

## Air Quality and Odour Monitoring Programme Summary of Results

### Site Activities

Site Activities which took place in September at the Avenue Site and their location on-site are shown in Figure 1.

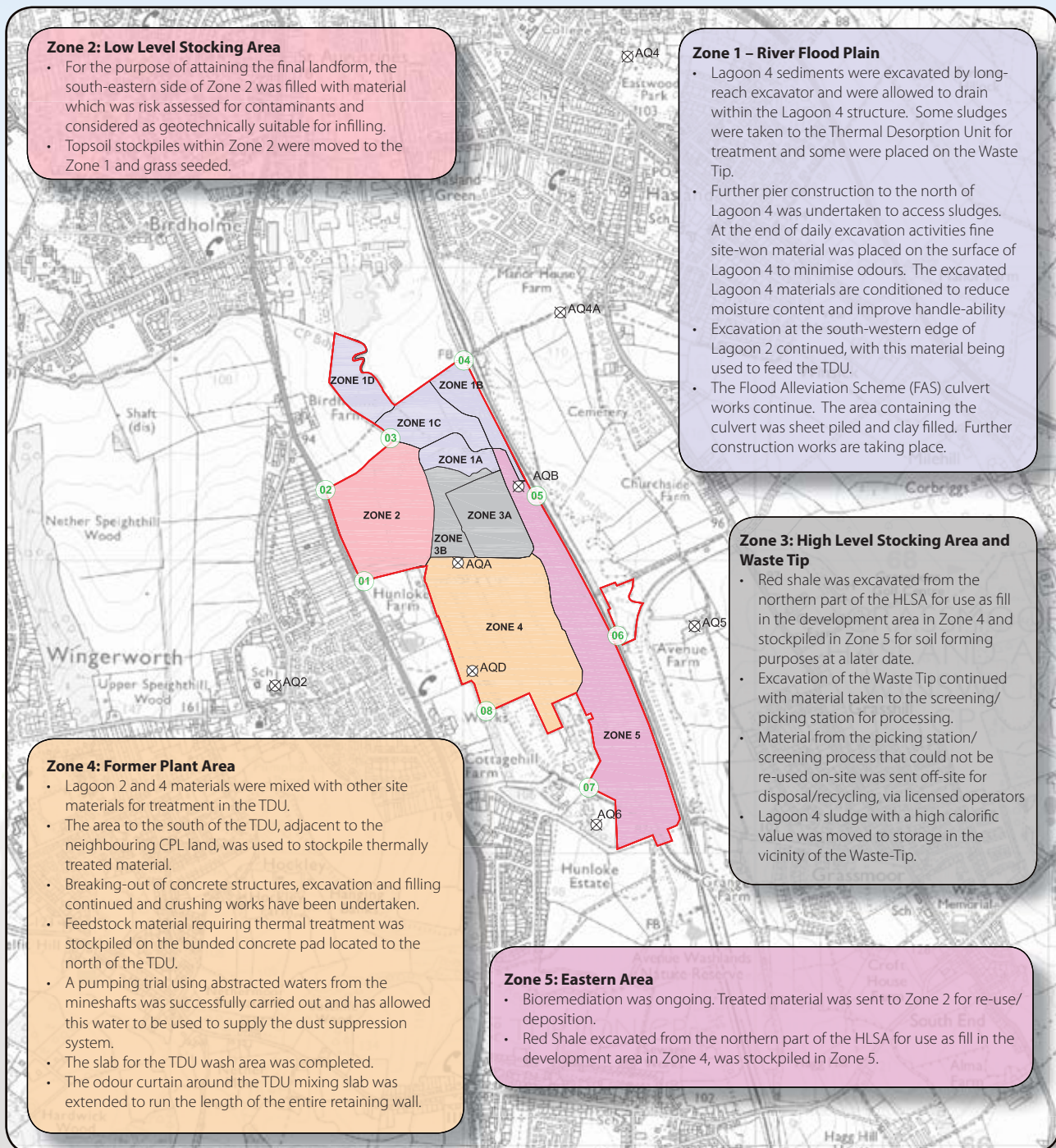


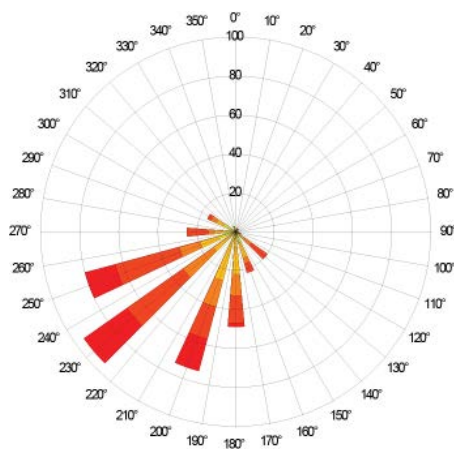
Figure 1. Site Activities Per Zone for September 2011

## Meteorological Conditions

The Avenue site has a fixed meteorological station which measures wind direction, wind speed and rainfall. The wind speed and wind direction for Period 1 (1st to 18th September) and Period 2 (19th to 30th September) are presented in Figure 2 as two wind roses.

