APPENDIX 12.1: AIR QUALITY OBJECTIVES

Table 1: UK Objectives included in the Air Quality Regulation 2000 and (Amendment) Regulations 2002 for the Purpose of Local Air Quality Management

Pollutant	Applies	Air Quality Objective		Date to be achieved by
		Concentration	**Measured as**	
Benzene	UK	16.25 µg/m³	Running annual mean	31.12.2003
	England and Wales	5.0 µg/m³	Annual mean	31.12.2010
	Scotland and Northern Ireland Only	3.25 µg/m³	Running annual mean	31.12.2010
1,3-Butadiene	UK	2.25 µg/m³	Running annual mean	31.12.2003
Carbon monoxide	UK	10.0 mg/m³	Maximum daily running 8-hour mean (running 8 hour mean in Scotland)	31.12.2003
Lead	UK	0.5 µg/m³	Annual mean	31.12.2004
	UK	0.25 µg/m³	Annual mean	31.12.2008
Nitrogen dioxide	UK	200 µg/m³ not to be exceeded more than 18 times a year	1 hour mean	31.12.2005
	UK	40 µg/m³	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	UK	50 µg/m³ not to be exceeded more than 35 times a year	24 Hour mean	31.12.2004
	UK	40 µg/m³	Annual mean	31.12.2004
	Scotland Only[a]	50 µg/ m³ not to be exceeded more than 7 times a year	24 Hour mean	31.12.2010
	Scotland Only[a]	18 µg/m³	Annual mean	31.12.2010
Sulphur dioxide	UK	266 µg/m³ not to be exceeded more than 35 times a year	15 minute mean	31.12.2005
	UK	350 µg/m³ not to be exceeded more than 24 times a year	1 hour mean	31.12.2004
	UK	125 µg/m³ not to be exceeded more than 3 times a year	24 hour mean	31.12.2004

Notes: [a] The 2010 air quality objectives for PM_{10} only apply in Scotland, as prescribed in the Air Quality (Scotland) Amendment Regulations 2002. [b]25 µg/m³ is a cap to be seen in conjunction with 15% reduction.

Table 2: Other UK Air Quality Objectives as set out in the Air Quality Strategy and the Air Quality Standards Regulations 2007 but not set in Air Quality Regulations for the Purpose of Local Air Quality Management

Pollutant	Applies	Objective		Compliance	Notes
		Concentration	Measured as		
For the Protection of Human Health					
Particles ($PM_{2.5}$) Exposure Reduction	All authorities in UK except Scotland	25 µg/m^3	Annual mean	2020	The UK Government and the Devolved Administrations had set this new objective for $PM_{2.5}$ but these are not yet incorporated into LAQM Regulations. Local authorities therefore have no statutory obligation to review and assess air quality against these objectives.
	Scotland	12 µg/m^3	Annual mean	2020	
	UK Urban Areas	Target of 15% reduction in concentrations at urban background[b]	Annual mean	Between 2010 and 2020	
Polycyclic aromatic hydrocarbons	UK	0.25 ng/m^3 B[a]p	Annual mean	31.12.2010	These objectives are not prescribed in LAQM Regulations. More of the Government's obligations to comply with EU Directives. Therefore, local authorities have no statutory duty to review and assess air quality against these objectives.
Ozone	UK	100 µg/m^3 not to be exceeded more than 10 times a year	8 hour mean	31.12.2005	
For the Protection of Vegetation and Ecosystems					
Ozone	UK	Target value of 18,000 µg/m^3 based on AOT40 to be calculated from 1 hour values from May to July, and to be achieved, so far as possible, by 2010	Average over 5 years	01.01.2010	Vegetative based Directives kept out of Regulations as more of a national problem.
Nitrogen oxides	UK	30 µg/m^3	Annual mean	31.12.2000	
Sulphur dioxide	UK	20 µg/m^3	Annual mean	31.12.2000	
		20 µg/m^3	Winter average	31.12.2000	

Table 3: European Obligations

Pollutant	Objective	Measured as	To be achieved by
For the Protection of Human Health			
Benzene	5 µg/m^3	Annual mean	01.01.2010
Carbon Monoxide	10.0 mg/m^3	Maximum daily running 8 hour mean	01.01.2005
Lead	0.5 µg/m^3	Annual mean	01.01.2005
Nitrogen dioxide	200 µg/m^3 not to be exceeded more than 18 times per year	1 hour mean	01.01.2010
	40 µg/m^3	Annual mean	01.01.2010
Particles (PM_{10}) (gravimetric)	50 µg/m^3 not to be exceeded more than 35 times per year.	24 hour mean	01.01.2005
	40 µg/m^3	Annual mean	01.01.2005
Sulphur Dioxide	350 µg/m^3 not to be exceeded more than 24 times per year	1 hour Mean	01.01.2005
	125 µg/m^3 not to be exceeded more than 3 times per year.	24 Hour Mean	01.01.2005
Polycyclic aromatic hydrocarbons	Target of 1 ng/m^3	Annual average	31.12.2012
Ozone	Target of 120 µg/m^3 not to be exceeded more than 25 times a year averaged over 3 years	8 hour mean	31.12.2010
For the Protection of Vegetation and Ecosystems			
Nitrogen oxides	30 µg/m^3	Annual mean	19.07.2001
Sulphur dioxide	20 µg/m^3	Annual mean	19.07.2001
	20 µg/m^3	Winter average	19.07.2001
Ozone	Target value of 18,000 µg/m^3 based on AOT40 to be calculated from 1 hour values from May to July, and to be achieved, so far as possible, by 2010	Average over 5 years	01.01.2010

APPENDIX 12.2: MODELLING METHODOLOGY

AAQuIRE was developed by Faber Maunsell Ltd to meet three requirements in predictive air quality studies. The first requirement was an immediate need for a system that produced results that could be interpreted easily by non-air quality specialists to allow for proper informed inclusion of air quality issues in wider fora, the main example being to allow consideration of air quality issues in planning processes. This was achieved by allowing results to be generated over a sufficiently large study area, and at an appropriate resolution, for the issue being considered. The results are also presented in a relevant format, which is normally a statistic directly comparable with an air quality criterion or set of measured data being considered. For example, the UKNAQS PM_{10} 24-hour objective level of 50 $\mu g/m^3$ is expressed as a 90^{th} percentile of hourly means. AAQuIRE can also produce results directly comparable with all ambient air quality standards.

