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Quinn Group

BALLYCONNELL CEMENT WORKS

Ballyconnell, County Cavan

Proposal to use Solid Recovered Fuel for the Cement Plant

Hydrogeological and Hydrological Assessment

April 2009

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APPENDICES

BCL CONSULTANT HYDROGEOLOGISTS LIMITED

EXPERIENCE & QUALIFICATIONS

BCL is an independent consultancy specialising in all aspects of hydrology and hydrogeology as they relate to minerals extraction, water supply and environmental issues.

Henry Lister (the author of this report) holds a Batchelor of Science (Honours) degree [Applied Geology] conferred by Plymouth University, 1992 and a Master of Science Degree [Groundwater Engineering], Newcastle University, 1994.

BCL has provided specialist services and advice to the extractive industry since 2000. During this time, experience has been gained from involvement in the study of hydrogeological and hydrological systems in connection with planning matters at over 100 quarries throughout the United Kingdom and Ireland.

1 INTRODUCTION

1.1 Background

1.1.1 Quinn Group (the Applicant) has commissioned the submission of a Planning Application (the Application) seeking consent for the use of Solid Recovered Fuel (SRF) to power the kiln at the Cement Plant at Ballyconnell, County Cavan.

1.1.2 The Applicant has appointed a specialist planning consultancy, Quarryplan Limited (Quarryplan), to coordinate the production of the Application.

1.1.3 Quarryplan has instructed BCL Consultant Hydrogeologists Limited (BCL) to assess the potential hydrological and hydrogeological impacts associated with the Proposed Development.

1.2 Aim, Scope and Methodology of Assessment

1.2.1 This report presents the findings of a hydrological and hydrogeological Baseline Study and Impact Assessment that is intended to inform consultations during the processing of the Planning Application.

1.2.2 The collection and interpretation of baseline data has facilitated a detailed understanding of the nature of, and interactions between, the groundwater and surface water systems operating at and around the Site.

1.2.3 The understanding of hydrological and hydrogeological conditions has been applied to assess the likely primary impacts of the Proposed Development upon the water environment.

1.2.4 Significant potential impacts identified during the course of investigations have been addressed by the incorporation, at the planning stage, of mitigation measures into the design of the Proposed Development.

1.2.5 Where appropriate, outline monitoring protocols have been advanced to facilitate validation / modification of the effectiveness of mitigation measures.

1.2.6 The scope of investigations has been informed by both co-fuelling and local planning policies, which reinforce the need to pay due regard to the likely effect of development upon various aspects of the water environment.

1.3 Data Sources

1.3.1 Site specific data include the following:

i. Topographic surveying commissioned by Quinn Group.

ii. Survey of surface water features within and bordering the Site (31st October to 2nd November 2002 and 13th January to 15th January 2003).

iii. Ongoing programme of hydrometric monitoring (visiting the Site in August 2006, June 2007, January 2008, July 2008 and January 2009).

1.3.2 Both published and unpublished documents and other sources of information that have been examined include:

i. Ordnance Survey of Northern Ireland (OSNI) topographic map, Discovery Series, sheet number 27, "Upper Lough Erne", at a scale of 1:50,000

ii. Geological Survey of Northern Ireland (GSNI): "Geological Map of Northern Ireland", Solid and Quaternary Editions, 1:250,000-scale.

iii. GSNI solid & drift geology maps (sheet numbers 57 & part of 58: "Lisnaskea"), at 1:50,000-scale, published 2005.

iv. British Geological Survey (BGS) and Department of the Environment for Northern Ireland (DoENI): "Hydrogeological Map of Northern Ireland" and "Groundwater Vulnerability Map of Northern Ireland", both at 1:250,000-scale.

v. Geological information from a programme of exploration drilling and geophysics undertaken in the vicinity of the Site.

vi. Groundwater level monitoring data from piezometers operated by the Applicant.

vii. Aquifer hydraulic data obtained by completing small-scale falling head tests and larger scale aquifer test-pumping exercises.

viii. Water quality data, derived from laboratory analysis of water samples taken from piezometers and surface watercourses surrounding the Site.

ix. Hydrological and hydrogeological data from the Environmental Protection Agency (EPA), the Northern Ireland Environment Agency (NIEA), the Geological Survey of Ireland (GSI) and Cavan County Council (CCC).

x. National Flood Hazard Mapping published by the Office of Public Works (OPW) and the Rivers Agency (Northern Ireland).

xi. National Parks and Wildlife Service (NPWS) and Northern Ireland Environment Agency (NIEA): Spatial mapping & citation information for Designated Sites of ecological interest.

xii. Rainfall data from the Climate Enquiries Office at Met Eireann.

xiii. Guidance on flood risk assessment, namely: "The Planning System and Flood Risk Management: Consultation Draft Guidelines for Planning Authorities", prepared by the OPW and the Department for the Environment, Heritage and Local Government (DEHLG).

xiv. Previous reports (prepared by BCL Consultant Hydrogeologists Limited) detailing the hydrogeology of the area, namely:

- "Aughrim and Mucklagh Quarry Complex: Hydrogeological and Hydrological Assessment" (October 2003).
- "Aughrim and Mucklagh Quarry Complex: Hydrology and Hydrogeology – Supplemental Submission to An Bord Pleanala" (September 2005).
- "New Cement Works, Scotchtown, Ballyconnell: Hydrogeological and Hydrological Assessment" (November 2005).

1.4 Report Structure

1.4.1 Baseline data concerning the topography, geology, hydrology and hydrogeology of the study area are presented at *section 2*.

1.4.2 An account of the Proposed Development, including description of intended working methods and water management measures, is given in *section 3*.

1.4.3 Assessment of the potential impacts of the Proposed Development and description of mitigation measures proposed to ameliorate significant such impacts are made in *section 4*.

1.4.4 A summary of the findings of hydrogeological and hydrological assessment together with report conclusions and recommendations are given in *section 5*.

1.4.5 All diagrams referred to by this report are included as ***appendix 1***.

2 BASELINE STUDY

2.1 Site Location & Topography

2.1.1 The Site (*figure 1, appendix 1*) is centred upon land at Irish Grid Reference (IGR) H $^{2}275$ $^{3}203$; approximately 1.5 km north of Ballyconnell, County Cavan.

2.1.2 The Site is located upon the southeast facing aspect of Slieve Rushen Mountain. Ground elevations generally fall to the south, southeast and east of the Site, and rise north-westwards toward the summit of Slieve Rushen.

2.1.3 The summit of Slieve Rushen Mountain, which attains an elevation of some 404 metres above Ordnance Datum (maOD), is situated approximately 4.5 km to the west-northwest of the Application Area.

2.1.4 Ground elevations within the boundaries of the Application Area fall from some 110 maOD upon the north-western boundary to some 60 maOD at the southern and eastern boundaries.

2.1.5 The cement plant is located upon a strip of land (approximately 250 m in width), which extends across the central part of Application Area, at an elevation of 80-90 maOD.

2.1.6 The Woodford River (Shannon-Erne Waterway) is some 400 m to the southeast of the Site, at its closest approach. The Woodford River valley has a southwest to northeast orientation.

2.1.7 Low-lying land within the Woodford River Valley is characterised by gently undulating topography and relatively subdued relief, with ground elevations in the region of 50 maOD.

2.1.8 Low rounded hillocks are interspersed with numerous small loughs and streams, which form tributaries to the Woodford River. The river flows generally north-eastwards, discharging into Upper Lough Erne, approximately 8.5 km east northeast of the Site.

2.2 Outline of Proposed Development

2.2.1 In outline, the Proposed Development involves the introduction of alternative fuel at the cement plant, and the associated engineering alterations.

2.2.2 The alternative fuel under consideration is Solid Recovered Fuel (SRF), obtained by mechanical biological treatment (MBT) of municipal waste, thus reducing the amount of biodegradable municipal waste going to landfill.

2.2.3 The technology is based on best knowledge and practice available appropriate to meet with the EU Waste Incineration Directive "2000/76/EC", with particular regard to ensuring compliance with the emission limits specified in this Directive.

2.3 Designated Sites

2.3.1 The NPWS and NIEA maps have been consulted to check for Natural Heritage Areas (NHA), Areas of Special Scientific Interest (ASSI), Special Areas of Conservation (SAC), Special Protected Areas (SPA), Nature Reserves and Ramsar Sites.

2.3.2 The closest NHA (proposed) is Annagh Lough, which is situated some 1.4 km to the southeast of the Application Area (*figure 1*). Lough Oughter and associated loughs (SAC and pNHA) are at a greater standoff, some 2.6 km to the SE of the Site

2.3.3 Moninea Bog ASSI and SAC lies 2 km to the northeast of the Site, at closest approach.

2.3.4 The bog at the summit of Slieve Rushen Mountain has NHA status; the boundary of the protected area extends to within 2.5 km of the western margin of the Application Area.

2.3.5 There are no other designated conservation areas within 4 km radius of the Site.

2.4 Landfills

2.4.1 It is an offence to carry out activities including keeping, recycling, crushing, baling, composting or dismantling waste materials without an appropriate Integrated Pollution Prevention and Control (IPPC) Licence (the equivalent being a PPC Permit in Northern Ireland), Waste Licence (or Waste Management Licence [WML] in Northern Ireland) or registered exemption.

2.4.2 The EPA and NIEA public registers have been consulted to check for local sites carrying out waste management activities in line with the above authorisation system.

2.4.3 Aside from the IPPC licences held by the Quinn Cement Limited and Quinn Therm Limited, the closest licensed site is operated by Eurothane Holdings Limited in Ballyconnell, 2 km to the south of the Application Area.

2.4.4 The civic amenity site at Teemore (WML 16/21), which accepts domestic waste, is at the outer limit of the 4 km radius of search.

2.4.5 The nearest landfill site is in Belturbet, beyond the 4 km radius of search.

2.5 Solid Geology

2.5.1 The geology within and surrounding the Site has been characterised by reference to the mapping and literature cited in *section 1.3.2*.

2.5.2 The Planning Application Area is sited upon the Dartry Limestone Formation, which is of Carboniferous (Visean) age (*figure 2a*).

2.5.3 The Dartry Limestone is a dark grey, fine-grained cherty limestone with associated mudstone. The regional thickness of the Dartry Limestone is reported as 220m, while its outcrop in the vicinity of the Site is some 3-4 km wide.

2.5.4 Boreholes drilled at or towards the foot of Slieve Rushen (in the vicinity of the Application Area) encountered an extremely weathered upper section of Dartry Limestone directly beneath drift deposits. This weathered section of the Dartry Formation, ranging in thickness between 9 m and 18 m within the boreholes, is present as an almost entirely disaggregated calcareous sand and gravel with no apparent consolidated structure or cohesive strength. This unit, which is referred to hereafter as "disaggregated limestone", is considered to be hydrogeologically significant due to its considerable thickness and apparent intergranular hydraulic properties (*section 2.9.3*).

2.5.5 The Meenymore Formation overlies the Dartry Limestone and comprises sandstone, siltstone, mudstone and evaporitic and marine limestones. The boundary between the Dartry Limestone and Meenymore Formations is unconformable; its surface expression passing approximately 650 m to the northwest of the Planning Application Area, at closest approach.

2.5.6 The Dartry Limestone and Meenymore Formations are underlain by the Benbulben Shale Formation, which consists of dark grey fossiliferous mudstone and thin bioclastic limestones. In turn, this is underlain by the Bundoran Shale Formation, which is a grey mudstone and bedded fossiliferous limestone.

2.5.7 A fault some 2 km to the southeast of the Planning Application Area brings the outcrop of the Bundoran Shale Formation against the Dartry Limestone, without the Benbulben Shale Formation in between.

2.5.8 The formations form approximately parallel layers, which dip slightly to the west (with dip measurements of 5-15°) in the vicinity of the Site. Each outcrops in an approximately north-south orientation in the vicinity of the Site, on the eastern side of the Slieve Rushen mountain.

2.6 Drift Geology

2.6.1 The published mapping data shows the Quaternary drift cover, overlying the solid geology, is of variable composition and extent (*figure 2b*).

2.6.2 The Planning Application Area (and the valley to the east) is underlain by glaciofluvial ice-contact drift.

2.6.3 Boreholes drilled to the east of the Application Area encountered a thick interbedded series of sands, sands and gravels, alluvium and clays, extending to a depth of some 15 m below the thin soil cover.

2.6.4 These deposits occur across an irregularly shaped area, generally some 1 km wide and aligned roughly north-south along the break of the slope at the eastern edge of the Planning Application Area.

2.6.5 To the west of the cement works, the land is indicated to have a till cover, although there are patches where the till is shown to be absent above the Meenymore Formation.

2.6.6 Along most of the line of the Woodford River, the mapped drift deposit is lacustrine alluvium.

2.7 Meteorology

2.7.1 Met Eireann maintains a rainfall gauging station at Clones, County Monaghan.

2.7.2 The 30-year annual average rainfall for this station is 928 mm, as measured during the period 1961-1990.

2.8 Hydrology

2.8.1 Regional Setting

2.8.1.1 The Application Area is located upon the southeast-facing slope of Slieve Rushen Mountain, in the catchment of the Woodford River.

2.8.1.2 In the vicinity of the Site, the Woodford River flows generally from south-west to north-east, veering east-northeast. The river is situated some 400 m to the south-east of the Application Area at its closest approach (*figure 3*).

2.8.1.3 The Woodford River discharges to Upper Lough Erne. Its confluence with the lough is situated approximately 8.5 km east-northeast of the Site.

2.8.1.4 Significant reaches of the Woodford River, including the stretch in closest proximity to the Site, have been canalised to create the Shannon-Erne Waterway. At Cloncoohy (some 1.5 km to the east of the Site), the canal "short-circuits" severe meanders followed by the river channel.

2.8.1.5 Knockadools Springs are located on the northwest side of the Woodford River, some 0.8 to 1.0 km to the east of the Site. Observations made in connection with previous investigations indicate that diffuse spring flow is collected in a network of field drainage ditches, ultimately discharging into the Woodford River.

2.8.1.6 The closest hydrometric monitoring station on the Woodford River is at Ballyheady Bridge (IGR H ^{2}250 ^{3}156), some 5 km SSW/upstream from the Site. This station is operated by the OPW. During the period 1974-1992, the highest recorded flood level was 53.09 maOD. OPW data indicates that this level would only be exceeded 1% of the time.

2.8.1.7 On the stretch of river adjacent to the Site, the equivalent flood level is estimated to be some 49 maOD.

2.8.1.8 The most recent water quality data collected by the OPW at Ballyheady Bridge indicate that the stream has a good status (Q value 4).

2.8.2 Local Hydrology

2.8.2.1 The low vertical permeability of the Meenymore Shales has provided the conditions for the development of an extensive peat blanket upstream of the Application Area.

2.8.2.2 The presence of peat will serve to attenuate rainfall, limiting peak discharges of runoff from the upland catchments. This is reflected in the generally limited development of surface watercourses in the area of the Site; drainage being afforded by relatively minor watercourses, all of which ultimately discharge into the Woodford River. Peat will also provide storage for incident rainfall, providing for the maintenance of surface water flow through prolonged dry periods.

2.8.2.3 During field surveying undertaken between October 2002 and January 2003, flow rates of less than 15 to 20 litres per second (l/s) were observed to be typical, even within downstream sections of watercourses following periods of prolonged and intense rainfall. No significant scouring or channel enlargement was observed, suggesting that the rate of rainfall run-off from the local catchments is regular rather than flashy.

2.8.2.4 Local watercourses are illustrated at *figure 4*. Estimated flow rates within the drainage network together with tentative catchment boundaries are illustrated at *figure 5*.

2.8.2.5 Gortawee Stream drains eastwards from the flank of the mountain, some 165 m northeast of the cement works, at closest approach. Leaving the high ground of the mountain, the watercourse veers southwards across the lower-lying ground of the Woodford valley. It joins the Woodford River some 0.5 km to the east of the Site.

2.8.2.6 The Gortawee Stream receives all surface water runoff arising within the cement works during rainfall events. Before being discharged into the stream, the runoff is directed into large covered settlement tanks located immediately to north of the entrance weighbridge. This is to ensure that the suspended solids content of the water is reduced to an acceptable limit prior to being discharged into the receiving watercourse. The settlement tanks include flow balancing capacity (to control the rate of discharge during storm events) and oil interceptor facilities.

2.8.2.7 Discharge from the settlement tanks is made via a culvert, which takes flow beneath the Ballyconnell-Derrylin road and outflows into a west to east aligned field ditch, which links with the Gortawee Stream. The head of the ditch lies some 100 m to the east of the entrance track to the abandoned Slieve Russell House. Surface water in the ditch flows eastwards for some 350 m before reaching its confluence with the Gortawee Stream.

2.8.3 Surface Water Quality

2.8.3.1 The results of baseline water quality sampling are detailed in the report entitled "New Cement Works, Scotchtown, Ballyconnell: Hydrogeological and Hydrological Assessment" (November 2005), prepared by BCL.

2.8.3.2 More recent data, collected on 23rd August 2008 and 3rd November 2008, are presented in *appendix 2*.

2.8.3.3 The data have been compared with the relevant standards put forward in the EPA Discussion Document "Environmental Quality Standards (EQS) for the Aquatic Environment" (1997); also the more recent consultation paper entitled "Proposals for Regulations establishing Environmental Objectives and Environmental Quality Standards for the classification and management of Surface Waters and requiring the implementation of measures to reduce water pollution and protect and restore Surface Waters", DEHLG, 5th September 2008.

2.8.3.4 With regard to monitoring the risk posed by current operations at the cement works, the key Water Quality Indicators are suspended solids, pH and hydrocarbons. For these three parameters, both the recent and 2005 data for Gortawee Stream comply with the standards: the suspended solids content is less than 50 mg/l, the pH is between 6-9 and there are no detected hydrocarbons.

2.8.3.5 Where suspended solids were not checked (23rd August 2008), the turbidity is recorded to be 0.07 FTU, meeting with recommendations: the Drinking Water Directive says, "Strive for less than 1 NTU (this being virtually equivalent to 1 FTU).

2.8.3.6 The nutrient content of the water samples retrieved from Gortawee Stream give an indication of problems caused by sources such as fertilisers, farmyard runoff and land-spreading. Looking at the parameters exceeding the EQS, the concentration of Orthophosphates and Kjeldahl Nitrogen is indicative of moderately polluted conditions, while the level of Ammoniacal Nitrogen is typical of A1-A2 Waters. There is pre-existing bacterial contamination (including Faecal Streptococci) within the stream.

2.8.3.7 With regard to principal metals, the baseline data indicates that the local watercourses commonly exhibit elevated concentrations of iron, although Gortawee Stream does comply with the EQS. This is a natural occurrence in limestone areas.

2.8.3.8 The concentration of aluminium in the majority of samples exceeds the recommended limits. This is likely to relate to the weathering of aluminium-bearing minerals within the Meenymore Shale Formation. The margin of non-compliance becomes more marked following heavy rainfall.

2.8.3.9 The copper data recorded during the first round of sampling failed to comply with the EQS (but did meet with drinking water standards).

2.8.3.10 All other data for Gortawee Stream are within the recommended limits.

2.8.4 Flooding

2.8.4.1 Maps detailing flood defence assets and watercourses as well as historic and predictive flood mapping are published on the OPW and Rivers Agency websites.

2.8.4.2 There is no risk of fluvial flooding at the Site (allowing for climate change). Ground elevation upon the closest stretch of floodplain equates to *circa* 50 maOD, which is 10 m below the lowest point on the Site boundary.

2.8.5 Waterbodies

2.8.5.1 The settlement system serving the cement works is described in *section 2.8.2.6*.

2.8.5.2 There are no other waterbodies within 1 km standoff from the development.

2.8.5.3 The closest such feature is Annagh Lough, which is some 1.7 km to the southeast of the Application Area (*figure 1*). The cement works and lough are situated on opposite sides of the Woodford River.

2.8.5.4 As described in *section 2.3.2*, Annagh Lough is a proposed Natural Heritage Area.

2.8.5.5 EPA mapping indicates that the water quality of the lough is indicative of oligotrophic/mesotrophic (least polluted) status.

2.9 Hydrogeology

2.9.1 Regional Hydrogeology

2.9.1.1 The Dartry Limestone Formation is classified by the GSI as a regionally important, fissured bedrock aquifer on the basis of its large outcrop area and relatively elevated transmissive properties. Due to the presence of a karstic flow component, groundwater flow rates and levels may be anticipated to vary significantly from location to location throughout the region.

2.9.1.2 The principle areas of karstification are identified by the GSI to be located within upland areas to the northwest of the region. Major springs occur several kilometres to the north of Ballyconnell and near Tully Forest in Northern Ireland.

2.9.1.3 In terms of groundwater resource protection, with respect to potentially polluting activities, the Dartry Limestone aquifer of the region is denoted to have a high to extreme vulnerability rating.

2.9.1.4 The Quaternary Sands and Gravels are classified as a regionally important, extensive sand/gravel aquifer. The drift aquifers of the region are categorised as moderately to highly vulnerable to potential contamination.

2.9.2 Groundwater Levels

2.9.2.1 The schedule of piezometers that, by condition, require automated logging of groundwater level is given below. The positions of groundwater level observation points are illustrated at *figure 6*.

Piezometer ID	NGR: X	NGR: Y	Cap Level (maOD)	Base Level (maOD)	Formation Monitored
PZ2002/04	227642	321393	118.199	28.199	Dartry Limestone
P05_03	226807	321316	196.792	171.792	Meenymore Shale Formation
P05_05	226577	321214	225.418	155.418	Meenymore Shale Formation
P05_07d (replacing P05_08d)	228075	319743	51.515	13.515	Dartry Limestone (disaggregated)
P05_12	227243	320563	149.641	29.641	Dartry Limestone
Q05_01d	226955	320932	188.109	85.109	Dartry Limestone
Q05_02	227287	321486	135.665	65.665	Dartry Limestone
Q05_04	227919	321931	70.994	-1.006	Dartry Limestone (disaggregated)
Q05_06	227037	320859	173.087	23.087	Dartry Limestone
NCP1	227675	319962	76.409		Dartry Limestone (disaggregated)
NCP2	227679	319971	76.421		Dartry Limestone (disaggregated)
CCC	*22757*	*31942*	*72*		Dartry Limestone (disaggregated)

italics - estimated

2.9.2.2 Full details of the results of the monitoring programme are reported in the BCL document entitled "Groundwater Level Monitoring Data Statement No.4: to January 2009", dated 11th March 2009. This data-statement presents all data available since commencement of logging in August 2006; representing the fourth report of a continuing series.

2.9.2.3 The available data indicates a south-easterly direction of groundwater flow within the Dartry Limestone (*figure 7*), broadly perpendicular to the geological strike and generally concordant with the surface topography.

2.9.2.4 Derived piezometric heads around the area of the contact between the Dartry Limestone and the overlying Meenymore Shales approximate to some 125 to 130 maOD. Groundwater levels within the limestone in the vicinity of the Ballyconnell to Derrylin road fall to between 55 maOD and 50 maOD.

2.9.2.5 The inferred south-easterly hydraulic gradient varies between 0.0467 (approximately 1:21) and 0.0583 (approximately 1:17).

2.9.2.6 Based upon the available piezometer data, the typical long-term range between minimum and maximum groundwater levels is between 2 m and 6.5 m.

2.9.3 Hydraulic Conductivity

2.9.3.1 A series of falling head hydraulic conductivity tests were carried out during January 2005 upon five piezometer boreholes installed at the Site.

2.9.3.2 A summary of the findings of the falling head testing, which have been analysed using the Ernst Auger Hole and Bouwer & Rice techniques, are presented below.

Summary Results of Falling Head Aquifer Testing: Hydraulic Conductivity					
Piezometer	PZ 2002/01	PZ 2002/02	PZ 2002/03	PZ 2002/04	PZ 2002/05
Maximum (m/d)	6	-	0.05	0.05	0.5
Minimum (m/d)	5	-	0.01	0.005	0.1
Analysis	Ernst auger hole analysis (water level change in screen).	Piezometer dry, quantitative analysis cannot be undertaken.	Bouwer and Rice slug test analysis (water level change above screen)	Bouwer and Rice slug test analysis (water level change above screen)	Bouwer and Rice slug test analysis (water level change above screen)
Notes	Analysis does not account for collapsed hole in broken stone and clay below base of piezometer (to depth of 72 mbgl)	Slug of water of volume 125 litres drained in 1100 s. Piezometer screen (in bottom 20 m of borehole) in “clay”			
Piezometers under test are partially penetrating through the limestone aquifer. The hydraulic conductivity values are, however, insensitive (maximum range of 5%) to the inaccuracy of the assumed values for the base of the aquifer.					

2.9.3.3 The results of the small-scale falling head testing exercise indicate significant heterogeneity within the sections of aquifer under test.

2.9.3.4 The values obtained from testing are entirely in accordance with the characteristic range of hydraulic conductivity attributable to limestone aquifers as observed during previous similar investigations and as reported elsewhere in literature.

2.9.3.5 A programme of aquifer test pumping conducted in July and August 2005 has informed further assessment of the hydraulic properties of the strata.

2.9.3.6 All tests conducted within the mechanically competent section of the Dartry Limestone produced extremely limited well yields. In contrast, testing of the disaggregated upper profile of the limestone (toward the valley floor east of the Site) produced a significant discharge rate for modest drawdown.

2.9.3.7 Data collected from the test pumping exercise has been analysed to provide values of aquifer hydraulic conductivity. The resultant values are presented below.

Summary Results of Aquifer Test Pumping Programme					
Abstraction Well I.D.	Monitoring Well	Transmissivity (m²/d)		Hydraulic conductivity (m/d)*	
		Early Data	Late Data	Early Data	Late Data
Q05_02	P05_09	2	-	0.033	-
	P05_10	4	-	0.067	-
Q05_04	P05_11	180	-	3.396	
Q05_05**	P05_09	26	2	0.419	0.032
	Q05_02	25	2	0.403	0.032
Q05_06	Q05_06	0.1	-	0.002	-
	Q05_01(d)	0.8	-	0.016	-

* Note: in all cases hydraulic conductivity is calculated from transmissivity applying assumption that effective depth of circulation is limited to base of abstraction borehole.
** Note: late data considered to be more robust due to higher pumping rate and resultant greater stress over wider volume of aquiifer

2.9.3.8 Values of hydraulic conductivity obtained for the competent section of the Dartry Limestone were extremely low, with a representative value, combining all tests, of some 0.03 m/d.

2.9.3.9 For the disaggregated limestone (mantling the solid strata of the valley floor), the calculated value of hydraulic conductivity equated to 3.4 m/d, which is in excess of 100 times greater than that of the mass of the competent limestone.

2.9.4 Relationship between Groundwater within the Dartry Limestone and Surface Watercourses

2.9.4.1 The depth to groundwater (as recorded in the Site piezometers) shows that the watercourses upon the flanks of Slieve Rushen exist a significant distance above the watertable. Thus, these streams cannot accrete flow from groundwater. Nor is there likely to be significant downward leakage, due to (*i*) the presence of low permeability boulder clay mantling the solid strata and (*ii*) the significant stream-bed gradients, resulting in relatively rapid stream velocities.

2.9.4.2 Upon the valley floor, the groundwater flowing within the mechanically competent sections of the Dartry Limestone is in continuity with, and thus laterally recharging, the disaggregated limestone and the drift deposits. Under gravity, there is diffuse seepage from the drift deposits into the Woodford River.

2.9.5 Local Abstractions

2.9.5.1 The abstraction points described below are illustrated upon *figure 6*.

2.9.5.2 The closest private groundwater supply borehole is located at the Kearns' property at Gortoorlan (approximate grid reference $^{2}271$ $^{3}200$), some 325 m to the southwest of the Application Area.

2.9.5.3 The Maguire's property at Gortoorlan is also served by an abstraction borehole (grid reference $^{2}2706$ $^{3}1988$), this being some 500 m southwest of the Site.

2.9.5.4 Cavan County Council (CCC) operate a groundwater abstraction borehole located adjacent to the Ballyconnell to Gortoorlan Road. It is sited at grid reference $^{2}2757$ $^{3}1939$, approximately 500 m to the south of the cement works.

2.9.5.5 It is understood that these boreholes abstract from the Dartry Limestone.

2.9.6 Groundwater Quality

2.9.6.1 The results of baseline water quality sampling are detailed in the report entitled "New Cement Works, Scotchtown, Ballyconnell: Hydrogeological and Hydrological Assessment" (November 2005), prepared by BCL.

2.9.6.2 The data have been compared with the relevant standards cited in *section 2.8.3.3*.

2.9.6.3 Alkaline groundwater is invariably associated with the limestone bedrock. However, the water sample taken from the abstraction borehole at the Cement Works is within the recommended range for pH.

2.9.6.4 The samples do not comply with the standards set for hardness but this is a common characteristic of groundwater sourced from the limestone aquifers. The GSI report that the total hardness of groundwater from these formations averages some 375 mg/l.

2.9.6.5 Suspended solids contained within samples retrieved from piezometers are an artefact of the drilling process. Whilst piezometers are purged prior to sampling, they are not subject to full well development in the manner typical for abstraction boreholes. Therefore, the suspended solids content is not considered representative of general aquifer conditions, but rather a reflection of localised disturbance of strata during drilling.

2.9.6.6 There was one instance of hydrocarbon contamination reported in Piezometer P05_06(d), which lies on the east/opposite side of the Ballyconnell-Derrylin road. This sample was taken during increasingly heavy rainfall and may relate to surface water run-off from the road. The problem did not recur during subsequent rounds of sampling.

2.9.6.7 There is pre-existing bacterial contamination (including Faecal Streptococci) within the groundwater system. The EPA state that "the most serious groundwater problems are likely to arise from activities that are not subject to a licensing regime either under control of the EPA or local authority or other strict control." Faecal bacteria are derived from sources such as farmyard runoff, land-spreading and sewage.

2.9.6.8 The same sources are likely to account for problems with ammonia, nitrate, nitrite and phosphorous species.

2.9.6.9 With regard to principal metals, the baseline data indicates that the groundwater commonly exhibits elevated concentrations of iron, which is a natural occurrence in limestone areas.

2.9.6.10 The concentration of aluminium in the majority of samples exceeds the recommended limits. This is likely to relate to the weathering of aluminium-bearing minerals within the Meenymore Shale Formation. The margin of non-compliance becomes more marked following heavy rainfall.

2.9.6.11 The copper data recorded during the first round of sampling failed to comply with the EQS (but did meet with drinking water standards).

2.9.6.12 Allowing for the hardness of the water, the nickel and zinc data meet with the EQS.

2.9.6.13 More recent data, collected on 23rd August 2008 and 3rd November 2008, are presented in *appendix 2*. After each visit, this data is reviewed and reported in a document entitled "Groundwater quality at Aughrim and Mucklagh Quarry Complex, Ballyconnell, Co. Cavan", prepared by F. J. Coyle and Associates (Civil and Environmental Consultants).

2.9.6.14 The most recent report states that: "The quality of the water in all of the monitoring boreholes is of a high standard. The samples are all within the Cavan County Council parameter limits. Quarrying activity is not affecting groundwater in the local area. The quality of the groundwater in the local area is of a very good standard".

2.9.6.15 In the context of the Water Framework Directive, EPA mapping indicates that the Dartry Limestone Aquifer is "expected to achieve good status".

3 SITE ACTIVITIES

3.1 Proposed Development

3.1.1 The Proposed Development involves implanting alternative fuel at the cement plant. The process and design of the facility is being orchestrated by FLSmidth (Alternative Fuels).

3.1.2 The alternative fuel under consideration is Solid Recovered Fuel (SRF), obtained by mechanical biological treatment (MBT) of municipal waste, thus reducing the amount of biodegradable municipal waste going to landfill.

3.1.3 Following MBT, the remaining dried waste consists mainly of dried organics, card, paper, plastics and other miscellaneous materials, ready for use as SRF.

3.1.4 The SRF will be delivered to Site pre-shredded to the desired size and clean from impurities like metal, over sizes, lumps, wooden pieces, bricks, etc.

3.1.5 Delivery of the SRF will be carried out by road trucks equipped with walking floor. The receiving station and storage units will be enclosed to exclude rainfall ingress.

3.1.6 The overall feed system is sized for 50% fines fraction (<30 mm and pneumatic) and 50% coarse fraction (<80 mm and mechanical).

3.1.7 The technology is based on best knowledge and practice available appropriate to meet with the EU Waste Incineration Directive “2000/76/EC”, with particular regard to ensuring compliance with the emission limits specified in this Directive.

3.2 Water Management

3.2.1 Water management will continue along the lines of the ongoing procedures at the Site.

3.2.2 The Gortawee Stream receives all surface water runoff arising within the cement works during rainfall events. Before being discharged into the stream, the runoff is directed into large covered settlement tanks located immediately to north of the entrance weighbridge. This is to ensure that the suspended solids content of the water is reduced to an acceptable limit prior to being discharged into the receiving watercourse. The settlement tanks include flow balancing capacity (to control the rate of discharge during storm events) and oil interceptor facilities.

3.2.3 With regard to incoming waste handling, transfer and storage areas: Given that the waste is to be delivered in a dried state, the exclusion of rainwater (by erecting roofed and walled enclosures for the receiving hoppers) is judged to be an effective means of avoiding problems such as the generation and emission of leachate.

3.2.4 FLSmidth has confirmed that there will be no wastewater arising from the waste co-fuelling process i.e. there will be no wet flue gas treatment for the air pollution control device; no boiler water treatment and blowdown; no scrubber liquor; no water from ash quenching; and no discharge of water from the cooling process.

4 IMPACT ASSESSMENT & RECOMMENDATIONS FOR MITIGATION

4.1 Background

4.1.1 Baseline assessment has facilitated a conceptual understanding of the extant groundwater and surface water regimes operating within and around the Site. This understanding has been applied to assess the potential impacts posed by the Proposed Development upon the water environment.

4.1.2 In common with other operations of this type and scale, it is considered that the Proposed Development has the potential to impact upon the water environment in the following primary ways:

- Abstraction of groundwater, causing a modification of groundwater levels and flow rates/direction within the limestone aquifer.
- Derogation of existing groundwater and surface water quality.
- Modification of existing flooding characteristics.

4.1.3 The foregoing matters are discussed separately below.

4.2 Potential for Modification of Groundwater Levels, Flow Rates and Direction

4.2.1 There are two abstraction boreholes on Site, which supply the raw water requirement (cooling water, process water and dust suppression) for the cement manufacturing process. The boreholes are installed within the Dartry Limestone Formation.

4.2.2 There will be no change in the demand for water; the pre-existing abstraction rate will be maintained.

4.2.3 In terms of groundwater flow direction, the available data indicates that the CCC abstraction borehole is located down hydraulic gradient from the New Cement Works, while the Gortoorlan private sources are located across gradient from the Site.

4.2.4 To date, there has been no reported decline in yield at the CCC borehole as a result of abstraction activities at the New Cement Works. With no proposed increase in abstraction on Site, the current status should be maintained.

4.2.5 The current schedule of monitoring of groundwater level within the CCC abstraction borehole will be continued to confirm this assessment.

4.3 Potential for Derogation of Existing Groundwater & Surface Water Quality

4.3.1 Overview

4.3.1.1 Although water is used in cement manufacturing, this process does not involve any discharge to surface water or groundwater; instead, water vapour is discharged to the atmosphere in the form of flue gases.

4.3.1.2 Pre-existing risks to water quality include:

- The discharge of surface water run-off from areas of hardstanding.
- Potential contaminant spillages.

4.3.1.3 The proposed use of SRF at the cement works does present some additional/new risk to groundwater and surface water quality:

- Risk of accidental runoff from the waste handling, transfer and storage areas.
- There will be no wastewater arising from the co-fuelling process (*section 3.2.4*).

4.3.2 Surface Water Runoff

4.3.2.1 All surface water runoff arising within the cement works during rainfall events is directed to a settlement tank. This is to ensure that the suspended solids content of the water is reduced to an acceptable limit prior to being discharged into the receiving watercourse (Gortawee Stream). The settlement tank includes flow balancing capacity (to control the rate of discharge during storm events) and oil interceptor facilities.

4.3.2.2 The proposed development does not involve any change in the surface water run-off pattern at the cement works i.e. no change in the overall size of the rainfall catchment area; no change in the gradient of the area; and no change in the percentage of impermeable area.

4.3.2.3 The pre-existing drainage infrastructure will receive no additional/new input of surface water run-off.

4.3.2.4 Therefore, there will be no reduction in the quality of runoff being discharged off Site.

4.3.3 Hydrocarbon Spillage

4.3.3.1 The operation of mobile and fixed plant presents a risk that pollutants may enter groundwater as a result of hydrocarbon spillage or leakage on Site. Such sources are identified as fuel, lubricating and hydraulic oils. Experience has demonstrated that the risk of such a pollution incident may be minimised by adoption of the following measures.

- A code of practice should be drafted for the refuelling of machinery. Such work shall be carried out only by trained personnel and take place within a surfaced area equipped with surface water interceptors and bunded tanks.
- Operators shall check their vehicles on a daily basis before starting work to confirm that leakages are not present. Operators will report any defect to ensure that repairs are undertaken to that vehicle before it enters the working area.
- Sufficient oil sorbant material (*3M Oil-Sorb* or similar) shall be available on Site to cope with a loss equal to the total fluid content of the largest item of plant.
- Following the use of such oil sorbant material, any contaminated materials shall be disposed from Site in accordance with current tipping legislation.
- Adequate containment should be provided for all oils stored on the Site, to be equipped with bunds to the relevant European Standards.

4.3.3.2 The foregoing measures have been incorporated within a draft fluids handling protocol that is included here at *appendix 3*. It is considered that the correct adoption of these measures will provide appropriate mitigation against the potential for derogation of water quality as a result of hydrocarbon spillage.

4.3.3.3 Furthermore, any runoff from Site is directed through oil interceptor facilities prior to discharge to Gortawee Stream (*section 4.3.2*).

4.3.4 Runoff from the Waste Handling, Transfer and Storage areas

4.3.4.1 With regard to incoming waste handling, transfer and storage areas: Given that the waste is to be delivered in a dried state, the exclusion of rainwater (by erecting roofed and walled enclosures for the receiving hoppers) is judged to be an effective means of avoiding problems such as the generation and emission of leachate.

4.3.4.2 To confirm the efficacy of these measures, it is recommended that the monitoring schedule be revised to include testing of additional parameters at key locations, namely: Gortawee Stream, the boreholes at the Cement Plant, the piezometers P05/6S and P05/6D, the CCC Borehole and the private supplies at Gortoorlan.

4.3.4.3 The additional chemical species should be appropriate to type of fuel (SRF) being brought on to the Site. Given that the SRF is derived from municipal (non-hazardous) waste, it is considered that the following parameters would serve as key indicators for detecting any adverse impact arising from Site operations: ammoniacal nitrogen (already tested), chloride, Polycyclic Aromatic Hydrocarbons (PAH) and nickel.

4.4 Modification of Existing Flooding Characteristics

4.4.1 Flood Risk Posed by the Proposed Development

4.4.1.1 As described in *section 4.3.2*, all surface water runoff arising within the cement works during rainfall events is directed to a settlement tank. The settlement tank includes flow balancing capacity to control the rate of discharge during storm events.

4.4.1.2 The proposed development does not involve any change in the surface water run-off pattern at the cement works. Therefore, the Site operations will not result in any increased risk of flooding on land and properties downstream/downhill from the cement works.

4.4.2 Risk of Fluvial Flooding

4.4.2.1 Maps detailing flood defence assets and watercourses as well as historic and predictive flood mapping are published on the OPW and Rivers Agency websites.

4.4.2.2 There is no risk of fluvial flooding at the Site (allowing for climate change). Ground elevation upon the closest stretch of floodplain equates to *circa* 50 maOD, which is 10 m below the lowest point on the Site boundary.

4.4.3 Risk of Flooding from Land

4.4.3.1 The Proposal Site constitutes a sub-catchment that is largely isolated from runoff from adjacent lands due to the existing surface water drainage network. Mucklagh Stream (*figure 5*) drains the land to the south and west of the Application Area. The catchment boundary roughly coincides with the haul road at the southwest boundary of the cement works. On the land to the north of the Site, the field ditches and roadway bypass the cement works and discharge directly into Gortawee Stream. Runoff generation is largely limited to rainfall that is directly incident upon the Proposal Site itself.

4.4.3.2 There will be no change in the surface water run-off pattern on the land uphill/upstream from the cement works; therefore, there will be no increased risk of floodwater coming on to Site from the hillside overlooking the cement works.

4.4.4 Risk of Flooding from Groundwater

4.4.4.1 The depth to groundwater (as recorded in the Site piezometers) shows that the watercourses upon the flanks of Slieve Rushen exist a significant distance above the watertable. Thus, these streams cannot accrete flow from groundwater.

4.4.4.2 There is considered to be no risk of flooding from groundwater at the cement works.

5 SUMMARY & CONCLUSIONS

5.1 Baseline Study

5.1.1 Quinn Group has commissioned the submission of a Planning Application seeking consent for the use of Solid Recovered Fuel (SRF) to power the kiln at the Cement Plant at Ballyconnell, County Cavan.

5.1.2 The Site is located upon the southeast facing aspect of Slieve Rushen Mountain. Ground elevations within the boundaries of the Application Area fall from some 110 maOD upon the north-western boundary to some 60 maOD at the southern and eastern boundaries.

5.1.3 The cement plant is located upon a strip of land (approximately 250 m in width), which extends across the central part of Application Area, at an elevation of 80-90 maOD.

5.1.4 The Woodford River (Shannon-Erne Waterway) is some 400 m to the southeast of the Site, at its closest approach. Locally, the Woodford River drains from southwest to northeast. Ground elevation upon the closest stretch of floodplain equates to *circa* 50 maOD, which is 10 m below the lowest point on the Site boundary.

5.1.5 The Gortawee Stream, a tributary of the Woodford River, receives all surface water runoff arising within the cement works during rainfall events. Before being discharged into the stream, the runoff is directed through settlement tanks to ensure that the suspended solids content of the water is reduced to an acceptable limit. The settlement tanks include flow balancing capacity (to control the rate of discharge during storm events) and oil interceptor facilities.

5.1.6 With regard to monitoring the risk posed to this watercourse by current operations at the cement works, the key Water Quality Indicators are suspended solids, pH and hydrocarbons. For these three parameters, both the recent and 2005 data for Gortawee Stream comply with the relevant standards.

5.1.7 Gortawee Stream drains eastwards from the flank of the mountain, some 165 m northeast of the cement works, at closest approach. Leaving the high ground of the mountain, the watercourse veers southwards to its confluence with the Woodford River, some 0.5 km to the east of the Site.

5.1.8 Annagh Lough, a proposed Natural Heritage Area, lies some 1.7 km to the southeast of the Application Area. The cement works and lough are situated on opposite sides of the Woodford River.

5.1.9 There are no other waterbodies within 1 km standoff from the development.

5.1.10 With respect to the hydrogeological setting of the cement works, the Dartry Limestone Formation is classified by the GSI as a regionally important, fissured bedrock aquifer.

5.1.11 The groundwater flow direction is towards the southeast, declining from 130 maOD at the contact between the Dartry Limestone and the overlying Meenymore Shales (650 m to the northwest of the Site), down to 50 maOD in the vicinity of the Ballyconnell-Derrylin Road.

5.1.12 Based upon the available piezometer data, the typical long-term range between minimum and maximum groundwater levels is between 2 m and 6.5 m.

5.1.13 Values of hydraulic conductivity obtained for the competent section of the Dartry Limestone were extremely low, *circa* 0.03 m/d. For the disaggregated limestone (mantling the solid strata of the valley floor), the calculated value of hydraulic conductivity equated to 3.4 m/d.

5.1.14 The watercourses upon the flanks of Slieve Rushen exist a significant distance above the watertable. Thus, these streams cannot accrete flow from groundwater. Upon the valley floor, there is diffuse seepage from the drift deposits into the Woodford River.

5.1.15 In terms of abstraction from the Dartry Limestone, aside from the Applicant's boreholes, the closest private groundwater supply boreholes are located at the Kearns property at Gortoorlan (325 m SW of the Site) and the neighbouring Maguire property (500 m SW of the Site).

5.1.16 Cavan County Council (CCC) operate a groundwater abstraction borehole located adjacent to the Ballyconnell to Gortoorlan Road, approximately 500 m standoff to the south of the cement works.

5.1.17 Groundwater quality data, collected on 23rd August 2008 and 3rd November 2008, is described as follows: "The quality of the water in all of the monitoring boreholes is of a high standard. The samples are all within the Cavan County Council parameter limits".

5.1.18 In the context of the Water Framework Directive, EPA mapping indicates that the Dartry Limestone Aquifer is "expected to achieve good status".

5.2 Proposed Development

5.2.1 The Proposed Development involves implanting Solid Recovered Fuel (SRF) at the cement plant. The SRF comprises dried waste: dried organics, card, paper, plastics and other miscellaneous materials.

5.2.2 The SRF will be delivered to Site pre-shredded to the desired size and clean from impurities like metal, over sizes, lumps, wooden pieces, bricks, etc.

5.2.3 The technology is based on best knowledge and practice available appropriate to meet with the EU Waste Incineration Directive "2000/76/EC", with particular regard to ensuring compliance with the emission limits specified in this Directive.

5.2.4 With regard to incoming waste handling, transfer and storage areas: Given that the waste is to be delivered in a dried state, the exclusion of rainwater (by erecting roofed and walled enclosures for the receiving hoppers) is judged to be an effective means of avoiding problems such as the generation and emission of leachate.

5.2.5 There will be no wastewater arising from the co-fuelling process i.e. there will be no wet flue gas treatment for the air pollution control device; no boiler water treatment and blowdown; no scrubber liquor; no water from ash quenching; and no discharge of water from the cooling process.

5.3 Impact Assessment

5.3.1 There are two abstraction boreholes on Site, which supply the raw water requirement (cooling water, process water and dust suppression) for the cement manufacturing process. The boreholes are installed within the Dartry Limestone Formation.

5.3.2 There will be no change in the demand for water; the pre-existing abstraction rate will be maintained; therefore, the current status of neighbouring supplies (the Gortoorlan and CCC boreholes) should be protected.

5.3.3 The current schedule of monitoring of groundwater level within these boreholes will be continued to confirm this assessment.

5.3.4 The risk of hydrocarbon spillages will be minimised by enforcing working procedures that conform to the Preferred Fluids Handing Protocol as described in this report. Trained personnel will undertake all re-fuelling and maintenance, following relevant environmental standards.

5.3.5 In the unlikely event of a hydrocarbon spillage, a contingency plan will be followed for containing and safely disposing of any contaminant.

5.3.6 All surface water runoff arising within the cement works during rainfall events is directed to settlement tanks. This is to ensure that the suspended solids content of the water is reduced to an acceptable limit prior to being discharged into the receiving watercourse (Gortawee Stream). The settlement tanks include flow balancing capacity (to control the rate of discharge during storm events) and oil interceptor facilities.

5.3.7 The proposed development does not involve any change in the surface water run-off pattern at the cement works i.e. no change in the overall size of the rainfall catchment area; no change in the gradient of the area; and no change in the percentage of impermeable area.

5.3.8 The pre-existing drainage infrastructure will receive no additional/new input of surface water run-off. Therefore, there will be no reduction in the quantity and quality of runoff being discharged off Site.

5.3.9 With regard to incoming waste handling, transfer and storage areas: The exclusion of rainwater (by erecting roofed and walled enclosures for the receiving hoppers) is judged to be an effective means of avoiding problems such as the generation and emission of leachate.

5.3.10 To confirm the efficacy of these measures, it is recommended that the monitoring schedule be revised to include testing of additional parameters at key locations, namely: Gortawee Stream, the boreholes at the Cement Plant, the piezometers P05/6S and P05/6D, the CCC Borehole and the private supplies at Gortoorlan.

5.3.11 The additional chemical species should be appropriate to type of fuel (SRF) being brought on to the Site. The following indicator parameters are proposed: ammoniacal nitrogen (already tested), chloride, PAH and nickel.

5.3.12 The implementation of the treatment systems, engineering measures, fluids handling protocol and monitoring schedule advanced to protect groundwater quality will, in turn, serve to safeguard the surface water environment and water supplies.

5.3.13 In terms of flood risk, there is no risk of fluvial flooding at the Site (allowing for climate change). Ground elevation upon the closest stretch of floodplain equates to *circa* 50 maOD, which is 10 m below the lowest point on the Site boundary.

5.3.14 The Proposal Site constitutes a sub-catchment that is largely isolated from runoff from adjacent lands due to the existing surface water drainage network. There will be no change in the surface water run-off pattern on the land uphill/upstream from the cement works; therefore, there will be no increased risk of floodwater coming on to Site from the hillside overlooking the cement works.

5.3.15 The depth to groundwater (as recorded in the Site piezometers) shows that the watercourses upon the flanks of Slieve Rushen exist a significant distance above the watertable. There is considered to be no risk of flooding from groundwater at the cement works.

5.3.16 On the basis of baseline study and subsequent impact assessment, there are considered to be no over-riding hydrological or hydrogeological related reasons why the Proposed Development should not proceed in the manner described by the Application. This conclusion assumes that any permission, if granted, should be conditioned by implementation and adherence to any relevant recommendations advanced within this report and other such conditions that may be reasonably imposed by the Planning Authority.

Henry Lister B.Sc., M.Sc.
Senior Hydrogeologist
BCL Consultant Hydrogeologists Limited
April 2009

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BCL Document Reference: BCL/htl/BCNL/007.doc

Quinn Group

BALLYCONNELL CEMENT WORKS

Ballyconnell, County Cavan

Proposal to use Solid Recovered Fuel
for the Cement Plant

Hydrogeological and Hydrological Assessment

April 2009

APPENDIX I
Figures

Consultant Hydrogeologists Limited

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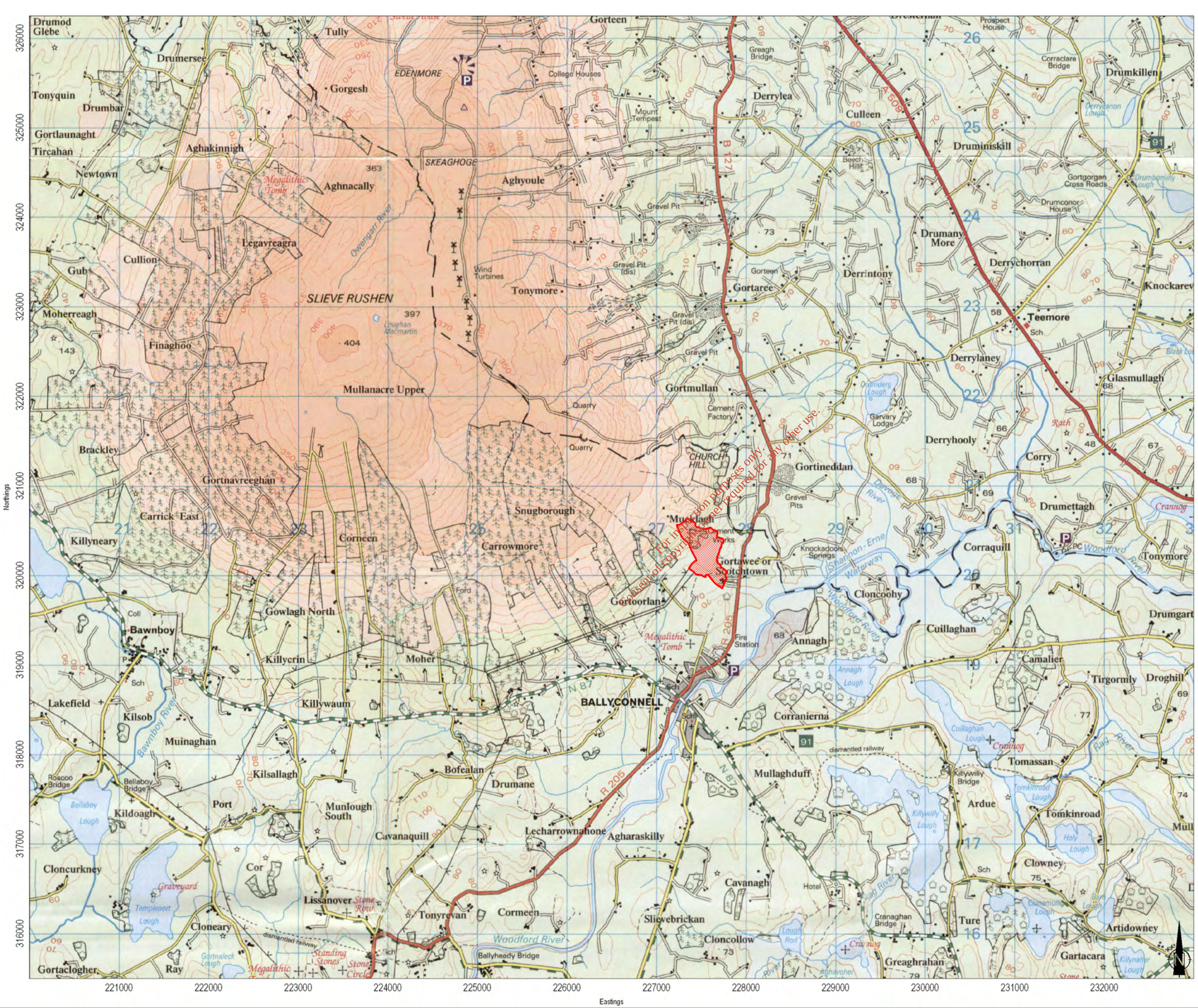
Registered in England & Wales. Registered Office: 33 Wolverhampton Road, Cannock.

Planning Application Area



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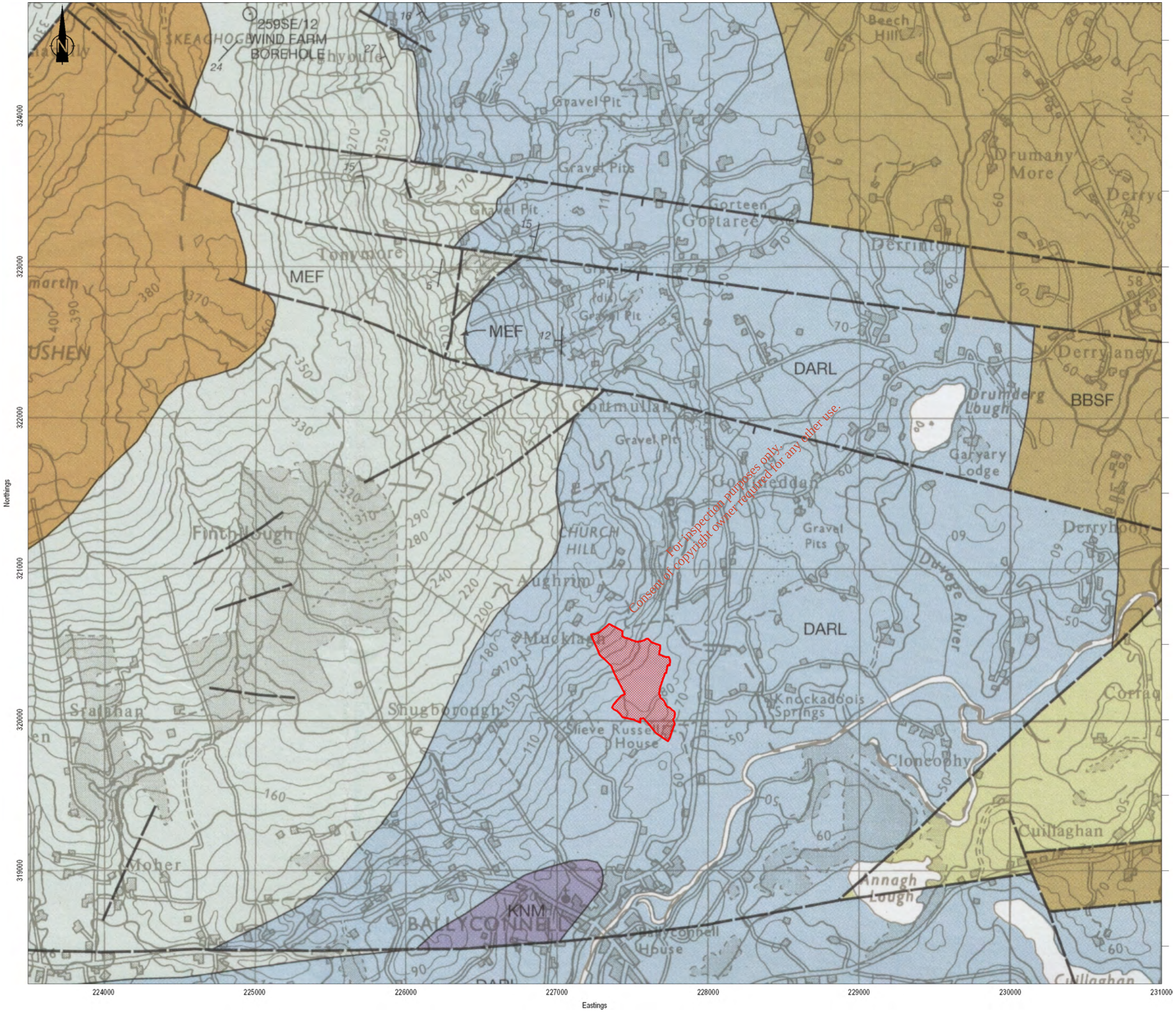
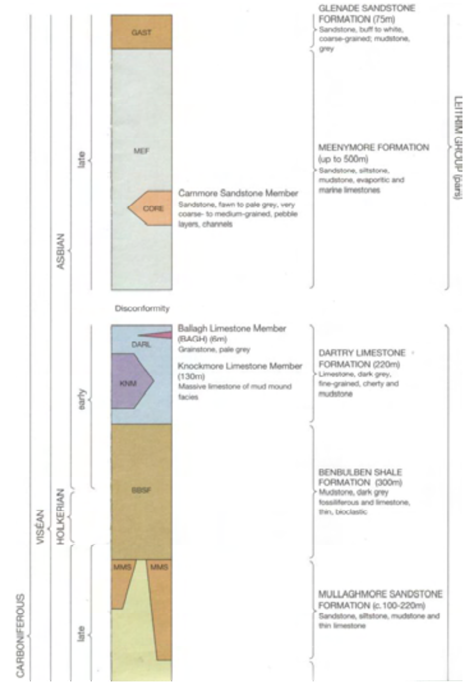
The Quinn Group: New Cement Works, Ballyconnell, County Cavan

Site Location

Drawn By:	HL	Scale:	1:40,000
Date:	Apr 2009	Fig No:	1





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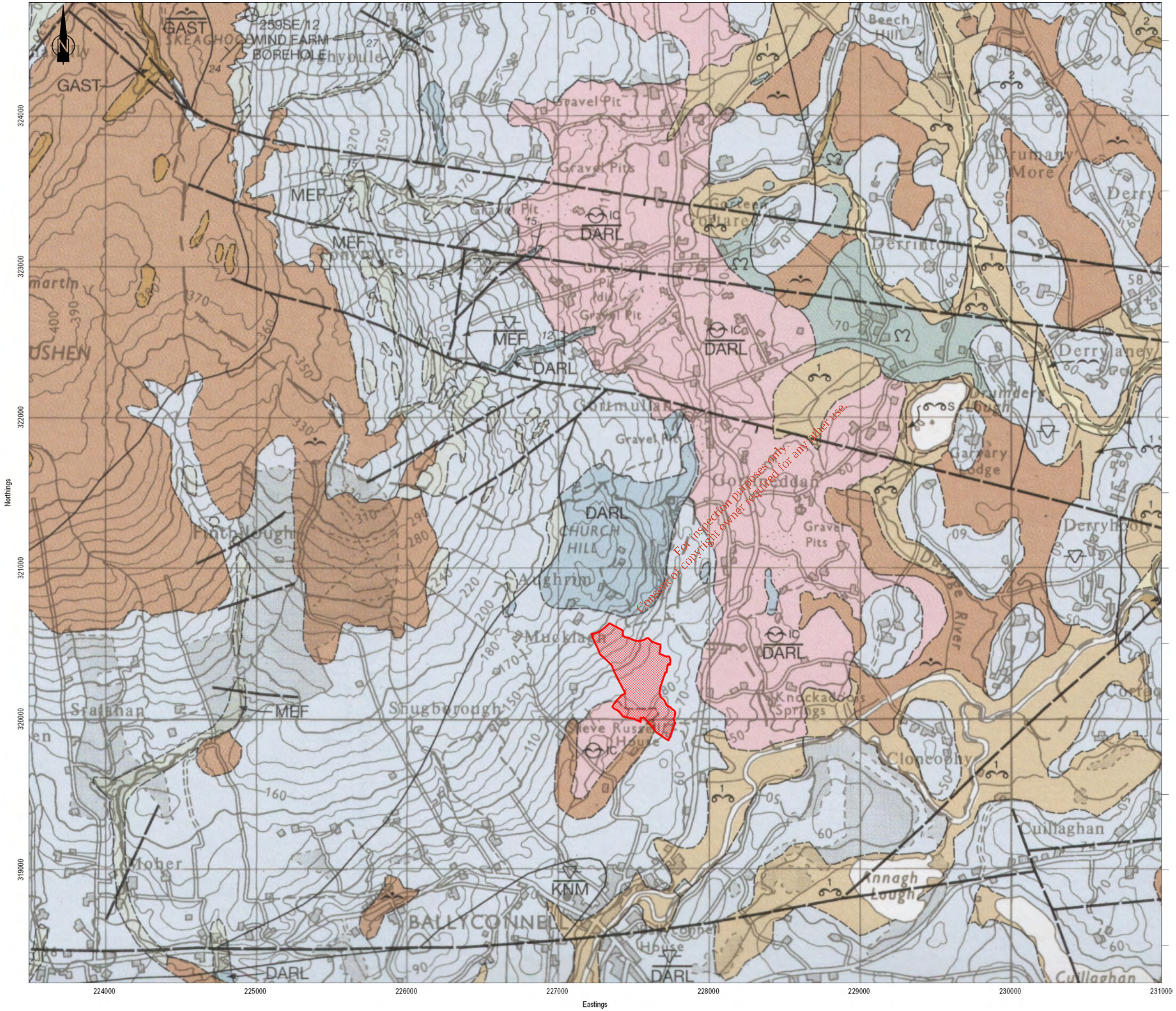
Published Geological Mapping: Solid Geology

Drawn By:	HL	Scale:	1:25,000
Date:	April 2009	Figure No:	2a



SUPERFICIAL DEPOSITS

QUATERNARY

- Alluvium
- Peat
- Lacustrine Shoreface and Beach Deposits
- Lacustrine Delta Deposits
- Lacustrine Alluvium, first level
- Lacustrine Alluvium, second level
- Lacustrine Alluvium, third level
- Lacustrine Alluvium, fourth level
- Lacustrine Alluvium, fifth level
- Lacustrine Alluvium, high level
- Glaciofluvial, Ice-contact Deposits
- Glaciofluvial, Sheet Deposits
- Hummocky (moundy) Glacial Deposits
- Till

See also Generalized Vertical Section

- Inclined strata, dip in degrees
- Geological boundary, Superficial
- Geological boundary, Bedrock
- Fault at bedrock surface, crossmark on downthrow side

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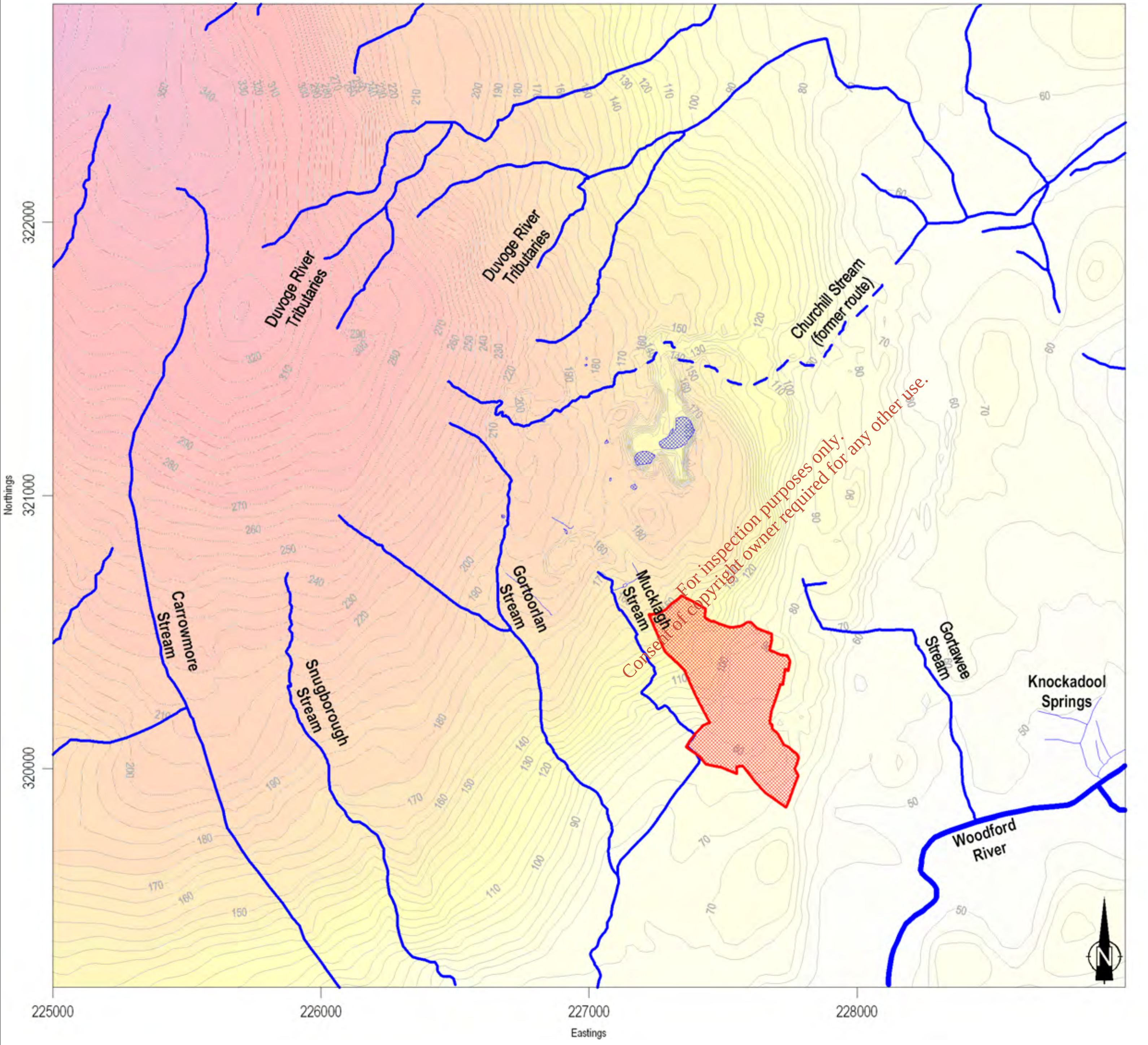
Published Geological Mapping: Solid & Drift Geology

