THREE KINGS QUARRY

RESOURCE CONSENT 12977

ANNUAL MONITORING REPORT

April 2012

ANNUAL THREE KING QUARRY MONITORING REPORT

Introduction

The following report is made with regard to Section 9 of the Monitoring and Contingency Plan for Dewatering Three Kings Quarry dated September 2005.

This report contains a compilation of all monitoring data and documents any settlement alarm level events, reviews and remedial action undertaken for the period of 1 April 2011 to 31 March 2012.

Monitoring Summary

The monitoring of groundwater levels has been undertaken monthly for the year ending March 31 2012. Groundwater levels within the quarry have been held above RL34m since the lowering of the groundwater table ceased in October 2002.

A groundwater monitoring bore was lost to kerb, channel and property entrance development work in June 2011 (BH 32 located outside 10 Shackleton Road). It is not proposed to replace this bore. No new groundwater monitoring bores were installed in the 12 month period ending 31 March 2012.

A survey of all precise level benchmarks was undertaken in March 2012.

Precise level surveys are currently being undertaken at 12 month intervals as dewatering has not been undertaken for more than 2 years, and there has been a cessation of settlement (as defined in the permit to dewater Three Kings Quarry).

Seven replacement marks were installed within the survey network, and differential settlement alarm values were continued to be recorded between marks within the general area of Mt Albert Road and Hillsborough Road.

Groundwater levels and precise level survey results are attached to this report.

Precise Level Survey Results

A precise level survey of all precise level marks was undertaken in March 2012.

All precise level survey marks were within 5mm of the previous reading.

Seven replacement marks were installed:

- RM1558A on Empire Road (replaces SS1558) – a new LINZ mark set in the concrete footpath
- AP6830A on The Drive (replaces RM6830) – a new mark (masonry anchor in the concrete footpath)
- AP62A and AP88A, Mt Albert/Hillsborough Rd intersection (replaces AP62 and AP88 respectively) – new masonry anchors in the concrete footpath

- AP77A, on the corner of Mt Albert Road/Warren Ave (replaces AP77) – intersection reshaped with new traffic islands and footpaths, the new mark is a masonry anchor in the new footpath
- AP119B, on the corner of Hayr Rd/Haughey Ave (replaces AP119A) – the new mark is an existing masonry anchor in the pram crossing on the south side of Haughey Ave
- AP132B on the corner of Carr Road and Clinker Street (replaces AP132A). AP132A was put in new concrete last year but same piece of concrete footpath has been renewed again. AP132B is a new masonry anchor in the concrete footpath.

Differential settlement alarm values are continued to be recorded between:

- AP92 and AP93, and AP92 and AP80 on Mt Albert Road,
- AP62A and AP88A at the intersection of Mt Albert Road and Hillsborough Road,
- AP110 and AP111 on Hillsborough Road, and
- OCP68 and AP114, AP69 and AP114, AP70 and AP117, and AP38 and AP117 on Budock Road.

No new differential settlement alarms were recorded compared with the previous survey.

The differential settlement alarm recorded in the March 2011 survey between AP67 and AP112 at the intersection of Hillsborough Road and Budock Road was not recorded in the recent survey. The differential settlement between these two marks is now greater than 1 in 5000 (currently recorded as 1 in 8890)

Marks	Location	Mar-12 Differential Settlement	Distance between Marks	Adjusted Difference in Levels between Marks
AP92 and AP93	Mt Albert Road	1 in 1071	16.7m	15.6mm
AP92 and AP80	Mt Albert Road	1 in 1105	17.7m	16.05mm
AP62A and AP88A	Mt Albert and Hillsborough	1 in 4235	28.0m	6.6mm
AP110 and AP111	Hillsborough Road	1 in 3363	17.7m	5.3mm
OCP68 and AP114	Budock Road	1 in 2099	23.0m	10.95mm
AP69 and AP114	Budock Road	1 in 2310	26.4m	9.95mm
AP70 and AP117	Budock Road	1 in 3016	21.5m	7.1mm
AP38 and AP117	Budock Road	1 in 3052	22.9m	7.5mm

The actions required for Differential Settlement Alarms Values less than 1 in 5000 but greater than 1 in 2000 are to report these to the Auckland Council and Three Kings Quarry Manager, and to install additional survey marks at 50 metre centres between existing survey marks.

These differential settlement alarms were reported to the Auckland Council and Three Kings Quarry Manager.

The spacing between these marks is less than 50 metres.

The action required for Differential Settlement Alarm Values less than 1 in 2000 but greater than 1 in 1000 are to:

- Install additional survey marks at 25metre centres between existing marks,
- Report these settlements to the Three Kings Quarry Manager, affected property owners, South Epsom Planning, Three Kings United, Epsom Environmental Effects, and Mt Roskill and Eden-Albert Community Boards.
- Assess the potential impact of on-going settlements on building and services, and
- Undertake a review of the groundwater model and settlement predictions.

The Differential Settlement Alarms between AP80, AP92 and AP93 on Mt Albert Road adjacent to the St Andrews Reserve are not a result of dewatering Three Kings Quarry. The reasons are as follows:

- AP80 and AP93 have recorded settlements consistent with other marks in this area (as shown on the attached table and graph), AP92 has risen since it was first surveyed with a 4mm rise this survey compared with March 2011, and
- Differential settlements between all immediately surrounding marks are greater than 1 in 7,000.

While there are no visual signs of significant deterioration or disturbance to the footpath (all these marks are survey nails in the footpath), there is a slight upward bowing in the concrete footpath compared with the kerb at the location of AP92 (photograph attached).

A detailed analysis of precise level survey marks in the vicinity of AP80, AP92 and AP93 is presented in the following table. The locations of precise level survey marks are shown on the attached drawings. The adjusted change in levels is undertaken to adjust for any difference in the time that the precise level marks were installed.

Precise Level Mark	*Change in Level since First Survey (mm)*	*Adjusted Change in Level (mm)*	*Precise Level Marks*	*Differential Settlement*	
				Spacing (metres)	Differential Settlement
RM 6813	-27.33	-27.33			
AP 97	-8.0	-26.66	RM6813-AP97	25.0	1 in 37097
AP 96	-7.0	-26.05	AP97-AP96	25.5	1 in 41833
AP 8B	-17.0	-28.43	AP96-AP8B	25.0	1 in 10504
AP 79	-10.0	-22.93			
AP 94	-7.67	-25.30	AP79-AP94	21.8	1 in 9207
AP 8B	-17.0	-28.43	AP94-AP8B	23.2	1 in 7396
AP 93	-8.33	-26.93	AP8B-AP93	23.7	1 in 15838
AP 92	+6.67	-11.35	AP93-AP92	16.7	1 in 1071
AP 80	-13.33	-27.40	AP92-AP80	17.7	1 in 1105
AP 91	-9.33	-27.15	AP80-AP91	20.9	1 in 83748
AP90	-10.0	-28.25	AP91-AP90	21.8	1 in 19884
RM 7647	-26.67	-26.67	AP90-RM7647	21.0	1 in 13233

The results show that the change in level of AP92 is anomalous and not consistent with the change in levels in the surrounding precise level survey marks. Its relative rise in level is not considered to be a result of dewatering Three Kings Quarry.

These differential settlement alarm values are being carefully tracked and any further assessments will be undertaken as required by the Monitoring and Contingency Plan for Dewatering Three Kings Quarry.

A review of the Stage Control Levels has been undertaken (Table 1, Section 7.0 of the Monitoring and Contingency Plan). Intermediate triggers have been recorded for total settlement in Settlement Zones I, II, IIB and III.

Section 7.1 of the Monitoring and Contingency Plan requires that if a Stage Control Trigger is recorded, dewatering (lowering of the groundwater table) is to cease. Section 7.2 requires a review of groundwater levels and precise level survey data, and section 7.3 requires that the results of this review be forwarded to the Auckland Council prior to dewatering recommencing.

Graphs showing the adjusted total settlements (any pre-existing settlement has been added to marks installed after dewatering commenced) of precise level marks for each Settlement Zone are attached together with the drawing showing the Settlement Zones.

In summary, the Immediate Trigger for Zone 1 for quarry drawdown at RL30m is 10mm, 20mm for Zone II, 45mm for Zone IIA, 15mm for Zone IIB, 10mm for Zones III and IV, 5mm for Zone V and 25mm for Zone IIIA. There are no precise settlement marks in Zone IIIB.

These triggers have been exceeded as summarised in the following table.

Settlement Zone	Intermediate Trigger (mm)	Current Maximum Total Settlement (mm)
Zone 1	10	16
Zone II	20	27 (31)
Zone IIA	45	29
Zone IIB	15	17
Zone III	10	12
Zone IIIA	25	15
Zone IIIB	20	-
Zone IV	10	8
Zone V	5	4

Please note in Zone II, two precise level marks (RM3901 and RM3895) are currently recording 31mm of movement however this movement is not considered to be solely a result of dewatering Three Kings Quarry. The movement of RM3895 is considered to be a result of the removal an adjacent large tree at some time in the past, and the recent movement in RM3901 is considered to be partly due to a leaking water main.

Although further dewatering is not being proposed, a review of groundwater levels and survey data has been undertaken.

Groundwater levels have stabilised since dewatering (lowering of the groundwater table) was ceased in October 2002. Groundwater levels have generally only varied due to season fluctuations since dewatering ceased with some rebound of groundwater levels following the reduced pumped rates being measured in isolated piezometers (bores 23, 26, 28a, 29, 30 and 33).

Precise level marks levels have stabilised since dewatering ceased with cessation of settlement

of precise level survey marks (no settlement greater than 5mm in any continuous 12 month period) having been recorded since September 2005.

In summary, the primary consolidation associated with dewatering ceased mid 2004. Precise level survey marks in Areas I, II, IIA and IIIA are recording some secondary consolidation but at a much reduced rate compared with the primary consolidation (3 to 4mm per year primary consolidation compared with 0.6 to 0.9mm per year secondary consolidation).

The Intermediate Stage Control Triggers are shown on the attached graphs with the location of the triggering points shown on the attached plan. The location of the triggering points are scattered but are generally grouped to the northwest and southeast of Three Kings Quarry.

No differential settlement triggers are associated with these Intermediate Stage Control Triggers.

With regard to section 7.2 of the Monitoring and Contingency Plan, ground settlements are not greater than 10mm per year; there are no differential settlement (as a result of the dewatering) greater than 1 in 2000; and there is no settlement greater than 100mm for points established prior to 30 September 2002, or greater than 75mm for points established after 30 September 2002.

There is no proposal to recommence dewatering. As required by section 7.3 of the Monitoring and Contingency Plan, should dewatering be recommenced, the results of a review undertaken prior to dewatering recommencing will be forwarded to the Auckland Council.

Seasonal Variation Calculations

As required by Section 6.7 of the Monitoring and Contingency Plan, seasonal variation calculations have been defined for bores 37, 38, 39 and 40. The calculated seasonal variation for the deep and shallow piezometers respectively in bores 37, 38, 39 and 40 are as follows:

Table 1: Deep Piezometers

	BH37a	BH38a	BH39a	BH40a
99% Confidence Limits	RL54.17m RL53.60m	RL54.73m RL53.80m	RL55.31m RL54.82m	RL62.07m RL61.23m
99.9% Confidence Limits	RL54.25m RL53.53m	RL54.85m RL53.67m	RL55.37m RL54.76m	RL62.19m RL61.12m

Table 2: Shallow Piezometers

	BH37b	BH38b	BH39b	BH40b
99% Confidence Limits	RL54.03m RL53.56m	RL53.80m RL53.33m	RL57.42m RL56.50m	RL63.86m RL63.31m
99.9% Confidence Limits	RL54.09m RL53.50m	RL53.87m RL53.26m	RL57.55m RL56.38m	RL63.94m RL63.23m

The groundwater levels in BH40a and BH40b have been in excess of seasonal variation (99% confidence limits) since December 2007. BH40 is the southern most of the Three Kings Quarry groundwater monitoring bores located on Hillsborough Road just to the north of the SH20.

Three Kings groundwater monitoring bores located closer to the Three Kings Quarry (boreholes 36 and 39) have not recorded any movement of groundwater levels beyond normal seasonal variations.

The groundwater level in BH40a (deep piezometer) has fallen approximately 0.85metres from an average level of approximately RL61.65m (to March 2007) to an average level of approximately RL60.8m.

The groundwater level in BH40b (shallower piezometer) has fallen 0.7m from an average level of approximately RL63.6m (to March 2007) to an average level of approximately RL62.9m.

The groundwater levels in BH40a and BH40b are currently rising slowly from groundwater lows recorded in mid-2010 (refer attached graphs).

Up until March 2008, Transits groundwater monitoring bores adjacent to the "Hillsborough Road cut" SH20 works recorded a similar or greater amount of change although the monitoring record is not complete as the Three Kings Quarry groundwater monitoring record. Transits BH15 on the crest of the Hillsborough Road cut recorded a fall in groundwater level of 1.9m since December 2006 (from RL64.44m to RL62.53m).

The Transit monitoring bores do not extend to the same depth as the Three Kings Quarry groundwater monitoring bores but all bores are located in East Coast Bays Formation (Waitemata).

As reported previously, although the monitoring results are not conclusive (with the deeper groundwater level in BH40a being drawn down more than the shallower groundwater level – BH40b), as the groundwater monitoring bores closer to the Three Kings Quarry (bores 36 and 39) are not being drawn down, it is considered unlikely that the falling groundwater levels being recorded in BH40a and BH40b are the result of dewatering Three Kings Quarry.

REVIEWS

Groundwater

The results of the groundwater level monitoring are checked and reviewed as the results are received. A review of groundwater levels and precise level survey marks has been undertaken as required by Section 7.2 of the Monitoring and Contingency Plan.

Surface Levels

The results of precise level surfaces are checked and reviewed when the results are received, with the results forwarded to the Auckland Council and Three Kings United Inc.

A review of precise level survey data was undertaken by Tonkin and Taylor in 2005. This report reviewed settlement data to the March 2005 survey and included the findings of the Pattle Delamore Annual Groundwater Report dated January 2005.

The Tonkin and Taylor report concluded that while surface settlement monitoring indicates that surface settlement is typically on-going about the quarry, it was at a much reduced rate.

The on-going settlement close to the quarry was concluded to be the result of secondary consolidation induced by changes in groundwater pressure associated with past quarry

dewatering. At increased distances from the quarry, Tonkin and Taylor concluded that it is possible that the ongoing surface settlement includes some delayed consolidation as a result primarily consolidation of soil strata not currently monitored by piezometers. In addition Tonkin and Taylor concluded that any groundwater drawdown effects at distance from the quarry are small and surface settlement data at the fringe of drawdown are within expected settlement tolerances.

A further review of the precise level survey information was undertaken in August 2005 to determine if cessation of settlement had occurred. It was found that cessation of settlement (as defined by the consent to dewater Three Kings Quarry) had occurred and this was reported more fully to the Auckland Regional Council in September 2005. As such, and because more than two years has elapsed since dewatering has been undertaken, precise level surveys are now required to be undertaken at 12 month intervals.

A review of the precise level data has been undertaken as required by Section 7.2 of the Monitoring and Contingency Plan – exceedance of an Intermediate Settlement Trigger. The review concluded that settlements are not in excess of 10mm per year; that the differential settlement between any two monitoring points caused by the exercise of the consent to dewater Three Kings Quarry is greater than 1 in 2000; and total settlement is not greater than 100mm (or 75mm for precise level survey marks installed after 30 September 2002).

There is currently no proposal to further dewater Three Kings Quarry.

REMEDIAL ACTION

No remedial action was required or undertaken for the 12 month period ending 31 March 2012.