For Period 1, the wind rose indicates that the wind was mainly coming from the south-west. In general wind speeds were high (more than 5 m/s) during the first period of the month.

For Period 2, the wind rose shows that winds coming from the south were dominant, with higher wind speeds than the other wind directions. During the second period of the month, winds from the west and north-west also occurred, although the wind speeds from these directions were lower than when from the south. In general, wind speeds for Period 2 were lower than those observed in Period 1.



According to the Met Office, September 2011 was dominated by periods of changeable weather as a result of westerly breezes, with period of showers and longer spells of rain, especially in the north-west of England. High winds were also experienced across the month and the last week of September saw a very fine, warm spell with some exceptionally high temperatures for this time of year. The total rainfall for September 2011 at the Avenue site was 11.2 mm. This was higher than the previous month. In addition, the rainfall was confined to certain days during the middle of the month in a similar pattern shown to the Met Office observations. In general the meteorological readings for the site are consistent with the meteorological conditions for the north-west of England recorded by the Met Office.

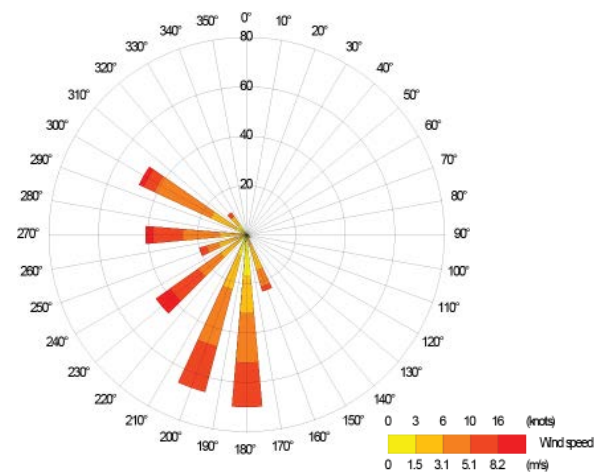


Figure 2. Wind Roses for the Site, September 2011 P1 and P2

## Particulate Monitoring

At the Avenue, measurement of  $PM_{10}$  and  $PM_{2.5}$  particulate matter is undertaken at all on-site and off-site monitoring locations. As specified in the Air Quality Management Plan (AQMP), Site 4 was relocated from the roof of the community centre in Hasland to the roof of the changing rooms at the playing fields to the north-east of the Avenue site. Owing to the relocation, data are reported to 21st September 2011;

following reconnection, the monitoring for particulates at the new location then commenced on 19th October 2011.

Monthly average concentrations of  $PM_{10}$  across all locations were in the range of 6.4 - 16.6  $\mu\text{g}/\text{m}^3$ , with concentrations of  $PM_{2.5}$  in the range of 2.6 - 6.2  $\mu\text{g}/\text{m}^3$ . This indicates a slight decrease on overall  $PM_{10}$  levels and a slight increase in  $PM_{2.5}$  levels from the previous month.

Pollutant	Target Level	Averaging Period	Max Values	Monthly Trend	Max 12 Month Rolling Average
Fine Particulate Matter ( $PM_{10}$ )	40 $\mu\text{g}/\text{m}^3$	Monthly Mean	16.6	Decreasing	20.5
Fine Particulate Matter ( $PM_{10}$ )	50 $\mu\text{g}/\text{m}^3$	24-hr Mean	33.7	Decreasing	-
Fine Particulate Matter ( $PM_{2.5}$ )	25 $\mu\text{g}/\text{m}^3$	Monthly Mean	6.2	Increasing	8.2
Dust Deposition - Directional Gauge (ON-SITE)	200 $\text{mg}/\text{m}^2$ day	Monthly Mean	1084	Increasing	-
Dust Deposition - Directional Gauge (OFF-SITE)	200 $\text{mg}/\text{m}^2$ day	Monthly Mean	147	Increasing	-
Dust Soiling - Sticky Pad	5% EAC day	Weekly	4.9	-	-

No Locations Exceeded	One Location Exceeded	Several Locations Exceeded
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Table 1. Particulate Matter and Dust Summary

As shown in Figure 3, none of the monitoring locations recorded concentrations of PM<sub>10</sub> above the relevant 24 hour Air Quality Objective (AQO) of 50 µg/m<sup>3</sup> with the maximum 24-hour mean of 33.7 µg/m<sup>3</sup> recorded at Site D. Long-term concentrations also remained below the 40 µg/m<sup>3</sup> annual average AQO at all of the monitors.