The second requirement was for a system to be based, initially, on existing and well-accepted and validated dispersion models. This has two advantages. The primary one is that it avoids the need to prove a new model against the accepted models and therefore enhances acceptability. The second advantage is that when appropriate new models are developed they can be included in AAQuIRE and be compared directly with the existing models, and sets of measured data, using the most appropriate statistics.

The final primary requirement for AAQuIRE was a consideration of quality assurance and control. An important aspect of modelling is proper record keeping ensuring repeatability of results. This is achieved within AAQuIRE by a set of log files, which record all aspects of a study and allow model runs to be easily repeated.

The ways in which AAQuIRE and the models currently available within it operate are discussed below.

The operation of AAQuIRE can be divided into five main stages. These are:

- the preparation of the input data;
- the generation of model input files;
- dispersion modelling;
- the statistical treatment of dispersion modelling results; and
- the presentation of results.

The first step in operating AAQuIRE is to prepare the input data. The following data are needed for the year and pollutant to be modelled:

- the presentation of meteorological data expressed as occurrence frequencies for specified combinations of wind speed, direction, stability and boundary layer height;
- road system layout and associated traffic data within and immediately surrounding the study area;
- industrial stack locations and parameters; and
- a grid of model prediction locations (receptors).

The modelling is always carried out to give annual average results from which appropriate shorter period concentrations can be derived.

The second stage is the generation of the model input files required for the study. All the data collated in the first stage can be easily input into AAQuIRE, using the worksheets, drop down boxes and click boxes in the Data Manager section of the software. Data from spreadsheets can be easily pasted into worksheets, so that any complicated procedures required for data manipulation can be achieved before entry into AAQuIRE. Several diurnal and seasonal profiles can be defined for each separate source. The relevant meteorological data can also be specified at this stage.

The third stage is executing the models. The study area will usually be divided up into manageable grids and run separately using the Run Manager in AAQuIRE. The results from the separate files can be combined at a later stage. Pollutant concentrations are determined for each receptor point and each meteorological category and are subsequently combined.

The fourth stage is the statistical processing of the raw dispersion results to produce results in the relevant averaging period. Traffic sources and industrial sources can be combined at this stage provided the same receptor grid has been used for both. Background concentrations should also be incorporated at this stage.

The final stage is presentation of results. Currently the result files from the statistical interpretation are formatted to be used directly by the SURFER package produced by Golden Software Inc. Alternative formats are available to permit interfacing with other software packages. On previous projects the results have been imported into a GIS (e.g. ArcView and Map Info).

Currently AAQuIRE uses the CALINE4 model for the dispersion of road-traffic emissions and AERMOD for all other sources. Both these models are fully validated and have been extensively used worldwide. These are relatively complex models designed for detailed studies of local areas, which are used within AAQuIRE for both local and larger scale studies. This is considered necessary because of the frequent importance of local effects, such as traffic junctions, in properly assessing ‘regional’ effects.

APPENDIX 12.3: METEOROLOGICAL DATA

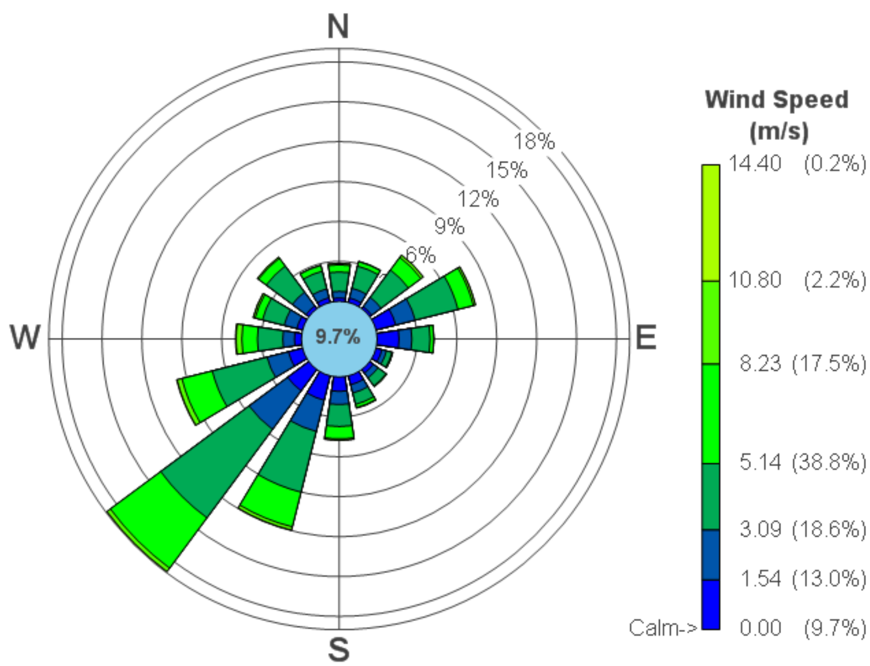
Meteorological data measured at Gatwick from 2008 were used for this modelling study. The data consisted of the frequencies of occurrence of wind speed 0 – 2, 2 – 4, 4 – 6, 6 – 10, 10+ m/s), wind direction (30° resolution) and Pasquill stability classes. Pasquill stability classes categorise the stability of the atmosphere from A (very unstable) through D (neutral) to G (very stable).

