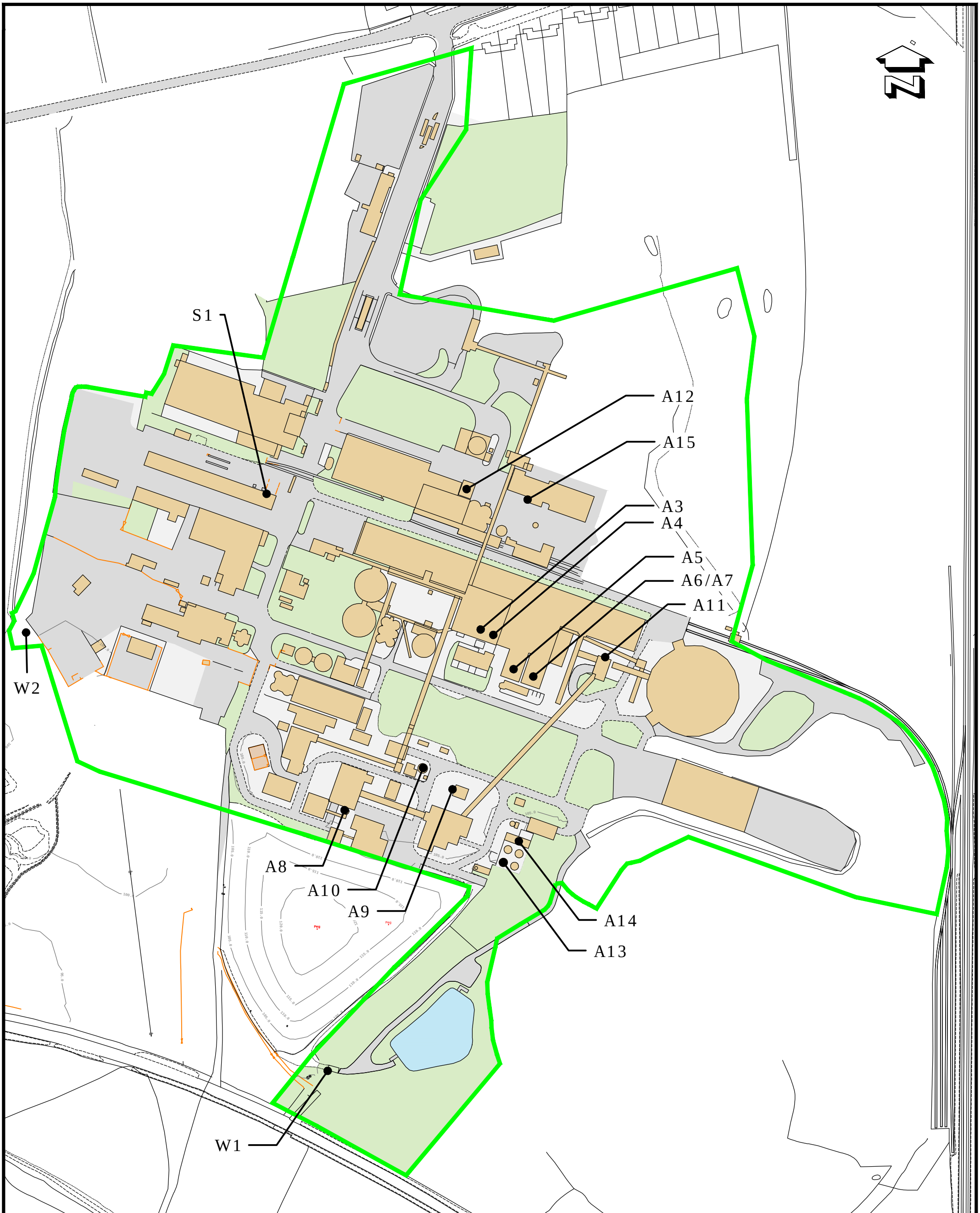
Hanson Cement, Padeswood Works

Application for variation to EPR permit BL1096

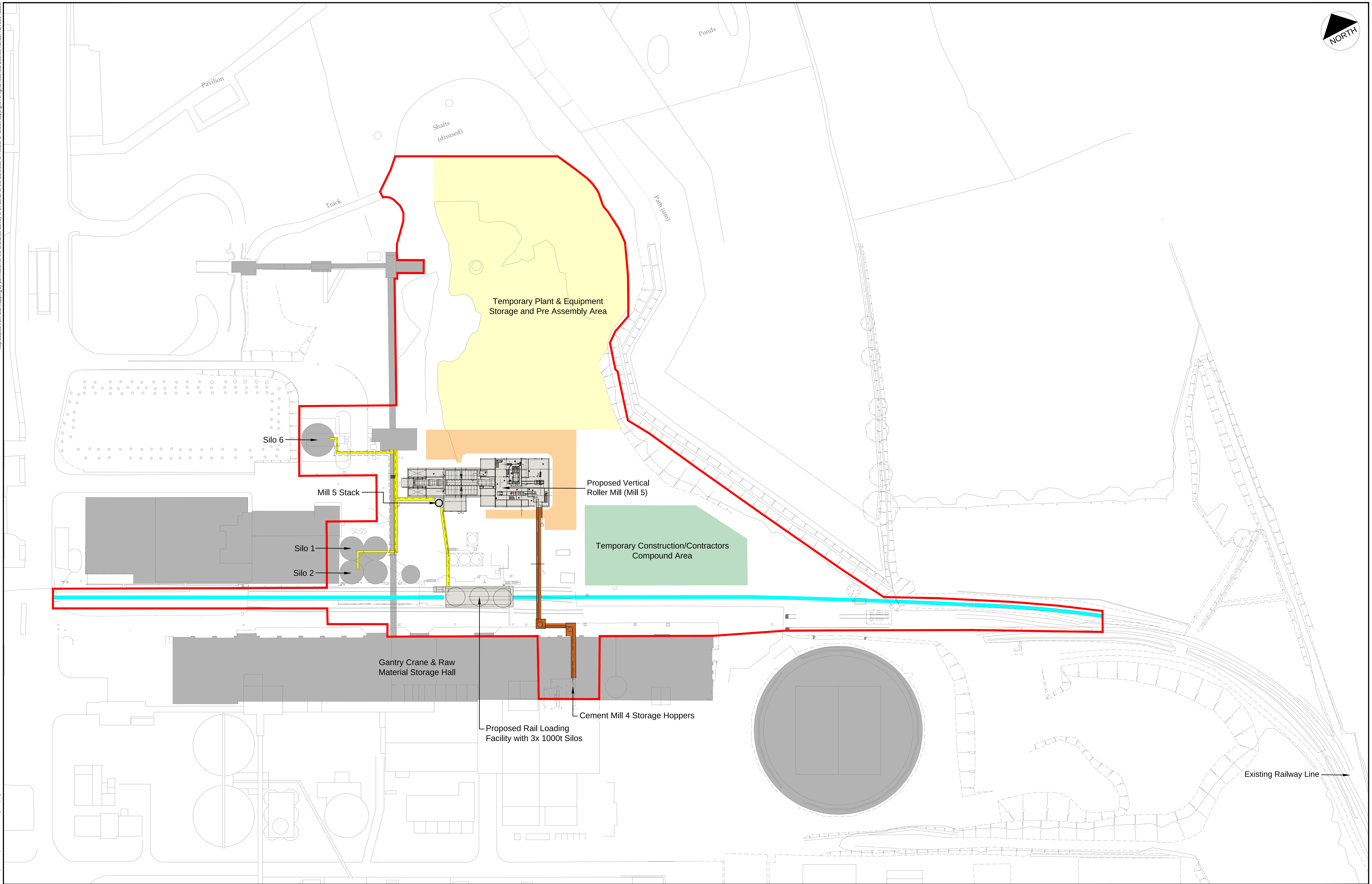
CM 5 Appendix 1 – Site Plan



F:\ege\Sites\Padeswood\CAD Drawings\P103-32 Environmental Permit Plan.dwg

Hanson
HEIDELBERGCEMENT Group

Site	PADESWOOD		
Title	Environmental Permit Plan		
Scale 1:5000	Paper Size A5	Drawn by AG	Drawing No. P103/32
Date MARCH 2017		Check by IW	Revision B



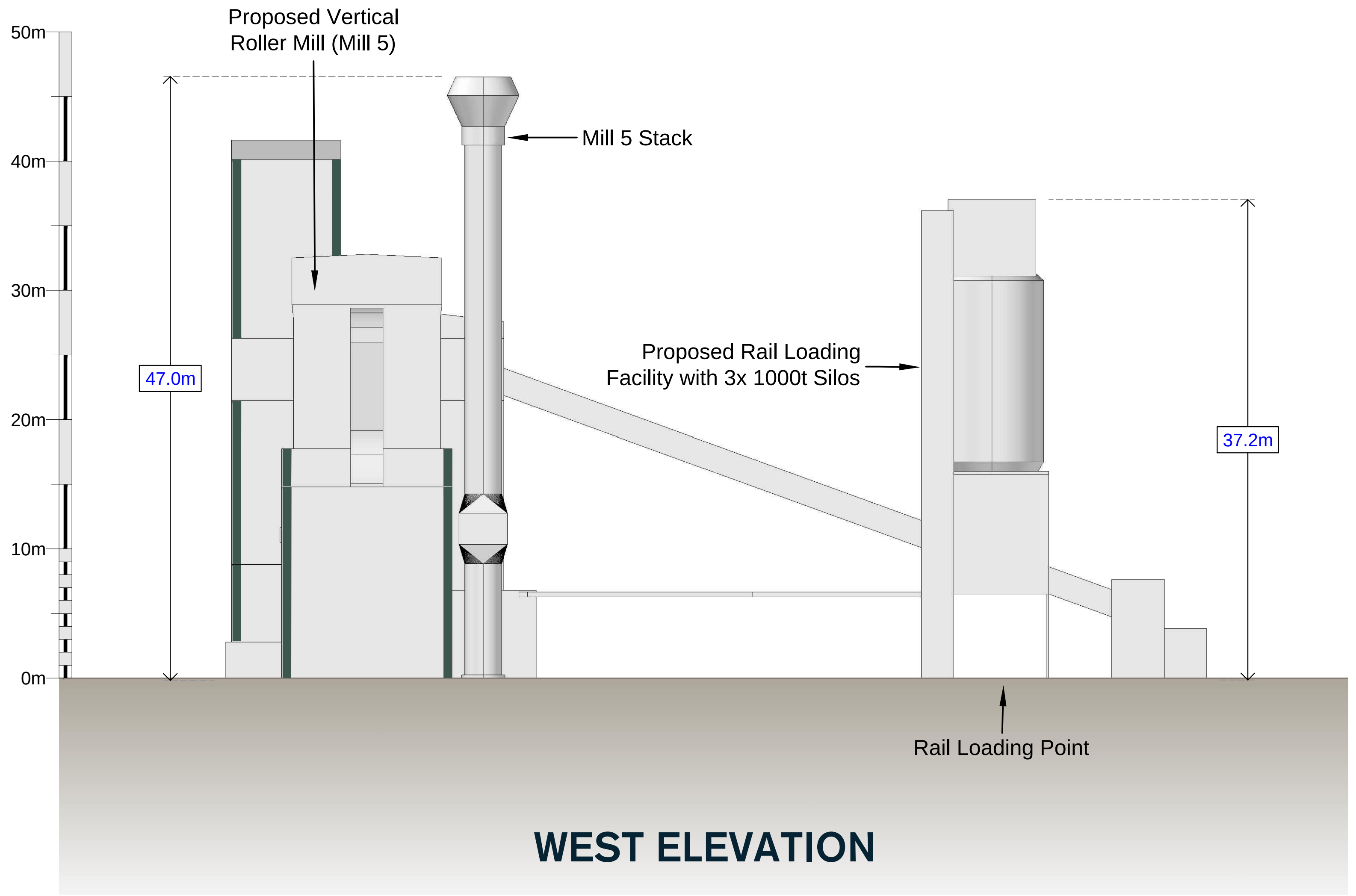
Hanson
HEIDELBERGCEMENT Group

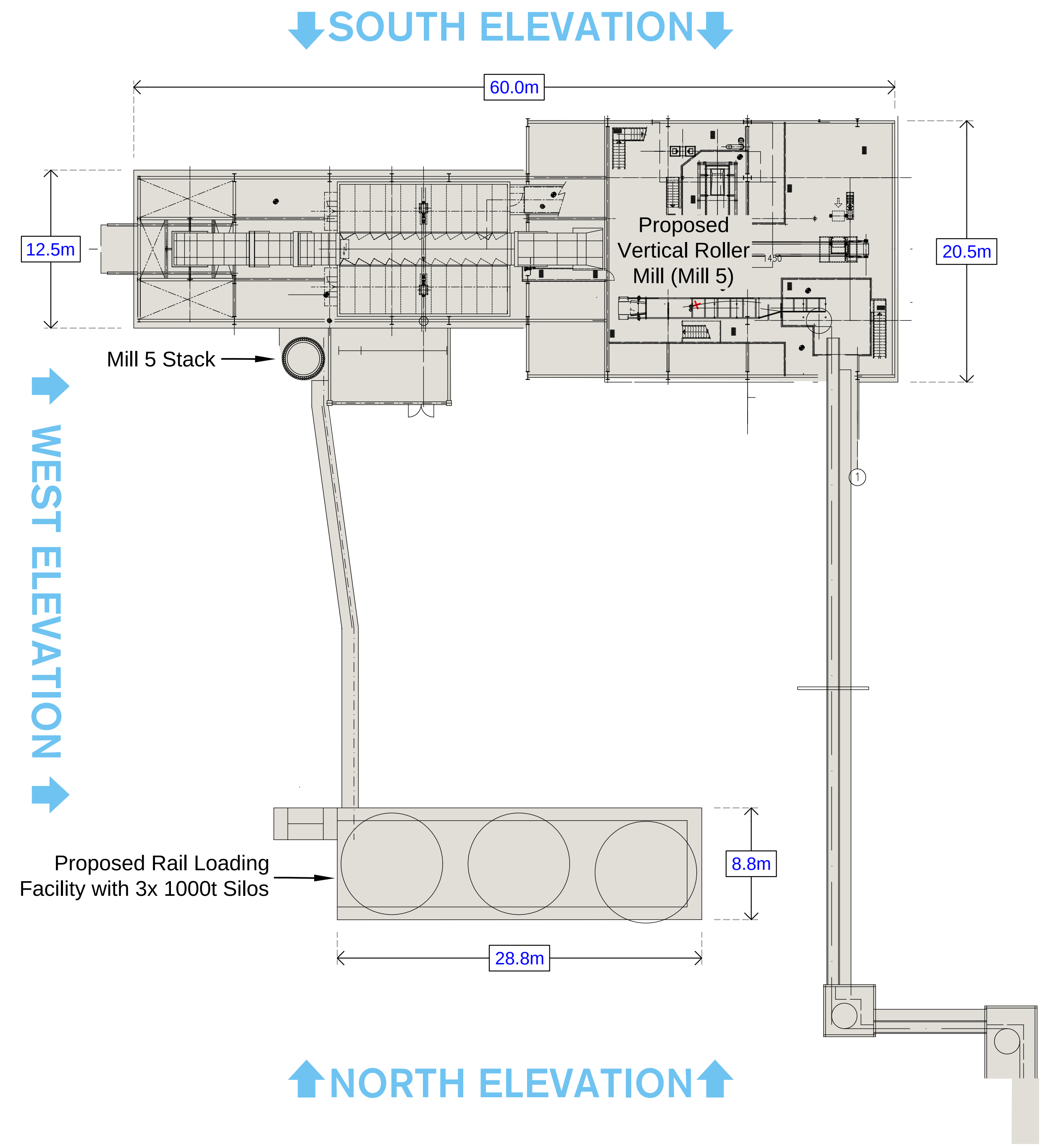
Legend

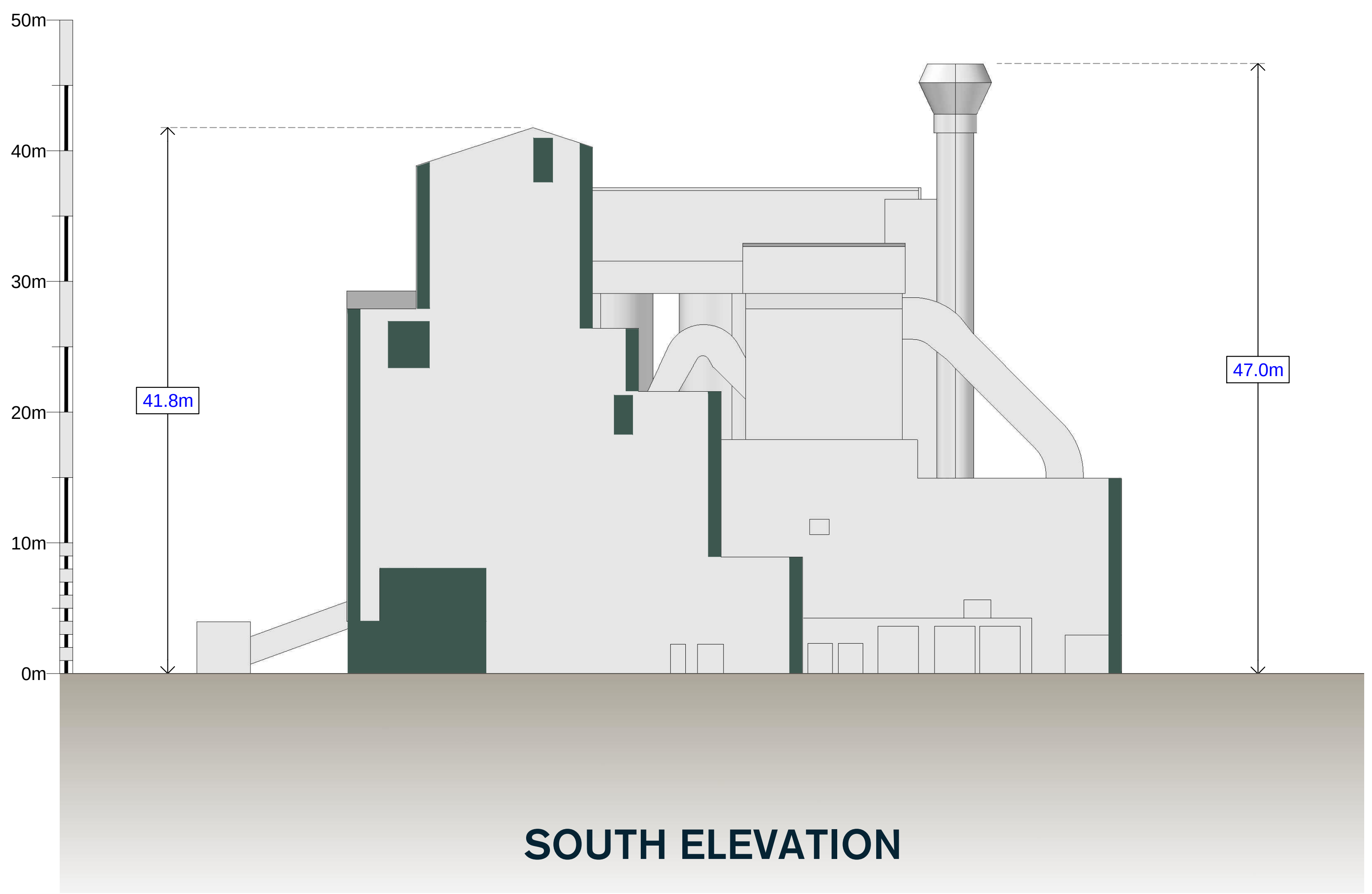
- Planning Application Area
- Proposed New/Realigned Railway Line
- Proposed New Concrete Road
- Existing Adjacent Structures
- Proposed Structures
- Temporary Construction/Contractors Compound Area
- Pneumatic Pipeline
- Sicon Conveyor System
- Temporary Plant & Equipment Storage and Pre Assembly Area

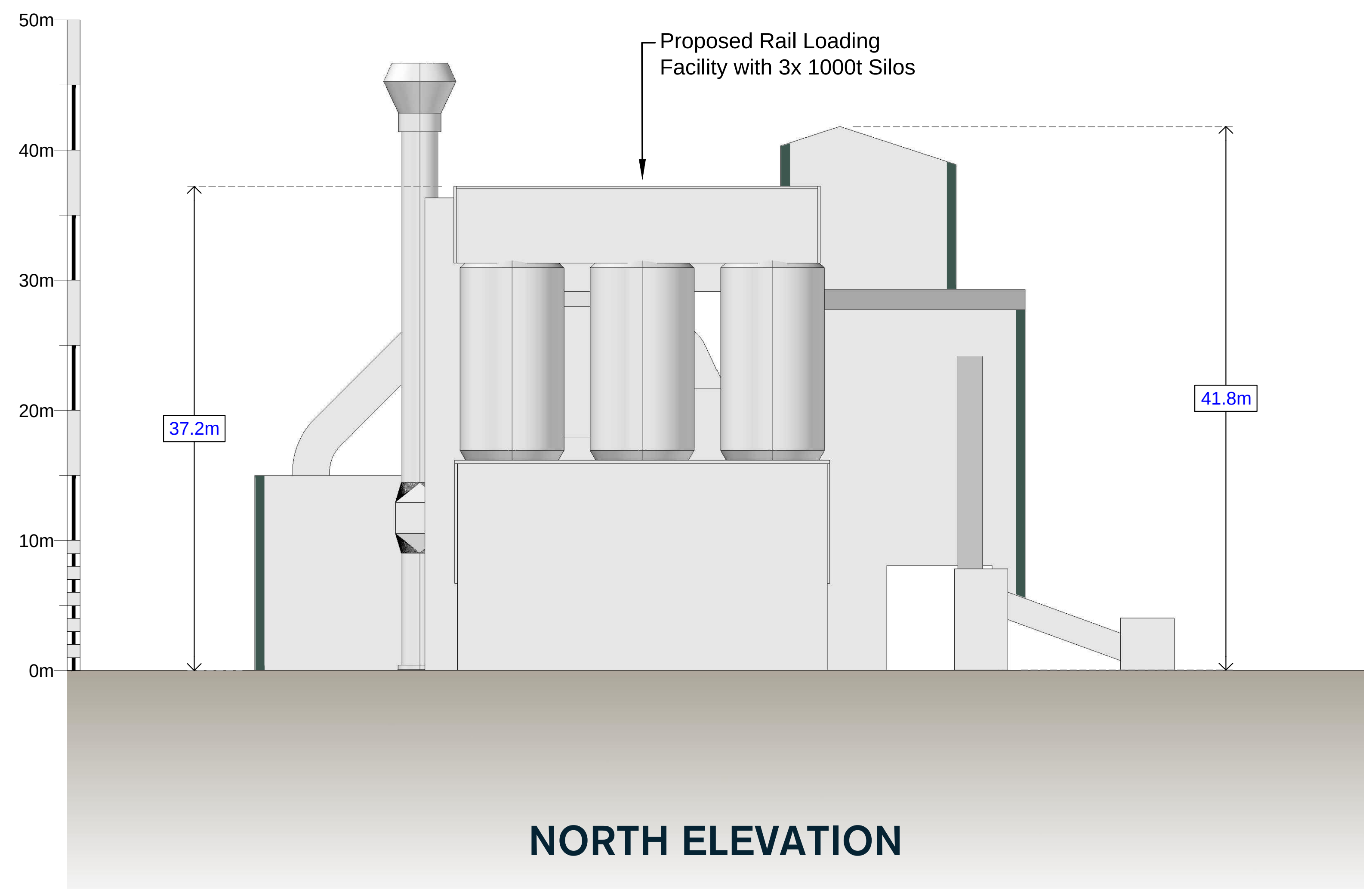
0m 20m 40m 60m 80m 100m

Site	PADESWOOD - PLAN 5
Title	Proposed Development Mill 5 & Rail Loading Facility
Scale	1:1000
Paper Size	A2
Drawn by	AG
Check by	AB
Date	MAY 2017
Drawing No.	P103/51
Revision	









Hanson
HEIDELBERGCEMENT Group

Note: The Vertical Roller Mill will be externally clad with steel sheeting. The roof will be coloured Silver Metallic 2007 (RAL 9006), with the sides coloured White Pyrenees 1006 (RAL 9010) with Green Navarre 3000 (RAL 6028) flashings. Conveyors, etc will be coloured to match the existing buildings at the Cement Works (BS Colour 22B15 Hamlet). Translucent panels will be included on the sides to allow natural light to enter the structure.

Site	PADESWOOD - PLAN 6
Title	Mill 5 & Rail Loading Facility Proposed Elevations

Scale	Paper Size	Drawn by	Drawing No.	Revision
1:500	A2	AG	P103/52	
Date		Check by		
MAY 2017		AB		

Hanson Cement, Padeswood Works

Application for variation to EPR permit BL1096

CM 5 Appendix 2 – List of wastes accepted

Wastes currently permitted for use as fuels

Code	Description	Hanson name
02 02 03	materials unsuitable for consumption or processing	MBM
16 01 03	End-of-Life Tyres	Tyres
19 02 08*	Liquid combustible waste containing dangerous substances	Cemfuel
19 02 10	Combustible waste other than those in 19 02 08* and 19 02 09*	Profuel/SRF
19 12 10	Other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11	Profuel/SRF

Wastes currently permitted for use as raw materials

Code	Description	Hanson name
01 04 10	dusty and powdery wastes other than those in mentioned in 01 04 07	Asphalt filler dust
02 02 03	materials unsuitable for consumption or processing	Sea Shells (Ex MRM)
10 01 02	Coal fly ash	Fly ash
10-02-13*	Sludges and filter cakes from gas treatment containing dangerous substances.	Iron Oxide, BOS filter cake
10 12 06	Discarded moulds	Plaster moulds
10 13 06	Particulates and dust (except 10 13 12 and 10 13 13)	washed bypass dust
10 13 12*	Solid wastes from gas treatment containing dangerous substances	bypass dust
10 13 13	Solid wastes from gas treatment other than those mentioned in 10 13 12	CKD
17 08 02	Gypsum-based construction materials other than those mentioned in 17 08 01	Plaster Board/ cemset
19 01 13*	Fly ash containing dangerous substances	Paper ash
19 02 03	Premixed wastes composed only of non-hazardous wastes	non hazardous blends
19 02 04*	Premixed wastes composed of at least one hazardous waste	hazardous blends
19 12 12	Other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11	synthetic gypsum blend

Hanson Cement, Padeswood Works

Application for variation to EPR permit BL1096

CM 5 Appendix 5 – EMS Management of Change Assessment

ERA Reference	Hazard	Receptor	Pathway	Risk management techniques	Probability of exposure	Consequence	Severity	Probability	Overall risk	Overall risk description
1	Dust emission from mill stack	Air	direct emission to air	Bag filter intalled to meet BATAEL,continuos monitoring of stack emission	Normal operation, continuous emission less than BATAEL	Very low impact on air quality, will not be measurable	1	5	5	Low
2	Increased dust emission from mill stack following bag failure	Air nuisance dust on cars and property	direct emission to air	Continous emission monitoring, process control alarms and interlocks to stop mill if trigger level exceeded	Likely to be short term only, less than a few hours per year at most	Catastrophic failure could lead to dust deposition on neighbouring properties	3	2	6	Low
3	Dust emission from rail silo filters	Air	direct emission to air	Planned preventative maintenance system for LEV filters. Routine checks on filter performance, Under normal operation low flow rate and very low dust concentration in vent air the impact will be on site only.	Continuous emissions at less than the ELV when the filters are operating under normal operation. Bag failure likely to occur less than once per year for a few hours at most	Impact restricted to on site areas	1	5	5	Low
4	Dust emission from rail silo filters bag failure	Air	direct emission to air	Planned preventative maintenance system for LEV filters. Routine checks on filter performance, Under normal operation low flow rate and very low dust concentration in vent air the impact will be on site only. Higher emissions possible in the event of a bag failure	Likely to be short term only, less than a few hours per year at most	Impact restricted to on site areas	2	2	4	very low
5	Fugitive dust from mill operation	Air	direct emission from mill body and duct work	Milling system operates under suction, mill and associated plant contained within building	Potential fugitive emissions will be contained within the mill building, fixed pipe vacuum system installed in mill building to deal with powder spillages	Impact restricted to on site areas	1	4	4	very low
6	Fugitive dust from raw material storage	Air	direct emission to air	Raw materials will be stored in the existing crane store, automatic crane used to minimise drop height and hence airborne dust in the store, building integrity checks carried out regularly	Doors to store opened for deliveries and maintenance work only, only a few hours per day and no change from current operation	Low level dust impact restricted to on site areas near the store	1	4	4	very low
7	Fugitive dust from raw material transport	Air nuisance dust on cars and property	direct emission to air	Conveyors enclosed within gantries or self sealing Sicon belt used. Planned maintenance regime in place to minimise risk of spillages and leaks. New conveying system to be installed complying with BAT conclusion 14. Gypsum and limestone are general damp materials so unlikely to be a source of dust emissions. Clinker is a coarse dry material the dust and cannot be wetted to minimise dust, conveyor transport to high level increases risk of release affecting neighbouring properties there is potential for nuisance complaints but due to the coarse nature of the dust it is very unlikely to be associated with health impacts	Conveyor transport to high level increases risk of release affecting neighbouring properties but this is unavoidable. There is potential for nuisance complaints but due to the coarse nature of the dust it is very unlikely to be associated with health impacts	Clinker dust is "sticky" any deposition off site on properties or cars will lead to complaints	3	3	9	Medium
8	Fugitive dust from cement transport	Air nuisance dust on cars and property	direct emission to air	Reduction in number of mills and pneumatic conveying lines from current operation , routine patrols by operators, planned preventative maintenance system in place for cement transport system	New conveying system to be installed complying with BAT conclusion 14. Cement is a "sticky" material any deposition on cars are windows is likely to lead to nuisance complaints	Cement is "sticky" any deposition off site on properties or cars will lead to complaints	3	2	6	low
9	Noise from mill operation	Nuisance at neighbouring properties	air	Noise level from roller mill less than ball mills. Mill operates within a building, doors kept closed during mill operation, full noise impact study being undertaken	Mill will run for over 7000 hours per year so noise will be effectively continuous	Potential nuisance noise at properties on Padeswood Drive	2	5	10	Medium
10	Noise from mill maitenance	Nuisance at neighbouring properties	air	Maintenance carreid out when mill stopped, only likely to be annual major work which could generate noise but will be at levels lower than in operation	Noisy maintennace activity likely to be only once per year or less at a major shutdown	Potential nuisance noise at properties on Padeswood Drive	1	3	3	very low
11	Vibration from mill operation	Nuisance at neighbouring properties	ground	Mill isolated from ground by vibration damping layer to prevent damage to mill, vribation may be noticable on start up in close proximity to mill	Unlikely to be any impact on neighbouring properities due to distance from installation	Potential nuisance noise at properties on Padeswood Drive	1	5	5	Low
12	Oil and grinding aid storage	Tributary to Black Brook	Works drainage system	Oil storage bunding provided, all surface run off water pass through oil interceptor and into settling pond. Settling pond visually checked before discharge to surface water	potential for release in the event of equipment fai	Trace release of oil to surface water	1	5	5	Low
13	Oill spillage during maintenance	Tributary to Black Brook	Works drainage system	Fitters and operators have spill prevention training and spill kits present in mill house. Drainage from CM5 area enters works drainage systyem and passes through oil interceptor before entering settling pond, water from pond reused in plant. Discharge from setling pond only done when water levels are high, pond visually inspected before opening Penstock.	Oil changes restricted to maintenance work	Trace release of oil to surface water	1	4	4	very low

Describe the Objectives

Depending on the reason for the assessment you will need to complete different parts of the tool.