From Figure 3 and Figure 6 it can be seen that the pattern of PM<sub>10</sub> concentrations is broadly similar at on-site monitors A, B and D, with the peaks in PM<sub>10</sub> concentrations of similar magnitude and around the same time. The pattern shown suggests these monitors are affected by the same on-site sources. The off-site monitoring locations show a similar pattern across September with little variation in PM<sub>10</sub> concentrations suggesting that there were no local or regional factors affecting the PM<sub>10</sub> concentrations at off-site locations. There were no exceedences of the 1-hour

PM<sub>10</sub> target level of 100 µg/m<sup>3</sup> at any of the monitors during September 2011.

Monthly average PM<sub>2.5</sub> concentrations at all of the monitoring sites were below 25 µg/m<sup>3</sup>. There were no exceedences of the 1-hour PM<sub>2.5</sub> trigger level of 50 µg/m<sup>3</sup> at any of the monitoring sites during September 2011. Particles classified as PM<sub>2.5</sub> (i.e. particles <2.5 µm in diameter) are a subset of particles classified as PM<sub>10</sub>, and therefore concentrations of PM<sub>2.5</sub> should always be lower than concentrations of PM<sub>10</sub> and broadly follow the same trends. As shown in Figure 3, at the time of elevated concentrations of PM<sub>10</sub>, the increase was generally driven by concentrations of coarse particles with diameters >2.5 µm and consequently there was more variability across the month in terms of concentrations of PM<sub>10</sub> compared to PM<sub>2.5</sub>.

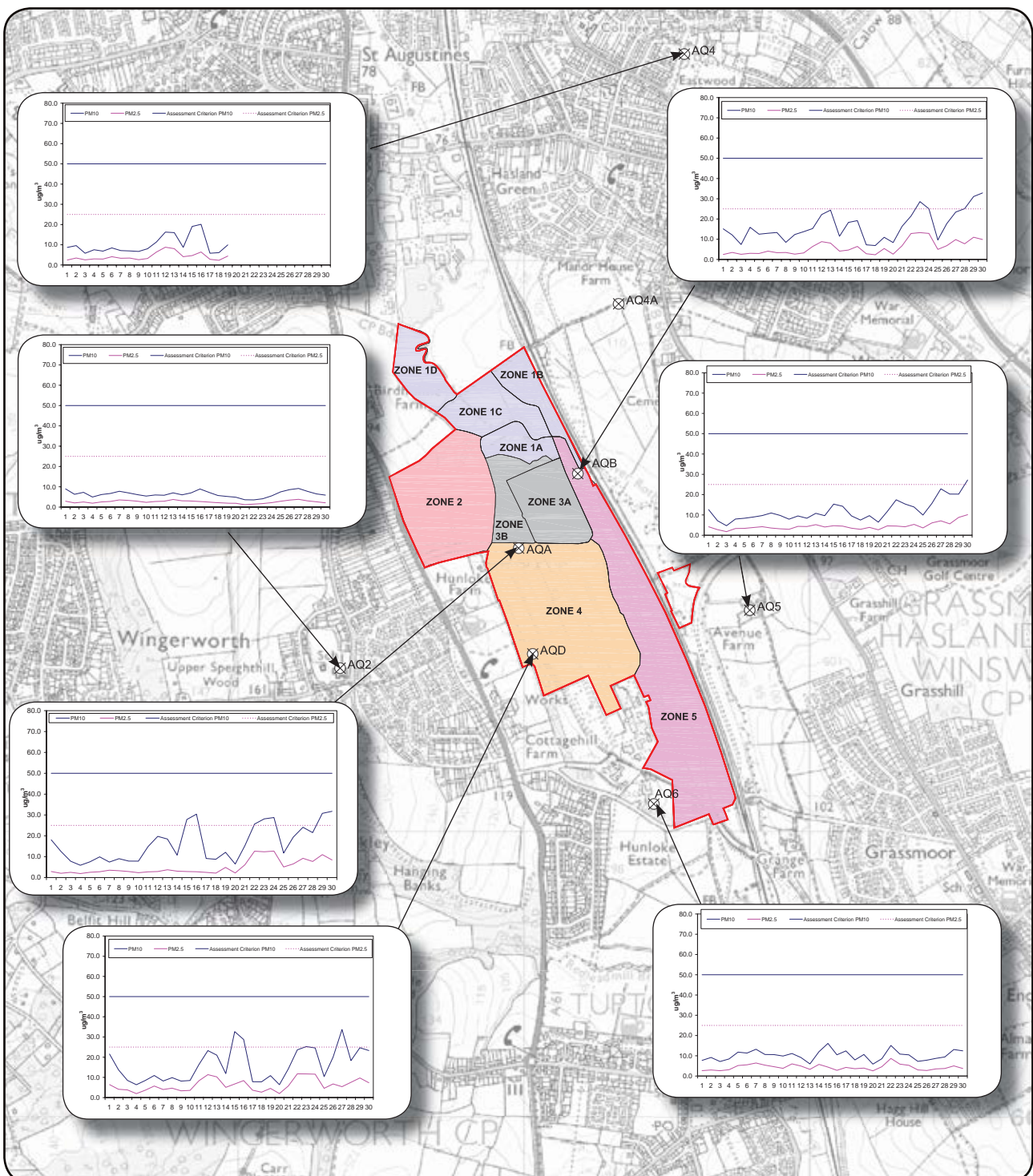


Figure 3. PM<sub>10</sub> and PM<sub>2.5</sub> Measurements for September 2011 (Daily Average Concentrations)

