EIA Report for Development for Further Replacement of Fossil Fuels with Alternative Fuels and Alternative Raw Materials

VOLUME 3 – APPENDICES

Brady Shipman Martin
Built. Environment.

Contents

Appendix 1.1

An Bord Pleanála SID Determination

Our Ref: 17.PC0221
P.A.Reg.Ref:

Your Ref: Irish Cement Limited

An Bord Pleanála

Thomas Burns
Brady Shipman Martin
Block B,
Canal House,
Canal Road,
Dublin 6.

0 9 MAY 2017

8th May 2017

Re:
Proposed development to allow further replacement of fossil fuels with alternative fuels and use of alternative raw materials at existing cement works at
Platin, Duleek, Co. Meath.

Dear Sir,

Please be advised that following consultations under section 37B of the Planning and Development Act, 2000 as amended, the Board hereby serves notice under section 37B(4)(a) that it is of the opinion that the proposed development falls within the scope of paragraphs 37A(2)(a) and (b) and (c) of the Act. Accordingly, the Board has decided that the proposed development would be strategic infrastructure within the meaning of section 37A of the Planning and Development Act, 2000, as amended. Any application for permission for the proposed development must therefore be made directly to An Bord Pleanála under section 37E of the Act.

Please also be informed that the Board considers that the pre-application consultation process in respect of this proposed development is now closed.

Attached is a list of prescribed bodies to be notified of the application for the proposed development.

In accordance with section 146(5) of the Planning and Development Act, 2000 as amended, the Board will make available for inspection and purchase at its offices the documents relating to the decision within 3 working days following its decision. This information is normally made available on the list of decided cases on the website on the Wednesday following the week in which the decision is made.

Overleaf contains information in relation to challenges to the validity of a decision of An Bord Pleanála under the provisions of the Planning and Development Act, 2000, as amended.

If you have any queries in relation to the matter please contact the undersigned officer of the Board. Please quote the above mentioned An Bord Pleanála reference number in any correspondence or telephone contact with the Board.

Yours faithfully,

pp. O. [signature]
Kieran Somers
Executive Officer
Direct Line:01-8737107

PC09.LTR

Teil	Tel	(01) 858 8100
Glao Áitiúil	LoCall	1890 275 175
Facs	Fax	(01) 872 2684
Láithreán Gréasáin	Website	www.pleanala.ie
Ríomhphost	Email	bord@pleanala.ie

64 Sráid Maoilbhríde
Baile Átha Cliath 1
D01 V902

64 Marlborough Street
Dublin 1
D01 V902

Judicial review of An Bord Pleanála decisions under the provisions of the Planning and Development Act, 20 as amended

A person wishing to challenge the validity of a Board decision may do so by way of judicial review only. Sections 50, 50A and 50B of the Planning and Development Act 2000 (as substituted by section 13 of the Planning and Development (Strategic Infrastructure) Act 2006, as amended/substituted by sections 32 and 33 of the Planning and Development (Amendment) Act 2010 and as amended by sections 20 and 21 of the Environment (Miscellaneous Provisions) Act 2011) contain provisions in relation to challenges to the validity of a decision of the Board.

The validity of a decision taken by the Board may only be questioned by making an application for judicial review under Order 84 of The Rules of the Superior Courts (S.I. No. 15 of 1986). Sub-section 50(6) of the Planning and Development Act 2000 requires that subject to any extension to the time period which may be allowed by the High Court in accordance with subsection 50(8), any application for judicial review must be made within 8 weeks of the decision of the Board. It should be noted that any challenge taken under section 50 may question only the validity of the decision and the Courts do not adjudicate on the merits of the development from the perspectives of the proper planning and sustainable development of the area and/or effects on the environment. Section 50A states that leave for judicial review shall not be granted unless the Court is satisfied that there are substantial grounds for contending that the decision is invalid or ought to be quashed and that the applicant has a sufficient interest in the matter which is the subject of the application or in cases involving environmental impact assessment is a body complying with specified criteria.

Section 50B contains provisions in relation to the cost of judicial review proceedings in the High Court relating to specified types of development (including proceedings relating to decisions or actions pursuant to a law of the state that gives effect to the public participation and access to justice provisions of Council Directive 85/337/EEC i.e. the EIA Directive and to the provisions of Directive 2001/12/EC i.e. Directive on the assessment of the effects on the environment of certain plans and programmes). The general provision contained in section 50B is that in such cases each party shall bear its own costs. The Court however may award costs against any party in specified circumstances. There is also provision for the Court to award the costs of proceedings or a portion of such costs to an applicant against a respondent or notice party where relief is obtained to the extent that the action or omission of the respondent or notice party contributed to the relief being obtained.

General information on judicial review procedures is contained on the following website, **www.citizensinformation.ie.**

Disclaimer: The above is intended for information purposes. It does not purport to be a legally binding interpretation of the relevant provisions and it would be advisable for persons contemplating legal action to seek legal advice.

List of Prescribed Bodies

Case Reference/ Description	17.PC0221 – Proposed development to allow further replacement of fossil fuels with alternative fuels and use if alternative raw material at existing cement works at Platin, Duleek, Co. Meath.
Case Type:	S.37E of the Planning and Development Act 2000 (as amended).

The following is a schedule of prescribed bodies considered relevant for the purposes of section 37E(3)(c) of the Principal Act:

a) Minister for Housing, Planning, Community and Local Government

b) Minister for Communications, Climate Action and Environment

c) Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs (Development Applications Unit)

d) Minister for Transport, Tourism and Sport

e) Eastern Midlands Regional Waste Office

f) Eastern and Midlands Regional Assembly

g) Meath County Council

h) Louth County Council

i) Inland Fisheries Ireland

j) An Taisce

k) Irish Water

l) Fáilte Ireland

m) Iarnród Éireann

n) An Chomhairle Ealaíon

o) Irish Aviation Authority

p) Health Service Executive

List of Prescribed Bodies

q) Health & Safety Authority

r) The Heritage Council

s) Environmental Protection Agency

t) Transport Infrastructure Ireland

Appendix 1.2

Scoping Letter and Responses

Name
Address
Address
Address

Date: **10th February 2017**

Re: **Continued fossil fuel replacement using Alternative Fuels; and introduction of Alternative Raw Materials at Platin Cement Works, Co. Meath.**

Dear Sir/Madam,

Irish Cement Ltd. (ICL) first received the necessary planning and licence permission in 2009 (*eath lannin e ef o S as amended by eath lannin e ef o S of*) to replace a portion of existing fossil fuel use with up to 120,000 tonnes of alternative fuels per annum at Platin Cement Works. In 2016, the Cement Works succeeded in reaching this 120,000 tonne restriction and now ICL is intending to seek permission to allow for continued fossil fuel replacement in the cement manufacturing process at Platin Cement Works, County Meath.

To that end please note that Irish Cement Ltd. (ICL) is currently holding pre-application consultations with An Bord Pleanála in respect of a proposed development having regard to Section 37B(3) of the Planning and Development 2000 Act, as amended. In the proposed development, ICL intends to seek a 10 year permission for development to allow for continued fossil fuel replacement by expanding the use and range of alternative fuels and to allow for the use of alternative raw materials in the cement manufacturing process at Platin Cement Works, County Meath.

Platin Cement Works operates under Industrial Emissions Licence (IE Licence No. P0030-04) issued by the Environmental Protection Agency (EPA). The proposed development will require a review of the IE licence. Separately and in advance of the licence review required as a result of the proposed development, the EPA has recently published notification (18th January 2017) of its intention to review the IE licence for Platin Cement Works (together with IE licences for all other cement plants) in order to bring these licences '*into om lian e ith the re uirements of the Commission Im lementin e ision on Best ailable e hni ues B on lusions for the rodu tion of ement lime and ma nesium o ide and a li able B on lusions*'. The EPA notes that this review, which is referenced as IE Licence No. P0030-05 for Platin Cement Works, will be known as 'BAT reviews'.

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T: + 353 1 208 1900

Partners:
John Kelly, David Bosonnêt,
Thomas Burns, Pauline Byrne

System Certification:
ISO 9001:2008
ISO 14001:2004

Platin Cement Works is the largest cement manufacturing facility in Ireland and produces on site a range of cement and cement products for national and export markets. The Works are located off the R152 Drogheda - Kilmoon Cross Regional Road, approximately 750m southwest of Junction 8 (Drogheda South) on the M1 Dublin Belfast Motorway. A limestone quarry lies to the west of Works. The overall Cement Works, which includes 2 cement manufacturing kilns (Kiln 2 and Kiln 3), extends to circa 40 hectares and the proposed development will be centrally located within the existing developed footprint of the Cement Works.

Limestone, which is extracted from the quarry, is the main raw material used in the manufacture of cement. Clay overburden, also from the quarry, together with shale and small quantities of bauxite and iron ore are also used in the process. These raw materials are crushed, ground and homogenised to produce a blend called 'raw meal'. This raw meal is then 'melted' at very high temperatures (>1,450°C) inside the cement kiln. Fuels are combusted at both ends of the kiln to provide the high temperatures needed to 'melt' the raw meal and manufacture cement clinker.

As a company, Irish Cement Ltd. is continuously investing in new technology in order to improve efficiency, market penetration and to sustain local employment in a competitive industry. This on-going investment has seen the expenditure, in 2008, of over €200m on a modern kiln (Kiln No.3) and more recently the on the introduction of permitted and licenced alternative fuels. ICL first received the necessary planning and licence permission for the use of alternative fuels in 2009 (*eath lannin e ef o S as amended by eath lannin e ef o S of*) and since 2011, has gradually introduced alternative fuels to its cement manufacturing process at Platin. In 2016, the Cement Works succeeded in reaching its 120,000 tonne restriction for use of alternative fuels.

The replacement of fossil fuels with suitable alternative fuels and use of alternative raw materials is now standard practice throughout the European cement industry and is in fact recognised under section 1.2.4 **Use of waste** in the BAT Conclusions (2013/163/EU as previously noted above): ' *ifferent ty es of aste materials an re la e rimary ra materials and or fossil fuels in ement manufacturing and will contribute to saving natural resources.'*

The use of alternative fuels not only saves natural resources but also reduces dependence on imported fossil fuels and is important in reducing annual CO_2 emissions at Platin. Continued replacement of fossil fuels will improve the environmental performance, competitiveness and sustainability of Platin Works.

Therefore, while Cement Works traditionally used fossil fuels (*e* petcoke and coal) to fire the cement kilns, increasingly alternative fuel sources are now being used in Ireland and across Europe. While Platin Cement Works continues to use fossil fuel, the Works has permission and licence approval to use up to 120,000 tonnes per annum (t/a) of alternative fuels in the firing of Kiln 3. This existing permission is for the use of 120,000t/a and provides for the use of 3 alternative fuels, namely: solid recovery fuel (SRF); meat and bone meal (MBM); and chipped used tyres. At present SRF is the only alternative fuel being used at Platin. The maximum permitted use of 120,000t/a of alternative fuels was reached during 2016, which resulted in the Cement Works having to increase its reliance on fossil fuel to meet the increasing demand for cement.

Details of the Proposed Development
Irish Cement Ltd. is applying for a proposed development to allow for the use of up to an additional 480,000 tonnes per annum (*i e* overall 600,000 tonnes per annum) of alternative fuel and for the use of alternative raw materials. In proposing this development, the eventual target for Irish Cement is to allow for the gradual replacement of virtually all fossil fuel. A small quality of fossil fuel will continue to be required *e* for initial start-up of the kilns after maintenance shut downs. At any stage should suitable alternative fuels not be available or be limited in availability, the balance of the heat requirement will be achieved from fossil fuel use.

While the development seeks to allow for the use of a wide range of alternative fuels, the SRF component of alternative fuel use will be limited to an additional 100,000t/a (*i e*. a total 220,000t/a in combination with existing 120,000t/a of permitted SRF use). This will ensure that the proposed development maintains compliance with Policy E15a of the Eastern - Midlands Region Waste management Plan 2015-2021, which '*su orts the de elo ment of u to tonnes of additional thermal a a ity for the treatment of non ha ardous astes nationally to ensure there is ade uate active and competitive treatment in the market and the State's self suffi ien y re uirements for the re o ery of muni i al aste are met* '

In allowing for the proposed continued fossil fuel replacement and for the use of alternative raw materials in the cement manufacturing process the proposed development will involve the provision of a number of new buildings, silos, tanks, structures and conveyors – all of which will be broadly similar to the nature of existing buildings, structures and plant on the existing Cement Works. The proposed buildings, structures and plant, which will be provided within the existing development at the Cement Works, will allow for the receiving, short-term storage, handling and introduction of alternative fuels and alternative raw materials to the cement manufacturing process. Procurement of alternative fuels will be contracted by approved off-site suppliers in accordance with an agreed quality specification and delivery to Platin Cement Works in a 'ready-to-use' and 'just-in-time' manner. Therefore, provision is only being made for immediate and short-term storage of alternatives fuels on-site.

The objective to replace virtually all fossil fuel will be achieved, progressively over time, by expanding the quantity and range of alternative fuels used at the facility. The proposed **Alternative Fuels** can be characterised into five broad categories based on their handling characteristics, as follows:

- **Fine Solids:** Fine materials typically sized 10-50mm (*e* chipped timber, shredded plastics, SRF, *et* .). These materials will be prepared off-site and delivered ready for use. They will be off-loaded from trucks into enclosed bays or halls from where they will be pneumatically conveyed to the kiln system.

The use of Fine Solids is similar to the existing permitted SRF handling and feeding system installed on Kiln 3.

- **Coarse Solids:** Materials typically of 30-120mm particle size will be prepared off site to a defined specification before delivery to site (*e* shredded wood, rubber, dry filter cakes, *et* .). These materials will be prepared off-site and delivered for off-loading from trucks into bunkers inside enclosed halls from where they will be transferred to the kiln feeding system using screw feeders or overhead cranes.

- **Free-flowing Solids:** Some fuels will be free-flowing solids or powders that will be off-loaded into sealed silos (*e* SRF pellets, sewage sludge pellets, *et* .). These fuels will be pneumatically conveyed from the storage silos to the kiln burners via enclosed pipelines.

- **Whole Tyres:** Whole Tyres no longer suitable or legal for their intended use will be delivered to site intact, off-loaded from trucks into the Tyre Storage Area from where they will be transported by conveyor and fed individually into the kiln.

- **Pumpable Fluids:** Fluid type materials (*e* secondary liquid fuels (SLF), waste oils, solvents, distillation residues, paint sludge, *et* .) that will be delivered by tanker and offloaded using pumps into on site storage tanks located within bunded compounds. These fuels will be pumped to the kiln bunkers via enclosed pipelines.

Alternative Raw Materials: The proposed development also seeks permission to allow for the introduction of alternative raw materials. These materials – mainly mineral wastes – will replace a proportion of traditional raw materials used in cement production. The quantity of proposed alternative raw materials is accommodated within the additional 480,000 tonnes per annum figure proposed for additional use of alternative fuels and for use of alternative raw materials.

Proposed development to allow for the above alternative fuels and raw materials, includes:

- An extension to the existing building for use of Fine Solids (*e* SRF) in Kiln 3;
- Relocation of an existing fire-water retention tank to facilitate the above extension;
- Provision of 3no. tanks for use of Pumpable Fluids for Kiln 2 and Kiln 3;
- Provision of a building for use of Fine Solids in Kiln 2;
- Provision of a building for use of Coarse Solids in Kiln 2 and Kiln 3;
- Provision of 2no. silos for use of Free-flowing Solids in Kiln 2;
- Provision of 2no. silos for use of Free-flowing Solids in Kiln 3;
- Provision of a facility for use of Whole Tyres in Kiln 2;
- Provision of a building for use of Alternative Raw Materials in Kiln 2 and Kiln 3;
- Provision of a Bag Filter for Kiln 2;
- Provision of a range of associated off-loading buildings, transfer structures, conveyors, bunding and firewater retention tanks.

The proposed development is broadly similar to a previous application made to Meath County Council in November 2015 (Planning Ref. No.: LB151288) on which the planning authority ultimately considered that it may not have jurisdiction.

Irish Cement Ltd. has appointed Brady Shipman Martin to prepare the application, which will include an Environmental Impact Statement (EIS), for the proposed development. This letter is being issued to you as part of the scoping process for the EIS. The Environmental Impact Statement to accompany the planning application will address the various aspects of the environment on which the proposed development could impact.

As part of the consultation process, we would be interested in receiving any comments you may have on the proposed development, relevant to your area of expertise, by Friday 25th February 2017.

Comments or acknowledgements can be sent via email to platinfuels@bradyshipmanmartin.com.

Yours sincerely,

____

Linda O'Grady
for
Brady Shipman Martin
Consult

Scoping Consultation List

Meath County Council (on-going)
Environmental Protection Agency (on-going)
Eastern Midlands Region Waste Office (on-going)

Louth County Council
Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs (NPWS)
Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs (National Monuments)
Minister for Department of Transport, Tourism and Sport
Minister for Communications, Climate Action and Environment
Inland Fisheries
An Taisce
Irish Water
Fáilte Ireland
Iarnród Éireann
Transport Infrastructure Ireland
The Heritage Council
Irish Aviation Authority
Health Service Executive
Health and Safety Authority

UISCE
ÉIREANN : IRISH
WATER

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Éire

Irish Water
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Ireland

T: +353 1 89 25000
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www.water.ie

Ref 17_IW_ES_6

Linda O'Grady
Brady Shipman Martin
Canal House
Canal Road
Dublin 6
23/02/2017

RE: Continued Fossil Fuel Replacement using Alternative Fuels; and introduction of Alternative Raw Materials at Platin Cement Works, Co. Meath.

Dear Ms O'Grady,

Irish Water (IW) acknowledges receipt of your letter dated 10th February regarding the Environmental Impact Statement (EIS) scoping for the above development.

Please see attached our suggested scope in relation to Water Services.

Yours Sincerely,

P.P

Suzanne Dempsey
Spatial Planning Strategy Specialist

Response to EIS Scoping Report Requests

IW currently does not have the capacity to advise on scoping of individual projects. However, in general we would like the following aspects of Water Services to be considered in the scope of an EIS where relevant;

a) Impacts of the development on the capacity of water services (do existing water services have the capacity to cater for the new development if required).
b) Any up-grading of water services infrastructure that would be required to accommodate the development.
c) In relation to a development that would discharge trade effluent – any upstream treatment or attenuation of discharges required prior to discharging to an IW collection network
d) In relation to the management of surface water; the potential impact of surface water discharges to combined sewer networks & potential measures to minimise/stop surface waters from combined sewers
e) Any physical impact on IW assets – reservoir, treatment works, pipes, pumping stations, discharges outfalls etc. including any relocation of assets
f) Any potential impacts on the assimilative capacity of receiving waters in relation to IW discharge outfalls including changes in dispersion /circulation characterises
g) Any potential impact on the contributing catchment of water sources either in terms of water abstraction for the development (and resultant potential impact on the capacity of the source) or the potential of the development to influence/ present a risk to the quality of the water abstracted by IW for public supply.
h) Where a development proposes to connect to an IW network and that network either abstracts water from or discharges waste water to a "protected"/sensitive area, consideration as to whether the integrity of the site/conservation objectives of the site would be compromised.
i) Mitigation measures in relation to any of the above

This is not an exhaustive list.

Please note

- If a development will require a connection to either a public water supply or sewage collection system the developer is advised to contact Irish Water's Connections and Developer Services Team prior to applying for planning permission.
- For Information on Irish Water assets please send a query to DataRequests@water.ie
- Irish Water will not normally accept new surface water discharges to combined sewer networks

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

HSE DNE
Environmental Health Service
Community Care Services
County Clinic
Navan
Co. Meath

Telephone: +353 (0) 46 9021595/9098729
Fax: 046 9022818

23rd February 2017

Linda O'Grady
Plantin Cement Works
Drogheda
Co. Louth

RE: Scoping of EIA for continued fossil fuel replacement with alternative fuels at Platin Cement Works, Co. Meath

Dear Ms O'Grady,

Please find enclosed a submission from the Environmental Health Service with regard to the scoping of the above EIA.

Sincerely,

Elish O'Reilly
Principal Environmental Health Officer

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

HSE DNE
Environmental Health Service
Community Care Services
County Clinic
Navan
Co. Meath

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Environmental Health Scoping Submission
21st February 2017
EIA Scoping for Platin Cement Works,
Co Meath

General

In preparation of the Environmental Impact Statement the following documents should be considered:

- Guidelines on the information to be contained in EIS (2002), 187kb
- Advice Notes on Current Practice in the preparation of EIS (2003), 435kb
- Guidelines for Planning Authorities and An Bord Pleanala on carrying out Environmental Impact Assessment
  http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/DevelopmentandHousing/Planning/FileDownLoad%2C32720%2Cen.pdf

Update of Guidelines

Adoption of the Directive (2014/52/EU) in April 2014 initiated a review of the above guidelines.

To ensure that the Guidelines are fully aligned with the relevant legislation it has been decided to publish the revised Guidelines after the transposition of Directive 2014/52/EU into national legislation. The transposition deadline set out in the Directive is 16 May 2017.

The draft new guidelines can be seen at:

http://www.epa.ie/pubs/consultation/reviewofdrafteisguidelinesadvicenotes/

Please note that the original Guidelines and Advice Notes are still applicable until such date as the final revision of the Guidelines are published i.e. after the transposition of Directive 2014/52/EU

Directive 2014/52/EU has an increased requirement to assess potential significant impacts on Population and Human Health.

Specific Assessment Requirements

Generally, the Environmental Impact Assessment should identify for each potentially significant impact:

a) The receiving environment;
b) The nature and scale of the impact;
c) Assessment of the impact; and
d) Mitigation measures

In the experience of the Environmental Health Service (EHS) the assessment methodology for concluding the significance of an impact has not always been clear in EIA carried out in Ireland. It is therefore requested that the EIA is very clear in the methodology used for assessing the significance of an impact and the residual, after proposed mitigation, impact clearly identified.

The EHS notes that the facility will be subject to a BAT review and operational emissions into the environment will be considered at the license review stage by the EPA. The EHS routinely makes submissions to the EPA when licenses are reviewed and will make a submission at the appropriate time. The main emphasis of this scoping submission is therefore the control of any potentially significant impacts from the construction stage.

The EHS makes the following recommendations for consideration of inclusion in EIA:

1. Discharges from the site to surface and ground water, both during construction and subsequent operation. The EIA should consider the protection of ground and surface water during the use of construction machinery, storage of chemicals and fuels and protection from silting and Petro-chemical contamination due to run off from the site during construction.

2. Emissions to air, particularly dust, during the construction phase. The EIA should identify a construction dust minimization plan that incorporates current good practice in this area.

3. The EIA should consider any impacts from the additional storage capacity required for the increased use of the intended fuels, including an assessment on any potential impacts from odour and noise and impacts from increased traffic movements. The EIA should identify if separate storage and/or segregation is required.

4. Noise and vibration during construction and operation should be assessed. The EHS considers the significance of noise impacts are due to the change in the noise environment and not a comparison against an absolute noise level.

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

30 MAR 2017

Ms. Linda O'Grady
Brady Shipman Martin
Canal House
Canal Road
Dublin 6

Dáta | Date	Ár dTag | Our Ref.	Bhur dTag | Your Ref.
28 March 2017	TII17-96841	

RE: Continued fossil fuel replacement using Alternative Fuels; an introduction of Alternative Raw Materials at Platin Cement Works, Co. Meath

Dear Ms. O'Grady,

I refer to your letter of 10 February 2017 regarding the above. The position in relation to your enquiry is as follows.

Transport Infrastructure Ireland (TII) wishes to advise that it is not in a position to engage directly with planning applicants in respect to proposed developments. TII will endeavour to consider and respond to planning applications referred to it given its status and duties as a statutory consultee under the Planning Acts. The approach to be adopted by TII in making such submissions or comments will seek to uphold official policy and guidelines as outlined in the Spatial Planning and National Roads Guidelines for Planning Authorities (DoECLG, 2012). Regard should also be had to other relevant guidance available at **www.TII.ie**.

The issuing of this correspondence is provided as best practice guidance only and does not prejudice TII's statutory right to make any observations, requests for further information, objections or appeals following the examination of any valid planning application referred.

With respect to Environmental Impact Statement (EIS) scoping issues, the recommendations indicated below provide only general guidance for the preparation of EIS, which may affect the National Roads Network.

The developer should have regard, inter alia, to the following;

- Consultations should be had with the relevant Local Authority/National Roads Design Office with regard to locations of existing and future national road schemes including but not limited the Leinster Orbital Route.
- TII would be specifically concerned as to potential significant impacts the development would have on the national road network (and junctions with national roads) in the proximity of the proposed development, M1 and associated junctions.
- The developer should assess visual impacts from existing national roads.

- The developer should have regard to any EIS and all conditions and/or modifications imposed by An Bord Pleanála regarding road schemes in the area. The developer should in particular have regard to any potential cumulative impact.
- The developer, in conducting the EIS, should have regard to TII Publications (formerly DMRB and the Manual of Contract Documents for Road Works).
- The developer, in conducting Environmental Impact Assessment, should have regard to TII's Environmental Assessment and Construction Guidelines, including the Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (National Roads Authority, 2006).
- The EIS should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see Guidelines for the Treatment of Noise and Vibration in National Road Schemes (1st Rev., National Roads Authority, 2004)).
- It would be important that, where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site with reference to impacts on the national road network and junctions of lower category roads with national roads. The Authority's Traffic and Transport Assessment Guidelines (2014) should be referred to in relation to proposed development with potential impacts on the national road network. The scheme promoter is also advised to have regard to Section 2.2 of the NRA/TII TTA Guidelines which addresses requirements for sub-threshold TTA.
- The designers are asked to consult TII Publications to determine whether a Road Safety Audit is required.
- In the interests of maintaining the safety and standard of the national road network, the EIS should identify the methods/techniques proposed for any works traversing/in proximity to the national road network.
- In relation to haul route identification, the applicant/developer should clearly identify haul routes proposed and fully assess the network to be traversed. Separate structure approvals/permits and other licences may be required in connection with the proposed haul route and all structures on the haul route should be checked by the applicant/developer to confirm their capacity to accommodate any abnormal load proposed.

Notwithstanding any of the above, the developer should be aware that this list is non-exhaustive, thus site and development specific issues should be addressed in accordance with best practise.

I hope that the above comments are of use in your EIS preparation.

Yours sincerely,

P.P. Mark Byrne

Michael McCormack
Senior Land Use Planner

Appendix 1.3

Irish Cement Platin Project Brochure

IRISH CEMENT PLATIN

INVESTING IN OUR FUTURE

Irish Cement

INTRODUCTION

Investing in our future.

The next phase of investment in Platin will see further energy efficiency improvements with on site electricity generation and reduced dependence on fossil fuels through advances in the range and quantity of alternative fuels.

Continuous investment in new technology has been the hallmark of Irish Cement's operations since the opening of the plant in Drogheda in 1938. In 1972, a new dry process plant, Kiln1 was constructed when operations transferred to the current site in Platin. A major upgrade was completed with the addition of Kiln 2 in 1977 and then again in 2008 with the construction of Kiln 3, making Platin one of the most energy efficient cement plants in Europe.

These investments have been vitally important in helping Platin to maintain efficiency and sustain local jobs in a competitive industry. As well as supplying cement to the domestic market Platin also exports cement to the UK and Europe.

Irish Cement is committed to sustainable cement production through three principal initiatives:

1. Energy efficiency investments

2. Product innovation

3. Fossil fuel replacement

CEMENT PRODUCTION

A precisely controlled, high temperature manufacturing process. Quality Control is critically important during all stages of the process.

1

RAW MATERIALS

Limestone, quarried on site, is the main raw material. Clay overburden, also from the site, with shale and small quantities of bauxite and iron ore are also required. These raw materials are crushed, ground and homogenised to produce a blend called 'raw meal'. This raw meal is then 'melted' inside the cement kiln.

2

FUEL

Traditionally fossil fuels are used to fire cement kilns. Since 2011, an increasing proportion of the fossil fuels in Platin have been replaced by Solid Recovered Fuel (SRF). Fuels are introduced and combusted at both ends of the kiln to provide the high temperatures needed to 'melt' the raw meal and manufacture clinker.

3

QUALITY CONTROL

Quality control is critical to each stage of the cement manufacturing process. Our laboratories, which are linked to a state-of-the-art central control room, operate continuous testing regimes for raw materials, fuel and our final products. Platin also has an R&D laboratory on site involved in on-going product development.

4

CHEMISTRY

The creation of clinker inside the kiln is the result of a precise set of chemical reactions between calcium oxide (CaO), silicon dioxide (SiO_2), aluminium oxide (Al_2O_3) and iron oxide (Fe_2O_3). At the high temperatures inside the kiln, these compounds combine to form new the clinker minerals.

5

TEMPERATURE

Large fans draw air into the kiln providing oxygen for fuel combustion. The powdered raw meal flowing towards the kiln is heated by this hot air. The flow of raw meal helps to remove particles and compounds from the hot air and return them to the kiln. Inside the kiln the heated raw meal 'melts' and in this molten state the clinker is formed. The temperature required for clinker formation is 1450°C.

6

CLINKER

The clinker is cooled from 1450°C to 120°C as it exits the kiln and it is then stored on site in dedicated silos. The hot air from the clinker is used to dry and preheat the raw materials. The exhaust air from the kiln is cooled and passes through a fabric filter which removes dust particles before it is discharged from the stack.

7

CEMENT

Cement is produced by milling the clinker to a fine powder with the addition of small quantities of gypsum to control the setting time. Eco-efficient CEM II cement is produced with the addition of unburnt limestone, reducing the energy requirement and carbon footprint of the cement. The finished cements are conveyed to silos for dispatch by tanker or packed into 25kg bags.

WASTE HEAT RECOVERY

An energy efficiency investment.

In 2015, Irish Cement received planning permission for a new development in Platin that can recover surplus heat from the process to generate up to 7.5 Megawatts (MW) of electricity on site. Once installed this heat recovery unit could supply around 25% of Platin's electricity needs. This project will also reduce annual CO_2 emissions in Platin.

There will be no change to the quantity or nature of the air discharged, other than it will be at a lower temperature because the heat contained in the exhaust will be used to generate electricity. In effect, existing hot gases from the process will be diverted through a heat exchanger or boiler, to generate steam that, in turn, drives a turbine to generate electricity. The 'cooled' gases will be filtered as normal before being discharged through the stack.

Platin will be the first cement plant in Ireland and among the first in Europe to install this type of technology. The benefits are that Platin will need less electricity from the grid, will make better use of existing heat and will improve competitiveness, helping to secure operations into the future.

PLATIN WILL USE LESS ELECTRICITY FROM THE GRID

REDUCTION OF ANNUAL CO_2 EMISSIONS

CO-PROCESSING

Our contribution to the circular economy.

Since 2011, Irish Cement has contributed to the circular economy through its recovery and reuse of discarded resources. The use of alternative fuels, known as 'co-processing', involves the recycling of materials and recovery of energy: two processes happening in parallel inside the kiln.

Co-processing delivers many benefits. It reduces CO_2 emissions from the process; contributes to improved resource efficiency, by reducing the use of primary resources, including fossil fuels and it also directly reduces the need for traditional disposal options like landfill.

In 2015, the average fossil fuel replacement rate around Europe was 41% with some countries at much higher levels. In Germany, for example, the average replacement rate is 62% and some of the cement plants have replaced 100% of their fossil fuels. The types of alternative fuels used in Germany includes tyres, oil, paper pulp, plastics, animal meal, SRF/RDF, wood, solvents, sewage sludge.

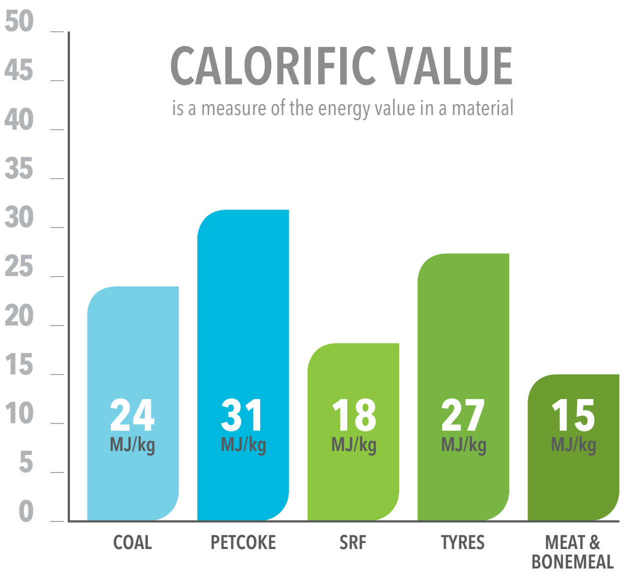
In 2011, Platin began replacing its fossil fuels with SRF and by 2016 had achieved 50% replacement. With the appropriate planning and licensing, a realistic target for Platin is to achieve 85% fossil fuel replacement. Many of the same alternative fuels used around Europe like tyres, solvents and sewage sludge are also available locally in Ireland. Irish Cement is now planning a phased programme of additional alternative fuel introductions in Kiln 2 and Kiln 3 to build on the success achieved to date and to further enhance the sustainability of the operations in Platin.

In many European countries, the use of suitable residual waste to fuel the cement plants helps to meet recovery and recycling targets.

In Switzerland, Germany and Sweden for example, the use of these fuels by local cement plants contributes to the achievement of high recycling rates, high energy recovery rates and zero or near-zero landfill rates.

In Ireland, the three Regional Waste Management Plans, published in 2015, recognise the important role of cement plants like Platin for the efficient recovery of residual waste.

FUELS AT PLATIN



Existing Fossil Fuels

PETCOKE

Petcoke (petroleum coke) is a by-product of the oil refining industry. This is currently the main fossil fuel used in Platin. It is imported by ship, delivered in trucks, milled and dried on site before being used. Calorific value 31MJ/kg.

COAL

Coal has been used in the past when it was sourced from a range of overseas locations. It was imported by ship, delivered to site in trucks, milled and dried before being used. Calorific value 24MJ/kg.

Existing Permitted Alternative Fuels

SRF

SRF (Solid Recovered Fuel) is made locally to a defined specification and contains fragments of paper, plastics, cardboard and textiles. SRF is produced from residual waste materials after the recyclable fractions are removed. It currently makes up 50% of the fuel mix in Platin. Calorific value 18MJ/kg.

TYRES

Tyres are not currently used in Platin. Consisting mainly of rubber compounds, textiles and small quantities of wire tyres are a common fuel for cement plants in Europe. Plans are in place to introduce them as a fuel over the coming years. Both chipped or whole tyres can be used in Platin Calorific value 27MJ/kg.

MEAT AND BONEMEAL

Currently Meat & Bonemeal (MBM) is not used in Platin. MBM is produced by rendering, grinding and sterilising at high temperature and pressure by-products of the meat industry. This fuel is produced off site to a defined chemical and physical standard for the cement industry. Calorific value 15MJ/kg.

ALTERNATIVE FUELS AND RAW MATERIALS

Irish Cement intends to apply for planning permission and for a review of the Industrial Emission (IE) licence in Platin to allow for an increase in the quantity and range of alternative fuels (AF) and alternative raw materials (ARM) to be used in both kilns. A range of materials have been selected as suitable for Platin following reference to existing permissions and guidance by the Environmental Authorities in Switzerland and Germany. These materials are already licensed by the Environmental Protection Agency (EPA) as fuel for cement production in Ireland. The use of these additional materials will advance the fossil fuel replacement programme in Platin.

Emissions from industrial facilities, like cement plants are tightly controlled under European Regulations. Experience in Europe, together with our own experience over the past 7 years, demonstrates that the emissions do not increase when we use alternative fuels. All of these materials can be processed safely in Platin because of the high operating temperature which ensures complete consumption. All materials accepted in Platin are subjected to testing to ensure they meet the agreed specifications and comply with strict quality control standards which are a requirement of the cement manufacturing process.

The range of proposed materials has been grouped into six general categories based on their handling characteristics and includes: fine, coarse and 'free-flowing' solids, pumpable fluids and alternative raw materials. Whole tyres can also be used in Platin and can be considered a separate category based on how they will be handled.

FINE SOLIDS

e.g. chipped timber, shredded plastics, shredded textiles, tyre fluff

These fine materials (typically sized 10-50mm) will be delivered to site, ready to use and offloaded from trucks into enclosed storage bays or halls from where they will be pneumatically conveyed to the kiln system. This system will be similar to the existing SRF handling and feeding system in Platin.

COARSE SOLIDS

e.g. shredded wood, dry filter cakes, and shredded rubber

These materials will be prepared off site to a defined specification before being delivered to site. The materials will typically have a larger particle size (30-120mm) and will be offloaded from trucks into bunkers inside enclosed halls and then transferred using screw-feeders or overhead cranes to the kiln feeding system.

FREE-FLOWING SOLIDS

e.g. sewage sludge pellets, SRF pellets

Some fuels will be 'free-flowing' solids or powders that will be offloaded into sealed silos. From here, they will be pneumatically conveyed to the kiln burners in enclosed pipelines.

PUMPABLE FLUIDS

e.g. secondary liquid fuels (SLF), waste oils, paint sludge

These fuels will be delivered by tanker and offloaded using pumps into on site storage tanks located in bunded areas. The fuels will be pumped to the kiln burners in enclosed pipelines.

WHOLE TYRES

e.g. car and van tyres

The whole tyres will be delivered by truck and offloaded onto a concrete storage pad. The tyres will be screened and mechanically conveyed to a double flap sluice feeding platform at the rear of the kiln. The feed rate will be automatically controlled based on the weight of each tyre.