Select the type of assessment:

- (●) a) to carry out an ENVIRONMENTAL ASSESSMENT of the releases resulting from the facility as a whole — Do Steps 1, 2 and 3 only
- ( ) b) to conduct a costs/benefits OPTIONS APPRAISAL to determine BAT or support the case for derogation under the Industrial Emission Directive. — Do Steps 1,2, 3 and 4 and continue with 5 and 6 if necessary

1.1 Briefly summarise the objectives and reason for the assessment in terms of the main environmental impacts or emissions to be controlled:

To assess the potential signifianct impacts of installing cement mill 5

Performance Indicators

Enter consumption data to determine your performance indicators

Which of the following parameters do you use for calculating your performance: Product

Please describe and justify your choice:

Normal practice in cement industry

Basic Consumption Data:

	Name	Annual Quantity	Units
Amount of Product:	CEM 1	400,000	tonnes
Main Raw Material:	Clinker	360,000.00	tonnes
Potable Water:		0.00	m3
Non Potable Water:		21,000.00	m3
Energy:		26,000.00	MWh
Waste: Inert:			tonne
Hazardous:			tonne
Stable Non-reactive Hazardous:			tonne
Biodegradable Non-hazardous:			tonne
Other Non-hazardous:			tonne

Specific Consumption per tonnes of CEM 1:

Production Efficiency:	1.11	tonnes/tonnes
Potable Water:	0.00	m3
Non Potable Water:	0.05	m3
Energy:	0.07	MWh
Waste: Inert:		tonne
Hazardous:		tonne
Stable Non-reactive Hazardous:		tonne
Biodegradable Non-hazardous:		tonne
Other Non-hazardous:		tonne

Performance Indicators

Enter consumption data to determine your performance indicators

Which of the following parameters do you use for calculating your performance: Product

Please describe and justify your choice:

Normal cemeent industry proactice

Basic Consumption Data:

	Name	Annual Quantity	Units
Amount of Product:	Cem 1	600,000	
Main Raw Material:	Clinker	550,000.00	
Potable Water:			m3
Non Potable Water:		5,000.00	m3
Energy:		27,000.00	MWh
Waste: Inert:			tonne
Hazardous:			tonne
Stable Non-reactive Hazardous:			tonne
Biodegradable Non-hazardous:			tonne
Other Non-hazardous:			tonne

Specific Consumption per of Cem 1:

Production Efficiency:	1.09	/
Potable Water:		m3
Non Potable Water:	0.01	m3
Energy:	0.05	MWh
Waste: Inert:		tonne
Hazardous:		tonne
Stable Non-reactive Hazardous:		tonne
Biodegradable Non-hazardous:		tonne
Other Non-hazardous:		tonne

Identify Relevant Impacts

Identify any environmental impacts that are not relevant to this assessment by deselecting from the list below:

Releases in Part 2?	Selected	Impact	Justification for omission
Yes	☑	Air	
Yes	☐	Deposition from Air to Land	Fine particulates only at very low concentrations deposition unlikely
No	☐	Water	No direct discharge to water from cement milling process
No	☐	Waste	Waste generation only from maintenance activity same as existing operation
Yes	☐	Visual	Already industrial location, visbile plume very small compared with kiln
Yes	☐	Ozone Creation	No ozone creating substances emitted from cement mills
Yes	☑	Global Warming	

If you have deselected an environmental impact as not relevant to this assessment,
no further assessment of this impact will be carried out
and associated assessment pages will be hidden

Local Environmental Quality

Describe the Quality of the Environment:

Provide a brief description of the main local factors that may influence the importance of the impact of emissions in the surrounding environment

Air Quality

Are there any Environmental Quality Standards relating to substances released from the activities, which may be at risk due to additional contribution from the activity ? (Environmental Quality Standards for air and water are described in EPR Technical Guidance Notes)	Unlikely as emissions are very low and exisitng site is acceptable in terms of no breach of EQS
Are there any Local Air Quality Management Plans applicable to releases from the activity?	No AQMP in area

Water Quality & Resources

Are there any Environmental Quality Standards relating to substances released from the activities, which may be at risk due to additional contribution from the activity?	No
Are proposals to abstract water satisfactory in order to obtain an abstraction licence?	No
Is the activity located in a groundwater vulnerable zone (for activities with direct releases to land only)?	No

Proximity to Sensitive Receptors

Is public annoyance likely to be an issue for noise, odour or plume visibility ?	Potential for noise nuisance as new plant is nearer tenants on Padeswood Drive compared to exisiting cement milling operation
Are there any wildlife habitats, eg Special Areas of Conservation,or Special Protection Areas, likely to be affected by releases from the activity? (Description of requirements of Habitats Directive is provided in EPR Technical Guidance Notes)	No low level sources dispersion of particulates unlikely to reach habitat sites. Nox emissions very low and infrequent

Air Impacts

Calculate Process Contributions of Emissions to Air

This table estimates the Process Contribution (PC), calculated as the maximum ground level concentration for each emission listed in the inventory, according to the release point parameters input earlier. If you have more accurate data obtained through dispersion modelling, this may be entered as indicated and will be used instead of the estimated PC.

		Long Term			Short Term		
Number	Substance	EAL	PC	* Modelled PC	EAL	PC	Modelled PC
		µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3
1	Particulates (PM10) (Annual Mean)	40	1.47			44.0	
2	Particulates (PM10) (24 hr Mean)		1.47		50	44.0	

Note that the Process Contribution shown for each substance is the sum of the individual process contributions of each point from which the substance is emitted. Process Contributions obtained from modelling data should incorporate all relevant release points and flow conditions.

* State the location of any detailed air dispersion modelling and also the main assumptions:	Comments	Separate report provided in appendix to variation application

Air Impacts

Calculate Process Contributions of Emissions to Air

This table estimates the Process Contribution (PC), calculated as the maximum ground level concentration for each emission listed in the inventory, according to the release point parameters input earlier. If you have more accurate data obtained through dispersion modelling, this may be entered as indicated and will be used instead of the estimated PC.

		Long Term			Short Term		
Number	Substance	EAL	PC	* Modelled PC	EAL	PC	Modelled PC
		µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3
1	Particulates (PM10) (Annual Mean)	40	0.292			13.3	
2	Particulates (PM10) (24 hr Mean)		0.292		50	13.3	
3	Carbon monoxide		0.0611		10000	19.9	
4	Nitrogen Dioxide	40	0.265		200	19.9	
5	Sulphur Dioxide (24 Hour Mean)		0.102		125	9.90	

Note that the Process Contribution shown for each substance is the sum of the individual process contributions of each point from which the substance is emitted. Process Contributions obtained from modelling data should incorporate all relevant release points and flow conditions.

* State the location of any detailed air dispersion modelling and also the main assumptions:

Comments: Separate report provided in appendix to variation application

Air Impact Screening Stage One

Screen out Insignificant Emissions to Air

This page displays the Process Contribution as a proportion of the EAL or EQS. Emissions with PCs that are less than the criteria indicated may be screened from further assessment as they are likely to have an insignificant impact.

				Long Term			Short Term		
Number	Substance	Long Term EAL	Short Term EAL	PC	% PC of EAL	> 1% of EAL?	PC	% PC of EAL	> 10% of EAL?
		µg/m3	µg/m3	µg/m3	%		µg/m3	%	
1	Particulates (PM10) (Annual Mean)	40.0	-	1.47	3.67	**Yes**	44.0	-	
2	Particulates (PM10) (24 hr Mean)	-	50.0	1.47	-		44.0	88.0	**Yes**

Air Impact Screening Stage One

Screen out Insignificant Emissions to Air

This page displays the Process Contribution as a proportion of the EAL or EQS. Emissions with PCs that are less than the criteria indicated may be screened from further assessment as they are likely to have an insignificant impact.

				Long Term			Short Term		
Number	Substance	Long Term EAL	Short Term EAL	PC	% PC of EAL	> 1% of EAL?	PC	% PC of EAL	> 10% of EAL?
		µg/m3	µg/m3	µg/m3	%		µg/m3	%	
1	Particulates (PM10) (Annual Mean)	40.0	-	0.292	0.728	**No**	13.3	-	
2	Particulates (PM10) (24 hr Mean)	-	50.0	0.292	-		13.3	26.5	**Yes**
3	Carbon monoxide	-	10,000	0.0611	-		19.9	0.198	**No**
4	Nitrogen Dioxide	40.0	200	0.265	0.662	**No**	19.9	9.90	**No**
5	Sulphur Dioxide (24 Hour Mean)	-	125	0.102	-		9.90	7.92	**No**

Air Impact Modelling Stage Two Screening

Identify need for Detailed Modelling of Emissions to Air

This page displays the Process Contributions in relation to the backgound pollutant levels and the EAL or EQS. You should use this information to decide whether to conduct detailed modelling. Note that releases that are insignificant are not shown as they are screened from further assessment. Also complete this page if you have already done detailed modelling.

			Long Term						Short Term		
Number	Substance	Air Bkgrnd Conc. µg/m3	PC µg/m3	% PC of headroom (EAL -	PEC mg/m3	% PEC of EAL %	% PEC of EAL >=70?	PC µg/m3	% PC of headroom (EAL - Bkgrnd)	% PC of headroom >=20?
1	Particulates (PM10) (Annual Mean)	13	1.47	5.43	14.5	36.2	**No**	44.0	-	
2	Particulates (PM10) (24 hr Mean)	13	1.47	-	0	-		44.0	183	**Yes**

Air Impact Modelling Stage Two Screening

Identify need for Detailed Modelling of Emissions to Air

This page displays the Process Contributions in relation to the backgound pollutant levels and the EAL or EQS. You should use this information to decide whether to conduct detailed modelling. Note that releases that are insignificant are not shown as they are screened from further assessment. Also complete this page if you have already done detailed modelling.

			Long Term					Short Term		
Number	Substance	Air Bkgrnd Conc.	PC	% PC of headroom (EAL -	PEC	% PEC of EAL	% PEC of EAL >=70?	PC	% PC of headroom (EAL - Bkgrnd)	% PC of headroom >=20?
		µg/m3	µg/m3		mg/m3	%		µg/m3		
2	Particulates (PM10) (24 hr Mean)	13	0.292	-	0	-		13.3	55.0	**Yes**

Air Impact Modelling Assessment

See guidelines in H1 Annex F section entitled "Decide if you need detailed air modelling.

Describe here the justification for whether detailed modelling is, or is not required for any of the releases. Refer to the quidelines in H1 Annex F	Detailed modelling will be carried out as large changes in emission limits have arisen through the BAT Conclusions variation
Describe source of background information:	Previous modelling reports data from DEFRA AURN sites
Document Reference of detailed modelling work:	Variation application appendix

Global Warming Potential Impacts

Substance	Source	Annual Rate MWh/yr	GWP Value per tonne	Annual GWP
C02 Energy: indirect	indirect emissions	26,000.00	1.00	10,358.40
			Total:	10,358.40

Comments

Global Warming Potential Impacts

Substance	Source	Annual Rate MWh/yr	GWP Value per tonne	Annual GWP
C02 Energy: indirect	indirect emissions	27,000.00	1.00	10,756.80
			Total:	10,756.80

Comments

Air Summary Tables

(Substances screened as insignificant are not shown)

Option 1 - Base-Case

Release Points

Number	Description	Location	Effective Height	Efflux Velocity	Total Flow
			metres	m/s	m3/hr
1	A3	CM1	17.5		2300
2	A4	CM2	12.5		2300
3	A6	CM4	16.7		9000
4	A7	CM4 DCE	21.5		38500

Long Term Impact

Substance Assessed	Background Contribution	EAL	PC	PEC	% PC of EAL	% PEC of EAL	EQ
	µg/l	µg/m3	µg/m3	µg/m3			
Particulates (PM10) (24 hr Mean)	13		1.46573	0.00			
Particulates (PM10) (Annual Mean)	13	40	1.46573	14.47	3.66	36.16	0.04
						Total:	**0.04**

Short Term Impact

Substance Assessed	Background Contribution	EAL	PC	PEC	% PC of EAL	% PEC of EAL	EQ
	µg/l	µg/m3	µg/m3	µg/m3			
Particulates (PM10) (24 hr Mean)	26	50	43.95703	69.96	87.91	139.91	0.88
Particulates (PM10) (Annual Mean)	26		43.95703	0.00			
						Total:	**0.88**

Option 2 - Mill 5

Release Points

Number	Description	Location	Effective Height	Efflux Velocity	Total Flow
			metres	m/s	m3/hr
1	A15	CM5	40	8.3	66000
2	combined silos		25	6	10000

Long Term Impact

Substance Assessed	Background Contribution	EAL	PC	PEC	% PC of EAL	% PEC of EAL	EQ
	µg/l	µg/m3	µg/m3	µg/m3			
Carbon monoxide			0.06105	0.00			
Nitrogen Dioxide		40	0.26455		0.66		0.01
Particulates (PM10) (24 hr Mean)	13		0.29100	0.00			
Particulates (PM10) (Annual Mean)	13	40	0.29100	13.29	0.73	33.23	0.01
Sulphur Dioxide (24 Hour Mean)			0.10175	0.00			
						Total:	**0.01**

Short Term Impact

Substance Assessed	Background Contribution	EAL	PC	PEC	% PC of EAL	% PEC of EAL	EQ
	µg/l	µg/m3	µg/m3	µg/m3			
Carbon monoxide		10000	19.80000	0.00	0.20	0.00	0.00
Nitrogen Dioxide		200	19.80000		9.90		0.10
Particulates (PM10) (24 hr Mean)	26	50	13.20556	39.21	26.41	78.41	0.26
Particulates (PM10) (Annual Mean)	26		13.20556	0.00			
Sulphur Dioxide (24 Hour Mean)		125	9.90000		7.92		0.08
						Total:	**0.44**

Option Summary

Long Term Option Summary

Substance Assessed	Option	% PC of EAL	% PEC of EAL	EQ
Particulates (PM10) (Annual Mean)	1	3.66	36.16	0.04

Global Warming Potential Summary Tables

(Substances screened as insignificant are not shown)

Option	Substance	GWP
Option 1 - Base-Case	C02 Energy: indirect	10358.4
Option 2 - Mill 5	C02 Energy: indirect	10756.8

Scope of Environmental Assessment

List the activities included in the assessment

Use the 'Add' button at the bottom left to create a new activity

Number	Activity
1	Cement mill 5 and associated plant
2	Rail silos and asociated plant

Comments: Assessment restricted to impact of change

Summary of Environmental Assessment

You have now completed all of the steps in this software for the environmental assessment. This will provide you with:

- an inventory of all emissions sources and substances emitted from your activities
- an information trail of how the impacts of these emissions have been assessed
- a summary of the impacts

You now need to use this information to confirm whether the emissions are acceptable, i.e. that they do not cause significant pollution to occur, by responding below:

Do any of the emissions exceed any of the folllowing:

Statutory Emission limit values:	No	If yes, identify the substances concerned and improvements that are needed to at least meet the statutory requirement
Environmental Quality Standards (air and water):	No	If yes, identify the substances concerned, the contribution from the activities and investigate whether further detailed fate and effect modelling and/or pollution controls are needed. Ensure that the relevant EQS reference conditions are applied.
Environmental Assessment Levels:	No	If yes, identify the substances concerned, the contribution from the activities and investigate whether further detailed fate and effect modelling and/or pollution controls are needed.

Use the box below to provide further information on any of the above to which you have responded 'Yes':

Finally, print all of the information and submit with your application. Remember to include any supplementary information and reports that you have had made reference to during the assessment procedure.

Compare the Options

Review the graphs and summary date to rank the options according to environmental impact

Is the best Option self-evident? i.e. results in the lowest impact in all environmental considerations	Yes
Are you going to implement the option that is self-evidently the best? If yes, no further assessment is necessary and you may end here.	Yes

Compare the Options

Review the graphs and summary date to rank the options according to environmental impact

Is the best Option self-evident? i.e. results in the lowest impact in all environmental considerations	No
Are you going to implement the option that is self-evidently the best? If yes, no further assessment is necessary and you may end here.	No

Resolve Cross Media Conflicts

Environmental Consideration		Importance	Comments / Justification
Releases to Air	Long Term:	low	Emissions below BAT AEL
	Short Term:	low	
Deposition to Land:		low	Fine dust
Releases to Water	Long Term:	low	No process release
	Short Term:	low	
Visual:		low	Already part of large industrial site
POCP:		low	None
GWP:		low	reduction in indirect releases per tonne product
Disposal of Waste:		low	No adddtional waste generated

Provide a description of how cross media conflicts have been resolved:

No conflicts

This will require reasoned judgement, with reference to any decisions or assumptions made over the relative importance of different environmental impacts. See H1 for requirements, guidelines and examples to assist in the process. You may submit this information separately.

Location or reference to information on resolution of cross media conflicts:

Present a summary of the final ranking of options in the table below:

Number	Title	Ranking
1	Base-Case	2
2	Mill 5	1

Resolve Cross Media Conflicts

Environmental Consideration		Importance	Comments / Justification
Releases to Air	Long Term:		
	Short Term:		
Deposition to Land:			
Releases to Water	Long Term:		
	Short Term:		
Visual:			
POCP:			
GWP:			
Disposal of Waste:			

Provide a description of how cross media conflicts have been resolved:

This will require reasoned judgement, with reference to any decisions or assumptions made over the relative importance of different environmental impacts. See H1 for requirements, guidelines and examples to assist in the process. You may submit this information separately.

Location or reference to information on resolution of cross media conflicts:

Present a summary of the final ranking of options in the table below:

Number	Title	Ranking
1	Base-Case	2
2	Mill 5	1

Describe the Candidate Options

Identify all reasonably applicable options of techniques

You should include:

a) a brief description of individual control measures or configurations of control measures seleted for each option, and the activities with which they are associated (the existing base-case may conveniently be the first option).

b) justification why any techniques generally applicable to the regulated facility have not been selected for assessment. (see relevant H1 annex) (This should be based on regulated facility-specific technical, not economic reasons).

c) for new projects, whether any initial environmental assessment that was done at the project evaluation stage, or any screening of technology or process routes prior to this assessment, particularly where this has a bearing on environmental performance. (see H1)

In the case of b) or c) please enter your Comments here: H1 is only being used to determine if detailed modelling is required

Option Number	Title	Description
1	Base-Case	Current cement operations
2	Mill 5	Operation with CM5, closure of CM4, mothballing mills 1 and 2

Once a series of options have been generated for the proposed project, it is recommended that the Operator discuss these with the local Regulator to check both parties agree that the options are satisfactory. This may save the Operator from spending resources on assessment of options which are unlikely to meet the required environmental performance.

List the main activity or activities to which the release control options are applicable and any other activities that will be affected by the candidate control option on the main activity:

Air Emissions Inventory

Please list all Substances released to Air for each Release Point identified in the previous page.

Number	Substance	Meas'ment Method	Operating Mode (% of	Data relating to Long Term effects			Data relating to Short Term effects			Annual Rate	ELV Conc.
				Conc.	Release Rate	Meas'ment Basis	Conc.	Release Rate	Meas'ment Basis		
				mg/m3	g/s		mg/m3	g/s		tonne/yr	mg/m3
1	Particulates (PM10) (24 hr Mean)	Continuous	100.0%	10.0	0.006389		10.0	0.006389	24 hr Mean	0.2015	10.00
2	Particulates (PM10) (Annual Mean)	Continuous	100.0%	10.0	0.006389		10.0	0.006389	24 hr Mean	0.2015	10.00

Measurement method: * provide detail in comments box

Comments:

Air Release Points

Please define your Release Points for Releases to Air

Are there any Air emissions? Yes

Number	Description	Location or Grid Reference	Activity or Activities	Effective Height metres	Efflux Velocity m/s	Total Flow m3/hr
1	A3	CM1		17.5		2300
2	A4	CM2		12.5		2300
3	A6	CM4		16.7		9000
4	A7	CM4 DCE		21.5		38500

Comments

Air Emissions Inventory

Please list all Substances released to Air for each Release Point identified in the previous page.

Number	Substance	Meas'ment Method	Operating Mode (% of	Data relating to Long Term effects			Data relating to Short Term effects			Annual Rate	ELV Conc.
				Conc. mg/m3	Release Rate g/s	Meas'ment Basis	Conc. mg/m3	Release Rate g/s	Meas'ment Basis	tonne/yr	mg/m3
1	Particulates (PM10) (Annual Mean)	Continuous	100.0%	10.0	0.025000		10.0	0.025000	24 hr Mean	0.7884	10.00
2	Particulates (PM10) (24 hr Mean)	Continuous	100.0%	10.0	0.025000		10.0	0.025000	24 hr Mean	0.7884	10.00

Measurement method: * provide detail in comments box

Comments:

Air Emissions Inventory

Please list all Substances released to Air for each Release Point identified in the previous page.

Number	Substance	Meas'ment Method	Operating Mode (% of	Data relating to Long Term effects			Data relating to Short Term effects			Annual Rate	ELV Conc.
				Conc. mg/m3	Release Rate g/s	Meas'ment Basis	Conc. mg/m3	Release Rate g/s	Meas'ment Basis	tonne/yr	mg/m3
1	Particulates (PM10) (24 hr Mean)	Continuous	100.0%	20.0	0.213889		20.0	0.213889	24 hr Mean	6.7452	10.00
2	Particulates (PM10) (Annual Mean)	Continuous	100.0%	20.0	0.213889		20.0	0.213889	24 hr Mean	6.7452	10.00

Measurement method: * provide detail in comments box

Comments:

Air Release Points

Please define your Release Points for Releases to Air

Are there any Air emissions? Yes

Number	Description	Location or Grid Reference	Activity or Activities	Effective Height (metres)	Efflux Velocity (m/s)	Total Flow (m3/hr)
1	A15	CM5		40	8.3	66000
2	combined silos			25	6	10000

Comments

Air Emissions Inventory

Please list all Substances released to Air for each Release Point identified in the previous page.

Number	Substance	Meas'ment Method	Operating Mode (% of	Data relating to Long Term effects			Data relating to Short Term effects			Annual Rate	ELV Conc.
				Conc. mg/m3	Release Rate g/s	Meas'ment Basis	Conc. mg/m3	Release Rate g/s	Meas'ment Basis	tonne/yr	mg/m3
1	Particulates (PM10) (24 hr Mean)	Estimated*	100.0%	10.0	0.027778		10.0	0.027778	24 hr Mean	0.8760	10.00
2	Particulates (PM10) (Annual Mean)	Estimated*	100.0%	10.0	0.027778		10.0	0.027778	24 hr Mean	0.8760	10.00

Measurement method: * provide detail in comments box

Comments:

Air Emissions Inventory

Please list all Substances released to Air for each Release Point identified in the previous page.

Number	Substance	Meas'ment Method	Operating Mode (% of	Data relating to Long Term effects Conc. mg/m3	Release Rate g/s	Meas'ment Basis	Data relating to Short Term effects Conc. mg/m3	Release Rate g/s	Meas'ment Basis	Annual Rate tonne/yr	ELV Conc. mg/m3
1	Particulates (PM10) (Annual Mean)	Continuous	100.0%	10.0	0.183333		10.0	0.183333	24 hr Mean	5.7816	10.00
2	Particulates (PM10) (24 hr Mean)	Continuous	100.0%	10.0	0.183333		10.0	0.183333	24 hr Mean	5.7816	10.00
3	Carbon monoxide	Estimated*	100.0%	3.0	0.055000		20.0	0.366667		1.7345	1000.00
4	Nitrogen Dioxide	Estimated*	100.0%	13.0	0.238333		20.0	0.366667		7.5161	
5	Sulphur Dioxide (24 Hour Mean)	Estimated*	100.0%	5.0	0.091667		10.0	0.183333	24 Hr Mean	2.8908	400.00

Measurement method: * provide detail in comments box

Comments:

Energy Consumption

Please list all Energy Sources and Annual Consumption

Select energy sources by Clicking on 'Add' and using the pull-down list.

Number	Energy Sources		Delivered MWh/yr	Conversion Factor	Primary MWh/yr	CO2 Factor	CO2 tonne/yr
1	Electricity from public supply	indirect emissions	26000	2.40	62,400	0.17	10,358

Comments

Energy Consumption

Please list all Energy Sources and Annual Consumption

Select energy sources by Clicking on 'Add' and using the pull-down list.

Number	Energy Sources		Delivered MWh/yr	Conversion Factor	Primary MWh/yr	CO2 Factor	CO2 tonne/yr
1	Electricity from public supply	indirect emissions	27000	2.40	64,800	0.17	10,757

Comments

Raw Materials

Please list all Raw Materials Consumed:

Number	Material	Annual Consumption	Units
1	Non-potable Water	21000	tonnes/year
2	Potable water	0	tonnes/year

Comments

Raw Materials

Please list all Raw Materials Consumed:

Number	Material	Annual Consumption	Units
1	Non-potable Water	5000	
2	Potable water		

Comments

Hanson Cement, Padeswood Works

Application for variation to EPR permit BL1096

CM 5 Appendix 4 – BAT Conclusions

CM5 Appendix 4 BAT Conclusions Cross References

BAT No.	Description	Applicable to CM 5	Reference
1	In order to improve the overall environmental performance of the plants/installations producing cement, lime and magnesium oxide, production BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features...	✓	CM5 Management Systems
2	In order to reduce/minimise noise emissions during the manufacturing processes for cement, lime and magnesium oxide, BAT is to use a combination of the following techniques…	✓	CM5 Noise
3	In order to reduce emissions from the kiln and use energy efficiently, BAT is to achieve a smooth and stable kiln process, operating close to the process parameter set points by using the following techniques…	N/A	
4	In order to prevent and/or reduce emissions, BAT is to carry out a careful selection and control of all substances entering the kiln.	N/A	
5	BAT is to carry out the monitoring and measurements of process parameters and emissions on a regular basis and to monitor emissions in accordance with the relevant EN standards or, if EN standards are not available, ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality, including the following...	✓	CM5 Monitoring
6	In order to reduce energy consumption, BAT is to use a dry process kiln with multistage preheating and precalcination.	N/A	
7	In order to reduce/minimise thermal energy consumption, BAT is to use a combination of the following techniques…	N/A	
8	In order to reduce primary energy consumption, BAT is to consider the reduction of the clinker content of cement and cement products.	✓	CM5 Raw materials
9	In order to reduce primary energy consumption, BAT is to consider cogeneration/combined heat and power plants.	N/A	
10	In order to reduce/minimise electrical energy consumption, BAT is to use one or a combination of the following techniques…	✓	CM5 Energy
11	In order to guarantee the characteristics of the wastes to be used as fuels and/or raw materials in a cement kiln and reduce emissions, BAT is to apply the following techniques…	N/A	
12	In order to ensure appropriate treatment of the wastes used as fuel and/or raw materials in the kiln, BAT is to use the following techniques…	N/A	
13	BAT is to apply safety management for the storage, handling and feeding of hazardous waste materials, such as using a risk-based approach according to the source and type of waste, for the labelling, checking, sampling and testing of waste to be handled.	N/A	
14	In order to minimise/prevent diffuse dust emissions from dusty operations, BAT is to use one or a combination of the following techniques…	✓	CM5 Operating Techniques
15	In order to minimise/prevent diffuse dust emissions from bulk storage areas, BAT is to use one or a combination of the following techniques…	✓	CM5 Operating Techniques

16	In order to reduce channelled dust emissions, BAT is to apply a maintenance management system which especially addresses the performance of filters applied to dusty operations, other than those from kiln firing, cooling and main milling processes. Taking this management system into account, BAT is to use dry flue-gas cleaning with a filter.	✓	CM5 Emissions
17	In order to reduce dust emissions from flue-gases of kiln firing processes, BAT is to use dry flue-gas cleaning with a filter.	N/A	
18	In order to reduce dust emissions from the flue-gases of cooling and milling processes, BAT is to use dry flue-gas cleaning with a filter.	✓	CM5 Emissions
19	In order to reduce the emissions of NOx from the flue-gases of kiln firing and/or preheating/precalcining processes, BAT is to use one or a combination of the following techniques…	N/A	
20	When SNCR is used, BAT is to achieve efficient NOx reduction, while keeping the ammonia slip as low as possible, by using the following technique…	N/A	
21	In order to reduce/minimise the emissions of SOx from the flue-gases of kiln firing and/or preheating/precalcining processes, BAT is to use one of the following techniques…	N/A	
22	In order to reduce SO2 emissions from the kiln, BAT is to optimise the raw milling processes.	N/A	
23	In order to minimise the frequency of CO trips and keep their total duration to below 30 minutes annually, when using electrostatic precipitators (ESPs) or hybrid filters, BAT is to use the following techniques in combination…	N/A	
24	In order to keep the emissions of TOC from the flue-gases of the kiln firing processes low, BAT is to avoid feeding raw materials with a high content of volatile organic compounds (VOC) into the kiln system via the raw material feeding route.	N/A	
25	In order prevent/reduce the emissions of HCl from flue-gases of the kiln firing processes, BAT is to use one or a combination of the following primary techniques…	N/A	
26	In order to prevent/reduce the emissions of HF from the flue-gases of the kiln firing processes, BAT is to use one or a combination of the following primary techniques…	N/A	
27	In order to prevent emissions of PCDD/F or to keep the emissions of PCDD/F from the flue-gases of the kiln firing processes low, BAT is to use one or a combination of the following techniques…	N/A	
28	In order to minimise the emissions of metals from the flue-gases of the kiln firing processes, BAT is to use one or a combination of the following techniques…	N/A	
29	In order to reduce solid waste from the cement manufacturing process along with raw material savings, BAT is to…	N/A	

Hanson Cement, Padeswood Works

Application for variation to EPR permit BL1096

CM 5 Appendix 3 – Environmental Risk Assessment

MANAGEMENT OF CHANGE ASSESSMENT Mill 5 Operation at Padeswood (NBb – does not consider the construction phase in detail)		
Description of the Operational Change		
Area to be considered	**Applies Y/N**	**Action Required / By who / By when**
ENVIRONMENTAL		
Update the Environmental Aspects and Impacts Assessment? (CP05)	Y	PW Q&E Manager
Obtain new permit or variation to an existing permit or surrender of a permit? (SP014)	Y	Project Team/IW
Alter bunds, drains & pits / Oil & Chemical Storage? (UKCP04)	?	Lubrication systems enclosed. Check design and Review as built
Changes to ground and surface water impacts, water abstraction licence or discharge consents?(SP10)	N	Water requirements within current abstraction licence, discharge volumes low no increase in volumes expected
Dust control of fugitive emissions? (CP05)	Y	To be considered as part of the project design and reviewed under CP05 when built
Energy Use & Efficiency, Back-up power supplies, carbon and energy? (CP11)	Y	Considered as part of the AFE
Environmental Permitting Regulations (EPR) Best Available Technology (BAT) justification?	Y	Considered as part of the AFE and in permit variation application
Is the proposed change covered by the relevant EPR Process Guidance Notes?	Y	Designg to be compliant with BAT conclusions
European Union Emissions Trading Scheme (EU ETS) & Climate Change Agreement (CCA) compliance with current EU ETS Permit (CP11)	Y	Fuel consumption from hot gas generation will be captured as part of the site stock control
Is new Instrumentation/Software for Environmental Monitoring required? (SP10)	Y	CEMS monitoring required on new stack/Project Team
Compliant with existing planning conditions? (SP014)	N	Planning permissions sought as part of the project/Project Team , LMR

New planning permission required? (SP014)	Y	See above
Control and Management of Incoming, Wastes, Fuels, Raw Materials and Alternative Fuels and Materials for Use in the Process? (CP07, Current PPC & EU ETS Permits)	Y	Fuel required for hot gas generator needs to be controlled and managed. PW Site
Are new technical competencies required such as Certificate of Technical Competence (COTC) required by EA RGN 5?	N	
Waste Management, waste risings, duty of care? (CP07)	N	
QUALITY	**Y/N**	**Action Required / By who / By when**
Assets Register / Plant inventory?	Y	Asset register will be updated as part of the capital process/Project team
Customer Requirements?	N	
Customer service?	N	
Product Certification e.g. Kite-mark and CE Marking?	N	
Product design and development? (SP13)	N	
Product Quality?	Y	Commissioning trials (Quality) will be required as part of the project. Project Team/PW Q&E Manager/HTC
Software Programming & Modification? Copy and back up existing plant operational settings and mix recipe programmes held within plant control systems?	Y	Implemented as part of the project/Project Team, PW Software engineer
Technical Specifications?	N	
HEALTH & SAFETY	**Y/N**	**Action Required / By who / By when**
Asbestos & Refractory Ceramic Fibre Hazard? (CP55)	N	
Excavation / Digging?	N	

Burning, Cutting & Grinding? (CP43)	Y	Risk Assessments required.
Confined Space? (CP47)	Y	Risk Assessments required
Construction & Design Management (CDM) (CP14)	Y	Project Team
Control of Major Accident Hazards (COMAH) Regulations?	N	
Corrosion/Erosion? (CP37)	Y	To be considered as part of the PM strategy for the new installation/Project team, PW Site personnel
COSHH Assessments? (CP16)	Y	Review lubrication on commissioning/PW Site team
Guarding, Isolations /Lock Off /Live Working? (CP20, CP50)	Y	Isolation requirements to be considered during the planning and build phase and isolation matrices and training required when built/Project team, Site personnel
Explosives (Quarry Operations) UKCP22	N	
Emissions – fume, dust, gases, etc. ? (CP16)	Y	As above for EA and I assessments.
Electricity at Work, Electricity at Work Regulations? (CP20)	Y	To be considered during project design phase and reviewed as built/Project team, PW Electrical Engineer
Emergency Lighting? (CP09, CP23)	Y	To be considered during project design phase and added to the site PM schedule/Project Team, PW Planning Engineer
Explosive Atmospheres Directive (ATEX), Dangerous Substances& Explosive Atmospheres Regulations (DSEAR)? (CP09)	N	
Fire Risk Assessment (CP23)	Y	Fire Risk Assessment review as built/Site Fire Wardens
Ionising Radiation? (CP54)	N	
Instrumentation/Software for Plant Safety?	N	
Lifting Equipment/Operations Lifting Operations (CP12)	Y	CDM regulations require that maintenance requirements post implementation are considered and adequate provision is made for maintenance – to include Lifting Equipment./ Project Team
Manual Handling/Ergonomics? CP29	N	
Mobile Plant? (CP13)	N	
Noise & Vibration-UKCP41	Y	Noise survey when operational to identify hearing protection zone and assess any potential off site impacts

