
Contractor

Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project

# FORTH REPLACEMENT CROSSING

Document title

# AIR QUALITY MONITORING REPORT

## AUGUST 2012

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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 August 2012.

**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 has not been 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.** Due to the issues at the Echline meter hand-held $PM_{10}$ monitoring was carried out throughout the month around this location. This consisted of taking three 15 minute average $PM_{10}$ results at different intervals throughout the day.

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

- signs of dust or odour leaving site;
- any burning occurring on site;
- adequate suppression and monitoring to prevent the spread of dust; and
- materials damped down or covered in vehicles leaving/entering the site.

**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 August |
|---|---|---|---|---|
| M1 | Whinny Hill | Frisbee | 21/03/12 | Drilling for blasting<br>Blasting<br>Rock Removal<br>Breaking out rock |
| | | Automatic light scatter meter | 16/02/12 | |
| M7 | Butlaw Fisheries | Frisbee | 05/10/11 | Works at S7 and S8<br>Marine works<br>S6 Access Track |
| M8 | Barracks West | Frisbee | 31/08/11 | Marine works<br>Drainage works |
| M9 | Barracks East | Frisbee | 31/08/11 | Marine works<br>Drainage works |
| M10 | Inchgarvie Lodge | Frisbee | 22/08/11 | Utility works<br>Works at S7 and S8<br>Drainage works<br>Excavation of material from launch |
| | | Automatic light scatter meter | 17/10/11 | |
| M11 | Linn Mill | Frisbee | 22/08/11 | Utility works<br>Excavation of material from launch<br>Drainage works |
| | | Automatic light scatter meter | 06/12/11 | |
| M12 | Clufflat | Frisbee | 29/08/11 | Utility works<br>Drainage works<br>Excavation of material from launch<br>Cut/Fill of East SUDS pond |
| M13 | Clufflat Brae | Frisbee | 21/09/11 | |
| | | Automatic light scatter meter | 24/10/11 | |
| M14 | Springfield | Frisbee | 15/08/11 | Utility works<br>Excavation of material from launch<br>Cut/Fill of East SUDS pond |
| M15 | Echline | Frisbee | 16/08/11 | Utility works<br>Cut from Queensferry gyratory<br>Fill to bunds |
| | | Automatic light scatter meter | 10/11/11 | |
| M16 | Scotstoun | Frisbee | 07/09/11 | Works at bus link<br>Utility works including top soil stripping |
| | | Automatic light scatter meter | 14/02/12 | |

| | | | | |
|---|---|---|---|---|
| M17 | Dundas Home Farm | Frisbee | 29/08/11 | Utilities works Haul road |
| | | 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 August 2012 have been presented in a monthly chart; this can be found in Appendix A. Results show that generally $PM_{10}$ levels were low and largely followed the same pattern across the site. There was a single exceedance of the $PM_{10}$ threshold during August; this occurred at Whinny Hill on 16 August, where a level of 58.41µg/$m^3$ was recorded. Real time triggers were received by the Environmental Team during this day and were investigated immediately. Drilling works were on-going in the Whinny Hill area on this day and it was found that these works were causing increased dust levels in this vicinity. The north networks section engineer was contacted and works were immediately stopped. It was found that a fault associated with the dust extraction system on the drilling rig was causing the increased dust levels. As a result of this, the drilling rig was changed, arriving on site on 17 August, when the works were restarted.

**3.1.2.** The 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. 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

August was largely due to regional changes in air quality. The increased $PM_{10}$ levels at Whinny Hill on 16 August were not reflected in the TEOM results, further indicating that this was due to construction works and the fault with the drilling rig detailed above (paragraph 3.1.1.).

**3.1.3.** Due to a loss of the power supply at Echline and faults with the equipment, the data from this meter is missing throughout August. FCBC worked throughout August to restore the power supply to this device and, whilst a power supply to this meter was sourced, there were faults with the connection. As a result, further works to restore the meter at this location have been undertaken by FCBC and a new enclosure was built at the end of August to house the monitoring equipment, including the light scatter meter, at Echline Corner. The monitoring equipment will be moved to the new location following connection to the mains power supply in September 2012. In the interim, inspections in the Echline area have increased and handheld $PM_{10}$ results have been gathered for the period and are reported in Appendix D – Daily Dust Log South.

**3.1.4.** The averaged handheld $PM_{10}$ results for the Echline area during this period did not show any exceedances and the majority of results mirrored the site-wide ambient levels, varying between 20-40µg/m3.

**3.1.5.** Although below the site action level, higher levels of $PM_{10}$ were noted between 10-15th August, mirroring an extended dry period and elevated $PM_{10}$ levels elsewhere on the site. Higher results were also obtained on 28-29th August.

**3.1.6.** Data is not included for Dundas throughout August 2012. Potential errors were noted by the Environmental Team with the data collected during August. Further to consultation with the supplier it was considered that the readings from the meter were incorrect. Re-calibration by the supplier was not found to solve the error with the

device and a site visit by an engineer has been organised for September.

### 3.2. Total Suspended Particles

**3.2.1.** The TSP results for August 2012 have been presented in a monthly chart; this can be found in Appendix B. TSP levels at all monitoring locations throughout August were low and generally found to follow a similar pattern across the site, demonstrating that the levels are influenced by regional changes in TSP levels, rather than construction works. One slight elevation in the results did occur at Whinny Hill on the 16 August, corresponding with the date on which high $PM_{10}$ results were recorded (see paragraph. 3.1.1. for further information); results were, however, significantly below the action threshold.

**3.2.2.** Due to a device error associated with the measurement of TSP at Dundas, the results for this location have been excluded from the graph. Measurements of TSP throughout August continued to be unrealistically low. FCBC have consulted with the supplier and an engineer will be visiting the site during September to resolve the issue. Data is also missing for Echline due to the loss of power, as noted in paragraph 3.1.3.

### 3.3. Frisbee Dust Deposition Results

**3.3.1.** The Frisbee dust deposition results for August 2012 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 are collected fortnightly, and the results averaged over this fortnight period to give a daily dust deposition rate. Two collection dates fell during August; 8 and 22 August 2012. The next collection date is due on the 5 September. Due to unforeseen circumstances the collection on the 8 August was delayed until the 9 August; the results for the first period are therefore averaged over a period of 15 days while the latter period is 13 days. Due to an error with the size sample bottle for Whinny Hill on the 22 August collection date, the results are missing from this report. The September report will include the data from Whinny Hill covering the period 9 August to 5 September.

