Contractor

Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project

FORTH REPLACEMENT CROSSING

Document title

AIR QUALITY MONITORING REPORT

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Contents

1. INTRODUCTION

1.1. Air quality monitoring is being undertaken by FCBC during the construction of the Forth Replacement Crossing and the associated road network. This report details the air quality monitoring that is currently being undertaken across the site and presents the monitoring results for April 2013.

1.2. Air quality monitoring during this period has been undertaken in accordance with the Code of Construction Practice (CoCP) and the Dust and Air Pollution Management Plan (DAPMP) contained within the Environmental Management Plan (EMP).

2. MONITORING EQUIPMENT AND LOCATIONS

2.1. Air quality is being monitored on site using both automatic light scatter dust meters and Frisbee gauge dust deposition monitoring. Thirteen Frisbee gauges are set up at sensitive locations across the site to measure dust deposition rates (Figure 1). Seven automatic light scatter meters have also been installed at various sensitive locations to measure real time particulate matter (PM_{10}) concentrations and the Total Suspended Particle (TSP) concentrations (Figure 2). Table 1 lists the air quality monitoring equipment present at each monitoring location. The installation of the air quality monitoring equipment was not simultaneous across the site, thus installation dates are also given in Table 1.

2.2. Light scatter type monitoring equipment have been selected as a site monitoring tool to create a live network which assesses the levels of fugitive particulate matter, principally airborne dust. These monitors require less space, maintenance and power than other real time monitors such as a Tapered Element Oscillating Microbalance (TEOM) which is used and designed to measure particulate levels to exceedingly high standards, including measuring long-term compliance to statutory limits. Light scatter meters are more practicable to deploy. However, the meters do generally record levels higher than those measured by the TEOM. The meters can also be affected by atmospheric moisture content which further increases reported levels. Accordingly, any elevations of statutory limits should be treated as precautionary exceedances. The monitors are reliable for on-site monitoring and the establishment of action thresholds to ensure unforeseen activities generating significant dust are identified and suitably controlled. Light scatter meters are becoming the construction and waste industries norm for particulate dust monitoring.

2.3. In association with air quality monitoring across the site, weather conditions (temperature and relative humidity) are also continually measured by the light scatter meters at Inchgarvie Lodge and Clufflat Brae. Weather stations, located at the sound level meters at Echline and Linn Mill which are adjacent

to the light scatter meters at these monitoring locations, also continually record weather data, including temperature, relative humidity, wind speed and wind direction.

2.4. In addition to the fixed monitoring equipment used at sensitive locations across the site, a daily dust log for both the North and South sites has been kept by the FCBC Environmental Department. This daily dust inspection is used to identify any dust occurring as a result of construction works and any actions required. This log also records the weather conditions at the time of the inspection.

2.5. Frequent environmental site inspections are also undertaken by members of the FCBC Environmental Department. These inspections include a dust check to assess the following:

- dust levels on site;
- suppression/dampening down; and
- transportation of materials.

In relation to these inspections, the FCBC Environmental Department hold an environmental actions register where any environmental issues, including those relating to air quality, can be noted and closed out appropriately.

Figure 1: Example of an Installed Frisbee Gauge Meters

Figure 2: Example of an installed Automatic Light Scatter Dust Meter

Table 1: Air Quality Monitoring Locations

Ref:	Monitoring Location	Monitoring Equipment	Installation Date	Construction Activities in April
M1	Whinny Hill	Frisbee	21/03/12	Loading of rock for transport to south side
		Automatic light scatter meter	16/02/12	
M7	Butlaw Fisheries	Frisbee	05/10/11	Drilling for de-stressing wells at S6 S6 excavation for foundation and rock cleaning Construction of S5 causeway Marine works
M8	Barracks West	Frisbee	31/08/11	Drilling for de-stressing wells at S6 S6 excavation for foundation and rock cleaning Construction of S5 causeway Marine works
M9	Barracks East	Frisbee	31/08/11	Drilling for de-stressing wells at S6 S6 excavation for foundation and rock cleaning Construction of S5 causeway Marine works
M10	Inchgarvie Lodge	Frisbee	22/08/11	Excavation of launch South Abutment works Works on launch foundations including fixing steel, erecting formwork and concreting
		Automatic light scatter meter	17/10/11	
M11	Linn Mill	Frisbee	22/08/11	Excavation of launch South Abutment works Works on launch foundations including fixing steel, erecting formwork and concreting
		Automatic light scatter meter	06/12/11	

M12	Clufflat	Frisbee	29/08/11	Excavation of launch South Abutment works Works on launch foundations including fixing steel, erecting formwork and concreting
M13	Clufflat Brae	Frisbee	21/09/11	
		Automatic light scatter meter	24/10/11	
M14	Springfield	Frisbee	15/08/11	Excavation of launch South Abutment works Works on launch foundations including fixing steel, erecting formwork and concreting Structure works at gyratory
M15	Echline	Frisbee	16/08/11	Excavation of launch Works on launch foundations including fixing steel, erecting formwork and concreting Structure works at gyratory Drainage works at A904/U221 U221 topsoil batters
		Automatic light scatter meter	10/11/11	
M16	Scotstoun	Frisbee	07/09/11	Drainage works Placing rock/clay for embankment
		Automatic light scatter meter	14/02/12	
M17	Dundas Home Farm	Frisbee	29/08/11	Utilities works Fill using clay for road network
		Automatic light scatter meter	23/02/12	
M18	Newton	Frisbee	22/08/11	None
		TEOM	23/05/12	

3. AIR QUALITY MONITORING RESULTS

3.1. Automatic Light Scatter Dust Meter Monitoring Results

3.1.1. Light scatter results for April 2013 have been presented in a monthly chart; this can be found in Appendix A. Results show that the PM_{10} levels were largely below threshold levels and generally followed the same pattern across the site. During April there were seven days on which exceedances of the threshold occurred at various locations. Table 2 lists the locations at which the exceedances occurred on these dates. The dust log (section 3.4 and appendix D) provides further details with regard to the conditions and the actions taken as a result of each exceedance.

