



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project **FORTH REPLACEMENT CROSSING**

Document title

**AIR QUALITY MONITORING REPORT
SEPTEMBER 2012**

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Contents

- 1. Introduction**
- 2. Monitoring Equipment and Locations**
- 3. Air Quality Monitoring Results**
 - 3.1. Automatic Light Scatter Meter Particulate Matter Monitoring Results**
 - 3.2. Total Suspended Particle Results**
 - 3.3. Frisbee Dust Deposition Results**
 - 3.4. Daily Dust Log and Weekly Environmental Inspections**

Appendices:

- Appendix A: Particulate Matter Results**
- Appendix B: Total Suspended Particle Results**
- Appendix C: Frisbee Dust Deposition Results**
- Appendix D: Daily Dust Log Summary**
- Appendix E: Summary of Environmental Inspections**

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 September 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 (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 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 in the vicinity of the works at Echline when the ground conditions were dry. 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 check to assess the following:

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



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 September |
|------|---------------------|-------------------------------|-------------------|--|
| M1 | Whinny Hill | Frisbee | 21/03/12 | Drilling for blasting Blasting Breaking and excavation of rock Haulage of rock |
| | | Automatic light scatter meter | 16/02/12 | |
| M7 | Butlaw Fisheries | Frisbee | 05/10/11 | Concreting at S7 & S8 Marine works S6 Access Track Drainage |
| M8 | Barracks West | Frisbee | 31/08/11 | Marine works Concreting at S7 & S8 S6 Access Track Drainage Removal of invasive species |
| M9 | Barracks East | Frisbee | 31/08/11 | Marine works Concreting at S7 & S8 S6 Access Track Drainage Removal of invasive species |
| M10 | Inchgarvie Lodge | Frisbee | 22/08/11 | Concreting at S7 & S8 S6 Access Track Drainage Drainage works Excavation of material from launch |
| | | Automatic light scatter meter | 17/10/11 | |
| M11 | Linn Mill | Frisbee | 22/08/11 | Excavation of material from launch Drainage works Cut/Fill of West SUDS pond |
| | | Automatic light scatter meter | 06/12/11 | |
| M12 | Clufflat | Frisbee | 29/08/11 | Drainage works Excavation of material from launch |
| M13 | Clufflat Brae | Frisbee | 21/09/11 | Cut of East SUDS pond and installation of bund |
| | | Automatic light scatter meter | 24/10/11 | |
| M14 | Springfield | Frisbee | 15/08/11 | Excavation of material from launch Cut of East SUDS pond and installation |

| | | | | |
|-----|------------------|-------------------------------|----------|--|
| M15 | Echline | Frisbee | 16/08/11 | Cut/Fill from Queensferry gyratory Fill to bunds |
| | | Automatic light scatter meter | 10/11/11 | |
| M16 | Scotstoun | Frisbee | 07/09/11 | Import of materials Utility works Soil stripping |
| | | Automatic light scatter meter | 14/02/12 | |
| M17 | Dundas Home Farm | Frisbee | 29/08/11 | Utilities works Soil Stripping |
| | | 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 September 2012 have been presented in a monthly chart; this can be found in Appendix A. Generally, results show that the PM₁₀ levels were low and largely followed the same pattern across the site. There were two dates during September on which there were exceedances of the PM₁₀ threshold; these occurred on 4 September at Whinny Hill (53.94 µg/m³), Scotstoun (47.84 µg/m³) and Clufflat Brae (107.58 µg/m³) and on 15 September at Whinny Hill (49.31 µg/m³). Real time triggers were received by the Environmental Team on these dates and the causes were investigated immediately.

3.1.2. Construction works were on-going within the vicinity of the monitoring locations on the dates on which the exceedances were caused. Strong winds on these dates were found to be causing elevated dust levels across site, largely due to the wind blowing dust from trucks moving on the haul roads and areas of excavation within both the north and south works areas.

- 3.1.3.** In response to the exceedances, FCBC took a number of actions. As an immediate response to the triggers received the FCBC Environmental Team contacted the site engineers to ensure that the bowser was operating in the areas where inspections identified increased levels of dust. Further mitigations put in place by FCBC include the deployment of a second tractor to enable increased water bowser movements across site and an additional attachment for the water bowser to allow water to be sprayed over excavation areas.
- 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. 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 September was largely due to regional changes in air quality.
- 3.1.5.** Elevated results were noted at all the TEOM monitoring locations on both dates on which exceedances were recorded at the light scatter meters on site. This, therefore, indicates that whilst the results obtained from the light scatter meters on site may have been exacerbated by increased dust levels arising on site, a regional increase was also noted on these dates. This is particularly true with regard to the exceedance on 15 September at Whinny Hill; it is possible that this result exceeded the limit due to the differences noted between the results from a light scatter and a TEOM as discussed in paragraph 2.2.
- 3.1.6.** Due to a loss of the power supply at Echline and faults with the equipment, the data from this meter is missing throughout September. FCBC and a third party worked throughout September to connect the mains power supply to the new enclosure built to house the monitoring equipment at Echline Corner. The monitoring equipment will be moved

to the new location imminently and the equipment is due to be fully functioning in early October. In the interim, inspections in the Echline area have increased and handheld PM₁₀ results have been gathered for the period, focussing on days where dry conditions are apparent on site, and are reported in Appendix D – Daily Dust Log South. On other days in the September period that were not monitored there were minimal works going on and the ground was either wet or damp.