ALTERNATIVE RAW MATERIALS

e.g. water treatment filter cake, soils and stones

These materials can have a variable consistency, from sludges, filter cakes, powders, dust, etc. They will be stored on site in covered storage areas and conveyed into the existing raw materials handling and dosing systems. The use of these materials will allow Platin to replace some of the traditional raw materials it currently consumes.

ENVIRONMENT

Platin, like all large industrial facilities, operates under an Industrial Emission (IE) licence from the Environmental Protection Agency (EPA) and all emissions are strictly monitored and controlled. The plant also operates to the international environmental management standard ISO 14001. Under the current IE licence, the use of alternative fuels is permitted in Kiln 3. As part of our new plans, an application will be submitted to the EPA for a revision of the existing licence to increase both the range and quantity of permitted alternatives fuels and to allow the introduction of alternative raw materials in both Kiln 2 and Kiln 3.

The IE licence is based on European Environment Regulations which set out minimum temperatures and residence time limits when waste is being used as fuel. Both the temperature and residence time in our kiln systems significantly exceed what is required under current Regulations.

When alternative fuels were first introduced to European cement plants, local communities naturally had questions about them, particularly in relation to emissions and traffic. These concerns were addressed by engaging in open dialogue and by providing information about the fuels, the technology and the controls in place.

Furthermore, the successful use of alternative fuels over time in Europe has contributed to confidence among the local communities. We now also have positive experience over the past seven years in Platin to confirm the safe use of alternative fuels.

Ahead of this proposed increase in alternative fuel use, detailed monitoring and modelling of future emissions and traffic have been completed.

This work demonstrates no increase in emissions from our operations and no traffic impacts on local roads around Platin.

HEALTH AND SAFETY

The health and wellbeing of our employees, visitors and neighbours is a primary concern for Irish Cement. All operations in Platin must be carried out in full compliance with Irish Cement safety procedures.

For Irish Cement, managing health and safety at our facilities is our primary concern. Safety Managers work closely with and assist managers and supervisors in developing safety management systems, improving safety performance and encouraging a 'Safety Culture' on site. The activities of our Safety Committee, which has members from across the workforce, helps to ensure employee engagement in eliminating day to day risks and identifying 'better ways of working'. Safety Statements provide the necessary detail for safe operations and work practices on site. Through the use of risk assessments, safety inductions and regular safety training, Irish Cement is dedicated to the ongoing safety of our employees, contractors, visitors and neighbours. Measurement and reporting against targets ensures that safety remains a top priority for workers and management alike.

Irish Cement's parent company, CRH, also sets the highest priority on Health and Safety and ensures that safety management is a daily priority for managers in every CRH location. CRH health and safety management systems are well established and are regularly reviewed, taking into account international best practice. Knowledge-sharing around the CRH Group also plays an important part in maintaining focus on safe working practices and elimination of risks.


Irish Cement
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TH!NK
SAFETY
WORK
SAFELY

KEY BENEFITS OF CO-PROCESSING ALTERNATIVE FUELS

Reduce dependence on imported fossil fuel

Increase recovery of valuable resources and reduce landfill

Reduce CO_2 emissions

Improve competitiveness

ADVANTAGES OF CEMENT KILNS

High temperatures and long residence times ensure complete combustion

Direct mixing of the powdered raw meal with the hot air helps to remove particles and compounds from the airflow

Extremely efficient at capturing energy from fuel

Produce no residual wastes

If you have any questions or would like to discuss any of the information contained within, please contact us.

Irish Cement Limited, Platin, Drogheda, Co. Louth

T 041 987 6000 W www.irishcement.ie E info@irishcement.ie

Appendix 1.4

Public Information Evening Notices

Captain Harry Collier with his brother Thomas Collier and sister Lucy McConnell at the Captain's Drive in at County Louth Golf Club

March verdict in Peter Butterly murder case

JUDGES at the Special Criminal Court trial of two men accused of murdering dissident republican Peter Butterly in a pub car park in Gormanston will return with a verdict on March 9th.

Mr Butterly (35) was shot dead outside The Huntsman Inn, Gormanston, Co Meath on March 6th, 2013.

Two Dublin men are charged with his murder.

Edward McGrath (35), of Land Dale Lawns, Springfield, Tallaght and Sharif Kelly (47), of Pinewood Green Road, Balbriggan have both pleaded not guilty to the alleged murder.

Mr McGrath has also pleaded not guilty to firearms offences on the same occasion.

A third accused, Dean Evans (24), of Grange Park Rise, Raheny, Dublin, failed to turn up for the trial, and has not been located by the gardai. The non-jury court decided to proceed with his two co-accused in Mr Evans's absence.

During the trial the court heard evidence from a protected witness, David Cullen, who was also originally accused of the murder. Cullen implicated his two former co-accused in the shooting.

The court heard the closing speech on Monday from Paul Greene SC, for Mr McGrath.

He said that the court can " only come to the conclusion that Mr McGrath has not been shown to have intended to kill or cause serious injury".

Mr Greene referred to the testimony of a member of the National Surveillance Unit, who told the trial that he saw Mr McGrath on March 4th, and that the same member was observing Cullen's apartment on March 5th, the night before the shooting, but did not see Mr McGrath.

Mr Greene suggested it was "surprising that a trained observer was able identify Mr McGrath on the 4th and name him but doesn't purport to do the same on the 5th".

During the trial, Cullen gave evidence that on March 5th a man with the initials KB told Mr McGrath to "make sure he [Mr Butterly] gets blocked in and can't get out, make sure it gets emptied into him."

Mr Greene said that, apart from Cullen's testimony, there is no evidence that his client was present.

He also cited the evidence that gardai found clothes with Mr Evans' DNA in the boot of an Opel Zafira stopped a mile and a half from the scene of the shooting.

Mr Greene said that the prosecution "has never said that Mr McGrath equipped himself with a change of clothing" following the shooting.

He said that these were "two highly significant pieces of evidence, indicative of an absence of proof that my client had an intention to kill or cause serious injury".

The barrister also submitted that there are "very real concerns about Cullen filling in the gaps".

"It beggars belief," he said, "that credence can be placed on the testimony of somebody who is such damaged goods."

The two accused men were remanded on continuing bail until March 9th, when the judges will deliver a verdict.

Wallet stolen at Lidl car park

Fiona MAGENNIS

GARDAI are investigating after a local woman had her wallet stolen in a 'distraction robbery' and more than €6,500 worth of transactions spent on her bank card before she realised what had happened.

The incident happened on Tuesday, February 21st shortly after 4.30pm in the Lidl car park at the M1 Retail Park.

The female victim said she was approached by a man who asked her for directions to Our Lady of Lourdes Hospital. She opened the car to get out a pen a write the directions down.

As she was doing this the man was leaning against the car and sometime later after she had left the area she noticed that the passenger door of the car was not closed properly.

Three hours later she was contacted by her bank to say there had been a total of 18 transactions made valuing €6,500.

She then discovered that her wallet had been stolen from the car.

ANYONE who might have noticed a man acting suspiciously around the retail park on the afternoon in question or who may have any information in relation to the incident is asked to contact Drogheda Garda Station on 041-98

Meanwhile, the theft of a number of power tools from a van is also being investigated.

The tools were stolen from a van parked at the Boyne Valley Hotel overnight from 9pm on February 21st to 8am the following morning. Items stolen included a Bosch powerdrill valued at €650 and a mikkitta drill valued at €700. CCTV footage of the incident is being examined.

€6,000 worth of jewellery stolen

GARDAI are investigating after more than €6,000 worth of jewellery was stolen from a home in the Nun's Walk area of town.

The break-in happened on Saturday, February 25th sometime between 8.15pm and 10pm when the culprits gained entry by forcing the front door.

The house was ransacked and jewellery valued at €6,100 was stolen.

A number of other burglaries around town over the past seven days are also being investigating.

On Thursday, February 23rd a house in Congress Avenue was broken into shortly after 9.30pm.

The resident of the house was upstairs in a bedroom at the time when she heard noises downstairs. The bedroom door was locked but a short time later she heard someone try the door on the outside.

When the house eventually went quiet she went downstairs and noticed the rear door open but nothing appeared to have been taken.

ON the same night, a house in Old Hill was broken into sometime between 8pm and 5am the following morning.

A rear window was forced and jewellery worth €250 was stolen from the house.

There was also €100 worth of damage caused to the window as a result of the break-in.

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Meath County Council - We, Moss Lane Investments Ltd, intend to apply for Planning Permission for development at Glebe, Rathmolyon, Co. Meath. The development will consist of the construction of 21 residential units consisting of 6 no. four bed terraced houses, 6 No. two bed terraced houses, 6 No. three bed semi-detached houses, 2 No. three bed townhouses, 1 No. one bed apartment and 1 No. ground floor retail unit including entrance, roads, car parking, landscaping and all ancillary services. The Planning Application may be inspected, or purchased at a fee not exceeding the reasonable cost of making a copy, at the offices of the planning authority during its public opening hours and a submission or observation in relation to the application may be made to the authority in writing on payment of the prescribed fee (€20) within the period of 5 weeks beginning on the date of receipt by the authority of the application.

PUBLIC NOTICES

Irish Cement

Irish Cement will be running a series of public information briefing sessions in the Model Room, Platin Works (main Works entrance off Platin Terrace) on the following dates and times:

Thursday, 2nd March	4:00pm to 8:00pm
Friday, 3rd March	11:00am to 4:00pm
Saturday, 4th March	11:00am to 2:00pm

Members of the public are invited to drop in during these times, when Irish Cement staff will be available to provide information on the status of the current fossil fuel replacement project in Platin. This project started with a planning application to Meath County Council in November 2015, and will shortly be lodged with An Bord Pleanála for decision.

Further information can be found on our website at www.irishcement.ie

Meath County Council - We Tom & Catherine McGorman intend to apply for permission for retention of development and planning permission for development at Lagore Little, Ratoath. The development will consist of 1) Permission for retention of sun room at side of existing dwelling. 2) Permission to extend existing dwelling with rear extension at ground floor incorporating new livingroom, relocating existing front door to side porch, existing front door to be replaced with window and other minor internal alterations and all ancillary site works. The planning application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy, at the offices of the Planning Authority during its public opening hours. A submission or observation in relation to the application may be made in writing to the Planning Authority on payment of the prescribed fee (€20.00) within the period of 5 weeks beginning on the date of receipt by the Planning Authority of the application and such submissions or observations will be considered by the Planning Authority in making a decision on the application. The Planning Authority may grant permission subject to or without conditions, or may refuse to grant permission. Signed : Ultan Blake, Eslin House Design (01) 8250465 Cultrummer, Drumree, Co. Meath. email:eslinhousedesign@yahoo.ie

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Meath County Council - I Danielle Clarke intend to apply for development at Crickstown, Curragha, Co Meath. The development will consist of outline planning permission with a change of applicant on 'Site B' previously granted outline planning permission under Planning Registry Reference AA/140723 for a detached two storey dwelling house with a detached garage and separate proprietary waste water treatment unit and percolation area, which forms part of an overall development of 4 individual houses all of which obtained outline planning permission under the above planning reference and under which full planning permission was granted for the vehicular entrance and access road to serve the above sites, along with the adjustments to the existing hedgerow, associated services, service connections, landscape and site development works. The planning application may be inspected or purchased, at a fee not exceeding the reasonable cost of making a copy, at the offices of the Planning Authority during its public opening hours. A submission or observation in relation to the application may be made in writing to the Planning Authority on payment of a fee of €20, within the period of 5 weeks, beginning on the date of receipt by the Planning Authority of the application and such submissions or observations will be considered by the planning authority in making a decision on the application. The Planning Authority may grant permission subject to or without conditions, or may refuse to grant permission.

Meath County Council - We, Caroline Preston and John Preston, intend to apply for permission for the conversion of the first floor of an existing outhouse into ancillary family accommodation at Swainstown House, Swainstown, Kilmessan, Co. Meath, a protected structure. The planning application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy, at the offices of the Planning Authority during its public opening hours. A submission or observation in relation to the application may be made in writing to the Planning Authority on payment of the prescribed fee (€20.00) within the period of 5 weeks beginning on the date of receipt by the Planning Authority of the application and such submissions or observations will be considered by the Planning Authority in making a decision on the application. The Planning Authority may grant permission subject to or without conditions or may refuse to grant permission.

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Appendix 3.1

Firewater Risk Assessment

Irish Cement Limited

IPPC Licence Reg. No. P0030-04

Review of Firewater Risk Assessment – Platin Cement Works

Issue F | 7 June 2017

Job number 325374-47

Ove Arup & Partners Ireland Ltd

Arup
50 Ringsend Road
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Contents

Appendices

Appendix A

Environmental Risk Assessment – Platin Cement Works

1 Executive Summary

A risk assessment has been carried out of potentially contaminated firewater arising from fires at Platin Cement Works, Co Meath. The risk assessment followed the methodology set out in the EPA's Draft Guidance Note to Industry on Requirements for the Establishment of Fire-Water Retention Facilities.

The following materials stored on-site were assessed with regard to potential impact on surface waters and groundwater in the event of a fire on-site: diesel oil, pet coke, aqueous ammonia, grinding aid, alternative fuels (Fine Solids, Coarse Solids, Free-flowing Solids, Pumpable Fluids and Whole Tyres), and Alternative Raw Materials.

The quantity of diesel oil/central heating oil stored on site exceeds the threshold quantity specified by the EPA for materials to which the risk phrase R52 has been assigned. Therefore, the site requires the provision of firewater retention facilities.

The environmental risk is assessed subjectively taking into account the following factors: fire load, or quantity of combustible materials, fire risk and environmental load.

Diesel oil, grinding aid, aqueous ammonia, Performax 3400 (polyacrylic acid and sulphuric acid) and Biosperse 3001 (hypochlorite solution) are stored in double-skin tanks or single skin tanks within concrete bunds. These materials are not flammable and contaminated firewater is unlikely to arise.

Firewater retention sumps have been or will be provided for containment of the firewater and coincident rain water at the Fine Solids, Coarse Solids and Whole Tyre storage and handling areas. Irish Cement Policy will be to allow fires in the Pumpable Fluids storage facility to burn out, but cooling water may be used to protect adjacent plant and equipment.

All surface water arising from buildings and hard standing on the site is piped to the water collection system which delivers process and storm water into storm balancing tanks followed by sedimentation/settlement tanks, both of which are used to reduce the levels of suspended solids.

2 Introduction

Irish Cement Limited (ICL) operates a cement manufacturing facility at Platin, Co Meath.

A fire water risk assessment was carried out for Platin Cement Works as required by Condition 3.9.2 of the Industrial Emissions (IE) Licence Register No P0030-04.

The previous fire water risk assessment report dated 20th March 2014, has been revised to take account of the proposed development required for receiving, storage and introduction of the proposed increased range and quantity of alternative fuels (AF) and the use of alternative Raw Materials (ARM).

3 Scope

This report is based on a survey of the site, a review of the plans and documents provided by ICL and discussions with ICL staff.

The report lists the areas within the factory where runoff from a fire could potentially pose an environmental hazard (refer to Appendix A: Environmental Risk Assessment). It describes the materials used, the firefighting facilities, and the drainage systems. The total quantity of fire-water likely to be applied in the event of a fire is calculated in accordance with the methodology described in the EPA (Draft) Guidance Note to Industry on the Requirements for Fire-Water Retention Facilities [1]. The flow patterns and destination of fire-water runoff are described. The impact of rainfall is evaluated in accordance with the EPA Guidance Note.

The environmental risk is assessed, taking into account fire load, fire risk and environmental load.

The information required under Appendix B Part 11 of the EPA Guidance Note is provided in the Platin Cement Works Emergency Response Procedure.

4 Irish Cement Limited Platin Cement Works Facilities

The site layout is shown in Figure 1 including the locations of all existing and proposed storage and storage facilities, including:

- bunded and double skinned tanks,
- storage facilities for alternative fuels and
- firewater retention tanks and sumps

The unit processes at the Platin Works can be summarised as follows:

- Limestone crushing and transport to store
- Shale crushing and transport to store
- Raw milling
- Raw meal homogenising and storage
- Coal milling
- Clinker manufacture in kilns
- Cement milling
- Cement packaging
- Bulk dispatch.

In addition, facilities are provided for storage of materials, including:

- Pet coke
- Alternative fuel
- Aqueous ammonia
- Grinding aid

Platin Cement Works already has permission for the use of up to 120,000 tonnes per annum of alternative fuels. Irish Cement Ltd is now applying to An Bord Pleanála for a 10-year planning permission for development to provide for on-site receiving, storage and introduction of up to an additional 480,000 tonnes per annum of alternative fuels and alternative raw materials.

To facilitate this increased use of alternative fuels, a number of additional structures and associated equipment are proposed for Platin. The broad categories of reception, temporary storage and handling systems can be subdivided based on the typical physical characteristics of the various waste materials;

- Fine Solids, e.g. solid recovered fuel (SRF), chipped timber, shredded plastics, shredded textiles, tyre fluff
- Coarse Solids, e.g. Shredded tyre chips, shredded wood, dry filter cakes, shredded rubber
- Pumpable Fluids, e.g. secondary liquid fuels SLF, solvents, waste oils, paint sludge, liquid animal fat
- Free-flowing Solids, e.g. Meat and bone meal, sewage sludge pellets, fine plastic pellets
- Whole Tyres
- Alternative Raw Materials, e.g. Alum filter cake, soils and stones, dusts.

The proposed development, which also includes for a proposed increase in the volumetric gas flow, will require a review of its existing Industrial Emissions (IE) Directive Licence (Register No P0030-04).

5 Materials

The following materials stored on-site were assessed with regard to potential impact on surface waters and groundwater in the event of a fire on-site:

- Diesel oil
- Pet coke
- Aqueous ammonia
- Grinding aid
- Alternative Fuels and Alternative Raw Materials

The EPA Draft Guidance Note gives threshold quantities for substances classified under specified risk phrase numbers. Of the materials listed above, only diesel oil has an EPA-specified risk phrase number, R52/53. None of the alternative fuels or alternative raw materials has been allocated any of the risk phrases R50, R51, R52 or R53.

The EPA Guidance Note states that industrial operations will generally require fire-water retention facilities where the quantities of dangerous materials exceed these threshold quantities. The threshold quantities are given in Table 1.

Table 1: Dangerous Substance Storage and Threshold Quantities

	Risk Phrase			
Risk Phrase No.	**R50**	**R51**	**R52**	**R53**
Material Quantity (approximate maximum storage capacity)	**Very toxic to aquatic organisms**	**Toxic to aquatic organisms**	**Harmful to aquatic organisms;**	**May cause long-term adverse effects in the aquatic environment**
Threshold Value (tonnes)	1	10	100	1000
Quantity of Diesel & Central heating Oil on site (R52/53) (tonnes)	-	-	500	500

From Table 1 it is evident that, for the risk phrase number R52, the inventory of materials on-site is in excess of the EPA indicative threshold quantity.

Table 2 describes the storage location and type of containment provided for materials that could potentially pollute the aquatic environment in the event of loss of containment or fire (refer also to Figure 1).

Concrete bund integrity testing is carried out periodically on concrete bunds in accordance with requirements of the IPPC Licence. All concrete bunds were found to be watertight in the assessments reported to the Agency in the 2012, 2013 and 2014 Annual Environmental Reports (AERs).

Table 2 Site Bund Schedule

Ref.	Substance	Status	Maximum Tank Capacity (L)	Tank Location	Tank Material	Containment
1	Taxed diesel	Existing	113,500	Opposite garage	Steel	Concrete bund
2	Quarry untaxed diesel	Existing	113,500	Top of quarry	Steel	Concrete bund
3	Production untaxed diesel	Existing	114,300	North of Raw Mill 1 building	Steel	Concrete bund
4	Diesel tanks	Existing	59,010	Under old Kiln 2 platform	Steel	Concrete bund
5	CEM I Grinding aid tanks	Existing	2 x 30,000 (60,000)	Above old Kiln 2 platform	Orthophthalic GRP	Concrete bund
6	CEM II Grinding aid tanks	Existing	2x 30,000 (60,000)	Adjacent to grate cooler DB room	Orthophthalic GRP	Concrete bund
7	Central heating oil	Existing	2 x 6,500 (13,000)	New Engineering Building	Steel	Double skinned tank
8	Central heating oil	Existing	3,000	Garage	Plastic	Double skinned tank
9	Furnace diesel oil	Existing	4,550	Raw Mill Building	Steel	Single skinned tank on bunded pallet
10	Emergency generator diesel oil	Existing	1,500	Kiln 2	Steel	Single skinned tank on bunded pallet
11	Central heating oil	Existing	3,500	Production Building	Steel	Double skinned tank
12	Ammonia water (<25%)	Existing	2 x 120,000 (240,000)	North of Raw Mill 1 building	Stainless steel	Concrete bund
13	Production untaxed diesel	Existing	2,300	Packing Plant	Steel	Double skinned
14	Crusher diesel oil	Existing	3,000	Right of Crusher	Plastic	Double skinned
15	Emergency generator diesel oil	Existing	4,000	Kiln 3	Steel	Concrete bund
16	Kiln burner diesel tank	Existing	20,000	Kiln 3	Steel	Concrete bund
17	Performax 3400 (polyacrylic acid and sulphuric acid)	Existing	300	Beside Blue Tank	Plastic	Single skinned tank in plastic bund
18	Biosperse 3001 (hypochlorite solution)	Existing	300	Beside Blue Tank	Plastic	Single skinned tank on bunded pallet
19	Performax 3400 (polyacrylic acid and sulphuric acid)	Existing	500	Next to CM4 cooling tower	Plastic	Single skinned tank on bunded pallet
20	Biosperse 3001 (hypochlorite solution)	Existing	2 x 300 (600)	Next to CM4 cooling tower	Plastic	Single skinned tank on bunded pallet

Ref.	Substance	Status	Maximum Tank Capacity (L)	Tank Location	Tank Material	Containment
21	Solid Recovered Fuel	Part Existing and part Proposed	5 bunkers – capacity 1,000 m³ (300 tonnes) each	South and east of Limestone Stores	Concrete	203m³ concrete bund above ground
22	Fire-water Retention tank	Existing to be replaced by larger tank	No tank – Bund only	Beside fine solids building for Kiln 3	Concrete	Existing concrete bund 200m³. Replacement concrete bund 400m³
23	Fire-water Retention tank (proposed)	Proposed	No tank – Bund only	Coarse solids handling building for Kilns 2 and 3	Concrete	Concrete bund 325 m³
24	Fire-water Retention tank (proposed)	Proposed	No tank – Bund only	Fine Solids Handling Building for Kiln 2	Concrete	Concrete bund 200m³
25	Pumpable fluids tanks for Kiln 2 and 3	Proposed	2 no. 20,000, 1 no. 7000	Pumpable fluids silos for Kiln 2 and 3	Steel	Concrete bund 840m³
26	Fire-water Retention tank (proposed)	Proposed	No tank – Bund only	Beside Alternative Raw Materials Facility	Concrete	Concrete bund 325m³
27	Fire-water Retention tank (proposed)	Proposed	No tank – Bund only	Whole Tyres Facility	Concrete	Concrete bund TBDm³
28	Free flowing Solids	Proposed		Silos for Free flowing Solids for Kiln 2	Concrete	Concrete bund 464m3
29	Free flowing Solids	Proposed		Silos for Free flowing Solids for Kiln 3	Concrete	Concrete bund 464m3

6 Fire Protection

ICL has emergency response procedures in place which outline the actions required and the people responsible for dealing with the following situations: fire, explosion and spill of flammable or environmentally harmful material. All employees are informed in the procedures including evacuation routes, alarm systems, reporting to supervisors and personal protective equipment.

Fire protection of the Platin Works consists of:

- Fire prevention;
- Fire containment;
- Fire detection;
- Fire suppression.

6.1 Fire Prevention

Fire prevention is achieved by:

- Minimising risk of loss of containment of flammable materials;
- Minimising risk of ignition of flammable or combustible materials;
- Training of staff.

The proposed storage tanks for pumpable fluids will be provided with inert gas blanketing to prevent the formation of potentially explosive atmospheres.

6.2 Fire Containment

Platin Cement Works is laid out as a series of discrete storage and production units. This layout is a major factor in limiting the potential for fire spread from one unit to another. In addition, the principal raw materials, intermediates and products of the cement manufacturing process are non-combustible.

Spill containment is achieved through bunding of tanks or use of a double skinned tank in the case of the central heating oil tank. Storage tanks are generally located away from potential sources of ignition.

All bunds referred to in Table 2 are designed in line with industry best practice. However, such bunds are not designed to retain large volumes of fire-water. The fire-water in excess of the bund capacity would enter the storm water drainage and treatment system, where there is potential to retain firewater in the balancing tanks.

6.3 Fire Detection

Automatic fire detection is provided in the electrical substation and in all office buildings.

Fire detection associated with existing and proposed storage of combustible materials including alternative fuels is as follows:

Table 3: Fire Detection

Material	Location	Fire Detection
Fine pet coke	Storage bin and bag filter hopper	Carbon monoxide (CO) detection
Fine Solids (e.g. SRF)	Shed/Unloading	Heat detectors Flame detectors CCTV
	Supply to Pre-calciner	Heat detector Flame detector
Coarse solids	Storage building	CCTV
Free-flowing solids	Store (silos)	CCTV
Whole tyres	Storage and handling area	CCTV
Pumpable fluids	Tanks and bund	CCTV
Alternative Raw Materials	Storage building	CCTV

6.4 Fire Suppression

Firefighting facilities comprise:

- A set of firefighting and emergency rescue equipment is located at the Central Fire Point under Kiln 1 drive station.
- Firefighting water hydrants and fireboxes are located as shown on the site risk map in the Platin Cement Works Emergency Response Procedure.
- Portable fire extinguishers are located at points around the Works shown on the site risk map.
- Foam concentrate is stored on site for use by the Fire Brigade which is equipped with a foam generation unit that would be brought on site in the event of a fire at the SRF storage area. Sufficient concentrate is stored for generation of foam for suppressing a 40 minute fire. The concentrate is intended for use at 1-3% dilution).
- Platin Cement Works has six spill response kits at locations close to the areas where chemicals/flammables are stored in larger quantities. The spill kit locations are:
    - At the main entrance to the cement milling building,
    - At the diesel/fuel oil tanks at the firing end of Kiln 2,
    - The untaxed diesel storage tank opposite the garage,
    - The diesel storage tank at the quarry entrance,
    - At the garage,
    - In the stores.

  Each spill kit contains a variety of absorbent materials.

Fire suppression facilities for proposed storage of alternative fuels and alternative raw materials will comprise hose reels, sprinklers and portable fire extinguishers as required for the fire risk presented in each storage unit.

7 Site Drainage

Management of process and storm water runoff on-site consists of a water collection system which delivers process and storm water into storm balancing tanks followed by sedimentation/settlement tanks, both of which are used to reduce the levels of suspended solids (refer to Figure 2).

Deep well water from the quarry is managed through continuous pumping of groundwater from the deep well in the quarry floor. It does not require any treatment.

Domestic effluent is treated in a purpose built package wastewater treatment plant on-site.

Treated process and storm water runoff discharges from the sedimentation tank and confluences with deep well water from the quarry and treated domestic effluent to form the final treated effluent which discharges to the outfall point into the River Nanny via a designated pipeline.

Table 5 shows the retention capacities of the various tanks at the site. The storm balancing tanks alone have a capacity of 1,365m³, which is more than 10 times the worst case volume of diesel oil that would be released.

Table 4: Surface water treatment system capacity

Parameter	Value	Units
Storm Balancing Tank (8 chambers)	1,365	m³
Sedimentation tanks	690	m³
Total retention capacity	2,055	m³
Average through-flow	2,000	m³/day
Average retention time	1.03	days

The treated final effluent is discharged through an underground 610mm diameter pipeline, 2637m long, which runs from the Cement Works to the outfall to the receiving waters of the River Nanny.

8 Firewater and Rainwater

8.1 Rainwater

The effect of rainwater is normally taken into account in fire-water containment studies. It is credible that in the event of a major fire on-site, there could also be a period of heavy rain, although this is extremely unlikely.

Rain falling on the Works buildings, plant equipment and hard standing areas drains through downpipes into the storm water system, which was described in section 6. This rainwater would normally be expected to be uncontaminated.

Rainfall data from the Meteorological Office show the following:

Table 5: Rainfall

Mean annual precipitation	931.6 mm (1)
4-hour precipitation event 20-year return	33.5 mm (2)
24-hour precipitation event 20-year return	60.7 mm (2)

(1) Met Éireann's website 30-year metrological data; http://www.met.ie/climate/mullingar.asp

(2) Met Éireann; Extreme Rainfall Return Period data

The EPA (Draft) Guidance Note recommends that fire-water runoff during a fire be based on the 24-hour event with a return period of 20 years, or 50 mm, whichever is greater. Rainfall data provided by Met Éireann shows that the 24-hour rainfall event for a 20 year return period for Easting: 306490 Northing: 271801 is 60.7 mm. As the maximum 24-hour figure, 20-year return is greater, it will be used to calculate the fire-water retention volume required.

Where the environmental risk assessment (refer to Appendix A) shows a high environmental risk, it is proposed to provide dedicated fire-water retention facilities for the area in question, such that rainwater falling on the area could be isolated from the site storm water drainage system. Therefore, the rainwater contribution to the volume of fire-water to be retained in the event of a fire in one of these areas is calculated based on the footprint of the area in question.

8.2 Fire Suppression Water

Water used to suppress a fire on-site would consist of ICL firefighting water and water brought on-site by Meath/Drogheda Fire Brigade.

Based on discussions with Meath Fire Brigade, in the event of a large fire, the fire brigade would be expected to bring two fire tenders on-site, each with a capacity of 11 m^3. This water would be used very quickly in the event of a large fire. Water used to fight the fire would predominantly come from the site fire hydrants which are supplied by:

- The internal borehole supply from the quarry, which is pumped to the 'Blue' ground level tank (capacity = 2,000 m^3) and thence re-pumped to the Break Pressure/Header tanks on top of the Raw Meal Silo (capacity = 280 m^3)
- Supply from the Cruicerath reservoir (capacity = 2,270 m^3) which draws from the Drogheda Corporation supply and which supplies the site via a 3.5 km long 300 mm dia. delivery main to the main site entrance

The internal water supply is utilised for process water with the Cruicerath supply used as a standby.

The adequacy of the firefighting water supply and runoff containment was assessed in a report in 1993 [6]. This report concluded that the internal water supply is capable of providing a 5 m^3/min flow for at least 9 hours. This is in line with Meath County Council requirements. The fire main is regularly tested by Abacus Fire & Safety Limited and achieves 4 bar at all hydrants tested.

The volumes of potentially contaminated fire-water that could be generated in the event of a fire in different areas of the Works are presented in Attachment A.

9 Environmental Risk Assessment

The environmental risk is assessed subjectively taking into account the following factors:

- Fire load, or quantity of combustible materials
- Fire risk
- Environmental load.

The environmental risk assessment methodology is described in Appendix A, Environmental Risk Assessment, section A.1.

9.1 Site Environmental Risk Assessment Areas

The environmental risk assessments of those areas of the site that could pose a risk to the aquatic environment are described in Appendix A, Environmental Risk Assessment, section A.2. The areas assessed in Appendix A.2 were selected based on the nature and quantities of the materials stored. The nature of these materials is discussed below.

9.1.1 Diesel Oil

Diesel oil is categorised by risk phrase R52/53, i.e. it is harmful to aquatic organisms and may cause long term adverse effects in the aquatic environment. Due to its high flash point (56ºC minimum), ignition of diesel oil is extremely unlikely.

9.1.2 Aqueous Ammonia

Aqueous ammonia with a concentration of less than 25% w/w ammonia is stored on-site in steel tanks. The tanks are located within retention bunds with a capacity of 110% of the largest tank. This material will be used for reducing emissions of nitrogen oxides to atmosphere in the kiln gases.

Ammonia solutions with a concentration of less than 25% are classified as “Corrosive” and carry the risk phrase R34.

The ammonia is stored in a stainless steel, single-sheathed tank. The tank is enclosed by a concrete bund, which is designed to retain up to 110% of the capacity of the tank. Therefore, in the event of total loss of containment, the bund will have sufficient capacity to retain the entire contents of the tank.

9.1.3 Grinding Aid

Grinding aid is a liquid mixture of a number of materials, of which only two are classified as hazardous:

Table 6: Grinding Aids

Material	CAS No	Risk phrases
2.5-10% triethanolamine	102-71-6)	R36/38 (Irritating to eyes and skin)
10-25% ethylene glycol	107-21-1	R22 (Harmful if swallowed)

9.1.4 Pet Coke

Petroleum coke (often referred to as Pet coke or petcoke) is a carbonaceous solid that is generated by oil refinery coker units or other cracking processes. It is a solid, composed of carbon and other high molecular weight and water insoluble materials. Some metals are present but usually at very low concentrations. The concentrations of these metals are quite variable depending upon the source of the coke.

Although there is no direct evidence on the leachability of components from petroleum coke, a study has been conducted on the leachability and ecotoxicity of coal gasifier solid waste, a similar material to petroleum coke. Extraction of this material in the form of bottom ash was accomplished with either distilled water or using the US EPA EP toxicity extraction procedure. The concentrations of metals in the extract were all at levels considered "non-hazardous" by US EPA (RCRA) standards.

It is concluded that a fire involving pet coke would not result in contamination of the receiving waters, i.e. River Nanny.

9.1.5 Fine Solids (Existing and Proposed)

Fine Solids are currently stored in a purpose built building on site for use in Kiln 3. It is proposed to extend the floor area of this building by 490m². Fine Solids for use in Kiln 2 will be stored at the northern end of the site in a new building with floor area approximately 1,242m².

While no data has been found to show Fine Solids runoff to be harmful the aquatic environment, it is considered appropriate to retain fire-water in order to protect surface and groundwater from any potentially harmful runoff as follows:

- An existing retention tank for the Fine Solids (SRF) building at Kiln 3, with capacity of 200m³will be replaced with a new tank of 400m³ at a new location a short distance to the west of its existing location. This is to facilitate the proposed extension of the existing building.
- A new retention tank with capacity 200m³ will be provided adjacent to the Fine Solids building for Kiln 2.

9.1.6 Coarse Solids (Proposed)

Coarse Solids will be stored in a building with a floor area of approximately 4,875 m^2. While no data has been found to show Coarse Solids runoff to be harmful the aquatic environment, it is considered appropriate to retain fire-water in order to protect surface and groundwater from any potentially harmful runoff as follows:

A retention tank with capacity 325m^3 will be provided.

9.1.6.1 Free-Flowing Solids Silos (Proposed)

Two Free-Flowing Solids silos will be provided for Kiln 2 and two for Kiln 3. Each pair of silos will be protected against fire by CO detection and inert gas system and enclosed within a concrete bund wall. Therefore, fire-water would not be generated in the case of a fire in any of these silos. However, hose reels for cooling of adjacent tank, plant and equipment in the event of a fire in adjacent facilities.

9.1.6.2 Pumpable Fluids Storage (Proposed)

The Pumpable Fluids blend used at Irish Cement will not be classified as dangerous to the environment. The policy with regard to fires in the solvent tank or bund will be to allow such fires to burn out, while using a water drenching system to cool adjacent tanks and hose streams to cool adjacent buildings. Portable powder fire extinguishers will be provided for suppressing small fires.

Hence contaminated firewater is not expected to arise from this facility.

An underground retention sump (capacity 25 m^3) will be provided for containing any spills that might arise during road tanker discharge.

The storage tanks will be located within a concrete bund with a capacity of approximately 840m^3.

9.1.6.3 Alternative Raw Materials (Proposed)

Alternative Raw Materials will be stored in a building with a floor area of approximately 2,853 m^2. These materials are non-combustible and insoluble in water. However, it is considered appropriate to provide a retention tank with capacity 325m^3.

9.1.6.4 Whole Tyres (Proposed)

Whole tyres will be stored within a contained area at the northern end of the site. Tyres will be loaded on to a conveyor for feeding to Kiln 2. The area used for storage will be 835 m^2 and the area within which the tyre handling equipment will be located is approximately 287m^2. It is considered appropriate to retain fire-water in order to protect surface and groundwater from any potentially harmful runoff. In order to contain firewater run-off and coincident rain runoff a retention tank with capacity 200m^3 will be provided.

10 Fire-Water Retention

In the event of small fires firewater would be contained in sumps local to the fire location as follows:

- Under the Fine Solids storage bays – fire water is pumped using a float switch to the Fine Solids fire water bund.
- Under the TULS (Fine Solids loading system) – fire water is pumped using a float switch to the Fine Solids fire water bund.
- Delivery yard – all firewater collects at a sump. A manual valve is closed to the plant storm water tanks and the fire water that has collected is pumped to the Fine Solids fire water bund.

It is proposed to provide in-line firewater retention tanks at the locations shown in Table 8.

Table 7: Firewater Retention tanks

Ref[1]	Material	Unit	Existing/Proposed	Description	Capacity (m^3)
21/22	Fine Solids (SRF)	Kiln 3	Existing – to be replaced	Tank for Fine Solids (SRF) Kiln 3 Facility	400
23	Coarse Solids		Proposed	Tank associated with Coarse Solids Facility	325
26	Alternative Raw Materials		Proposed	Tank associated with Alternative Raw Materials Facility	325
24	Fine Solids	Kiln 2	Proposed	Tank associated with Fine Solids Kiln 2 Facility	200
27	Whole Tyres		Proposed	Tank associated with Whole Tyres Facility	200
25	Pumpable Fluids		Proposed	Pumpable Fluids Tanks for K2 and K3 are located within a bunded Facility	300
28	Free Flowing Solids	Kiln 2	Proposed	Silos for Free flowing Solids for K2 are located within a bunded Facility	NA
29	Free Flowing Solids	Kiln 3	Proposed	Silos for Free flowing Solids for K3 are located within a bunded Facility	NA
Note 1: Reference in Figure 1					

In the event of a large fire, some of the firewater runoff could reach the surface water drainage system. However, all will be retained onsite in the storm balancing tanks and the sedimentation tanks.