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

**3.3.4.** Throughout August the dust deposition rates for Groups 3, 4 and 5 were within the threshold levels. For Group 1, results for all locations were within the threshold dust deposition levels for the period ending on 22 August. However, there was an exceedance of the site review level at Inchgarvie Lodge (173 $mg.m^{-2}d^{-1}$) for the period ending on the 9 August. The results for Group 2 show that results for all locations were also within the threshold levels for the period ending on the 22 August,

although there was an exceedance of the review level for the period ending on 9 August for Clufflat (159 $mg.m^{-2}d^{-1}$). There were no exceedances of the site action level throughout August.

**3.3.5.** Due to the exceedances of the site review level during August, at two different locations, FCBC conducted a review into site wide dust levels and the construction works being undertaken at these locations. Construction works were being undertaken in the area of Clufflat and Inchgarvie, including the construction of the East SUDS pond and the excavation of the Southern Launch. It is possible, therefore, that the exceedances at these locations were caused by these works. However, contact with the section engineers throughout the period ensured that the water bowser was in use at this location to dampen down as required. It should also be noted that there was a period of very wet weather beginning on the 31 July and works in this location were ceased for a number of days as a result. The ground surface was also noted to be mostly wet or damp during this period.

### 3.4. Daily Dust Log and Environmental Inspections

**3.4.1.** A summary of the daily dust log for August can be found in Appendix D. Three instances of visual dust on site were noted in the northern networks area. One of these exceedances was caused by vehicle movements on dry tracks; the use of the water bowser was subsequently increased to dampen down the area. The other exceedances in the north (16 and 17 August) were caused by a fault with the drilling rig on Whinny Hill; as noted above (paragraph 3.1.1.) this rig was replaced.

**3.4.2.** Five daily dust logs noted dust within the southern networks sections of the site. These were largely due to vehicle movements on dry tracks, whilst on 28 August strong winds were found to be blowing dust from dry areas of site. The water bowser was used to dampen down these

areas. During other dry periods noted within the log, the bowser was on site effectively dampening down materials where required.

**3.4.3.** During this period a number of environmental inspections were also undertaken across the site. A summary of the Dust and Air Quality section of these environmental checks has been included in Appendix E. Nine inspections across the site were undertaken by the FCBC Environmental Department during August, focussing on areas in which works were being undertaken. Due to continuing wet weather into August, dust levels throughout were generally not found to be an issue. No signs of dust leaving the site were noted and where conditions were dry the water bowser was present on site to provide adequate dampening down. All materials seen to be entering/leaving the site at the time of inspections were covered to prevent the spread of dust.