Table 2: Exceedances of the PM10 threshold

Date	Monitoring Location	Notable conditions
09/04/13	Dundas	Dry conditions
10/04/13	Dundas and Whinny Hill	Damp conditions
11/04/13	Dundas	Damp conditions however tracks dry
19/04/13	Scotstoun	Dry conditions
23/04/13	Inchgarvie and Scotstoun	Strong winds resulting in generally dusty conditions across area, including off-site areas. Gusty showers.
29/04/13	Inchgarvie and Clufflat	Strong winds and generally dusty conditions. Dust also arising from areas outwith construction site.
30/04/13	Scotstoun	Dry conditions. Light winds. Hazy.

3.1.2. It is possible that the exceedances were partially caused by construction works. However, many of the results show the same trend across site, indicating that the results are generally caused by regional conditions, though construction works may have also been influential. A

localised dust event can be identified at Scotstoun during dry conditions on 19 April.

3.1.3. Where automatic trigger alerts were received within site operating hours, site investigations were undertaken. Dust arising due to dry haulage tracks was noted during some inspections and, in response to these investigations, appropriate action was taken. A bowser was in use site wide to dampen down, with a second bowser also available where conditions required.

3.1.4. Towards the end of April, strong winds were found to exacerbate dust. During these conditions FCBC endeavoured to dampen down haulage tracks and excavation areas as far as reasonably practicable. However, it should be noted that during strong winds, dust was also noted blowing from surrounding areas, including fields outwith the construction site, and therefore any dust exceedances on these dates cannot be solely attributed to dust arising from site.

3.1.5. It should also be noted that the Frisbee results confirm that dust levels across site were generally low throughout the period to 17 April (see 3.3 Frisbee Dust Deposition Results).

3.1.6. The PM_{10} results have also been compared to the daily mean results obtained from the TEOM air quality monitoring stations located in Newton, Rosyth, Broxburn, Queensferry Road, Edinburgh and St Leonards, Edinburgh (an urban background site). The TEOM at Newton was installed by West Lothian Council, facilitated by FCBC, during May 2012. The comparison between the light scatter and TEOM results demonstrates that both sets of results generally follow the same pattern at similar levels, indicating that the pattern observed throughout April was largely due to regional changes in air quality.

3.2. Total Suspended Particles

3.2.1. The TSP results for April 2013 have been presented in a monthly chart; this can be found in Appendix B. The TSP levels at monitoring locations during April were generally low and within the threshold level. A single exceedance occurred on 29 April at Inchgarvie. This exceedance is associated with the exceedance of the PM_{10} threshold, and was related to strong winds observed on this date (see 3.1.4). All locations were found to follow a similar pattern across the site, demonstrating that in general the levels were influenced by regional changes in TSP levels, rather than construction works.

3.3. Frisbee Dust Deposition Results

3.3.1. The Frisbee dust deposition results for April 2013 have been presented in charts and can be found in Appendix C. To present results, all the monitoring locations have been grouped, based on locality, into the following:

- ***Group 1:*** M7 Butlaw Fisheries, M8 Barracks West, M9 Barracks East, M10 Inchgarvie Lodge and M11 Linn Mill;
- ***Group 2:*** M12 Clufflat, M13 Clufflat Brae, M14 Springfield and M15 Echline;
- ***Group 3:*** M16 Scotstoun Park and M17 Dundas Home Farm;
- ***Group 4:*** M18 Newton; and
- ***Group 5:*** M1 Whinny Hill.

3.3.2. Frisbee dust data deposition results were collected fortnightly, and the results averaged over this fortnight period to give a daily dust deposition rate. Two collection dates occurred during April; one on the 3 April, with another a fortnight later on the 17 April 2013. Due to unforeseen circumstances related to the delivery of the samples to the testing laboratory, the collection due on 20 March was delayed until 22 March. This resulted in the results being averaged over 12 days between 22 March and 3 April rather than the usual fortnightly period.

3.3.3. The site action level for the dust deposition rate has been set at 250 mg/m^2/day. Exceedances of this level are treated as a potential incident and a formal review of the works in the vicinity of the site is instigated. A lower, site review level has been set at 140 mg/m^2/day. Where concentrations exceed the lower action threshold the site works are reviewed to ensure good practice is implemented; it is essentially a warning that additional controls may be required.

3.3.4. During April there were no exceedances of the threshold levels. Frisbee results from monitoring locations across site were generally found to be low. Frisbee results covering the final two weeks of April will be presented in the May 2013 report as the collection date fell on 1 May 2013.

3.4. Daily Dust Log and Environmental Inspections

3.4.1. A summary of the daily dust log for April can be found in Appendix D. Dust was noted in the southern areas of site on five dates, with two instances noted in the northern works areas. Vehicle movements on haulage tracks were largely noted to be the cause of dust on site, with strong winds also found to be blowing dust on site, and on to site from adjacent areas, on 22 and 29 April in the southern works areas. In each instance, measures to dampen down the works areas as far as reasonably practicable were employed, notably the use of the bowser to dampen down the tracks and excavation areas.

3.4.2. During this period full environmental inspections were also undertaken weekly across the site and covered areas where works were being undertaken. In April one instance of dust was noted during one of these inspections in the north networks area (see table 3). Dust was seen to be rising from site. However, this action was immediately closed out as, whilst undertaking the inspection, the bowser was observed re-filling