- 3.1.7.** The averaged handheld PM₁₀ results for the Echline area during this period did not show any exceedances and the majority of results mirrored the site-wide ambient levels with the majority of readings between 15-40µg/m³.
- 3.1.8.** Data is not included for Dundas throughout September 2012. Potential errors were noted by the Environmental Team with the data collected during September. 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 FCBC are awaiting a site visit by an engineer.

3.2. Total Suspended Particles

- 3.2.1.** The TSP results for September 2012 have been presented in a monthly chart; this can be found in Appendix B. TSP levels at all monitoring locations throughout September were within the threshold level and found to follow a similar pattern across the site, demonstrating that in general the levels are influenced by regional changes in TSP levels, rather than construction works. Elevated results were noted at all locations, though notably Clufflat Brae, on the 4 September. As noted in paragraph 3.1.5, it is considered that construction works were likely to have influenced the results obtained, however strong winds were found to exacerbate the results and a regional increase was also noted on this date.

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 September continued to be unrealistically low. FCBC have consulted with the supplier and are awaiting a visit from engineer to resolve the issue. Data is also missing for Echline due to the loss of power, as noted in paragraph 3.1.6.

3.3. Frisbee Dust Deposition Results

3.3.1. The Frisbee dust deposition results for September 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 September; 5 and 19 September 2012. The next collection date is due on the 3 October. Due to unforeseen circumstances the collection on the 19 September was delayed until the 20 September; the results for the second period are therefore averaged over a period of 15 days. Due to an error with the size of the sample bottle for Whinny Hill on the 22 August collection date, the data for the first period from Whinny Hill covers the period 9 August to 6 September.

- 3.3.3.** The site action level for the dust deposition rate has been set at 250 mg/m²/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/m²/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 September the dust deposition rates for all groups were within the site action level threshold. All dust deposition rates for Groups 1, 3 and 4 were also within the lower, site review level threshold. For Group 2, results for all locations were within the threshold dust deposition levels for the period ending on 5 September. However, there was an exceedance of the site review level at Echline (171 mg.m⁻²d⁻¹) for the period ending on the 20 September. The results for Group 5 show that results for Whinny Hill were within the threshold levels for the period ending on the 20 September, although there was an exceedance of the review level for the period ending on 5 September (161 mg.m⁻²d⁻¹).
- 3.3.5.** Due to the exceedances of the site review level during September, at two different locations, FCBC conducted a review into site wide dust levels and the construction works being undertaken at these locations. As construction works were being undertaken in the area around Echline Corner it is possible, therefore, that the exceedance at this location was caused by dust generated from these works. On 6 September, dust was noted blowing in strong winds from the area of the Queensferry gyratory excavation during the daily inspection (see paragraph 3.4.2) which may have influenced the results obtained for the Frisbee at Echline. Contact with the section engineers throughout the period ensured that the water bowser was in use at this location to dampen down as required. Additional mitigation measures were also

put in place during September both as a result of the light scatter PM₁₀ results and the Frisbee results (see paragraph 3.1.3).

- 3.3.6.** With regard to the exceedance at Whinny Hill, it is likely that this result was influenced by increased dust levels noted within August due to faults with the dust extraction system on the drilling rig which were subsequently rectified. For further information regarding this please refer to the Air Quality Monitoring Report: August 2012 (REP-00060-00).