The meteorological data were used to produce a wind/stability rose. The rose consisted of 12 wind direction sectors of 30°, 5 wind speed bands and 3 stability classes.

Calm winds were distributed evenly between the wind direction sectors in the 1 m/s category. The stability classes used were C, D and E where all of the unstable classes (A-C) were grouped in C and all of the stable classes (E-G) in E. The windrose is shown in the figure below.

Interpretation of Windroses

Each windrose bar is designed to illustrate three wind properties: the direction the wind is coming from; the relative number of hours the wind is from this direction; and the magnitude of the wind speeds. These data are also tabulated to show the total number of hours and the wind speed split for each wind direction sector.



Wind Direction	Wind Speed						
	<=1.54	<=3.09	<=5.14	<=8.23	<=10.80	>10.80	Total
0.0	0.24	0.50	1.46	0.55	0.09	0.02	2.86
22.5	0.34	0.75	1.72	0.34	0.02	0.00	3.18
45.0	0.18	0.88	2.56	1.18	0.20	0.01	5.02
67.5	1.53	1.51	3.31	1.20	0.16	0.01	7.72
90.0	1.64	0.97	1.38	0.27	0.01	0.00	4.27
112.5	0.46	0.35	0.42	0.07	0.00	0.00	1.30
135.0	0.33	0.44	0.74	0.07	0.00	0.00	1.58
157.5	0.68	0.64	0.88	0.26	0.03	0.00	2.49
180.0	1.08	0.99	1.65	0.92	0.09	0.02	4.76
202.5	1.88	2.42	4.71	2.69	0.25	0.01	11.96
225.0	1.98	3.61	8.29	4.71	0.32	0.01	18.92
247.5	1.09	1.65	4.26	2.36	0.38	0.03	9.77
270.0	0.52	0.88	1.91	1.17	0.42	0.06	4.96
292.5	0.44	0.98	1.68	0.57	0.14	0.02	3.84
315.0	0.26	1.29	2.44	0.73	0.10	0.01	4.83
337.5	0.35	0.69	1.37	0.44	0.01	0.00	2.87
Total	13.01	18.56	38.78	17.53	2.23	0.22	90.32
Calms							9.68
Missing							0.00
Total							100.00

APPENDIX 12.4: ROAD TRAFFIC DATA

Table 4: Traffic Data Used in this Assessment

Ref	Description	AADT 2008	AADT 2011 DM	AADT 2011 DS	AADT 2016 DM	AADT 2016 DS	Average Speed (Kph)	HGV % 2008	HGV % 2011 DM	HGV % 2011 DS	HGV % 2016 DM	HGV % 2016 DS
1	A20 Ashford Road west of Roundwell	11573	11950	11952	12318	13330	48	12.6	12.6	12.6	12.6	11.7
2	Roundwell north of A20	3424	3506	3506	3644	3851	48	9.2	9.2	9.2	9.2	8.7
3	A20 Ashford Road west of KIG	12698	13112	13114	13516	14705	48	12.0	12.0	12.0	12.0	11.1
4	KIG Employee Access	0	0	0	0	5525	32	0.0	0.0	0.0	0.0	0.0
5	A20 Ashford Road between KIG accesses	12698	13112	13121	13516	17861	48	12.0	12.0	12.0	12.0	9.1
6	KIG HGV Access	0	0		0	3473	32	0.0	0.0	0.0	0.0	100.0
7	A20 Ashford Road east of KIG	12698	6852	6958	13516	21328	48	12.0	12.0	12.7	12.0	23.9
9	A20 Ashford Road between link road and B2163	21675	3506	3506	23071	23765	48	4.1	4.1	4.1	4.1	4.9
10	B2163 Erhorne St. north of A20	3384	3466	3466	3602	3602	48	3.0	3.0	3.0	3.0	3.0
11	A20 between B2163 junctions	27151	27807	27813	28899	29593	48	7.9	7.9	7.9	7.9	8.4
12	B2163 Penfold Hill south of A20	9328	9553	9559	9929	10338	48	2.9	2.9	3.0	2.9	4.9
13	A20 Ashford Road east of B2163	14205	14548	14549	15120	15405	48	5.0	5.0	5.0	5.0	5.0
14	M20 east of Junction 8	55446	57264	57288	59016	60288	96	16.5	16.5	16.6	16.5	17.6
15	M20 e/b on	2902	2976	3000	3089	3646	80	7.2	7.2	8.0	7.2	15.7
16	M20 e/b off	8630	8832	8856	9186	9898	80	7.6	7.6	7.9	7.6	12.2
17	M20 west of Junction 8	70567	72864	72936	75110	80954	96	13.0	13.0	13.0	13.0	15.0
18	M20 w/b on	9577	9816	9888	10194	13192	80	5.3	5.3	5.9	5.3	13.7
19	M20 w/b off	2306	2352	2424	2454	5300	80	5.4	5.4	7.8	5.4	23.5
20	M20 at Junction 8	58680	60096	60096	62462	62462	96	14.6	14.6	14.6	14.6	14.6
21	A20/M20 link road NB	11952	12240	12288	12720	16275	48	5.1	5.1	5.5	5.1	14.0
22	A20/M20 link road SB	10416	10656	10704	11077	14635	48	6.5	6.5	6.9	6.5	16.0
23	Junction 8 RB A	12720	13034	13132	564	564	32	19.4	19.4	19.9	19.4	19.5
24	Junction 8 RB B	69648	71338	71436	3089	3646	32	7.2	7.2	7.3	7.2	15.7
25	Junction 8 RB C	112272	114973	115071	4979	8382	32	4.9	4.9	5.0	4.9	20.4
26	Junction 8 RB D	55344	56669	56767	2454	5300	32	5.4	5.4	5.6	5.4	23.5
27	Ashford Road Flyover	6000	6153	6159	6395	7091	48	9.3	9.3	9.4	9.3	11.6