Note:
Origin of Levels
CA55 SO49930
RL65.1412m
in same terms as
M205 SO54417
RL59.305m

● SS3316 = Precise Level Survey Benchmarks

⊕ BH16 = Borehole Location

REF	AMENDMENT	BY	DATE
B	BHs 37, 37A, 38, 38A, 39, 39A, 40 & 40A ADDED	MD	10/3/05
A	SCALE BAR ADDED	MD	11/5/04

DESIGNED: DATE: SIGNATURE:
DRAWN: DATE: SIGNATURE:
CHECKED: DATE: SIGNATURE:
APPROVED: DATE: SIGNATURE:

PLOT DATE: 10/5/05
CAD REF: BOREHOLES
CAD XREF:
SURVEY BY: MD
SURVEY DATE: 10/3/05
SDR REF: BOR

ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND

ISO 9001 QUALITY ASSURED

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PROJECT:
WINSTONE AGGREGATES LTD
THREE KINGS QUARRY

TITLE:
BOREHOLE LOCATION PLAN
AS AT 10-3-05

PLOT STATUS:

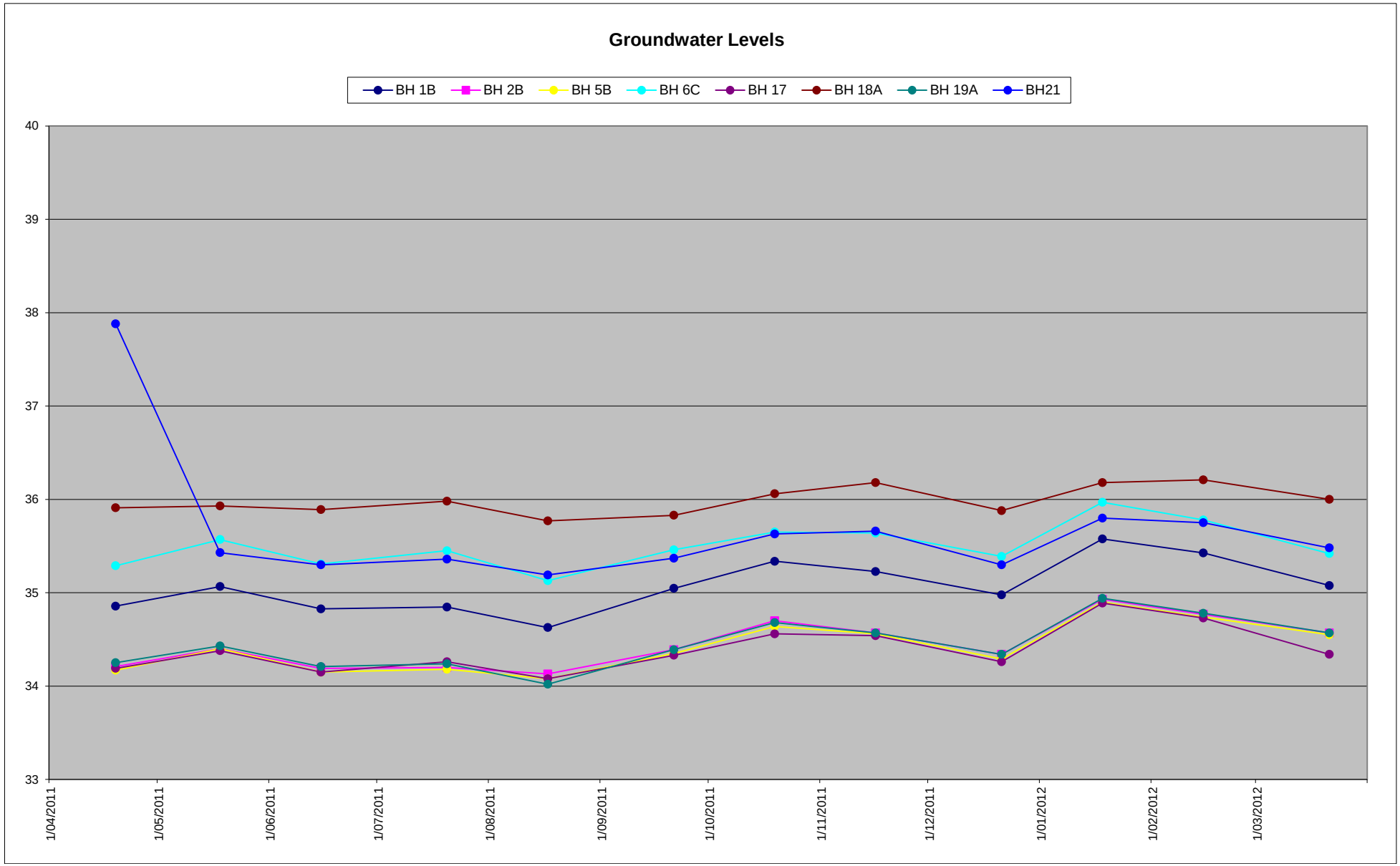
PROJECT No: 1130/006451
SCALES: A1 1:5000 A3 1:10000
A1 A3
DRAWING No: 6451-100
REV B

THREE KINGS GROUNDWATER LEVEL RECORD SHEET

Date	BH 1B	BH 2B	BH 5B	BH 6A	BH 6B	BH 6C	BH 7	BH 10a	BH 10b	BH 11b	BH 12a	BH 12b	BH 13a	BH 13c	BH 16	BH 17	BH 18A	BH 18B	BH 19A	BH 19B
19-Apr-11	34.86	34.21	34.17	45.35	40.00	35.29	40.13	50.93	72.68	72.45	50.96	67.18	55.42	66.33	51.39	34.19	35.91	45.83	34.25	38.58
18-May-11	35.07	34.40	34.40	45.59	40.22	35.57	41.01	51.34	72.69	72.46	51.40	67.20	58.98	66.33	51.74	34.38	35.93	45.80	34.43	38.57
15-Jun-11	34.83	34.19	34.15	46.22	40.21	35.31	40.71	51.39	72.69	72.46	51.43	67.18	59.05	66.33	51.89	34.15	35.89	46.22	34.21	38.57
20-Jul-11	34.85	34.20	34.18	46.78	40.31	35.45	40.73	51.51	72.69	72.44	51.53	67.18	59.23	66.34	52.02	34.26	35.98	47.02	34.24	38.61
17-Aug-11	34.63	34.13	34.08	46.81	40.25	35.13	40.40	51.44	72.69	72.44	51.46	67.14	59.25	66.33	51.98	34.08	35.77	46.93	34.02	38.64
21-Sep-11	35.05	34.39	34.35	46.40	40.30	35.46	40.30	51.13	72.69	72.47	51.19	67.14	59.07	66.33	51.72	34.33	35.83	46.53	34.39	38.66
19-Oct-11	35.34	34.70	34.64	46.16	40.29	35.65	40.39	51.08	72.68	72.47	51.15	67.17	58.78	66.34	51.64	34.56	36.06	46.53	34.68	38.88
16-Nov-11	35.23	34.57	34.56	46.09	40.33	35.64	40.09	51.06	72.69	72.44	51.12	67.10	59.15	66.34	51.65	34.54	36.18	46.41	34.57	38.67
21-Dec-11	34.98	34.34	34.29	45.80	40.11	35.39	40.15	50.93	72.69	72.44	50.91	67.13	56.67	66.33	51.41	34.26	35.88	46.48	34.34	38.64
18-Jan-12	35.58	34.93	34.90	45.68	40.40	35.97	40.54	51.06	72.68	72.44	51.14	67.15	58.48	66.41	51.57	34.89	36.18	46.42	34.94	38.77
15-Feb-12	35.43	34.77	34.74	45.69	40.32	35.78	40.32	50.93	72.68	72.44	50.96	66.96	57.75	66.34	51.49	34.73	36.21	46.36	34.78	38.78
21-Mar-12	35.08	34.57	34.55	45.51	40.17	35.42	40.80	50.92	72.68	72.45	50.88	67.13	56.10	66.38	51.35	34.34	36.00	46.18	34.57	38.77

Date	BH 20	BH 20A	BH21	BH22	BH22a	BH23	BH23a	BH24	BH24a	BH25	BH25a	BH25b1	BH25b2	BH26	BH26a	BH27	BH28a	BH28b	BH29	BH30
19-Apr-11	54.95	51.18	37.88	41.21	64.50	51.69	51.16	56.23	60.72	37.18	48.85	48.53	51.61	59.44	54.26	49.59	51.48	52.65	58.40	55.30
18-May-11	55.28	52.09	35.43	41.20	65.23	51.71	51.32	56.35	60.71	37.21	49.32	49.08	52.43	59.44	54.40	49.59	51.63	53.71	58.55	55.51
15-Jun-11	55.47	52.23	35.30	41.20	65.21	51.77	51.43	56.45	60.71	37.22	49.58	49.41	52.67	59.44	54.41	49.59	51.72	53.59	58.60	55.70
20-Jul-11	55.64	52.43	35.36	41.20	65.20	51.84	51.60	56.55	60.71	37.22	49.73	49.46	52.79	59.44	54.44	49.59	51.75	53.63	58.72	55.70
17-Aug-11	55.67	52.20	35.19	41.20	65.20	51.91	51.63	56.60	60.70	37.13	49.64	49.46	52.54	59.43	54.40	49.59	51.74	53.32	58.72	55.69
21-Sep-11	55.61	51.68	35.37	41.19	64.86	51.91	51.53	56.53	60.70	37.20	49.20	49.34	52.07	59.44	54.36	49.59	51.68	52.92	58.66	55.62
19-Oct-11	55.62	51.54	35.63	41.20	64.83	51.95	51.45	56.45	60.69	37.23	49.45	49.32	51.95	59.44	54.40	49.59	51.72	52.89	58.67	55.56
16-Nov-11	55.46	51.50	35.66	41.20	64.88	51.86	51.40	56.40	60.67	37.31	47.70	47.78	51.90	59.44	54.32	49.59	51.68	52.95	58.64	55.45
21-Dec-11	55.14	51.10	35.30	41.19	64.57	51.80	51.31	56.37	60.65	37.14	48.51	47.82	51.49	59.44	54.30	49.59	51.57	53.74	58.61	55.38
18-Jan-12	55.21	51.51	35.80	41.20	64.87	51.78	51.32	56.34	60.62	37.23	48.06	48.09	51.94	59.43	54.36	49.59	51.63	53.46	58.64	55.43
15-Feb-12	55.02	51.20	35.75	41.19	64.63	51.75	51.27	56.34	60.60	37.32	47.84	47.50	51.51	59.43	54.26	49.59	51.62	52.55	58.63	55.40
21-Mar-12	55.10	50.98	35.48	41.19	64.45	51.81	51.22	56.28	60.58	37.36	48.45	48.05	51.52	59.44	54.37	49.60	51.65	52.86	58.67	55.51

Date	BH31a	BH31b	BH32	BH33	BH34	BH35a	BH35b	BH36a	BH36b	BH37a	BH37b	BH38a	BH38b	BH39a	BH39b	BH40a	BH40b
19-Apr-11	48.99	50.30	54.68	59.37	49.36	50.07	55.35	59.00	59.07	53.92	53.81	54.31	53.59	54.84	57.19	60.60	62.69
18-May-11	49.10	50.43	55.31	59.49	48.89	49.05	55.43	59.17	59.23	53.99	54.36	54.40	53.74	54.87	57.27	60.73	62.79
15-Jun-11	49.23	50.57		59.59	50.05	49.03	55.52	59.21	59.27	54.00	54.02	54.39	53.72	54.83	57.34	60.70	62.79
20-Jul-11	49.24	50.65		59.64	50.15	49.05	55.57	59.29	59.33	54.05	54.00	54.46	53.81	54.86	57.36	60.80	62.91
17-Aug-11	49.23	50.66		59.62	50.03	49.61	55.57	59.23	59.27	54.03	53.94	54.44	53.75	54.98	57.37	60.85	62.94
21-Sep-11	49.19	50.50		59.53	49.80	49.62	55.48	59.14	59.17	54.11	53.93	54.42	53.65	55.03	57.32	61.10	62.92
19-Oct-11	49.12	50.55		59.47	49.76	49.62	55.53	59.12	59.16	54.07	53.90	54.40	53.62	54.96	57.31	60.86	62.83
16-Nov-11	49.04	50.49		59.31	49.10	49.55	55.47	59.09	59.15	54.07	53.91	54.38	53.56	54.93	57.26	60.81	62.85
21-Dec-11	49.01	50.44		59.18	49.09	49.53	55.38	59.08	59.11	54.08	53.89	54.47	53.61	54.89	57.22	60.75	62.85
18-Jan-12	49.07	50.42		59.14	49.36	49.31	55.42	59.08	59.17	54.10	53.91	54.48	53.65	54.86	57.25	60.75	62.89
15-Feb-12	49.03	50.38		59.04	48.85	49.03	55.46	59.04	59.10	54.06	53.86	54.38	53.61	54.79	57.23	60.79	62.93
21-Mar-12	49.05	50.69		59.33	49.10	48.93	55.44	59.05	59.11	54.05	53.88	54.42	53.63	54.79	57.24	60.83	62.81


Groundwater Levels
BH 1B
BH 2B
BH 5B
BH 6C
BH 17
BH 18A
BH 19A
BH21
40
39
38
37
36
35
34
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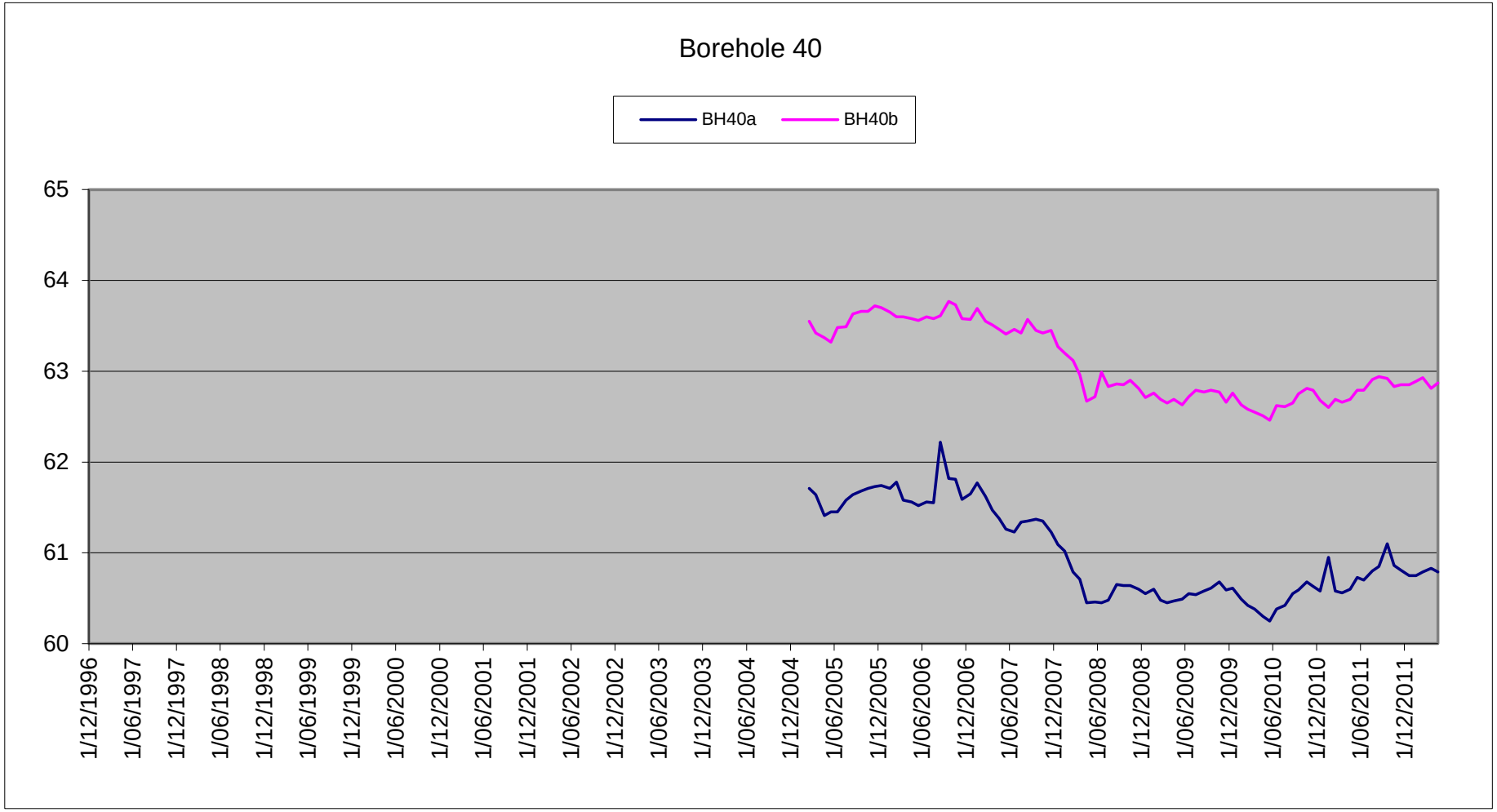
Borehole 40
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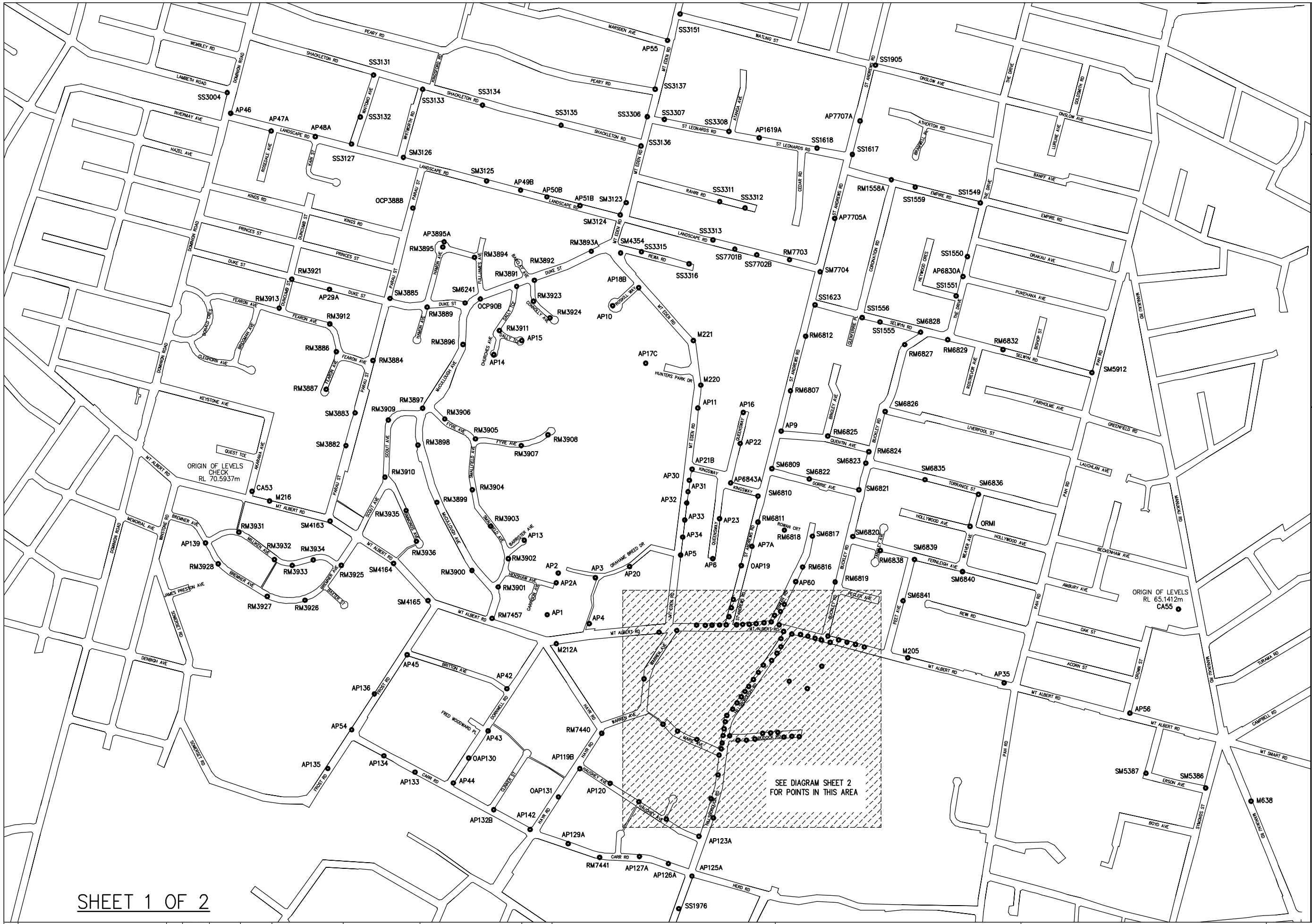