Overhead Clearance, Overhead hazards?	N	
Personal Protective Equipment (UKCP39)	Y	Personal exposure assessments for noise and dust to be completed following build. PPE and signage requirements to be determined /Site Team
Plant Design Limits/Life Cycle?	N	
Pneumatic or Hydraulic Systems? Isolation/Venting?	Y	To be reviewed and considered as part of the isolation review on completion/Site Team
Pressure Systems? (UKCP31)	Y	Pressure vessels (including rams), to be identified and added to PM system on completion/ PW Site Team
Provision & Use of Work Equipment (PUWER) risk assessment?	Y	All guarding to be checked for suitability
Radio Frequency Signals/ Electromagnetic Interference?	N	
Repetitive Tasks	N	
Risk Assessment, Safe Work Practices, Method statement. (UKCP01, UKCP02)	Y	Risk assessments to be generated as tasks become required after completion. Consider contacting Purfleet for their risk assessments/ Site Team
Safety Interlocks e.g. Castell systems (UKCP20)	N	
Temperature extremes? (UKCP38)	Y	By risk assessment for mill entry/Site Team
Trip/Alarm/Control Schedule	Y	Review on commissioning/Commissioning Team/Site Team
Vehicle Access/Movements/Traffic/ Pedestrians (CP39)	N	Should have been provided for in design under CDM. Update Traffic Risk Assessment/Site Team
Water Systems, legionella (CP19)	N	No additional water storage requirements
Working at Height (CP48)	Y	Control by risk assessment/Site Team
Interaction with Other Areas of the Plant	Y	Potential for interaction with cement mills, packing plant, distribution, rail etc.
Pipework Identification/Isolation	Y	If not completed during construction phase then must be reviewed and identified on/after commissioning/Project Team, Site Team
Connection of Electronic Systems to the Site Network	Y	Project Team/PW Electrical engineer
HAZOP Study (CP25)	N	
Legal compliance checks (SP9)	Y	To be completed during commissioning/Project Team

Weather Conditions				
MISCELANEOUS	**Y/N**	**Action Required / By who / By when**		
Is a new or modified IMS Procedure required? (SP001)	N			
Control of Contractors? (CP01)	N			
Commissioning Documentation?	Y	To be completed by commissioning team/PW Site Personnel		
Effect on other company departments?	N			
Emergency Instructions & Emergency Response? (CP09)	Y	Area to be considered as part of the site emergency plans at annual review/PW Site Team		
Equipment Supplier contracts & specification?	N			
Instrumentation/Software for Plant Control?	Y	Review as part of commissioning/Commissioning Team/PW Site Personnel		
Maintenance Instructions?	Y	As part of the maintenance programme to be developed during commissioning/Commissioning team/PW Site Personnel		
Plant/Product Labels/Re-labelling?	Y	Review during commissioning/Commissioning Team		
Preventative Maintenance plan? (Including SHEQ critical items)	Y	As relevant items above		
Process & Engineering Drawings/Diagrams?	Y	As relevant items above		
Project Management?	N	Only relevant to the construction phase		
Spares?	Y	As relevant items above		
Induction, Training, Competence , Awareness and Authorisation (SP06, SP08, CP44)	Y	As part of the commissioning/handover phase		
Person(s) completing the Management of Change review		David Quick	**Date**	1st June 17

Hanson Cement, Padeswood Works

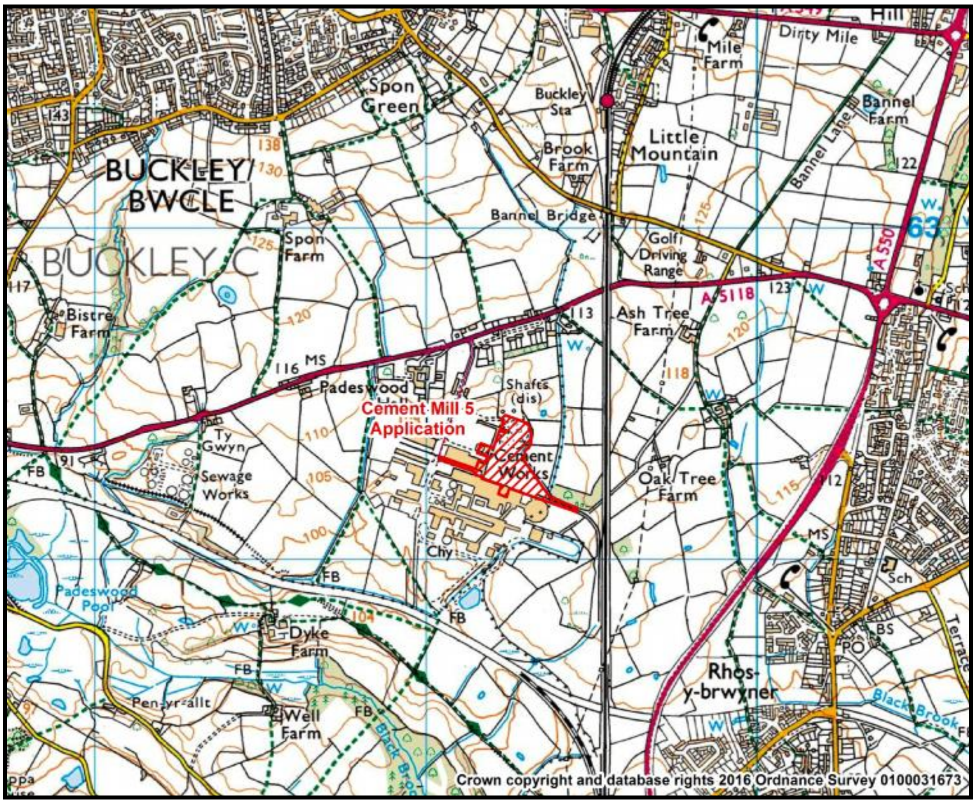
Application for variation to EPR permit BL1096

CM 5 Appendix 6 – Dispersion Modelling Report

HANSON CEMENT

AIR QUALITY ASSESSMENT OF MILL 5:

PADESWOOD CEMENT WORKS



July 2017

Report Reference: C35-P09-R01

Independent Air Quality & Odour Specialists

CONTENTS

1 INTRODUCTION

1.1 PURPOSE OF THE ASSESSMENT

Gair Consulting Ltd has been commissioned by Hanson Cement to undertake an air quality assessment of a new cement mill at the Padeswood Cement Works in Flintshire. The assessment is principally in support of the planning application for the proposed new cement mill but also provides information to support the variation to Environmental Permit for the site.

This assessment provides an assessment of the potential air quality impacts of the operation of Mill 5. It focuses on emissions of fine particles. As the Padeswood Cement Works is a source of particle emissions from a wide variety of sources, a cumulative assessment is provided of existing emissions and the additional emissions to air from the operation of the new mill.

1.2 SCOPE OF THE ASSESSMENT

The main focus of the assessment is to provide the following:

- The quantification of particle emissions from the cement works for the various sources.
- A dispersion modelling assessment of emissions of particles from the Padeswood Cement Works with and without the additional emissions from Mill 5.
- An assessment of other emissions associated with the proposed new cement mill including changes in vehicle movements.

1.3 BACKGROUND TO THE STUDY AREA

The Padeswood Cement Works is located approximately 500 m west of Penyffordd and around 1,500 m south of Buckley. The village of Padeswood is directly to the north of the works and there are a number of residential properties on the southern periphery of the village that are in close proximity to the boundary of the Works. The location of the Padeswood Cement Works is presented in *Figure 1.1*.

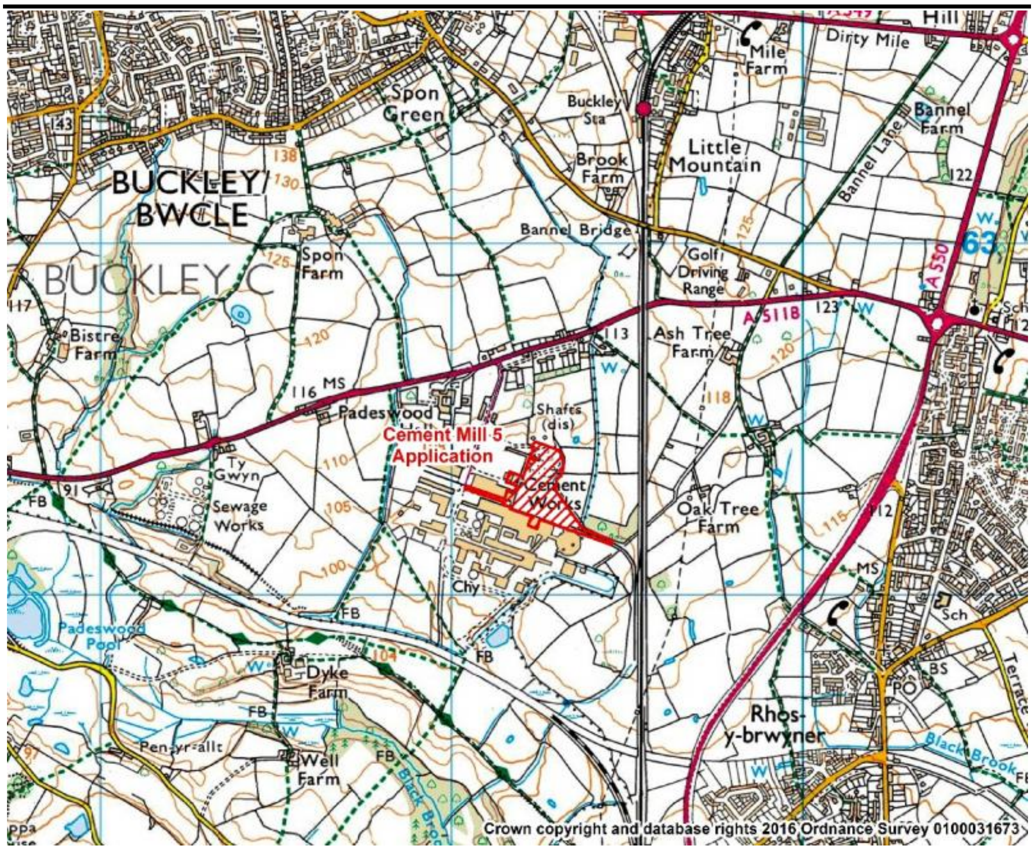
The Works manufactures cement and the installation includes:

- raw material handling and processing;
- clinker manufacturing, handling, grinding and storage;
- cement handling, storage and bulk despatch; and
- fuel handling, storage and processing.

All of these activities have the potential to generate particle emissions either from various emission control systems (e.g. bag filters) and here referred to as point sources, or from fugitive releases (i.e. unintended releases from uncontrolled sources).

The project will involve the demolition of existing cement storage and loading facilities and the erection of a new vertical roller mill, rail loading facility and modification to (and extension of) the existing railway line, together with ancillary development (including three steel cement storage silos, belt conveyors and pneumatic pipelines). The application area extends to approximately 3.1 hectares.

FIGURE 1.1 LOCATION OF THE PADESWOOD CEMENT WORKS



1.4 SCOPE OF WORK

The assessment has considered the impact of the Cement Mill 5 emissions during operation. The main emission from the cement mill is total suspended particles (TSP) which will comprise a range of particle sizes. For human health effects, fine particles (i.e. particles of less than 10 µm in diameter, termed PM_{10} or less than 2.5 µm termed $PM_{2.5}$) are of most concern. Therefore, as a worst-case it is assumed that particle emissions from the cement works comprise entirely of these finer fractions. The larger particles will settle quicker and be less likely to remain airborne as well as being of less concern for human health effects.

There is a hot gas generator (HGG) associated with the new cement mill. This is used to dry the material during grinding mainly due to the moisture content of the gypsum and limestone. The HGG would utilise gas oil, kerosene or processed fuel oil and will result in combustion emissions (e.g. oxides of nitrogen, carbon monoxide and sulphur dioxide). However, the HGG would only be used at start-up from cold and during grinding of some products during the winter.

To support the permit variation an assessment of emissions from the HGG using the H1 tool has been carried out by Hanson Cement. This was carried out assuming that the HGG operates continuously and represents very worst-case conditions as it is anticipated that it will only operate up to a maximum of 20% and likely to be much less than this. The results of the H1 assessment under these worst-case operating conditions, indicate that annual mean NO_2 concentrations would be less than 1% of the long term Environmental Assessment Level (EAL) and short term concentrations would be less than 10% of the short term EAL. Therefore, it is concluded that a detailed assessment of emissions of the oxides of nitrogen, as well as other pollutants associated with the combustion process is not required. Furthermore, background concentrations of NO_2 (key pollutant from combustion processes) in the local area are very low (refer *Section 2.4.1*). Therefore, the focus of the assessment of emissions from the cement mill has been with respect to particle emissions. However, in addition the impact of NO_x emissions from the HGG has been considered for sensitive receptors including habitat sites.

It is considered that fugitive emissions from the new cement mill and associated facilities will be minimal as all transport and storage of product will be covered or enclosed. Therefore, it is concluded that the impact of fugitive emissions on human and habitat receptors would be minimal and is not considered further.

In addition to operational impacts of the cement mill, it will be necessary to assess the potential impact on air quality of the construction phase and associated activities. These include the following:

- Construction activities associated with the cement mill, associated silos and upgrading of the railway sidings; and
- Increases in vehicle movements (e.g. road and rail) associated with the commissioning of the new cement mill.

As a result of the introduction of the new cement mill, it is anticipated that there will be a reduction in road traffic vehicle movements but an increase in rail movements. The reduction in road traffic is estimated as 31 vehicles per day (62 vehicle movements into and out of the site).

The number of heavy duty vehicles (HDV's) accessing the site is estimated at an average of 35 movements per week (approximately 6 per day for a 6 day working week) over the duration of the construction period. At worst, there would be around 28 HDV movements per day due to the movement of materials off site (estimated as 675 HDV vehicles, 1,350 movements, over an eight-week period). Construction personnel will result in an additional 85 vehicles (170 movements) per day assuming each worker travels in their own vehicle. The number of additional rail movements is estimated to be 175 trains (350 rail movements) per year. Therefore, there would be approximately one movement per day on average. Therefore, it is concluded that the impact of rail traffic and road traffic on local air quality can be screened out of the assessment.

1.5 STRUCTURE OF THE REPORT

The remainder of this report is presented as follows:

- *Section 2* summarises the relevant assessment criteria, reviews air quality monitoring data in the vicinity of the proposed cement mill and provides a discussion of local meteorological conditions affecting the dispersion and dilution of emissions.
- *Section 3* provides an assessment of the potential air quality impacts associated with the construction of the cement mill and associated activities (e.g. construction dust impacts).
- *Section 4* provides an overview of the assessment methodology for operational impacts.
- *Section 5* provides an assessment of the potential air quality impacts arising from the operation of the cement mill.
- *Section 6* summarises and concludes the assessment and provides recommendations for further work or consultation, where necessary.

2 BASELINE CONDITIONS

2.1 INTRODUCTION

This section of the report defines the baseline environment for the assessment and provides the following:

- a discussion of appropriate ambient air quality assessment criteria for PM_{10} and $PM_{2.5}$;
- a review of background monitoring data for the local area;
- a description of local conditions that will affect the dispersion and dilution of emissions arising from the installation.

The construction of the cement mill and associated infrastructure will have the potential to generate dust from construction activities and also the generation of combustion-type pollutants (e.g. oxides of nitrogen and fine particles) from construction traffic accessing the site and from on-site construction plant.

During the operation of the development there is the potential for impacts to arise from the operation of the cement mill and emissions of particles as other potential sources (e.g. road and rail transport) have been screened out of the assessment.

2.2 ASSESSMENT CRITERIA

2.2.1 Oxides of Nitrogen (NO_x)

The oxides of nitrogen comprise principally of nitric oxide (NO) and nitrogen dioxide (NO_2). The oxides of nitrogen (NOx) in combustion processes may be formed from the oxidation of nitrogen in the fuel or from the reaction of nitrogen and oxygen at high temperatures. The majority of NOx is emitted from combustion processes as NO (typically over 90%), a relatively innocuous substance that rapidly oxidises to NO_2 in ambient air. Health based standards for NOx generally relate to NO_2.

A Directive (2008/50/EC of the European Parliament and of the Council of 21st May 2008, on ambient air quality and cleaner air for Europe) was adopted in June 2008. The Directive streamlines the European Union's air quality legislation by replacing four of the five existing Air Quality Daughter Directives within a single, integrated instrument.

Directive 2008/50/EC retains the existing air quality standards for NO_2, but provides greater clarity on where to assess air quality, so that the focus is on areas of potential public exposure. The Directive has been transposed into the

Air Quality Standards Regulations 2010, which came into force on the 11th June 2010. Air quality limits and objectives for NO_2 are summarised in *Table 2.1*

TABLE 2.1 AIR QUALITY OBJECTIVES AND LIMIT VALUES FOR NITROGEN DIOXIDE

Pollutant	Description	Averaging Period	Value («g m^{-3})
Air Quality Standards (a)			
Nitrogen dioxide (NO_2)	Objective for the protection of human health	1-hour mean, not to be exceeded more than 18 times a year (b)	200
		Annual mean	40
EC Directive on Ambient Air Quality (c)			
Nitrogen dioxide (NO_2)	Limit value	1-hour mean, not to be exceeded more than 18 times a year (b)	200
		Annual mean	40

(a) Air Quality Standards Regulations 2010
(b) This corresponds to the 99.8th percentile of hourly means
(c) Directive 2008/50/EC of the European Parliament

2.2.2 Fine Particles (PM_{10} and $PM_{2.5}$)

Air quality standards for particulate matter generally refer to particles of less than 10 micrometres in diameter, termed PM_{10} and particles of less than 2.5 micrometres in diameter, termed $PM_{2.5}$. Current air quality objectives and limit values for PM_{10} and $PM_{2.5}$ applicable to the assessment are summarised in *Tables 2.2* and *2.3* respectively.

TABLE 2.2 AIR QUALITY OBJECTIVES AND LIMIT VALUES FOR PM_{10}

Pollutant	Description	Averaging Period	Value («g m^{-3})
Air Quality Standards (a)			
Fine particles (PM_{10})	Objective for the protection of human health	24-hour mean, not to be exceeded more than 35 times a year (b)	50
		Annual mean	40
Directive on Ambient Air Quality (c)			
Fine particles (PM_{10})	Limit value	24-hour mean, not to be exceeded more than 35 times a year (b)	50
		Annual mean	40

(a) Air Quality Standards Regulations 2010
(b) This corresponds to the 90.4th percentile of 24-hour means.
(c) Directive 2008/50/EC of the European Parliament

TABLE 2.3 AIR QUALITY OBJECTIVES AND LIMIT VALUES FOR $PM_{2.5}$

Set In 2010 UK Regulations? (a)	Description	Averaging Period	Value («g m^{-3})
Air Quality Strategy (b)			
No	Objective for 2020, UK except Scotland	Annual mean	25
	Exposure reduction target for urban background areas	Annual mean	20% reduction in annual mean concentration between 2010 and 2020
Directive on Ambient Air Quality (c)			
No	Target value to be achieved by 1 Jan 2010	Annual mean	25
Yes	Stage 1 limit value (by 1 Jan 2015)	Annual mean	25
No	Stage 2 limit value (by 1 Jan 2020 – to be reviewed in 2013)	Annual mean	20

(a) Air Quality Standards Regulations 2010
(b) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. July 2007
(c) Directive 2008/50/EC of the European Parliament

2.2.3 Impact Significance Criteria

Environmental Protection UK's Planning for Air Quality 2010 guidance [1] has been updated in association with the Institute of Air Quality Management (IAQM [2]). This provides some changes to the impact descriptors and the assessment of significance. The impact descriptors for individual receptors are presented in *Table 2.4*. The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers. Changes of 0% (i.e. less than 0.5%) would be described as Negligible.

The assessment of significance is principally left to professional opinion and guidance is provided on the factors that need to be considered when judging significance and include the following:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to impacts;
- the worst-case assumptions adopted when undertaking the prediction of impacts; and
- the extent to which the proposed development has adopted best practice to eliminate and minimise emissions.

1 Environmental Protection UK, Development Control: Planning for Air Quality, 2010 Update.

2 Land-Use Planning & Development Control: Planning for Air Quality, EPUK and IAQM (January 2017)

TABLE 2.4 IMPACT DESCRIPTION FOR INDIVIDUAL RECEPTORS

Concentration with Development	Percentage Change in Air Quality Relative to the Air Quality Assessment Level (AQAL)			
	1%	**2 to 5%**	**6 to 10%**	**>10%**
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 to 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 to 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 to 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

In relation to short-term impacts, the IAQM/EPUK guidance states:

> *'6.39 Where such peak short term concentrations from an elevated source are in the range 11-20% of the relevant AQAL, then their magnitude can be described as small, those in the range 21-50% medium and those above 51% as large. These are the maximum concentrations experienced in any year and the severity of this impact can be described as slight, moderate and substantial respectively, without the need to reference background or baseline concentrations. That is not to say that background concentrations are unimportant, but they will, on an annual average basis, be a much smaller quantity than the peak concentration caused by a substantial plume and it is the contribution that is used as a measure of the impact, not the overall concentration at a receptor. This approach is intended to be a streamlined and pragmatic assessment procedure that avoids undue complexity.'*

Therefore, the following descriptors for assessing the impact magnitude resulting from short term impacts are applied in this assessment:

- 10% or less: negligible;
- 11-20%: small;
- 21-50%: medium; and
- 51% or greater: large.

2.3 LOCAL AIR QUALITY MANAGEMENT

Local Authorities are required to periodically review and assess the current and future quality of air in their areas. Where it is determined that an air quality objective is not likely to be met within the relevant time period, the authority must designate an Air Quality Management Area (AQMA) and produce a local action plan. Flintshire County Council are responsible for reviewing air quality within the County and their latest air quality management and review report was issued in October 2016 [3]. The Annual Progress Report considers all new monitoring data and assesses the data against the air quality guidelines and objectives. It also considers any changes that may have an impact on air quality.

Previous rounds of review and assessment of air quality have identified areas in the County where exceedances of the annual mean objectives have occurred. Detailed Assessments have been carried out in 2004 and 2010 for PM_{10} and NO_2. Both Detailed Assessments concluded that no AQMA was required in the assessment area. Therefore, no AQMAs have been declared in the County.

2.4 LOCAL MONITORING

2.4.1 Nitrogen Dioxide (NO_2)

Automatic monitoring of NO_2 was carried out at one site in the County during 2015 at a location near Mold. Measured concentrations at this location would not be characteristic of NO_2 concentrations at the cement works site.

Monitoring of NO_2 using passive diffusion tubes was carried out at 52 sites in 2015. The nearest location to the cement works is Diffusion Tube 41. This is located approximately 1 km to the west of the cement works and is a kerbside site at a distance of 15 m from the kerb. Measured concentrations of NO_2 as the annual mean for the last five years are as follows:

- 15.9 μg m^{-3} (40% of the air quality objective) for 2011;
- 14.5 μg m^{-3} (36%) for 2012;
- 11.8 μg m^{-3} (30%) for 2013;
- 10.6 μg m^{-3} (27%) for 2014; and
- 9.9 μg m^{-3} (25%) for 2015.

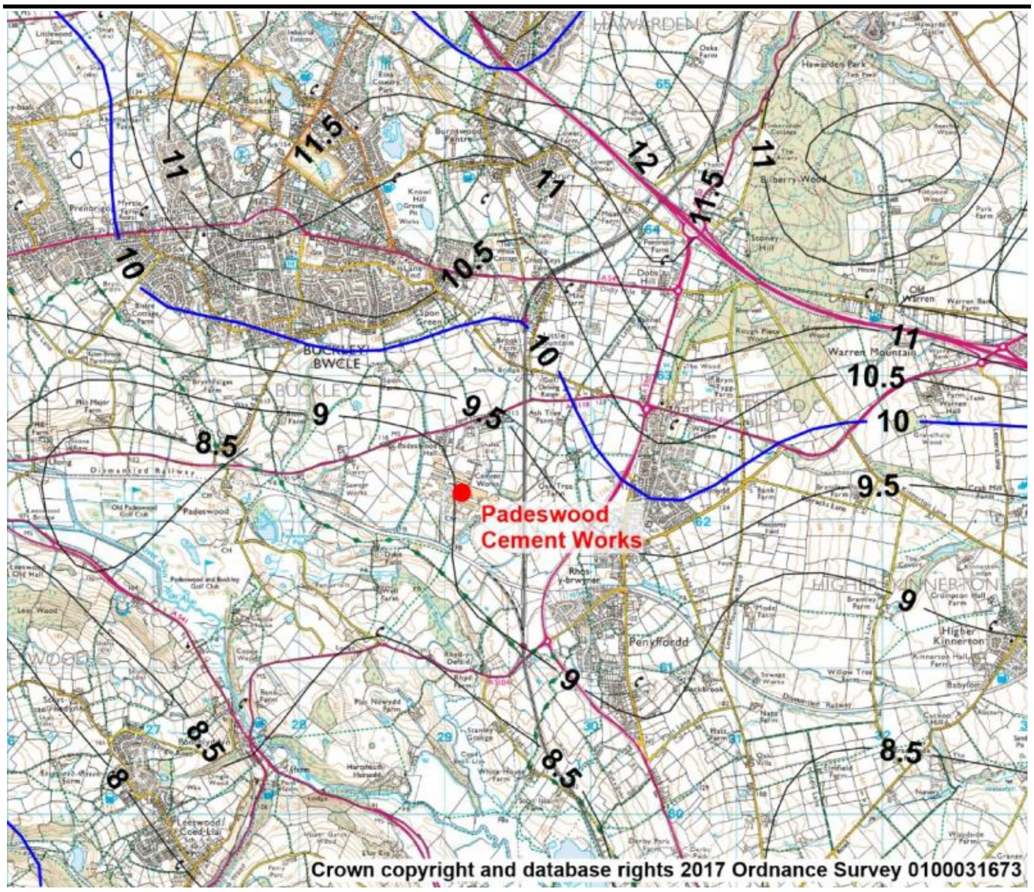
There would appear to have been a gradual decrease in measured NO_2 concentrations at this monitoring site over the five-year period.

Ambient background concentrations of NO_2 have also been obtained from the Defra UK Background Air Pollution Maps [4]. These 1 km grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites. Annual mean background mapped NO_2 concentrations for 2017 are presented in *Figure 2.1*.

3 Flintshire County Council 2016 Air Quality Progress Report (October 2016)

4 https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013

FIGURE 2.1 ANNUAL MEAN NO_2 BACKGROUND CONCENTRATION FOR 2017 ($\mu g\ m^{-3}$)



Mapped annual mean NO_2 concentrations around the cement works are between 8.5 and 10 $\mu g\ m^{-3}$ and are consistent with the measured concentrations using diffusion tubes in 2015. Therefore, for the purposes of the assessment a background NO_2 concentration of 12.5 $\mu g\ m^{-3}$ (mean of the five years at the diffusion tube site) has been assumed. This is well below the air quality objective of 40 $\mu g\ m^{-3}$.

2.4.2 Fine Particles (PM_{10} and $PM_{2.5}$)

Monitoring of PM_{10} by Flintshire County Council is carried out at the Mold monitoring site but as for NO_2 this would not be representative of measured PM_{10} at the cement works site.

There has been some historic monitoring of PM_{10} and $PM_{2.5}$ carried out by both Castle Cement and the Environment Agency. Data obtained by Castle Cement is considered to be less reliable than that obtained by the Environment Agency. Concentrations of PM_{10} and $PM_{2.5}$ were measured by the Environment Agency between 10 February 2006 and 3 December 2007 [5]. Assuming the period of monitoring is representative of the measured concentrations in 2006 and 2007,

5 Study of Ambient Air Quality at Pen-y-ffordd, 10 February 2006 and 3 December 2007, Environment Agency Report (July 2008)

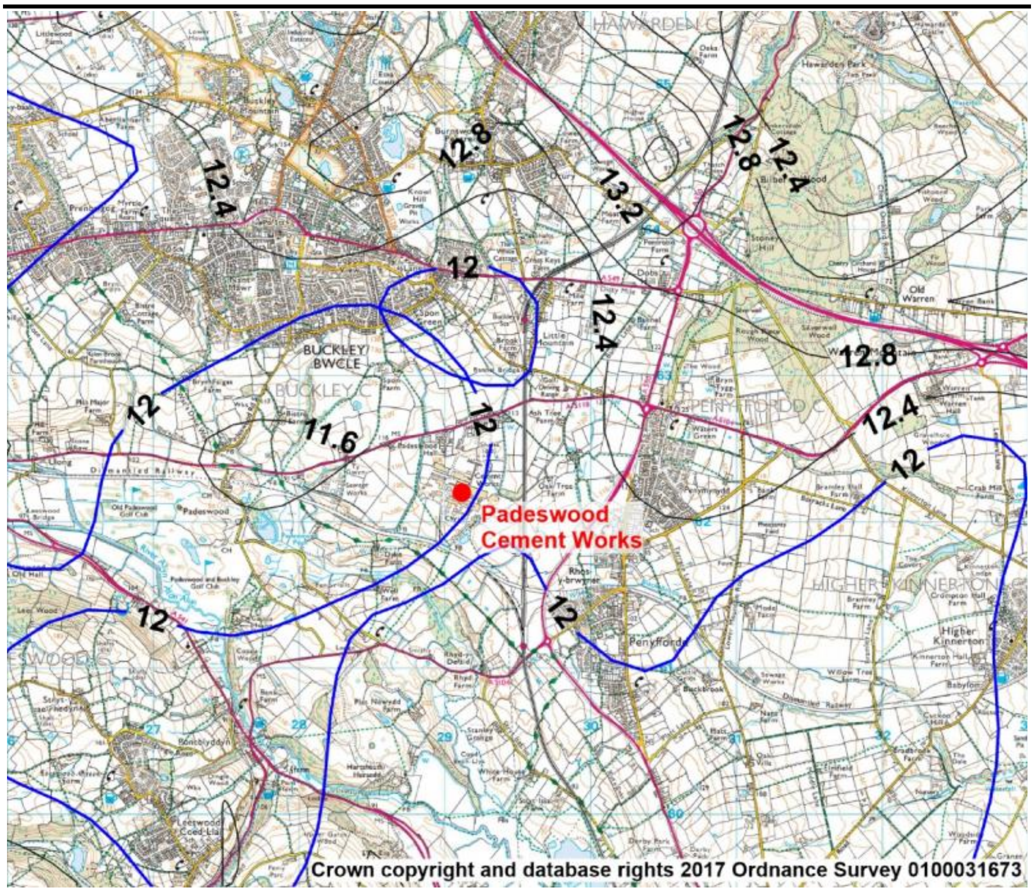
a summary of measured concentrations is presented in *Table 2.5*. Measured concentrations were well below the relevant air quality objectives (AQO's).