3.4. Daily Dust Log and Environmental Inspections

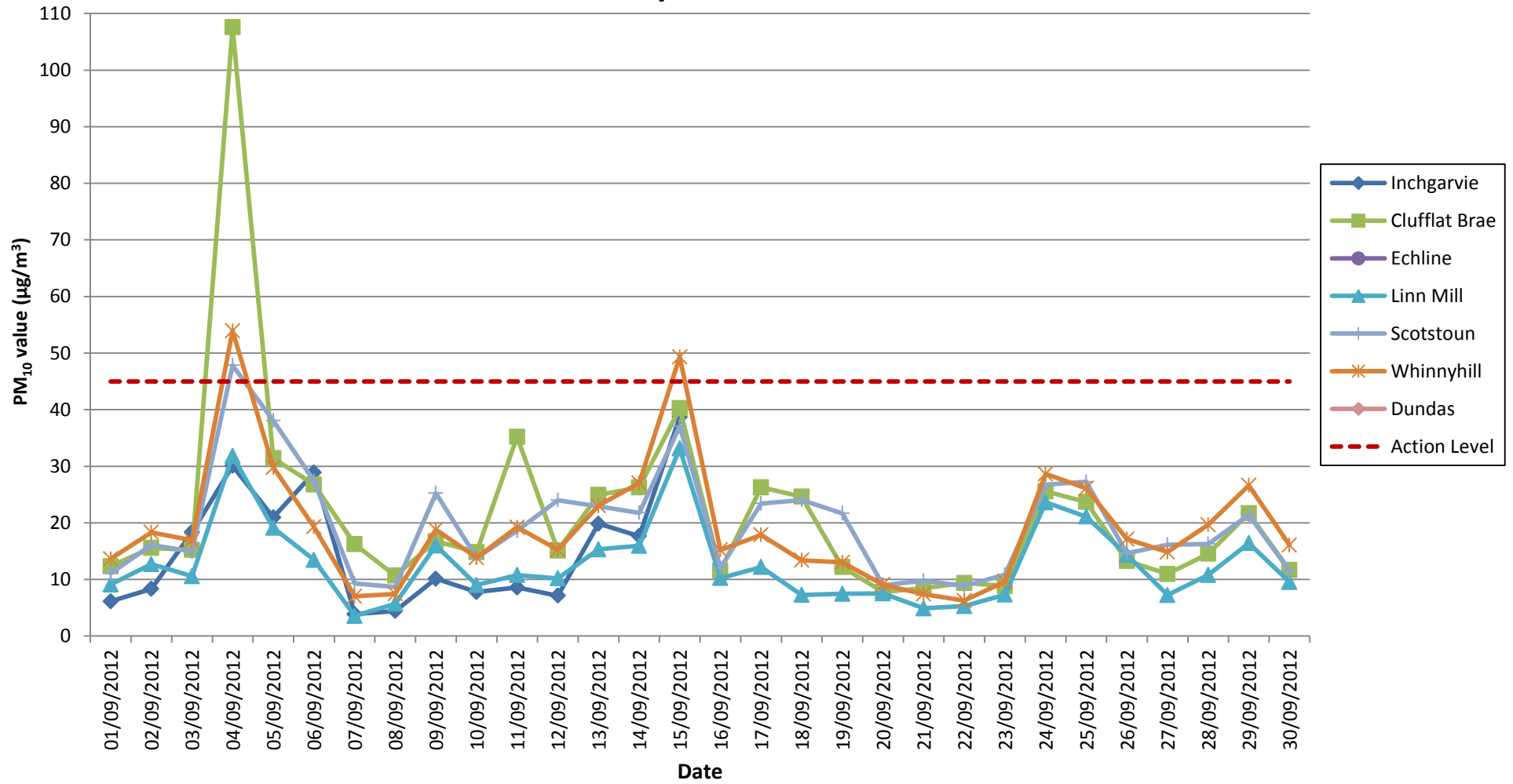
- 3.4.1.** A summary of the daily dust log for September can be found in Appendix D. Five instances of visual dust on site were noted in the northern networks area. The causes of the exceedances were found to be vehicle movements on dry access tracks, on-going excavation works at Whinny Hill and pecking and other activities in the area of the north abutment. On the 5 and 6 September the dust levels were worsened by strong winds. Further to noting dust during inspections the appropriate section engineers were contacted and the water bowser was subsequently used to dampen down the areas identified. Additional discussions were held with the networks teams to identify further mitigation measures (see paragraph 3.1.3).
- 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 and excavation activities. Further to noting dust during inspections the appropriate section engineers were contacted and the water bowser was subsequently used to dampen down the areas identified. Additional discussions were held with the networks teams to identify further mitigation measures (see paragraph 3.1.3).

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. Seven inspections across the site were undertaken by the FCBC Environmental Department during September, focussing on areas in which works were being undertaken. Inspections of the north and south networks areas on 5 September identified unsatisfactory dust levels at the time of the inspection. These inspections were accompanied by a section engineer and as a result adequate mitigation measures were immediately put in place.