SHEET 1 OF 2

Note:
Origin of Levels
CA55 SO49930
RL65.1412m
in same terms as
M205 SO54417
RL59.305m
(as at 5/02)

● SS3316 = Level Control Pt Existing

4	AP6830A, RM1558A, AP62A, AP88A, AP77A, AP119B	MD	03/12	DESIGNED:	DATE:	SIGNATURE:	
	ADDED						
	RM6830, SS1558, AP62, AP88, AP77, AP119A			DRAWN:	DATE:	SIGNATURE:	
	DELETED						
	SS1558 - UNUSABLE DUE TO MOVED LID			CHECKED:	DATE:	SIGNATURE:	
	AP112, RM3894 - COORDINATES UPDATED						
M	ORIGIN OF LEVELS CHANGED	MD	5/02	APPROVED:	DATE:	SIGNATURE:	
REF	AMENDMENT	BY	DATE				

PLOT DATE: 20/03/2012
CAD REF: 6451-102 Control Pts Plan
CAD XREF:
SURVEY BY:
SURVEY DATE:
SDR REF:

ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND — ISO 9001 QUALITY ASSURED

THIS DRAWING AND DESIGN REMAINS THE PROPERTY OF, AND MAY NOT BE REPRODUCED OR ALTERED, WITHOUT THE WRITTEN PERMISSION OF HARRISON GRIERSON CONSULTANTS LIMITED. NO LIABILITY SHALL BE ACCEPTED FOR UNAUTHORISED USE OF THIS DRAWING.

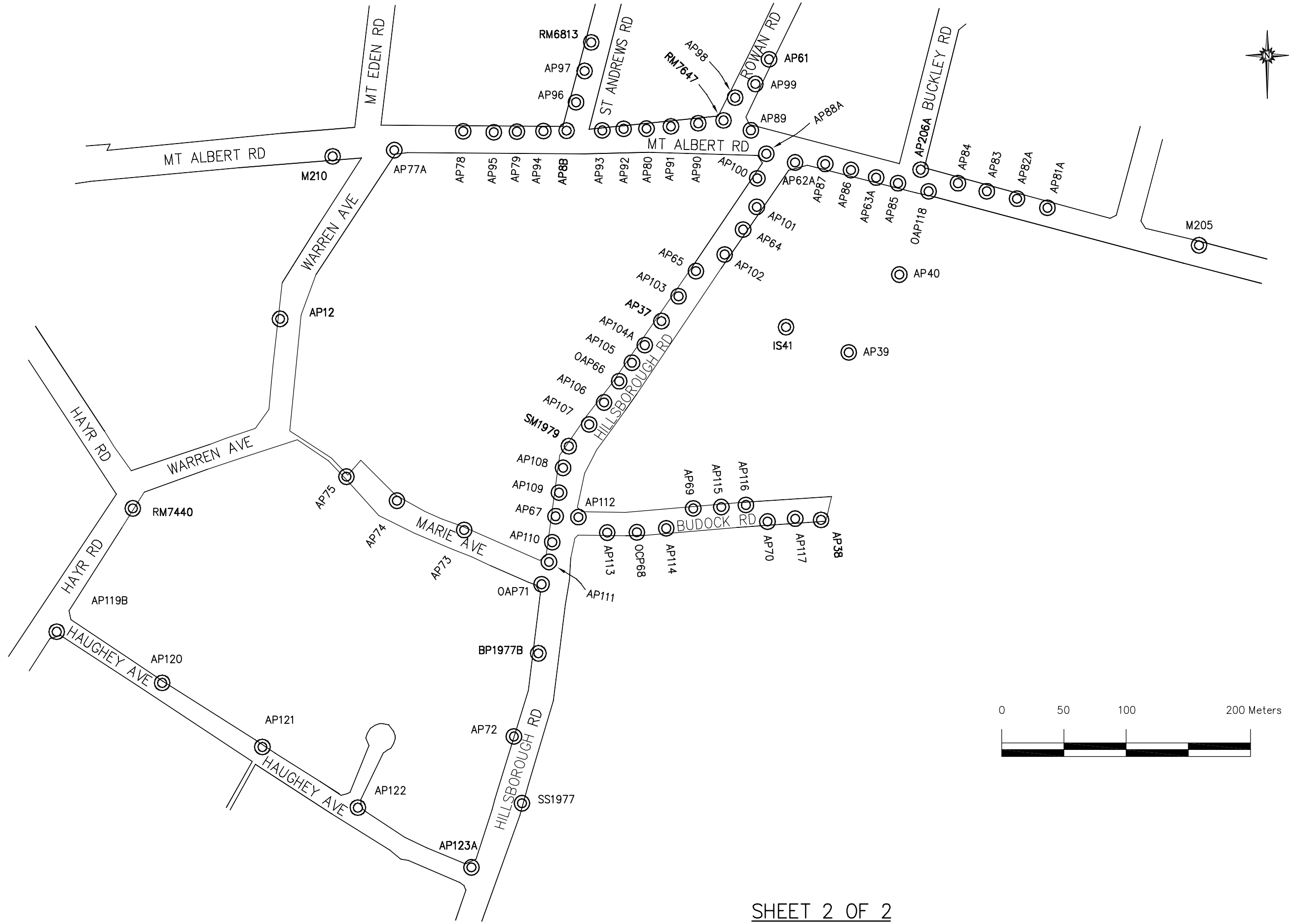
HARRISON GRIERSON
CONSULTING ENGINEERS SURVEYORS PLANNERS
Level 5 Cogita House. 20 Amersham Way Manukau City Ph 09 966 3380 Fax 09 966 3390

PROJECT:
WINSTONE AGGREGATES
THREE KINGS QUARRY

TITLE:
SURVEY MONITORING
LEVEL CONTROL POINTS

PLOT STATUS:

PROJECT No: 1130-006451-01
SCALES: A1 1:5000, A3 1:10000
A1 A3
DRAWING No: 6451_102
REV 4



SHEET 2 OF 2

4	SEE SHEET 1	MD	20/03/12	DESIGNED:	DATE:	SIGNATURE:	PLOT DATE: 20/03/2012	ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND	ISO 9001 QUALITY ASSURED	HARRISON GRIERSON CONSULTING ENGINEERS SURVEYORS PLANNERS	PROJECT: WINSTONE AGGREGATES THREE KINGS QUARRY
				DRAWN:	DATE:	SIGNATURE:	CAD REF: 6451-102 Control Pts Plan				TITLE: SURVEY MONITORING LEVEL CONTROL POINTS
				CHECKED:	DATE:	SIGNATURE:	CAD XREF:				PLOT STATUS:
M	ORIGIN OF LEVELS CHANGED	MD	5/02	APPROVED:	DATE:	SIGNATURE:	SURVEY BY:				PROJECT No: 1130-006451-01 SCALES: A1 1:1500 A3 1:3000 A1 A3
REF	AMENDMENT	BY	DATE				SURVEY DATE:				DRAWING No: 6451_102 REV 4
							SDR REF:				

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Level 5 Cogita House. 20 Amersham Way Manukau City Ph 09 966 3380 Fax 09 966 3390

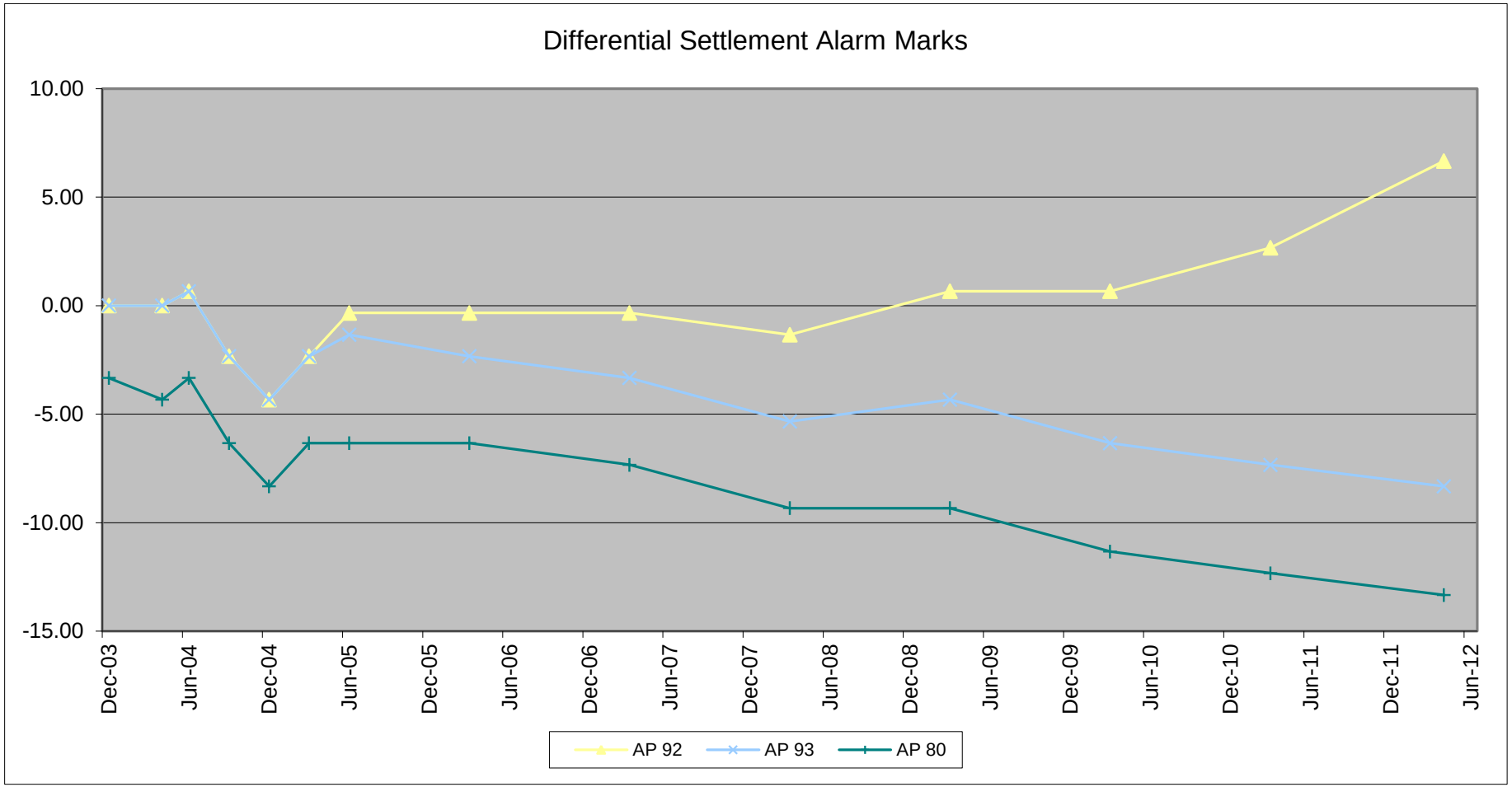
THREE KINGS SURVEY RECORD

Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)		Mar 12 cf Mar 11 (mm)
		mN	mE		Mar-11	Mar-12	Mar-11	Mar-12	
SS 3136	Mt Eden Rd	697910.68	299385.73	63.047	63.031	63.030	-16	-17	-1
SS 3137	Mt Eden Rd	698072.60	299427.08	63.343	63.341	63.339	-2	-4	-2
M 212A	Mt Albert Rd	696504.39	299153.17	86.127	86.109	86.110	-18	-17	1
SM 4163	Mt Albert Rd	696843.03	298513.03	74.142	74.141	74.142	-1	0	1
SM 4164	Mt Albert Rd	696728.57	298688.37	75.851	75.844	75.843	-7	-8	-1
SM 4165	Mt Albert Rd	696625.11	298783.31	83.632	83.621	83.621	-11	-11	0
SM 3882	Parau St	697063.26	298555.52	63.302	63.300	63.300	-2	-2	0
RM 3898	McCullough Ave	697067.11	298760.28	76.078	76.064	76.063	-14	-15	-1
RM 3899	McCullough Ave	696900.99	298813.23	77.811	77.800	77.800	-11	-11	0
RM 3900	McCullough Ave	696713.60	298916.53	76.657	76.640	76.641	-17	-16	1
RM 3901	Smallfield Ave	696669.58	298986.57	78.931	78.905	78.900	-26	-31	-5
RM 3902	Smallfield Ave	696747.40	299014.21	80.177	80.161	80.162	-16	-15	1
RM 3903	Smallfield Ave	696834.73	298965.09	82.524	82.512	82.513	-12	-11	1
RM 3904	Smallfield Ave	696939.98	298912.45	82.708	82.696	82.696	-12	-12	0
RM 3907	Fyvie Ave	697063.27	299054.59	80.321	80.314	80.314	-7	-7	0
RM 3910	Scout Ave	696974.91	298672.88	83.414	83.402	83.402	-12	-12	0
RM 3925	Bremner Ave	696727.72	298541.52	65.423	65.426	65.424	3	1	-2
RM 3926	Bremner Ave	696630.47	298448.99	59.088	59.092	59.090	4	2	-2
RM 3933	Milliken Rd	696725.14	298412.65	71.049	71.056	71.054	7	5	-2
RM 3934	Milliken Rd	696742.66	298472.30	66.303	66.308	66.307	5	4	-1
RM 3935	Simmonds Ave	696876.97	298725.70	91.755	91.741	91.742	-14	-13	1
RM 3936	Simmonds Ave	696788.84	298756.78	90.869	90.850	90.850	-19	-19	0
RM 7440	Hayr Rd	696258.10	299279.70	84.033	84.022	84.023	-11	-10	1
RM 7457	Mt Albert Rd	696575.40	298967.90	85.707	85.689	85.690	-18	-17	1
AP 1	Plaza, Mt Albert Rd	696589.80	299127.20	81.269	81.248	81.248	-21	-21	0
AP 2	Plaza, Mt Albert Rd	696706.40	299158.20	76.290	76.274	76.273	-16	-17	-1
AP 2A	Plaza, Mt Albert Rd	696679.30	299152.50	77.582	77.567	77.566	-15	-16	-1
AP 3	Plaza, Mt Albert Rd	696693.00	299259.10	77.367	77.353	77.353	-14	-14	0
AP 4	Plaza, Mt Albert Rd	696564.80	299244.90	83.366	83.344	83.344	-22	-22	0
AP 13	Barrister Ave	696796.00	299064.30	79.867	79.859	79.859	-8	-8	0
AP 20	Grahame Breed Dr	696723.10	299358.50	76.792	76.784	76.785	-8	-7	1
SM 3123	Mt Eden Rd	697750.13	299344.75	75.676	75.656	75.657	-20	-19	1
SM 3124	Landscape Rd	697715.79	299327.99	77.724	77.703	77.704	-21	-20	1
SM 3125	Landscape Rd	697810.23	298959.44	69.440	69.429	69.428	-11	-12	-1
SM 3126	Landscape Rd	697873.04	298716.42	63.015	63.009	63.008	-6	-7	-1
SS 3127	Landscape Rd	697911.99	298565.74	59.724	59.722	59.721	-2	-3	-1
SS 3132	Waitomo St	697987.80	298590.90	61.689	61.688	61.687	-1	-2	-1
SM 3883	Parau St	697156.95	298581.04	64.371	64.367	64.366	-4	-5	-1
RM 3884	Parau St	697301.96	298629.21	62.539	62.536	62.534	-3	-5	-2
SM 3885	Duke St	697474.42	298680.34	61.857	61.848	61.846	-9	-11	-2
RM 3886	Fearon Ave	697329.55	298529.49	55.236	55.236	55.234	0	-2	-2
RM 3887	Fearon Ave	697221.32	298498.22	51.548	51.540	51.537	-8	-11	-3
OCP 3888	Parau St	697732.59	298744.43	62.513	62.504	62.503	-9	-10	-1
RM 3889	Duke St	697452.34	298785.50	69.233	69.211	69.211	-22	-22	0
RM 3891	Duke St	697515.89	299039.80	77.575	77.559	77.559	-16	-16	0
RM 3892	Duke St	697529.22	299086.26	78.012	77.997	77.997	-15	-15	0
RM 3893A	Duke St	697610.68	299248.02	79.110	79.110	79.110	0	0	0
RM 3894	Fulljames Ave	697589.82	298923.43	72.082	72.061	72.060	-21	-22	-1
RM 3895	Hamon Ave	697620.41	298829.46	65.188	65.158	65.157	-30	-31	-1
AP 3895A	Hamon Ave	697631.96	298839.08	65.612	65.613	65.613	1	1	0
RM 3896	McCullough Ave	697345.49	298887.04	69.820	69.799	69.798	-21	-22	-1
RM 3897	McCullough Ave	697170.56	298776.56	75.084	75.068	75.067	-16	-17	-1
RM 3905	Fyvie Ave	697080.60	298923.97	75.813	75.804	75.804	-9	-9	0
RM 3906	Fyvie Ave	697134.57	298836.07	77.447	77.434	77.433	-13	-14	-1
RM 3908	Fyvie Ave	697093.64	299129.18	82.069	82.064	82.063	-5	-6	-1
RM 3909	Scout Ave	697136.38	298680.63	80.056	80.044	80.043	-12	-13	-1
RM 3911	Dally Tce	697387.46	298991.05	88.894	88.880	88.878	-14	-16	-2
RM 3912	Fearon Ave	697399.31	298512.83	51.652	51.655	51.653	3	1	-2
RM 3913	Fearon Ave	697445.84	298362.01	49.238	49.245	49.243	7	5	-2
RM 3921	Duncumb St	697530.84	298402.67	50.034	50.039	50.037	5	3	-2
RM 3923	Connelly Ave	697465.89	299086.33	74.293	74.278	74.278	-15	-15	0
RM 3924	Connelly Ave	697424.55	299131.88	73.034	73.019	73.018	-15	-16	-1
SM 4354	Mt Eden Rd	697606.00	299322.20	80.155	80.129	80.130	-26	-25	1
SM 6241	Duke St	697468.58	298893.36	70.012	69.985	69.985	-27	-27	0
OCP 90B	Duke St	697480.39	298934.30	71.805	71.786	71.785	-19	-20	-1
AP 10	Roskill Way	697458.10	299308.70	82.673	82.659	82.661	-14	-12	2
AP 14	Churches Ave	697318.10	298969.20	91.334	91.321	91.320	-13	-14	-1
AP 15	Dally Terrace	697357.20	299055.90	90.821	90.809	90.807	-12	-14	-2
AP 17C	Hunters Park Dr	697293.89	299402.87	74.602	74.594	74.594	-8	-8	0
AP 29A	Duke St	697501.58	298517.84	49.542	49.541	49.540	-1	-2	-1
M 220	Mt Eden Rd	697232.61	299557.19	81.700	81.664	81.665	-36	-35	1
M 221	Mt Eden Rd	697359.09	299539.94	83.449	83.433	83.434	-16	-15	1
SS 1555	Selwyn Rd	697413.60	300062.90	99.584	99.581	99.581	-3	-3	0

Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)		Mar 12 cf Mar 11 (mm)
		mN	mE		Mar-11	Mar-12	Mar-11	Mar-12	
SS 1556	Selwyn Rd	697425.87	300012.81	102.373	102.369	102.370	-4	-3	1
SS 1617	St Andrews Rd	697887.68	299983.32	81.442	81.441	81.443	-1	1	2
SS 1618	St Leonards Rd	697906.03	299884.48	78.478	78.477	78.476	-1	-2	-1
AP 1619A	St Leonards Rd	697935.70	299724.63	66.609	66.610	66.608	1	-1	-2
SS 1623	St Andrews Rd	697461.10	299874.96	107.522	107.513	107.515	-9	-7	2
SS 3306	Mt Eden Rd	697993.20	299406.80	60.565	60.556	60.554	-9	-11	-2
SS 3307	St Leonards Rd	697985.83	299454.69	59.661	59.654	59.652	-7	-9	-2
SS 3308	St Leonards Rd	697952.15	299635.99	63.275	63.272	63.270	-3	-5	-2
SS 3311	Rahiri Rd	697752.00	299610.94	95.306	95.291	95.293	-15	-13	2
SS 3312	Rahiri Rd	697733.64	299682.97	95.929	95.916	95.917	-13	-12	1
SS 3313	Landscape Rd	697648.30	299592.51	112.633	112.614	112.617	-19	-16	3
SS 3315	Rewa Rd	697613.41	299396.64	80.938	80.914	80.915	-24	-23	1
SS 3316	Rewa Rd	697579.48	299529.80	98.902	98.882	98.886	-20	-16	4
RM 6807	St Andrews Rd	697216.70	299808.10	102.487	102.472	102.473	-15	-14	1
RM 6812	St Andrews Rd	697370.60	299846.60	108.907	108.892	108.895	-15	-12	3
SM 6826	Buckley Rd	697157.90	300077.50	74.710	74.708	74.705	-2	-5	-3
RM 6827	Buckley Rd	697345.96	300128.04	83.332	83.334	83.332	2	0	-2
SM 6828	Buckley Rd	697383.80	300177.40	87.952	87.954	87.952	2	0	-2
SS 7701B	Landscape Rd	697619.71	299657.05	115.509	115.504	115.507	-5	-2	3
SS 7702B	Landscape Rd	697602.26	299725.78	110.538	110.533	110.535	-5	-3	2
RM 7703	Landscape Rd	697589.21	299808.37	100.149	100.130	100.132	-19	-17	2
SM 7704	St Andrews Rd	697556.90	299894.50	97.816	97.807	97.809	-9	-7	2
AP 7705A	St Andrews Rd	697700.05	299930.56	88.195	88.195	88.195	0	0	0
AP 9	St Andrews Rd	697103.90	299782.20	92.802	92.781	92.782	-21	-20	1
AP 11	Mt Eden Rd	697168.40	299548.70	80.191	80.181	80.182	-10	-9	1
AP 16	Queens Way	697156.20	299676.20	83.646	83.634	83.637	-12	-9	3
AP 18B	Mt Eden Rd	697509.31	299384.27	81.641	81.639	81.640	-2	-1	1
M 205	Mt Albert Rd	696471.16	300138.54	59.305	59.304	59.302	-1	-3	-2
AP 206A	Mt Albert Rd	696527.29	299919.36	59.997	59.996	59.993	-1	-4	-3
M 210	Mt Albert Rd	696536.06	299441.55	83.050	83.028	83.029	-22	-21	1
SM 1979	Hillsborough Rd	696308.02	299637.25	61.241	61.213	61.212	-28	-29	-1
BP 1977B	Hillsborough Rd	696141.75	299609.93	71.993	71.985	71.984	-8	-9	-1
SM 6809	St Andrews Rd	697001.27	299757.44	81.800	81.777	81.778	-23	-22	1
SM 6810	St Andrews Rd	696925.56	299720.86	76.956	76.935	76.936	-21	-20	1
RM 6811	St Andrews Rd	696849.02	299715.44	76.526	76.502	76.503	-24	-23	1
RM 6813	St Andrews Rd	696631.95	299652.97	80.905	80.877	80.878	-28	-27	1
RM 6816	Rowan Rd	696721.88	299845.69	78.908	78.884	78.884	-24	-24	0
SM 6817	Rowan Rd	696808.83	299876.79	80.995	80.976	80.976	-19	-19	0
RM 6818	Rowan Rd	696826.70	299791.25	81.966	81.944	81.945	-22	-21	1
RM 6819	Buckley Rd	696678.00	299942.25	65.620	65.606	65.605	-14	-15	-1
SM 6820	Buckley Rd	696808.11	299988.79	71.955	71.946	71.946	-9	-9	0
SM 6821	Buckley Rd	696938.51	300004.30	71.114	71.108	71.107	-6	-7	-1
SM 6822	Gorrie Ave	696973.90	299863.23	81.874	81.855	81.856	-19	-18	1
SM 6823	Buckley Rd	697012.43	300021.72	70.593	70.586	70.585	-7	-8	-1
RM 6824	Buckley Rd	697044.38	300030.36	71.084	71.080	71.079	-4	-5	-1
RM 6825	Quentin Ave	697092.90	299916.80	81.386	81.374	81.372	-12	-14	-2
SM 6835	Torrance St	696969.98	300185.70	70.784	70.785	70.784	1	0	-1
SM 6836	Torrance St	696930.33	300343.26	65.955	65.957	65.956	2	1	-1
RM 6838	Fernleigh Ave	696773.28	300065.80	70.304	70.297	70.297	-7	-7	0
SM 6839	Fernleigh Ave	696748.10	300163.47	67.487	67.485	67.485	-2	-2	0
SM 6840	Fernleigh Ave	696714.69	300296.02	63.278	63.279	63.278	1	0	-1
SM 6841	Peet Ave	696626.68	300131.57	65.698	65.695	65.694	-3	-4	-1
AP 6843A	Kings Way	696958.45	299642.05	75.221	75.218	75.219	-3	-2	1
RM 7647	Mt Albert Rd	696565.00	299755.10	67.601	67.575	67.574	-26	-27	-1
ORM.I	Weaver Street	696836.50	300316.20	63.578	63.580	63.579	2	1	-1
AP 5	Mt Eden Rd	696757.00	299500.90	75.746	75.734	75.735	-12	-11	1
AP 6	Queens Way	696746.90	299590.60	75.306	75.284	75.286	-22	-20	2
AP 7A	St Andrews Rd	696778.94	299702.10	76.820	76.816	76.816	-4	-4	0
AP 8B	Mt Albert Rd	696559.06	299633.48	75.740	75.724	75.723	-16	-17	-1
AP 12	Warren Ave	696409.10	299402.20	94.357	94.337	94.339	-20	-18	2
OAP 19	St Andrews Rd	696725.00	299676.40	77.508	77.482	77.482	-26	-26	0
AP 21B	Mt Eden Rd	696995.04	299530.41	77.649	77.649	77.649		0	0
AP 22	Queens Way	697069.30	299667.60	78.352	78.343	78.346	-9	-6	3
AP 23	Queens Way	696858.57	299609.62	74.402	74.389	74.391	-13	-11	2
AP 30	Mt Eden Rd	696966.19	299525.13	77.329	77.318	77.319	-11	-10	1
AP 31	Mt Eden Rd	696934.22	299521.42	76.857	76.851	76.852	-6	-5	1
AP 32	Mt Eden Rd	696902.63	299517.81	76.203	76.193	76.193	-10	-10	0
AP 33	Mt Eden Rd	696855.06	299512.27	75.121	75.110	75.111	-11	-10	1
AP 34	Mt Eden Rd	696807.28	299506.75	74.937	74.923	74.925	-14	-12	2
SM 5387	Erson Ave	696146.21	300815.94	56.747	56.748	56.747	1	0	-1
SM 5386	Symonds St	696104.12	300983.29	55.184	55.186	55.185	2	1	-1
M 638	Manukau Rd	696081.51	301109.25	54.690	54.691	54.689	1	-1	-2
CA 55	Manukau Rd	696605.90	300894.30	65.141	65.141	65.141	0	0	0
CA 53	Akarana Ave	696935.90	298292.10	70.594	70.594	70.594	0	0	0
M 216	Mt Albert Rd	696903.54	298347.91	72.658	72.658	72.658	0	0	0

Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)		Mar 12 cf Mar 11 (mm)
		mN	mE		Mar-11	Mar-12	Mar-11	Mar-12	
SS 1977	Hillsborough Rd	696020.20	299595.82	74.453	74.448	74.447	-5	-6	-1
RM 3927	Bremner Ave	696633.32	298338.77	62.651	62.652	62.650	1	-1	-2
RM 3928	Bremner Ave	696727.76	298195.81	56.144	56.146	56.143	2	-1	-3
AP 139	Bremner Ave	696788.02	298157.42	56.225	56.224	56.222	-1	-3	-2
RM 3931	Milliken Ave	696817.47	298257.51	62.500	62.500	62.500	0	0	0
RM 3932	Milliken Ave	696733.95	298363.24	71.719	71.720	71.718	1	-1	-2
SS 3004	Dominion Rd	698058.80	298223.46	51.812	51.811	51.810	-1	-2	-1
SS 3131	Shackleton Rd	698110.53	298631.80	59.419	59.418	59.416	-1	-3	-2
SS 3133	Shackleton Rd	698071.30	298770.71	59.554	59.551	59.549	-3	-5	-2
SS 3134	Shackleton Rd	698021.66	298946.50	61.479	61.473	61.472	-6	-7	-1
SS 3135	Shackleton Rd	697966.25	299165.81	61.684	61.681	61.680	-3	-4	-1
SS 3151	Mt Eden Rd	698285.87	299497.70	67.987	67.989	67.987	2	0	-2
SS 1905	St Andrews Rd	698147.73	300049.39	88.810	88.807	88.809	-3	-1	2
AP 7707A	St Andrews Rd	697977.74	300004.98	81.535	81.535	81.536	0	1	1
SS 1558	Empire Rd	697813.79	300111.39	92.169	92.163		-6		
RM 1558A	Empire Rd	697816.18	300105.63	91.684		91.684			
SS 1559	Empire Rd	697800.00	300165.50	96.024	96.019	96.023	-5	-1	4
SS 1549	The Drive	697753.34	300348.67	85.871	85.868	85.870	-3	-1	2
SS 1550	The Drive	697589.88	300306.71	84.432	84.433	84.431	1	-1	-2
RM 6830	The Drive	697538.21	300294.84	81.638	81.637		-1		
AP 6830A	The Drive	697538.37	300293.82	81.766		81.766			
SS 1551	The Drive	697492.54	300281.71	77.481	77.479	77.477	-2	-4	-2
RM 6829	Selwyn Rd	697363.05	300258.05	79.864	79.857	79.856	-7	-8	-1
RM 6832	Selwyn Rd	697337.40	300403.57	80.190	80.190	80.189	0	-1	-1
SM 5912	Pah Rd	697278.09	300666.24	74.285	74.285	74.285	0	0	0
AP 35	Mt Albert Rd	696402.12	300407.23	54.190	54.194	54.192	4	2	-2
AP 37	Hillsborough Rd	696407.39	299705.88	59.335	59.322	59.320	-13	-15	-2
AP 38	Budock Rd	696246.76	299834.65	69.274	69.267	69.266	-7	-7	-1
AP 39	Hillsborough Bowling	696383.07	299856.28	56.297	56.292	56.290	-5	-7	-2
AP 40	Hillsborough Bowling	696445.91	299895.62	55.757	55.752	55.752	-5	-5	0
IS 41	Hillsborough Bowling	696403.82	299804.75	56.336	56.330	56.329	-6	-7	-1
AP 42	Dornwell Rd	696378.41	299015.87	76.373	76.361	76.360	-12	-13	-1
AP 43	Dornwell Rd	696260.57	298956.76	66.002	65.993	65.991	-9	-11	-2
AP 44	Dornwell Rd	696110.00	298858.85	58.493	58.483	58.480	-10	-13	-3
AP 45	Frost Rd	696471.85	298726.92	64.920	64.911	64.909	-9	-11	-2
AP 54	Frost Rd	696264.66	298577.84	57.855	57.843	57.840	-12	-15	-3
AP 46	Dominion Rd	697995.61	298226.64	50.443	50.441	50.439	-2	-4	-2
AP 47A	Landscape Rd	697951.78	298343.10	52.565	52.566	52.565	1	0	-1
AP 48A	Landscape Rd	697937.88	298463.58	57.065	57.065	57.063	0	-2	-2
AP 49B	Landscape Rd	697788.49	299044.88	70.340	70.339	70.338	-1	-2	-1
AP 50B	Landscape Rd	697766.32	299132.16	71.659	71.659	71.658	0	-1	-1
AP 51B	Landscape Rd	697745.03	299214.61	74.120	74.119	74.119	-1	-1	0
AP 55	Mt Eden Rd	698209.04	299461.78	68.263	68.264	68.262	1	-1	-2
AP 56	Mt Albert Rd	696314.42	300774.76	58.409	58.411	58.409	2	0	-2
AP 60	Rowan Rd	696681.05	299826.31	76.276	76.265	76.265	-11	-11	0
AP 61	Rowan Rd	696616.53	299797.11	71.310	71.296	71.298	-14	-12	2
AP 62	Mt Albert Rd	696530.18	299814.00	63.068	63.059		-9		
AP 62A	Mt Albert Rd	696527.21	299808.44	62.894		62.894			
AP 63A	Mt Albert Rd	696520.06	299875.15	61.370	61.368	61.366	-2	-4	-2
AP 64	Hillsborough Rd	696478.45	299774.30	60.579	60.571	60.569	-8	-10	-2
AP 65	Hillsborough Rd	696446.58	299735.84	59.546	59.535	59.533	-11	-13	-2
OAP 66	Hillsborough Rd	696359.44	299672.76	59.987	59.979	59.978	-8	-9	-1
AP 67	Hillsborough Rd	696248.43	299622.21	63.871	63.863	63.862	-8	-9	-1
OCP 68	Budock Rd	696235.97	299684.44	66.304	66.299	66.297	-5	-7	-2
AP 69	Budock Rd	696249.57	299731.19	65.977	65.972	65.970	-5	-7	-2
AP 70	Budock Rd	696244.13	299790.39	71.208	71.204	71.202	-4	-6	-2
OAP 71	Hillsborough Rd	696195.17	299615.83	67.651	67.646	67.644	-5	-7	-2
AP 72	Hillsborough Rd	696072.41	299594.01	74.077	74.072	74.071	-5	-6	-1
AP 73	Marie Ave	696238.34	299544.47	70.874	70.864	70.864	-10	-10	0
AP 74	Marie Ave	696260.93	299489.18	80.330	80.319	80.320	-11	-10	1
AP 75	Marie Ave	696280.07	299452.86	86.876	86.869	86.871	-7	-5	2
AP 77	Mt Albert Rd	696539.58	299487.18	82.751	82.739		-12		
AP 77A	Mt Albert Rd	696539.72	299479.95	83.034		83.034			
AP 78	Mt Albert Rd	696559.36	299551.48	81.022	81.011	81.012	-11	-10	1
AP 79	Mt Albert Rd	696558.48	299588.52	78.663	78.653	78.653	-10	-10	0
AP 80	Mt Albert Rd	696561.89	299691.52	71.414	71.402	71.401	-12	-13	-1
AP 81A	Mt Albert Rd	696501.72	300015.21	58.551	58.549	58.547	-2	-4	-2
AP 82A	Mt Albert Rd	696507.72	299991.38	58.575	58.574	58.572	-1	-3	-2
AP 83	Mt Albert Rd	696514.36	299966.95	58.863	58.860	58.858	-3	-5	-2
AP 84	Mt Albert Rd	696520.40	299943.25	59.350	59.347	59.344	-3	-6	-3
AP 85	Mt Albert Rd	696516.23	299894.40	60.619	60.614	60.611	-5	-8	-3
AP 86	Mt Albert Rd	696524.80	299855.75	62.051	62.046	62.044	-5	-7	-2
AP 87	Mt Albert Rd	696530.55	299833.50	62.733	62.728	62.726	-5	-7	-2
AP 88	Mt Albert Rd	696541.65	299788.51	64.828	64.817		-11		
AP 88A	Mt Albert Rd	696541.44	299788.97	64.679		64.679			

Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)		Mar 12 cf Mar 11 (mm)
		mN	mE		Mar-11	Mar-12	Mar-11	Mar-12	
AP 89	Mt Albert Rd	696560.86	299777.80	65.939	65.931	65.929	-8	-10	-2
AP 90	Mt Albert Rd	696562.93	299734.25	68.687	68.678	68.677	-9	-10	-1
AP 91	Mt Albert Rd	696562.43	299712.45	70.075	70.067	70.066	-8	-9	-1
AP 92	Mt Albert Rd	696560.50	299673.84	72.613	72.616	72.620	3	7	4
AP 93	Mt Albert Rd	696559.89	299657.17	73.864	73.857	73.856	-7	-8	-1
AP 94	Mt Albert Rd	696558.57	299610.31	77.101	77.092	77.093	-9	-8	1
AP 95	Mt Albert Rd	696559.21	299569.96	79.957	79.947	79.948	-10	-9	1
AP 96	St Andrews Rd	696582.87	299641.10	77.897	77.888	77.890	-9	-7	2
AP 97	St Andrews Rd	696607.72	299646.90	80.321	80.313	80.313	-8	-8	0
AP 98	Rowan Rd	696588.07	299763.68	68.501	68.493	68.493	-8	-8	0
AP 99	Rowan Rd	696594.23	299786.13	69.478	69.470	69.470	-8	-8	0
AP 100	Hillsborough Rd	696521.99	299784.89	62.966	62.957	62.955	-9	-11	-2
AP 101	Hillsborough Rd	696494.72	299786.95	61.359	61.351	61.350	-8	-9	-1
AP 102	Hillsborough Rd	696457.24	299761.13	60.006	59.999	59.997	-7	-9	-2
AP 103	Hillsborough Rd	696427.81	299719.78	59.404	59.394	59.393	-10	-11	-1
AP 104A	Hillsborough Rd	696385.14	299690.23	59.554	59.547	59.545	-7	-9	-2
AP 105	Hillsborough Rd	696373.80	299682.70	59.711	59.704	59.702	-7	-9	-2
AP 106	Hillsborough Rd	696341.88	299660.52	60.458	60.453	60.452	-5	-6	-1
AP 107	Hillsborough Rd	696324.59	299648.55	60.881	60.875	60.874	-6	-7	-1
AP 108	Hillsborough Rd	696290.76	299628.82	62.060	62.055	62.054	-5	-6	-1
AP 109	Hillsborough Rd	696270.02	299627.79	62.806	62.801	62.799	-5	-7	-2
AP 110	Hillsborough Rd	696230.60	299619.62	64.997	64.990	64.988	-7	-9	-2
AP 111	Hillsborough Rd	696213.05	299617.07	66.322	66.318	66.316	-4	-6	-2
AP 112	Budock Rd	696247.78	299639.80	63.699	63.695	63.693	-4	-6	-2
AP 113	Budock Rd	696235.55	299662.37	65.546	65.544	65.543	-2	-3	-1
AP 114	Budock Rd	696238.48	299707.28	65.879	65.885	65.884	6	5	-1
AP 115	Budock Rd	696251.17	299753.13	67.579	67.575	67.573	-4	-6	-2
AP 116	Budock Rd	696251.91	299773.34	69.485	69.483	69.481	-2	-4	-2
AP 117	Budock Rd	696245.16	299811.84	70.833	70.838	70.842	5	9	4
OAP 118	Mt Albert Rd	696509.17	299918.39	59.895	59.889	59.887	-6	-8	-2
AP 119A	Haughey Ave	696164.45	299223.61	72.891	72.889		-6		
AP 119B	Haughey Ave	696153.08	299217.86	71.930		71.930			
AP 120	Haughey Ave	696109.88	299304.27	67.450	67.445	67.443	-5	-7	-2
AP 121	Haughey Ave	696056.80	299385.05	66.666	66.660	66.659	-6	-7	-1
AP 122	Haughey Ave	696006.86	299462.68	66.032	66.027	66.026	-5	-6	-1
AP 123A	Haughey Ave	695959.41	299557.72	73.518	73.518	73.517	0	-1	-1
AP 125A	Hillsborough Rd	695847.28	299535.57	69.946	69.947	69.944	1	-2	-3
SS 1976	Hillsborough Rd	695759.40	299503.94	71.137	71.129	71.127	-8	-10	-2
AP 126A	Carr Rd	695885.14	299465.23	65.244	65.245	65.240	1	-4	-5
AP 127A	Carr Rd	695905.29	299374.82	61.514	61.514	61.511	0	-3	-3
RM 7441	Carr Rd	695901.87	299261.38	58.499	58.495	58.492	-4	-7	-3
AP 129A	Carr Rd	695938.31	299190.92	58.156	58.155	58.152	-1	-4	-3
OAP 130	Dornwell Rd	696185.75	298907.65	60.670	60.667	60.664	-3	-6	-3
OAP 131	Hayr Rd	696067.40	299157.71	63.120	63.118	63.115	-2	-5	-3
AP142	Carr/Hayr Rds	695981.15	299082.87	58.438	58.439	58.436		-2	-3
AP 132A	Carr Rd	696037.11	298976.78	58.345	58.345				
AP 132B	Carr Rd	696036.51	298977.06	58.355		58.355			
AP 133	Carr Rd	696128.84	298776.82	58.156	58.155	58.151	-1	-5	-4
AP 134	Carr Rd	696177.86	298685.47	58.033	58.032	58.029	-1	-4	-3
AP 135	Frost Rd	696157.94	298506.10	57.399	57.400	57.397	1	-2	-3
AP 136	Frost Rd	696363.44	298640.34	59.265	59.262	59.260	-3	-5	-2


Differential Settlement Alarm Marks
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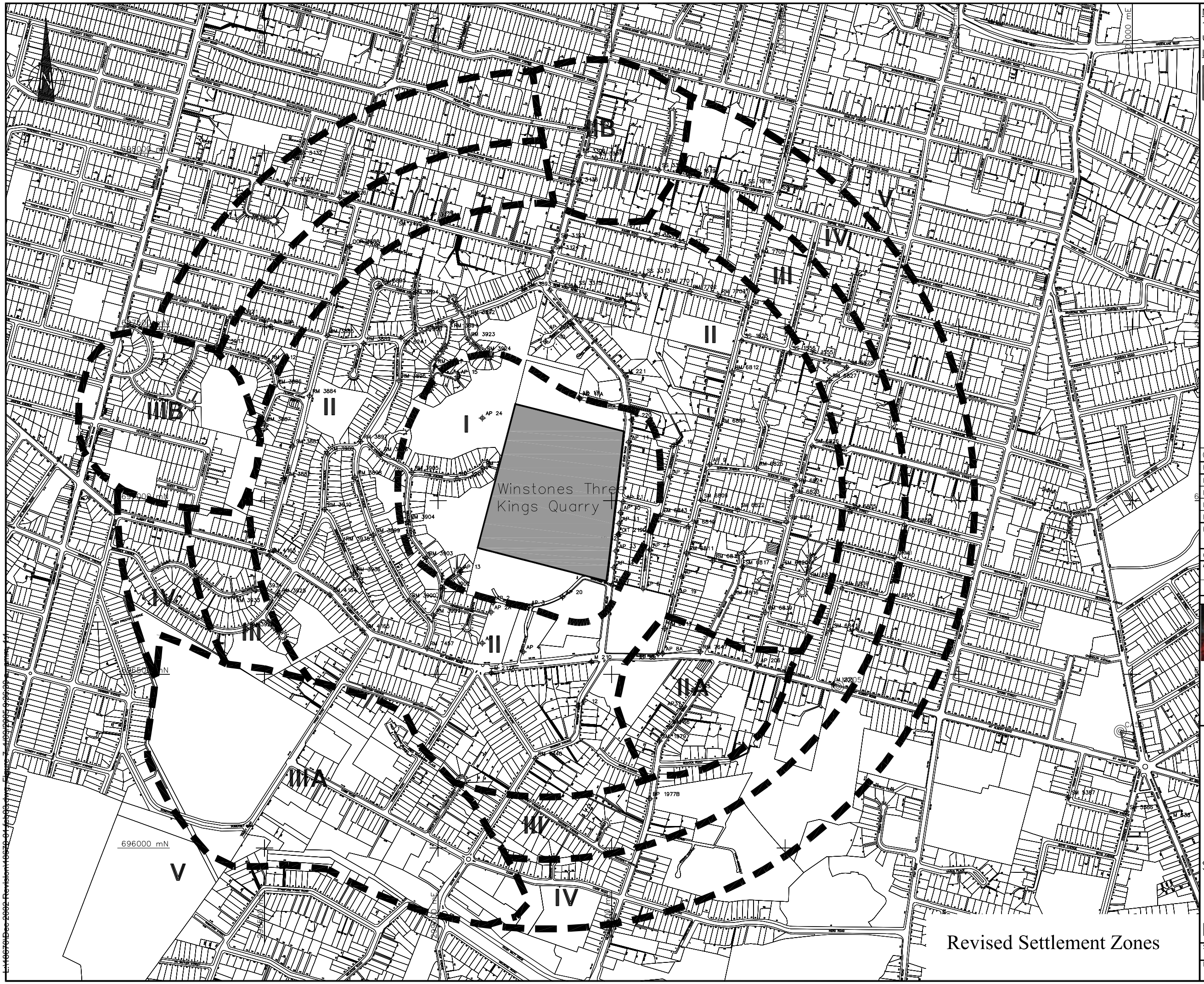
AP 92
AP 93
AP 80

ST-ANDREWS RESERVE

Liquor ban area



Revised Settlement Zones

NOTES

1. All dimensions are in metres unless noted otherwise.

LEGEND

Quarry

0	First Issue		
REVISION DESCRIPTION		BY	DATE
DESIGNED :			
DRAWN :		AMM	OCT 02
DESIGN CHECKED :			
DRAFTING CHECKED :			
REFERENCE :			

CADFILE : L:\18670\18670-01

APPROVED :

NOT FOR CONSTRUCTION

This drawing is not to be used for construction purposes unless signed as approved

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Environmental & Engineering Consultants
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Email : auck@tonkin.co.nz
□Wellington □Christchurch
□Hamilton □Nelson □Whangarei