Ref	Description	AADT					Average Speed (Kph)	HGV %				
		2008	2011 DM	2011 DS	2016 DM	2016 DS		2008	2011 DM	2011 DS	2016 DM	2016 DS
28	A20 Ashford Road east of KIG after link road	6696	6852	6958	7121	14237	48	14.5	14.5	15.7	14.5	30.0
29	A20 Ashford Road before link road and B2163	15672	16046	16052	16676	16674	48	2.1	2.1	2.1	2.1	2.0
30	M20 Junction 4-5	116545	120360	120408	124056	129888	96	13.0	13.0	13.1	13.0	17.7
31	M20 Junction 5-6	120672	124608	124680	128484	134280	96	13.0	13.0	13.1	13.0	17.7
32	M20 Junction 6-7	107256	110736	110808	114144	120360	96	13.0	13.0	13.1	13.0	17.7

SOURCE: Haskoning UK Denis Wilson Business Group, Transportation Planning, Infrastructure Design and Highway Safety Consultants.

NOTE: Vehicle speeds were reduced to 20 – 40 kph near traffic lights, junctions and roundabouts, as specified in LAQM.TG(09).

APPENDIX 12.5: SENSITIVE RECEPTORS

Tables 1 and 2 below provide details of the sensitive receptors modelled in this assessment. Figures 1 and 2 show the geographical locations of modelled receptors and verification tubes in the Maidstone study area as well as the car parking spaces at the proposed KIG site. Figure 3 show the locations of modelled receptors and verification tubes in the Tonbridge and Malling study area. All receptors have been modelled at a height of 1.5 metres.

Table 5: Sensitive Receptors Modelled in this Assessment (Maidstone Study Area)

No.	Name	OS Grid Ref
1	45 Mallings Drive	580660, 155853
2	Springfield	580720, 155529
3	Nether Lodge	580835, 155211
4	Tollgate House	581216, 155074
5	Pine Cottage	581658, 154893
6	The Caves	582256, 154554
7	Old England Cottage	582575, 154454
8	Elsfield House	582777, 154399
9	Woodcut Cottage, Crismill Lane	581955, 155499
10	1 Eyhorne Street, Hollingbourne	583144, 154565
11	Sandling Primary School	576630, 157814
12	Chestnuts, Ashford Road	581940, 154883
13	2 Crismill Cottage	581350, 155189
14	1 Keepers Cottages, Thurnham	580135, 156658
15	112 Hockers lane	579030, 156873
16	8 Harbour lane cottages	577038, 157735
17	Amberleigh, Harbour Lane Close	576987, 157758
18	68 Hockers Lane	579091, 157589
19	40 Boxley Close	576884, 157731
20	Sheepwash Cottage, Downs View Road	576583, 157939
21	Cookes Cottage	576480, 158231
22	Little Holland, Boarley Lane	575709, 158673
23	4 Farthings Cottages	575715, 158475
24	Stream Cottages	575168, 158332
25	Willow Lodge	574996, 158332
26	29a Forstal Cottages	573929, 158763
27	Cobtree Manor House, Forstal Road, Sandling	574740, 158661
28	Hillside	577005, 157758
29	12 Ashford road	578658, 155367

Table 6: Sensitive Receptors Modelled in this Assessment (Tonbridge and Malling Study Area)

No.	Name	OS Grid Ref
30	Preston Hall Hospital	572930, 158158
31	17 Ash Close	572425, 158495
32	13 The Beeches	572360, 158503
33	11 Yew Tree Close	572278, 158519
34	10 Sedley Close	572603, 158600
35	Aylesford School Sports College	571956, 158499
36	101 Teapot Lane	572010, 158579
37	131 Station Road	571618, 158689
38	2 Oak Drive	570806, 158834
39	15 Cygnet Close	570319, 158958
40	Brookfield Junior School	570162, 158774
41	237 Lunsford Lane	569733, 159216

Figure 1: Sensitive Receptors Located in the Maidstone Study Area (M20 Junction 7 to Junction 8) and Proposed Car Parks