Table 9 shows the retention capacities of the various tanks at the site. The storm balancing tanks alone have a capacity of 1,365m³, which is more than 10 times the worst case volume of diesel oil that would be released.

Table 8: Surface water treatment system capacity

Parameter	Value	Units
Storm Balancing Tank (8 chambers)	1,365	m³
Sedimentation tanks	690	m³
Total retention capacity	2,055	m³
Average throughflow	2,000	m³/day
Retention Time	1.03	days

Any fire-water retained on-site would be disposed of by a method agreed with the Agency. The proposed disposal methods include:

- Disposal off-site by a licensed contractor
- Reuse in the plant as process water
- Pumping to the site storm water drainage system subject to analysis of the water showing it was safe to do so.

11 Conclusions

The quantities of fire-water and coincident rainwater have been calculated for those areas of the Cement Works where the nature and quantities of materials stored pose a risk to the aquatic environment in the event of fire. The volumes of contaminated fire-water that could potentially be generated during a fire on-site have been calculated in accordance with the methodology specified by the EPA.

All bunds provided on-site are designed and constructed in line with industry best practice. Assessment of the environmental risk associated with these areas shows that the risk to the aquatic environment is low to medium. Therefore, it is not considered that the risk warrants the provision of additional containment to that provided by the bunds.

Fire-water containment is provided for the existing alternative fuels unloading and storage facilities by the storage facilities themselves and the existing firewater retention sump. Additional firewater retention tanks and/or bunded facilities will be provided for the proposed alternative fuel and alternative raw materials storage and handling facilities.

References

[1] Environmental Protection Agency (1995) Draft Guidance Note to Industry on Requirements for the Establishment of Fire-Water Retention Facilities

[2] CONCAWE (1993) Petroleum coke product dossier no. 93/105

[3] Environmental Protection Agency (2004) IPPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities

[4] CIRIA (1997) Report 163 Construction of bunds for oil storage tanks

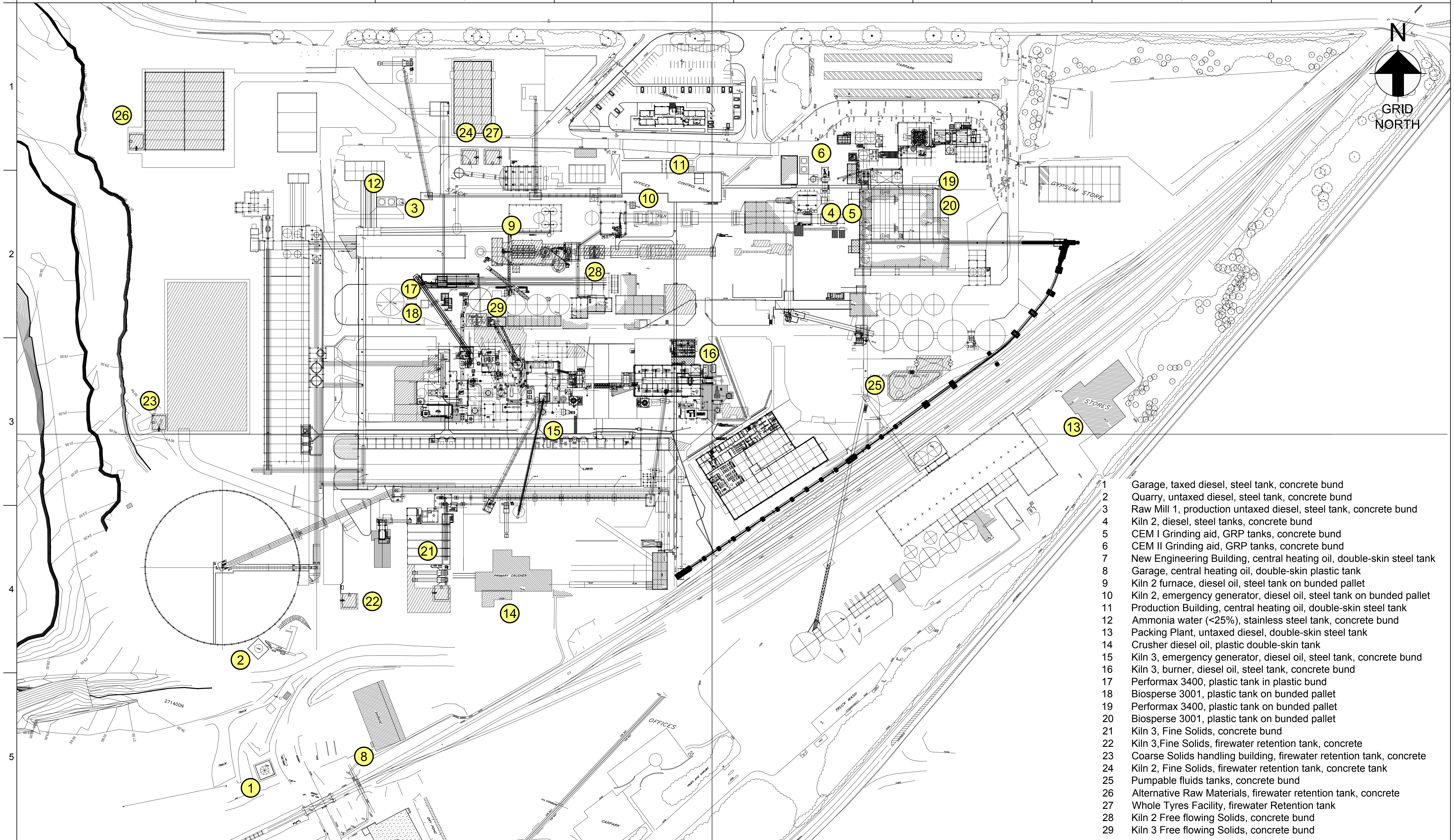
[5] CIRIA (2003) C598 Chemical storage tank systems – good practice

[6] E.G. Pettit & Co. (1993), Report *Irish Cement Ltd. Platin Works Firefighting Water Supply*

Figures

Figure 1 Location of Bunds and Double Skin Tanks

A3



1 Garage, taxed diesel, steel tank, concrete bund
2 Quarry, untaxed diesel, steel tank, concrete bund
3 Raw Mill 1, production untaxed diesel, steel tank, concrete bund
4 Kiln 2, diesel, steel tanks, concrete bund
5 CEM I Grinding aid, GRP tanks, concrete bund
6 CEM II Grinding aid, GRP tanks, concrete bund
7 New Engineering Building, central heating oil, double-skin steel tank
8 Garage, central heating oil, double-skin plastic tank
9 Kiln 2 furnace, diesel oil, steel tank on bunded pallet
10 Kiln 2, emergency generator, diesel oil, steel tank on bunded pallet
11 Production Building, central heating oil, double-skin steel tank
12 Ammonia water (<25%), stainless steel tank, concrete bund
13 Packing Plant, untaxed diesel, double-skin steel tank
14 Crusher diesel oil, plastic double-skin tank
15 Kiln 3, emergency generator, diesel oil, steel tank, concrete bund
16 Kiln 3, burner, diesel oil, steel tank, concrete bund
17 Performax 3400, plastic tank in plastic bund
18 Biosperse 3001, plastic tank on bunded pallet
19 Performax 3400, plastic tank on bunded pallet
20 Biosperse 3001, plastic tank on bunded pallet
21 Kiln 3, Fine Solids, concrete bund
22 Kiln 3,Fine Solids, firewater retention tank, concrete
23 Coarse Solids handling building, firewater retention tank, concrete
24 Kiln 2, Fine Solids, firewater retention tank, concrete tank
25 Pumpable fluids tanks, concrete bund
26 Alternative Raw Materials, firewater retention tank, concrete
27 Whole Tyres Facility, firewater Retention tank
28 Kiln 2 Free flowing Solids, concrete bund
29 Kiln 3 Free flowing Solids, concrete bund

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R1	22/05/17	GMcT	DM	DM
Issue	Date	By	Chkd	Appd

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Job Title
Review of IE Licence
Reg. No. P0030-04

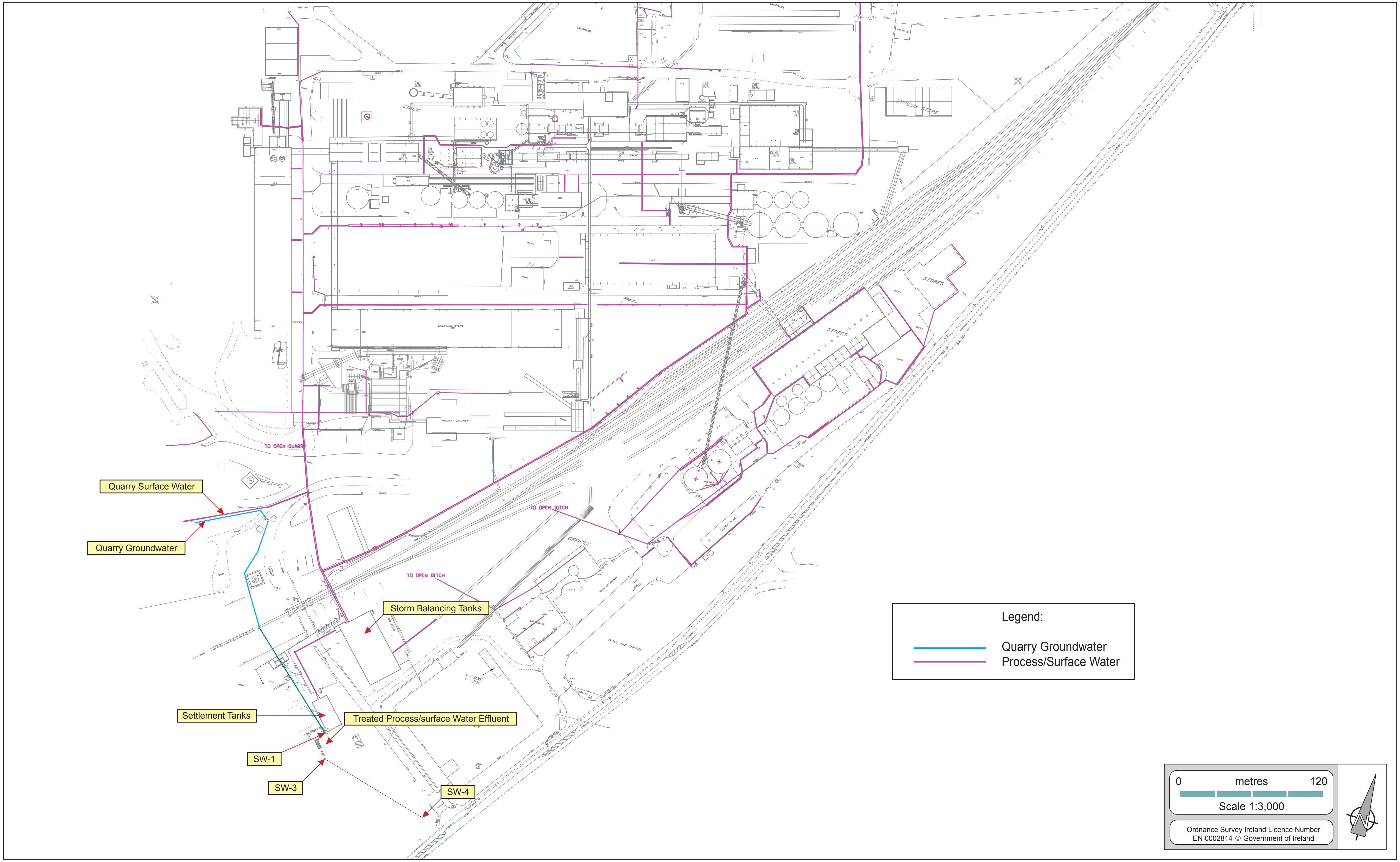
Client
Irish Cement Ltd

Drawing Title
Figure 1
Location of Bunds and Double Skinned Tanks

Scale at A3 1:2500
Discipline Consulting
Job No 325374-47
Drawing Status Report
Drawing No N2012
Issue R1

Do not scale

Figure 2 Process/Storm Water Conveyance, Treatment Plant and Emission Points



ARUP

Process/Surface Water and Groundwater Conveyance, Treatment Plant and Emission Points

Irish Cement Ltd IPPC Licence Reg. No. P0030-04

D5374.41	March 2014	Figure 2

Appendix A

Environmental Risk Assessment – Platin Cement Works

A1 Risk Assessment Methodology

Environmental risk includes the risk and extent of fire, the environmental load and the area at risk. The area at risk includes:

- The extent of the water polluted.
- Any uses to which the receiving waters are put (potable water, livestock water, crop irrigation, fishing, amenity use, wild life habitat).

The environmental risk is assessed subjectively taking into account the following factors:

- Fire load, or quantity of combustible materials
- Fire risk
- Environmental load.

A1.1 Fire Load

The fire load is a function of the quantities of combustible materials present and the likely rate of combustion. The following broad classification of fire load is used:

Fire Load	Description	Fire Load Factor
Low	Aqueous solutions, metal items (machinery, storage racking) or glass.	1
Medium	Significant quantities of packing materials, stationery etc.	2
High	Substantial quantities of combustible materials, or large quantities of flammable liquids.	3

A1.2 Fire Likelihood

The likelihood of fire depends on the following factors:

- Likelihood of ignition
- Likelihood of non-detection
- Likelihood of failure to extinguish promptly.

The likelihood of ignition is lowest where there are no flammable or highly flammable liquids or gases, or only small quantities.

The likelihood of non-detection is highest where the relevant area is unoccupied for most of the time, and where there is no automatic fire detection or sprinkler system.

The likelihood of failure to extinguish promptly, given that the fire has been detected promptly, is low, where there are automatic sprinklers, and medium elsewhere.

Fire Likelihood	Description	Fire Likelihood Factor
Low	A fire is unlikely	1
Medium	A fire is possible	2
High	A fire is likely	3

A1.3 Environmental Load

The environmental load is an assessment of the total potential for environmental damage. The environmental load depends on the characteristics and quantities of materials which could cause environmental damage, in this case damage to the receiving waters. The characteristics include:

- BOD
- Acute toxicity effects
- Persistence of the pollutant
- Risk of bio-accumulation.

Environmental Load	Description	Environmental Load Factor
Low	Little potential for any significant damage to the receiving waters.	1
Medium	Potential for minor damage or long term effects.	2
High	Potential for major damage, and likely long term effects.	3

A1.4 Methodology For Determining Environmental Risk

The Environmental Risk Score is calculated as the product of the scores for the three above factors.

The environmental risk is judged to be high, medium or low according to the following scale:

Environmental Risk Score	Environmental Risk	Description
>12	High	Situation is hazardous in relation to the environment (receiving waters), and action is required
7-12	Medium	Discernible risk, may require remedial measures if within reasonable resource
≤6	Low	Risk not significant

A2 Risk Assessment

A2.1 Assessment of Existing Concrete Bunded Tanks

A2.1.2 Storage of Untaxed Diesel Tank at top of Quarry
A2.1.3 Storage of Untaxed Diesel North of Raw Mill 1 Building
A2.1.4 Storage of Diesel Oil under old Kiln 2 Platform
A2.1.5 Storage of CEM I Grinding Aid above old Kiln 2 Platform
A2.1.6 Storage of CEM II Grinding Aid adjacent to Grate Cooler DB Room
A2.1.7 Storage of Aqueous Ammonia north of Raw Mill 1 Building
A2.1.8 Storage of Untaxed Diesel Oil at Kiln 3

A2.1.1 Taxed Diesel Oil Tank Opposite Garage

Item	Description	
Activities	Storage of diesel oil	
Materials	Diesel oil	
Fire fighting	A diesel oil tank fire would be attended by Meath/Drogheda Fire Brigade.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	High	
Environmental Risk	**Medium**	
Area	Surface area of tank or fire surface in bund.	109 m^2
Firewater		0 m^3
Rainwater	Surface area of bund x rainfall	7 m^3
Quantity of fire-water and rainwater runoff	**N/A**	**7 m^3**
Containment of fire-water	Fire-water would be largely retained in the bund.	700 m^3
Comment	The environmental risk is medium. As the fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund of capacity 110% of the tank, further fire-water retention is not considered necessary.	

A2.1.2 Untaxed Diesel Oil Tank at Top of Quarry

Item	Description	
Activities	Storage of diesel oil	
Materials	Diesel oil	
Fire Fighting	A diesel oil tank fire would be attended by Meath/Drogheda Fire Brigade.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	High	
Environmental Risk	**Medium**	
Area	Surface area of tank or fire surface.	106 m^2
Firewater		0 m^3
Rainwater	Surface area of bund x rainfall	6 m^3
Quantity of fire-water and rainwater runoff	**N/A**	**6 m^3**
Containment of fire-water	Fire-water would be largely retained in the bund.	
Comment	The environmental risk is medium. .As the fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund of capacity 110% of the tank, further fire-water retention is not considered necessary.	

A2.1.3 Untaxed Diesel Tank North of Raw Mill 1 Building

Item	Description	
Activities	Storage of diesl oil	
Materials	Diesel oil	
Fire Fighting	A diesel oil tank fire would be attended by Meath/Drogheda Fire Brigade.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	High	
Environmental Risk	**Medium**	
Area	Surface area of diesel oil tank or fire surface.	93 m^2
Firewater		0 m^3
Rainwater	Surface area of bund x rainfall	6 m^3
Quantity of fire-water and rainwater runoff	**N/A**	**6 m^3**
Containment of fire-water	Fire-water would be largely retained in the bund.	
Comment	The environmental risk is medium. .As the fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund of capacity 110% of the tank, further fire-water retention is not considered necessary.	

A2.1.4 Diesel Oil Tank under Old Kiln 2 Platform

Item	Description	
Activities	Storage of Diesl oil	
Materials	Diesel oil	
Fire Fighting	A fire in this area would be attended by Meath/Drogheda Fire Brigade.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	High	
Environmental Risk	**Medium**	
Area	Surface area of diesel oil tank(s) or fire surface.	92 m^2
Firewater		0 m^3
Rainwater	Surface area of bund x rainfall	6 m^3
Quantity of fire-water and rainwater runoff	**N/A**	**6 m^3**
Containment of fire-water	Fire-water would be largely retained in the bund.	
Comment	The environmental risk is medium. As the fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund of capacity 110% of the tank, further fire-water retention is not considered necessary.	

A2.1.5 CEM I Grinding Aid Tank above Old Kiln 2 Platform

Item	Description	
Activities	Storage of grinding aid	
Materials	CEM I grinding aid	
Fire Fighting	CEM I grinding aid is non-flammable, therefore a fire in this bund is not considered credible.	
Fire Load	Low	
Fire Likelihood	Low	
Environmental Load	Low	
Environmental Risk	**Low**	
Area	N/A	
Rainwater	N/A	
Firewater		
Quantity of fire-water and rainwater runoff	**N/A. Cooling water would be applied to the CEM I grinding aid tanks in the event of a diesel tank fire under the platform.**	
Containment of fire-water	Fire-water would be largely retained in the bund.	
Comment	The environmental risk is low, therefore, no further fire-water containment is considered necessary. The fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund with capacity equal to the greater of 110% of the tank/25% capacity of both tanks.	

A2.1.6 CEM II Grinding Aid Tank adjacent to Grate Cooler DB Room

Item	Description
Activities	Storage of grinding aid
Materials	CEM II grinding aid
Fire Fighting	CEM II grinding aid is non-flammable, therefore a fire in this bund is not considered credible
Fire Load	Low
Fire Likelihood	Low
Environmental Load	Low
Environmental Risk	**Low**
Area	N/A
Rainwater	N/A
Firewater	
Quantity of fire-water and rainwater runoff	**N/A**
Containment of fire-water	Fire-water would be largely retained in the bund
Comment	The environmental risk is low, therefore, no further fire-water containment is considered necessary. The fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund with capacity equal to the greater of 110% of the tank/25% capacity of both tanks.

A2.1.7 Aqueous Ammonia Tanks North of Raw Mill 1 Building

Item	Description	
Activities	Storage of aqueous ammonia	
Materials	Ammonia water (<25%)	
Fire Fighting	Ammonia water is non-flammable, therefore a fire in this bund is not considered credible.	
Fire Load	Low	
Fire Likelihood	Low	
Environmental Load	Medium	
Environmental Risk	**Low**	
Area	N/A	
Rainwater	N/A	
Quantity of Fire-water runoff	**N/A. Cooling water would be applied to the ammonia water tanks in the event of a diesel tank fire to prevent buckling.**	
Containment of fire-water	N/A	
Comment	The environmental risk is low, therefore, no further fire-water containment is considered necessary. The fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund with capacity equal to the greater of 110% of the tank/25% capacity of both tanks.	

A2.1.8 Untaxed Diesel Oil Tank at Kiln 3

Item	Description	
Activities	Storage of diesel oil	
Materials	Diesel oil	
Fire Fighting	A diesel oil tank fire would be attended by Meath/Drogheda Fire Brigade	
Fire Load	Low	
Fire Likelihood	Medium	
Environmental Load	High	
Environmental Risk	**Medium**	
Fire suppression water	Water would not be applied to a fire. Cooling water would be applied to the tank in the event of a tank fire to prevent buckling.	
Quantity of fire-water runoff	**N/A**	
Containment of fire-water	Fire-water would be largely retained in the bund	
Comment	The environmental risk is medium. As the fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund of capacity 110% of the tank, further fire-water retention is not considered necessary.	

A2.2 Assessment of Existing Double and Single Skinned Tanks

Where it is not considered practical to provide a concrete bund for diesel oil, heating oil or other materials, either double skinned tanks with leak detection or bunded pallets are used (refer to Figure 1 and Table 2, Refs. 7, 8, 9, 10, 11, 13, 14, 17, 18).

EPA guidelines [3] list CIRIA Report 163 [4] as a recognised design standard. In relation to double-skinned tanks CIRIA Report 163 states that *'a double-skinned storage tank could be considered to be either (a) a high specification primary container (high specification in that it has two skins rather than the normal one) or (b) a combination of primary containment (the inner skin) and secondary containment (the outer skin)'*. CIRIA C598 [5] states that a double skinned tank may be used where there are physical or practical limitations to the size of a bund that may be constructed.

The environmental risk associated with these areas is assessed as follows:

Fire Load	High
Fire Likelihood	Low
Environmental Load	Low
Environmental Risk	**Low**

As the environmental risk is low, no additional fire-water containment is proposed.

A2.3 Assessment of Existing Petroleum Coke Stockpile

A2.3 Petroleum Coke Stockpile

Item	Description
Activities	Storage of Pet Coke
Materials	Petroleum coke
Fire Fighting	A large fire in this area would be fought by Meath/Drogheda Fire Brigade
Fire Load	High
Fire Likelihood	Low
Environmental Load	Low
Environmental Risk	**Low**
Area	Fire surface area
Rainwater	See below
Quantity of fire-water runoff	**The total quantity of fire-water would comprise the water applied to the fire by the fire brigade and the coincident rainwater. The fire brigade would apply water from tenders, but would rely on the ICL water supply for a large fire. A large fire could require application of water for several hours. Rainwater from this area would not be separated from rainwater falling elsewhere on the site.**
Containment of fire-water	Some fire-water would be absorbed by the pet coke. Fire-water would also enter the storm water drainage system
Comment	The environmental risk is low, therefore, fire-water containment is not considered necessary

A2.4 Assessment of Existing and Proposed Facilities for Storage and Handling of Alternative Fuels and Alternative Raw Materials

A2.4.1 Storage of Fine Solids for Kiln 3
A2.4.2 Existing and Proposed Fine Solids Unloading Area at Kiln 3
A2.4.3 Storage of Fine Solids for Kiln 2
A2.4.4 Fine Solids Introduction and Metering Building for Kiln 2
A2.4.5 Coarse Solids Storage and Handling Building for Kiln 2 and Kiln 3
A2.4.6 Coarse Solids Conveying Building for Kiln 3
A2.4.7 Pumpable Fluids Storage
A2.4.8 Pumpable Fluids Unloading
A2.4.9 Whole Tyre Storage and Handling
A2.4.10 Alternative Raw Materials Storage
A2.4.11 Free-Flowing Solids

A2.4.1 Storage of Fine Solids for Kiln 3

Item	Description	
Activities	Storage of Fine Solids	
Materials	Fine Solids	
Fire Fighting	Hose reels, foam solution, fire brigade tenders	
Fire Load	Medium	
Fire Likelihood	Medium	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area	A fire is assumed to occur in one bunker only.	131 m^2
Fire suppression water	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min ea for 40 min	76 m^3
Rainwater		8 m^3
Quantity of fire-water and rainwater runoff		**106 m^3**
Containment of fire-water	Gross volume of Drag Chain void	759 m^3
	SRF shed divided into 5 bunkers volume 1,000 m^3 each. % void space = (1- bulk density/particle density) x 100 = (1 – 300 kg/m^3/1,000 kg/m^3) x 100	70%
	Gross vol of cellar under bunkers approx. =	531 m^3
	Sump - replaces existing sump	400 m^3
Comment	Fire-water would flow to the cellar under the bunkers.	
	Rainwater contribution to fire-water is calculated assuming collapse of the roof over the bunker and a concurrent 24 hour event for a 20 year return	
	The bays are separated by fire resisting walls. 280 m^3 water is available to manufacture foam. It is conservatively assumed that all foam would be used in the event of a fire in the bunker.	

A2.4.2 Existing and Proposed Fine Solids Unloading Area at Kiln 3

Item	Description	
Activities	Unloading of Fine Solids	
Materials	Fine Solids	
Fire Fighting	Hose reels, foam solution, fire brigade tenders	
Fire Load	Medium	
Fire Likelihood	Medium	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area	A fire is assumed to occur in one bunker only.	131 m^2
	A fire covering the surface area (1,000 m^2) of one bunker in the shed is assumed.	
Fire suppression water	2 No. fire tenders @ 11 m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min ea for 40 min	76 m^3
Rainwater		8 m^3
Quantity of fire-water runoff		**106 m^3**
Containment of fire-water	Sump - replaces existing sump	400 m^3
	This area is designed for vehicle access and as such is not suitable for fire-	
	Firewater would drain into the Drag Chain Void and cellar under the	

A2.4.3 Storage of Fine Solids for Kiln 2

Item	Description	
Activities	Storage of Fine Solids	
Materials	Fine Solids	
Fire Fighting	Hose reels, foam solution, fire brigade tenders	
Fire Load	High	
Fire Likelihood	Medium	
Environmental Load	High	
Environmental Risk	**High**	
Area	A fire is assumed to occur in one bunker only.	131 m^2
Fire suppression water	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min ea for 40 min	76 m^3
Rainwater		8 m^3
Quantity of fire-water and rainwater runoff		**106 m^3**
Containment of fire-water	In-line Firewater Retention tank	200 m^3
	Gross volume of Drag Chain void	759 m^3
	SRF shed divided into 5 bunkers volume 1,000 m^3 each. % void space = (1- bulk density/particle density) x 100 = (1 – 300 kg/m^3/1,000 kg/m^3) x 100 70% Gross vol of cellar under bunkers approx. =	531 m^3
Comment	Fire-water would flow to the cellar under the bunkers.	
	Rainwater contribution to fire-water is calculated assuming collapse of the roof over the bunker and a concurrent 24 hour event for a 20 year return	
	The bays are separated by fire resisting walls.	
	280 m^3 water is available to manufacture foam. It is conservatively assumed that all foam would be used in the event of a fire in the bunker.	

A2.4.4 Fine Solids Introduction and Metering Building for Kiln 2

Item	Description	
Activities	Fine Solids metering and feed	
Materials	Fine Solids	
Fire Fighting	Hose reels, foam solution, fire brigade tenders	
Fire Load	Medium	
Fire Likelihood	Medium	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area	A fire is assumed to occur in one bunker only.	131 m²
	A fire covering the surface area (1,000 m²) of one bunker in the shed is assumed.	
Fire suppression water	2 No. fire tenders @ 11 m³	22 m³
	Hose reels: 2 No. @ 950 litre/min ea for 40 min	76 m³
Rainwater		8 m³
Quantity of fire-water runoff		**106 m³**
Containment of fire-water	In-line Firewater Retention tank	200 m³
~~Comment~~	This area is designed for vehicle access and as such is not suitable for fire-	
	Firewater would drain into the Drag Chain Void and cellar under the	

A2.4.5 Coarse Solids Storage and Handling Building for Kiln 2 and Kiln 3

Item	**Description**	
Activities	Storage and handling of Coarse Solids	
Materials	Coarse Solids	
Fire Fighting	Hose reels, fire brigade tenders	
Fire Load	High	
Fire Likelihood	Medium	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area		4,875 m^2
Fire suppression water	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m^3
Rainwater		296 m^3
Quantity of fire-water and rainwater runoff		**394 m^3**
Containment of fire-water	In-line Firewater Retention tank	400 m^3

A2.4.6 Coarse Solids Conveying Building for Kiln 3

Item	Description	
Activities	Coarse Solids Conveying	
Materials	Coarse Solids	
Fire Fighting	Hose reels, fire brigade tenders	
Fire Load	Medium	
Fire Likelihood	Medium	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area		287 m^2
Fire suppression water	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m^3
Rainwater		17 m^3
Quantity of fire-water and rainwater runoff		**115 m^3**
Containment of fire-water	In-line Firewater Retention tank (Where the conveying building is remote from the coarse solids building)	325 m^3

A2.4.7 Pumpable Fluids Storage

Item	Description	
Activities	Pumpable fluids (flammable liquids)	
Materials	900 tonnes Pumpable Fluids	
Fire Fighting	Inert gas suppression system. Hose reels for cooling of tank in the event of a fire in adjacent facilities.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area	Unloading area 230m² + bunded area 420m²	550 m²
Coolling water for tank, etc	2 No. fire tenders @ 11m³	22 m³
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m³
Rainwater		33 m³
Quantity of fire-water and rainwater runoff		**131 m³**
Containment of run-off	Bund (also sump under unloading area, 25m³)	840 m³

A2.4.8 Pumpable Fluids Unloading

Item	Description	
Activities	Discharging road tankers containing pumpable fluids	
Materials	20 tonnes Pumpable Fluids in road tanker	
Fire Fighting	Inert gas suppression system in storage tank. Hose reels for cooling of tank in the event of a fire in adjacent facilities.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area	Unloading Area	100 m^2
	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m^3
Rainwater		6 m^3
Quantity of fire-water and rainwater runoff		**104 m^3**
Containment of run-off	Sump beneath unloading area	25 m^3

A2.4.9 Whole Tyre Storage and Handling

Item	Description	
Activities	Storage and handling of whole rubber tyres	
Materials	Whole rubber tyres	
Fire Fighting	Hose reels, fire brigade tenders	
Fire Load	High	
Fire Likelihood	Medium	
Environmental Load	High	
Environmental Risk	**High**	
Area	Storage 835m², Handling 287m²	1,122 m²
	2 No. fire tenders @ 11m³	22 m³
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m³
Rainwater		68 m³
Quantity of fire-water and rainwater runoff		**166 m³**
Containment of run-off	In-line Firewater Retention tank	200 m³

A2.4.10 Alternative Raw Materials Storage

Item	Description	
Activities	Storage of alternative Raw Materials	
Materials	Alternative Raw Materials - non-combustible	
Fire Fighting	None required	
Fire Load	Low	
Fire Likelihood	Low	
Environmental Load	Low	
Environmental Risk	**Low**	
Area	Storage Shed	100 m^2
	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m^3
Rainwater	Unloading area (+10%) x rainfall = 100m^2 x 1.1 x 0.0607 m	6 m^3
Quantity of fire-water and rainwater runoff		**104 m^3**
Containment of run-off	In-line Firewater Retention tank	700 m^3

A2.4.11 Free-Flowing Solids

Item	Description	
Activities	Storage of Free-Flowing Solids	
Materials	Free-Flowing solids	
Fire Fighting	Each pair of silos will be protected against fire by CO detection and inert gas system and enclosed within a concrete bund wall. Hose reels for cooling of adjacent tank, plant and equipment in the event of a fire in adjacent facilities.	
Fire Load	Medium	
Fire Likelihood	Low	
Environmental Load	Medium	
Environmental Risk	**Low**	
Area	Bund area	114 m^2
	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m^3
Rainwater		7 m^3
Quantity of fire-water and rainwater runoff		**105 m^3**
Containment of run-off	Bund	200 m^3

Appendix 3.2

Emergency Response Procedures

EMERGENCY RESPONSE PROCEDURES PLATIN WORKS

These procedures are intended to cover any incident or disaster which may occur in Platin Works, directly involving Irish Cement Limited personnel and facilities or involving third party company personnel and facilities on our site or having a potential for any adverse impact on the environment

Distribution and updating: The control version of this document is the electronic master copy on the ICL Platin Intranet. Any paper copies are deemed obsolete. The Environmental Manager or his nominated deputy has overall responsibility for issuing necessary amendments to the controlled intranet version

M.Butler

Environmental Engineer
01/06/2017

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Revisions to Issue No 4

Revision No.	Topic	Page No.	Date Effective	Approved by
4	**All**	**All**	**Nov 2012**	**S Breen**
5	**All**	**25**	**Sept 2013**	**S Breen**
6	**Immediate Response Action- Assembly Points Update & Insurance Company Details**	**7,8**	**June 2017**	**M. Butler**

Disaster and Post - Disaster Plan

Objective

The purpose of this plan is to identify an appropriate response to be followed in the event of a disaster occurring. Revision no 4 incorporates recently implemented changes to Platin works including Kiln 3 system, response to Ammonia spills and fire in SRF system.

Scope

This plan is intended to cover any disaster which may occur in Platin Works, directly involving Irish Cement Limited personnel and facilities or involving third party company personnel and facilities on our site or having a potential for any adverse impact on the environment. A site risk map is included in Annex 1.

For detailed safety procedures, refer to Safety Procedures Manual for Platin Works.

Stage 1 Immediate Response – During Office Hours

1A.1 Evaluate Situation

- Management/Supervisor should quickly brief themselves of the situation and decide on appropriate response.

- The Shift Supervisor on duty will control and co-ordinate the emergency response for the plant (See below for the quarry and dispatch areas). Upon the arrival of the Fire Brigade, the Senior Fire Officer will, in accordance with Section 27 of the Fire Services Act 1981, assume sole charge of all fire fighting operations. In this activity the Senior Fire Officer must receive the direct guidance and advice of the shift supervisor, especially in relation to the safety of Fire Brigade personnel.

- The quarry supervisor shall control and co-ordinate the emergency response for the quarry. Should an emergency situation arise when the quarry supervisor is off site, the shift supervisor shall hand over control of the emergency situation as soon as the quarry supervisor arrives on site.

- The dispatch supervisor shall control and co-ordinate the emergency response for the dispatch area. Should an emergency situation arise when the dispatch supervisor is off site, the shift supervisor shall hand over control of the emergency situation as soon as the dispatch supervisor arrives on site.

- The plant management will provide advice and assistance to the shift supervisor as necessary.

- The shift supervisor should refer to the safety manual or environmental manual for detailed instructions and guidelines, which are located in the Central Control Room and the company intranet.

1A.2 Notify Medical and Fire Services

These services should immediately be requested if appropriate.

Service	Telephone No.
Fire Brigade Drogheda / Navan	041-9832222 / 046-9021666
Drogheda Ambulance	041-9837601 / 999 / 112
Garda Station Drogheda/Duleek	041-9874200 / 041-9823222
Lourdes Hospital	041-9837601

A more complete list of numbers is included in Annex 2.

1A.3 Notify Third Party Companies

If the disaster involves any third party companies on site then the responsible person (s) must be notified immediately.

1A.4 Notify Civil Authorities

If the disaster requires the involvement of the Civil Authorities then they should be notified immediately.

Stage 1 Immediate Response – Outside Office Hours

1B.1 Receive Details of the Disaster

- Verify, identify and confirm location of the incident and confirm name and telephone number of caller.

- Obtain Briefing

    - WHERE did the incident occur?
    - WHAT happened? E.g. fire, explosion, chemical spill etc
    - WHO was involved?
    - Is immediate medical assistance required ?

- Issue caller with instructions for immediate life saving / fire fighting or other appropriate actions if it is safe to do so.
- Advise caller of your action plan as appropriate

1B.2 Notify Third Party Companies

- If the disaster involves any of the third party companies on site then the responsible person (s) must be notified immediately.

1B.3 Notify Medical and Fire Authorities

- These services should be immediately requested if appropriate. See Annex 2.

1B.4 Notify Company Personnel

- Alert Company personnel as appropriate and if necessary request them to assemble on site at a certain time to form a Response Team. Delegate this task to one person to save time.

1B.5 Notify Civil Authorities / EPA / Fisheries Board

- If the disaster requires the involvement of the civil authorities then they should be notified immediately. The specific procedure for notifying the EPA is outlined in Annex 3.

1B.6 Media Enquiries

- Any media inquiries should be directed toward the Works Manager or Company Technical Manager.

1B.7 Receive Update

- If possible communicate with caller or site to obtain update on developments.

- Advise site of action which has been taken.

- Advise site of appropriate further actions until Response Team arrive.