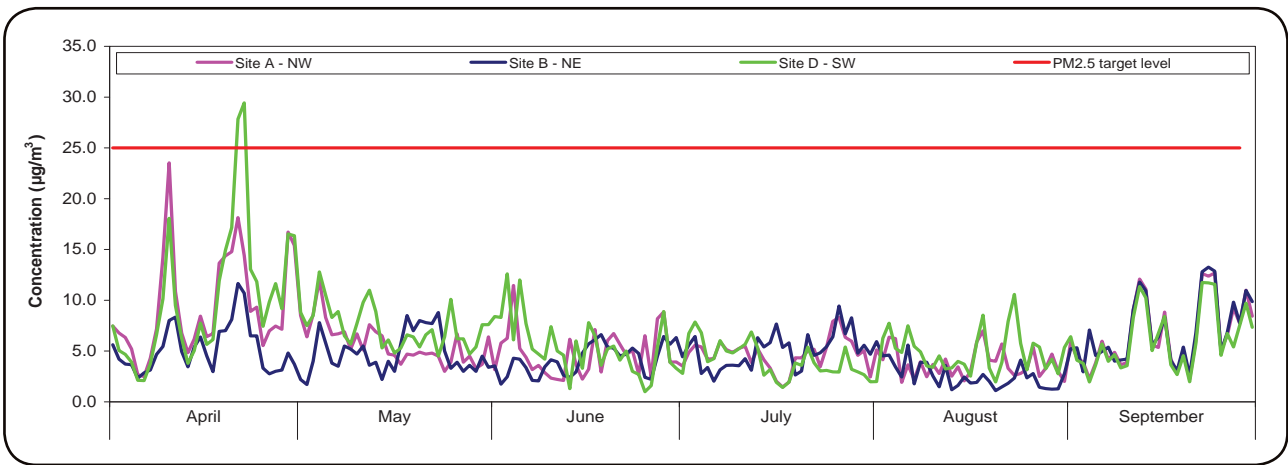


Figure 4. PM<sub>2.5</sub> 6 Month Measurements - On-Site (Daily Average Concentrations)

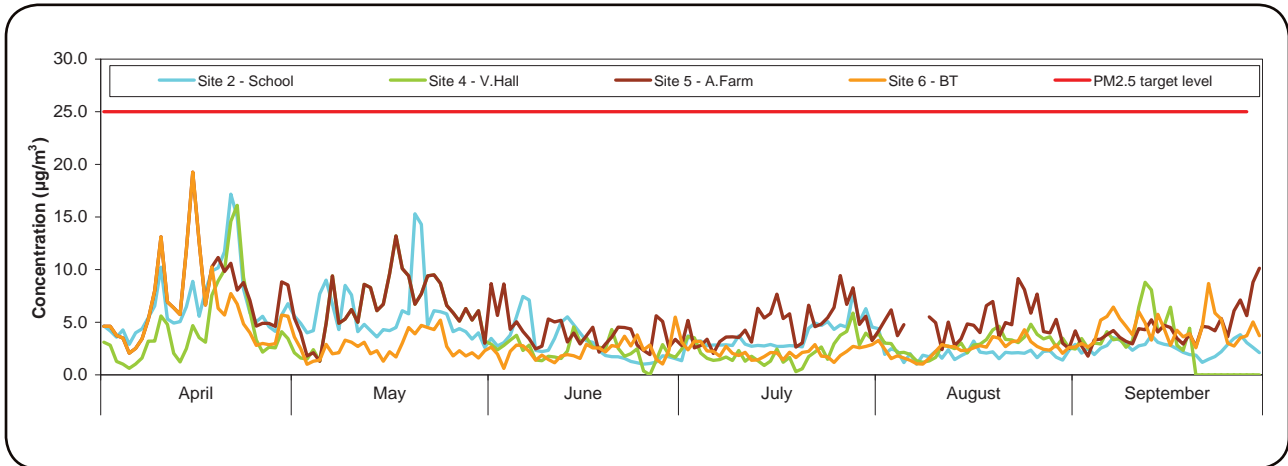


Figure 5. PM<sub>2.5</sub> 6 Month Measurements - Off-Site (Daily Average Concentrations)