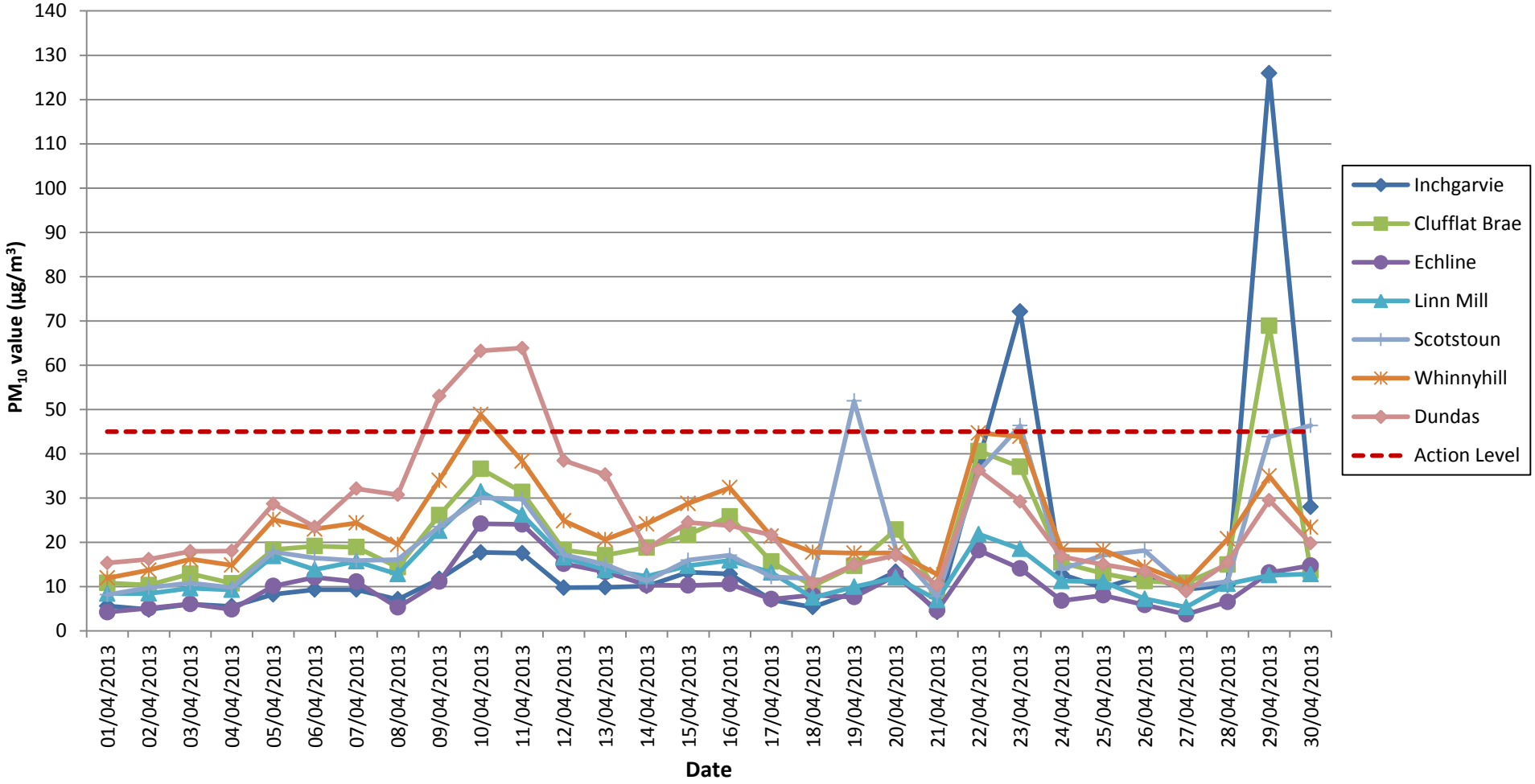
and subsequently dampening down the track earlier noted as giving rise to dust.

Table 3: Extract from Environmental Actions Register

Date	Inspection by	Location	Issue identified	Due date	Date actioned	Actioned by	Actions
04/04/2013	ESE	B981	Dust rising from tracks – require dampening down	04-Apr	04-Apr	ESE	Whilst undertaking the inspection, the bowser was then seen re-filling with water at Ferrytoll embankment to dampen down area

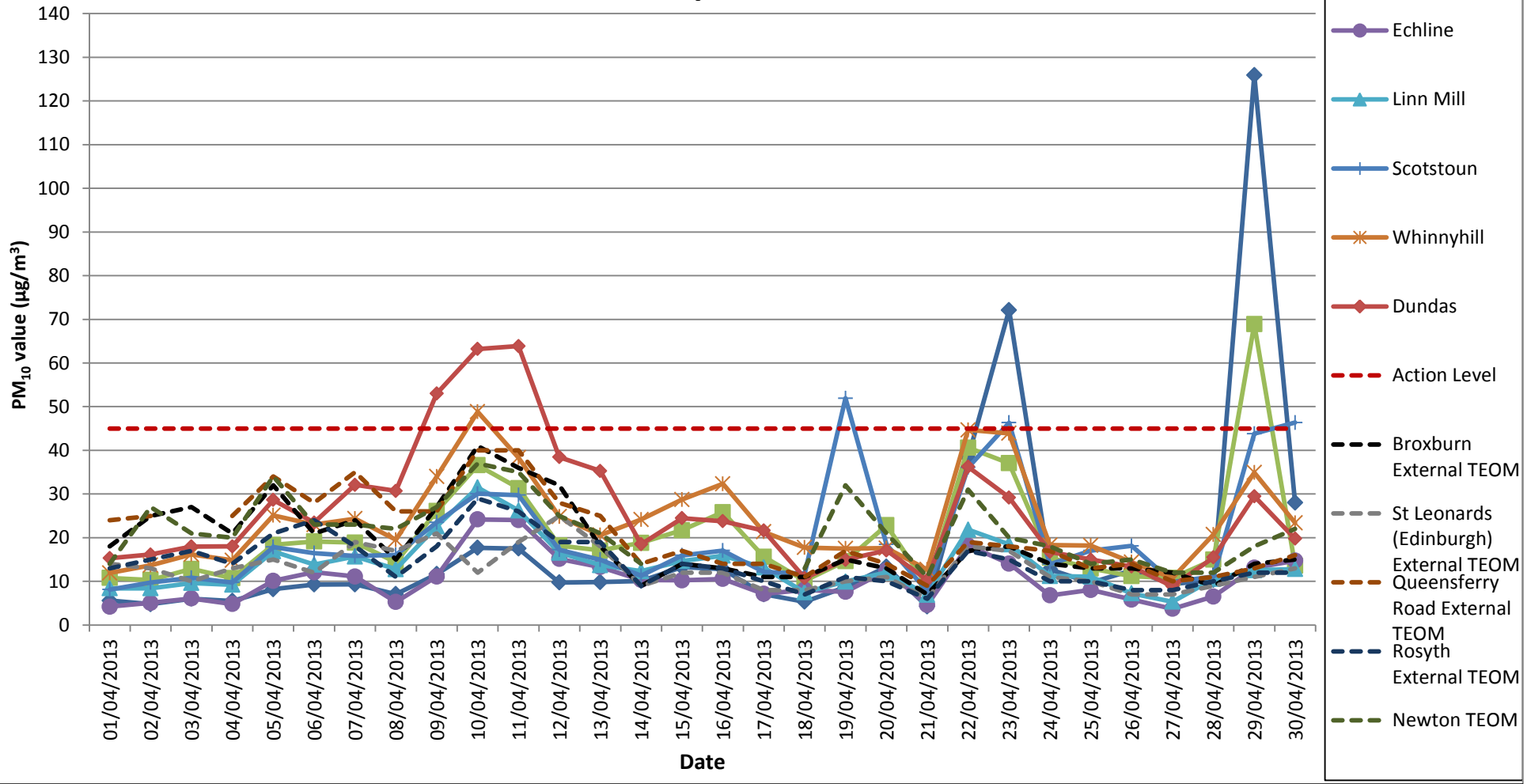
APPENDIX A: LIGHT SCATTER METER RESULTS

Air Quality Monitoring
Particulate Matter (PM10) Results for all Monitoring Locations
April 2013



