



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project **FORTH REPLACEMENT CROSSING**

Document title

AIR QUALITY MONITORING REPORT
OCTOBER 2013

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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 October 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 (PM₁₀) 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 Meter



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 October |
|------|---------------------|-------------------------------|-------------------|--|
| M1 | Whinny Hill | Frisbee | 21/03/12 | <ul style="list-style-type: none"> • Drainage works at Castlandhill Road • King Malcolm Drive embankment landscaping fill |
| | | Automatic light scatter meter | 16/02/12 | |
| M7 | Butlaw Fisheries | Frisbee | 05/10/11 | <ul style="list-style-type: none"> • Marine works • Society Road works |
| M8 | Barracks West | Frisbee | 31/08/11 | <ul style="list-style-type: none"> • Marine works • Society Road works • Placing segments/rebar, concreting and waterproofing at S7/S8 • Access to S5 causeway |
| M9 | Barracks East | Frisbee | 31/08/11 | |
| M10 | Inchgarvie Lodge | Frisbee | 22/08/11 | <ul style="list-style-type: none"> • Launch – assembly of steel sections and placement of stillages • South abutment – preparatory works for the launch of west section • Placing segments/rebar, concreting and waterproofing at S7/S8 • Society Road works |
| | | Automatic light scatter meter | 17/10/11 | |
| M11 | Linn Mill | Frisbee | 22/08/11 | <ul style="list-style-type: none"> • Launch – assembly of steel sections and placement of stillages • South abutment – preparatory works for the launch of west section • Placing segments/rebar, concreting and waterproofing at S7/S8 • Society Road works |
| | | Automatic light scatter meter | 06/12/11 | |
| M12 | Clufflat | Frisbee | 29/08/11 | <ul style="list-style-type: none"> • Launch – assembly of steel sections and placement of stillages • South abutment – preparatory works for the launch of west section • Placing segments/rebar, concreting and waterproofing at S7/S8 • Society Road works • Echline cut – ripping rock |
| M13 | Clufflat Brae | Frisbee | 21/09/11 | |
| | | Automatic light scatter meter | 24/10/11 | |

| | | | | |
|-----|------------------|-------------------------------|----------|---|
| M14 | Springfield | Frisbee | 15/08/11 | <ul style="list-style-type: none"> • Launch – assembly of steel sections and placement of stillages • South abutment – preparatory works for the launch of west section • Placing segments/rebar, concreting and waterproofing at S7/S8 • Society Road works • Echline cut – ripping rock |
| M15 | Echline | Frisbee | 16/08/11 | <ul style="list-style-type: none"> • Launch – assembly of steel sections and placement of stillages • South abutment – preparatory works for the launch of west section • Placing segments/rebar, concreting and waterproofing at S7/S8 • Society Road works • Echline cut – ripping rock • Gyrotory – structures including on-site fabrication of beams • A904 west tie in road works |
| | | Automatic light scatter meter | 10/11/11 | |
| M16 | Scotstoun | Frisbee | 07/09/11 | <ul style="list-style-type: none"> • Utilities works • Structure works |
| | | Automatic light scatter meter | 14/02/12 | |
| M17 | Dundas Home Farm | Frisbee | 29/08/11 | <ul style="list-style-type: none"> • Utility works • Ditch drainage • Environmental bund |
| | | Automatic light scatter meter | 23/02/12 | |
| M18 | Newton | Frisbee | 22/08/11 | <ul style="list-style-type: none"> • 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 October 2013 have been presented in a monthly chart; this can be found in Appendix A. Results show that the PM₁₀ levels were below threshold levels throughout October and generally followed the same pattern across the site.

- 3.1.2.** Throughout October, the environmental department were notified by alerts where 15 minute trigger levels were exceeded. However, on no instances were construction works found to be causing high dust levels at any of the receptors.
- 3.1.3.** Some PM₁₀ data is missing for October. At Inchgarvie an extended period is missing as a device error was identified by the environmental team and the meter was returned to the supplier for servicing. The device was reinstalled on site on 28 October. Some data is also missing for Dundas Home Farm due to loss of power to the device that was caused by a third party. Where data is missing, FCBC endeavour to increase the on-site checks, though it should be noted that air quality monitoring continued at these locations with the dust deposition gauges.
- 3.1.4.** The PM₁₀ 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 October was largely driven by regional changes in air quality.

3.2. Total Suspended Particles

- 3.2.1.** The TSP results for October 2013 have been presented in a monthly chart; this can be found in Appendix B. The TSP levels at monitoring locations during October were generally low and all within the threshold level. All locations were mostly 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.

3.2.2. As with the PM_{10} results, data is missing for Inchgarvie and Dundas for the reasons noted above (see 3.1.3.).

3.3. Frisbee Dust Deposition Results

3.3.1. The Frisbee dust deposition results for October 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. Three collections were made in October; 2, 16 and 30 October. The collection made on 2 October covers the 12 days at the end of September and, therefore, should be considered alongside the construction activities for September (see Air Quality Monitoring Report: September 2013).

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 October there were six exceedances of the site review level and two exceedances of the site action level (see Table 4). With the

exception of the locations where exceedances occurred, Frisbee results from monitoring locations across site were generally found to be low.

Table 4: Exceedances of the dust deposition thresholds

| Fortnight ending | Threshold Exceeded | Monitoring Location | Considerations | Weather conditions during period |
|------------------|--------------------|---------------------|--|--|
| 02/10/13 | Review | Scotstoun | Located underneath trees | Generally damp |
| | | Inchgarvie | Located close to trees | |
| | | Echline | Located close to trees | |
| | Action | Barracks East | Located at viaducts storage and parking area | |
| 16/10/13 | Review | Barracks East | Located at viaducts storage and parking area | Damp with some dry days. Some strong winds. |
| | | Springfield | Located underneath trees | |
| 30/10/13 | Review | Whinny Hill | Located amongst vegetation | Generally damp conditions with some dry days |
| | Action | Barracks East | Located at viaducts storage and parking area | |

3.3.5. For each of the exceedances of the review level, a review of the works in each of the areas, weather conditions, and the mitigation measures in place was undertaken. Other considerations were also made, such as where the gauge is located; where gauges are located underneath vegetation this may give rise to false increase levels, particularly during autumn when vegetation begins to fall. Where available, the Frisbee results were also considered alongside the particulate matter data for the same period; particulate matter levels were low and within the threshold levels.