TABLE 2.5 MEASURED PM_{10} AND $PM_{2.5}$ CONCENTRATIONS AT THE ENVIRONMENT AGENCY'S PENYFFORDD MONITORING STATION

Statistic/ Year	2006	2007	AQO
Annual Mean PM_{10}	21.1	20.4	40
Number of Exceedances of 24-hour Mean	9	8	35 (a)
Annual mean $PM_{2.5}$	11.9	11.7	25
(a) 35 allowable exceedances per annum			

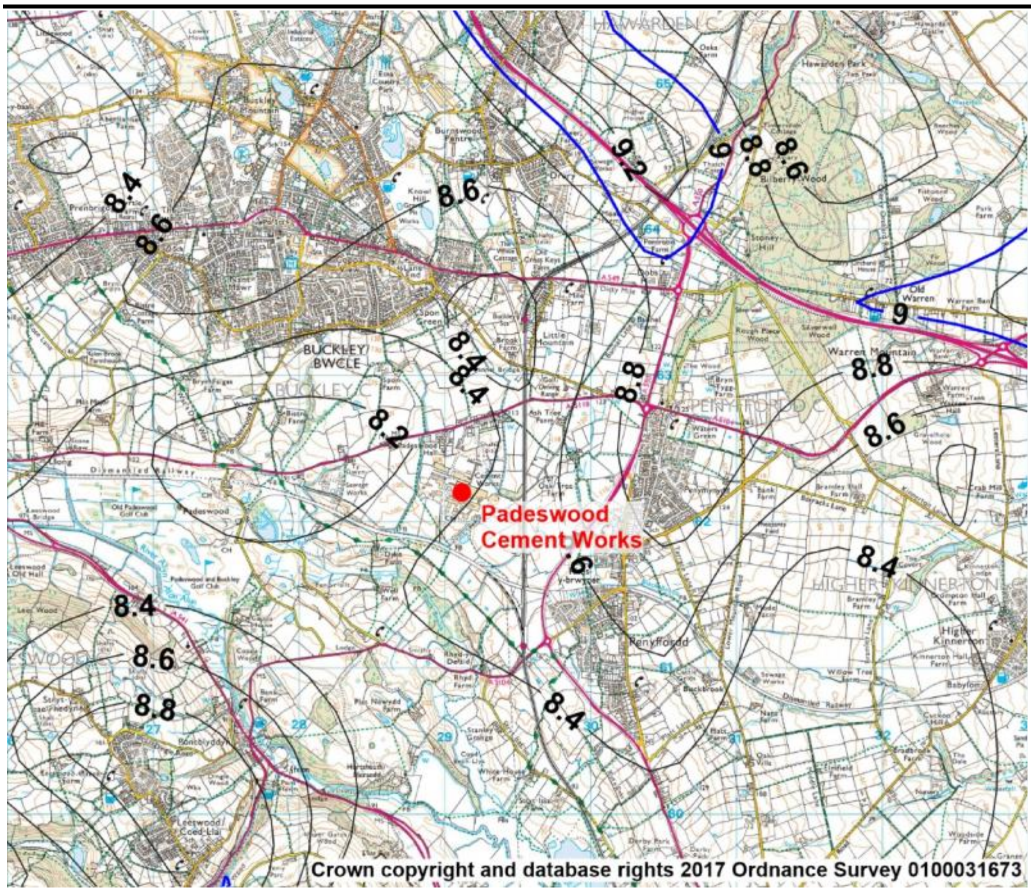
Mapped background concentrations of PM_{10} and $PM_{2.5}$ are presented in *Figure 2.2* and *Figure 2.3*, respectively. However, it should be noted that these will include a contribution from the cement works.

FIGURE 2.2 ANNUAL MEAN PM_{10} BACKGROUND CONCENTRATION FOR 2017 ($\mu g\ m^{-3}$)



Measured concentrations of PM_{10} around the cement works are around 12 to 13 $\mu g\ m^{-3}$ and are well below the air quality objective of 40 $\mu g\ m^{-3}$. For the purposes of the assessment an annual mean concentration of 13 $\mu g\ m^{-3}$ has been assumed which is the higher mapped background level. Measured concentrations at Penyffordd are higher but these measurements were obtained over ten years ago and there have been significant reductions in emissions from the cement works since that time.

FIGURE 2.3 ANNUAL MEAN $PM_{2.5}$ BACKGROUND CONCENTRATION FOR 2017 ($\mu g\ m^{-3}$)



Measured concentrations of $PM_{2.5}$ around the cement works are around 8 to 9 $\mu g\ m^{-3}$ and are well below the air quality objective of 25 $\mu g\ m^{-3}$. For the purposes of the assessment an annual mean concentration of 9 $\mu g\ m^{-3}$ has been assumed which is the upper mapped background concentration.

2.5 LOCAL CONDITIONS

2.5.1 The Dispersion and Dilution of Emissions

For meteorological data to be suitable for dispersion modelling purposes a number of meteorological parameters need to be measured, on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made. In the UK, all of these sites are quality controlled by the Met Office.

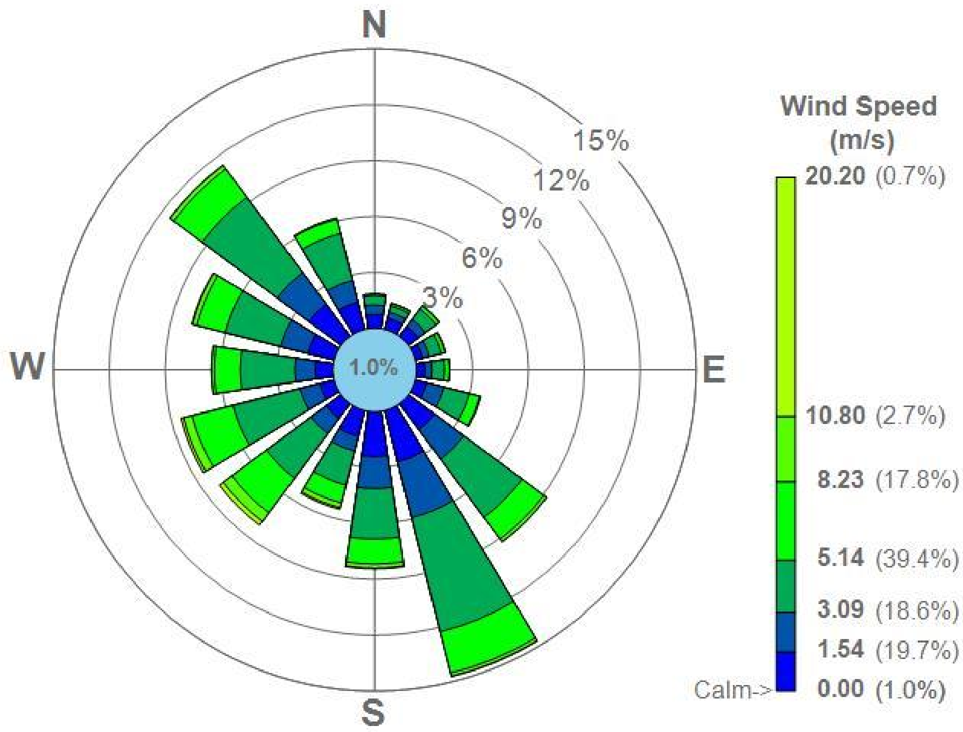
The most important climatological parameters governing the atmospheric dispersion of pollutants are as follows.

- **Wind direction** determines the broad transport of the emission and the sector of the compass into which the emission is dispersed.
- **Wind speed** will affect ground level emissions by increasing the initial dilution of pollutants in the emission.
- **Atmospheric stability** is a measure of the turbulence, particularly of the vertical motions present.

2.5.2 Local Wind Speed and Direction Data

Five years (2012 to 2016) of meteorological data were obtained for Hawarden and a wind rose for the five years is presented in *Figure 2.4*.

FIGURE 2.4 WIND ROSE FOR HAWARDEN (2012 TO 2016)



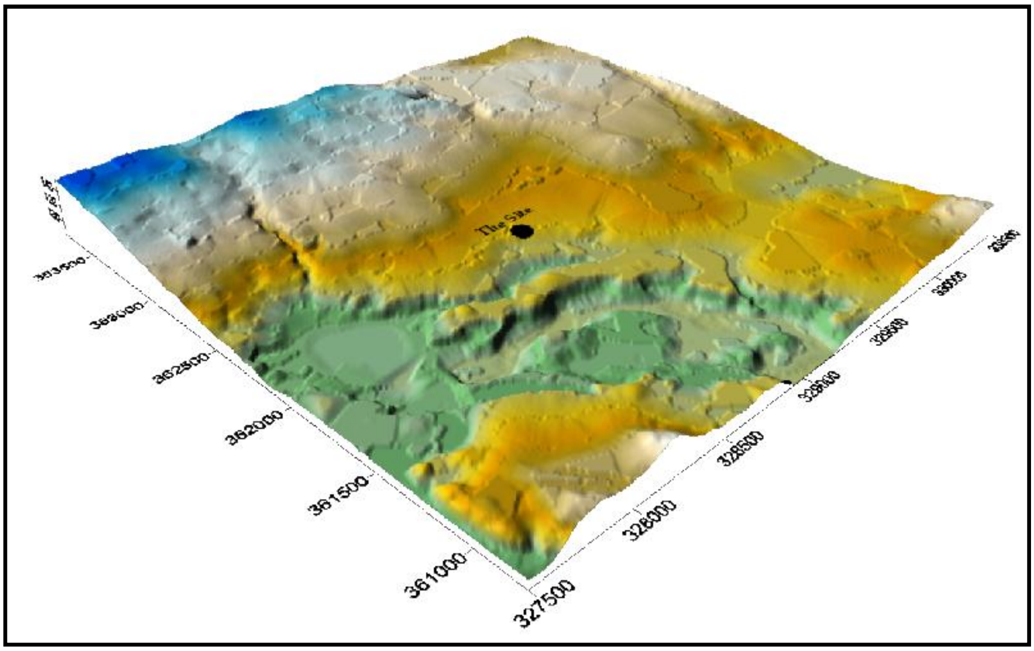
There are two dominant wind directions for Hawarden from the south-southeast (14.7%) and from the northwest (11.5%). The north-westerly to south-easterly bias is likely due to the channelling of winds along the Dee Estuary and Dee Valley. Calm conditions occur for around 1.0% of the time.

2.5.3 Topography

The presence of elevated terrain can significantly affect the dispersion of pollutants in a number of ways. For stack emissions, the presence of elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to an elevated source and reducing concentrations further away. For low level sources such as from the cement works (excluding the main kiln stack), increased turbulence will result in improved dilution and dispersion but could also result in an increase in emissions from sources that are susceptible to wind erosion.

The works is located in an area of relatively complex terrain. Consequently, information relating to the topography of the area surrounding the site has been used in the dispersion modelling to assess the impact of terrain features on the dispersion of emissions from the Works. A three-dimensional visualisation of the terrain around the cement works is presented in *Figure 2.5*. It should be noted that the height scale has been accentuated four-fold to highlight the areas of elevated terrain. The cement works is located in the centre of the area and the most prominent terrain rises towards Buckley to the north.

FIGURE 2.5 3D VISUALISATION OF TERRAIN AROUND THE WORKS



3 IMPACT OF DUST-GENERATING ACTIVITIES DURING THE CONSTRUCTION PHASE

3.1 DUST ANNOYANCE

3.1.1 Introduction

Dust in the community is normally perceived as an accumulated deposit on surfaces such as washing, window ledges, paintwork and other light coloured horizontal surfaces, e.g. car roofs. When the rate of accumulation is sufficiently rapid to cause noticeable fouling, discoloration or staining (and thus decrease the time between cleaning) then the dust is generally considered to be an annoyance. However, the point at which an individual makes a complaint regarding dust is highly subjective.

Any form of demolition or construction activity has the potential to generate dust emission and thereby cause annoyance to people in the vicinity.

3.1.2 Characterisation of Particles

Principally, particles are characterised by their size and their chemical composition. Particle emissions arising from construction activities will vary, particularly with regard to their size. Large particles (in excess of 10 µm) are associated with annoyance nuisance impacts, as these particles are rapidly removed from the atmosphere and deposit onto horizontal surfaces where they may cause a soiling affect.

Smaller particles (less than 10 µm) are of concern due to their potential impact on human health. The size distribution of particles in urban air is conventionally characterised by three modes. The smallest of these, below 0.1 µm in diameter, is called the nucleation mode and is formed by condensation of hot vapour from combustion sources and from chemical conversion of gases to particles in the atmosphere. Particles of this size have a high chance of deposition in the gas-exchanging (alveolar) part of the lung; they are relatively short-lived and grow into larger particles between 0.1 and about 1 µm in diameter, known as the accumulation mode. These particles remain suspended for up to several weeks in the air, and are not readily removed by rain. The third, coarse, mode comprises particles greater than about 2 µm in diameter. These are generally formed by the break-up of larger matter, and include wind-blown dust and soil, particles from construction and sea spray. Their size means that they remain in the air for relatively short periods. Conventionally, for the classification of health impacts, fine particles are referred to as $PM_{2.5}$ (particles with an aerodynamic diameter of less than 2.5 µm).

Particles are also frequently referred to as PM_{10} (aerodynamic diameter of less than 10 µm); these include the coarse (greater than 2 µm in diameter) and the fine fraction. Particles larger than PM_{10} are mainly associated with annoyance impacts and tend to be generated by mechanical processes. A large proportion of the particle releases from construction activities will comprise this larger fraction (i.e. larger than PM_{10}), particularly from the handling and processing of materials. Finer particles may also arise from on-site mobile and fixed construction plant.

3.2 METHODOLOGY

The impact of dust generated during the construction phase of the Development has been assessed using the methodology described by the Institute of Air Quality Management (IAQM) Construction Dust Guidance [6].

The most common air quality impacts relating to construction activities are as follows:

- dust deposition, resulting in the soiling of surfaces;
- visible dust plumes, which are evidence of dust emissions;
- elevated PM_{10} concentrations, as a result of dust generating activities on site; and
- an increase in concentrations of airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment used on site (non-road mobile machinery, NRMM) and vehicles accessing the site.

The risk of dust emissions from a demolition/construction site causing loss of amenity and/or health or ecological impact is related to:

- the activities being undertaken;
- the duration of these activities;
- the size of the site;
- the meteorological conditions (wind speed, direction and rainfall);
- the proximity of receptors to the activities;
- the adequacy of the mitigation measures applied to reduce or eliminate dust; and
- the sensitivity of the receptors to dust.

6 Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, February 2014.

The IAQM methodology considers four aspects that may give rise to dust emissions:

- demolition of existing structures;
- construction of the new facilities;
- earthworks; and
- 'trackout' of dust on vehicles.

The potential for dust emissions is assessed for each activity that is likely to take place. If an activity is not taking place (e.g. demolition) then it does not need to be assessed. The assessment methodology considers three separate dust impacts as follows:

- annoyance due to dust soiling;
- the risk of health effects due to an increase in exposure to PM_{10}; and
- harm to ecological receptors.

Step 1 of the IAQM Guidance is to screen the requirement for a more detailed assessment. An assessment will normally be required where there is a human receptor within:

- 350 m of the construction site boundary; or
- 50 m of a road used by construction traffic up to 500 m from the site entrance.

For ecological receptors, an assessment will be required where a sensitive habitat site is within:

- 50 m of the boundary of the site; or
- 50 m of a road used by construction traffic up to 500 m from the site entrance.

It should be noted that the criteria are deliberately conservative and detailed assessments are required for most proposed developments, recognising that dust arising from construction activities within urban areas is a significant source of airborne particles.

Where appropriate, the four potential sources of dust and PM_{10} (demolition, construction, earthworks and track-out) are considered individually, adopting the methodology in the IAQM guidance to assess the risk of dust annoyance (soiling), adverse impact on human health due to elevated PM_{10} concentrations and adverse impact on habitat sites from dust deposition.

In Step 2, a site is allocated a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large; and
- the sensitivity of the area to dust impacts which is defined as low, medium or high sensitivity.

The dust emission magnitude is based on the scale of the anticipated works and example definitions are presented in *Table 3.1*.

The sensitivity of the area takes account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

TABLE 3.1 POTENTIAL DUST EMISSION MAGNITUDE

Activity	Large	Medium	Small
Demolition	Building volume >50,000 m³, potentially dusty construction materials, demolition at above 20 m in height	Building volume 20,000 to 50,000 m³, potentially dusty construction materials, demolition height 10-20 m in height	Building volume <20,000 m³, material with low potential for dust release, demolition height <10 m
Earthworks	Site area >10,000 m², potentially dusty soil type, >10 heavy earth moving vehicles, bunds >8 m in height, total material moved >100,000 tonnes	Site area of 2,500 to10,000 m², moderately dusty soil type, 5-10 heavy earth moving vehicles, bunds 4-8 m in height, total material moved 20,000 to 100,000 tonnes	Site area <2,500 m², low dust potential soil type, <5 heavy earth moving vehicles, bunds <4 m in height, total material moved <20,000 tonnes
Construction	Total building volume >100,000 m³, on site concrete batching, sandblasting	Total building volume 25,000 to 100,000 m³, potentially dusty construction material	Total building volume <25,000 m³, material with low potential for dust release
Trackout	>50 outbound HGV movements in any day, potentially dust surface material, unpaved road length >100 m	10-50 outbound HGV movements in any day, moderately dusty surface material, unpaved road length 50 to100 m	<10 outbound HGV movements in any day, surface material with low potential for dust, unpaved road length <50 m

The IAQM document provides guidance on the categorisation of receptors into high, medium and low sensitivities for dust soiling, health effects and ecological effects. For dust soiling, the sensitivity of people and their property to soiling will depend on the level of amenity and the appearance aesthetics and value of property. For health effects from exposure to PM_{10}, sensitivity will depend on whether or not the receptor is likely to be exposed over relevant timescales to elevated concentrations over a 24-hour period. For ecological effects, the sensitivity will depend on the type of the habitat designation (e.g. European site, national or local designations) and the sensitivity of the habitat to dust deposition effects.

3.3 ASSESSMENT OF IMPACTS

3.3.1 Description of Development and Surroundings

The Development Site

The development site extends to approximately 3.1 hectares and lies within the north-eastern part of the existing Padeswood Cement Works. The development area currently comprises of hardstanding and disturbed ground, used for vehicle and rail access. The proposed development is for the demolition of existing cement storage silos and loading facilities and the erection of a new vertical roller mill, rail loading facility and modification to (and extension of) the existing railway line, together with ancillary development (including three steel cement storage silos, belt conveyors and pneumatic pipelines).

The area is bounded to the north by a belt of mature woodland and agricultural land with the residential properties on Padeswood Drive lying approximately 200 m beyond. To the east lies natural woodland and agricultural land bisected by the Liverpool to Wrexham railway line, which runs in a north-south direction. The site lies within the industrial setting of the Cement Works, which itself lies within open countryside, to the west of the villages of Penyffordd and Penymynydd.

Construction Activities

To allow the installation of the new vertical roller mill and rail loading silos, some existing plant must be removed or demolished. The main items to be removed are four existing steel silos (Silos 7, 8, 9 and 10) and Silos 11 and 12.

In addition, to the above, a small railway cabin situated adjacent to the existing railway track will be demolished to allow the railway line to be realigned.

The removal of the silos and associated structures allows the new rail loading facility to be installed in a location that facilitates access to the existing cement distribution system and allows good traffic and pedestrian segregation.

A plant storage and assembly area will be established adjacent to the proposed vertical roller mill. The area upon which the new vertical roller mill is to be situated will first be levelled and then piled (45 piles expected) to form the foundations for the vertical roller mill equipment and building.

A new vertical roller mill with associated covered conveyors will be erected, with the capacity to produce 95 tonnes of cement per hour or 650,000 tonnes per annum. Other construction activities include the provision of a new rail loading facility which will comprise the following:

- static rail tanker weighbridge facilities;
- three 1000 tonne steel cement storage silos;
- silo aeration including blowers;
- rail tanker loading facilities rated at 250 tonne/hour per outlet;
- road tanker loading facility rated at 250 tonne/hour from silo; and
- silo level and safety systems.

The Liverpool to Wrexham railway line runs adjacent to the Cement Works and includes a set of signals and rail points. The rail line is currently used for importing coal. This operation will continue and therefore, once the rail loading facility and track modifications are complete, the Cement Works will be able to both receive deliveries of coal and export cement.

The works required to the railway line will involve approximately 600 m of new rail track, which will either directly renew, realign or extend the existing railway line and will include a curve through the proposed location for the new rail loading facility and proceed towards the main site road.

Therefore, demolition, earthworks and construction proposed for the development are as follows:

- site profiling to achieve required ground levels;
- civil foundations, services and access roadways for Mill 5;
- the demolition of silos 11 and 12, the existing rail loading facility (including silos 7, 8, 9 and 10) and a small railway cabin;
- the construction of a new vertical roller mill with an associated stack with a height of approximately 47 m.
- ancillary development, comprising mainly belt conveyors and pneumatic pipelines, required to feed clinker and other raw materials to the mill and feed the resulting cement to existing and proposed cement storage silos and rail loading facility;
- erect three new steel cement storage silos approximately, each with a storage capacity of 1,000 tonnes, fitted with rail and road loading facilities; and
- the laying of approximately 445 m of new or realigned railway track to service the proposed rail loading facility.

3.3.2 Meteorological Influences

In addition to the magnitude of the release, dust impacts in the vicinity of the development site will be dependent on the frequency of wind speeds capable of carrying airborne dust (i.e. greater than 3 m/s [7]) and frequency of rainfall considered sufficient to effectively suppress wind-blown dust emissions (greater than 0.2 mm/day [8]).

Based on the average wind rose for Hawarden (see *Figure 2.1*) wind speeds in excess of 3 m/s, occur for 61% of the time. Daily rainfall of less than 0.2 mm occurs for 47% of the time. Combined, hourly wind speeds of greater than 3 m/s and daily rainfall of less than 0.2 mm (i.e. capable of exacerbating dust impacts) occur for 25% of the time. Therefore, there is a moderate risk of dust emissions from the site under ambient conditions.

3.3.3 Screening of Impacts

Buffer distances (20 m, 50 m, 100 m, 200 m and 350 m) from the site boundary are provided in *Figure 3.1*. In addition, this provides a 50 m buffer distance for the construction traffic route for a distance of 500 m from the site.

Based on the IAQM Guidance there are sensitive receptors within 350 m of the construction site boundary and within 50 m of a road used by construction traffic. Therefore, a more detailed assessment of construction dust impacts will be required to assess the impact on dust soiling and human health.

The nearest habitat site to the proposed development site is the locally designated site Black Brook Plantation, located approximately 700 m to the south of the construction site boundary. This is sufficiently far (less than 50 m of the construction site boundary) that construction impacts will be negligible. Furthermore, this site is not located within 50 m of roads used by construction vehicles. Therefore, the impact of construction activities on habitat sites can be screened out from further assessment.

Activities at the site will included demolition, earthworks, construction and there will be vehicles accessing the site for the delivery of materials and for the removal of excess soil and demolition material and rubble. Therefore, the assessment has considered the following:

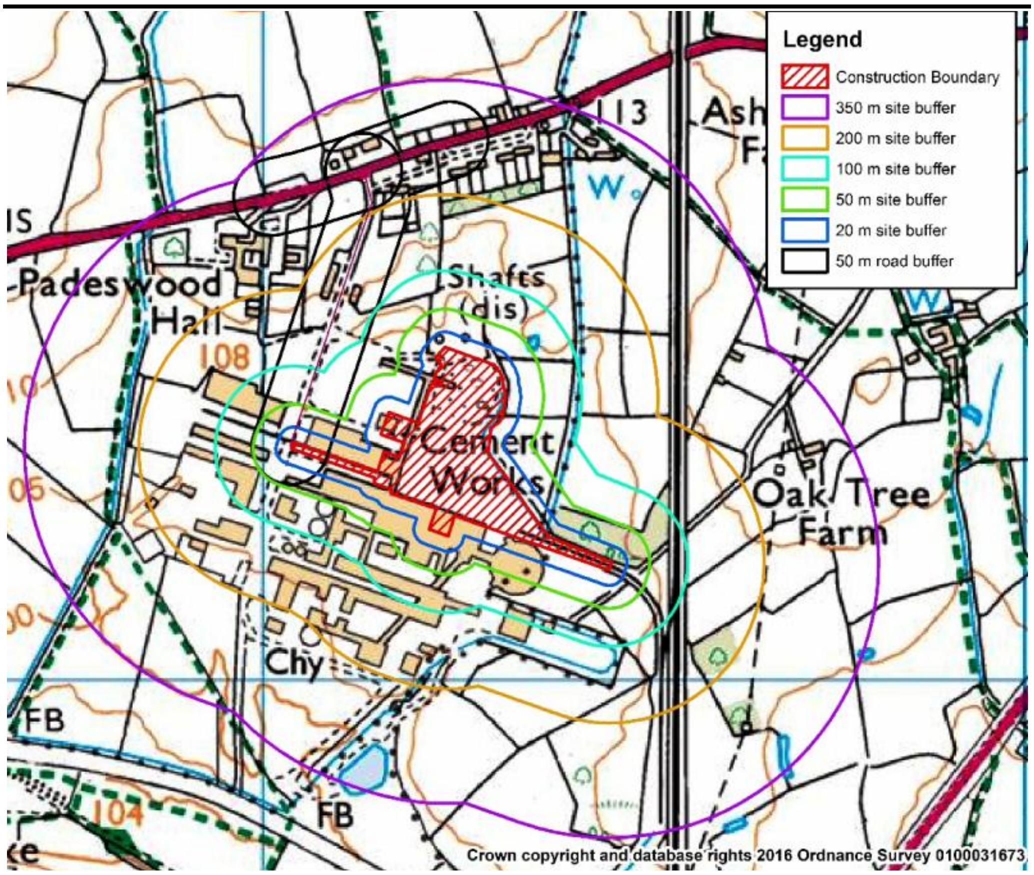
- the impact of demolition on human receptors;
- the impact of earthworks on human receptors;
- the impact of construction on human receptors; and

7 K. W. Nicholson (1988) A review of particle re-suspension. Atmospheric Environment Volume 22, Issue 12, 1988, Pages 2639-2651

8 Arup Environmental and Ove Arup and Partners (Dec 1995), The Environmental Effects of Dust from Surface Mineral Workings Volume 2. Prepared for Department of the Environment Minerals Division

- the impact of trackout on human receptors.

FIGURE 3.1 BUFFER DISTANCES FOR THE CONSIDERATION OF CONSTRUCTION DUST IMPACTS



3.3.4 Define the Potential Dust Emission Magnitude

The assessment has considered the overall construction of the development such that any mitigation measures can be focussed where required for each activity. A description of the emission magnitude for the anticipated works is provided in *Table 3.2*.

TABLE 3.2 ASSESSMENT OF POTENTIAL DUST EMISSION MAGNITUDE

Demolition	Earthworks	Construction	Trackout
Building volume is greater than 50,000 m3 and demolition height is greater than 20 m. However, the majority of structures to be demolished have a low potential for dust (e.g. steel silos). Therefore, the potential dust emission magnitude is defined as *Medium* assuming that the silos are emptied before demolition commences.	Area of the site for earthworks is greater than 10,000 m^2. Piling will be required for the cement mill building. There are likely to be up to six heavy earth moving vehicles on-site. Therefore, the potential dust emission magnitude is defined as *Medium*.	Total building volume is medium between 25,000 m^3 and 100,000 m^3. However, there will be no on site concrete batching plant. The silos will be constructed of steel and the building will be constructed of steel and cladded. Therefore, construction methods are considered to have low dust potential. Therefore, potential dust emission magnitude is defined as *Small*.	HDV movements assumed to be less than 10 outbound except for a short duration when excavated material is removed. Minimal unpaved road length and certainly less than 50 m. Surface material with low potential for dust release. Therefore, the potential dust emission magnitude is defined as *Small* given the number of vehicles accessing the site and the condition of access roads.

For demolition earthworks, construction and trackout the assessment of the potential dust emission magnitude is summarised in *Table 3.3*.

TABLE 3.3 SUMMARY OF DUST EMISSION MAGNITUDE

Demolition	Earthworks	Construction	Trackout
Medium	Medium	Small	Small

3.3.5 Define the Sensitivity of the Area

Dust Soiling

The sensitivity of the area to the potential impacts assessed (dust soiling) have been defined using the IAQM guidance as presented in *Table 3.4*. Receptors are identified as being of High, Medium or Low sensitivity as follows:

- High – users can reasonably be expected to enjoy a high level of amenity or the appearance or aesthetics or value of their property would reasonably be expected to be present continuously. These would include dwellings, museums, car show rooms etc.
- Medium - users would expect to enjoy a reasonable level of amenity but not at the same level as in their home or the appearance, aesthetics or value of their property could be diminished by soiling. People or property would not be expected to be present continuously. Examples include places of work and parks.

- Low – the enjoyment of amenity would not reasonably be expected or property would be expected to diminish in appearance, aesthetics or value and there would be transient exposure. Examples include playing fields, farmland, footpaths and short term car parks.

TABLE 3.4 METHODOLOGY ON ASSESSING THE SENSITIVITY OF THE AREA TO DUST SOILING

Phase/ Receptor Sensitivity	No. of Receptors	Distance from the Source			
		< 20 m	<50 m	< 100 m	<350 m
High	> 100	High	High	Medium	Low
	10 - 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low
Medium	> 1	Medium	Low	Low	Low
Low	> 1	Low	Low	Low	Low

Using GIS and the buffer distances provided in *Figure 3.1*, the number of receptors located within the distances identified by the IAQM has been determined and the sensitivity of these to dust soiling has been assessed. This is summarised in *Table 3.5*.

TABLE 3.5 SUMMARY OF SENSITIVITY OF THE AREA TO DUST SOILING

Demolition	Earthworks	Construction	Trackout
Low	Low	Low	Medium

There are no sensitive receptors within 100 m of the proposed construction area. Therefore, the sensitivity of the area to dust soiling for demolition, earthworks and construction would be assessed as *Low*. For trackout, the sensitivity of the area to dust soiling has been assessed as *Medium* given the proximity of residential properties on Padeswood Drive to construction traffic.

Human Health Impacts

The sensitivity of the area to human health impacts is assessed on the distance of receptors from the various activities and the existing background PM_{10} concentration. Background PM_{10} for the local area has been obtained from the Defra background maps which indicate that background concentrations for the area are 13.0 $\mu g\ m^{-3}$ for 2017. However, the existing sources at the cement works contribute around 6 $\mu g\ m^{-3}$ (refer *Section 5.3*). Therefore, the background PM_{10} concentration is assumed to be 19 $\mu g\ m^{-3}$. Therefore, the sensitivity of the area to human health impacts is determined based on the IAQM guidance as presented in *Table 3.6* for background PM_{10} concentrations of less than 24 $\mu g\ m^{-3}$. Receptors are identified as being of High, Medium or Low sensitivity as follows:

- High – locations where members of the public are exposed over a time period relevant to the air quality objective (e.g. exposed for 8 hours or more per day). Indicative examples include residential properties, hospitals, schools and residential care homes.
- Medium – locations where people exposed are workers and are exposed for 8 hours or more per day. Receptors would include office and shop workers but not workers occupationally exposed to PM_{10}.
- Low – locations where human exposure is transient and would include public footpaths, playing fields, parks and shopping streets.

TABLE 3.6 METHODOLOGY FOR ASSESSING THE SENSITIVITY OF THE AREA TO HUMAN HEALTH IMPACTS

Phase/ Receptor Sensitivity	No. of Receptors	Distance from the Source			
		< 20 m	<50 m	< 100 m	<350 m
High PM_{10} less than 24 µg m^{-3}	> 100	Medium	Low	Low	Low
	10 - 100	Low	Low	Low	Low
	1 - 10	Low	Low	Low	Low
Medium	> 10	High	Medium	Low	Low
	1- 10	Medium	Low	Low	Low
Low	> 1	Low	Low	Low	Low

Using GIS and the buffer distances provided in *Figure 3.1*, the number of receptors located within the distances identified by the IAQM has been determined and the sensitivity of these to human health impacts has been assessed. This is summarised in *Table 3.7*.

TABLE 3.7 SUMMARY OF SENSITIVITY OF THE AREA TO HUMAN HEALTH IMPACTS

Demolition	Earthworks	Construction	Trackout
Low	Low	Low	Low

There are less than 100 high sensitivity receptors (e.g. residential) within 20 m of the construction boundary (as discussed above) and would be assessed as *Low* sensitivity for health impacts. Therefore, overall demolition, construction and earthworks would be assessed as of *Low* sensitivity to health impacts. For trackout, the sensitivity of the area to health impacts has also been assessed as *Low* given the small number of properties located in close proximity to the construction route.

3.3.6 Define the Risk of Impacts

The dust emission magnitude and sensitivity of the area are combined to determine the risk of impacts using Table 6 (demolition), Table 7 (earthworks), Table 8 (construction) and Table 9 (trackout) of the IAQM guidance. A summary of the risks is presented in *Table 3.8*. These are defined on the basis of no mitigation beyond that required by legislation. Where the risk is assessed as 'negligible' no additional mitigation is considered necessary.

TABLE 3.8 SUMMARY OF DUST SOILING RISK AND HUMAN HEALTH RISK TO DEFINE SITE-SPECIFIC MITIGATION

Impact	Demolition	Earthworks	Construction	Trackout
Dust soiling	Low risk	Low risk	Negligible risk	Negligible risk
Human health	Low risk	Low risk	Negligible risk	Negligible risk

For dust soiling and human health, the risk is identified as 'low risk' or 'negligible risk'. Therefore, additional mitigation measures may be required to alleviate dust annoyance and elevated fine particles for sensitive receptors but for demolition and earthworks only.

3.4 CONSTRUCTION DUST MITIGATION MEASURES

It is not possible to eliminate emissions of dust from the construction activities completely. In order to minimise the impacts of construction activities, a mitigation programme will be required and should include the following.