Note: Please refer to section 3 of the Air Quality Monitoring Report: April 2013

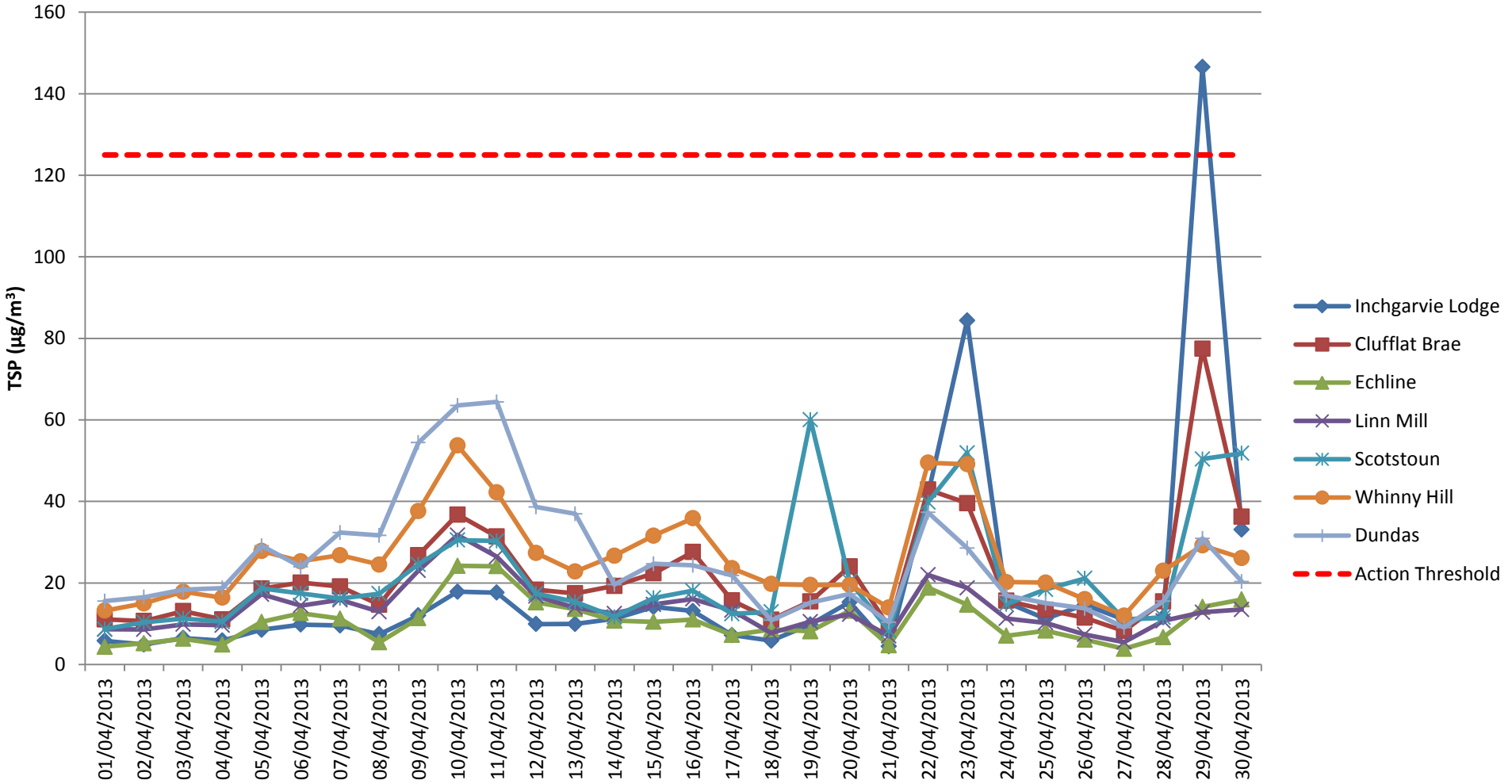
Air Quality Monitoring
Particulate Matter (PM10) and TEOM Results
April 2013



