

20180130_Five_Point_Mine_12345_Supporting Information**Owner: Gold Star Mining****Operation Name: Five Point Mine****Mining Permit #: 12345****Transformation Parameters Information****Date of transformation:** 01 Aug 2017**Determination of Transformation Parameters**

Five Point Mine Grid is a truncated version of New Zealand Map Grid. The original site coordinates and levels were established by a terrestrial traverse carried out by Contract Surveyors in 1991. Mine grid coordinates are in terms of New Zealand Map Grid and levels in terms of Lyttelton MSL 1937 vertical datum.

A GPS base station was established on site and coordinated in terms of existing site control. A local site coordinate was calculated for the base location. All site as-built information has been coordinated in terms of this control (terrestrial and GPS).

Current Local Site Base Coordinate	mN	mE	RL
Mine Grid (truncated NZMG: Lyttelton MSL 1937)	92992.61	18838.44	553.66
Translation (Site Grid to NZMG1949)	5800000.00	2400000.00	
NZMG1949 Lyttelton MSL 1937	5892992.61	2418838.44	553.66

A post processed static GPS survey was undertaken on 22 Nov 2010 to confirm the base coordinates and levels; and get a connection to NZGD2000 horizontal coordinates and Lyttelton MSL 1937 datum. This survey incorporated two LINZ 5th order marks (Linz Geodetic Database code AAYH and ADUQ) which had been coordinated in terms of NZGD2000.

The base coordinates obtained from the post processed GPS survey (22 Nov 2010) were generated in terms of Grey 2000 circuit – NZGD2000 and levels in terms of Lyttelton MSL 1937. These coordinates were converted to NZMG using the LINZ online coordinate transformation and compared to the local site coordinate for the base.

GPS Base Refined Position Nov 2010	mN	mE	RL
Grey Circuit 2000; Lyttelton MSL 1937	818694.64	428681.93	552.97
NZMG Lyttelton MSL 1937 (Source LINZ Coord Trans)	5892992.82	2418838.67	552.97

The following differences were calculated between the local site base coordinate and the revised GPS survey (Nov 2010) coordinate:

GPS Base Translation (Site Grid to Nov 2010)	mN	mE	RL
Local Site (NZMG1949 Lyttelton MSL 1937)	5892992.61	2418838.44	553.66
Nov 2010 (NZMG1949 Lyttelton MSL 1937)	5892992.82	2418838.67	552.97
Difference (Local to Nov 2010)	+ 0.21	+0.23	-0.69

As the previous local base coordinate was generated in terms of the original terrestrial based site control it was decided that all site as built data would be translated by the calculated differences between the local base coordinate and GPS survey base coordinate. This would make the as built data in terms of the revised base coordinate and with a direct connection to GD2000.

All site data was translated to NZMG1949 coordinates by applying the NZMG1949 coordinate offset (+ 5800000mN, + 2400000mE) and the local to Nov 2010 base coordinate difference (+ 0.21mN, + 0.23mE, - 0.69mRL). The site data was then transformed from NZMG 1949 to NZTM 2000 within Trimble Geomatics Office software. The translated local site base NZMG 1949 coordinate was checked by transforming it to NZTM2000 using the LINZ online coordinate conversion transformation. There was no difference between the two transformed coordinates.

The base height generated by the GPS survey in 2010 was in terms of Lyttelton MSL 1937. This was converted to NZVD2016 using the LINZ online coordinate conversion transformation. The height difference calculated was **-0.26m**.

The height difference calculated was applied to all site as built data to bring in terms of NZVD2016.

This was comparable to the height differences calculated between Lyttelton MSL 1937 heights and NZVD2016 heights that are shown on the two calibration marks AAYH and ADUQ.

Height Correction (Lyttelton MSL 1937 to NZVD2016)			
	AAYH	ADUQ	Base 2010
Height Order	1V	1V	
Ortho Height NZVD 2016	363.85	241.39	
Ortho Height Lyttelton MSL 1937	364.10	241.64	552.97
Height Difference	-0.25	-0.25	-0.26

The height difference calculated (-0.26m) was applied to all site as built data to bring in terms of NZVD2016.

Plan Detail Notes

The Base coordinate refers to the center of the fixed GPS antennae which is mounted to the roof of the main office. It is shown as a survey mark on the plan primarily due to it being the basis for the site transformation.

The origin of coordinates and levels is ADUQ (LINZ Geodetic Database) as it was utilised for the re-determination of the base coordinate in 2010 and is located closest to site.

Site Survey Points:

**Five Point Local Mine Grid (Truncated NZMG
Lyttelton MSL Vertical Datum)**

Name	mE	mN	RL
Base1	18838.67	92992.84	553.77
FP1	17892.45	91599.01	526.91
FP2	17740.71	91395.05	525.75
FP3	17768.83	91254.69	525.34
FP4	18000.09	91699.79	509.02
GP8	18008.27	92620.11	471.82
ORI 01	18232.36	92941.04	464.77
PPP1	18796.41	92909.90	553.98
PPP2	18764.35	92869.67	550.51
PPP3	18733.75	92875.72	549.78
SVN001	18773.12	90938.83	563.64

**NZTM2000 NZVD2016 (Transformed from Local
Mine Grid)**

Name	mE	mN	RL
Base1	1508871.69	5331338.75	552.71
FP1	1507925.75	5329945.76	525.96
FP2	1507774.02	5329741.90	524.80
FP3	1507802.10	5329601.58	524.39
FP4	1508033.37	5330046.49	508.07
GP8	1508041.72	5330966.52	470.87
ORI 01	1508265.79	5331287.31	463.82
PPP1	1508829.66	5331256.07	553.03
PPP2	1508797.61	5331215.86	549.56
PPP3	1508767.02	5331221.91	548.83
SVN001	1508806.02	5329285.62	562.69

Fixed Calibration points relate to the verification of the GPS base coordinate in 2010 in terms of GD2000 and NZVD2016.