1B.8 Assemble an Appropriate Response Team

- On arrival on site Response Team should quickly brief themselves of situation and if necessary first attend to life saving measures.

Stage 2 – Immediate Response Action

2.1 Initiate Evacuation Procedure if Appropriate

- Evacuate all personnel from building or area under threat.
- Assemble in a safe location away from disaster area.
- Designated Assembly Points are located at the following locations:
    - Front of Engineering Building
    - Car Park in front of Production Building
    - Outside Packing Plant
    - In Front of Quarry Offices
    - Head Office Car Park

2.2 Render Medical Assistance if necessary

- Assist as necessary to aid those in need of medical attention until the proper authorities arrive. If possible medical assistance should be given by a qualified first aid person.

2.3 Identify Personnel Casualties

- Identify any personnel casualties that may have occurred as a result of the disaster and as soon as practical record details of the injured person and injury and the subsequent action taken.

2.4 Assemble Response Team

- Assemble appropriate personnel in to a Response Team and issue clear 'action required' instructions to each member.

2.5 Send Home Non-Essential Personnel

- If appropriate send home non-essential personnel until further notice and advise them to refer the media or other outside concerns to the plant management for any comment on the situation.

2.6 Protect Premises, Plant and Environment

- Once all life threatening situations have been addressed and casualties attended to actions must be immediately identified to protect premises, documentation, plant and equipment and the environment. The emergency response procedure for dealing with environmental emergencies is outline below

2.7 Notify Insurance Company

- If appropriate notify insurance company giving as much information as necessary via Head Office.

Pembroke International Insurance Company Ltd

22 Pembroke St

Dublin 2

Stage 3 – Post Disaster Plan

- In the aftermath of the disaster, an assessment must be carried out on its impact and an appropriate contingency plan devised.

3.1 If Operations have stopped

- How long will stocks last to meet demands?
- Identify priorities and likely timescales to re-establish operations.

3.2 If Plant is out of Commission

- How long with stocks last to service customers?
- Evaluate damage and decided on repairs route or contract plant hire.
- Advise Head Office

3.3 Environmental Disaster

- The Environmental Manager should inform the Environmental Protection Agency and any other relevant Authorities, as per Condition 11 of the IPPC Licence. The procedure for notifying the EPA is outlined in Annex 3.

Emergency Response - General

- **Proceed to Accident Location**
  - Shift supervisor should go immediately to the location of the accident to evaluate the situation.

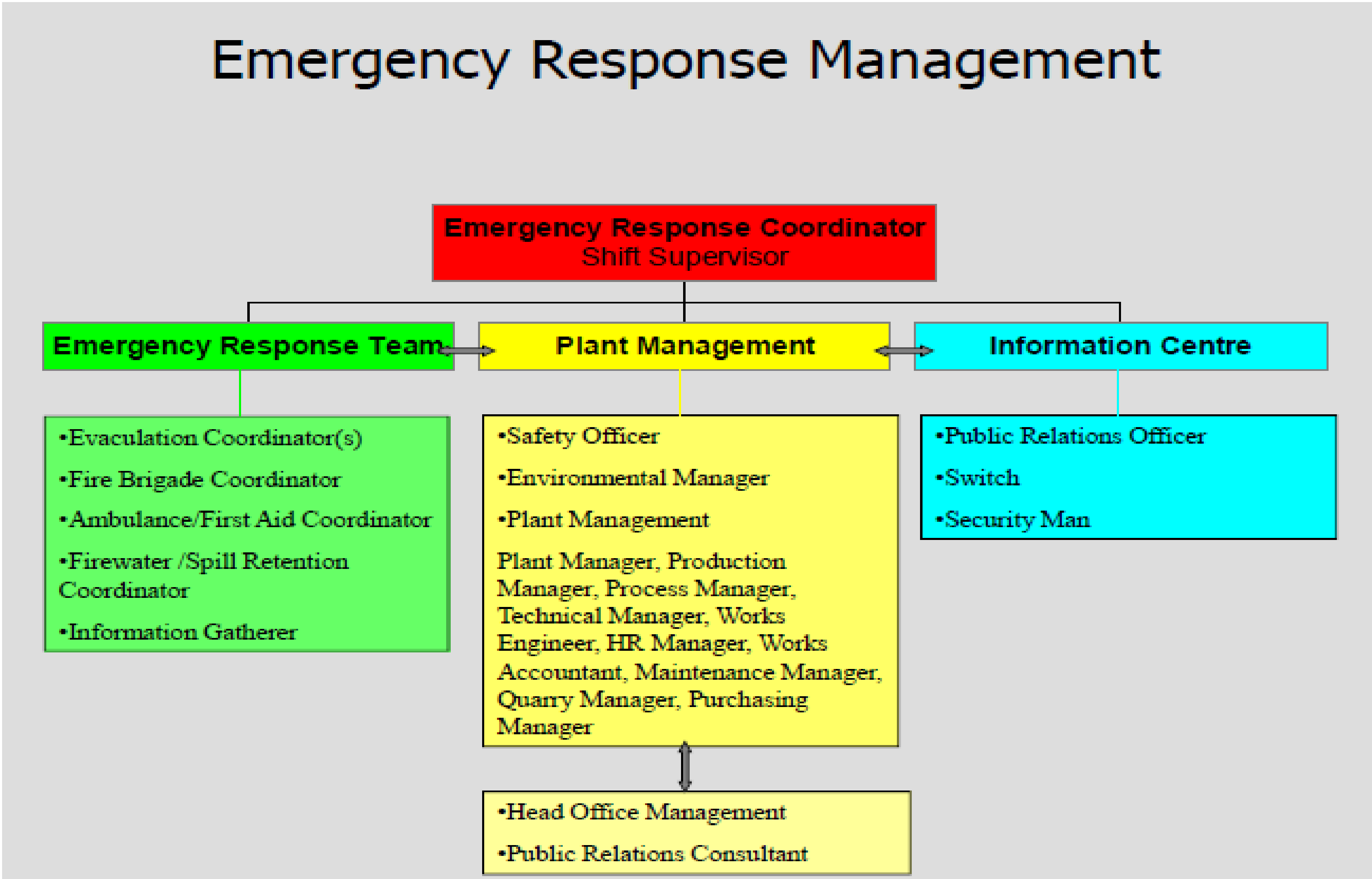
- **Initiate Evacuation Procedure if Appropriate**
  - Sound the fire alarm, and evacuate all personnel from the building or area under threat.
  - Instruct personnel to assemble at a designated assembly point away from the disaster area.
  - Nominate a staff member for a personnel roll call and account for the whereabouts of all staff members.
  - Nominate a staff member to meet the emergency services at the appropriate entrance and guide them to the scene of the emergency.

- **Render Medical Assistance if necessary**
  - Assist as necessary to aid those in need of medical attention until the proper emergency services arrive. Any qualified first aid person should be called as required to give medical assistance.
  - First aid people should obtain any medical supplies/resuscitators required from the following locations: Central control building-First aid room, Main office building-First aid room, Garage-First aid box in canteen, Despatch area-First aid box in road bulk loaders office, Quarry-Supervisors office.

- **Identify Personnel Casualties**
  - Identify any personnel casualties that have occurred as a result of the disaster and as soon as practical record details of the injured person and injury.

- **Assemble Response Team**
  - Assemble appropriate personnel into a Response Team and issue clear instructions to each member.
  - The first priority must be to remove any threat to human life.
  - The response team may assist the emergency services as required. The team must also try to prevent the emergency from developing further.
  - The team should assist in preventing any damage to the environment by building bunds or blocking drains as appropriate (see environmental section).

- **Send Home Non-Essential Personnel**
  - If appropriate send home non-essential personnel until further notice and advise them to refer the media or other outside concerns to the plant management for any comment on the situation.



Further details of each coordinator function is included in Annex 4.

Emergency Response – Fire

- A set of fire fighting and emergency rescue equipment including the high expansion foam generator, is located at the Central Fire Point under Kiln No.1 drive station.
- Fire fighting water hydrants and fireboxes are located as shown on the site risk map.
- Various types of fire extinguishers are located at points around the Works shown on the site risk map.
- Drogheda Fire Brigade is always available at 041-9832222 or Navan 046-9021666. Give your mobile no. and ensure someone is waiting at site entrance for arrival of the fire services, with a copy of the site risk map.
- Internal fire alarms should be sounded.
- When using an extinguisher, follow the instructions for that extinguisher- Ensure that the correct extinguisher is being used.
- Assist in fighting the fire using an appropriate extinguisher only if it safe and you are confident to do so.
- If the fire can no longer be contained, then vacate the building/work area immediate by the nearest clear exit, closing all doors behind you.
- Personnel should proceed to the designated assembly point.
- Personnel should report to the assembly point controller and identify themselves
- The person who discovered the fire should inform the shift supervisor of the situation at the scene of the emergency, outlining how far advanced the fire or emergency was as they left it.
- If possible erect a barrier/bund to contain the firewater and block the surface drains. See spill emergency response section.
- Lift the buoy on the Storm Water Tanks in the Water Treatment Plant to retain any firewater /spill in the tanks, and prevent it entering the river Nanny.
- In the case of a major fire a bund/barrier should be erected to contain the firewater and prevent it entering the drainage system. Request that the quarry stop the quarry surface water pumps.

- Fire Fighting Equipment & Usage
  - Water hydrants
  - Fire fighting equipment boxes containing stand pipes, hoses, keys, nozzles.
  - Hose reels
  - High expansion foam generator, used for fires in the cable tunnels or in the coal mill filters
  - Water fog/spray: used for Class A fibres, carbonaceous materials, textiles, paper timber etc.
  - Dry powder: Class B fires

SRF System – Fire detection & suppression

TULS system

The TULS system is designed for unloading trucks and transporting SRF to the storage bays. Hence it is not envisaged that SRF material will be present in this system for long periods of time.
There is no direct fire suppression system in this area
In the event of a fire either (a) the fire brigade or (b) hoses from the hydrants, will be used to extinguish the fire.
Water from this area will either be collected in the sump below the TULS (automatically pumped to drain) or run off from the ground to drain
A manual valve in the drain system should be manually closed. This will then direct the run off water to an overflow sump which will then be pumped to the firewater retention bund.

Storage Bays

Four storage bays are available for SRF. Each bay has one fire detector and three temperature probes for fire and heat detection. The fire detector (fire alarm panel) will alarm if the temp exceeds 55degC and the temp probes will alarm on the control system if the temperature exceeds 45 (H) and 50 (HH) alarms. In the event of an alarm the following should completed
Determine from temperature curves as to whether the alarm appears real i.e. rate of temp increase, temp increase is visible on one or more temp probes
Attend top of storage bays to determine if smell of fire is evident.
If safe, the inspection ports on top of the bays can be opened to determine whether fire exists.

If at any stage of the process a fire is determined to be real the following should be completed.
Open manual wheel valve to the relevant storage bay on the south (quarry haul road) side of the storage bays.

Water flow rate is circa 900l/min

Do not put yourself in danger trying to put out a fire. If in doubt call the fire brigade.

Emergency Response – Explosion

- Stop supply of any flammable and combustible material reaching the affected zone, i.e. shutting off of fuel and other flammable liquids. Ensure all sources of ignition are extinguished.
- Prevent access of machinery delivering flammable or combustible material or liquids.
- Remove any machinery containing fuel away from the disaster area.
- Stop all necessary plant.
- Secure any plant and machinery that could cause injury and damage due to it having become destabilised by the explosion.
- Extinguish any fire resulting from the explosion and at the source of the explosion.
- In the case of quarry blasting ‘misfires’, refer to the intranet safety section, procedure 3.24

Emergency Response – Major Industrial Accident

In the event of an industrial accident such as the collapse of a plant item or machinery or a collision of mobile plant:

- Secure and isolate any plant and machinery that have been affected by the accident.
- Isolate the area to prevent any further accident and evacuate and isolate any adjacent areas that have the potential to be affected by the accident.
- In the event of a vehicular collision involving flammable, toxic or dangerous materials the supplier of the materials must be contacted, the material safety data sheet must be consulted and the shift supervisor must decide on the appropriate response.
- In the event of fire or release of material with the potential to harm the environment, consult the relevant section in the emergency response procedure.

Emergency Response – Spill of Flammable or Environmentally Harmful Material

- Platin Works has dedicated spill response kits at locations close to the areas where chemicals/flammables are stored in larger quantities. The spill kit locations are:
    - At the main entrance to the cement milling building.
    - At the diesel/fuel oil tanks at the firing end of kiln 2.
    - The untaxed diesel storage tank opposite the garage.
    - The diesel storage tank at the quarry entrance.
    - At the garage.
    - In the stores.
    - Kiln 3 Diesel Oil Tank

- Each spill kit contains a bag of oil spill absorbent 'green sawdust', absorbing boom and other absorbing devices. Each kit also contains emergency eye wash solution.

- The first priority following a major spill should be the determination what the material is, getting the Material Safety Data Sheet, seeing if the spilled material is flammable and ensuring the response/cleanup team or people nominated to clean the spill are wearing the correct PPE.

- If the spill is flammable, all sources of ignition should be extinguished/removed. If practical, the spillage may be covered with expanding foam to prevent ignition.

- The area must be kept well ventilated if in a confined space.

- Ensure all untrained or unnecessary personnel are kept well away from the area of the spill.

- The material spilling should be stopped and contained as much as possible.

- The material should not be allowed to enter the surface water drainage system. A loading shovel is available to the shift supervisor at all times. The shovel may be used for any of the following containment procedures depending on the situation:

    - If possible a bund or barrier should be built around the spillage to keep the material in place and stop it spreading or entering the drains. The shovel may use limestone fines, shale, overburden or other suitable materials.
    - If the material has the potential to enter the surface drains, the drain in question should be blocked downstream of the blockage using suitable materials mentioned above.
    - Lift the buoy on the Storm Water Tanks in the Water Treatment Plant to retain any firewater /spill in the tanks, and prevent it entering the river Nanny.

- In the case of a major fire a bund/barrier should be erected to contain the firewater and prevent it entering the drainage system. Request that the quarry stop the quarry surface water pumps.

Emergency Response – Ammonia

Ammonia Solution (up to

1. Introduction

This procedure details the actions to be taken in the event of a substantial release of ammonia, which could occur due to any of the following:

- Leaks from pipe work and fittings on the plant;
- Rupture of auxiliary piping or other cause of leakage during deliveries of ammonia solution
- Breach of ammonia solution storage tank due to structural defects or other damage

2. Description of ammonia solution

The ammonia solution onsite is stored in 2*120 (capacity) cubic metre stainless steel, single skinned, storage tank, sited within a bund rated at 110% of the tanks total storage capacity. The amount of ammonia within the tank is limited to 100 Cubic Metres (90 Tonnes). The tank is situated on the West side of the factory at the front of Raw Mill 2. Pedestrian traffic is very low in this area and any traffic past the tanks is generally between 08.00 and 16.00 and is low.

3. Potential affected areas

Ammonia vapour is lighter than air and will tend to disperse readily. If there is a sudden release of large quantities, this may result in a cloud of ammonia vapour. An ammonia cloud is likely to be invisible and will drift with the wind direction. Areas within the site that may be affected will depend on the direction of the wind. Wind direction may be checked by referring to the instrumentation in the CCR. There is also a wind sock on top of the Ammonia tanks for reference.

4. Ammonia solution storage (25% dilution) – Raising the alarm

In the event of an ammonia leak and/or the ammonia detector in the storage tank bund being activated:

- Contact the Shift Supervisor and inform him of the location. Immediately move upwind of the leak. The Shift Supervisor and/or his shift team should investigate the source and magnitude of the leak. Wear all Ammonia PPE at all times. Stop leak at source only if it is safe to do so. Do not approach the area if in doubt.
- The alarm will be audible and visual

- If the alarm is activated in the storage tank bund, the Shift Supervisor will issue a announcement via radio and/or the works PA system warning of a "potential Ammonia leak". He will give a clear indication of wind direction and inform people to go into the nearest building and close the windows.
- Upon hearing this announcement all personnel must make their way indoors and close the windows and await the all clear from the Shift Supervisor or relevant person(s)
- The Shift Supervisor will co-ordinate an investigation into the leak.
- If the alarm is spurious or can be actioned and the area made safe, the Shift Supervisor should plan for this and inform CCR of his decision.
- If there is a major leak or the Shift Supervisor believes that there is the potential for such then he should:
    - Contact the designated Environmental emergency clean away company and the Environmental Coordinator
    - Call the Fire Brigade informing them of the situation.

The fire Brigade will need to know the following information

- *Company name, location and telephone number;*
- *Details of the incident involving 25% ammonia solution;*
- *Wind direction;*
- *Any other relevant information*

- The Shift Supervisor will contact someone to meet the Fire Brigade at the main works entrance.
- The Shift Supervisor will contact the on Duty Security Officer and inform him of the situation and instruct him to stay at his post to ensure the Fire Brigade (And any other emergency service) have access to site.

6. Roll call

All departments will take a roll call of employees and contractors who are working for them. This information will be needed by the Fire brigade, via the SS, should a major incident happen.

- *A Supervisor from each department should take a roll call and note down any person/s unaccounted for with the task/area where they are most likely to be. When called by the SS this information must be passed to them. This must include contractors and visitors.*

- *The Supervisor will contact the CCR and inform them of anyone unaccounted for.*

7. Liaison with the Emergency Services

The Shift Supervisor will meet with the Fire brigade upon arrival to familiarise them with these emergency procedures.

8. First aid treatment

Danger, Response, Airways, Breathing, Circulation.

If you suspect that there is a casualty due to Ammonia vapour contact Supervisor/Team Coordinator to remove the casualty to a safe area.

Vapour inhalation

- Summon medical assistance through CCR
- Keep the patient warm and stationary until help arrives

Ingestion

- Summon medical assistance through CCR
- Encourage the patient to drink large quantity of water
- Do not induce vomiting

Eyes – Splashes or concentrated vapour

- Irrigate eyes immediately
- Summon medical assistance through CCR
- Summon first aider and move patient to fresh air

Skin

- Summon medical assistance through CCR
- Wash immediately, preferably using deluge shower
- Remove affected clothing
- Keep the patient warm and stationary until help arrives

9. Training

Exercises/scenarios of this procedure shall be held periodically to ensure all staff are familiar with it and are aware of its importance

EMERGENCY ADVICE

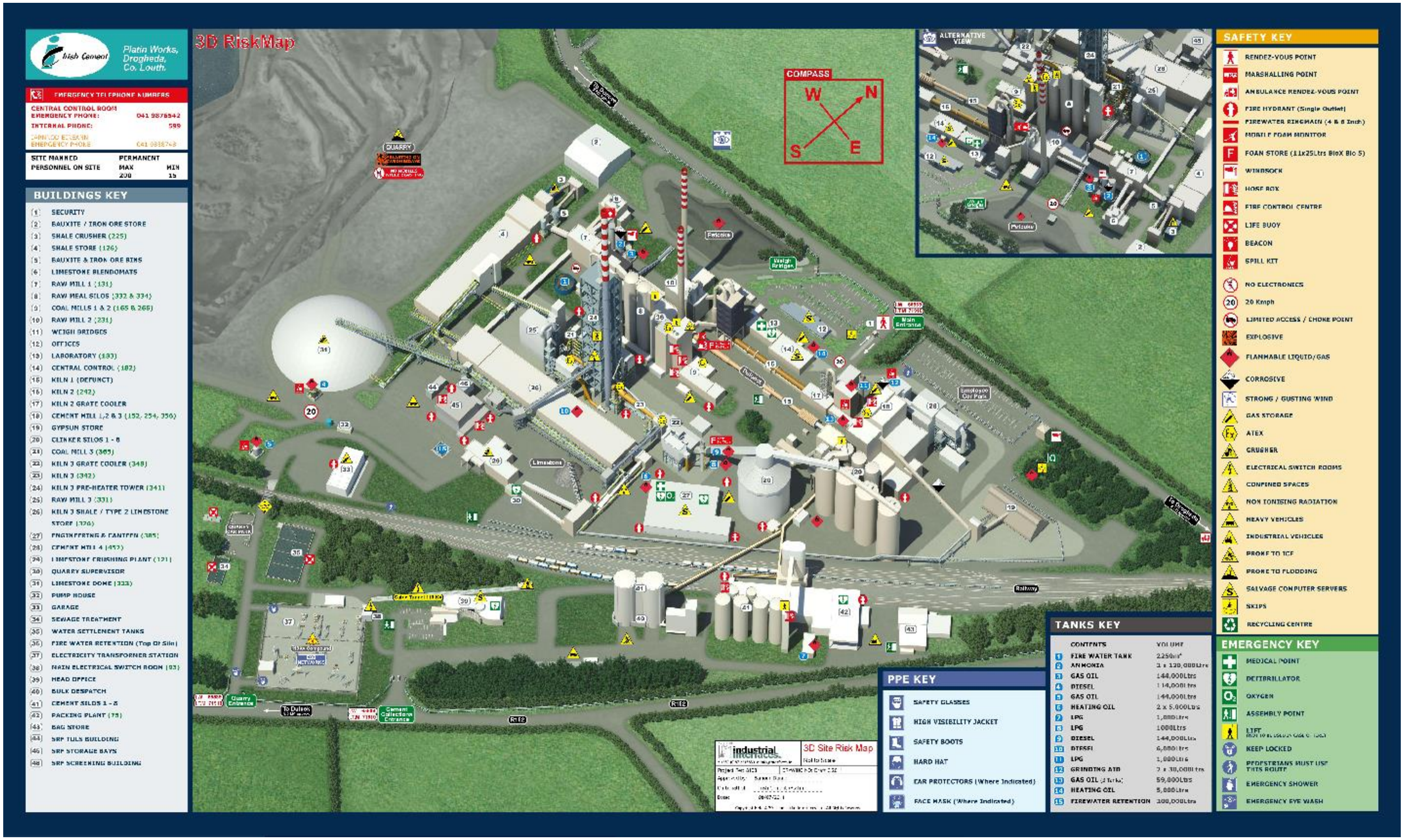
In the case of actual or imminent leakage of ammonia, advice and assistance may be obtained 24 hours a day by phoning:

0044-1642 452461

Unaccounted For

Department	Name of unaccounted for person	Last known or likely area to be

Annex 1 – Site Risk Map



Annex 2 – Emergency Telephone Numbers

Service	Telephone No.
Fire Brigade Drogheda / Navan	041-9832222 / 046-9021666
Ambulance	041-9837601 / 999 / 112
Garda Station Drogheda/Duleek	041-9874200 / 041-9823222
Lourdes Hospital	041-9837601
R.C. Presbytery, Duleek	041 9823205
R.C. Presbytery, St. Marys Drogheda	041 9838347
Securicor	041 9836066/01 4541351
Health and Safety Authority	1890 289 389
Environmental Protection Agency (EPA) Fax	01 268 0100 / 053-9160600 01 268 0199 / 053-9160699
Meath County Council	046 909 7000
Eastern Fisheries Board	01 278 7022
Health Services Executive, Co. Meath	046 9021595
Food Safety Authority of Ireland	01 817 1300
Plant Management	As per list in control room
General Emergency Services	999 / 112
Ammonia emergency	0044-1642 452461
Spill emergency - ENVA 24hr contact	1850-504 504

Annex 3 - Notification of environmental impact to EPA

The Environmental/Production Manager is responsible for notifying the EPA. When notifying the EPA, the notification can be made electronically via alder or by both phone and by fax, where the incident is categorised as either.

- Category 1 incident Minor (No contamination, localised effects)
- Category 2 incident Limited (Simple contamination, localised effects of short duration)
- Category 3 incident Serious (Simple contamination, widespread effects of extended duration)
- Category 4 incident Very Serious (Heavy contamination, localised effects of extended duration)
- Category 5 incident Catastrophic (Very Heavy contamination, widespread effects of extended duration)

Actions should be taken to minimise the effect on the environment and all details of the incident should be recorded.

In the event that the shift supervisor seems that an environmental incident may impact on neighbours, the above named personnel shall be contacted and the EPA notified of same. An investigation will be carried out, as soon as practicable, to ascertain any potential for future incidents.

In the event of any incident which relates to discharges to water, the Eastern Region Fisheries Board must be notified.

The Environmental Manager is responsible for contacting the EPA, County Council and the Fisheries Board.

The EPA will publish incidents of Category 2 or higher on the web. Before the incident is published a review with site personnel will be conducted by the EPA and the facility will be informed of the intention to post the notification.

Annex 4 – Response coordinator functions

Emergency Response Coordinator

1. Investigate and evaluate the incident immediately
2. If immediate evacuation of a building is required, sound alarm (intercom, fire alarm etc)
3. Telephone Emergency Services immediately (if required),
   - Ambulance 041 9837601/ 999 / 112
   - Fire Brigade 041 9832222 / 046 902 1666
4. Assemble and brief Emergency Response Team
   - Evaculation Coordinator, Fire Brigade Coordinator, Ambulance / First Aid Coordinator, Fire Water / Spill Retention Coordinator, Information Gatherer
5. Distribute PPE and mobile phones to everyone on the Emergency Response Team
6. Notify the Safety Officer (who will in turn notify the H&S Authority and others)
7. Notify the Environmental Manager (who will in turn notify the EPA and others)
8. Notify Plant Management (who will in turn coordinate PR / Media response)
9. Notify Information Centre, i.e. Head Office Switch "9" and Security (who will record any employee / public / media queries or complaints)
10. Coordinate Emergency Response

Annex 4

Evacuation Coordinator(s)

1. If evacuation of a building is required, ensure the alarm in the building is being sounded (intercom, fire alarm etc.)
2. Do not enter the building
3. Gather evacuated persons at a safe designated assembly point and record all names
4. Determine a list of missing persons
5. Notify the Ambulance / First aid Coordinator of any injured persons
6. When the evacuation is complete, send all evacuated persons to a safe building where all persons will be briefed by Plant Management on the incident before being sent home
7. Report progress to the Emergency Response Coordinator
8. Report to the Information Gatherer; the names of all evacuated persons, the names of evacuated persons sent home, names of any missing persons

Annex 4

Fire Brigade Coordinator

1. Confirm the Fire Brigade's expected time of arrival and give the Fire Brigade your mobile phone number
    - Fire Brigade 041 9832222 / 046 902 1666
2. Collect the Fire Hydrant Map from the Control Room
3. Wait at the factory entrance for the Fire Brigade to arrive and direct them immediately to the fire
4. Using Fire Hydrant Map, direct the Fire Brigade to the nearest fire hydrants
5. Inform the Fire Brigade of the Irish Cement fire fighting and emergency rescue equipment (including the high expansion foam generator), which is located at the Central Fire Point under Kiln No.1 drive.
6. Inform the Fire Brigade any Diesel / Chemical / Gas storage tanks that are near the fire
7. Do not get involved in fire fighting
8. Liase with the Firewater retention Coordinator to ensure fire water is retained
9. Report progress to the Emergency Response Coordinator
10. Report to the Information Gatherer (for each Fire brigade that arrives);
    - Arrival time, fire fighters names, departure time

Annex 4

Fire Water/Spill Retention Coordinator

1. Request that the Quarry stop the Quarry Surface Water pumps
2. Request that the Quarry lift the buoy on the Storm Tanks in the Water Treatment Plant to retain any fire water / spill in the Tanks, and prevent it entering the River Nanny
3. Identify water drains near the incident where the fire / spill has occurred
4. Request the Quarry install a temporary firewater retention berm of clay/stone at the area of fire / spill to protect the firewater or spill entering the water drains. Ensure that access to and from the incident site for the Ambulance(s) and Fire Brigade(s) is not restricted.
5. Coordinate retained firewater / spill clean up,
    - Consult Safety Data Sheets of spillage material to ensure clean up is carried out in a safe manner
    - Spill kits are located around the site at all Diesel and Chemical tank bunds, containing absorbent 'green sawdust' and other absorbing devices.
    - If a large quantity of firewater / spill has been generated that is not suitable for going to drain or for cleaning up, an external contractor will be requested to come on-site and collect the liquid.
6. Report progress to the Emergency Response Coordinator
7. Report progress to the Environmental Manager

Annex 4

Information Gatherer

1. Record the following information (supplied by the Emergency Response Coordinator and Team)

- Time of Incident (i.e. fire / explosion / spill / building collapse)
- Names of all evacuated persons, the names of evacuated persons sent home, names of any missing persons
- For each fire brigade unit that arrives, record the,
  - Arrival time, fire fighters names, departure time
- For each ambulance that arrives, record the,
  - Arrival time, Ambulance medical staff names, names of injured persons taken in Ambulances, departure time

2. As information becomes available, inform the Emergency Response Coordinator and Plant Management

Appendix 3.3

Environmental Queries and Complaints Policy

Environmental Queries & Complaints Policy

As a matter of policy, Irish Cement Ltd seeks to operate our facilities in a socially responsible manner and to be a good neighbour in the communities within which we operate.

To contribute to this objective Irish Cement Ltd. operates an ISO14001 accredited Environmental Management System (EMS) whereby all queries of a verbal or written nature are logged and investigated.

Any queries which, upon thorough investigation, have been identified as originating (or having the potential to have originated) from the activities of Irish Cement facilities are logged as complaints upon request of the originator of the query.

The procedure for the handling of all Environmental Queries & Complaints at each facility shall adhere to the following principles:

- **All queries shall be logged**

Written Correspondence:
All written correspondence is directed for the attention of the Environmental Manager and the Production Manager of the relevant facility. Written correspondence includes letters, emails or faxes from members of the public or the EPA.

Verbal contact:
All telephone queries are to be directed to the Environmental Manager or the Production Manager (or their deputy) at the earliest opportunity. In the event that these personnel are unavailable, telephone queries shall be logged by the recipient (reception, the control room or shift supervisor). Details including the name and telephone number of the caller, the nature of the report, the time and date of the alleged incident and the time of the phone call shall be recorded and provided to the Environmental Manager or Production Manager at the earliest convenience. Shift Supervisors shall log the receipt of a query in the daily shift report.

- **All queries shall be investigated and actioned and the outcome (both internally and externally) shall be recorded**

It is the responsibility of the Environmental Manager and the Production Manager to ensure that all environmental queries are followed up. This shall include:

- Contacting the originator of the query, and if appropriate, arranging for a visit
- Conducting a thorough investigation of each query addressing, at a minimum, relevant process activity on site, weather conditions and deliveries of materials at the relevant time.
- Where applicable, identification and implementation of corrective actions for relevant events which may have given rise to the query.

- **Queries and Complaints shall rectified to the satisfaction of the originator**

Upon completion of the ensuing investigation, the Production or Environmental Manager (or their deputy) shall contact the originator of the query and provide details of the investigation carried out along with details of the corrective actions identified and implemented (where applicable).

Prior to closure of the issue, the originator of the query shall be asked if they wish to record the incident as a complaint.

In the event that the query is logged as a complaint, the Environmental Manager (or their deputy) shall notify the EPA in accordance with the relevant notification procedures contained within the site IPPC Licence.

- **Queries and Complaints are reviewed as part of Management Review**

All environmental queries and complaints shall be reviewed as part of the Annual Management Review. The effectiveness of the corrective actions implemented for each relevant query or complaint shall be reviewed in order to reduce the likelihood of recurrence. Any additional action required shall be discussed and incorporated into the Irish Cement Ltd. ISO14001 Environmental Management System where applicable.

Signed:

Séamus Breen

Seamus Breen
Head of Quality and Sustainability
Irish Cement Limited

Dated: 1st December 2015
Issue Number: 2.0

Appendix 3.4

Construction and Environmental Management Plan

Irish Cement Ltd.

Development for Expansion of Alternative Fuels and use of Alternative Raw Materials

Construction and Environmental Management Plan

REP1

Final | 1 June 2017

Job number 325374-47

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ARUP

Document Verification

ARUP

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		Signature			
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		Name			
		Signature			

Issue Document Verification with Document ✓

Contents

1 Introduction

This outline construction environmental management plan (CEMP) includes a description of the proposed works and the controls and monitoring activities put forward to ensure that potential negative effects are minimised.

This outline will be further developed by the contractor appointed to construct the development. Any significant variations to this document will be advised to the planning authority in advance of the relevant construction works taking place.

2 Project Description

2.1 Site Description

The location of Platin Cement Works is between Drogheda and Duleek, Co. Meath. The junction between the R152 Drogheda to Kilmoon cross regional road and the CR311 country road is directly northeast of the site, while Junction 8 (Drogheda South) on the M1 Dublin-Belfast motorway is located c. 0.75km northeast of the site.

Irish Cement Ltd. also operates a quarry adjacent to site. This quarry extracts limestone which is the primary raw material used in the cement making process at Platin Cement Works.

The site for the proposed development extends to c.22.5 hectares centrally located within the c.40 hectares of Platin Cement Works. The Drogheda-Navan railway crosses the Cement Works, dividing it into two separate areas. The main cement production area is located to the north/northwest of the railway, while the cement dispatch/output area, ESB sub-station and Irish Cement Ltd. offices are located to the south/southeast of the railway.

The proposed development area where construction is planned to occur is c. 22.5 hectares in size and is located within the cement production area to the north/northwest of the railway (see **Figure 1**).

Two cement kilns are located within the Platin Cement Works site; Kiln 2 and Kiln 3. Only Kiln 3 is currently operational.

2.2 Development Description

Irish Cement Ltd. is making an application to An Bord Pleanála for a 10 year planning permission for development to increase replacement of fossil fuels with alternative fuels and to allow for the use of alternative raw materials at the Platin Cement Works, Co. Meath.

The proposed development aims to allow for an increase of 480,000 tonnes per annum of locally sourced alternative fuels and alternative raw materials to be used in both Kiln 2 and Kiln 3 as a replacement for the existing use of imported fossil fuels. This is planned to take place gradually over a number of years and is dependent on the availability of suitable alternative fuels. Proposed alternative fuels to be used include:

- fine solids (e.g. SRF, chipped timber, shredded plastics)
- coarse solids (e.g. shredded wood, rubber, dry filter cakes)
- free flowing solids (e.g. secondary liquid fuels (SLF), waste oils, sludge)
- pumpable fluids (e.g. solvents, distillation residues)

The proposed development also aims to make use of alternative raw materials for the cement making process, including materials such as alum filter cake, soils, stones, dust etc.

To allow for the proposed replacement of fossil fuels with alternative fuels, a number of buildings, silos and associated conveyors, etc. for the receiving, handling and introduction of alternative fuels to the cement plant will be constructed gradually over time.

Further details regarding the proposed structures to be constructed on site are presented in **Section 3**.

3 Construction Activities

3.1 Introduction

This section describes the main activities involved in the construction of the proposed development.

3.2 Construction Schedule

Construction is scheduled to be carried out on a gradual basis over a period of approximately 10 years, subject to planning and other approvals.

The general sequence of construction will be divided into short term, medium term and long term phases of activities. Short term indicates that the structures are planned to be completed within 0-4 years, medium term within 3-7 years and long term within 6-10 years.

While the above phases are proposed, an overlap of timing is likely to occur between them. Construction activities within each phase will generally happen in sequence but a lot of the activities will run in parallel with one another.

Table 1 details the proposed structures, together with the general sequence in which they are likely to be constructed. Locations referenced in **Table 1** are shown in **Figure 1**.

Table 1 List of Proposed Structures for Alternative Fuels Expansion

Details of Proposed Structures (with reference to location as indicated on Figure 1)	**Approximate Overall Building Dimensions (LxWxH)(m) Silo Dimensions (HxDia)(m)**	**Proposed External Treatment of Walls/Roof**
Short-Term		
1a. Fine Solids Building for Kiln 3 (As an extension to existing Fine Solids (SRF) building) Fire-water Retention Tank (i.e. relocation on existing tank, which is to be demolished)	Building c.17m x 29m x 16m Concrete tank c.16.6m x 10.6m x 2.5m high on concrete pad c. 18.6m x 11.6m	Exposed cast concrete, steelwork & metal corrugated cladding Exposed cast concrete & steelwork
2. Proposed Pumpable Fluids Tanks for Kilns 2 and 3 Bunded Area surrounding tanks Tanker off-loading area	2 no. Tanks c.9m x 8.24m dia. 1no. Tank c.9m x 5m dia. 420sq.m enclosed by 2m high wall Concrete yard of c.23m x 10m, with 25m3 underground storage sump. Enclosed by 2.5m security fence	Exposed cast concrete, steelwork and metal corrugated cladding Exposed cast concrete and steelwork Exposed cast concrete, & steelwork
3. Proposed 'Free Flowing' Solids Silos for Kiln 3 Bunded Area	2 no. silos c.26m x 5.5m dia. 9.2m x 15.1m x 4m high	Steel silos/tanks and steelwork Exposed cast concrete & steelwork
4. Alternative Raw Materials Building for Kilns 2 & Kiln 3 Fire-water Retention Tank	Building c.53.7m x 53m x 14.3m 13.6m x 10.6m x 2.5m high on concrete pad c. 14.6m x 11.6m	Exposed cast concrete, steelwork & metal corrugated cladding Exposed cast concrete & steelwork

Medium-Term		
5 Proposed general Fine Solids Building for back end of Kiln 2 Fire-water Retention Tank	Building c.26 x 49.5 x 8m Concrete tank c.9.6m x 9.6m x 2.5m high on concrete pad c. 10.6m x 11.6m	Exposed cast concrete, steelwork & metal corrugated cladding Exposed cast concrete & steelwork
6. Proposed 'selected' Fine Solids fuel introduction / metering structures for front end of Kiln 2	Building c.7.5m x 6m x 26.7m 2 no. truck off-loading stations c.4m x 7.5m x 5.5m and c.35m length of conveyor	Exposed cast concrete, steelwork & metal corrugated cladding
Longer-Term		
7. Tyre Storage and Handling Area Tyre Intake Station and Conveyor Transfer Station and Conveyor Fire-water Retention Tank	Height 835 sq. m x 3m high c.18 x 16 x 30 plus c. 57m proposed conveyor. c.8.5 x 5.5 plus c 55.3m proposed conveyor Concrete tank c.9.6m x 9.6m x 2.5 high on concrete pad c. 10.6m x 11.6m	Exposed cast concrete. Exposed cast concrete, steelwork & metal corrugated cladding Exposed cast concrete, steelwork & metal corrugated cladding Exposed cast concrete & steelwork
8a. Proposed Coarse Solids handling building for Kiln 2 & 3 Fire-water Retention Tank 8b. Conveying Building and Conveyors for Kiln 3	Building c.97.5m x 50m x 12.15m 13.6m x 10.6m x 2.5m high on concrete pad c. 14.6m x 11.6m c.18m x 16m x 30.5m plus c.83m of proposed conveyor	Exposed cast concrete, steelwork & metal corrugated cladding Exposed cast concrete & steelwork Exposed cast concrete, steelwork & metal corrugated cladding
9. Proposed Free-flowing Solids for Kiln 2. Bunded Area	2no. silos c.26m x 5.5m dia. 9.2m x 15.1m x 4m high	Steel silos/tanks & steelwork Exposed cast concrete & steelwork
10. Bypass Filter for Kiln 2	c.9m x 15m x 24m, with cooling tower to c.46m x 5.0.2m dia.	Steel, steelwork & ductwork
Proposed Coarse Solids for Kiln 2 (makes use of same building as provided under Item 7a above.)	Makes use of same building as provided under Item 7a above. c.16m x 18m x 30.5m	Exposed cast concrete, steelwork & metal corrugated cladding.