3.3.6. With regard to the exceedances at Scotstoun, Inchgarvie, Echline, Whinny Hill and Springfield, it is thought that the levels may have been

influenced by their proximity to vegetation. Whilst construction activities cannot be excluded from considerations, a review of the works at these locations and the weather conditions demonstrate that the impact of construction activities on the dust levels at these receptors is likely to have been minimal during the periods in question. Mitigation measures were on-going throughout October, with use of the bowser for dampening down across site as required.

- 3.3.7.** A full review was undertaken due to the exceedances at Barracks East, which took into account factors such as the location of the gauge, any works undertaken and the weather conditions. However, it should be noted that this is not a sensitive receptor and the Barracks West meter, located within 100m, did not show any corresponding high levels.
- 3.3.8.** No viaducts works were undertaken during October or late September (see Air Quality Monitoring Report: September 2013) in the Barracks area. Though the gauge is located at the parking area where small quantities of material are also stored, no cutting operations or other dust generating activities have been undertaken in this area. It is possible that the on-going works at Society Road may have partially influenced the results, in particularly the result for the period ending on 30/10/13 when tree felling occurred in this area during the period 16 to 30 October on 2 days which may have caused increased dust in the area for this period. However, the impacts of this tree felling operation were not noted at other receptors. Due to the high results at this location, the programme of works for the immediate area is reviewed daily for any dust generating activities to ensure that appropriate mitigation measures are employed. Additionally, FCBC are reviewing the location of the gauge to ensure that it is positioned so not be influenced by factors that do not reflect the dust levels in the area.

3.4. Daily Dust Log and Environmental Inspections

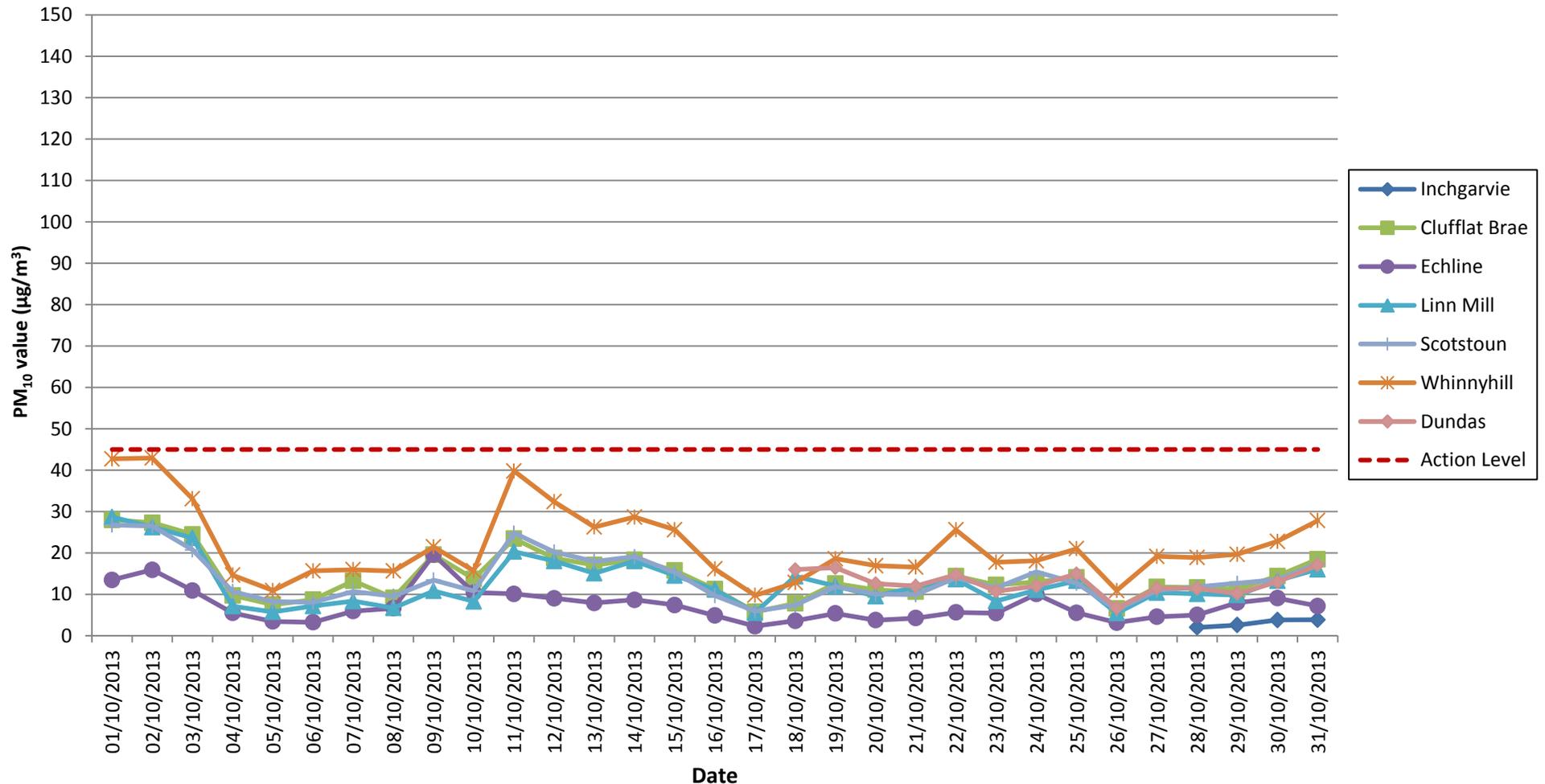
- 3.4.1.** A summary of the daily dust log for October can be found in Appendix D. During this period no instances of dust were noted on site. However, tree felling occurred at Society Road during the period and the operation was noted to cause localised sawdust, though the extent of this was minimal.
- 3.4.2.** During this period full environmental inspections were also undertaken across the site and covered areas where works were being undertaken. In October, no instances of dust were noted during inspections.