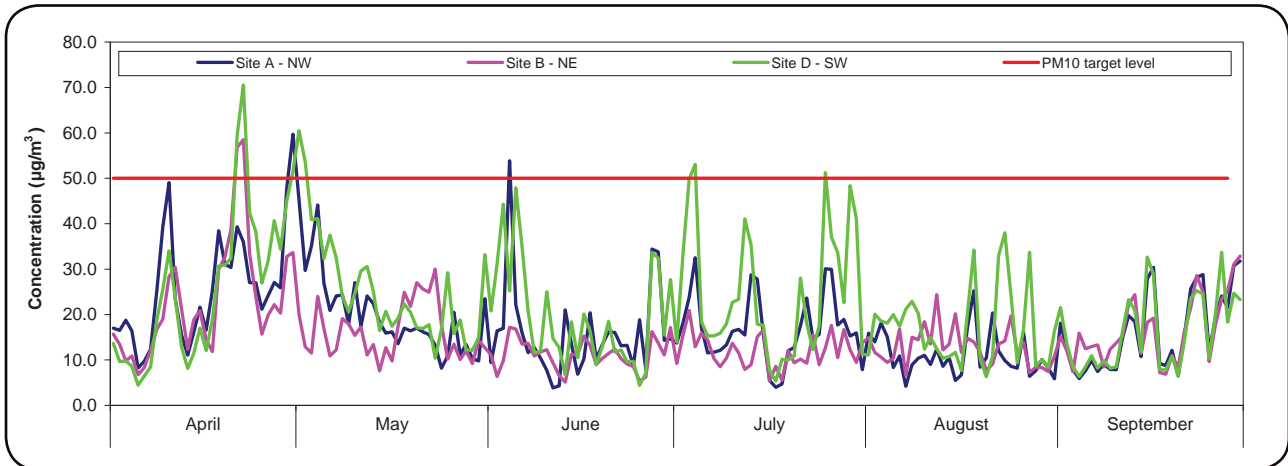


Figure 6. PM<sub>10</sub> 6 Month measurements - On-Site (Daily Average Concentrations)

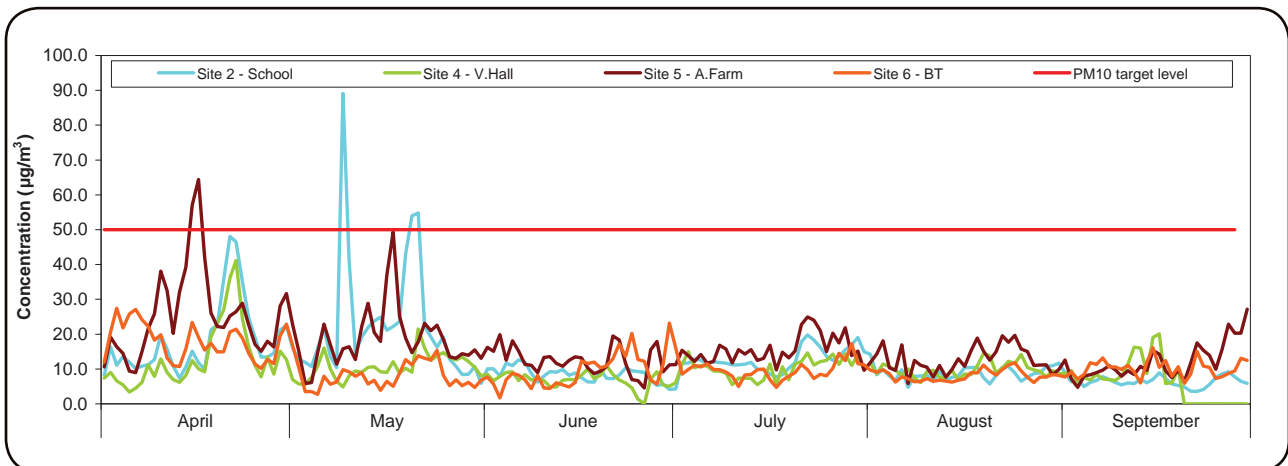


Figure 7. PM<sub>10</sub> 6 Month Measurements - Off-Site (Daily Average Concentrations)