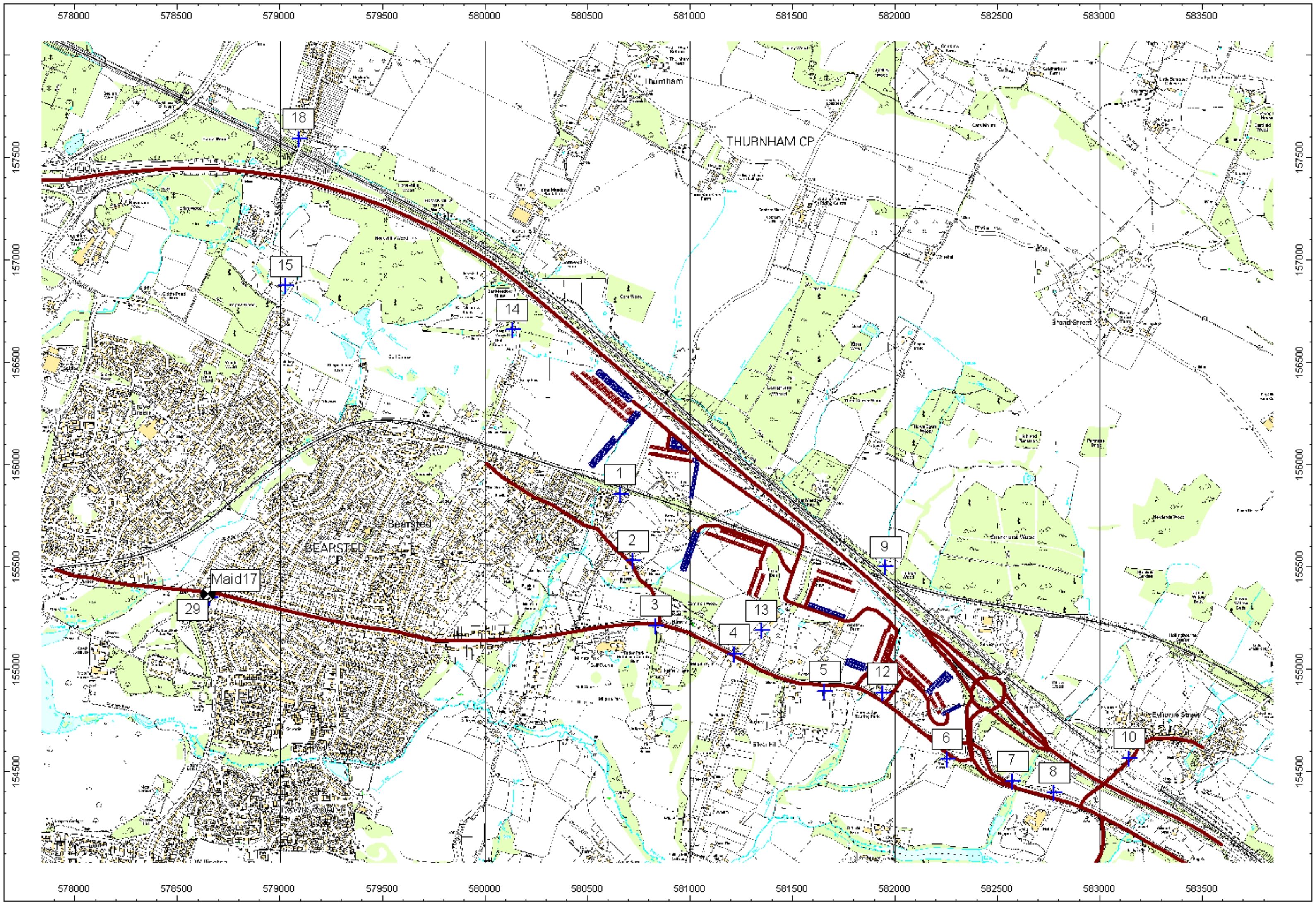


Figure 2: Sensitive Receptors Located in the Maidstone Study Area (M20 Junction 6 to Junction 7)