11. Truck off-loading / elevator / buffer building Transfer Station	c.8.5m x 5.5m x 38.5m plus c.200m of proposed conveyor	Exposed cast concrete, steelwork & metal corrugated cladding. Exposed cast concrete, steelwork & metal corrugated cladding

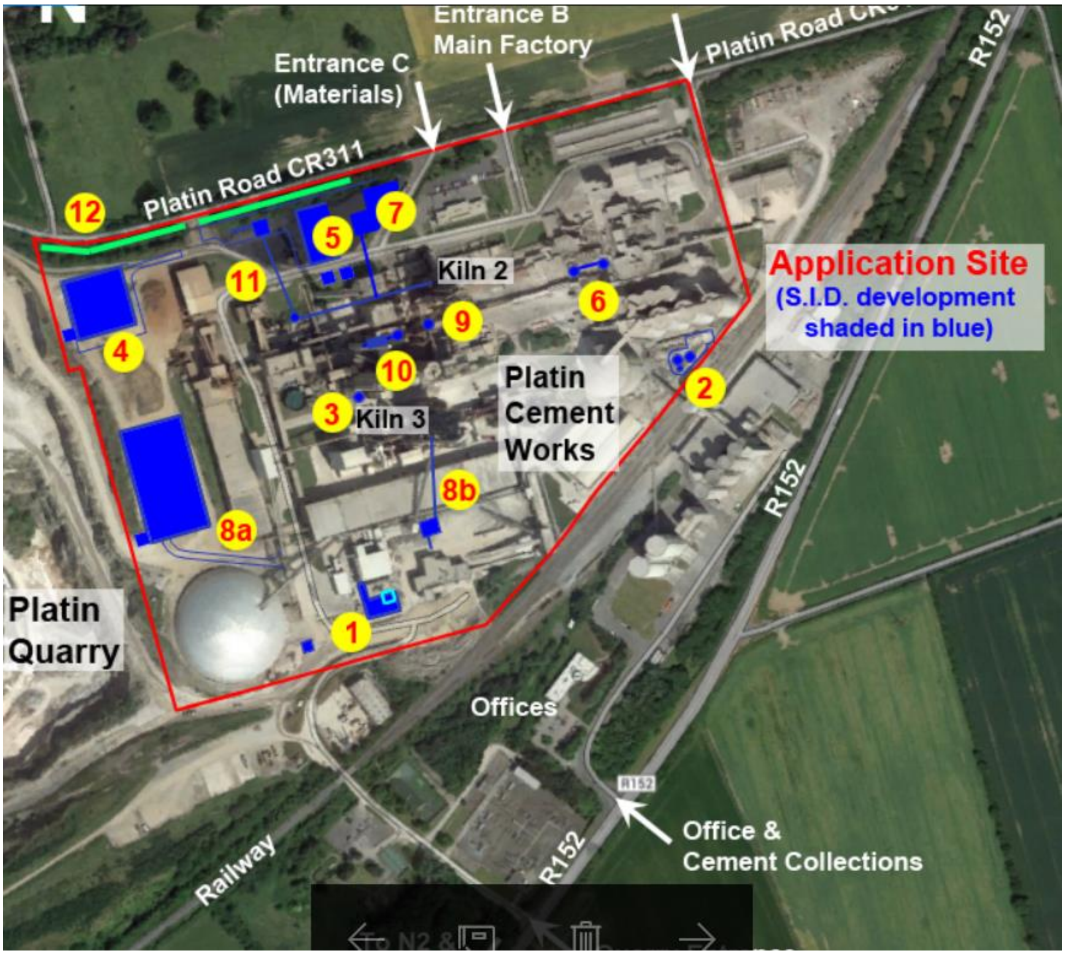

Figure 1 Locations of proposed structures

4 Method Statement for Construction

A detailed Environmental Management Plan and Construction Health and Safety Plan will be developed by the contractor appointed to carry out the works.

4.1 Site Preparation Works

Site preparation works will include the 'site establishment' set up by the contractor which will include the following:

- Setting up of access control to the site;
-
- Erection of site office;
- Site facilities (canteen, toilets, etc.);
- Office for construction management team;
- Secure compound for the storage of all on-site machinery and materials;
- Permanent and temporary fencing;
- Erection of signage.

Prior to commencement of construction, the contractor will consult Irish Cement Ltd. records and drawings to establish the location of existing buried services.

4.2 Construction Compound

A temporary construction compound will be required for each phase of construction. This will be located within the Platin Cement Works site.

The temporary construction compound will include a site office for the construction management team and site facilities for the construction staff. The compound will be serviced with electrical power, water supply and toilet facilities. It is envisaged that the existing Platin Cement Works facility will supply these services. If not, electrical power will be supplied from a low noise, double bunded diesel generator sited within the compound, water will be delivered to the site by bowser and sewerage/effluent will be stored in septic tanks and removed from site. The compound will be used as a storage area for the various components, fuels and materials required for construction. The compound will be fenced off to ensure site security is maintained. The compound will be decommissioned and reinstated to its original condition at the end of the construction period.

4.3 Construction of New Structures

The development comprises the construction of a number of new structures, including buildings, silos and associated conveyors, etc. These structures are detailed in **Table 1**, presented in **Section 3.2**.

These structures will vary in size but will generally be of low elevation when compared with existing structures within the site. The proposed structures will be in keeping with the existing character of the site, with a mixture of exposed cast concrete, steelwork and corrugated sheeting used for their construction.

4.4 Construction of Services

4.4.1 Electrical Connections

Power will be required for the construction compound. It is anticipated that power will be required for temporary lighting and temporary signals during the works. If a connection to the existing network is not available a generator will be used.

4.4.2 Surface Water/Drainage System

No new surface water services will be constructed as part of the proposed development.

Construction activities will be carried out within the catchment area of the current site drainage system. This drainage system discharges under an IE licence to an outfall point into the River Nanny. Prior to discharge to this point, surface water from the site passes through balancing and settlement tanks which remove suspended solids and oil interceptors and absorbent booms which remove any accidental oil or hydrocarbon spills.

4.4.3 Potential for Historic Contamination on the Site

Based on the soil baseline survey carried out all relevant limits for contaminated soils were complied with.

In the event of any evidence of soil contamination being found during the excavation phase of the construction works, the appropriate remediation measures will be employed. Any work of this nature will be carried out in accordance with the appropriate waste management legislation.

4.5 Health and Safety

As required by the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared by the Contractor which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed as the development progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations.

Safety on site will be of paramount importance. During the selection of the relevant contractor and the respective subcontractors their safety records will be investigated. Only contractors with the highest safety standards will be selected.

Prior to working on site, each individual will receive a full safety briefing and will be provided with all of the safety equipment relevant to the tasks the individual will be required to perform during employment on site.

Safety briefings will be held regularly and prior to any onerous or special task. ‘Toolbox talks’ will be held to ensure all workers are fully aware of the tasks to be undertaken and the parameters required to ensure that the task will be successfully and safely completed.

All visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team.

Regular site safety audits will be carried out throughout the construction programme to ensure that the rules and regulations established for the site are complied with at all times.

At any time that a potentially unsafe practice is observed, the site safety manager will have the right as well as the responsibility to halt the work in question, until a safe system of working is again put in place.

4.6 Materials – Source and Transportation

The selection and specification of construction materials will be informed by the local availability of these materials. Within the necessary constraints of performance, durability and cost, construction materials will be sourced from local suppliers and manufacturers, where possible.

4.7 Employment and Accommodation

While there will be some variation in numbers working on site throughout construction, it is anticipated that approximately 30 workers will be employed during each phase of construction.

Temporary office accommodation and other construction facilities will be installed on site for the construction phase. All temporary units will be of a high standard in accordance with statutory regulations as a minimum.

The co-ordination of people and materials on site will be one of the key activities throughout the construction phases. A construction management plan will be put in place prior to the commencement of the works. This plan will designate traffic routes, timings and parking arrangements.

Typical working hours during the construction phases would be envisaged as:

Start	**Finish**	
07:00	19:00	Monday – Friday
07:00	14:00	Saturday

Currently, there are no significant works foreseen outside of normal working hours.

5 Potential Construction Phase Environmental Effects and Control Measures

5.1 Introduction

The construction activities described in **Section 3** will have a range of effects. This section describes the likely consequences of the works and outlines the proposed control measures that will minimise potential environmental impacts.

The potential construction phase impacts include emissions to air such as dust, noise and vibration, construction traffic, and poorly controlled construction waste. Surface water run-off from the site during periods of heavy rainfall and leaks or spills from construction plant and equipment have the potential to impact on the quality of soils, surface water and groundwater.

5.2 Noise

The construction phase of the proposed development will involve minimal site demolition works, site clearance, excavation and the construction of buildings and structures associated with the proposed development. A variety of items of mobile plant will be in use, such as excavators, breakers, lifting equipment, dumper trucks, compressors, generators and pile drivers. There will be vehicular movements to and from the site that will make use of the existing roads and site access points.

A number of measures will be employed by the contractor in order to minimise the potential noise and vibration disturbance in the surrounding area and to ensure compliance with the construction noise limits set in the current EPA licence for the site.

BS 5228 (2009+A1:2014) *Code of ra ti e for noise and ibration ontrol on onstru tion and o en sites – oise and ibration* provides guidance on the implementation of measures to reduce the impact of construction noise and vibration.

The measures to be implemented on site include, but are not limited to;

- Selection of plant/location of plant
- Prior to deployment of construction plant on site, an assessment of the noise characteristics of each of the individual plant items in terms of noise and vibration emissions will be undertaken. Where possible, plant which will have the least impact in term of noise will be selected. In addition, plant will only be left running during works and will be switched off at all other times. Plant will not be left idling.
- Hours of work - all construction related works, other than emergency works, security and pumping out of excavations will be carried out during normal construction working hours.

5.3 Dust

Based on the assessment criteria presented in the Transport Infrastructure Ireland (TII) document *uidelines for the reatment of ir Quality durin the lannin and Construction of National Road Schemes'* 2011, the proposed construction site is considered to be at a 'minor' scale. This category of site has the potential for significant soiling impacts within 25m; PM_{10} impacts within 10m; and vegetation impacts within 10m of the site boundary if standard mitigation measures are in place.

As no sensitive receptors are located within 25m of the areas of the proposed construction works, no significant impacts due to construction activities are envisaged.

Nonetheless, measures will be undertaken during the construction works to minimise dust generation. The following measures will be implemented at a minimum:

- Spraying of exposed earthwork activities and site haul roads during dry weather.
- Control of vehicle speeds on site.
- Sweeping of hard surfaces on-site and in the surrounding area, as required.

Dust deposition monitoring is required by Irish Cement's Industrial Emission Licence on a quarterly basis. Dust deposition monitoring will be carried out and compared to the limit of 350mg/m^2/day (averaged over a 30-day period) to ensure the effectiveness of the measures outlined above.

An outline dust minimisation plan has been prepared and is included in Appendix 8.1.

The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness:

- Daily inspections will be undertaken to monitor tidiness.
- A regular program of site tidying will be established to ensure a safe and orderly site.
- If necessary, scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind.
- Food waste will be strictly controlled on all parts of the site.
- Loaded lorries, delivery vehicles and all trucks for the movement of materials on and off site will be covered. Skips will also be covered. Contractors will ensure that delivery agents are compliant in this regard.
- Surrounding roads used by trucks to access to and egress from the site will be inspected regularly and cleaned, using an approved mechanical road sweeper, when required. Roads will be cleaned subject to local authority

requirements. Site roads will be cleaned on a daily basis, or more regularly, as required.

- Road edges and footpaths will be cleaned using a hand broom with controlled damping.
- Wheel wash facilities will be provided with rumble grids to remove excess mud from wheels. These facilities will be located at all exits from the site.
- In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.

5.4 Soils, Geology and Groundwater

The employment of the following good construction management practices will minimise the risk of pollution of soil, geology and groundwater:

- Good housekeeping (daily site clean-ups, use of disposal bins, etc.) on the site during construction, and the proper use, storage and disposal of substances and their containers will prevent soil contamination.
- Material such as, fuels, lubricants and hydraulic fluids will be carefully handled and stored to avoid spillages. Potential pollutants shall also be adequately secured against vandalism and will be provided with proper containment according to codes of practice. Any spillages will be immediately contained and contaminated soil removed from the site and disposed of in a licensed waste facility.

5.5 Surface Water

Surface construction activities may pose a potentially significant risk to all watercourses as these sites will be exposed to rainfall which has the potential to produce run-off. Surface water run-off from surface construction activities has the potential to become contaminated. The main contaminants arising from surface construction activities include:

- Suspended solids: arising from ground disturbance and excavation;
- Hydrocarbons: accidental spillage from construction plant and storage depots;
- Faecal coliforms: contamination from coliforms can arise if there is inadequate containment and treatment of on site toilet and washing facilities; and
- Concrete/cementitious products: arising from construction materials.
- These pollutants pose a temporary risk to surface water quality for the duration of construction if not properly contained and managed.

Suspended solids, which can include silt, affect surface water turbidity and are considered to be the most significant risk to surface water quality from construction activities. Suspended solids can also reduce light penetration, visually impact the receiving water and damage the ecosystem. Potential construction activities that could generate suspended solids include:

- Water removal from surface excavations as a result of rainfall or groundwater seepage;
- Runoff from exposed work areas and excavated material storage areas; and
- Washdown areas: The potential for washdown containing cement to increase the pH of water above a neutral range, that is typically pH 6 to 9, could pose a threat to aquatic species living in a watercourse.
- Potential activities that could generate the other pollutants listed above include:
- Inappropriate handling and storage;
- Leakage of temporary foul water services; and

  Solid (municipal) wastes entering the watercourses or drainage systems.

All construction activities will be carried out within the catchment area of the site drainage system. All surface water from the site passes through balancing and settlement tanks and these are effective in removing suspended solids. In addition, oil interceptors and absorbent booms in the existing surface water treatment system are effective in removing any accidental spills of oils or other hydrocarbons

Prior to construction the Contractor will be required to develop a detailed Environmental Management Plan which will incorporate the mitigation measures detailed below. These mitigation measures apply for the prevention of pollution to all waters during construction.

- Prepare an Emergency Response Plan detailing the procedures to be undertaken in the event of flooding, a spill of chemical, fuel or other hazardous wastes, a fire, or a non-compliance incident. This plan will contain the following information:
  - Containment measures;
  - List of appropriate equipment and clean-up materials;
  - Maintenance schedule for equipment;
  - Details of trained staff, location, and provision for 24-hour cover;
  - Details of staff responsibilities;
  - Notification procedures to inform the relevant environmental authorities;
  - Audit and review schedule;

- Telephone numbers of Meath County Council Drainage and Pollution Control Divisions; and
- List of specialist pollution clean-up companies and their telephone numbers.
- Ensure site staff are trained in the implementation of the Emergency Response Plan and the use of any spill control equipment as necessary;
- Prepare method statements for the control, treatment and disposal of potentially contaminated surface water;
- Prepare a site plan showing the location of all surface water drainage lines and proposed infiltration areas/discharge to combined sewer. This shall include the location of all existing and proposed surface water protection measures, including monitoring points and treatment facilities;
- Ensure that all appropriate licences required for construction are obtained from the relevant authorities.

The Contractor will comply with the following guidance documents:

- CIRIA – *uideline o ument C Control of ater ollution from Constru tion Sites* (CIRIA, 2001) and
- CIRIA – *uideline o ument C e elo ment and lood is uidan e for the onstru tion industry* (CIRIA, 2004).

5.6 Waste Management

This section describes the measures to mitigate the significant impacts for the construction phase of the proposed scheme.

The recommended mitigation for the demolition, excavation and construction phases of the scheme comprises the preparation of a Construction Waste Management Plan which meets the requirements of the *Best ra ti e uidelines on the re aration of aste ana ement lans for Constru tion emolition ro e ts* (DoEHLG, 2006a). Where waste generation cannot be avoided this will maximise the quantity and quality of waste delivered for recycling and facilitate its movement up the waste hierarchy away from landfill disposal and reduce its environmental impact.

Possibilities for re-use of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use. Where excavation material cannot be re-used within the proposed works it will be disposed of accordingly by an authorised contractor.

The contractor will ensure that any off-site facilities to which construction waste is delivered have the appropriate Certificate of Registration, Waste Facility Permit or Waste Licence in place.

In addition to the above during the construction phase the following mitigation measures are proposed:

- Source Segregation: Where possible metal, timber, glass and other recyclable material will be segregated during demolition works and removed off site to a permitted/licensed facility for recycling. Waste stream colour coding and photographs will be used to facilitate segregation;
- Material Management: ‘ *ust in time*’ delivery will be used so far as is reasonably practicable to minimise material wastage; and
- Waste Auditing: The Contractor will record the quantity in tonnes and types of waste and materials leaving site during the construction phase. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material whether is recovered or disposed of.

6 Environmental Emergency Response Plan

Emergency response preparedness will be addressed in detail by the selected contractor, in consultation with Irish Cement’s on-site EHS team.

Environmental emergencies at the site requiring intervention may include:

- Discovery of a fire within the site boundary
- Uncontained spillage/leak/loss of containment incident
- Discovery of material of archaeological interest

A list of site emergency contact numbers and the general emergency response actions will be compiled by the contractor and posted at strategic locations throughout the site, such as the site entrance, safety stop-boards and contractor cabins. The emergency contact number list will be updated by each contractor to include their Safety Representative contact name and telephone number.

An example of emergency response actions is as follows for action to be taken in the event of a spillage:

- IF SAFE, stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- IF SAFE (USE PPE), contain the spill using the absorbent spills material provided. Do not spread or flush away the spill.
- Cover or bund-off any vulnerable areas where appropriate.
- If possible, clean up as much as possible using the absorbent spills materials.

- Do not hose the spillage down or use any detergents.
- Contain any used absorbent material so that further contamination is limited. Note: This material is a waste and must be treated as such. The Safety Data Sheet (SDS) for the material will determine whether the spill material is hazardous or non-hazardous and will need to be disposed of accordingly.
- Notify the Irish Cement Ltd. Construction Safety Representative at the earliest opportunity.
- An incident investigation will be performed in accordance with procedures and the report sent to the Irish Cement Ltd. Safety Representative.

The Construction Manager will ensure that fully detailed records are maintained of any "incident/event" likely to cause harm to the environment. Contractors who report an incident will ensure details are identified and recorded.

Environmental incidents will be recorded on an appropriate form.

Complaints and Follow up Actions on the construction site will be managed by the Construction Manager in liaison with Irish Cement Ltd. and contractors will ensure that all complaints are recorded according to Irish Cement Ltd. requirements. A complaints log will be kept, and any complaint from interested parties will be actioned and recorded.

Each contractor will be responsible for ensuring that a full record and copy of all **Safety Data Sheets (SDS)** pertaining to their works is kept on file and up to date in their site offices. Contractors will also retain a duplicate copy of all SDSs held by the contractors.

7 References

CIRIA (2001) *uideline o ument C Control of ater ollution from Constru tion Sites*

CIRIA (2004) *uideline o ument C e elo ment and lood is uidan e for the onstru tion industry*

Appendix 3.5

List of Wastes (LOW)

Appendix 3.5 – List of Waste

The EWC (European Waste Catalogue) codes have been replaced by the List of Wastes (LOW) codes[1]. However, the 6 digit coding system has been retained. The proposed materials have been categorized and described in the EIS, into five alternative fuel types and alternative raw material types depending on their handling and physical characteristics. These categories, together with the various LOW codes, are provided in the Table below.

Proposed Development and List of Waste Codes

Whole Tyres LOW Codes: 16 01 03
Fine Solids Fine materials, like Solid Recovered Fuel (SRF), typically sized 10-50mm (*e.g.* chipped timber, shredded plastics, *etc*.) LOW Codes: 02 01 02**; 02 01 04; 03 01 01; 03 01 05; 03 03 01; 03 03 08; 07 02 13; 12 01 05; 15 01 01; 15 01 02; 15 01 03; 15 01 05; 15 01 06; 15 02 03; 17 02 01; 17 02 03; 19 12 01; 19 12 04; 19 12 07; 19 12 08; 19 12 10; 19 12 12; 20 01 01; 20 01 38; 20 01 39.
Free-flowing Solids: Some fuels will be free-flowing solids or powders (*e.g.* SRF pellets, sewage sludge pellets, bio-solids *etc*.). LOW Codes: 02 02 03**; 02 03 04; 19 08 05; 19 10 03*; 19 10 04
Pumpable fluids: Fluid type materials (*e.g.* secondary liquid fuels (SLF), waste oils, solvents, distillation residues, paint sludges, *etc*.) LOW Codes: 02 01 08*; 02 01 09; 07 01 01*; 07 01 03*; 07 01 04*; 07 02 01*; 07 02 03*; 07 02 04*; 07 03 01*; 07 03 03*; 07 03 04*; 07 04 01*; 07 04 03*; 07 04 04*; 07 05 01*; 07 05 03*; 07 05 04*; 07 06 01*; 07 06 03*; 07 06 04*; 07 06 99; 07 07 01*; 07 07 03*; 07 07 04*; 08 01 11*; 08 01 12; 08 04 09*; 08 04 10; 13 07 01*; 13 07 03*; 19 02 07*; 19 02 10; 20 01 13*; 20 01 25; 20 01 26*
Coarse Solids: Materials typically of 30-120mm particle size (*e.g.* shredded wood, rubber, dry filter cakes, *etc*.) LOW Codes: 02 01 03; 02 01 06; 02 01 07; 02 07 02; 02 07 04; 03 01 04*; 05 01 07*; 05 06 01*; 15 01 10; 15 02 02; 16 01 03; 16 11 01; 16 11 02; 19 11 02; 19 12 06; 19 12 11; 20 01 37
Raw Materials LOW Codes: 01 01 01; 01 01 02; 01 03 06; 01 03 08; 01 03 09; 01 05 05*; 01 05 06*; 02 03 05; 03 03 09; 06 02 03*; 10 01 05; 10 01 07; 10 01 17; 10 03 05; 17 05 03*; 17 05 05*; 17 08 02; 19 01 12; 19 01 17*; 19 01 18; 19 03 05; 19 07 02*; 19 07 03; 19 08 05; 19 08 12; 19 08 14; 19 09 02; 19 13 01*; 19 13 02; 19 13 03*; 19 13 04

* Hazardous

** Animal by-product

[1] https://www.epa.ie/pubs/reports/waste/stats/wasteclassification/EPA_Waste_Classification_2015_Web.pdf

Appendix 4.1

Human Health Risk Assessment

Irish Cement Ltd

Development for the expansion of use of Alternative Fuels and use of Alternative Raw Materials – Platin Cement Works

Human Health Risk Assessment - PCDD/Fs

Rev A | 31 May 2017

Job number 325374-47

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1 Introduction

Irish Cement Ltd is applying to An Bord Pleanála for planning permission under Section 37E of the Planning and Development Acts 2000 to 2006 as amended, for a development to allow for an increase in the use of alternative fuels and in the range of alternative fuels and for the use of alternative raw materials at its existing Cement Works at Platin, Co Meath.

This Report presents the results of Human Health Risk Assessment (HHRA) modelling in relation to polychlorinated dibenzodioxins, polychlorinated dibenzofurans and dioxin-like polychlorinated biphenyls (PCBs) (referred to in this report as "PCDD/Fs") undertaken using the U.S. Environmental Protection Agency's Human Health Risk Assessment Protocol (HHRAP) [1] in relation to potential emissions from the Cement Works.

2 Scope

The scope of this Human Health Risk Assessment (HHRA) comprises an assessment of potential future emissions of PCDD/Fs from the Cement Works.

An Emission Limit Value (ELV) is specified for PCDD/Fs in the Industrial Emissions Directive (IED) [2] for the co-incineration of waste in cement plants.

Measurements taken at cement plants throughout Europe burning alternative fuels show that emissions generally and in particular emissions of PCDD/Fs are much lower than the IED ELV. Monitoring of emissions from Platin Cement Works when using alternative fuels shows an average concentration of PCDD/Fs of 0.0033 ng/Nm^3, which is 0.33% of the ELV.

The HHRAP methodology is based on very conservative assumptions. The methodology has been applied to calculate potential future emissions of PCDD/Fs from the Cement Works assuming that the PCDD/F emissions occur at the IED limit rather than at the actual levels which are expected to be much lower. This is a standard methodology for such models and this conservative approach ensures additional safety in arriving at a conclusion.

3 PCDD/Fs

“Dioxins” is a term that is commonly applied to three groups of substances that are toxic environmental persistent organic pollutants (POPs).

- Polychlorinated dibenzo-p-dioxins (PCDDs)
- Polychlorinated dibenzofurans (PCDFs)
- Polychlorinated/polybrominated biphenyls (PCBs/PBBs)

The different related compounds in each of the above groups are referred to as congeners. Congeners within each group are distinguished by the number of chlorine atoms in the molecule and the location of the chlorine atoms in the molecular structure.

Of the 210 congeners of PCDDs and PCDFs, only 17 are considered potentially toxic so as to warrant detailed consideration in health impact assessments. This group is referred to in this report as “PCDD/Fs”.

In order to take account of the differences in potential toxicity to humans of the 17 congeners a weighting factor is applied to each to convert concentrations to the equivalent concentration of congener 2,3,7,8-TCDD, which is regarded as the most toxic congener and is therefore used as the standard benchmark for all PCDD/Fs.

The World Health Organisation approved weighting factors set out in the IED are referred to as Toxic Equivalents (WHO-TEQ) and are listed in Appendix F.

PCDD/Fs have the potential to affect human health by two routes:

- the direct pathway via inhalation; and
- indirect pathways, i.e. ingestion of soil, food grown, or animals grazed on contaminated soil as a result of aerial deposition of pollutants.

More than 90% of human exposure to PCDD/Fs is through food, mainly meat and dairy products, fish and shellfish. [15] PCDD/Fs are defined as compounds of potential concern (COPCs).

> *They persist for long periods of time in the environment and can accumulate and pass from one species to the next through the food chain.* [4]

The potential for direct exposure via inhalation is been considered in the Environmental Impact Assessment Report (EIA Report) (Chapter 8 – Air Quality and Climate) being submitted with the planning application. Currently no internationally recognised air quality standards are prescribed for PCDD/Fs in ambient air. The World Health Organization (WHO) guidance [3] states that “concentrations of 0.3 pg/m^3 (0.0000003 µg/m^3) or higher are indications of local emission sources that need to be identified and controlled”. This is described as an “indicative value”. In the EIA Report the predicted Ground Level Concentration of PCDD/Fs was shown to be well below the WHO Indicative Value (annual average).

The evaluation of potential risk in the HHRAP is based on a hypothetical worst case exposure pathway, in that it has been assumed that the most sensitive receptor is consuming vegetables and livestock grown and reared at the point of maximum ground level exposure.

Dioxin-like PCBs were not considered in the emissions for the following reasons.

- The Industrial Emissions Directive (IED) sets an Emission Limit Value (ELV) for PCDD/Fs. The ELV is 0.1 ng/Nm³. The IED requires that, to determine compliance with this ELV, the mass concentration of each of the 17 congeners to be multiplied by the equivalence factors (TEFs) before summing. The TEFs are those published by the World Health Organisation (WHO). The IED does not require inclusion of the mass concentrations of dioxin-like PCBs when assessing compliance with this ELV.
- The USEPA monitored emissions from over 150 large Municipal Waste Combustion (MWC) facilities [10]. On page 10-4 of the USEPA report it is stated:

  Although it has been demonstrated that small quantities of dioxin-like PCBs can be emitted into the air during waste combustion, no strong evidence exists that they are emitted in significant quantities as by-products during combustion.

Further, the WHO TEFs for most of the dioxin-like PCBs are extremely low compared to those of PCDD/Fs.

4 Methodology

The U.S. Environmental Protection Agency (US-EPA) Office of Solid Waste (OSW) has developed an approach for conducting multi-pathway, site-specific human health risk assessments for energy from waste facilities. The approach is known as the Human Health Risk Assessment Protocol (HHRAP) [1].

The HHRA methodology incorporates the following elements:

- Facility characterisation,
- Atmospheric dispersion modelling,
- Identification of exposure scenarios,
- Estimating media concentrations,
- Quantifying exposure,
- Characterising Risk and Hazard.

The computer model IRAP-h View (Industrial Risk Assessment Program-Health Version 4.5.5) used in this assessment has been designed by Lakes Environmental Software to carry out human health risk assessments following the requirements and methodology of the HHRAP.

Details of the methodology are set out in Appendix E.

5 Facility and Emission Characterisation

The sections below describe the release parameters, potential emission concentrations and the resultant predicted emission rates from Platin Cement Works.

5.1 Emission Source Process Conditions

The emission characteristics applied in the air dispersion model and process conditions used to determine the pollutant emission rates are presented in Table 1. The emission rate is based on Emission Limit Value for PCDD/Fs in the IED, a figure which is much higher than the likely actual emissions.

Table 1: Stack Emission Characteristics

Parameter	Value	
	Kiln 2	Kiln 3
Stack Diameter (m)	3.7	3.75
Stack Exhaust Height (m AGL)	103.04	123
Volume Flow (Nm^3/hr) (273K, 10%, dry)	650,000	650000
Volume Flow (Nm^3/s) (273K, 10%, dry)	181	181
Emission Temperature (K)	121	108
Emission velocity (m/s)	26.96	11.44
Particulate Emission Rate (g/s)	3.6	3.6
PCDD/F Emission Rate (ng/s)	286.90	286.90
PCDD/F Emission Rate (ng TEQ/s)	18.06	18.06

5.2 Potential Emissions of PCDD/Fs

The potential emission rate of PCDD/Fs has been determined on the worst-case conservative basis of the Cement Works operating continuously at the IED ELV for PCDD/Fs of 0.1 WHO-TEQ ng/m^3.[1]

As each specific PCDD/F congener has different physico-chemical properties, congener-specific emission data are required. A summary of the relative contribution of each of the 17 congeners from site-specific and published data is included as Appendix A.

The most complete dataset available is from measurements undertaken on behalf of the USEPA in 2000, which included congener profiles for emissions from more than 150 large facilities. The USEPA derived congener split [10] has been applied in this assessment given the number of datasets which support this split.

[1] The IED requires dioxins to be reported using the I-TEQ reporting convention to assess compliance against an emission limit of 0.1ng I-TEQ / Nm^3. The UK's independent health advisory committee, Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT), has adopted the World Health Authority (WHO) toxicity equivalence factors (TEF) for dioxins in their recent review of Tolerable Daily Intake (TDI) criteria.

Because much more data is available on the congener profiles when burning MSW than rubber tyres and other alternative fuels, it is considered that combustion of MSW is the best approximation to combustion of SRF and other alternative fuels to be used at the Cement Works.

The use of a different congener profile would not result in higher emissions of PCDD/Fs – these would be limited by the ELV of 0.1 ng/Nm^3 (WHO-TEQ) specified in the IED, expressed in terms of I-TEQ.

The potential mass emission of each congener has been calculated on the basis of the USEPA congener profile, factored empirically on the basis of WHO Toxic Equivalency Factors (TEF) at the IED emission concentration. The congener specific emission rates applied in the model are detailed in Appendix F.

6 Air Dispersion Modelling

The atmospheric dispersion modelling for the HHRA has been completed using the AERMOD model as stated in Chapter 8 of the EIA Report. The area modelled was a 10 km x 10km square centred on the Cement Works, with receptors at 500m intervals and receptors more closely spaced in the vicinity of the Cement Works. Modelling was carried out using meteorological data for Dublin airport for the years 2011-2015.

The model was used to determine the highest of the five annual average Ground Level Concentrations (GLCs) and the highest of the 43,824 hourly average GLCs averages for each receptor.

Modelling also took account of particle deposition under dry and wet conditions.

Receptors referred to above are the nodes or points of intersection of the grid lines and allows for a systematic comparison of different parts of the grid.

Further details are given in Appendix G.

7 Exposure Scenarios

7.1 Site and Surroundings

The site forms part of the Irish Cement holding at Platin. The site is located approximately 1 km to the west of the M1 motorway and approximately 3km southwest of the centre of Drogheda town.

Land in the immediate area is largely agricultural with some residential development. The Indaver waste to energy facility is located a short distance to the west of the Cement Works.

7.2 Ambient PCDD/Fs

7.2.1 Ambient Air

Ambient air was sampled and analysed for PCDD/Fs in December 2016 at three locations. Refer to Appendix C.

The results are summarised in Table 2.

Table 2: Ambient Air Sampling for PCDD/Fs

Location		Concentration of PCDD/Fs, ng/m³, I-TEQ Measured (48-hour average)
Ref	Description	
1	Security hut on the entrance route to the factory which is c. 0.2km North East of the kiln.	0.00005527
2	At Platin Cement Works, located c. 0.2km South West of the kiln.	0.00005598
3	At Platin Cement Works, located c. 0.3km West South West of the kiln	0.00005846

Currently, no internationally recognised ambient air quality concentration or deposition standards exist for PCDD/Fs. However, the World Health Organisation (WHO) guidance states that "concentrations of 0.0003ng/m³ or higher are indications of local emission sources that need to be identified and controlled". [18] This is an annual average and is described as an "indicative value".

The measured values in Table 2 are very low relative to the WHO 'indicative value'.

7.2.2 Soils

Soil samples were also taken from five locations and analysed for PCDD/Fs refer to Appendix D. The results are shown in Table 3.

Table 3: Soil Sampling for PCDD/Fs

Location	PCDD/Fs ng/kg of soil I-TEQ (WHO)
1	0.3662
2	0.3891
3	0.3791
4	0.4037
5	0.3507
Average	**0.3778**

These are values are considered to be very low, essentially “background” values, well below a level of concern, 10 ng/kg. Therefore, no significance can be attributed to variations between locations. At such low concentrations variation of a factor of 5 between samples from the same location would not be considered unusual.

By way of comparison, the English Environment Agency has reported [17] the following median values for PCDD/Fs:

Table 4: Comparative statistics for rural and urban soils

Region	WHO-TEQ (median values) (ng/kg)[1]	
	Rural Soils	Urban Soils
England	2.53	11.11
Northern Ireland	1.28	1.14
Scotland	2.13	6.57
Wales	2.02	3.47

[1]2001/2002

It is concluded that the PCDD/F concentrations in the soil sampled in the Platin area are very low.

7.3 Assessment of Worst Case Exposure Pathways

Based on the methodology described in Appendix E the following specific exposure scenarios have been identified as of relevance to this HHRA.

- ingestion of food,
- ingestion of soil.

Inhalation has not been included because of the WHO conclusion that more than 90% of human exposure to PCDD/Fs is through food consumption.

The model sets out a selection of theoretical receptors that are assumed to reside in the local area. Potential exposure pathways are determined by the diet of the receptor and the proportion of this diet which is local produce.

For example, a residential receptor may be less likely to ingest home-reared pork compared to a farmer. However, a residential receptor may ingest home-grown vegetables. The receptors and exposure scenarios assessed arising from ingestion are summarised in Table 5.

Table 5 Ingestion Exposure by Receptor Type

Exposure Pathways (Ingestion Path)	Recommended Exposure Scenarios[a]					
	Resident	Resident Child	Farmer	Farmer Child	Fisher	Fisher Child
Inhalation of Vapors and Particulates	N	N	N	N	N	N
Incidental Ingestion of Soil	Y	Y	Y	Y	Y	Y
Ingestion of Drinking Water from Surface Water Sources	Y	Y	Y	Y	Y	Y
Ingestion of Homegrown Produce	Y	Y	Y	Y	Y	Y
Ingestion of Homegrown Beef	N	N	Y	Y	N	N
Ingestion of Milk from Homegrown Cows	N	N	Y	Y	N	N
Ingestion of Homegrown Chicken	N	N	Y	Y	N	N
Ingestion of Eggs from Homegrown Chickens	N	N	Y	Y	N	N
Ingestion of Homegrown Pork	N	N	Y	Y	N	N
Ingestion of Fish	Y	Y	Y	Y	Y	Y

Notes:
Based on Table 4-1 of Reference [1]
Y Pathway is included in exposure scenario.
N Pathway is not included in exposure scenario.
a Exposure scenarios are defined as a combination of exposure pathways evaluated for a receptor at a specific location.