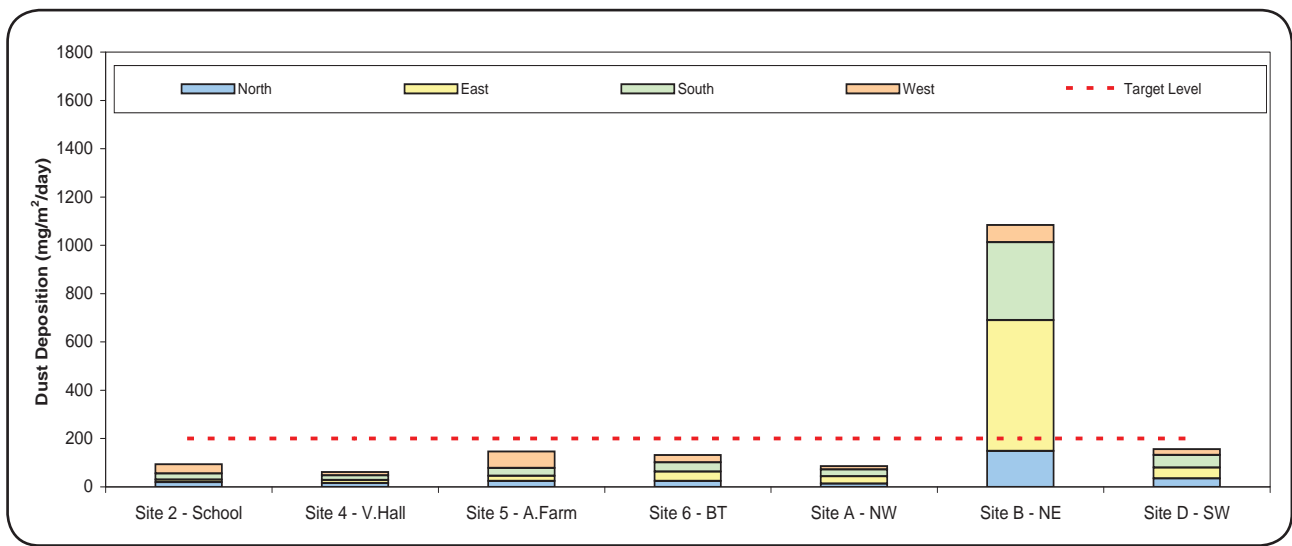


Figure 8. Measured Dust Deposition Levels (mg/m<sup>2</sup>/day)

### Dust Monitoring

During the month, there was one exceedence of the Avenue target deposition level of 200 mg/m<sup>2</sup>/day. This occurred at Site B with a deposition level of 1084 mg/m<sup>2</sup>/day. Figure 8 shows that over half of the deposited dust at Site B came from an easterly direction, with most of the remaining dust originating from the south and north. To the east of Site B, activities relating to the enhancements works for the railway embankment have been ongoing. This may have resulted in the high dust levels seen at the monitor at Site B.

The highest obscuration levels were measured in Week 3 at Site 5 with a value of 4.9% EAC/day recorded for the western side of the sticky pad, indicating that the source of the dust was from the site activities to the west of the monitoring site. The site haul road is located to the west of Site 5 and activities on the haul road at this time may have resulted in the elevated obscuration levels at this location. Recorded obscuration levels at this location for all of the weeks in September were also of a level where complaints might be expected to occur (i.e. >2% EAC/day) if such levels coincided with the location of a residential property. However, since the closest sensitive receptors are located a considerable distance from this monitor, no complaints have been received.

### Odour Monitoring

There continues to be a number of separate operations that are taking place at the Avenue that have the potential to generate malodours of various types and magnitude. These include the excavation and processing of waste tip materials in Zone 3 and lagoon sediments in Zone 1 and their transportation to stockpiling on the storage pad to the north of the TDU. However, since July 2011, odour mitigation has also been installed around Lagoon 4 (Zone 1) and Zone 3 to reduce odours from the site. Furthermore, during September, the odour curtain around the TDU mixing slab was extended to run the entire length of the retaining wall. Working practices have also been altered

to minimise the generation of odours on-site, including the placement of fine site-won material over the surface of Lagoon 4.

During the month there were 19 occasions over 15 days when the diarists recorded odour intensities exceeding Level 4 (see Figure 9). This is a decrease in the number of odour incidences on the previous month when there were 45 occasions over 20 days. The number of incidences reflects the odour diarists recording more than one odour incidence on the same day on a number of occasions throughout the month. Odour incidences occurred throughout the month and were mainly linked to odours of chemical or tar/asphalt/creosote in nature.

There were also 15 complaints relating to odour from the site during the month. These complaints were received on the same days as odours were observed by the diarists. All complainants were contacted and where necessary additional odour surveys were undertaken. These found that maximum odour impact annoyance was considered to be medium.

Sensory field odour surveys were carried out on 1st, 8th, 14th and 20th September at each of the fixed monitoring stations. At all locations, the maximum odour annoyance impact was considered to be medium.

### Thermal Desorption Unit

The TDU was operational for 24-hours a day during most of the month, although there were three short periods when it was shut-down. The three periods were from 3rd to 5th September due to a broken drum belt; 19th to 22nd September for planned works involving the cleaning of one of the ventilators and replacing some parts; and on 26th September for a 24 hour period due to a broken part in the kiln. As part of the requirements for emissions abatement, the new sodium hydroxide plant used in the removal of emissions of nitrogen oxides from the flue gas, was also installed at the TDU and began to operate in September.