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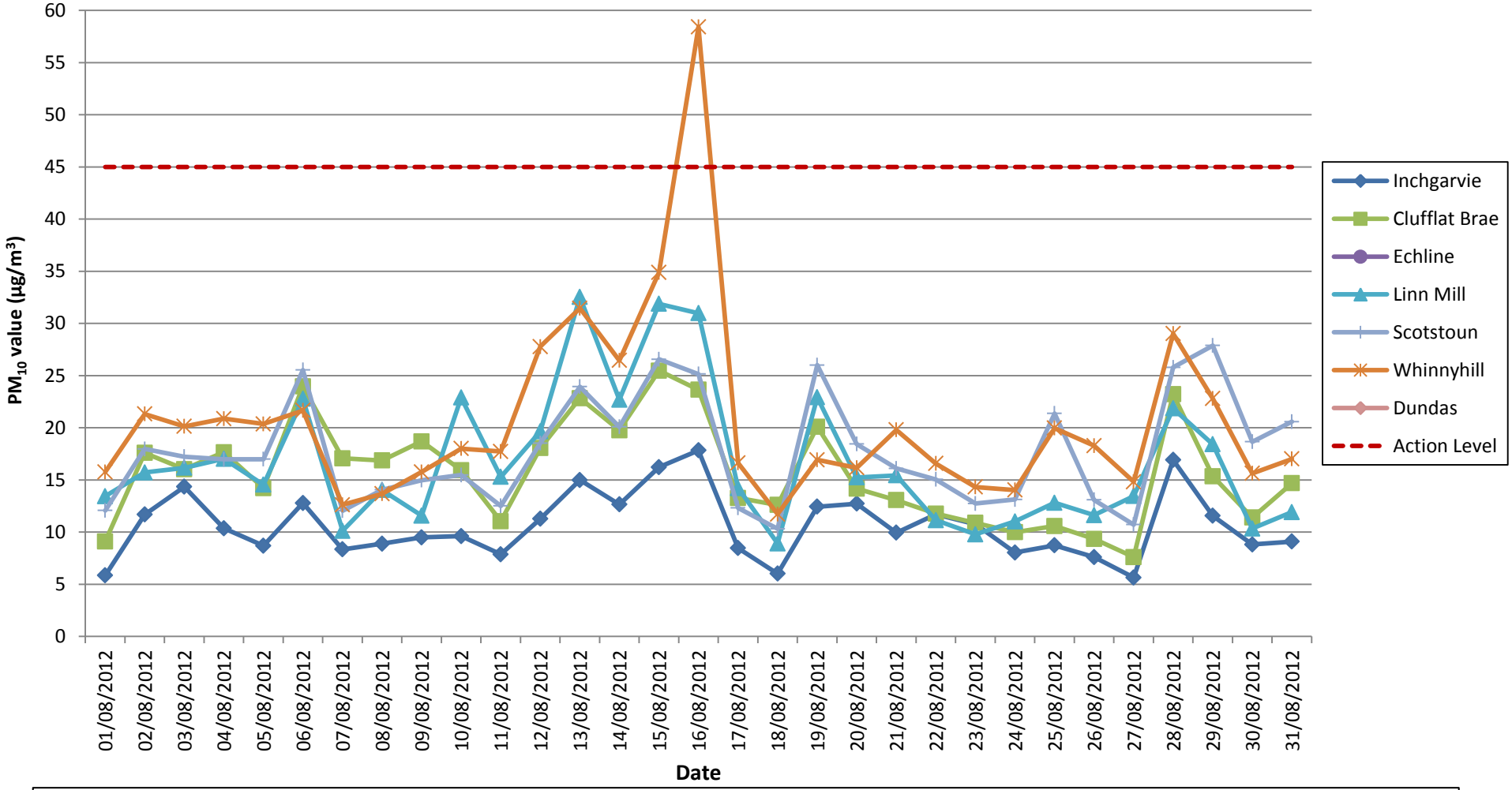
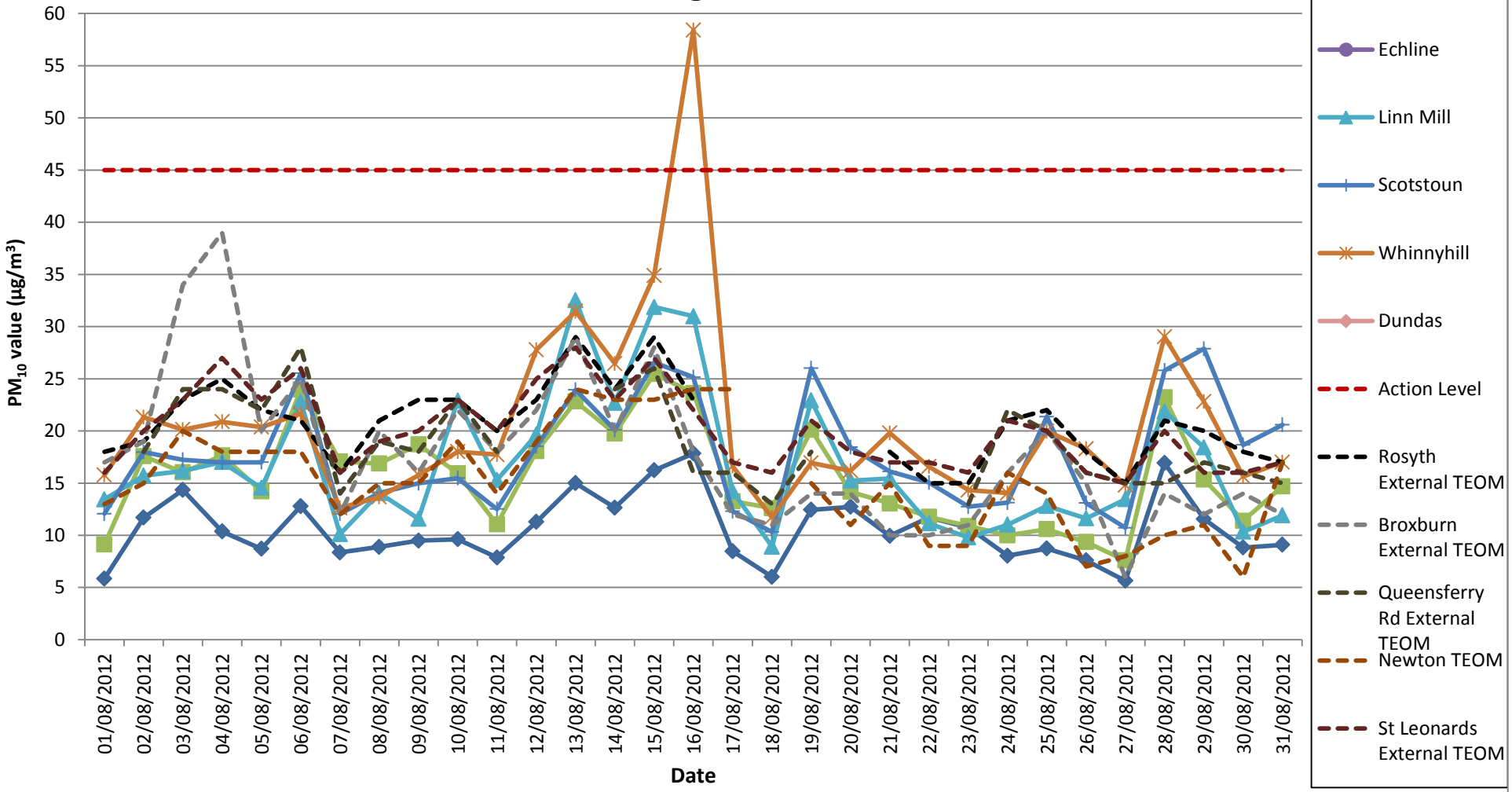
# APPENDIX A: LIGHT SCATTER METER RESULTS

# Air Quality Monitoring
# Particulate Matter (PM10) Results for all Monitoring Locations
# August 2012




**Note:** Due to a power failure at Echline, no $PM_{10}$ data is available for this location. Due to an error associated with the Dundas device the results for this location have been excluded.