- The name and contact details of person(s) accountable for air quality and dust issues will be displayed on the site boundary/construction main access
- The head office contact information will also be displayed at the site boundary.
- A Dust Management Plan (DMP) should be developed and implemented for the construction site. This should include the requirement for visual inspections to be carried out to ensure mitigation measures are effective.
- All dust and air quality complaints should be recorded, the cause identified and appropriate measures taken to reduce emissions in a timely manner. The complaints log should be made available to the local authority when requested.
- Any exceptional incidents giving rise to dust and or air emissions, either on or off-site should be recorded and the action taken to resolve the situation should be recorded.
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results and make an inspection log available for the local authority when required.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to

produce dust are being carried out and during prolonged dry or windy conditions.

- Plan site layout so that machinery and dust causing activities are located away from receptors (including habitat receptors) as far as possible.
- Erect solid screens or barriers around dusty activities.
- Avoid site runoff of water or mud.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction.
- Ensure an adequate supply water supply on the site for the effective dust/particle suppression/ mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment where appropriate.
- Avoid bonfires and burning of waste material.
- Ensure all vehicles switch off engines when stationary – no idling vehicles.
- Ensure water suppression is used during demolition operations.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives for demolition.
- Bag and remove any biological debris or damp down such material before demolition.
- Ensure cement bags are sealed after use and stored appropriately to prevent dust.
- Ensure sand and other aggregates are stored in bunded areas and are not allows to dry out.
- Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site.
- Ensure vehicles entering and leaving the sites are covered to prevent escape of materials during transport.
- Inspection and cleaning of vehicles wheels before vehicles leave the site.
- Record all inspections of haul routes and any subsequent action in a site log book.

3.5 RESIDUAL IMPACT

The main objective of the IAQM methodology is to determine the risk of dust emissions from construction sites and then to define the mitigation measures required to ensure that impacts are 'not significant'. Therefore, with the adoption of the recommended mitigation measures provided in *Section 3.4*, it is concluded that the residual risk would be '*negligible*' and the impact on dust soiling and human health would be '*not significant*'. However, it is noted that even with a rigorous DMP in place there may be occasions when dust mitigation measures may not be effective (e.g. extreme weather, interruption of water supplies or accidental releases).

3.6 MONITORING OF DUST IMPACTS

The IAQM has published guidance relating to the monitoring of dust at demolition and construction sites [9]. The IAQM guidance states that as part of the Dust Management Plan for the site, monitoring of dust impacts should be carried out on a daily basis. This ensures that the mitigation measures employed on site are adequately controlling dust emissions, thereby reducing the risk of dust annoyance or exceedances of the air quality objectives for PM_{10} and/or $PM_{2.5}$.

The level of dust monitoring that should be carried out is dependent on the phase of the development and the estimated risk of impacts occurring. For example, steelwork erection, cladding and fit-out would be very low risk.

As a negligible risk following the implementation of mitigation measures provided in *Section 3.4*, visual monitoring of dust is proposed. This would involve a daily visual inspection of dust deposition to surfaces both on and off-site. This is particularly important at times where meteorological conditions are likely to increase impacts off-site (e.g. dry and windy) or if the prevailing wind is in the direction of sensitive receptors. Observations should be recorded in a site log, providing a useful reference document in the event of complaints relating to dust annoyance. A log of complaints from the public, and the measures taken to address any complaints, where necessary, would also be maintained.

Visual assessment of on-site dust releases such as stockpiling and earthwork activities should also be carried out as a matter of course to ensure the mitigation measures employed are effective.

9 Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites, IAQM, 2012

4 ASSESSMENT METHODOLOGY FOR OPERATIONAL IMPACTS

4.1 INTRODUCTION

The potential impact on local air quality of particle emissions from the Padeswood Cement Works has been assessed using a dispersion model to predict airborne ground level concentrations of particles from the entire cement works with and without the operation of Mill 5.

Dispersion modelling of emissions from the cement works has been undertaken using the United US EPA AERMOD Prime dispersion model (US EPA Version 16216r). As preferred by the Environment Agency, this is a newer generation dispersion model that incorporates the latest understanding of the atmospheric boundary layer. It is used extensively in the UK for assessing the air quality impacts of industrial and other polluting processes.

The model used is a commercial version of AERMOD Prime produced by Trinity Consultants (Version 7.12.1).

This methodology has followed the guidance for dispersion modelling assessments set out by the Royal Meteorological Society [10] and Atmospheric Dispersion Modelling Liaison Committee (ADMLC) [11].

4.2 QUANTIFICATION OF POINT SOURCE EMISSIONS

4.2.1 Introduction

Point emission sources include the new cement mill, the main kiln stack, the other cement mills and other small bag filters etc. Due to the monitoring and maintenance required for these emission sources, these are relatively well characterised. The assessment has considered all low-level point source emissions where the greatest impact is likely to be at the site boundary. The main stack emission has been excluded since as a high-level emission this disperses further and maximum concentrations are some distance from the site.

10 Atmospheric Dispersion Modelling – Guidelines on the Choice and Use of Models and the Communication and Reporting of Results, Royal Meteorological Society (May 1995).

11 Guidelines for the Preparation of Dispersion Modelling Assessments for Compliance with Regulatory Requirements – an Update to the 1995 Royal Meteorological Society Guidance, ADMLC (2004.)

4.2.2 Detailed Inventory of Emissions

A detailed emissions inventory for the Padeswood Cement Works has been generated. This has included detailed information, which is required for modelling these point emissions as follows:

- grid reference for source;
- emission height above ground level;
- stack diameter or area of emission at source;
- orientation of source (i.e. vertical, horizontal);
- volume flow rate of air through source;
- temperature of emission;
- particle emission concentration; and
- operational hours.

Detailed emission parameters for all sources considered are summarised in *Table 4.1*. Information required for dispersion modelling of the emissions is provided in *Table 4.2*. Sources P42 to P48 are new emissions associated with Cement Mill 5. However, some of the existing sources will be decommissioned as a result of the new cement mill. Therefore, the sources are separated into 'existing only', 'both existing and future' and 'future only'. Mill 4 will be mothballed rather than decommissioned and it could be bought back into use in the future. However, this would not be able to operate at the same time as Mill 5. Therefore, it has not been included in the future emissions.

4.2.3 Worst-case Emissions

In order to represent a worst-case scenario, the works is assumed to operate for 100% of the year. In reality, the works would not operate continuously to allow for necessary maintenance periods, therefore predicted annual average concentrations may be overestimated. For example, the new Mill 5 is expected to operate for 6,990 hours per year (80% of the year).

Emissions of NO_x from Mill 5 when the HGG is operating have been measured at 13 mg m^{-3} prior to it being dismantled. Assuming as a worst-case that the HGG operates continuously then the NO_x emission rate would be 0.24 g s^{-1}.

TABLE 4.1: DETAILED PARTICLE EMISSIONS INVENTORY FOR POINT SOURCES

Ref.	Source Description	Existing or Future Source	NGR Easting	NGR Northing	Emission Height (m)	Area of Emissions (m^2)	Volume Flow ($Am^3 h^{-1}$) (a)	Normalised Volume Flow ($Nm^3 s^{-1}$) (b)	Temp. (°C)	Emission Concentration (mg Am^{-3}) (a)
P1	Clinker Cooler	Both	329140	362040	35	2.81	86,859	18.00	93	20
P2	Cement Mill 1	Both	329200	362134	17.5	0.20	3,015	0.65	80	10
P3	Cement Mill 2	Both	329200	362134	12.7	0.20	3,015	0.65	80	10
P4	Cement Mill 3	Both	329200	362134	27	2.27	44,942	9.65	80	20
P5	Cement Mill 4 - Mill	Existing only	329228	362138	16.7	0.40	11,260	2.49	70	10
P6	Cement Mill 4 - DCE	Existing only	329228	362138	21.5	1.27	48,340	10.69	70	20
P7	Clinker Store BF41	Both	329241	362145	15	0.58	24,885	5.50	70	10
P8	Raw Meal Blending	Both	329015	362138	26	0.20	8,906	2.27	25	10
P9	Raw Meal Storage	Both	329086	362146	34	0.20	8,836	2.25	25	10
P10	Crumbeliser Silo 1	Both	329049	362106	20	0.09	2,026	0.48	50	10
P11	Silos 1 - 4	Both	329203	362274	24	0.17	9,181	2.16	50	10
P12	Silo 5	Both	329203	362274	27	0.17	1,124	0.26	50	10
P13	Silo 6 - Bottom	Both	329167	362319	8	0.17	4,068	0.96	50	10
P14	Packing Bay -	Both	329162	362308	27	0.20	5,883	1.38	50	10
P15	Packing Bay -	Both	329162	362308	27	0.50	4,343	1.02	50	10
P16	Packing Bay - Packer	Both	329162	362308	11	0.17	4,367	1.03	50	10
P17	Silos 11	Existing only	329224	362262	31	0.06	1,855	0.44	50	10
P18	Silos 12	Existing only	329224	362262	32	0.06	1,855	0.44	50	10
P19	Silo 16	Both	329224	362262	31	0.06	1,855	0.44	50	10
P20	Silo 7 Top	Existing only	329240	362247	27	0.06	1,855	0.44	50	10
P21	Silo 8 Top	Existing only	329240	362247	27	0.06	1,855	0.44	50	10
P22	Silo 9 Top	Existing only	329240	362247	27	0.06	1,855	0.44	50	10

TABLE 4.1: DETAILED PARTICLE EMISSIONS INVENTORY FOR POINT SOURCES

Ref.	Source Description	Existing or Future Source	NGR Easting	NGR Northing	Emission Height (m)	Area of Emissions (m^2)	Volume Flow ($Am^3\ h^{-1}$) (a)	Normalised Volume Flow ($Nm^3\ s^{-1}$) (b)	Temp. (°C)	Emission Concentration ($mg\ Am^{-3}$) (a)
P23	Silo 10 Top	Existing only	329240	362247	27	0.06	1,855	0.44	50	10
P24	Silo 7 Bottom	Existing only	329240	362247	7	0.03	1,259	0.30	50	10
P25	Silo 8 Bottom	Existing only	329240	362247	7	0.03	1,259	0.30	50	10
P26	Silo 9 Bottom	Existing only	329240	362247	7	0.03	1,259	0.30	50	10
P27	Silo 10 Bottom	Existing only	329240	362247	7	0.03	1,259	0.30	50	10
P28	Silo 13	Both	329216	362262	31	0.05	1,962	0.46	50	10
P29	Silo 14	Both	329216	362262	31	0.05	1,962	0.46	50	10
P30	Silo 15	Both	329216	362262	31	0.05	1,962	0.46	50	10
P31	Between Silos 11 and	Existing only	329224	362262	5	0.02	1,323	0.31	50	10
P32	Bottom of Silos 2, 3, 5	Both	329203	362274	6	0.09	4,707	1.11	50	10
P33	Cement Mill 3 dedusting	Both	329200	362134	20	0.10	4,617	1.08	50	10
P34	Limestone Receiving 1	Both	329194	362306	4	0.17	9,094	2.31	25	10
P35	Limestone Receiving 2	Both	329194	362307	10	0.17	9,094	2.31	25	10
P36	Limestone Receiving 3	Both	329194	362308	27	0.17	9,094	2.31	25	10
P37	Crumbeliser Silo 2	Both	329049	362106	20	0.09	1,961	0.46	50	10
P38	Pressure Relief Coal	Both	329060	362070	30	0.25	1,773	0.45	25	10
P39	Dedusting Coal/Shale	Both	329015	362120	15	0.44	3,181	0.81	25	10
P40	Arodo Packer filter	Both	329155	362305	15	0.28	16,000	4.07	25	10
P41	Silo 6 top	Both	329166	362334	34	0.07	1,080	0.25	50	10
P42	Rail silo 1 dedusting Filter	Future only	329200	362251	34	0.07	1,080	0.25	50	10
P43	Rail silo 2 dedusting Filter	Future only	329209	362248	34	0.07	1,080	0.25	50	10
P44	Rail silo 3 dedusting Filter	Future only	329218	362244	34	0.07	1,080	0.25	50	10

TABLE 4.1: DETAILED PARTICLE EMISSIONS INVENTORY FOR POINT SOURCES

Ref.	Source Description	Existing or Future Source	NGR Easting	NGR Northing	Emission Height (m)	Area of Emissions (m^2)	Volume Flow ($Am^3\ h^{-1}$) (a)	Normalised Volume Flow ($Nm^3\ s^{-1}$) (b)	Temp. (°C)	Emission Concentration (mg Am^{-3}) (a)
P45	Rail silo loading head	Future only	329210	362250	5	0.10	5,760	1.35	50	10
P46	Clinker transport at mill 4	Future only	329231	362200	5	0.07	1,080	0.25	50	10
P47	Clinker transport at mill 5	Future only	329248	362283	25	0.07	1,080	0.25	50	10
P48	Mill 5 Stack New	Future only	329206	362293	47	4.34	67,788	13.99	94.5	10

(a) The volume flow rate is expressed at actual conditions but the emission concentration is expressed at normal conditions which vary depending on the source

(b) Normalised flow rate at 273K and 1 atmosphere

TABLE 4.2: MODEL INPUT PARAMETERS REQUIRED FOR DISPERSION MODELLING OF POINT SOURCE EMISSIONS

Model Ref.	Source Description	NGR Easting	NGR Northing	Emission Height (m)	Diameter of Emission (m)	Velocity of Emission (m s^{-1})	Volume Flow ($Am^3 s^{-1}$)	Temp. (K)	Emission Rate (g s^{-1})
P1	Clinker Cooler	329140	362040	35	1.89	8.6	24.1	366	0.360
P2	Cement Mill 1	329200	362134	17.5	0.51	4.1	0.8	353	0.0065
P3	Cement Mill 2	329200	362134	12.7	0.51	4.1	0.8	353	0.0065
P4	Cement Mill 3	329200	362134	27	1.7	5.5	12.5	353	0.193
P5	Cement Mill 4 - Mill	329228	362138	16.7	0.71	7.9	3.1	343	0.025
P6	Cement Mill 4 - DCE	329228	362138	21.5	1.27	10.6	13.4	343	0.214
P7	Clinker Store BF41	329241	362145	15	0.86	11.9	6.9	343	0.055
P8	Raw Meal Blending	329015	362138	26	0.5	12.6	2.5	298	0.023
P9	Raw Meal Storage	329086	362146	34	0.5	12.5	2.5	298	0.022
P10	Crumbeliser Silo 1	329049	362106	20	0.34	6.2	0.6	323	0.005
P11	Silos 1 - 4	329203	362274	24	0.47	14.7	2.6	323	0.022
P12	Silo 5	329203	362274	27	0.47	1.8	0.3	323	0.003
P13	Silo 6 - Bottom	329167	362319	8	0.46	6.8	1.1	323	0.010
P14	Packing Bay -	329162	362308	27	0.51	8	1.6	323	0.014
P15	Packing Bay -	329162	362308	27	0.8	2.4	1.2	323	0.010
P16	Packing Bay - Packer	329162	362308	11	0.46	7.3	1.2	323	0.010
P17	Silos 11	329224	362262	31	0.27	9	0.5	323	0.0044
P18	Silos 12	329224	362262	32	0.27	9	0.5	323	0.0044
P19	Silo 16	329224	362262	31	0.27	9	0.5	323	0.0044
P20	Silo 7 Top	329240	362247	27	0.27	9	0.5	323	0.0044
P21	Silo 8 Top	329240	362247	27	0.27	9	0.5	323	0.0044
P22	Silo 9 Top	329240	362247	27	0.27	9	0.5	323	0.0044

TABLE 4.2: MODEL INPUT PARAMETERS REQUIRED FOR DISPERSION MODELLING OF POINT SOURCE EMISSIONS

Model Ref.	Source Description	NGR Easting	NGR Northing	Emission Height (m)	Diameter of Emission (m)	Velocity of Emission ($m\ s^{-1}$)	Volume Flow ($Am^3\ s^{-1}$)	Temp. (K)	Emission Rate ($g\ s^{-1}$)
P23	Silo 10 Top	329240	362247	27	0.27	9	0.5	323	0.0044
P24	Silo 7 Bottom	329240	362247	7	0.21	10.1	0.3	323	0.0030
P25	Silo 8 Bottom	329240	362247	7	0.21	10.1	0.3	323	0.0030
P26	Silo 9 Bottom	329240	362247	7	0.21	10.1	0.3	323	0.0030
P27	Silo 10 Bottom	329240	362247	7	0.21	10.1	0.3	323	0.0030
P28	Silo 13	329216	362262	31	0.25	11.1	0.5	323	0.0046
P29	Silo 14	329216	362262	31	0.25	11.1	0.5	323	0.0046
P30	Silo 15	329216	362262	31	0.25	11.1	0.5	323	0.0046
P31	Between Silos 11 and	329224	362262	5	0.15	20.8	0.4	323	0.0031
P32	Bottom of Silos 2, 3, 5	329203	362274	6	0.34	14.4	1.3	323	0.011
P33	Cement Mill 3 dedusting	329200	362134	20	0.36	12.6	1.3	323	0.011
P34	Limestone Receiving 1	329194	362306	4	0.46	15.2	2.5	298	0.023
P35	Limestone Receiving 2	329194	362307	10	0.46	15.2	2.5	298	0.023
P36	Limestone Receiving 3	329194	362308	27	0.46	15.2	2.5	298	0.023
P37	Crumbeliser Silo 2	329049	362106	20	0.34	6	0.5	323	0.0046
P38	Pressure Relief Coal	329060	362070	30	0.56	2	0.5	298	0.0045
P39	Dedusting Coal/Shale	329015	362120	15	0.75	2	0.9	298	0.0081
P40	Arodo Packer filter	329155	362305	15	0.6	15.7	4.44	298	0.041
P41	Silo 6 top	329166	362334	34	0.3	4.2	0.3	323	0.003
P42	Rail silo 1 dedusting Filter	329200	362251	34	0.3	4.2	0.3	323	0.003
P43	Rail silo 2 dedusting Filter	329209	362248	34	0.3	4.2	0.3	323	0.003
P44	Rail silo 3 dedusting Filter	329218	362244	34	0.3	4.2	0.3	323	0.003

TABLE 4.2: MODEL INPUT PARAMETERS REQUIRED FOR DISPERSION MODELLING OF POINT SOURCE EMISSIONS

Model Ref.	Source Description	NGR Easting	NGR Northing	Emission Height (m)	Diameter of Emission (m)	Velocity of Emission (m s^{-1})	Volume Flow (Am^3 s^{-1})	Temp. (K)	Emission Rate (g s^{-1})
P45	Rail silo loading head	329210	362250	5	0.35	16.6	1.6	323	0.014
P46	Clinker transport at mill 4	329231	362200	5	0.3	4.2	0.3	323	0.003
P47	Clinker transport at mill 5	329248	362283	25	0.3	4.2	0.3	323	0.003
P48	Mill 5 Stack New	329206	362293	47	2.35	8.3	18.83	368	0.14

4.3 MODEL DESCRIPTION

AERMOD is a PC-based model for simulating dispersion in the atmosphere of pollutants released from industrial sources. AERMOD has been comprehensively validated and independently reviewed. The model incorporates the following key features:

- Characterisation of the boundary layer in terms of two parameters: the boundary layer depth and the Monin-Obhukov length, rather than using the "old-generation" stability categories.
- AERMAP; a terrain pre-processor, which provides information for streamline height algorithms and uses digital data to obtain receptor elevations.
- AERMET; a meteorological pre-processor, which estimates vertical profiles of wind, turbulence and temperature based on meteorological parameters (surface roughness, bowen ratio and albedo) representative of the modelling domain.
- Multiple source definition including point, area and volume source types. Source groups may also be defined.
- Discrete and boundary receptors, allowing maximum off-site concentrations to be calculated. On-site receptors may be removed from the project.
- Wet and dry deposition.
- PRIME building downwash module.
- Base map and terrain (3D) visualisation and layering with source and receptor information.

4.4 SENSITIVE RECEPTORS

4.4.1 Human Receptors

The nearest residential properties to the Works are located at a number of isolated farms and along Padeswood Drive to the north of the cement works. Penyffordd is the nearest area of relatively high-density residential properties. A number of discrete receptors have been included in the modelling. The locations of the receptors considered are presented in *Figure 4.1* and *Table 4.3*.

FIGURE 4.1 LOCATIONS OF SENSITIVE RECEPTORS CONSIDERED FOR THE ASSESSMENT

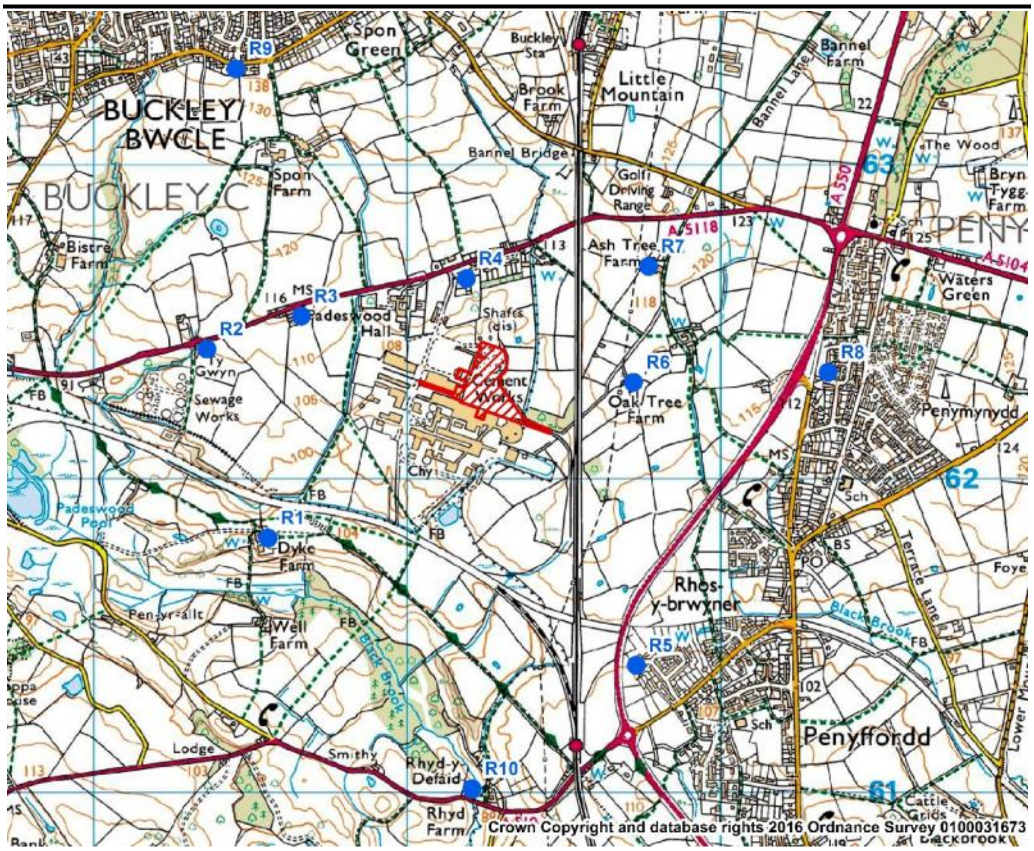


TABLE 4.3 LOCATIONS OF SENSITIVE RECEPTORS CONSIDERED FOR THE ASSESSMENT

Receptor	Receptor Type	Easting	Northing
R1 Dyke Farm	Farm/Residential	328556	361812
R2 Ty Gwyn	Residential	328361	362414
R3 Oak Tree Farm (west)	Farm/Residential	328662	362519
R4 Padeswood Drive	Residential	329188	362639
R5 Penyffordd West	Residential	329730	361406
R6 Oak Tree Farm	Farm/Residential	329721	362308
R7 Ash Tree Farm	Farm/Residential	329769	362678
R8 Penymynydd	Residential	330342	362340
R9 Buckley	Residential	328454	363308
R10 Rhyd Farm	Farm/Residential	329206	361013

4.4.2 Habitat Receptors

The nearest habitat receptor to the site is Black Brook Plantation, a local wildlife site (LWS) located around 700 m to the south of the new cement mill. The nearest European habitat site is the Deeside and Buckley Newt site which is a

Special Area of Conservation (SAC) and Site of Special Scientific Interest (Buckley Claypits and Commons SSSI) and is located approximately 1.5 km to the north of the site. Emission sources associated with the new cement mill are all low level and the greatest impact will be experienced close to the site boundary. Therefore, it is concluded that the impact of emissions from the new cement mill will be negligible at these habitat sites particularly when emissions from the cement works as a whole are taken into consideration. Therefore, the impact of operational emissions or particles on habitat sites is not considered further.

The HGG will operate for around 20% of the time and will give rise to emissions of NO_x. Therefore, the impact of the HGG on the LWS and the SAC has been considered assuming as a worst-case that it operates continuously.

4.5 OPERATIONAL SCENARIOS

The dispersion modelling assessment will consider the impact of emissions of particulates from low-level sources (i.e. excludes the main kiln stack which has an emission height of 110 m) at the site with and without Mill 5. Modelling has been undertaken based on worst-case emissions from all sources (e.g. emissions at the emission limits, continuous operation of all emission sources).

4.6 OTHER MODELLING PARAMETERS

4.6.1 Building Downwash

In AERMOD, downwash effects are only significant where building heights are greater than 40% of the emission release height. The downwash structures also have to be sufficiently close for their influence to be significant. The height, dimensions and location of buildings regarded as potential downwash structures and included in the modelling are summarised in *Table 4.4*.

4.6.2 Grid Size

A grid size of 3 km by 3 km and grid spacing of 50 m has been used for the dispersion modelling assessment.

TABLE 4.4 BUILDINGS INCLUDED IN THE DISPERSION MODEL (a)

Building	Height (m)	Location of Northwest Corner		X Length (m)	Y Length (m)	Angle (°)
Raw Mill	31.0	329025	362137	17.2	19.7	19
Raw Meal Silos (west)	31.0	329016	362175	9.1	7.0	19
Raw Meal Silos (east)	34.0	329042	362134	31.8	14.2	19
Cranestore	29.0	329074	362250	211	25.7	19
Packing Plant	26.0	329080	362304	20.0	21.0	19
Pre-heater	95.5	329054	362064	20.0	20.0	19
Clinker Store	40.0	329333	362145	Radius = 36		-
Kiln 4	107.8	329062	362069	Radius = 3.5		-
Mill 5 Building (a)	26	329200	362311	60.0	16.0	19
Rail silos (a)	37	329197	362257	28.0	10.0	19

(a) The height and building dimensions are the values assumed for the purposes of the modelling and may differ from the actual dimensions where the buildings have variable heights, widths and lengths

5 PREDICTED OPERATIONAL IMPACT

5.1 ANNUAL VARIABILITY

For assessing annual variability, worst-case ground level concentrations have been predicted for all five meteorological data sets (2012 to 2016). Modelling has been carried out for all low-level sources at operational emission limits. Predicted concentrations are presented for the maximum off-site concentration (i.e. at or beyond the installation boundary) and for the discrete receptors identified in *Section 4.4*.

5.2 CEMENT MILL 5 ALONE

5.2.1 Predicted PM_{10}

Predicted worst-case annual mean and 24-hour ground level concentrations of PM_{10} as a result of emissions from the new Mill 5 are presented *Table 5.1*. The predicted concentrations are for the seven new sources associated with the proposed new cement mill.

The results presented in this section assume 100% of particles are PM_{10}, which represents a worst-case assessment.

TABLE 5.1 PREDICTED ANNUAL MEAN AND 24-HOUR MEAN PM_{10} CONCENTRATIONS – CEMENT MILL 5 SOURCES ALONE

Receptor	Annual Mean ($\mu g\ m^{-3}$)	Annual Mean Percentage of AQO	24-hour Mean as 90.4th %ile ($\mu g\ m^{-3}$)	24-hour Mean Percentage of AQO
Maximum Off-site	0.44	1%	1.3	3%
R1 Dyke Farm	0.03	0%	0.10	0%
R2 Ty Gwyn	0.03	0%	0.09	0%
R3 Oak Tree Farm (west)	0.07	0%	0.23	0%
R4 Padeswood Drive	0.16	0%	0.41	1%
R5 Penyffordd West	0.08	0%	0.27	1%
R6 Oak Tree Farm	0.10	0%	0.29	1%
R7 Ash Tree Farm	0.09	0%	0.27	1%
R8 Penymynydd	0.04	0%	0.12	0%
R9 Buckley	0.07	0%	0.20	0%
R10 Rhyd Farm	0.01	0%	0.03	0%
Air Quality Objective	*40*		*50*	

Predicted concentrations would all be described as 'negligible' in accordance with the IAQM planning guidance. Maximum predicted annual mean concentrations represent 1% of the annual mean AQO and the maximum 24-hour mean as the 90.4th percentile is 3% of the AQO. At sensitive receptors locations predicted concentrations are substantially lower. Therefore, it is concluded that emissions of PM_{10} from the new cement mill alone would be 'not significant'.

5.2.2 Predicted $PM_{2.5}$

Predicted worst-case annual mean ground level concentrations of $PM_{2.5}$ as a result of emissions from the new Mill 5 are presented *Table 5.2*. The predicted concentrations are for the seven new sources associated with the proposed new cement mill.

The results presented in this section assume 100% of particles are $PM_{2.5}$, which represents a worst-case assessment.

TABLE 5.2 PREDICTED ANNUAL MEAN $PM_{2.5}$ CONCENTRATIONS – CEMENT MILL 5 SOURCES ALONE

Receptor	Annual Mean ($\mu g\ m^{-3}$)	Annual Mean Percentage of AQO
Maximum Off-site	0.44	2%
R1 Dyke Farm	0.03	0%
R2 Ty Gwyn	0.03	0%
R3 Oak Tree Farm (west)	0.07	0%
R4 Padeswood Drive	0.16	1%
R5 Penyffordd West	0.08	0%
R6 Oak Tree Farm	0.10	0%
R7 Ash Tree Farm	0.09	0%
R8 Penymynydd	0.04	0%
R9 Buckley	0.07	0%
R10 Rhyd Farm	0.01	0%
Air Quality Objective	*25*	

Predicted concentrations would all be described as 'negligible' in accordance with the IAQM planning guidance. Maximum predicted annual mean concentrations represent 2% of the annual mean AQO. At sensitive receptors locations predicted concentrations are substantially lower. Therefore, it is concluded that emissions of $PM_{2.5}$ from the new cement mill alone would be 'not significant'.

5.2.3 Predicted NO_2

Predicted annual mean NO_2 concentrations arising from the continuous operation of the HGG at sensitive receptors are summarised in *Table 5.3*. It is assumed that 70% of NO_x is NO_2.

TABLE 5.3 PREDICTED ANNUAL MEAN NO_2 CONCENTRATIONS – CEMENT MILL 5 SOURCES ALONE

Receptor	Annual Mean ($\mu g\ m^{-3}$)	Annual Mean Percentage of AQO
Maximum Off-site	0.53	1%
R1 Dyke Farm	0.04	0%
R2 Ty Gwyn	0.03	0%
R3 Oak Tree Farm (west)	0.09	0%
R4 Padeswood Drive	0.20	0%
R5 Penyffordd West	0.10	0%
R6 Oak Tree Farm	0.11	0%
R7 Ash Tree Farm	0.11	0%
R8 Penymynydd	0.04	0%
R9 Buckley	0.08	0%
R10 Rhyd Farm	0.02	0%
Air Quality Objective	*40*	

The maximum predicted concentration of 0.53 $\mu g\ m^{-3}$ is 1% of the AQO of 40 $\mu g\ m^{-3}$. At sensitive receptors, predicted concentrations are all 0% of the AQO. Therefore, it is concluded that the impact of Mill 5 on NO_2 concentrations is not significant.

5.2.4 Predicted NO_x at Habitat Sites

Predicted annual mean and 24-hour mean NO_x at the LWS and SAC/SSSI are presented in *Table 5.4*.

TABLE 5.4 PREDICTED NO_X CONCENTRATIONS AT HABITAT SITES – CEMENT MILL 5 SOURCES ALONE

Receptor	Predicted NO_x Concentration ($\mu g\ m^{-3}$)	Percentage of Critical Level
Annual Mean		
Deeside and Buckley Newt Sites SAC	0.057	0.2%
Black Brook Plantation LWS	0.049	0.2%
24-hour Mean		
Deeside and Buckley Newt Sites SAC	0.24	0.3%
Black Brook Plantation LWS	0.21	0.3%

Predicted annual mean concentrations at both habitats are less than 1% of the critical level of 30 $\mu g\ m^{-3}$ and 24-hour means are less than 10% of the critical level of 75 $\mu g\ m^{-3}$. Therefore, the impact of NO_x emissions on habitat sites is considered to be not significant.

5.3 CHANGE IN PREDICTED CONCENTRATIONS

5.3.1 Predicted PM_{10}

Predicted concentrations provided in *Section 5.2* are for emissions from the new cement mill stack and other associated emissions. However, it is the change in predicted concentrations which is the important consideration as well as the cumulative impact of total emissions from the cement works on local air quality. The proposed development introduces seven new emission points including the Mill 5 stack. However, there are a number of existing emission sources which will be decommissioned as a result of the new cement mill development.