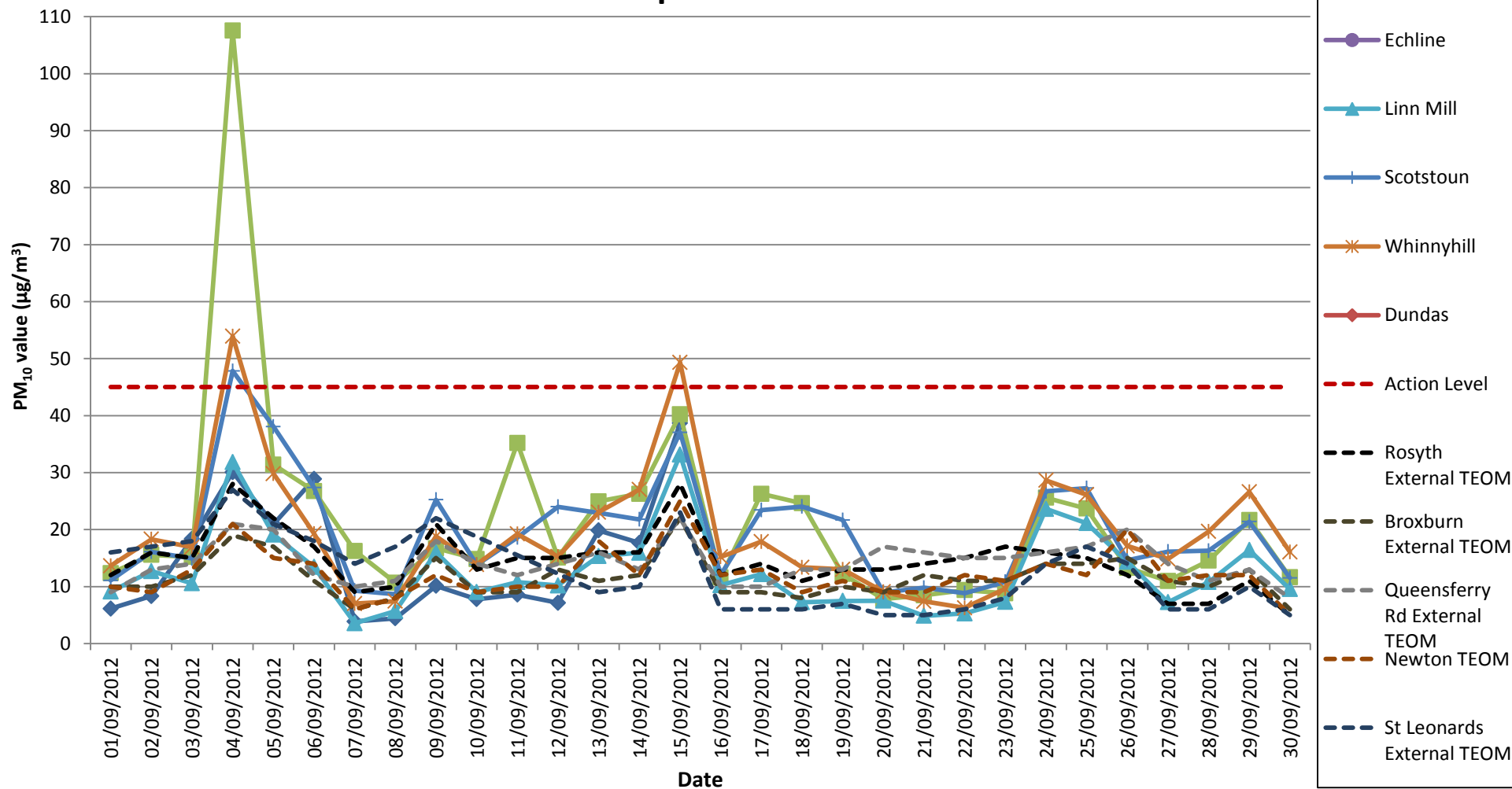
APPENDIX A: LIGHT SCATTER METER RESULTS

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



Note: Due to a power failure at Echline, no PM₁₀ data is available for this location. Due to an error associated with the Dundas device the results for this location have been excluded. Data is missing from Inchgarvie from 15/09/12 due to an error with the connection accidentally caused by a third party.

Particulate Matter (PM10) Results (Including TEOM Results) All Monitoring Locations September 2012

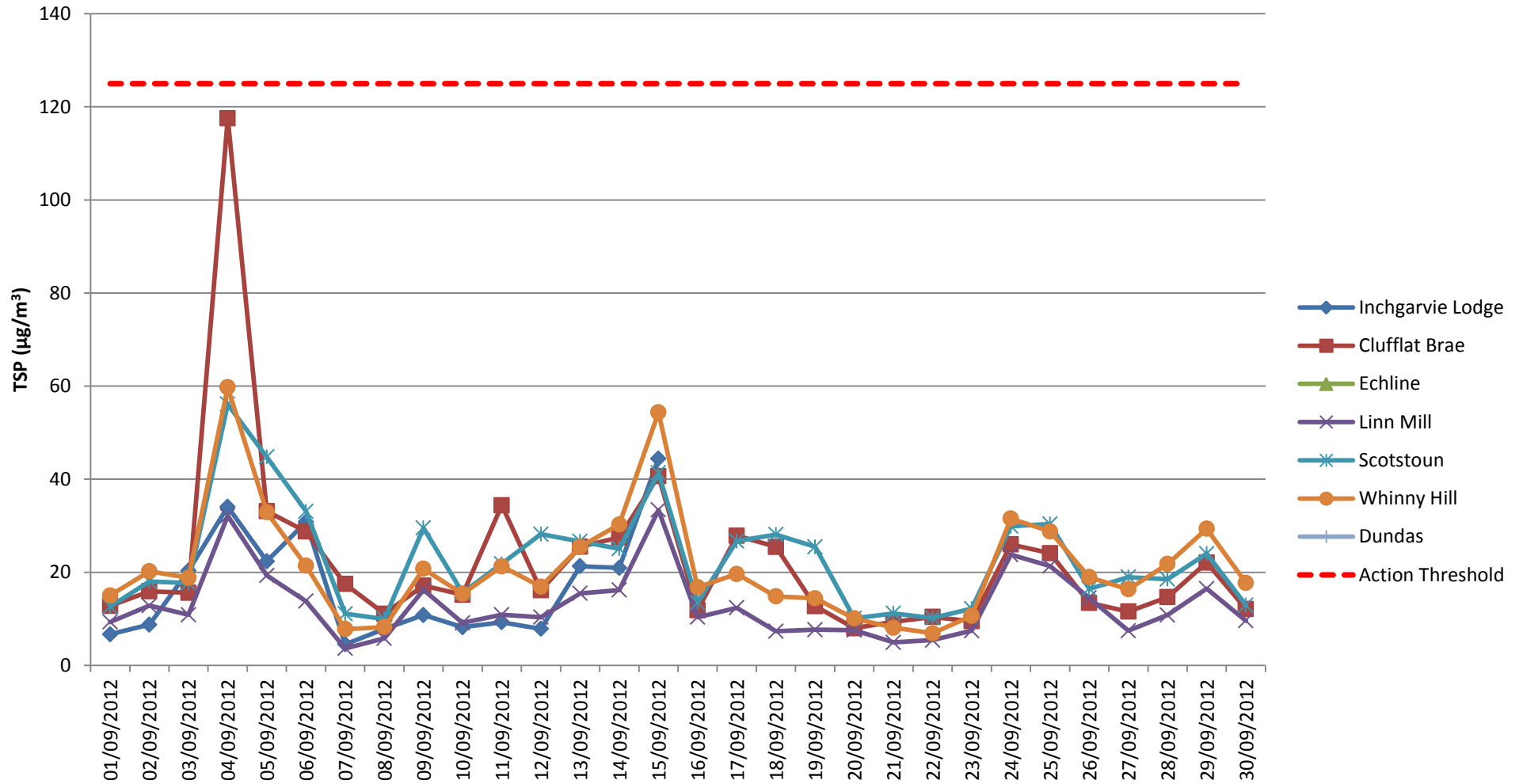


Note: Due to a power failure at Echline, no PM₁₀ data is available for this location. Due to an error associated with the Dundas device the results for this location have been excluded. Data is missing from Inchgarvie from 15/09/12 due to an error with the connection accidentally caused by a third party.