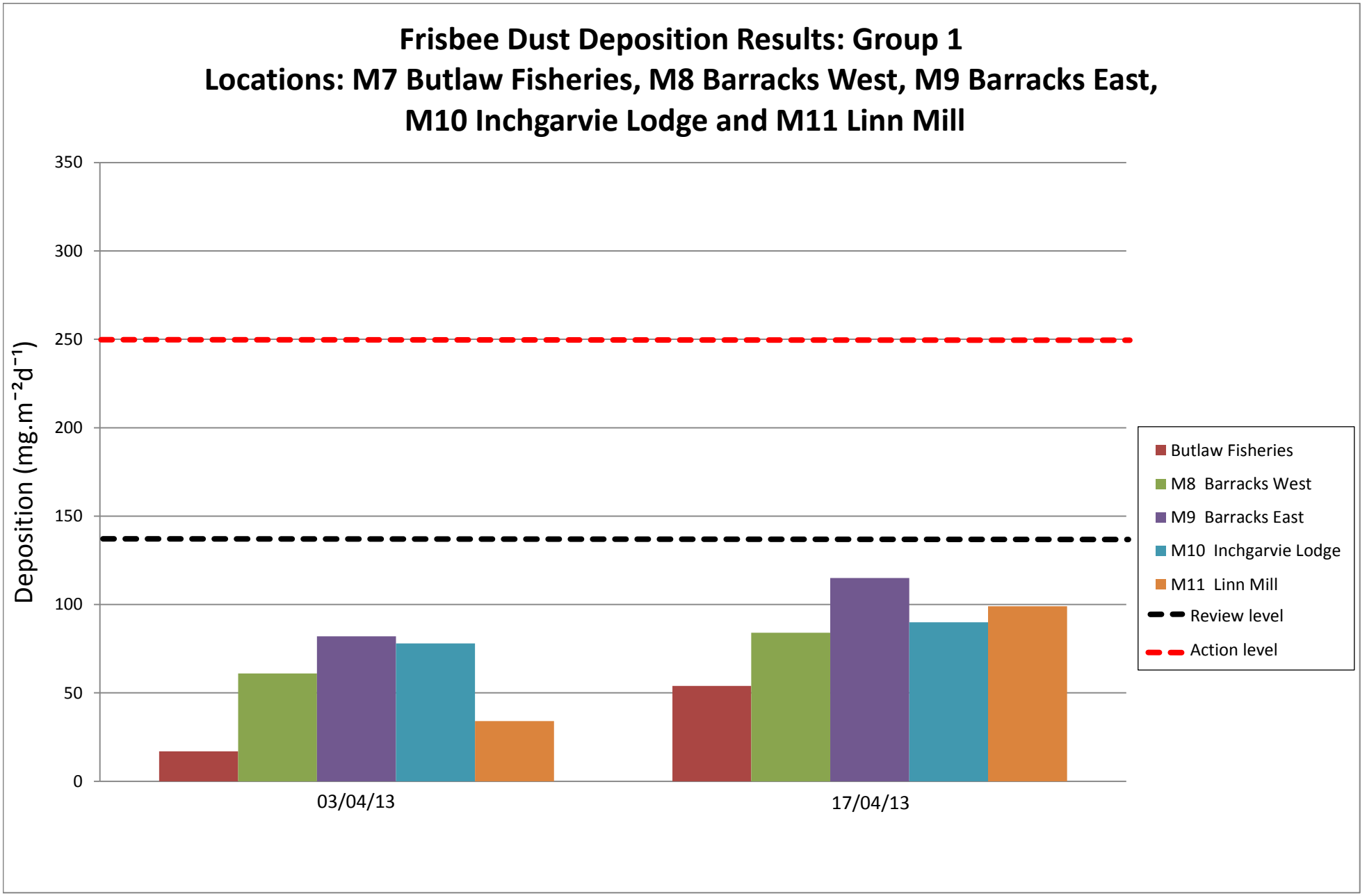
Note: Please refer to section 3 of the Air Quality Monitoring Report: April 2013

APPENDIX B: TOTAL SUSPENDED PARTICLES

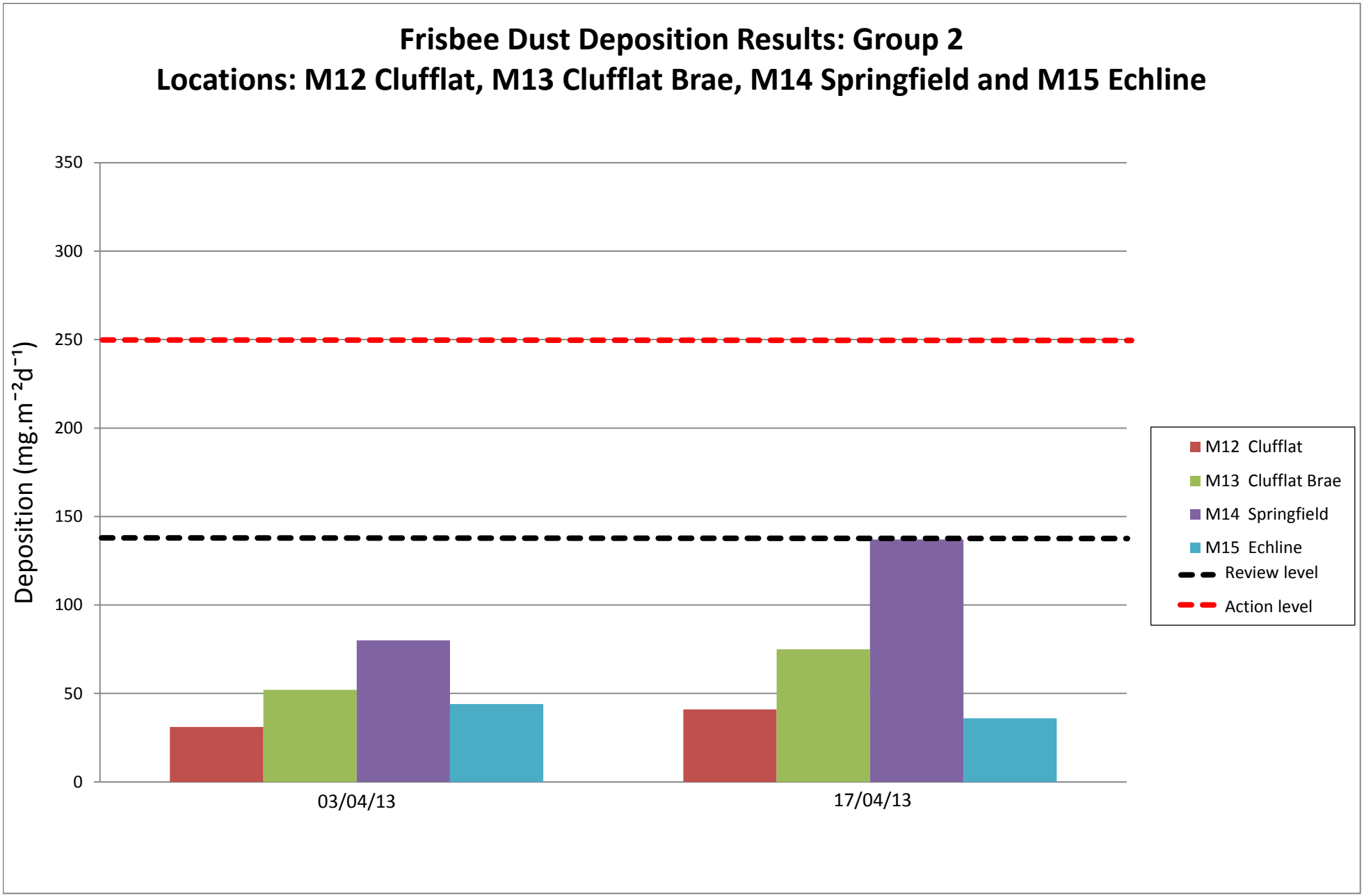
Total Suspended Particles (TSP) Results
April 2013