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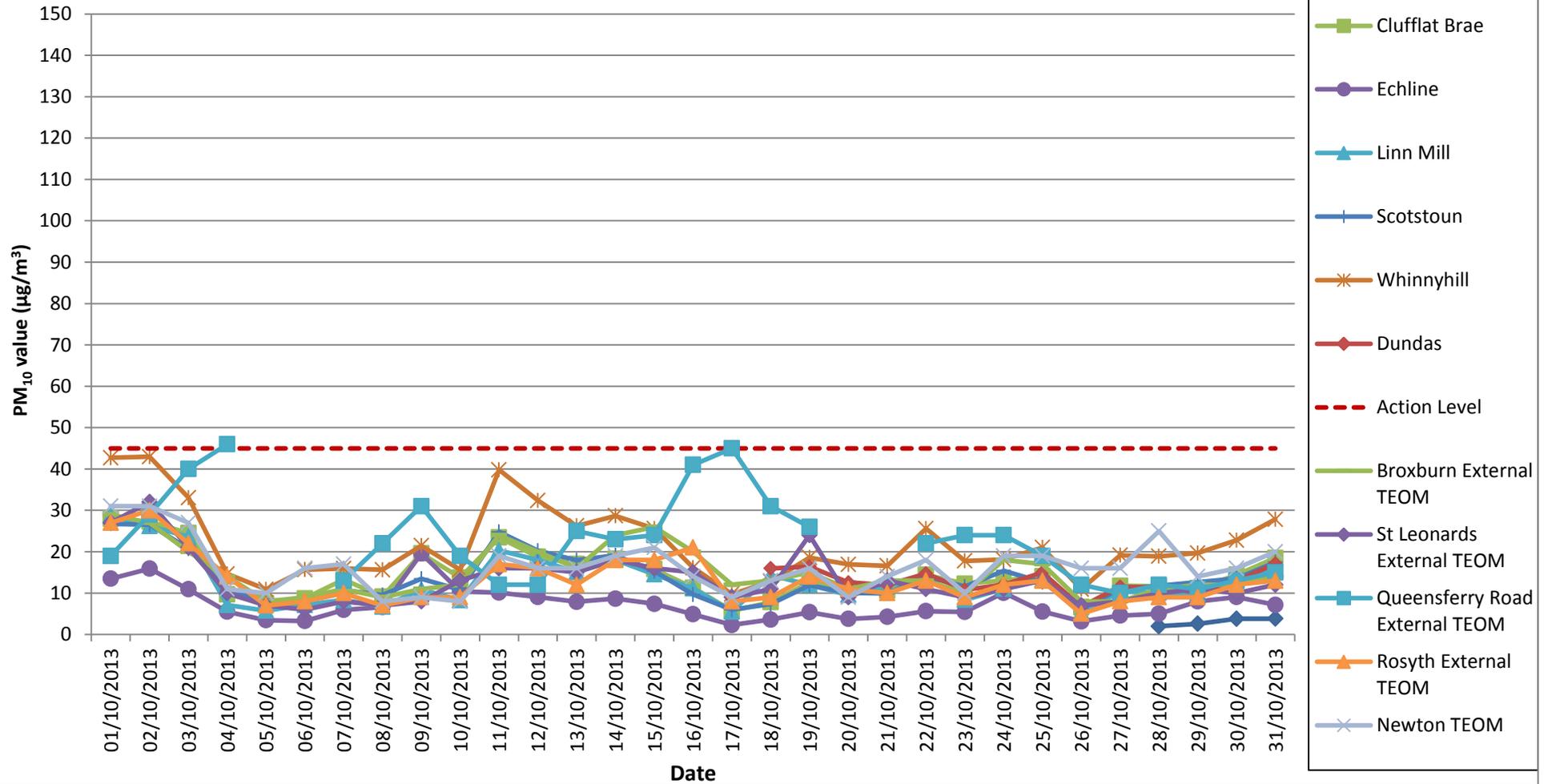
APPENDIX A: LIGHT SCATTER METER RESULTS

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



Note: Please refer to section 3 of the Air Quality Monitoring Report: October 2013. Data is missing from Inchgarvie for the period 01/10/13 to 27/10/13 as the device had to be returned to the supplier for servicing due to an error with the device. Data is also missing for Dundas for the period 01/10/13 to 17/10/13 due to loss of power caused by a third party.