APPENDIX B: TOTAL SUSPENDED PARTICLES

Total Suspended Particles (TSP) Results September 2012

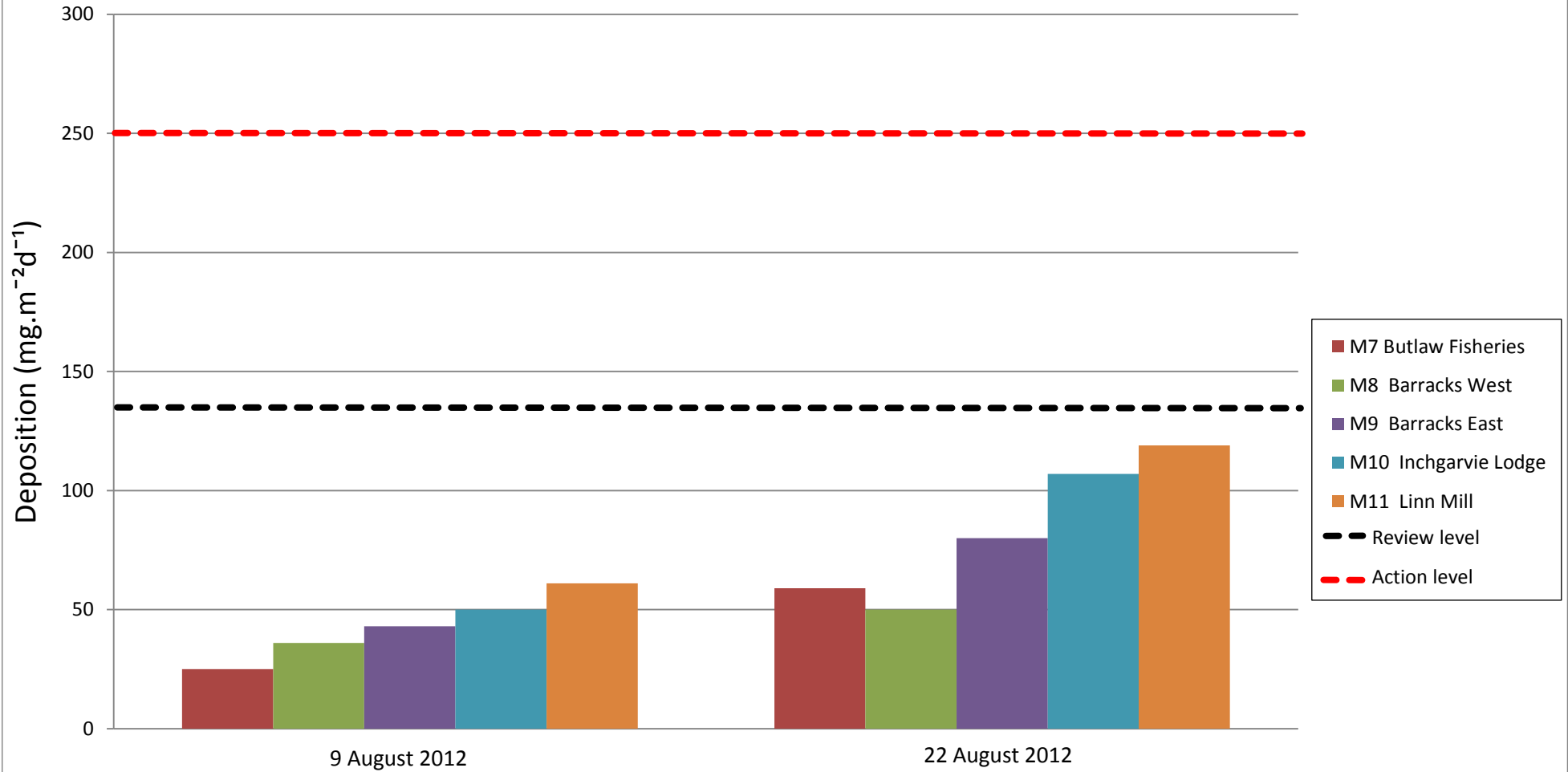


Note: Due to a loss of power at Echline, no TSP results are available for this location. Due to errors associated with the TSP results for Dundas, these results have been excluded. Data is missing from Inchgarvie from 15/09/12 due to an error with the connection accidentally caused by at third party.