Drawn By:	HL	Scale:	1:25,000
Date:	April 2009	Figure No:	2b



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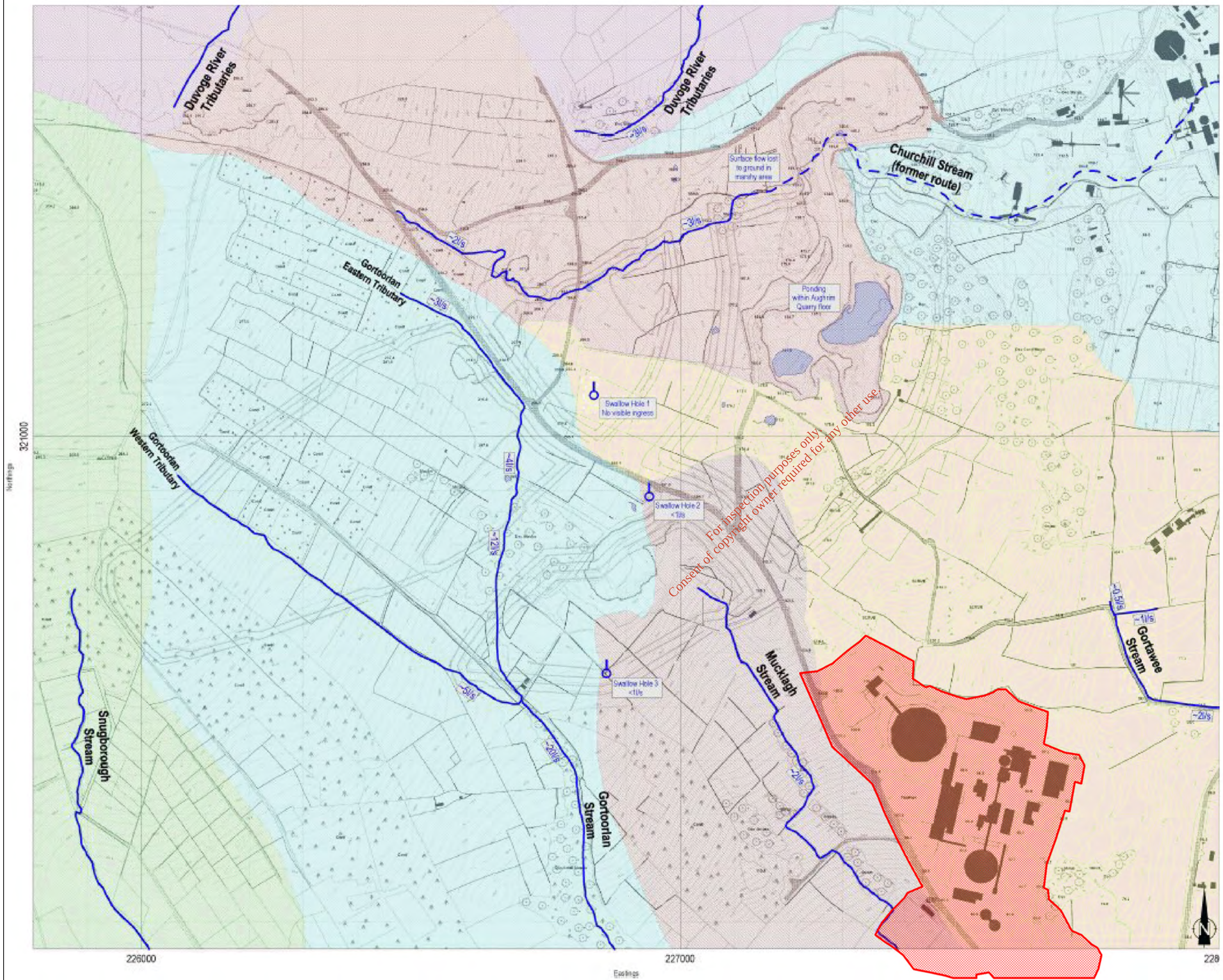
Water Features (1:20,000)

Drawn By:	HL	Scale:	N/A
Date:	April 2009	Figure No.	3



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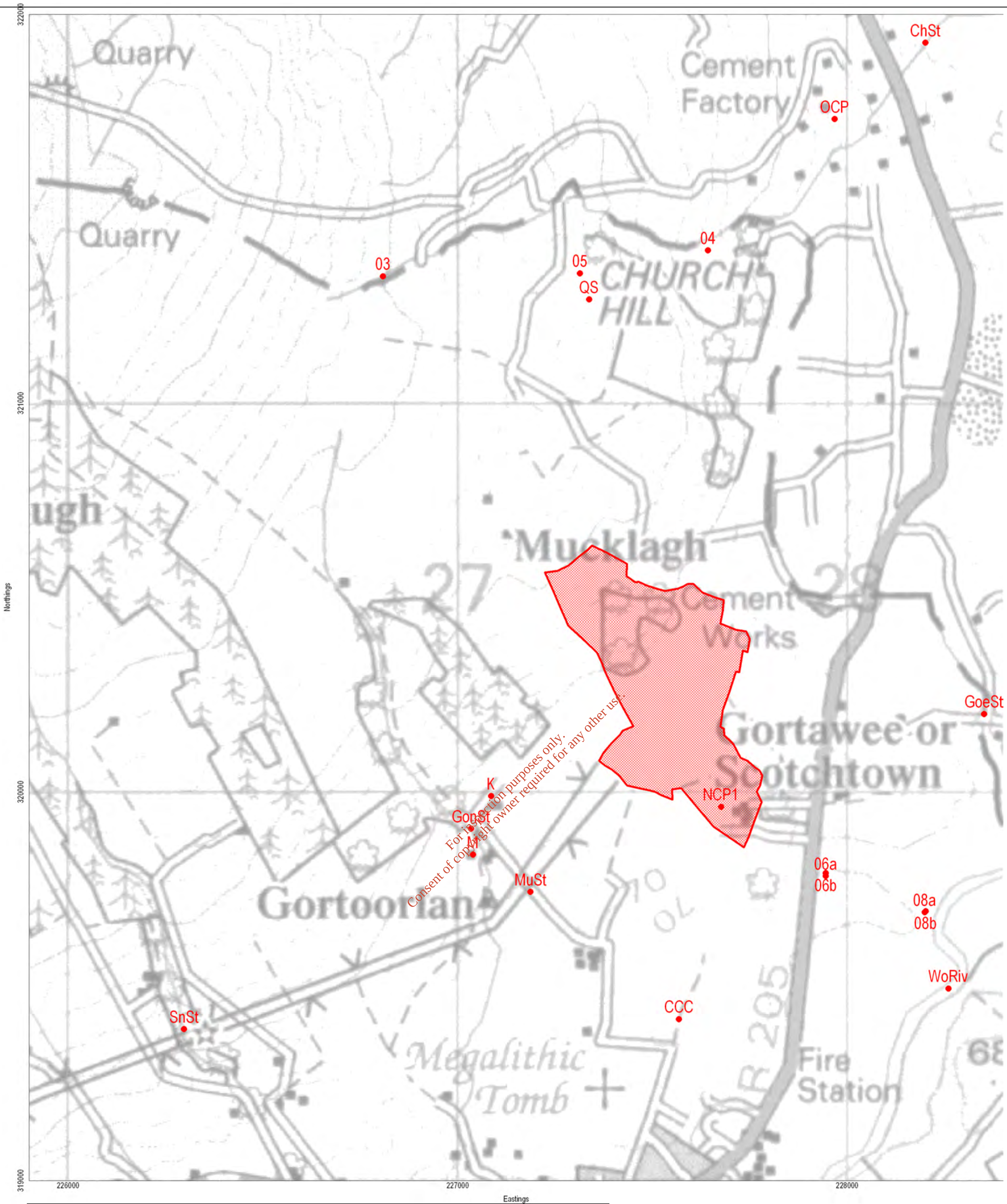
Water Features & Sub Catchment Boundaries

Drawn By:	HL	Scale:	1:7,000
Date:	April 2009	Figure No:	4



Sample Key Code	NGR x	NGR y	Identification	ground / surface water
03	226807.6	321326.4	Piezometer PZ2002/03	g
04	227642.2	321393.1	Piezometer PZ2002/04	g
05	227313.1	321334.1	Piezometer PZ2002/05	g
06a	227944.1	319783.7	Piezometer P05_06a	g
06b	227944.3	319791.3	Piezometer P05_06b	g
08a	228197.9	319690.6	Piezometer P05_08a	g
08b	228200.5	319693.9	Piezometer P05_08b	g
CCC	227567.9	319415.9	Cavan County Council Public Water Supply Well	g
K	227085.3	319989.6	Kearn's Well	g
M	227039.2	319839.1	McGuires Well	g
NCP1	227675.4	319961.9	New Cement Plant Waterwell 1	g
OCP	227967.5	321730.8	Old Cement Plant Waterwell 1	g
QS	227337.1	321266.8	Quarry Void Sump	g
ChSt	228200.1	321927.2	Churchill Stream	s
GoeSt	228350.5	320200.7	Gortawee Stream	s
GonSt	227033.8	319905.6	Gortoorlan Stream	s
MuSt	227186.7	319743	Mucklagh Stream	s
SnSt	226297.2	319389.9	Snugborough Stream	s
WoRiv	228259.1	319494.6	Woodford River	s

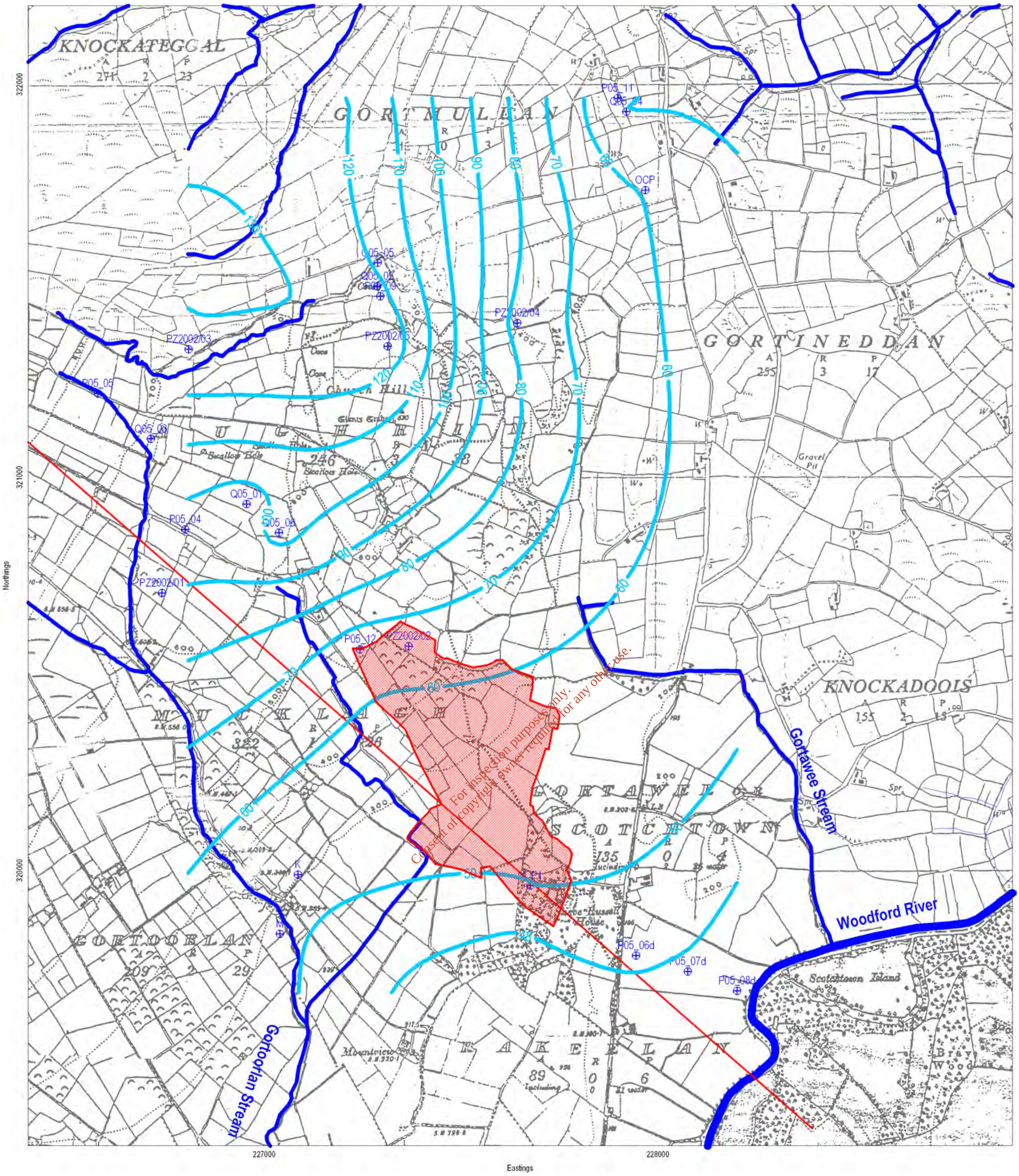
Quinn Group
Derrylin
Co.
Fermanagh
N. Ireland
BT92 9AU

Technology Centre, Wolverhampton
Science Park Wolverhampton, WV10 9RU
tel: 01902 824111 fax: 01902 824112
email: info@bclhydro.co.uk
www: http://www.bclhydro.co.uk

The Quinn Group: New Cement Works, Ballyconnell, County Cavan

Water Quality Sample Locations

Drawn By:	HL	Scale:	1:10:000
Date:	April 2009	Figure No:	5



50 Interpolated Groundwater Level Contour (maOD)

Quinn Group
Derrylin
Co.
Fermanagh
N. Ireland
BT92 9AU

BCL
Technology Centre, Wolverhampton Science Park Wolverhampton, WV10 9RU
tel: 01902 824111 fax: 01902 824112
email: info@bclhydro.co.uk
www: http://www.bclhydro.co.uk

The Quinn Group: New Cement Works, Ballyconnell, County Cavan

Groundwater Level Contours (metres above Ordnance Datum)

Drawn By:	HL	Scale:	1:10:000
Date:	April 2009	Figure No:	6

Quinn Group

BALLYCONNELL CEMENT WORKS

Ballyconnell, County Cavan

Proposal to use Solid Recovered Fuel
for the Cement Plant

Hydrogeological and Hydrological Assessment

April 2009

APPENDIX II

Water Quality Data, 23rd August & 3rd November 2008

Consultant Hydrogeologists

Technology Centre
Wolverhampton Science Park, Wolverhampton, WV10 9RU
Tel: 01902 824111, Fax: 01902 824112
email: info@bclhydro.co.uk www: http://www.bclhydro.co.uk

Company Registration Number: 4043373
Registered in England & Wales. Registered Office: 33 Wolverhampton Road, Cannock.

Microlabs Food & Water Laboratory
Microlabs Ltd. • Drumillard Little • Monaghan Road • Castleblayney • Co. Monaghan • Ireland
Tel. 042 9746653 • Fax. 042 9746675 • Email: microlab@iol.ie
Campden & Chorleywood - CLAS accredited Laboratory

WATER ANALYSIS REPORT 15/10/2008

MR. FERGAL COYLE,
F. J. COYLE & ASSOCCIATES
3 CHURCH SQ
MONAGHAN.

Sample: Water
Date: 28/08/08

Sample Ref	Ammonia Nitrogen mg/l	Nitrate Nitrogen mg/l	Total Nitrogen mg/l	Susp. Solids Mg/l	Total Phosph. as P mg/l	Ph	Conductivity Micro Siemens @ 20deg C	Turbidity Ftu	Total Coliforms per 100 mls	Faecal Coliforms per 100 mls
Bh 10	0.04	2.2	1.7	0	0.20	7.1	330	0.33	28	20
Bh 11	0.03	2.5	2.7	31	0.19	6.8	312	53	8	0
Bh 14	0.05	3.1	3.8	17	0.12	7.2	364	72	0	0
Bh 16	0 06	3.5	3.1	2	0.16	7.0	553	2.3	41	9
Bh 48	0.04	4.2	2.7	9	0.24	7.0	550	1.9	29	24
Bh 49	0.07	2.1	3.9	1	0.11	7.3	396	0.2	6	0

Signed: ....
Martin McGuire

Microlabs Food & Water Laboratory
Microlabs Ltd. • Drumillard Little • Monaghan Road • Castleblayney • Co. Monaghan • Ireland
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Campden & Chorleywood - CLAS accredited Laboratory

WATER ANALYSIS REPORT 16/10/2008

MR. FERGAL COYLE,
F. J. COYLE & ASSOCCIATES
3 CHURCH SQ
MONAGHAN.

Sample: Surface Water
Date: 28/08/08

Sample Ref	Ammonia Nitrogen mg/l	Iron mg/l	Manganese mg/l	Colour Pt Co Units	Sodium as P mg/l	Ph	Conductivity Micro Siemens @ 20deg C	Turbidity Ftu	O-phosphate Mg/l P	Faecal Coliforms per 100 mls
Gortawee Stream	0.28	0.03	0.01	27	9.2	8.1	497	0.07	0.07	<1
Churchill Stream	0.02	3.3	0.03	18	7.3	7.7	377	280	280	34
Snug Stream	0 48	5.4	0.02	19	11.2	7.9	117	2.4	2.4	21
Gort Stream	0.48	1 8	<0.01	19	6.8	7.9	117	2.4	2.4	21

Signed: ....
Martin McGuire

Microlabs *Food & Water Laboratory*

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Campden & Chorleywood - CLAS accredited Laboratory

WATER ANALYSIS REPORT 15/10/2008

MR. FERGAL COYLE,
F. J. COYLE & ASSOCCIATES
3 CHURCH SQ
MONAGHAN.

Sample: Groundwater
Date: 28/08/08

Sample Ref	Ammonia Nitrogen mg/l	Iron mg/l	Manganese mg/l	Colour Pt Co Units	Sodium as P mg/l	Ph	Conductivity Micro Siemens @ 20deg C	Turbidity Ftu	Faecal Coliforms per 100 mls
Bh 1, Cement Plant	0.02	0.01	<0.01	1	25	6.8	309	0.3	0
Bh 2, Cement Plant	0.03	0.01	<0.01	1	27	7.0	366	0.4	0
P05-06 D	0.02	0.02	<0.01	3	22	6.9	372	1.0	0
P05-06 S	0.03	<0.01	<0.01	2	21	7.3	312	0.8	0
Ballyconnell Water Supply	0.04	0.01	<0.01	1	27	7.4	306	0.3	0
Maguire Private Borehole	0.02	0.02	0.01	1	24	7.0	298	0.3	0
Kearns Private Borehole	0.01	0.03	<0.01	2	26	7.2	344	0.5	0

Signed: ....
Martin McGuire

ALcontrol Laboratories (Dublin)

18a Rosemount Business Park,
Ballycoolin,
Dublin 11
Ireland
Tel: +353 (0) 1 8829893
Fax: +353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client: F J Coyle & Associates
No 3 High Street
Monaghan
Co.Monaghan

Attention: Conor Foy

Date: 14 October, 2008

Our Reference: 08-B05576/01

Your Reference: Quinn Quarry/Cement

Location:

A total of 16 samples was received for analysis on Wednesday, 24 September 2008. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

Dylan Halpin

Dylan Halpin
Team Leader Project Co-ordination

Lorraine McNamara

Lorraine McNamara
General Manager

Compiled By

Norah O'Connor

Norah O'Connor

UKAS TESTING
1291
GROUP

Printed at 10:42 on 15/10/2008

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 08-B05576/01
Client: F J Coyle & Associates
Date of Receipt: 24/09/2008

Sample Type: WATER
Location:
Client Contact: Conor Foy
Client Ref: Quinn Quarry/Cement

			Detection Method	Calculation	GC	GC	GC	GC	GC	GC	GC	GC	GC	GRAVIMETRIC	ICP IRIS	IR	KONE
UKAS Accredited [Testing Laboratory] No. 1291				✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ALcontrol Reference	Sample Identity	Other ID	P / V	Total Oxidised Nitrogen as N	Diesel Range Organics	Mineral Oil by GC	DRO Interpretation	Benzene	Ethylbenzene	Petrol Range Organics C5-C9	Petrol Range Organics C10-12	Toluene	Total Xylene	Total Suspended Solids	Total Phosphorous	Total Organic Carbon	Nitrate as NO3
08-B05576-S0006-A01	GORTAVEE STREAM	UNKNOWN	Non-Alcontrol Plastic Tub	-	-	-	-	-	-	-	-	-	-	-	-	-	-
08-B05576-S0006-A02	GORTAVEE STREAM	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0007-A01	CEMENT PLANT BH1	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0008-A01	CEMENT PLANT BH2	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0009-A01	BH10	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0010-A01	BH16	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0011-A01	BH49	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0012-A01	BH48	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0013-A01	BH11	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0014-A01	BH16	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0015-A01	POS 065	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0016-A01	POS 060	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0017-A01	SNUG STREAM	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0018-A01	MAGUIRES	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0019-A01	CHURCHILL STREAM	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0020-A01	KEARNS	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X
08-B05576-S0021-A01	BALLYCONNELL	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X	X	X	X	X	X	X	X	X	X	X

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 08-B05576/01
Client: F J Coyle & Associates
Date of Receipt: 24/09/2008

Sample Type: WATER
Location:
Client Contact: Conor Foy
Client Ref: Quinn Quarry/Cement

Detection Method				METER	SPECTRO	SPECTRO	SPECTRO
UKAS Accredited [Testing Laboratory] No. 1291							
ALcontrol Reference	Sample Identity	Other ID	P / V	Turbidity	Ammoniacal Nitrogen as N	Kjeldahl Nitrogen	Total Nitrogen as N
08-B05576-S0006-A01	GORTAVEE STREAM	UNKNOWN	Non-Alcontrol Plastic Tub	-	-	X	X
08-B05576-S0006-A02	GORTAVEE STREAM	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	-	X
08-B05576-S0007-A01	CEMENT PLANT BH1	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0008-A01	CEMENT PLANT BH2	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0009-A01	BH10	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0010-A01	BH16	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0011-A01	BH49	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0012-A01	BH48	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0013-A01	BH11	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0014-A01	BH16	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0015-A01	POS 065	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0016-A01	POS 060	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0017-A01	SNUG STREAM	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0018-A01	MAGUIRES	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0019-A01	CHURCHILL STREAM	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0020-A01	KEARNS	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X
08-B05576-S0021-A01	BALLYCONNELL	UNKNOWN	Non-Alcontrol Plastic Tub	X	X	X	X

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule Summary

Ref Number: **08-B05576/01**
Client: F J Coyle & Associates
Date of Receipt: 24/09/2008

Sample Type: **WATER**
Location:
Client Contact: Conor Foy
Client Ref: Quinn Quarry/Cement

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

SCHEDULE	METHOD	TEST NAME	TOTAL
X	Calculation	Total Oxidised Nitrogen	16
X	GC	DRO + Mineral Oil by GC	16
X	GC	DRO Interpretation	16
X	GC	PRO & BTEX	16
X	GRAVIMETRIC	Total Suspended Solids	16
X	ICP IRIS	Total Phosphorus	16
X	IR	Total Organic Carbon	16
X	KONE	Nitrate as NO3	16
X	METER	Turbidity	16
X	SPECTRO	Ammoniacal Nitrogen	16
X	SPECTRO	Kjeldahl Nitrogen	16
X	SPECTRO	Total Nitrogen	16

☐ Interim

☑ Validated

ALcontrol Laboratories Ireland
Table Of Results

Ref Number: 08-B05576/01
Client: F J Coyle & Associates
Date of Receipt: 24/09/2008
(of first sample)

Sample Type: WATER
Location:
Client Contact: Conor Foy
Client Ref: Quinn Quarry/Cement

ALcontrol Reference	Sample Identity	Other ID	Total Oxidised Nitrogen as N	Diesel Range Organics	Mineral Oil by GC	DRO Interpretation	Petrol Range Organics C5-C9	Petrol Range Organics C10-12	Benzene	Toluene	Ethylbenzene	Total Xylene	Total Suspended Solids	Total Phosphorous	Total Organic Carbon	Nitrate as NO3	Turbidity
Detection Method			Calculation	GC	GC	GC	GC	GC	GC	GC	GC	GC	GRAVIMETRIC	ICP IRIS	IR	KONE	METER
Method Detection Limit			<0.3mg/l	<10ug/l	<10ug/l	n/a	<10ug/l	<10ug/l	<10ug/l	<10ug/l	<10ug/l	<10ug/l	<10mg/l	<0.05mg/l	<2mg/l	<0.3mg/l	<0.1NTU
UKAS Accredited [Testing Laboratory] No. 1291			✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
			mg/l	ug/l	ug/l		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	NTU
08-B05576-S0006	GORTAVEE STREAM	UNKNOWN	<0.3	<10	<10	See attached	<10	<10	<10	<10	<10	<10	39	<0.05	25	<0.3	7.9
08-B05576-S0007	CEMENT PLANT BH1	UNKNOWN	2.0	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	<2	8.5	0.2
08-B05576-S0008	CEMENT PLANT BH2	UNKNOWN	1.9	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	<2	8.0	0.3
08-B05576-S0009	BH10	UNKNOWN	2.7	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	2	11.7	0.2
08-B05576-S0010	BH16	UNKNOWN	4.6	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	3	20.1	0.3
08-B05576-S0011	BH49	UNKNOWN	1.2	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	<2	5.3	0.4
08-B05576-S0012	BH48	UNKNOWN	3.6	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	4	15.5	0.4
08-B05576-S0013	BH11	UNKNOWN	0.7	<10	<10	See attached	<10	<10	<10	<10	<10	<10	18	<0.05	<2	2.9	0.6
08-B05576-S0014	BH16	UNKNOWN	1.4	<10	<10	See attached	<10	<10	<10	<10	<10	<10	24	<0.05	6	5.9	8.5
08-B05576-S0015	POS 065	UNKNOWN	1.8	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	<2	7.6	0.2
08-B05576-S0016	POS 060	UNKNOWN	1.4	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	<2	5.9	0.2
08-B05576-S0017	SNUG STREAM	UNKNOWN	<0.3	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	33	<0.3	1.7
08-B05576-S0018	MAGUIRES	UNKNOWN	<0.3	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	<2	<0.3	0.3
08-B05576-S0019	CHURCHILL STREAM	UNKNOWN	<0.3	<10	<10	See attached	<10	<10	<10	<10	<10	<10	41	<0.05	15	0.5	1.5
08-B05576-S0020	KEARNS	UNKNOWN	0.7	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	<2	3.0	0.2
08-B05576-S0021	BALLYCONNELL	UNKNOWN	0.7	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<10	<0.05	<2	3.2	0.2

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Norah O'Connor

Printed at 10:42 on 15/10/2008

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland
Table Of Results

Ref Number: 08-B05576/01
Client: F J Coyle & Associates
Date of Receipt: 24/09/2008
(of first sample)

Sample Type: WATER
Location:
Client Contact: Conor Foy
Client Ref: Quinn Quarry/Cement

ALcontrol Reference	Sample Identity	Other ID	Total Nitrogen as N	Ammoniacal Nitrogen as N	Kjeldahl Nitrogen
		Detection Method	SPECTRO	SPECTRO	SPECTRO
		Method Detection Limit	<1mg/l	<0.2mg/l	<1mg/l
UKAS Accredited [Testing Laboratory] No. 1291					
			mg/l	mg/l	mg/l
08-B05576-S0006	GORTAVEE STREAM	UNKNOWN	4	<0.2	4
08-B05576-S0007	CEMENT PLANT BH1	UNKNOWN	14	<0.2	7
08-B05576-S0008	CEMENT PLANT BH2	UNKNOWN	36	<0.2	15
08-B05576-S0009	BH10	UNKNOWN	37	<0.2	17
08-B05576-S0010	BH16	UNKNOWN	33	<0.2	14
08-B05576-S0011	BH49	UNKNOWN	24	<0.2	12
08-B05576-S0012	BH48	UNKNOWN	33	<0.2	15
08-B05576-S0013	BH11	UNKNOWN	31	<0.2	15
08-B05576-S0014	BH16	UNKNOWN	98	<0.2	49
08-B05576-S0015	POS 065	UNKNOWN	17	<0.2	8
08-B05576-S0016	POS 060	UNKNOWN	25	<0.2	12
08-B05576-S0017	SNUG STREAM	UNKNOWN	67	<0.2	34
08-B05576-S0018	MAGUIRES	UNKNOWN	56	<0.2	28
08-B05576-S0019	CHURCHILL STREAM	UNKNOWN	71	<0.2	<1
08-B05576-S0020	KEARNS	UNKNOWN	72	<0.2	35
08-B05576-S0021	BALLYCONNELL	UNKNOWN	72	<0.2	36

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Norah O'Connor

Printed at 10:42 on 15/10/2008

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

Geochem Analytical Services

Diesel Range Organics/Mineral Oil
by
G.C.

Client Name F J Coyle & Associates
Client Ref Quinn Quarry/Cement
Sample Matrix Water

Job Number B05576
Date Extracted/Prepared 01.10.08
Date Analysed 02.10.08

Separatory Funnel Ext No
Soxtec Extraction No
Column Extraction No

Sample number	Sample Identity	Depth	Diesel Range Hydrocarbons (µg/litre)	Mineral Oil (µg/litre)	Interpretation
006	GORTAVEE STREAM	UNKNOWN	< 10	< 10	No Identification Possible
007	CEMENT PLANT BH1	UNKNOWN	< 10	< 10	No Identification Possible
008	CEMENT PLANT BH2	UNKNOWN	< 10	< 10	No Identification Possible
009	BH10	UNKNOWN	< 10	< 10	No Identification Possible
010	BH16	UNKNOWN	< 10	< 10	No Identification Possible
011	BH49	UNKNOWN	< 10	< 10	No Identification Possible
012	BH48	UNKNOWN	< 10	< 10	No Identification Possible
013	BH11	UNKNOWN	< 10	< 10	No Identification Possible
014	BH16	UNKNOWN	< 10	< 10	No Identification Possible
015	POS 065	UNKNOWN	< 10	< 10	No Identification Possible
016	POS 060	UNKNOWN	< 10	< 10	No Identification Possible
017	SNUG STREAM	UNKNOWN	< 10	< 10	No Identification Possible
018	MAGUIRES	UNKNOWN	< 10	< 10	No Identification Possible
019	CHURCHILL STREAM	UNKNOWN	< 10	< 10	No Identification Possible
020	KEARNS	UNKNOWN	< 10	< 10	No Identification Possible
021	BALLYCONNELL	UNKNOWN	< 10	< 10	No Identification Possible

Checked by Natallia Flynn

APPENDIX

APPENDIX

1. Results are expressed as mg/kg dry weight (dried at 30°C) on all soil analyses except for the following: NRA Leach tests, flash point, and ammoniacal N_2 by the BRE method, VOC, PRO, Cyanide, Acid Soluble Sulphide,TPH by IR, OFGs and SEM.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. A sub sample of all samples received will be retained free of charge for one month for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, then identification and quantification is carried out by ALcontrol Technichem or Alcontrol Shutlers in the UK. If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample are undertaken.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.

8. NDP – No Determination Possible due to insufficient/unsuitable sample.

9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.

10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

Last updated February 2005

Microlabs *Food & Water Laboratory*

Microlabs Ltd. • Drumillard Little • Monaghan Road • Castleblayney • Co. Monaghan • Ireland
Tel. 042 9746653 • Fax. 042 9746675 • Email: microlab@iol.ie
Campden & Chorleywood - CLAS accredited Laboratory

MR. FERGAL COYLE,
F. J. COYLE & ASSOCCIATES
NO 3 HIGH STREET
MONAGHAN TOWN

WATER ANALYSIS REPORT 16/01/2009

Sample: Groundwater
Date: 03/11/08

Sample Ref	Ammonia Nitrogen mg/l	Nitrate as NO3 mg/l	Total Nitrogen mg/l	Total Phosphorous as P mg/l	Ph	Conductivity Micro Siemens @ 20deg C	Turbidity Ftu	Faecal Coliforms per 100 mls	TOC mg/L
P05-06 D	0.05	4.4	1.0	0.11	7.1	381	0.5	0	6.8
P05-06 S	0.04	4.9	1.4	0.13	7.0	278	3.5	0	6.2
Ballyconnell Water Supply	0.03	4.0	1.4	0.10	7.2	402	0.3	0	4.1
Kearns Well	0.02	4.9	1.5	0.14	7.2	266	0.5	0	3.7
Bh 1, Cement Plant	0.04	5.3	3.2	0.16	6.7	279	0.3	0	5.1
Bh 2, Cement Plant	0.02	5.8	2.2	0.14	6.9	295	0.4	0	6.7
Bh 10	0.03	6.2	1.7	0.21	7.1	282	0.4	0	4.8
Bh 11	0.04	7.5	2.7	0.13	6.9	276	5.7	0	5.6
Bh 14	0.05	5.8	3.8	0.15	7.3	307	84	0	6.0
Bh 16	0.06	4.4	3.1	0.12	7.2	285	1.7	9	5.4
Bh 48	0.07	5.8	2.7	0.16	7.1	502	3.9	16	5.3
Bh 49	0.03	6.6	3.9	0.08	7.3	344	2.4	0	6.2

Signed: ....
Martin McGuire

ALcontrol Laboratories (Dublin)

18a Rosemount Business Park,
Ballycoolin,
Dublin 11
Ireland
Tel: +353 (0) 1 8829893
Fax: +353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client: F J Coyle & Associates
No 3 High Street
Monaghan
Co.Monaghan

Attention: Fergal Coyle

Date: 18 November, 2008

Our Reference: 08-B06473/01

Your Reference: Quinn Quarry

Location:

A total of 15 samples was received for analysis on Thursday, 6 November 2008. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

Dylan Halpin

Dylan Halpin
Team Leader Project Co-ordination

Lorraine McNamara

Lorraine McNamara
General Manager

Dylan Halpin

Compiled By ....

Dylan Halpin

UKAS TESTING
1291
GROUP

Printed at 14:59 on 25/11/2008

ALcontrol Geochem Ireland is a trading division of ALcontrol UK Limited.
Registered Office: Templeborough House, Mill Close, Rotherham, S60 1BZ. Registered in England and Wales No. 4057291

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 08-B06473/01
Client: F J Coyle & Associates
Date of Receipt: 06/11/2008

Sample Type: WATER
Location:
Client Contact: Fergal Coyle
Client Ref: Quinn Quarry

			Detection Method	GC	GC	GC	GC	GC	GC	GC	GC	GC	IR				
UKAS Accredited [Testing Laboratory] No. 1291				✓			✓	✓	✓	✓	✓	✓	✓				
ALcontrol Reference	Sample Identity	Other ID	P / V	Diesel Range Organics	Mineral Oil by GC	DRO Interpretation	Benzene	Ethylbenzene	Petrol Range Organics C5-C9	Petrol Range Organics C10-12	Toluene	Total Xylene	Total Organic Carbon				
08-B06473-S0003-A01	GORTOORLAN STREAM	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	-				
08-B06473-S0004-A01	SNUG STREAM	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	-				
08-B06473-S0005-A01	GORTAWEE STREAM	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	-				
08-B06473-S0006-A01	CEMENT PLANT BH1	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0007-A01	CEMENT PLANT BH2	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0008-A01	KEARNS PRIVATE BOREHOLE	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0009-A01	BALLYCONNELL WATER SUPPLY	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0010-A01	P05-06S	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0011-A01	P05-06D	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0012-A01	BH10	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0013-A01	BH11	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0014-A01	BH14	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0015-A01	BH16	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0016-A01	BH48	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				
08-B06473-S0017-A01	BH49	UNKNOWN	Plastic Bottle	X	-	X	X	X	X	X	X	X	X				

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

Printed at 14:59 on 25/11/2008

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule Summary

Ref Number:	**08-B06473/01**	**Sample Type:**	**WATER**
Client:	F J Coyle & Associates	Location:	
Date of Receipt:	06/11/2008	Client Contact:	Fergal Coyle
		Client Ref:	Quinn Quarry

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

SCHEDULE	METHOD	TEST NAME	TOTAL
X	GC	DRO + Mineral Oil by GC	15
X	GC	DRO Interpretation	15
X	GC	PRO & BTEX	15
X	IR	Total Organic Carbon	12

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 08-B06473/01
Client: F J Coyle & Associates
Date of Receipt: 06/11/2008
(of first sample)

Sample Type: WATER
Location:
Client Contact: Fergal Coyle
Client Ref: Quinn Quarry

ALcontrol Reference	Sample Identity	Other ID	Diesel Range Organics	Mineral Oil by GC	DRO Interpretation	Petrol Range Organics C5-C9	Petrol Range Organics C10-12	Benzene	Toluene	Ethylbenzene	Total Xylene	Total Organic Carbon
Detection Method			GC	GC	GC	GC	GC	GC	GC	GC	GC	IR
Method Detection Limit			<10ug/l	<10ug/l	n/a	<10ug/l	<10ug/l	<10ug/l	<10ug/l	<10ug/l	<10ug/l	<2mg/l
UKAS Accredited [Testing Laboratory] No. 1291			✓			✓	✓	✓	✓	✓	✓	✓
			ug/l	ug/l		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l
08-B06473-S0003	GORTOORLAN STREAM	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	-
08-B06473-S0004	SNUG STREAM	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	-
08-B06473-S0005	GORTAWEE STREAM	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	-
08-B06473-S0006	CEMENT PLANT BH1	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	3
08-B06473-S0007	CEMENT PLANT BH2	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<2
08-B06473-S0008	KEARNS PRIVATE BOREHOLE	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<2
08-B06473-S0009	BALLYCONNELL WATER SUPPLY	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<2
08-B06473-S0010	P05-06S	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<2
08-B06473-S0011	P05-06D	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<2
08-B06473-S0012	BH10	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	3
08-B06473-S0013	BH11	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<2
08-B06473-S0014	BH14	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	5
08-B06473-S0015	BH16	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	3
08-B06473-S0016	BH48	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	5
08-B06473-S0017	BH49	UNKNOWN	<10	<10	See attached	<10	<10	<10	<10	<10	<10	<2

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Dylan Halpin

Geochem Analytical Services

Diesel Range Organics/Mineral Oil
by
G.C.

Client Name F J Coyle & Associates
Client Ref Quinn Quarry
Sample Matrix Water

Job Number B06473
Date Extracted/Prepared 14-Nov-08
Date Analysed 17-Nov-08

Separatory Funnel Ext No
Soxtec Extraction No
Column Extraction No

Sample number	Sample Identity	Depth	Diesel Range Hydrocarbons (µg/litre)	Mineral Oil (µg/litre)	Interpretation
S0003	GORTOORLAN STREAM	-	< 10	< 10	No Identification Possible
S0004	SNUG STREAM	-	< 10	< 10	No Identification Possible
S0005	GORTAWEE STREAM	-	< 10	< 10	No Identification Possible
S0006	CEMENT PLANT BH1	-	< 10	< 10	No Identification Possible
S0007	CEMENT PLANT BH2	-	< 10	< 10	No Identification Possible
S0008	EARNS PRIVATE BOREHOL	-	< 10	< 10	No Identification Possible
S0009	LLYCONNELL WATER SUPP	-	< 10	< 10	No Identification Possible
S0010	P05-06S	-	< 10	< 10	No Identification Possible
S0011	P05-06D	-	< 10	< 10	No Identification Possible
S0012	BH10	-	< 10	< 10	No Identification Possible
S0013	BH11	-	< 10	< 10	No Identification Possible
S0014	BH14	-	< 10	< 10	No Identification Possible
S0015	BH16	-	< 10	< 10	No Identification Possible
S0016	BH48	-	< 10	< 10	No Identification Possible
S0017	BH49	-	< 10	< 10	No Identification Possible

Checked by Patricia Morado

APPENDIX

APPENDIX

1. Results are expressed as mg/kg dry weight (dried at 30°C) on all soil analyses except for the following: NRA Leach tests, flash point, and ammoniacal N_2 by the BRE method, VOC, PRO, Cyanide, Acid Soluble Sulphide,TPH by IR, OFGs and SEM.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. A sub sample of all samples received will be retained free of charge for one month for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, then identification and quantification is carried out by ALcontrol Technichem or Alcontrol Shutlers in the UK. If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample are undertaken.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.

8. NDP – No Determination Possible due to insufficient/unsuitable sample.

9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.

10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

Last updated February 2005

Quinn Group

BALLYCONNELL CEMENT WORKS

Ballyconnell, County Cavan

Proposal to use Solid Recovered Fuel
for the Cement Plant

Hydrogeological and Hydrological Assessment

April 2009

APPENDIX III

Preferred Fluids Handling Protocol

Consultant Hydrogeologists Limited

Technology Centre
Wolverhampton Science Park, Wolverhampton, WV10 9RU
Tel: 01902 824111, Fax: 01902 824112
email: info@bclhydro.co.uk www: http://www.bclhydro.co.uk

Company Registration Number: 4043373
Registered in England & Wales. Registered Office: 33 Wolverhampton Road, Cannock.

Introduction

Inappropriate storage and handling of fuels and oils can result in contamination of ground, groundwater and surface water.

This procedure covers:

Bulk storage of fuels and oils, including waste oil
Filling of bulk storage tanks
Storage and handling of drums
Refuelling operations
Procedure for emptying bunded areas
Fuel and oil spills

Bulk storage of fuels and oils, including waste oil

1. All fuels and oils in bulk shall be kept in bunded storage, the location of which shall be identified on a site plan.
2. The walls and floor of storage bunds must be impervious to oil.
3. Tank filling points shall be inside the bunded area.
4. Delivery lines shall be overhead or, if underground, sleeved.
5. Delivery nozzles shall be stored inside the bund and locked when not in use.
6. Bund drain valves, where fitted, shall be designed so that they can only be removed by key or hand held tool, except when emptying the bund under controlled conditions.
7. All bulk storage tanks shall be appropriately labelled with contents and capacity.
8. Spill kits shall be provided close to hand.
9. Bunded areas shall be checked weekly for build up of oil residues, rainwater or debris.
10. The inside of the bund shall have a line painted to identify when 10% of the capacity has been filled by rainwater etc.

Filling of bulk storage tanks

1. A member of site staff must supervise all tank filling operations.
2. Storage tank levels must be checked to gauge spare capacity before starting filling operations.
3. Check delivery hoses and hose connections for leaks.
4. Report spillages and leaks and clean them up promptly, disposing of waste correctly according to the requirements of prevailing regulation(s).

Storage and handling of drums

1. All drums and containers used for the storage of fuels and oils, including waste oil, shall be appropriately labelled and kept in designated areas identified on a site plan. This will include temporary storage areas.
2. All drums or containers will be kept in bunded storage or on bund trays. This will include temporary storage.
3. Where drum taps are fitted these should be secure. The tap should be positioned over a bund tray to collect drips and spillage.
4. No drum shall be stored in the open without a drum cap fitted.
5. Drums shall be secured when moving them about the site.
6. Report spillages and leaks and clean them up promptly.
7. Spill kits shall be provided.
8. Drum storage areas shall be checked weekly for evidence of poor practice.

Refuelling operations

1. The person refuelling the vehicle must be present throughout the entire refuelling operation.
2. Check vehicle fuel tank level before starting refuelling operations to gauge how much fuel is required.
3. Check delivery hose from the pump / tank to the nozzle for leaks.
4. All delivery nozzles shall be fitted with an automatic cut-out to prevent over-filling.
5. Ensure delivery nozzle is held upright when moving between storage tank and vehicle.
6. Operatives should be prepared to react to any gas oil splashing out whilst re-fuelling.
7. Fuel delivery nozzles shall be locked or similarly disabled when not in use.
8. Report spillages and leaks and clean them up promptly.

Procedure for emptying bunded areas

1. Authority of site management is required before emptying a bund.
2. Details of bund emptying shall be recorded and maintained on site.
3. If the contents of the bund include floating oil then the water underneath this oil should be carefully pumped out. The remaining oil coated water should be collected and disposed of through a licensed contractor.
4. The reason for bund contamination shall be investigated.

Fuel and oil spills

1. Any spillage that cannot be cleaned up promptly with a rag or use of a shovel-full of absorbent material must be reported to the site manager or his designated deputy who will co-ordinate the response and investigate the cause.
2. Spills to ground shall be absorbed and prevented from spreading by using absorbent materials such as sand, fines, absorbent mats, paper or cloth.
3. Halt the movement of fuel or oil towards a watercourse by creating a barrier in front of it by sand bagging, deployment of absorbent boom or use of 3mm or finer dust.
4. If oil enters a watercourse, prevent it spreading by deploying an absorbent boom.
5. If spilt oil or fuel leaves the site the Site Manager must inform the regulatory authorities.
6. Contaminated materials from clean-up should be put in an appropriately labelled container and disposed of through a licensed contractor in line with regulatory requirements.

Quinn Cement Ltd

IPPC Licence Application

ATTACHMENT Nº I.1
DETAILED DISPERSION MODELLING

Contents

Tables

Figures

Appendices

SI Mass Unit Multiples

Multiple (of grams)	Name	Symbol
1×10^{6}	megagram (tonne)	Mg
1×10^{3}	kilogram	kg
1×10^{0}	gram	g
1×10^{-3}	milligrams	mg
1×10^{-6}	microgram	µg
1×10^{-9}	nanogram	ng
1×10^{-12}	picogram	pg
1×10^{-15}	femtogram	fg

Units and Abbreviations Used

As	Arsenic
C_6H_6	Benzene
°C	Temperature (in degrees Celsius)
Cd	Cadmium
CO	Carbon monoxide
Cr	Chromium
DEFRA	Department for Environment, Food and Rural Affairs
EA	UK Environment Agency
EPA	Environmental Protection Agency
$g.s^{-1}$	Gram per second
HCl	Hydrogen chloride
HF	Hydrogen fluoride
IGR	Irish Grid Reference
IPPC	Integrated Pollution Prevention and Control
K	Temperature (in Kelvin)
kPa	Pressure (in kilopascals)
LA	Local Authority
$m.s^{-1}$	Velocity (in metres per second)
$\mu g.m^{-3}$	Concentration (in micrograms per cubic metre)
µm	Micrometre
$m^3.s^{-1}$	Volumetric flow rate (in cubic meters of air per second)
$mg.Nm^{-3}$	Concentration (in milligrams per cubic metre at standard conditions)
$mg.s^{-1}$	Emission rate (in milligrams per second)
NGR	UK National Grid Reference
Ni	Nickel
NO_2	Nitrogen dioxide
NO	Nitric oxide
NO_X	Total oxides of nitrogen
O_3	Ozone
Pb	Lead
PCDD	Polychlorinated dibenzo-*p*-dioxins
PCDF	Polychlorinated dibenzo-*p*-furans
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres
Sb	Antimony
STP	Standard temperature and pressure
SO_2	Sulphur dioxide
Tl	Thallium
TOC	Total Organic Carbon
VOC	Volatile Organic Compound
WHO	World Health Organisation
WYG	WYG Environment Planning Transport
%ile	Percentile
%(v/v)	Percentage (volume per volume)

1 Introduction

1.1 This dispersion modelling assessment has been undertaken to assess the potential impacts of atmospheric emissions arising from the Quinn Cement Ballyconnell facility as a result of the proposed change of fuel and associated process modifications.

1.2 Quinn Cement also operate a cement works in Gortmullan, County Fermanagh, Northern Ireland, located approximately 2km north of the Ballyconnell plant. At the request of the Environmental Protection Agency (EPA), the dispersion modelling assessment includes the cumulative impact of atmospheric emissions from both the Ballyconnell and Gortmullan cement facilities.

1.3 Ambient monitoring has been undertaken in the vicinity of the Ballyconnell cement works in order to assess existing background pollutant concentrations. This has been reviewed in the context of this assessment.

SITE LOCATION AND CONTEXT

1.4 Quinn Cement currently operate a cement manufacturing facility at their Ballyconnell site, Republic of Ireland. The approximate Irish Grid Reference (IGR) of the site is 227500, 320500. Reference should be made to the Figures section for a map of the site and surrounding area.

1.5 Quinn Cement currently produce 1.4million tonnes of cement per year at the Ballyconnell facility. The process is currently coal fuelled and it is proposed to replace approximately 55% of this with Solid Recovered Fuel (SRF). The operation of the co-fuelled plant has the potential to vary the existing atmospheric emissions profile, with potential impacts on local air quality.

1.6 Ground level pollutant concentrations were predicted through detailed computational dispersion modelling in order to quantify the maximum impact of the process at identified receptors within the vicinity of the plant. Predicted concentrations were compared with the relevant Air Quality Standards (AQS), as presented in Appendix I.1b, in order to identify areas of potential exceedence.

1.7 This report details the methodology and results of the dispersion modelling assessment undertaken in order to assess the impact of the change in fuel use at the Quinn Cement Ballyconnell facility on local air quality.

2 Extant Policy, Legislation and Relevant Agencies

CONSULTATION DOCUMENTS

2.1 Documents consulted during the study and referred to within this dispersion modelling assessment include:

Legislation and Best Practice Guidance

- Air Quality Standard Regulations, 2002 (S.I. No 271 of 2002);
- Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations, 1999 (SI 33 of 1999);
- Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations, 2009;
- Ozone in Ambient Air Regulations, 2004 (S.I. No. 53 of 2004);
- Integrated Pollution Prevention and Control Directive 96/61/EC, 1996;
- EPA Licensing Regulations 1994 S.I No. 85 of 1994, 1994;
- EPA Licensing (Amendment) (Regulations) 2008 SI 382 of 2008;
- Guidelines for the Preparation of Dispersion Modelling Assessments for Compliance with Regulatory Requirements – an Update to the 1995 Royal Meteorological Society Guidance, 2004; and,
- Protection of the Environment Act, 2003.

Websites Consulted

- Environmental Protection Agency (www.epa.ie).

Site Specific Reference Documents

- Ambient Air Quality Monitoring Report for Quinn Group, Environmental Efficiency Consulting Engineers, 2009; and,
- Air Quality Impact Assessment of Gortmullan Cement Works, Enviros, 2004.

AIR QUALITY LEGISLATIVE FRAMEWORK

2.2 Air quality legislation in Ireland is based on European Commission Directives, with the initial principles of Regulation set in 1996 within the Air Quality Framework Directive on Ambient Air Quality Assessment and Management (96/62/EC). This Framework Directive requires the Commission to propose 'Daughter' Directive setting air quality objectives, limit values and alert thresholds for specific pollutants. The principles of this initial legislation became Irish law through the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations (1999) (SI 33 of 1999).

2.3 European air quality legislation is consolidated under Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides new air quality objectives for fine particulates. The consolidated Directives include:

- **Directive 99/30/EC** – the First Air Quality "Daughter" Directive – sets ambient air limit values for nitrogen dioxide and oxides of nitrogen, sulphur dioxide, lead and particulate matter; and,
- **Directive 2000/69/EC** – the Second Air Quality "Daughter" Directive – sets ambient air limit values for benzene and carbon monoxide.

2.4 European Union (EU) Directives 99/30/EC and 2000/69/EC were ratified into Irish law within the Air Quality Standards Regulations (2002) with attainment dates in line with the European Directives.

2.5 Two additional EU Directives on air quality are defined as:

- **Directive 2002/3/EC** – the Third Air Quality "Daughter" Directive – seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air; and,
- **Directive 2004/107/EC** – the Fourth Air Quality "Daughter" Directive – sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

2.6 EU Directives 2002/3/EC and 2004/107/EC were transposed into Irish law as the Ozone in Ambient Air Regulations (2004) and Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations (2009), respectively.

2.7 The First, Second and Third EU “Daughter” Directives are currently undergoing a period of review of their transposition into Irish law through the Clean Air for Europe (CAFE) Directive (2008). The CAFE Directive will seek to review and include the Fourth Daughter Directive at a later date.

2.8 The AQS for pollutants relevant to this assessment are presented in Appendix I.1b.

2.9 The Air Framework Directive deals with each EU member state in terms of "Zones" and "Agglomerations". Within the Republic of Ireland, four zones are defined within the Air Quality Standards Regulations (2002), subsequently amended by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations (2009). The main areas defined in each zone are:

- **Zone A:** Dublin Conurbation;
- **Zone B:** Cork Conurbation;
- **Zone C:** Other cities and large towns comprising Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Letterkenny, Celbridge, Newbridge, Mullingar and Balbriggan; and,
- **Zone D:** Rural Ireland, i.e. the remainder of the State excluding Zones A, B and C.

INDUSTRIAL POLLUTION REGULATION

2.10 Industrial process emissions to air are controlled in the Republic of Ireland through the Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EC), which is implemented through the Environmental Protection Agency Acts 1992 to 2007 and the associated licensing Regulations. The Ballyconnell facility is classified under Annex I of the IPPC Directive and, as such, must operate under the IPPC Licence requirements as defined and granted by the EPA. Amongst conditions of operation are stated emission limits for various pollutants produced by the process, as well as best practice guidelines for fugitive dust and odour control.

2.11 The proposed change in fuel use will also result in the plant being covered by the EC Directive on the incineration of waste (2000/76/EC).

3 Baseline Conditions

3.1 This section provides a review of existing air quality in the vicinity of the Quinn Cement Ballyconnell facility in order to provide a benchmark against which to assess potential air quality impacts.

SITE CONTEXT

3.2 The Ballyconnell facility is located approximately 3km to the north of the town of Ballyconnell and covers an area of approximately 35-hectares. Reference should be made to Figure 1 for a graphical representation of the site location, boundary and surrounding area.

3.3 Quinn Cement are currently authorised to carry out a cement production process with a capacity of approximately 1,400,000tonnes.year^{-1}. The installation (as currently permitted) is licensed under the Environmental Protection Agency Act 1992 and 2003, IPPC Licence number P0378-01.

3.4 Quinn Cement additionally operate a sister plant approximately 5km south of Derrylin town centre and 2km to the north of the Ballyconnell facility, at IGR: 228100, 321850.

3.5 Quinn Cement are seeking a revision to the current operation at the Ballyconnell facility in order to include the use of SRF to co-fuel the facility, which would reduce the annual coal use by approximately 55%. The SRF is to be generated by the recovery of combustible material from municipal waste arisings, and delivered to the Ballyconnell facility from surrounding waste-transfer facilities and material recycling facilities. It has been estimated by Quinn Cement that the net calorific values of coal and SRF are:

- Coal: 25 – 26MJ.kg^{-1}; and,
- SRF: 16 – 17MJ.kg^{-1}.

3.6 The above net calorific value for SRF is considered to be conservative, and it may be possible to achieve values between 20 – 22MJ.kg^{-1}. However, based on the above figures, it has been calculated that there is coal:SRF ratio of approximately 1:1.5.

3.7 Therefore, based upon the average coal consumption of 155,000tonnes, it has been calculated that there is a requirement for 127,875tonnes of SRF in order to produce 1.4million tonnes of cement (based upon the assumed 55% fuel replacement ratio).

3.8 The Ballyconnell facility will therefore fall under Section 10 and Section 11 of the First Schedule of the Environmental Protection Agency Act (1992) and (2003). This is defined as:

> "***Section 10 Cement***
>
> *10.1 The production of cement*
>
> ***Section 11 Waste***
>
> *11.1 The recovery or disposal of waste in a facility, within the meaning of the Act of 1996, which facility is connected or associated with another activity specified in this Schedule in respect of which a licence or revised licence under Part IV is in force or in respect of which a licence under the said Part is or will be required."*

3.9 This activity is a category referred to in Annex I of the IPPC Directive (96/61/EC). The following categories apply:

> *"Category 3.1 - Installations for the production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or lime in rotary kilns with a production capacity exceeding 50 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day.*
>
> *Category 5.3 - Installations for the disposal of non-hazardous waste as defined in Annex II A to Directive 75/442/EEC under headings D8 and D9, with a capacity exceeding 50 tonnes per day."*

3.10 As such the proposed change in fuel use requires a revision to the current IPPC Licence.

AIR QUALITY IN COUNTY CAVAN

3.11 The EPA and Local Authorities operate monitoring stations throughout the Republic of Ireland as part of the National Air Quality Monitoring Program. Section 65 of the Environmental Protection Agency Act (1992) stipulates the requirements for air quality monitoring networks. County Cavan and the locale surrounding the Quinn Cement Ballyconnell facility fall within the 'Zone D' classification (rural Ireland).

3.12 Air quality is not routinely monitored within County Cavan, with the closest National Air Quality Monitoring Program station located in Kilkitt, County Monaghan. This monitoring station is located approximately 45km to the north-north-east of the Ballyconnell facility within Zone D (rural Ireland).

3.13 The Kilkitt site is located at a drinking water treatment works within a rural setting with little traffic or other influences on air quality. Continuous monitoring is undertaken for nitrogen oxides (NO_X), sulphur dioxide (SO_2), and particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}). Monitoring data from the Kilkitt site for 2005 – 2007 is presented within Table 1.

Table 1 Monitored Background Data - Kilkitt

Pollutant	Concentration (µg.m^{-3})		
	2005	2006	2007
NO_2	2.10	5.34	- (1)
PM_{10}	- (1)	10.16	10.09
SO_2	3.00	2.27	- (1)

NOTE: (1) No monitoring data was available at the time of assessment.

3.14 Monitoring data presented within Table 1 illustrates that all pollutant concentrations are in compliance with the relative AQS during all calendar years.

3.15 Monitoring data is available sporadically for the Kilkitt monitoring station and was not available for lead (Pb) or carbon monoxide (CO). The EPA was contacted in order to obtain more up-to-date monitoring results; however, no further data was available at the time of assessment.

3.16 Monitoring is not routinely undertaken for volatile organic compounds (VOCs) in the immediate vicinity of the Ballyconnell facility or at Kilkitt.

AIR QUALITY MONITORING

3.17 The Automatic Urban and Rural Network (AURN) is a country-wide network of air quality monitoring stations operated on behalf of Department for Environment Food and Rural Affairs (DEFRA) throughout the United Kingdom (UK). Monitoring data for AURN sites is available from the UK National Air Quality Archive[1] and has been reviewed in the following section. Given the

[1] www.airquality.co.uk, accessed June 2009.

proximity of the Ballyconnell facility to the border between the Republic of Ireland and Northern Ireland, it has been considered prudent to additionally consider these potential data sources.

3.18 The closest AURN monitoring site to the proposed development is Lough Navar (UK National Grid Reference (NGR): 206500, 354500), approximately 50km north-west of the Ballyconnell facility. This monitoring station is classified as a remote site (a site in open country, located in an isolated rural area, experiencing regional background pollutant concentrations for much of the time). This monitoring station was commissioned in 1987 for ozone (O_3) monitoring and in 1996 for PM_{10}.

3.19 Given the distance between the Lough Navar AURN monitoring station and the Ballyconnell facility, it is not considered that similar pollutant concentrations would be experienced at both locations. Therefore, this source of data has not been considered further in the context of this assessment.

Heavy Metals

3.20 Monitoring of heavy metals is carried out by DEFRA at 24No. industrial sites and 10No. rural sites throughout the UK. Heavy metals monitoring is not routinely undertaken within the Republic of Ireland.

3.21 The closest monitoring location to the Ballyconnell facility is Loch Navar. As previously stated, due to the distance between the two locations similar pollutant concentrations would not be expected and therefore this source of data has not been considered further.

BACKGROUND POLLUTANT MAPPING

3.22 Background pollutant concentration data on a 1km x 1km spatial resolution is provided by the UK National Air Quality Archive and is routinely used in assessing background pollutant concentrations where monitoring has not taken place. The Republic of Ireland do not currently routinely produce background pollutant concentration data and therefore this resource has been reviewed in lieu of more relevant information.

3.23 Future year predictions of AQS pollutants at the application site have been downloaded from the UK National Air Quality Archive[2] for grid square NGR: 228500, 321500. This is located approximately 1.5km north of the Ballyconnell facility and as such represents the closest grid square to the site.

3.24 Predicted benzene (C_6H_6) and CO concentrations were not available for grid square NGR: 228500, 321500 and have alternatively been obtained from grid square NGR: 228500, 321500, as being the closest grid square to the Ballyconnell site with available data.

3.25 Predicted SO_2 concentrations were not available for grid square NGR: 228500, 321500 and have alternatively been obtained from grid square NGR: 228500, 322500, as being the closest grid square to the Ballyconnell site with available data.

3.26 Background concentration predictions for 2009 are shown in Table 2. Any exceedence of the relevant AQS is shown in **bold** text. Predicted annual mean concentrations for SO_2, C_6H_6 and CO are based on 2001 emissions data, whilst NO_X, NO_2 and PM_{10} are based on 2006 emissions data.

Table 2 Predicted Annual Mean Background Concentrations

Pollutant	Base Year 2009 ($\mu g.m^{-3}$)
NO_x	4.26
NO_2	3.59
PM_{10}	11.41
CO	0.12
SO_2	0.33
C_6H_6	0.03

SITE SPECIFIC AIR QUALITY MONITORING

3.27 Due to the gap in representative monitoring data surrounding the Ballyconnell facility and at the request of the EPA, a period of ambient air quality monitoring was commissioned in order to assess current pollutant concentrations prior to the proposed change in fuel-use. This monitoring was undertaken by Environmental Efficiency Consulting Engineers and the monitoring report is presented within Appendix I.1c. A summary of the findings is provided the following sections.

2 www.airquality.co.uk, accessed June 2009.

3.28 Monitoring was undertaken between September and December 2008 and included the following:

- Continuous monitoring of NO_2, SO_2 and PM_{10} on the north-eastern boundary of the site (predominantly downwind of the main sources);
- Passive sampling of NO_2, SO_2, fluoride and chloride at 6No. locations surrounding the plant, close to the site boundary; and,
- 2No. dioxin samples each taken over 3-day periods at 'downwind' locations.

3.29 Monitoring was carried out as follows:

- Continuous sampler for SO_X, NO_X and PM_{10} at one location from the 6th August 2008 to the 29th September 2008 and then another location from the 30th September 2008 to the 8th December 2008;
- Diffusion tubes for SO_X and NO_X at 6No. locations plus 1No. location adjacent to the continuous sampler for 2No. months. Hydrochloric (HCl) and hydrofluoric (HF) acids were also monitored at six locations for 2No. months; and,
- 2No. 3-day dioxin (PCDD) and furan (PCDF) samples were taken using a high volume PUF sampler (Sven Leckel Sequential Sampler SEQ47/50).

3.30 Due to technical problems, the continuous analyser was not operational for the recording of PM_{10} concentrations from the 15th October 2008 to the 24th October 2008.

Continuous Monitoring

3.31 Table 3 summarises the monitored concentrations recorded during the continuous monitoring at the Ballyconnell site. Concentrations in **bold** represent exceedences of the AQS.

Table 3 Summary of Continuous Monitoring Results

Pollutant	Projected Annual Mean ($\mu g.m^{-3}$)	1-Hour Maximum ($\mu g.m^{-3}$)	24-hour Maximum ($\mu g.m^{-3}$)	15-Minute Maximum ($\mu g.m^{-3}$)
NO_2	6.89	49.41	N/A	N/A
SO_2	2.69	64.86	2.74	82.29
PM_{10}	**44.01**	995.00	162.17	N/A

3.32 During the monitoring, some of the results for SO_2 and NO_X/NO_2 were found to have negative values. EnviroTechnology Solutions, the company who provided the continuous analyser, indicated that this could occur during the normal operation of the equipment due to zero drift when used for long periods. Recorded concentrations were therefore adjusted by Environmental Efficiency Consulting Engineers in order to account for these periods.

3.33 Table 3 illustrates that concentrations of NO_2 are within the annual mean and 1-hour AQS of 40µg.m^{-3} and 200µg.m^{-3}, respectively, and concentrations of SO_2 are within the annual mean, 1-hour mean and 24-hour mean AQS of 30µg.m^{-3}, 266µg.m^{-3} and 125µg.m^{-3}, respectively.

3.34 Monitored PM_{10} concentrations, which have been adjusted to an annual mean, illustrate an exceedence of the AQS of 40µg.m^{-3}. As monitoring was not undertaken for a full year it is not possible to compare the 24-hour results directly to the relevant AQS, as this allows 35No. exceedences per annum. However, the number of 24-hour periods where monitored concentrations were above 50µg.m^{-3} is stated within the report for both monitoring locations. This indicates that exceedences of the 24-hour AQS would be likely at both locations.

3.35 It should be noted that due to power supply constraints and land ownership constraints, the continuous analyser was positioned within the Ballyconnell facility site boundary as far as was reasonably practicable from the facility. As such, elevated pollutant concentrations would be expected, particularly of PM_{10}, due to vehicle induced turbulence in these areas. The monitoring sites would not be considered representative of relevant exposure therefore the AQSs would not apply at these locations.