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



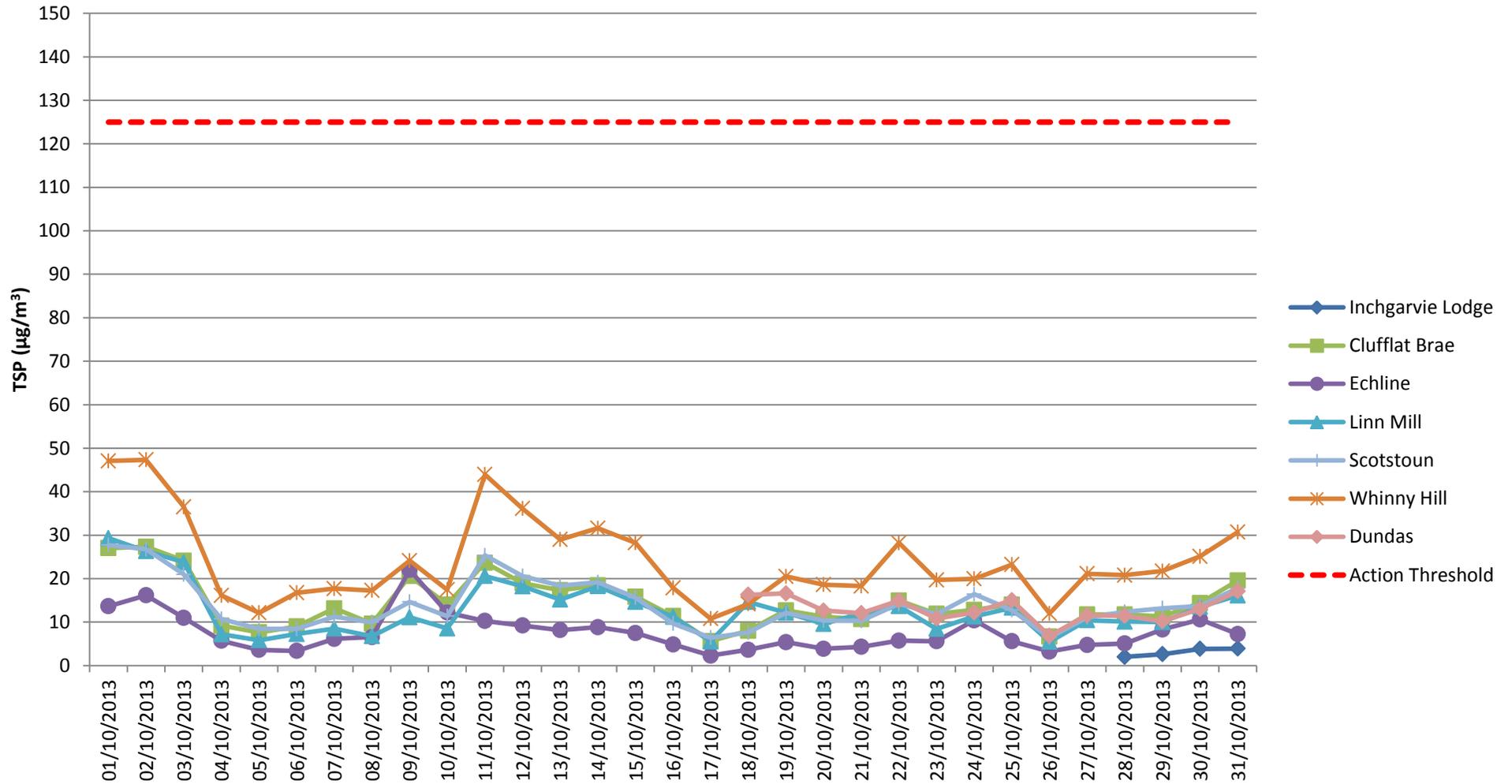
Note: Please refer to section 3 of the Air Quality Monitoring Report: October 2013. Data is missing from Inchgarvie for the period 01/10/13 to 27/10/13 as the device had to be returned to the supplier for servicing due to an error with the device. Data is also missing for Dundas for the period 01/10/13 to 17/10/13 due to loss of power caused by a third party.



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APPENDIX B: TOTAL SUSPENDED PARTICLES

Total Suspended Particles (TSP) Results October 2013



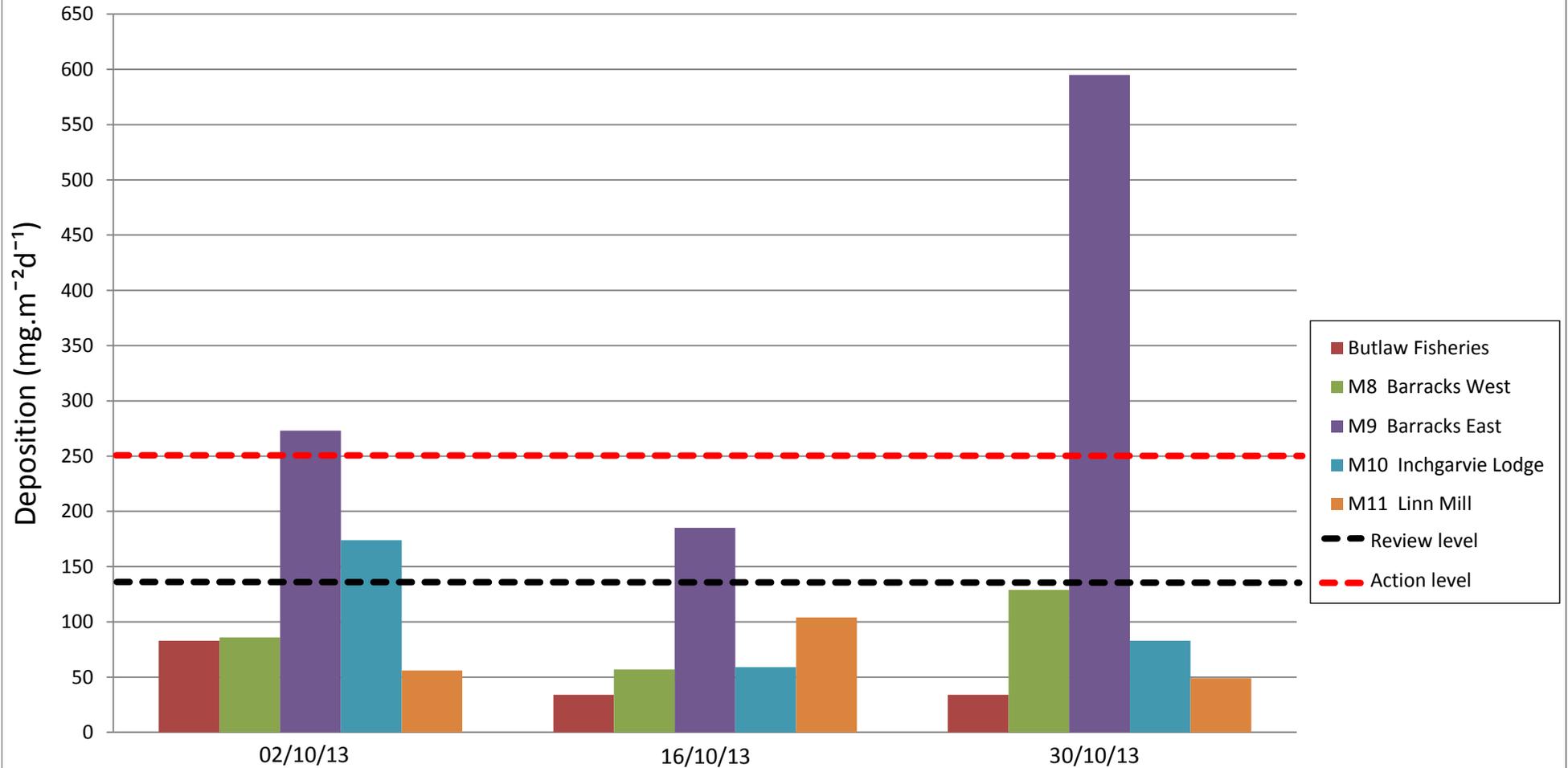
Note: Data is missing from Inchgarvie for the period 01/10/13 to 27/10/13 as the device had to be returned to the supplier for servicing due to an error with the device. Data is also missing for Dundas for the period 01/10/13 to 17/10/13 due to loss of power caused by a third party.