The impact of existing and future emissions on annual mean and 24-hour mean PM_{10} concentrations is presented in *Table 5.5* and *Table 5.6*, respectively.

TABLE 5.5 PREDICTED ANNUAL MEAN PM_{10} CONCENTRATIONS – EXISTING AND FUTURE EMISSIONS

Receptor	Existing Annual Mean ($\mu g\ m^{-3}$)	Future Annual Mean ($\mu g\ m^{-3}$)	Difference ($\mu g\ m^{-3}$)	Difference as Percentage of AQO
Maximum Off-site	5.6	5.1	-0.5	-1%
R1 Dyke Farm	0.32	0.27	-0.1	0%
R2 Ty Gwyn	0.39	0.33	-0.1	0%
R3 Oak Tree Farm (west)	0.80	0.74	-0.1	0%
R4 Padeswood Drive	2.5	2.2	-0.4	-1%
R5 Penyffordd West	0.82	0.68	-0.1	0%
R6 Oak Tree Farm	1.4	0.97	-0.4	-1%
R7 Ash Tree Farm	0.77	0.63	-0.1	0%
R8 Penymynydd	0.49	0.35	-0.1	0%
R9 Buckley	0.79	0.65	-0.1	0%
R10 Rhyd Farm	0.19	0.13	-0.1	0%
Air Quality Objective	*40*			-

For all receptors, predicted concentrations decrease as a result of the new Mill 5 due to the decommissioning of some of the existing emission sources. The maximum predicted total concentration (background plus cement works contribution) for the future is 18.1 $\mu g\ m^{-3}$ for a background concentration of 13 $\mu g\ m^{-3}$. This is 45% of the annual mean AQO of 40 $\mu g\ m^{-3}$. Therefore, although there is a reduction in PM_{10} concentrations the benefit is not considered to be significant in accordance with the IAQM planning guidance.

As for the annual mean, predicted 90.4^{th} percentile of 24-hour mean concentrations for the future scenario are lower than the existing scenario demonstrating that the new cement mill has a beneficial impact on local air quality. For the maximum predicted concentration, the difference between the existing and future emissions is 2% of the AQO. Therefore, the beneficial impact is considered 'not significant'.

TABLE 5.6 PREDICTED 90.4TH PERCENTILE OF 24-HOUR MEAN PM_{10} CONCENTRATIONS – EXISTING AND FUTURE EMISSIONS

Receptor	Existing 24-hour Mean ($\mu g\ m^{-3}$)	Future 24-hour Mean ($\mu g\ m^{-3}$)	Difference ($\mu g\ m^{-3}$)	Difference as Percentage of AQO
Maximum Off-site	13.3	12.4	-0.9	-2%
R1 Dyke Farm	1.0	0.83	-0.2	0%
R2 Ty Gwyn	1.2	1.1	-0.1	0%
R3 Oak Tree Farm (west)	2.1	2.0	-0.1	0%
R4 Padeswood Drive	5.9	5.7	-0.3	-1%
R5 Penyffordd West	2.4	2.0	-0.4	-1%
R6 Oak Tree Farm	3.8	2.6	-1.2	-2%
R7 Ash Tree Farm	2.0	1.8	-0.3	-1%
R8 Penymynydd	1.4	1.0	-0.4	-1%
R9 Buckley	2.2	1.8	-0.4	-1%
R10 Rhyd Farm	0.59	0.39	-0.2	0%
Air Quality Objective	*50*			-

5.3.2 Predicted $PM_{2.5}$

The impact of existing and future emissions on annual mean $PM_{2.5}$ concentrations is presented in *Table 5.7*. This assumes as a worst-case that all emissions are $PM_{2.5}$.

TABLE 5.7 PREDICTED ANNUAL MEAN $PM_{2.5}$ CONCENTRATIONS – EXISTING AND FUTURE EMISSIONS

Receptor	Existing Annual Mean ($\mu g\ m^{-3}$)	Future Annual Mean ($\mu g\ m^{-3}$)	Difference ($\mu g\ m^{-3}$)	Difference as Percentage of AQO
Maximum Off-site	5.6	5.1	-0.5	-2%
R1 Dyke Farm	0.32	0.27	-0.1	0%
R2 Ty Gwyn	0.39	0.33	-0.1	0%
R3 Oak Tree Farm (west)	0.80	0.74	-0.1	0%
R4 Padeswood Drive	2.5	2.2	-0.4	-2%
R5 Penyffordd West	0.82	0.68	-0.1	-1%
R6 Oak Tree Farm	1.4	0.97	-0.4	-2%
R7 Ash Tree Farm	0.77	0.63	-0.1	-1%
R8 Penymynydd	0.49	0.35	-0.1	-1%
R9 Buckley	0.79	0.65	-0.1	-1%
R10 Rhyd Farm	0.19	0.13	-0.1	0%
Air Quality Objective	*25*			-

For all receptors, predicted $PM_{2.5}$ concentrations decrease as a result of the new Mill 5 due to the decommissioning of some of the existing emission sources. The maximum predicted total concentration (background plus cement works contribution) for the future is 14.1 µg m^{-3} for a background concentration of 9 µg m^{-3}. This is 56% of the annual mean AQO of 25 µg m^{-3}. Therefore, although there is a reduction in $PM_{2.5}$ concentrations the benefit is not considered to be significant in accordance with the IAQM planning guidance.

5.4 DISTRIBUTION OF PREDICTED CONCENTRATIONS

For the future scenario (with Cement Mill 5 operating), predicted annual mean PM_{10}/$PM_{2.5}$ and 90.4th percentile of 24-hour mean PM_{10} concentrations are presented as contour plots in *Figure 5.1* and *Figure 5.2*, respectively. These are provided for the most recent meteorological year

FIGURE 5.1 PREDICTED ANNUAL MEAN CONCENTRATIONS OF PM_{10} AND $PM_{2.5}$ – ALL FUTURE SOURCES FOR 2016 (µg m^{-3})

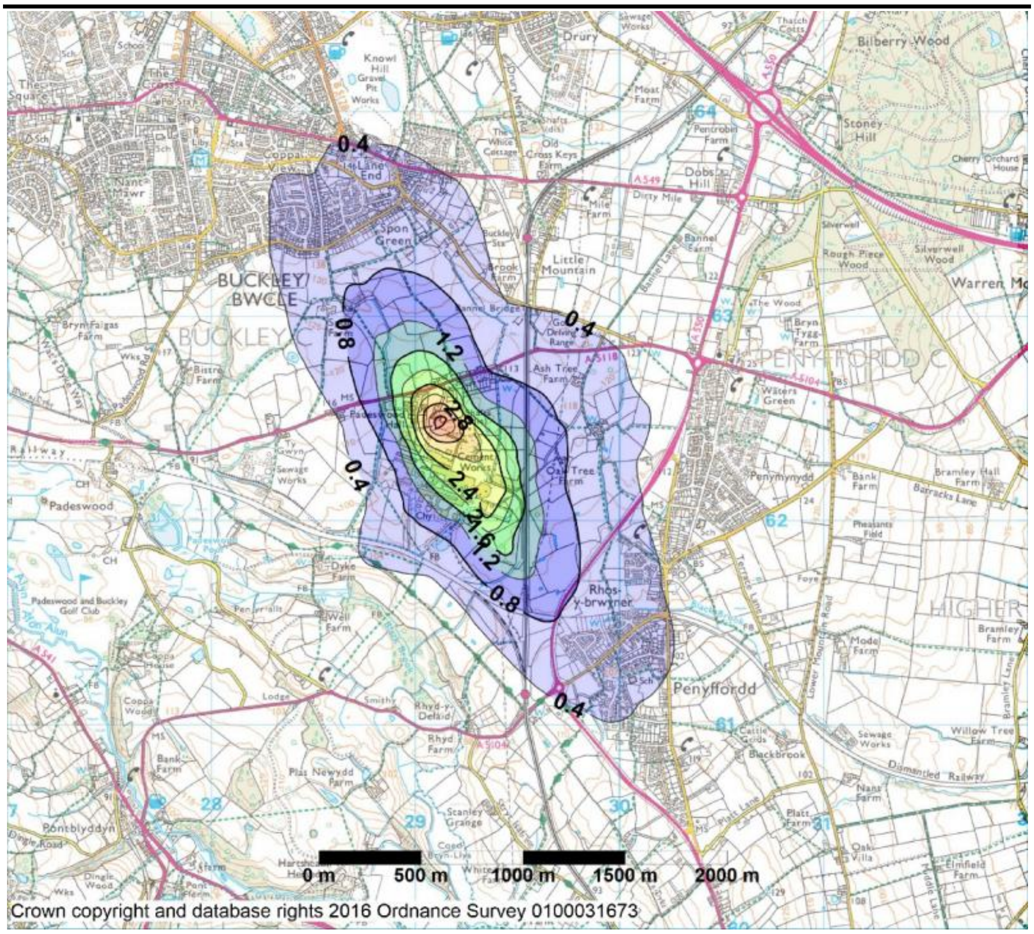
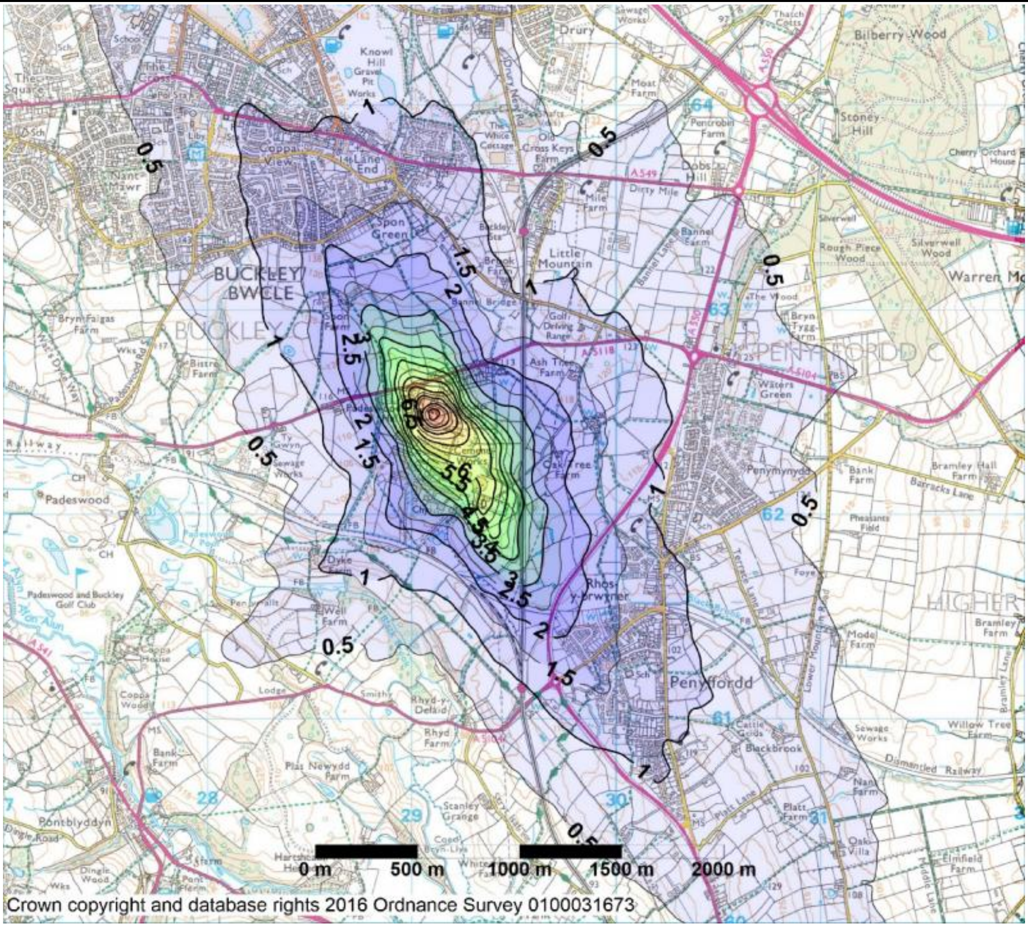


FIGURE 5.2 PREDICTED 90.4TH PERCENTILE OF 24-HOUR MEAN CONCENTRATIONS OF PM_{10} – ALL FUTURE SOURCES FOR 2016 (µg m^{-3})



6 CONCLUSIONS

6.1 SUMMARY

An assessment of air quality impacts associated with the installation of a new cement mill at the Padeswood cement works has been carried out. This has considered potential air quality impacts during construction and operation and the impact on human and habitat receptors.

The assessment has considered traffic-related air quality impacts during construction and operation, construction dust impacts and the operational impacts of the new cement mill.

The main emission from the cement mill is total suspended particles (TSP) which will comprise a range of particle sizes. For human health effects, fine particles (i.e. particles of less than 10 µm in diameter, termed PM_{10} or less than 2.5 µm termed $PM_{2.5}$) are of most concern. Therefore, as a worst-case it is assumed that particle emissions from the cement works comprise entirely of these finer fractions. The larger particles will settle quicker and be less likely to remain airborne as well as being of less concern for human health effects.

It is considered that fugitive emissions from the new cement mill and associated facilities will be minimal as all transport and storage of product will be covered or enclosed. Therefore, it is concluded that the impact of fugitive emissions on human and habitat receptors would be minimal and has been screened out of the assessment.

In addition to operational impacts of the cement mill, it was necessary to assess the potential impact on air quality of the construction phase and associated activities. These include the following:

- Construction activities associated with the cement mill, associated silos and upgrading of the railway sidings; and
- Increases in vehicle movements (e.g. road and rail) associated with the commissioning of the new cement mill.

As a result of the introduction of the new cement mill, it is anticipated that there will be a reduction in road traffic vehicle movements but an increase in rail movements. The reduction in road traffic is estimated as 31 vehicles per day (62 vehicle movements into and out of the site).

The number of heavy duty vehicles (HDV's) accessing the site during construction is estimated at an average of 35 movement per week (approximately 6 movements per day for a 6 day working week) over the duration of the construction period. At worst, there would be around 28 HDV movements per day due to the movement of materials off site (estimated as 675 HDV vehicles, 1,350 movements, over an eight-week period). Construction personnel will result in an additional 85 vehicles (170 movements) per day assuming each worker travels in their own vehicle. The number of additional rail movements is estimated to be 175 trains (350 rail movements) per year. Therefore, there would be approximately one movement per day on average. Therefore, it was concluded that the impact of rail traffic and road traffic on local air quality can be screened out of the assessment.

Therefore, the focus of the assessment was on construction dust impacts and operational impacts from the operation of the kiln and emissions via the stack.

The construction dust assessment considered the impact of demolition, earthworks, construction and trackout on dust soiling and human health. The impact on habitat sites was screened out of the assessment given the distance from construction activities and construction routes. Prior to mitigation, the impact of demolition and earthworks was assessed as 'low risk' whereas the impact of construction and trackout was assessed as 'negligible risk'. Mitigation measures for minimising impacts have been recommended.

The quantitative assessment of particle emissions from the cement works with and without the new cement mill was undertaken to assess the impact of the new cement mill at the site. In addition, emissions of NO_x from a hot gas generator (HGG) have also been considered. Dispersion modelling was undertaken using the US EPA AERMOD Prime dispersion model and five years of meteorological data from Hawarden (2012 to 2016).

Predicted ground level concentrations for emissions of PM_{10} and $PM_{2.5}$ from low-level sources at the site are compared with air quality objectives and existing air quality. Predicted NO_2 and NO_x concentrations have been compared with air quality objectives for human health and critical levels for habitat sites.

The results of this assessment indicate that maximum predicted annual mean PM_{10} and $PM_{2.5}$ and 24-hour mean PM_{10} ground level concentrations are substantially less than the relevant air quality objective set for the protection of human health. Furthermore, predicted concentrations with the new cement mill were less than existing emission sources. However, it was concluded that this reduction in concentrations was not significant.

At sensitive human receptor locations predicted NO_2 concentrations were assessed as negligible. At habitat sites, predicted annual mean concentrations at habitats were less than 1% of the critical level of 30 $\mu g\ m^{-3}$ and 24-hour means were less than 10% of the critical level of 75 $\mu g\ m^{-3}$. Therefore, the impact of NO_x emissions on human health and on habitat sites is considered to be not significant.

6.2 CONCLUSIONS

The results of this assessment indicate that the additional releases from the proposed Cement Mill 5 will not have a significant impact on local air quality.

Gair Consulting Limited
3 Ware Leys Close
Marsh Gibbon
Bicester
OX27 0EN

Tel: 01869 278889

Hanson Cement, Padeswood Works

Application for variation to EPR permit BL1096

CM 5 Appendix 7 – Noise Impact Assessment Report

Hanson Cement
Padeswood Works
Vertical Roller Mill
Noise Impact Assessment

File reference number: GA001
May 2017

Northumbrian Water Environmental Services
Head Office
Howdon STW
Newcastle-upon-Tyne
Tyne and Wear
NE28 0QD

Report Title	Hanson Cement Padeswood VRM Noise Impact Assessment
Client	Golder Associates
NWG Report No:	GA001
Status & Version	V4
Date of Release	May 2017

	Name	**Signature**	**Position**	**Date**
Author	Jeff Hood		Senior Consultant	May 2017

This report is not to be used for contractual or engineering purposes unless the front cover sheet is signed where indicated by the originator of the report and the report is designated 'Final' on the cover sheet.

Table of contents

Tables

Figures

Noise Impact Assessment

1.0 Introduction

1.1. An assessment has been carried out to determine the potential noise impact from the installation of a vertical roller mill (VRM), known as "Mill 5" and the mothballing of cement mills 1, 2 and 4 at Padeswood Cement Works (the Cement Works). Cement mill 3 will remain operational for periods where the VRM is out of operation or there is an upturn in the production requirements. The Cement Works currently has four operational cement mills; mills 1-4. The noise assessment was undertaken in accordance with the scope set out in the Screening and Scoping Report prepared by Golder Associates in March 2017 (re: 1773079.500/A.0) and issued to Flintshire County Council.

1.2. The baseline noise levels from the works have been measured at 10 locations (Figure 2) as part of historic PPC permit conditions between 2007 and 2013. Measurements were taken again at these locations during February and March 2017 to assess the existing background noise levels in the area with the works operational. Comparisons with the historic data and the 2017 data have been made.

1.3. An identical VRM, of similar construction, is in operation at Hanson's Purfleet Works; this was visited on 22nd February 2017 and noise levels were assessed inside and outside the building. This data has been used in the modelled predictions.

1.4. The noise impact from the reduction in traffic movements and the addition of train movements have also be assessed. Measurements of typical train movements and loading were taken at Hanson Cement's Ketton Cement Works on the 13th March 2017. The movements are of a similar nature and measurements were not influenced by the main works noise. The data collected was used in the Cadna model.

1.5. Predictions of noise levels have been made for the surrounding area and specifically for nearby residential properties to show the existing situation and the proposed situation. The construction and demolition works have also been assessed. The assessment results have been compared to Technical Advice Note (Wales) 11: 1997 'Noise' (TAN11), BS4142:2014, and World Health Organisation recommendations and criteria. Where appropriate, proposals for suggested mitigation measures, in order to minimise any potential negative impacts arising from the development have been provided with a prediction of any residual affects which may remain following implementation of the proposed mitigation measures.

1.6. A glossary of terms is provided in Appendix 1.

2.0 Description

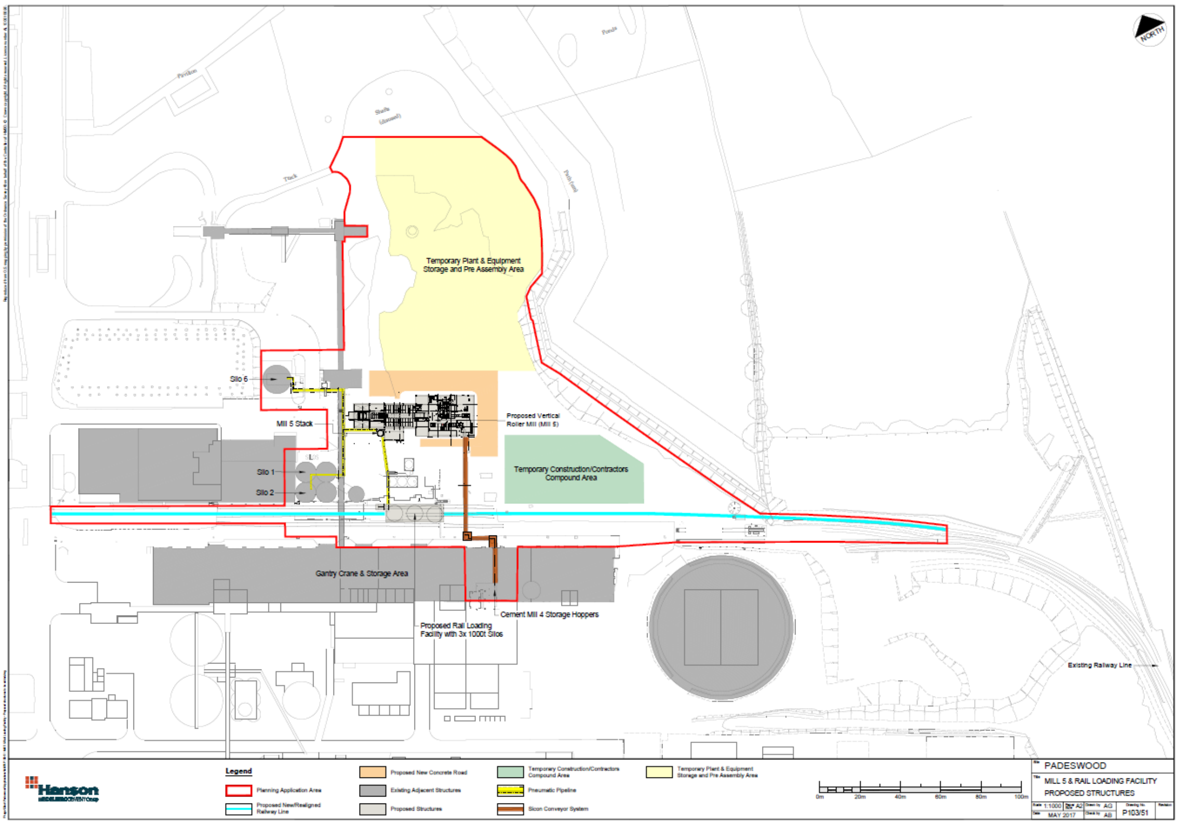
2.1. The development site is located within the existing operational footprint of the Cement Works. The location of the development site is shown edged red on Figure 1 below.

2.2. The Cement Works is situated within a mainly rural setting and surrounded by farm land with the closest receptors being the surrounding farm buildings and the properties on the A5118 Padeswood Road. The development site lies within the north east part of the existing Cement Works at Padeswood, near Mold, in Flintshire, North Wales.

2.3. The nearby principal residential areas are the villages of Penyffordd, Penymynydd, and Buckley. A plan of the site in relation to these residential areas is provided in Figure 2, which also illustrates the location of the 10 noise sensitive receptor locations referred to throughout this report. The area is well served by transport links including the local trunk road network, the A5118 Padeswood Road to the north of the site, and to the east the A550, also known as Hawarden Road. Also to the east, located between the Cement Works and the Hawarden Road, is the rail link between Liverpool and Wrexham.

2.4. A plan of the development area is shown in Figure 1

Figure 1: Development Site Plan



3.0 Standards and guidance

The following relevant guidance documents were considered whilst undertaking this assessment.

2.1. **Planning Policy Wales Edition 9 – November 2016**, describes the planning development policies of the Welsh Assembly Government. Chapter 13 of the policy "*Minimising and Managing Environmental Risks and Pollution"* sets out the policy objectives with regard to noise from new development; this is summarised in paragraph 13.15.1 of the document:

"Noise can be a material planning consideration, for example in proposals to use or develop land near an existing source of noise or where a proposed new development is likely to generate noise. Local planning authorities should make a careful assessment of likely noise levels and have regard to any relevant Noise Action Plan before determining such planning applications and in some circumstances it will be necessary for a technical noise assessment to be provided by the developer."

2.2. The introduction of **Technical Advice Note (Wales) 11: 1997 'Noise' (TAN11)** states:

"This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business."

TAN11 provides the following information:

- it indicates how noise issues should be handled in development plans and development control;
- outlines ways of mitigating the adverse impact of noise;
- provides specific guidance on noisy and noise-sensitive development;
- introduces the use of noise exposure categories; and
- guidance on the use of planning conditions relating to noise.

2.3. The TAN11 guidance introduces the concept of Noise Exposure Categories (NEC), which has been derived to assist local planning authorities in their consideration of planning applications for residential development near transport-related noise sources. The NEC procedure is only applicable for the introduction of a new residential development into an area with an existing noise source. Annex 1 of TAN11 provides guidance on various types of noise sources, which includes road traffic, aircraft and railways.

2.4. For reference, the recommended NEC for new dwellings near existing sources is provided in Table 1. Note that these noise categories are based upon measurements taken in an open site (i.e. without any proposed noise attenuating features in place).

2.5. The level at the boundary of NEC A and NEC B is based on guidance provided by the World Health Organisation (WHO) health criteria from 1999, which states that *"general daytime outdoor noise levels of less than 55 dB(A) L_{eq} are desirable to present any significant community annoyance"*.

2.6. The night time noise level at the boundary of NEC A and NEC B is also based upon the WHO health criteria, stating *"based on limited data available, a level of* *less than 35 dB(A) L_{eq} is recommended to preserve the restorative process of sleep"*. A level of 30 dB(A) is also recommended in BS8233 for bedrooms.

Table 1 provides an interpretation of the TAN11 NEC categories in terms of granting planning permission.

Table 1: TAN11 NEC categories

NEC category	Description	Noise range $L_{Aeq,T}$ dB
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.	<55 dB(A) daytime (16hr) <45 dB(A) night-time (8hr) Road, rail and mixed sources
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.	55-63 dB(A) daytime (16hr) 45-57 dB(A) night-time (8hr) Road and mixed sources
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.	63-72 dB(A) daytime (16hr) 57-66 dB(A) night-time (8hr) Road and mixed sources
D	Planning permission should normally be refused.	>72 dB(A) daytime (16hr) >66 dB(A) night-time (8hr) Road and mixed sources

In applying these noise exposure categories, TAN11 states:

"where there is a clear need for new residential development in an already noisy area some or all NECs might be increased by up to 3 dB(A) above the recommended levels. In other cases, a reduction of up to 3 dB(A) may be justified."

3.7 World Health Organisation 'Guidelines for Community Noise'

Table 1 of the WHO document *Guidelines for Community Noise* recommends the following limits when assessed in or near to a dwelling to reduce the likelihood of adverse health effects:

i) An upper limit of 50-55 dB $L_{Aeq,(16\ Hour)}$ in outdoor living environments during day and evening periods;

ii) 35 dB $L_{Aeq,\ (16\ Hour)}$ in indoor living areas during day and evening periods; and

iii) 30 dB $L_{Aeq,\ (8\ Hour)}$ in bedrooms during the night time period.

3.8 **British Standard 4142:2014** describes a method for rating and assessing sound levels of an industrial and/or commercial nature, and the effects the sound may have on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

3.9 The sound from the industrial/commercial source is rated by taking into account the sound level of the source, known as the specific sound level, and its characteristics, such as tonal, impulsive or intermittency of the source, and applying an appropriate correction or penalty to give the rating level of the sound source. To gain an initial estimate of the potential impacts of the sound source, its rating level is compared to the background sound level, and the level by which it exceeds the background sound level indicates the following potential impacts:

a) Typically, the greater this difference, the greater the magnitude of the impact.
b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
d) The lower the rating level is relative to the measured background sound level; the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

3.10. Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

In terms of establishing the rating level, corrections for the noise character has to be taken into consideration. These include the following factors:

3.11. ***Tonality***

For sound ranging from “not tonal” to “prominently tonal” penalty levels of between 0 dB and +6 dB for tonality can be applied. Subjectively, this can be conceded to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

3.12. ***Impulsivity***

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be conceded to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

3.13. ***Other sound characteristics***

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

3.14. ***Intermittency***

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

3.15 **British Standard 8233:2014 *Sound Insulation and Noise Reduction for Buildings*** states criteria for continuous noise of 30 dB to 35 dB $L_{Aeq,T}$ for bedrooms and 30 dB to 40 dB $L_{Aeq,T}$ for living rooms. In gardens and on balconies etc., it is desirable that the steady noise level does not exceed 50 dB $L_{Aeq,T}$ and 55 dB $L_{Aeq,T}$ should be regarded as the upper limit. Allowing for a 15dB reduction for open window as suggested by BS 8233 and the WHO guidelines, this indicates that external levels of no more than 45dB $L_{Aeq,T}$ will ensure that the guideline values can be met in any receptor bedrooms and living areas surrounding the development site.

Construction Noise

3.16. **British Standard 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1: Noise.** This document provides recommendations for basic methods of noise and vibration control relating to construction and open sites where work activities/operations generate significant noise and/or vibration levels. The legislative background to noise and vibration control is described and recommendations are given regarding procedures for the establishment of effective liaison between developers, site operators and local authorities. This British Standard provides guidance on methods of predicting and measuring noise and assessing its impact on those exposed to it.

3.17 Hanson Cement has provided an estimate on the expected plant in operation and the expected timescales for the demolition and construction period. The noise levels have been assessed at the closest receptors against the recommendations given in BS5228:2009 +A1 2014, as follows:

- Civils: 20 men peak for 1 month in 3 months (1 month ahead of mechanical) (September 2017- Dec 2017);
- Mechanical: 30 men peak, for 9 months reducing to completion (Jan 2018 – Sep 2018); and
- Electrical: 20 men peak for 4 months, 2 months behind mechanical including help with pre-commissioning (July 2018- Nov 2018).

Maximum peak loading for personnel 70 men for 4 months decreasing towards the end of installation:

- Deliveries: 4 deliveries/day, 5 days/week, each month for 3 months;

- Demolition Plant: 1 x 72 Tonne Giraffe, 3 x Excavators, 3 x Lorries for 2 weeks during civil construction; and

- Installation Plant: 4 x Mobile Cranes, 4 x Cherry Pickers, 2 x Sky Jacks, 2 x 15 KVA Generators & Bunded Fuel Tanks c/ deliveries for 6 months.

The predicted noise levels at the closest receptors using demolition and construction phase equipment has been modelled using the above information.

4.0 Noise Measurements

Padeswood Measurements

4.1 Measurements were repeated at the noise sensitive receptors previously monitored between 2007 and 2013 for PPC and planning purposes. The aim was to re-assess the noise levels at these locations and compare the levels with previously collected data. If the data was similar to the historical data then it could be assumed that the noise levels from the cement works has not changed in terms of decibel levels measured at these locations. The sites were visited on 28th February 2017 for the night measurements and 10th March 2017 for the day measurements. All the locations could not be completed on both visits due to changes in weather conditions. Some measurement positions were reduced from 60 minutes to 30 minutes so data could be collected from more locations before weather prevented further measurements being taken. The 30 minute measurement was a representative measurement period to give an accurate L_{Aeq} and L_{A90} figure for the measurement point. Night measurements were 15 minute measurements.

4.2 During the measurements the weather conditions were dry and cool with very light variable winds at ground level. The general wind direction was from the west. Wind speed and direction data was collected. The measurements were made at the locations shown in Figure 2.