Diffusion Tube Monitoring

3.36 Table 4 summarises the passive diffusion tube monitoring results.

Table 4 Summary of Passive Sampling Results

Monitoring Location	Sampling Period	Concentrations (µg.m^{-3})			
		NO_2	SO_2	HCl	HF
1	25/08/2008	20.00	2.00	0.00	5.00
	08/09/2008	13.00	4.00	5.00	0.08
	22/09/2008	18.00	2.00	7.00	0.08
	06/10/2008	2.00	0.09	8.00	0.08
	AVERAGE:	**13.25**	**2.02**	**5**	**1.31**
2	25/08/2008	15.00	2.00	17.00	4.00
	08/09/2008	7.00	6.00	6.00	0.08
	22/09/2008	13.00	0.09	9.00	0.08
	06/10/2008	1.00	0.09	9.00	1.00

Monitoring Location	Sampling Period	Concentrations (µg.m[-3])			
		NO_2	SO_2	HCl	HF
	AVERAGE:	**9**	**2.05**	**10.25**	**1.29**
3	25/08/2008	7.00	2.00	4.00	4.00
	08/09/2008	7.00	3.00	4.00	0.08
	22/09/2008	7.00	0.09	10.00	0.08
	06/10/2008	10.00	0.09	- (1)	- (1)
	11/11/2008	- (1)	- (1)	3.00	0.08
	AVERAGE:	**7.75**	**1.30**	**5.25**	**1.06**
4	25/08/2008	13.00	3.00	2.00	4.00
	08/09/2008	5.00	5.00	5.00	0.08
	22/09/2008	10.00	0.09	7.00	0.08
	06/10/2008	12.00	0.09	- (1)	- (1)
	11/11/2008	- (1)	- (1)	2.00	1.00
	AVERAGE:	**10.00**	**2.05**	**4.00**	**1.29**
5	25/08/2008	9.00	1.00	3.50	3.00
	08/09/2008	3.00	7.00	3.00	0.08
	22/09/2008	6.00	2.00	8.00	0.08
	06/10/2008	- (1)	0.09	14.00	1.00
	11/11/2008	8.00	0.00	- (1)	- (1)
	AVERAGE:	**6.50**	**2.02**	**7.13**	**1.04**
6	25/08/2008	9.00	1.00	4.00	9.00
	08/09/2008	3.00	4.00	6.00	0.08
	22/09/2008	8.00	2.00	8.00	0.08
	06/10/2008	9.00	0.09	- (1)	- (1)
	11/11/2008	- (1)	- (1)	3.00	1.00
	AVERAGE:	**7.25**	**1.77**	**5.25**	**2.54**
Continuous Analyser Co-location	25/08/2008	10.00	2.00	- (1)	- (1)
	08/09/2008	3.00	5.00	- (1)	- (1)
	22/09/2008	12.00	5.00	- (1)	- (1)
	06/10/2008	12.00	0.09	- (1)	- (1)
	AVERAGE:	**9.25**	**3.02**	**-**	**-**

NOTE: (1) Result not provided in monitoring report.

3.37 As indicated within Table 4, all pollutant concentrations measured during the passive diffusion tube survey were below the relevant AQSs. It should be noted that limit values for HCl or HF concentrations have not been declared within the Republic of Ireland.

3.38 2No. dioxin samples were taken at the site. The samples were collected at Location 7 using a single LVS3 sampler with PUF filter with each sampling period lasting for 72-hours (3No. days). Monitoring results are summarised in Table 5.

Table 5 Dioxin and Furan Monitoring Results

Sample Period	Dioxin Concentration ($pg.m^{-3}$)	Furan Concentration ($pg.m^{-3}$)
22/11/2008 – 24/11/2008	2.437	3.004
30/11/2008 – 01/12/2008	0.734	0.778

3.39 It should be noted that limit values for PCDD and PCDF concentrations have not been declared within the Republic of Ireland.

3.40 As presented within Appendix I.1c, all monitoring locations were approximately on the Ballyconnell facility site boundary. Therefore, it is considered that monitored concentrations would posses a significant contribution from existing site emissions and as such cannot be considered to be ambient mean background concentrations. This is particularly evident from the PM_{10} results, which illustrate that the projected annual mean concentration is in exceedence of the AQS. Given the remote location of the Ballyconnell site, background PM_{10} concentrations would be expected to be significantly lower than those presented.

BACKGROUND CONCENTRATIONS USED IN DISPERSION MODELLING ASSESSMENT

3.41 A review of the previously identified background pollutant data within the vicinity of the Ballyconnell facility was undertaken to determine suitable concentrations for use within the modelling study.

3.42 The background pollutant concentration and data source used in the assessment are shown in Table 6.

Table 6 2009 Background Pollutant Concentrations

Parameter	Annual Mean Background Concentration	Units	Source
NO_2	9.00	$\mu g.m^{-3}$	Site specific air quality monitoring
NO_x	3.69	$\mu g.m^{-3}$	DEFRA mapping study
PM_{10}	9.86	$\mu g.m^{-3}$	DEFRA mapping study
CO	0.12	$mg.m^{-3}$	DEFRA mapping study
SO_2	2.03	$\mu g.m^{-3}$	Site specific air quality monitoring
C_6H_6	0.03	$\mu g.m^{-3}$	DEFRA mapping study
Pb	- (1)	- (1)	- (1)
Cd	- (1)	- (1)	- (1)
As	- (1)	- (1)	- (1)
PCDDs and PCDFs	3.47	$pg.m^{-3}$	Site specific air quality monitoring
HCl	4.44	$\mu g.m^{-3}$	Site specific air quality monitoring
HF	1.42	$\mu g.m^{-3}$	Site specific air quality monitoring

NOTE: (1) Relevant data not available for assessment - no background has been used.

3.43 As indicated in Table 6, the most appropriate background concentrations for use in the assessment were considered to be from the DEFRA mapping study and site specific air quality monitoring assessment for use throughout the modelling extents.

3.44 Where background concentrations from the site specific air quality monitoring assessment have been used, these are the mean of results from all monitoring locations. These have been used to provide a *worst-case* background value as monitored concentrations were greater than those provided by the DEFRA mapping study. This is likely to be due to combustion gas emissions from existing sources.

3.45 Background PM_{10} concentrations from the DEFRA mapping study have been used in preference to the site specific air quality monitoring concentrations due to the high assessment results. As discussed in paragraph 3.40, current site emissions are likely to represent a considerable proportion of these levels and therefore use as a background across the entire modelling area would significantly over-estimate impacts at local receptor locations. The dispersion modelling includes the majority of PM_{10} sources from both the Ballyconnell and Gortmullan facilities and therefore emissions from these locations are included within the predicted concentrations.

3.46 It should be noted that the background pollutant concentration for short-term assessment criteria is assumed to be twice the long-term ambient concentration, as prescribed in UK Environment Agency Guidance EPR: H1[3]. Although it is recognised that this guidance document does not strictly relate to legislation within the Republic of Ireland, this methodology is utilised in lieu of more appropriate guidance.

SENSITIVE RECEPTORS

3.47 The term 'sensitive receptors' includes any persons, locations or systems that may be susceptible to change in abiotic factors or loss of amenity as a consequence of emissions to air from the plant. Discrete sensitive receptors identified for the purposes of this assessment are contained in Table 7. Where these sensitive receptors are referenced in the report text, they are referred to as R1 to R13.

Table 7 Identified Sensitive Receptors

Discrete Sensitive Receptor		IGR (m)	
		X	Y
R1	Doon Heights	227622	319400
R2	Doon Beg	227502	319110
R3	Court House	227219	318787
R4	Preaching House Lane	227096	319080
R5	Church Street	227054	318825
R6	Main Street	227384	318845
R7	Market House	227339	318784
R8	Ballyconnell House	227527	318694
R9	Derryginny Gardens	227071	318440
R10	Farm 1	227094	319981
R11	Farm 2	227345	319572
R12	Farm 3	228330	320466
R13	Farm 4	229179	320629

3.48 Reference should be made to Appendix I.1 Figure 2 for a graphical representation of discrete receptor locations.

3 Environmental Risk Assessment EPR: H1, Environment Agency, 2008.

4 Modelling Parameters

4.1 The dispersion modelling has assessed cumulative impact of emissions from the Ballyconnell and Gortmullan facilities.

4.2 In order to consider the air quality impacts of the change in fuel on the local region a *quantitative* assessment using the third generation AERMOD-PRIME dispersion model has been undertaken. AERMOD is a development from the ISC3 dispersion model and incorporates improved dispersion algorithms and pre-processors to integrate the impact of meteorology and topography within the modelling output.

4.3 The main emission points at Ballyconnell are identified within Attachment E.1.A. These have been summarised in Table 8. A graphical representation of stack locations is included within Attachment E.1.A.

Table 8 Ballyconnell Facility Emission Points

Emission Point	Pollutants
A2-01 – Raw Mill/Kiln	Particulate matter (PM) NO_2 SO_2 Mercury(Hg) Cadmium (Cd) Metals (Antimony (Sb), Arsenic (As), Pb, Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni) and Vanadium (V)) Total Organic Carbon (TOC) PCDF and PCDD HCl HF
A2-02 – Clinker Cooler	PM
A2-03 – Coal Mill	PM
A2-04 – Cement Mill	PM
A2-05 – Cement Mill Sepax Separator	PM

4.4 Emission sources at the Gortmullan facility are summarised in Table 9.

Table 9 Gortmullan Facility Emission Points

Emission Point	Pollutants Emitted
A13 – Coal Mill	PM
A14 – Cement Mill	PM
A15 – Cement Mill Sepax Separator	PM

Emission Point	Pollutants Emitted
A16 – Raw Mill/Kiln Stack	PM NO_2 SO_2 CO

4.5 Reference should be made to Appendix I.1f for a brief method statement for modelling with AERMOD-PRIME.

MODELLING SCENARIOS

4.6 The scenarios considered within the modelling assessment are detailed in Table 10.

Table 10 Modelling Scenarios

Parameter	Modelling Scenario	
	Short Term	Long Term
NO_2	99.8^{th} %ile 1-hour mean	Annual mean
NO_X	Not applicable	Annual mean(1)
As PM_{10}	90.4^{th} %ile 24-hour Mean	Annual mean
SO_2	99.73^{rd} %ile 1-hour mean 99.0^{th} %ile 24-hour mean	Annual mean(2)
CO	8-hour maximum	Not applicable
Metals	Not applicable	Annual mean
TOC (as C_6H_6)	Not applicable	Annual mean
PCDD and PCDF	Not applicable	Annual mean(3)
HCl	1-hour mean(3)	Annual mean(3)
HF	1-hour mean(3)	Annual mean(3)

NOTE: (1) Annual mean NO_x concentration for the protection of vegetation and ecosystems.
(2) Annual mean SO_2 concentration for the protection of vegetation and ecosystems.
(3) No relevant designated AQS.

PROCESS CONDITIONS

4.7 Process conditions were provided through correspondence with Quinn Cement. Reference should be made to the following tables for details of the process inputs used within the modelling assessment.

Ballyconnell Facility Process Conditions

Table 11 Process Conditions – Emission Point A2-01 Raw Mill / Kiln

Condition	Units	Value
Stack location	(IGR)	227605, 320380

Condition	Units	Value
Stack height	(m)	118
Stack diameter (internal)	(m)	3.5
Flue gas emission velocity (stack conditions)	($m.s^{-1}$)	27.91
Volumetric flow rate (stack conditions)	($m^3.s^{-1}$)	268.57
Temperature	(K)	406
Atmospheric pressure	(kPa)	101

Table 12 Process Conditions – Emission Point A2-02 Clinker Grate Cooler

Condition	Units	Value
Stack location	(NGR)	227555, 320285
Stack height	(m)	33.56
Stack diameter (internal)	(m)	3.0
Flue gas emission velocity (stack conditions)	($m.s^{-1}$)	26.55
Volumetric flow rate (stack conditions)	($m^3.s^{-1}$)	187.66
Temperature	(K)	527
Atmospheric pressure	(kPa)	101

Table 13 Process Conditions – Emission Point A2-03 Coal Mill

Condition	Units	Value
Stack location	(NGR)	227565, 320255
Stack height	(m)	47.5
Stack diameter (internal)	(m)	1.0
Flue gas emission velocity (stack conditions)	($m.s^{-1}$)	39.08
Volumetric flow rate (stack conditions)	($m^3.s^{-1}$)	30.69
Temperature	(K)	355
Atmospheric pressure	(kPa)	101

Table 14 Process Conditions – Emission Point A2-04 Cement Mill

Condition	Units	Value
Stack location	(NGR)	227575, 320155
Stack height	(m)	38.90
Stack diameter (internal)	(m)	1.12

Condition	Units	Value
Flue gas emission velocity (stack conditions)	($m.s^{-1}$)	32.05
Volumetric flow rate (stack conditions)	($m^3.s^{-1}$)	31.58
Temperature	(K)	368
Atmospheric pressure	(kPa)	101

Table 15 Process Conditions – Emission Point A2-05 Bag Filter Exhaust (Sepax Separator)

Condition	Units	Value
Stack location	(NGR)	227540, 320155
Stack height	(m)	38.90
Stack diameter (internal)	(m)	2.0
Flue gas emission velocity (stack conditions)	($m.s^{-1}$)	36.82
Volumetric flow rate (stack conditions)	($m^3.s^{-1}$)	115.66
Temperature	(K)	352
Atmospheric pressure	(kPa)	101

Gortmullan Facility Process Conditions

4.8 Process parameters for Gortmullan stack sources were provided by Quinn Manufacturing Ltd from a previous Air Quality Impact Assessment undertaken by Enviros Ltd in 2004 (reference: (Sby100704rpt_V1)Quinnaqia-Cdrrev28-07-04). These are summarised in the following tables.

Table 16 Process Conditions – Emission Point A13 Coal Mill

Condition	Units	Value
Stack location	(NGR)	228053, 321703
Stack height	(m)	35
Stack diameter (internal)	(m)	0.91
Flue gas emission velocity (stack conditions)	($m.s^{-1}$)	16.24
Volumetric flow rate (stack conditions)	($m^3.s^{-1}$)	10.56
Temperature	(K)	353
Atmospheric pressure	(kPa)	101

Table 17 Process Conditions – Emission Point A14 Cement Mill

Condition	Units	Value
Stack location	(NGR)	228040, 321800
Stack height	(m)	43
Stack diameter (internal)	(m)	1.02
Flue gas emission velocity (stack conditions)	($m.s^{-1}$)	7.81
Volumetric flow rate (stack conditions)	($m^3.s^{-1}$)	6.38
Temperature	(K)	373
Atmospheric pressure	(kPa)	101

Table 18 Process Conditions – Emission Point A15 Sepax Cement Mill

Condition	Units	Value
Stack location	(NGR)	228038, 321808
Stack height	(m)	50
Stack diameter (internal)	(m)	1.72
Flue gas emission velocity (stack conditions)	($m.s^{-1}$)	14.59
Volumetric flow rate (stack conditions)	($m^3.s^{-1}$)	33.91
Temperature	(K)	333
Atmospheric pressure	(kPa)	101

Table 19 Process Conditions – Emission Point A16 Main Stack

Condition	Units	Value
Stack location	(NGR)	228050, 321689
Stack height	(m)	80
Stack diameter (internal)	(m)	1.7
Flue gas emission velocity (stack conditions)	($m.s^{-1}$)	30.10
Volumetric flow rate (stack conditions)	($m^3.s^{-1}$)	68.32
Temperature	(K)	373
Atmospheric pressure	(kPa)	101

PROCESS EMISSIONS

4.9 Emission rates used in the assessment are contained within the following tables. In order to present a *worst-case* scenario, emission rates for the Ballyconnell main stack (A2-01) have been based upon Emission Limit Values (ELVs) presented within EC Directive 2000/76/EC on the incineration of waste, as per Annex II for the *special provision for cement kilns co-incinerating waste*. Other modelling inputs have been derived from the existing ELVs, or in the case of CO and VOC, from data provided by the plant engineers.

4.10 It should be noted that a derivation for the stated SO_2 ELV is being applied for within this IPPC Licence application. This is due to the amount of sulphur contained within the raw materials. It is considered that abatement plant required to achieve the $50mg.m^{-3}$ ELV stated within EC Directive 2000/76/EC would not be considered Best Available Technique (BAT) as the sulphur input is associated with the raw material and is not associated with the SRF. An ELV of $500mg.m^{-3}$ is therefore being applied for and has been used within this modelling assessment.

4.11 It should be noted that a derivation for the stated TOC ELV is being applied for within this IPPC Licence application. This is because it is anticipated that TOC emissions will not arise as a result of the combustion of SRF and therefore the installation of abatement plant to achieve the $10mg.m^{-3}$ ELV stated within EC Directive 2000/76/EC would not be considered BAT. An ELV of $40mg.m^{-3}$ is therefore being applied for and has been used within this modelling assessment.

Table 20 Ballyconnell Facility – Emission Point A2-01 Raw Mill / Kiln

Pollutant	**Emission Concentration ($mg.Nm^{-3}$)**	**Mass Emission Rate ($g.s^{-1}$)**
NO_x	800	133.33
SO_2	500	83.33
PM	30	5.00
CO(1)	6,000	1,000
Cd and Tl	0.05	0.0083
Metals	0.5	0.0833
VOC	40	6.67
PCDD and PCDF	0.0000001	1.67×10^{-8}
HCl	10	1.6667
HF	1	0.1667

NOTE (1) An ELV is not set within WID for CO from co-fuelled cement kilns. Emissions have therefore been based upon information provided by FLS, the plant engineers and an assessment has been included for completeness.

Table 21 Ballyconnell Facility – Emission Point A2-02 Clinker Grate Cooler

Pollutant	Emission Concentration ($mg.Nm^{-3}$)	Mass Emission Rate ($g.s^{-1}$)
PM	50	4.86

Table 22 Ballyconnell Facility – Emission Point A2-03 Coal Mill

Pollutant	Emission Concentration ($mg.Nm^{-3}$)	Mass Emission Rate ($g.s^{-1}$)
PM	50	0.83

Table 23 Ballyconnell Facility – Emission Point A2-04 Cement Mill

Pollutant	Emission Concentration ($mg.Nm^{-3}$)	Mass Emission Rate ($g.s^{-1}$)
PM	50	0.97

Table 24 Ballyconnell Facility – Emission Point A2-05 Bag Filter Exhaust (Sepax Separator)

Pollutant	Emission Concentration ($mg.Nm^{-3}$)	Mass Emission Rate ($g.s^{-1}$)
PM	50	4.17

4.12 In order to provide a *worst-case* assessment, emissions from the Gortmullan facility have been derived from the ELVs stated within the plants permit.

Table 25 Gortmullan Facility Emissions

Emission Point	PM Emission Concentration ($mg.Nm^{-3}$)	PM Mass Emission Rate ($g.s^{-1}$)
A13	30	0.2451
A14	40	0.1868
A15	40	1.1120

Table 26 Gortmullan Facility – Kiln Exhaust and Raw Mill, Main Stack (A16) Emissions

Pollutant	Emission Concentration ($mg.Nm^{-3}$)	Mass Emission Rate ($g.s^{-1}$)
NO_X	900	45
SO_2	400	20
PM	40	2

4.13 The ELV for NO_2 and NO is stated as total NO_x. However, for the purposes of the modelling it was considered that the entire NO_x emission consisted of only NO_2. This allowed the maximum ground level impacts, with respect to the AQS to be considered, as actual plant emissions of NO_x are unlikely to consist entirely of NO_2.

4.14 The ELVs detailed for PM is stated as total dust. However, for the purposes of the modelling it was considered that the entire PM emission consisted of only PM_{10}. This allowed maximum ground level impacts, with respect to the AQSs to be considered. As actual plant emissions are unlikely to only consist of this PM fraction, this results in a *worst-case* assessment scenario.

4.15 The ELVs detailed for VOC is stated as total organic carbon. However, for the purposes of the modelling it was considered that the entire emission consisted of only C_6H_6 for comparison against the C_6H_6 AQS. This allowed maximum ground level impacts, with respect to the AQSs to be considered. As actual plant emissions are unlikely to only consist of C_6H_6, this results in a *worst-case* assessment scenario.

4.16 The ELV for Cd and Tl is stated as a total of both metals. However, for the purposes of the modelling it was considered that this entire emission consisted of only Cd for comparison against the target value prescribed within the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations (2009). This allowed a *worst-case* scenario to be considered as emissions of Cd and Tl are unlikely to only consist of one species. Therefore, by considering only Cd, maximum ground level concentrations and hence the maximum impacts, have been predicted.

4.17 The ELV for Antimony Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V is stated as total heavy metals. However, for the purposes of the modelling they were considered individually to allow comparison with their associated AQS. However, it is considered unlikely that the full $0.1mg.m^{-3}$ emission permitted for total heavy metals would consist of only one metal species; therefore, by considering each metal individually, maximum ground level concentrations and hence the maximum impacts, have been predicted.

4.18 Emissions were assumed to be constant, with the plant in operation for 24-hours per day, 365-days per year. Communication with Quinn Cement has determined that the plant will be operational for approximately 330-days per year. Therefore, the assumed continuous operation is considered to represent a *worst-case* scenario as this does not allow for plant shut-down or periods of reduced work load.

METEOROLOGICAL DATA

4.19 Meteorological data used in this assessment was taken from St Angelo meteorological station, over the period 1st January 2004 to 31st December 2008 (inclusive). St Angelo is located at NGR: 236840, 625380 which is approximately 30km to the north of the Ballyconnell facility.

4.20 All meteorological data used in the assessment was provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of meteorological data within the UK and Republic of Ireland.

4.21 In order to allow consideration of a *worst-case* scenario, dispersion modelling was undertaken for each meteorological year between 2004 and 2008. A sensitivity analysis was undertaken in order to determine the meteorological year resulting in the maximum modelled predicted concentration. This was undertaken for PM emissions, as all stacks at the Ballyconnell and Gortmullan facility emit this pollutant. Modelling of all other pollutants was subsequently undertaken using the *worst-case* meteorological data-set. Reference should be made to Appendix I.1f for further details of the meteorological data sensitivity analysis.

TERRAIN DATA

4.22 The model was run with OS 1:50,000 scale digital height contour data at 10m vertical intervals. Data was processed by the AERMAP function within AERMOD to calculate terrain heights and interpolate data to calculate terrain heights for sources, buildings and receptors.

ASSESSMENT AREA

4.23 Air quality impacts were assessed over an area of 5.1km x 4.9km (IGR: 225069, 317807 to 230141, 322737). 1No. uniform Cartesian grid was used in the detailed modelling assessment at a resolution of 50m.

4.24 It should be noted that the resolution of the digitised grid is less than 1.5 times the stack height of the Ballyconnell facility, as required by English Environment Agency best-practice modelling guidance. Although this does not specifically relate to modelling assessments undertaken for the Republic of Ireland, this document has been followed in lieu of more appropriate country-specific guidance.

4.25 Discrete receptors were included in the model as detailed in Table 7. These were included in order to quantify predicted pollutant concentrations at sensitive locations within the vicinity of the site.

BUILDING DOWNWASH

4.26 The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations.

4.27 Building heights and dimensions of the Ballyconnell facility were provided by Quinn Cement and are presented within Table 27. Building heights and dimensions of the Gortmullan facility were provided by Quinn Cement from the Air Quality Impact Assessment undertaken by Enviros Ltd. These building heights and dimensions are presented within Table 28.

Table 27 Ballyconnell Facility – Buildings Modelled

Building Name	IGR (m)		Height (m)	Radius (m)
	X	Y		
Cement Mill	227503.6	320163.5	31.70	-
Bagging Plant	227622.8	320243.9	15.00	-
Raw Mill	227617.2	320426.1	25.00	-
Workshop	227682.6	320398.1	10.00	-
Office Building	227642.0	320322.7	10.00	-
Waste Storage Bays	227628.5	320448.9	4.00	-
Additive Bins	227503.6	320415.7	20.00	-
Coal Storage	227463.0	320281.2	29.00	-
Cement Silo 1	227560.5	320111.7	57.00	10.45
Cement silo 2	227577.8	320091.5	57.00	10.45
Cement silo 3	227593.6	320069.2	57.00	10.45
CF Silo	227600.2	320398.3	70.00	10.55
Clinker Shed	227554.9	320200.8	42.00	32.40

Table 28 Gortmullan Facility – Buildings Modelled

Building Name	NGR (m)		Height (m)	Length (m)	Width (m)	Angle to North (°)
	X	Y				
Preblending Shed	227984.1	321663.4	20	31	34	15
Raw Mill	228048.2	321678.3	54	9	24	15
Coal Mill	228035.3	321690.4	25	6	11	15
Coal Storage Bunker	228015.7	321723.8	15	21	22	15
Clinker Shed	227998.0	321771.2	18	28	28	40
Cement Mill	228030.7	321793.5	30	8	18	40
Cement Silos	228042.6	321806.4	52	10	21	40
Cement Bagging	228037.5	321824.1	30	8	9	40
DAF Store	228023.9	321835.3	20	24	28	7

4.28 All on-site structures were input into the BPIP Building Downwash pre-processor. The building dimension inputs were based on the widest parts of each structure. This ensured that the maximum possible building downwash was considered.

NO_X TO NO_2 CONVERSION

4.29 Emissions of NO_x from combustion processes are predominantly in the form of NO. Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO_2. Given the short travel time to the areas of maximum concentration and the rate of reaction to convert NO to NO_2, it is unlikely that more than 30% of the NO_X is present at ground level as NO_2. This conversion factor is based on comparison of ambient NO and NO_2 continuous measurements evaluated over recent years.

4.30 Ground level NO_X concentrations have been predicted through dispersion modelling. NO_2 concentrations reported in the results section assume 100% conversion from NO_x to NO_2 for annual averages and a 50% conversion for short-term (hourly) concentrations, based upon English Environment Agency methodology for *worst-case* screening assessments. Although it is acknowledged that English Environment Agency guidance is country specific and thus is not strictly relevant, this has been utilised in lieu of more appropriate guidance.

4.31 It should therefore be noted that these predictions are likely to be an overestimation of actual plant contributions.

5 Modelling Assessment Results

5.1 The detailed computational modelling assessment was undertaken using the input parameters detailed in Section 4. Reference should be made to the following appendices of this report:

- Appendix I.1d Detailed Modelling Plot Files;
- Appendix I.1e Detailed Modelling Results Tables; and,
- Appendix I.1f Brief Method Statement – Detailed Modelling by AERMOD-Prime.

5.2 Full colour isopleth plots of predicted ground level pollutant concentrations are presented in Appendix I.1e.

5.3 Where applicable, the predicted pollutant concentrations have been compared to the appropriate AQS and target value for the relevant assessment year, as detailed within Appendix I.1b.

RESULTS

5.4 A sensitivity analysis was undertaken on St. Angelo metrological data sets from 2004 to 2008, inclusive, in order to determine the year resulting in the highest predicted ground-level concentrations, as detailed previously. This indicated that the 2007 meteorological data set resulted in the maximum predicted pollutant concentrations and therefore provided a *worst-case* assessment. All results are therefore presented based on 2007 meteorology.

5.5 Reference should be made to Appendix I.1f for details of the sensitivity analysis.

Nitrogen Dioxide

5.6 Predicted ground level NO_2 concentrations were assessed against the relevant AQSs. The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 29. Where modelling results exceed the relevant AQS, these are shown in **bold** text.

Table 29 Summary of Predicted NO_2 Concentrations

Receptor	Predicted Annual Mean Concentration ($\mu g.m^{-3}$)(1)	Predicted 99.8th Percentile 1-hour Concentration ($\mu g.m^{-3}$)(2)
R1	9.64	35.90
R2	9.59	34.84
R3	9.54	33.82

Receptor	Predicted Annual Mean Concentration (µg.m^{-3})$^{(1)}$	Predicted 99.8th Percentile 1-hour Concentration (µg.m^{-3})$^{(2)}$
R4	9.60	35.32
R5	9.56	34.09
R6	9.55	33.05
R7	9.54	33.27
R8	9.54	32.56
R9	9.49	32.53
R10	9.72	33.63
R11	9.62	36.75
R12	10.09	32.49
R13	10.80	32.02

NOTE (1) Inclusive of background concentration of 9.00µg.m^{-3}.
(2) Inclusive of background concentration of 18.00µg.m^{-3}.

5.7 As indicated in Table 29, there were no predicted exceedences of the relevant AQSs for NO_2 at any discrete receptor location.

5.8 A review of the plotfiles contained within Appendix I.1d indicates that there were no predicted exceedences of either AQS for NO_2 throughout the entire modelling area.

Particulate Matter - PM_{10}

5.9 Predicted ground level PM_{10} concentrations were assessed against the relevant AQSs. The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 30. Where modelling results exceed the relevant AQS, these are shown in **bold** text.

Table 30 Summary of Predicted PM_{10} Concentrations

Receptor	Predicted Annual Mean Concentration (µg.m^{-3})$^{(1)}$	Predicted 90.4th Percentile 24-hour Concentration (µg.m^{-3})$^{(2)}$
R1	10.28	20.76
R2	10.16	20.52
R3	10.04	20.31
R4	10.14	20.59
R5	10.06	20.32
R6	10.07	20.21
R7	10.05	20.18
R8	10.07	20.31
R9	10.00	20.16

Receptor	Predicted Annual Mean Concentration (µg.m^{-3})$^{(1)}$	Predicted 90.4th Percentile 24-hour Concentration (µg.m^{-3})$^{(2)}$
R10	10.48	21.46
R11	10.27	21.12
R12	11.17	23.37
R13	10.60	21.63

NOTE (1) Inclusive of background concentration of 9.86µg.m^{-3}.
(2) Inclusive of background concentration of 19.72µg.m^{-3}.

5.10 As indicated in Table 30, there were no predicted exceedences of the relevant AQSs for PM_{10} at any discrete receptor location.

5.11 A review of the plotfiles contained within Appendix I.1d indicates that there were no predicted exceedences of either AQS for PM_{10} throughout the entire modelling area.

Oxides of Nitrogen

5.12 Predicted ground level NOx concentrations were assessed against the relevant AQS. The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 31. Where modelling results exceed the relevant AQS, these are shown in **bold** text.

Table 31 Summary of Predicted NO_x Concentrations

Receptor	Predicted Annual Mean Concentration (µg.m^{-3})$^{(1)}$
R1	4.33
R2	4.28
R3	4.23
R4	4.29
R5	4.25
R6	4.24
R7	4.23
R8	4.23
R9	4.18
R10	4.41
R11	4.31
R12	4.78
R13	5.49

NOTE (1) Inclusive of background concentration of 3.69µg.m^{-3}.

5.13 As indicated in Table 31, there were no predicted exceedences of the annual mean AQS for NO_x at any discrete receptor location.

5.14 A review of the plotfiles contained within Appendix I.1d indicates that there were no predicted exceedences of the AQS for NO_x throughout the entire modelling area.

Sulphur Dioxide

5.15 Predicted ground level SO_2 concentrations were assessed against the relevant AQSs. The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 32. Where modelling results exceed the relevant AQS, these are shown in **bold** text.

Table 32 Summary of Predicted SO_2 Concentrations

Receptor	Predicted Annual Mean Concentration ($\mu g.m^{-3}$)$^{(1)}$	Predicted 99th Percentile 24-hour Concentration ($\mu g.m^{-3}$)$^{(2)}$	Predicted 99.7th Percentile 1-hour Concentration ($\mu g.m^{-3}$)$^{(2)}$
R1	2.39	8.97	22.12
R2	2.37	9.01	21.40
R3	2.34	9.47	21.38
R4	2.37	9.54	22.14
R5	2.35	9.16	21.50
R6	2.34	9.30	20.45
R7	2.34	9.27	20.18
R8	2.34	8.77	19.11
R9	2.31	8.78	19.33
R10	2.42	10.13	20.88
R11	2.37	8.76	22.44
R12	2.61	8.05	17.23
R13	3.00	9.17	20.70

NOTE (1) Inclusive of background concentration of 2.03$\mu g.m^{-3}$.
(2) Inclusive of background concentration of 4.06$\mu g.m^{-3}$.

5.16 As indicated in Table 32, there were no predicted exceedences of the relevant AQSs for SO_2 at any discrete receptor location.

5.17 A review of the plotfiles contained within Appendix I.1d indicates that there were no predicted exceedences of any AQS for SO_2 throughout the entire modelling area.

5.18 Based upon the results of the dispersion modelling, it is considered that setting the ELV for SO_2 at 500mg.m^{-3}, as proposed, would not cause exceedences of the relevant AQSs at any location.

Carbon Monoxide

5.19 Predicted ground level CO concentrations were assessed against the relevant AQS. The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 33. Where modelling results exceed the relevant AQS, these are shown in **bold** text.

Table 33 Summary of Predicted CO Concentrations

Receptor	Predicted 8-hour Mean Concentration (mg.m^{-3})(1)
R1	0.28
R2	0.27
R3	0.27
R4	0.31
R5	0.29
R6	0.25
R7	0.25
R8	0.23
R9	0.26
R10	0.27
R11	0.29
R12	0.21
R13	0.26

NOTE (1) Inclusive of background concentration of 0.12mg.m^{-3}.

5.20 As indicated in Table 33, there were no predicted exceedences of the relevant AQS for CO at any discrete receptor location.

5.21 A review of the plotfiles contained within Appendix I.1d indicates that there were no predicted exceedences of the AQS for CO throughout the entire modelling area.

Volatile Organic Compounds

5.22 VOC emissions are likely to consist of a variety of species, with the relevant ELV being set for Total Organic Carbon (TOC). For the purposes of this assessment, it has been assumed that the entire TOC emission consists of only C_6H_6 in order to allow comparison with the AQS. This is considered a worst-case scenario as TOC emissions are unlikely to consist of only one species.

5.23 The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 34. Where modelling results exceed the relevant AQS, these are shown in **bold** text.

Table 34 Summary of Predicted C_6H_6 Concentrations

Receptor	Predicted Annual Mean Concentration ($\mu g.m^{-3}$)(1)
R1	0.05
R2	0.05
R3	0.05
R4	0.05
R5	0.05
R6	0.05
R7	0.05
R8	0.05
R9	0.05
R10	0.05
R11	0.05
R12	0.06
R13	0.08

NOTE (1) Inclusive of background concentration of $0.03\mu g.m^{-3}$.

5.24 As indicated in Table 34, there were no predicted exceedences of the annual mean AQS for C_6H_6 at any discrete receptor location.

5.25 A review of the plotfiles contained within Appendix I.1d indicates that there were no predicted exceedences of the AQS for C_6H_6 throughout the entire modelling area.

Metals

5.26 The ELV for Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V will be stated as total heavy metals. However, for the purpose of this assessment they were considered individually to allow comparison with any relevant AQS. It is considered unlikely that the full $0.1mg.m^{-3}$ emission permitted for total heavy metals would consist of only one metal species; therefore, by considering each metal individually, maximum ground level concentrations and hence the maximum impacts, have been predicted.

5.27 Predicted metal concentrations have been compared to the annual AQS for Pb, Ni and As as limits have not been set for any of the other metal species within the Republic of Ireland. The lowest of these is for As, and therefore the demonstration of compliance with this standard would also demonstrate compliance with all others.

5.28 The results of the model predictions at each discrete receptor are summarised in Table 35. Where modelling results exceed the relevant AQS, these are shown in **bold** text.

Table 35 Summary of Predicted Pb Concentrations

Receptor	Predicted Annual Mean Concentration (µg.m^{-3})
R1	0.0003
R2	0.0003
R3	0.0002
R4	0.0003
R5	0.0002
R6	0.0002
R7	0.0002
R8	0.0002
R9	0.0002
R10	0.0002
R11	0.0002
R12	0.0003
R13	0.0006

5.29 As indicated in Table 35, there were no predicted exceedences of the relevant AQS for Pb, Ni or As at any discrete receptor location.

5.30 A review of the plotfiles contained within Appendix I.1d indicates that there were no predicted exceedences of the relevant AQS for Pb, Ni or As throughout the entire modelling area.

Cadmium and Thallium

5.31 The ELV for Cd and Tl will be stated as the total of both species. However, for the purpose of this assessment they were considered individually to allow comparison with the relevant AQS for Cd. It is considered unlikely that the full 0.05mg.m^{-3} emission permitted for total Cd and Tl would consist of only one species; therefore, by considering each individually, maximum ground level concentrations and hence the maximum impacts, have been predicted.

5.32 Predicted concentrations have been compared to the annual AQS for Cd as limits have not been set for Tl within the Republic of Ireland.

5.33 The results of the model predictions at each discrete receptor are summarised in Table 35. Where modelling results exceed the relevant AQS, these are shown in **bold** text.

Table 36 Summary of Predicted Cd Concentrations

Receptor	Predicted Annual Mean Concentration (µg.m^{-3})
R1	0.000026
R2	0.000025
R3	0.000023
R4	0.000025
R5	0.000024
R6	0.000024
R7	0.000023
R8	0.000023
R9	0.000021
R10	0.000024
R11	0.000023
R12	0.000034
R13	0.000059

5.34 As indicated in Table 35, there were no predicted exceedences of the relevant AQS for Cd at any discrete receptor location.

5.35 A review of the plotfiles contained within Appendix I.1d indicates that there were no predicted exceedences of the AQS for Cd throughout the entire modelling area.

Dioxins and Furans

5.36 The results of the model predictions for ground level PCDD and PCDF concentrations at each discrete receptor, inclusive of background, are summarised in Table 37.

Table 37 Summary of Predicted PCDD and PCDF Concentrations

Receptor	Predicted Annual Mean Concentration (pg.m^{-3})$^{(1)}$
R1	3.47001
R2	3.47001
R3	3.47000

Receptor	Predicted Annual Mean Concentration ($pg.m^{-3}$)(1)
R4	3.47001
R5	3.47000
R6	3.47000
R7	3.47000
R8	3.47000
R9	3.47000
R10	3.47000
R11	3.47000
R12	3.47001
R13	3.47001

NOTE (1) Inclusive of background concentration of $3.47pg.m^{-3}$.

5.37 Although an AQS has not been declared for PCDDs and PCDFs, the predicted concentrations at all receptor locations are significantly lower than those recorded during the baseline monitoring survey undertaken at Ballyconnell. It is therefore considered that PCDD and PCDF emissions associated with the change in fuel use would not result in significant impacts on existing baseline concentrations.

Hydrogen Chloride

5.38 The results of the model predictions for ground level HCl concentrations at each discrete receptor, inclusive of background, are summarised in Table 38.

Table 38 Summary of Predicted HCl Concentrations

Receptor	Predicted Annual Mean Concentration ($\mu g.m^{-3}$)(1)	Predicted 1-hour Concentration ($\mu g.m^{-3}$)(2)
R1	4.4436	9.3356
R2	4.4433	9.3191
R3	4.4430	9.3785
R4	4.4434	9.3411
R5	4.4431	9.3565
R6	4.4431	9.3972
R7	4.4430	9.4040
R8	4.4431	9.4047
R9	4.4426	9.4165
R10	4.4431	9.3413
R11	4.4429	9.3372

Receptor	Predicted Annual Mean Concentration (μg.m^{-3})$^{(1)}$	Predicted 1-hour Concentration (μg.m^{-3})$^{(2)}$
R12	4.4451	9.3797
R13	4.4501	9.7998

NOTE (1) Inclusive of background concentration of 4.44μg.m^{-3}.
(2) Inclusive of background concentration of 8.88μg.m^{-3}.

5.39 Although an AQS has not been declared for HCl, the predicted concentrations at all receptor locations are considerably lower than those recorded during the baseline monitoring survey undertaken at Ballyconnell. It is therefore considered that HCl emissions associated with the change in fuel use would not result in significant impacts on existing baseline concentrations.

Hydrogen Fluoride

5.40 The results of the model predictions for ground level HF concentrations at each discrete receptor are summarised in Table 39.

Table 39 Summary of Predicted HF Concentrations

Receptor	Predicted Annual Mean Concentration (μg.m^{-3})	Predicted 1-hour Concentration (μg.m^{-3})
R1	1.4222	2.8893
R2	1.4222	2.8877
R3	1.4221	2.8936
R4	1.4222	2.8899
R5	1.4221	2.8914
R6	1.4221	2.8955
R7	1.4221	2.8962
R8	1.4221	2.8962
R9	1.4221	2.8974
R10	1.4221	2.8899
R11	1.4221	2.8895
R12	1.4223	2.8937
R13	1.4228	2.9358

NOTE (1) Inclusive of background concentration of 1.42μg.m^{-3}.
(2) Inclusive of background concentration of 2.84μg.m^{-3}.

5.41 Although an AQS has not been declared for HF, the predicted concentrations at all receptor locations are considerably lower than those recorded during the baseline monitoring survey undertaken at Ballyconnell. It is therefore considered that HF emissions associated with the change in fuel use would not result in significant impacts on existing baseline concentrations.

6 Summary and Conclusion

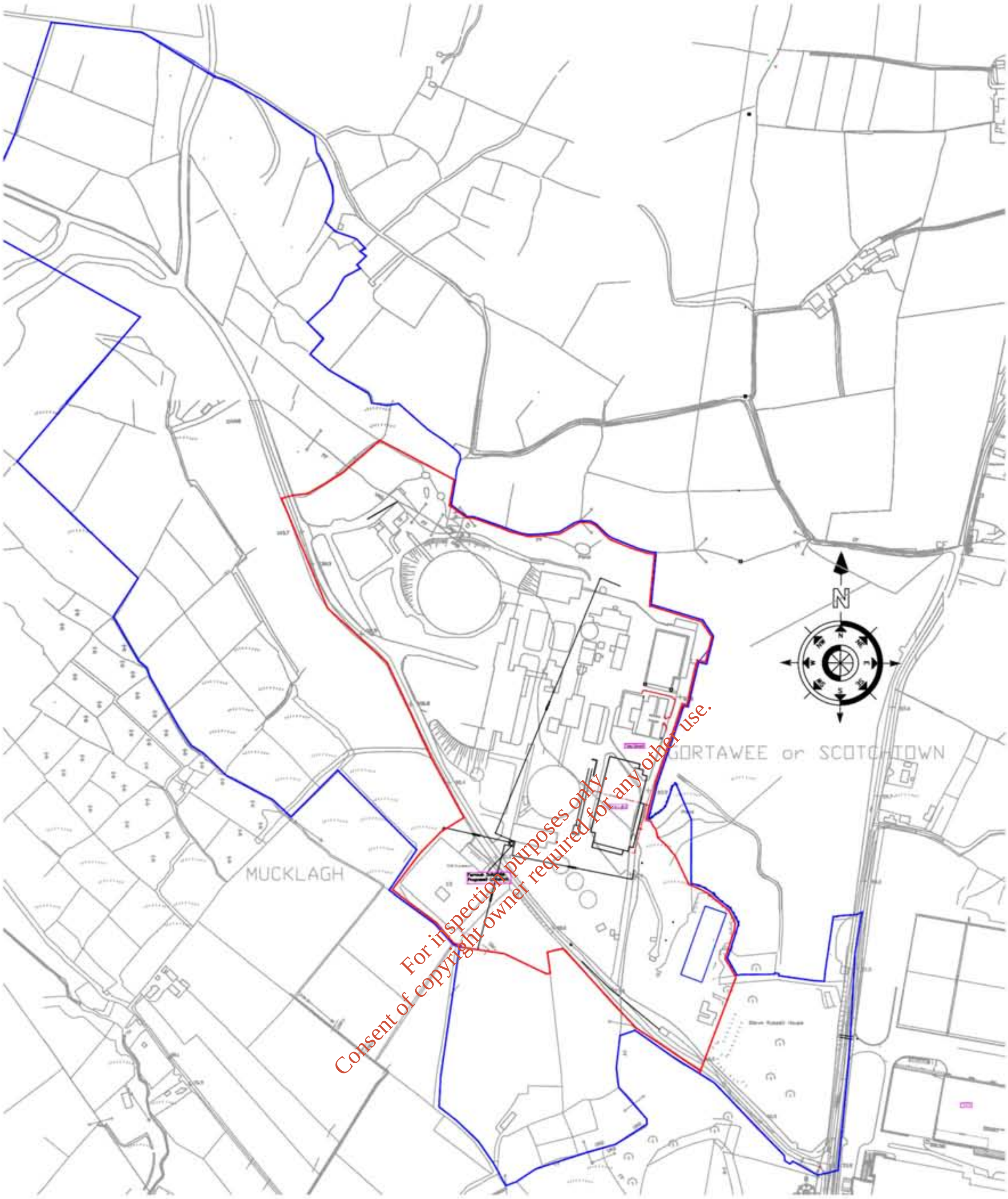
6.1 A detailed dispersion modelling assessment was undertaken to assess potential impacts associated with atmospheric emissions from the Ballyconnell and Gortmullan cement production facilities. Predicted pollutant concentrations were compared with the relevant AQSs as appropriate.

6.2 The results of the modelling assessment indicated no exceedences of any AQS at any location within the modelling extents.

6.3 It should be noted that all concentrations were predicted on a *worst-case* scenario, including constant emissions from both plants at the maximum permitted 24-hours per day 365-days per year. Actual ground level concentrations are therefore likely to be lower than those predicted.

6.4 Although an AQS has not been declared for PCDDs and PCDFs, HCl or HF, the predicted concentrations at all receptor locations are considerably lower than those recorded during the monitoring survey undertaken at Ballyconnell. It is therefore considered that PCDDs and PCDFs, HCl and HF emissions associated with the change in fuel use would not result in significant impacts on existing baseline concentrations.

FIGURES



Appendix I.1 Figure 1

Site Location Plan

Dispersion Modelling Assessment on behalf of: Project Number: A044734 / 588

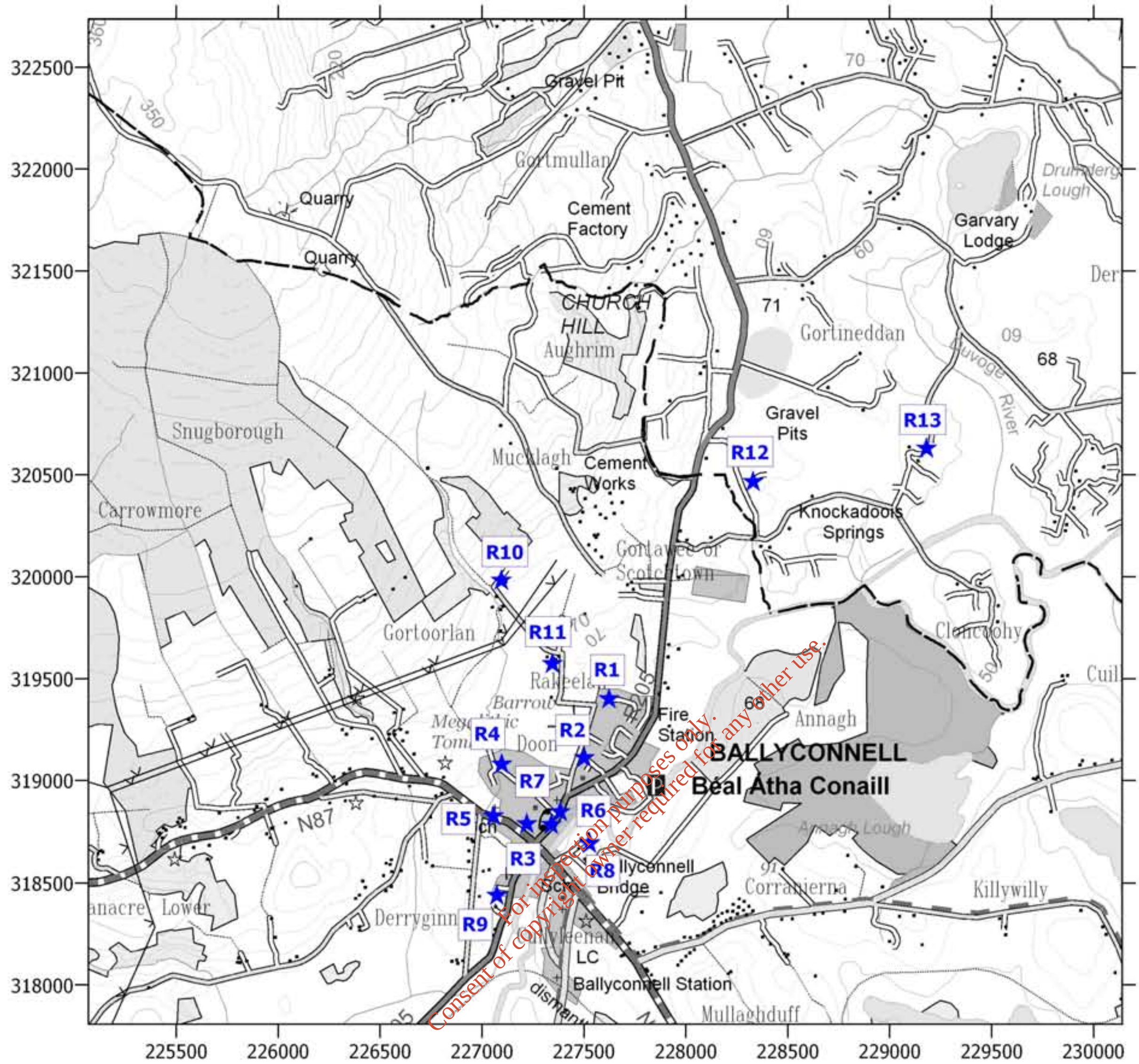
Quinn Cement Ltd

LEGEND

Site Boundary

WYG Environment Planning Transport

part of the **WYG** group



Appendix I.1 Figure 2

Sensitive Receptor Locations

Dispersion Modelling Assessment on behalf of:

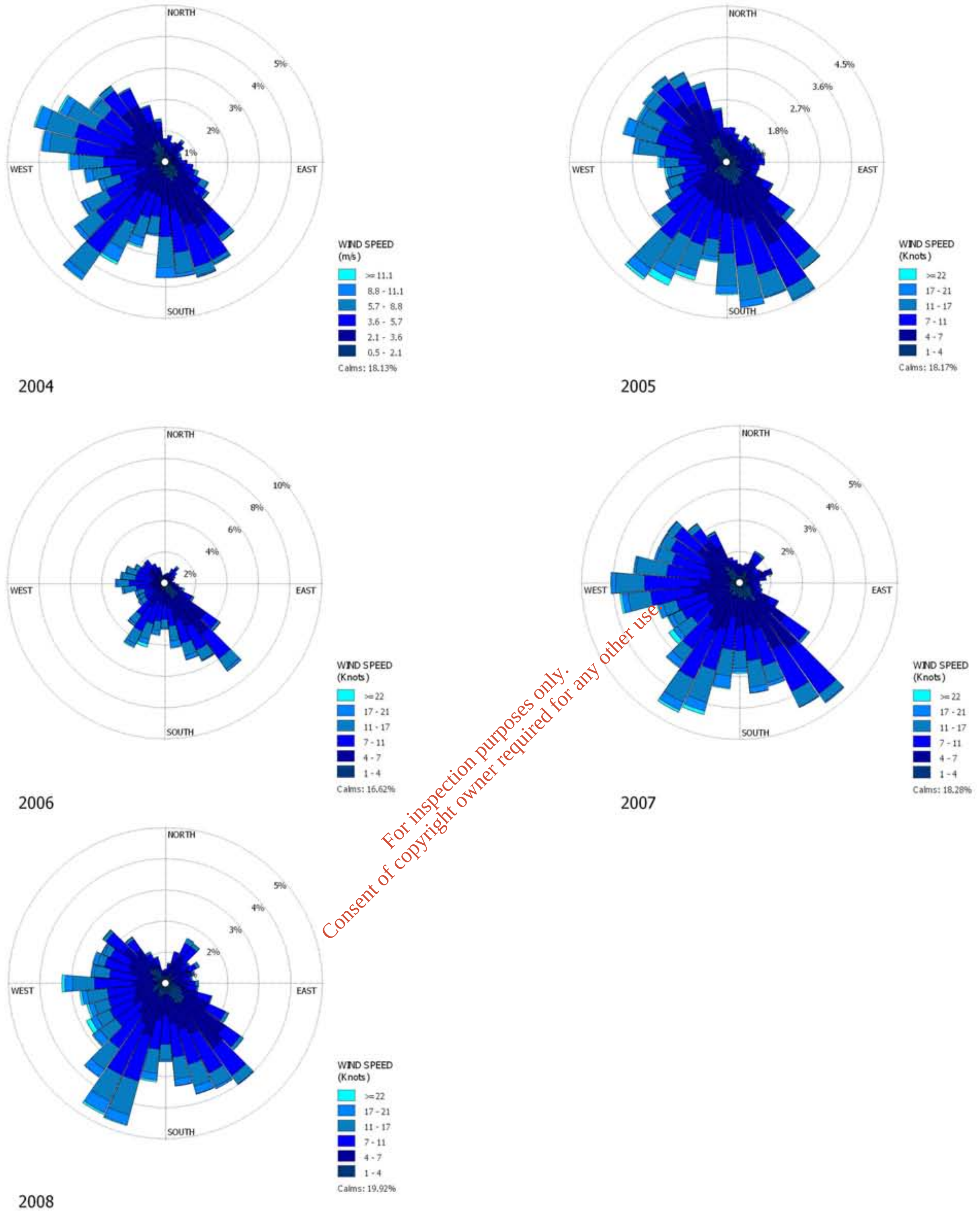
Quinn Cement Ltd

Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

★ Sensitive Receptor Location



Appendix I.1 Figure 3

Wind Roses of St Angelo Meteorological Data 2004 to 2008

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

WYG Environment Planning Transport

part of the **WYG** group

Appendix I.1a

Report Conditions

WYG ENVIRONMENT PLANNING TRANSPORT LTD

REPORT CONDITIONS
DETAILED DISPERSION MODELLING ASSESSMENT
QUINN CEMENT BALLYCONNELL FACILITY

This report is produced solely for the benefit of Quinn Cement Ltd and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYG Environmental Planning Transport Ltd. In time improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYG Environmental Planning Transport Ltd using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYG Environmental Planning Transport Ltd by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the representativeness of data used by the model and the assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYG Environmental Planning Transport Ltd accept no liability for issues with performance arising from such factors

February 2006

Appendix I.1b

Air Quality Standards

Air Quality Standards, Objectives, Limit and Target Values

Pollutant	Averaging Period	Receptor	EU Daughter Directive Limit Value	WHO Guidelines
Nitrogen dioxide (NO_2)	1-hour mean	Protection of Human Health	200µg.m^{-3} by end of 2009 (max 18 exceedences a year) (A)	200µg.m^{-3} 105ppb
	Annual mean	Protection of Human Health	40µg.m^{-3} by end of 2009 (A)	40µg.m^{-3}
Oxides of Nitrogen (NO_X)	Annual mean	Protection of Ecosystems	30µg.m^{-3} as NO_x 19th July 2001 (A)	-
Particulate (as PM_{10})	24-hour mean	Protection of Human Health	50µg.m^{-3} by end of 2004 (max 35 exceedences a year) by 1st January 2010 (max 7 exceedences (A)	-
	Annual mean	Protection of Human Health	40µg.m^{-3} by end of 2004 (A)	-
Sulphur Dioxide (SO_2)	1-hour mean	Protection of Human Health	350µg.m^{-3} by end of 2004 (max 24 exceedences a year) (A)	-
	24-hour mean	Protection of Human Health	125µg.m^{-3} by end of 2004 (max 3 exceedences a year) (A)	-
	Annual mean	Protection of Vegetation	20µg.m^{-3} by 1st January 2005 (A)	-
	Winter Mean (1st October to 31st March)	Protection of Vegetation	20µg.m^{-3} by 1st January 2005 (A)	-
Lead (Pb)	Annual mean	Protection of Human Health	0.5µg.m^{-3} by end of 2004 (A)	
Carbon Monoxide (CO)	8-hour mean	Protection of Human Health	Maximum daily 8-hour mean 10mg.m^{-3} by end of 2004	10mg.m^{-3}
Benzene (C_6H_6)	Annual mean	Protection of Human Health	5µg.m^{-3} 1.54ppb by 1st January 2010	-
Arsenic (As)	Annual mean	Protection of Human Health	6ng.m^{-3} by 31st December 2012	-
Cadmium (Cd)	Annual mean	Protection of Human Health	5ng.m^{-3} by 31st December 2012	-
Nickel (Ni)	Annual mean	Protection of Human Health	20ng.m^{-3} by 31st December 2012	-

NOTE: (A) Limit values of Directive 2008/50/EC and 1999/30/EC;
(B) Limit values of Directive 2008/50/EC and 2000/69/EC; and,
(C) Limit values of Directive 2004/107/EC.

Air Quality Alter Thresholds

Pollutant	Averaging Period	Limit Value ($\mu g.m^{-3}$) [(A)]
Sulphur Dioxide (SO_2)	1-hour mean	500
Nitrogen dioxide (NO_2)	1-hour mean	400

NOTE: (A) The public must be informed if the above thresholds are exceeded for three consecutive hours.

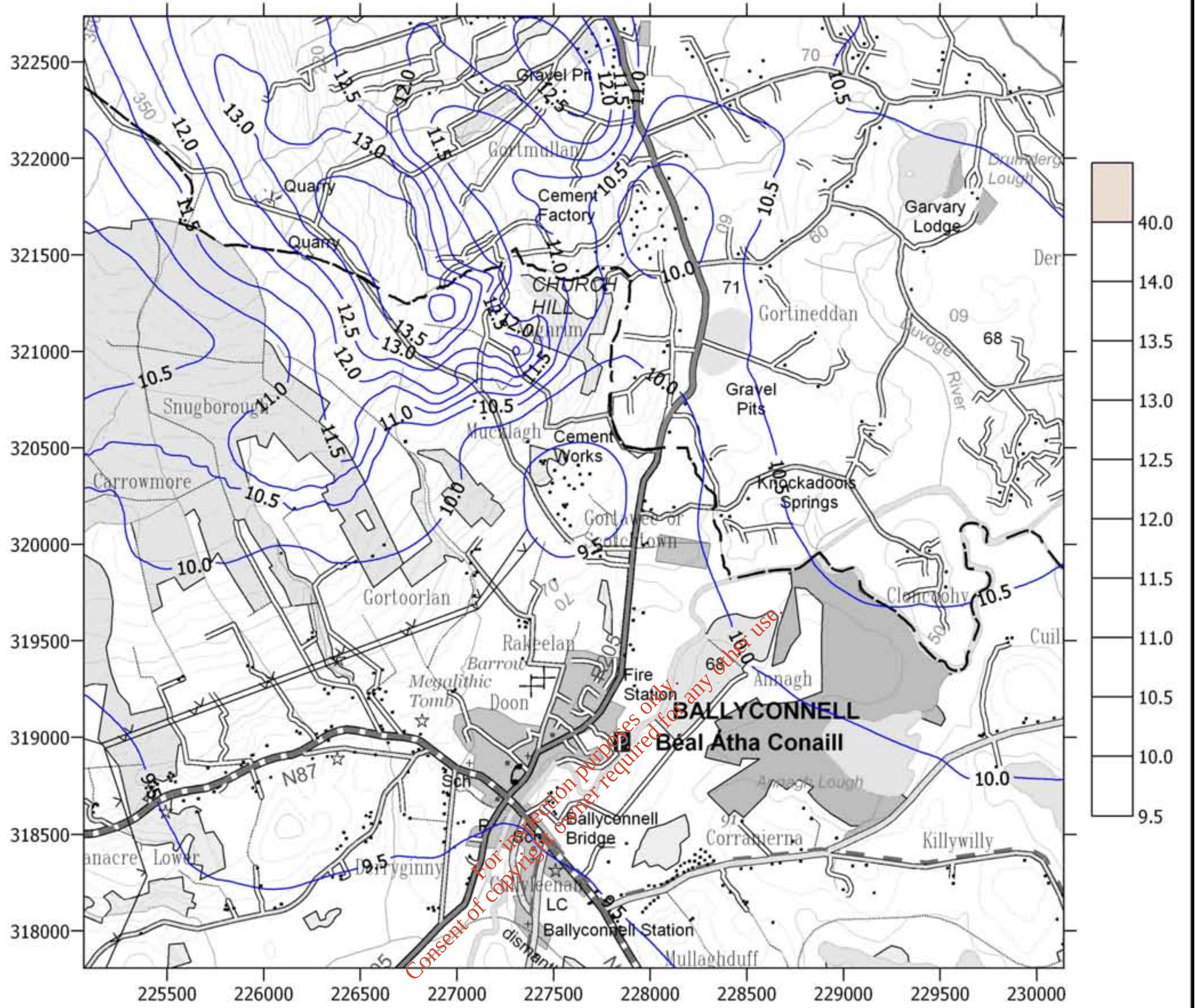
Appendix I.1c

Environmental Efficiency Consulting Engineers – Ambient Air Quality Monitoring Report for Quinn Group

Appendix I.1d

Detailed Dispersion Modelling Plotfiles

NB: Care must be taken when interpreting the plotfiles. Please note that the scales applied have been used to compare the results to relevant AQS, accounting for uncertainty. Note that the scale used may not be linear.