# Particulate Matter (PM10) Results (with TEOM Results)
## All Monitoring Locations
## August 2012




**Note:** Due to a power failure at Echline, no $PM_{10}$ data is available for this location

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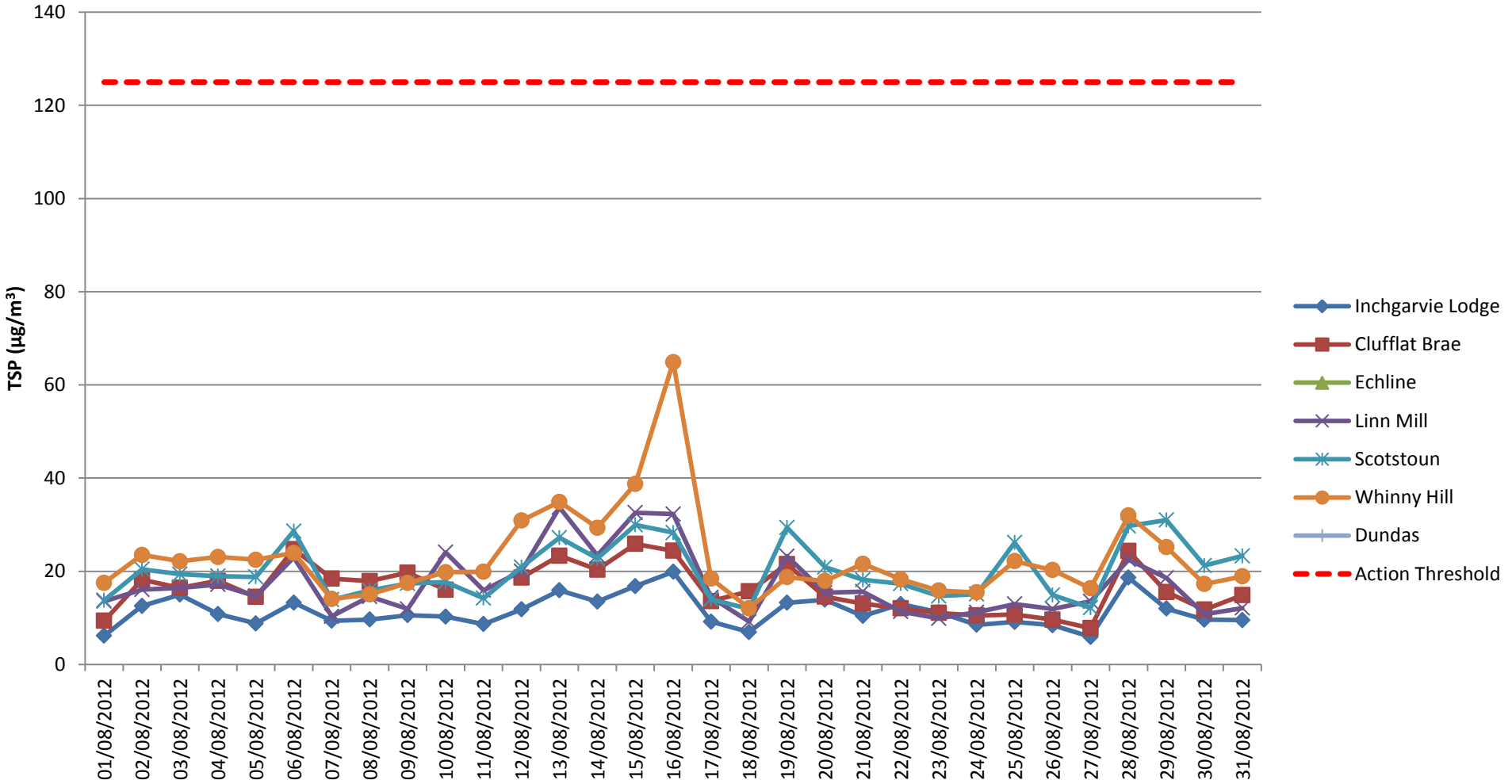
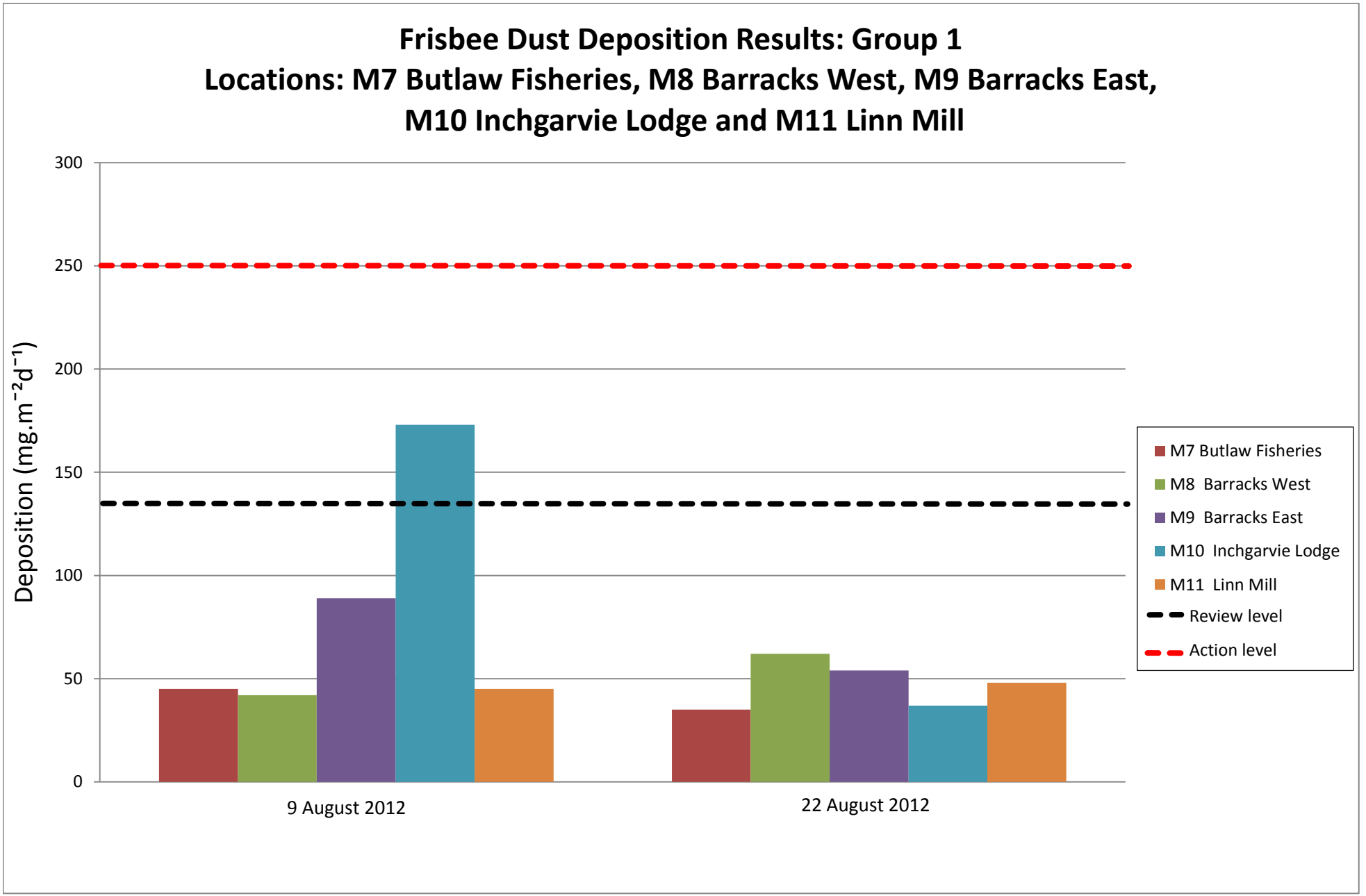
# APPENDIX B: TOTAL SUSPENDED PARTICLES

