00 NONE
CLAC	Trimble NetR3	30767584	TRM57971.00 NONE
CLBN	Trimble NetR5	1440932055	TRM57971.00 NONE
CRSY	Leica GRX1200+GNSS	10321003	LEIAS10 NONE
EBNK	Trimble NetR5	31050722	TRM57971.00 NONE
ECHU	Trimble NetR5	30882659	TRM57971.00 NONE
EPSM	Trimble NetR5	31050429	TRM57971.00 NONE
EURO	Trimble NetR5	1440932134	TRM57971.00 NONE
GEES	Trimble NetR5	30767586	TRM57971.00 NONE
GELA	Trimble NetR5	1440932044	TRM57971.00 NONE
GLDN	Trimble NetR5	1440929147	TRM57971.00 NONE
GLEN	Trimble NetR5	1440929158	TRM57971.00 NONE
GNOA	Trimble NetR5	1441004040	TRM57971.00 NONE
GORO	Trimble NetR5	1440929099	TRM57971.00 NONE
HATT	Trimble NetR5	1440921294	TRM57971.00 NONE
HMLT	Trimble NetR5	1440932157	TRM57971.00 NONE
HOTH	Trimble NetR5	1441009222	TRM57971.00 NONE
HRSM	Trimble NetR5	31050729	TRM57971.00 NONE
IRYM	Trimble NetR5	30473532	TRM55971.00 NONE
KRNG	Trimble NetR9	1441112008	TRM57971.00 NONE

Station	GPS receiver type	GPS antenna serial number	IGS antenna type and dome type
LALB	Trimble NetR5	1440925066	TRM57971.00 NONE
LCLA	Trimble NetR5	1440929125	TRM57971.00 NONE
LIPO	Trimble NetR5	1440932034	TRM57971.00 NONE
MAFF	Trimble NetR5	1440932308	TRM57971.00 NONE
MANY	Trimble NetR5	144092930	TRM57971.00 NONE
MARY	Trimble netR5	1441004127	TRM57971.00 NONE
MENO	Trimble NetR5	1440929027	TRM57971.00 NONE
MIMI	Trimble NetR5	1441004561	TRM57971.00 NONE
MITT	Trimble NetR5	1440932067	TRM57971.00 NONE
MLAK	Trimble NetR5	1440931111	TRM57971.00 NONE
MNSF	Trimble NetR5	1440929203	TRM57971.00 NONE
MOOR	Trimble NetR5	1441009157	TRM57971.00 NONE
MRNO	Trimble NetR5	1440925245	TRM57971.00 NONE
MRNT	Trimble NetR9	1441107709	TRM57971.00 NONE
MURR	Trimble NetR5	1440921049	TRM57971.00 NONE
MYRT	Trimble NetR5	1441004145	TRM57971.00 NONE
NELN	Trimble NetR5	1440932073	TRM57971.00 NONE
OMEO	Trimble NetR5	1441004037	TRM57971.00 NONE
ORBO	Trimble NetR5	1440929187	TRM57971.00 NONE
PIAN	Trimble NetR5	1440932243	TRM57971.00 NONE
PKVL	Leica GRX1200GG Pro	6400046	LEIAX1202GG NONE
POCA	Trimble NetR5	1441004593	TRM57971.00 NONE
PRTF	Trimble NetR5	1441004411	TRM57971.00 NONE
RNBW	Trimble NetR5	1440932241	TRM57971.00 NONE
RUTH	Trimble NetR5	1440929104	TRM57971.00 NONE
SEAL	Trimble NetR5	1440932026	TRM57971.00 NONE
SEMR	Trimble NetR5	31171731	TRM57971.00 NONE
SKIP	Trimble NetR5	1441004137	TRM57971.00 NONE
SRVC	Trimble NetR5	1440921084	TRM57971.00 NONE
STAR	Leica GRX1200+GNSS	10321032	LEIAS10 NONE
STRH	Trimble NetR5	1441004206	TRM57971.00 NONE
TATU	Trimble NetR5	30874021	TRM57971.00 NONE
TELO	Trimble NetR5	1440932188	TRM57971.00 NONE
THOM	Trimble NetR5	30767549	TRM57971.00 NONE
UNDE	Trimble NetR5	1440929069	TRM57971.00 NONE
WALW	Trimble NetR5	1440929149	TRM57971.00 NONE
WEDD	Trimble NetR5	1441004384	TRM57971.00 NONE
WHTL	Trimble NetR5	30966067	TRM57971.00 NONE