Appendix I.1D Figure 1

Predicted Annual Mean NO2 Concentrations (µg.m-³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

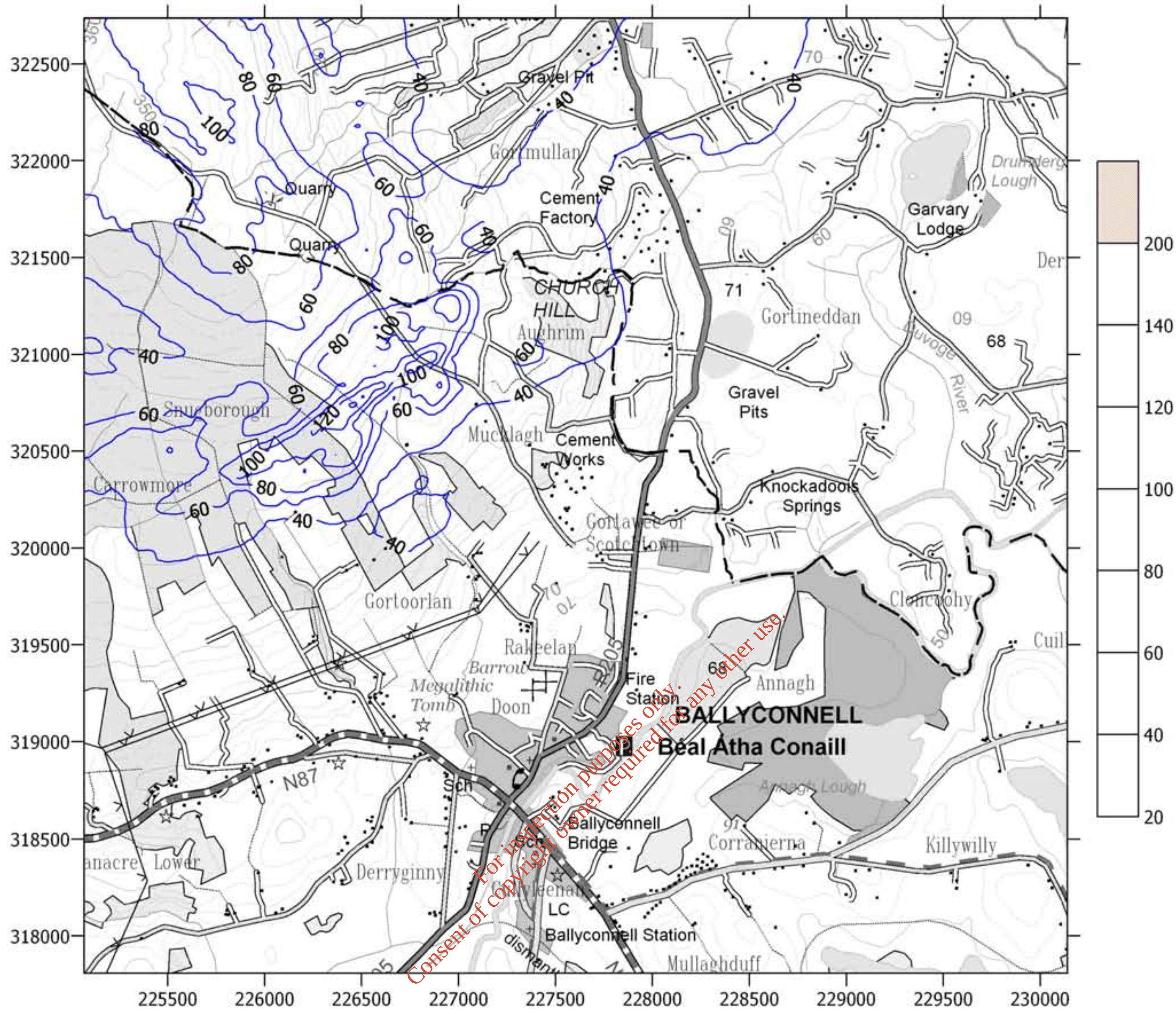
Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

WYG Environment Planning Transport

part of the **WYG** group



Appendix I.1D Figure 2

Predicted 99.8%ile 1-hour Mean NO2 Concentrations (µg.m-³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

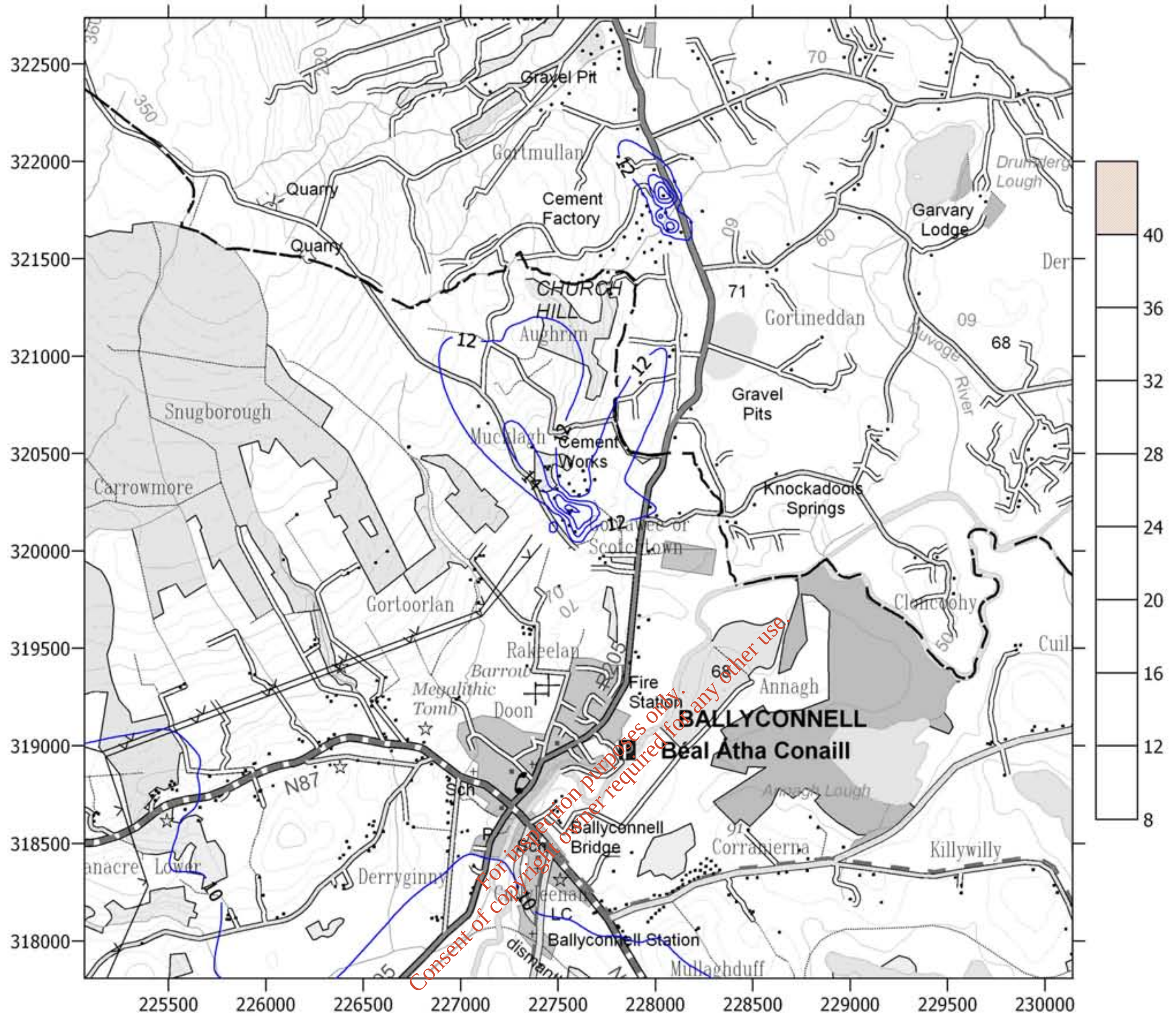
Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

WYG Environment Planning Transport

part of the **WYG** group



Appendix I.1D Figure 3

Predicted Annual Mean PM10 Concentrations (μg.m-³)

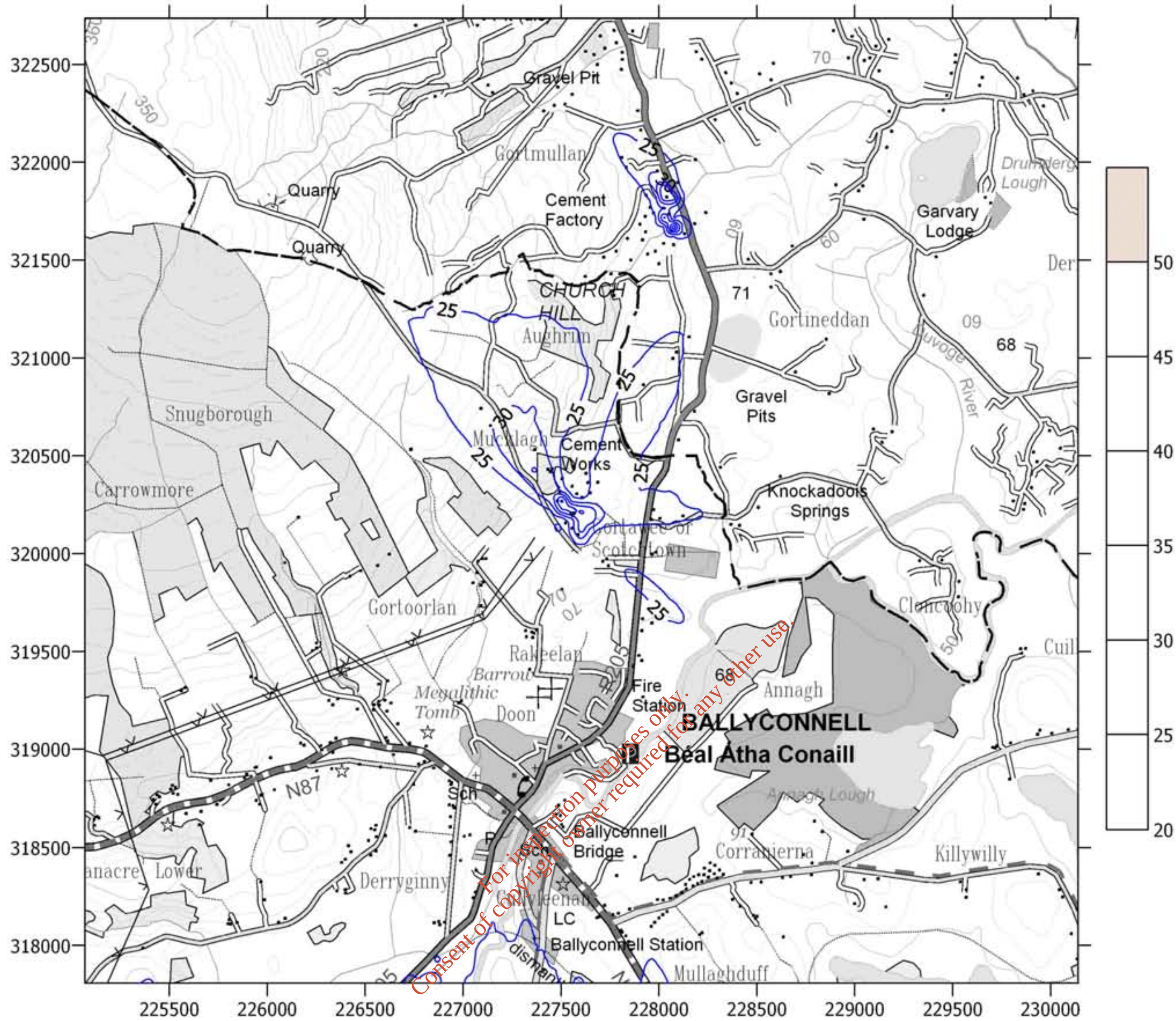
Dispersion Modelling Assessment on behalf of: Project Number: A044734 / 588

Quinn Cement Ltd NGR: 225069, 317807 to 230141, 322737

LEGEND

WYG Environment Planning Transport

part of the **WYG** group



Appendix I.1D Figure 4

Predicted 90.4%ile 24-hour Mean PM10 Concentrations (µg.m⁻³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

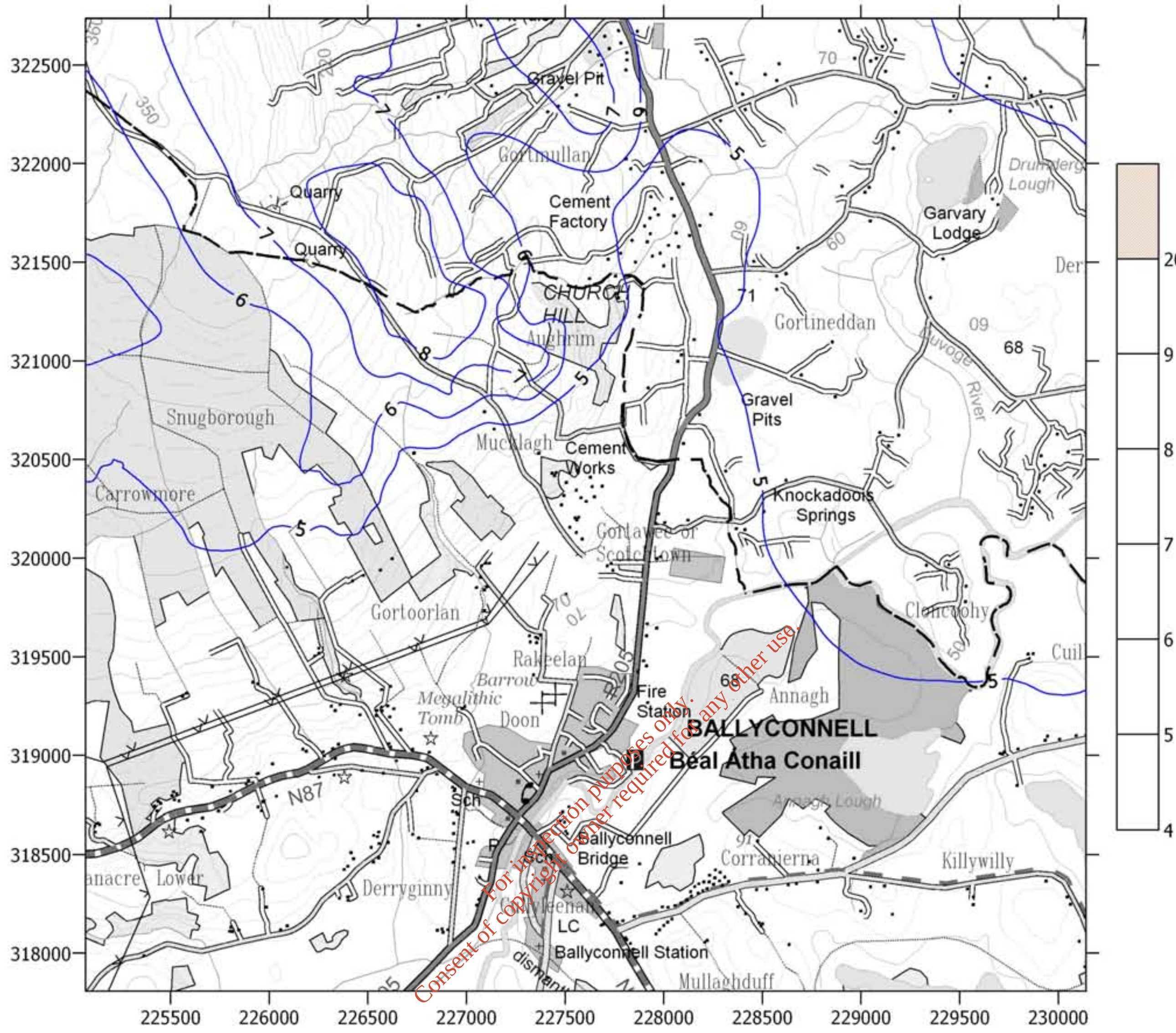
Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

WYG Environment Planning Transport

part of the **WYG** group



Appendix I.1D Figure 5

Predicted Annual Mean NOx Concentrations (μg.m-³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

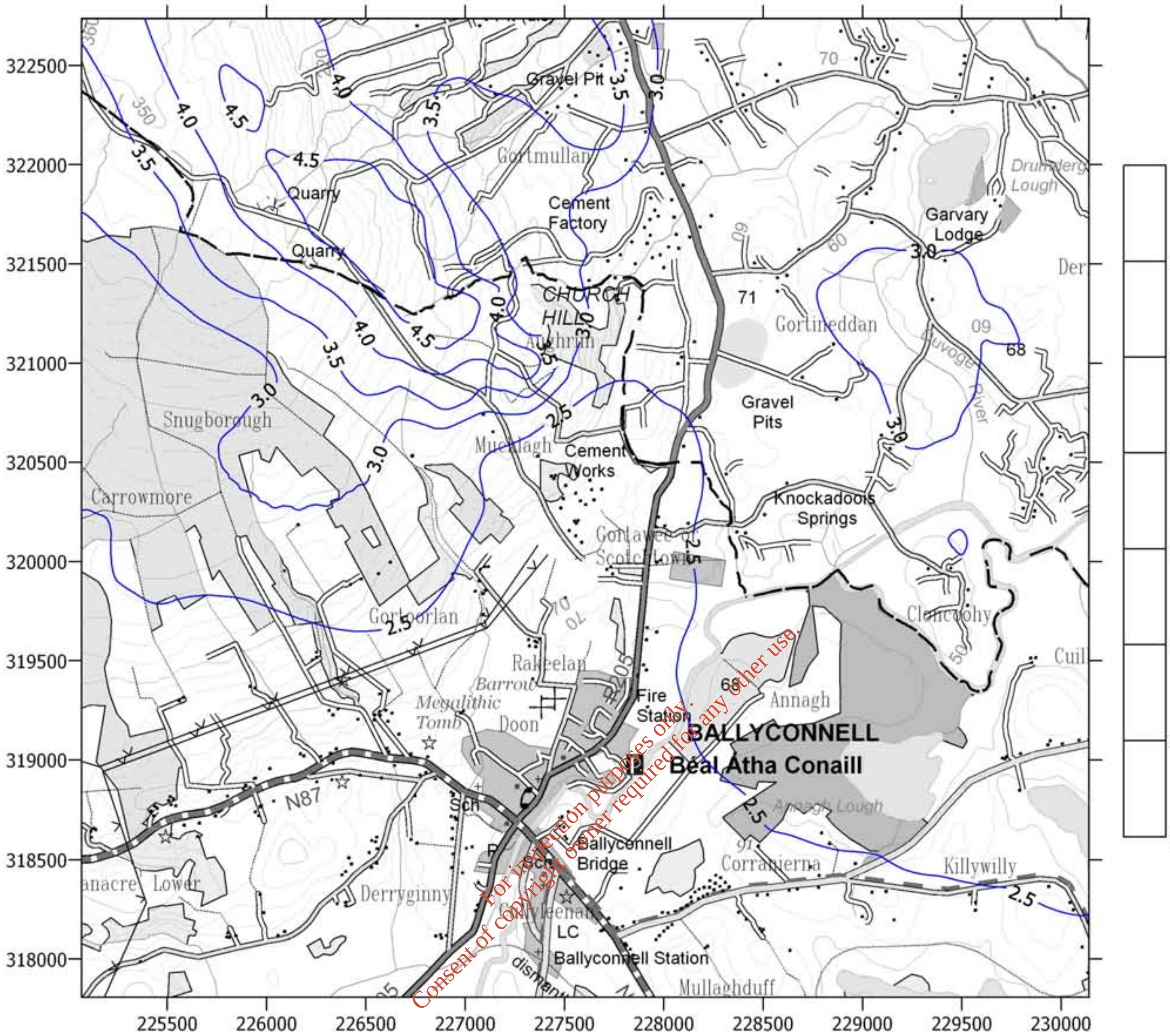
NGR: 225069, 317807 to 230141, 322737

LEGEND

It should be noted that the annual mean Air Quality Standard for NOx has been designated for the protection of eco-systems and not human health.

WYG Environment Planning Transport

part of the **WYG** group



Appendix I.1D Figure 6

Predicted Annual Mean SO2 Concentrations (µg.m-³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

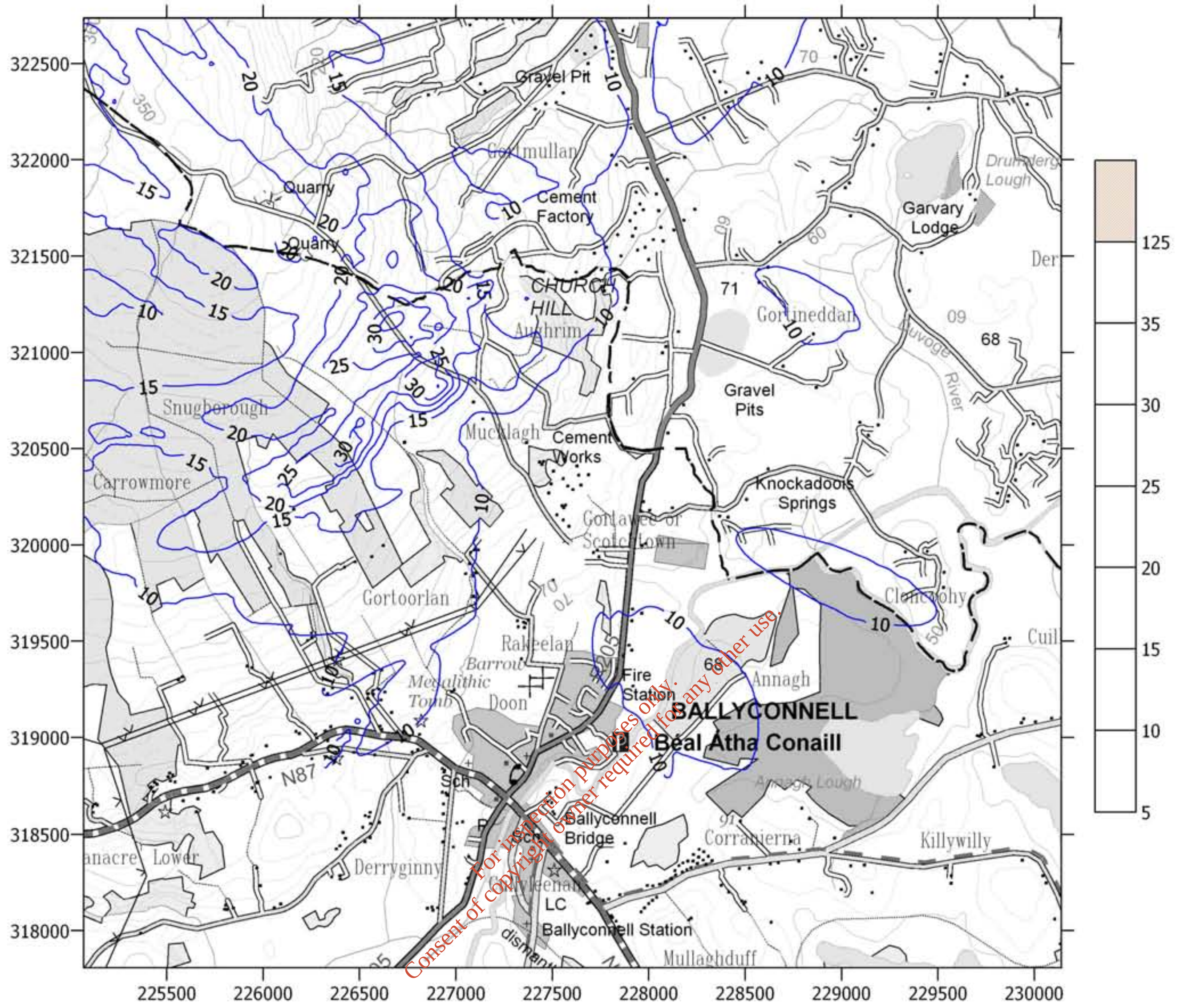
NGR: 225069, 317807 to 230141, 322737

LEGEND

It should be noted that the annual mean Air Quality Standard for SO2 has been designated for the protection of eco-systems and not human health.

WYG Environment Planning Transport

part of the **WYG** group



Appendix I.1D Figure 7

Predicted 99%ile 24-hour Mean SO_2 Concentrations (µg.m^{-3})

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

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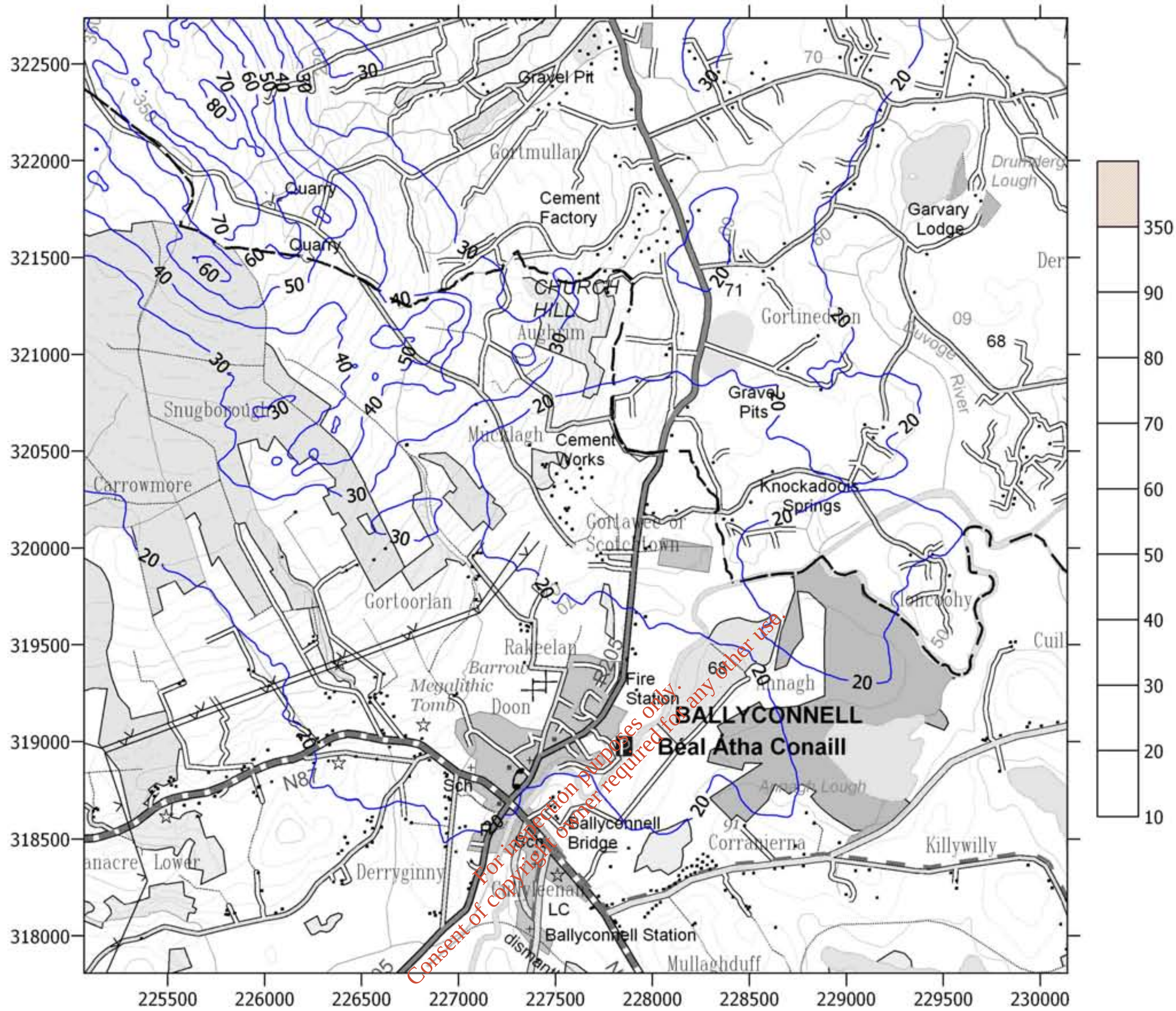


Appendix I.1D Figure 8

Predicted 99.7%ile 1-hour Mean SO2 Concentrations (µg.m-³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

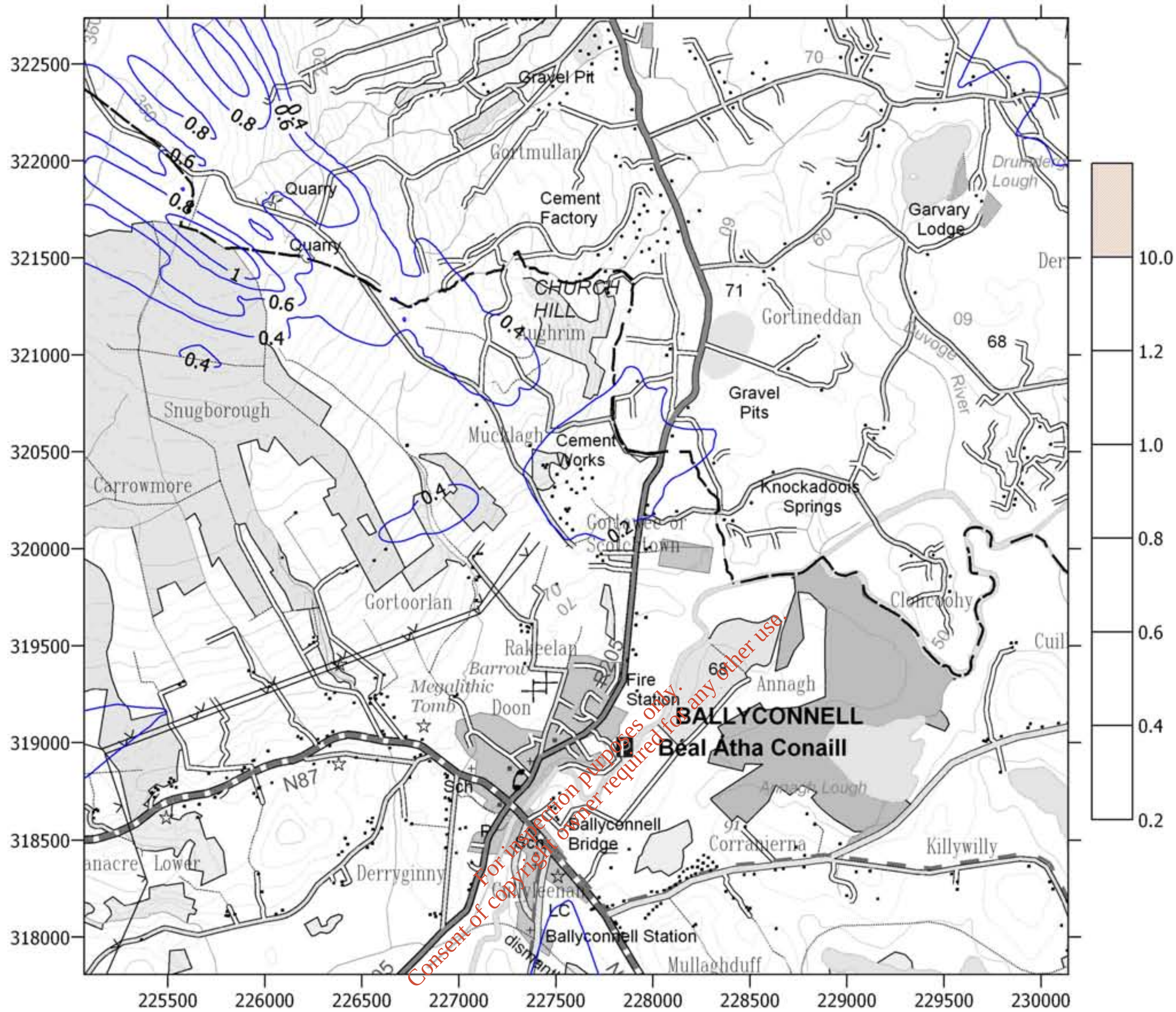
Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

WYG Environment Planning Transport

part of the **WYG** group



Appendix I.1D Figure 9

Predicted 8-hour Mean CO Concentrations (mg.m-³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

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WYG Environment Planning Transport

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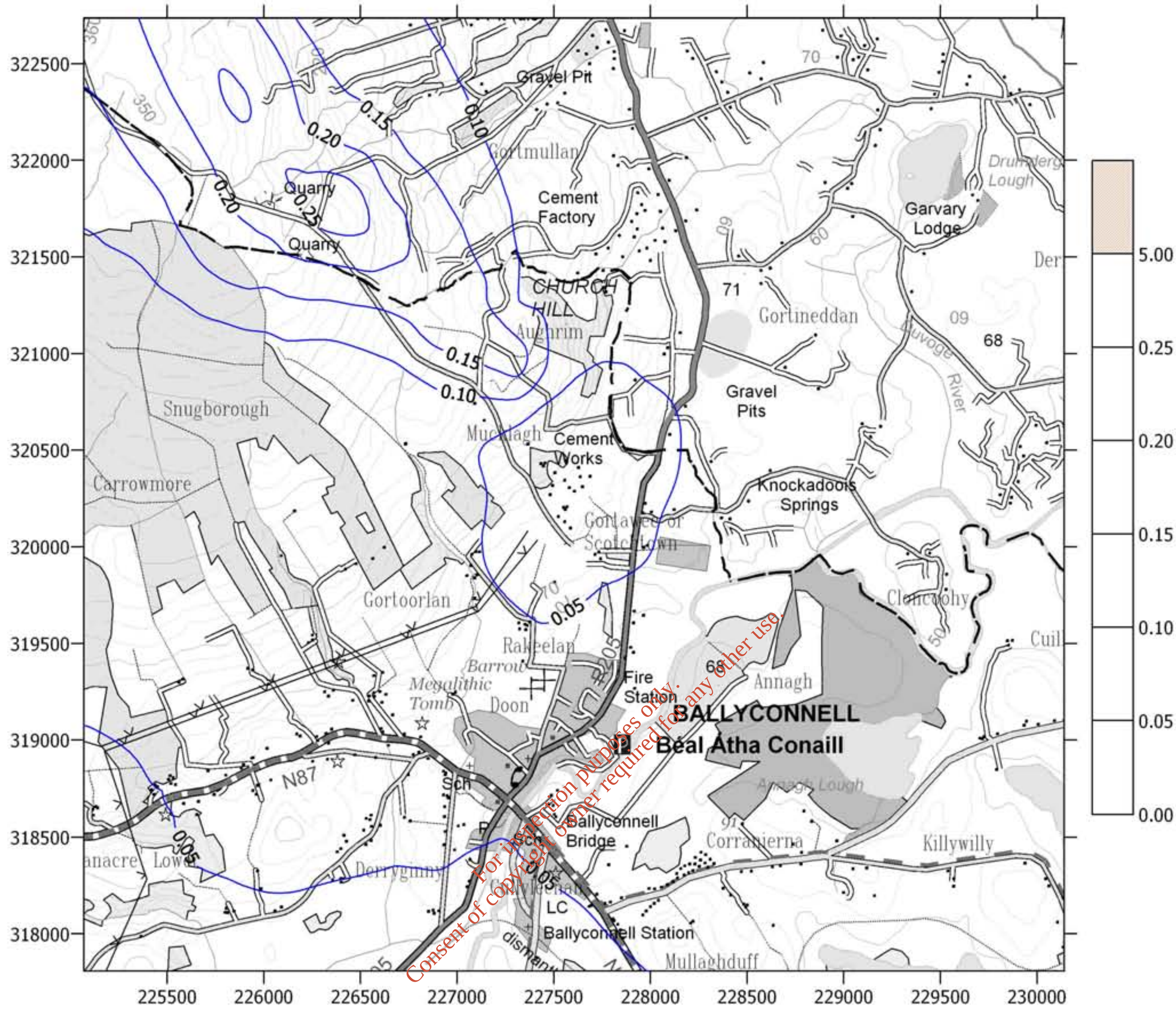

Appendix I.1D Figure 10

Predicted Annual Mean C6H6 Concentrations (µg.m-³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

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WYG Environment Planning Transport

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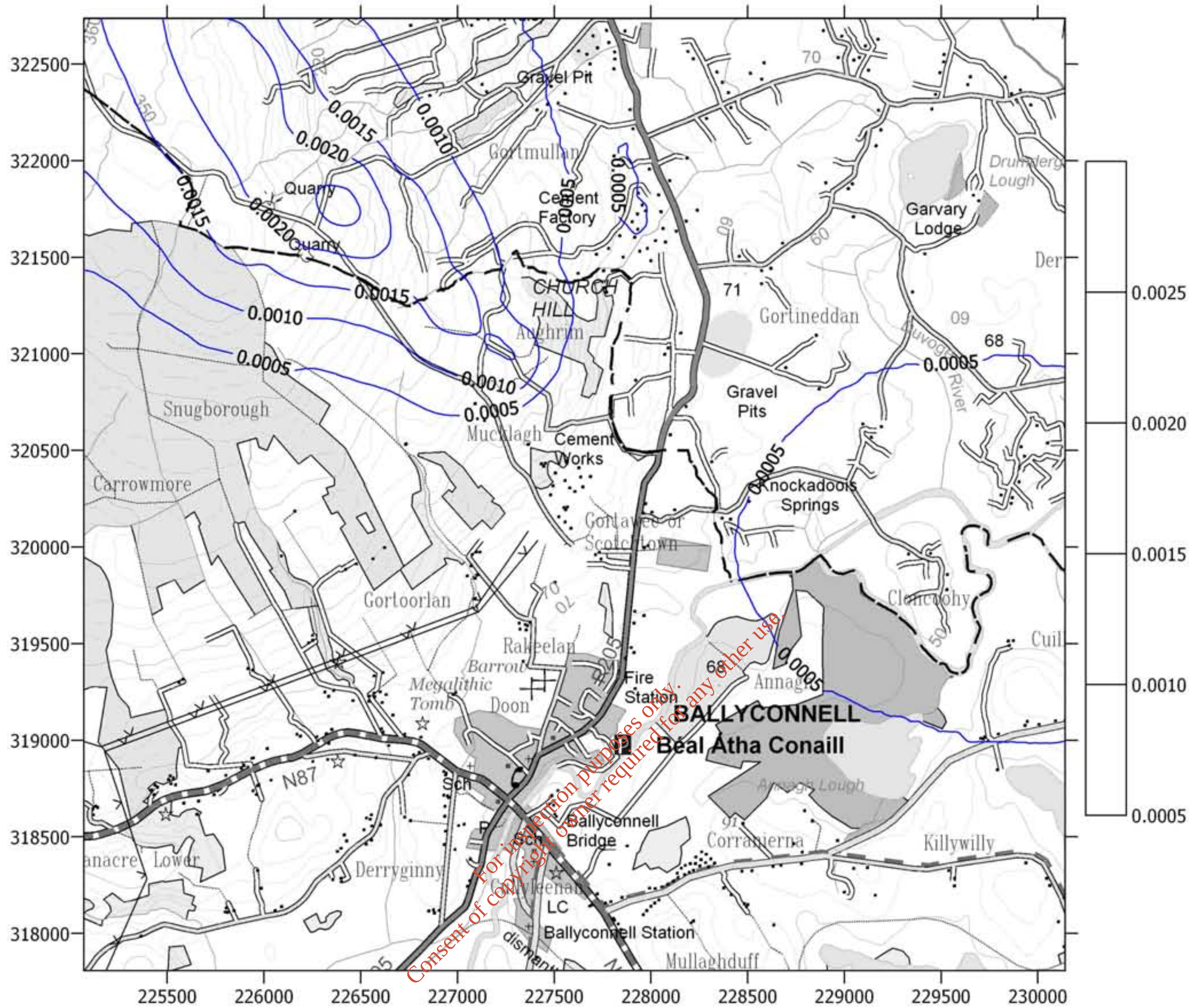

Appendix I.1D Figure 11

Predicted Annual Mean Pb, Ni or As Concentrations (µg.m⁻³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

Annual Mean Air Quality Standards for Metals:
Pb = 0.5µg.m-3
Ni = 0.02µg.m-3
As = 0.006µg.m-3

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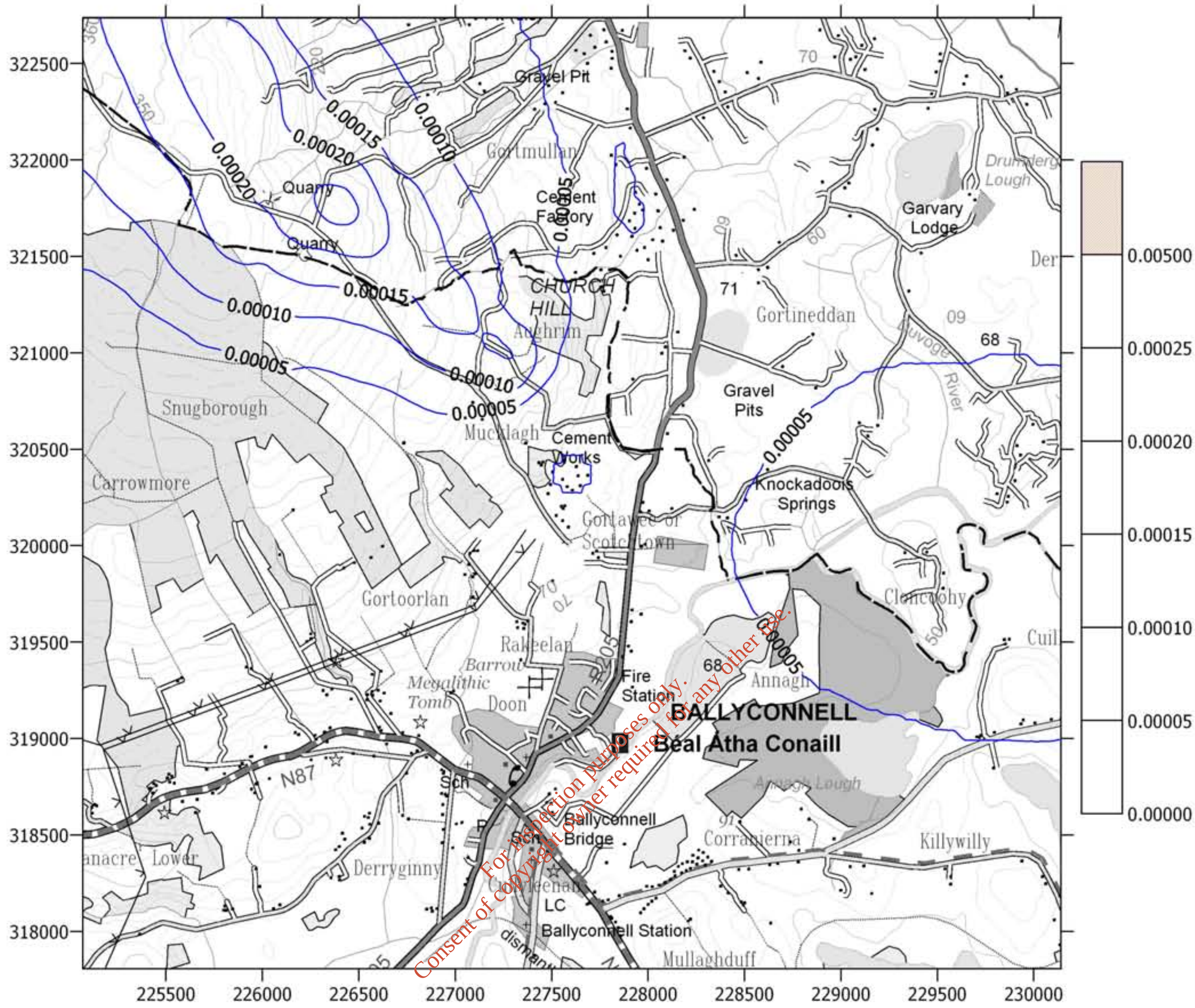
part of the WYG group



Appendix I.1D Figure 12

Predicted Annual Mean Cd Concentrations (µg.m⁻³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

WYG Environment Planning Transport

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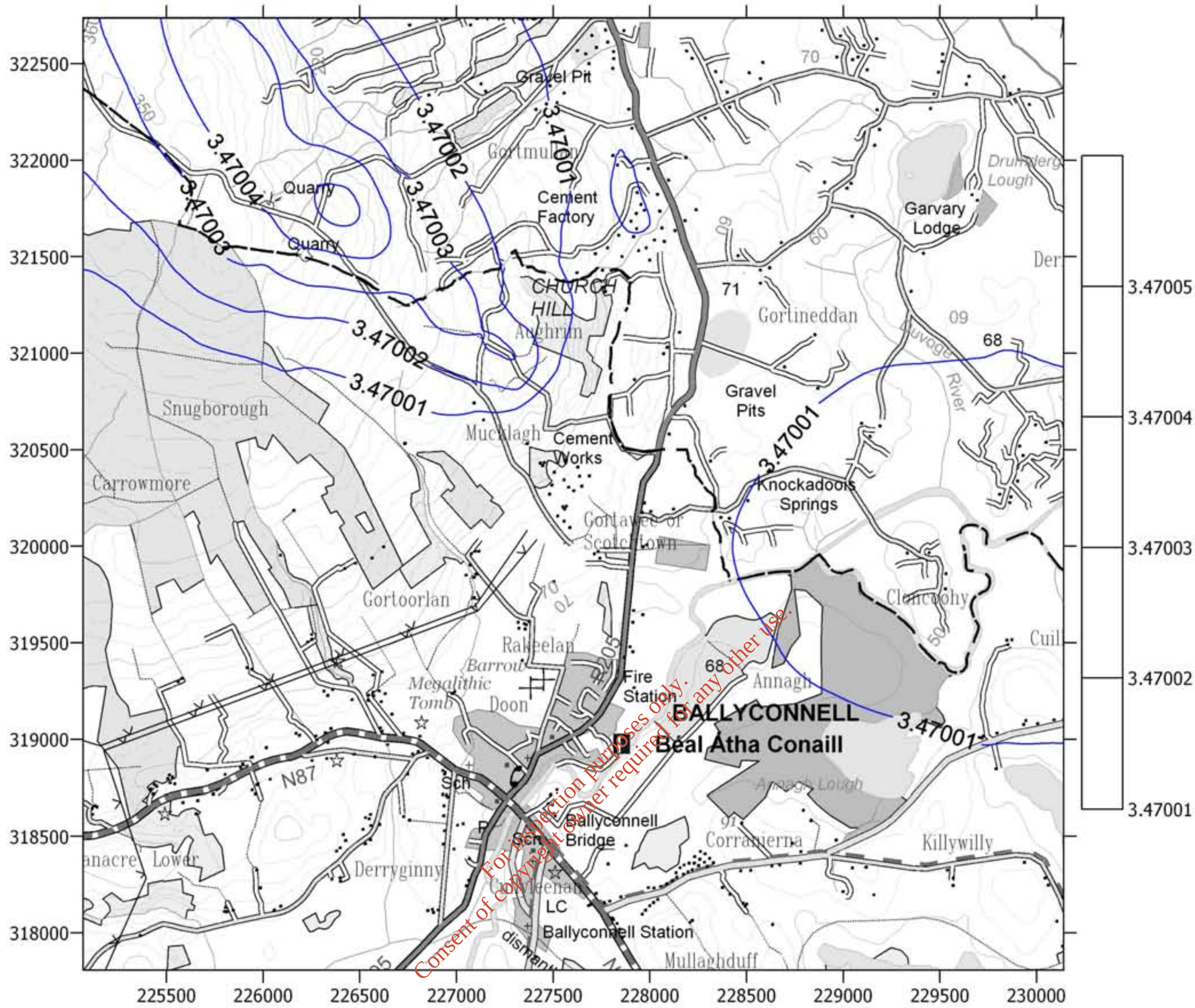

Appendix I.1D Figure 13

Predicted Annual Mean PCDD and PCDF Concentrations (pg.m-³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

WYG Environment Planning Transport

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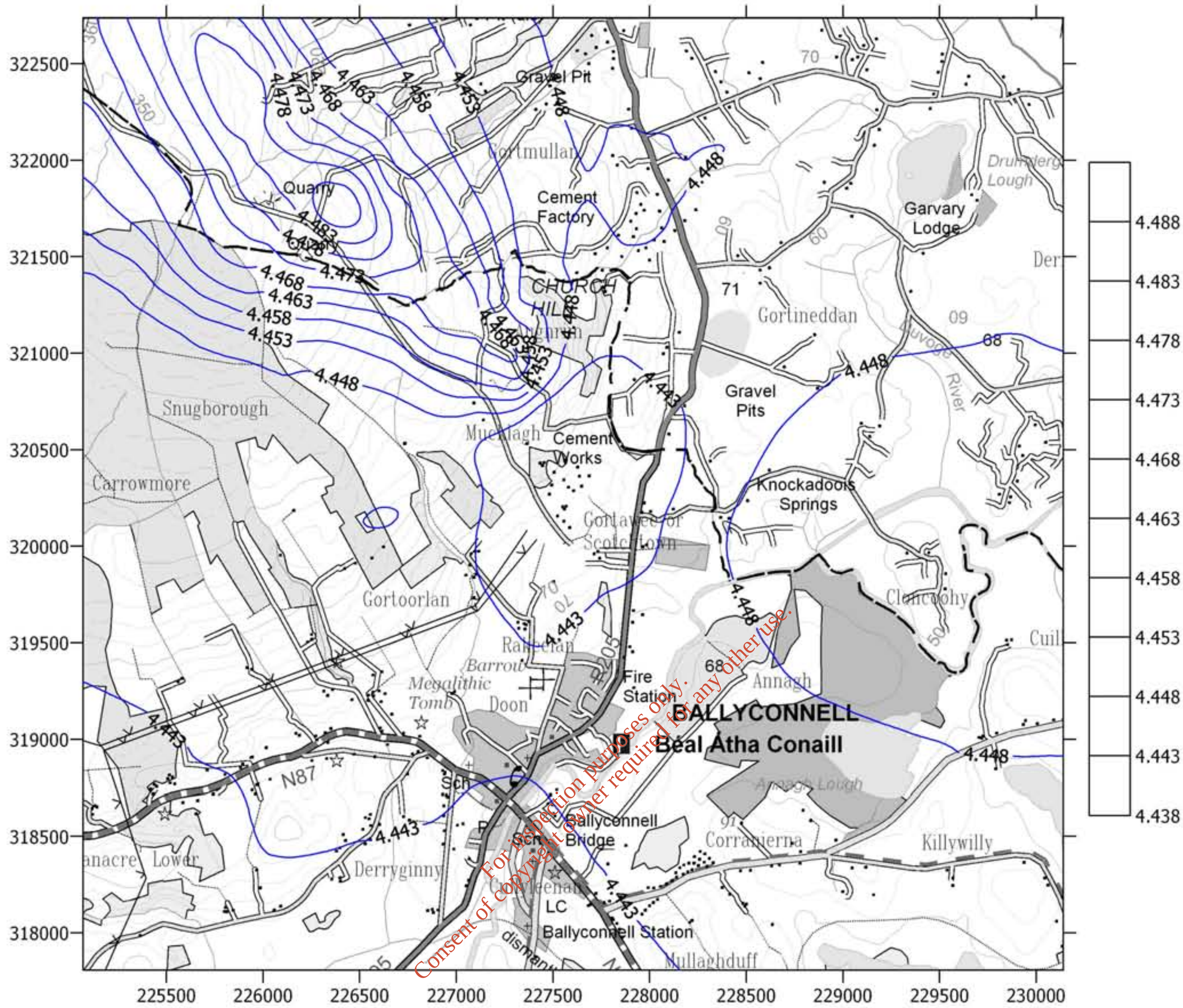


Appendix I.1D Figure 14

Predicted Annual Mean HCl Concentrations (µg.m⁻³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

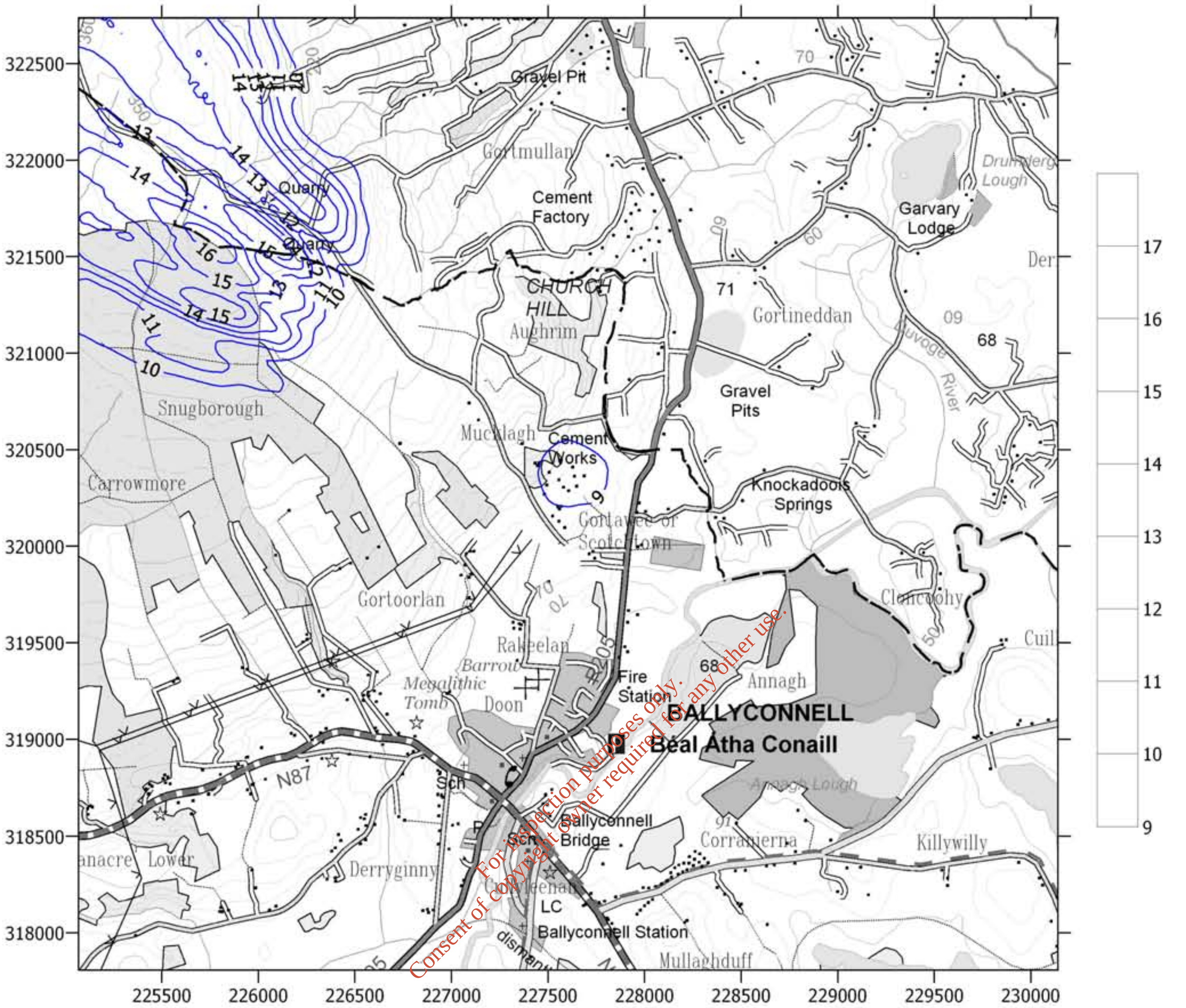
Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

WYG Environment Planning Transport

part of the WYG group



Appendix I.1D Figure 15

Predicted 1-hour Mean HCl Concentrations (µg.m⁻³)

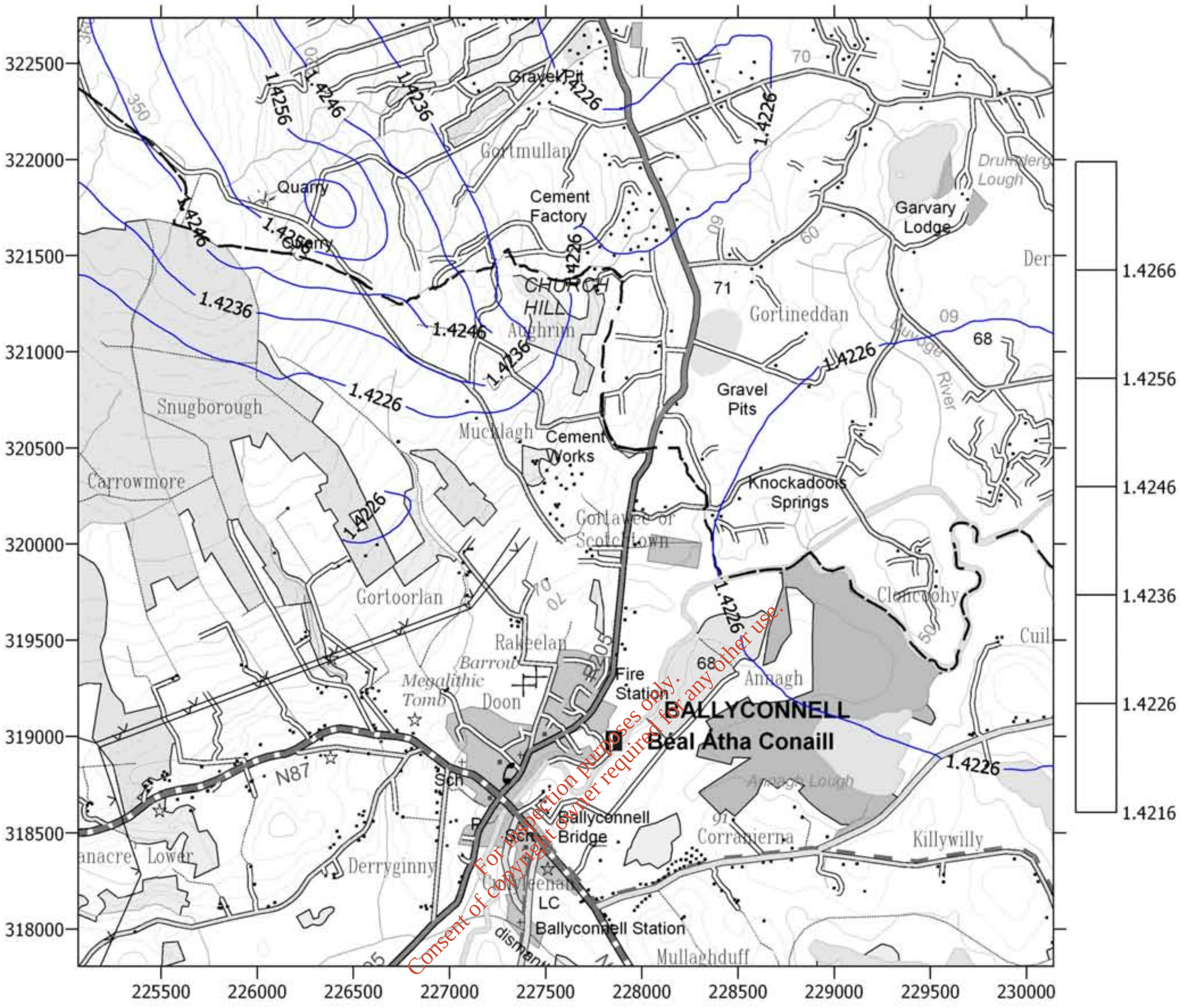
Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND



Appendix I.1D Figure 16

Predicted Annual Mean HF Concentrations (µg.m⁻³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

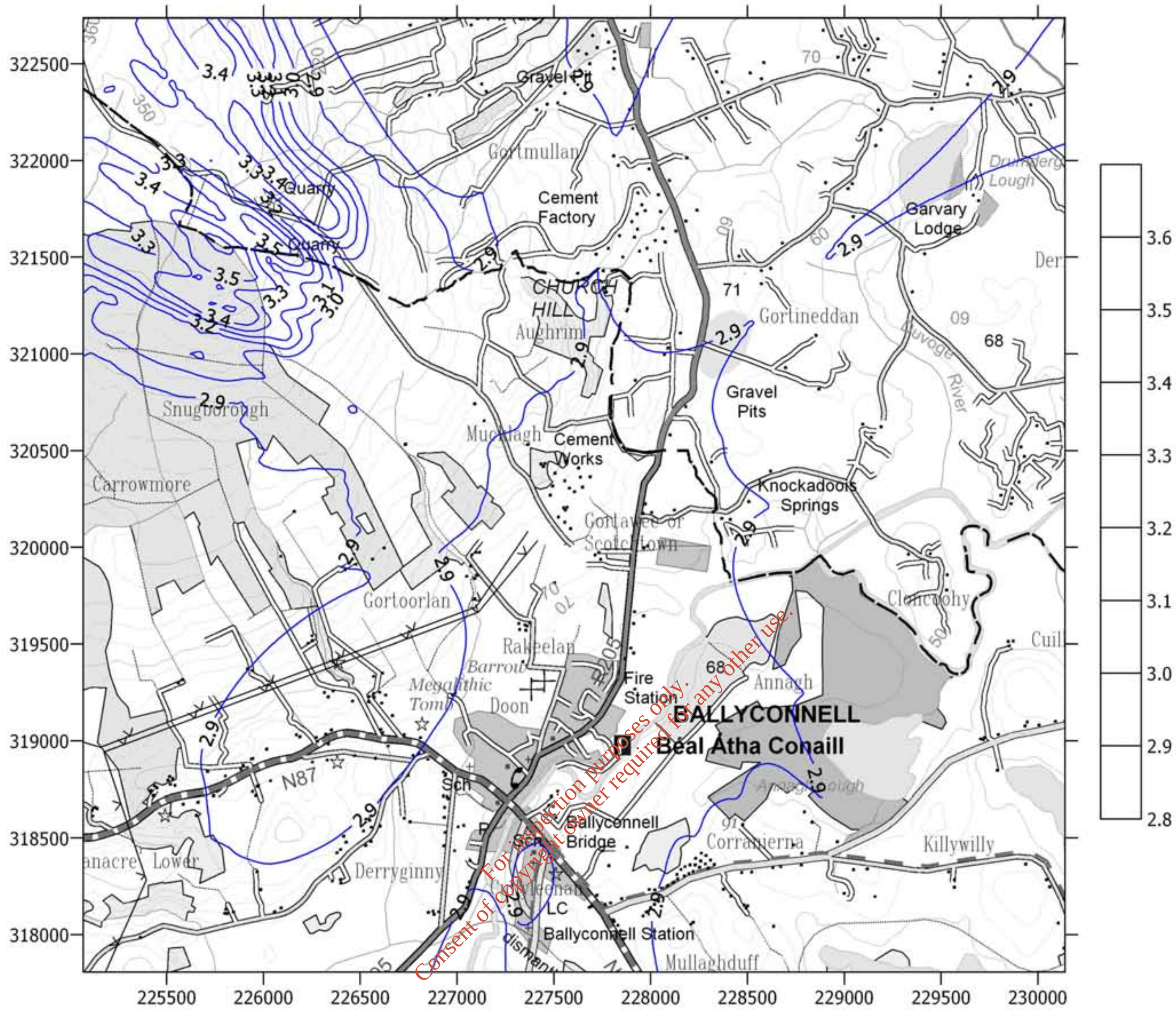
Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

WYG Environment Planning Transport

part of the **WYG** group



Appendix I.1D Figure 17

Predicted 1-hour Mean HF Concentrations (μg.m⁻³)

Dispersion Modelling Assessment on behalf of:

Quinn Cement Ltd

Project Number: A044734 / 588

NGR: 225069, 317807 to 230141, 322737

LEGEND

WYG Environment Planning Transport

part of the **WYG** group

Appendix I.1e

Detailed Dispersion Modelling Results Tables

Appendix I.1E **Table 1**

R1 **Doon Heights**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	$\mu g.m^{-3}$	9.00	0.64	9.64	24.11	✓
	1-hour	200	$\mu g.m^{-3}$	18.00	17.90	35.90	17.95	✓
NO_x	Annual	40	$\mu g.m^{-3}$	3.69	0.64	4.33	10.83	✓
PM_{10}	Annual	40	$\mu g.m^{-3}$	9.86	0.42	10.28	25.70	✓
	24-hour	50	$\mu g.m^{-3}$	19.72	1.06	20.78	41.55	✓
CO	8 hour	10	$mg.m^{-3}$	0.12	0.16	0.28	2.79	✓
SO_2	Annual	20	$\mu g.m^{-3}$	2.03	0.36	2.39	11.97	✓
	24-hour	125	$\mu g.m^{-3}$	4.06	4.91	8.97	7.17	✓
	1-hour	350	$\mu g.m^{-3}$	4.06	18.06	22.12	6.32	✓
Cd	Annual	0.005	$\mu g.m^{-3}$	0.00000	0.00003	0.00003	0.52	✓
Metals (2)	Annual	n/a	$\mu g.m^{-3}$	0.0000	0.0003	0.0003	n/a	n/a
C_6H_6	Annual	5	$\mu g.m^{-3}$	0.030	0.024	0.054	1.09	✓
PCDDs and PCDFs	Annual	n/a	$pg.m^{-3}$	3.47000	0.00001	3.47001	n/a	n/a
HCl	Annual	n/a	$\mu g.m^{-3}$	4.440	0.004	4.444	n/a	n/a
	1-hour	n/a	$\mu g.m^{-3}$	8.880	0.456	9.336	n/a	n/a
HF	Annual	n/a	$\mu g.m^{-3}$	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	$\mu g.m^{-3}$	2.840	0.049	2.889	n/a	n/a

NB: (1) Air Quality Standard.

(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E **Table 2**

R2 **Doon Beg**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	$\mu g.m^{-3}$	9.00	0.59	9.59	23.98	✓
	1-hour	200	$\mu g.m^{-3}$	18.00	16.84	34.84	17.42	✓
NO_x	Annual	40	$\mu g.m^{-3}$	3.69	0.59	4.28	10.71	✓
PM_{10}	Annual	40	$\mu g.m^{-3}$	9.86	0.30	10.16	25.39	✓
	24-hour	50	$\mu g.m^{-3}$	19.72	0.82	20.54	41.08	✓
CO	8 hour	10	$mg.m^{-3}$	0.12	0.15	0.27	2.69	✓
SO_2	Annual	20	$\mu g.m^{-3}$	2.03	0.34	2.37	11.85	✓
	24-hour	125	$\mu g.m^{-3}$	4.06	4.95	9.01	7.21	✓
	1-hour	350	$\mu g.m^{-3}$	4.06	17.34	21.40	6.11	✓
Cd	Annual	0.005	$\mu g.m^{-3}$	0.00000	0.00003	0.00003	0.50	✓
Metals (2)	Annual	n/a	$\mu g.m^{-3}$	0.0000	0.0003	0.0003	n/a	n/a
C_6H_6	Annual	5	$\mu g.m^{-3}$	0.030	0.023	0.053	1.07	✓
PCDDs and PCDFs	Annual	n/a	$pg.m^{-3}$	3.47000	0.00001	3.47001	n/a	n/a
HCl	Annual	n/a	$\mu g.m^{-3}$	4.440	0.003	4.443	n/a	n/a
	1-hour	n/a	$\mu g.m^{-3}$	8.880	0.439	9.319	n/a	n/a
HF	Annual	n/a	$\mu g.m^{-3}$	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	$\mu g.m^{-3}$	2.840	0.048	2.888	n/a	n/a

NB: (1) Air Quality Standard.

(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E **Table 3**

R3 **Court House**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	µg.m^{-3}	9.00	0.54	9.54	23.85	✓
	1-hour	200	µg.m^{-3}	18.00	15.82	33.82	16.91	✓
NO_x	Annual	40	µg.m^{-3}	3.69	0.54	4.23	10.57	✓
PM_{10}	Annual	40	µg.m^{-3}	9.86	0.18	10.04	25.10	✓
	24-hour	50	µg.m^{-3}	19.72	0.61	20.33	40.66	✓
CO	8 hour	10	mg.m^{-3}	0.12	0.15	0.27	2.70	✓
SO_2	Annual	20	µg.m^{-3}	2.03	0.31	2.34	11.70	✓
	24-hour	125	µg.m^{-3}	4.06	5.41	9.47	7.58	✓
	1-hour	350	µg.m^{-3}	4.06	17.32	21.38	6.11	✓
Cd	Annual	0.005	µg.m^{-3}	0.00000	0.00002	0.00002	0.46	✓
Metals (2)	Annual	n/a	µg.m^{-3}	0.0000	0.0002	0.0002	n/a	n/a
C_6H_6	Annual	5	µg.m^{-3}	0.030	0.022	0.052	1.03	✓
PCDDs and PCDFs	Annual	n/a	pg.m^{-3}	3.47000	0.00000	3.47000	n/a	n/a
HCl	Annual	n/a	µg.m^{-3}	4.440	0.003	4.443	n/a	n/a
	1-hour	n/a	µg.m^{-3}	8.880	0.499	9.379	n/a	n/a
HF	Annual	n/a	µg.m^{-3}	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	µg.m^{-3}	2.840	0.054	2.894	n/a	n/a

NB: (1) Air Quality Standard.

(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E **Table 4**

R4 **Preaching House Lane**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	µg.m^{-3}	9.00	0.60	9.60	24.01	✓
	1-hour	200	µg.m^{-3}	18.00	17.32	35.32	17.66	✓
NO_x	Annual	40	µg.m^{-3}	3.69	0.60	4.29	10.73	✓
PM_{10}	Annual	40	µg.m^{-3}	9.86	0.28	10.14	25.36	✓
	24-hour	50	µg.m^{-3}	19.72	0.87	20.59	41.18	✓
CO	8 hour	10	mg.m^{-3}	0.12	0.19	0.31	3.08	✓
SO_2	Annual	20	µg.m^{-3}	2.03	0.34	2.37	11.87	✓
	24-hour	125	µg.m^{-3}	4.06	5.48	9.54	7.63	✓
	1-hour	350	µg.m^{-3}	4.06	18.08	22.14	6.33	✓
Cd	Annual	0.005	µg.m^{-3}	0.00000	0.00003	0.00003	0.50	✓
Metals (2)	Annual	n/a	µg.m^{-3}	0.0000	0.0003	0.0003	n/a	n/a
C_6H_6	Annual	5	µg.m^{-3}	0.030	0.024	0.054	1.07	✓
PCDDs and PCDFs	Annual	n/a	pg.m^{-3}	3.47000	0.00001	3.47001	n/a	n/a
HCl	Annual	n/a	µg.m^{-3}	4.440	0.003	4.443	n/a	n/a
	1-hour	n/a	µg.m^{-3}	8.880	0.461	9.341	n/a	n/a
HF	Annual	n/a	µg.m^{-3}	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	µg.m^{-3}	2.840	0.050	2.890	n/a	n/a

NB: (1) Air Quality Standard.

(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E **Table 5**
R5 **Church Street**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	$\mu g.m^{-3}$	9.00	0.56	9.56	23.89	✓
	1-hour	200	$\mu g.m^{-3}$	18.00	16.09	34.09	17.05	✓
NO_x	Annual	40	$\mu g.m^{-3}$	3.69	0.56	4.25	10.62	✓
PM_{10}	Annual	40	$\mu g.m^{-3}$	9.86	0.20	10.06	25.15	✓
	24-hour	50	$\mu g.m^{-3}$	19.72	0.60	20.32	40.64	✓
CO	8 hour	10	$mg.m^{-3}$	0.12	0.17	0.29	2.92	✓
SO_2	Annual	20	$\mu g.m^{-3}$	2.03	0.32	2.35	11.75	✓
	24-hour	125	$\mu g.m^{-3}$	4.06	5.10	9.16	7.33	✓
	1-hour	350	$\mu g.m^{-3}$	4.06	17.44	21.50	6.14	✓
Cd	Annual	0.005	$\mu g.m^{-3}$	0.00000	0.00002	0.00002	0.48	✓
Metals (2)	Annual	n/a	$\mu g.m^{-3}$	0.0000	0.0002	0.0002	n/a	n/a
C_6H_6	Annual	5	$\mu g.m^{-3}$	0.030	0.022	0.052	1.05	✓
PCDDs and PCDFs	Annual	n/a	$pg.m^{-3}$	3.47000	0.00000	3.47000	n/a	n/a
HCl	Annual	n/a	$\mu g.m^{-3}$	4.440	0.003	4.443	n/a	n/a
	1-hour	n/a	$\mu g.m^{-3}$	8.880	0.477	9.357	n/a	n/a
HF	Annual	n/a	$\mu g.m^{-3}$	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	$\mu g.m^{-3}$	2.840	0.051	2.891	n/a	n/a

NB: (1) Air Quality Standard.
(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E **Table 6**
R6 **Main Street**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	$\mu g.m^{-3}$	9.00	0.55	9.55	23.87	✓
	1-hour	200	$\mu g.m^{-3}$	18.00	15.05	33.05	16.53	✓
NO_x	Annual	40	$\mu g.m^{-3}$	3.69	0.55	4.24	10.60	✓
PM_{10}	Annual	40	$\mu g.m^{-3}$	9.86	0.21	10.07	25.18	✓
	24-hour	50	$\mu g.m^{-3}$	19.72	0.51	20.23	40.45	✓
CO	8 hour	10	$mg.m^{-3}$	0.12	0.13	0.25	2.46	✓
SO_2	Annual	20	$\mu g.m^{-3}$	2.03	0.31	2.34	11.72	✓
	24-hour	125	$\mu g.m^{-3}$	4.06	5.24	9.30	7.44	✓
	1-hour	350	$\mu g.m^{-3}$	4.06	16.39	20.45	5.84	✓
Cd	Annual	0.005	$\mu g.m^{-3}$	0.00000	0.00002	0.00002	0.48	✓
Metals (2)	Annual	n/a	$\mu g.m^{-3}$	0.0000	0.0002	0.0002	n/a	n/a
C_6H_6	Annual	5	$\mu g.m^{-3}$	0.030	0.022	0.052	1.04	✓
PCDDs and PCDFs	Annual	n/a	$pg.m^{-3}$	3.47000	0.00000	3.47000	n/a	n/a
HCl	Annual	n/a	$\mu g.m^{-3}$	4.440	0.003	4.443	n/a	n/a
	1-hour	n/a	$\mu g.m^{-3}$	8.880	0.517	9.397	n/a	n/a
HF	Annual	n/a	$\mu g.m^{-3}$	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	$\mu g.m^{-3}$	2.840	0.055	2.895	n/a	n/a

NB: (1) Air Quality Standard.
(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E Table 7

R7 Market House

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	µg.m^{-3}	9.00	0.54	9.54	23.84	✓
	1-hour	200	µg.m^{-3}	18.00	15.27	33.27	16.64	✓
NO_x	Annual	40	µg.m^{-3}	3.69	0.54	4.23	10.57	✓
PM_{10}	Annual	40	µg.m^{-3}	9.86	0.19	10.05	25.13	✓
	24-hour	50	µg.m^{-3}	19.72	0.50	20.22	40.45	✓
CO	8 hour	10	mg.m^{-3}	0.12	0.13	0.25	2.47	✓
SO_2	Annual	20	µg.m^{-3}	2.03	0.31	2.34	11.69	✓
	24-hour	125	µg.m^{-3}	4.06	5.21	9.27	7.41	✓
	1-hour	350	µg.m^{-3}	4.06	16.12	20.18	5.76	✓
Cd	Annual	0.005	µg.m^{-3}	0.00000	0.00002	0.00002	0.46	✓
Metals (2)	Annual	n/a	µg.m^{-3}	0.0000	0.0002	0.0002	n/a	n/a
C_6H_6	Annual	5	µg.m^{-3}	0.030	0.022	0.052	1.03	✓
PCDDs and PCDFs	Annual	n/a	pg.m^{-3}	3.47000	0.00000	3.47000	n/a	n/a
HCl	Annual	n/a	µg.m^{-3}	4.440	0.003	4.443	n/a	n/a
	1-hour	n/a	µg.m^{-3}	8.880	0.524	9.404	n/a	n/a
HF	Annual	n/a	µg.m^{-3}	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	µg.m^{-3}	2.840	0.056	2.896	n/a	n/a

NB: (1) Air Quality Standard.