WINSTONE AGGREGATES LTD

THREE KINGS QUARRY DEWATERING

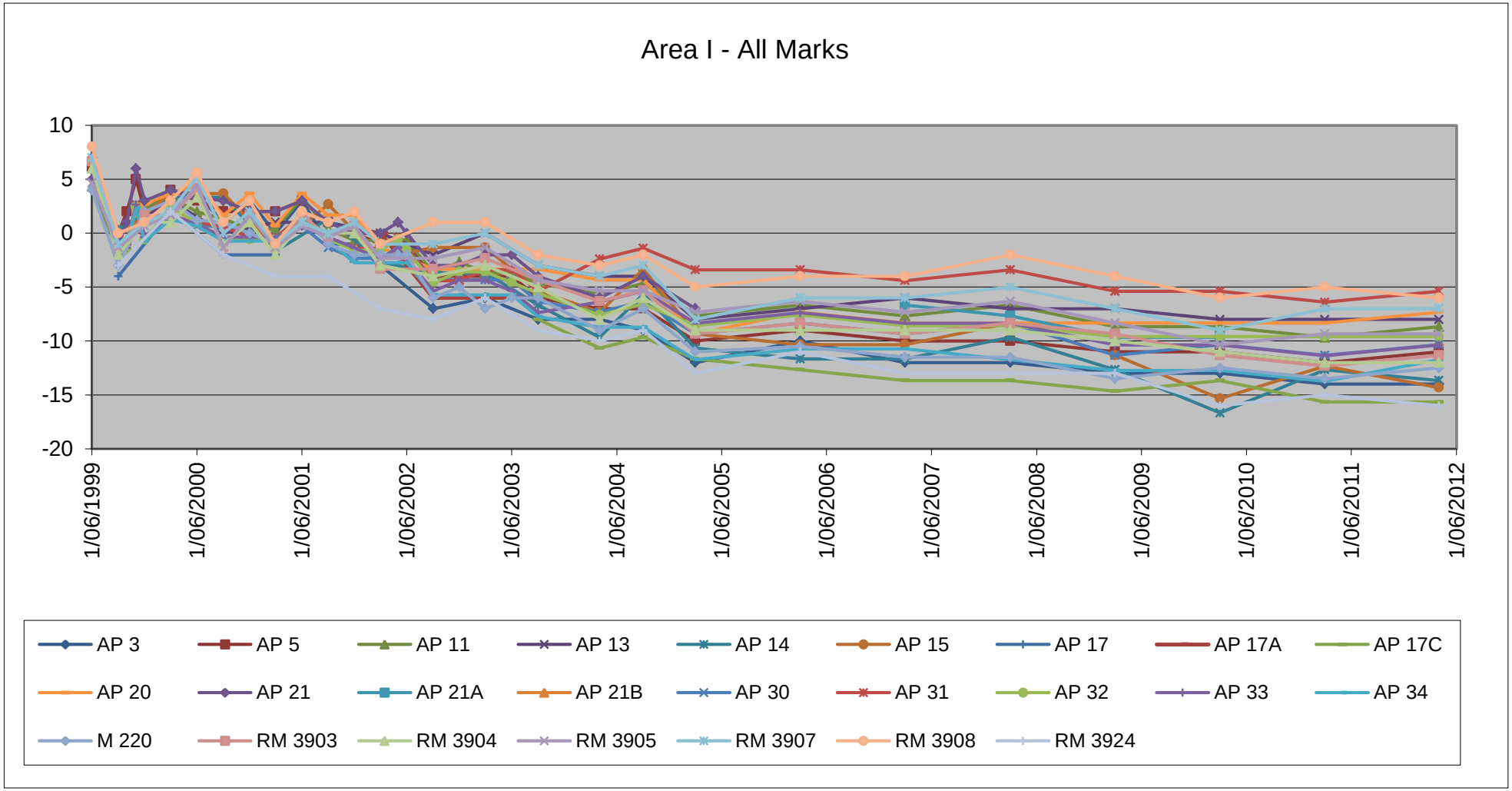
REVIEW OF SETTLEMENT PREDICTIONS

Figure 7

SCALES (AT A3 SIZE) 1: 10000

DWG. No. 18670-04

REV. 0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AP 3
AP 5
AP 11
AP 13
AP 14
AP 15
AP 17
AP 17A
AP 17C
AP 20
AP 21
AP 21A
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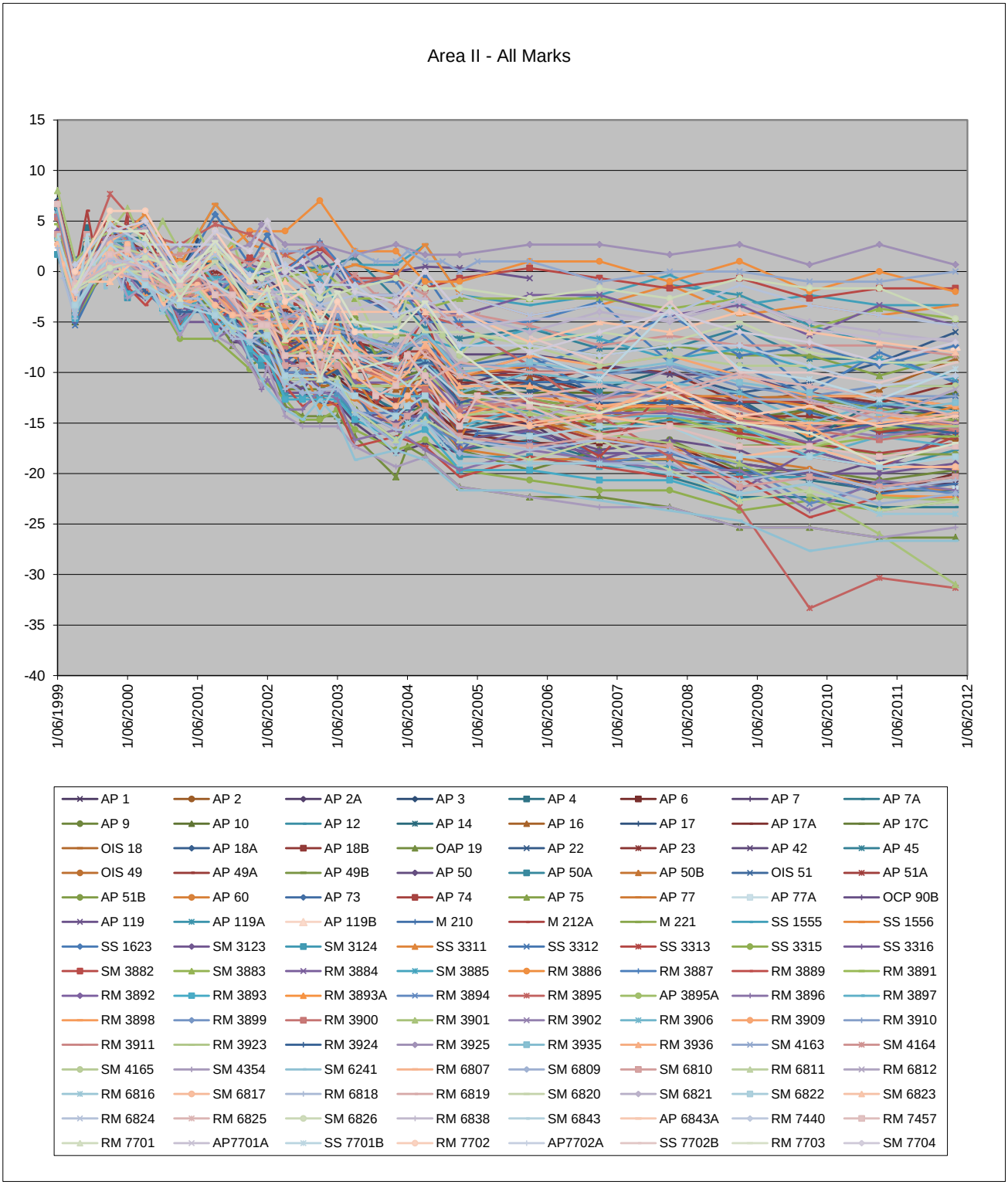
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AP 4
AP 6
AP 7
AP 7A
AP 9
AP 10
AP 12
AP 14
AP 16
AP 17
AP 17A
AP 17C
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AP 18B
OAP 19
AP 22
AP 23
AP 42
AP 45
OIS 49
AP 49A
AP 49B
AP 50
AP 50A
AP 50B
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AP 73
AP 74
AP 75
AP 77
AP 77A
OCP 90B
AP 119
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AP 119B
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M 221
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SS 1556
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SS 3312
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SS 3316
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SM 3883
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RM 3899
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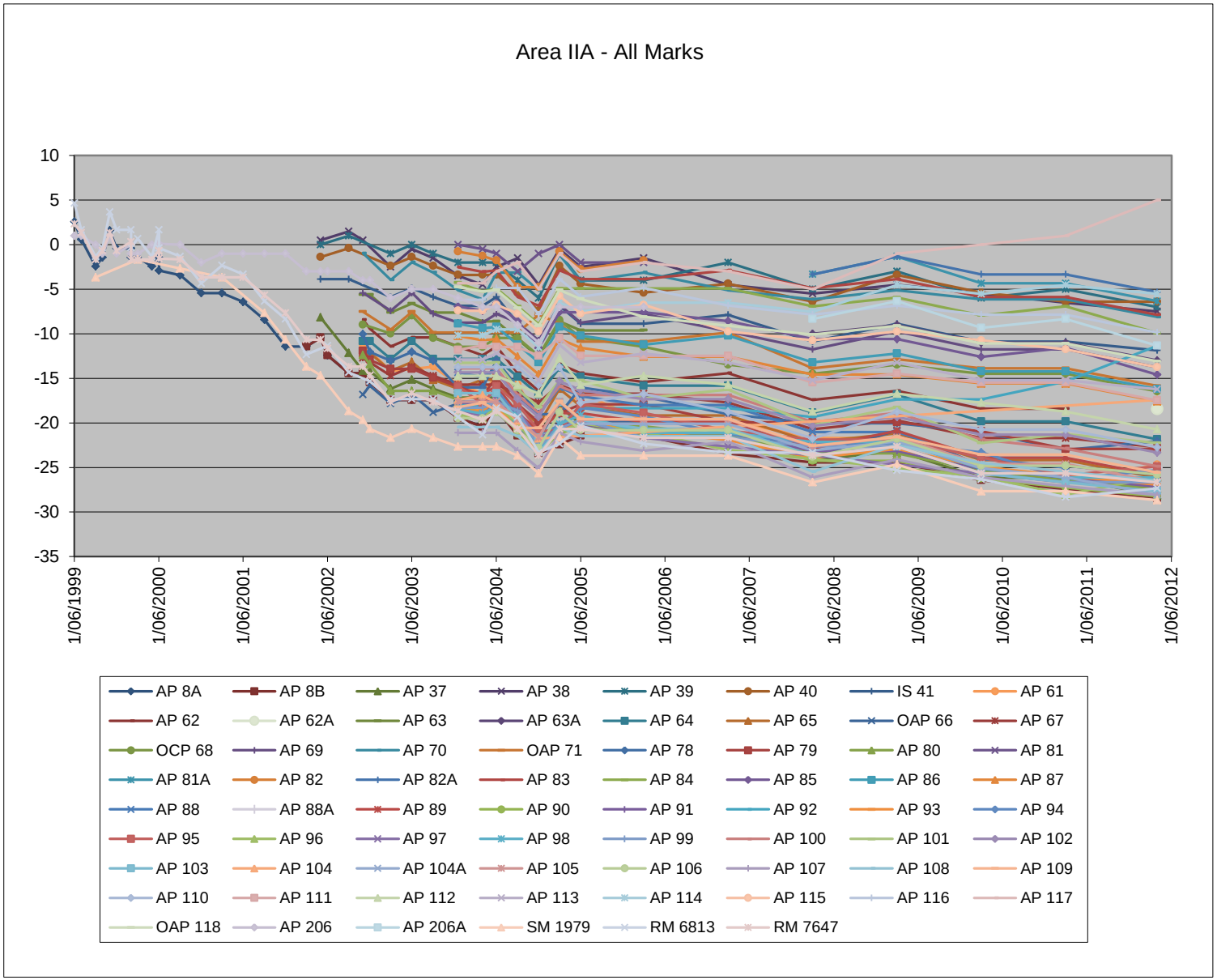
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AP 39
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AP 61
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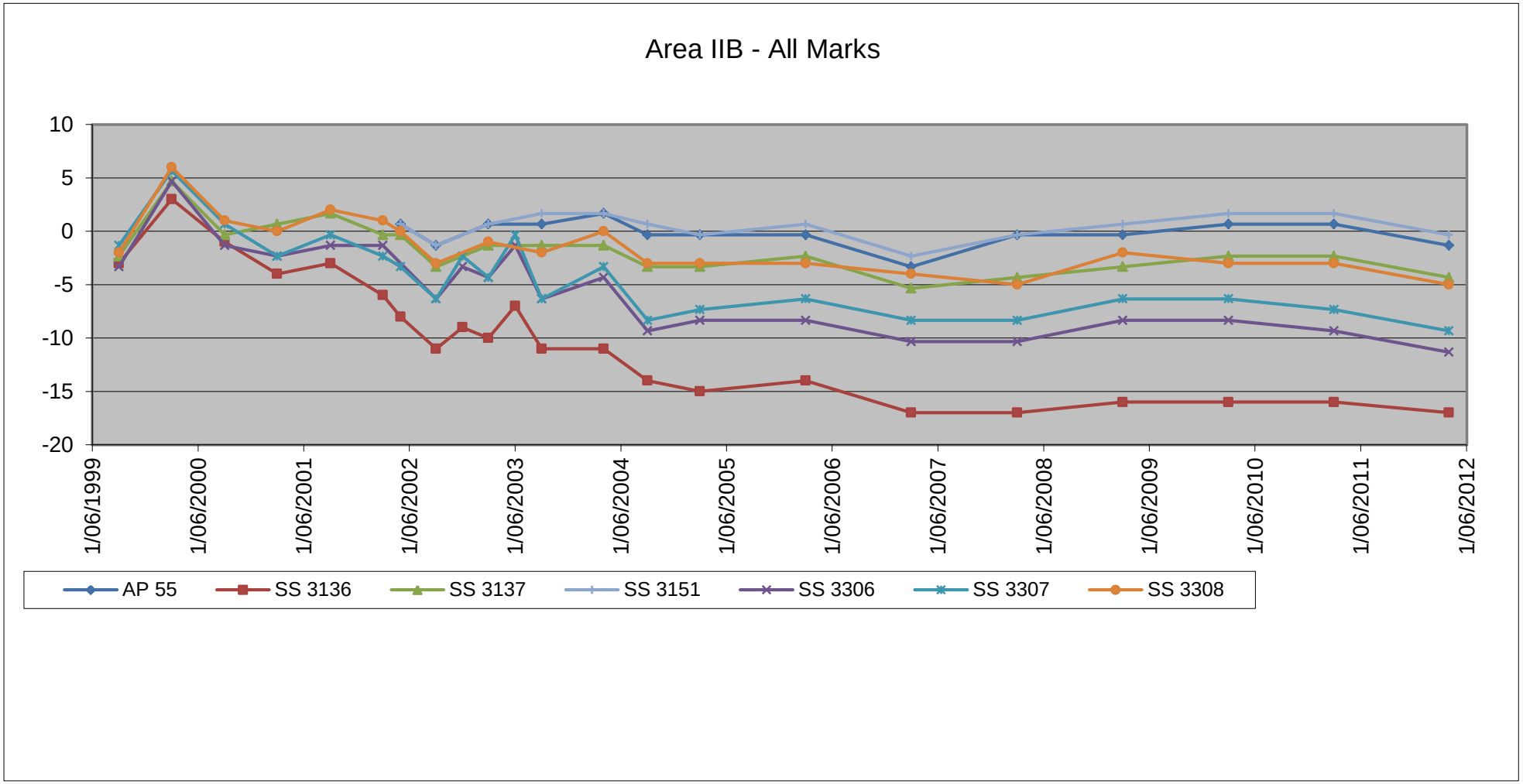
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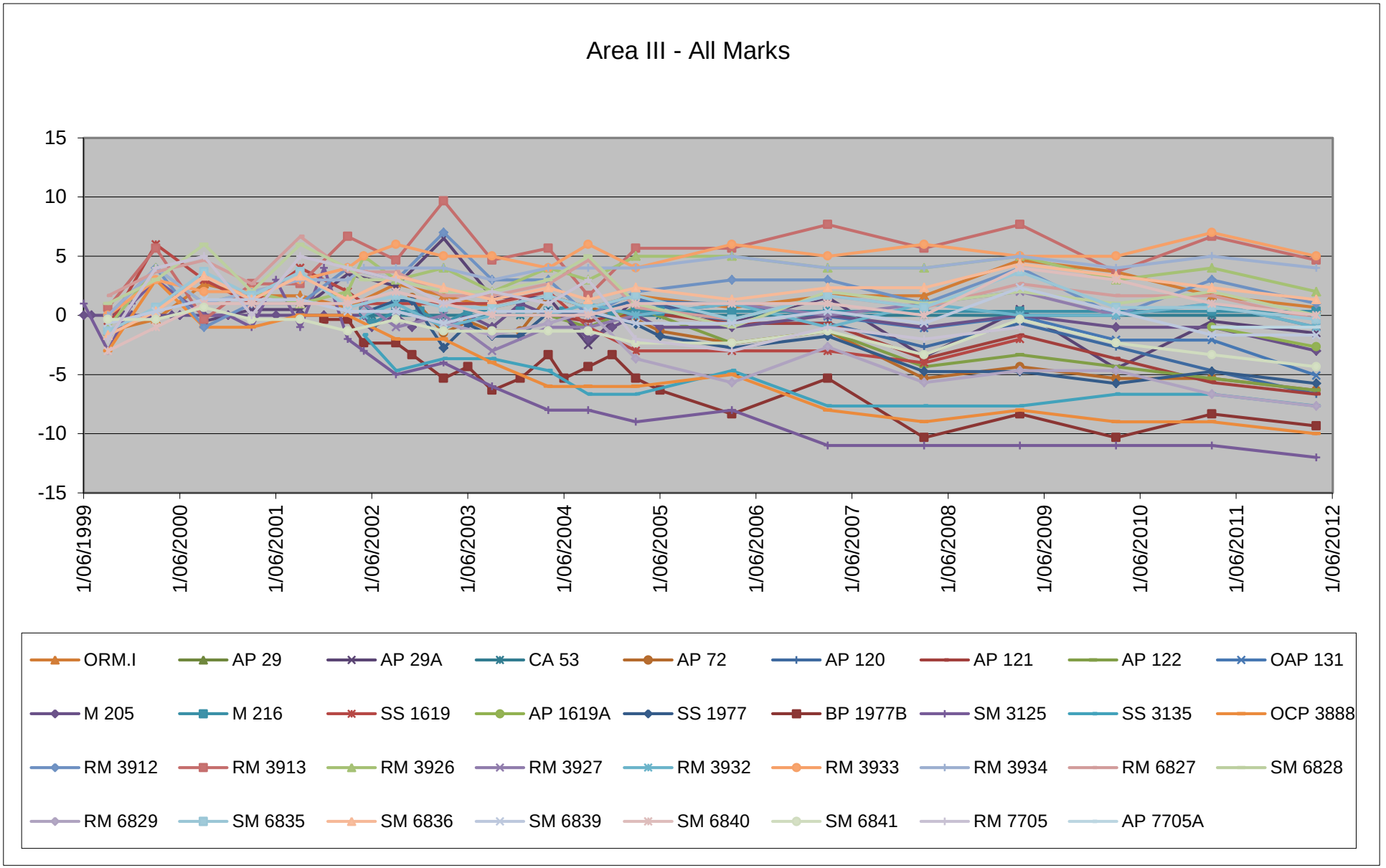
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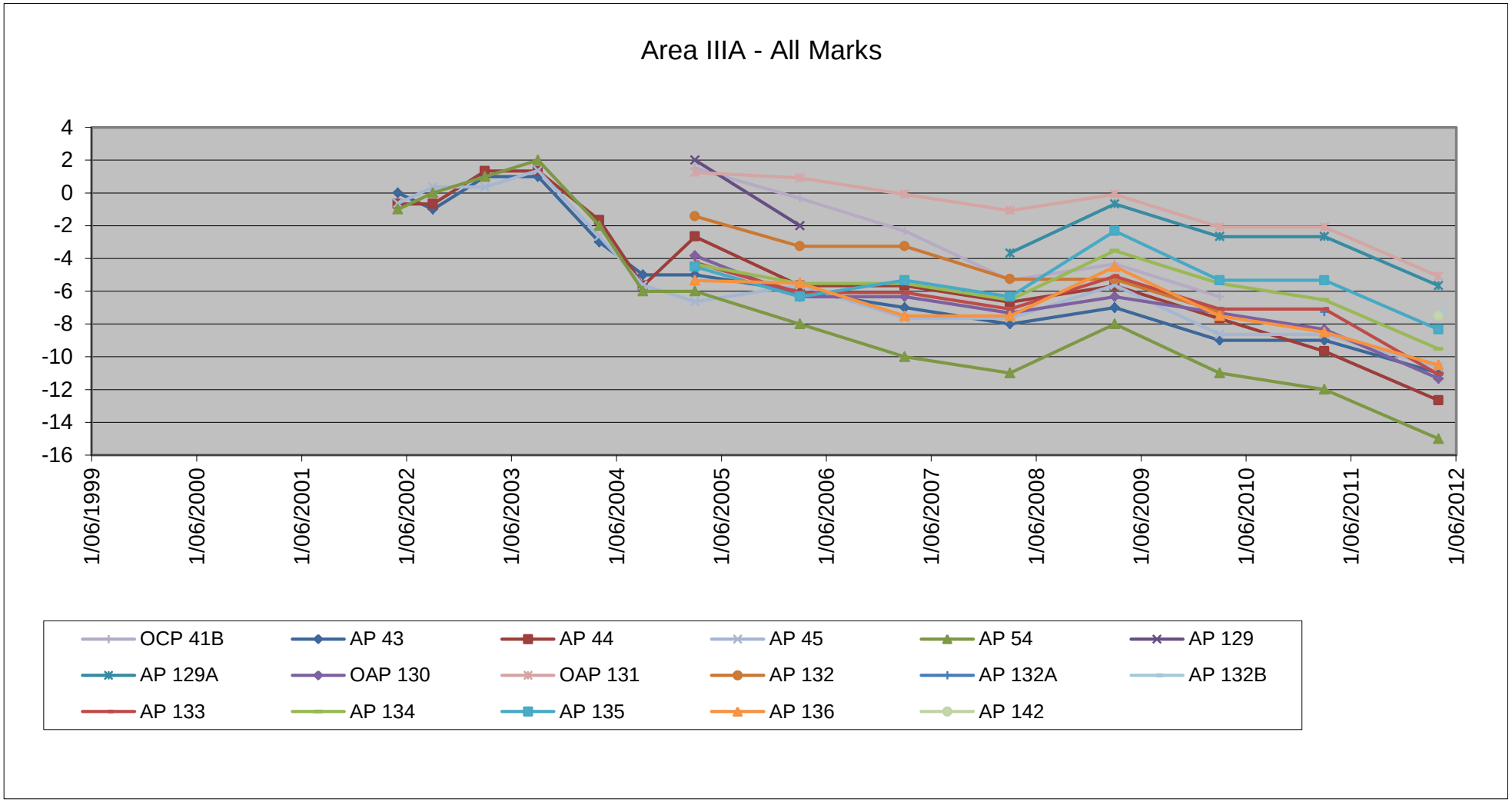
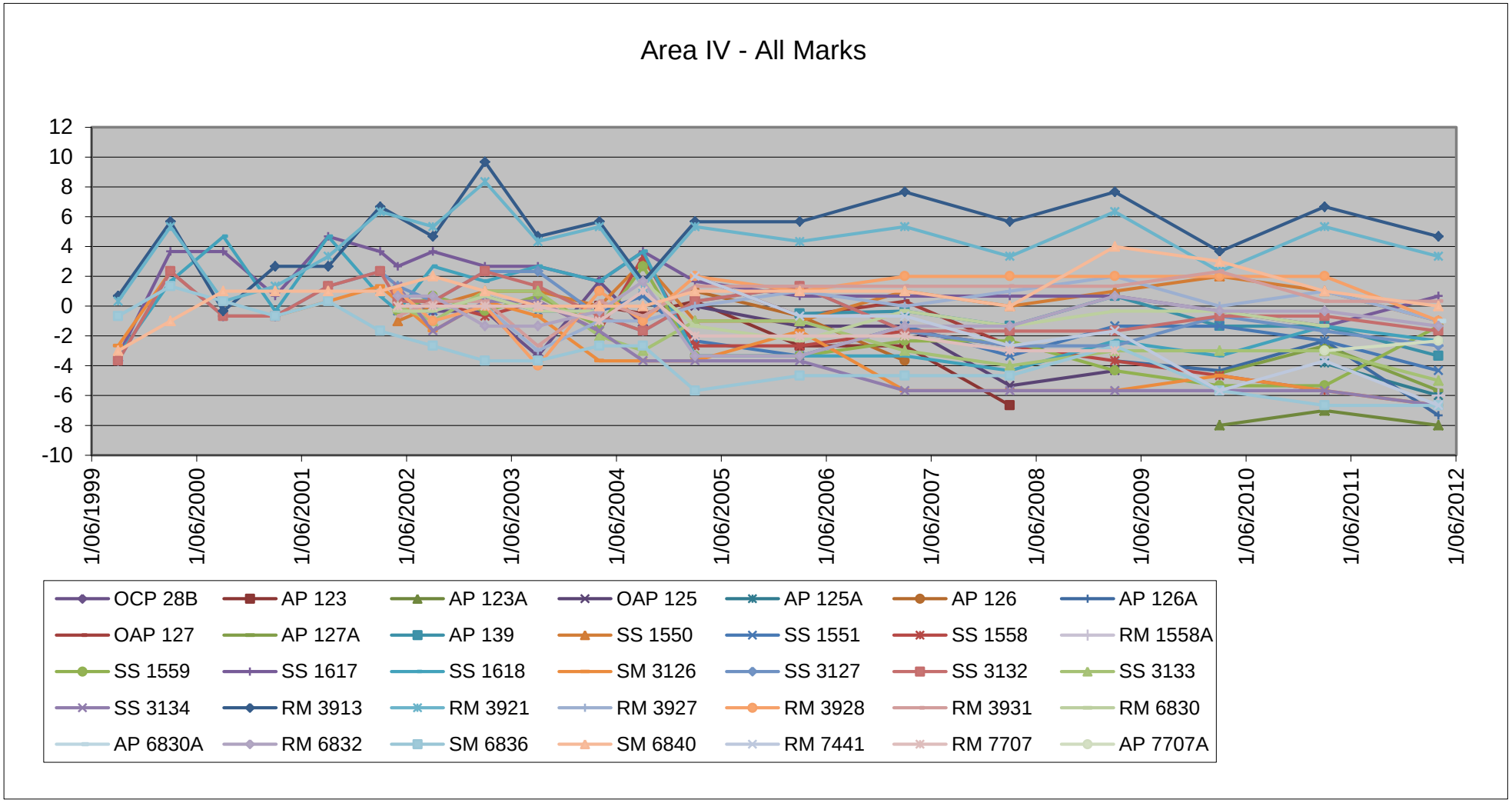
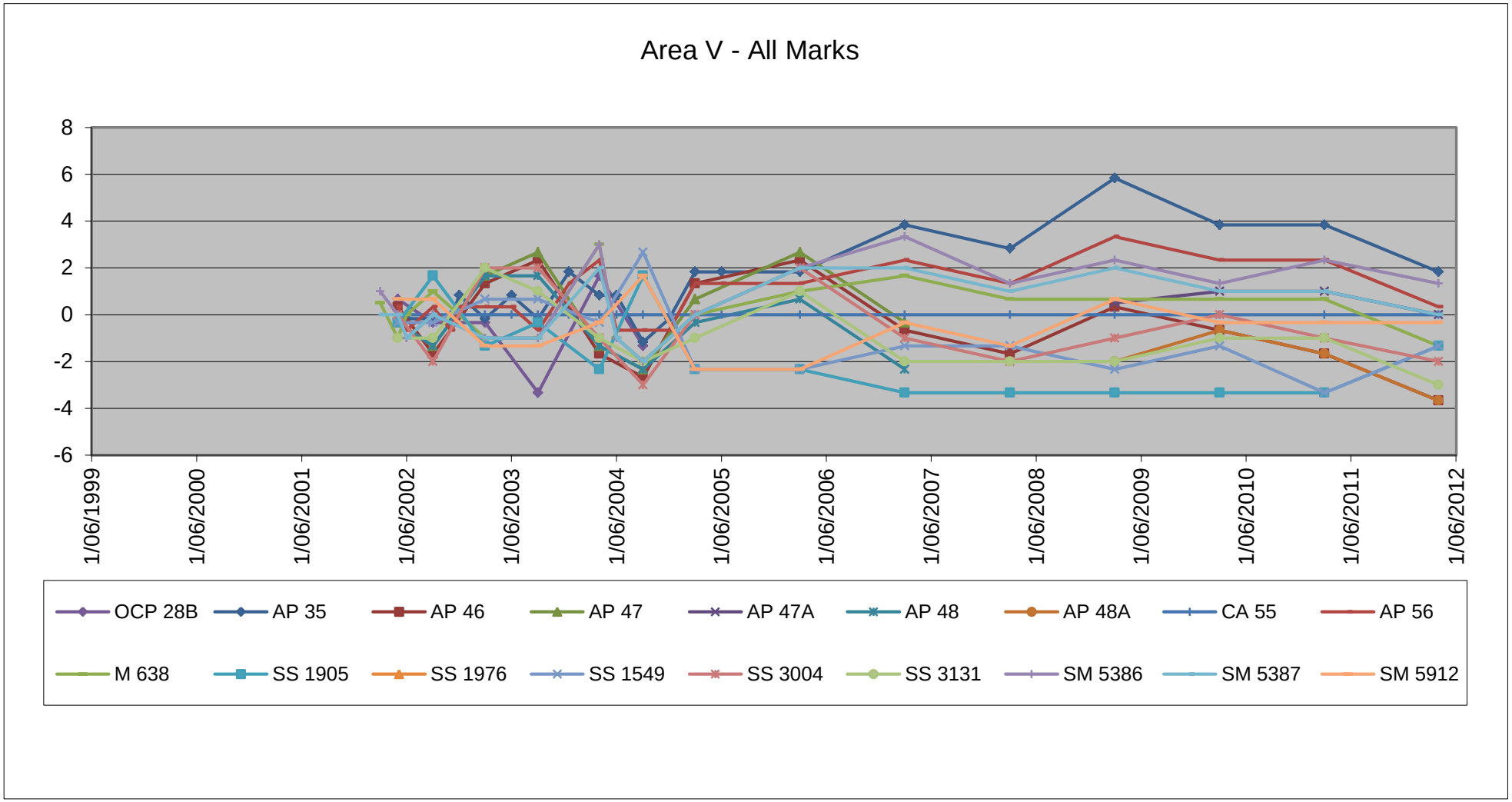
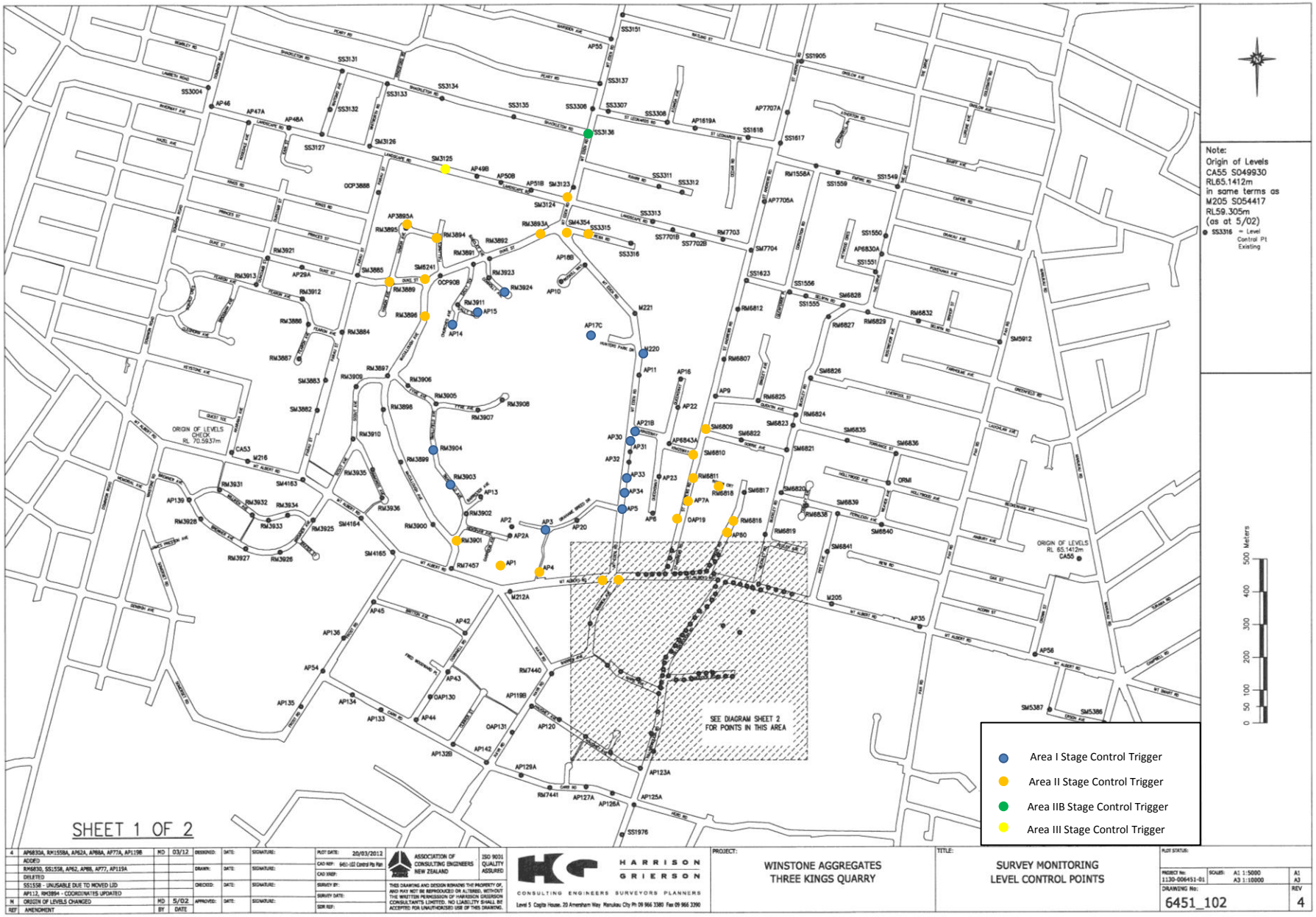
AP 1619A
SS 1977
BP 1977B
SM 3125
SS 3135
OCP 3888
RM 3912
RM 3913
RM 3926
RM 3927
RM 3932
RM 3933
RM 3934
RM 6827
SM 6828
RM 6829
SM 6835
SM 6836
SM 6839
SM 6840
SM 6841
RM 7705
AP 7705A