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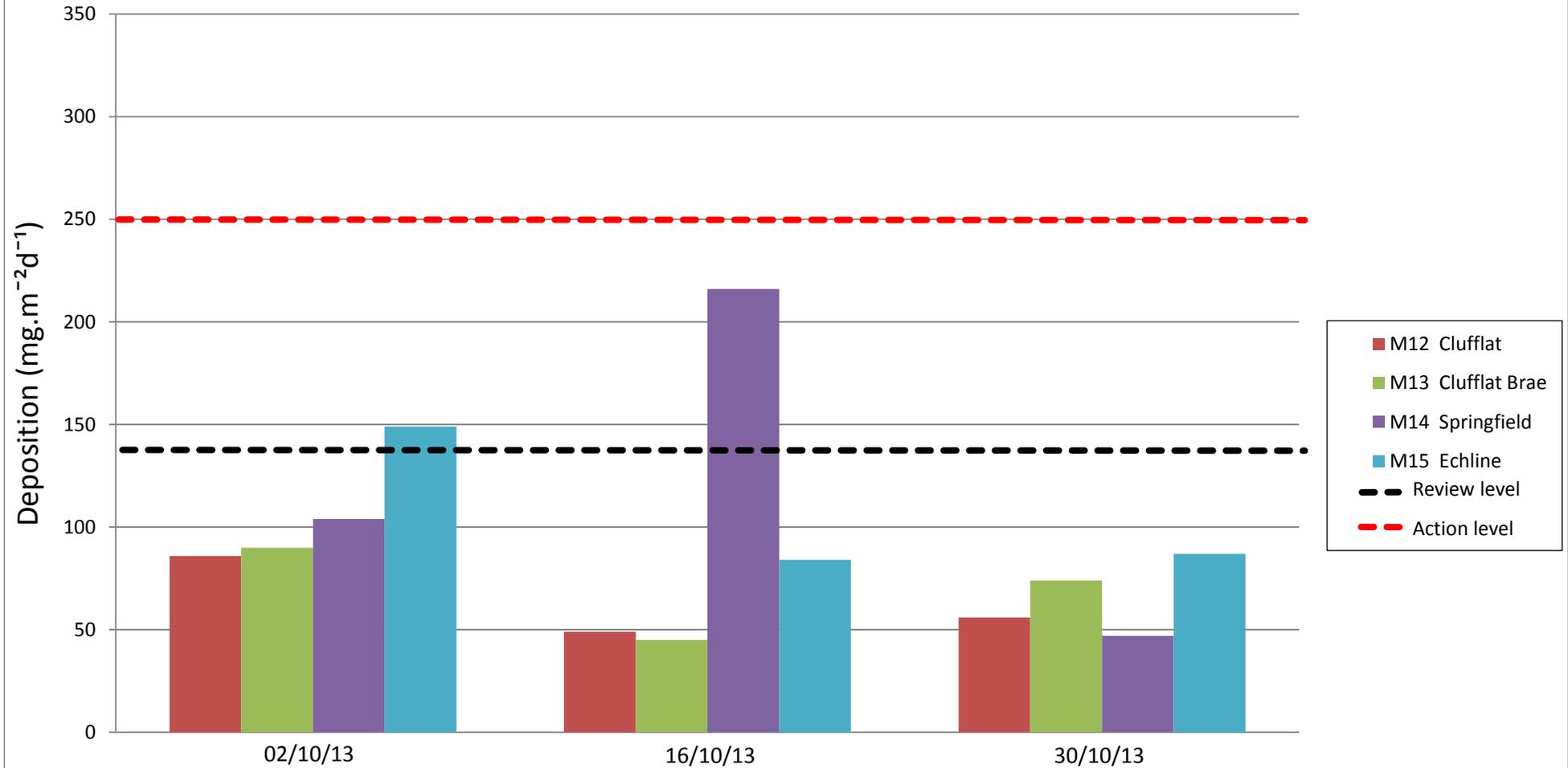
APPENDIX C: FRISBEE GAUGE RESULTS

Frisbee Dust Deposition Results: Group 1
Locations: M7 Butlaw Fisheries, M8 Barracks West, M9 Barracks East, M10 Inchgarvie Lodge and M11 Linn Mill