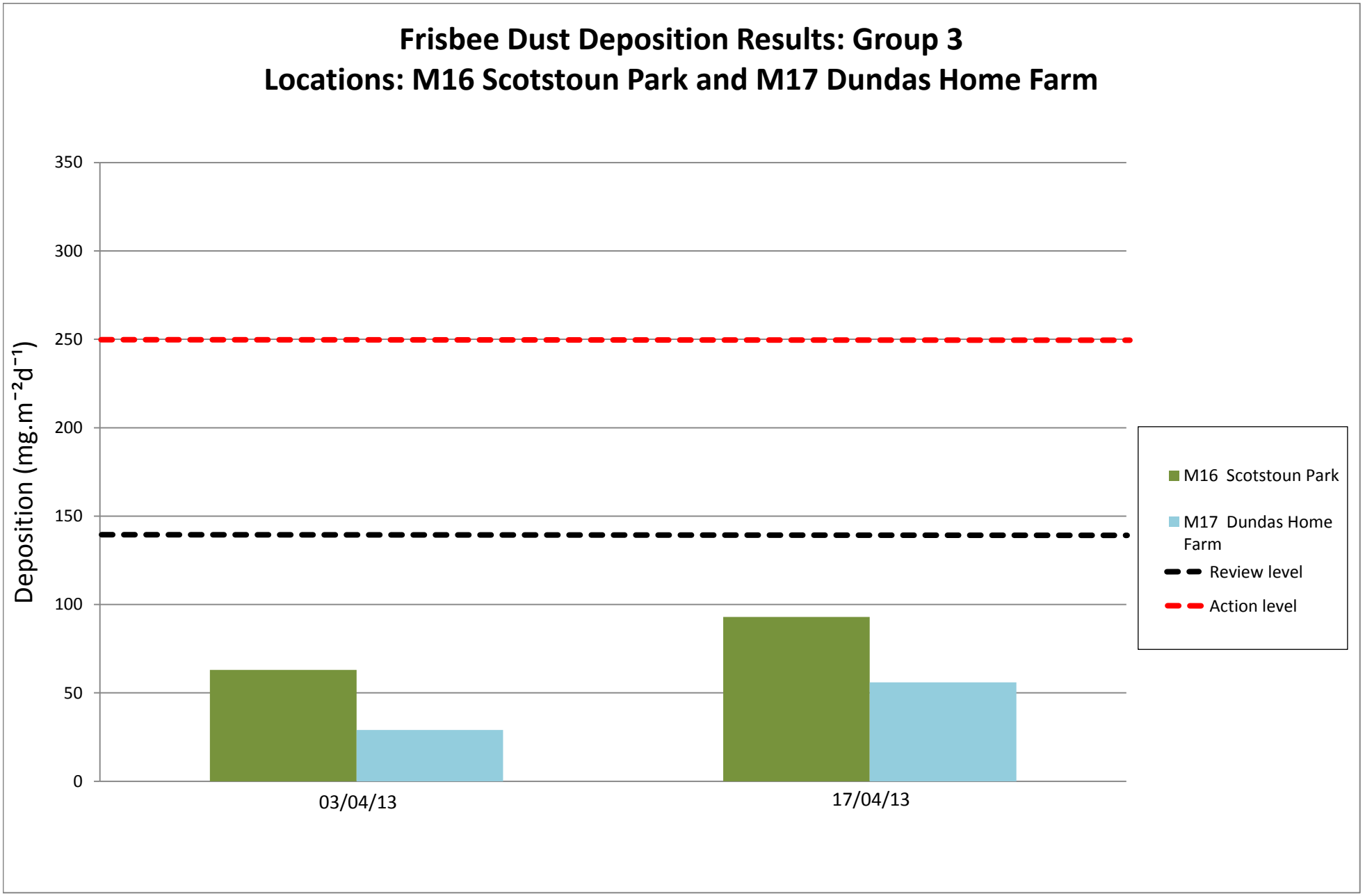
APPENDIX C: FRISBEE GAUGE RESULTS

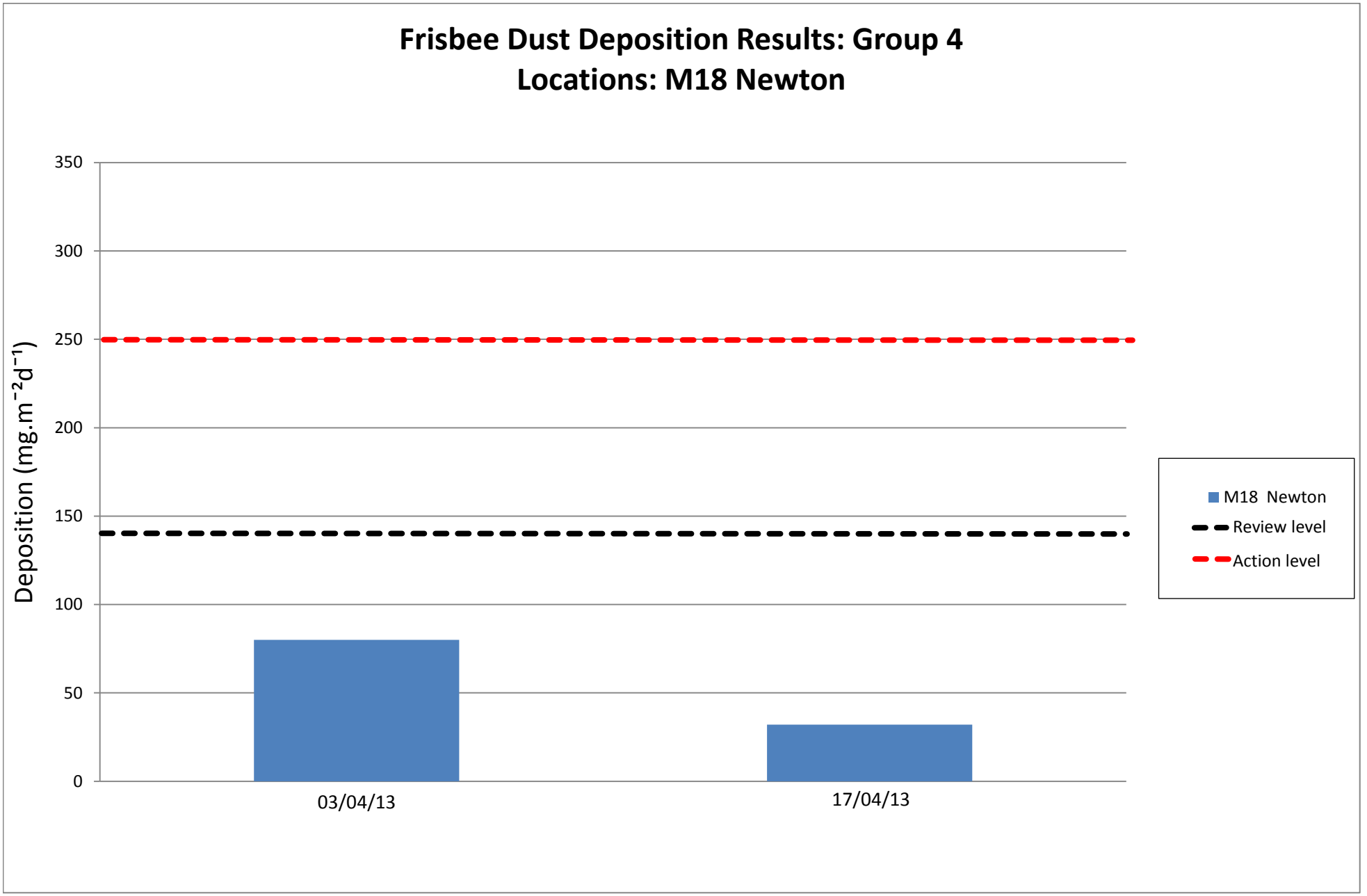

Frisbee Dust Deposition Results: Group 1
Locations: M7 Butlaw Fisheries, M8 Barracks West, M9 Barracks East,
M10 Inchgarvie Lodge and M11 Linn Mill
Deposition (mg.m⁻²d⁻¹)
350
300
250
200