Area IIIA - All Marks
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
1/06/1999
1/06/2000
1/06/2001
1/06/2002
1/06/2003
1/06/2004
1/06/2005
1/06/2006
1/06/2007
1/06/2008
1/06/2009
1/06/2010
1/06/2011
1/06/2012
OCP 41B
AP 43
AP 44
AP 45
AP 54
AP 129
AP 129A
OAP 130
OAP 131
AP 132
AP 132A
AP 132B
AP 133
AP 134
AP 135
AP 136
AP 142


Area IV - All Marks
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
1/06/1999
1/06/2000
1/06/2001
1/06/2002
1/06/2003
1/06/2004
1/06/2005
1/06/2006
1/06/2007
1/06/2008
1/06/2009
1/06/2010
1/06/2011
1/06/2012
OCP 28B
AP 123
AP 123A
OAP 125
AP 125A
AP 126
AP 126A
OAP 127
AP 127A
AP 139
SS 1550
SS 1551
SS 1558
RM 1558A
SS 1559
SS 1617
SS 1618
SM 3126
SS 3127
SS 3132
SS 3133
SS 3134
RM 3913
RM 3921
RM 3927
RM 3928
RM 3931
RM 6830
AP 6830A
RM 6832
SM 6836
SM 6840
RM 7441
RM 7707
AP 7707A


Area V - All Marks
8
6
4
2
0
-2
-4
-6
1/06/1999
1/06/2000
1/06/2001
1/06/2002
1/06/2003
1/06/2004
1/06/2005
1/06/2006
1/06/2007
1/06/2008
1/06/2009
1/06/2010
1/06/2011
1/06/2012
OCP 28B
AP 35
AP 46
AP 47
AP 47A
AP 48
AP 48A
CA 55
AP 56
M 638
SS 1905
SS 1976
SS 1549
SS 3004
SS 3131
SM 5386
SM 5387
SM 5912



REF	AMENDMENT	BY	DATE
4	AP6830A, RM1558A, AP62A, AP88A, AP77A, AP119B ADDED	MD	03/12
	RM6830, SS1558, AP62, AP88, AP77, AP119A DELETED		
	SS1558 - UNUSABLE DUE TO MOVED LID		
	AP112, RM3894 - COORDINATES UPDATED		
N	ORIGIN OF LEVELS CHANGED	MD	5/02

DESIGNED: DATE: SIGNATURE:
DRAWN: DATE: SIGNATURE:
CHECKED: DATE: SIGNATURE:
APPROVED: DATE: SIGNATURE:

PLOT DATE: 20/03/2012
CAD REF: 6451-102 Control Pts Plan
CAD XREF:
SURVEY BY:
SURVEY DATE:
SDR REF:

ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND | ISO 9001 QUALITY ASSURED