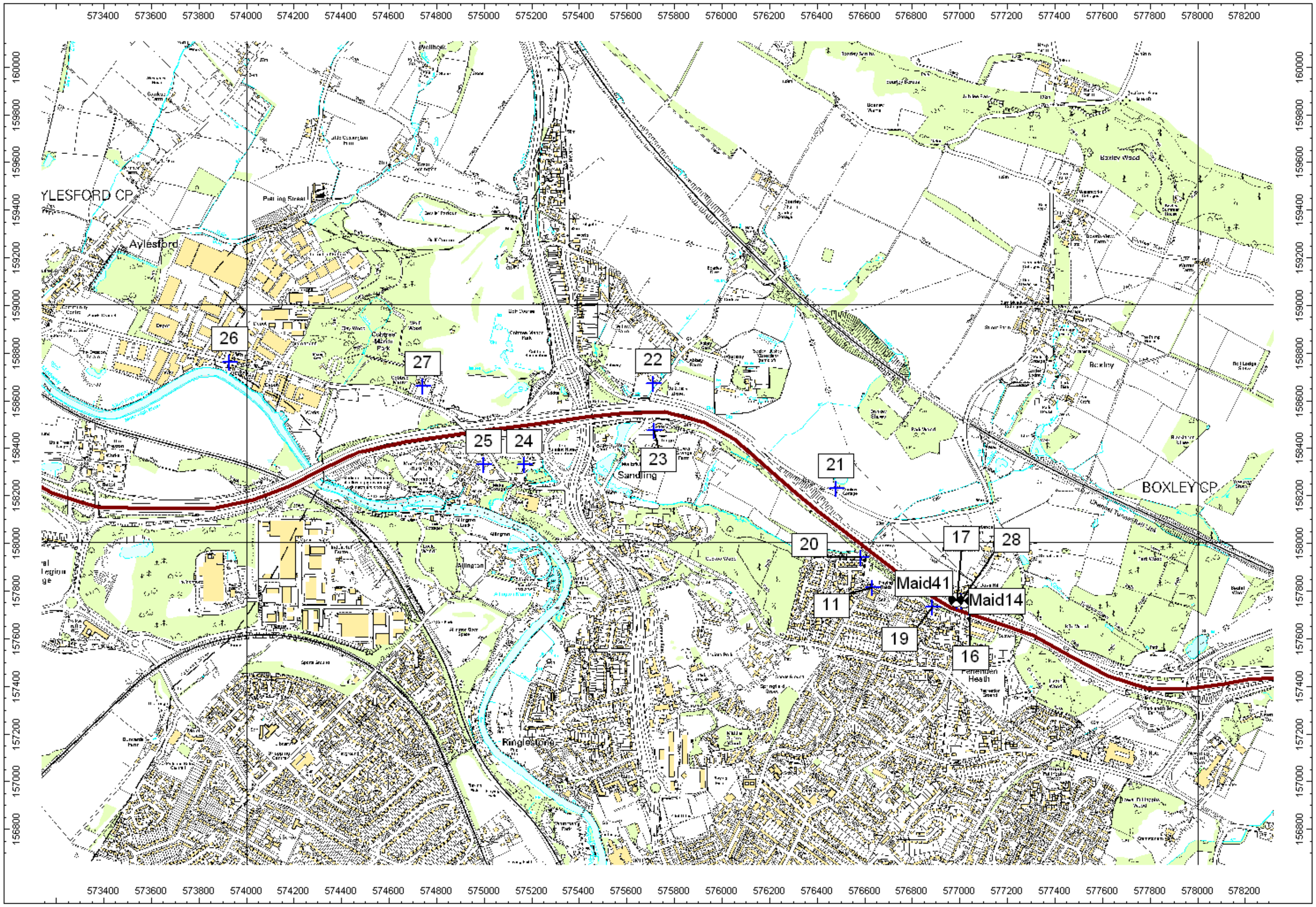
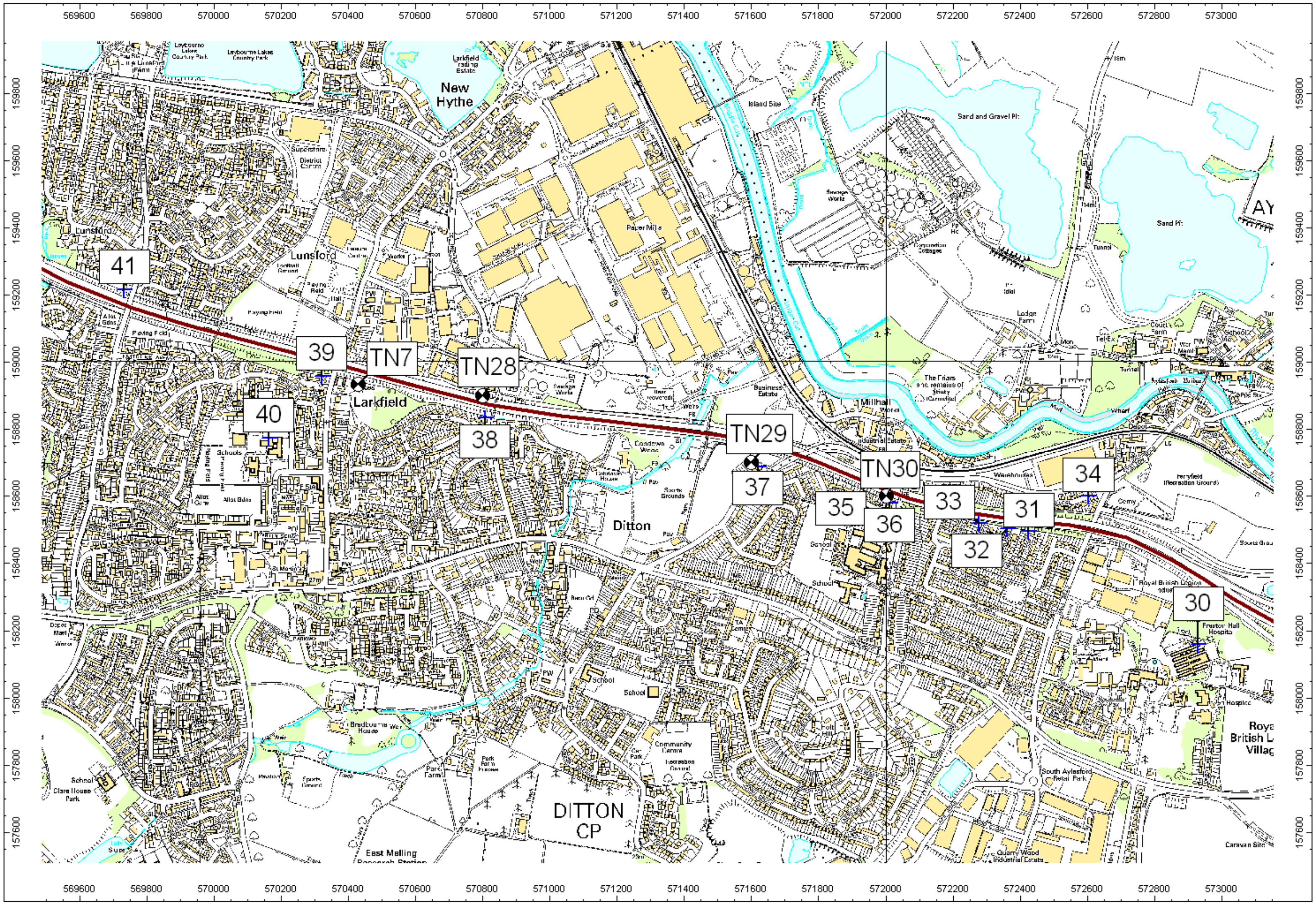


Figure 2: Sensitive Receptors Located in the Tonbridge and Malling Study Area



APPENDIX 12.6: BIOMASS SHORT-TERM CALCULATIONS

The methodology detailed in LAQM.TG(09) for NO_2 states that the 99.8th percentile of total NO_2 from an elevated point source is equal to the minimum of either Equation A or Equation B:

Equation A

99.8th %ile Hourly Background Total Oxidant + 0.05 x (99.8th %ile Process Contribution NO_X)

The total oxidant, which is the sum of NO_2 and O_3, were sourced from the Detling Continuous Monitoring Station for 2008.