# Total Suspended Particles (TSP) Results
# August 2012

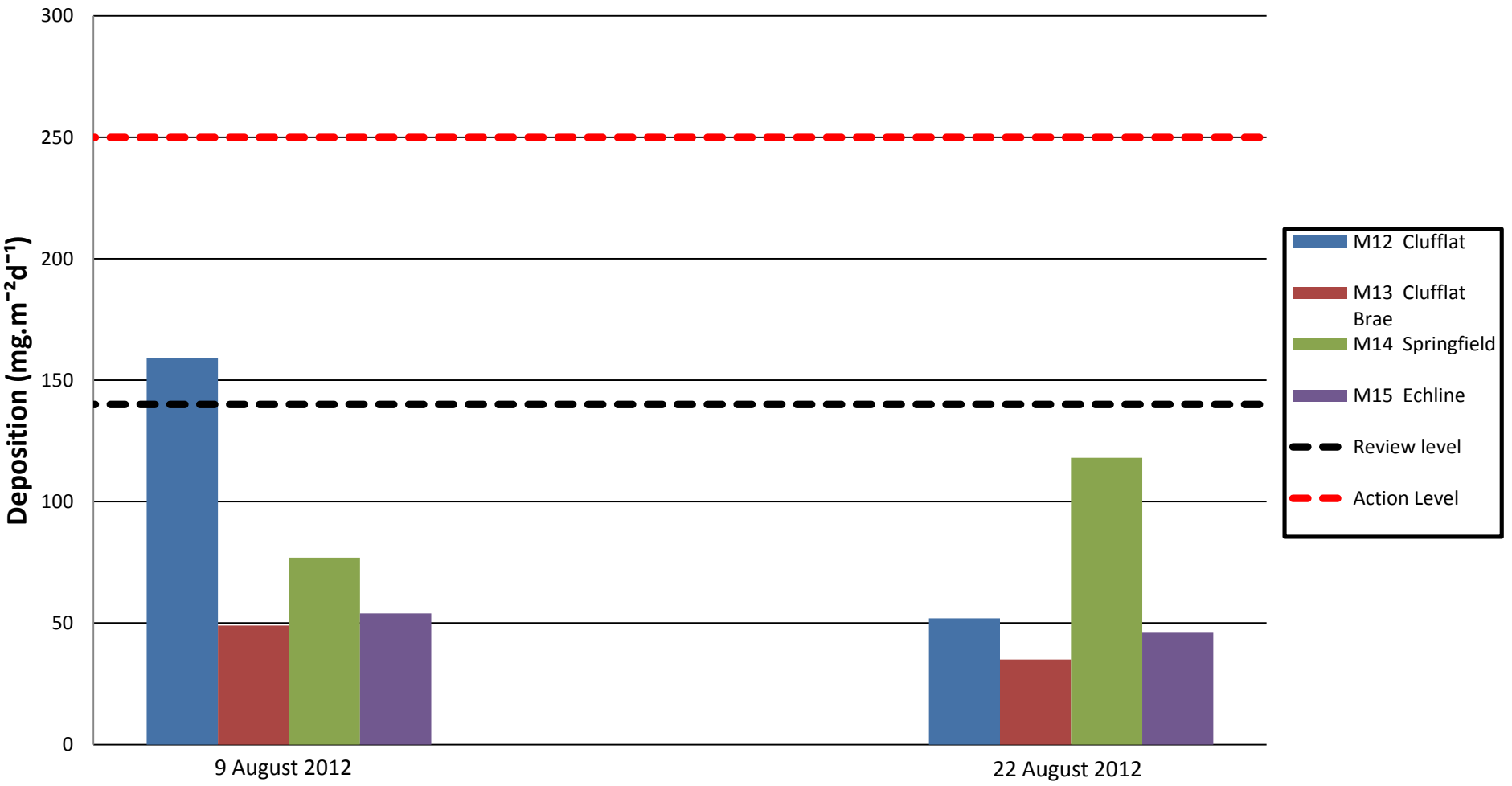


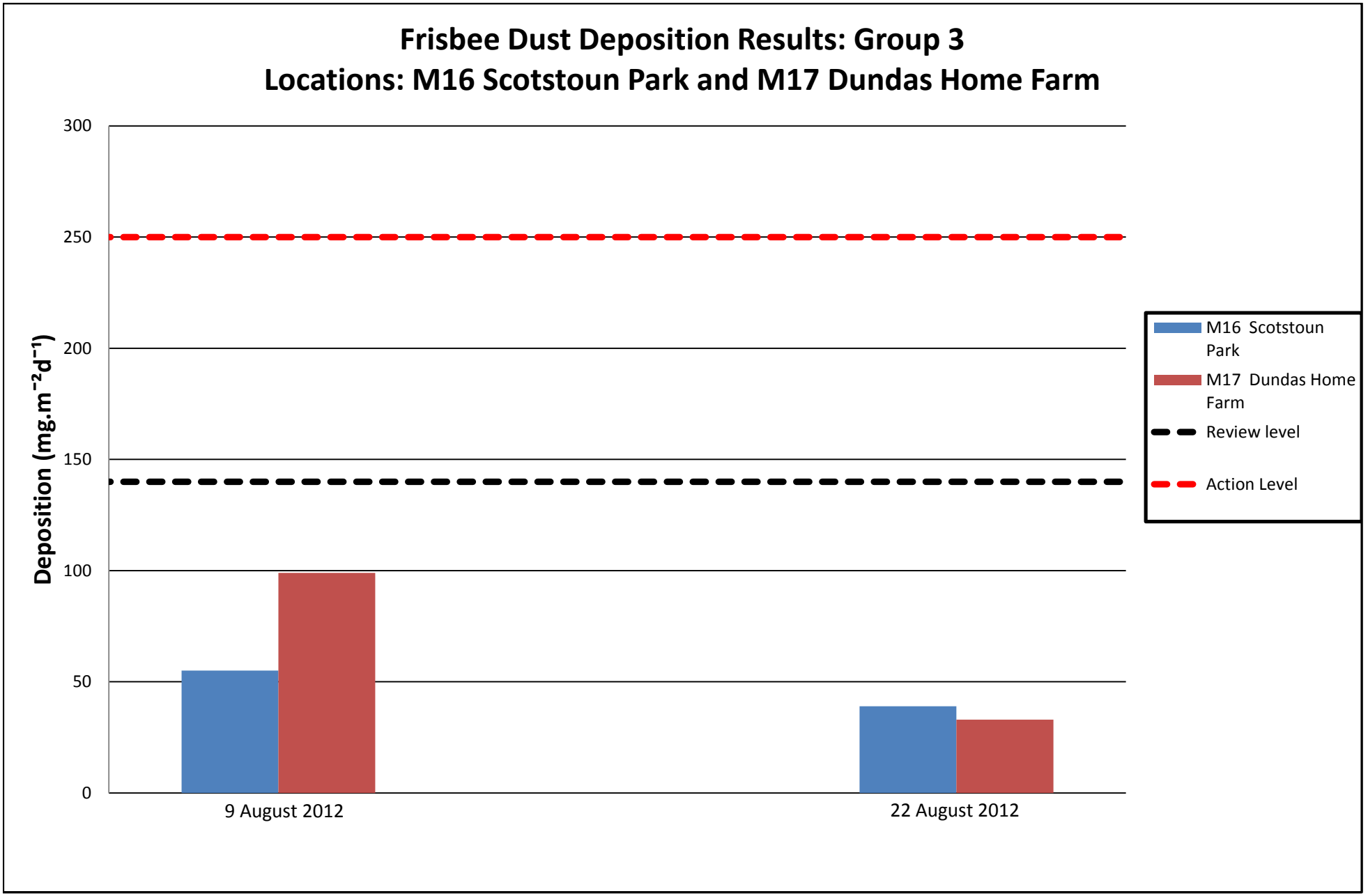

**Note:** Due to a loss of power at Echline, no TSP results are available for this location throughout June. Due to errors associated with the TSP results for Dundas, these results have been excluded.