7.4 Identification of Sensitive Receptor Location

This HHRA has considered a hypothetical worst case receptor i.e. a person present at the point of maximum impact as predicted by AERMOD, which occurs on the south-east site boundary at the R152 Duleek to Drogheda road.

The impact on all other receptors is less than for this receptor.

7.5 Parameters

The parameters for estimating media concentrations are set out in Appendix H.

8 Predicted Intake of PCDD/Fs

The predicted intake of PCDD/F congeners by each receptor at the location of maximum impact is summed to provide the total intake. The results are shown in the following table. As can be seen from the table all predicted intakes are below the UK COT standard of 2 pg/kg bw per day.

Table 6 Summary of Predicted PCDD/F Intake

Scenario	PCDD/F Intake	
	pg/kg bw[1] per day	Fraction of TDI
Farmer	0.0373	1.87%
Farmer Child	0.0561	2.80%
Resident	0.0018	0.09%
Resident Child	0.0064	0.32%
Fisher	0.0018	0.09%
Fisher Child	0.0064	0.32%
Farmer Infant	0.151	7.57%
Resident Infant	0.005	0.27%
Fisher Infant	0.005	0.27%

Note 1: bw = bodyweight

9 Conclusions

The findings of the assessment are that the intake of PCDD/Fs that could arise from potential emissions from Platin Cement Works at the location of highest concentration and deposition of dioxins is within the limit of 2 pg/kg bodyweight per day for the protection of human health based on WHO and UK guidance.

This conclusion is considered robust on the basis of the worst case approach adopted and the hypothetical worst case exposure scenario considered in the assessment.

The hypothetical worst case location is on the south-eastern site boundary adjacent to busy road (R152).

It should be noted that the IED licence for the Cement Works, which is currently under review by the EPA, will also require compliance with an ELV for PCDD/Fs. The findings of the assessment are based on these worst-case emission limit values.

Measurements taken at cement plants throughout Europe burning alternative fuels show that emissions generally and in particular emissions of PCDD/Fs are much lower than the IED ELV. Alternative fuels are currently uses in Platin Cement Works. Monitoring over a number of years shows an average concentration of PCDD/Fs of 0.0033 ng/Nm³, which is 0.33% of the ELV.

Monitoring for PCDD/Fs in the atmosphere and in the soil in the area has shown that values are exceedingly low and well below levels that could cause concern.

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[18] WHO Air Quality Guidelines, 1995.

Appendix A

Congener Split Review

A1 Congener Partitioning (% Contribution)

Congener	Source			
	USEPA (Table 3-4) [20]		HMIP Table 7.2a [21]	
	Measured (ng/m^3)	% contribution	Measured (ng/m^3)	% contributio n
2,3,7,8 –TCCD	0.0050	0.37%	0.0310	0.15%
1,2,3,7,8–PeCDD	0.0160	1.18%	0.2450	1.22%
1,2,3,4,7,8–Hx CDD	0.0160	1.18%	0.2870	1.42%
1,2,3,6,7,8–HxCDD	0.0370	2.74%	0.2580	1.28%
1,2,3,7,8,9–HxCCD	0.0320	2.37%	0.2050	1.02%
1,2,3,4,6,7,8–HpCCD	0.2190	16.21%	1.7040	8.46%
OCCD	0.3450	25.54%	4.0420	20.06%
2,3,7,8-TCDF	0.0720	5.33%	0.2770	1.37%
1,2,3,7,8-PeCDF	0.0500	3.70%	0.2770	1.37%
2,3,4,7,8-PeCDF	0.0690	5.11%	0.5350	2.66%
1,2,3,4,7,8-HxCDF	0.0820	6.07%	2.1790	10.81%
1,2,3,6,7,8-HxCDF	0.0590	4.37%	0.8070	4.00%
1,2,3,7,8,9-HxCDF	0.0130	0.96%	0.0420	0.21%
2,3,4,6,7,8-HxCDF	0.0660	4.89%	0.8710	4.32%
1,2,3,4,6,7,8-HpCDF	0.1560	11.55%	4.3950	21.81%
1,2,3,4,7,8,9-HpCDF	0.0240	1.78%	0.4290	2.13%
OCDF	0.0900	6.66%	3.5660	17.70%

Appendix B

Glossary, Abbreviations and Acronyms

B1 Glossary, Abbreviations and Acronyms

Acronym	Description
ADD	Average Daily Dose
AERMOD	Air Dispersion Model
APCD	Air Pollution Control Device
bw, BW	Body Weight
CLEA	Contaminated Land Exposure Assessment
Congener	Related compounds within groups of PCDDs, PCDFs and dioxin-like substances
COPCs	Compounds of Potential Concern
COT	UK Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment
CSF	Cancer Slope Factor
EIS	Environmental Impact Statement
EIA Report	Environmental Impact Assessment Report
EP	Environmental Permit
EPA	Environmental Protection Agency
Fv	Fraction in Vapour Phase
HHRA	Human Health Risk Assessment
HHRAP	Human Health Risk Assessment Protocol
HI	Hazard Index
HQ	Hazard Quotient
ICL	Irish Cement Ltd
IED	Industrial Emissions Directive
I-TEQ	International Toxicity Equivalent
m AGL	Metres above ground level
m AOD	Metres above datum
MDI	Mean Daily Intake
MSW	Municipal Solid Waste
NGR	National Grid Reference
OSW	Office of Solid Waste
PBB	Polybrominated Biphenyls
PCBs	Polychlorinated Biphenyls
PCDDs	Polychlorinated dibenzo-p-dioxins
PCDFs	Polychlorinated dibenzofurans
RfC	Reference Dose for direct inhalation exposures
RfD	Reference Dose for oral exposure
RFI	Request for Further Information
SRF	Solid Recovered Fuel
TDI	Tolerable Daily Intake
TEF	Toxicity Equivalence Factor
URF	Unit Risk Factor
US-EPA	U.S. Environmental Protection Agency

Acronym	Description
WHO	World Health Organization

Appendix C

Ambient Air Sampling and Analysis

Air I Noise I Water I Soil I Environmental Consultancy
www.axisenv.ie

Unit 5 Cahirdavin Business Centre,
Ennis Road,
Limerick.

ARUP Consulting Engineers,
Hartstonge Place,
Upper Hartstonge Street,
Limerick

Irish Cement Platin, Co Meath
Ambient Dioxin and Furan (PCDD/F's) Monitoring Report
December 2016

Report Reference Number:	**4410-16-02**
Version:	**Draft 1**
Date of Issue:	**25-01-2017**
Report Compiled by:	**Daniel Mullins**
Report Reviewed by:	**Mark McGarry**

Report Title	Ambient Dioxin and Furan Monitoring
Company address	AXIS environmental services., Unit 5, Caherdavin Business Centre, Caherdavin, Park, Ennis Road, Limerick V94 NT63.
Testing Report Commissioned by	ARUP Consulting Engineers
Facility Name	Limerick Office
Contact Person	Cormac McKenna / Sinead Whyte
EPA Licence Number	Not applicable
Licence Holder	Not applicable
Report Reference Number	4410-16-02_01
Dates of the Monitoring Campaign	Location 1: 12 – 14th December 2016 Location 2 : 14 – 16th December 2016 Location 3: 16 – 18th December 2016
Job Reference Number	4410-16-02
Report Written By	Mr. Daniel Mullins
Report Approved by	Mr. Mark McGarry
Testing Team	Mark McGarry, Daniel Mullins, Robert O Brien
Report Date	25-01-2017
Report Type	Test Report Assessment Monitoring
Version	1
Signature of Approver	**Environmental Manager**

Executive Summary

Monitoring Objectives

Overall Aim of the monitoring Campaign

The aim of the monitoring campaign was to assess ambient concentrations of Dioxins and Furans (PCDD/F's) in the vicinity of Irish Cement Limited, Platin, Co Meath.

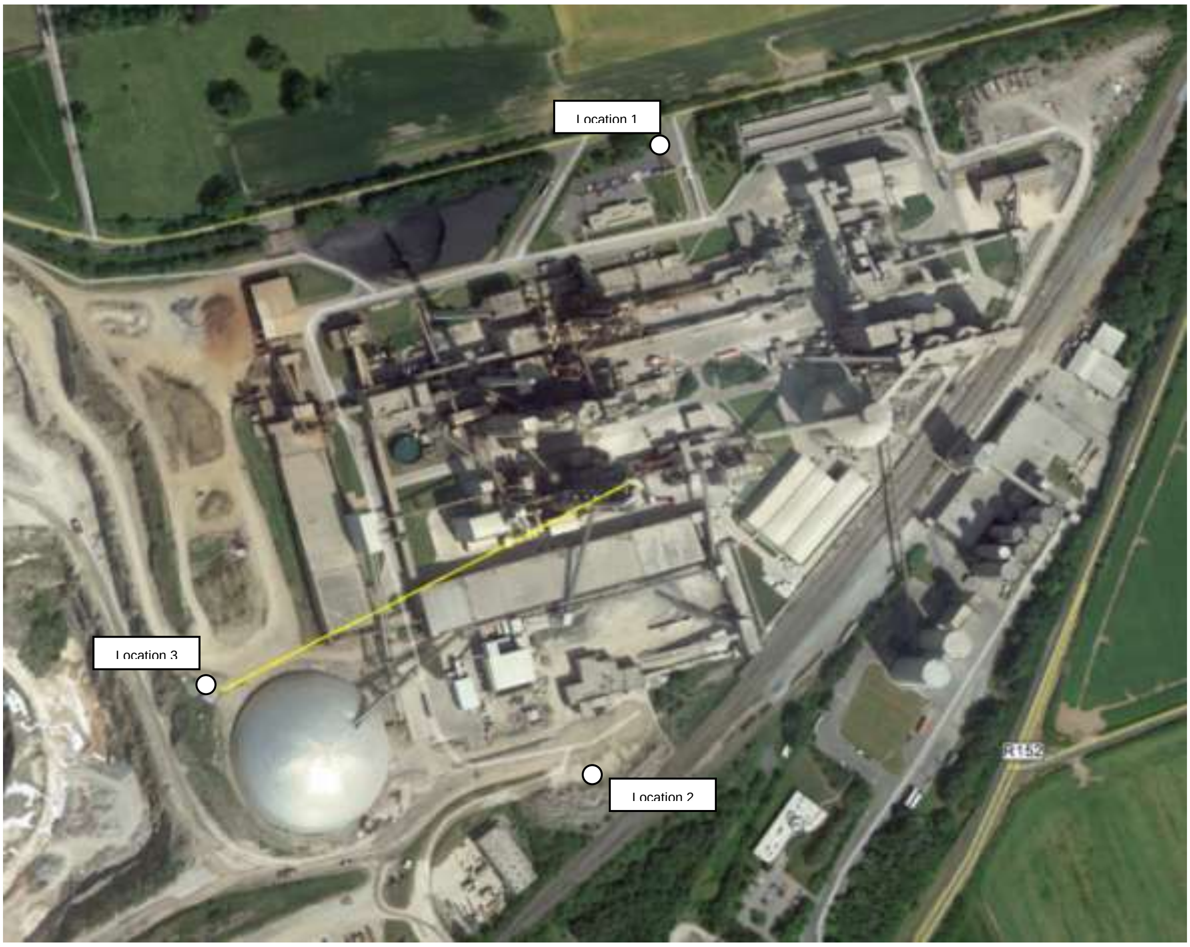
There were 3 locations monitored during the survey in opposing directions from the factory.

Location 1 was situated at the security hut on the entrance route to the factory which is c. 0.2km North East of the kiln.

Location 2 was positioned at Irish Cement, located c. 0.2km South West of the kiln.

Location 3 was positioned at Irish Cement, located c. 0.3km West South West of the kiln

Map of Locations



Target Parameters

Dioxins and Furans (PCDD/F's)

Ambient Limit Values

Ground Level Concentrations	$ng.m^{-3}$
Location 1	Not applicable
Location 2	Not applicable
Location 3	Not applicable

Executive Summary

Overall Results

Location 1	**Concentration**				
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Compliant**
2,3,7,8-TCDF	$ng.m^{-3}$	<0.00000181	0.000000058	-	-
1,2,3,7,8-PeCDF	$ng.m^{-3}$	<0.00000091	0.000000029	-	-
2,3,4,7,8-PeCDF	$ng.m^{-3}$	<0.00000906	0.000000288	-	-
1,2,3,4,7,8-HxCDF	$ng.m^{-3}$	<0.00000226	0.000000072	-	-
1,2,3,6,7,8-HxCDF	$ng.m^{-3}$	<0.00000023	0.000000007	-	-
2,3,4,6,7,8-HxCDF	$ng.m^{-3}$	<0.00000226	0.000000072	-	-
1,2,3,7,8,9-HxCDF	$ng.m^{-3}$	<0.00000254	0.000000081	-	-
1,2,3,4,6,7,8-HpCDF	$ng.m^{-3}$	<0.00000072	0.000000023	-	-
1,2,3,4,7,8,9-HpCDF	$ng.m^{-3}$	<0.00000072	0.000000023	-	-
OCDF	$ng.m^{-3}$	<0.00000011	0.000000003	-	-
2,3,7,8-TCDD	$ng.m^{-3}$	<0.00001812	0.000000575	-	-
1,2,3,7,8-PeCDD	$ng.m^{-3}$	<0.00000906	0.000000288	-	-
1,2,3,4,7,8-HxCDD	$ng.m^{-3}$	<0.00000181	0.000000058	-	-
1,2,3,6,7,8-HxCDD	$ng.m^{-3}$	<0.00000181	0.000000058	-	-
1,2,3,7,8,9-HxCDD	$ng.m^{-3}$	<0.00000181	0.000000058	-	-
1,2,3,4,6,7,8-HpCDD	$ng.m^{-3}$	<0.00000181	0.000000058	-	-
OCDD	$ng.m^{-3}$	<0.00000023	0.000000007	-	-
Total	**$ng.m^{-3}$**	**<0.00005527**	**0.000001754**	**-**	**-**

Location 2	**Concentration**				
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Compliant**
2,3,7,8-TCDF	ng.m^{-3}	<0.00000181	0.000000057	-	-
1,2,3,7,8-PeCDF	ng.m^{-3}	<0.00000091	0.000000029	-	-
2,3,4,7,8-PeCDF	ng.m^{-3}	<0.00000906	0.000000285	-	-
1,2,3,4,7,8-HxCDF	ng.m^{-3}	<0.00000254	0.000000080	-	-
1,2,3,6,7,8-HxCDF	ng.m^{-3}	<0.00000254	0.000000080	-	-
2,3,4,6,7,8-HxCDF	ng.m^{-3}	<0.00000236	0.000000074	-	-
1,2,3,7,8,9-HxCDF	ng.m^{-3}	<0.00000236	0.000000074	-	-
1,2,3,4,6,7,8-HpCDF	ng.m^{-3}	<0.00000042	0.000000013	-	-
1,2,3,4,7,8,9-HpCDF	ng.m^{-3}	<0.00000042	0.000000013	-	-
OCDF	ng.m^{-3}	<0.00000007	0.000000002	-	-
2,3,7,8-TCDD	ng.m^{-3}	<0.00001812	0.000000570	-	-
1,2,3,7,8-PeCDD	ng.m^{-3}	<0.00000906	0.000000285	-	-
1,2,3,4,7,8-HxCDD	ng.m^{-3}	<0.00000181	0.000000057	-	-
1,2,3,6,7,8-HxCDD	ng.m^{-3}	<0.00000181	0.000000057	-	-
1,2,3,7,8,9-HxCDD	ng.m^{-3}	<0.00000181	0.000000057	-	-
1,2,3,4,6,7,8-HpCDD	ng.m^{-3}	<0.00000072	0.000000023	-	-
OCDD	ng.m^{-3}	<0.00000018	0.000000006	-	-
Total	ng.m^{-3}	**<0.00005598**	0.000001763	**-**	**-**

Location 3	**Concentration**				
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Compliant**
2,3,7,8-TCDF	$ng.m^{-3}$	<0.00000181	0.000000057	-	-
1,2,3,7,8-PeCDF	$ng.m^{-3}$	<0.00000100	0.000000031	-	-
2,3,4,7,8-PeCDF	$ng.m^{-3}$	<0.00000996	0.000000314	-	-
1,2,3,4,7,8-HxCDF	$ng.m^{-3}$	<0.00000181	0.000000057	-	-
1,2,3,6,7,8-HxCDF	$ng.m^{-3}$	<0.00000181	0.000000057	-	-
2,3,4,6,7,8-HxCDF	$ng.m^{-3}$	<0.00000181	0.000000057	-	-
1,2,3,7,8,9-HxCDF	$ng.m^{-3}$	<0.00000000	0.000000000	-	-
1,2,3,4,6,7,8-HpCDF	$ng.m^{-3}$	<0.00000100	0.000000031	-	-
1,2,3,4,7,8,9-HpCDF	$ng.m^{-3}$	<0.00000100	0.000000031	-	-
OCDF	$ng.m^{-3}$	<0.00000009	0.000000003	-	-
2,3,7,8-TCDD	$ng.m^{-3}$	<0.00001812	0.000000572	-	-
1,2,3,7,8-PeCDD	$ng.m^{-3}$	<0.00001359	0.000000429	-	-
1,2,3,4,7,8-HxCDD	$ng.m^{-3}$	<0.00000181	0.000000057	-	-
1,2,3,6,7,8-HxCDD	$ng.m^{-3}$	<0.00000181	0.000000057	-	-
1,2,3,7,8,9-HxCDD	$ng.m^{-3}$	<0.00000181	0.000000057	-	-
1,2,3,4,6,7,8-HpCDD	$ng.m^{-3}$	<0.00000091	0.000000029	-	-
OCDD	$ng.m^{-3}$	<0.00000013	0.000000004	-	-
Total	$ng.m^{-3}$	**0.00005846**	0.000001845	**-**	**-**

Accreditation details

External Analytical Laboratory	Accreditation number: UKAS 1549

Executive Summary

Sample Location Details

Location	1
Relation to Kiln	North East
Surrounding Area	Adjacent to the security hut and factory entrance road, Cement plant and Tillage
Adjacent Roads	R152, M1, Station Road
Adjacent Industries within 1km	Agricultural Grazing and Tillage, Quarry, Cement Plant, Indaver
Co-ordinates	672588.55 m E, 5951784.05 m N
Elevation above GL	1.5m
Dates	12 – 14th December 2016
Sample Time	48 hours
	12th December
Rainfall (mm)	1.8
Maximum Temperature (ºC)	10.2
Minimum Temperature (ºC)	-3.5
Mean Wind Speed (m/s)	2.98
Predominant Wind Direction	SE
	13th December
Rainfall (mm)	3.5
Maximum Temperature (ºC)	12.9
Minimum Temperature (ºC)	9
Mean Wind Speed (m/s)	5.76
Predominant Wind Direction	SE
	14th December
Rainfall (mm)	6
Maximum Temperature (ºC)	10
Minimum Temperature (ºC)	2.4
Mean Wind Speed (m/s)	4.68
Predominant Wind Direction	W

Met data obtained from Dublin Airport

Location	2
Relation to Kiln	South West
Surrounding Area	Agricultural Grazing and Tillage, Indaver
Adjacent Roads	Regional and local
Adjacent Industries within 1km	Agricultural Grazing and Tillage, Quarry, Cement Plant, Indaver
Co-ordinates	672491.26 m E, 5951273.86 m N
Elevation above GL	1.5m
Dates	16 – 18th December
Sample Time	48 hours
	14th December
Rainfall (mm)	9
Maximum Temperature (ºC)	12.9
Minimum Temperature (ºC)	2
Mean Wind Speed (m/s)	3.65
Predominant Wind Direction	SE
	15th December
Rainfall (mm)	2.9
Maximum Temperature (ºC)	11.7
Minimum Temperature (ºC)	3.3
Mean Wind Speed (m/s)	3.7
Predominant Wind Direction	SE
	16th December
Rainfall (mm)	6
Maximum Temperature (ºC)	10
Minimum Temperature (ºC)	2.4
Mean Wind Speed (m/s)	4.68
Predominant Wind Direction	W

Met data obtained from Dublin Airport

Location	3
Relation to Kiln	West South West
Surrounding Area	Agricultural Grazing and Tillage, Quarry, Cement Plant, Indaver
Adjacent Roads	Regional and local
Adjacent Industries within 1km	Irish Cement Quarry, Cement Plant. Indaver Incinerator
Co-ordinates	672282.97 m E, 5951397.74 m N
Elevation above GL	1.5m
Dates	18 – 20th December
Sample Time	48 hours
	16th December
Rainfall (mm)	6
Maximum Temperature (ºC)	10
Minimum Temperature (ºC)	2.4
Mean Wind Speed (m/s)	4.68
Predominant Wind Direction	W
	17th December
Rainfall (mm)	0
Maximum Temperature (ºC)	7.4
Minimum Temperature (ºC)	1.8
Mean Wind Speed (m/s)	3.34
Predominant Wind Direction	SW
	18th December
Rainfall (mm)	0
Maximum Temperature (ºC)	8.8
Minimum Temperature (ºC)	5.6
Mean Wind Speed (m/s)	4.06
Predominant Wind Direction	SW

Met data obtained from Dublin Airport

Executive Summary

Monitoring, Equipment & Analytical Methods

Parameter	Standard	Technical Procedure	Analytical Technique	Equipment / Media	Equipment ID Used on Site
Dioxins and Furans (PCDD/F's)	Compendium Method TO9A Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air	2100	Analytical procedures based on high resolution gas chromatography-high resolution mass spectrometry	High Volume Gas Sampler Polyurethane Foam (PUF) Quartz fibre filter	ASLLK12EQ526 ASLLK13EQ503 ASLLK13EQ504

APPENDICES

Appendix I Monitoring Personnel & Equipment

Monitoring Personnel

Team Leader	**Name**	Mark McGarry
	System approval	AXIS Team Leader Approved
Team Leader	**Name**	Daniel Mullins
	System approval	AXIS Team Leader Approved
Team Leader	**Name**	Robert O Brien
	System approval	AXIS Team Leader Approved

Appendix II Raw Data

Title:	***Determination of Dioxins and Furans***	
Method:	Method TO-9A	
Client:	ARUP / Irish Cement Platin	
Test Date:	12-12-2016 - 14-12-2016	
Laboratory Used:	SAL	
Location Name	Location 1	
Volume of Air Sampled	110.4	m^3

Uncertainty Data

Temperature at Pump	8	Deg C
Pressure at Pump	100.4	kPa
Air Volume at Pump	110.4	m^3
Humidity at Pump	1	%

Leak Check Results	**Result**		**% Leak**
Before Sample 1	0	m^3/hour	0.0
After Sample 1	0	m^3/hour	0.0
Average Flow Rate	2.8	m^3/hour	0.0

Sample Calculations

	I-TEF	**Amount ng**	**I-TEQ ng**	**Concentration $ng.m^{-3}$**	**Uncertainty $ng.m^{-3}$**
2,3,7,8-TCDF	0.1	0.0020	0.00020	0.00000181	0.000000058
1,2,3,7,8-PeCDF	0.05	0.0020	0.00010	0.00000091	0.000000029
2,3,4,7,8-PeCDF	0.5	0.0020	0.00100	0.00000906	0.000000288
1,2,3,4,7,8-HxCDF	0.1	0.0025	0.00025	0.00000226	0.000000072
1,2,3,6,7,8-HxCDF	0.1	0.0003	0.00003	0.00000023	0.000000007
2,3,4,6,7,8-HxCDF	0.1	0.0025	0.00025	0.00000226	0.000000072
1,2,3,7,8,9-HxCDF	0.1	0.0028	0.00028	0.00000254	0.000000081
1,2,3,4,6,7,8-HpCDF	0.01	0.0080	0.00008	0.00000072	0.000000023
1,2,3,4,7,8,9-HpCDF	0.01	0.0080	0.00008	0.00000072	0.000000023
OCDF	0.001	0.0120	0.00001	0.00000011	0.000000003
2,3,7,8-TCDD	1	0.0020	0.00200	0.00001812	0.000000575
1,2,3,7,8-PeCDD	0.5	0.0020	0.00100	0.00000906	0.000000288
1,2,3,4,7,8-HxCDD	0.1	0.0020	0.00020	0.00000181	0.000000058
1,2,3,6,7,8-HxCDD	0.1	0.0020	0.00020	0.00000181	0.000000058
1,2,3,7,8,9-HxCDD	0.1	0.0020	0.00020	0.00000181	0.000000058
1,2,3,4,6,7,8-HpCDD	0.01	0.0200	0.00020	0.00000181	0.000000058
OCDD	0.001	0.0250	0.00003	0.00000023	0.000000007
Total Amount		**0.0971**	**0.0061**	**0.00005527**	0.000001754

Title:	***Determination of Dioxins and Furans***	
Method:	Method TO-9A	
Client:	ARUP / Irish Cement Platin	
Test Date:	14-12-2016 - 16-12-2016	
Laboratory Used:	SAL	
Location Name	Location 2	
Volume of Air Sampled	110.4	m^3

Uncertainty Data

Temperature at Pump	10	Deg C
Pressure at Pump	102.1	kPa
Air Volume at Pump	110.4	m^3
Humidity at Pump	1	%

Leak Check Results	**Result**		**% Leak**
Before Sample 1	0	m^3/hour	0.0
After Sample 1	0	m^3/hour	0.0
Average Flow Rate	2.8	m^3/hour	0.0

Sample Calculations

	I-TEF	**Amount ng**	**I-TEQ ng**	**Concentration $ng.m^{-3}$**	**Uncertainty $ng.m^{-3}$**
2,3,7,8-TCDF	0.1	0.0020	0.00020	0.00000181	0.000000057
1,2,3,7,8-PeCDF	0.05	0.0020	0.00010	0.00000091	0.000000029
2,3,4,7,8-PeCDF	0.5	0.0020	0.00100	0.00000906	0.000000285
1,2,3,4,7,8-HxCDF	0.1	0.0028	0.00028	0.00000254	0.000000080
1,2,3,6,7,8-HxCDF	0.1	0.0028	0.00028	0.00000254	0.000000080
2,3,4,6,7,8-HxCDF	0.1	0.0026	0.00026	0.00000236	0.000000074
1,2,3,7,8,9-HxCDF	0.1	0.0026	0.00026	0.00000236	0.000000074
1,2,3,4,6,7,8-HpCDF	0.01	0.0046	0.00005	0.00000042	0.000000013
1,2,3,4,7,8,9-HpCDF	0.01	0.0046	0.00005	0.00000042	0.000000013
OCDF	0.001	0.0080	0.00001	0.00000007	0.000000002
2,3,7,8-TCDD	1	0.0020	0.00200	0.00001812	0.000000570
1,2,3,7,8-PeCDD	0.5	0.0020	0.00100	0.00000906	0.000000285
1,2,3,4,7,8-HxCDD	0.1	0.0020	0.00020	0.00000181	0.000000057
1,2,3,6,7,8-HxCDD	0.1	0.0020	0.00020	0.00000181	0.000000057
1,2,3,7,8,9-HxCDD	0.1	0.0020	0.00020	0.00000181	0.000000057
1,2,3,4,6,7,8-HpCDD	0.01	0.0080	0.00008	0.00000072	0.000000023
OCDD	0.001	0.0200	0.00002	0.00000018	0.000000006
Total Amount		**0.0720**	**0.0062**	**0.00005598**	0.000001763

Title:	***<u>Determination of Dioxins and Furans</u>***	
Method:	Method TO-9A	
Client:	ARUP / Irish Cement Platin	
Test Date:	16-12-2016 - 18-12-2016	
Laboratory Used:	SAL	
Location Name	Location 3	
Volume of Air Sampled	110.4	m^3

Uncertainty Data

Temperature at Pump	11	Deg C
Pressure at Pump	101.4	kPa
Air Volume at Pump	110.4	m^3
Humidity at Pump	1	%

Leak Check Results	**Result**		**% Leak**
Before Sample 1	0	m^3/hour	0.0
After Sample 1	0	m^3/hour	0.0
Average Flow Rate	2.8	m^3/hour	0.0

Sample Calculations

	I-TEF	Amount ng	I-TEQ ng	Concentration $ng.m^{-3}$	Uncertainty $ng.m^{-3}$
2,3,7,8-TCDF	0.1	0.0020	0.00020	0.00000181	0.000000057
1,2,3,7,8-PeCDF	0.05	0.0022	0.00011	0.00000100	0.000000031
2,3,4,7,8-PeCDF	0.5	0.0022	0.00110	0.00000996	0.000000314
1,2,3,4,7,8-HxCDF	0.1	0.0020	0.00020	0.00000181	0.000000057
1,2,3,6,7,8-HxCDF	0.1	0.0020	0.00020	0.00000181	0.000000057
2,3,4,6,7,8-HxCDF	0.1	0.0020	0.00020	0.00000181	0.000000057
1,2,3,7,8,9-HxCDF	0.1	0.0000	0.00000	0.00000000	0.000000000
1,2,3,4,6,7,8-HpCDF	0.01	0.0110	0.00011	0.00000100	0.000000031
1,2,3,4,7,8,9-HpCDF	0.01	0.0110	0.00011	0.00000100	0.000000031
OCDF	0.001	0.0100	0.00001	0.00000009	0.000000003
2,3,7,8-TCDD	1	0.0020	0.00200	0.00001812	0.000000572
1,2,3,7,8-PeCDD	0.5	0.0030	0.00150	0.00001359	0.000000429
1,2,3,4,7,8-HxCDD	0.1	0.0020	0.00020	0.00000181	0.000000057
1,2,3,6,7,8-HxCDD	0.1	0.0020	0.00020	0.00000181	0.000000057
1,2,3,7,8,9-HxCDD	0.1	0.0020	0.00020	0.00000181	0.000000057
1,2,3,4,6,7,8-HpCDD	0.01	0.0100	0.00010	0.00000091	0.000000029
OCDD	0.001	0.0140	0.00001	0.00000013	0.000000004
Total Amount		**0.0794**	**0.0065**	**0.00005846**	0.000001845

Certificate of Analysis

SCIENTIFIC ANALYSIS LABORATORIES
DELIVERING SCIENCE

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2404

Report Number: 623721-1

Date of Report: 10-Jan-2017

Customer: Air Scientific
Unit 5
Cahirdavin Shopping Centre
Ennis Road
Limerick

Customer Contact: Project Management

Customer Job Reference: IRDR AMBIENT DIOXINS
Date Job Received at SAL: 22-Dec-2016
Date Analysis Started: 29-Dec-2016
Date Analysis Completed: 09-Jan-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with SAL SOPs

All results have been reviewed in accordance with Section 25 of the SAL Quality Manual

UKAS TESTING
1549

Report checked
and authorised by :
Mary Hughes
Customer Service Manager

Issued by :
Mary Hughes
Customer Service Manager

Summary Of Results

Combined

Dioxins

SAL Reference	Customer Sample Reference	Analysis	Symbol	ITEQ Toxic Equivalents ng Lower Bound	ITEQ Toxic Equivalents ng Upper Bound
623721 007	Combined 2.LOCATION 1 DIOXIN TRAP + 1.LOCATION 1 FILTER	Dioxins and Furans (Based on US EPA Method 23)	U	0.0	**0.0064**
623721 008	Combined 3.LOCATION 2 FILTER + 4.LOCATION 2 DIOXIN TRAP	Dioxins and Furans (Based on US EPA Method 23)	U	0.0	**0.0062**
623721 009	Combined 6.LOCATION 3 DIOXIN TRAP + 5.LOCATION 3 FILTER	Dioxins and Furans (Based on US EPA Method 23)	U	0.0	**0.0067**

Sampling Recoveries

SAL Reference	Customer Sample Reference	Determinand	Sampling Recovery %
623721 007	Combined 2.LOCATION 1 DIOXIN TRAP + 1.LOCATION 1 FILTER	1,2,3,7,8-PeCDF	98
		1,2,3,7,8,9-HxCDF	95
		1,2,3,4,7,8,9-HpCDF	122
623721 008	Combined 3.LOCATION 2 FILTER + 4.LOCATION 2 DIOXIN TRAP	1,2,3,7,8-PeCDF	97
		1,2,3,7,8,9-HxCDF	94
		1,2,3,4,7,8,9-HpCDF	120
623721 009	Combined 6.LOCATION 3 DIOXIN TRAP + 5.LOCATION 3 FILTER	1,2,3,7,8-PeCDF	103
		1,2,3,7,8,9-HxCDF	87
		1,2,3,4,7,8,9-HpCDF	121

Combined

Customer Sample Reference : Combined 2.LOCATION 1 DIOXIN TRAP + 1.LOCATION 1 FILTER

SAL Sample Reference : 623721 007

Dioxins and Furans (Based on US EPA Method 23)

Technique : GC/MS (HR)

Determinand	Symbol	LOD ng	Result ng	Internal Recovery %	ITEQ Toxic Equivalents ng Lower Bound	ITEQ Toxic Equivalents ng Upper Bound
2,3,7,8-TCDD	U	0.0020	<0.0020	73	0.0	**0.0020**
1,2,3,7,8-PeCDD	U	0.0020	<0.0020	83	0.0	**0.0010**
1,2,3,4,7,8-HxCDD	U	0.0020	<0.0020	79	0.0	**0.00020**
1,2,3,6,7,8-HxCDD	U	0.0020	<0.0020	67	0.0	**0.00020**
1,2,3,7,8,9-HxCDD	U	0.0020	<0.0020		0.0	**0.00020**
1,2,3,4,6,7,8-HpCDD	U	0.020	<0.020	99	0.0	**0.00020**
OCDD	U	0.025	<0.025	123	0.0	**0.00003**
				Dioxins Totals :	0.0	**0.0038**
2,3,7,8-TCDF	U	0.0020	<0.0020	79	0.0	**0.00020**
1,2,3,7,8-PeCDF	U	0.0020	<0.0020		0.0	**0.00010**
2,3,4,7,8-PeCDF	U	0.0020	<0.0020	78	0.0	**0.0010**
1,2,3,4,7,8-HxCDF	U	0.0025	<0.0025	62	0.0	**0.00025**
1,2,3,6,7,8-HxCDF	U	0.0025	<0.0025	63	0.0	**0.00025**
2,3,4,6,7,8-HxCDF	U	0.0028	<0.0028	70	0.0	**0.00028**
1,2,3,7,8,9-HxCDF	U	0.0028	<0.0028		0.0	**0.00028**
1,2,3,4,6,7,8-HpCDF	U	0.0080	<0.0080	83	0.0	**0.00008**
1,2,3,4,7,8,9-HpCDF	U	0.0080	<0.0080		0.0	**0.00008**
OCDF	U	0.012	<0.012	129	0.0	**0.00001**
				Furans Totals :	0.0	**0.0025**
				Totals :	**0.0**	**0.0064**

Combined

Customer Sample Reference : Combined 3.LOCATION 2 FILTER + 4.LOCATION 2 DIOXIN TRAP

SAL Sample Reference : 623721 008

Dioxins and Furans (Based on US EPA Method 23)

Technique : GC/MS (HR)

Determinand	Symbol	LOD ng	Result ng	Internal Recovery %	ITEQ Toxic Equivalents ng Lower Bound	ITEQ Toxic Equivalents ng Upper Bound
2,3,7,8-TCDD	U	0.0020	<0.0020	74	0.0	**0.0020**
1,2,3,7,8-PeCDD	U	0.0020	<0.0020	83	0.0	**0.0010**
1,2,3,4,7,8-HxCDD	U	0.0020	<0.0020	82	0.0	**0.00020**
1,2,3,6,7,8-HxCDD	U	0.0020	<0.0020	69	0.0	**0.00020**
1,2,3,7,8,9-HxCDD	U	0.0020	<0.0020		0.0	**0.00020**
1,2,3,4,6,7,8-HpCDD	U	0.0080	<0.0080	103	0.0	**0.00008**
OCDD	U	0.020	<0.020	125	0.0	**0.00002**
				Dioxins Totals :	0.0	**0.0037**
2,3,7,8-TCDF	U	0.0020	<0.0020	83	0.0	**0.00020**
1,2,3,7,8-PeCDF	U	0.0020	<0.0020		0.0	**0.00010**
2,3,4,7,8-PeCDF	U	0.0020	<0.0020	78	0.0	**0.0010**
1,2,3,4,7,8-HxCDF	U	0.0028	<0.0028	71	0.0	**0.00028**
1,2,3,6,7,8-HxCDF	U	0.0028	<0.0028	72	0.0	**0.00028**
2,3,4,6,7,8-HxCDF	U	0.0026	<0.0026	76	0.0	**0.00026**
1,2,3,7,8,9-HxCDF	U	0.0026	<0.0026		0.0	**0.00026**
1,2,3,4,6,7,8-HpCDF	U	0.0046	<0.0046	87	0.0	**0.00005**
1,2,3,4,7,8,9-HpCDF	U	0.0046	<0.0046		0.0	**0.00005**
OCDF	U	0.0080	<0.0080	124	0.0	**0.00001**
				Furans Totals :	0.0	**0.0025**
				Totals :	**0.0**	**0.0062**

Combined

Customer Sample Reference : Combined 6.LOCATION 3 DIOXIN TRAP + 5.LOCATION 3 FILTER

SAL Sample Reference : 623721 009

Dioxins and Furans (Based on US EPA Method 23)

Technique : GC/MS (HR)

					ITEQ Toxic Equivalents ng	
Determinand	**Symbol**	**LOD ng**	**Result ng**	**Internal Recovery %**	**Lower Bound**	**Upper Bound**
2,3,7,8-TCDD	U	0.0020	<0.0020	31	0.0	**0.0020**
1,2,3,7,8-PeCDD	U	0.0030	<0.0030	29	0.0	**0.0015**
1,2,3,4,7,8-HxCDD	U	0.0020	<0.0020	38	0.0	**0.00020**
1,2,3,6,7,8-HxCDD	U	0.0020	<0.0020	31	0.0	**0.00020**
1,2,3,7,8,9-HxCDD	U	0.0020	<0.0020		0.0	**0.00020**
1,2,3,4,6,7,8-HpCDD	U	0.010	<0.010	43	0.0	**0.00010**
OCDD	U	0.014	<0.014	76	0.0	**0.00001**
				Dioxins Totals :	0.0	**0.0042**
2,3,7,8-TCDF	U	0.0020	<0.0020	33	0.0	**0.00020**
1,2,3,7,8-PeCDF	U	0.0022	<0.0022		0.0	**0.00011**
2,3,4,7,8-PeCDF	U	0.0022	<0.0022	28	0.0	**0.0011**
1,2,3,4,7,8-HxCDF	U	0.0020	<0.0020	29	0.0	**0.00020**
1,2,3,6,7,8-HxCDF	U	0.0020	<0.0020	27	0.0	**0.00020**
2,3,4,6,7,8-HxCDF	U	0.0020	<0.0020	37	0.0	**0.00020**
1,2,3,7,8,9-HxCDF	U	0.0020	<0.0020		0.0	**0.00020**
1,2,3,4,6,7,8-HpCDF	U	0.011	<0.011	36	0.0	**0.00011**
1,2,3,4,7,8,9-HpCDF	U	0.011	<0.011		0.0	**0.00011**
OCDF	U	0.010	<0.010	76	0.0	**0.00001**
				Furans Totals :	0.0	**0.0024**
				Totals :	**0.0**	**0.0067**

Index to symbols used in 623721-1

Value	Description
AR	As Received
U	Analysis is UKAS accredited

Appendix D

Soil Sampling and Analysis

File Note

ARUP

50 Ringsend Road
Dublin 4
D04 T6X0
Ireland
www.arup.com

t +353 1 233 4455
f +353 1 668 3169

Project title	Irish Cement Platin	Job number	325374-47
cc		File reference	
Prepared by		Date	1 February 2017
Subject	Soil Sampling for PCDD/F Analysis		

1 Introduction

Areal Composite Methodology was used as it is the most applicable approach for determining background soil concentrations for an area. This method ensures the sample collected is representative of an area. Briefly, the methodology consists of taking a number of samples in an identical manner and of an identical size and then combining these samples to form a composite sample, which is then thoroughly mixed. A sample of this composite material is then sent for analysis.