Station	GPS receiver type	GPS antenna serial number	IGS antenna type and dome type
WORI	Trimble NetR9	1441107808	TRM57971.00 NONE
WOTG	Trimble NetR5	31051061	TRM57971.00 NONE
WYCH	Trimble NetR5	1440932252	TRM57971.00 NONE
YALL	Trimble NetR5	30132034	TRM55971.00 NONE
YANK	Leica GRX1200GG Pro	7120090	LEIAX1202GG NONE
YARS	Trimble NetR5	1440929122	TRM57971.00 NONE
YIEL	Trimble NetR5	1440929077	TRM57971.00 NONE
YRRM	Trimble NetR5	1440929089	TRM57971.00 NONE

Table 4 GPS antenna heights to ARP used in GPS processing for the minimally constrained AFN/ARGN/IGS stations.

Station	Domes number	Antenna height to ARP (m)	Station	Domes number	Antenna height to ARP (m)
ALIC	50137M001	0.0015	MOBS	50182M001	0.0000
CEDU	50138M001	0.0060	STR1	50119M002	0.0040
DARW	50134M001	0.0025	SYDN	50124M003	0.0300
HOB2	50116M004	0.0000	TIDB	50103M108	0.0614
KARR	50139M001	0.0010	TOW2	50140M001	0.0033
MAC1	50135M001	0.0280	YARR	50107M006	0.0045

Method

Analysis was undertaken following the procedures detailed in Geoscience Australia's GPS Analysis Manual for the Verification of Position Issue 1.15.

In summary, daily solutions of the stations of GPSnet in Victoria and AFN/ARGN/IGS/other site data were processed using Bernese GPS Processing Software version 5.0. The Bernese GPS Software conforms to the IERS2003 conventions. IGS final GPS satellite ephemerides and earth orientation parameters were used in the computations. The double difference carrier phase observables at 30-second epoch intervals were used for GPS data processing. Other measurement modelling and parameter estimation included:

- Receiver clock corrections.
- Absolute antenna elevation-dependent phase centre variation corrections.
- Solid earth tide displacements.
- Ocean tide loading displacements.
- Elevation cutoff of 10° for all observations.
- QIF integer ambiguity resolution strategy.
- Elevation dependent observation weighting.
- Troposphere zenith delays estimated at 1-hour intervals for all stations.
- Minimum constraint condition for daily network solution in terms of the ITRF2008 using subset of the IGS08 reference stations.

This solution was transformed to GDA94 using the transformation approach detailed in: ITRF to GDA94 coordinate transformation, John Dawson and Alex Woods, *Journal of Applied Geodesy* 4 (2010), no. 4, pp. 189-199, available online at http://www.reference-global.com/loi/jag.

Results

Table 5 and Table 6 list the Root Mean Square (RMS) of the daily station coordinate values. Table 7 lists the station coordinates resulting from the combination of the daily ITRF solutions and their subsequent transformation to GDA94.

Table 5 Root Mean Square (RMS) of daily station coordinates for the minimally constrained AFN/ARGN/IGS.

Station	North (mm)	East (mm)	Up (mm)	Station	North (mm)	East (mm)	Up (mm)
ALIC	0.7	0.9	2.5	MOBS	0.9	0.7	2.9
CEDU	0.4	1.1	3.1	STR1	0.8	0.7	2.4
DARW	1.7	1.6	4.4	SYDN	0.5	1.3	4.5
HOB2	1.4	0.8	2.2	TIDB	0.8	1.2	2.4
KARR	0.6	1.1	2.8	TOW2	1.3	3.0	3.3
MAC1	1.3	1.7	5.4	YARR	0.8	1.4	1.9

Table 6 Root Mean Square (RMS) of daily station coordinates for the stations of GPSnet in Victoria.