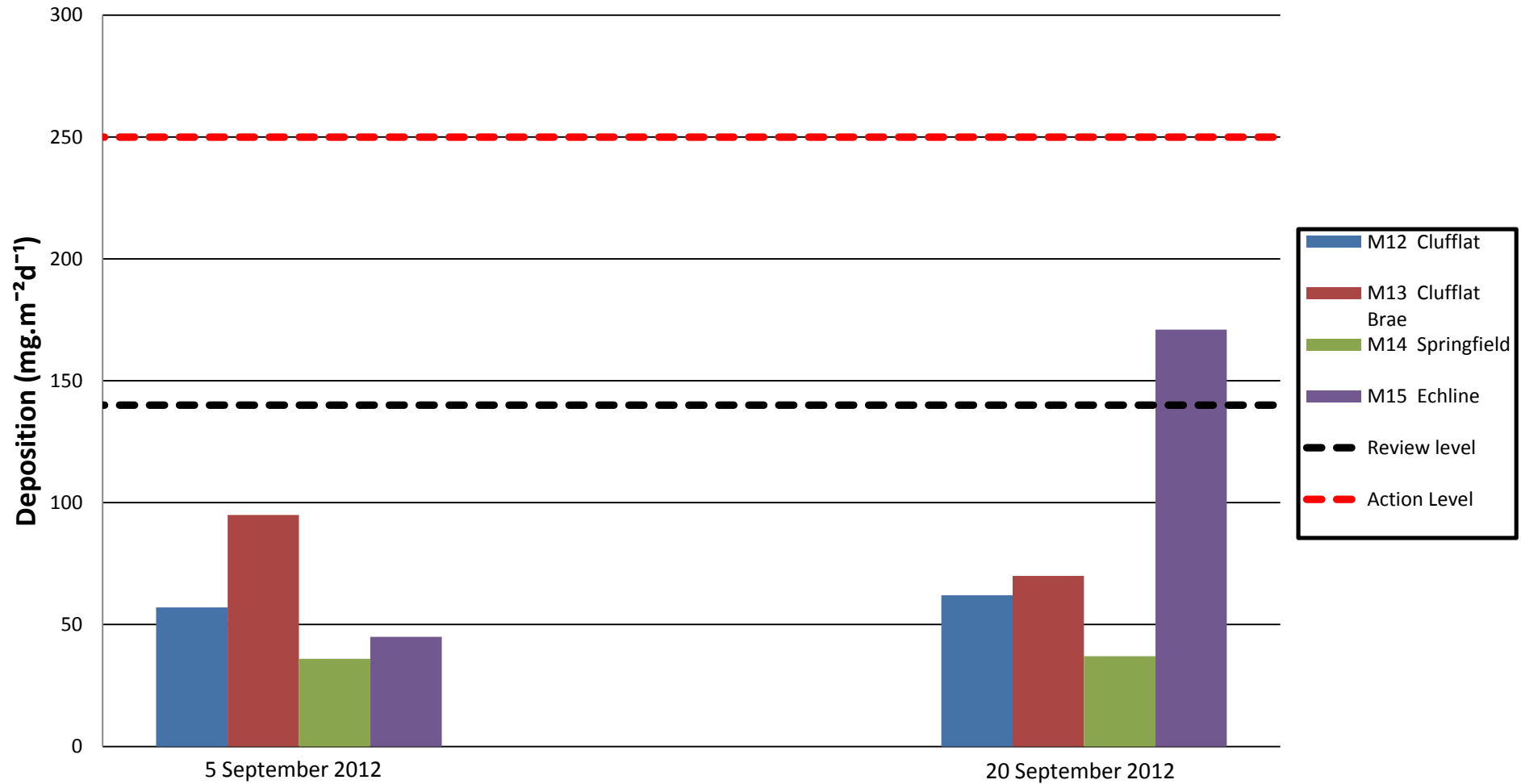


APPENDIX C: FRISBEE GAUGE RESULTS

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

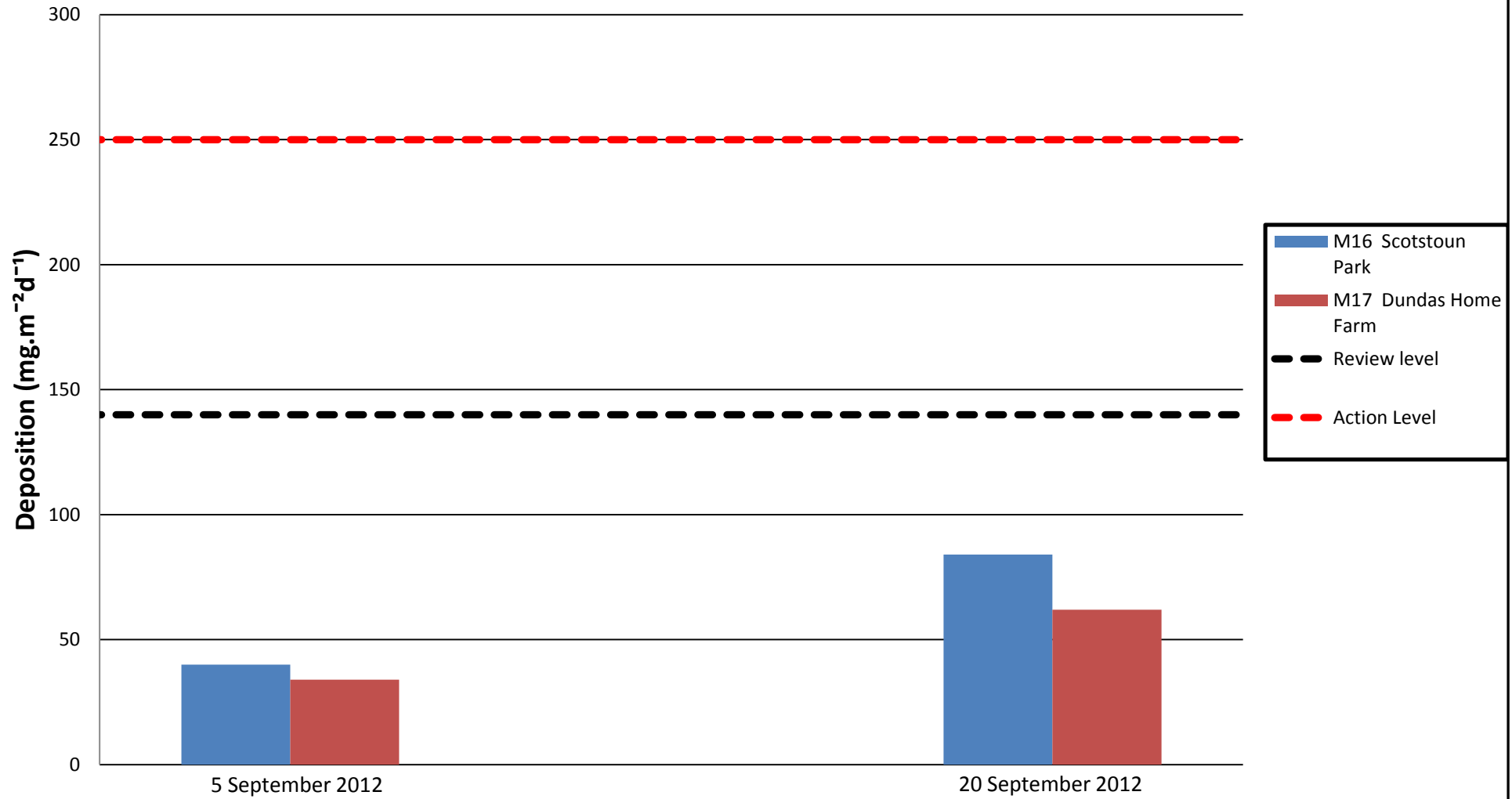