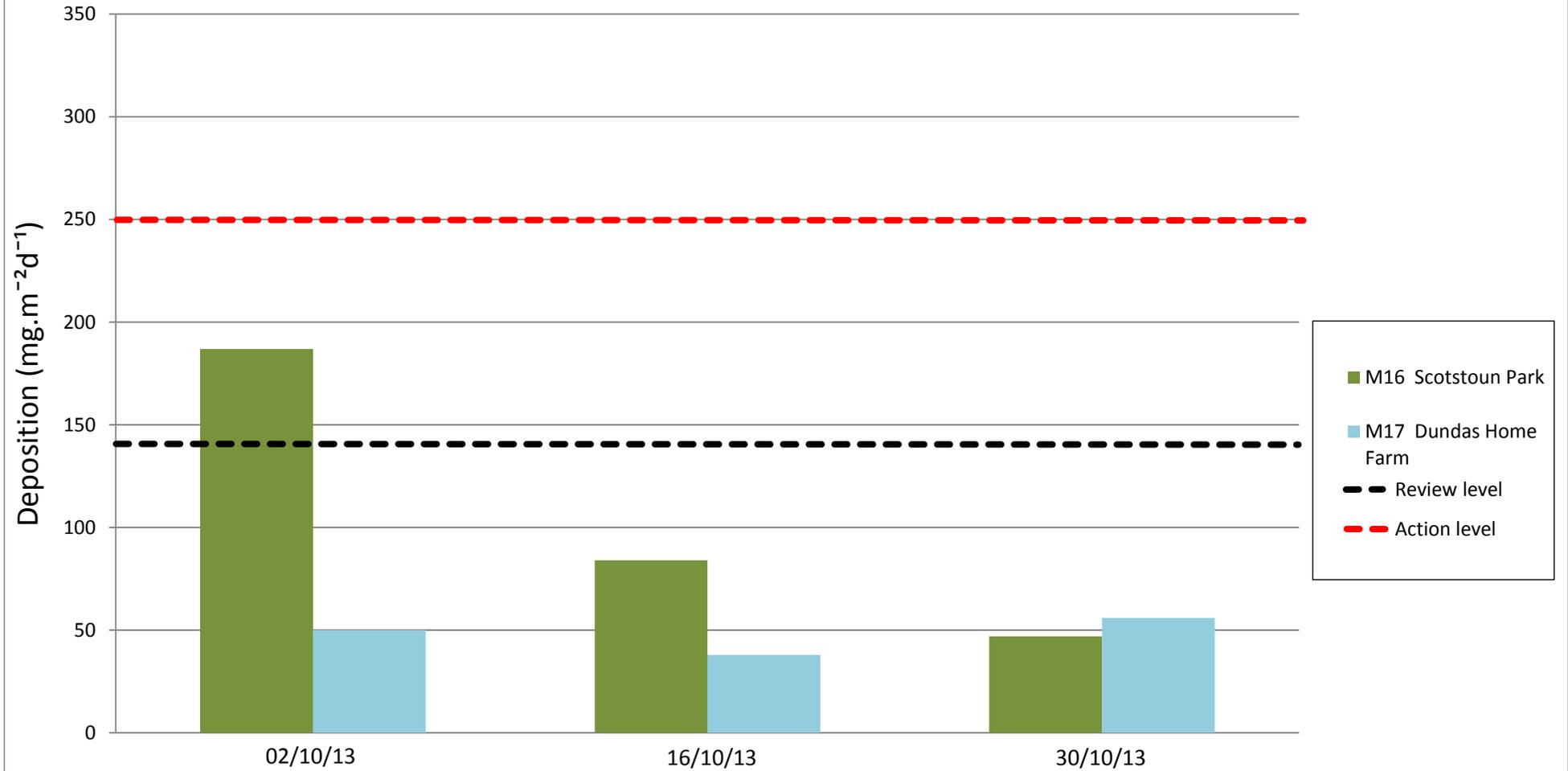
Frisbee Dust Deposition Results: Group 2