2 Sample Locations

Five sampling locations were selected in the vicinity of the Irish Cement factory.

Sampling was conducted by marking out an area of approximately 100m x 100m, at the determined location. A “W” pattern is outlined with 25m long legs, where possible. The sampling depth was 14cm. The sediment samples were taken using a 4cm diameter corer along the “W” pattern legs.

Samples were thoroughly mixed in a clean plastic basin and then a 1kg aliquot was extracted from the mixed sample. The 1kg sample was divided evenly between two (acetone rinsed) amber glass jars. One of the samples would serve as a duplicate in the event of breakage of the main sample during transportation to the laboratory or in the event of a requirement to carry out additional future analysis.

3 Analysis Parameters

All samples were sent for analysis by an accredited laboratory for a number of parameters, including the following:

PCBs	Jones Environmental
PCDD/Fs	Marchwood Scientific Services

Exova Jones Environmental

Registered Address : Exova (UK) Ltd, Lochend Industrial Estate, Newbridge, Midlothian, EH28 8PL

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

Irish Cement Limited
Platin
Drogheda
Co Louth
Ireland

Attention :	Mark Butler
Date :	5th December, 2016
Your reference :	
Our reference :	Test Report 16/17346 Batch 1
Location :	
Date samples received :	21st November, 2016
Status :	Final report
Issue :	1

Ten samples were received for analysis on 21st November, 2016 of which five were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Phil Sommerton BSc
Project Manager

Exova Jones Environmental

Client Name: Irish Cement Limited
Reference:
Location:
Contact: Mark Butler
JE Job No.: 16/17346

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1	2	3	4	5								
Sample ID	1A	2A	3A	4A	5A								
Depth													
COC No / misc													
Containers	J	J	J	J	J								
Sample Date	<>	<>	<>	<>	<>								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1						LOD/LOR	Units	Method No.
Date of Receipt	21/11/2016	21/11/2016	21/11/2016	21/11/2016	21/11/2016								
PCB 77	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 81	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 105	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 114	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 118	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 123	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 126	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 156	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 157	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 167	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 169	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
PCB 189	<5	<5	<5	<5	<5						<5	ug/kg	TM16/PM8
Total 12 PCBs	<60	<60	<60	<60	<60						<60	ug/kg	TM16/PM8
Natural Moisture Content	41.9	35.9	30.1	23.2	25.4						<0.1	%	PM4/PM0
Furans													
2378-TCDF	0.240	0.249	0.249	0.293	0.118							ng/kg	Subcontracted
12378-PCDF	0.194	0.149	0.286	0.218	0.227							ng/kg	Subcontracted
23478-PCDF	0.224	0.315	0.296	0.206	0.248							ng/kg	Subcontracted
123478-HxCDF	0.577	0.366	0.408	0.373	0.259							ng/kg	Subcontracted
123678-HxCDF	0.405	0.306	0.233	0.285	0.171							ng/kg	Subcontracted
234678-HxCDF	ND	0.340	0.279	0.295	0.218							ng/kg	Subcontracted
123789-HxCDF	ND	0.125	0.0912	0.188	0.0739							ng/kg	Subcontracted
1234678-HpCDF	3.010	2.150	1.780	2.060	1.710							ng/kg	Subcontracted
1234789-HpCDF	0.240	0.235	0.202	0.176	ND							ng/kg	Subcontracted
OCDF	3.860	2.510	2.380	2.600	1.800							ng/kg	Subcontracted
Total 2,3,7,8-Furans	8.740	6.740	6.200	6.700	4.830							ng/kg	Subcontracted

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Exova Jones Environmental

Client Name: Irish Cement Limited
Reference:
Location:
Contact: Mark Butler
JE Job No.: 16/17346

Report : **Solid**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1	2	3	4	5	LOD/LOR	Units	Method No.
Sample ID	1A	2A	3A	4A	5A			
Depth								
COC No / misc								
Containers	J	J	J	J	J			
Sample Date	<>	<>	<>	<>	<>			
Sample Type	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1			
Date of Receipt	21/11/2016	21/11/2016	21/11/2016	21/11/2016	21/11/2016			
Dioxins								
2378-TCDD	ND	ND	ND	ND	ND		ng/kg	Subcontracted
12378-PCDD	ND	ND	ND	0.163	ND		ng/kg	Subcontracted
123478-HxCDD	0.171	0.190	0.194	0.244	0.205		ng/kg	Subcontracted
123678-HxCDD	0.322	0.339	0.310	0.348	0.437		ng/kg	Subcontracted
123789-HxCDD	0.409	0.427	0.392	0.413	0.418		ng/kg	Subcontracted
1234678-HpCDD	4.110	2.800	3.840	5.610	5.090		ng/kg	Subcontracted
OCDD	20.000	11.200	24.000	40.800	36.400		ng/kg	Subcontracted
Total 2,3,7,8-Dioxins	25.000	14.900	28.800	47.600	42.500		ng/kg	Subcontracted
TEQ(1) - Max	0.491	0.527	0.512	0.588	0.489		ng/kg	Subcontracted
TEQ(2) - Min	0.431	0.465	0.462	0.561	0.432		ng/kg	Subcontracted
TEQ(1) (WHO)- Mammals	0.448	0.477	0.450	0.593	0.433		ng/kg	Subcontracted
TEQ(2) (WHO)- Mammals	0.366	0.389	0.379	0.567	0.351		ng/kg	Subcontracted
TEQ(1) (WHO)- Fish	0.445	0.510	0.477	0.594	0.433		ng/kg	Subcontracted
TEQ(2) (WHO)- Fish	0.363	0.422	0.406	0.567	0.351		ng/kg	Subcontracted
TEQ(1) (WHO)- Birds	0.754	0.864	0.824	0.914	0.626		ng/kg	Subcontracted
TEQ(2) (WHO)- Birds	0.673	0.776	0.752	0.888	0.544		ng/kg	Subcontracted

Client Name: Irish Cement Limited
Reference:
Location:
Contact: Mark Butler

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
No deviating sample report results for job 16/17346						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/17346

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
SA	ISO17025 (SANAS) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/17346

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
TM16	Modified USEPA 8270. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
Subcontracted	Subcontracted analysis, sent to an ISO 17025 accredited laboratory where possible.						Yes

MSS
Marchwood Scientific Services

371 Millbrook Rd West
Southampton
SO15 0HW

Tel: 02380 786979

Name of Client : Exova Jones Environmental
Test Certificate No: 116-9780
Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Flintshire, CH5 2UA
0

ANALYSIS OF PCDDs and PCDFs

Job Reference: 0
Sample Identifier : 16/17346-1
Sample No: 116-9780
Order No: E20816000142
Sample Type: Soil
Sample Condition : normal
Instrument : Thermo DFS
GC Column : DB5
Calibration File : 281116

Date of Receipt : 24/11/16
Date of Analysis : 29/11/16
Date of Report : 30/11/16

Test Method : 2002a
Blank : 281116
Sample Size : 2.0

expressed as ng /kg

Congener	Conc	DL	Rec %	Congener	Conc	DL	Rec %
2378-TCDF	0.24	0.0353	74	2378-TCDD	*	0.0287	79
12378-PCDF	0.194	0.0428	80	12378-PCDD	*	0.0437	86
23478-PCDF	0.224	0.0379	84	123478-HxCDD	0.171	0.0495	77
123478-HxCDF	0.577	0.0470	83	123678-HxCDD	0.322	0.0499	78
123678-HxCDF	0.405	0.0437	86	123789-HxCDD	0.409	0.0516	
234678-HxCDF	*	0.0426	81	1234678-HpCDD	4.11	0.0423	77
123789-HxCDF	*	0.0498	83	OCDD	20	0.0720	68
1234678-HpCDF	3.01	0.0205	78				
1234789-HpCDF	0.24	0.0255	75				
OCDF	3.86	0.0326					
Total 2,3,7,8-Furans	8.74			Total 2,3,7,8-Dioxins	25		
		TEQ[1]	TEQ[2]			TEQ[1]	TEQ[2]
TEQ (Nato)		0.491	0.431	TEQ (WHO)- Mammals		0.448	0.366
				TEQ (WHO)- Fish		0.445	0.363
				TEQ (WHO)- Birds		0.754	0.673

*	Isomer Not detected
TEQ	Toxic Equivalent Value
TEF	Toxic Equivalent Factor
Conc	Concentration
DL	Detection Value
REC	Recovery
TEQ[1]	Concentration of Non Detected Congeners at Detection Limit
TEQ[2]	Concentration of Non Detected Congeners at Zero

Reported by : K Pettit
Position : Technical Manager

Signature : Karl Pettit

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371 Millbrook Rd West
Southampton
SO15 0HW

Tel: 02380 786979

Name of Client : Exova Jones Environmental
Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Flintshire, CH5 2UA
0

Test Certificate No: 116-9781

ANALYSIS OF PCDDs and PCDFs

Job Reference: 0
Sample Identifier : 16/17346-2
Sample No: 116-9781
Order No: E20816000142
Sample Type: Soil
Sample Condition : normal
Instrument : Thermo DFS
GC Column : DB5
Calibration File : 281116

Date of Receipt : 24/11/16
Date of Analysis : 29/11/16
Date of Report : 30/11/16

Test Method : 2002a
Blank : 281116
Sample Size : 2.0

expressed as ng /kg

Congener	Conc	DL	Rec %	Congener	Conc	DL	Rec %
2378-TCDF	0.249	0.0483	74	2378-TCDD	*	0.0376	80
12378-PCDF	0.149	0.0469	79	12378-PCDD	*	0.0506	86
23478-PCDF	0.315	0.0431	82	123478-HxCDD	0.19	0.0529	75
123478-HxCDF	0.366	0.0500	81	123678-HxCDD	0.339	0.0543	79
123678-HxCDF	0.306	0.0485	84	123789-HxCDD	0.427	0.0561	
234678-HxCDF	0.34	0.0449	80	1234678-HpCDD	2.8	0.0490	73
123789-HxCDF	0.125	0.0554	82	OCDD	11.2	0.0846	64
1234678-HpCDF	2.15	0.0229	74				
1234789-HpCDF	0.235	0.0283	72				
OCDF	2.51	0.0487					
Total 2,3,7,8-Furans	**6.74**			**Total 2,3,7,8-Dioxins**	**14.9**		
		TEQ[1]	**TEQ[2]**			**TEQ[1]**	**TEQ[2]**
TEQ (Nato)		**0.527**	**0.465**	**TEQ (WHO)- Mammals**		**0.477**	**0.389**
				TEQ (WHO)- Fish		**0.51**	**0.422**
				TEQ (WHO)- Birds		**0.864**	**0.776**

*	Isomer Not detected
TEQ	Toxic Equivalent Value
TEF	Toxic Equivalent Factor
Conc	Concentration
DL	Detection Value
REC	Recovery
TEQ[1]	Concentration of Non Detected Congeners at Detection Limit
TEQ[2]	Concentration of Non Detected Congeners at Zero

Reported by : K Pettit
Position : Technical Manager

Signature : Karl Pettit

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Name of Client : Exova Jones Environmental
Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Flintshire, CH5 2UA
0

Test Certificate No: 116-9782

ANALYSIS OF PCDDs and PCDFs

Job Reference: 0
Sample Identifier : 16/17346-3
Sample No: 116-9782
Order No: E20816000142
Sample Type: Soil
Sample Condition : normal
Instrument : Thermo DFS
GC Column : DB5
Calibration File : 281116

Date of Receipt : 24/11/16
Date of Analysis : 29/11/16
Date of Report : 30/11/16

Test Method : 2002a
Blank : 281116
Sample Size : 2.0

expressed as ng /kg

Congener	Conc	DL	Rec %	Congener	Conc	DL	Rec %
2378-TCDF	0.249	0.0376	71	2378-TCDD	*	0.0283	78
12378-PCDF	0.286	0.0421	77	12378-PCDD	*	0.0429	83
23478-PCDF	0.296	0.0385	80	123478-HxCDD	0.194	0.0459	74
123478-HxCDF	0.408	0.0401	79	123678-HxCDD	0.31	0.0470	77
123678-HxCDF	0.233	0.0379	81	123789-HxCDD	0.392	0.0485	
234678-HxCDF	0.279	0.0351	78	1234678-HpCDD	3.84	0.0492	74
123789-HxCDF	0.0912	0.0426	79	OCDD	24	0.0669	66
1234678-HpCDF	1.78	0.0188	72				
1234789-HpCDF	0.202	0.0232	71				
OCDF	2.38	0.0373					
Total 2,3,7,8-Furans	**6.2**			**Total 2,3,7,8-Dioxins**	**28.8**		

	TEQ[1]	TEQ[2]		TEQ[1]	TEQ[2]
TEQ (Nato)	**0.512**	**0.462**	**TEQ (WHO)- Mammals**	**0.45**	**0.379**
			TEQ (WHO)- Fish	**0.477**	**0.406**
			TEQ (WHO)- Birds	**0.824**	**0.752**

*	Isomer Not detected
TEQ	Toxic Equivalent Value
TEF	Toxic Equivalent Factor
Conc	Concentration
DL	Detection Value
REC	Recovery
TEQ[1]	Concentration of Non Detected Congeners at Detection Limit
TEQ[2]	Concentration of Non Detected Congeners at Zero

Reported by : K Pettit
Position : Technical Manager

Signature : Karl Pettit

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Tel: 02380 786979

Name of Client : Exova Jones Environmental
Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Flintshire, CH5 2UA
0

Test Certificate No: 116-9783

ANALYSIS OF PCDDs and PCDFs

Job Reference: 0
Sample Identifier : 16/17346-4
Sample No: 116-9783
Order No: E20816000142
Sample Type: Soil
Sample Condition : normal
Instrument : Thermo DFS
GC Column : DB5
Calibration File : 281116

Date of Receipt : 24/11/16
Date of Analysis : 30/11/16
Date of Report : 01/12/16

Test Method : 2002a
Blank : 281116
Sample Size : 2.0

expressed as ng /kg

Congener	Conc	DL	Rec %	Congener	Conc	DL	Rec %
2378-TCDF	0.293	0.0428	75	2378-TCDD	*	0.0264	83
12378-PCDF	0.218	0.0371	84	12378-PCDD	0.163	0.0407	89
23478-PCDF	0.206	0.0331	87	123478-HxCDD	0.244	0.0445	76
123478-HxCDF	0.373	0.0329	85	123678-HxCDD	0.348	0.0469	79
123678-HxCDF	0.285	0.0316	85	123789-HxCDD	0.413	0.0485	
234678-HxCDF	0.295	0.0297	82	1234678-HpCDD	5.61	0.0392	76
123789-HxCDF	0.188	0.0348	85	OCDD	40.8	0.0568	64
1234678-HpCDF	2.06	0.0158	75				
1234789-HpCDF	0.176	0.0193	75				
OCDF	2.6	0.0284					
Total 2,3,7,8-Furans	6.7			Total 2,3,7,8-Dioxins	47.6		
		TEQ[1]	TEQ[2]			TEQ[1]	TEQ[2]
TEQ (Nato)		0.588	0.561	TEQ (WHO)- Mammals		0.593	0.567
				TEQ (WHO)- Fish		0.594	0.567
				TEQ (WHO)- Birds		0.914	0.888

*	Isomer Not detected
TEQ	Toxic Equivalent Value
TEF	Toxic Equivalent Factor
Conc	Concentration
DL	Detection Value
REC	Recovery
TEQ[1]	Concentration of Non Detected Congeners at Detection Limit
TEQ[2]	Concentration of Non Detected Congeners at Zero

Reported by : K Pettit
Position : Technical Manager

Signature : Karl Pettit

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Tel: 02380 786979

Name of Client : Exova Jones Environmental
Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Flintshire, CH5 2UA
0

Test Certificate No: 116-9784

ANALYSIS OF PCDDs and PCDFs

Job Reference: 0
Sample Identifier : 16/17346-5
Sample No: 116-9784
Order No: E20816000142
Sample Type: Soil
Sample Condition : normal
Instrument : Thermo DFS
GC Column : DB5
Calibration File : 281116

Date of Receipt : 24/11/16
Date of Analysis : 30/11/16
Date of Report : 01/12/16

Test Method : 2002a
Blank : 281116
Sample Size : 2.0

expressed as ng /kg

Congener	Conc	DL	Rec %	Congener	Conc	DL	Rec %
2378-TCDF	0.118	0.0373	74	2378-TCDD	*	0.0315	81
12378-PCDF	0.227	0.0411	84	12378-PCDD	*	0.0503	89
23478-PCDF	0.248	0.0382	87	123478-HxCDD	0.205	0.0549	78
123478-HxCDF	0.259	0.0387	82	123678-HxCDD	0.437	0.0564	79
123678-HxCDF	0.171	0.0370	85	123789-HxCDD	0.418	0.0583	
234678-HxCDF	0.218	0.0358	80	1234678-HpCDD	5.09	0.0515	76
123789-HxCDF	0.0739	0.0412	84	OCDD	36.4	0.0747	65
1234678-HpCDF	1.71	0.0200	73				
1234789-HpCDF	*	0.0235	73				
OCDF	1.8	0.0423					
Total 2,3,7,8-Furans	**4.83**			**Total 2,3,7,8-Dioxins**	**42.5**		

	TEQ[1]	TEQ[2]		TEQ[1]	TEQ[2]
TEQ (Nato)	**0.489**	**0.432**	**TEQ (WHO)- Mammals**	**0.433**	**0.351**
			TEQ (WHO)- Fish	**0.433**	**0.351**
			TEQ (WHO)- Birds	**0.626**	**0.544**

*	Isomer Not detected
TEQ	Toxic Equivalent Value
TEF	Toxic Equivalent Factor
Conc	Concentration
DL	Detection Value
REC	Recovery
TEQ[1]	Concentration of Non Detected Congeners at Detection Limit
TEQ[2]	Concentration of Non Detected Congeners at Zero

Reported by : K Pettit
Position : Technical Manager

Signature : Karl Pettit

Appendix E

Methodology

E1 Methodology

E1.1 Introduction

The U.S. Environmental Protection Agency (US-EPA) Office of Solid Waste (OSW) has developed an approach for conducting multi-pathway, site-specific human health risk assessments for energy from waste facilities. The approach is known as the Human Health Risk Assessment Protocol (HHRAP) [1].

The HHRA methodology incorporates the following elements:

- Facility characterisation,
- Atmospheric dispersion modelling,
- Identification of exposure scenarios,
- Estimating media concentrations,
- Quantifying exposure,
- Characterising Risk and Hazard.

The computer model IRAP-h View (Industrial Risk Assessment Program-Health Version 4.5.5) used in this assessment has been designed by Lakes Environmental Software to carry out human health risk assessments following the requirements and methodology of the HHRAP.

The methodology is described below. Site specific details are provided in the remainder of the report.

E1.2 Facility Characterisation

Facility characterisation is the initial stage of the HHRAP and comprises collection of information on emissions from Platin Cement Works. Emissions are described in the EIA Report (Chapter 8: Air Quality & Climate) including information on the following:

- identification of stacks and buildings locations and dimensions,
- definition of stack emission parameters (velocity, temperature, volume),
- calculation of PCDD/Fs release rate (g/s).

E1.3 Atmospheric Dispersion Modelling

An atmospheric dispersion model (AERMOD, v. 7.7) has been used to calculate air concentrations and deposition rates for PCDDFs across the entire study area. Site-specific characteristics input for air modelling include:

- information obtained from the ‘Facility Characterisation’ step,
- partitioning emissions (i.e. vapour phase / particle deposition characteristics),
- surrounding terrain topography,
- surrounding land use,
- facility building characteristics,

- meteorological data.

E1.4 Identification of Exposure Scenarios

Identifying exposure scenarios consist of:

- characterising the exposure setting,
- identifying recommended exposure scenarios,
- selecting exposure scenario locations.

For the purposes of the HHRAP, receptors come into contact with PCDD/Fs via two primary exposure routes: either directly via inhalation; or indirectly via PCDD/F deposition and subsequent ingestion of water, soil, vegetation, and animals that have been contaminated by PCDD/Fs through the food chain. The HHRAP identifies a number of generic exposure scenarios for adults, children and infants, classified as farmer, resident or fisher. These scenarios define the pathway to which human receptors would be exposed and the degree to which they would be exposed to inhalation and ingestion.

Parameters such as typical ingestion rates, body weights, and inhalation rates (amongst others) that affect the assessment of risk and hazard are defined in the HHRAP. Default values of these parameters were used except where stated in this report.

On the basis of these standardised scenarios, exposure locations have been identified within the assessment area considering the land uses and receptor types present.

E1.5 Estimating Media Concentrations

This step of the HHRAP estimates the concentrations of PCDD/Fs within the affected media within the identified exposure scenarios. The calculations are detailed within the HHRAP they cover:

- calculating PCDD/F concentrations in air for direct inhalation,
- calculating PCDD/F concentrations in soil,
- calculating PCDD/F concentrations in produce,
- calculating PCDD/F concentrations in beef, pork, chicken,
- calculating PCDD/F concentrations drinking water and fish.

The calculation of media concentrations requires definition of parameters that are set out in the HHRAP.

For the purposes of this assessment the default HHRAP parameters have been used to define the characteristics of the receptors, with exception in that longer exposure durations have been considered. The exposures calculated using the HHRAP are intended to represent reasonable maximum exposure (RME) conditions.

Site specific parameters are also required and are detailed in this report for the following parameters:

- annual average evapotranspiration rate,
- annual average precipitation,
- annual average irrigation,
- annual average runoff,
- annual average wind velocity,
- time period over which deposition occurs.

E1.6 Quantifying Potential Exposure

Calculating potential PCDD/F-specific exposure rates for each exposure pathway involves some or all of the following, depending upon the medium being assessed:

- estimated PCDD/F media concentrations,
- consumption rates of the medium,
- receptor body weight,
- frequency and duration of exposure.

The information required includes the following:

- food (meat, dairy products, fish and vegetables), water and soil consumption rates for each receptor type;
- fraction of contaminated food, water and soil which is consumed by each receptor type;
- input data for the inhalation exposure including: inhalation exposure duration, inhalation exposure frequency, inhalation exposure time; and inhalation rate;
- input data for the ingestion exposure including: exposure duration, exposure frequency, exposure time; and body weight of receptor.

For the purposes of this assessment the default HHRAP parameters have been used to define the characteristics of the receptors, with exception in that longer exposure durations have been considered. The potential exposures calculated using the HHRAP are intended to represent reasonable maximum exposure (RME) conditions.

E1.7 Toxicity Factors for PCDD/Fs considered in the Assessment

The UK COT [9] recommended 2pg I-TEQ/kg Bodyweight (BW) per day as the reference dose for the total of all PCDD/Fs expressed as 2,3,7,8- TCDD.

The UK Environment Agency guidance [7], in situations where the MDI exceeds the TDI, is that a minimum of 50% of the TDI is reserved for exposure from land.

Appendix F

Toxic Equivalence Factors

F1 Toxic Equivalence Factors

Table 7: WHO TEFs for PCDD/Fs (Van den Berg et al, 2006)

PCDD/F (Congener)	WHO TEF
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0003
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.03
2,3,4,7,8-PeCDF	0.3
1,2,3,4,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0003

Table 8: PCDD/Fs – Applied Congener Emission Rates

PCDD/F	Emission Concentration (ng/Nm³) based on WHO-TEFs	Emission Rate (ng/s)	
		Kiln 2	Kiln 3
2,3,7,8 –TCCD	0.0059	1.062	1.062
1,2,3,7,8–PeCDD	0.0188	3.398	3.398
1,2,3,4,7,8–Hx CDD	0.0019	3.398	3.398
1,2,3,6,7,8–HxCDD	0.0044	7.857	7.857
1,2,3,7,8,9–HxCCD	0.0038	6.796	6.796
1,2,3,4,6,7,8–HpCCD	0.0026	46.508	46.508
OCCD	0.0001	73.265	73.265
2,3,7,8-TCDF	0.0085	15.290	15.290
1,2,3,7,8-PeCDF	0.0018	10.618	10.618
2,3,4,7,8-PeCDF	0.0243	14.653	14.653
1,2,3,4,7,8-HxCDF	0.0096	17.414	17.414
1,2,3,6,7,8-HxCDF	0.0069	12.529	12.529
1,2,3,7,8,9-HxCDF	0.0015	2.761	2.761
2,3,4,6,7,8-HxCDF	0.0078	14.016	14.016
1,2,3,4,6,7,8-HpCDF	0.0018	33.129	33.129
1,2,3,4,7,8,9-HpCDF	0.0003	5.097	5.097
OCDF	0.00003	19.113	19.113
TOTAL	**0.1000**	**286.903**	**286.903**

Appendix G

Air Dispersion Modelling

G1 Air Dispersion Modelling

The atmospheric dispersion modelling for the HHRA has been completed using the AERMOD model as stated in Chapter 8 of the EIA Report.

G1.1 Modelling Scenarios

The dispersion modelling of potential future emissions from the Cement Works considers a ‘worst case’ scenario. This scenario assumes that the Cement Works is operated continuously throughout the year and that emissions of pollutants occur at ELVs specified by the IED.

G1.2 Assessment Area

The potential air quality impact of the Cement Works was initially assessed in the EIA Report Chapter 8 – Air Quality and Climate. The model was run to determine the location of maximum ground level concentration and maximum deposition rate resulting from the emissions.

G1.3 Meteorological Data

Meteorological data used in this assessment comprised a 5-year sequential hourly average dataset from Dublin Airport, approximately 12km to the west of the Cement Works. Meteorological data used in this assessment was for the calendar years 2011 to 2015 inclusive. The meteorological data includes hourly values for wind speed, wind direction, atmospheric stability, ambient temperature and mixing height.

A windrose for Dublin Airport meteorological data for the calendar years 2011 to 2015 inclusive period, providing the frequency of wind speed and direction, is presented in Figure 1. The windrose shows that the prevailing wind direction is from the south west, with winds from the south-east being relatively infrequent.

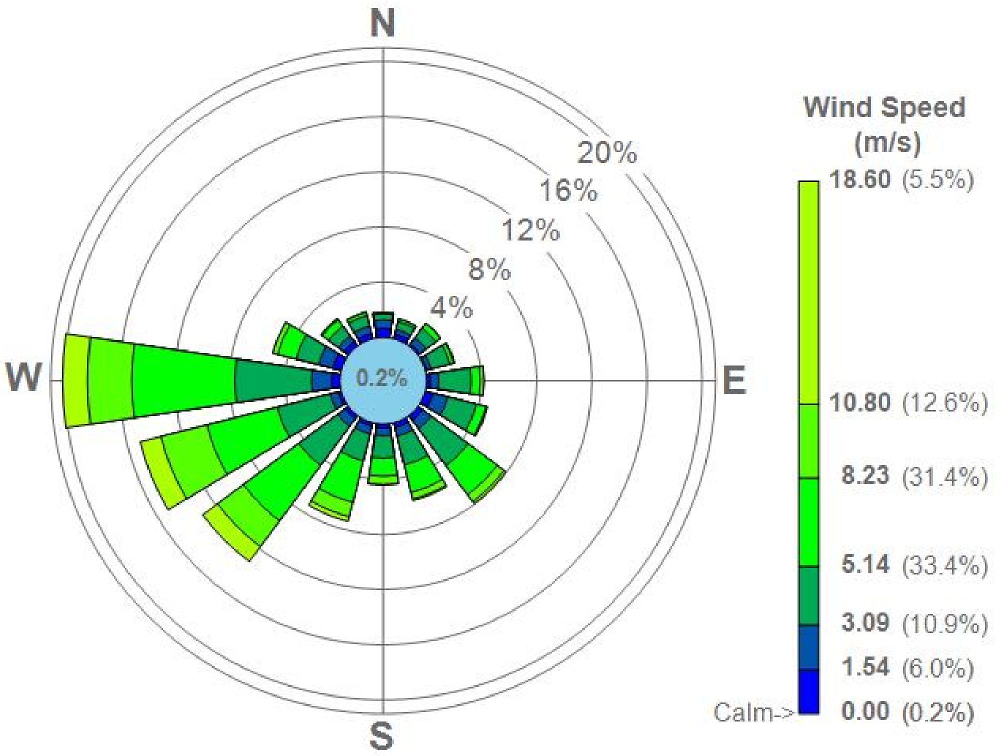

Figure 1: Windrose for Dublin Airport 2011

G1.4 Topography

The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Terrain elevations have been included in the dispersion model.

G1.5 Unitization

A nominal emission rate of 1g/s for each source was used as required by HHRAP, to generate “unitized” concentrations and deposition rates which are the input parameters required by IRAP-h.

G1.6 Partitioning

The potential emissions to atmosphere from the Cement Works occur as either vapour or particulate matter and the modelling methodology depends on the phase in which the pollutant is emitted from the facility.

Guidance indicates that in general it can be assumed that:

- Most pollutants with very low volatility (i.e. fraction of the pollutant in the vapour phase is less than 0.05) occur only in the particle phase,
- Highly volatile pollutants occur only in the vapour phase (i.e. the fraction of the pollutant in the vapour phase is 1.0),

- The remaining pollutants are condensed onto the surface of particulate matter (particle-bound).

G1.6.1 Particulate Deposition

Particle deposition is determined mainly by the particle size (aerodynamic) and density, with the terminal velocity of a particle determining how far and soon it will deposit. AERMOD incorporates two methods for modelling deposition of particles:

- Method 1 is used when a significant fraction (> 10%) of the total particulate mass has a diameter greater than 10 microns and the particle size distribution is reasonably well known.
- Method 2 is used when the particle size distribution is not well known and when a small fraction (less than 10% of the mass) consists of particles with a diameter of 10 microns or larger.

For this assessment, the Method 1 approach has been applied using published data [17] relating to particle size distribution as shown in Table 9.

Table 9: Assigned Deposition Parameters for Particulates

Mean Particle Diameter (µm)	Fraction of Total Mass	Particle density (g/cm^3)[2]	Particle Radius (µm)	Surface Area/ Volume (μm^{-1})	Proportion Available Surface Area	Fraction of Total Surface Area
10	0.51	2.7	5	0.600	0.3060	0.1488
2.4	0.34	2.7	1.2	2.500	0.8500	0.4134
1	0.15	2.7	0.5	6.000	0.9000	0.4377
	1.000				2.0560	1.0000

[1]Particulate matter and elemental emissions from a cement kiln, R.K. Gupta, Deepanjan Majumdar, J.V. Trivedi, A.D. Bhanarkar

[2]http://www.cementkilns.co.uk/exhaust.html

G1.6.2 Vapour Deposition

Vapour phase compounds are deposited via both wet and dry processes, dependent on factors relating to their solubility and not by particle size, mass or surface area. Published data [18] relating to solubility has been applied to the 17 congeners and a weighted average used, as shown in Table 10.

Table 10: Assigned Deposition Parameters for Vapours

Deposition Parameter	Value
Diffusivity in air (cm^2/s)	0.050329737
Diffusivity in water (cm^2/s)	0.0000077
Cuticular resistance (s/cm)	7.84
Henry's constant (Pa m^3/mol)	0.969475504

G1.7 Model Output

The AERMOD dispersion model has been used to produce the following outputs as 1-hour (acute) and annual averages based on 5 years of meteorological data:

- the airborne concentration of vapour, particle and particle bound substances emitted;
- the dry deposition rate of particle and particle-bound substances.

Appendix H

Parameters for Estimating Media Concentrations

H1 Parameters for Estimating Media Concentrations

H1.1 Receptor Site Parameters

Receptor site parameters were specified for the study area as shown in the following table. Parameters are generally based on Met Éireann data for Dublin Airport:

Table 11: Receptor Parameters

Parameter	Value	Comments
Annual average precipitation	77.12 cm/annum	
Annual average evapo-transpiration rate	53.86 cm/annum	
Annual average irrigation	0 cm/annum	no significant irrigation in the area
Annual average runoff	23.26 cm/annum	to balance
Annual average wind velocity	5.29 m/s	
Time period over which deposition occurs	90 years	

H1.2 Site Parameters for Water Catchments and Waterbody

Site parameters for the water catchments and the waterbody (Bunlicky Pond) were specified for the study area shown in the following table.

Table 12: Site Parameters for Water Catchments and Waterbodies

Parameter	Value	
Water Catchments	***All***	
C = USLE cover management factor	0.1	
RF = USLE rainfall (or erosivity) factor	500	
Waterbody	***River Boyne***	***River Nanny***
d_{wc} = Depth of water column	2m	0.5m
u = Current velocity	0.1 m/s	0.1 m/s
V_{fx} = average volumetric flow rate through water body	1,117,320,480 m^3/yr	71271360 m^3/yr

Appendix 5.1

Ecological and Sediment Study of the River Nanny

Irish Cement Ltd.
Integrated Pollution Control License Register Number P0030-04.

AQUATIC MONITORING OF THE RIVER NANNY NEAR DULEEK, CO. MEATH

(2016 Report)

Version: 31st August 2016

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1. INTRODUCTION

1.1 Background

Irish Cement Ltd. operates a large limestone quarry and cement manufacturing facility at the Platin Works near Drogheda, County Louth. The trade effluent from this site is discharged into the River Nanny near Duleek, Co. Meath. This discharge is licensed by the Environmental Protection Agency (EPA) under Integrated Pollution Control (IPC) License Register Number P0030-04. This license has a number of conditions in relation to the monitoring of the receiving water. The current assessment addresses the receiving water monitoring issues in relation to the following conditions as follows:

- *Condition 6.14.1 The licensee shall annually evaluate the impact, if any, of the discharge to the River Nanny. The evaluation shall be based on the ambient sampling required under Schedule C.6 Ambient monitoring [receiving water monitoring]. In particular the evaluation shall consider the impact of fine particulate matter in the discharge*

- *Condition 6.14.2 The licensee shall, if necessary, based on the results of the evaluation incorporate additional mitigation measures for the treatment of surface water prior to discharge.*

- *Condition 6.14.3 The acute toxicity of the undiluted final effluent to at least four aquatic species from different trophic levels shall be determined by standardized and internationally accepted procedures and be carried out by a competent laboratory. The name of the laboratory and the scope of testing to be undertaken shall be subject to the agreement of the agency. The testing shall be carried out within three months of the date of grant of this license. Copies of the complete reports shall be submitted to the agency within 6 weeks of completion of the testing.*

- *Condition 6.14.4 Having identified the most sensitive species outlined in Condition 6.14.3, subsequent compliance toxicity monitoring on the two most sensitive species shall be carried out annually by the laboratory identified in Condition 6.14.3, or an alternative as may be agreed. Copies of the complete reports shall be submitted to the agency within 6 weeks of completion of the testing.*

- *Condition 6.14.5 A representative sample of effluent shall be screened annually for the presence of organic compounds and heavy metals. The specification of such shall be amended upon the instruction of the Agency. Copies of the complete reports shall be submitted to the Agency as part of the AER.*

This study provides all the required information and meets these conditions. The current study was undertaken by Ecofact Environmental Consultants Ltd. and follows a similar assessments completed in from 2008 to 2015 as part of the requirements for the same discharge license. (Ecofact, 2008 to Ecofact, 2015).