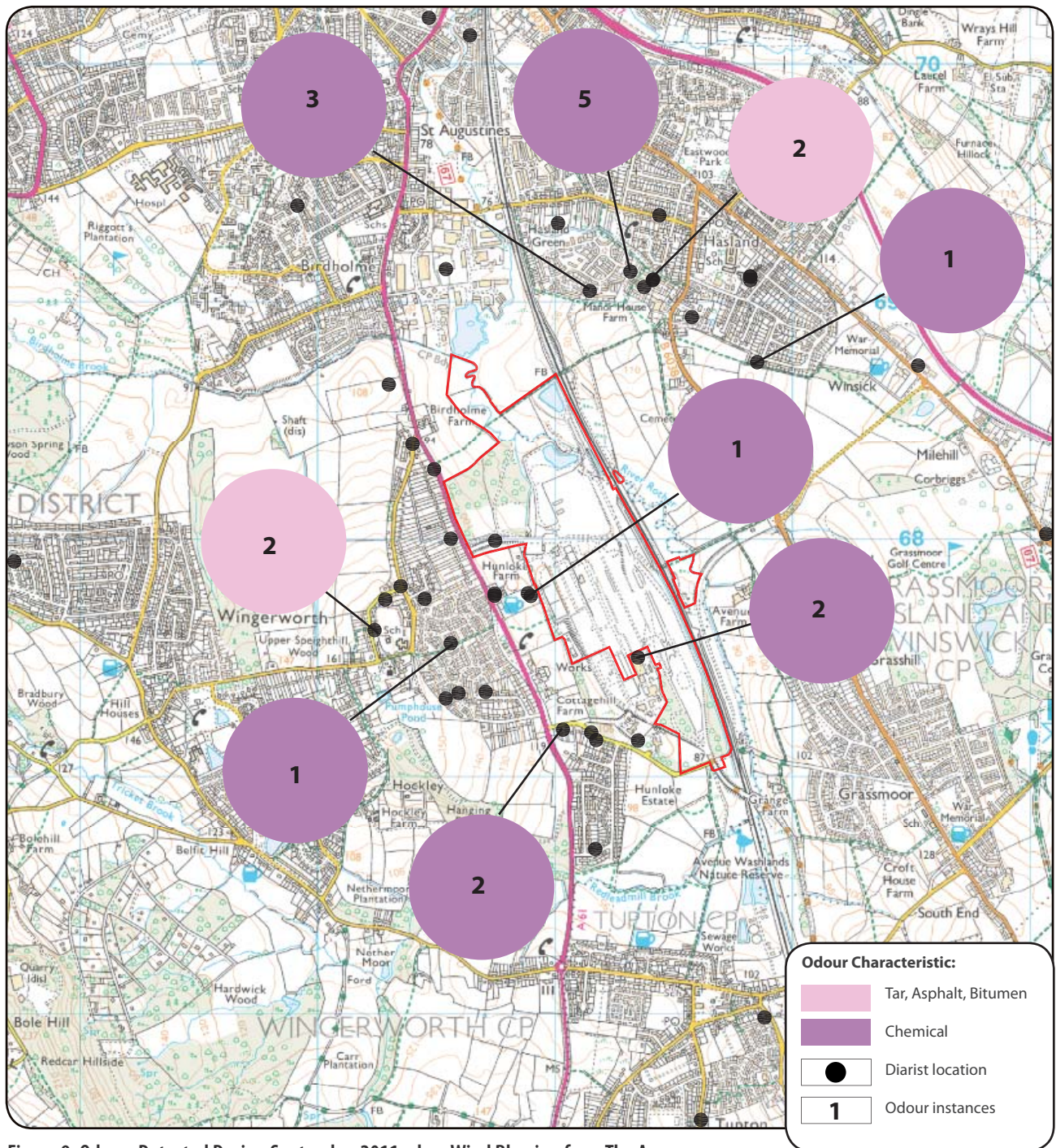


Figure 9. Odours Detected During September 2011 when Wind Blowing from The Avenue

### Other Pollutants

Pollutants measured at the Avenue include nitrogen dioxide, metals (including cadmium), cyanide, poly-aromatic hydrocarbons (including naphthalene), phenols, volatile organic compounds (including Benzene) and asbestos. Monitoring of VOCs commenced at the new Site 4A on 19th September to coincide with Period 2. All other pollutants measured by passive sampling (Dust deposition and nitrogen dioxide) were continued at the original Site 4 until October. All pollutants measured using continuous methods (metals (including cadmium), cyanide, poly-aromatic hydrocarbons (including naphthalene) and phenols) are shown for the original Site 4 until 21st September. Power was not connected to the new monitor 4A until 19th October. Therefore no data for the pollutants measured continuously at monitor 4A are presented in this report. The recorded concentrations of VOC (Benzene) during the month exceeded the target level of  $5 \mu\text{g}/\text{m}^3$  at