Locations: M12 Clufflat, M13 Clufflat Brae, M14 Springfield and M15 Echline



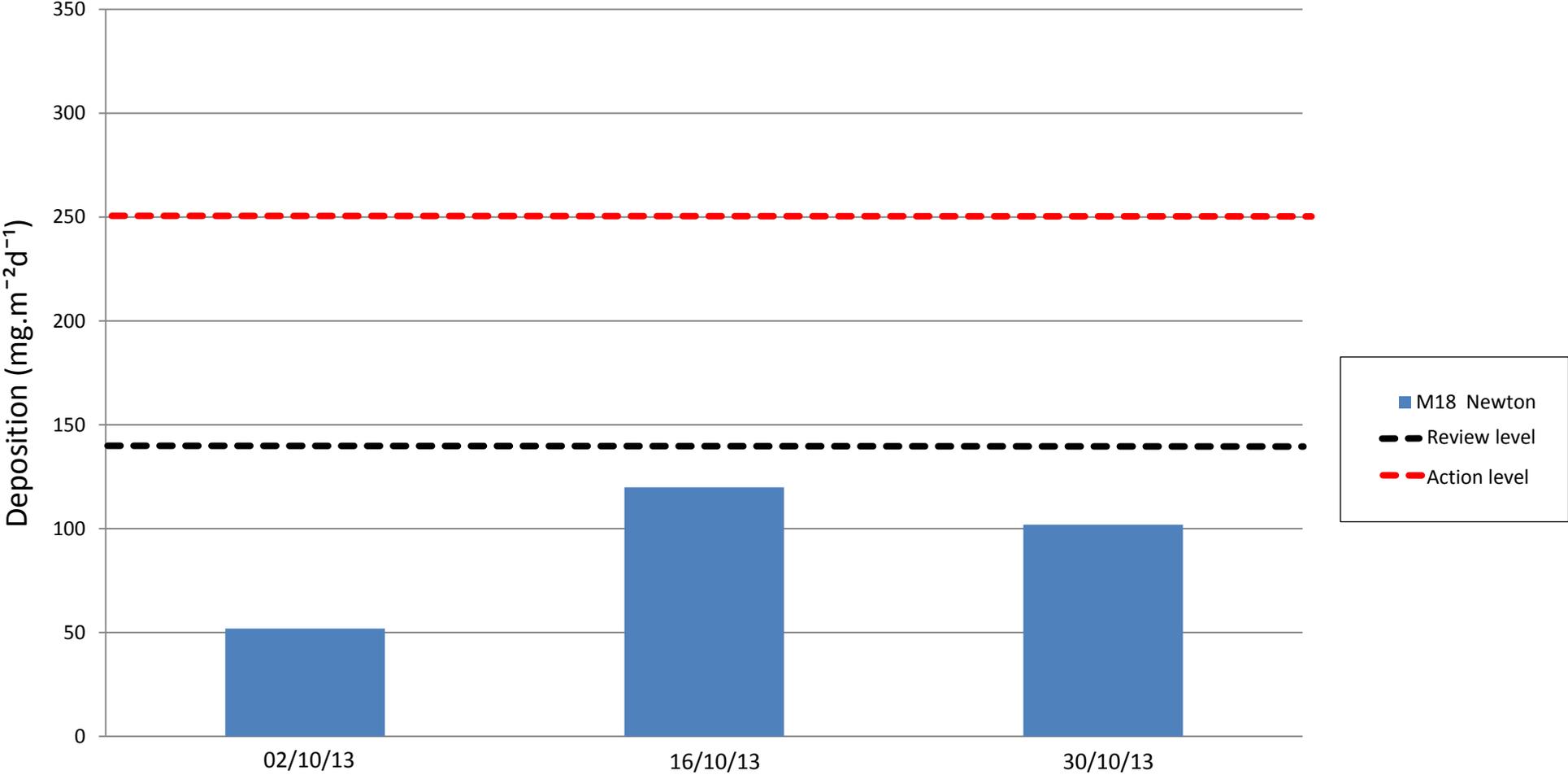
Frisbee Dust Deposition Results: Group 3

Locations: M16 Scotstoun Park and M17 Dundas Home Farm



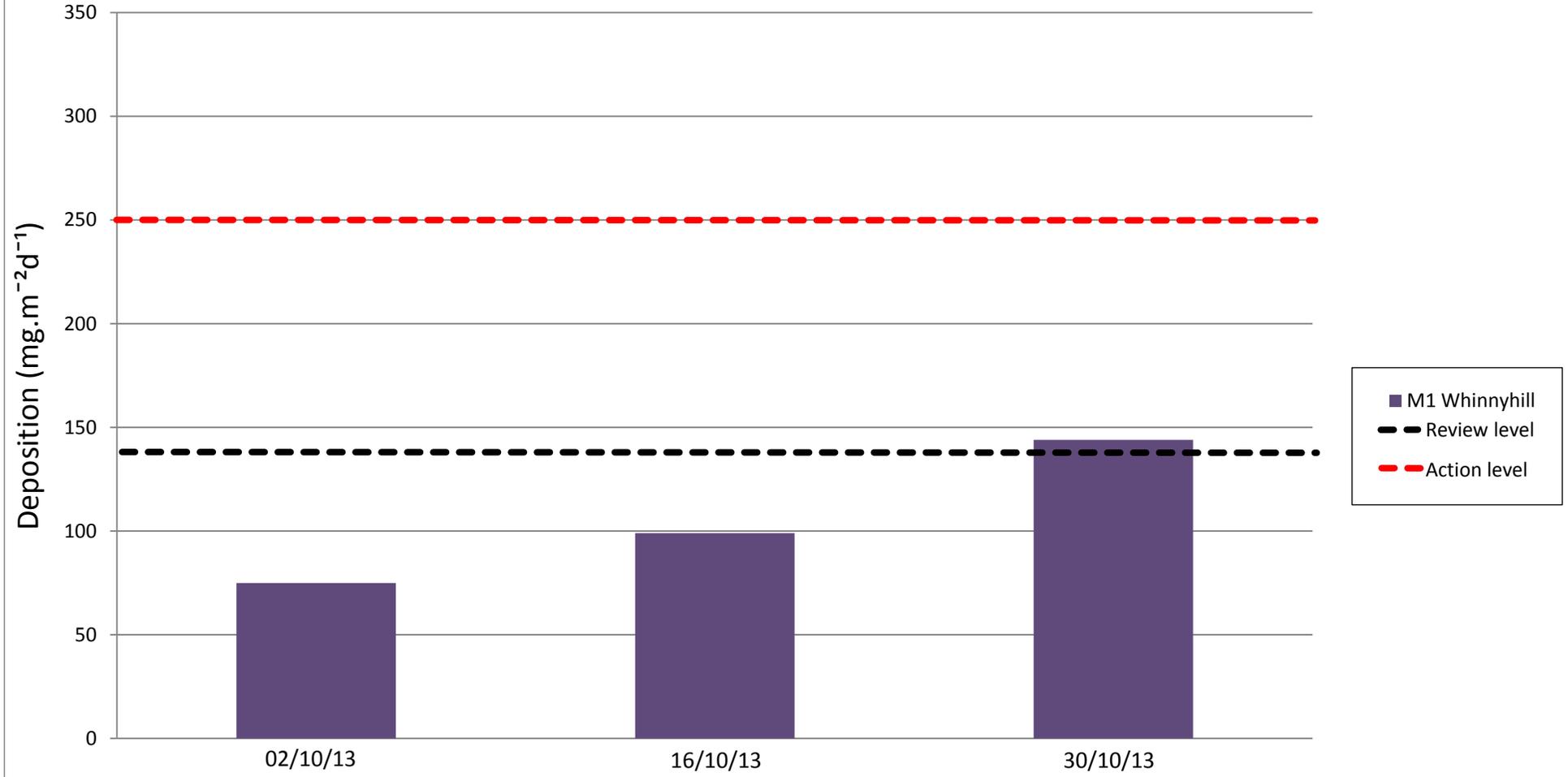
Frisbee Dust Deposition Results: Group 4