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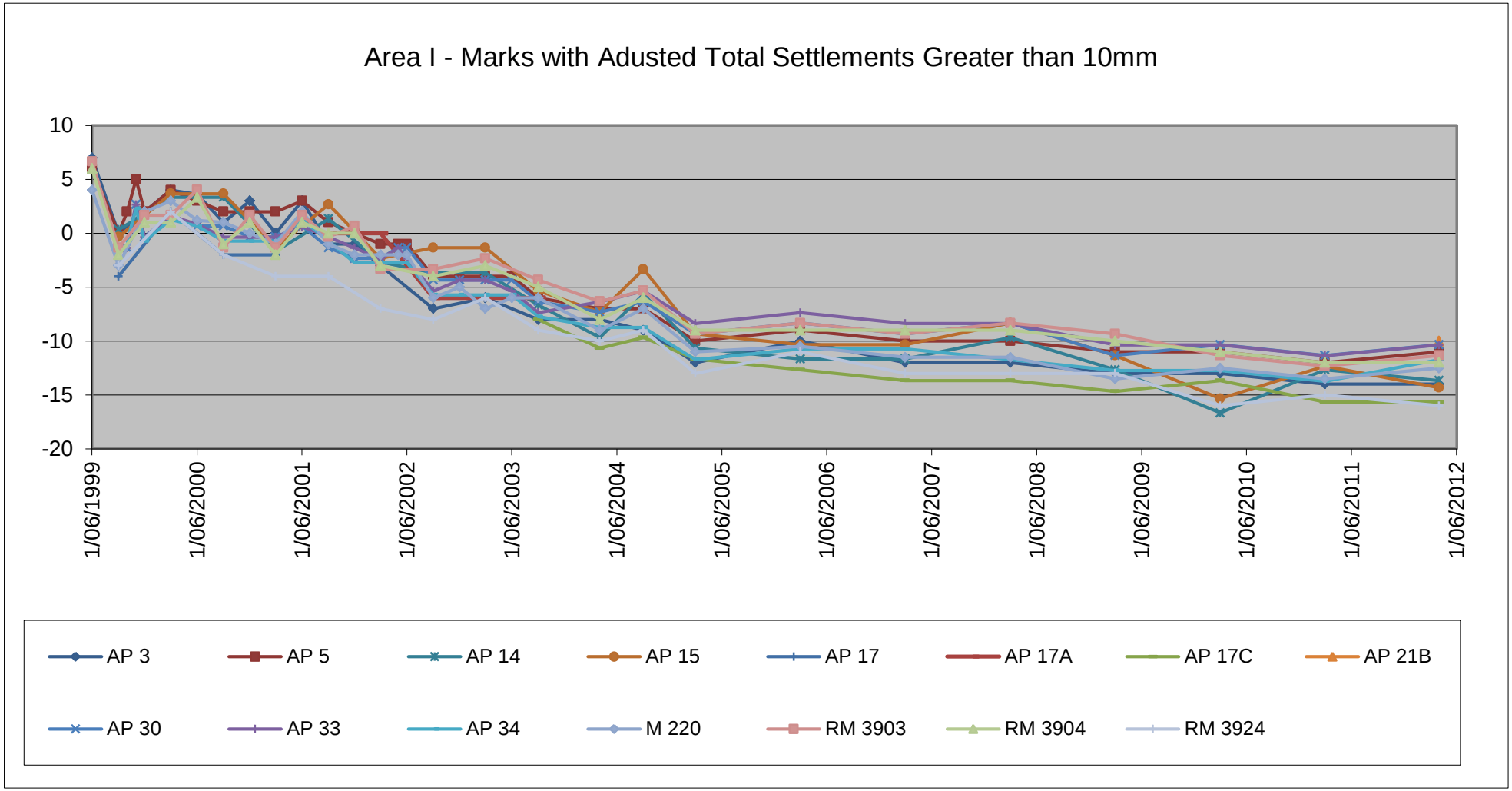
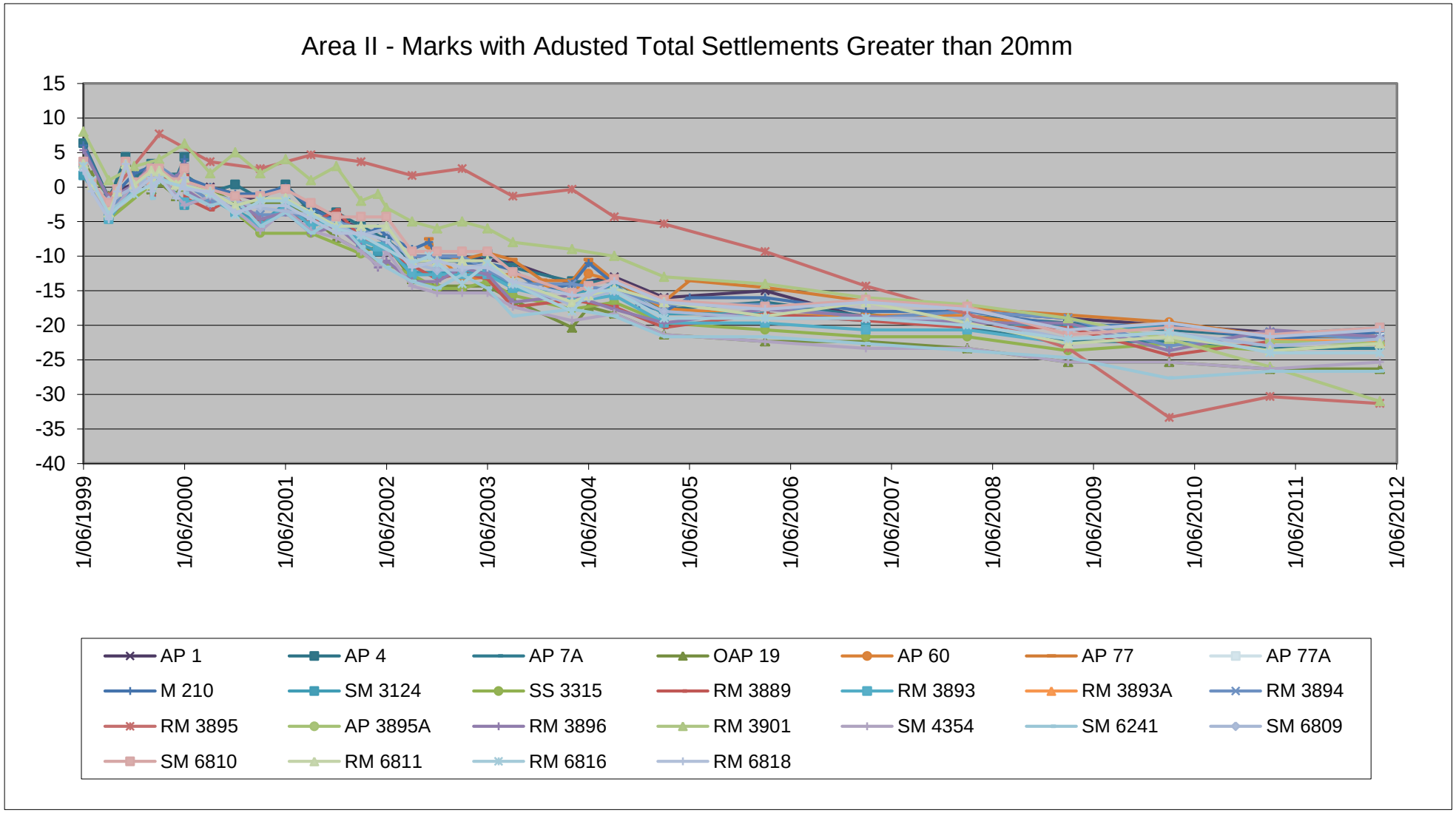
Level 5 Cagita House, 20 Amersham Way Manukau City Ph 09 966 3380 Fax 09 966 3390

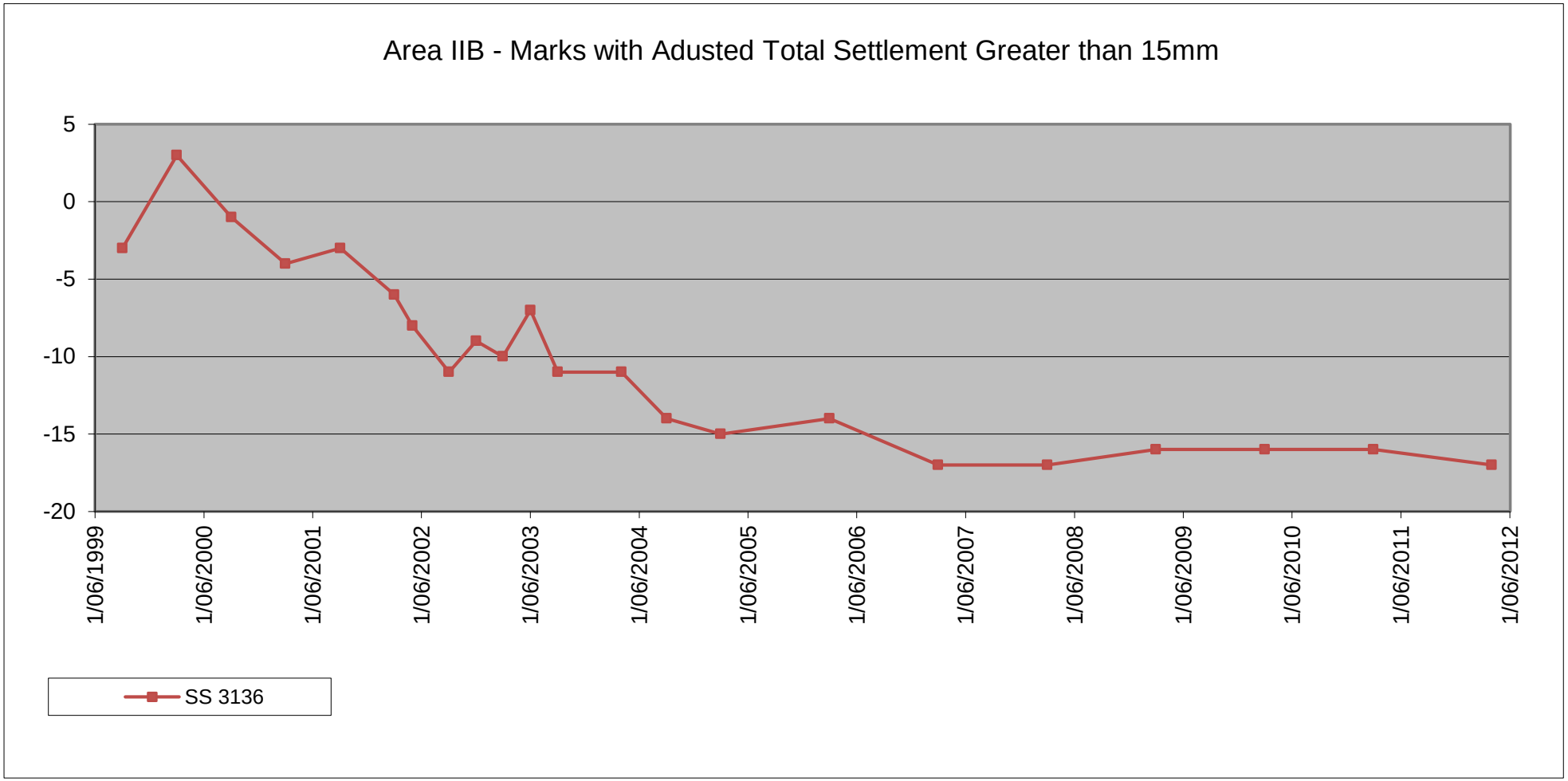
PROJECT: WINSTONE AGGREGATES THREE KINGS QUARRY

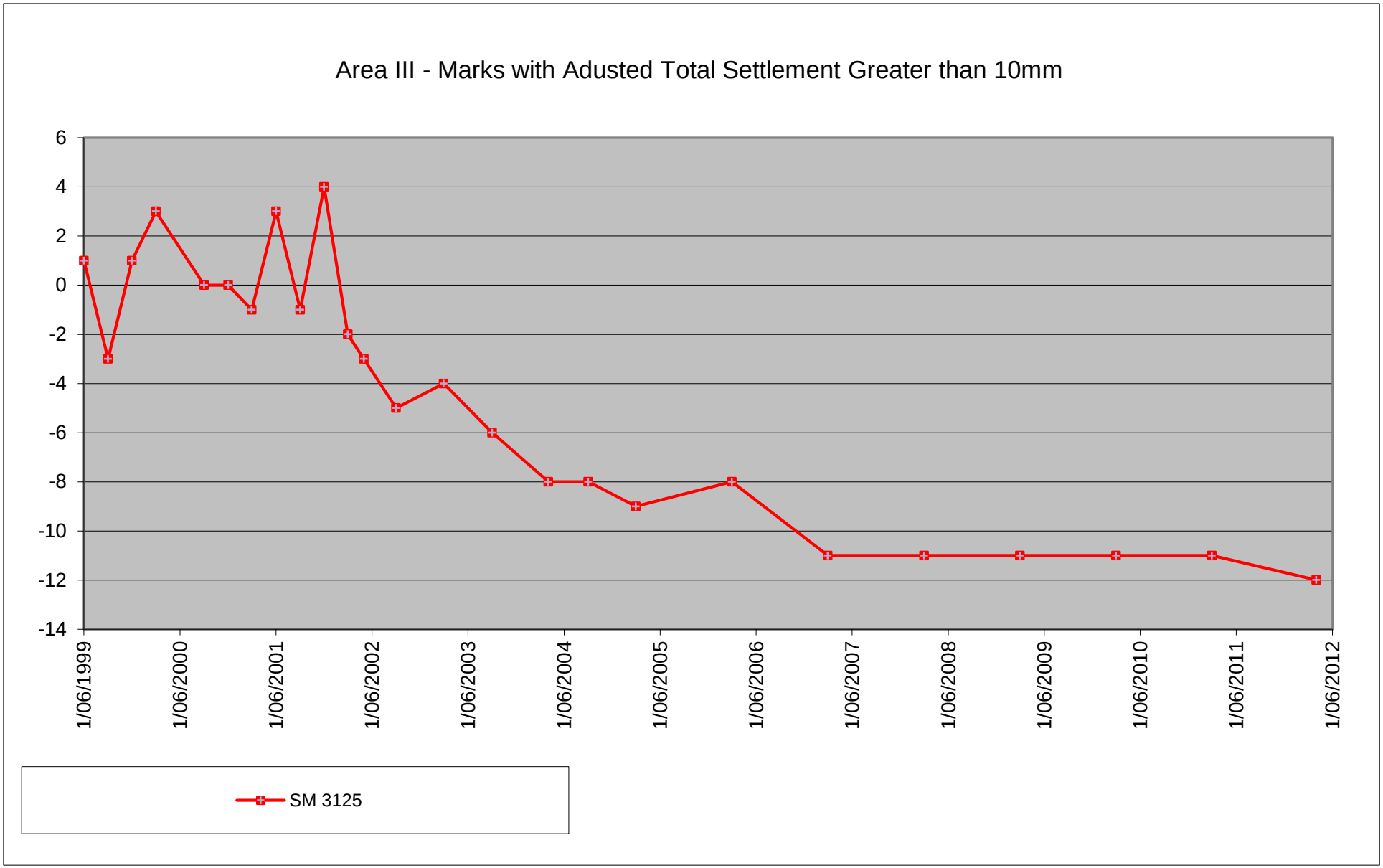
TITLE: SURVEY MONITORING LEVEL CONTROL POINTS

PLOT STATUS:
PROJECT No: 1130-006451-01
SCALES: A1 1:5000 A3 1:10000
A1 A3
DRAWING No: 6451_102
REV 4


Area I - Marks with Adusted Total Settlements Greater than 10mm
10
5
0
-5
-10
-15
-20
1/06/1999
1/06/2000
1/06/2001
1/06/2002
1/06/2003
1/06/2004
1/06/2005
1/06/2006
1/06/2007
1/06/2008
1/06/2009
1/06/2010
1/06/2011
1/06/2012
AP 3
AP 5
AP 14
AP 15
AP 17
AP 17A
AP 17C
AP 21B
AP 30
AP 33
AP 34
M 220
RM 3903
RM 3904
RM 3924


Area II - Marks with Adusted Total Settlements Greater than 20mm
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
1/06/1999
1/06/2000
1/06/2001
1/06/2002
1/06/2003
1/06/2004
1/06/2005
1/06/2006
1/06/2007
1/06/2008
1/06/2009
1/06/2010
1/06/2011
1/06/2012
AP 1
AP 4
AP 7A
OAP 19
AP 60
AP 77
AP 77A
M 210
SM 3124
SS 3315
RM 3889
RM 3893
RM 3893A
RM 3894
RM 3895
AP 3895A
RM 3896
RM 3901
SM 4354
SM 6241
SM 6809
SM 6810
RM 6811
RM 6816
RM 6818


Area IIB - Marks with Adusted Total Settlement Greater than 15mm
5
0
-5
-10
-15
-20
1/06/1999
1/06/2000
1/06/2001
1/06/2002
1/06/2003
1/06/2004
1/06/2005
1/06/2006
1/06/2007
1/06/2008
1/06/2009
1/06/2010
1/06/2011
1/06/2012
SS 3136


Area III - Marks with Adusted Total Settlement Greater than 10mm
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
1/06/1999
1/06/2000
1/06/2001
1/06/2002
1/06/2003
1/06/2004
1/06/2005
1/06/2006
1/06/2007
1/06/2008
1/06/2009
1/06/2010
1/06/2011
1/06/2012
SM 3125