(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E Table 8

R8 Ballyconnell House

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	µg.m^{-3}	9.00	0.54	9.54	23.84	✓
	1-hour	200	µg.m^{-3}	18.00	14.56	32.56	16.28	✓
NO_x	Annual	40	µg.m^{-3}	3.69	0.54	4.23	10.57	✓
PM_{10}	Annual	40	µg.m^{-3}	9.86	0.21	10.07	25.17	✓
	24-hour	50	µg.m^{-3}	19.72	0.59	20.31	40.62	✓
CO	8 hour	10	mg.m^{-3}	0.12	0.11	0.23	2.31	✓
SO_2	Annual	20	µg.m^{-3}	2.03	0.31	2.34	11.70	✓
	24-hour	125	µg.m^{-3}	4.06	4.71	8.77	7.02	✓
	1-hour	350	µg.m^{-3}	4.06	15.05	19.11	5.46	✓
Cd	Annual	0.005	µg.m^{-3}	0.00000	0.00002	0.00002	0.46	✓
Metals (2)	Annual	n/a	µg.m^{-3}	0.0000	0.0002	0.0002	n/a	n/a
C_6H_6	Annual	5	µg.m^{-3}	0.030	0.022	0.052	1.04	✓
PCDDs and PCDFs	Annual	n/a	pg.m^{-3}	3.47000	0.00000	3.47000	n/a	n/a
HCl	Annual	n/a	µg.m^{-3}	4.440	0.003	4.443	n/a	n/a
	1-hour	n/a	µg.m^{-3}	8.880	0.525	9.405	n/a	n/a
HF	Annual	n/a	µg.m^{-3}	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	µg.m^{-3}	2.840	0.056	2.896	n/a	n/a

NB: (1) Air Quality Standard.

(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E **Table 9**

R9 **Derryginny Gardens**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	µg.m^{-3}	9.00	0.49	9.49	23.73	✓
	1-hour	200	µg.m^{-3}	18.00	14.53	32.53	16.26	✓
NO_x	Annual	40	µg.m^{-3}	3.69	0.49	4.18	10.46	✓
PM_{10}	Annual	40	µg.m^{-3}	9.86	0.14	10.00	25.00	✓
	24-hour	50	µg.m^{-3}	19.72	0.45	20.17	40.34	✓
CO	8 hour	10	mg.m^{-3}	0.12	0.14	0.26	2.61	✓
SO_2	Annual	20	µg.m^{-3}	2.03	0.28	2.31	11.57	✓
	24-hour	125	µg.m^{-3}	4.06	4.72	8.78	7.03	✓
	1-hour	350	µg.m^{-3}	4.06	15.27	19.33	5.52	✓
Cd	Annual	0.005	µg.m^{-3}	0.00000	0.00002	0.00002	0.42	✓
Metals (2)	Annual	n/a	µg.m^{-3}	0.0000	0.0002	0.0002	n/a	n/a
C_6H_6	Annual	5	µg.m^{-3}	0.030	0.020	0.050	1.00	✓
PCDDs and PCDFs	Annual	n/a	pg.m^{-3}	3.47000	0.00000	3.47000	n/a	n/a
HCl	Annual	n/a	µg.m^{-3}	4.440	0.003	4.443	n/a	n/a
	1-hour	n/a	µg.m^{-3}	8.880	0.537	9.417	n/a	n/a
HF	Annual	n/a	µg.m^{-3}	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	µg.m^{-3}	2.840	0.057	2.897	n/a	n/a

NB: (1) Air Quality Standard.

(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E **Table 10**

R10 **Farm 1**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	µg.m^{-3}	9.00	0.72	9.72	24.30	✓
	1-hour	200	µg.m^{-3}	18.00	15.63	33.63	16.82	✓
NO_x	Annual	40	µg.m^{-3}	3.69	0.72	4.41	11.02	✓
PM_{10}	Annual	40	µg.m^{-3}	9.86	0.62	10.48	26.21	✓
	24-hour	50	µg.m^{-3}	19.72	1.75	21.47	42.94	✓
CO	8 hour	10	mg.m^{-3}	0.12	0.15	0.27	2.73	✓
SO_2	Annual	20	µg.m^{-3}	2.03	0.39	2.42	12.10	✓
	24-hour	125	µg.m^{-3}	4.06	6.07	10.13	8.10	✓
	1-hour	350	µg.m^{-3}	4.06	16.82	20.88	5.97	✓
Cd	Annual	0.005	µg.m^{-3}	0.00000	0.00002	0.00002	0.48	✓
Metals (2)	Annual	n/a	µg.m^{-3}	0.0000	0.0002	0.0002	n/a	n/a
C_6H_6	Annual	5	µg.m^{-3}	0.030	0.022	0.052	1.04	✓
PCDDs and PCDFs	Annual	n/a	pg.m^{-3}	3.47000	0.00000	3.47000	n/a	n/a
HCl	Annual	n/a	µg.m^{-3}	4.440	0.003	4.443	n/a	n/a
	1-hour	n/a	µg.m^{-3}	8.880	0.461	9.341	n/a	n/a
HF	Annual	n/a	µg.m^{-3}	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	µg.m^{-3}	2.840	0.050	2.890	n/a	n/a

NB: (1) Air Quality Standard.

(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E **Table** **11**

R11 **Farm 2**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	μg.m^{-3}	9.00	0.62	9.62	24.04	✓
	1-hour	200	μg.m^{-3}	18.00	18.75	36.75	18.37	✓
NO_x	Annual	40	μg.m^{-3}	3.69	0.62	4.31	10.76	✓
PM_{10}	Annual	40	μg.m^{-3}	9.86	0.41	10.27	25.68	✓
	24-hour	50	μg.m^{-3}	19.72	1.40	21.12	42.25	✓
CO	8 hour	10	mg.m^{-3}	0.12	0.17	0.29	2.92	✓
SO_2	Annual	20	μg.m^{-3}	2.03	0.34	2.37	11.86	✓
	24-hour	125	μg.m^{-3}	4.06	4.70	8.76	7.01	✓
	1-hour	350	μg.m^{-3}	4.06	18.38	22.44	6.41	✓
Cd	Annual	0.005	μg.m^{-3}	0.00000	0.00002	0.00002	0.46	✓
Metals (2)	Annual	n/a	μg.m^{-3}	0.0000	0.0002	0.0002	n/a	n/a
C_6H_6	Annual	5	μg.m^{-3}	0.030	0.021	0.051	1.03	✓
PCDDs and PCDFs	Annual	n/a	pg.m^{-3}	3.47000	0.00000	3.47000	n/a	n/a
HCl	Annual	n/a	μg.m^{-3}	4.440	0.003	4.443	n/a	n/a
	1-hour	n/a	μg.m^{-3}	8.880	0.457	9.337	n/a	n/a
HF	Annual	n/a	μg.m^{-3}	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	μg.m^{-3}	2.840	0.049	2.889	n/a	n/a

NB: (1) Air Quality Standard.

(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E **Table** **12**

R12 **Farm 3**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	μg.m^{-3}	9.00	1.09	10.09	25.22	✓
	1-hour	200	μg.m^{-3}	18.00	14.49	32.49	16.24	✓
NO_x	Annual	40	μg.m^{-3}	3.69	1.09	4.78	11.95	✓
PM_{10}	Annual	40	μg.m^{-3}	9.86	1.31	11.17	27.94	✓
	24-hour	50	μg.m^{-3}	19.72	3.65	23.37	46.74	✓
CO	8 hour	10	mg.m^{-3}	0.12	0.09	0.21	2.12	✓
SO_2	Annual	20	μg.m^{-3}	2.03	0.58	2.61	13.07	✓
	24-hour	125	μg.m^{-3}	4.06	3.99	8.05	6.44	✓
	1-hour	350	μg.m^{-3}	4.06	13.17	17.23	4.92	✓
Cd	Annual	0.005	μg.m^{-3}	0.00000	0.00003	0.00003	0.68	✓
Metals (2)	Annual	n/a	μg.m^{-3}	0.0000	0.0003	0.0003	n/a	n/a
C_6H_6	Annual	5	μg.m^{-3}	0.030	0.032	0.062	1.23	✓
PCDDs and PCDFs	Annual	n/a	pg.m^{-3}	3.47000	0.00001	3.47001	n/a	n/a
HCl	Annual	n/a	μg.m^{-3}	4.440	0.005	4.445	n/a	n/a
	1-hour	n/a	μg.m^{-3}	8.880	0.500	9.380	n/a	n/a
HF	Annual	n/a	μg.m^{-3}	1.420	0.002	1.422	n/a	n/a
	1-hour	n/a	μg.m^{-3}	2.840	0.054	2.894	n/a	n/a

NB: (1) Air Quality Standard.

(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1E **Table** **13**
R13 **Farm 4**

Parameter	Averaging Period	Criterion Value (1)	Units	Background Conc.	Process Contribution	Total Impact	% of Criterion	Compliance/ Exceedence
NO_2	Annual	40	µg.m^{-3}	9.00	1.80	10.80	27.01	✓
	1-hour	200	µg.m^{-3}	18.00	14.02	32.02	16.01	✓
NO_x	Annual	40	µg.m^{-3}	3.69	1.80	5.49	13.73	✓
PM_{10}	Annual	40	µg.m^{-3}	9.86	0.74	10.60	26.50	✓
	24-hour	50	µg.m^{-3}	19.72	2.33	22.05	44.11	✓
CO	8 hour	10	mg.m^{-3}	0.12	0.14	0.26	2.61	✓
SO_2	Annual	20	µg.m^{-3}	2.03	0.97	3.00	15.02	✓
	24-hour	125	µg.m^{-3}	4.06	5.11	9.17	7.34	✓
	1-hour	350	µg.m^{-3}	4.06	16.64	20.70	5.92	✓
Cd	Annual	0.005	µg.m^{-3}	0.00000	0.00006	0.00006	1.18	✓
Metals (2)	Annual	n/a	µg.m^{-3}	0.0000	0.0006	0.0006	n/a	n/a
C_6H_6	Annual	5	µg.m^{-3}	0.030	0.055	0.085	1.70	✓
PCDDs and PCDFs	Annual	n/a	pg.m^{-3}	3.47000	0.00001	3.47001	n/a	n/a
HCl	Annual	n/a	µg.m^{-3}	4.440	0.010	4.450	n/a	n/a
	1-hour	n/a	µg.m^{-3}	8.880	0.920	9.800	n/a	n/a
HF	Annual	n/a	µg.m^{-3}	1.420	0.003	1.423	n/a	n/a
	1-hour	n/a	µg.m^{-3}	2.840	0.096	2.936	n/a	n/a

NB: (1) Air Quality Standard.
(2) Emission limit value is stated for total metals, which includes Pb, Ni and As.

Appendix I.1f

Brief Method Statement – Detailed Modelling by AERMOD-PRIME

INTRODUCTION

WYG have undertaken an atmospheric dispersion modelling study for the Quinn Cement Ballyconnell facility, Republic of Ireland. This assessment was undertaken using the Breeze-AERMOD-Prime dispersion model to quantify the potential impacts of process emissions in the vicinity of the site. AERMOD-Prime was developed by the United States Environmental Protection Agency for the prediction of pollutant dispersion throughout a defined area and is commonly used for environmental assessment throughout the World.

In order to investigate the impact of the plant one modelling scenario has been considered for 2009 with maximum permitted emissions from the Ballyconnell and Gortmullan facilities.

This Appendix provides a brief method statement concerning the detailed dispersion modelling.

MODELLING METHODOLOGY

Input Data

Model input data was provided by Quinn Cement and is presented in the main report text.

Background Air Quality

Background pollutant concentrations for 2009 have been derived from the UK National Air Quality Archive and national pollutant monitoring networks, and are presented in the main report text.

DISPERSION MODELLING RESULTS

The modelling study determined the following parameters at ground level:

- NO_2 annual mean;
- PM_{10} annual mean;
- SO_2 annual mean;
- VOC annual mean;
- Dioxins annual mean;
- Metals annual mean;
- HCl annual mean;
- HF annual mean;
- NO_2 99.8th percentile of 1-hour maximums;
- PM_{10} 90.4th percentile of 24-hour maximums;
- SO_2 99.73rd percentile of 1-hour maximums;
- SO_2 99.0th percentile of 24-hour maximums;

- CO 8-hour mean;
- HCl 1-hour maximum; and,
- HF 1-hour maximum.

Copies of all isopleth plots generated by the modelling assessment are presented in Appendix I.1d. Predicted ground level concentrations at discrete receptor locations are presented in Appendix I.1e.

SENSITIVITY ANALYSIS

Meteorological Conditions

The meteorological site chosen for the assessment, St. Angelo's, is situated at NGR: 236840, 625380, which is approximately 30km to the north of the Ballyconnell facility. Due to the proximity of the meteorological station to the plant, it is considered that a reasonable correlation between meteorological conditions at the two sites would be expected. This data set was recommended to WYG by ADM Ltd, an established distributor of meteorological data within the UK and Republic of Ireland.

As all stacks of the Ballyconnell facility emits PM, the *worst-case* meteorological year has been determined based upon the maximum modelled 24-hour mean ground level concentration, as presented within Table AI.1fa.

Table AI.1fa Sensitivity Analysis – Maximum Predicted 24-hour PM_{10} Concentration

Calendar Year	Maximum Predicted 24-hour Concentration ($\mu g.m^{-3}$)
2004	49.60
2005	55.94
2006	59.62
2007	68.63
2008	57.48

As presented within Table AI.1fa, the St. Angelo meteorology from 2007 results in the maximum predicted ground level concentration of PM. Therefore, in order to present a *worst-case* scenario, predicted concentration for all other pollutants are presented based upon 2007 meteorology.

It should be noted that the results presented in Table AI.1fa are for the maximum predicted 24-hour mean concentration at any location within the modelling domain and do not represent areas of relevant exposure.

Figure 3 displays the wind direction and frequency for each of the years between 2004 and 2008. The wind speed direction and frequency for the period 1st January 2007 to 31st December 2007 used in this assessment was similar to that 2004, 2005 and 2008 in terms of prevailing wind direction and speed. However, the 2006 calendar year experienced wind-speeds and a prevailing wind direction that was relatively different from the other meteorological data-sets. It is considered that the 2007 data-set is comparable to average meteorological conditions at the Ballyconnell site and therefore would provide suitable dispersion modelling results.

Emission Parameters

Plant operating conditions for the Ballyconnell facility were provided to WYG by Quinn Cement. Plant operating conditions for the Gortmullan facility were obtained from a previous dispersion modelling assessment undertaken by Enviros in 2004. These have been calculated from the SRF co-fuelled kiln design specification and existing operational monitoring data and are considered to represent conditions under normal plant operation.

The plant is assumed to operate 365-days per year without allowance for plant shut-down. Communication with Quinn Cement has determined that the plant is estimated to be in operation for approximately 330-days per year. Therefore, an assumed 365-days per year operation represents a *worst-case* scenario as the plant is assumed to emit the maximum concentration of each pollutant for the entire modelling period. As the annual operation of the plant would include periods of maintenance and planned shut-downs, it would be expected that predicted annual mean ground level pollutant concentrations would be reduced.

It is considered that as the assessment has been undertaken at the stated ELVs, the impact assessment would over-estimate both long-term and short-term pollutant concentrations.

Receptor Grid Resolution

Sensitivity analysis of grid spacing has not been undertaken. However, as relevant guidance was followed during the dispersion modelling assessment it is considered that the grid spacing was refined enough as to ensure the accuracy of all predicted results.

The maximum impacts have been predicted within close proximity to the source. This area was covered by Cartesian Grid, which had a resolution of 50m. This is considered to offer sufficient detail for an assessment of this type. If significant impacts had been predicted off-site then a finer grid would have been considered, however as low impacts were predicted this was not deemed necessary.

Terrain and Building Height Data

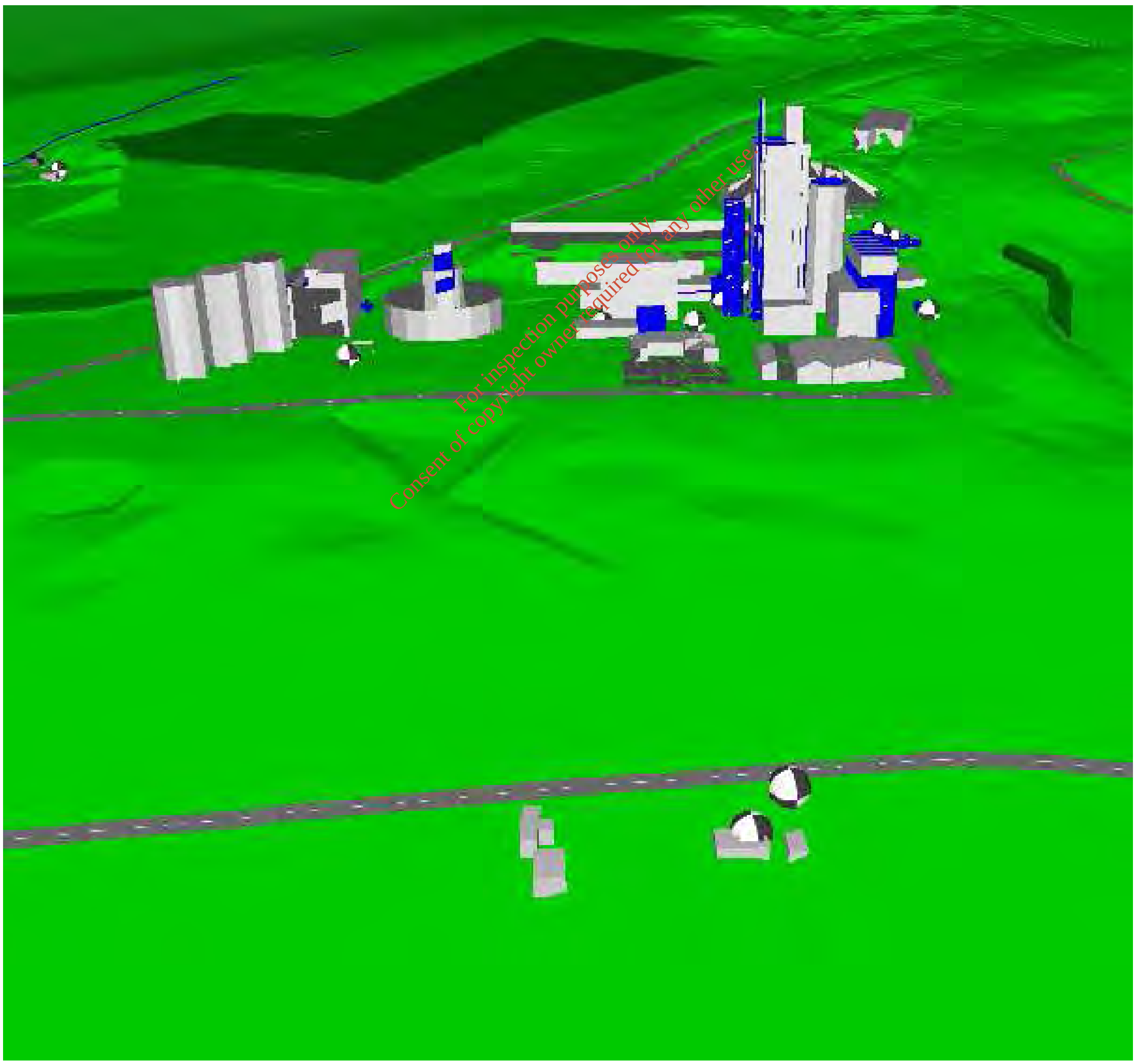
Both terrain data and building height data were used in the assessment as detailed in Section 4 of the main report. This is considered best practice and is likely to improve the accuracy of predicted results. Building heights were included for all structures on the Ballyconnell and Gortmullan sites, based upon information provided by Quinn Cement.

WYG Ireland

part of the WYG group

Report to Quinn Cement
Project: Ballyconnell Cement Plant Noise Impact Assessment for IPPC License

Date: 7th October 2009



creative minds safe hands

QUINN GROUP

Quinn Cement, Ballyconnell Plant

Noise Impact Assessment for the IPPC License Renewal
IPPC License Register Number 378

7th October 2009

REPORT CONTROL

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Contents

Figures

Appendices

1 INTRODUCTION

This report presents the noise impact assessment on the nearest sensitive receptors from the proposed alternative fuel process at the Quinn Cement plant, Ballyconnell, Co. Cavan. The proposed location for the plant modification is in the vicinity of existing cement manufacturing plant buildings and other industrial installations. A baseline noise survey was carried out during day and night time at the four nearest sensitive receptors. As part of the baseline noise survey, noise measurements were taken on site. The baseline noise data was used to develop a CadnaA noise model of the Quinn plant and the surrounding area. Using noise data supplied by FLSmidth A/S for equipment to be used in the proposed installation, the noise impact on nearby sensitive receptors was predicted using CadnaA noise modelling software. The predicted noise level was then compared with the current noise climate at nearby sensitive receptors using measured noise data from the baseline noise survey and predictions made in the baseline noise model. Subsequently, the noise impact as a result of the proposed installation was compared with the current noise limits as set out in IPPC license register number 378.

2 DESCRIPTION OF THE EXISTING ENVIRONMENT

A noise monitoring survey was carried out at NSR1, 2, 3 and 4 on the 9th of March 2009 during daytime and night time hours. Noise monitoring locations are shown on Figures 2 to 4. This was a manned noise monitoring survey and noise data collected throughout this survey can be viewed in full detail in Appendix A. A glossary of noise terminology can be found in Appendix D. The noise levels recorded at each monitoring location are displayed in the table below. The L_{A90} is representative of the background noise level at any location. The audible noise from the Quinn site at each of the nearby receptors was observed to be a constant background hum. Hence, the L_{A90} from each measurement location is deemed to be representative of the existing noise impact from the Quinn site at each residential receptor.

Measurement Location	Daytime		Night Time	
	dB $L_{Aeq,t}$	dB L_{A90}	dB $L_{Aeq,t}$	dB L_{A90}
NSR 1	73.5	48.1	66.3	48.4
NSR 2	47.4	46.2	49.4	47.7
NSR 3	54.6	49.7	47.6	46.2
NSR 4	59.2	44.5	45.2	36.8

Table 1: Noise monitoring survey measured noise levels

2.1 Weather Conditions

Weather conditions were clear and dry when noise measurements were taken with temperatures of between 10°C and 12°C during daytime hours and between 9°C and 11°C during night time hours. There was a slight westerly breeze throughout the day and night time noise measurements. The breeze was observed to be of average windspeed <5m/s. Relative humidity was observed to be low throughout all noise measurements.

2.2 Noise Survey Methodology

Noise measurements were taken in accordance with the EPA Environmental Noise Survey Guidance Document (Reference 3) and ISO 1996 Acoustics – Description and Measurement of Environmental Noise (Reference 4). A wind shield was used on the microphone to minimise the effect of wind noise and all measurements were attended to ensure that measured noise events are attributable to a specific noise source or otherwise. The sound level meter used was a Norsonic 140 IEC Class 1 meter and A-weighted sound level measurements were taken simultaneously with a 1/3rd octave band filter. The calibration certification for the meter and calibrator can be viewed in Appendix C. Each noise measurement was taken at a location as close as possible to the residence but not at the façade of the residence.

2.3 Measurement Range

Measurements were taken between 6.3 Hz and 20 KHz. The normal maximum audible range is from 20 Hz to 20 KHz.

2.4 Noise Measurement Locations

Observations made of the audible noise environment at each monitoring location are detailed in this section.

NSR1

This residential receptor was on the side of the R205 and for both the day and night time noise surveys, a number of vehicles passed along this route. During daytime, there was an audible hum from the Quinn plant. Road traffic was the dominant audible noise source during the day time noise measurement. At night time, when road traffic was reduced, the dominant audible noise source was the hum from the Quinn Plant however there was still a significant noise impact from road traffic during the night time noise measurement. There was no other audible constant background noise during day or night time in addition to the background hum from the Quinn site.

NSR2

This residential receptor is to the north of the Quinn site. During day and night time, the dominant audible noise source was the hum from the plant. There was no other constant background noise at this location. Infrequent noise at this location included distant traffic, birdsong and the movement of farm animals.

NSR3

This residential receptor is located to the south west of the Quinn site. The dominant audible noise source during the day and night time at this location was the constant hum from the plant. There is also a stream running alongside the monitoring location and this is considered a constant yet minor background noise source. During the daytime noise measurement, a light agricultural earth mover was operational for a short period towards the end of the measurement. Shortly after the start of the night time measurement, a dog barked on a small number of occasions.

NSR4

This location is to the south of the Quinn site. During the day time measurement, there was significant noise generated by agricultural activity at the receptor location which included a tractor "idling" throughout the measurement. Other activity included the use of agricultural machinery and a dog barking. At night time, the dominant noise source was the hum from the Quinn site. There were no other significant background noise sources at this location other than the background hum from the Quinn site.

3 NOISE IMPACT ASSESSMENT METHODOLOGY

The computational modelling of proposed changes at the Quinn site is discussed in this section. The computational noise model used was CadnaA, Version 3.71.125 by DataKustik GmbH.

3.1 Noise Modelling Methodology

The existing scenario and scenario with proposed changes on the Quinn site were modelled. Relevant data used included topographical data for the region, accurate building heights with other relevant background noise sources such as streams, equipment and buildings on the Quinn site including all major noise sources. Where there was significant foliage between the plant and any of the four receptors, this foliage was represented in the model. One storey residences were represented with a receptor at a height of 1.5m and two storey residences represented with a receptor at 4m height. Receptors used in the noise model to represent the noise level at the façade of living spaces were placed within 1m of the nearest façade to the Quinn site.

Existing buildings and main noise sources on the Quinn site were inputted to the model. Given that there was a constant audible hum from the Quinn site at all residential receptors, the L_{90} from each receptor was used as the existing direct noise impact from the Quinn site as the L_{90} is recognised as being representative of the measured background noise level. The L_{90} as measured was subsequently compared with the L_{eq} as predicted by the noise model as the only noise sources included in the model were production equipment and buildings on the Quinn site. Noise sources observed on site were inputted to the noise model as either point, line or area sources. The sound power level for on site sources was determined using noise measurements taken on site during the baseline noise survey. The noise model was further validated using baseline noise measurement data from the residential receptors.

The noise model was refined and validated by comparing the predicted noise levels for the existing scenario with measured noise levels from the site and at nearby sensitive receptors. On site noise measurements were taken at locations N1 to N8 which are shown on Figure 1. Noise data from on site measurement locations is displayed in Appendix B. Once the noise model of the existing scenario was accurately validated, the additional equipment and proposed changes on the site were implemented in the baseline noise model to develop a model for the proposed scenario. Hence the noise impact at NSR1 to NSR4 due to changes on the Quinn site was determined. The validation and prediction process is detailed below.

3.2 Assessment Methodology

3.2.1 Operational Phase

The existing IPPC License for the facility states the following under Condition 8: Noise:

"Activities on-site shall not give rise to noise levels at any noise sensitive location off site, which exceed the following sound pressure limits (Leq, 15 minute) :

Daytime: 55 dB(A); Night-time: 45 dB(A)."

Given that the noise generated by the Quinn plant remains relatively constant over each 24 hour cycle, the night time noise limit will be used to determine compliance with the IPPC limits as this is more stringent than the day time limit.

In the interests of not intruding upon residents, noise measurements were taken at a location close to each residential façade but not at the actual façade. Noise measurements were made at NML1, 2, 3 and 4. These noise monitoring locations were in the vicinity of the four residences, at a short distance from the residential façade. Using these measured noise levels to validate the baseline model, noise levels as a result of the Quinn site were predicted at the nearest actual façade to the Quinn site in the case of each residence. This predicted noise level can then be compared directly with the limits as set out in the IPPC license.

3.2.2 Construction Phase

All modifications to be made to the Quinn site to implement alternative fuels will be made within the confines of the site and according to Quinn Cement, the construction phase is not extensive. The noise impact due to this installation phase is therefore deemed to be negligible.

3.3 Noise Model Validation

The major noise sources on site were noted and these were represented in the noise model. Subsequently, sound power levels from all on site noise sources were adapted until the predicted noise levels using the model matched measured noise levels. The predicted and measured levels are shown below. Noise measurements were made on site at receptor locations N1 to N8.

Receptor	Measured	Modelled	Difference
	dB L_{A90}	dB L_{Aeq}	dB
N1	66.5	66.4	-0.1
N2	71.7	71.6	-0.1
N3	74.4	74.4	0
N4	76	76	0
N5	74.3	73.1	-1.2
N6	70.3	69.9	-0.4
N7	63	63.5	0.5
N8	66.8	67.1	0.3
NML1	48.4	48.2	-0.2
NML2	47.7	49	1.3
NML3	46.2	46.2	0
NML4	36.8	37.7	0.9
NSR1 McKiernans		47.9	
NSR2 McCafferys		44.3	
NSR3 Kearns		45.3	
NSR4 Bradys		43.4	

Table 2: Measured noise levels compared with modelled noise levels from the validation noise model. The table also shows modelled noise levels at residential receptors.

As can be seen from Table 2 above, the difference between predicted and measured noise levels is below 2dB in all cases. This deems the baseline noise model to be of sufficient accuracy to predict the noise impact due to proposed changes on site.

In the baseline noise model, receptor points have been set up at the nearest façade of each residence to the Quinn site. The receptor in each case predicts the existing noise level at the residential façade due to the noise emanating from the Quinn site and is deemed an accurate representation of the noise level at the residential façade given the compliance shown above between the measured noise levels and modelled noise levels at NML1 to NML4.

4 PREDICTED IMPACT OF PROPOSED INSTALLATION

4.1 New Plant Equipment

It is proposed that the following manufacturing equipment will be introduced to the Quinn site.

Sound Pressure Levels for New Plant Equipment		
	Sound Pressure Level @ 1m	Modelled Source Type
B&W SAMSON Surface Feeder	<80dB(A)	Rectangular Area Source with Height of 3m
VECOPLAN storage and unloading system	<80dB(A)	Rectangular Area Source with Height of 13m off ground level
Quench Air Fan	70dB(A)	Point Source with Height of 15m
By-pass fan casing	74dB(A)	Point Source with Height of 2m
Quench Camber Fan	67dB(A)	Point Source with Height of 3m
ID-fan: Sound pressure level around SPL casing with acoustic insulation	85dB(A)	Point Source with Height of 10m
Pfister feeders: Sound pressure level with hood	72dB(A)	Rectangular Area Source with Height of 10m
SNCR	64dB(A)	Rectangular Area Source with Height of 3m

Table 3: Sound pressure levels for new plant equipment

New and Replaced Equipment

A number of fans on the site are to be replaced should the proposed installation progress. In taking noise measurements on site and subsequently validating the noise model, sound power levels were given to the fans as they currently exist on site. The new sound power levels for replacement fans were supplied by FLS A/C.

The sound power levels given to existing fans are shown below in addition to the sound power levels given to new fans as calculated using noise data supplied by FLSmidth A/S. The sound power levels as given to the existing fans are deemed to be the most accurate representation for the existing fans as these are derived using near field sound measurements of the fan in the current state of wear and tear of the fan, where site specific factors are directly accounted for by noise measurement.

Sound Power Levels assumed in Noise Model for Existing and New Equipment		
	Existing Equipment	New Equipment
	Sound Power Level	**Sound Power Level**
	Lw dB	**Lw dB**
Quench Air Fan	86	78
By-pass fan	90	82
Quench Camber Fan	83	75
ID-fan	101	93

Table 4: Sound power levels for existing and new plant equipment

4.2 Predicted Noise Impact

The noise impact at the four residential receptors has been predicted with the proposed new equipment in place on the Quinn site and is compared in Table 5 below to predicted levels at residential receptors with the existing scenario and with the IPPC license night time noise limit. The Existing Scenario below also refers to the predicted noise level at each of the receptors during the night time. The existing scenario figures below have been validated in Table 2. The "With Proposed Changes" are the CadnaA predicted noise levels due to proposed changes on site.

Receptor	Existing Scenario	With Proposed Changes	Relative to IPPC Night Time Limit of 45dB L_{Aeq}
	dB L_{A90}	dB L_{Aeq}	dB
NSR1 McKiernan's	48.6	47.9	+2.9
NSR2 McCaffery's	44.2	44.3	-0.7
NSR3 Kearn's	44.9	45.3	+0.3
NSR4 Brady's	41.4	43.4	-1.6

Table 5: Predicted changes in noise level at nearby residential receptors due to proposed installations on the Quinn site with comparison to the IPPC license night time limit.

As can be seen from Table 5 above, the predicted noise level at NSR1 and NSR3 is marginally above the IPPC license night time limit. Therefore, further mitigation measures are deemed appropriate to reduce the noise levels at NSR1 and NSR3 to below the limit as required by the EPA.

5 MITIGATION MEASURES

Using predictions made by the noise model for the site with proposed changes, it can be seen that the noise level at all receptors is primarily due to the contribution made by existing equipment that shall remain after proposed changes are put into place. Therefore, in order to minimise the noise impact as a result of activity on the site, mitigation measures for existing equipment and existing activity is required. The most dominant noise source from the list of newly proposed equipment is the Vecoplan Storage Bins. However, the noise contribution made by this equipment remains insignificant when compared with that made by existing equipment.

5.1 Existing Equipment

It is understood by WYG that during the construction phase for the proposed changes at the Quinn Cement site, the following noise reduction measures are to be implemented on the site to minimise the noise impact on nearby residential receptors:

- Construction of a noise barrier at the kiln drive.
- Repair / replace two attenuators on the cement mill.
- Fully enclose PFA silos (gap in sheeting) and provide access to cement mill through a small door. The door is to be fitted with a closing spring system to ensure this door is consistently kept closed.
- Install a curtain on the door at the cement mill east of PFA silo to minimise noise breakout from the building.
- Remove Power Screen loader and replace sheeting at the coal mill.
- Assess suppression on all fans.
- Seal the gap at the top of the large raw mill roller door and investigate the benefits of installing a curtain to minimise noise breakout through this doorway.
- Consider enclosing and putting a door at the raw mill dump bin.

As a pre completion check, noise monitoring shall be carried out at the nearby sensitive receptors to quantify the reduction achieved by proposed changes at the site and additional mitigation measures applied to existing equipment. It is likely that such mitigation measures and techniques will reduce the noise level at the McKiernan residence (NSR1) to below the 45dB L_{Aeq} night time IPPC limit and also similarly reduce the noise level at the other three residential receptors and on the surrounding amenity.

5.2 New Plant Equipment

As discussed above, the Vecoplan Storage Bins are the most dominant noise source identified as part of the proposed changes to be implemented on site. Notwithstanding the above, the noise generated by the Vecoplan Storage Bins is significantly less than the noise generated by existing production equipment at the facility. In the interests of best practice, it is recommended to investigate the possibility of applying attenuation measures to the Vecoplan Storage Bins. If the Vecoplan Storage Bins are attenuated by 10dB R'w, the contribution made to the noise level at each of the residential receptors will be as displayed in the table below.

Receptor	Sound Reduction Index dB R'w	Predicted Noise Level with Attenuation $L_{eq,T}$ dB(A)	Previously Predicted Noise Level $L_{eq,T}$ dB(A)
NSR1 McKiernan's	10	14.4	25.0
NSR2 McCaffery's	10	18.9	28.9
NSR3 Kearn's	10	19.8	29.8
NSR4 Brady's	10	21.8	31.8

Table 6: Noise level specifically as a result of the Vecoplan Storage Bins with and without attenuation of 10dB R'w.

The predicted noise level with attenuation applied to the Vecoplan Storage Bins as shown above is significantly below the night time noise limit of 45dB L_{Aeq}. Therefore the contribution made by the Vecoplan Storage Bins will be insignificant in terms of the final overall noise level at the above receptors.

6 CONCLUSION

By implementing the proposed changes to the production equipment on the site, the noise level at all four residential receptors is predicted to remain for the most part as it is. There will not be any significant difference in noise level as a result of the proposed changes alone. The primary reason for this is that the noise level at nearby residential receptors and the amenity is as a result of existing production equipment on the Quinn site. The noise level as a result of the existing equipment is dominant over the noise level predicted from newly proposed equipment. Given the complexity of the Quinn site and large number of individual noise sources, it is difficult to evaluate the reduction in noise level as a result of the mitigation measures and techniques as proposed by Quinn Cement and detailed in Section 5.1. However, based on previous experience, it is the belief of WYG that the implementation of the proposed mitigation measures as outlined will effectively reduce the noise level at nearby residential receptors to below the noise limits as set out in the IPPC license for the facility.

7 REFERENCES

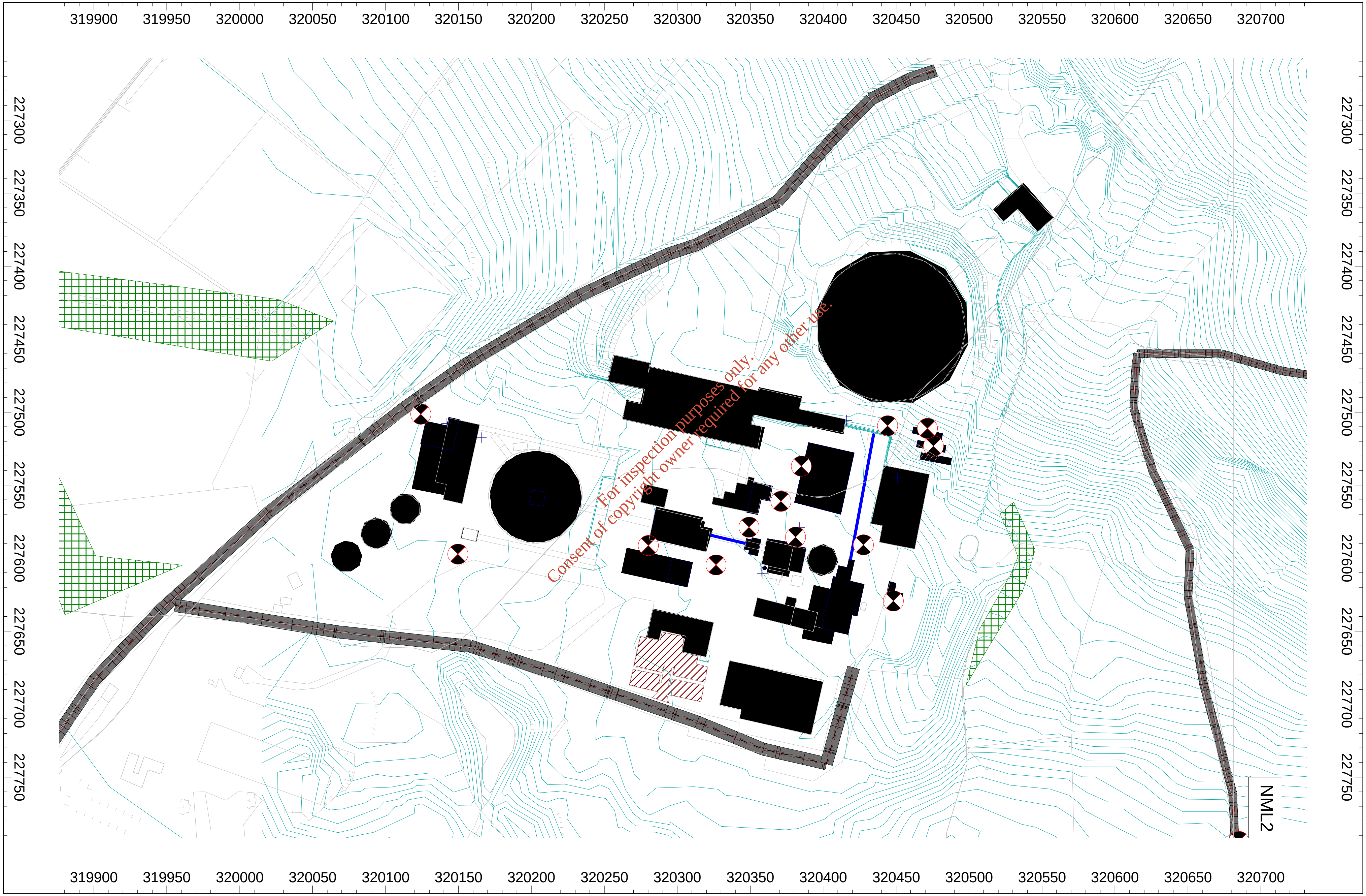
Reference 1: Guidelines for Community Noise
WORLD HEALTH ORGANISATION (WHO): 2000

Reference 2: Method for Rating Industrial Noise affecting mixed residential and industrial areas
BS4142: 1997

Reference 3: Environmental Noise Survey Guidance Document
ENVIRONMENTAL PROTECTION AGENCY

Reference 4: ISO 1996 Acoustics – Description and Measurement of Environmental Noise – Part 1 & 2
International Standards Organisation

FIGURES



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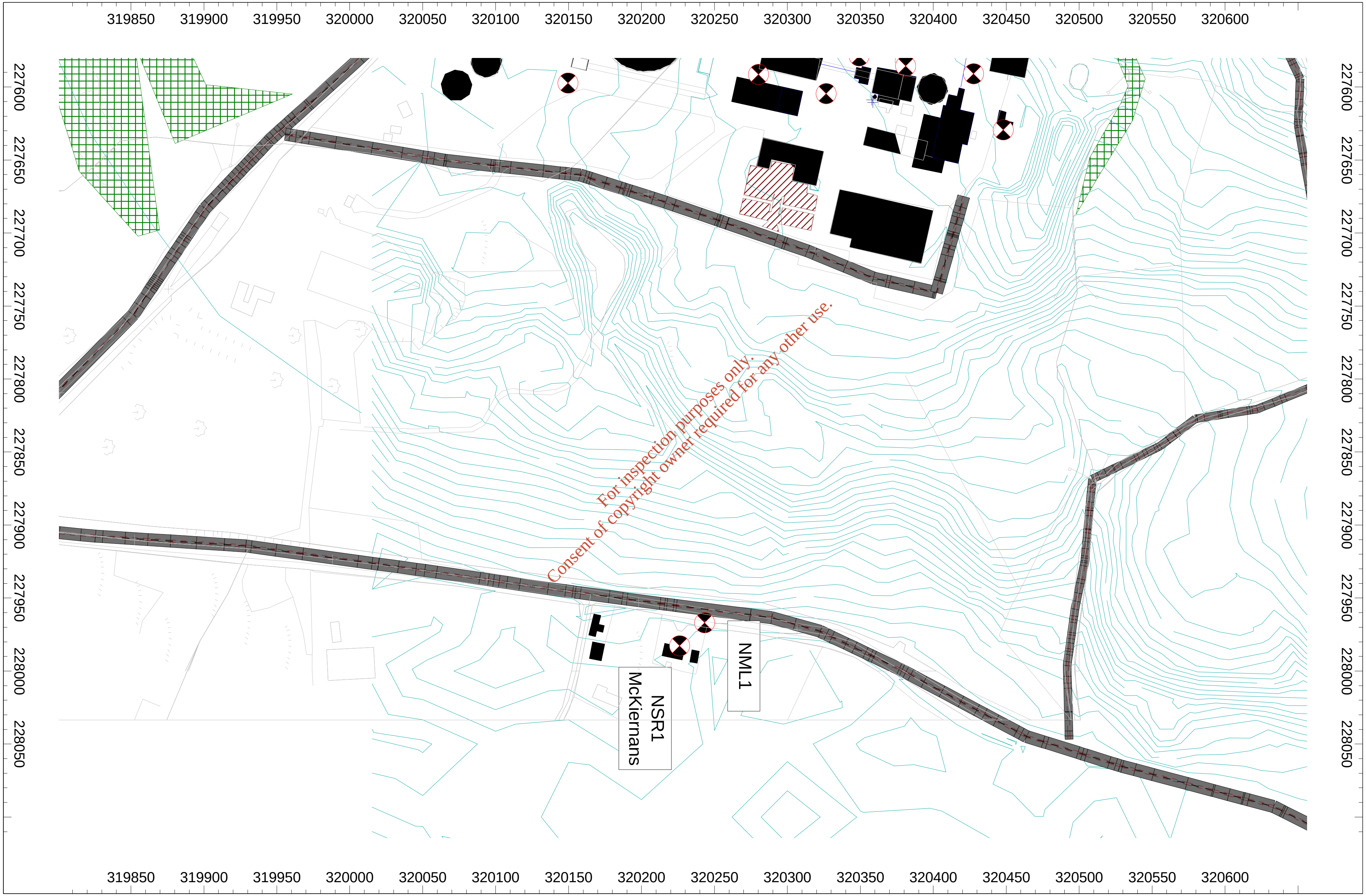
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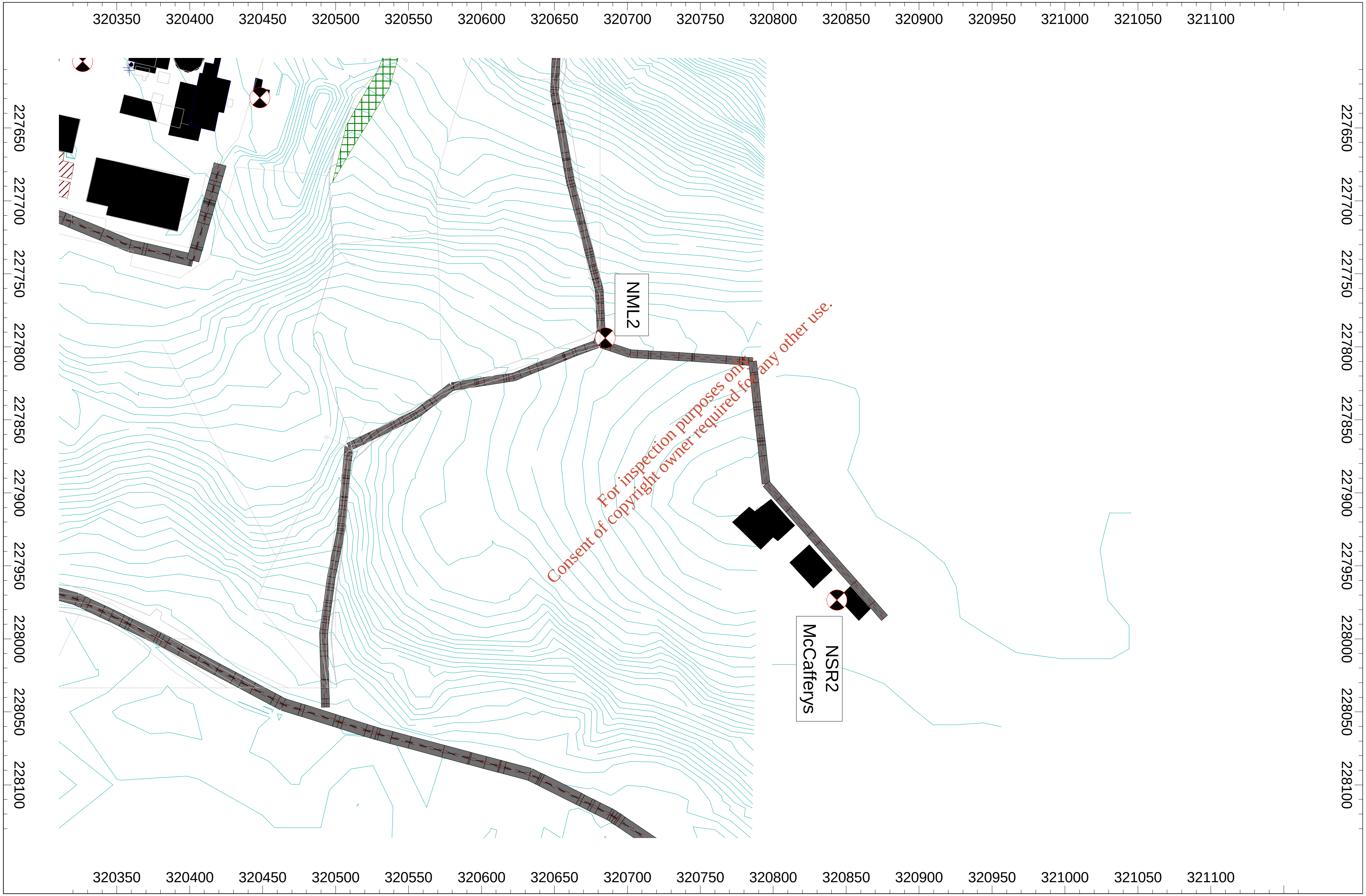
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NSR2
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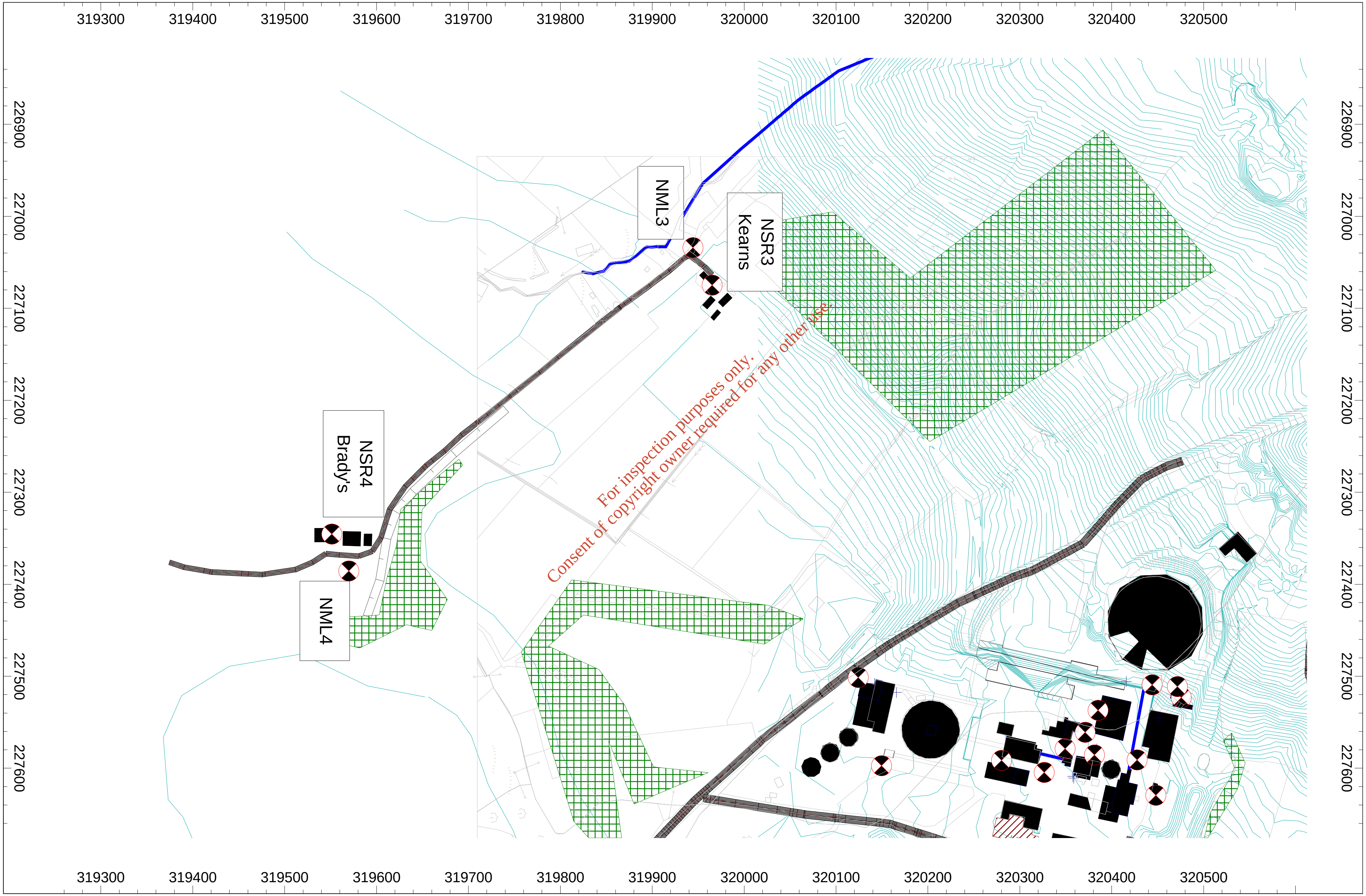
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227200
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227400
227500
227600
NML3
NSR3
Kearns
NSR4
Brady's
NML4

Appendix A

Noise Monitoring Data

Nearby sensitive Receptors

Norsonic AS
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Tel. +47 3285 8900, Fax +47 3285 2208
www.norsonic.com, info@norsonic.com

Customer:

QUINN CEMENT

Project title:	NSR1 DAY
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type:	Nor140	**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:		**Operator:**
Measurement title: NOR140_8204585_090310_0009		**Date:** 10/03/2009 15:48:58
Measurement duration: 0 00:30:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:	**Instrument sensitivity:** -26.4 dB	**End calibration level:**

10. 3. 2009 18:31:02

Norsonic AS
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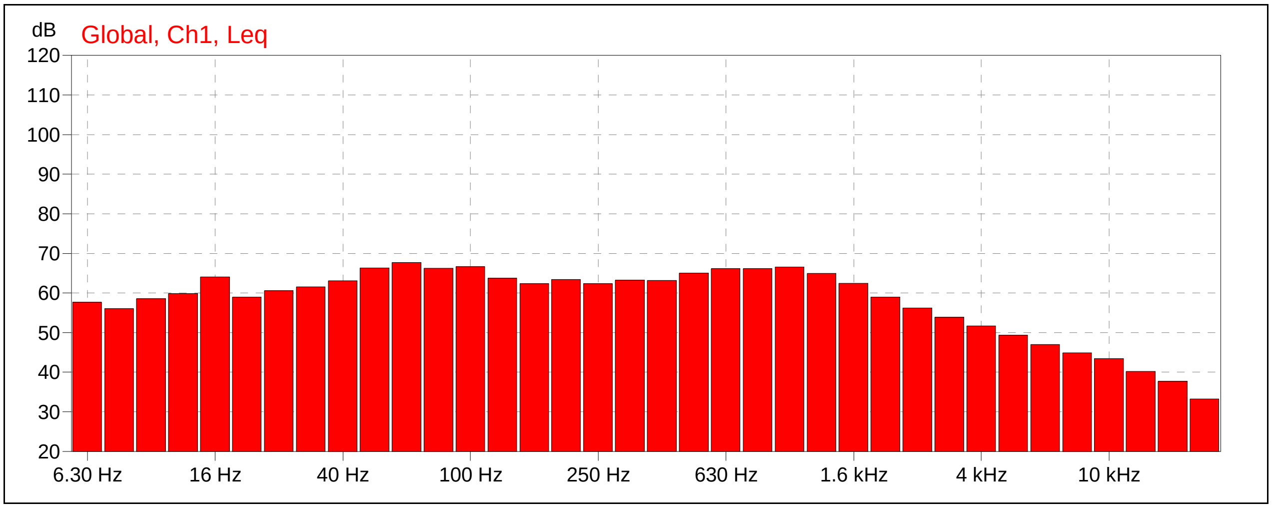

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LF,90.0% (dB)	LF,10.0% (dB)	LF(TM5) (dB)
A	73.5 dB	90.2 dB	45.2 dB	48.1 dB	77.9 dB	
C	77.4 dB	95.9 dB	61.6 dB	64.5 dB	80.6 dB	
FRQ						
6.30 Hz	57.7 dB	80.4 dB	35.5 dB	49.2 dB	60.1 dB	
8 Hz	56.1 dB	77.4 dB	35.1 dB	47.4 dB	57.9 dB	
10 Hz	58.5 dB	80.9 dB	39.5 dB	50.0 dB	60.6 dB	
12.5 Hz	59.9 dB	84.9 dB	41.7 dB	51.6 dB	61.4 dB	
16 Hz	64.1 dB	82.1 dB	47.6 dB	58.6 dB	66.2 dB	
20 Hz	59.0 dB	79.3 dB	44.8 dB	52.3 dB	60.7 dB	
25 Hz	60.6 dB	81.7 dB	44.7 dB	52.9 dB	61.7 dB	
31.5 Hz	61.6 dB	82.8 dB	47.9 dB	55.7 dB	63.2 dB	
40 Hz	63.1 dB	86.8 dB	49.3 dB	56.4 dB	64.7 dB	
50 Hz	66.3 dB	92.0 dB	49.8 dB	56.4 dB	65.9 dB	
63 Hz	67.7 dB	92.7 dB	48.0 dB	53.0 dB	68.6 dB	
80 Hz	66.3 dB	92.1 dB	46.2 dB	52.3 dB	66.9 dB	
100 Hz	66.7 dB	94.8 dB	46.2 dB	51.4 dB	64.6 dB	
125 Hz	63.7 dB	87.5 dB	44.6 dB	49.5 dB	63.9 dB	
160 Hz	62.4 dB	87.6 dB	41.7 dB	47.2 dB	63.6 dB	
200 Hz	63.4 dB	87.5 dB	40.2 dB	44.9 dB	65.0 dB	
250 Hz	62.3 dB	84.6 dB	36.6 dB	41.2 dB	65.1 dB	
315 Hz	63.2 dB	86.9 dB	33.9 dB	38.1 dB	65.3 dB	
400 Hz	63.1 dB	86.4 dB	33.8 dB	37.7 dB	65.3 dB	
500 Hz	65.1 dB	86.1 dB	35.5 dB	41.8 dB	67.4 dB	
630 Hz	66.2 dB	87.7 dB	35.4 dB	40.2 dB	68.4 dB	
800 Hz	66.2 dB	84.0 dB	33.8 dB	38.1 dB	70.0 dB	
1 kHz	66.6 dB	83.3 dB	33.2 dB	37.8 dB	71.1 dB	
1.25 kHz	65.0 dB	82.6 dB	31.5 dB	36.5 dB	69.6 dB	
1.6 kHz	62.4 dB	79.4 dB	28.7 dB	33.7 dB	67.2 dB	
2 kHz	59.0 dB	77.2 dB	26.0 dB	29.7 dB	63.5 dB	
2.5 kHz	56.2 dB	75.6 dB	21.9 dB	26.0 dB	60.0 dB	
3.15 kHz	53.9 dB	78.3 dB	16.5 dB	20.8 dB	57.1 dB	
4 kHz	51.7 dB	75.8 dB	10.5 dB	16.9 dB	54.0 dB	
5 kHz	49.4 dB	75.5 dB	6.1 dB	10.3 dB	51.0 dB	
6.3 kHz	47.0 dB	73.9 dB	5.0 dB	9.9 dB	47.6 dB	
8 kHz	44.9 dB	68.4 dB	5.5 dB	9.8 dB	44.3 dB	
10 kHz	43.4 dB	67.5 dB	5.3 dB	9.8 dB	41.0 dB	
12.5 kHz	40.1 dB	64.3 dB	5.1 dB	9.8 dB	36.8 dB	
16 kHz	37.7 dB	65.2 dB	5.0 dB	9.8 dB	33.0 dB	
20 kHz	33.3 dB	59.6 dB	7.1 dB	9.8 dB	27.5 dB	

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Customer:

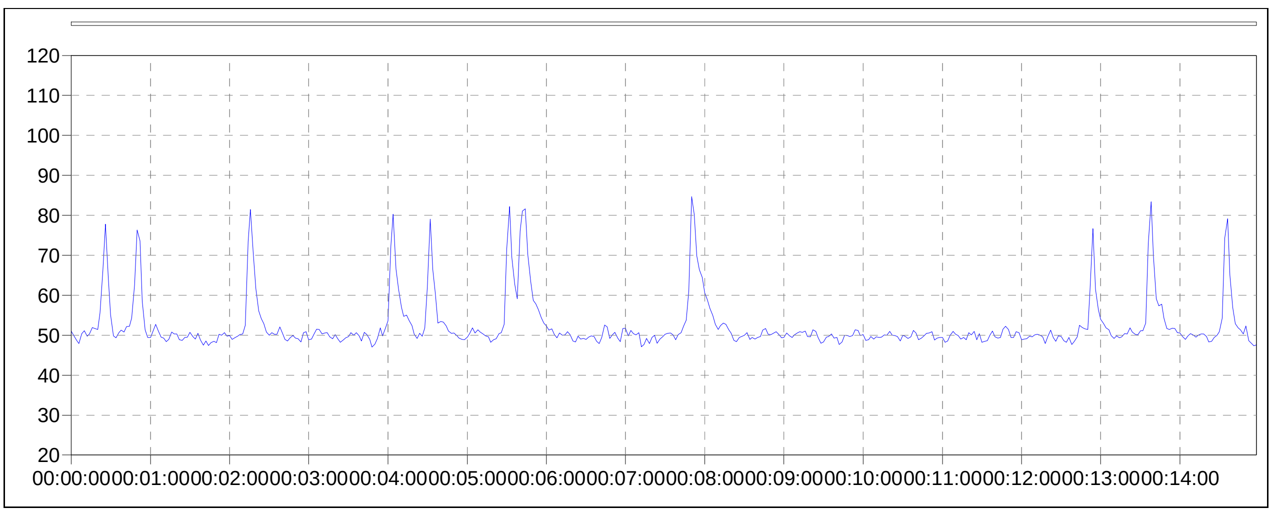
QUINN CEMENT

Project title:	NSR1 NIGHT
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type:	Nor140	**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:				**Operator:**	
Measurement title:	NOR140_8204585_090310_0015			**Date:**	10/03/2009 23:51:12
Measurement duration:	0 00:15:00.000	**Period length:**	0 00:00:01.000	**Filter bandwidth:**	1/3-octave
Initial calibration level:		**Instrument sensitivity:**	-26.4 dB	**End calibration level:**	



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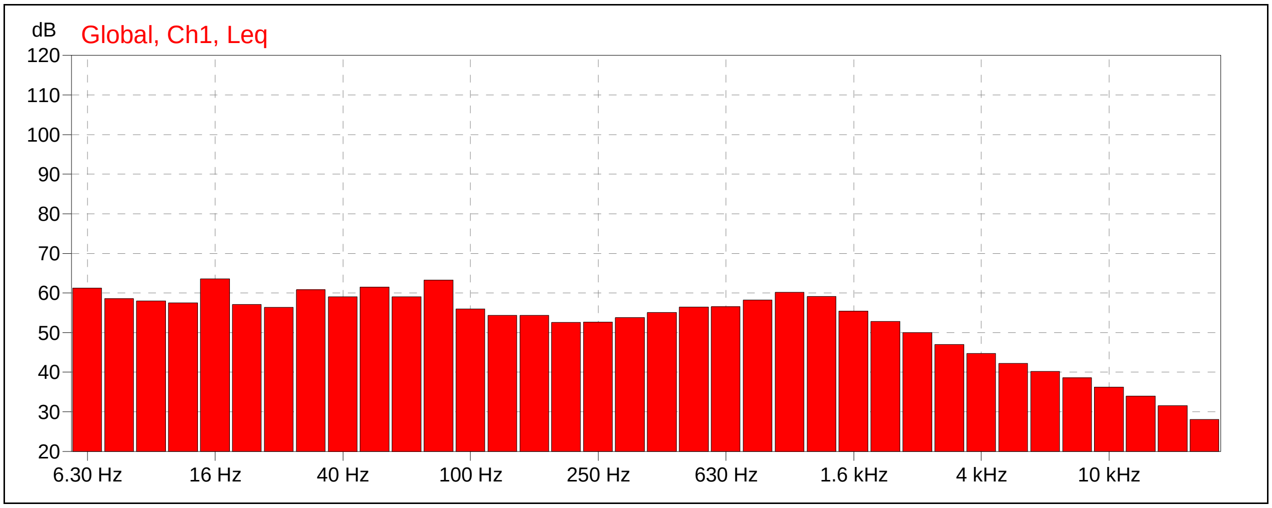