150
100
50
0
03/04/13
17/04/13
Butlaw Fisheries
M8 Barracks West
M9 Barracks East
M10 Inchgarvie Lodge
M11 Linn Mill
Review level
Action level

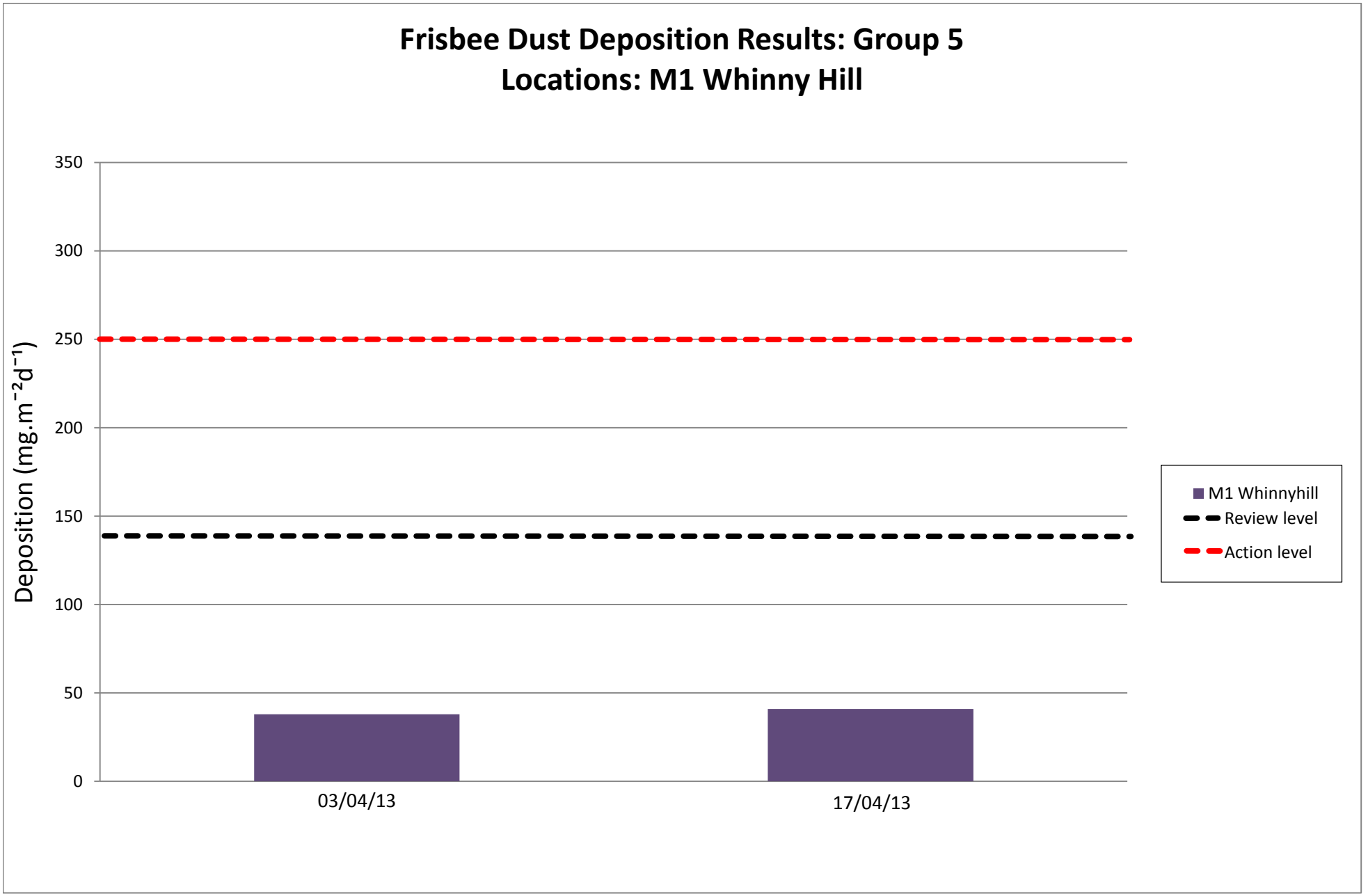
Frisbee Dust Deposition Results: Group 2
Locations: M12 Clufflat, M13 Clufflat Brae, M14 Springfield and M15 Echline