Figure 2: Noise Monitoring Locations

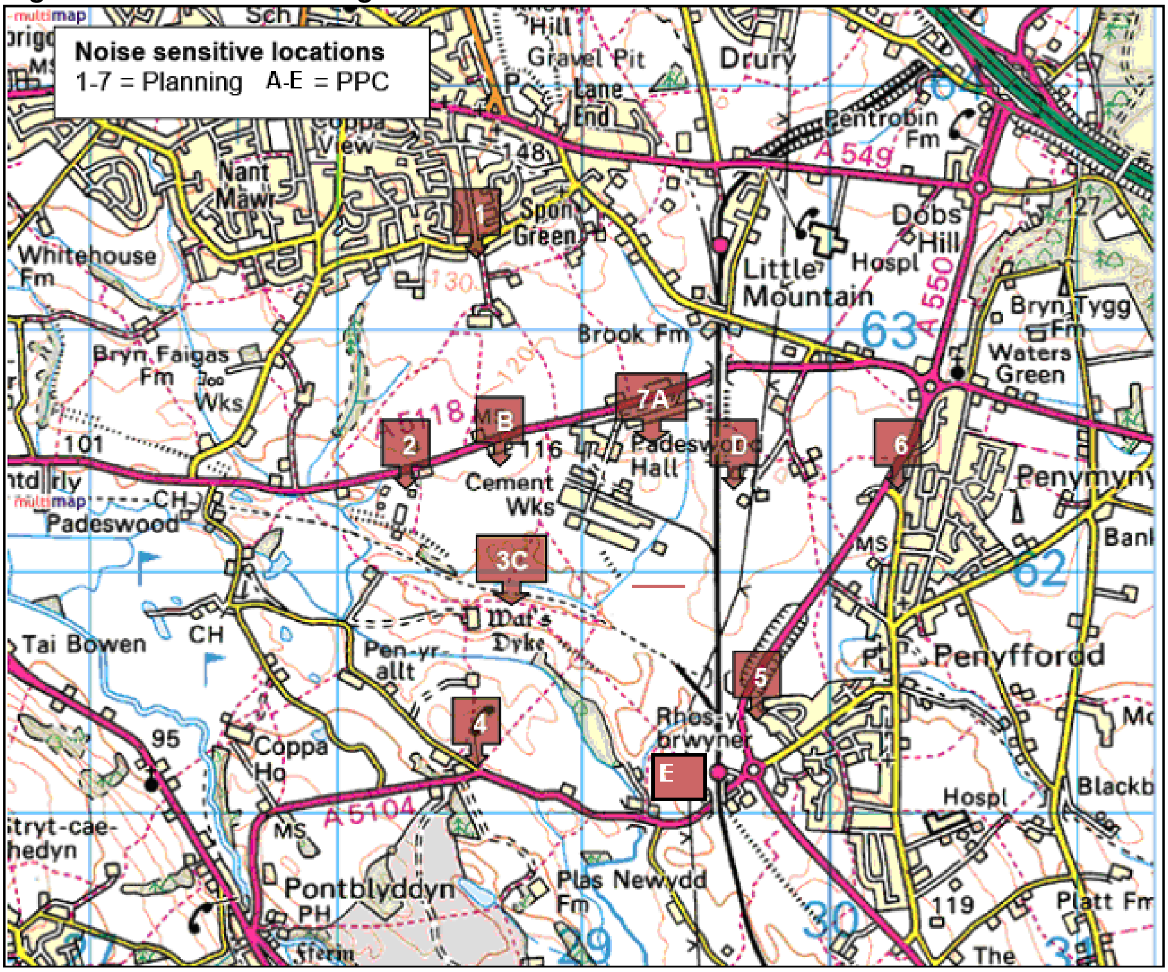


Table 2: Noise Monitoring Location Results February – March 2017

Receptor ID	Location Description	*Day* L_{Aeq}	*Day* L_{A90}	*Night* L_{Aeq}	*Night* L_{A90}
1	Spon Green	62	43	-	-
2	Ty Gwyn	67	47	-	-
3C	Dyke Farm*	42	34	28	26
4	Toll Bar Cottage	58	41	46	31
5	Penyffordd Play Area	51	46	41	37
6	Hawarden Road Lay-by	-	-	48	37
7A	Padeswood Sports Ground	-	-	43	40
B	Oak Tree Farm (West)	69	47	42	40
D	Oak Tree Farm (East)	54	46	43	41
E	Penyffordd Station Car park	59	44	-	-

*Measured at gate entrance

4.3 The main background noise was from local and distant road traffic with occasional aircraft. The main intermittent noise was from occasional passing vehicles which temporarily increased the otherwise stable background level. The works was just audible at downwind measurement locations in lulls in traffic noise levels.

4.4 The 2017 measured L_{A90} levels in Table 2 were found to be similar to the historical measurements taken between 2007 and 2013. No significant change in the general background L_{A90} noise levels from the Cement Works has be seen between 2009 and 2017. As an example the data in Figures 3 and 4 show the noise levels at the receptor locations taken during the monthly monitoring during 2009. The fluctuation seen in noise levels between months is generally dependent on wind direction and the general level of background traffic noise in the area or local traffic and activities.

4.5 The Cement Works noise was modelled in 2009 to reflect the existing situation at receptor locations. Measurements were taken around the Cement Works and the major noise sources were used in the 2009 model. On the basis of the 2017 measurements this model was considered to represent the current situation and was used as the template for assessing any impact from the VRM and rail loading facility. Worst case scenarios have been compared.

Figure 3: L_{A90} data from 2009 daytime levels

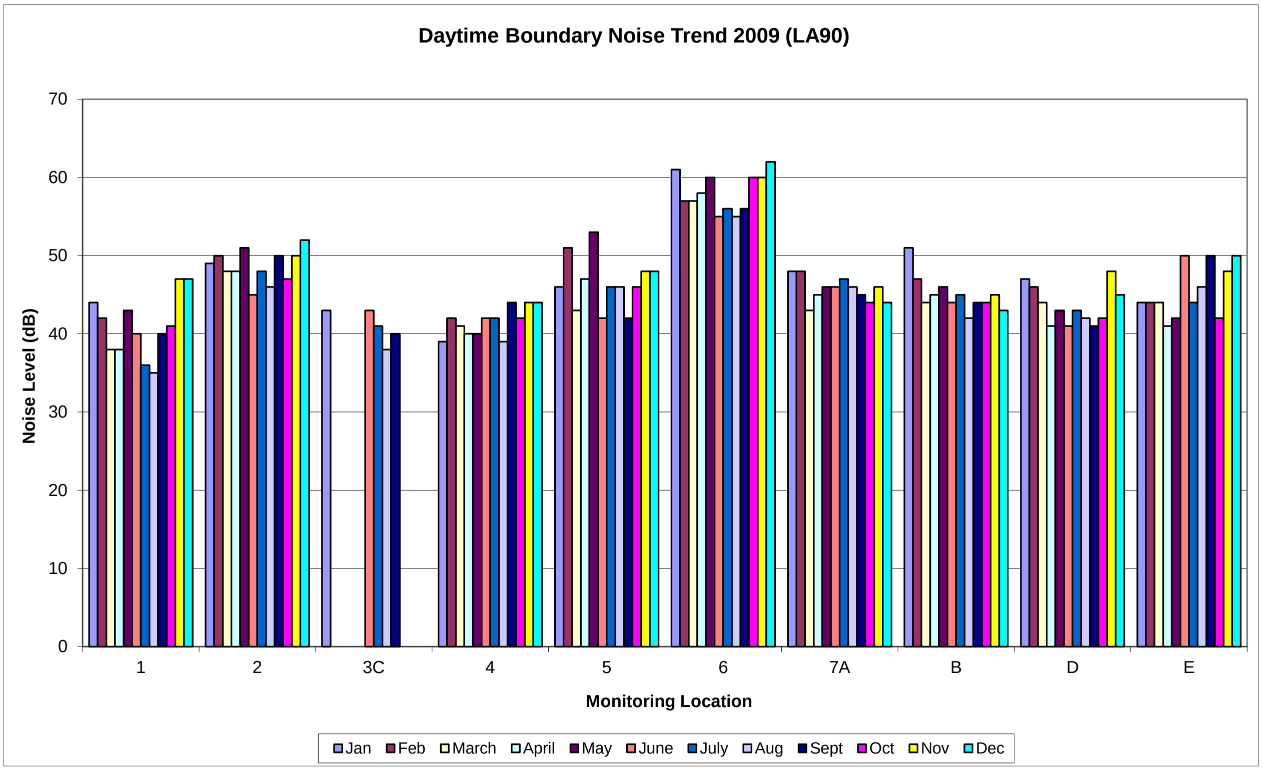
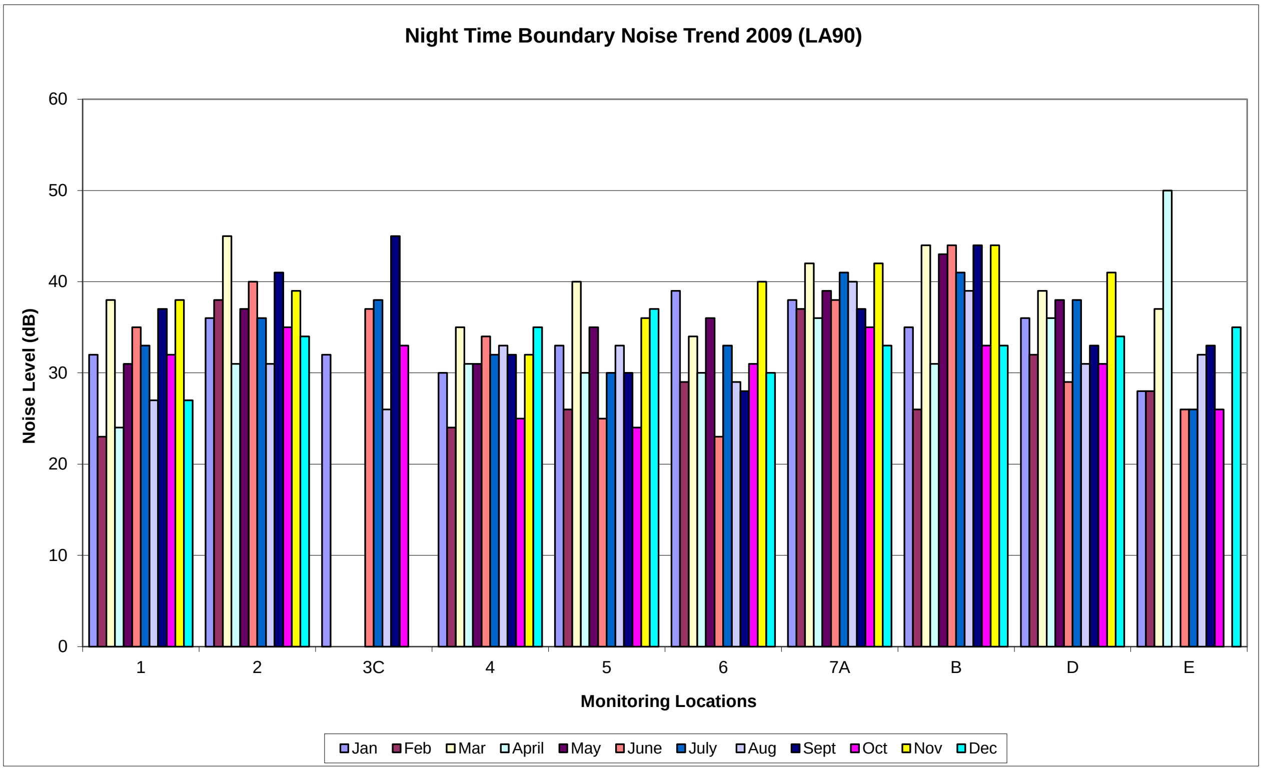


Figure 4: L_{A90} data from 2009 night time levels



Ketton Measurements

4.6 Hanson Cement's Ketton Cement Works has a rail link into the site. The site was visited on the 13th March 2017 and measurements of train movements and loading were monitored.

Table 3: Measurements taken from Ketton rail activity

Ketton measurement locations	dB LAeq
Train stationary loading rear of loco@3m	76.5
Train moving position @3m	74
Train pass with load	88
Train pass empty	87
Train moving position in loading bay@30m	59

4.7 The noise levels from loading product were found to be low, the main source of noise is from the locomotive engine in tick over during loading and when the train is moved to locate the carriage under the hopper.

Purfleet Measurements

4.8 Hanson Cement has an identical VRM in operation, of similar construction, at the company's Purfleet Works. This VRM is used to mill slag from the steel industry and is located in an industrial area close to the M25 Dartford Tunnel entrance. The Purfleet site was visited on 22nd February 2017. Noise levels were assessed inside building during operation. Measured internal noise levels around the mill building were found to be between 85 -95 dBA.

Table 4: Measurements taken around Purfleet VRM

Purfleet measurements	L_{Aeq}
loading silo	77.7
Roller shutter doors 1m outside	77
Air extraction 1m	90.1
Electrical air extraction @1m	81.8
Edge of road conveyor entrance side of building@ 10m	70.5
Outside small roller shutter door exit shoot @1m	78.6
Elevator side of building in compound	72.4
@ motor next to shutter door	91.7
Mill motor @1m	95
Ground floor hydraulics	91.4
Under roller mill@1m	94.3
Inside @ large roller shutters	89.2
Under roller of mill @1m	93.9
Ground level mill conveyor	89.1
Ground level mill conveyor	88.3
Gas burner	86.8
Middle levels stairs	86.8
Bag filter floor centre	82
Upper floor above mill	85.5
Upper floor conveyor	83.6
Conveyor in	84.6
Mill from conveyor in platform	86.8
1m from mill middle height	90.4
1m from louvers outside	78.4
Compressor room	81.8
Mill fan/motor room	81.6
Top of silos	73
Stack exit Platform @3m	70.7

5.0 Noise Predictions

5.1 Predictions of the noise from the operation of the VRM have been carried out using CadnaA noise modelling computer program based on ISO9613.

5.2 In order to provide an assessment of the worst case operational conditions, CadnaA model has been used to predict noise levels from the Cement Works with the VRM and mills 1, 2 and 3 being operational. All plant items have been assumed to operate 24 hours a day. It is understood that train movements will operate over an 8 hour period with four visits per week. The measured data from the Purfleet Works and Ketton Works has been utilised in the model.

5.3 The noise sources on the Cement Works were measured in 2009 and a CadnaA model was produced. The measured levels in 2017 confirmed that this model was still valid and represents the existing background noise level with the Cement Works operational at receptor locations. The output of this model has been used as the background noise level in this assessment. As the works operates continuously, so comparison with 'site off L_{90} levels', to assess the impact of the addition of the VRM are not thought appropriate. To provide a worst case comparison, the model outputs from the existing situation with cement mills 1, 2, 3 and 4 running were compared against the situation in which the VRM is operational together with mills 1, 2, and 3 running. An additional model with the works and VRM only was also modelled.

5.4 The modelled data and levels difference against operational background are provided in Table 15. Additional receptors have been added to the model to give facade levels at the rear of the properties on Padeswood Drive and are labelled as blocks 1–6. Padeswood Drive receptor points 1-6 represent the centre rear facade of each block of houses, location 1 being the closest to the entrance to the works and numbered sequentially.

5.5 The 2009 model used site measured levels to calculate sound power levels of sources at a known distance from the effective acoustic centre of a source. If uniform hemispherical spreading is assumed, then the sound power can be calculated. Difficulties arise in determining the location of the effective acoustic centre as measurements can be affected by background noise. These problems can be reduced by making measurements at several distances back from a source. This was done in this case. Sound power levels were determined by assuming hemispherical spreading and making assumptions about: background noise; effective extra distance to centre of source; and height of source. A prediction of the sound power was made for each measurement, and then the assumed values for background noise, effective extra distance to centre of source, and height of source were adjusted, within realistic limits, to minimise the variance between predictions.

5.6 All significant noise sources are represented in the CadnaA, data and was checked against measured data taken around the Cement Works where possible. For this type of plant, sources can be either point sources or area sources representing fans, stack exits, and walls/roofs of buildings containing plant. The local ground has been assumed to be non-absorbing, to represent a worst case. Topographic data has also been utilised in the model with the addition of the landfill mound. The latest site layout and building heights have been used within the model. Other buildings surrounding the site will potentially screen noise from the areas beyond and have also been added to the model. Their layout has been taken from up-to-date plans and plans provided by Hanson Cement. Their position and layout is indicated on the plots in Appendix 4.

5.7 ISO9613 recommends that directionality of vertical sources be taken into account. To represent a worst case, a 3dB directionality correction has been added to noise emissions from vertical area sources.

5.8 From the noise measurements taken at the Purfleet Works, a good estimate can be made of the likely internal reverberant noise levels in the new VRM buildings. The logarithmic sum of the noise levels measured from plant items within each building have been used to represent the worst case reverberant internal noise levels. Where external noise levels are known at 1m distances, virtual receptors have been used in the CadnaA model and the sound power of the facades adjusted to provide the appropriate external figure. An appropriate sound power figure has then been calculated with CadnaA that is necessary to generate this sound pressure level.

5.9 Estimates based on typical manufacturers' attenuation data have been necessary for the external cladding to be used on the VRM buildings. The existing cladding on the VRM buildings is to be reused. The specification of the panel is 0.6mm PL40/250 but no R_w value for the panel was available. An estimation of the panel R_w value has been made. An example of a typical panel used in this type of construction is provided in Table 5.

5.10 The sound insulation of typical panels used to construct industrial buildings is available from the Kingspan guide. For the purposes of the model an R_w of 25dB has been assumed for the wall panels and roof panels on the mill buildings. It has been assumed that any doors, including roller shutter doors will have a sound reduction R_w of 20dB, and that the door will be kept closed when not in use. An area of 20m2 on the north facing facade of the VRM has been allocated as doorways.

5.11 Two elevated point sources have been used to represent extraction vents in the north and south facade, line sources have also been included for the conveyors. The silo tops also have had point sources added to represent any fans/motors.

Table 5: Information on sound attenuation of available wall and roof panels

Frequency Hz	**Sound reduction index dB**
	KS1000 RW/80 + no lining
31.5	14
63	20
125	18
250	20
500	24
1000	20
2000	29
4000	39
8000	47
R_w	25

6.0 Vehicle Movements

6.1 The traffic assessment for the development site indicates that overall there will be a reduction in vehicle movements in 2018 on the access roads with the VRM in operation, 323 trips/day for the existing operations and 292 trips/day for the new development. This represents a 10% reduction. There will also be no significant change in the composition of the vehicles accessing the site which will continue to be mainly HGVs. The access routes and speed limits will continue to be the same. An increase or decrease of traffic flow by 25% equates to a 1dB(A) change in noise level. A 1dB(A) change is barely perceptible and as the expected change is well below 25% there will be no perceptible change in the noise level from the movement of HGV operations and no further assessment is required.

7.0 Train Movements

7.1 The information gathered at Hanson Cement's Ketton Works during train loading activities has been used in the model. The train has been entered as a slow moving line source over an eight hour loading period to represent the worst case loading visit.

8.0 Construction and Demolition Noise

8.1 The CadnaA noise model was used to assess the noise levels for the construction and demolition activities. These were calculated using the methods and guidance in BS 5228-1:2009+A1:2014. This Standard provides methods for predicting receptor noise levels from construction works based on the number and type of construction plant and activities operating on site, with corrections to account for:

- the 'on-time' of the plant, as a percentage of the assessment period;
- distance from source to receptor;
- acoustic screening by barriers, buildings or topography; and
- ground type.

8.2 Source noise levels for each piece of plant equipment operating were used as the basis for the calculation and were derived from Annex C and D of BS 5228-1:2009+A1:2014.

The typical noise emissions, derived from BS 5228-1:2009+A1:2014 were used for the noise assessment and presented in Table 6 and Table 7. Plant percentage on-times have been assumed and presented as a worst case scenario in terms of the potential to generate noise.

The following assumptions were made:

- general construction activities would take place between 08:00 and 19:00, Monday to Friday; and 08:00 to 13:00 Saturday
- all ground was assumed to have an absorption factor of 0.6
- a percentage 'on-time' for all plant was assumed
- all noise sources were modelled as point sources

8.3 The CadnaA propagation calculation methodologies take into account distance attenuation, barriers and ground absorption and the latter also takes into account air absorption, topographical screening effects from source to receptor. The model incorporated noise sources located in the proposed scheme area, and intervening ground cover and topographical information.

Table 6: List of demolition plant

Demolition Stage	Plant / Activity	BS5228 Reference	Number	Noise level *(dB L_{Aeq} at 10m)*	On-time *(%)*
General Demolition	72t Giraffe	C.4.39	1	77	70
	Excavator	C.2.2	3	77	70
	Dump Truck	C.2.26	3	79	50

Table 7: List of construction plant

Construction Stage	Plant / Activity	BS5228 Reference	Number	Noise level *(dB L_{Aeq} at 10m)*	On-time *(%)*
Excavation and general construction	Mobile Crane	C.4.39	4	77	70
	Cherry pickers	C.4.54	4	79	50
	Dump Truck visit	C.2.26	1	79	10
	Sky Jacks	C.4.59	2	78	50
	15 KvA Generators	C.4.28	2	65	100

8.4 The predicted construction noise levels were assessed against noise limits derived from advice within Annex E of BS 5228-1:2009+A1:2014. The Standard details the “ABC method”, which specifies a construction noise limit based on the existing ambient noise level.

Table 8, reproduced from BS 5228-1:2009+A1:2014, demonstrates the criteria for selection of a noise limit for a specific receptor location.

Table 8: Construction Noise Threshold Levels Based on the ABC Method (BS5228)

Assessment category and threshold value period (L_{Aeq})	**Threshold value, in decibels (dB)**		
	Category A[A)]	**Category B[B)]**	**Category C[C)]**
Evening and weekends [D)]	55	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00 - 13.00)	65	70	75
[A)] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.			
[B)] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.			
[C)] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			
[D)] 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.			

The closest residential receptors, or groups of residential receptors, to the proposed construction works were assessed. The results are shown below in Table 9.

Table 9: Construction Noise Receptor Locations and Derived Threshold Category

Receptor Identifier	**Description**	**BS5228 Threshold Category Daytime (dB Level)**
7A	Padeswood Drive	A (65)
D	Oak Tree Farm East	A (65)
B	Oak Tree Farm West	A (65)

The criteria for assessing the significance of predicted noise impacts in relation to the above ABC construction noise thresholds, is detailed in Table 10.

Table 10: Daytime Construction Noise Significance Criteria (Residential)

Construction noise level (dB)			**Predicted impact**
A 65dB threshold	**B 70dB threshold**	**C 75dB threshold**	
≤ 65	≤70	≤ 75	No Impact
66 – 68	71 – 73	76 – 78	Very low
69 – 71	74 – 76	79 – 81	Low
72 – 74	77 – 79	82 – 84	Medium
≥ 75	≥ 80	≥ 85	High

8.5 The subsequent thresholds for varying degrees of impact are defined for each category; A, B or C. The thresholds for change between the significance levels were determined on the basis that the smallest perceptible change in environmental noise is typically 3dB, and that a change of 10dB typically relates to a subjective doubling or halving of the apparent loudness of a noise source.

8.6 The levels of construction-related HGV traffic are unlikely to be at levels where there will be a significant increase to noise levels. Over a 50 week construction period 5 HGV trips per week are expected. This will have little impact on noise levels from the works. Any potential noise generated by construction and HGV movements should be addressed and mitigated through the scheme Construction Environmental Management Plan (CEMP).

9.0 Impact assessment

9.1 Construction noise

9.1.1 Tables 11 and 12 present the calculated construction noise level at receiver floor level and provides a comparison between the calculated level and the BS 5228-1:2009+A1:2014 construction noise limit for the closest receptors. The noise contour plots are available in Appendix 4.

Table 11: Predicted Demolition Noise Impacts

Demolition Activity	Receptor Location	Estimated Distance to nearest construction works (m)	Daytime noise threshold dB $L_{Aeq,}$	Predicted Construction Activity Level at NSR ($L_{Aeq,T}$) (dB)	Daytime Period Impact (Yes/No)
Excavation, and general Demolition	Padeswood Drive	350	65	53	No
	D	400	65	50	No
	B	900	65	50	No

Table 12: Predicted Construction Noise Impacts

Construction Activity	Receptor Location	Estimated Distance to nearest construction works (m)	Daytime noise threshold dB $L_{Aeq,}$	Predicted Construction Activity Level at NSR ($L_{Aeq,T}$) (dB)	Daytime Period Impact (Yes/No)
Excavation, and general construction	Padeswood Drive	350	65	54	No
	D	400	65	50	No
	B	900	65	48	No

9.2 BS 4142:2014

9.2.1 In relation to BS 4142:2014 the predicted noise from the VRM has been assessed against general production background noise levels. The proposed development site is considered and our opinion on noise character is provided below:

- For the background noise level in this assessment, the existing noise level with the Cement Works operational has been used as the Cement Works operates continuously. The background level has been taken from a model that represents the worst case existing situation with the Cement Works in production and cement mills 1, 2, 3 and 4 operational. This allows the assessment to compare the existing situation and any increase in noise level from the addition of the VRM to the model at each receiver location.
- In terms of tonality, the plant that is likely to contain this type of characteristic would be the large fans inside the VRM building. These sources are located inside the building so any external impact of any tones will be limited - it is also noted that no significant tones were observed during the measurements at the similar VRM at the Purfleet Works. Any ventilation fans for cooling electrical switch rooms or venting from the VRM buildings also have potential to be tonal in nature. As cement mills 1, 2 and 4 will be mothballed three potential sources with tonal characteristics will be removed so the impact from the general tonal output from the works will be reduced. Taking into account the location of the VRM and the impact from other operational areas on the Cement Works, the resultant noise contribution from tonal noise sources from the VRM and Cement works, relative to the background noise level, would be expected to be audible at the nearest receptor. A tonal penalty correction should be applied in this case.
- The changes in to BS4142 in 2014 allow a variable tonal penalty to be used depending on the relative impact of the works to the receptor. Tonal penalty values of between +2dB and +6dB can be applied depending on the relative impact. In this case a +4dB tonal penalty correction has been applied to the closest receptors and +2dB penalty to distant receptors. The lower penalties reflect the reduction in tonal sources due to the relative distance from the Cement Works/mills.
- In terms of impulsivity characteristics the VRM when operational has low level impulsivity and generally constant sound level. Any impulsivity would relate to occasional vehicle movements external to the building. Taking into consideration the operational noise contribution at the nearest receptors, measured site boundary L_{Amax} levels and residual noise from road traffic during daytime and night periods we would expect this characteristic to be occasionally just perceptible and not discernible over road traffic in the area so no penalty has been applied.
- In terms of intermittency the only likely intermittent activity on site is likely to be external offloading and loading, mobile plant and HGV movements. Taking into account the predicted noise contribution relative to the residual noise levels we would anticipate that the intermittency is unlikely to be distinctive at nearest sensitive receptors due to measured ambient noise levels compared with noise contribution so no additional penalty has been applied.

9.2.2 In conclusion, a tonal penalty of +4dB has been added to the calculated operational VRM noise contribution for receptor locations 7A, D, B and Padeswood Drive. A tonal penalty of +2dB has been applied to all other receptor locations.

9.2.3 In Table 13 the noise levels from the existing situation and the predicted impact of the addition of the VRM are presented. The tonal penalty was added to the VRM predicted values and the difference between the calculated rating level and the existing situation gives the assessment level. The higher the difference between the two values the greater indication of adverse impact.

9.2.4 BS 4142:2014 describes methods for rating and assessing sound of an industrial and/or commercial nature in terms of adverse impact on a noise sensitive receptor. According to BS 4142:2014:

- *"A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context."*
- *"A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context."*
- *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific source having a low impact, depending on the context.*

Table 13: Predicted levels with VRM in place when compared to the existing situation.

Receiver location	Existing Background (Works in Production + cement mills1,2,3,4 operational) (dBA)	VRM (Production + cement mill 1,2,3 and VRM operational) (dBA)	Tonal penalty applied (dBA)	Calculated rating level (tonal penalty applied to VRM) (dBA)	BS4142 assessment level (Existing background - rating level) (dBA)
1	36	36	2	38	+2
2	47	47	2	49	+2
3c	46	46	2	48	+2
4	41	41	2	43	+2
5	44	42	2	44	0
6	34	35	2	37	+3
7A	46	46	4	50	+4
B	45	46	4	50	+5
D	43	44	4	48	+5
E	39	37	2	39	0
Padeswood Drive 5	44	45	4	49	+5

9.2.5 Padeswood Drive receptor points 1-6 represent the centre rear facade of each block of houses, location 1 being the closest to the entrance to the works and numbered sequentially. Padeswood Drive location 5 was chosen as this point showed the highest level difference of 0.9dB. The level difference information can be found in Table 15.

9.2.6 Table 13 indicates that the calculated noise levels from the addition of the VRM have little impact at the receptor locations. Noise levels have increased by <1dBA at receptor locations 6, B, D and Padeswood Drive. Some locations have reduced by 2dBA due to the removal of cement mill 4 as a noise source when the VRM is running. The assessment levels after the tonal penalty is applied are considered to be lower than the level of potential "adverse impact", with guidance of BS 4142 and considering the context of the assessment no discernible difference in noise level will be observed with the VRM in place compared to the existing situation.

9.3 TAN 11

9.3.1 In relation to the VRM operational noise predictions, TAN11 requires the daytime and night time noise exposures to be evaluated (mixed sources category) to be below 55 dB $L_{Aeq16hr}$ for day noise levels and 45dB $L_{Aeq\ 8hr}$ night levels have to be considered for residential planning.

Table 14: TAN11 assessment

Position	Predicted levels with VRM in place $L_{Aeq(16\ hour)}$ (dB)	TAN11 Category
1	36	A
2	47	B
3c	46	B
4	41	A
5	42	A
6	35	A
7A	46	B
B	46	B
D	44	A
E	37	A
Padeswood Drive 5	45	B

9.3.2 Table 14 demonstrates that the receptor locations will fall within TAN11 category A and B during night periods. Category B meaning noise should be taken into account when determining residential planning applications and category A meaning noise may need not be considered as a determining factor in granting residential planning permission. No existing developments would be affected in the vicinity of the works.

9.4 External noise climate

9.4.1 Outdoor recreation areas – private and communal garden areas: The propagated noise associated with the operational facility within the private and communal garden areas at all the receptor locations will achieve the lower limit of 50dBA L_{Aeq} as recommended by the WHO for external amenity spaces.

9.5 Uncertainty

9.5.1 Where possible, uncertainty in this assessment has been minimised. Uncertainty in the calculated impact has been reduced by the use of a calculation method in accordance with ISO 9613-2:1996.

10.0 Mitigation

10.1 No mitigation is required as the addition of the VRM has little impact on the noise levels at the measured receptor locations. Other, more dominant, noise sources on the Cement Works that affect the receptor locations, such as elevated noise sources and extraction fans on buildings that face receptor locations, should continue to be investigated, as part of the routine site noise monitoring and acoustic camera assessments, to identify opportunities for continuous improvement of the noise environment at the Cement Works.

11.0 Summary

11.1 An assessment has been carried out of the potential noise impact from the proposed new VRM (Mill 5) at Hanson Cement's Padeswood Cement Works.

11.2 Measurements of the existing noise levels were measured at the historic planning and PPC receptor locations and were carried out during February and March 2017. The levels were then compared with historic data. The levels measured were within the variance of the historic data from 2007 - 2013; noise levels from the works have not changed significantly at these receptor locations.

11.3 Predictions of noise emitted from the Cement Works was modelled in 2009. This model remains representative of the existing noise levels from the works and gives similar output levels to the measured levels taken in 2017. The new VRM, additional buildings, conveyors and rail line have been added to this model and comparisons between the existing situation and the addition of the VRM have been made.

11.4 Typical sound insulation specifications for the VRM and buildings were used within the model. Wall panels and roof panels with an R_w of 25dB were used and an R_w of 20dB for doorways on the north facade of the main mill building. Point sources were added on the VRM building facades and on the silo tops to represent fans and motors. Line sources were used to represent conveyors and rail lines.

11.5 The BS4142 assessment, based on the comparison between noise predictions, with the existing situation and the addition of the VRM indicates that there will be little impact on nearby residential properties as the increase in noise level from the introduction of the new mill will be less than 1dB at all the receptor positions. Although the noise levels have not increased significantly or at all at some receptors, the Cement Works and VRM has the potential to have tonal sources which may be audible at receptor positions. The mothballing of mills 1, 2 and 4 will reduce the total number of tonal sources from the works, but as the VRM may have audible tonal sources a penalty should still apply. The predicted noise levels with the VRM in place have had a penalty applied, 4dB penalty for the closest receptors to the mill and 2dB for distant receptors. After the penalty has been applied the difference between the existing situation and the proposed VRM gives rating values of +5, +4 and +2dB. The threshold of +5dB is where it is likely to be an indication of an adverse impact. The output of this assessment represents little change to the existing situation. It is thought unlikely that the small increase in dB level at some receptors, and any tonal characteristics from the VRM will be discernible from the existing situation.

11.6 Table 15 provides a comparison of the worst case scenarios between the outputs of the two models .This shows little impact on receptors in terms of dB noise level increase, some receptors have shown a decrease in noise level. The majority of the noise from the new VRM is contained within the boundary of the Cement Works. The highest predicted facade noise levels where an increase is seen with the VRM in place is 45.8dBA at the rear of Padeswood Drive 1. The existing situation with mills 1, 2, 3, and 4 running gives a similar noise level of 45.7dBA. Receptor location Padeswood Drive 5 showed the highest increase of 0.9dBA. The assessment model output levels at receptor locations can be found in Table 15 for comparison. Table 16 shows the receptor levels when only the VRM is operational for comparison.

11.7 The propagated noise associated with the operational facility within the private and communal garden areas at all the receptor locations will achieve the lower limit of 50dBA as recommended by the WHO for external amenity spaces. The recommended facade level of 45dBA to achieve the 30dBA in bedrooms assuming 15 dB reductions from an open window based on the guidance in BS8233 and WHO guidance, is not met at several locations by a small margin. This is not a consequence of the addition of the VRM as existing noise levels are above 45dB.