Station	North (mm)	East (mm)	Up (mm)	Station	North (mm)	East (mm)	Up (mm)
ADEL	0.9	0.8	2.1	MARY	0.5	0.8	1.8
ANGL	0.9	0.6	4.9	MENO	2.3	0.9	2.3
ANTW	0.6	0.4	2.7	MIMI	1.3	2.2	5.8
APSL	2.7	2.9	5.6	MITT	0.4	0.6	2.8
BALL	0.7	0.6	2.3	MLAK	0.7	0.7	1.7
BALM	0.7	0.6	2.6	MNSF	0.7	0.6	3.9
BCUS	0.6	0.7	3.7	MOOR	0.6	0.6	1.8
BEUA	0.3	0.3	2.5	MRNO	1.6	1.3	1.9
BIGG	1.0	1.1	1.9	MRNT	0.8	0.8	3.7
BIRC	0.6	0.5	1.2	MURR	0.4	0.8	1.6
BNDC	0.8	0.8	3.3	MYRT	0.6	0.8	3.4
BNLA	0.5	1.0	3.9	NELN	0.5	0.8	2.7
BOLC	1.0	0.7	5.1	OMEO	1.2	0.9	3.3
BOOL	1.0	0.4	2.5	ORBO	0.7	0.8	2.5
BORT	1.1	1.0	3.4	PIAN	0.5	2.0	2.6
BUCH	1.1	0.8	3.7	PKVL	0.6	0.9	3.0
BUXT	1.1	0.9	4.6	POCA	1.0	0.7	2.8
CANR	0.4	0.7	3.0	PRTF	0.9	0.7	3.1

Station	North (mm)	East (mm)	Up (mm)	Station	North (mm)	East (mm)	Up (mm)
CLAC	0.6	0.5	2.6	RNBW	0.5	0.4	1.8
CLBN	0.4	0.7	2.1	RUTH	0.6	0.4	2.9
CRSY	1.0	1.0	3.8	SEAL	0.6	0.7	2.3
EBNK	0.8	0.9	3.2	SEMR	0.5	0.7	4.4
ECHU	0.9	0.6	3.1	SKIP	0.4	0.7	2.7
EPSM	1.1	0.7	2.7	SRVC	0.7	0.5	2.2
EURO	0.7	0.8	1.7	STAR	0.5	0.7	0.9
GEES	0.9	0.6	3.8	STRH	0.7	0.6	2.1
GELA	0.6	0.7	3.6	TATU	0.5	0.5	3.1
GLDN	0.6	1.0	3.1	TELO	0.4	0.6	1.7
GLEN	0.7	0.6	2.0	THOM	1.4	1.1	7.3
GNOA	0.8	1.2	3.9	UNDE	0.6	0.5	2.0
GORO	0.6	0.5	2.2	WALW	0.9	0.8	3.9
HATT	0.3	0.6	3.0	WEDD	0.6	0.6	2.2
HMLT	0.6	0.7	2.7	WHTL	1.0	0.7	3.3
HOTH	1.2	1.3	4.4	WORI	0.9	0.9	3.0
HRSM	1.0	0.5	2.9	WOTG	0.8	0.6	3.6
IRYM	0.5	0.4	1.9	WYCH	0.5	0.5	1.7
KRNG	0.5	0.3	2.8	YALL	1.2	1.0	4.1
LALB	0.3	0.4	1.7	YANK	0.6	0.7	3.1
LCLA	0.9	0.7	9.9	YARS	0.5	1.4	2.5
LIPO	0.4	0.5	2.3	YIEL	0.7	0.5	1.3
MAFF	1.2	0.7	4.1	YRRM	0.8	0.8	2.3
MANY	0.4	0.6	2.2				

Table 7 Computed Geocentric Datum of Australia (GDA94) geodetic coordinates and their uncertainty for the stations of GPSnet in Victoria. The uncertainties are calculated in accordance with the principles of the ISO Guide to the Expression of Uncertainty in Measurement (1995), with an interval estimated to have a confidence level of 95% at the time of verification. The combined standard uncertainty was converted to an expanded uncertainty using a coverage factor, k, of 2.

Station	Longitude (DMS east) Uncertainty (m)			Latitude (DMS south) Uncertainty (m)			Ellipsoidal height (m) Uncertainty (m)
ADEL	138	36	13.16945	34	55	52.38328	55.0844
			±0.008			±0.008	±0.020
ANGL	144	11	35.43956	38	23	46.77762	19.6401
			±0.008			±0.008	±0.020
ANTW	142	1	36.44658	36	17	43.49006	103.6394
			±0.008			±0.008	±0.021