Frisbee Dust Deposition Results: Group 3
Locations: M16 Scotstoun Park and M17 Dundas Home Farm




Frisbee Dust Deposition Results: Group 4
Locations: M18 Newton
Deposition (mg.m⁻²d⁻¹)
350
300
250
200
150
100
50
0
03/04/13
17/04/13
M18 Newton
Review level
Action level


Frisbee Dust Deposition Results: Group 5
Locations: M1 Whinny Hill
Deposition (mg.m⁻²d⁻¹)
350
300
250
200
150
100
50
0
03/04/13
17/04/13
M1 Whinnyhill
Review level
Action level

APPENDIX D: DAILY DUST LOG

Daily Dust Log - North - March 2013

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	OTHER COMMENTS	Actions (if applicable)
01/04/2013	N	LIGHT	WNW	DRY	N				
02/04/2013	N	LIGHT	ENE	DRY	N				
03/04/2013	N	LIGHT	ENE	DAMP	N				
04/04/2013	N	LIGHT	WNW	DRY	Y	Y	Vehicles on tracks	During site inspection bowser was noted re-filling with water	Bowser deployed onsite
05/04/2013	N	LIGHT	WSW	DRY	N				
06/04/2013	N								
07/04/2013	N								
08/04/2013	N	LIGHT	ENE	DRY	N				
09/04/2013	N	LIGHT	W	DAMP	N				
10/04/2013	N	LIGHT	ENE	DAMP	N			Trigger alert received for Whinny Hill - inspection undertaken. Damp conditions noted at time of inspection.	
11/04/2013	N	LIGHT	ENE	DAMP	Y	Y	Vehicles on tracks	Haulage tracks dry despite damp conditions	Bowser deployed on site
12/04/2013	N	STRONG	ENE	DRY	N				
13/04/2013	N								
14/04/2013	N								
15/04/2013	N	STRONG	SE	DAMP	N				
16/04/2013	N	STRONG	SSE	DAMP	N			very strong winds and gusty showers	
17/04/2013	N	STRONG	W	WET	N			very strong winds and gusty showers	
18/04/2013	N	STRONG	WNW	DAMP	N			very strong winds and gusty showers	
19/04/2013	N	STRONG	S	DRY	N				
20/04/2013	N								
21/04/2013	N								
22/04/2013	N	STRONG	W	DAMP	N				
23/04/2013	N	STRONG	W	DRY	N				
24/04/2013	N	STRONG	W	DAMP	N				
25/04/2013	N	STRONG	W	DAMP	N				
26/04/2013	N	LIGHT	NNW	DAMP	N				
27/04/2013	N								
28/04/2013	N								
29/04/2013	N	STRONG	W	DRY	N				
30/04/2013	N	LIGHT	W	DRY	N				

Daily Dust Log - South - March 2013

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	OTHER COMMENTS	Actions (if applicable)
01/04/2013	S	LIGHT	WNW	DRY	N				
02/04/2013	S	LIGHT	ENE	DRY	N				
03/04/2013	S	LIGHT	ENE	DAMP	N				
04/04/2013	S	LIGHT	WNW	DRY	N				
05/04/2013	S	LIGHT	WSW	DRY	N				
06/04/2013	S								
07/04/2013	S								
08/04/2013	S	LIGHT	ENE	DRY	Y	Y	Vehicle movements	Dust noted at Dundas area due to vehicle movements on haulage tracks	Bowser deployed on site
09/04/2013	S	LIGHT	W	DAMP	N			Trigger alert received for Dundas - site inspection undertaken - no dust noted. Damp conditions at time of inspection	
10/04/2013	S	LIGHT	ENE	DAMP	N			Trigger alert received for Dundas - site inspection undertaken. No dust noted at time of inspection. Site generally damp however tracks dry - although no requirement for bowser at time of inspection bowser available if required	
11/04/2013	S	LIGHT	ENE	DAMP	N				
12/04/2013	S	STRONG	ENE	DRY	N				
13/04/2013	S								
14/04/2013	S								
15/04/2013	S	STRONG	SE	DAMP	N				
16/04/2013	S	STRONG	SSE	DAMP	N			very strong winds and gusty showers	
17/04/2013	S	STRONG	W	WET	N			very strong winds and gusty showers	
18/04/2013	S	STRONG	WNW	DAMP	N			very strong winds and gusty showers	
19/04/2013	S	STRONG	S	DRY	N			dust triggers received for Scotstoun. Site visit undertaken - no visible signs of dust noted however deliveries noted at south bound bus link. Contact with the site foreman confirmed that the bowser was active on site - evidence of this noted during a second site visit	
20/04/2013	S								
21/04/2013	S								
22/04/2013	S	STRONG	W	DAMP	Y	Y	Strong winds blowing dust from site	Strong winds and gusty showers throughout the day. Generally across site no dust was seen to be rising however at Dundas some dust was seen blowing due to strong winds. Generall hazy/dusty conditions across area due to strong winds	Bowser deployed on site
23/04/2013	S	STRONG	W	DRY	Y	Y	Vehicle movements	Strong winds throughout the day. Trigger alerts received for Scotstoun and Clufflats. Site visit undertaken - slight dust noted on site however was dampened by frequent rain showers.	Bowser deployed on site
24/04/2013	S	STRONG	W	DAMP	N				

25/04/2013	S	STRONG	W	DAMP	N				
26/04/2013	S	LIGHT	NNW	DAMP	N			Trigger alert received for Dundas - site inspection undertaken - no dust noted. Rain showers at time of inspection.	
27/04/2013	S								
28/04/2013	S								
29/04/2013	S	STRONG	W	DRY	Y	Y	Vehcile movements and strong winds blowing dust on site	Trigger alerts at Scotstoun, Clufflat and Inchgarvie. Inspections undertaken across site. Dust noted blowing on access tracks due to strong winds and vehicle movements. Contact with site foremen confirmed that two bowsers were in use across the south sections of site. Conditions exacerbated by strong winds	Two bowsers deployed on site
30/04/2013	S	LIGHT	W	DRY	Y	Y	Vehicle movements	Trigger alerts received for Clufflat and Scotstoun. Site inspection undertaken. Hazy conditions noted at Scotsoun. Further contact with site foremen to confirm mitigation measures operational - measures in place as far as reasonably practicable.	Bowser deployed on site