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LF,90.0% (dB)	LF,10.0% (dB)	LF(TM5) (dB)
A	66.3 dB	89.4 dB	46.2 dB	48.4 dB	58.3 dB	
C	70.6 dB	93.9 dB	61.7 dB	64.3 dB	68.0 dB	
FRQ						
6.30 Hz	61.3 dB	88.5 dB	33.1 dB	50.8 dB	63.2 dB	
8 Hz	58.5 dB	85.3 dB	36.4 dB	48.3 dB	60.6 dB	
10 Hz	58.0 dB	79.1 dB	40.2 dB	50.1 dB	60.8 dB	
12.5 Hz	57.5 dB	80.3 dB	41.2 dB	50.9 dB	60.0 dB	
16 Hz	63.5 dB	77.4 dB	47.9 dB	58.8 dB	66.1 dB	
20 Hz	57.1 dB	75.3 dB	41.6 dB	52.3 dB	59.5 dB	
25 Hz	56.4 dB	78.0 dB	42.8 dB	51.1 dB	58.6 dB	
31.5 Hz	60.8 dB	82.9 dB	50.0 dB	56.8 dB	62.5 dB	
40 Hz	59.1 dB	81.8 dB	48.0 dB	55.2 dB	60.6 dB	
50 Hz	61.5 dB	78.4 dB	50.5 dB	56.7 dB	64.0 dB	
63 Hz	59.1 dB	82.9 dB	48.1 dB	52.4 dB	57.8 dB	
80 Hz	63.3 dB	91.2 dB	47.1 dB	51.6 dB	56.8 dB	
100 Hz	56.0 dB	80.7 dB	44.9 dB	50.4 dB	58.7 dB	
125 Hz	54.3 dB	79.0 dB	44.3 dB	49.0 dB	53.8 dB	
160 Hz	54.4 dB	83.0 dB	43.4 dB	47.4 dB	52.3 dB	
200 Hz	52.5 dB	77.8 dB	40.9 dB	45.0 dB	49.3 dB	
250 Hz	52.7 dB	80.4 dB	36.3 dB	40.4 dB	46.5 dB	
315 Hz	53.8 dB	81.9 dB	32.9 dB	36.4 dB	45.4 dB	
400 Hz	55.2 dB	84.1 dB	34.3 dB	38.4 dB	46.5 dB	
500 Hz	56.5 dB	84.3 dB	38.4 dB	45.4 dB	52.7 dB	
630 Hz	56.6 dB	82.8 dB	35.3 dB	39.2 dB	49.2 dB	
800 Hz	58.2 dB	83.5 dB	33.9 dB	36.5 dB	49.3 dB	
1 kHz	60.2 dB	83.1 dB	33.5 dB	36.0 dB	50.3 dB	
1.25 kHz	59.1 dB	82.7 dB	31.9 dB	34.4 dB	50.1 dB	
1.6 kHz	55.4 dB	78.2 dB	27.4 dB	31.1 dB	48.3 dB	
2 kHz	52.9 dB	75.2 dB	26.8 dB	28.8 dB	45.0 dB	
2.5 kHz	49.9 dB	75.0 dB	24.1 dB	27.3 dB	40.6 dB	
3.15 kHz	47.0 dB	71.3 dB	18.7 dB	21.0 dB	36.9 dB	
4 kHz	44.7 dB	70.3 dB	14.3 dB	16.2 dB	32.5 dB	
5 kHz	42.2 dB	68.5 dB	8.6 dB	10.4 dB	27.4 dB	
6.3 kHz	40.2 dB	67.1 dB	5.9 dB	9.8 dB	22.2 dB	
8 kHz	38.6 dB	66.1 dB	5.5 dB	9.8 dB	18.0 dB	
10 kHz	36.2 dB	64.0 dB	6.0 dB	9.8 dB	15.0 dB	
12.5 kHz	34.1 dB	62.5 dB	5.7 dB	9.8 dB	12.9 dB	
16 kHz	31.5 dB	59.7 dB	5.0 dB	9.8 dB	11.2 dB	
20 kHz	28.1 dB	57.1 dB	6.5 dB	9.8 dB	10.7 dB	

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Customer:

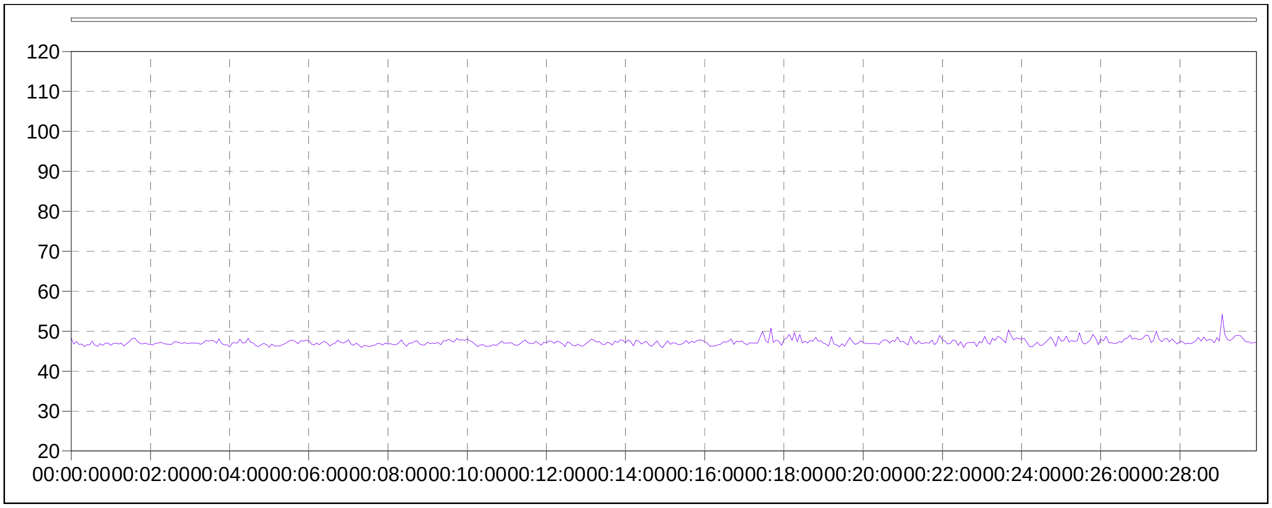
QUINN CEMENT

Project title:	NSR2 DAY
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type:	Nor140	**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:			**Operator:**
Measurement title:	NOR140_8204585_090310_0010		**Date:** 10/03/2009 16:31:22
Measurement duration:	0 00:30:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:		**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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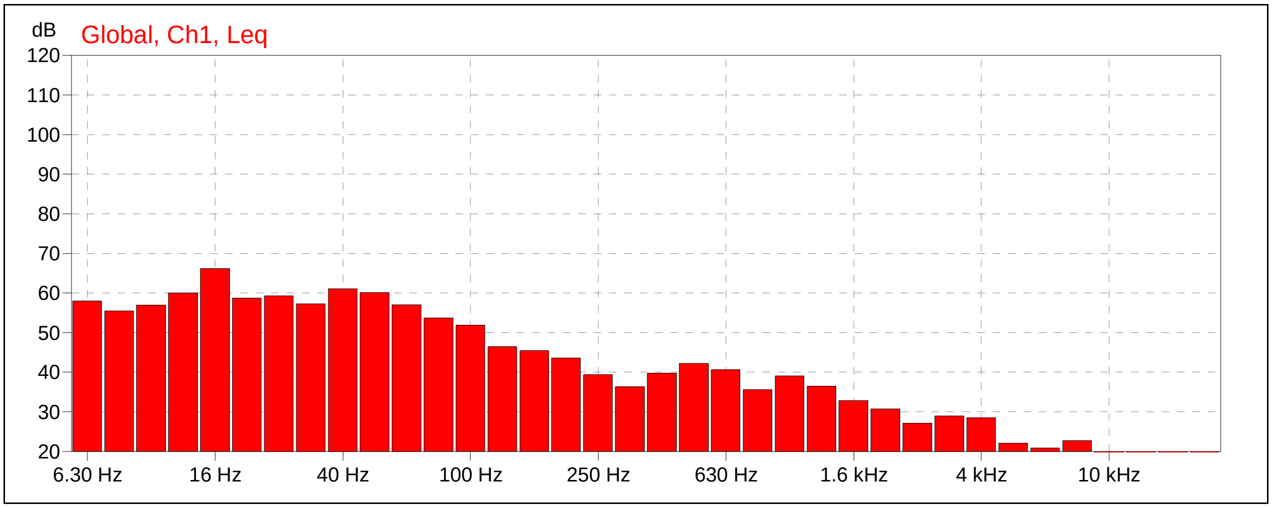

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LF,90.0% (dB)	LF,10.0% (dB)	LF(TM5) (dB)
A	47.4 dB	65.7 dB	44.6 dB	46.2 dB	48.2 dB	
C	66.0 dB	85.4 dB	61.5 dB	64.3 dB	67.4 dB	
FRQ						
6.30 Hz	58.0 dB	67.4 dB	34.5 dB	50.7 dB	61.4 dB	
8 Hz	55.5 dB	66.6 dB	38.8 dB	49.0 dB	58.7 dB	
10 Hz	56.9 dB	70.1 dB	40.1 dB	50.7 dB	60.1 dB	
12.5 Hz	60.0 dB	71.9 dB	44.8 dB	54.5 dB	63.1 dB	
16 Hz	66.1 dB	75.9 dB	53.0 dB	61.8 dB	68.6 dB	
20 Hz	58.7 dB	81.4 dB	46.2 dB	54.4 dB	61.2 dB	
25 Hz	59.3 dB	75.3 dB	46.1 dB	54.5 dB	62.1 dB	
31.5 Hz	57.3 dB	70.4 dB	46.8 dB	53.3 dB	59.7 dB	
40 Hz	61.0 dB	73.5 dB	49.7 dB	57.2 dB	63.5 dB	
50 Hz	60.1 dB	79.8 dB	49.7 dB	56.0 dB	62.7 dB	
63 Hz	57.0 dB	78.7 dB	46.9 dB	53.3 dB	59.2 dB	
80 Hz	53.7 dB	74.6 dB	45.1 dB	50.3 dB	55.8 dB	
100 Hz	51.9 dB	76.8 dB	44.1 dB	49.0 dB	53.7 dB	
125 Hz	46.5 dB	73.0 dB	39.7 dB	44.0 dB	47.9 dB	
160 Hz	45.5 dB	70.7 dB	39.3 dB	43.4 dB	46.8 dB	
200 Hz	43.6 dB	63.7 dB	38.0 dB	41.6 dB	45.0 dB	
250 Hz	39.4 dB	60.1 dB	34.7 dB	37.7 dB	40.7 dB	
315 Hz	36.3 dB	56.6 dB	31.8 dB	34.7 dB	37.5 dB	
400 Hz	39.8 dB	56.1 dB	34.2 dB	38.0 dB	41.2 dB	
500 Hz	42.3 dB	55.7 dB	36.9 dB	40.2 dB	43.9 dB	
630 Hz	40.6 dB	53.9 dB	34.5 dB	37.6 dB	42.8 dB	
800 Hz	35.6 dB	54.7 dB	31.8 dB	34.2 dB	36.8 dB	
1 kHz	39.1 dB	52.3 dB	35.0 dB	37.5 dB	40.5 dB	
1.25 kHz	36.5 dB	49.3 dB	32.1 dB	34.6 dB	38.0 dB	
1.6 kHz	32.9 dB	46.9 dB	28.9 dB	31.4 dB	34.1 dB	
2 kHz	30.8 dB	47.7 dB	27.2 dB	29.2 dB	32.0 dB	
2.5 kHz	27.1 dB	45.9 dB	21.8 dB	24.3 dB	28.5 dB	
3.15 kHz	29.0 dB	53.6 dB	17.7 dB	20.3 dB	28.2 dB	
4 kHz	28.5 dB	52.4 dB	13.0 dB	15.0 dB	27.8 dB	
5 kHz	22.1 dB	50.7 dB	7.0 dB	9.9 dB	20.7 dB	
6.3 kHz	20.9 dB	51.0 dB	5.3 dB	9.8 dB	16.5 dB	
8 kHz	22.7 dB	48.5 dB	5.2 dB	9.8 dB	13.5 dB	
10 kHz	11.6 dB	40.5 dB	5.5 dB	9.8 dB	10.0 dB	
12.5 kHz	8.8 dB	39.2 dB	5.4 dB	9.8 dB	10.0 dB	
16 kHz	7.3 dB	37.3 dB	4.8 dB	9.8 dB	10.0 dB	
20 kHz	7.6 dB	36.0 dB	6.0 dB	9.8 dB	10.0 dB	

10. 3. 2009 18:31:15

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Customer:

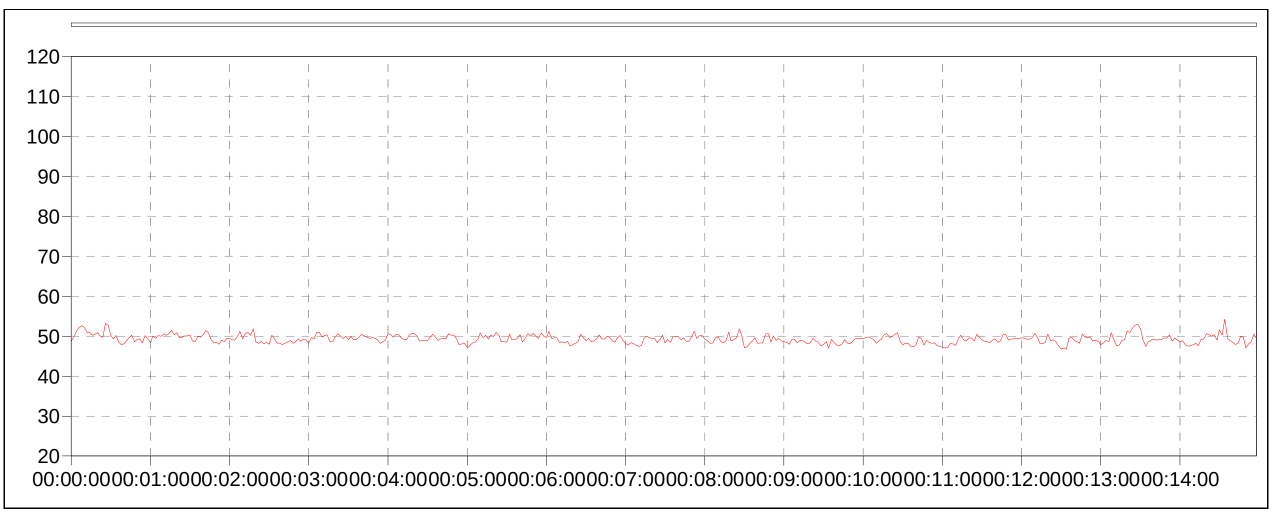
QUINN CEMENT

Project title: NSR2 NIGHT	
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type: Nor140	**Serial no:**
Preamflifier type:	**Serial no:**
Microphone type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:		**Operator:**
Measurement title: NOR140_8204585_090311_0001		**Date:** 11/03/2009 00:10:30
Measurement duration: 0 00:15:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:	**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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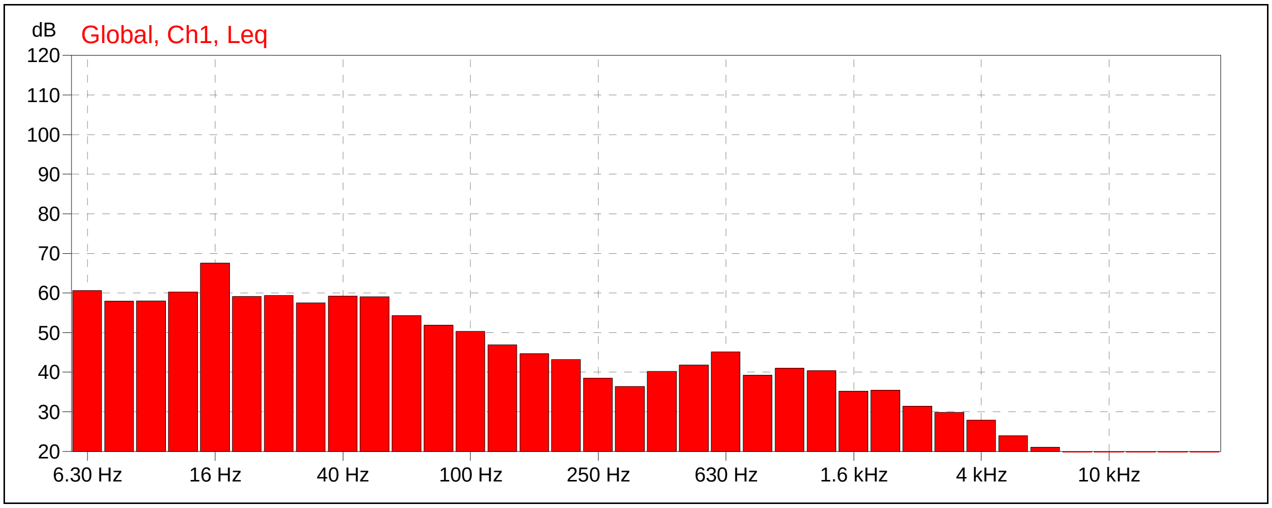

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LF,90.0% (dB)	LF,10.0% (dB)	LF(TM5) (dB)
A	49.4 dB	63.1 dB	46.0 dB	47.7 dB	50.8 dB	
C	65.5 dB	81.9 dB	61.0 dB	64.0 dB	66.8 dB	
FRQ						
6.30 Hz	60.6 dB	80.4 dB	40.3 dB	51.9 dB	63.6 dB	
8 Hz	57.9 dB	77.0 dB	38.5 dB	49.6 dB	61.1 dB	
10 Hz	58.0 dB	72.9 dB	40.4 dB	50.6 dB	61.1 dB	
12.5 Hz	60.3 dB	73.2 dB	45.1 dB	54.2 dB	63.3 dB	
16 Hz	67.6 dB	76.8 dB	55.3 dB	63.8 dB	69.9 dB	
20 Hz	59.1 dB	75.2 dB	46.9 dB	55.0 dB	61.6 dB	
25 Hz	59.4 dB	75.6 dB	44.7 dB	54.2 dB	62.2 dB	
31.5 Hz	57.5 dB	68.5 dB	47.3 dB	53.5 dB	59.9 dB	
40 Hz	59.2 dB	70.7 dB	47.8 dB	55.8 dB	61.5 dB	
50 Hz	59.1 dB	74.6 dB	47.8 dB	54.9 dB	61.7 dB	
63 Hz	54.3 dB	75.4 dB	45.4 dB	51.1 dB	56.1 dB	
80 Hz	51.9 dB	68.1 dB	44.4 dB	49.1 dB	53.7 dB	
100 Hz	50.3 dB	69.8 dB	41.4 dB	47.5 dB	52.2 dB	
125 Hz	47.0 dB	72.6 dB	40.0 dB	44.3 dB	48.3 dB	
160 Hz	44.6 dB	67.7 dB	38.7 dB	42.4 dB	46.0 dB	
200 Hz	43.2 dB	64.3 dB	37.3 dB	41.1 dB	44.7 dB	
250 Hz	38.5 dB	60.6 dB	32.9 dB	36.4 dB	39.8 dB	
315 Hz	36.4 dB	60.2 dB	30.5 dB	34.0 dB	37.6 dB	
400 Hz	40.1 dB	60.2 dB	33.9 dB	37.4 dB	42.0 dB	
500 Hz	41.8 dB	55.6 dB	35.5 dB	39.2 dB	43.8 dB	
630 Hz	45.2 dB	53.1 dB	36.7 dB	41.4 dB	47.8 dB	
800 Hz	39.2 dB	49.1 dB	34.7 dB	37.5 dB	40.6 dB	
1 kHz	41.0 dB	49.3 dB	35.2 dB	38.9 dB	42.6 dB	
1.25 kHz	40.4 dB	49.1 dB	34.8 dB	37.8 dB	42.3 dB	
1.6 kHz	35.2 dB	49.8 dB	30.3 dB	33.0 dB	36.7 dB	
2 kHz	35.5 dB	50.1 dB	30.1 dB	33.1 dB	37.2 dB	
2.5 kHz	31.4 dB	49.9 dB	25.5 dB	28.1 dB	33.5 dB	
3.15 kHz	29.8 dB	48.6 dB	22.1 dB	24.7 dB	32.7 dB	
4 kHz	27.9 dB	50.3 dB	18.7 dB	21.5 dB	30.6 dB	
5 kHz	24.0 dB	47.2 dB	12.8 dB	15.9 dB	26.2 dB	
6.3 kHz	21.1 dB	46.7 dB	7.8 dB	10.2 dB	23.1 dB	
8 kHz	19.2 dB	45.4 dB	6.3 dB	9.9 dB	21.5 dB	
10 kHz	17.7 dB	42.0 dB	7.4 dB	9.9 dB	20.3 dB	
12.5 kHz	16.1 dB	38.3 dB	5.6 dB	9.9 dB	19.5 dB	
16 kHz	15.8 dB	36.1 dB	5.3 dB	9.9 dB	19.4 dB	
20 kHz	14.9 dB	35.9 dB	6.2 dB	9.9 dB	18.3 dB	

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Customer:

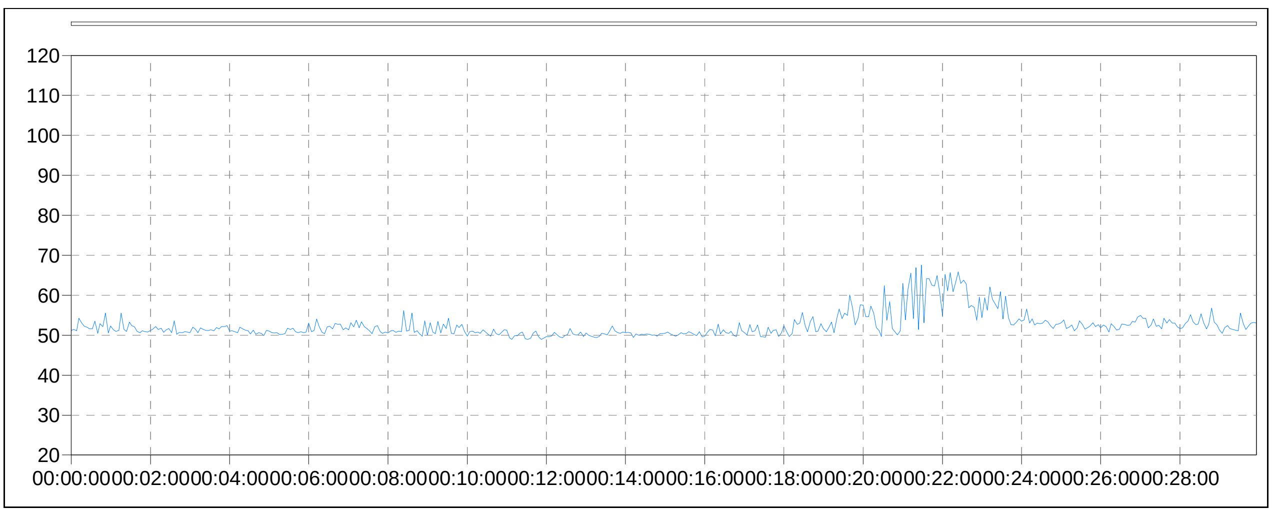
QUINN CEMENT

Project title:	NSR3 DAY
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type:	Nor140	**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:			**Operator:**
Measurement title:	NOR140_8204585_090310_0011		**Date:** 10/03/2009 17:09:39
Measurement duration:	0 00:30:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:		**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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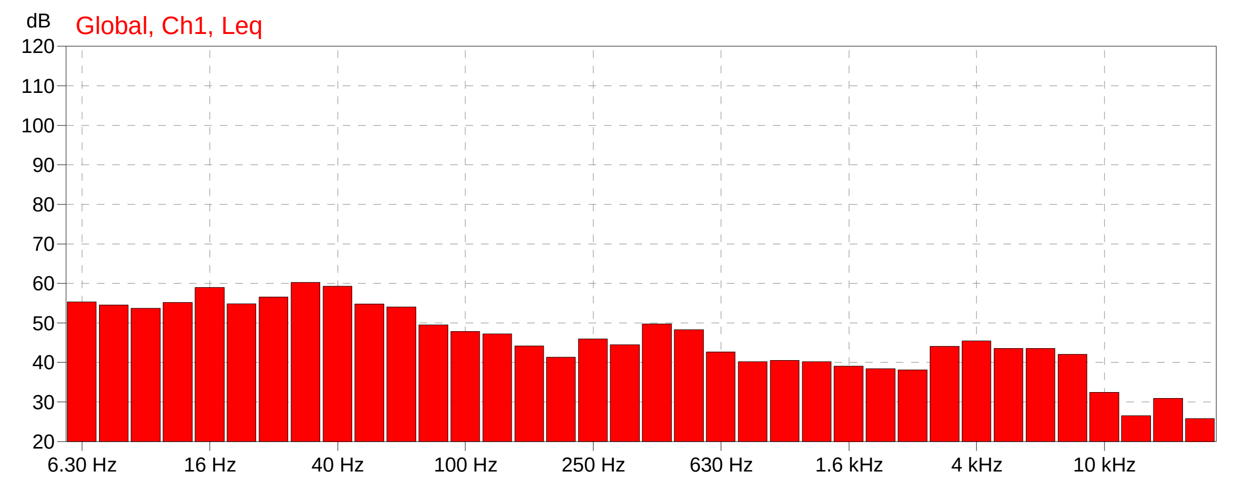

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LF,90.0% (dB)	LF,10.0% (dB)	LF(TM5) (dB)
A	54.6 dB	76.1 dB	48.0 dB	49.7 dB	54.9 dB	
C	64.2 dB	85.5 dB	58.3 dB	61.5 dB	65.1 dB	
FRQ						
6.30 Hz	55.4 dB	76.2 dB	33.3 dB	46.8 dB	58.6 dB	
8 Hz	54.6 dB	75.5 dB	34.6 dB	46.7 dB	57.6 dB	
10 Hz	53.7 dB	77.1 dB	35.1 dB	46.7 dB	56.5 dB	
12.5 Hz	55.2 dB	79.3 dB	38.5 dB	48.7 dB	58.0 dB	
16 Hz	59.0 dB	81.0 dB	42.2 dB	51.7 dB	61.2 dB	
20 Hz	54.8 dB	81.1 dB	42.1 dB	49.6 dB	57.1 dB	
25 Hz	56.6 dB	78.8 dB	41.5 dB	51.6 dB	59.2 dB	
31.5 Hz	60.3 dB	75.8 dB	47.3 dB	56.0 dB	62.6 dB	
40 Hz	59.3 dB	77.1 dB	44.6 dB	52.7 dB	60.2 dB	
50 Hz	54.8 dB	78.9 dB	42.0 dB	48.0 dB	56.7 dB	
63 Hz	54.1 dB	79.2 dB	38.9 dB	46.5 dB	57.5 dB	
80 Hz	49.5 dB	72.6 dB	38.9 dB	44.9 dB	51.4 dB	
100 Hz	47.8 dB	71.8 dB	39.2 dB	44.5 dB	49.5 dB	
125 Hz	47.2 dB	73.3 dB	38.4 dB	43.7 dB	48.8 dB	
160 Hz	44.2 dB	68.2 dB	35.1 dB	40.1 dB	45.0 dB	
200 Hz	41.3 dB	65.6 dB	32.7 dB	36.2 dB	40.3 dB	
250 Hz	46.0 dB	63.8 dB	36.8 dB	41.4 dB	48.0 dB	
315 Hz	44.5 dB	67.2 dB	35.9 dB	40.9 dB	44.7 dB	
400 Hz	49.8 dB	66.5 dB	37.2 dB	45.3 dB	52.9 dB	
500 Hz	48.3 dB	60.6 dB	40.0 dB	44.5 dB	50.8 dB	
630 Hz	42.6 dB	59.5 dB	37.0 dB	39.9 dB	43.7 dB	
800 Hz	40.2 dB	60.7 dB	34.6 dB	37.2 dB	40.8 dB	
1 kHz	40.6 dB	60.4 dB	35.6 dB	37.8 dB	41.3 dB	
1.25 kHz	40.2 dB	59.7 dB	35.3 dB	37.4 dB	40.5 dB	
1.6 kHz	39.1 dB	57.7 dB	34.5 dB	36.3 dB	38.9 dB	
2 kHz	38.5 dB	58.1 dB	33.8 dB	35.4 dB	38.4 dB	
2.5 kHz	38.2 dB	63.0 dB	32.4 dB	34.0 dB	37.3 dB	
3.15 kHz	44.1 dB	74.0 dB	31.5 dB	32.7 dB	42.5 dB	
4 kHz	45.5 dB	73.2 dB	29.8 dB	31.0 dB	43.4 dB	
5 kHz	43.5 dB	72.1 dB	27.2 dB	28.5 dB	37.5 dB	
6.3 kHz	43.6 dB	72.6 dB	24.3 dB	25.2 dB	35.6 dB	
8 kHz	42.1 dB	72.3 dB	20.4 dB	21.4 dB	36.4 dB	
10 kHz	32.5 dB	65.3 dB	16.2 dB	17.1 dB	25.1 dB	
12.5 kHz	26.5 dB	54.5 dB	11.5 dB	12.3 dB	18.3 dB	
16 kHz	30.9 dB	62.8 dB	7.3 dB	9.8 dB	16.8 dB	
20 kHz	25.8 dB	60.3 dB	6.2 dB	9.8 dB	11.0 dB	

10. 3. 2009 18:31:28

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Customer:

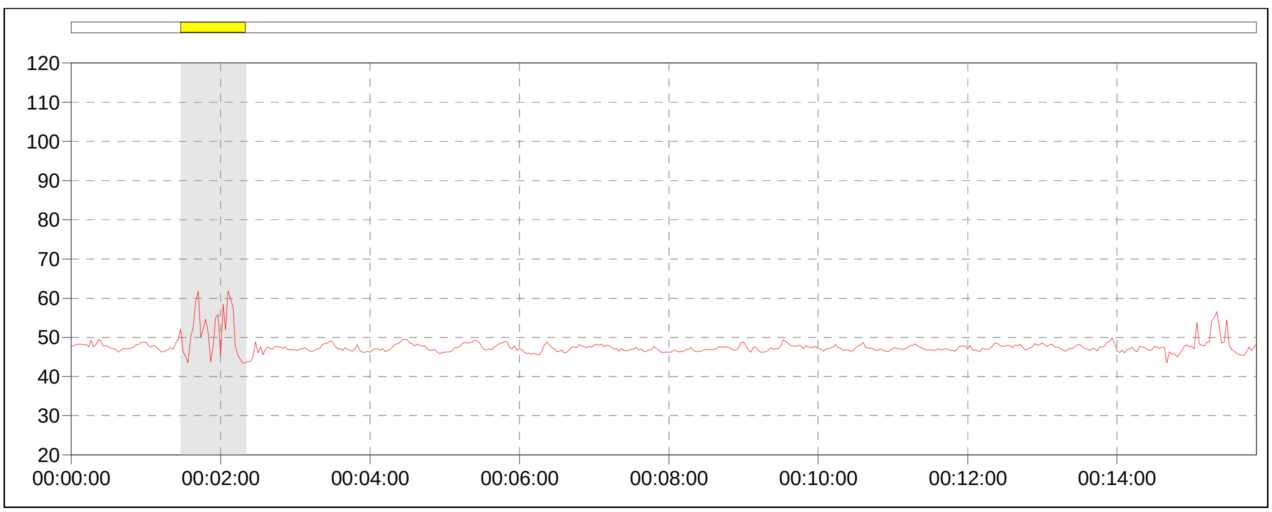
QUINN CEMENT

Project title:	NSR3 NIGHT
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type:	Nor140	**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:			**Operator:**
Measurement title:	NOR140_8204585_090310_0013		**Date:** 10/03/2009 23:10:18
Measurement duration:	0 00:15:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:		**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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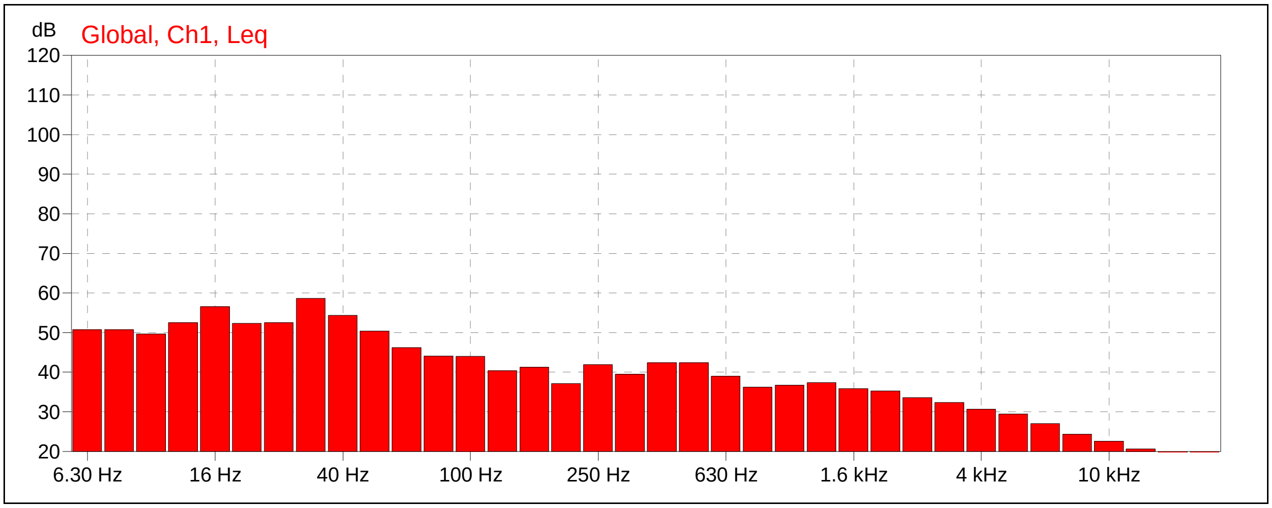

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LF,90.0% (dB)	LF,10.0% (dB)	LF(TM5) (dB)
A	47.6 dB	67.5 dB	41.0 dB	46.2 dB	48.5 dB	
C	60.3 dB	73.6 dB	56.1 dB	58.7 dB	61.5 dB	
FRQ						
6.30 Hz	50.7 dB	62.3 dB	32.5 dB	43.2 dB	54.1 dB	
8 Hz	50.7 dB	62.3 dB	28.7 dB	43.5 dB	54.0 dB	
10 Hz	49.7 dB	63.1 dB	31.7 dB	43.6 dB	52.7 dB	
12.5 Hz	52.5 dB	61.9 dB	36.9 dB	46.3 dB	55.6 dB	
16 Hz	56.6 dB	71.9 dB	38.8 dB	49.8 dB	59.4 dB	
20 Hz	52.3 dB	64.5 dB	37.2 dB	47.4 dB	55.1 dB	
25 Hz	52.4 dB	66.6 dB	41.1 dB	47.8 dB	55.2 dB	
31.5 Hz	58.6 dB	64.5 dB	48.9 dB	56.1 dB	60.5 dB	
40 Hz	54.4 dB	68.4 dB	43.2 dB	51.6 dB	56.2 dB	
50 Hz	50.5 dB	65.8 dB	35.4 dB	45.1 dB	53.0 dB	
63 Hz	46.2 dB	71.2 dB	33.3 dB	41.8 dB	48.1 dB	
80 Hz	44.1 dB	65.6 dB	35.5 dB	40.8 dB	45.8 dB	
100 Hz	44.1 dB	56.5 dB	33.2 dB	39.8 dB	46.3 dB	
125 Hz	40.4 dB	53.0 dB	31.9 dB	37.8 dB	42.2 dB	
160 Hz	41.3 dB	59.4 dB	33.1 dB	38.3 dB	43.1 dB	
200 Hz	37.1 dB	57.5 dB	29.4 dB	34.0 dB	38.7 dB	
250 Hz	41.9 dB	52.0 dB	33.9 dB	38.8 dB	44.0 dB	
315 Hz	39.5 dB	51.9 dB	31.1 dB	37.1 dB	41.3 dB	
400 Hz	42.4 dB	57.8 dB	29.0 dB	37.7 dB	45.1 dB	
500 Hz	42.4 dB	54.6 dB	30.5 dB	38.9 dB	44.8 dB	
630 Hz	39.0 dB	57.3 dB	29.2 dB	36.7 dB	40.5 dB	
800 Hz	36.2 dB	54.5 dB	29.7 dB	34.7 dB	37.3 dB	
1 kHz	36.8 dB	56.5 dB	30.0 dB	35.4 dB	37.7 dB	
1.25 kHz	37.4 dB	54.9 dB	30.9 dB	35.6 dB	38.8 dB	
1.6 kHz	35.8 dB	56.9 dB	30.0 dB	34.6 dB	36.4 dB	
2 kHz	35.3 dB	60.0 dB	29.5 dB	33.8 dB	35.3 dB	
2.5 kHz	33.6 dB	56.5 dB	28.4 dB	32.4 dB	33.8 dB	
3.15 kHz	32.4 dB	56.5 dB	27.2 dB	30.9 dB	32.3 dB	
4 kHz	30.7 dB	55.3 dB	25.2 dB	29.2 dB	30.7 dB	
5 kHz	29.5 dB	55.5 dB	23.2 dB	27.1 dB	28.6 dB	
6.3 kHz	27.1 dB	56.6 dB	21.0 dB	24.1 dB	25.9 dB	
8 kHz	24.4 dB	53.8 dB	18.0 dB	20.0 dB	22.5 dB	
10 kHz	22.6 dB	55.6 dB	14.3 dB	15.0 dB	19.1 dB	
12.5 kHz	20.7 dB	51.9 dB	9.9 dB	10.5 dB	16.7 dB	
16 kHz	18.1 dB	51.2 dB	6.4 dB	9.8 dB	14.0 dB	
20 kHz	14.1 dB	44.9 dB	6.1 dB	9.9 dB	13.9 dB	

11. 3. 2009 16:53:21

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Customer:

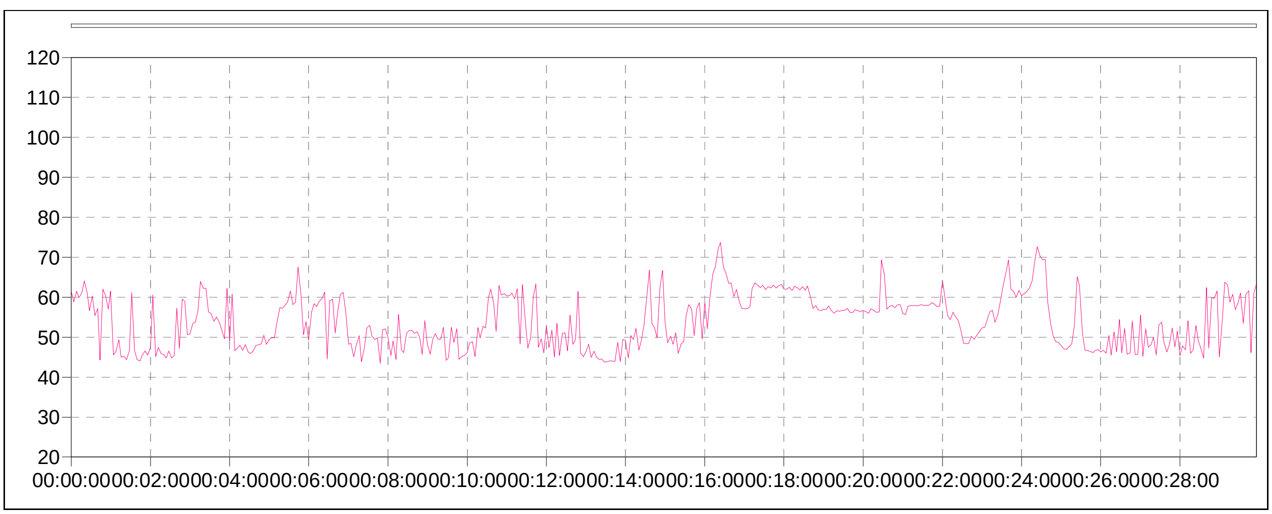
QUINN CEMENT

Project title:	NSR4 DAY
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type:	Nor140	**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:				**Operator:**	
Measurement title:	NOR140_8204585_090310_0012			**Date:**	10/03/2009 17:41:42
Measurement duration:	0 00:30:00.000	**Period length:**	0 00:00:01.000	**Filter bandwidth:**	1/3-octave
Initial calibration level:		**Instrument sensitivity:**	-26.4 dB	**End calibration level:**	



 10. 3. 2009 18:31:39

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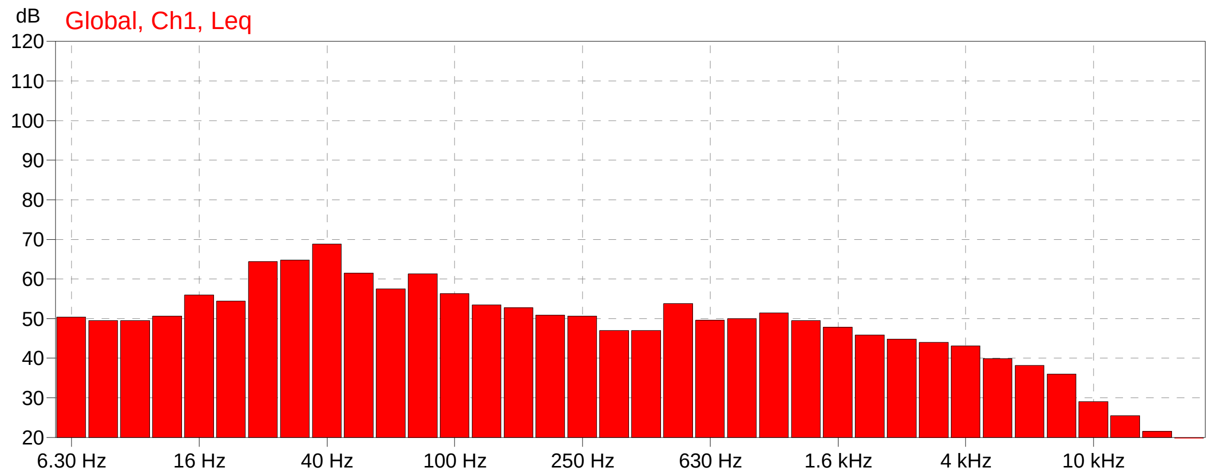

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LF,90.0% (dB)	LF,10.0% (dB)	LF(TM5) (dB)
A	59.2 dB	76.4 dB	41.6 dB	44.5 dB	62.3 dB	
C	71.0 dB	86.5 dB	59.9 dB	63.5 dB	74.8 dB	
FRQ						
6.30 Hz	50.5 dB	68.1 dB	30.4 dB	42.7 dB	53.8 dB	
8 Hz	49.5 dB	73.7 dB	26.2 dB	42.3 dB	52.5 dB	
10 Hz	49.5 dB	77.8 dB	31.6 dB	42.3 dB	52.1 dB	
12.5 Hz	50.7 dB	79.6 dB	34.9 dB	44.0 dB	53.1 dB	
16 Hz	56.0 dB	80.9 dB	37.1 dB	49.0 dB	58.7 dB	
20 Hz	54.5 dB	81.2 dB	38.0 dB	47.9 dB	56.5 dB	
25 Hz	64.4 dB	81.4 dB	42.6 dB	52.0 dB	69.9 dB	
31.5 Hz	64.7 dB	84.2 dB	51.3 dB	60.6 dB	65.1 dB	
40 Hz	68.9 dB	87.3 dB	49.1 dB	56.5 dB	71.0 dB	
50 Hz	61.5 dB	81.0 dB	44.4 dB	52.8 dB	63.1 dB	
63 Hz	57.6 dB	78.3 dB	45.3 dB	52.0 dB	58.5 dB	
80 Hz	61.3 dB	80.1 dB	40.8 dB	48.8 dB	64.2 dB	
100 Hz	56.3 dB	77.1 dB	39.4 dB	47.7 dB	58.8 dB	
125 Hz	53.5 dB	73.6 dB	37.6 dB	43.3 dB	57.8 dB	
160 Hz	52.8 dB	77.6 dB	31.8 dB	36.4 dB	56.9 dB	
200 Hz	50.9 dB	70.5 dB	27.4 dB	31.5 dB	55.5 dB	
250 Hz	50.7 dB	71.5 dB	28.9 dB	35.7 dB	54.8 dB	
315 Hz	47.0 dB	71.3 dB	30.1 dB	34.9 dB	49.4 dB	
400 Hz	47.0 dB	64.8 dB	31.1 dB	36.9 dB	50.2 dB	
500 Hz	53.8 dB	74.9 dB	34.0 dB	40.7 dB	52.7 dB	
630 Hz	49.6 dB	69.4 dB	34.3 dB	38.7 dB	51.5 dB	
800 Hz	50.0 dB	67.9 dB	27.8 dB	31.2 dB	53.9 dB	
1 kHz	51.5 dB	74.0 dB	26.9 dB	30.6 dB	53.2 dB	
1.25 kHz	49.5 dB	68.2 dB	24.2 dB	27.5 dB	52.3 dB	
1.6 kHz	47.8 dB	67.2 dB	19.8 dB	23.1 dB	51.8 dB	
2 kHz	45.9 dB	67.8 dB	15.3 dB	19.1 dB	49.3 dB	
2.5 kHz	44.8 dB	66.8 dB	11.0 dB	16.5 dB	47.0 dB	
3.15 kHz	44.1 dB	67.1 dB	8.0 dB	16.8 dB	46.0 dB	
4 kHz	43.2 dB	64.5 dB	6.5 dB	16.3 dB	45.5 dB	
5 kHz	39.9 dB	63.2 dB	5.5 dB	12.5 dB	41.3 dB	
6.3 kHz	38.2 dB	62.5 dB	5.4 dB	10.0 dB	38.1 dB	
8 kHz	36.0 dB	59.5 dB	5.5 dB	9.9 dB	36.0 dB	
10 kHz	29.0 dB	55.5 dB	5.5 dB	9.8 dB	24.5 dB	
12.5 kHz	25.5 dB	55.2 dB	5.4 dB	9.8 dB	18.3 dB	
16 kHz	21.5 dB	47.5 dB	4.9 dB	9.8 dB	15.4 dB	
20 kHz	16.1 dB	42.4 dB	5.3 dB	9.8 dB	10.0 dB	

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Customer:

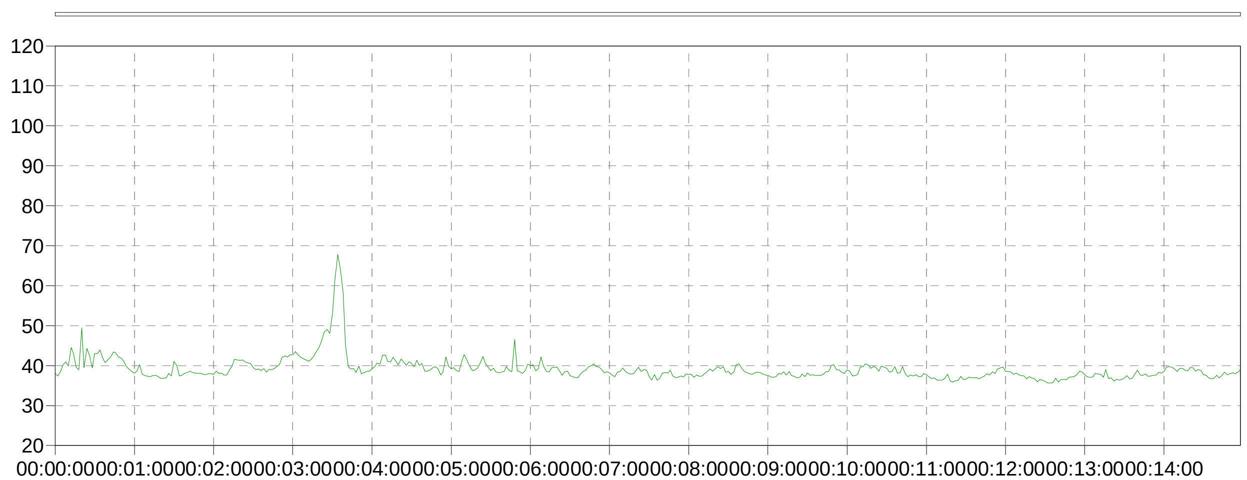
QUINN CEMENT

Project title:	NSR4 NIGHT
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type:	Nor140	**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:		**Operator:**
Measurement title: NOR140_8204585_090310_0014		**Date:** 10/03/2009 23:29:29
Measurement duration: 0 00:15:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:	**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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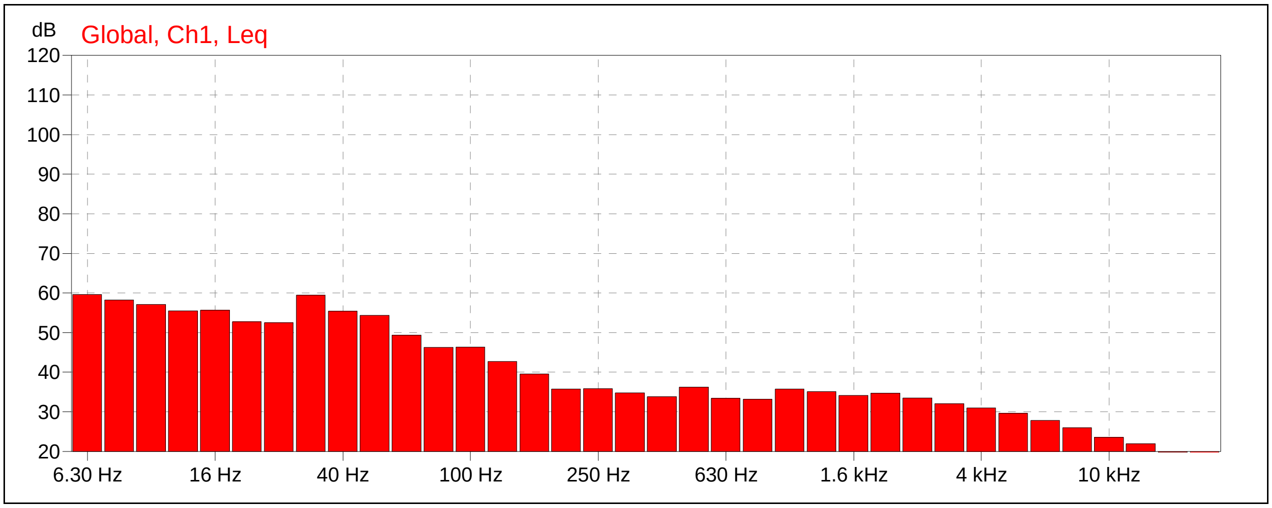

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LF,90.0% (dB)	LF,10.0% (dB)	LF(TM5) (dB)
A	45.2 dB	70.6 dB	34.7 dB	36.8 dB	41.5 dB	
C	61.4 dB	76.6 dB	56.4 dB	59.3 dB	62.6 dB	
FRQ						
6.30 Hz	59.6 dB	76.6 dB	27.6 dB	47.2 dB	63.4 dB	
8 Hz	58.2 dB	75.7 dB	29.5 dB	44.8 dB	62.1 dB	
10 Hz	57.1 dB	73.8 dB	31.2 dB	43.9 dB	60.8 dB	
12.5 Hz	55.5 dB	70.6 dB	33.1 dB	44.2 dB	59.4 dB	
16 Hz	55.7 dB	72.2 dB	36.6 dB	47.5 dB	58.9 dB	
20 Hz	52.8 dB	71.0 dB	36.2 dB	45.5 dB	55.6 dB	
25 Hz	52.5 dB	66.5 dB	39.3 dB	47.2 dB	55.3 dB	
31.5 Hz	59.5 dB	64.6 dB	45.0 dB	56.7 dB	61.3 dB	
40 Hz	55.4 dB	64.1 dB	44.7 dB	53.2 dB	57.0 dB	
50 Hz	54.4 dB	76.0 dB	40.3 dB	49.2 dB	56.1 dB	
63 Hz	49.4 dB	71.0 dB	40.2 dB	45.1 dB	50.8 dB	
80 Hz	46.2 dB	63.5 dB	37.0 dB	42.8 dB	48.0 dB	
100 Hz	46.4 dB	65.2 dB	38.9 dB	43.1 dB	47.8 dB	
125 Hz	42.8 dB	63.7 dB	33.4 dB	38.9 dB	44.2 dB	
160 Hz	39.6 dB	62.3 dB	30.8 dB	35.1 dB	40.1 dB	
200 Hz	35.8 dB	58.1 dB	25.1 dB	29.3 dB	34.0 dB	
250 Hz	35.8 dB	60.8 dB	21.8 dB	26.5 dB	31.9 dB	
315 Hz	34.8 dB	59.3 dB	22.7 dB	26.4 dB	31.0 dB	
400 Hz	33.8 dB	56.6 dB	23.4 dB	27.9 dB	33.1 dB	
500 Hz	36.2 dB	56.2 dB	24.7 dB	28.7 dB	38.7 dB	
630 Hz	33.4 dB	56.8 dB	23.5 dB	26.9 dB	33.4 dB	
800 Hz	33.2 dB	57.1 dB	21.5 dB	24.9 dB	31.5 dB	
1 kHz	35.8 dB	61.0 dB	22.5 dB	25.1 dB	32.6 dB	
1.25 kHz	35.1 dB	61.2 dB	21.1 dB	23.7 dB	29.8 dB	
1.6 kHz	34.2 dB	60.9 dB	18.1 dB	20.6 dB	27.4 dB	
2 kHz	34.8 dB	61.9 dB	15.1 dB	18.7 dB	25.3 dB	
2.5 kHz	33.5 dB	61.1 dB	11.8 dB	15.8 dB	25.0 dB	
3.15 kHz	32.1 dB	60.1 dB	9.5 dB	13.7 dB	23.7 dB	
4 kHz	31.0 dB	58.6 dB	8.2 dB	11.9 dB	20.8 dB	
5 kHz	29.6 dB	58.2 dB	7.6 dB	10.6 dB	18.3 dB	
6.3 kHz	27.9 dB	56.8 dB	7.0 dB	9.9 dB	16.1 dB	
8 kHz	26.0 dB	54.5 dB	6.8 dB	9.9 dB	14.0 dB	
10 kHz	23.6 dB	52.3 dB	6.3 dB	9.8 dB	12.1 dB	
12.5 kHz	22.0 dB	51.5 dB	6.2 dB	9.8 dB	11.6 dB	
16 kHz	19.7 dB	49.1 dB	5.9 dB	9.8 dB	11.4 dB	
20 kHz	16.9 dB	45.5 dB	8.5 dB	9.9 dB	11.8 dB	

Appendix B

Noise Monitoring Data

On Site

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Customer:

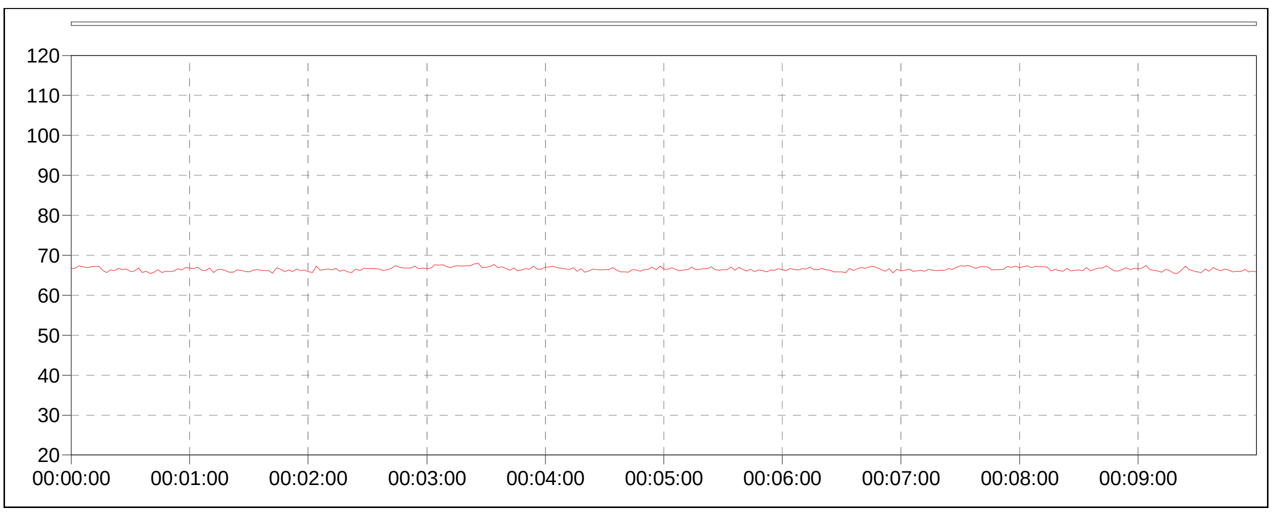
QUINN CEMENT

Project title: N1	
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type: Nor140	**Serial no:**
Preamflifier type:	**Serial no:**
Microphone type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:		**Operator:**
Measurement title: NOR140_8204585_090310_0001		**Date:** 10/03/2009 14:19:57
Measurement duration: 0 00:10:01.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:	**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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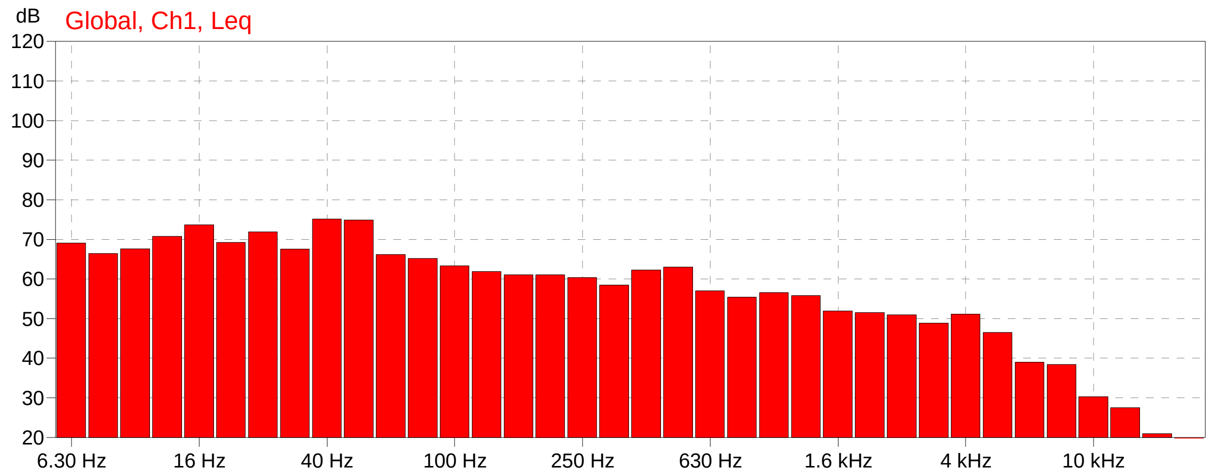

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LE (dB)	Lpeak (dB)	LF(TM5) (dB)
A	66.5 dB	70.8 dB	64.8 dB	94.3 dB	88.0 dB	
C	79.2 dB	87.2 dB	73.7 dB	107.0 dB	94.2 dB	
FRQ						
6.30 Hz	69.1 dB	77.5 dB	48.5 dB	96.9 dB		
8 Hz	66.4 dB	75.0 dB	45.7 dB	94.2 dB		
10 Hz	67.7 dB	76.9 dB	50.5 dB	95.5 dB		
12.5 Hz	70.8 dB	79.4 dB	52.6 dB	98.6 dB		
16 Hz	73.8 dB	82.6 dB	59.0 dB	101.6 dB		
20 Hz	69.2 dB	76.9 dB	58.2 dB	97.0 dB		
25 Hz	71.9 dB	79.8 dB	57.3 dB	99.7 dB		
31.5 Hz	67.6 dB	75.7 dB	57.8 dB	95.4 dB		
40 Hz	75.1 dB	85.3 dB	62.7 dB	102.9 dB		
50 Hz	74.9 dB	84.4 dB	59.5 dB	102.7 dB		
63 Hz	66.1 dB	73.1 dB	58.5 dB	93.9 dB		
80 Hz	65.2 dB	70.9 dB	58.2 dB	93.0 dB		
100 Hz	63.4 dB	70.0 dB	56.8 dB	91.1 dB		
125 Hz	61.9 dB	67.2 dB	55.9 dB	89.7 dB		
160 Hz	61.0 dB	66.2 dB	54.5 dB	88.8 dB		
200 Hz	61.0 dB	64.9 dB	56.0 dB	88.8 dB		
250 Hz	60.4 dB	64.8 dB	55.2 dB	88.2 dB		
315 Hz	58.5 dB	62.1 dB	54.3 dB	86.3 dB		
400 Hz	62.2 dB	67.0 dB	58.3 dB	90.0 dB		
500 Hz	63.1 dB	69.1 dB	56.0 dB	90.8 dB		
630 Hz	57.0 dB	60.0 dB	53.8 dB	84.8 dB		
800 Hz	55.5 dB	59.1 dB	52.6 dB	83.2 dB		
1 kHz	56.6 dB	60.8 dB	53.2 dB	84.4 dB		
1.25 kHz	55.8 dB	59.3 dB	52.4 dB	83.6 dB		
1.6 kHz	51.9 dB	58.1 dB	49.5 dB	79.7 dB		
2 kHz	51.5 dB	60.8 dB	49.0 dB	79.3 dB		
2.5 kHz	50.9 dB	61.5 dB	47.1 dB	78.7 dB		
3.15 kHz	48.9 dB	60.7 dB	45.1 dB	76.7 dB		
4 kHz	51.1 dB	61.1 dB	47.0 dB	78.9 dB		
5 kHz	46.5 dB	58.8 dB	41.3 dB	74.3 dB		
6.3 kHz	39.0 dB	57.6 dB	34.0 dB	66.8 dB		
8 kHz	38.4 dB	55.7 dB	33.9 dB	66.2 dB		
10 kHz	30.3 dB	51.2 dB	25.4 dB	58.0 dB		
12.5 kHz	27.5 dB	47.4 dB	20.5 dB	55.3 dB		
16 kHz	21.0 dB	44.1 dB	11.6 dB	48.8 dB		
20 kHz	16.8 dB	39.0 dB	7.9 dB	44.6 dB		

10. 3. 2009 18:27:06

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Customer:

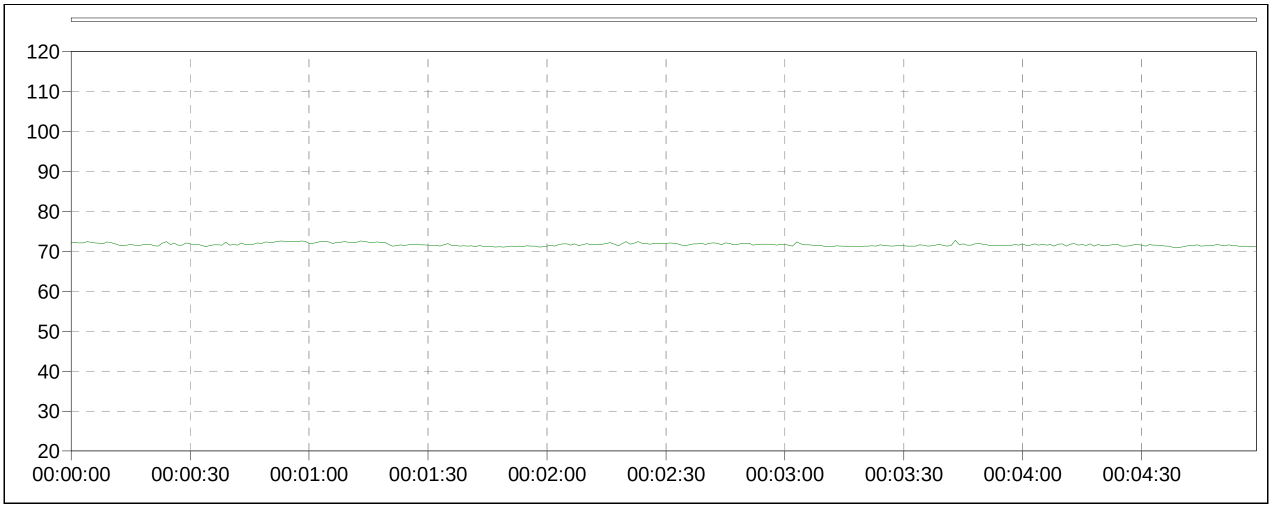
QUINN CEMENT

Project title: N2	
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type: Nor140	**Serial no:**
Preamflifier type:	**Serial no:**
Microphone type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:		**Operator:**
Measurement title: NOR140_8204585_090310_0002		**Date:** 10/03/2009 14:31:52
Measurement duration: 0 00:05:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:	**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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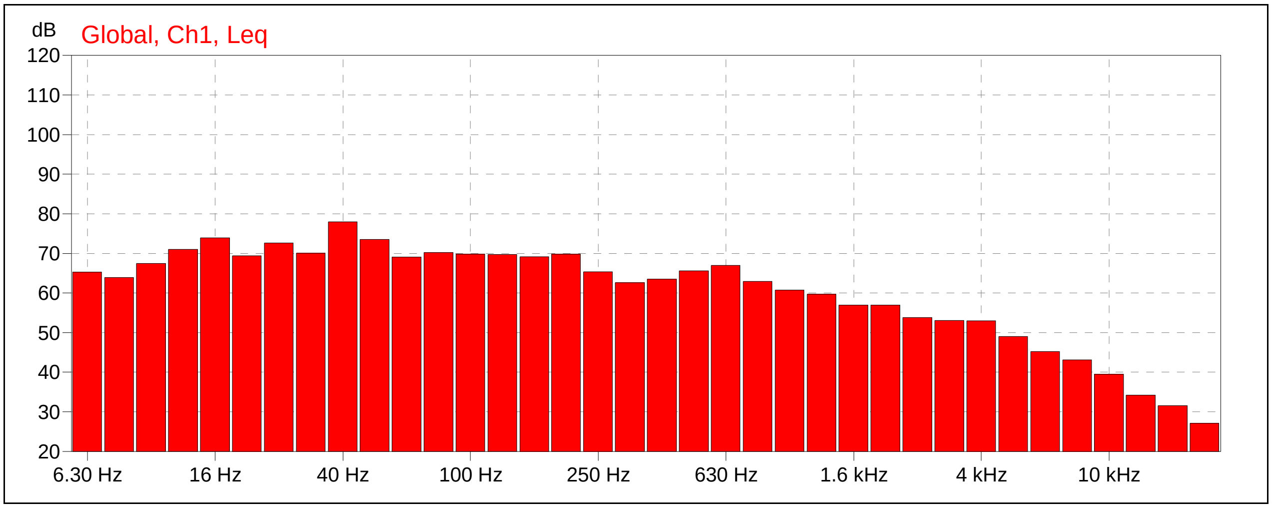