Station	Longitude (DMS east)			Latitude (DMS south)			Ellipsoidal height (m)
	Uncertainty (m)			Uncertainty (m)			Uncertainty (m)
APSL	141	4	59.63343	36	58	3.26075	112.1993
			±0.008			±0.008	±0.021
BALL	143	51	17.69940	37	33	32.00110	463.2764
			±0.008			±0.008	±0.019
BALM	141	50	32.04109	37	14	55.65671	191.4208
			±0.008			±0.008	±0.021
BCUS	144	26	31.61397	37	40	36.49391	112.4911
			±0.008			±0.008	±0.020
BEUA	142	24	52.93604	35	56	24.04745	97.2693
			±0.008			±0.008	±0.021
BIGG	148	1	34.41441	36	16	50.73779	330.1672
			±0.008			±0.008	±0.020
BIRC	142	54	46.21161	35	59	7.62093	117.3899
			±0.008			±0.008	±0.021
BNDC	148	53	5.66055	37	8	50.97644	848.2105
			±0.008			±0.008	±0.020
BNLA	146	0	21.48938	36	32	37.89799	187.4521
			±0.008			±0.008	±0.020
BOLC	142	50	27.36935	37	42	41.64097	220.0917
			±0.008			±0.008	±0.020
BOOL	142	40	4.81891	36	20	24.67964	129.4854
			±0.008			±0.008	±0.021
BORT	143	43	21.25793	36	8	9.34478	113.9003
			±0.008			±0.008	±0.020
BUCH	148	10	4.04689	37	29	52.84584	184.4777
			±0.008			±0.008	±0.020
BUXT	145	42	44.16516	37	25	34.01526	300.6269
			±0.008			±0.008	±0.020
CANR	149	9	26.96702	37	33	53.52666	137.1798
			±0.008			±0.008	±0.020
CLAC	143	35	6.49625	38	20	32.55330	144.6686
			±0.008			±0.008	±0.019
CLBN	144	47	53.51928	36	35	30.69388	129.8312
			±0.008			±0.008	±0.020
CRSY	143	38	23.06955	38	1	41.50784	157.8815
			±0.008			±0.008	±0.020
EBNK	145	56	9.72899	38	14	36.66394	181.9500
			±0.008			±0.008	±0.020

Station	Longitude (DMS east) Uncertainty (m)			Latitude (DMS south) Uncertainty (m)			Ellipsoidal height (m) Uncertainty (m)
ECHU	144	45	12.89162	36	8	25.15456	112.1753
			±0.008			±0.008	±0.020
EPSM	144	18	52.56012	36	43	5.12667	206.9679
			±0.008			±0.008	±0.021
EURO	145	34	22.19257	36	45	11.41580	195.4428
			±0.008			±0.008	±0.020
GEES	144	21	42.24742	38	9	34.01064	29.4864
			±0.008			±0.008	±0.020
GELA	148	15	53.20691	37	13	6.95221	779.4738
			±0.008			±0.008	±0.020
GLDN	147	24	9.87586	38	12	31.94948	25.2768
			±0.008			±0.008	±0.020
GLEN	142	39	42.76508	36	54	32.29991	180.6824
			±0.008			±0.008	±0.021
GNOA	149	35	22.14037	37	28	36.85228	32.0430
			±0.008			±0.008	±0.021
GORO	141	28	21.95260	36	43	5.51731	170.7658
			±0.008			±0.008	±0.021
HATT	142	20	22.28051	34	45	20.53316	61.6548
			±0.008			±0.008	±0.021
HMLT	142	1	29.06849	37	44	42.73915	197.6385
			±0.008			±0.008	±0.021
HOTH	147	8	30.63382	36	58	55.47383	1774.0086
			±0.008			±0.008	±0.020
HRSM	142	10	29.50331	36	43	21.93764	144.3036
			±0.008			±0.008	±0.021
IRYM	142	11	28.35568	34	13	11.01469	72.2685
			±0.008			±0.008	±0.021
KRNG	143	55	20.28205	35	44	7.45755	90.5449
			±0.008			±0.008	±0.021
LALB	143	22	31.17145	35	40	24.48023	97.7915
LCLA	146	37	20.25947	37	37	41.57267	210.1032
			±0.008			±0.008	±0.021
LIPO	141	0	40.37412	34	6	19.40241	64.1339
			±0.008			±0.008	±0.021
MAFF	146	59	7.05199	37	58	19.88874	42.7458
			±0.008			±0.008	±0.020