11.8 The 10% decrease in HGV traffic accessing the works is not significant in regards to noise impact. The decrease would give rise to an imperceptible drop in the $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ levels when compared to the current site situation.

11.9 Construction and demolition phase noise levels were below the noise threshold category A levels at the closest receptor locations.

Table 15: Comparison of assessment model run output levels - worst case example of all available mills running for each scenario

Receptor ID	Location	Existing Background (Production + cement mills1,2,3,4 operational) (dBA)	Existing Background+ VRM (Production + cement mill 1,2,3 and VRM operational) (dBA)	Level difference (dBA)	X Coordinates (m)	Y Coordinates (m)
1	Spon Green	35.8	36.0	0.2	328545	363299
2	Ty Gwyn	46.6	46.5	-0.1	328319	362372
3C	Dyke Farm	46.1	46.0	-0.1	328489	361832
4	Toll Bar Cottage	40.9	40.5	-0.4	328563	361184
5	Penyffordd Play area	43.8	41.9	-1.9	329734	361442
6	Hawarden Road	34.4	34.8	0.4	330305	362434
7A	Sports Ground	45.9	46.3	0.4	329216	362582
B	Oak Tree Farm West	45.3	45.5	0.2	328629	362499
D	Oak Tree Farm East	43.1	43.5	0.4	329675	362352
E	Penyffordd Station	39.1	37.3	-1.8	329555	361097
	Padeswood Drive garden	45.4	45.7	0.3	329199	362593
	Padeswood Drive 1	45.7	45.8	0.1	329184	362638
	Padewsood Drive 2	45.2	45.5	0.3	329216	362648
	Padeswood Drive 3	44.0	44.4	0.4	329256	362661
	Padeswood Drive 4	44.6	45.0	0.4	329286	362673
	Padeswood Drive 5	43.6	44.5	0.9	329316	362681
	Padeswood Drive 6	43.6	44.0	0.4	329346	362691
	Oak Tree Farm East Facard	38.6	37.4	-1.2	329711	362293
	Ash Tree Farm Facard	39.0	39.4	0.4	329781	362664

Padeswood Drive receptor points 1-6 represent the centre rear facade of each block of houses, location 1 being the closest to the entrance to the works and numbered sequentially.

Table 16: Comparison of model output levels between existing background with mills 1-4 running and VRM

Receptor ID	Location	Existing Background (Production + cement mills1,2,3,4 operational) (dBA)	Existing background + VRM only all other mills off(dBA)	Level difference (dBA)	X Coordinates (m)	Y Coordinates (m)
1	Spon Green	35.8	35.9	0.1	328545	363299
2	Ty Gwyn	46.6	40.2	-6.4	328319	362372
3C	Dyke Farm	46.1	45.2	-0.9	328489	361832
4	Toll Bar Cottage	40.9	37.5	-3.4	328563	361184
5	Penyffordd Play area	43.8	38.9	-4.9	329734	361442
6	Hawarden Road	34.4	34.6	0.2	330305	362434
7A	Sports Ground	45.9	46.2	0.3	329216	362582
B	Oak Tree Farm West	45.3	44.7	-0.6	328629	362499
D	Oak Tree Farm East	43.1	43.3	0.2	329675	362352
E	Penyffordd Station	39.1	34.5	-4.6	329555	361097
	Padeswood Drive garden	45.4	45.6	0.2	329199	362593
	Padeswood Drive 1	45.7	45.7	0.0	329184	362638
	Padewsood Drive 2	45.2	45.4	0.2	329216	362648
	Padeswood Drive 3	44.0	44.3	0.3	329256	362661
	Padeswood Drive 4	44.6	44.9	0.3	329286	362673
	Padeswood Drive 5	43.6	44.4	0.8	329316	362681
	Padeswood Drive 6	43.6	43.9	0.3	329346	362691
	Oak Tree Farm East Facard	38.6	36.9	-1.7	329711	362293
	Ash Tree Farm Facard	39.0	39.3	0.3	329781	362664

11.10 The noise assessment has used the worst case situations with all available cement mills operational to assess the noise impact at receptors. This scenario with all mills running simultaneously is unlikely during normal operations. The VRM is likely to be the only mill in operation for the majority of the time. The noise levels expected at receptor locations with the VRM only have been provided in Table 16.The noise levels are lower at all the receptors than the predicted worst case scenario and at some receptors a significant reduction in noise levels is seen due to the removal of the noise sources from cement mills 1 to 4.

Appendix 1 Acoustic terminology

1. Sound Pressure Level (L_p)

The basic unit of sound measurement is the sound pressure level, based on pressure measurement. As the pressures to which the human ear responds can range from 20 mPa to 200 Pa, a linear measurement of sound levels would involve very large numbers. To avoid this, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$$L_p = 20 \log (p/p_0)$$

where L_p = sound pressure level in dB; p = rms sound pressure level; and p_0 = reference sound pressure (20 mPa).

2. Sound Level (L_{pA})

Sound level is the value measured with a sound level meter which incorporates frequency weighting networks. These attenuate the signal at some frequencies and amplify it at others. Sound levels measured with the A-weighting network are expressed in dB(A). The A-weighting network approximately corresponds to the frequency response of the human ear.

3. Sound Power Level (L_W)

The sound power level of a source is an absolute measure of the sound output, but it cannot be measured directly. It is usually calculated from a sound pressure level and the distance from the source at which that sound pressure level is measured. For sound radiating uniformly and hemispherically from a point source on a flat reflecting surface, the equation is:

$$L_W = L_p + 20 \log r + 8$$

where L_W = sound power level in dB re 10^{-12} W; and L_p = sound pressure level in dB re 20 mPa at a distance r metres from the source.

4. Equivalent Continuous Sound Level (L_{Aeq})

Sound levels invariably fluctuate. A summation can be made of the sound energy in the fluctuating sound and a steady level of the same total energy calculated. This steady level is termed the equivalent continuous sound level. L_{Aeq} can be determined over any time period, which is indicated as $L_{Aeq,T}$ where T is the time period (e.g.$L_{Aeq,1\ hour}$, $L_{Aeq,12\ hour}$, etc.).

In mathematical terms, L_{Aeq} is given by:

$$L_{Aeq} = 10 \log \left\{ \frac{1}{T} \int_{t=0}^{t=T} \left(\frac{p_A(t)}{p_0} \right)^2 dt \right\}$$

where L_{Aeq} = equivalent continuous sound level in dB over a time period T; $p_A(t)$ = instantaneous sound pressure in Pa varying with time t; and p_0 = reference sound pressure (20 mPa).

5. Background Noise ($L_{A90,T}$)

Background noise is the measured noise level exceeded for 90% of the time over the specified period T. It is the basic noise level in a locality and does not include the effects of short duration noise.

6. Ambient Noise ($L_{Aeq,T}$)

Ambient noise is a measure of the average noise level over the specified time period T and include contributions of all noise sources.

7. Maximum Noise (L_{Amax})

This is the highest A-weighted sound pressure level recorded by the sound level meter during the measurement period.

8. Level Exceeded for 10% of the Time ($L_{A10,T}$)

This is a measure of the higher noise levels to which a locality is exposed during time T. The noise produced from road traffic is generally expressed in terms of $L_{A10,18\ hour}$.

9. Sound Exposure Level (SEL or L_{AE})

This is the energy produced by a discrete noise event averaged over one second no matter how long the event actually took. This allows for comparisons to be made between different noise events which occur for different lengths of time.

In mathematical terms, L_{AE} is given by:

$$L_{AE} = 10 \log \left\{ \frac{1}{T_0} \int_{t=0}^{t=T} \left(\frac{p_A(t)}{p_0} \right)^2 dt \right\}$$

where L_{AE} = sound exposure level in dB;
$P_A(t)$ = instantaneous sound pressure in Pa varying with time t;
T = time interval long enough to encompass all significant sound energy
P_O = reference sound pressure (20 µPa);
T_O = reference duration (1 second).

The equivalent continuous A-weighted sound pressure level can be calculated for a series of events over a given time period as follows:

$L_{Aeq,T} = L_{AE} + 10 \log N - 10 \log T$

where N = number of events during time T;
T = time period in second.

Appendix 2 Equipment used

Sound Level Meter:	Bruel & Kjaer Hand Held Analyzer Type 2250
Conforms to:	IEC 60651 (1979) Type 1
	IEC 60804 (2000) Type 1
	IEC 61260 (1995) Octave & ⅓ Octave Bands
Serial no.	2590535
UKAS Calibration Date:	Oct 2016
UKAS Calibration Due:	Oct 2018
Calibrator:	Bruel & Kjaer 4231
Conforms to:	IEC 942 (1988) Class 1
Serial No.:	2518040
UKAS Calibration Date:	Oct 2016
UKAS Calibration Due:	Oct 2017

Appendix 3 Model input data

Traffic and Train data

	2016 actual		2018 without mill 5		2018 with mill 5	
	Annual	Daily	Annual	Daily	Annual	Daily
Total raw material movements	45183	162	59268	213	59268	213
TotalProduct movements	21898	84	28892	111	20369	78
Train movements					175	
Total movements	67081	246	88160	324	79812	291

Reduction in daily rd movements	33
Reduction in annual road movements	8523
Additional Annual Rail movenents	175

Point sources	Result. PWL	Coordinates	
		X	Y
	(dBA)	(m)	(m)
Fan top pre heater tower	104.8	329048.22	362063.52
ID Fan	99.2	329036.25	362067.08
Bag Filter Plant top cement mill 3	91.5	329207.59	362180.16
Heat Exchanger Cooler Fan 2	104.2	329131.16	362053.09
Heat Exchanger Cooler Fan 3	104.2	329131.15	362053.06
heat exchanger cooler fan 1	104.2	329131.17	362053.11
clinker tower fan outlet	104.2	329250.48	362156.95
Kiln Seal Fan	105	329112.42	362048.45
Bag Filter Plant	95.5	329051.95	362038.8
Mill 3 stack	88	329214.03	362179.22
Raw Mill Silo ground level Fan	93.9	329000.14	362145.65
Raw Mill Silo Elevator drives	89.4	329027.63	362135.83
Heat Exchanger ground floor fan	90.4	329136.88	362073.6
Kiln Drive Gear	102.2	329077.78	362054.22
Vibration plate	103.1	329001.04	362144.81
Raw Mill Fan FN31	87.9	329022.05	362137.42
Bypass Blower screw drive	93	329053.5	362108.49
VRM 5 stack exit	73.8	329200.17	362295.19
VRM5 fan	91.8	329221.48	362308.08
VRM5 fan	91.8	329206.5	362290.69
VRM5 fan	91.8	329162.09	362287.61
VRM5 fan	91.8	329158.98	362279
VRM5 fan	91.8	329172.47	362284.42
VRM5 fan	91.8	329170.88	362274.64
VRM5 fan	91.8	329183.05	362267.1
mill 1stack	73.8	329193.04	362192.41
mill 2stack	73.8	329177.15	362198.57
mill 4stack	73.8	329239.03	362180.95

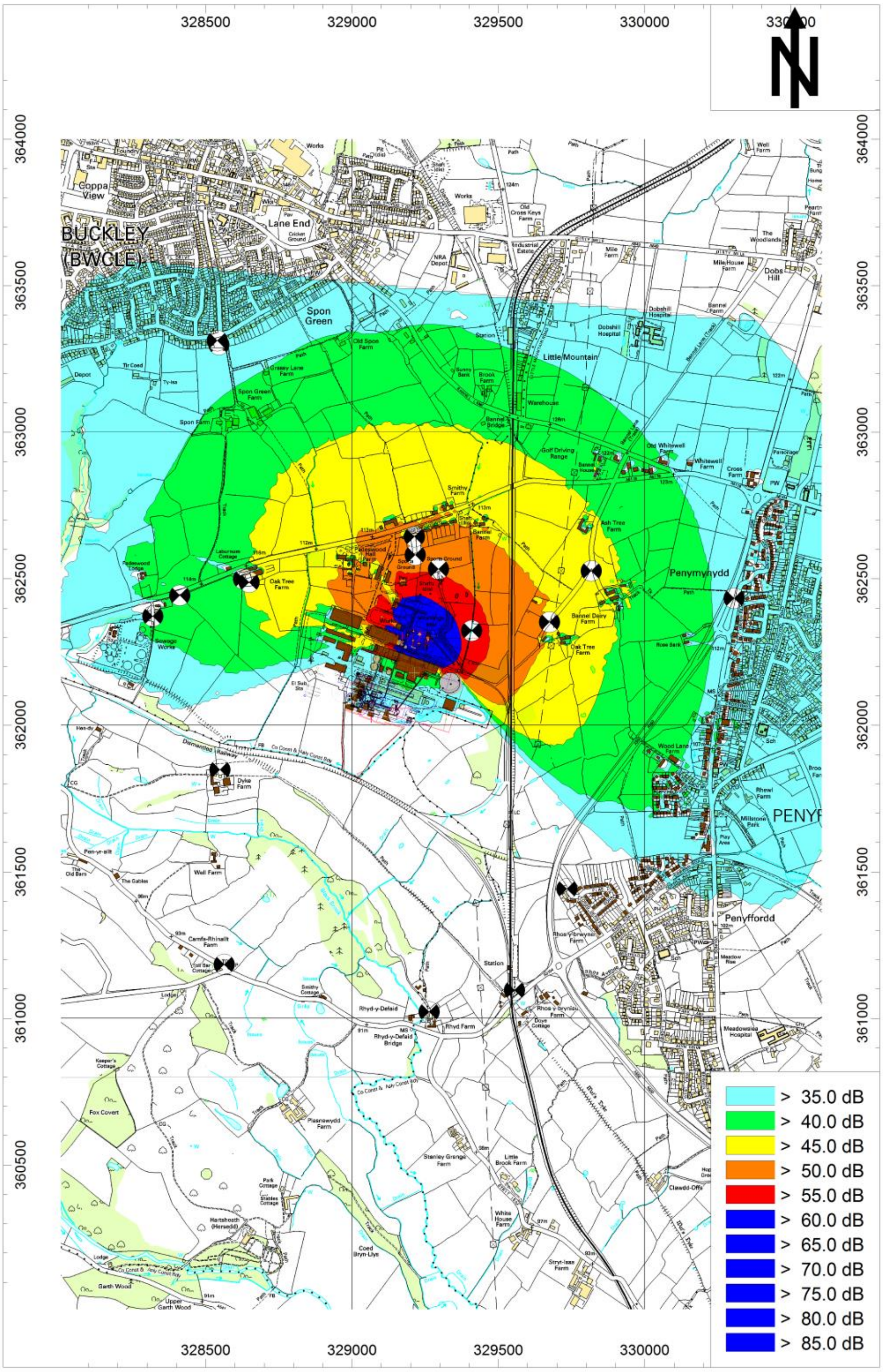
Vertical area source	Result. PWL (dBA)
Cement Mill 1-3 bldg	113.6
Cement Mill 4 Bldg	111.6
Raw mill bldg outside	110.3
Coal Mill bldg outside	92.5
Limestone Intake	87.1
Raw Mill Fan cladding	97.3
Packing bay fan new	107.7
Mill 3 door	113.5
Acoustic louvres	102.8
Silo 6 filter fan	104
Mill4	104
Bag Filter Plant	113.4
VRM mill 5 building	92.6
VRM mill 5 building	93
VRM mill 5 building	92.6
VRM mill 5 building	81.9
VRM mill 5 building	84
VRM mill 5 building	77
VRM mill 5 building	78.1
VRM mill 5 building	77
VRM doorways	83
train loading silo building	70.3
train loading silo building	64.8
train loading silo building	64.7
train loading silo building	70.7
train loading silo building	68.3
train loading silo building	66.2
train loading silo building	62.2
bucket elevator silo 6	62.6
bucket elevator silo 6	62
bucket elevator silo 6	62.1
cm4 storage	61.3
bucket elevator silo 6	60.4
cm4 storage	64
cm4 storage	66.2

Line source	Result. PWL
	(dBA)
Kiln 4 drive	110.6
VRM conveyor	81.6
VRM conveyor	83.6
VRM conveyor	84.5
VRM conveyor	82.6
train line	94.6
VRM conveyor	83.5

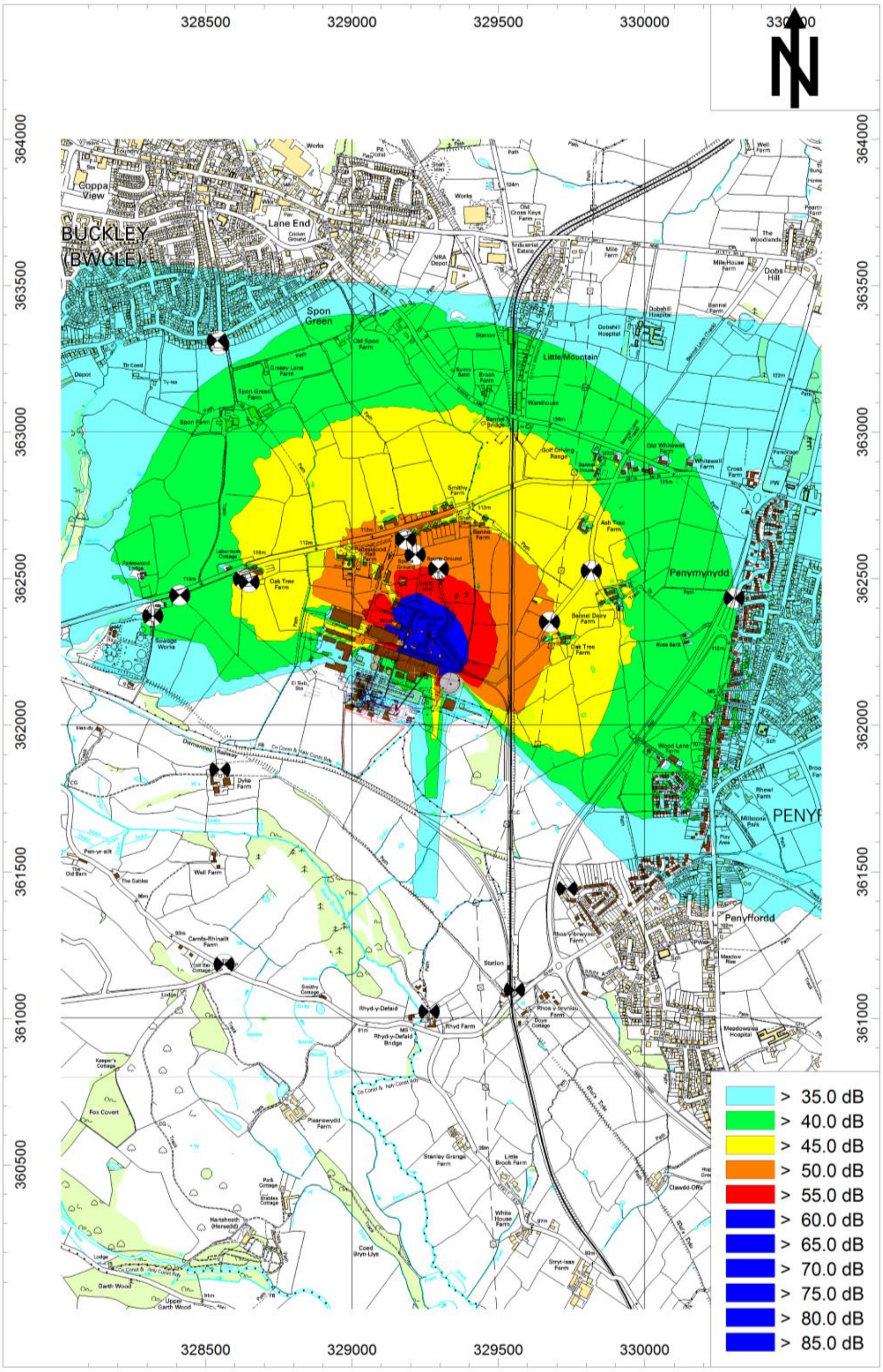
Area sources	Result. PWL
	(dBA)
mill 5	84.2
mill 5	81.3
mill 5	79.2
train loading silo	67.9
bucket elevator	50.8
cm4 storage	59.4

Appendix 4 CadnaA Predicted Noise Level Contour Plots

Construction

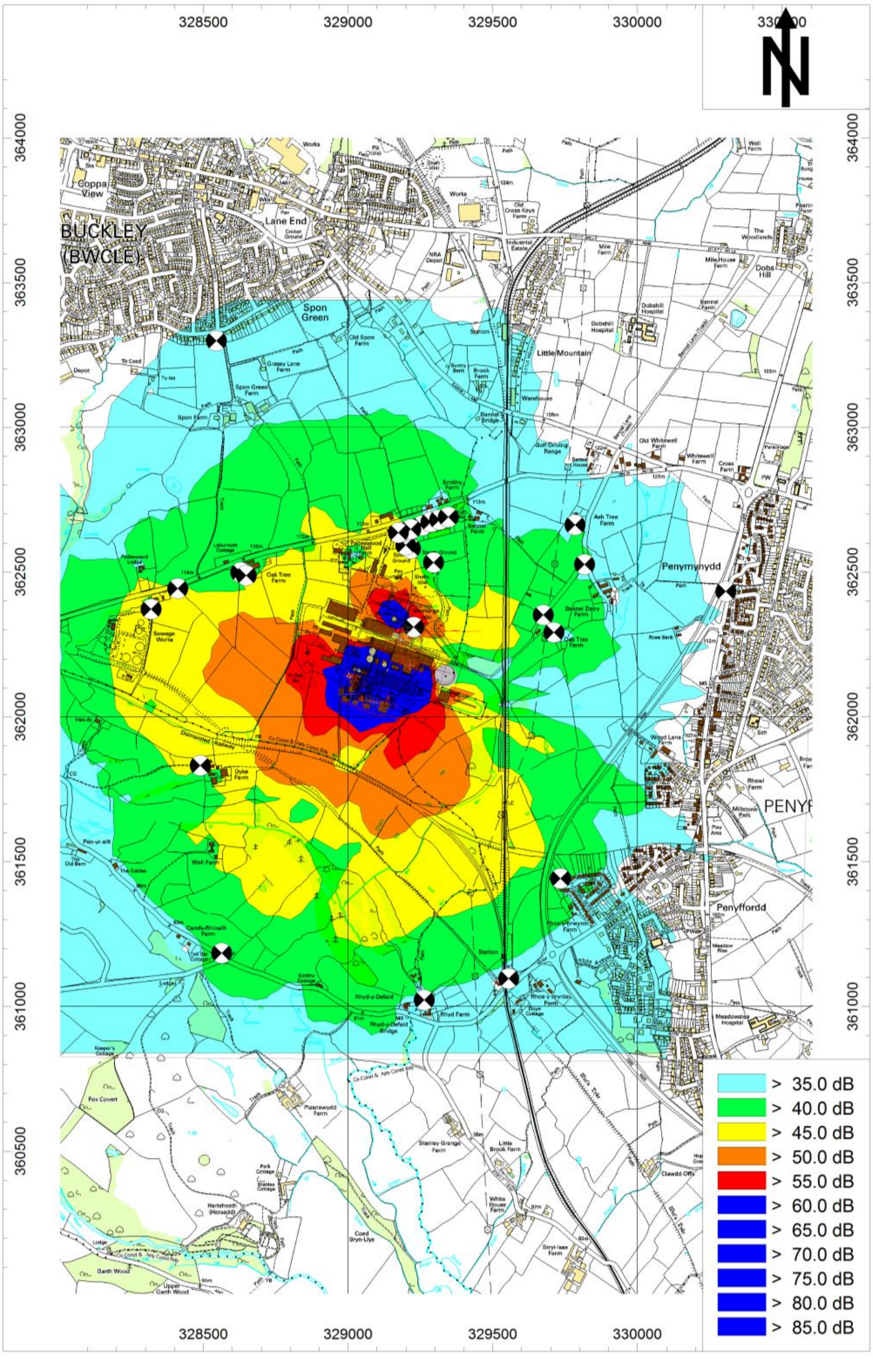


Demolition

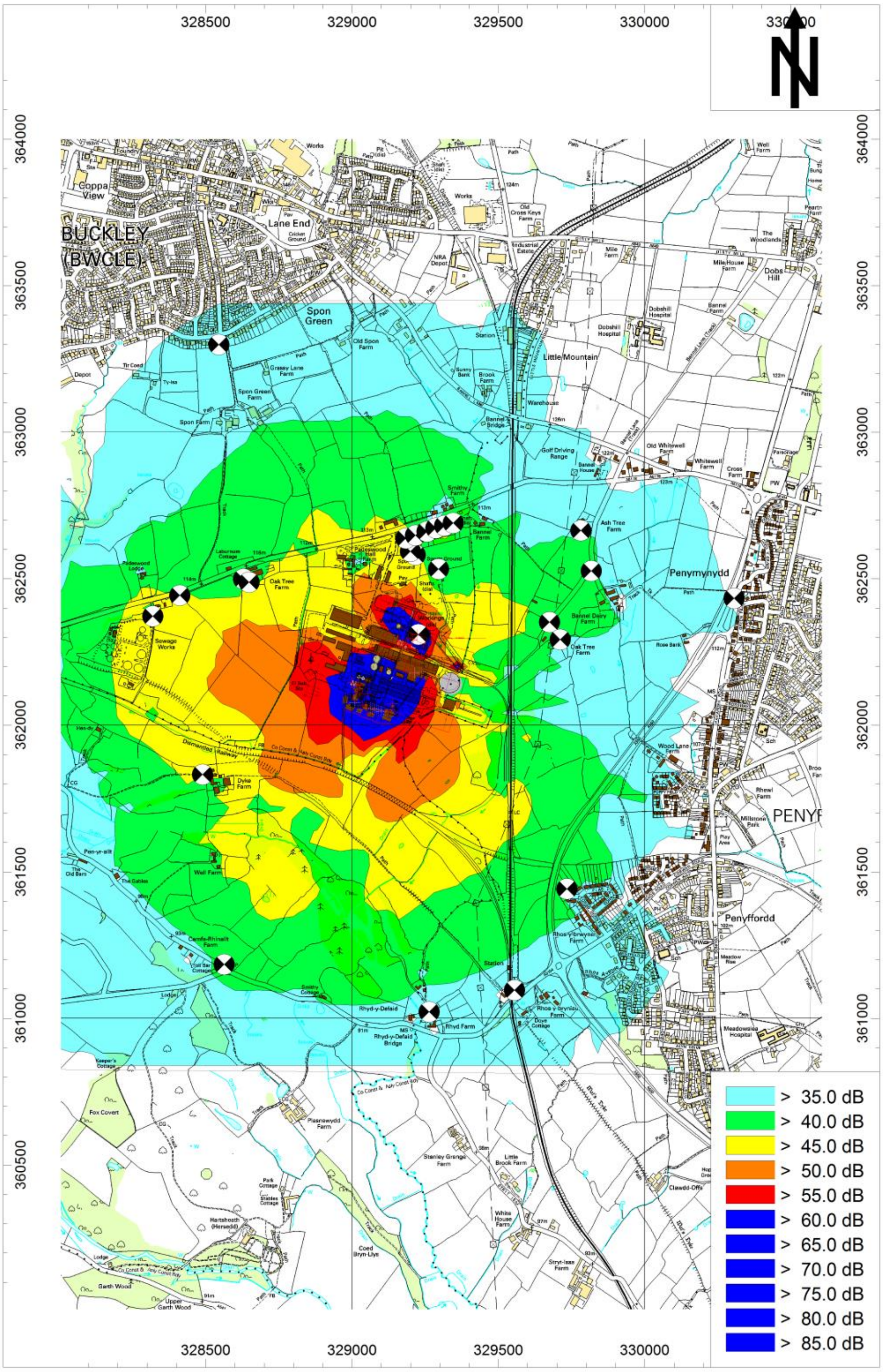


328500
329000
329500
330000
364000
363500
363000
362500
362000
361500
361000
360500
N
BUCKLEY (BWCLE)
Coppa View
Lane End
Spon Green
Little Mountain
Penymynydd
PENYF
Penyffordd
> 35.0 dB
> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB
> 85.0 dB

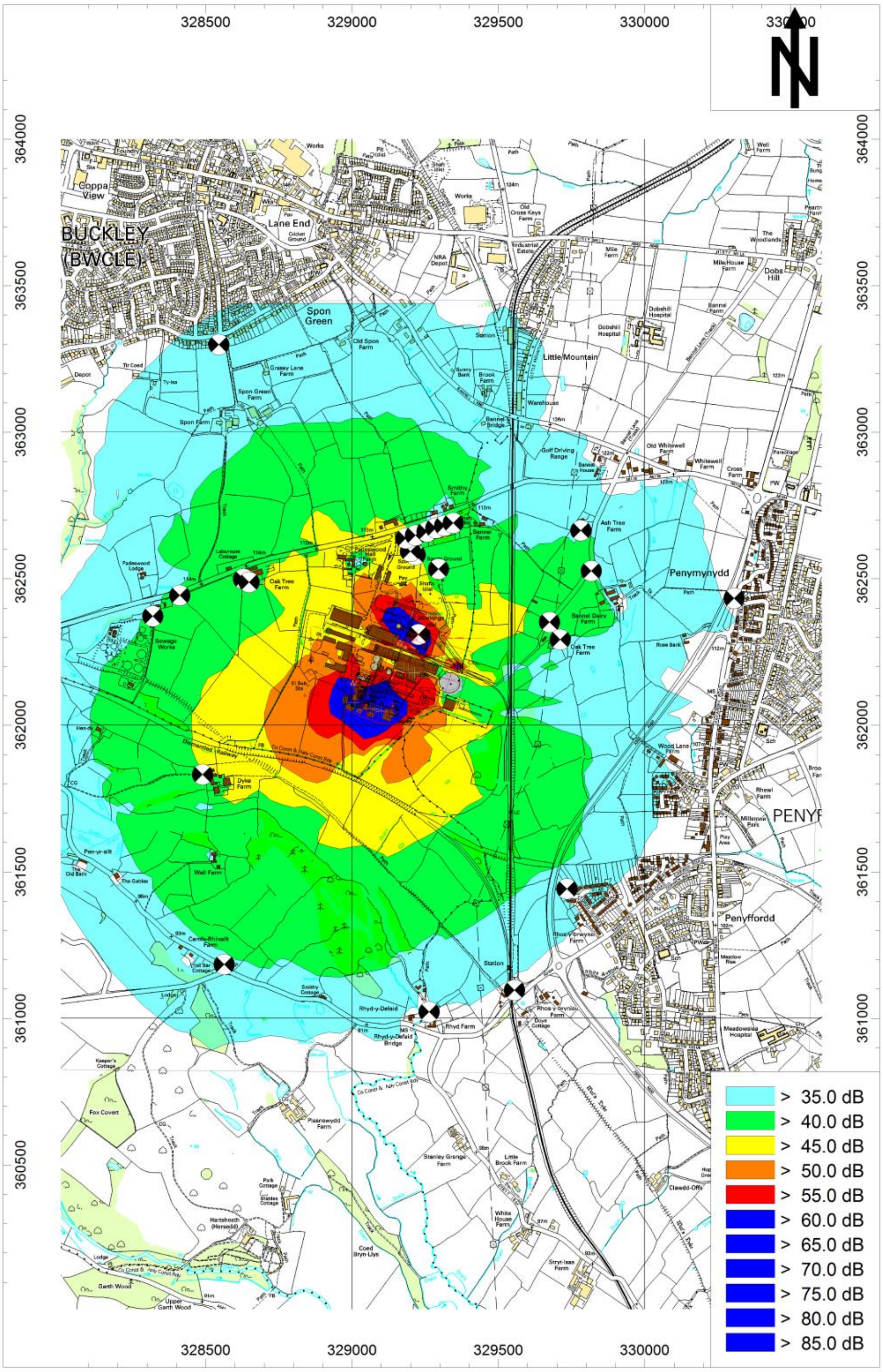
Existing situation with mills 1-4 running



New VRM mills 1-3 running and rail loading facility



New VRM only and rail loading facility



Hanson Cement, Padeswood Works

Application for variation to EPR permit BL1096

CM 5 Appendix 3 – Environmental Risk Assessment

CERTIFICATE OF INCORPORATION

OF A PRIVATE LIMITED COMPANY

No. 2182762

I hereby certify that

ECLIPSEHOLD LIMITED

is this day incorporated under the Companies Act 1985
as a private company and that the Company is limited.

Given under my hand at the Companies Registration Office,
Cardiff the 23 OCTOBER 1987

D. G. BLACKSTOCK
an authorised officer

CERTIFICATE OF INCORPORATION

ON CHANGE OF NAME

No. 2182762

I hereby certify that

ECLIPSEHOLD LIMITED

having by special resolution changed its name,

is now incorporated under the name of

CASTLE CEMENT LIMITED

Given under my hand at the Companies Registration Office,

Cardiff the 30 MARCH 1988

P. A. Rowley

MRS P.A. ROWLEY

an authorised officer