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LE (dB)	Lpeak (dB)	LF(TM5) (dB)
A	71.7 dB	75.2 dB	70.3 dB	96.5 dB	90.7 dB	
C	81.8 dB	86.2 dB	79.3 dB	106.6 dB	95.7 dB	
FRQ						
6.30 Hz	65.3 dB	76.4 dB	48.4 dB	90.1 dB		
8 Hz	64.0 dB	72.5 dB	48.3 dB	88.7 dB		
10 Hz	67.5 dB	76.3 dB	49.6 dB	92.3 dB		
12.5 Hz	71.0 dB	79.6 dB	57.1 dB	95.8 dB		
16 Hz	73.9 dB	80.3 dB	59.5 dB	98.7 dB		
20 Hz	69.4 dB	77.3 dB	57.2 dB	94.1 dB		
25 Hz	72.6 dB	81.3 dB	59.6 dB	97.4 dB		
31.5 Hz	70.1 dB	76.9 dB	59.4 dB	94.8 dB		
40 Hz	78.0 dB	85.6 dB	71.9 dB	102.8 dB		
50 Hz	73.5 dB	81.0 dB	66.4 dB	98.3 dB		
63 Hz	69.1 dB	76.5 dB	61.6 dB	93.9 dB		
80 Hz	70.3 dB	76.4 dB	63.3 dB	95.0 dB		
100 Hz	69.8 dB	76.1 dB	62.5 dB	94.6 dB		
125 Hz	69.7 dB	74.1 dB	64.1 dB	94.5 dB		
160 Hz	69.2 dB	72.2 dB	65.2 dB	93.9 dB		
200 Hz	69.8 dB	72.6 dB	66.2 dB	94.6 dB		
250 Hz	65.4 dB	68.8 dB	61.5 dB	90.1 dB		
315 Hz	62.6 dB	66.2 dB	58.5 dB	87.4 dB		
400 Hz	63.5 dB	67.1 dB	60.2 dB	88.2 dB		
500 Hz	65.6 dB	70.8 dB	61.0 dB	90.3 dB		
630 Hz	67.0 dB	69.9 dB	64.0 dB	91.7 dB		
800 Hz	63.0 dB	65.4 dB	60.6 dB	87.7 dB		
1 kHz	60.8 dB	64.1 dB	57.3 dB	85.5 dB		
1.25 kHz	59.7 dB	62.1 dB	57.5 dB	84.5 dB		
1.6 kHz	57.0 dB	60.6 dB	55.1 dB	81.7 dB		
2 kHz	56.9 dB	63.3 dB	54.7 dB	81.7 dB		
2.5 kHz	53.8 dB	66.6 dB	51.6 dB	78.6 dB		
3.15 kHz	53.1 dB	64.2 dB	51.1 dB	77.9 dB		
4 kHz	53.0 dB	63.8 dB	50.2 dB	77.8 dB		
5 kHz	49.0 dB	64.3 dB	46.7 dB	73.8 dB		
6.3 kHz	45.3 dB	65.9 dB	42.2 dB	70.1 dB		
8 kHz	43.2 dB	63.5 dB	39.8 dB	68.0 dB		
10 kHz	39.5 dB	59.4 dB	35.4 dB	64.3 dB		
12.5 kHz	34.3 dB	56.0 dB	29.6 dB	59.1 dB		
16 kHz	31.5 dB	57.3 dB	24.7 dB	56.3 dB		
20 kHz	27.1 dB	52.3 dB	18.7 dB	51.9 dB		

 10. 3. 2009 18:28:22

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Customer:

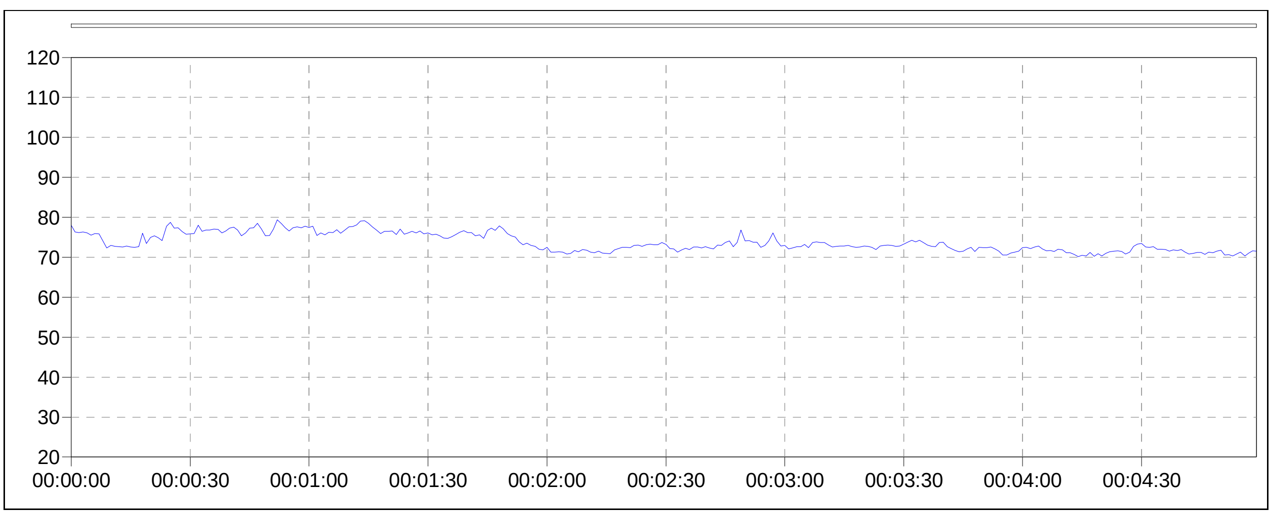
QUINN CEMENT

Project title:	N3
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type:	Nor140	**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:				**Operator:**	
Measurement title:	NOR140_8204585_090310_0003			**Date:**	10/03/2009 14:40:21
Measurement duration:	0 00:05:00.000	**Period length:**	0 00:00:01.000	**Filter bandwidth:**	1/3-octave
Initial calibration level:		**Instrument sensitivity:**	-26.4 dB	**End calibration level:**	



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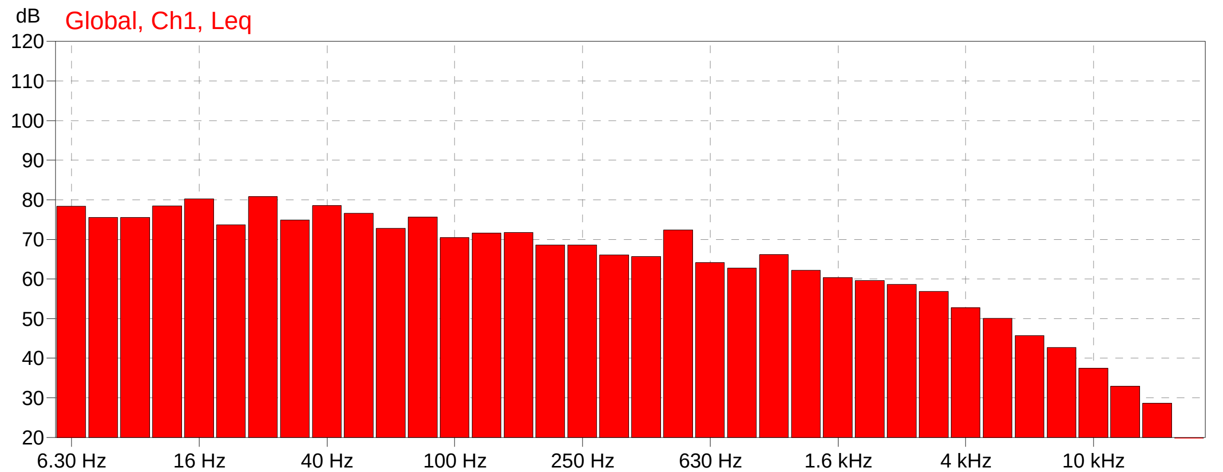

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LE (dB)	Lpeak (dB)	LF(TM5) (dB)
A	74.4 dB	80.7 dB	69.5 dB	99.1 dB	93.3 dB	
C	84.9 dB	91.2 dB	80.3 dB	109.7 dB	101.1 dB	
FRQ						
6.30 Hz	78.3 dB	87.2 dB	59.4 dB	103.1 dB		
8 Hz	75.6 dB	84.7 dB	59.9 dB	100.3 dB		
10 Hz	75.6 dB	83.6 dB	61.1 dB	100.3 dB		
12.5 Hz	78.4 dB	87.0 dB	63.3 dB	103.2 dB		
16 Hz	80.3 dB	87.3 dB	68.5 dB	105.0 dB		
20 Hz	73.7 dB	80.9 dB	62.3 dB	98.5 dB		
25 Hz	80.8 dB	87.2 dB	69.9 dB	105.6 dB		
31.5 Hz	74.9 dB	82.0 dB	65.2 dB	99.7 dB		
40 Hz	78.5 dB	87.1 dB	70.2 dB	103.3 dB		
50 Hz	76.6 dB	87.4 dB	63.8 dB	101.4 dB		
63 Hz	72.8 dB	83.9 dB	62.7 dB	97.6 dB		
80 Hz	75.6 dB	84.7 dB	66.0 dB	100.4 dB		
100 Hz	70.5 dB	85.4 dB	62.4 dB	95.2 dB		
125 Hz	71.6 dB	89.3 dB	61.1 dB	96.4 dB		
160 Hz	71.8 dB	84.4 dB	63.0 dB	96.5 dB		
200 Hz	68.6 dB	79.8 dB	60.8 dB	93.4 dB		
250 Hz	68.6 dB	79.7 dB	61.9 dB	93.3 dB		
315 Hz	66.0 dB	75.1 dB	60.3 dB	90.8 dB		
400 Hz	65.7 dB	74.4 dB	60.5 dB	90.5 dB		
500 Hz	72.4 dB	78.1 dB	63.7 dB	97.2 dB		
630 Hz	64.2 dB	73.3 dB	59.3 dB	88.9 dB		
800 Hz	62.8 dB	71.6 dB	57.3 dB	87.6 dB		
1 kHz	66.2 dB	72.7 dB	58.6 dB	91.0 dB		
1.25 kHz	62.2 dB	70.6 dB	56.6 dB	87.0 dB		
1.6 kHz	60.4 dB	69.7 dB	54.4 dB	85.2 dB		
2 kHz	59.6 dB	68.2 dB	53.1 dB	84.3 dB		
2.5 kHz	58.6 dB	70.3 dB	51.3 dB	83.4 dB		
3.15 kHz	56.9 dB	78.5 dB	48.7 dB	81.7 dB		
4 kHz	52.8 dB	63.4 dB	46.9 dB	77.6 dB		
5 kHz	50.0 dB	61.2 dB	43.7 dB	74.8 dB		
6.3 kHz	45.7 dB	59.0 dB	38.8 dB	70.5 dB		
8 kHz	42.8 dB	51.8 dB	37.4 dB	67.5 dB		
10 kHz	37.5 dB	48.9 dB	31.0 dB	62.2 dB		
12.5 kHz	33.0 dB	43.3 dB	28.2 dB	57.8 dB		
16 kHz	28.7 dB	40.3 dB	21.8 dB	53.4 dB		
20 kHz	19.3 dB	36.3 dB	12.9 dB	44.0 dB		

 10. 3. 2009 18:28:42

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Customer:

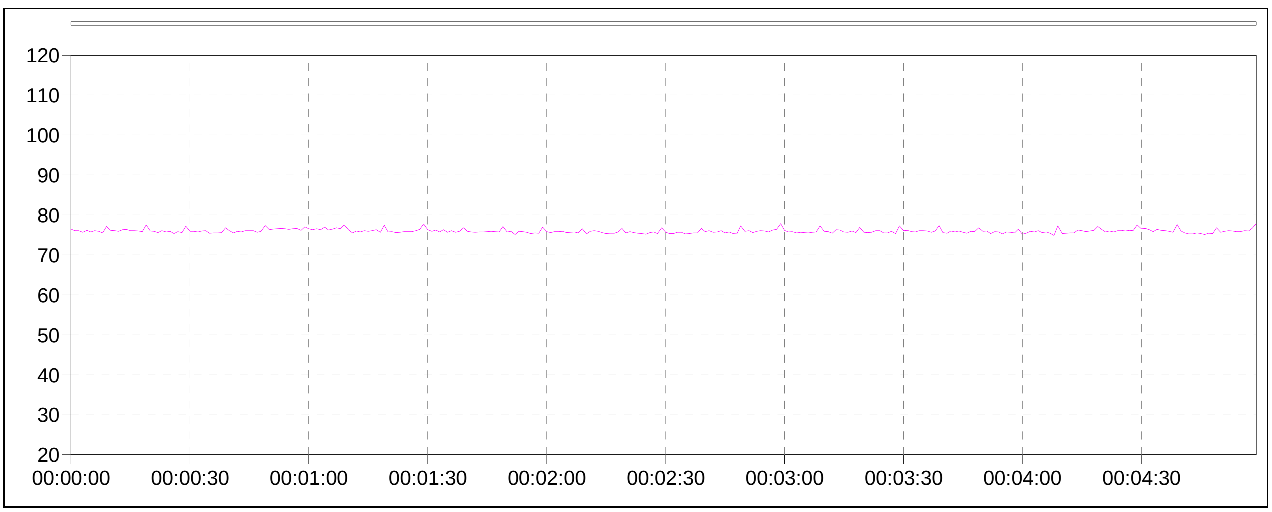
QUINN CEMENT

Project title: N4	
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type: Nor140	**Serial no:**
Preamflifier type:	**Serial no:**
Microphone type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:		**Operator:**
Measurement title: NOR140_8204585_090310_0004		**Date:** 10/03/2009 14:47:02
Measurement duration: 0 00:05:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:	**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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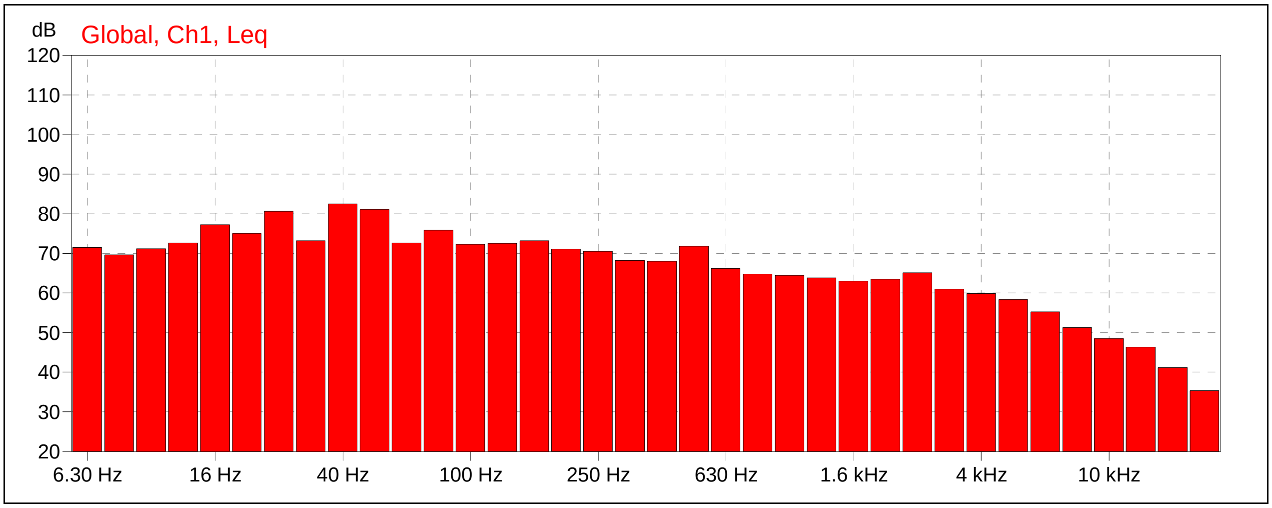

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LE (dB)	Lpeak (dB)	LF(TM5) (dB)
A	76.0 dB	81.7 dB	74.5 dB	100.8 dB	99.5 dB	
C	86.8 dB	94.3 dB	82.3 dB	111.6 dB	102.7 dB	
FRQ						
6.30 Hz	71.5 dB	81.5 dB	51.8 dB	96.3 dB		
8 Hz	69.6 dB	78.4 dB	52.5 dB	94.4 dB		
10 Hz	71.2 dB	79.8 dB	53.0 dB	95.9 dB		
12.5 Hz	72.7 dB	80.4 dB	58.7 dB	97.4 dB		
16 Hz	77.2 dB	84.5 dB	63.4 dB	102.0 dB		
20 Hz	75.0 dB	82.5 dB	65.2 dB	99.8 dB		
25 Hz	80.6 dB	87.4 dB	69.3 dB	105.4 dB		
31.5 Hz	73.2 dB	88.7 dB	61.9 dB	98.0 dB		
40 Hz	82.5 dB	92.4 dB	68.5 dB	107.3 dB		
50 Hz	81.1 dB	91.2 dB	66.1 dB	105.8 dB		
63 Hz	72.7 dB	77.5 dB	65.8 dB	97.4 dB		
80 Hz	75.8 dB	81.0 dB	67.9 dB	100.6 dB		
100 Hz	72.3 dB	77.8 dB	65.0 dB	97.1 dB		
125 Hz	72.6 dB	78.2 dB	66.6 dB	97.4 dB		
160 Hz	73.2 dB	77.5 dB	67.5 dB	98.0 dB		
200 Hz	71.1 dB	75.4 dB	66.7 dB	95.9 dB		
250 Hz	70.5 dB	73.9 dB	66.2 dB	95.3 dB		
315 Hz	68.2 dB	71.8 dB	64.5 dB	92.9 dB		
400 Hz	68.0 dB	71.9 dB	64.0 dB	92.8 dB		
500 Hz	71.8 dB	76.7 dB	66.2 dB	96.6 dB		
630 Hz	66.1 dB	68.8 dB	63.1 dB	90.9 dB		
800 Hz	64.8 dB	68.5 dB	62.3 dB	89.6 dB		
1 kHz	64.5 dB	67.1 dB	62.1 dB	89.2 dB		
1.25 kHz	63.9 dB	66.7 dB	61.3 dB	88.7 dB		
1.6 kHz	63.0 dB	69.0 dB	60.7 dB	87.8 dB		
2 kHz	63.4 dB	73.4 dB	60.4 dB	88.2 dB		
2.5 kHz	65.1 dB	74.0 dB	60.4 dB	89.9 dB		
3.15 kHz	61.0 dB	73.3 dB	57.2 dB	85.7 dB		
4 kHz	59.8 dB	72.1 dB	56.1 dB	84.6 dB		
5 kHz	58.3 dB	69.8 dB	53.9 dB	83.1 dB		
6.3 kHz	55.3 dB	67.3 dB	51.6 dB	80.0 dB		
8 kHz	51.2 dB	64.5 dB	47.6 dB	76.0 dB		
10 kHz	48.5 dB	62.4 dB	45.1 dB	73.2 dB		
12.5 kHz	46.4 dB	56.2 dB	41.6 dB	71.1 dB		
16 kHz	41.2 dB	53.3 dB	36.5 dB	65.9 dB		
20 kHz	35.4 dB	46.7 dB	30.7 dB	60.1 dB		

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Customer:

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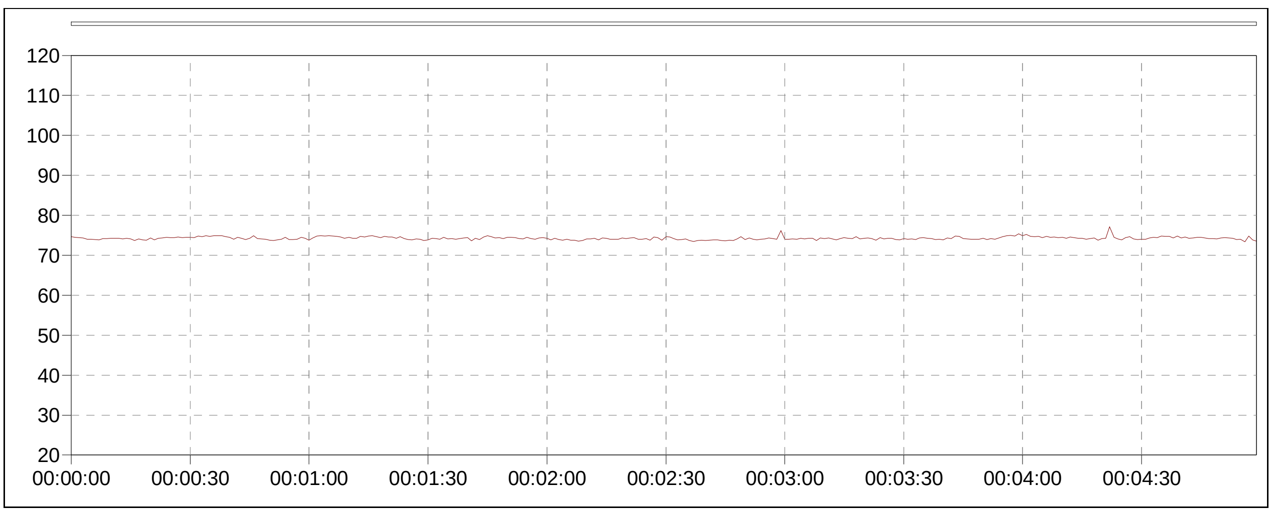
Project title:	N5	
Project description:		
Notes:		
Project file-name:		**Project responsible:**

Instrument type:	Nor140	**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:			**Operator:**
Measurement title:	NOR140_8204585_090310_0005		**Date:** 10/03/2009 14:54:18
Measurement duration:	0 00:05:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:		**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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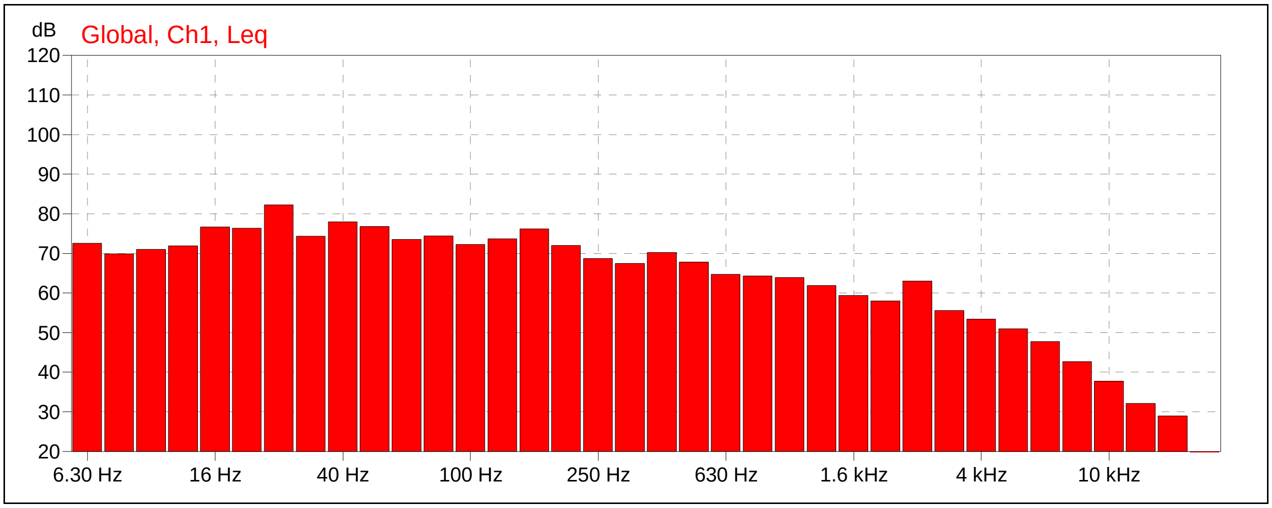

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LE (dB)	Lpeak (dB)	LF(TM5) (dB)
A	74.3 dB	79.9 dB	72.9 dB	99.0 dB	92.3 dB	
C	85.4 dB	89.9 dB	82.4 dB	110.2 dB	99.5 dB	
FRQ						
6.30 Hz	72.6 dB	81.4 dB	49.3 dB	97.3 dB		
8 Hz	69.9 dB	78.6 dB	54.4 dB	94.6 dB		
10 Hz	71.0 dB	79.6 dB	55.8 dB	95.8 dB		
12.5 Hz	71.9 dB	80.2 dB	57.2 dB	96.6 dB		
16 Hz	76.7 dB	83.2 dB	59.6 dB	101.5 dB		
20 Hz	76.4 dB	84.2 dB	65.8 dB	101.2 dB		
25 Hz	82.2 dB	88.9 dB	67.7 dB	107.0 dB		
31.5 Hz	74.3 dB	80.9 dB	63.6 dB	99.1 dB		
40 Hz	78.0 dB	87.2 dB	67.4 dB	102.7 dB		
50 Hz	76.7 dB	86.4 dB	66.1 dB	101.5 dB		
63 Hz	73.5 dB	78.8 dB	64.5 dB	98.2 dB		
80 Hz	74.4 dB	79.7 dB	67.5 dB	99.2 dB		
100 Hz	72.2 dB	78.4 dB	66.0 dB	97.0 dB		
125 Hz	73.7 dB	77.9 dB	68.5 dB	98.5 dB		
160 Hz	76.2 dB	81.2 dB	70.0 dB	101.0 dB		
200 Hz	72.0 dB	75.3 dB	67.7 dB	96.7 dB		
250 Hz	68.7 dB	73.1 dB	64.1 dB	93.5 dB		
315 Hz	67.4 dB	75.4 dB	63.4 dB	92.2 dB		
400 Hz	70.2 dB	74.4 dB	64.9 dB	95.0 dB		
500 Hz	67.8 dB	71.7 dB	63.5 dB	92.6 dB		
630 Hz	64.7 dB	67.7 dB	61.5 dB	89.5 dB		
800 Hz	64.3 dB	68.1 dB	60.4 dB	89.1 dB		
1 kHz	63.9 dB	69.8 dB	60.7 dB	88.7 dB		
1.25 kHz	61.9 dB	69.2 dB	59.0 dB	86.7 dB		
1.6 kHz	59.4 dB	70.1 dB	57.5 dB	84.2 dB		
2 kHz	58.0 dB	69.4 dB	56.0 dB	82.8 dB		
2.5 kHz	63.0 dB	69.1 dB	57.7 dB	87.8 dB		
3.15 kHz	55.6 dB	68.3 dB	53.6 dB	80.4 dB		
4 kHz	53.4 dB	69.7 dB	51.3 dB	78.2 dB		
5 kHz	51.0 dB	68.0 dB	48.7 dB	75.8 dB		
6.3 kHz	47.7 dB	65.5 dB	45.4 dB	72.5 dB		
8 kHz	42.6 dB	63.8 dB	40.4 dB	67.4 dB		
10 kHz	37.7 dB	61.4 dB	35.0 dB	62.4 dB		
12.5 kHz	32.1 dB	57.5 dB	28.7 dB	56.9 dB		
16 kHz	29.0 dB	52.4 dB	24.3 dB	53.7 dB		
20 kHz	19.1 dB	44.4 dB	14.6 dB	43.9 dB		

10. 3. 2009 18:29:11

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Customer:

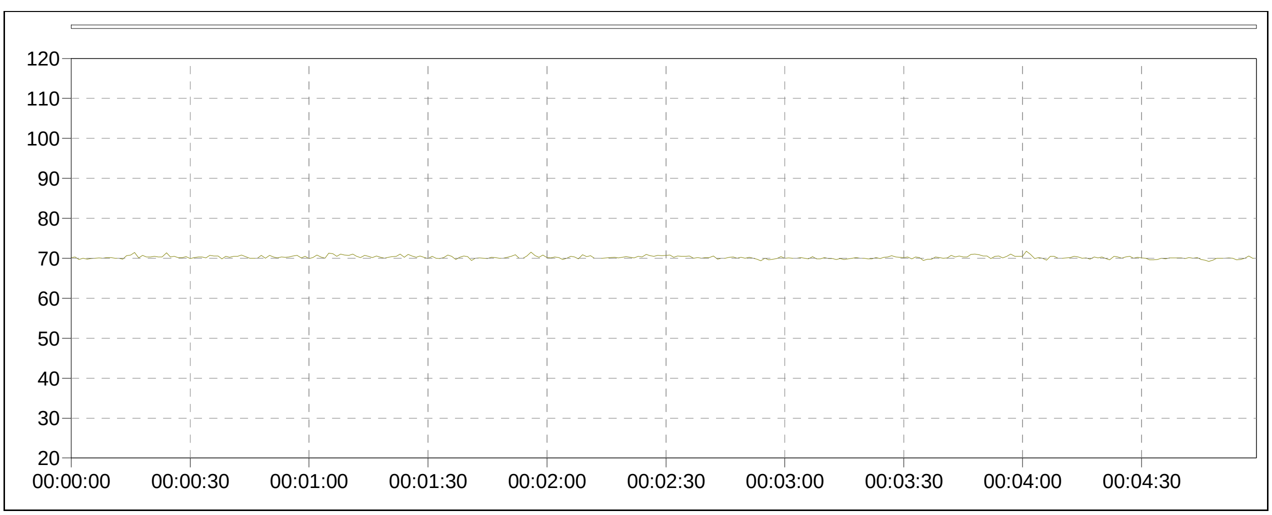
QUINN CEMENT

Project title: N6	
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type: Nor140	**Serial no:**
Preamflifier type:	**Serial no:**
Microphone type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:		**Operator:**
Measurement title: NOR140_8204585_090310_0006		**Date:** 10/03/2009 15:00:11
Measurement duration: 0 00:05:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:	**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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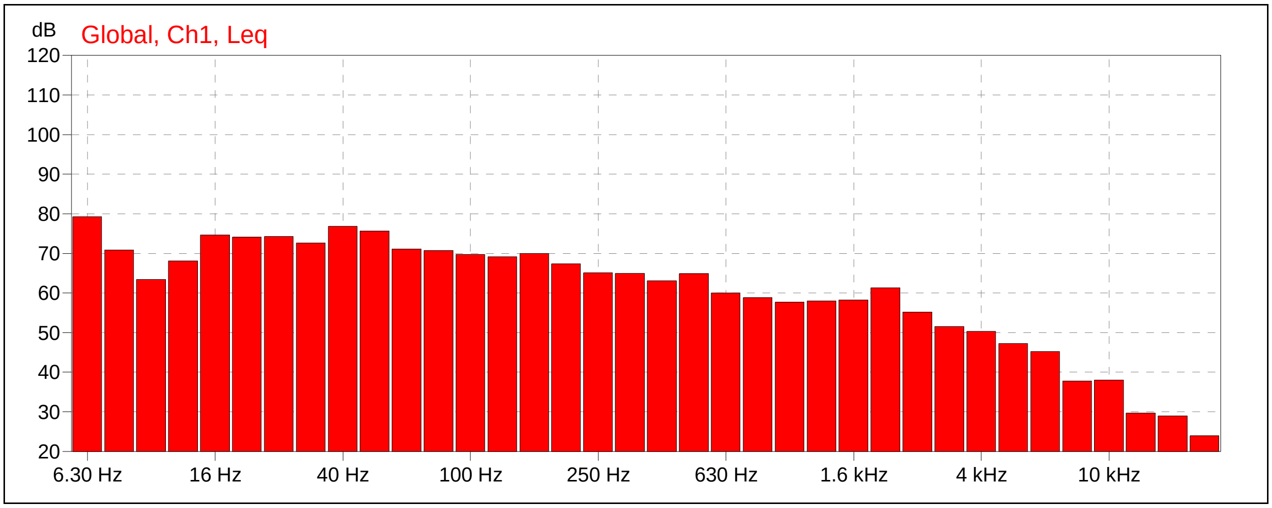

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LE (dB)	Lpeak (dB)	LF(TM5) (dB)
A	70.3 dB	72.7 dB	68.7 dB	95.0 dB	86.2 dB	
C	82.0 dB	85.7 dB	79.1 dB	106.8 dB	95.8 dB	
FRQ						
6.30 Hz	79.3 dB	85.1 dB	65.9 dB	104.0 dB		
8 Hz	70.8 dB	80.4 dB	54.3 dB	95.6 dB		
10 Hz	63.4 dB	71.8 dB	50.2 dB	88.2 dB		
12.5 Hz	68.1 dB	75.8 dB	54.7 dB	92.9 dB		
16 Hz	74.6 dB	81.2 dB	60.8 dB	99.4 dB		
20 Hz	74.1 dB	81.5 dB	60.7 dB	98.9 dB		
25 Hz	74.3 dB	81.4 dB	62.3 dB	99.1 dB		
31.5 Hz	72.6 dB	80.0 dB	61.8 dB	97.4 dB		
40 Hz	76.8 dB	84.8 dB	65.5 dB	101.6 dB		
50 Hz	75.6 dB	82.6 dB	64.9 dB	100.4 dB		
63 Hz	71.0 dB	76.6 dB	64.5 dB	95.8 dB		
80 Hz	70.7 dB	75.7 dB	63.5 dB	95.4 dB		
100 Hz	69.7 dB	75.0 dB	63.2 dB	94.5 dB		
125 Hz	69.1 dB	74.8 dB	62.3 dB	93.9 dB		
160 Hz	70.0 dB	74.7 dB	63.7 dB	94.7 dB		
200 Hz	67.4 dB	71.8 dB	62.4 dB	92.1 dB		
250 Hz	65.2 dB	69.0 dB	61.3 dB	90.0 dB		
315 Hz	65.0 dB	68.9 dB	60.7 dB	89.7 dB		
400 Hz	63.1 dB	66.3 dB	59.0 dB	87.9 dB		
500 Hz	64.9 dB	69.5 dB	59.6 dB	89.6 dB		
630 Hz	60.1 dB	63.4 dB	57.2 dB	84.8 dB		
800 Hz	58.8 dB	63.9 dB	55.9 dB	83.6 dB		
1 kHz	57.7 dB	60.1 dB	55.1 dB	82.5 dB		
1.25 kHz	58.0 dB	61.2 dB	55.2 dB	82.8 dB		
1.6 kHz	58.2 dB	60.8 dB	55.6 dB	83.0 dB		
2 kHz	61.3 dB	68.6 dB	56.1 dB	86.1 dB		
2.5 kHz	55.2 dB	61.7 dB	52.0 dB	80.0 dB		
3.15 kHz	51.6 dB	56.0 dB	48.3 dB	76.4 dB		
4 kHz	50.3 dB	57.1 dB	46.0 dB	75.1 dB		
5 kHz	47.2 dB	54.1 dB	44.2 dB	72.0 dB		
6.3 kHz	45.2 dB	50.9 dB	41.7 dB	70.0 dB		
8 kHz	37.9 dB	46.1 dB	35.0 dB	62.6 dB		
10 kHz	38.1 dB	41.1 dB	35.9 dB	62.9 dB		
12.5 kHz	29.7 dB	37.6 dB	27.6 dB	54.5 dB		
16 kHz	29.0 dB	33.3 dB	26.3 dB	53.8 dB		
20 kHz	23.9 dB	31.9 dB	20.4 dB	48.7 dB		

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Customer:

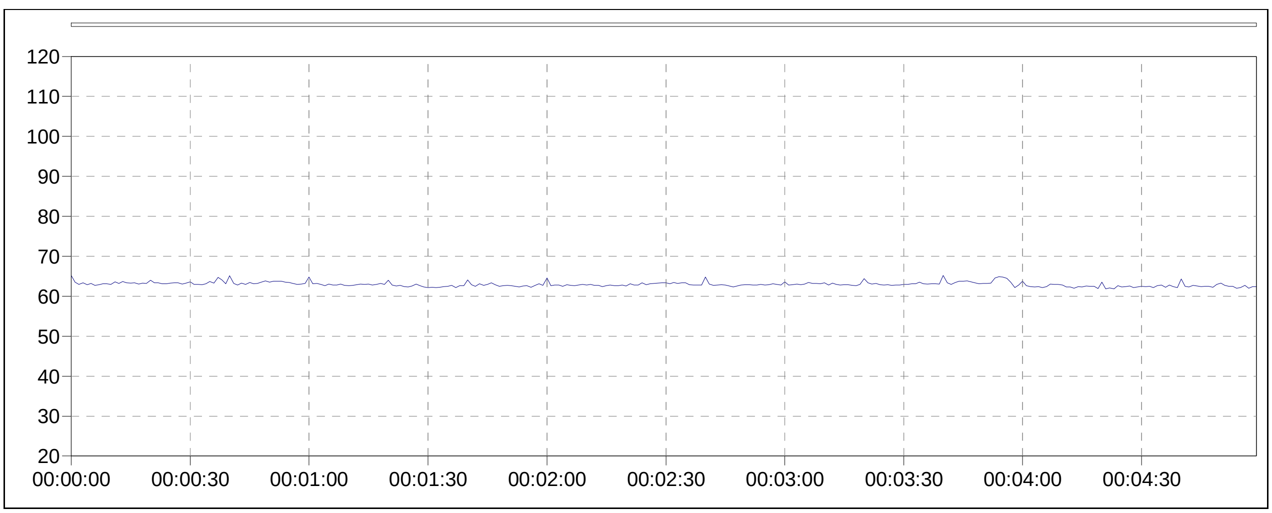
QUINN CEMENT

Project title:	N7
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type: Nor140		**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:		**Operator:**
Measurement title: NOR140_8204585_090310_0007		**Date:** 10/03/2009 15:07:36
Measurement duration: 0 00:05:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:** 1/3-octave
Initial calibration level:	**Instrument sensitivity:** -26.4 dB	**End calibration level:**



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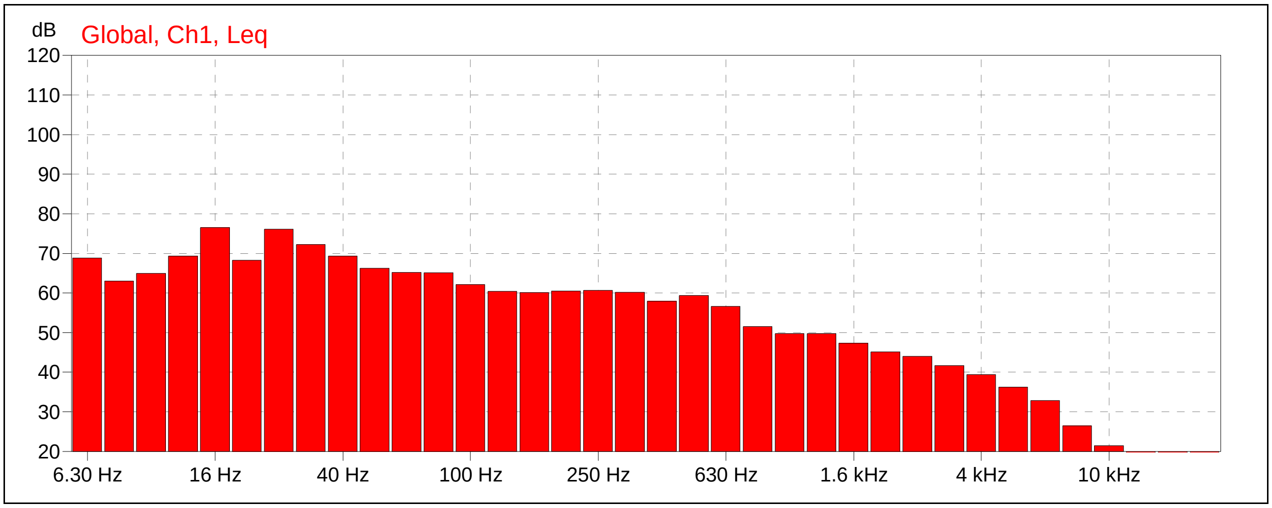

	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LE (dB)	Lpeak (dB)	LF(TM5) (dB)
A	63.0 dB	67.0 dB	61.2 dB	87.8 dB	79.8 dB	
C	77.5 dB	85.2 dB	73.7 dB	102.3 dB	96.4 dB	
FRQ						
6.30 Hz	68.8 dB	76.1 dB	53.7 dB	93.6 dB		
8 Hz	63.1 dB	71.3 dB	46.2 dB	87.8 dB		
10 Hz	64.9 dB	73.0 dB	49.6 dB	89.7 dB		
12.5 Hz	69.3 dB	78.5 dB	54.2 dB	94.1 dB		
16 Hz	76.5 dB	89.0 dB	59.1 dB	101.3 dB		
20 Hz	68.2 dB	75.5 dB	58.4 dB	93.0 dB		
25 Hz	76.1 dB	80.9 dB	63.9 dB	100.8 dB		
31.5 Hz	72.2 dB	79.9 dB	62.5 dB	97.0 dB		
40 Hz	69.3 dB	76.7 dB	61.4 dB	94.1 dB		
50 Hz	66.3 dB	77.5 dB	57.1 dB	91.1 dB		
63 Hz	65.2 dB	79.6 dB	55.5 dB	90.0 dB		
80 Hz	65.1 dB	81.5 dB	56.3 dB	89.9 dB		
100 Hz	62.1 dB	69.1 dB	55.5 dB	86.8 dB		
125 Hz	60.4 dB	65.9 dB	54.7 dB	85.2 dB		
160 Hz	60.1 dB	66.5 dB	55.0 dB	84.9 dB		
200 Hz	60.5 dB	65.0 dB	55.5 dB	85.3 dB		
250 Hz	60.6 dB	67.4 dB	56.2 dB	85.4 dB		
315 Hz	60.2 dB	63.9 dB	55.6 dB	85.0 dB		
400 Hz	57.9 dB	61.4 dB	53.9 dB	82.7 dB		
500 Hz	59.3 dB	63.1 dB	55.0 dB	84.1 dB		
630 Hz	56.6 dB	60.6 dB	51.2 dB	81.4 dB		
800 Hz	51.5 dB	56.9 dB	48.8 dB	76.3 dB		
1 kHz	49.7 dB	56.0 dB	47.1 dB	74.5 dB		
1.25 kHz	49.7 dB	56.0 dB	46.2 dB	74.5 dB		
1.6 kHz	47.3 dB	55.8 dB	44.1 dB	72.1 dB		
2 kHz	45.2 dB	55.7 dB	41.5 dB	70.0 dB		
2.5 kHz	44.0 dB	57.0 dB	39.8 dB	68.8 dB		
3.15 kHz	41.7 dB	57.5 dB	36.6 dB	66.5 dB		
4 kHz	39.4 dB	55.7 dB	32.8 dB	64.2 dB		
5 kHz	36.3 dB	53.7 dB	28.5 dB	61.0 dB		
6.3 kHz	32.9 dB	52.9 dB	22.8 dB	57.7 dB		
8 kHz	26.5 dB	44.1 dB	17.0 dB	51.2 dB		
10 kHz	21.5 dB	40.8 dB	9.7 dB	46.2 dB		
12.5 kHz	17.2 dB	36.8 dB	6.4 dB	42.0 dB		
16 kHz	14.4 dB	36.4 dB	5.0 dB	39.2 dB		
20 kHz	12.6 dB	34.8 dB	5.8 dB	37.4 dB		

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Customer:

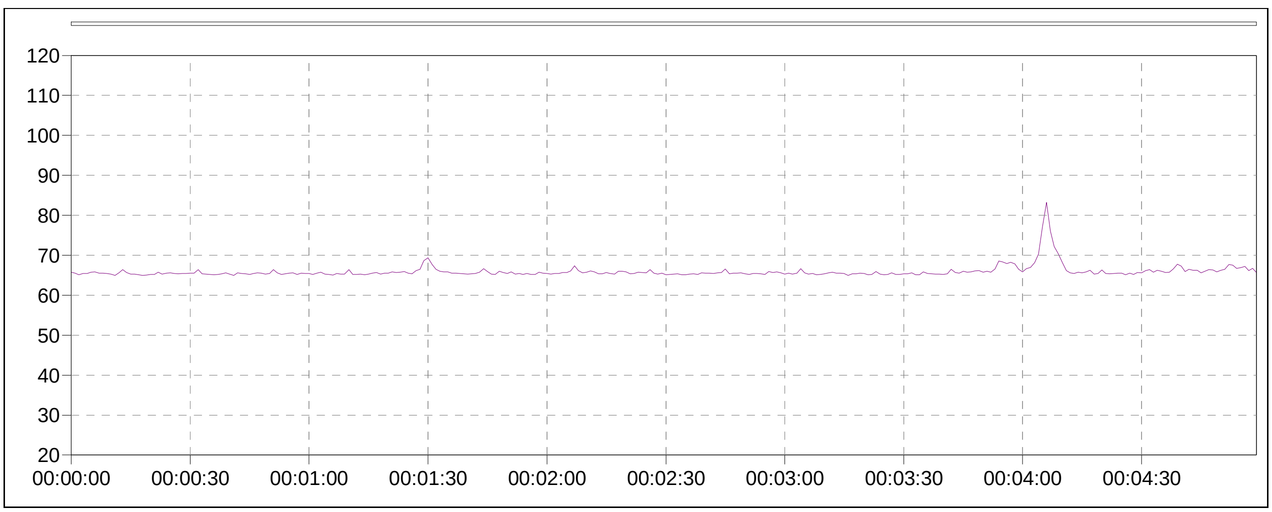
QUINN CEMENT

Project title:	N8
Project description:	
Notes:	
Project file-name:	**Project responsible:**

Instrument type:	Nor140	**Serial no:**
Preamflifier type:		**Serial no:**
Microphone type:		**Serial no:**
Traceable periodic laboratory verification by:		
Date of last verification:		

Calibrator type:	**Serial no:**
Traceable periodic laboratory verification by:	
Date of last verification:	

Microphone position:		**Operator:**	
Measurement title: NOR140_8204585_090310_0008		**Date:**	10/03/2009 15:14:12
Measurement duration: 0 00:05:00.000	**Period length:** 0 00:00:01.000	**Filter bandwidth:**	1/3-octave
Initial calibration level:	**Instrument sensitivity:** -26.4 dB	**End calibration level:**	



Norsonic AS
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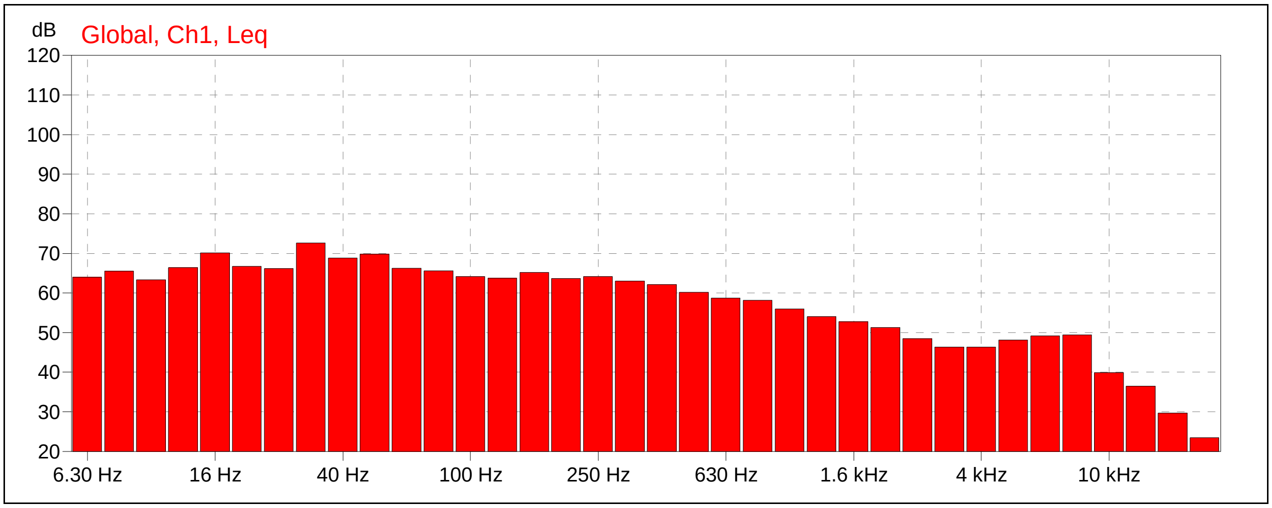


	Leq (dB)	LF(max) (dB)	LF(min) (dB)	LE (dB)	Lpeak (dB)	LF(TM5) (dB)
A	66.8 dB	85.3 dB	64.2 dB	91.6 dB	98.5 dB	
C	77.3 dB	87.4 dB	73.8 dB	102.0 dB	98.9 dB	
FRQ						
6.30 Hz	64.0 dB	75.2 dB	43.3 dB	88.7 dB		
8 Hz	65.5 dB	76.1 dB	48.0 dB	90.3 dB		
10 Hz	63.3 dB	74.3 dB	48.0 dB	88.1 dB		
12.5 Hz	66.4 dB	74.7 dB	51.6 dB	91.2 dB		
16 Hz	70.2 dB	80.3 dB	56.7 dB	94.9 dB		
20 Hz	66.7 dB	74.8 dB	54.2 dB	91.5 dB		
25 Hz	66.2 dB	75.5 dB	54.6 dB	90.9 dB		
31.5 Hz	72.7 dB	80.5 dB	61.8 dB	97.4 dB		
40 Hz	68.9 dB	83.6 dB	60.0 dB	93.7 dB		
50 Hz	69.8 dB	88.1 dB	58.1 dB	94.5 dB		
63 Hz	66.3 dB	75.7 dB	57.2 dB	91.1 dB		
80 Hz	65.6 dB	74.7 dB	57.2 dB	90.3 dB		
100 Hz	64.1 dB	72.0 dB	57.7 dB	88.9 dB		
125 Hz	63.8 dB	70.0 dB	58.7 dB	88.6 dB		
160 Hz	65.2 dB	76.4 dB	59.5 dB	90.0 dB		
200 Hz	63.6 dB	71.3 dB	58.7 dB	88.4 dB		
250 Hz	64.2 dB	72.2 dB	59.3 dB	88.9 dB		
315 Hz	63.0 dB	74.6 dB	58.8 dB	87.8 dB		
400 Hz	62.1 dB	71.7 dB	58.4 dB	86.9 dB		
500 Hz	60.2 dB	74.6 dB	56.5 dB	85.0 dB		
630 Hz	58.7 dB	79.4 dB	54.3 dB	83.5 dB		
800 Hz	58.1 dB	80.6 dB	52.4 dB	82.9 dB		
1 kHz	56.0 dB	75.9 dB	49.9 dB	80.7 dB		
1.25 kHz	54.1 dB	72.5 dB	48.6 dB	78.8 dB		
1.6 kHz	52.8 dB	70.7 dB	48.0 dB	77.5 dB		
2 kHz	51.2 dB	69.7 dB	45.3 dB	76.0 dB		
2.5 kHz	48.4 dB	68.3 dB	43.0 dB	73.2 dB		
3.15 kHz	46.4 dB	67.3 dB	40.4 dB	71.2 dB		
4 kHz	46.3 dB	68.8 dB	39.2 dB	71.1 dB		
5 kHz	48.1 dB	74.2 dB	37.4 dB	72.9 dB		
6.3 kHz	49.2 dB	76.4 dB	34.9 dB	73.9 dB		
8 kHz	49.4 dB	72.1 dB	39.5 dB	74.2 dB		
10 kHz	39.9 dB	67.7 dB	23.8 dB	64.6 dB		
12.5 kHz	36.5 dB	64.3 dB	17.6 dB	61.3 dB		
16 kHz	29.7 dB	57.1 dB	13.4 dB	54.5 dB		
20 kHz	23.5 dB	51.1 dB	8.6 dB	48.2 dB		

10. 3. 2009 18:30:49

Appendix C

Calibration Certification

Certificate of Calibration

Certificate No.: 1400289

Object	Sound Analyser Nor-140
Supplier	Norsonic AS
Type	Nor140
Serial number	1402988
Client	White Young Green Environmental ENGLAND

Calibration complies with the following standard(s)

IEC 61672-1:2002 class 1
IEC 60651 type 1
IEC 60804 type 1
IEC 61260 class 1
ANSI S1.4-1983 (R2001) with amd. S1.4A-1985 class 1
ANSI S1.43-1997 (R2002) class 1
ANSI S1.11-2004 class 1
DIN 45 657, Applicable parts
Norsonic production standard set for the Nor-140

Instrumentation used for calibration traceable to

Electrical Parameters: MT, Norway
Acoustical Parameters: PTB, Germany
Environmental Parameters: IKM, Norway. Justervesenet. Norway

Adjustments None

Comments None

Date of calibration	**Calibration interval recommended**
18.10.2007	2 years

The environmental parameters applicable to this calibration are kept well within limits ensuring negligible deviation on obtained measurement results.

Calibrated by
Hien Van Le Thanh

Sign. HienVan

Norsonic
LIERSKOGEN, NORWAY

Norsonic AS, P.B 24, 3421 Lierskogen. Visitor address: Gunnersbråtan 2, Tranby, Norway.
Phone +47 32858900 Fax.: +47 32852208. email: norsonic@online.no

Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Equipment Details

Instrument Manufacturer	Cirrus Research plc
Instrument Type	Acoustic Calibrator
Model Number	CR:513A
Serial Number	029805

Calibration Procedure

The acoustic calibrator detailed above has been calibrated to the published data as described in the operating manual. The procedures and techniques used to follow the recommendations of the IEC standard Electroacoustics – Sound Calibrators IEC 60942:2003, IEC 60942:1997, BS EN 60942:1998 and BS EN 60942:2003 where applicable.. The calibrator's main output is 94.00 dB (1 Pa) and this was set within the 0.01 dB resolution of the test system, i.e. one hundredth of a decibel. Numbers in {parenthesis} refer to the paragraph in IEC 60942.

Calibration Traceability

The calibrator above was calibrated against the calibration laboratory standards held by Cirrus Research plc. These are traceable to International Standards {A.0.6}. The standards are:

Microphone Type	B&K4180	Serial Number	1893453	Calibration Ref. S 5505
Pistonphone Type	B&K4220	Serial Number	613843	Calibration Ref. S 5423

Calibration Climate Conditions

The climatic test conditions were all maintained within the permitted limits of IEC 60942:1997.

Temperature	{B.3.2}	Permitted band 15°C to 25°C
Humidity	{B.3.2}	Permitted band 30% to 90% RH
Static Pressure	{B.3.2}	Permitted band 85 kPa to 105 kPa
Ambient Noise Level	{B.3.3.6}	Max permitted level 64 dB(Z)

Measurement Results

The figures below are the Calibration Laboratory test limits for this model calibrator and have a smaller tolerance than those permitted in IEC 60942.

94 dB Output	93.98	dB	Permitted band	93.95 to 94.05 dB
104 dB Output	103.93	dB	Permitted band	103.80 to 104.30 dB
Frequency	1006	Hz	Permitted band	990 to 1010 Hz

Uncertainty

With an uncertainty coefficient of k=2, i.e. a 95% confidence level, the uncertainty of each measure is

94 dB Output	± 0.13 dB	104 dB Output	± 0.14 dB
Frequency	± 0.1 Hz	Level Stability	± 0.04 dB

Calibrated by T. A. Goodhil

Calibration Date 15 September 2008

Calibration Certificate Number 163183

This Calibration Certificate is valid for 12 months from the date above.

Cirrus Research plc, Acoustic House, Bridlington Road, Hunmanby, North Yorkshire, YO14 0PH
Telephone: +44 (0) 1723 891655 Fax: +44 (0) 1723 891742
Email: sales@cirrusresearch.co.uk

Appendix D

Glossary of Noise Terminology

GLOSSARY OF NOISE TERMINOLOGY

Air Over pressure
Intensity of pressure wave caused by blasting, expressed as dB(Lin).

Ambient Noise
Totally encompassing sound in a given situation at a given time usually composed of a sound from many sources near and far.

Background noise level
The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using time weighting F, and quoted to the nearest whole number of decibels.

Day: Night:
0800 hrs to 2200 hrs: 2200 hrs to 0800hrs

Decibel (dB)
The unit of sound pressure level, calculated as a logarithm of the intensity of sound. 0 dB is the threshold of hearing, 140 dB is the threshold of pain. A change of 1 dB is detectable only under laboratory conditions. A change of 10 dB corresponds approximately to halving or doubling the loudness of sound.

dB(A)
Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sound of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with peoples assessment of loudness.

dB(Lin) max peak
Instantaneous Maximum Peak Sound pressure level measured in decibels on a sound level meter, without the use of a frequency weighting system.

Hertz (Hz)
Unit of frequency (pitch) of a sound.

Impulsive Noise
A noise which is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.

1/3 Octave band analysis
Frequency analysis of sound such that the frequency spectrum is sub divided into bands of one third of an octave each. An octave is taken to be the frequency interval, the upper limit of which is twice the lower limit (in Hertz).

L(A)eq
Equivalent Continuous A-weighted Sound Level. The continuous steady noise level, which would have the same total A-weighted acoustic energy as the real fluctuating noise measured over the same period of time.

L(A)10
The noise level that is equaled or exceeded for 10% of the measurement period.

L(A)90
The noise level that is equaled or exceeded for 90% of the measurement period.

Noise
Unwanted sound. Any sound which has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it, or any sound which has the potential to cause actual physiological harm to a subject exposed to it or physical damage to any structure exposed to it, is known as noise.

Noise Sensitive Receptor
A noise sensitive receptor is regarded as any dwelling house, hotel or hostel, health building, educational establishment, places of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

Peak Particle Velocity
The rate of change of displacement of the particles in a solid medium. It is the term usually used to describe vibration in relation to activities involving blasting. Velocity will vary from zero to a maximum value – the peak particle velocity, and the units used are millimeters per second.

Rating level L,ArTr
The specific noise level plus any adjustment for the characteristic features of the noise.

Residual Noise
The ambient noise remaining at a given position in a given situation when the specific noise source is suppressed to a degree such that it does not contribute to the ambient noise.

Sound Power
The energy output from a source. It is measured in Watts (W).

Specific Noise source
The noise source under investigation for assessing the likelihood of complaint.

Tone
A noise with a narrow frequency composition.

Vibration
Regularly repeated movement about a fixed point.

Report to:
Quarryplan,
Chartered Quarrying Consultants,
Crossgar,
Co. Down

May 2009

ECOLOGICAL ASSESSMENT OF LAND AND THE PROPOSED PART REPLACEMENT OF COAL WITH SRF AT THE SCOTCHTOWN CEMENT PLANT, NEAR BALLYCONNELL, Co CAVAN.

ANDREWS WARD
ASSOCIATES
CONSULTANT ECOLOGISTS

SUITE 3 THE PODS,
SALMON PARADE,,
BRIDGWATER, TA6 5JT
Tel 01278 429290
www.awaecology.co.uk

ECOLOGICAL ASSESSMENT OF LAND AND THE PART REPLACEMENT OF COAL WITH SRF AT THE SCOTCHTOWN CEMENT PLANT, NEAR BALLYCONNELL, CO. CAVAN

1. SUMMARY

1.1.1 This report presents the results of an ecological assessment of land within and adjacent to the Quinn Cement Ltd cement processing plant at Scotchtown, north of Ballyconnell, Co. Cavan, undertaken in 2005 and applies the data, updated as necessary in 2009, to a proposal to modify the existing consented works to enable the use of Solid Recovered Fuel.

1.1.2 The 2005 survey recorded plant species and habitat structure and used the findings to predict the importance of the site for fauna.

1.1.3 The survey site contained a number of different habitat types. As well as the operational works it included ornamental landscaping, scrub, semi-improved pasture, parkland, mature hedgerows, the derelict Slieve Russell House and various water-bodies.

1.1.4 The plant communities within the site comprised common and widespread species. In the operational area there was minimal plant cover except in landscaped beds.

1.1.5 The age and condition of the habitats present indicated that the invertebrate fauna will consist of widespread and common species. A single large pond in the eastern sector of the site might hold fish but no uncommon fish occur in ponds of this nature. No uncommon amphibian species or reptiles were predicted to occur.

1.1.6 The site was considered to be unlikely to hold any uncommon bird species but the derelict Slieve Russell House and various mature trees were potentially suitable for roosting bats.. All bat species and their roost sites have full legal protection. No evidence was found of use of the site by badgers.

1.1.7 Based on the survey and evaluation, the site was assessed as having low ecological value, with the caveat that if bats were present, it would be of moderate value.

1.1.8 The application envisages new construction works entirely within the developed footprint of the existing consented plant site. Assessment in 2009 found that there had been no significant change in this area. Thus the development has no impact on semi-natural habitats or on important flora or fauna. The result of the specific air dispersion modeling indicate that there will be no exceedances of air quality standards as a result of the proposed alteration of fuel source and therefore the proposal will have no negative ecological effects within the existing site curtilage or within the extended environs.

2. BACKGROUND

2.1.1 Quinn Cement Ltd wish to modify their existing consented plant at Scotchtown, north of Ballyconnell, Co. Cavan to enable the use of Solid Recovered Fuel and reduce their reliance on coal. In order to assess the ecological implications of this, reference has been made to survey in 2005, updated as necessary in 2009.

2.1.2 Drawing QNS/001, next page, shows within the red line the existing consented area. Ecological survey in 2005 extended outside this boundary. The footprint of the proposed alterations to the site that are the subject of the current application are shown in green and lie wholly within the developed part of the works site.

2.1.2 Andrews Ward Associates carried out the survey and the current assessment. Andrews Ward Associates is an independent ecological consultancy with extensive experience of habitat assessment and management, working with conservation agencies, academic, commercial and industrial clients in the U.K. and overseas.

3. METHODS OF ASSESSMENT

3.1.1 The wildlife value of the existing habitats in the survey area was evaluated on a national and local basis applying established principles, for example as set out in *Nature conservation in Environmental Assessment* (Ramsey 1994) and *Guidelines for Baseline Ecological Assessment* (Institute of Environmental Assessment 1995).

3.1.2 Citations for statutory wildlife sites in the locality were obtained from the Heritage Council. In addition, information on nearby statutory sites in County Fermanagh was obtained from the Environment and Heritage Service, Northern Ireland.

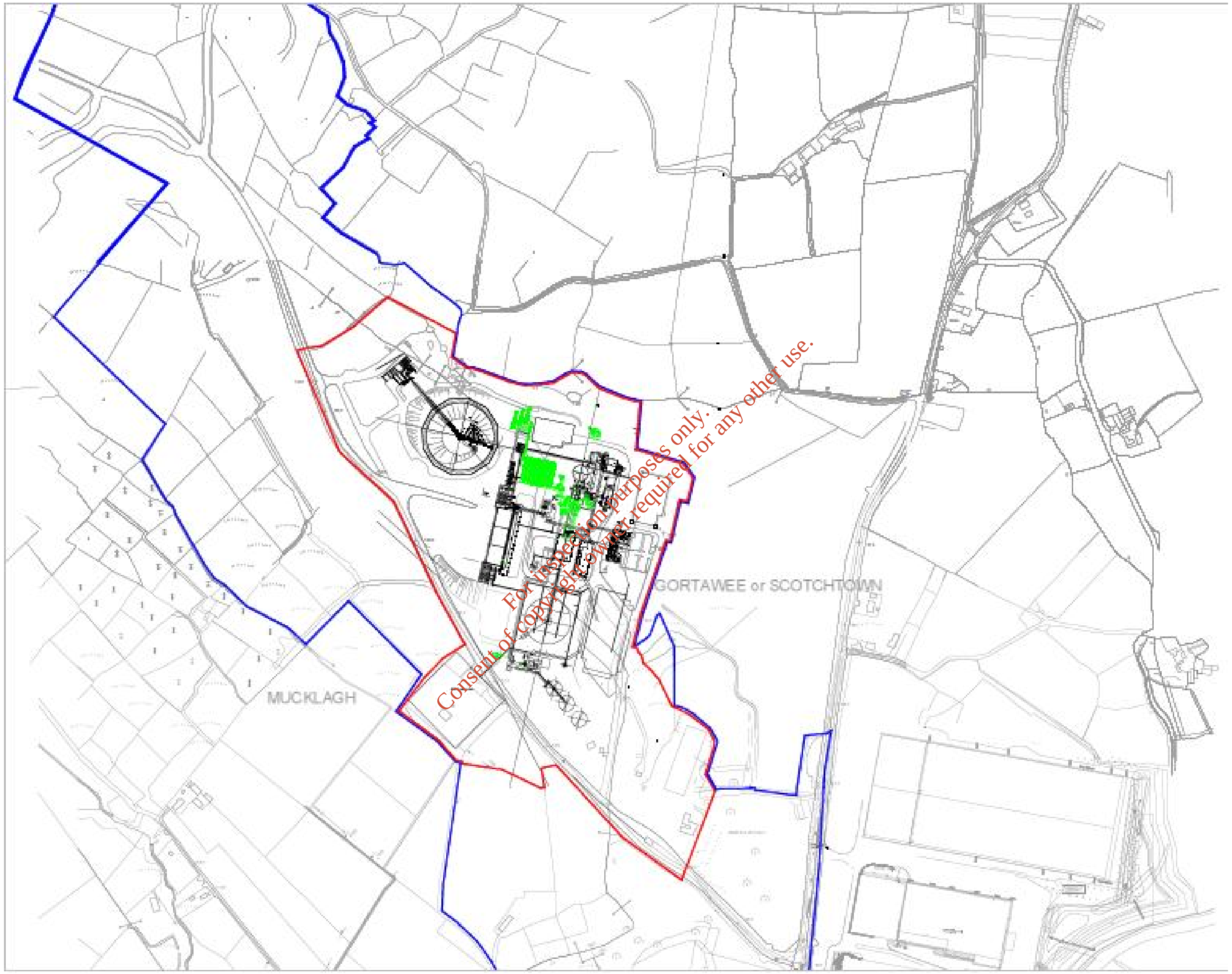
3.1.3 None of the application site lies within a designated Natural Heritage Area, Special Area of Conservation (SAC) or Special Protection Area (SPA). Mullinacre Upper (Site Code 0009) is a Natural Heritage Area lying approximately 1 km north-west of the application site. This is a moorland site overlying shale and with a fairly intact bog surface. To the south-east there are two proposed Natural Heritage Areas, Annagh Lough (Site Code 0974) and Lough Oughter and Associated Loughs (Site Code 0007), both wetland ecosystems.

3.1.4 There are also two designated Areas of Special Scientific Interest nearby in county Fermanagh. One is Moninea Bog, a raised bog which is also a candidate SAC, and is located approximately 2 km to the east. The other is Killymackan Lough, a botanically-rich lake and fen, some 5 km eastward. It is part of the Upper Lough Erne SPA, Ramsar site and cSAC.