Frisbee Dust Deposition Results: Group 2
Locations: M12 Clufflat, M13 Clufflat Brae, M14 Springfield and M15 Echline



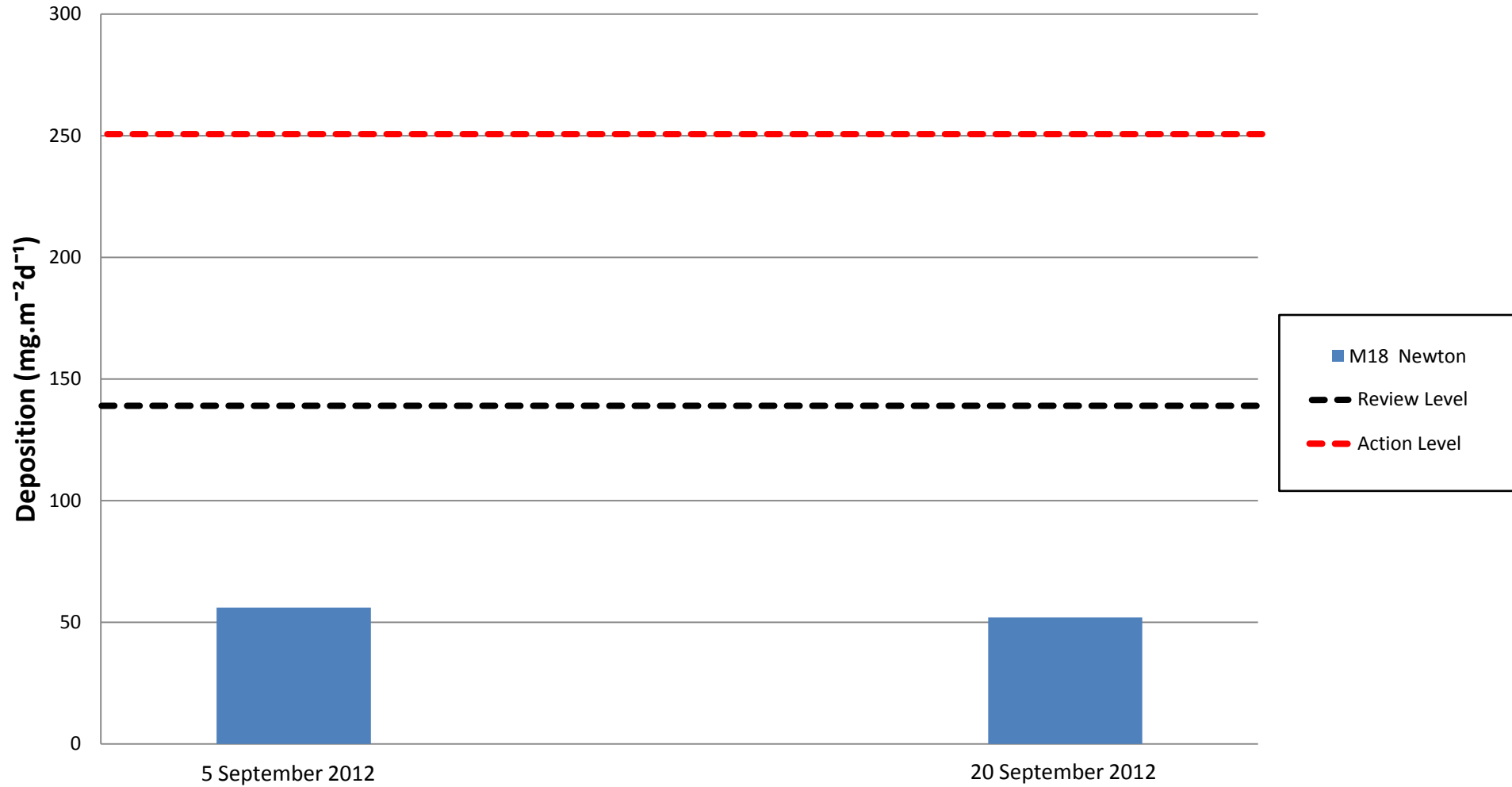
Frisbee Dust Deposition Results: Group 3