Locations: M18 Newton



Frisbee Dust Deposition Results: Group 5

Locations: M1 Whinny Hill





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APPENDIX D: DAILY DUST LOG

Daily Dust Log - North - October 2013

| DATE | LOCATION | WIND | WIND DIRECTION | GROUND SURFACE | VISIBLE DUST | DUST DUE TO WORKS (if applicable) | CAUSES OF DUST (if applicable) | COMMENTS AND ACTIONS |
|------------|----------|--------|----------------|----------------|--------------|-----------------------------------|--------------------------------|----------------------|
| 01/10/2013 | N | MEDIUM | NE | DRY | N | | | Hazy pm |
| 02/10/2013 | N | MEDIUM | NE | WET | N | | | |
| 03/10/2013 | N | LIGHT | NE | DAMP | N | | | |
| 04/10/2013 | N | LIGHT | SW | DAMP | N | | | |
| 05/10/2013 | N | | | | | | | |
| 06/10/2013 | N | | | | | | | |
| 07/10/2013 | N | LIGHT | SSW | DRY | N | | | |
| 08/10/2013 | N | LIGHT | SW | DRY | N | | | |
| 09/10/2013 | N | STRONG | SW | DRY | N | | | |
| 10/10/2013 | N | LIGHT | WNW | DRY | N | | | |
| 11/10/2013 | N | LIGHT | N | DRY | N | | | |
| 12/10/2013 | N | | | | | | | |
| 13/10/2013 | N | | | | | | | |
| 14/10/2013 | N | LIGHT | NNE | DRY | N | | | |
| 15/10/2013 | N | LIGHT | NE | DAMP | N | | | |
| 16/10/2013 | N | LIGHT | NE | WET | N | | | |
| 17/10/2013 | N | LIGHT | NE | WET | N | | | |
| 18/10/2013 | N | LIGHT | NE | DAMP | N | | | |
| 19/10/2013 | N | | | | | | | |
| 20/10/2013 | N | | | | | | | |
| 21/10/2013 | N | LIGHT | NE | DRY | N | | | |
| 22/10/2013 | N | LIGHT | SSE | DAMP | N | | | |
| 23/10/2013 | N | LIGHT | SW | DAMP | N | | | |
| 24/10/2013 | N | LIGHT | SW | DRY | N | | | |
| 25/10/2013 | N | LIGHT | NE | DAMP | N | | | |
| 26/10/2013 | N | | | | | | | |
| 27/10/2013 | N | | | | | | | |
| 28/10/2013 | N | LIGHT | SW | DRY | N | | | |
| 29/10/2013 | N | MEDIUM | SW | DRY | N | | | |
| 30/10/2013 | N | MEDIUM | SW | DRY | N | | | |
| 31/10/2013 | N | STRONG | S | DRY | N | | | |

Daily Dust Log - South - October 2013

| DATE | LOCATION | WIND | WIND DIRECTION | GROUND SURFACE | VISIBLE DUST | DUST DUE TO WORKS (if applicable) | CAUSES OF DUST (if applicable) | COMMENTS AND ACTIONS |
|------------|----------|--------|----------------|----------------|--------------|-----------------------------------|--------------------------------|------------------------------|
| 01/10/2013 | S | MEDIUM | NE | DRY | N | | | |
| 02/10/2013 | S | MEDIUM | NE | WET | N | | | |
| 03/10/2013 | S | LIGHT | NE | DAMP | N | | | |
| 04/10/2013 | S | LIGHT | SW | DAMP | N | | | |
| 05/10/2013 | S | | | | | | | |
| 06/10/2013 | S | | | | | | | |
| 07/10/2013 | S | LIGHT | SSW | DRY | N | | | |
| 08/10/2013 | S | LIGHT | SW | DRY | N | | | |
| 09/10/2013 | S | STRONG | SW | DRY | N | | | |
| 10/10/2013 | S | LIGHT | WNW | DRY | N | | | |
| 11/10/2013 | S | LIGHT | N | DRY | N | | | |
| 12/10/2013 | S | | | | | | | |
| 13/10/2013 | S | | | | | | | |
| 14/10/2013 | S | LIGHT | NNE | DRY | N | | | |
| 15/10/2013 | S | LIGHT | NE | DAMP | N | | | |
| 16/10/2013 | S | LIGHT | NE | WET | N | | | |
| 17/10/2013 | S | LIGHT | NE | WET | N | | | |
| 18/10/2013 | S | LIGHT | NE | DAMP | N | | | |
| 19/10/2013 | S | | | | | | | |
| 20/10/2013 | S | | | | | | | |
| 21/10/2013 | S | LIGHT | NE | DRY | N | | | |
| 22/10/2013 | S | LIGHT | SSE | DAMP | N | | | |
| 23/10/2013 | S | LIGHT | SW | DAMP | N | | | |
| 24/10/2013 | S | LIGHT | SW | DRY | N | | | |
| 25/10/2013 | S | LIGHT | NE | DAMP | N | | | |
| 26/10/2013 | S | | | | | | | |
| 27/10/2013 | S | | | | | | | |
| 28/10/2013 | S | LIGHT | SW | DRY | N | | | Tree felling at Society Road |
| 29/10/2013 | S | MEDIUM | SW | DRY | N | | | Tree felling at Society Road |
| 30/10/2013 | S | MEDIUM | SW | DRY | N | | | |
| 31/10/2013 | S | STRONG | S | DRY | N | | | |