These are AAYH and ADUQ.

Geodetic Code	Name	mE	mN	RL	Source
AAYH	NA 60	1515274.35	5319647.84	363.85	LINZ Geodetic Database
ADUQ	NA 49 SO 11840	1511507.70	5330897.21	241.39	LINZ Geodetic Database

These were observed as part of the base survey on 22 Nov 2010.

Transformation Parameters Supporting Information

LINZ Coordinate Transformations (pdf)

Base 2010 coordinate transformation Grey Circuit 2000 to NZMG

Base 2010 coordinate transformation NZMG to NZTM2000

Base 2010 coordinate transformation Lyttelton MSL 1937 to NZVD2016

TGO Coordinate system details:

TGO – NZMG1949 Coordinate System Details (pdf)

TGO – NZTM2000 Coordinate System Details (pdf)

Spreadsheet Coordinate transformation data summary

Current Local Site Base Coordinate		mN	mE	RL
	Mine Grid (truncated NZMG: Lyttelton MSL 1937)	92992.61	18838.44	553.66
	Translation NZMG	5800000.00	2400000.00	
	NZMG Lyttelton MSL 1937	5892992.61	2418838.44	553.66
	GPS Refined Position Nov 2010			
	Grey Circuit 2000; Lyttelton MSL 1937	818694.64	428681.93	552.97
	NZMG Lyttelton MSL 1937 (Source Linz)	5892992.82	2418838.67	552.97
Block Shift	Site Grid translations to NZMG Lyttelton MSL 1937	5800000.21	2400000.20	-0.69

Transformation NZMG to NZTM2000

TGO Software

System New Zealand Map Grid Zone

New Zealand-Datum Grid

Datum New Zealand Geodetic 1949

System New Zealand GD2000

Zone NZ Transverse Mercator (NZTM)

Datum New Zealand Geodetic 2000

Height Adjustment for NZVD2016

-0.26

Checks on both trigs showed that there was no significant deviation from -0.263 for Lyttleton VD to NZVD2016 so this adjustment was combined within the block shift

	Trig Check AAYH		Trig Check ADUQ		
	363.8513	NZVD2016	241.3859	NZVD2016	
	364.1014	Lytt VD1937	241.637	Lytt VD1937	
	-0.2501	Corr	-0.2511	Corr	
			mN	mE	RL
Mine Grid to NZMG & NZVD2016			5800000.21	2400000.23	-0.95
Base coordinate Linz Transformation NZMG to NZTM2000					
			5331338.75	1508871.69	552.71
GSM Transformation from TGO Value			5331338.75	1508871.69	552.71
Coordinate difference			0.00	0.00	0.00

Mining Permit #: 12345

Supporting Information

Measurement:

All site survey as built data has been collected from surveys conducted by Gold Star staff or contractors using terrestrial (total station) or GPS surveys. The positional accuracy of these surveys are generally of the order of +/-0.015m positional accuracy and in the case of GPS surveys +/- 0.03m vertical accuracy. All site as built data was collected in terms of the site mine grid which is a truncated version of New Zealand Map Grid 1949 and in terms of Lyttelton Mean Sea Level Datum 1937.

The site as built data is accumulated over time and added to in a piece-meal fashion – appreciable changes are merged into the site as built as they have been constructed and excavated throughout the period of mining. There are no overarching records of surveys that have been conducted throughout the period of mining as survey data is stored as local grid coordinate data only.

Plan Layers:

The following plans have been supplied:

Gold Star Mining Five Point Mine MP 12345 – Mining Permit Location (this layer shows the extent of the Mining permit)

Gold Star Mining Five Point Mine MP 12345 – Survey Marks (As per NZP&M Checklist Ref L_1 Survey Marks)

Gold Star Mining Five Point Mine MP 12345 – Drillholes (As per NZP&M Checklist Ref L_2 Boreholes, Drillholes, Shafts)

Gold Star Mining Five Point Mine MP 12345 – Planned Development (As per NZP&M Checklist Ref L_3 Planned Development)

Gold Star Mining Five Point Mine MP 12345 – Geology (As per NZP&M Checklist Ref L_4 Lithological)

Gold Star Mining Five Point Mine MP 12345 – Timing Planned (As per NZP&M Checklist Ref L_5 Timing Planned)

Gold Star Mining Five Point Mine MP 12345 – In Ground Resources (As per NZP&M Checklist Ref L_6 In ground Resources)

Gold Star Mining Five Point Mine MP 12345 – In Ground Resources Long Section (As per NZP&M Checklist Ref L_6 In ground Resources)

Gold Star Mining Five Point Mine MP 12345 – In Ground Resources Cross Section (As per NZP&M Checklist Ref L_6 In ground Resources)

Gold Star Mining Five Point Mine MP 12345 – Current Pit Outline (As per NZP&M Checklist Ref L_7 Current Pit Outline)

Gold Star Mining Five Point Mine MP 12345 – Resource Mined (As per NZP&M Checklist Ref L_8 Resource Mined)

Gold Star Mining Five Point Mine MP 12345 – Backfill (As per NZP&M Checklist Ref L_9 Backfill)

Gold Star Mining Five Point Mine MP 12345 – Current Development (As per NZP&M Checklist Ref L_10 Current Development)

Planned Development Drilling and As Drilled Drill hole files to be attached separately.