3.1.5 The site was surveyed by Henry Andrews on 27th & 28th October 2005. Plant species and habitat structure were recorded and used to predict the importance of the site for fauna. A list of all plant species noted is given at Appendix A.

3.1.6 Due to the timing of this survey some species such as spring annual plants may have been missed. However, there were no areas of undisturbed ground or unusual habitat types that might potentially hold uncommon species and there is little likelihood that the area will have been colonized by uncommon species from the surrounding landscape. It is therefore considered that the survey was adequate to assess the probable ecological importance of the site.

3.1.7 The survey has been updated as necessary in 2009.


GORTAWEE or SCOTCHTOWN
MUCKLAGH

4. SITE CHARACTER & CONTEXT

4.1.1 The site is a cement processing plant located directly to the north of Ballyconnell, Co, Cavan. On its northern boundary the site abuts the Quinn Group Ltd quarry complex, while to the south and west are fields of pasture of varying quality with small amounts of broad-leaved woodland and to the east is improved parkland with the R205 beyond.

4.1.2 The site is located in an area of pastoral agriculture with plantation woodland, mineral extraction and large industrial units.

5. HABITATS & PLANTS

5.1 General

5.1.1 The site centres on the cement plant with large concrete hoppers, processing units, covered conveyors, storage areas both covered and open, office buildings, roads and landscaped plantings. Around it, there are various ponds, pasture, remnant hedgerows, mature trees and the large derelict Slieve Russell House.

5.2 Cement plant

5.2.1 The operational areas of the cement plant are well maintained and for the most part entirely bare of vegetation; thus botanical interest is limited to ornamental beds flanking the plant entrance at the R205, with landscaped road verges and a single ornamental hedge within the administrational area and associated car park .

5.2.2 Beds on either side of the plant entrance contain wall cotoneaster *Cotoneaster horizontalis*, laurustinus *Viburnum tinus*, cypress sp., dogwood *Cornus sanguinea*, Norway maple *Acer platanoides*, holly *Ilex aquifolium*, silver birch *Betula pendula*, rowan *Sorbus aucuparia*, hawthorn *Crataegus monogyna* and gorse *Ulex europaeus* with what appears to be 'goldheart' ivy *Hedera helix*. Scattered specimens of sapling goat willow *Salix caprea*, eared willow *Salix aurita* and sycamore *Acer pseudoplatanus* are also present with many casual colonists of bare ground in the form of bramble *Rubus fruticosus* agg., common ragwort *Senecio jacobaea*, creeping thistle *Cirsium arvense*, spear thistle *Cirsium vulgare*, prickly sow-thistle *Sonchus asper*, rosebay *Chamerion angustifolium*, broad-leaved willowherb *Epilobium montanum*, herb-Robert *Geranium robertianum*, colt's-foot *Tussilago farfara*, cat's-ear *Hypochaeris radicata*, dandelion *Taraxacum officinale*, groundsel *Senecio vulgaris*, daisy *Bellis perennis*, pineappleweed *Matricaria discoidea*, shepherd's-purse *Capsella bursa-pastoris*, yarrow *Achillea millefolium*, common mouse-ear *Cerastium fontanum*, sticky mouse-ear *Cerastium glomeratum*, wavy bittercress *Cardamine flexuosa*, creeping buttercup *Ranunculus repens*, ribwort plantain *Plantago lanceolata*, greater plantain *Plantago major*, knotgrass *Polygonum aviculare*, procumbent pearlwort *Sagina procumbens*, marsh cudweed *Gnaphalium uliginosum*, soft rush *Juncus effusus* and toad rush *Juncus bufonis* agg.. Grass species present include annual meadow-grass *Poa annua*, cock's-foot *Dactylis glomerata*, Yorkshire-fog *Holcus lanatus*, sweet vernal-grass *Anthoxanthum odoratum* and red fescue *Festuca rubra* with white moss *Leucobryum glaucum* noted on exposed stones.

5.2.3 A short distance from the entrance the road widens to incorporate the weigh-bridge and associated offices. At this point the verges either side hold several large mature standards of beech *Fagus sylvatica*, horse-chestnut *Aesculus hippocastanum*, sessile oak *Quercus petraea* and a heavily-ivied sycamore over smaller silver birch, hawthorn and rowan. The ground layer is a sparse combination of abundant herb-Robert with soft shield-fern *Polystichum setiferum* and small amounts of neat moss *Scleropodium purum*.

5.2.4 Beyond the weigh-bridge the road forks both north and east. The eastern leg continues into the storage and administrational areas with the main office complex. The verge here contains single species blocks of silver birch, rowan, dogwood etc. The office parking areas are marked by a hedge of cherry-laurel *Prunus laurocerasus* with several small pedunculate oak *Quercus robur*. There is also a large mature oak next to the office block.

5.2.5 The northern leg of the access road proceeds up into the operational areas of the plant and is flanked on the eastern side by large blocks of sapling ash *Fraxinus excelsior*, birch and dogwood in a state of reversion and thus described under the heading of 'scrub'.

5.2.6 The production plant area contains built structures, concrete hard standing and running surfaces. There is minimal vegetation cover. The area proposed for the new facilities holds very small amounts of primary colonist species such as the common grasses and plants with windborne seeds such as colt’s-foot (see Photos 1 and 2 next page).

5.2.7 Perimeter areas on the western, northern and eastern sides of the plant contain various small stands of gorse and soft rush within a rough grass sward of cock's-foot, Yorkshire-fog, sweet vernal-grass, creeping bent *Agrostis stolonifera* and velvet bent *Agrostis canina* with curled dock *Rumex crispus*, common sorrel *Rumex acetosa*, creeping buttercup, meadow buttercup *Ranunculus acris*, common vetch *Vicia sativa*, red clover *Trifolium pratense*, redshank *Persicaria maculosa*, hairy sedge *Carex hirta* and bulbous rush *Juncus bulbosus*. There are fragments of hedgerows containing mature and often heavily ivied hawthorn and holly with small specimens of sycamore. These areas are often thick with bramble and stinging nettle *Urtica dioica* with broad-leaved dock *Rumex obtusifolius*.

5.2.8 Gravel areas where plant vehicles turn and park are for the most part bare with only creeping thistle, colt's-foot, groundsel and annual meadow-grass noted. Perimeter areas, such as the fenceline of the electricity sub-station in the western sector, contain sometimes dense goat willow. The shallow, and for the most part heavily silted, track-side drains hold little botanical interest save floating sweet-grass *Glyceria fluitans* in permanently damp areas.

Photo 1. Showing the location proposed for the plant site modifications

Photo 2. Plant cover comprises common colonist species in small amounts

5.2.9 Several moderately large and in places steeply-sloping banks within the western sector of the complex, which originated as landscape plantation, are reverting to a scrub character due both to lack of maintenance and the underlying hydrology. These areas contain a mixture of young ash and silver birch with goat willow, eared willow, hawthorn and gorse over a rough sward including soft rush, sharp-flowered rush *Juncus acutiflorus*, tufted hair-grass *Deschampsia cespitosa* and creeping bent with wild angelica *Angelica sylvestris*, meadowsweet *Filipendula ulmaria*, ragged robin *Lychnis flos-cuculi*, common knapweed *Centaurea nigra* agg., tormentil *Potentilla erecta*, carnation sedge *Carex panicea* and glaucous sedge *Carex flacca*. Single species planting, entirely of dogwood, appears to be resisting colonisation by weed species due to the shade cast by the dense foliage. Also in this area, separating two tracks, is a raised earth bank holding a dense sward of gorse and bramble, perforate St John's-wort *Hypericum perforatum*, great horsetail *Equisetum telmateia* and meadow vetchling *Lathyrus pratensis* among common species already listed.

5.2.10 In the higher northern-most areas the sward is of a more natural composition, dominated by dense gorse with two small mature pedunculate oaks, over species previously listed.

5.3 Pasture

5.3.1 On the western side of the plant access road there still remain fragments of the original rough pastures of Yorkshire-fog, creeping bent and sweet vernal-grass. Although the area is grazed by a small herd of cattle there is much gorse, alder *Alnus glutinosa* and eared willow invasion. Soft rush is abundant with frequent common knapweed, creeping thistle, smooth sow-thistle *Sonchus oleraceus*, curled dock, bush vetch *Vicia sepium*, white clover *Trifolium repens*, creeping buttercup, self-heal *Prunella vulgaris*, colt's-foot and ribwort plantain. The ground slopes away to the west and south on a moderately steep gradient and on the boundary edge there is a dense band of 6 m tall alder scrub with bramble, foxglove *Digitalis purpurea*, yellow pimpernel *Lysimachia nemorum*, remote sedge *Carex remota* and ordinary moss *Brachythecium rutabulum*.

5.3.2 Fields to the south of the plant, either side of the entrance and to the east are of improved grass pasture. The dominant species present are Yorkshire-fog, perennial ryegrass *Lolium perenne*, crested dog's-tail *Cynosurus cristatus* and common bent *Agrostis capillaris* with white clover, red clover, selfheal, creeping buttercup, common chickweed *Stellaria media*, common mouse-ear, wavy bittercress, lesser stitchwort *Stellaria graminea* and dandelion. Additional species noted include common ragwort, creeping thistle, spear thistle, rough sow-thistle, broad-leaved dock, hogweed *Heracleum sphondylium*, burdock *Arctium minus*, stinging nettle and soft rush. Mouse-ear hawkweed *Pilosella officinarum*, autumn hawkbit *Leontodon autumnalis* and lady's-bedstraw *Galium verum* were noted within turf dominated by lawn moss *Rhytidiadelphus squarrosus* on the slopes immediately to the south-east of the Sieve Russell House.

5.4 Hedges

5.4.1 Above the plant on the northern boundary there is a small stand of Scots pine *Pinus sylvestris* within an area of hedgerow remnants of hazel *Corylus avellana*, holly, dog rose *Rosa canina*, blackthorn *Prunus spinosa* and ivied goat willow with bramble. This connects with a mature hedgerow on a low earth bank which, combined with a deeply incised but only damp drain, marks the northern boundary of the survey site.

5.4.2 The hedgerow is both tall and leggy and would not be stock-proof without its integral post and wire fence. The primary hedgerow species is hazel with sapling beech and ash, holly, hawthorn, rowan and small pedunculate oak. The hedge understorey holds ivy, bracken *Pteridium aquilinum*, soft shield-fern, male fern *Dryopteris filix-mas*, scaly male fern *Dryopteris affinis*, broad buckler-fern *Dryopteris dilatata*, violet *Viola* sp., herb-Robert and abundant wild strawberry *Fragaria vesca*. The drain itself held no new species but abundant meadowsweet, wild angelica and slender St John's-wort *Hypericum pulchrum* were noted on the surrounding damp ground. The hedge holds many small dead beech standards and mid-way down its length there is a particularly large and heavily-ivied pedunculate oak which holds much dead wood with cracks and crevices.

5.4.3 The only other length of hedge is in the south-east sector of the site. This hedgerow also consists of a low earth bank but topped with well-spaced mature pedunculate oaks, two of which are heavily ivied, over smaller beech, silver birch, holly, snowberry *Symphoricarpos albus*, gorse and bramble with ivy, herb-Robert, greater stitchwort *Stellaria holostea* and broad buckler-fern.

5.4.4 Remaining field boundaries are of post and wire.

5.5 Trees

5.5.1 Within pasture fields to the east are several scattered specimens of sessile oak, whilst in the fields surrounding Slieve Russell House there are stands of beech, sycamore and horse-chestnut with pedunculate oak, yew *Taxus baccata*, silver fir *Abies alba* and a single probable veteran small-leaved lime *Tilia cordata* which has polypody *Polypodium vulgare* growing on several of the larger limbs.

5.6 Ponds

5.6.1 In the farthest northern corner of the site there is a complex of many small interconnected drainage/settlement ponds, the largest of which is approximately 60 m^2 in surface diameter, which take run-off from the adjacent processing areas via a narrow and shallow drain no more than 1 m wide by 1 m deep and on the day of survey carrying just a trickle of water. The ponds range from holding up to 0.3 m depth of standing water, through entirely silted but holding no surface vegetation to densely vegetated with soft rush and tufted hair-grass. None of the ponds holds any aquatic vegetation.

5.6.2 Mid-way on the steeply sloping northern boundary is a far larger settlement pond which takes the overflow run-off from the ponds above. This pond is approximately 140 m² and appears permanent. The banks are steep and on the higher northern side are up to 3 m. On the day of survey the pond held approximately 0.3 m depth of water and will only hold a maximum of 0.5 m before the overflow drains via a piped culvert. Aquatic species present consist of a large stand of branched bur-reed *Sparganium erectum* and another of bulrush *Typha latifolia* with brooklime *Veronica beccabunga* and much soft and sharp-flowered rush with tufted hair-grass and yellow sedge *Carex viridula* subsp. *oedocarpa*. Amongst common species already listed were abundant field horse-tail *Equisteum arvense*, tufted vetch *Vicia cracca*, creeping cinquefoil *Potentilla reptans* and silverweed *Potentilla anserina*.

5.6.3 The final and largest of all the ponds lies within the improved eastern pasture in a wooded dell. Though a wide path runs down to the eastern edge from the north-western corner through a dense patch of gorse, the pond is inaccessible on the entire northern bank, due to the impenetrable vegetation of goat willow, eared willow, gorse, bramble and bracken. The southern bank holds many large mature specimens of beech, holly, rowan, sycamore, Scots pine, larch *Larix decidua*, silver birch and pedunculate oak over an open sward including wood sorrel *Oxalis acetosella*, foxglove, herb-Robert and remote sedge. A surface film combined with a covering of fallen leaves made the maximum depth impossible to gauge, nor could aquatic vegetation be recorded. The bank is accessible to grazing cattle in the eastern corner and the ground is heavily poached with much pale persicaria *Persicaria lapathifolia* whilst damp areas on the western edge hold reed canary-grass *Phalaris arundinacea*, bulrush, brooklime and abundant floating sweet-grass with bittersweet *Solanum dulcamara* and marsh thistle *Cirsium palustris* noted in higher areas. The western end of the pond is immediately below the access road and storage areas of the operational plant and is supported by block stone boulders, bare of vegetation, with a piped culvert opening into the pond beneath.

5.7 Slieve Russell House

5.7.1 Slieve Russell House is in the south-east of the site within parkland pasture and visible from the R205 and plant access road. The house has been unoccupied for many years and is now derelict. In many areas substantial portions of the roof have fallen in, but there are still some areas where the eaves, roof and loft spaces are sound. There is no cellar. Hartstongue *Phyllitis scolopendrium* was noted on floor beams within one of the rooms at the front of the house.

5.7.2 Part of the immediate grounds hold cattle pens and much of the ground is heavily poached but the remaining areas hold a well-grazed grass sward with stands of rhododendron *Rhododendron ponticum* with Hooker's barberry *Berberis hookeri*, holly, sycamore, ash, an unidentified rose *Rosa* sp., raspberry *Rubus idaeus*, male fern and cleavers *Galium aparine* with much stinging nettle.

6. FAUNA

6.1 Invertebrates

6.1.1 The diversity of invertebrate species that can potentially occur in any site is enormous and even extensive survey effort can do no more than sample a limited number of groups. As the distribution and abundance of many species are little known and as their habitat requirements are often not known except in the most general terms, the data collected may be of limited value in determining whether a site is important and, if so, how it should be managed. Upland invertebrates are particularly poorly studied. However, several general principles apply. First, there is the greatest probability of finding rare species in sites that contain habitats that are themselves uncommon or restricted in distribution. Second, such sites need to have long historic continuity of management to minimise the probability of species having been lost due to changes in conditions. Third, sites with abundant nectar-producing plants usually support many more species than sites where such plants are scarce or absent. Applying these general principles to this site, the habitats are not uncommon but very widespread in the locality so that it is unlikely to hold species that are not generally present in the area. Management continuity within the application area can be predicted to be erratic and overall the site is poor in nectar plants. On balance, it is concluded that there is only a low probability of the site holding species which are important in the context of Ireland.

6.2 Fish

6.2.1 The small ponds in the north of the site will not hold fish due to their temporary nature and poor, heavily-silted, water quality from hard-standing run-off. The large pond on the eastern boundary is permanent and would appear to be of some age, thus may well hold fish, though no visual inspection could be made during this survey due to surface film and fallen leaves. However, there are no grounds to predict the presence of uncommon fish species anywhere within the site.

6.3 Amphibians and reptiles

6.3.1 Smooth newt *Triturus vulgaris* use the full range of water bodies and are frequently colonisers of the shallow edges of lakes (Bullock and Oldham 1998). They are frequently found in small ponds and will tolerate both the presence of fish and periodical drying out. The species prefers waterbodies with a diversity of submerged and emergent vegetation giving approximately 25% cover, while water bodies that are deep with a surface area of over 100 m² are far less favoured. Thus the size of the largest pond on the eastern boundary make it sub-optimal. Although the smaller ponds in the north of the site, with their surrounding rough grass sward, would appear superficially suitable their isolated situation and the poor water quality, heavy in silt, make the presence of breeding smooth newt unlikely and thus it is predicted that the species will not occur here.

6.3.2 It is likely that common frog *Rana temporaria* will be present as a breeding species in the waterbodies present within the site.

6.3.3 The presence of common lizard *Zootoca vivipara* is considered unlikely. The species is known to require topographically diverse ground, with dense but short vegetation to 0.5 m, preferably free from pesticide application, that is open to the sun, with nearby scrub cover for both foraging and refuge from predators (Beebee and Griffiths 2000). The species is known not to occur on closely grazed improved pasture. The location of the site, the lack of basking areas, the dense shade of the close canopy scrub, the small amount of suitable foraging habitat and the predominantly damp nature of the site, combine with the sparse and distinctly coastal distribution of the species in Ireland, to make its existence within the site improbable.

6.4 Birds

6.4.1 Improved grassland supports a very limited breeding bird assemblage. Depending on grazing intensity, skylark *Alauda arvensis* may occur and a number of other common species including Corvids, starling *Sturnus vulgaris* and blackbird *Turdus merula* may feed. A colony of jackdaws *Corvus monedula* was making use of the roof space in the Slieve Russell House.

6.4.2 Other species that may be predicted to be present are typical of hedges with trees and include wood pigeon *Columba palumbus*, stock dove *Columba oenas*, blackbird *Turdus merula*, dunnock *Prunella modularis*, robin *Erithecus rubecula*, wren *Troglodytes troglodytes*, blue tit *Parus caerulea*, great tit *Parus major*, magpie *Pica pica*, whitethroat *Sylvia communis* and chaffinch *Fringilla coelebs.* Goldfinches *Carduelis carduelis* were noted in the pond-side trees. All are common and widespread.

6.4.3 The large pond will undoubtedly draw in waterfowl such as mallard *Anas platyrhynchos*. Moorhen *Gallinula chloropus* may also be present.

6.5 Mammals

6.5.1 The grassland and heath areas will hold common small mammal species. There was no evidence within the site to suggest the presence of badgers *Meles meles* such as latrines, tracks, pathways etc. However a juvenile badger was recorded dead on the R205 a short distance north of the site and thus it is considered possible that the species could colonise the site at some point in the future. A fox *Vulpes vulpes* was noted in the Slieve Russell House.

6.5.2 Many of the native species of bats in Ireland use the roof spacing in houses as roosting sites. Bats favour well maintained structures as they possess a more stable microclimate important for roosting particularly in maternity and hibernation sites. The Slieve Russell House has been unoccupied and without maintenance for some time. Almost all the windows are broken, the roof has several large holes and in many areas the ceiling has entirely fallen in leaving the loft space open to the elements. This makes the presence of a large roost of any species unlikely and the suitability of the house as a maternity/hibernation site sub-optimal. However, parts of the roof and eaves are sound and it is possible, given the fidelity of many house roosting species to traditional sites, that the Slieve Russell House is still utilised by bats during the summer months.

6.5.3 There are many mature trees within the site, such as those in the southern parkland, either side of the weigh-bridge, in the area of the large pond on the eastern boundary and a single large oak on the northern boundary that are of medium/high roost potential due to their size and age. Many hold cavities and cracks visible from the ground and some also hold a thick covering of ivy. The rough, damp pasture in the west of the site, the hedgerows in the north and east with the large pond provide excellent foraging habitat for a number of species.

6.5.4 All bat species and their roost sites are fully protected under the *Wildlife Act 1976 (as amended).*

6.5.5 It is unlikely, though not impossible, that a large modern office building within the plant complex may be used by roosting bats, such as pipistrelle *Pipistrellus pipistrelleus*, within cavities in the roof and eaves. However, no evidence of use by bats was observed from the ground. The remaining processing and storage structures are unlikely to hold bat roosts due to the methods of construction which, being primarily of block concrete, does not leave cracks and crevices suitable for bats. The remaining warehouses have roofs of corrugated steel, which does not provide the stable microclimate bats favour.

7. IMPACTS & EFFECTS

7.1 Habitat loss

7.1.1 The proposal is for alteration to the existing operational cement plant area and entails no loss of habitat..

7.2 Human and Noise Disturbance

7.2.1 Wild animals are potentially susceptible to disturbance by human presence and by noise, either of which may deny them the opportunity to use otherwise suitable habitat for feeding or breeding and in extreme cases cause desertion of occupied breeding sites. It also causes needless expenditure of energy and may expose them to increased risk of predation. However, many show a degree of tolerance of human presence (Hockin *et al* 1992) and all species that occur in the vicinity of quarry processing plants will co-exist with occasional or frequent human activity.

7.2.2 There are no studies measuring the effect on birds or mammals of the noise of quarry processing operations. Study of the effects of traffic on waders and other birds breeding in grasslands (Zande *et al* 1980, Reijnen *et al* 1996) concluded that traffic noise reduced the numbers of pairs of some species of birds attempting to breed on adjacent land. Similarly, studies indicate that some woodland bird species are affected by traffic noise (Reijnen *et al* 1995). However, all studies found that the effect reduced with distance and was associated with trunk roads and sustained high levels of noise.

7.2.3 The works necessary to modify the plant and the change of use in fuel type are not predicted to have an effect on fauna as the plant already operates on a 24 hour programme and production noise from the plant is constant..

7.3 Air Emissions

7.3.1 The application envisages new construction works entirely within the developed footprint of the existing consented plant site, however, the introduction of the Solid Recovered Fuel into the Cement Manufacturing process by way of an alternative to Coal will see burning of the fuel and therefore the potential for emissions outside the extent of the existing industrial curtilage.

7.3.2 The result of the specific air dispersion modeling undertaken by White Young Green and presented in Section 17 (Appendix 2) of the full document indicates that there will be no exceedances of air quality standards as a result of the proposed alteration of fuel source.

7.3.3 Therefore the proposal will have no negative ecological effects within the existing site curtilage or within the extended environs.

7.4 Effects on designated sites

7.4.1 There is no potential for direct effects on designated sites in the locality, either in County Cavan or County Fermanagh, as all are at sufficient distance from the plant (the nearest being 1 km to the north-west) to be outside the range of influence.

7.4.2 Assuming compliance with the appropriate emission standards, there are no known grounds to assume any significant negative offsite effects.

8. CONCLUSIONS

8.1.1 The proposed alterations to the cement plant to enable the use of Solid Recovered Fuel will have no significant negative ecological effects in the local or the wider context of the site.

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APPENDIX A.
PLANT SPECIES AT SCOTCHTOWN CEMENT PLANT

Abies alba	Silver fir
Acer platanoides	Norway maple
Acer pseudoplatanus	Sycamore
Achillea millefolium	Yarrow
Aesculus hippocastanum	Horse chestnut
Agrostis canina	Velvet bent
Agrostis capillaris	Common bent
Agrostis stolonifera	Creeping bent
Alnus glutinosa	Alder
Angelica sylvestris	Wild angelica
Anthoxanthum odoratum	Sweet vernal-grass
Arctium minus agg.	Burdock
Bellis perennis	Daisy
Berberis hookeri	Hooker's barberry
Betula pendula	Silver birch
Brachythecium rutabulum	Ordinary moss
Buddleja davidii	Buddleia
Capsella bursa-pastoris	Shepherd's-purse
Cardamine flexuosa	Wavy bitter-cress
Carex flacca	Glaucous sedge
Carex hirta	Hairy sedge
Carex panicea	Carnation sedge
Carex remota	Remote sedge
Carex viridula	Yellow sedge
Centaurea nigra	Common knapweed
Cerastium fontanum	Common mouse-ear
Cerastium glomeratum	Sticky mouse-ear
Chamerion angustifolium	Rosebay
Cirsium arvense	Creeping thistle
Cirsium palustre	Marsh thistle
Cirsium vulgare	Spear thistle
Cornus sanguinea	Dogwood
Corylus avellana	Hazel
Cotoneaster horizontalis	Wall cotoneaster
Crataegus monogyna	Hawthorn
Cynosurus cristatus	Crested dog's-tail
Dactylis glomerata	Cock's-foot
Deschampsia cespitosa	Tufted hair-grass
Digitalis purpurea	Foxglove
Dryopteris affinis	Scaly male-fern
Dryopteris dilatata	Broad buckler-fern
Dryopteris filis-mas	Male fern
Epilobium montanum	Broad-leaved willowherb
Equisetum arvense	Field horsetail
Equisetum telmateia	Great horsetail
Fagus sylvatica	Beech
Festuca rubra	Red fescue
Filipendula ulmaria	Meadowsweet
Fraxinus excelsior	Ash
Frageria vesca	Wild strawberry
Galium aparine	Cleavers
Galium verum	Ladies bedstraw
Geranium robertianum	Herb-Robert
Glyceria fluitans	Floating sweet-grass
Gnaphalium uliginosum	Marsh cudweed
Hedera helix	Ivy

Heracleum sphondylium	Hogweed
Holcus lanatus	Yorkshire-fog
Hypericum perforatum	Perforate St John’s-wort
Hypericum pulchrum	Slender St John's-wort
Hypochaeris radicata	Common cat’s-ear
Ilex aquifolium	Holly
Juncus acutiflorus	Sharp-flowered rush
Juncus bufonius	Toad rush
Juncus bulbosus	Bulbous rush
Juncus effusus	Soft rush
Larix decidua	European larch
Lathyrus pratensis	Meadow vetchling
Leucobryum glaucum	White moss
Lolium perenne	Perennial rye-grass
Lychnis flos-cuculi	Ragged-Robin
Matricaria discoidea	Pineappleweed
Oxalis acetosella	Wood-sorrel
Persicaria lapathifolia	Pale persicaria
Persicaria maculosa	Redshank
Phalaris arundinacea	Reed canary-grass
Pilosella officinarum	Mouse-ear hawkweed
Pinus sylvestris	Scots pine
Plantago lanceolata	Ribwort plantain
Plantago major	Greater plantain
Poa annua	Annual meadow-grass
Polygonum aviculare	Knotgrass
Polypodium vulgare	Common polypody
Polystichum setiferum	Soft shield-fern
Potentilla anserina	Silverweed
Potentilla erecta	Tormentil
Potentilla reptans	Creeping cinquefoil
Prunella vulgaris	Self-heal
Prunus laurocerasus	Cherry-laurel
Prunus spinosa	Blackthorn
Pteridium aquilinum	Bracken
Quercus petraea	Sessile oak
Quercus robur	Pedunculate oak
Ranunculus acris	Meadow buttercup
Ranunculus repens	Creeping buttercup
Rhododendron ponticum	Rhododendron
Rhytidiadelphus squarrosus	Lawn moss
Rosa arvensis	Field rose
Rosa canina	Dog rose
Rosa sp.	Wild rose
Rubus fruticosus agg.	Bramble
Rubus idaeus	Raspberry
Rumex acetosa	Sorrel
Rumex crispus	Curled dock
Rumex obtusifolius	Broad-leaved dock
Sagina procumbens	Procumbent pearlwort
Salix aurita	Eared willow
Salix caprea	Goat willow
Salix cinerea	Grey willow
Sambucus nigra	Elder
Senecio jacobea	Ragwort
Senecio vulgaris	Groundsel
Solanum dulcamara	Bittersweet
Sonchus asper	Prickly sow-thistle
Sonchus oleraceus	Smooth sow-thistle

Sorbus aucuparia	Rowan
Sparganium erectum	Branched bur-reed
Stellaria graminea	Lesser stitchwort
Stellaria holostea	Greater stitchwort
Stellaria media	Chickweed
Symphoricarpus albus	Snowberry
Taraxacum officinale	Dandelion
Taxus baccata	Yew
Tilia cordata	Small-leaved lime
Trifolium pratense	Red clover
Trifolium repens	White clover
Tussilago farfara	Coltsfoot
Typha latifolia	Bulrush
Ulex europaeus	Common gorse
Urtica dioica	Stinging nettle
Veronica beccabunga	Brooklime
Vicia cracca	Tufted vetch
Vicia sativa	Common vetch
Vicia sepium	Bush vetch
Viola sp	Violet

The Hurlstone Partnership

PROPOSED PARTIAL TRANSFER TO SOLID RECOVERED FUEL AT QUINN CEMENT LTD'S NEW CEMENT WORKS, NEAR BALLYCONNELL

Highway Assessment

August 2009

JPH/080604/D4

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PROPOSED PARTIAL TRANSFER TO SOLID RECOVERED FUEL AT QUINN CEMENT LTD'S NEW CEMENT WORKS, NEAR BALLYCONNELL

Document Status – 4th Draft

Produced by: - - - - - - J P Hurlstone Date: August 2009

Transportation Planning, Highway Design and Environmental Assessment

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FIGURES

1 INTRODUCTION

1.1 Quinn Cement Ltd currently operates a cement production plant at its New Cement Works to the north of Ballyconnell, in the northwest of County Cavan on the lower south-eastern slopes of Slieve Rushen.

1.2 The site was opened in 2000 following the granting of planning permission in 1997. The planning permission at the site included a limit on the output from the site to 1.0 million tonnes per annum. Planning permission was subsequently granted to raise the output to 1.4 million tonnes per annum, at which the site currently operates.

1.3 In order to reduce consumption of finite fuel reserves and following recent advancements in technology, Quinn Cement Ltd is seeking planning permission to install new elements of plant which would enable the introduction of the Solid Recovered Fuel, to replace a proportion of the existing coal used in the annual production of 1.4 million tonnes of cement.

1.4 In order to allow the local highway authority, Cavan County Council, to consider the impact of the proposed substitution of a proportion of the existing coal with Solid Recovered Fuel, The Hurlstone Partnership was commissioned to undertake an assessment of the existing road network and the implications associated with the additional traffic attracted to the site.

1.5 The remainder of this report details the findings of the study undertaken.

2 PLANNING HISTORY

2.1 When the original application for the New Cement Works was made, a Traffic Impact Assessment (TIA) was undertaken to consider the implications of the development on the local highway network.

2.2 At the time the original TIA for the New Cement Works was prepared, there was a specific constraint on the local road network that had a significant impact on the distribution of traffic through the area; namely the Aghalane bridge had been damaged, which precluded the use of the A509/N3 corridor for vehicles wishing to travel south towards Belturbet and beyond.

2.3 The bridge has since been replaced and the carriageway upgraded. The new crossing named "The Senator George Mitchell Peace Bridge" provides the main link between Northern Ireland and the Republic of Ireland for people travelling between Enniskillen and Dublin, and it is the point at which the A509 becomes the N3 at the border crossing.

2.4 The original development of the New Cement Works predicted an output of approximately 1 million tonnes per annum, which resulted in a total of 203 HGVs per day travelling along the public road network (406 movements) in addition to staff and visitor movements, which would comprise light traffic. Although the site is operational for 24 hours per day, the distribution of cement in HGVs only takes place between 07:00 – 19:00 under normal circumstances.

2.5 The impact of the proposed development was assessed on the network and found to be acceptable, as was the new access provided to serve the site.

2.6 A Highway Assessment report was also prepared in December 2005 to assess the impact of the previous proposal to increase the original output limit, which was subsequently deemed acceptable.

3 THE LOCAL HIGHWAY NETWORK

3.1 Following consultation with Quinn Cement Ltd, it was established that there are two main haul routes on the public highway network used by the company for distribution of cement from the New Cement Works.

3.2 The route to the north follows the R205, which becomes the B127 at the County boundary. Vehicles continuing north remain on the B127 and travel to Derrylin and the double mini-roundabout with the A509. However, many of the vehicles turn right off the B127 to travel east to Teemore and the crossroads junction with the A509. At this point, vehicles turn right to travel south towards Belturbet and the south or southeast.

3.3 The alternative route directs traffic towards the south and/or southwest. This route follows the R205 south to Ballyconnell where vehicles stop at the crossroads before continuing straight on along the R205 to the R199 T junction.

3.4 The site access was constructed in accordance with the relevant design standards to provide a safe junction layout. The access provides a through traffic lane in each direction plus a central lane for vehicles turning right into the site from the southbound carriageway of the R205. There is a short area of hatching beyond which a right turn lane is introduced to serve an industrial development on the opposite side of the R205.

3.5 In the vicinity of the access the R205 is a 10m wide single carriageway with a 3.0m right turn lane.

3.6 The access also provides a diverge lane for vehicles turning left into the site from the northbound carriageway of the R205. An overrun area is also provided for vehicles turning left onto the R205 to travel northbound, which ensures HGVs do not encroach upon the opposing right turn traffic lane when leaving the site.

3.7 The site access road itself is approximately 8m wide with signed speed limit of 15kph. On the approach to the R205, drivers joining the R205 benefit from excellent visibility in both directions, which is well in excess of the normal requirements for a road subject to a 60 kph speed limit.

3.8 Travelling south into Ballyconnell the speed limit reduces to 50 kph when entering the town. The R205 is one of the main routes through the town and is lined with shops and businesses on both sides when approaching the crossroads in the town centre.

3.9 Although the width of the carriageway in the town centre is some 9m wide, on street parking is permitted which reduces the effective carriageway width. It was noted that there was a limited amount of parking on double yellow lines within the town on the west side of the R205, which further reduced the effective carriageway width to approximately 4.7m in places. This resulted in opposing flows giving way to each other with disrupted traffic movement through the town.

3.10 When reaching the crossroads, regulatory STOP signs and road-markings are provided for drivers approaching on the R205, which forms the two minor arms of the priority junction. Visibility on the northern approach of the R205 (i.e. for southbound vehicles) is restricted in both directions by existing buildings constructed at the back of the footways. Clear visibility of the full width of the major route is available in both directions from set-backs of 1.3m to the left and 2.0m to the right.

3.11 Continuing straight across the crossroads along the R205, the carriageway width reduces initially to 7m at the junction bellmouth before reducing to a minimum width of approximately 5.5m at the narrowest point between an existing wall and building. Beyond this constraint the road width increases in width for a distance of approximately 200m, where a recent development has been constructed, before reducing to a nominal width of 5.8m for approximately 1km when leaving Ballyconnell.

3.12 The speed limit remains at 50kph beyond the town boundary and the carriageway width increases to between 8.4m and 8.8m following recent widening works, which extend approximately 3km from Ballyconnell.

3.13 For drivers travelling north along the R205, visibility at the crossroads of the oncoming traffic lane extends to approximately 70m to the right from a set-back of 2.0m. Visibility to the left is significantly further from the same position.

3.14 To the north of the New Cement Works access, the speed limit on the R205 increases to 80 kph before reaching the County Boundary, at which point the route becomes the B127 and the speed limit increases to 60 mph. Between the boundary and Derrylin the B127 has a nominal width of between 6.5 – 7.3m along its length. Localised widening is provided in the vicinity of another Quinn Group site, which incorporates ongoing quarrying and other engineering activities plus the Old Cement Plant. The localised widening facilitates the provision of a ghost island right turn lane for vehicles entering the site from the southbound traffic lane.

3.15 Between this site and the County Boundary to the south, at the time of the site visit there are several bends along the B127.

3.16 Continuing to the north, the route meanders its way in a generally northern direction to Derrylin. Along the route there are several minor priority junctions and direct accesses to various dwellings, farms and businesses, including Quinn Glass and a further Quinn Quarry.

3.17 Approximately 0.5 km to the north of the Old Cement Plant access there is a priority T junction with a minor road on the east side of the B127. The minor road continues in a generally easterly direction to Teemore where it meets the A509. At its western end the road has a nominal width of approximately 6.5m in the vicinity of the junction. Visibility to the left is excellent from a set-back of 4.5m. To the right, visibility towards oncoming traffic extends to approximately 95m. A crest in the road on a left hand bend when travelling towards the junction on the B127 provides the limiting factor to visibility to the right from the junction.

3.18 When travelling east from the junction along the road towards Teemore, which is approximately 2 miles long, the carriageway narrows to approximately 4.6m for a short distance before widening to nominal width of 5.2m which increases to 6.3m as the road passes through several bends before widening further to approximately 7.3m within Teemore. Along the narrower parts of the route towards its western end there are regular areas of localised widening which serve as inter-visible passing places.

3.19 The route is a typical rural carriageway with hedgerows on either side, field gateways and accesses to various residential and business premises which are distributed sporadically along its length. With the exception of the eastern end at Teemore, there are no footways or street lighting along the road, which is subject to a speed limit of 60 mph.

3.20 At its eastern end, the minor road meets the A509 at a priority crossroads. Right turn lanes are provided on the A509 for traffic entering both minor arms from the priority route. The carriageway width in the vicinity of the junction is 10.0m, which includes the 3.5m right turn lane. Pedestrian footways are provided in the vicinity of the junction and within Teemore itself, together with street lighting. This reflects the more built up nature of Teemore, which provides facilities including a school, shop, church, off street and roadside parking in addition to residential development.

3.21 When approaching the junction from the west, visibility for drivers wishing to join the A509 is approximately 215m to the right over the full carriageway width from a set-back of 4.5m. From the same position on the minor road approach visibility is restricted to the left by an existing bus stop shelter. Although visibility extends to 215m towards the oncoming traffic lane from this point, it is not possible to see the full carriageway width until the set-back from the Give Way line reduces to 3.1m. At this point, the bus stop shelter falls behind the line of sight, which extends to more than 500m over the full carriageway width.

3.22 Signage at the Teemore crossroads directs drivers along the minor road to "Cement Factory 2 ½, Ballyconnell 4 ½ and (B127). It is therefore apparent that this route is the preferred and signed road to/from the Cement Factory on the local highway network.

4 BASELINE TRAFFIC FLOWS

4.1 In order to establish baseline traffic flows on the local highway network when the previous Highway Assessment was undertaken, new traffic surveys were undertaken at strategic points.

4.2 The ATCs were installed to record traffic flows over a one week period from 15th – 23rd October 2005 inclusive. The ATCs recorded directional flows and vehicle classifications along the following links:-

- A509 800m South of Teemore Crossroads
- Teemore Road West of the A509 Junction
- Teemore Road east of the B127 Junction
- B127 North of Teemore Road junction (800m North of Quinn Glass access)
- B127 North of New Cement Works access at Gortineddan
- R205 South of New Cement Works access
- R205 1000m South of Ballyconnell

4.3 The ATCs recorded all vehicle movements in hourly time intervals 24 hours per day over the nine day survey period. However, as the proposed increase in output would have no material change in terms of daily activity except for HGV movements, the analyses of the results has been restricted to the period 07:00 – 19:00, which covers the normal distribution times of products to and from the site.

4.4 Since the previous surveys were undertaken, new surveys have been carried out on behalf of Cavan County Council in order to assist in the assessment of the approved Ballyconnell Inner Relief Road scheme. Cavan County Council kindly provided a copy of traffic survey data from February 2007 and June 2007. These more recent flows have been compared with those of 2005 in the following paragraphs.

4.5 Taking each count site in turn, the survey results reveal:-

A509 South of Teemore Crossroads

4.6 During the 2005 surveys, the busiest day of the week was found to be Friday 21 October, when a total of 2932 vehicles were recorded at the count site over the 12 hour period, of which 499 (17.02%) were classified as HGVs. As would be expected, the flows during the weekend were lower than the working week (Monday to Friday). The daily variation in the total flow between Monday to Friday inclusive was found to be 448 vehicles.

4.7 When considering HGV flows in isolation, the busiest day was Wednesday 19 October, when 536 HGV movements were recorded at the count site. The daily variation in HGV flows between Monday – Friday was found to be 65 movements over the 12 hour period.

4.8 The peak hour of traffic flow at this count site was found to be 17:00 – 18:00 on Friday 21 October, when a total of 360 vehicles, including 44 HGVs (12.22%) were recorded.

4.9 By way of comparison, the traffic surveys on Friday 22nd June 2007 revealed a 12 hour flow of 3207 movements including 459 (14.3%) HGVs. In terms of the peak hour, this remained between 17:00 – 18:00 when 409 movements were recorded including 30 HGVs (7.33%).

4.10 It is therefore apparent that the total vehicle flows along the A509 have increased over the 12 hour and peak hour periods but the number of HGV movements has reduced during the same period on the comparable Fridays between 2005 and 2007.

Teemore Road West of A509 Junction

4.11 During the 2005 surveys the busiest day of the week was found to be Monday 17 October, when a total of 1194 vehicles were recorded at the count site over the 12 hour period, of which 331 (27.72%) were classified as HGVs. As would be expected, the flows during the weekend were lower than the working week (Monday to Friday). The daily variation in the total flow between Monday to Friday inclusive was found to be 97 vehicles.

4.12 When considering HGV flows in isolation, the busiest day was Tuesday 18 October, when 346 HGV movements were recorded at the count site. The daily variation in HGV flows between Monday – Friday was found to be 25 movements over the 12 hour period.

4.13 The peak hour of traffic flow at this count site was found to be 17:00 – 18:00 on Friday 21 October, when a total of 162 vehicles, including 24 HGVs (14.81%) were recorded.

4.14 By way of comparison, the traffic surveys on Friday 22nd June 2007 revealed a 12 hour flow of 1432 movements including 324 (22.63%) HGVs. In terms of the peak hour, this remained between 17:00 – 18:00 when 160 movements were recorded including 8 HGVs (5.00%).

4.15 It is therefore apparent that the total vehicle flow along Teemore Road has increased over the 12 hour periods but the number of HGV movements has reduced during the same period on the comparable Fridays between 2005 and 2007. Both the total flow and number of HGVs within the total reduced during the peak between 2005 and 2007.

Teemore Road East of B127 Junction

4.16 The busiest day of the week was found to be Monday 17 October, when a total of 1061 vehicles were recorded at the count site over the 12 hour period, of which 407 (38.36%) were classified as HGVs. Once again, the flows during the weekend periods were lower than the working week (Monday to Friday). The daily variation in the total flow between Monday to Friday inclusive was found to be 102 vehicles.

4.17 When considering HGV flows in isolation, the busiest day was Tuesday 18 October, when 414 HGV movements were recorded at the count site. The daily variation in HGV flows between Monday – Friday was found to be 57 movements over the 12 hour period.

4.18 The peak hour of traffic flow at this count site was found to be 17:00 – 18:00 on Monday 17 October, when a total of 134 vehicles, including 35 HGVs (26.12%) were recorded.

4.19 There was no available count data for 2007 at this site.

B127 North of Teemore Road Junction

4.20 The busiest day of the week was found to be Friday 21 October, when a total of 3250 vehicles were recorded at the count site over the 12 hour period, of which 572 (17.60%) were classified as HGVs. The flows during the weekend periods were lower than the working week (Monday to Friday). The daily variation in the total flow between Monday to Friday inclusive was found to be 263 vehicles.

4.21 When considering HGV flows in isolation, the busiest day was Thursday 20 October, when 618 HGV movements were recorded at the count site. The daily variation in HGV flows between Monday – Friday was found to be 73 movements over the 12 hour period.

4.22 The peak hour of traffic flow at this count site was found to be 17:00 – 18:00 on Friday 21 October, when a total of 464 vehicles, including 37 HGVs (7.97%) were recorded.

4.23 There was no available count data for 2007 at this site.

B127 North of New Cement Works at Gortineddan

4.24 The busiest day of the week was found to be Friday 21 October, when a total of 4148 vehicles were recorded at the count site over the 12 hour period, of which 1040 (25.07%) were classified as HGVs. As with the preceding sites, the flows during the weekend were lower than the working week (Monday to Friday). The daily variation in the total flow between Monday to Friday inclusive was found to be 420 vehicles.

4.25 When considering HGV flows in isolation, the busiest day was Tuesday 18 October, when 1084 HGV movements were recorded at the count site. The daily range in HGV flows between Monday – Friday was found to be 112 movements over the 12 hour period.

4.26 The peak hour of traffic flow at this count site was found to be 17:00 – 18:00 on Friday 21 October, when a total of 478 vehicles, including 67 HGVs (14.02%) were recorded.

4.27 There was no available count data for 2007 at this site.

R205 South of New Cement Works

4.28 The busiest day of the week was found to be Friday 21 October, when a total of 3697 vehicles were recorded at the count site over the 12 hour period, of which 711 (19.23%) were classified as HGVs. The flows during the weekend were once again lower than the working week (Monday to Friday). The daily variation in the total flow between Monday to Friday inclusive was found to be 501 vehicles.

4.29 When considering HGV flows in isolation, the busiest day was Friday 21 October, when 711 HGV movements were recorded at the count site. The daily range in HGV flows between Monday – Friday was found to be 152 movements over the 12 hour period.

4.30 The peak hour of traffic flow at this count site was found to be 17:00 – 18:00 on Friday 21 October, when a total of 441 vehicles, including 41 HGVs (9.30%) were recorded.

4.31 By way of comparison, the traffic surveys on Friday 22nd June 2007 revealed a 12 hour flow of 3880 movements including 606 (15.62%) HGVs. In terms of the peak hour, this remained between 17:00 – 18:00 when 464 movements were recorded including 32 HGVs (5.00%).

4.32 It is therefore apparent that the total vehicle flow along this section of the R205 has increased over both the 12 hour and peak hour periods. However, the number of HGV movements has reduced on the comparable Fridays between 2005 and 2007.

R205 South of Ballyconnell

4.33 The busiest day of the week was found to be Friday 21 October, when a total of 1405 vehicles were recorded at the count site over the 12 hour period, of which 290 (20.64%) were classified as HGVs. As with all of the other count sites, the flows during the weekend were lower than the working week (Monday to Friday). The daily variation in the total flow between Monday to Friday inclusive was found to be 232 vehicles.

4.34 When considering HGV flows in isolation, the busiest day was Tuesday 18 October, when 298 HGV movements were recorded at the count site. The daily range in HGV flows between Monday – Friday was found to be 40 movements over the 12 hour period.

4.35 The peak hour of traffic flow at this count site was found to be 16:00 – 17:00 on Friday 21 October, when a total of 182 vehicles, including 24 HGVs (13.19%) were recorded.

4.36 By way of comparison, the traffic surveys on Friday 22nd June 2007 revealed a 12 hour flow of 2158 movements including 259 (12.00%) HGVs. In terms of the peak hour, this shifted to between 16:30 – 17:30 when 273 movements were recorded including 21 HGVs (7.69%). However, it was noted that there was only one less movement between 16:00 and 17:00, which was the peak hour observed in 2005.

4.37 It is therefore apparent that the total vehicle flow along the R205 has increased significantly over the 12 hour period, although there has been a reduction in HGV traffic. Despite the increase over the 12 hour day, the peak hour total and HGV flows are lower than the peak observed in 2005.

Comment on Traffic Survey Results

4.38 The survey results demonstrate that there is a wide variation in traffic volumes on the local road network. It is interesting to note that the flows on the B127 and R205 north of Ballyconnell are higher than those on the A509 during the working week (Monday to Friday). This is likely to be a result of the numerous industrial developments along the B127/R205 corridor, which attract relatively high volumes of traffic, and particularly HGVs.

4.39 Notwithstanding the wide variation in traffic flows, it is apparent that all of the routes are relatively lightly trafficked when compared to their respective design capacities. The highest hourly flow recorded on any of the routes considered was 478 movements on the B127 to the north of the New Cement Works.

4.40 As described in section 3 of this report, the carriageway width of the B127 varies between 6.5 to 7.3m along its length. TA 79/99 "Traffic Capacity of Urban Roads" details hourly capacities for carriageways of similar width as varying between 1250 vehicles for a 6.1m wide busy high street with unrestricted access, parking pedestrian crossings etc. to 2450 vehicles on a 7.3m wide single carriageway route with frontage access, access to properties and more than two side roads per km.

4.41 Although much of the network considered would not normally be classified as urban, the capacities quoted within the advice note provide a useful benchmark against which the observed flows may be assessed. TA 46/97 "Traffic Flow Ranges for use in the Assessment of New Rural Roads" identifies a capacity in the year of opening for a 7.3m wide carriageway as 13,000 vehicles per day Annual Average Weekday Traffic (AADT), which is the average daily flow over the whole year, including weekends.

4.42 When considering the capacity of the local highway network and the level of traffic observed to be travelling on it, it is apparent that a significant level of reserve capacity exists under current conditions.

New Cement Works Traffic

4.43 At present, the production and distribution of 1.4 million tonnes of cement results in an average total of 207 loads per day being distributed from the site, which results in 414 HGV movements.

4.44 The distribution of cement has been analysed by Quinn Cement Ltd. It was established that of the 207 loads per day, 104 were delivered trade and the remaining 103 was collect trade.

4.45 In addition to the distribution of cement there are additional HGV movements associated with imports of raw materials.

4.46 Based on records kept by Quinn Cement Ltd, the number of deliveries associated with the production of 1.4 million tonnes of cement per annum is calculated to be an average total of 53 loads per day (106 movements).

4.47 In terms of coal imports, the annual consumption at the site associated with the production of 1.4 million tonnes of cement is 155,000 tonnes. This is currently imported in 30 tonne payloads giving a total of 5167 loads per annum or an average of 19 loads per day based on the deliveries taking place 5.5 days per week for 51 weeks per annum.

4.48 The total daily HGV flow associated with the output of 1.4 million tonnes of cement per annum is therefore calculated to be 260 loads (520 movements).

4.49 When considering the distribution of traffic on the local road network, it was established that the directional split at the site access is 57.5% northbound/42.5% southbound.

4.50 Based on the total number of HGVs and the above distribution, it is established that 150 vehicles travel to/from the north or south (300 movements) via Derrylin and Teemore Cross Roads respectively, and 110 vehicles travel to/from the south (220 movements) via Ballyconnell.

5 PROPOSED DEVELOPMENT

5.1 As described in the introduction, the proposed development would result in the partial substitution of existing coal supplies with Solid Recovered Fuel.

5.2 It is predicted that the distribution of traffic entering and leaving the site in terms of supplies and sales of products other than coal and the Solid Recovered Fuel would not alter as a result of the proposed development, as there is a consistent additional demand across the existing customer base. There would be no increase in staff movements associated with the proposed development.

5.3 It is not proposed to revise the existing access arrangement or transportation methods in order to accommodate the proposed development, as the existing arrangement is considered to be acceptable.

5.4 Similarly, the haulage/distribution times associated with the development would continue to be 5.5 days per week between 07:00 – 19:00 Monday to Friday and 07:00 – 13:00 on Saturdays, in accordance with the approved operations.

5.5 The substitution of up to 55% of coal by Solid Recovered Fuel would result in a variation in traffic flow at the site access due to the different characteristics of the material. As a result of the different characteristics, Solid Recovered Fuel would typically be transported in 22 tonne payloads, as its density and calorific value are lower than coal, hence for the same volume of product within a load there is less mass.

5.6 The Solid Recovered Fuel is sourced from waste. Quinn Cement Ltd has identified the main sources of the fuel to be split between Dublin and Northern Ireland. Therefore, in accordance with the existing sources of coal, the majority of traffic would enter via the north (i.e. right into and left out of the site). Beyond this point drivers would distribute along the B127 to the north and Teemore Road/A509 to the south,

Development Traffic

5.7 Based on records kept by Quinn Cement Ltd, the number of deliveries associated with the production of 1.4 million tonnes of cement per annum is calculated to be an average total of 53 loads per day (106 movements).

5.8 In terms of coal imports, the annual consumption at the site associated with the production of 1.4 million tonnes of cement is 155,000 tonnes. This is currently imported in 30 tonne payloads giving a total of 5167 loads per annum or an average of 19 loads per day based on the deliveries taking place 5.5 days per week for 51 weeks per annum.

5.9 By deducting the coal movements from the total imports, it is established that 34 loads per day are associated with other imports.

5.10 In terms of the coal and Solid Recovered Fuel imports, taking the worst case scenario in terms of traffic increases, whereby 55% of the coal consumption is replaced by Solid Recovered Fuel, it is calculated that the equivalent of 85,250 tonnes of coal would be replaced by of Solid Recovered Fuel with the residual 45% (69,750 tonnes) of required fuel being coal imports.

5.11 Based on a Solid Recovered Fuel calorific value of 16 MJ/Kg an additional 50% of material is required to generate the equivalent energy as coal i.e. for every 1 tonne of coal 1.5 tonnes of Solid Recovered Fuel is required. This is based on a Solid Recovered Fuel with the lowest calorific value acceptable to the plant at 16 MJ/Kg. It is anticipated that Solid Recovered Fuel of a higher calorific value will be used at the plant. This will result in improved coal displacement ratios, resulting in less Solid Recovered Fuel being required and therefore less haulage traffic. Therefore, the following calculations represent the worst case scenario in terms of predicted increases in vehicle movements.

5.12 The displaced 85,250 tonnes of coal therefore equates to 127,875 tonnes of Solid Recovered Fuel. When taking into account the 22 tonne payload, a total of 5812.5 (say 5813) loads would be imported annually. This equates to 21 loads per working day and 42 movements. In addition, the residual coal requirement of 69,750 tonnes would be transported in 2475 loads annually, which equates to 8.3, say 9 loads/18 movements per day.

5.13 Based on the foregoing, it is calculated that in terms of fuel/coal imports, the proposed development would result in 30 loads/60 movements per day compared with 19 loads/38 movements currently, giving an uplift of 11 loads/22 movements per day.

5.14 Based on the sources of coal and Solid Recovered Fuel, the increase in traffic would occur on the routes to the north of the site (i.e. right into and left out of the New cement Works access) where they would distribute between the north and south via Derrylin and Teemore Cross Roads respectively

5.15 On the assumption that the traffic flows are distributed fairly evenly throughout the day and that there is a 50/50 distribution between the north and south at the Teemore Road/B127 junction, the traffic flows illustrated on Figure 1 at the back of this report are established. As half of 11 movements do not divide equally between the two routes, an additional vehicle has been added for simplicity.

5.16 Based on this distribution it is calculated that the hourly flows would be 1 loads/2 movements per hour between the site access and B127/Teemore Road junction, then 0 – 1 loads/0 – 2 movements per hour along both the B127 to the north and Teemore Road/A509 to the east/south. There would be no additional traffic travelling to the south of the site access through Ballyconnell.

Traffic Impact

5.17 A comparison between the 2005 and 2007 traffic flows indicate that when permission was granted to increase the output from the site from 1.0 to 1.4 million tonnes of cement per annum, whilst overall traffic movements were lower, the number of HGV movements within the total flow was higher.

5.18 On those routes for which data is available, over the 12 hour working day it is apparent that on the A509 south of Teemore Road the proposed development would add up to 12 HGV movements per day over the 12 hour period based on the 50/50 split at the B127/Teemore Road junction. This increase falls well below the reduction in 12 hour HGV flow observed on the route between the 2005 and 2007 surveys. During the peak hour, a reduction of 14 HGV movements was observed between 2005 and 2007, which compares with a predicted increase of up to 2 HGV movements associated with the proposed development. Therefore, when compared with the situation when the previous application to increase output from 1.0 to 1.4 million tonnes was approved, there would be a reduction in HGV traffic over the 12 hour day and during the peak hour. The additional HGV traffic associated with the proposed development would remain within the observed 2005 day to day variations along the A509.

5.19 On Teemore Road to the west of the A509 the 12 hour HGV flow has reduced by 7 movements and the peak hour HGV flow by 16 movements. The daily range in HGV movements was established to be 25 movements in 2005. The proposed development would add up to 12 HGV movements per day and up to 2 HGV movements per hour to the route, based on the 50/50 distribution. It is therefore apparent that the increase would fall within the observed daily range and result in a daily increase of 5 movements when compared with the 2005 12 hour figure. It is noted that the predicted increase would remain within the peak hour reduction between 2005 and 2007 of 16 movements, leaving a net reduction of 14 to 15 HGV movements during the busiest hour of the day when compared with the 2005 volumes.

5.20 On the R205 to the south of the site access, the proposed development would have no impact.

5.21 Whilst there were no 2007 flows available on the B127 north of the site access, B127 north of Teemore Road or on Teemore Road east of the B127 junction, the observed 2005 day to day variations in 12 hour HGV flow were found to be 112, 73 and 57 movements respectively. These may be compared with the predicted increases associated with the proposed development of between 11 and 22 movements.

5.22 Based on the foregoing, it is apparent that the proposed increase in HGV activity falls within the observed day to day range and 12 hour reductions in HGV activity between 2005 and 2007 on all routes except Teemore Road to the west of the A509. However, during the peak hour, when demands on the network are highest, the proposed increase associated with the proposed development remains well within the observed reduction in HGV activity between 2005 and 2007.

5.23 This is true of all routes in the area along which the identified development traffic would travel. Notwithstanding the variations in traffic flow observed between 2005 and 2007, the additional traffic volumes associated with the proposed development remain modest and would not result in unacceptably compromised highway capacity irrespective of which figures are used as the baseline scenario.

5.24 Having considered the relatively low volumes of traffic on the local road network in combination with the level of reserve capacity together with observed variations in traffic flow both on a daily basis and over the intervening period, it is considered that the impact of the proposed substitution of up to 55% of coal with Solid Recovered Fuel would be insignificant. It should also be recognised that this conclusion is reached based on the worst case scenario in terms of potential increases in HGV activity associated with the proposed development.

5.25 Consideration should also be given to the sustainable use of Solid Recovered Fuel when compared with coal. Using Solid Recovered Fuel instead of coal not only reduces consumption of finite coal reserves, but also diverts a significant volume of waste to a practical use, which would otherwise unnecessarily be deposited in landfill sites.

6 SUMMARY AND CONCLUSION

Summary

6.1 Quinn Cement Ltd currently operates a cement production plant at its New Cement Works to the north of Ballyconnell, in the northwest of County Cavan on the lower south-eastern slopes of Slieve Rushden.

6.2 As a result of increased demand in the marketplace, the output from the site has progressively increased from the original level of 1.0 million tonne per annum to its current level of 1.4 million tonnes per annum.

6.3 It is proposed to install new plant and machinery at the existing New Cement Works to enable the site to be able to accept and accommodate the introduction of Solid Recovered Fuel. As a result of the new plant it is proposed to substitute up to 55% of the current coal supply used in the production process with Solid Recovered Fuel.

6.4 Solid Recovered Fuel is effectively a processed waste product that would be diverted to landfill in the event it was not re-used in the production process. As a result, the proposed substitution would result in reduced consumption of finite coal reserves and also reduce the volume of material diverted to landfill, thereby extending the life of existing mineral and waste facilities.

6.5 In order to allow the local highway authority, Cavan County Council, to consider the impact of the proposed development, The Hurlstone Partnership was commissioned to undertake an assessment of the existing road network and the implications associated with the additional traffic attracted to the site.

6.6 The study considered the impact of the additional traffic on the local road network including the site access, the R205 to the south through and beyond Ballyconnell, the R205/B278 to the north up to Derrylin and the minor road between the B278 and Teemore to the east.

6.7 The geometric characteristics of the local road network were reviewed, together with highway capacity based on recent traffic flows provided by Cavan County Council, which were recorded as part of the Ballyconnell Inner Relief Road scheme, and those that prevailed when the previous planning permission was granted at the site.

6.8 It was found that the traffic flows on all links of the network fluctuated significantly from day to day, both in terms of total flow and HGV content.

6.9 The increase in output from the site will not require the employment of additional staff. However, it does result in increased HGV traffic delivering raw materials to the site.

6.10 To establish the number of additional HGVs travelling on the network, Quinn Cement Ltd reviewed its records of distribution, collections and deliveries of raw materials over a 12 month period.

6.11 It was found that the substitution of 55% of coal with Solid Recovered Fuel would result in an additional 11 HGVs (22 movements) per day travelling on the local road network when compared to the existing permitted operations.

6.12 This increase represents the worst case scenario as Solid Recovered Fuel has a lower density and calorific value than coal. Therefore for a given level of energy output more Solid Recovered Fuel would be required than coal, which results in additional loads being required.

6.13 When taking into account the directional distribution at the site access, it was established the greatest increase occurred immediately to the north of the site where 11 vehicles (22 movements) per day were attributed to substitution of 55% of the coal with Solid Recovered Fuel. This equates to 1 - 2 vehicles (2 - 4 movements) per hour, or up to one HGV movement every 15 minutes.

6.14 As vehicles distribute amongst other links and junctions, the number of additional movements on each subsequent link would further reduce.

6.15 However, when the 2007 traffic flows were compared to those recorded in 2005, which is when the impact of the current permitted output of 1.4 million tonnes was assessed, it was found that whilst there had been an overall increase in traffic volumes on most routes, the number of HGV movements during the 12 hour working day and during the peak hour had reduced.

6.16 It was also found that by adding the increased traffic associated with the proposed development to the 2007 flows, the number of HGV movements remained below the 2005 levels on most routes both over the 12 hour day and during the peak hours.

6.17 On all links along which the development traffic would travel, the associated increase arising from the coal substitution fell within the range of existing day-to-day variations in HGV activity. On all links, the increase attributable to the proposed development fell within the day to day range of total traffic flow.

6.18 The increase in traffic associated with the proposed development would not have a significant detrimental impact on highway capacity on any links considered within the study area as a significant level of reserve capacity would be retained.

Conclusion

6.19 As a result of the proposed alterations to the existing New Cement Works, to enable the plant to be able to accept and accommodate the introduction of Solid Recovered Fuel, the plant will attract additional HGV deliveries.

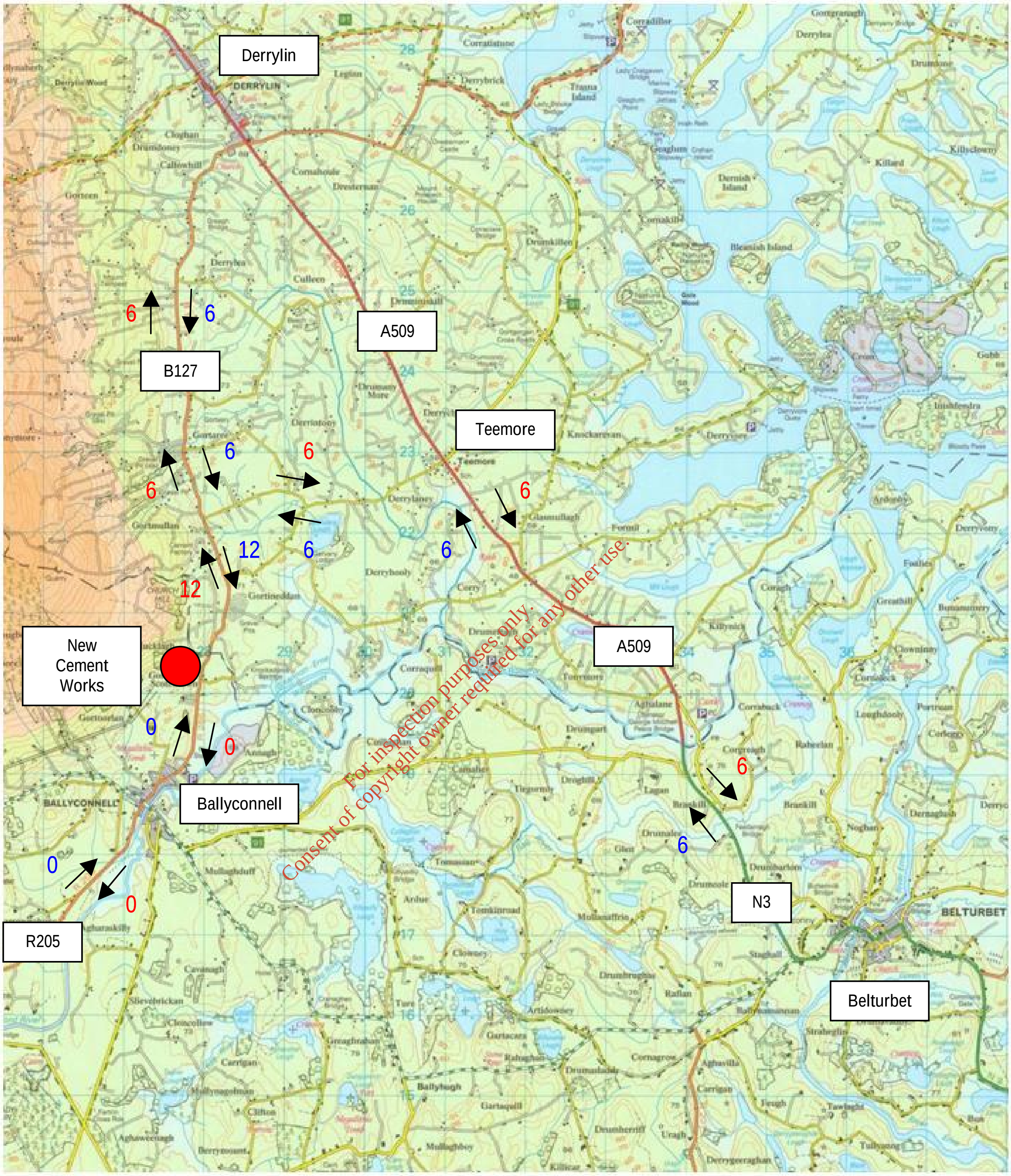
6.20 The distribution of traffic is such that the highest average hourly increase on any given link is approximately 4 movements (2 in/2 out) per hour, which equates to 1 movement every 15 minutes.

6.21 Comparison of empirical traffic flow data revealed that with the proposed development in place, the total volume of HGV traffic on most links would remain below the 2005 levels when the existing output limit was assessed, particularly during the peak hour periods when the demands on the network are highest.

6.22 When assessed against the baseline flows on the network and the reserve capacity available on the local roads, it is concluded that the increased output would have an insignificant impact on the area.

FIGURES

The Hurlstone Partnership



Development Traffic Distribution on Local Highway Network:
Daily HGV Flows

12 Outbound / 12 Inbound

FIGURE 1

PROPOSED PARTIAL TRANSFER TO SOLID RECOVERED FUEL AT QUINN CEMENT LTD'S NEW CEMENT WORKS, NEAR BALLYCONNELL
JPH/080604/D4
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