Station	Longitude (DMS east) Uncertainty (m)			Latitude (DMS south) Uncertainty (m)			Ellipsoidal height (m) Uncertainty (m)
MANY	141	3	42.84088	35	2	55.13689	85.0741
			±0.008			±0.008	±0.021
MARY	143	45	35.35732	37	0	19.52805	219.5896
			±0.008			±0.008	±0.020
MENO	141	48	23.85393	34	16	20.49011	62.3628
			±0.008			±0.008	±0.021
MIMI	147	22	23.61652	36	31	56.00338	290.6877
			±0.008			±0.008	±0.020
MITT	142	39	27.56427	35	9	21.54247	72.7514
			±0.008			±0.008	±0.022
MLAK	142	48	30.27445	38	4	53.65984	140.2558
			±0.008			±0.008	±0.020
MNSF	146	5	11.25604	37	3	55.78802	356.8299
			±0.008			±0.008	±0.020
MOOR	142	7	52.86794	37	24	7.75654	279.5167
			±0.008			±0.008	±0.021
MRNO	141	32	55.47721	37	43	10.91257	88.0554
			±0.008			±0.008	±0.020
MRNT	145	3	58.81938	38	13	45.40305	60.2524
			±0.008			±0.008	±0.020
MURR	141	10	52.01293	35	15	45.32319	77.6132
			±0.008			±0.008	±0.021
MYRT	146	43	19.91180	36	33	28.68936	227.2737
			±0.008			±0.008	±0.020
NELN	141	0	22.34801	38	2	52.52317	9.4840
			±0.008			±0.008	±0.020
OMEO	147	36	2.03200	37	6	7.19055	712.4388
			±0.008			±0.008	±0.020
ORBO	148	27	18.48137	37	42	14.80722	45.5475
			±0.008			±0.008	±0.020
PIAN	143	19	39.79941	35	3	15.61268	78.7928
			±0.008			±0.008	±0.021
PKVL	144	57	39.28752	37	47	59.36171	67.4993
			±0.008			±0.008	±0.020
POCA	142	59	49.27266	38	37	2.74412	12.6309
			±0.008			±0.008	±0.019
PRTF	142	14	17.79037	38	23	6.17130	12.7214
			±0.008			±0.008	±0.020

Station	Longitude (DMS east)			Latitude (DMS south)			Ellipsoidal height (m)
	Uncertainty (m)			Uncertainty (m)			Uncertainty (m)
RNBW	141	59	34.58950	35	54	35.18276	116.3619
			±0.008			±0.008	±0.021
RUTH	146	30	32.00837	36	5	54.50817	211.2163
			±0.008			±0.008	±0.021
SEAL	142	50	55.47909	35	30	16.32213	70.9662
			±0.008			±0.008	±0.021
SEMR	145	8	21.05465	37	1	27.23715	156.5902
			±0.008			±0.008	±0.020
SKIP	143	21	34.21947	37	41	5.50972	302.2185
			±0.008			±0.008	±0.020
SRVC	140	59	21.01245	36	22	40.42621	127.3437
			±0.008			±0.008	±0.021
STAR	143	15	26.55824	36	36	55.02287	258.6759
			±0.008			±0.008	±0.021
STRH	141	8	11.53982	37	43	43.63873	70.4046
			±0.008			±0.008	±0.020
TATU	145	16	13.58403	36	26	22.74077	129.6814
			±0.008			±0.008	±0.020
TELO	141	6	39.39192	36	7	33.66475	144.4255
			±0.008			±0.008	±0.021
THOM	146	23	53.63608	37	50	36.75721	479.7833
			±0.008			±0.008	±0.020
UNDE	141	48	45.49627	35	10	16.47370	68.5999
			±0.008			±0.008	±0.020
WALW	147	44	3.04239	35	57	57.65815	242.2879
			±0.008			±0.008	±0.020
WEDD	143	36	50.49530	36	25	31.88755	199.1411
			±0.008			±0.008	±0.020
WHTL	145	4	3.45311	37	38	42.06222	163.1799
			±0.008			±0.008	±0.020
WORI	145	31	48.10106	37	46	37.48052	117.9546
			±0.008			±0.008	±0.020
WOTG	145	35	27.07614	38	36	29.15956	51.8838
			±0.008			±0.008	±0.020
WYCH	143	13	33.36049	36	4	38.88950	120.4808
			±0.008			±0.008	±0.021
YALL	146	20	56.47624	38	10	55.58417	64.8755
			±0.008			±0.008	±0.020

Station	Longitude (DMS east) Uncertainty (m)			Latitude (DMS south) Uncertainty (m)			Ellipsoidal height (m) Uncertainty (m)
YANK	146	12	24.80635	38	48	44.19894	29.9040
			±0.008			±0.008	±0.020
YARS	141	27	16.55853	34	31	40.73059	97.0803
			±0.008			±0.008	±0.021
YIEL	145	14	8.99434	35	55	40.60728	117.1364
			±0.008			±0.008	±0.021
YRRM	146	40	30.68066	38	33	54.61070	35.7743
			±0.008			±0.008	±0.020

END OF REPORT