Locations: M16 Scotstoun Park and M17 Dundas Home Farm



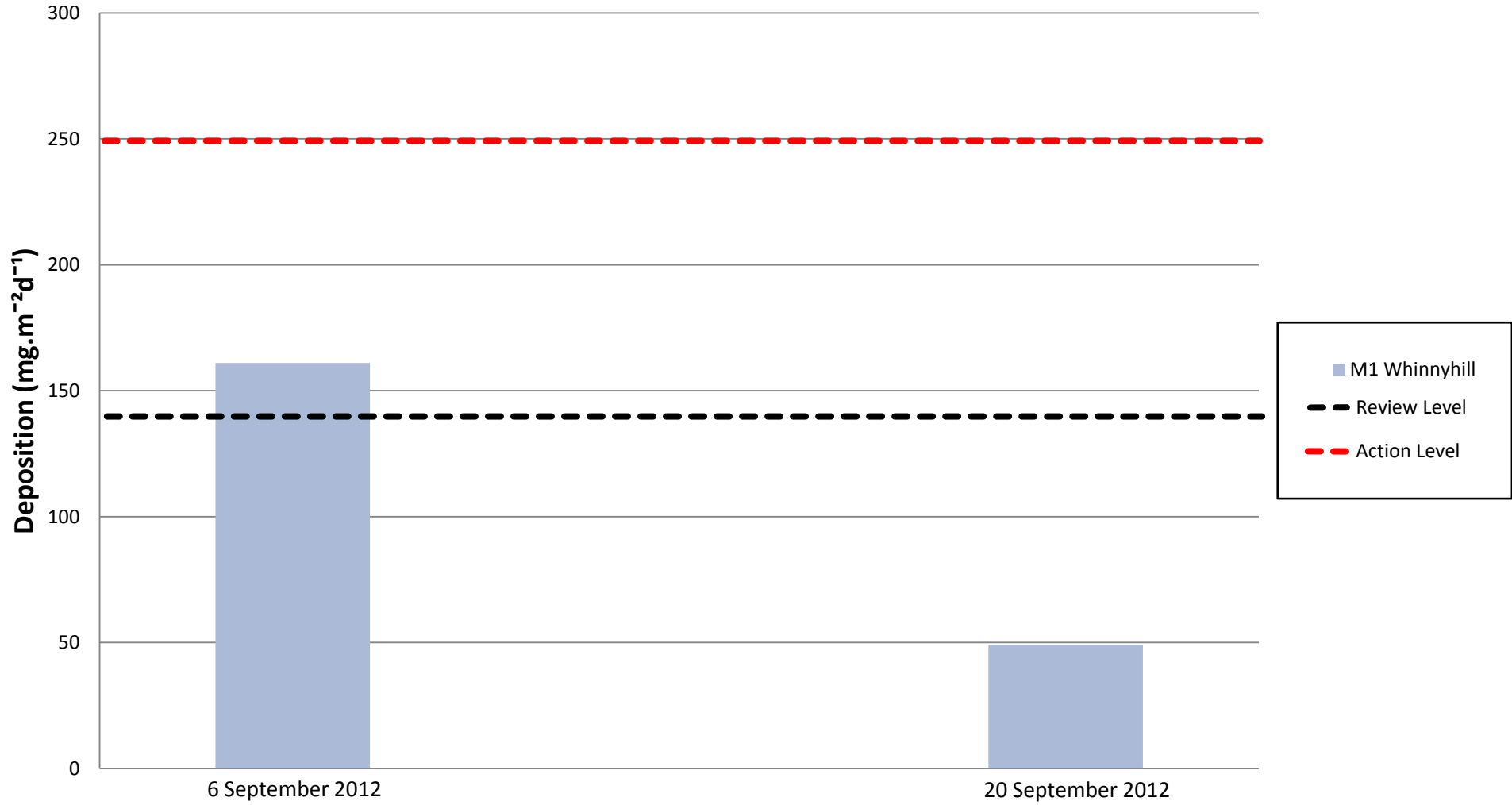
Frisbee Dust Deposition Results: Group 4

Location: M18 Newton



Frisbee Dust Deposition Results: Group 5

Location: M1 Whinny Hill



Note: Due to an error with the sampling bottle at this location, no data was collected from this location for the period ending on 22 August. The results presented for 5 September therefore cover the period 9 August to 6 September.



APPENDIX D: DAILY DUST LOG



APPENDIX E: SUMMARY OF ENVIRONMENTAL INSPECTIONS

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

| Date | Location | Dust Levels | Suppression/ Dampening down | Transportation of materials | Comments/Actions |
|------------|---------------------|------------------|--------------------------------|--------------------------------|---|
| 05/09/2012 | South Networks | Not Satisfactory | Not Satisfactory | Satisfactory | In process of dampening down during inspecion - effective where bowser had already been. Area south of A904 requires use of bowser activity. Site inspection undertaken alongside section engineer - all issues closed out at time of inspection. |
| 05/09/2012 | North Networks | Not Satisfactory | Not Satisfactory | Not Satisfactory | Dust levels high at Whinny Hill at time of inspecion - this area requires dampening down. Requirement for all trucks to be covered. Site inspection undertaken alongside section engineer - all issues closed out at time of inspection. |
| 13/09/2012 | Marine Yard | Not Applicable | Not Applicable | Not Applicable | |
| 18/09/2012 | St Margaret's Marsh | Satisfactory | Satisfactory | Satisfactory | |
| 25/09/2012 | Viaducts (S7 & S8) | Satisfactory | Satisfactory | Satisfactory | |
| 26/09/2012 | North Networks | Satisfactory | Satisfactory | Satisfactory | |
| 26/09/2012 | North Structures | Satisfactory | Satisfactory | Satisfactory | |