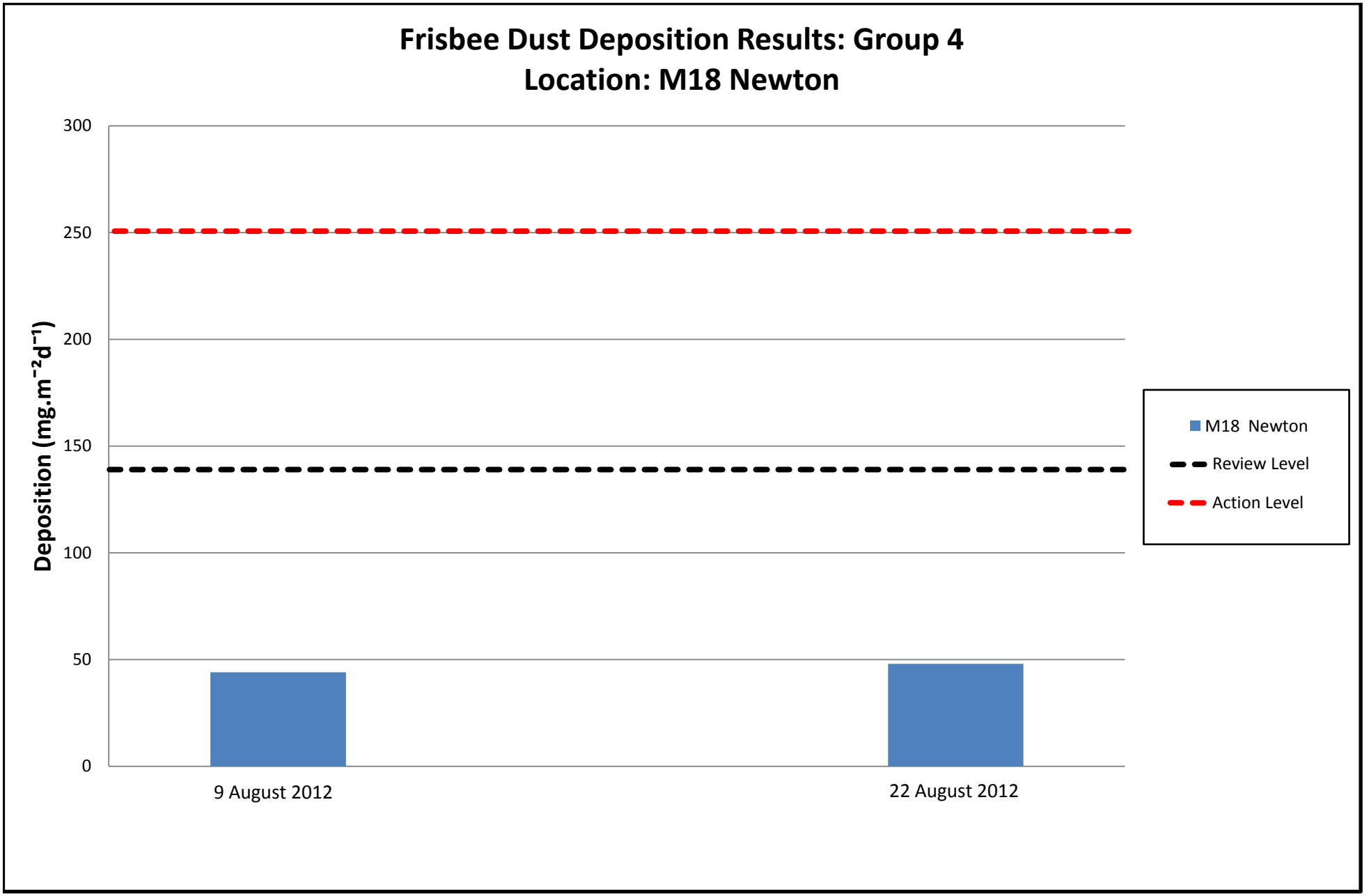
# APPENDIX C: FRISBEE GAUGE RESULTS


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)
300
250
200
150
100
50
0
9 August 2012
22 August 2012
M7 Butlaw Fisheries
M8 Barracks West
M9 Barracks East
M10 Inchgarvie Lodge
M11 Linn Mill
Review level
Action level