all of the on-site locations. During 2011 the highest levels have generally been measured at Site D, which is the station that is located closest to the TDU mixing tent. This is despite being located to the west of the odour source and therefore generally upwind in terms of the prevailing wind direction. During September the maximum concentration was again measured at Site D, with a Benzene concentration of  $33 \mu\text{g}/\text{m}^3$  recorded during the second period in the month. The average for the month at Site D was  $25 \mu\text{g}/\text{m}^3$ . At Site A and Site B, the maximum fortnightly measured concentrations were  $29 \mu\text{g}/\text{m}^3$  and  $20 \mu\text{g}/\text{m}^3$  respectively, with averages for the month being measured as  $17 \mu\text{g}/\text{m}^3$  and  $18 \mu\text{g}/\text{m}^3$  at each site.

To provide further monitoring data additional diffusion tube monitoring has been carried out between Site D and the western site boundary since April 2011 (Site DX1). A second tube (Site DX2) has then installed between the boundary and the A61 since June 2011 to provide data on Benzene

concentrations at publicly accessible locations beyond the site western boundary in the vicinity of the TDU mixing area. The DX2 results for the July and August periods, have ranged between 6.8 µg/m<sup>3</sup> and 32 µg/m<sup>3</sup> for the four fortnightly periods, and have exceeded the AQMP target level of 5 µg/m<sup>3</sup>. Accordingly this prompted further investigation as to the reason for the increase in local Benzene levels and monitoring at Site DX1 was subsequently suspended for September in favour of the carrying out of duplicate monitoring at Site DX2 for the two week period commencing 23rd September.

Although the recorded Benzene levels at DX2 for the first two week period (9th to 23rd) were 1.8 µg/m<sup>3</sup>, the duplicate monitoring, undertaken between 23rd September and 4th October, measured concentrations of 12 µg/m<sup>3</sup> at both tubes. These results have therefore prompted further investigation, including the deployment of additional tubes. During this investigation it was discovered that there could have been a breach of the quality control measures normally associated with the packaging and transport of monitoring equipment from the laboratory. This potential problem could have affected the accuracy of the reported tube data in this period and shed's some doubt on the previous months benzene results. A comprehensive and detailed review of Benzene monitoring has been initiated and the outcome will be reported over the coming months.

Despite the recorded levels at the on-site monitoring stations over recent months and during September, concentrations of Benzene at all of the permanent off-site monitoring locations (Sites 2, 4, 5 and 6) were below the target level of 5 µg/m<sup>3</sup>, with all measurements below the limit of detection of 1.7 µg/m<sup>3</sup>. This illustrates that although recorded concentrations of VOCs have been elevated within the site boundary, levels rapidly decrease with distance from the Avenue site.

All other pollutants measured at the Avenue site did not record exceedences of the relevant target levels during the month.

The target levels currently used for the other pollutants may alter as a result of ongoing discussions with the Health Protection Agency and the Environment Agency. This is part of the process of the Air Quality Management Plan which is continually updated as new practices and guidance is made available.

Additional ambient asbestos monitoring was undertaken during the month at the Waste-Tip and picking operation locations; all measurements were below the 0.01 f/ml target value.

Pollutant	Target Level	Averaging Period	Max Values	Monthly Trend	Max 12 month rolling average
Nitrogen Dioxide	40 µg/m <sup>3</sup>	Monthly Mean	19.8	Increasing	23.4
Metals (Lead)	0.25 µg/m <sup>3</sup>	Monthly Mean	0.02	Decreasing	0.01
Metals (Cadmium)	0.005 µg/m <sup>3</sup>	Monthly Mean	<0.001	Same	0.002
Cyanide	50 µg/m <sup>3</sup>	2-week Mean	<0.02	Increasing	0.01
PAHs (Coal Tar pitches) On-Site	0.48 µg/m <sup>3</sup>	2-week Mean	0.30	Decreasing	0.184
PAHs (Coal Tar pitches) Off - Site	0.48 µg/m <sup>3</sup>	2-week Mean	0.05	Same	0.032
PAHs (Naphthalene)	126 µg/m <sup>3</sup>	2-week Mean	0.022	Decreasing	0.024
Phenols (Phenol)	48 µg/m <sup>3</sup>	2-week Mean	<0.2 LOD	Same	0.2
Phenols (Cresole)	220 µg/m <sup>3</sup>	2-week Mean	<0.2 LOD	Same	0.2
VOCs (Benzene) On-Site	5 µg/m <sup>3</sup>	2-week Mean	33	Decreasing	18.8
VOCs (Benzene) Off-Site	5 µg/m <sup>3</sup>	2-week Mean	<1.7 LOD	Decreasing	2.1

**Table 2. Other Pollutants Summary**

**Note:** 12 month rolling average is calculated using the limit of detection value in the absence of an actual figure. This may result in a higher average value than is actually present.

### Further Information

Should you require any further information regarding any of the data in this report please contact:

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