Equation B:

The maximum of either:

B1. 99.8th %ile Installation Contribution of NO_X + 2 x (Annual Mean Background NO_2); or

B2. 99.8th %ile Hourly Background NO_2 + 2 x (Annual Mean Installation Contribution of NO_X).

Equation B2 is used for the short-term NO_2 calculations in this assessment.

The total PM_{10} concentration from the energy centres in this assessment was calculated following the methodology of LAQM.TG(09), which states that the 90.4th %ile Total 24-hour Mean PM_{10} is equal to the maximum of either Equation A or Equation B:

Equation A

90.4th %ile 24-Hour Mean Background PM_{10} + Annual Mean Installation Contribution PM_{10}; or

Equation B

90.4th %ile 24-Hour Mean Installation Contribution + Annual Mean Background PM_{10}.

Short-term PM_{10} results for biomass in this assessment were calculated using Equation A.

APPENDIX 12.7: AREA SOURCES – CAR PARKS

Table 7 below provides information on the emission rates used in this assessment to model pollutant emissions arising from the proposed car parking spaces.

Table 7: Car Park Emission Rates used in this Assessment

Name	NO_x Emission Rate (g/s)	PM_{10} Emission Rate (g/s)
Building 1-Car Park-A	4.6×10^{-7}	1.5×10^{-8}
Building 1-Car Park-B	4.3×10^{-7}	1.2×10^{-8}
Building 1-HGVS	1.0×10^{-6}	5.9×10^{-8}
Building 2-HGVS	4.0×1010^{-7}	4.6×10^{-8}
Building 2-Car Park-A	3.8×10^{-7}	1.0×10^{-8}
Building 2-Car Park-B	4.1×10^{-7}	1.0×10^{-8}
Building E-Car Park	4.0×10^{-7}	1.1×10^{-8}
Building E-HGVS-A	3.7×10^{-7}	2.8×10^{-8}
Building E-HGVS-B	3.5×10^{-7}	4.6×10^{-8}
Building D-HGVS	5.7×10^{-7}	5.0×10^{-8}
Building D-Car Park	3.6×10^{-7}	9.1×10^{-9}
Building C-Car Park	3.7×10^{-7}	1.1×10^{-8}
Building C-HGVS	4.1×10^{-7}	4.6×10^{-8}
Building B-HGVS	6.3×10^{-7}	5.3×10^{-8}
Building B-CAR Park	3.5×10^{-7}	9.3×10^{-9}
Building A-HGVS	3.3×10^{-7}	4.4×10^{-8}
Building A-CAR Park	3.6×10^{-7}	8.6×10^{-9}

APPENDIX 12.8: CONSTRUCTION MITIGATION MEASURES

Background

Dust and fine particle generation from construction and demolition activities can be substantially reduced through carefully selected mitigation techniques and effective management. Once particles are airborne, it is very difficult to prevent them from dispersing into the surrounding area. The most effective technique is to control dust at source and prevent it from becoming airborne, since suppression is virtually impossible once it has become airborne.

The control guidance given in the following sections sets out techniques and methods currently used by industry, with many of the methods applicable to a variety of dust and particle problems. They have not been validated under controlled conditions and therefore have yet to be subject to independent verification.

Consequential risks, such as those related to water (eg slips, skids, chemical reactions, electrical hazards and contamination/blockage of water services) or dust explosion in contaminated areas are outside the scope of this document and have not been dealt with.

Roads, surfaces and public highways

During dry and windy weather conditions, dust and mud from roads and haulage routes can become airborne through movement of vehicles, both on and outside the site. Relevant control measures should be taken to minimise this problem by drawing on the guidance given in the table below as appropriate. Since many of the techniques given in the table below rely on washing and damping down, it is important that the run-off water does not itself become a source of water pollution.

Table 8: Dust Control Guidance for Roads, Surfaces and Highways

Potential dust source	**Dust Control Guidance**
Major haul roads and traffic routes	Install permanent surfaces with regular inspection and maintenance Plan routes to be away from residents and other sensitive receptors, such as schools and hospitals.
Construction and maintenance of unsurfaced roads on verges	Grade fine materials from unsurfaced haul roads. Keep in compacted condition using static sprinklers, bowsers, commercially available additives and binders (subject to Environment Agency (EA), Scottish Environment Protection Agency (SEPA) requirements).
Public roads	Clean regularly subject to Local Authority or Highway Authority approval.
Edges of roads and footpaths	Clean by using hand broom with damping, as necessary
High level walkways and surfaces (scaffold planking and other surfaces)	Clean regularly using wet methods and not dry sweeping.
Vehicle waiting areas and hard standings	Regularly inspect and keep clean by brushing or vacuum sweeping. Spray regularly with water to maintain surface moisture if needed.
Vehicle and wheel washing	Washing facilities, such as hose-pipes and ample water supply should be provided at site exits, including mechanical wheel spinners where practicable. If necessary, all vehicles should be washed down before exiting the site.
Site traffic - management - speed control	Restrict general site traffic to watered or treated haul roads. Keep vehicle movements to a minimum. Limit vehicle speeds - the slower the vehicle speeds, the lower the dust generation. Typical recommendations are: - 20 mph or less for surfaced roads - 5 mph for unmade surfaces.
Road cleaning	Approved mechanical road sweeper should be readily available, with circular brush commonly fitted to side for cleaning kerbs, removed. Frequency of cleaning will depend on site size, location and operation. However, cleaning should be carried out on a daily basis (working day) or more frequently if required.