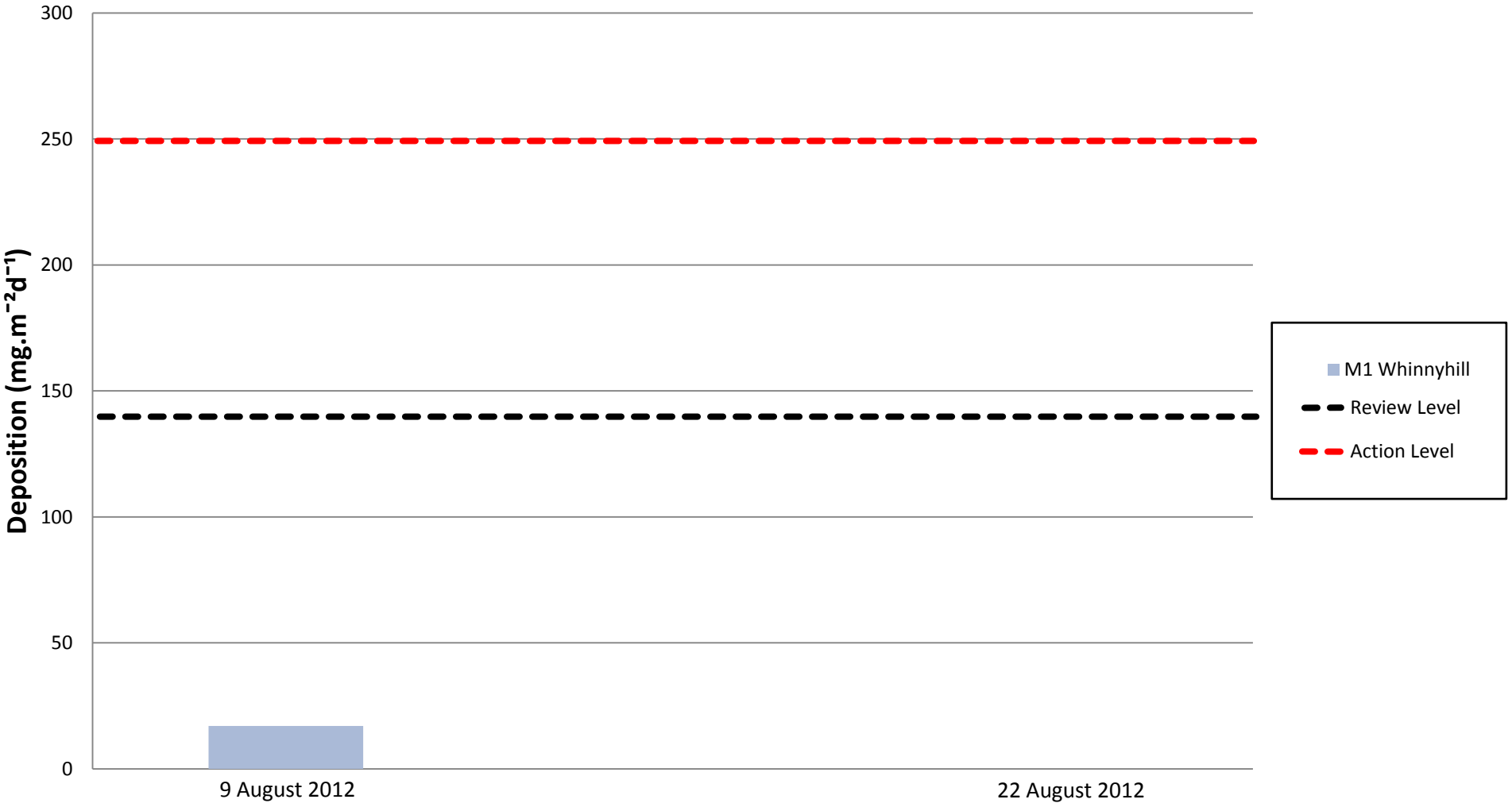
# Frisbee Dust Deposition Results: Group 2
## Locations: M12 Clufflat, M13 Clufflat Brae, M14 Springfield and M15 Echline




Frisbee Dust Deposition Results: Group 3
Locations: M16 Scotstoun Park and M17 Dundas Home Farm
Deposition (mg.m⁻²d⁻¹)
300
250
200
150
100
50
0
9 August 2012
22 August 2012
M16 Scotstoun Park
M17 Dundas Home Farm
Review level
Action Level


Frisbee Dust Deposition Results: Group 4
Location: M18 Newton
Deposition (mg.m-2d-1)
300
250
200
150
100
50
0
9 August 2012
22 August 2012
M18 Newton
Review Level
Action Level

# Frisbee Dust Deposition Results: Group 5
# Location: M1 Whinny Hill




**Note:** Due to an error with the sampling bottle at this location, no data is available for the period ending on 22 August. Results covering the period 9 August to 6 September will be covered in the September report.

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## APPENDIX D: DAILY DUST LOG

# Daily Dust Log - North - August 2012

| DATE | COMPLETED BY | TIME | LOCATION | WIND | WIND DIRECTION | GROUND SURFACE | VISIBLE DUST | DUST DUE TO WORKS (if applicable) | CAUSES OF DUST (if applicable) | OTHER COMMENTS | Actions (if applicable) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01/08/2012 | LSN | PM | N | STRONG | NE | WET | N | | | | |
| 02/08/2012 | SSD | PM | N | LIGHT | W | DAMP | N | | | | |
| 03/08/2012 | SSD | AM | N | LIGHT | NE | DRY | N | | | | |
| 04/08/2012 | | | | | | | | | | | |
| 05/08/2012 | | | | | | | | | | | |
| 06/08/2012 | ESE | AM | N | LIGHT | NE | WET | N | | | | |
| 07/08/2012 | ESE | PM | N | LIGHT | SW | DAMP | N | | | | |
| 08/08/2012 | SSD | AM | N | STRONG | NE | WET | N | | | | |
| 09/08/2012 | SSD | AM | N | LIGHT | W | DAMP | N | | | | |
| 10/08/2012 | LSN | PM | N | LIGHT | SW | DRY | N | | | | |
| 11/08/2012 | | | | | | | | | | | |
| 12/08/2012 | | | | | | | | | | | |
| 13/08/2012 | LSN | AM | N | STRONG | SW | DRY | Y | Y | Vehicles | Bowser on site just not in area at time of visit | Contact with site engineer to ensure bowser in use in all areas of site |
| 14/08/2012 | SSD | AM | N | STRONG | SW | DRY | N | | | | |
| 15/08/2012 | LSN | PM | N | STRONG | SW | DRY | N | | | | |
| 16/08/2012 | ESE | AM | N | STRONG | SW | DRY | Y | Y | Drilling | Drilling on Whinny Hill. Fault with dust extraction system. | ESE contacted ISN - spoke to sub contractors. SSD at residential at Whinny Hill - limited dust reaching this location - visible dust not migrating off site. |
| 17/08/2012 | ESE | AM | N | STRONG | SW | WET | Y | Y | Drilling | Some dust from drilling though not speading off site due to wet weather conditions | New drilling rig on site. Dust extraction system working correctly. |
| 18/08/2012 | | | | | | | | | | | |
| 19/08/2012 | | | | | | | | | | | |
| 20/08/2012 | SSD | PM | N | LIGHT | SW | WET | N | | | | |
| 21/08/2012 | SSD | AM | N | LIGHT | SW | WET | N | | | | |
| 22/08/2012 | SSD | AM | N | LIGHT | SW | WET | N | | | | |
| 23/08/2012 | ESE | AM | N | LIGHT | SW | DAMP/WET | N | | | | |
| 24/08/2012 | SSD | AM | N | LIGHT | SE | DAMP | N | | | | |
| 25/08/2012 | | | | | | | | | | | |
| 26/08/2012 | | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27/08/2012 | ESE | AM | N | LIGHT | SE | WET | N | | | | |
| 28/08/2012 | ESE | AM | N | STRONG | SE | DAMP | N | | | | |
| 29/08/2012 | ESE | AM | N | LIGHT | SE | DAMP | N | | | | |
| 30/08/2012 | ESE | AM | N | LIGHT | NW | DAMP | N | | | | |
| 31/08/2012 | LSN | AM | N | LIGHT | W | DAMP/WET | N | | | | |

# Daily Dust Log - South - August 2012

| DATE | COMPLETED BY | TIME | LOCATION | WIND | WIND DIRECTION | GROUND SURFACE | VISIBLE DUST | DUST DUE TO WORKS (if applicable) | CAUSES OF DUST (if applicable) | PM10 level Echline area) (Handheld 15 minute average) | OTHER COMMENTS | Actions (if applicable) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01/08/2012 | LSN | AM | S | STRONG | NE | WET | N | | | | | |
| 02/08/2012 | SSD | AM | S | LIGHT | W | DAMP | N | | | | | |
| 03/08/2012 | SSD | PM | S | LIGHT | NE | DRY | N | | | | | |
| 04/08/2012 | | | | | | | | | | | | |
| 05/08/2012 | | | | | | | | | | | | |
| 06/08/2012 | LSN | PM | S | LIGHT | NE | WET | N | | | | | |
| 07/08/2012 | SSD | AM | S | LIGHT | SW | DAMP | N | | | 25 | | |
| 08/08/2012 | ESE | AM | S | LIGHT | NE | WET | N | | | 32 | | |
| 09/08/2012 | ESE | PM | S | LIGHT | W | DAMP | N | | | 34 | | |
| 10/08/2012 | LSN | AM | S | LIGHT | SW | DRY | Y | Y | Vehicle movements | 41 | Bowser was on site, although it was being fixed at time of visit (puncture) | Bowser fixed |
| 11/08/2012 | | | | | | | | | | | | |
| 12/08/2012 | | | | | | | | | | | | |
| 13/08/2012 | LSN | AM | S | STRONG | SW | DRY | Y | Y | Vehicle movements | 43 | Bowsers arrived in section as I was leaving the site. | Use of bowser across site |
| 14/08/2012 | SSD | AM | S | STRONG | SW | DRY | Y | Y | Vehicle movements | 39 | Bowser on site | Use of bowser across site |
| 15/08/2012 | LSN | PM | S | STRONG | SW | DRY | Y | Y | Vehicle movements | 40 | Dust noted at lower Echline Field. Bowser present on site | LSN informed KMD and DTD during south networks meeting. Increased use of bowser across works area. |
| 16/08/2012 | SSD | PM | S | STRONG | SW | DRY | N | | | 36 | | |
| 17/08/2012 | ESE | AM | S | STRONG | SW | WET | N | | | | | |
| 18/08/2012 | | | | | | | | | | | | |
| 19/08/2012 | | | | | | | | | | | | |
| 20/08/2012 | SSD | PM | S | LIGHT | SW | WET | N | | | 25 | | |
| 21/08/2012 | SSD | PM | S | LIGHT | SW | WET | N | | | | | |
| 22/08/2012 | SSD | PM | S | LIGHT | SW | WET | N | | | 16 | | |
| 23/08/2012 | ESE | AM | S | LIGHT | SW | DAMP/WET | N | | | 31 | | |
| 24/08/2012 | SSD | AM | S | LIGHT | SE | DAMP | N | | | 22 | | |
| 25/08/2012 | | | | | | | | | | | | |
| 26/08/2012 | | | | | | | | | | | | |
| 27/08/2012 | ESE | AM | S | LIGHT | SE | WET | N | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28/08/2012 | MWN | PM | S | STRONG | SE | DRY | Y | Y | Some dust from dry areas of the site | 45 | No specific works causing the dust - strong winds causing dust. | Use of bowser across site |
| 29/08/2012 | ESE | AM | S | LIGHT | SE | DAMP/WET | N | | | 41 | | |
| 30/08/2012 | ESE | AM | S | LIGHT | NW | DAMP | N | | | 26 | | |
| 31/08/2012 | LSN | PM | S | LIGHT | W | DAMP/WET | N | | | 22 | | |

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# APPENDIX E: SUMMARY OF ENIVIRONMENTAL INSPECTIONS

## Summary of Dust and Air Quality Section of Environmental Inspections Undertaken in August 2012

| Date | Location | Dust and Odour | | | | Comments/Actions |
|---|---|---|---|---|---|---|
| | | Signs of dust or odour leaving site | Burning on site | Adequate suppression/ monitoring | Materials damped down/covered when entering/leaving site | |
| 01/08/2012 | St Margaret's Hope | No | No | Yes | N/A | Raining at time of site inspection |
| 01/08/2012 | Castlandhill | No | No | Yes | N/A | Bowser on site |
| 01/08/2012 | Whinny Hill | No | No | Yes | N/A | Bowser on site |
| 09/08/2012 | Echline Field | No | No | Yes | Yes | Haul roads damp due to weather conditions |
| 15/08/2012 | Echline Field | Yes | No | No | Yes | Bowser mobilised during inspection to reduce dust emissions |
| 23/08/2012 | Inchgarvie | No | No | Yes | Yes | Haul roads damp due to weather conditions |
| 23/08/2012 | Echline Field | No | No | Yes | Yes | |
| 29/08/2012 | North Networks | No | No | Yes | Yes | |
| 29/08/2012 | South Networks | No | No | Yes | Yes | |