Static and mobile combustion plant emissions

Engine exhaust emissions, especially from those operating on diesel fuel, can be a significant source of fine particle generation from construction sites. As the particles are small, they can easily be transported to beyond the site boundary and affect the local environmental air quality and health. Control guidance for these types of emissions is given below:

Table 9: Dust Control Guidance for Static and mobile combustion plant emissions

Potential dust source	**Dust control guidance**
Visible exhaust smoke	Vehicles and equipment should not emit black smoke from exhaust systems except during ignition at start-up.
Maintenance	Engines and exhaust systems should be maintained so that exhaust emissions do not breach statutory emission limits set for the vehicle / equipment type and mode of operation.
Servicing	This should be routinely scheduled, rather than just following breakdowns.
Operating Time	Internal combustion plant should not be left running unnecessarily.
Exhaust direction	Vehicle exhausts should be directed away from the ground and other surfaces and preferably upwards to avoid road dust being re-suspended to the air.
Exhaust heights	Exhausts should be positioned at a sufficient height to ensure adequate local dispersal of emissions.
Location of plant and equipment	Plant and equipment should be operated away from residential areas or sensitive receptors near to the site.

Tarmac laying, bitumen surfacing and coating

It is difficult to avoid the production of black smoke particles with the types of hot bitumen processes commonly used in construction, although it can be minimised, as below.

Table 10: Dust Control Guidance for Tarmac laying, bitumen surfacing and coating

Potential Dust Source	**Dust Control guidance**
Bitumen overheating	Do not overheat bitumen, but use minimum acceptable temperature. Measure temperature directly, especially on large heating plant. Avoid if possible, heating with open flame burners.
Fume production	Cover pots or tanks containing hot bitumen.
Small accidential fires	Extinguish immediately.
Spillage	Minimise spillages, especially any likely to contact open flames.
Direct application of open flames (torching)	Use great care. Avoid overheating the surface.

Handling, storage, stockpiling and spillage of dusty materials

Method statements and procedures for the storage and handling of fine, powdery and dry materials should be established and agreed at the planning stage of the project. Previously settled dust has the potential to become airborne during windy weather conditions. Solid fencing or hoarding can provide shelter from the wind and reduce the possibility of dust suspension from the ground. However, any improvement will occur only in the region of the fence.

Sheltering efficiency can be improved by using porous fences. Fence porosities (the fraction of the fence area that is open) up to ~50% are best. The porosity can be achieved by vertical or horizontal slatting or by a mesh structure, as long as the element size is no more than about a fifth of the fence height. Hedges typically have the same properties. Areas of the site that are expected to be strong local sources of dust generation can be fenced in this way. In general, fences around for example stockpiles, need to be of the same approximate size as the object being protected or slightly larger, if they are to be effective.

Wet material is likely to dry out during periods of hot weather and more frequent damping will be required. Advice and approval from the Environment Agency may be required on how to control the run-off of slurry when dusty material is damped down using water.

Table 11: Dust Control Guidance for Handling, storage, stockpiling and spillage of dusty materials

Potential dust source	**Dust control guidance**
Material handling operations	Always keep the number of handling operations to a minimum by ensuring that dusty material isn't moved or handled unnecessarily.
Transport of fine powdery materials	Use closed tankers.
Transport of dusty materials and aggregates	Use enclosed or sheeted vehicles.
Handling areas	Keep clean and free from dust.
Vehicle loading	Use material handling methods that minimise the generation of airborne dust. Damp down using water.
Loading materials onto vehicles and conveyors	Drop heights must be kept to a minimum and enclosed wherever possible. Damp down with water.
Chutes, skips and conveyor transfer points	Drop heights must be kept to a minimum and enclosed wherever possible Damp down with water.
Conveyor loads	Damp down wherever possible.
Dust dispersing over the site boundary	Use static sprinklers, bowsers, hand held hoses and other watering methods, as necessary.

Table 12: Dust control guidance for emissions from stockpiles

Potential dust source	Dust control guidance
Stockpile location	Stockpiles should be located away from sensitive receptors eg residential, commercial and educational buildings, places of public access or other features, such as watercourses.
Building stockpiles	Ensure slopes of stockpiles, tips and mounds are at an angle not greater than the natural angle of repose of the material. Avoid sharp changes of shape.
Small and short-term stockpiles – protecting from wind erosion	Where possible, ensure stockpiles are kept enclosed or under sheeting. Dusty materials can be damped down using suitable and sufficient water sprays. Wind barriers (protective fences) of similar size and height to the stockpile may be used.
Larger and long-term stockpiles – protecting from wind erosion	Shrouding, wind shielding using screens, watering and controlled spraying of the surface with chemical bonding agents, should be carried out (subject to necessary approval from the Environment Agency). Wind barriers (protective fences) of similar size and height to the stockpile may be used. Long-term stockpiles can be capped or grassed over.

Table 13: Dust control guidance for emissions during site preparation and restoration

Potential dust source	Dust control guidance
Earthworks, excavation and digging	Vegetation and cover should be removed in discrete sections and not all at once. Earthworks, excavation and digging activities should be kept damp and, if possible, be avoided during exceptionally dry weather periods.
Completed earthworks	Stabilise surfaces and/or re-vegetate as soon as possible.
Storage Mounds	Seal surfaces by seeding or surface with vegetation that has previously been removed from the site. For example, turfing which has been removed may be stored and reused. Alternatively, cover with correctly secured tarpaulins.
Landscaping	Soils may be landscaped into suitable shapes for secondary functions, such as visual screening.
Transitory soil mounds	Soil mounds should be treated with surface binding agents to reduce wind erosion. Consultation with the Environment Agency is necessary before employing any binding agent.
Processing aggregates, crushing and screening	Crushers should be sited as far away as possible from sensitive receptors. Mobile plant for crushing, screening and grading of materials may require authorisation (under the Environmental Protection Act, 1990) by the appropriate Local Authority in whose area the operating company's registered office is situated.