1.2 The River Nanny

The River Nanny (OS Catchment No: 160; EPA code: 08N01) is located in County Meath in the Eastern River Basin District (Hydrometric Area 8). The River Nanny rises near Kentstown and flows east through Duleek and Julianstown to enter the sea at Laytown, roughly 6 km south of Drogheda. Overall it has a total length of approximately 28km and a catchment area of 239 km^2 (McGinnity *et al*, 2003). Upstream of the discharge point, the catchment area of the River Nanny is approximately $200km^2$. At this location, the river has a 50%ile and 95%ile flow of $1.91m^3/s$ and $0.323m^3/s$ respectively (EPA Hydrometric data system).

The River Nanny has a long history of pollution; mainly from agricultural sources (McGarrigle *et al*, 2004). In Appendix 2, a summary of water quality in the River Nanny along with overall water quality in Hydrometric Area 8 during the most recently published EPA survey is presented.

The entire River Nanny was in an unsatisfactory ecological condition when most recently monitored by the EPA in September 2014 (source EPA website). The stations at Folistown (0400) and the east Bridge at Kentstown (0110) were both rated 'Moderately Polluted (Q3)', equivalent to Water Framework Directive (WFD) 'poor status'. The nearest EPA biological monitoring station upstream of the Irish Cement discharge is at the Bridge NE of Bellewstown House (station 0500). In 2014, this part of the river was rated 'Slightly polluted (Q3-4)' corresponding to WFD 'moderate status'. The nearest EPA biological monitoring station downstream of the discharge point is at Beaumont Bridge (0600). The River Nanny was rated ''Moderately Polluted (Q3)' by the EPA at Beaumont Bridge in 2016.

The River Nanny is in the Eastern River Basin District and is within the Nanny Water Management Unit (WMU) where the land use is predominantly agricultural (ERBD, 2009). A Water Management Unit (WMU) is a geographic area primarily defined by similar hydrology and topography.

2. METHODS

2.1 Site location

The locations of the six study sites (Site N1 to N6) are given in Table 1 and Figure 1. The location of the discharge from the Irish Cement plant is also indicated in Figure 1. Site photographs are provided in Plates 1 to 6. The sites surveyed are at the same locations as in previous assessments (i.e. Ecofact, 2008 - Ecofact, 2015). The sampling location for the Irish Cement discharge was located at the outfall point to the Nanny River.

Table 1 Location of six biological and sediment sampling sites.

Site	N1	N2	N3	N4	N5	N6
Habitat Category	Riffle	Glide	Pool	Pool	Glide	Riffle
Sample type	Receptor	Receptor	Receptor	Reference	Reference	Reference
Location	Downstream of outfall	Downstream of outfall	Downstream of outfall	Upstream of outfall	Upstream of outfall	Upstream of outfall
NOS Grid Reference	O07976 69254	O07865 69186	O07783 69171	O07589 69186	O07537 69165	O07349 69166

2.1 Biological Assessments

2.1.1 Macroinvertebrate sampling

Semi-quantitative sampling of benthic macroinvertebrates was undertaken at the six sites listed using kick or sweep sampling (Toner *et al*, 2005). Sampling was undertaken on the 4th and 5th of June 2015. A total of three sites were located within a 0.5 km section of river extending upstream of the Irish Cement discharge point (reference sites), and three sites were located over a similar distance downstream (receptor sites). Representative riffle, glide and pool habitats (EA, 2003) were sampled at both reference and receptor locations. Site 1 was located downstream of an old mill weir while site N2 was located upstream of this impoundment. The presence of this weir on the section can be expected to influence local sedimentation rates.

The biological sampling procedure followed at each site involved the use of a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter) which was submerged on the river bed with its mouth directed upstream. The substrate upstream of the net was then kicked for one minute in order to dislodge invertebrates, which were subsequently caught in the net. This procedure was undertaken at three points along/across the watercourse. Stone washings and vegetation sweeps were also undertaken over a further 1-minute period to ensure a representative sample of the fauna present at each site was collected.

All three samples of invertebrates from each substation were combined and live sorted on the river bank for 20 minutes with the assistance of a headband magnifier. Specimens were fixed in a 10% formalin solution. Identification was undertaken in the laboratory using high-power and low-power binocular microscopes. All collected samples have been archived and will be retained for 1 year.

2.1.2 Biotic Indices

2.1.2.1 The Quality Rating (Q) System

The Quality Rating (Q) System (Toner *et al*, 2005) is the standard biotic index which is used by the EPA. This method categorises invertebrates into one of five groups, depending on their sensitivity to pollution. Further details on the Q-rating system and its relationship to the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) are provided in Appendix 1.

2.1.2.2 BMWP (Biological Monitoring Working Party) Score

In the revised BMWP scheme (Walley and Hawkes, 1997) biotic index of water quality, each family recorded in the sample is assigned a habitat specific score. This score depends on the pollution sensitivity of the invertebrate family together with the characteristics of the site where the invertebrates were found. A site is classed as one of the following depending on substrate type: riffle (>= 70% boulders and pebbles), pool (>= 70% sand and silt) or riffle/pool (the remainder). The BMWP score is the sum of the individual scores of the families recorded at each site - a family scores if present. A higher BMWP score is considered to reflect a better water quality and a score over 100 is indicative of very good water quality.

2.1.2.3 Trent Biotic Index

The Trent Biotic Index (Woodiwiss, 1960) is based on the number of defined taxa of benthic invertebrates in relation to the presence of six key organisms found in the fauna of the sample site. Depending on the number of taxonomic groups present and the key organisms found in the fauna, the TBI index ranges from fifteen for clean water, to zero for polluted water.

2.1.2.4 Chandler Biotic Score

The Chandler Biotic Score (Chandler, 1970) also assigns values to taxonomic groups ranked in terms of pollution sensitivity but, in addition, provides scores for each species which is present in the taxonomic groups. This is a more powerful, albeit more taxonomically demanding, system than the previous biotic indices. Each group is given a score according to its abundance. The total score represents the index and the higher the score the cleaner the water.

2.1.3 Functional Group Analyses

Functional Group analysis is a classification technique for stream macroinvertebrates which involves the functional analysis of invertebrate feeding, based on morpho-behavioural mechanisms of food acquisition. A number of functional feeding groups of invertebrates occur in streams. These are Shredders, Collectors (or filterers), Scrapers (or grazers), and Predators. Shredders chew, mine, bore and gouge large particles such as leaves, sterns and branches which may be dead or alive. Filterers filter particulate matter, alive or dead, from the water. Collectors again feed on small particulate matter but gather the fine detritus off the sediment or other surfaces rather than from the open water. Grazers graze and scrape the periphyton off other surfaces. Predators are subdivided into engulfers, which eat the whole prey item swallowing it whole or by chewing, and piercers, which pierce the prey and suck fluids out. Food sources vary along the length of a river. Narrow upland streams, for example, rely heavily on allochthonous leaf debris (known as CPOM or Coarse Particulate Organic Matter) which can be used by shredders. In downstream areas, the fine debris of demolished leaves (fine particulate organic matter, FPOM) will support collectors. Changes in functional groups reflect changes in food sources, nutrient processing and energy flow in the river system. Human influences on a river can dramatically alter food sources and in turn affect the trophic groups. This method of analyses was therefore used as it provides a high resolution insight into the ecology of a river and has the ability to detect more subtle changes in community structure than would be apparent from biotic indices. Some of the mayfly larvae recorded exhibit dual feeding strategies (scrapers and collector gatherers). In the functional group analysis, where this occurred 50% of mayfly larvae were categorized as scrapers and 50% as collector gatherers.

2.1 Sediment and Water Sampling

A sediment sample was obtained for analyses at each of the six sites using a large trowel. Three sub-samples were taken and combined into a composite sample for each site. Each sub-sample was taken from undisturbed relatively homogeneous sediment deposits at the site. Each sample was placed into a mixing bowl and objects such as sticks and leaves etc. were removed as necessary. The sample was then stirred thoroughly with a mixing spoon to homogenize. The sample was then placed into a labelled container.

A water sample of the effluent was taken on the 24thJune 2015. The water sample was analysed for Total Hydrocarbons, Heavy Metals and Petroleum Range Organics. BOD (Biochemical Oxygen Demand) and

Total Hardness were analysed in samples taken from Sites N1 and N6. Samples were labeled and placed in a cooler box and were promptly delivered to the laboratory by courier. During sampling appropriate measures to prevent contamination from other sources was undertaken and all sampling equipment had been thoroughly cleaned.

2.2 Eco-toxicology testing

Condition 6.14.4 of the IPPC license requires toxicological testing to be carried out on the two most sensitive species tested in 2010. The species chosen for toxicity resting was a freshwater crustacean *Daphnia magna* which was subject to an immobilization test and a bioluminescent bacteria *Vibrio fischeri* in a Microtox - light inhibition test.

Toxic pollutants can be described in terms of acute and chronic toxicity. Acute toxicity is when a large dose of pollutant is released in a short period of time whereas chronic toxicity is a low dose of pollutant released over a long period of time, the former having more of a lethal effect on the biota of the receiving water. Chronic toxicity can be lethal or sub-lethal and can result in the mal-functioning of organisms by impairing biochemical, physiological, behavioral or life-cycle functions. When toxic pollutants enter the aquatic environment they may be altered by influences such as temperature, the quality of the water, pH and hardness. It is well known that temperature influences the metabolic activity and behavior of organisms however it can also alter the physical and chemical state of pollutants. For some toxicants, increasing temperature results in increasing toxicity of the pollutant.

Toxic contaminants are rarely individual chemicals, effluents or metals; more often than not they are mixture of poisons. When two or more pollutants are present in an effluent they may exert a combined effect on an organism which is said to be *additive*, the contaminants may also interfere with one another, an antagonistic effect or the overall effect of the pollutant on an organism maybe greater than when acting alone, a synergism effect (Mason, 2002). In order to minimize the effects of pollutants on the environment toxicity tests have been developed to assess the toxicity of an effluent and to predict, in conjunction with other information e.g. available dilution, chemical characterisation, the impact it will have on the receiving waterbody. The receiving waterbody dictates the selection of the test organisms. The receiving waterbody is freshwater. Toxicity testing is essentially for environmental protection of an area, to control the wastes from animal residues and humans, to monitor industrial and manufacturing processes in order to issue discharge licences, for legal and ethical issues i.e. to protect biota in aquatic ecosystems.

A sample of the discharge from the Irish Cement plant was taken on the 24th June 2016. The sample consisted of 1 litre and was taken from outfall at the River Nanny approximately 100m south of the R150 (O07712 69161). The sample of the discharge was placed in a cooler box. The sample was transported to the Aquatic Services Unit of the Environmental Research Institute (ASU), Lee Road, Cork where toxicology tests were carried out on the sample. This is a specialised facility for culturing and testing aquatic organism which has been accredited for *Daphnia* and Microtox testing. The tests carried out were as follows:

- 48 h EC_{50} to *Daphnia magna*
- 15,30 min EC_{50} to *Vibrio fischeri*

The methodology used for each of the above tests followed the "Organization for Economic Co-operation and Development (OECD) guidelines for testing of chemicals". Data from each test was used to screen for toxicity i.e. to determine if the effluent was toxic. Each test is discussed separately below. In each test a concentration series is set up where the test organism is placed in 100%, 56%, 32%, 18%, and 10% neat effluent. A control is set up; for *Daphnia* potassium dichromate is a reference chemical and for the bacteria *Vibrio fischeri*, the metal zinc sulphate is commonly used. Exposure times are pre-determined depending on the species being tested. Further details of each test are provided below.

The objectives of toxicity tests were to:

1. Assess the toxicity and lethality of compounds i.e. to what extent are the compounds hazardous to the environment, to humans, to animals etc;
2. To test the effects of environmental factors on waste toxicity i.e. temperature, pH, salinity, water hardness;
3. To investigate trophic mobility i.e. how do compounds move up through the ecosystem; and
4. To test the toxicity of a waste to a test species i.e. at each trophic level a test species is investigated e.g. a primary producer, primary consumer and secondary consumer.

2.2.1 Daphnia magna Bioassay

The *Daphnia* bioassay was carried out following standard methods as described in UK Environment Agency guidelines (2007). The effluent was tested for toxicity at the following concentrations 6.25, 12.5, 25, 50, and 100%. Twenty *Daphnia* neonates (animals less than 24 hours old) were tested for each concentration. These animals were added into 4 replicates of five animals per test chamber for each concentration. A concurrent reference toxicant bioassay was also carried out to determine the health and suitability of the organisms. Testing was carried out in a constant temperature room at a temperature of 20ºC ± 2 throughout the test. A light regime of 16 hours light / 8 hours dark was used throughout the testing period. The test duration was 48 hours. Reconstituted water made from 2 parts Ballygowan mineral water and 3 parts distilled water was used as control and dilution water. The *D. magna* were obtained from in house cultures at ASU.

2.2.2 Vibrio fischeri bacteria bioassay using Microtox system

This test involves using the marine bacteria *Vibrio fischeri*. The luminescent bacteria *Vibrio fischeri* are used exclusively in the Microtox system. Testing was carried out following the Azur Environmental guidelines for a Basic Test (Azur Environmental, 1995). The concentrations of effluent tested ranged from 2.5% to 81.9%. Two replicates were used for each concentration tested. A concurrent reference toxicant bioassay was also carried out to determine the health and suitability of the bacteria.

2.2.3 Statistical Analyses

Statistical analyses to generate LC50 (Lethal Concentration to cause 50 percent mortality) or EC50 (Effective Concentration to cause 50 percent effect) data were performed using the ToxCalc v5.0.32 Environmental Toxicity Data Analysis System, (Tidepool Scientific 2007). Statistical analyses on the Microtox Data were performed using the proprietary Microtox Omni software (Azur Environmental 1995).

2.3 Habitat Survey

Physical habitat assessments were undertaken at the six biological sampling sites. Habitat has a key influence on the macroinvertebrate communities, which occur in rivers and streams. The physical habitats of study sites were assessed in relation to macroinvertebrates using a method given by Barbour and Stribling (1991). This method assesses habitat parameters and rates each parameter as optimal, sub-optimal, marginal or poor (scores 5, 10, 15 and 20 respectively). The scores for each parameter are then added up to give an overall habitat score.

2.4 Other WQ parameters

During the current survey Conductivity (µs cm^{-1}), water temperature (^{o}C), and Dissolved Oxygen (mgl^{-1} and % saturation) were measured using on-site using portable meters. These parameters, along with salinity and pH were also measured in the water sample provided to ASU for eco-toxicology testing.

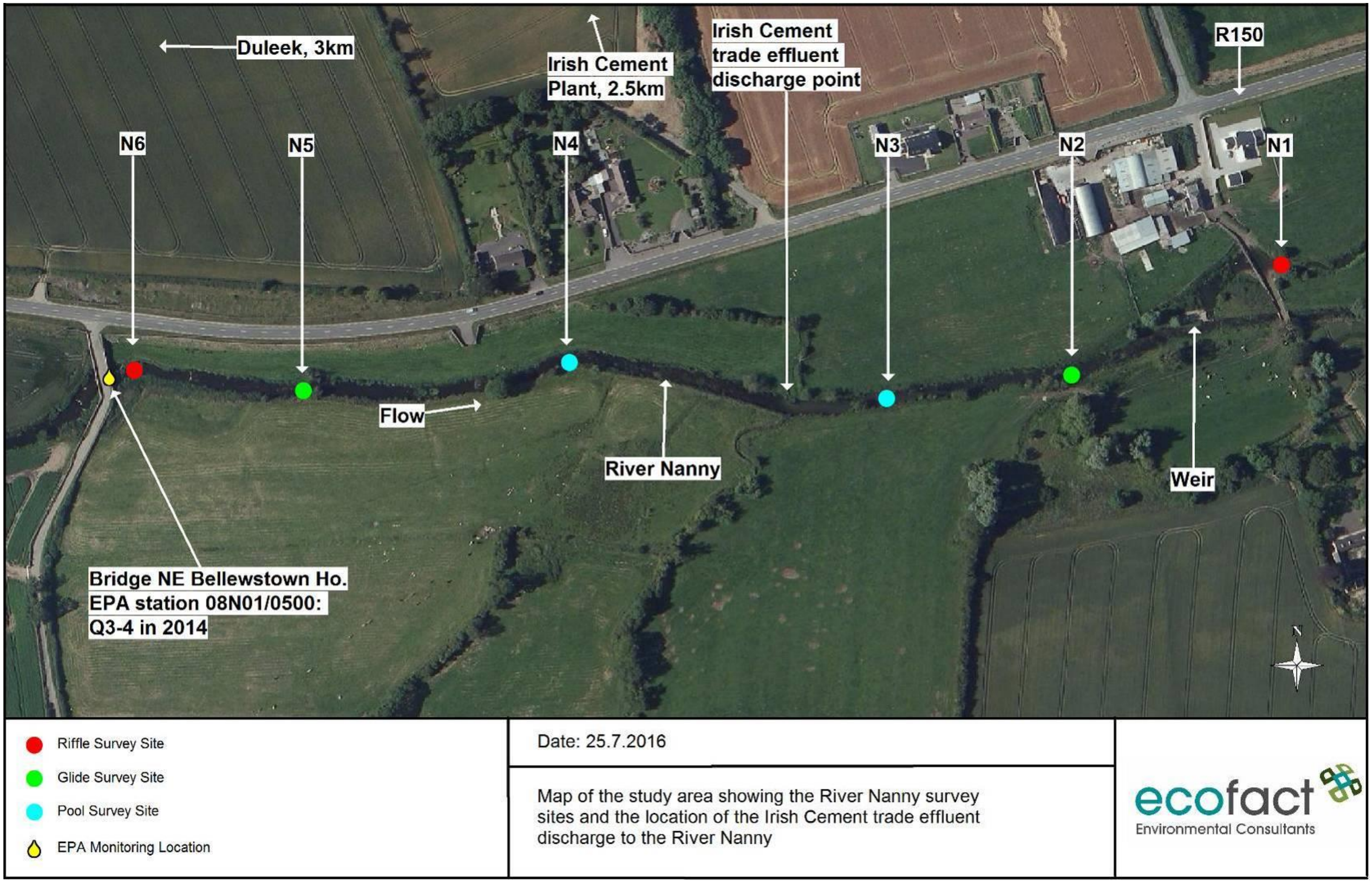


Figure 1 Map of the study area showing the location of the Irish Cement outfall to the River Nanny and river survey site.

3 RESULTS AND DISCUSSION

3.1 Physical Habitat

The physical habitat characteristics of the six sites assessed during the June 2016 survey are presented in Table 2. The physical habitat assessment of the six sites with respect to their suitability for macroinvertebrate production is presented in Table 3. All sites were rated as being sub-optimal for macro-invertebrate production with generally marginal pool quality, habitat complexity and canopy cover. Siltation in the surveyed stretch of river continues to be a problem despite the unusually wet summer brought about by the high rainfall levels. In the past, the EPA has indicated that land disturbance (such as ploughing) could possibly be a cause of siltation in the river. Indeed, a large proportion of lands in the study area are used for crops such as potatoes and grains which require ground preparation and exposing bare soil, with potential for suspended solids runoff.

Table 2 Physical characteristics at the six sampling sites.

Parameter	N1	N2	N3	N4	N5	N6
Habitat Category	Riffle	Glide	Pool	Pool	Glide	Riffle
Sample type	Receptor	Receptor	Receptor	Reference	Reference	Reference
Wetted width (m)	5	7	7	6	7	6
Bank height (cm)	130	100	100	100	150	50
Bank cover (%)	95	95	100	100	95	100
Bank slope (degrees)	50	65	70	80	65	40
Canopy cover (%)	10	5	5	5	0	0
Flow (cm/s)	25	5	0	0	5	30
Riffle (%)	35	0	0	0	0	35
Glide (%)	45	10	0	0	20	35
Pool (%)	45	90	100	100	70	30
Mean depth (cm)	25	95	70	85	70	45
Maximum depth (cm)	60	120	100	100	110	75
Rock (%)	20	20	40	20	25	5
Cobble (%)	30	40	25	15	25	15
Gravel (%)	20	15	15	15	20	60
Fine (%)	30	25	20	50	30	20
In-stream vegetation (%)	25	25	35	25	15	25

Table 3 Physical habitat assessment of the six sites for their suitability for macroinvertebrate production (adapted from Barbour and Stribling, 1991).

Site Habitat Category Sample type	N1 Riffle Receptor	N2 Glide Receptor	N3 Pool Receptor	N4 Pool Reference	N5 Glide Reference	N6 Riffle Reference
Bottom substrate	10	5	5	5	5	10
Habitat complexity	15	10	10	10	10	15
Pool quality	5	5	5	5	5	5
Bank stability	15	15	20	20	15	20
Bank protection	15	15	20	20	15	20
Canopy	10	10	10	10	10	5
Score	**70**	**60**	**70**	**70**	**60**	**75**
Overall Assessment	**Suboptimal**	**Suboptimal**	**Suboptimal**	**Suboptimal**	**Suboptimal**	**Suboptimal**

3.2 Temperature, Conductivity, Dissolved Oxygen and other WQ parameters

3.2.1 Results of the on-site assessments

On-site water quality assessments were carried out on the 23rd and 24th of June 2016 at the six sites sampled on the River Nanny. The six D.O. readings were taken from downstream to upstream within 35 minutes beginning at 10.15. Dissolved Oxygen (D.O.) concentrations ranged from 80.5% saturation at Site N3 to 111.4% saturation at Site N6. The highest D.O. concentration downstream of the discharge was at Site N1 where riffled flow and shallow water with a mat of algal cover are thought to have strongly influenced oxygenation conditions. There was little disparity between D.O. in the River along the stretch from Site N2 to Site N4 where D.O. saturation was 8.26% at N2, 80.5% at N3 and 84% at N4. It is noted that the D.O. concentration in the discharge within this time interval was 99.2%. The greatest D.O. saturations were recorded at Sites N5 and N6 where readings of 106.8% and 111.4% were recorded respectively. Again, well aerated water at Site N6 is deemed to have affected D.O. saturation here.

Diurnal fluctuations in D.O. can be expected to occur naturally in rivers and the D.O. range is in indication of aerobic activity and Biochemical Oxygen Demand (B.O.D.). Conversely, the D.O. saturation decreases by night when sub-aquatic plants undergo cellular respiration. During the current survey, D.O. saturation was seen to increase considerably over 35 minutes. The difference in maxima and minima D.O. saturations in the current survey was 30.9%. This range of saturation is not unexpected given the presence of luxuriant filamentous algal growth recorded on the bed and within the water column of the river at all sites.

Filamentous algae is considered a primary driver of D.O. in the subject stretch if the River Nanny where underwater photosynthetic action of algae and other submerged plants is apparently excessive when light is available. In the EPA Q-rating scheme, a D.O. within the range 80%-120% is indicative of ‘moderate status’ conditions. Collective D.O. concentrations downstream and upstream of the discharge are indicative of unsatisfactory oxygenation conditions. A range in D.O. far greater than this can be expected in the river Nanny within the study area however i.e. much lower concentrations at dawn due to plant respiration and depleted D.O. and much higher concentrations in the evening following a long day of photosynthesis. Based on the on-site chemical results for Dissolved Oxygen, there was no evidence to suggest that the River Nanny was being negatively affected by the Irish Cement discharge.

Based on the on-site assessments, Conductivity in the river Nanny was in the range 403µS/cm - 437µS/cm. The mean conductivity at Site N1, N2 and N3 (downstream of the discharge) was 434µS/cm and the mean conductivity at Site N4, N5 and N6 (upstream of the discharge) was also 409µS/cm while the Conductivity of the discharge was 560µS/cm. Based on the results of the current assessment, it is considered that the discharge was having the effect of slightly increasing Conductivity in the River Nanny downstream of the discharge i.e. an increase of ca. 6%.

The water temperature variations across the six sites between 10.15 and 10.50 on the 24th June 2016 was minimal, ranging from 14.8°C to 15°C. The mean water temperature of the three sites downstream of the Irish Cement discharge was 14.83°C while the mean water temperature of the three sites upstream of the Irish Cement discharge was 14.86°C. The water temperature of the Irish Cement discharge to the River Nanny at 10:35 was 14.8°C. The effect of the discharge on the ambient temperature of the River Nanny at the time of the current survey was negligible.

Table 4 Results of the June 2016 on-site water quality assessments.

	Site N1	Site N2	Site N3	Site N4	Site N5	Site N6	Discharge
Temperature (^oC)	15	14.9	14.6	14.9	14.9	14.8	14.8
Dissolved Oxygen (%)	88.8	82.6	80.5	84.0	106.8	111.4	99.2
Dissolved Oxygen (mg O_2l^{-1})	8.96	8.24	8.16	8.41	10.77	11.27	10.01
Conductivity (µS cm^{-1})	435	430	437	409	416	403	560
Time	10.15	10.25	10.30	10.40	10.45	10.50	10.35

3.2.2 Laboratory results

In the Freshwater Fish Directive (79/923/EEC) and Salmonid Waters Regulations (1988) there are no recommended or mandatory limit values for Hydrocarbons. However, it is stated that Petroleum products must not be present (in water) in such quantities that they: - form a visible film on the surface of the water or form coatings on the beds of water-courses and lakes - impart a detectable 'hydrocarbon' taste to fish - produce harmful effects in fish. In this respect, the discharge was compliant as no slick was seen nor did it impair the water surface of the River Nanny following mixing. Appendix 3 presents laboratory result for the discharge sample taken on 24^{th}June 2016.

Water quality analysis assessed levels of potentially harmful chemical elements and Heavy Metals. These were the non-metals Arsenic <0.814µg/l and Selenium <3.57µg/l and Heavy Metals Chromium <4.02µg/l, Copper <0.919µg/l, Nickel <1.33µg/l, Lead 0.05µg/l, Zinc <0.41µg/l.

Total Petroleum Hydrocarbons and Mineral Oils in the discharge sample were both below the level of detection of 1mg/l.

BOD (Biochemical Oxygen Demand) and Total Hardness results from Sites N1 and N6 on the River Nanny. BOD downstream and upstream of the discharge was <1mg/l for both sites. Total hardness downstream (Site 1) and upstream (Site 6) of the discharge was 282mg/l and 302mg/l respectively.

Based on laboratory results for BOD, Hardness, Organic compounds Non-metal and Metal groups analysed, there was no evidence to suggest that the River Nanny was being negatively affected by the Irish Cement discharge. The overall results obtained are similar to the previous monitoring assessments.

3.3 Sediment PSD

The results of the PSD (particle size distribution) analyses of fine sediments sampled at the six survey sites are presented in Table 5. The bulk of the fine sediments sampled in the current study comprised sand and gravels. The generally fine particles in the samples indicate that the samples were taken from depositing areas. This is a requirement in determining the effect of the discharge on PSD in the river downstream of the discharge point, as it is fine particles in the discharge that could affect aquatic ecology in the River Nanny. The following interpretations of results for PSD are therefore focused on the smaller fraction of the sediment sample results.

The smallest particle category was very fine (silt/clay) of size 0.063mm or less. There was considerable variation in the silt/clay component of samples with a minimum quantity at Site N6 (2.1%) and the largest amount at N5 (27.4%). Overall, there was no evidence to suggest that there were greater quantities of finer particles in the subject stretch of the River Nanny downstream of the discharge. This observation is based on the mean proportion of silt/clay at Sites N1, N2 and N3 of 8.3% measured against a mean of 11.3% with respect to Sites N4, N5 and N6. Indeed, a trend of smaller average quantities of finer particles at the receptor sites (N1, N2, and N3) compared to reference sites (N4, N5 and N6) was also observed for smaller sized sand particles i.e. those within the 0.125mm - 0.6mm.

At both Sites N1 and N6, there was a high and similar proportion of gravel. Smaller particle sizes of sand (<0.125mm – <1mm) and silt/clay (<0.63) were more frequent at reference Site N1 downstream of the discharge than at Site N6 upstream. At N2 and N5 there was a high degree of variation between the PSD for smaller particle sizes. The pool sites (N3 and N4) upstream and downstream of the discharge point were the most similar with respect to PSD.

The current PSD show noteworthy differences in fine substrate composition between samples taken upstream and downstream of the Irish Cement trade effluent discharge point. In particular, the component of the substrate most likely to be influenced by the discharge (i.e. the silt/clay fraction of samples) fluctuated between all sample sites but there was no trend to suggest that the proportion of fine particles increased downstream of the discharge point.

Table 5 Results of the Particle Size Distribution Analysis of fine sediments sampled at the six survey sites.

Category	Particle size (mm)	% Passing in each sample					
		N1	N2	N3	N4	N5	N6
Habitat type		Riffle	Glide	Pool	Pool	Glide	Riffle
Sample type		Receptor	Receptor	Receptor	Reference	Reference	Reference
Gravel	9.5	84.91	97.95	94.73	77.42	90.46	94.83
	5.6	71.68	92.04	78.46	60.36	80.80	86.02
Sand	4	64.74	85.45	69.36	53.07	74.69	79.78
	2	52.88	61.86	52.42	38.94	59.97	52.32
	1	36.40	30.06	32.78	24.18	44.91	21.91
	0.6	26.26	15.96	17.62	16.08	40.06	10.27
	0.250	17.07	8.01	5.31	6.09	34.32	2.42
	0.125	15.19	6.78	4.76	4.49	30.94	2.46
Silt/Clay	0.063	14.39	6.23	4.18	4.34	27.43	2.11

3.4 Macroinvertebrate Diversity and Abundance

Table 6 presents the results of the on-site macroinvertebrate survey at the six sites surveyed on the River Nanny during June 2015. Macroinvertebrate diversity and abundance at each of the six sampling sites is illustrated in Figure 2.

During the survey of the six sites, a total of 2622 macroinvertebrates comprising 26 families were identified. At the receptor sites a total of 1420 macroinvertebrates were collected while a total of 1202 macroinvertebrates were collected at the references sites. Family richness for the receptor sites combined was 23 in comparison with 24 at the references sites combined.

Macroinvertebrate family diversity at Site N1, the receptor riffled site was 20. Ephemeropterans recorded at this site were larval stage pollution tolerant *Baetis rhodani* (common) and *Ephemerella ignita* (scarce). Pollution tolerant *Gammarus duebeni* was the most abundant organism at this location. Molluscs recorded at this site were pollution tolerant *Bithynia tentaculata* and *Ancylus fluviatilis* with *Pisidium sp.* also common. Trichopterans (caddisflies) were represented by two cased (*Potamophylax* sp. and *Athripsodes cinereus*) and a single un-cased family (*Rhyacophila dorsalis*). The beetle *Elmis* sp. as well as the aquatic earthworms (*Lumbricidae*) was also recorded among the macroinvertebrate assemblage at this site.

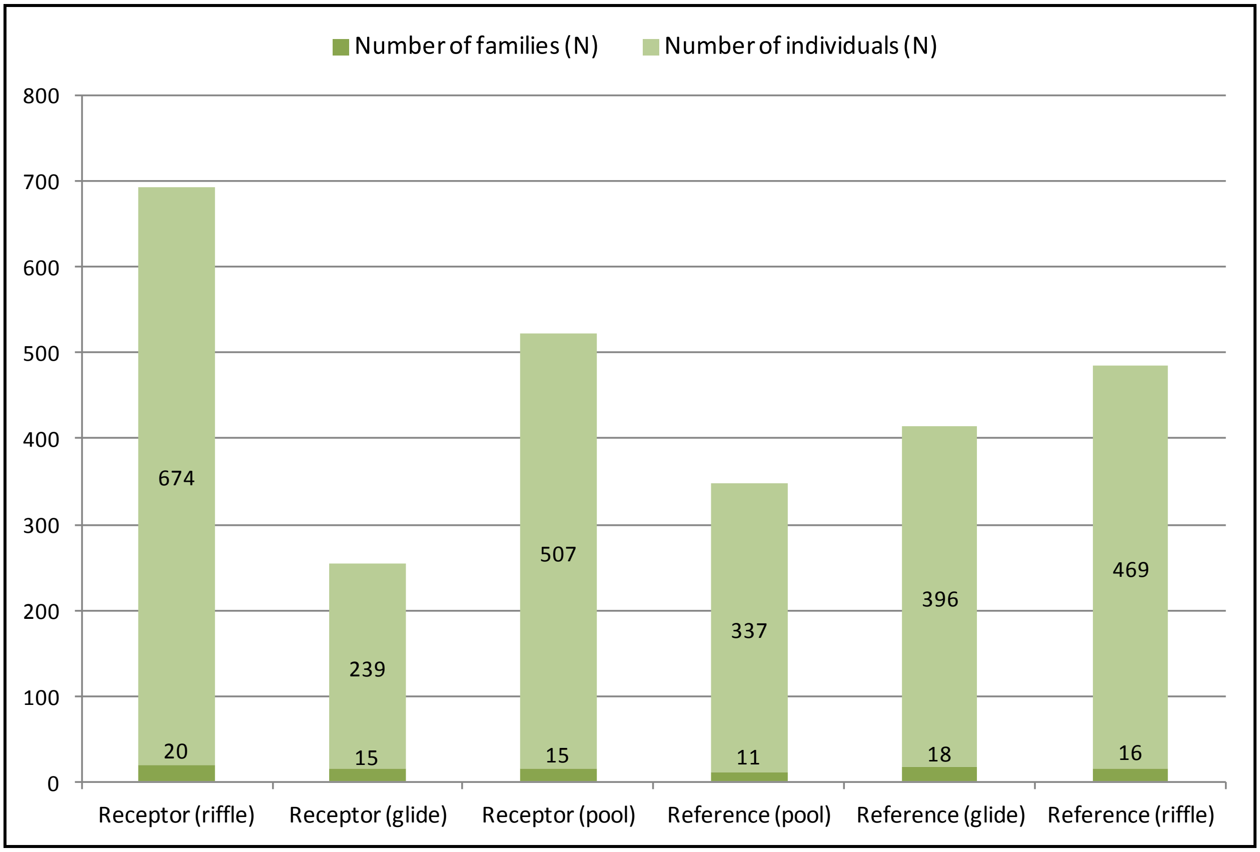


Figure 2 Macroinvertebrate diversity and abundance at each of the six sampling sites.

The receptor glide site (N2) had a family richness of 15. Ephemeropterans were represented by only one species the pollution tolerant larvae of *B. rhodani* (present). Four families of Trichopteran were recorded with larvae of the following species: *P. kingi*, Limnephilidae, and *R. dorsalis.* Dipteran larvae recorded at this location were *Chironomous* sp. and green chironomids. The only Mollus recorded at this site was *Bithynia tentaculata*. *Helephorus sp.* was the only Coelopteran recorded at this location. The most abundant macroinvertebrate was *G. duebeni*, the pollution intolerant Crustacea *Asellus aquaticus* was scarce at this site. The very tolerant leech *Erpobdella octoculata* and Alderfly larvae (Sialidae) were present. The bugs *Sigara dorsalis* and *Gerris* sp. were also recorded at this site.

A total of 15 macroinvertebrates families were recorded at the receptor pool site (N3). Ephemeropterans were represented by only one species, namely pollution tolerant larvae of *E. ignita*. Trichopterans were the most diverse order of macroinvertebrate at this site with cased caddisfly larvae in 3 families recorded (*Potamophylax sp., Hydroptilidae* and *Sericostoma personatum*) and 1 family of caseless caddisfly (*R. dorsalis*). Molluscs were also a well represented order at this site with pollution tolerant *Bithynia tentaculata (62)* and *Ancylus fluviatilis* occuring. The most abundant and numerous macroinvertebrate was the Crustacean *G. duebeni.* The pollution tolerant bugs *S. dorsalis and Gerris sp.* were also present. Alderfly larvae *Sialis* sp. was also recorded at N3. Three families of Diptera were represented in the sample: *Simulidae, Chironomidae,* and *Chironomous* sp*.* The Leech *Erpobdella octoculata* was also present at this site*.*

A total of 11 macroinvertebrates families were recorded at the reference pool site (N4). Ephemeropterans were represented in fair numbers by only one species, the pollution tolerant larva of *E. ignita*. Trichopterans were also represented by only one species of cased caddisfly (*Potamophylax sp*.) The most abundant and numerous macroinvertebrate was *G. duebeni,* while very pollution tolerant *Asellus aquaticus* was also found. Damselfly larvae of the *Banded jewelwing Agrion splendens* was scarce*. Gerris sp.* of Hemiptera was present while the only Dipteran recorded was the scarce *Chironomous sp.* The beetles *Elmis* sp. and *Helephorus* sp. as well as the aquatic earthworm (*Lumbricidae)* were also recorded among macroinvertebrate assemblage at this site.

A total of 18 macroinvertebrates families were recorded at the reference glide site (N5). The sole Ephemeropteran representative was pollution tolerant larvae of *E. ignita*. Trichopterans were a well represented group at this site with 3 cased caddisfly families (*Potamophylax sp., A. cinereus, and S. personatum*) with caseless caddisfly larvae of *R. dorsalis* and *P. kingi* scarce. Fair numbers of the Molluscs *B. tentaculata,* and *Pisidium sp.* were recorded. The most abundant macroinvertebrate was *G. duebeni* which was dominant. The beetles *Haliplus* sp. and *P. depressus elegans* as well as the pollution intolerant bugs *S. dorsalis* were also present at this site. Pollution tolerant true fly larvae of the Simulidae were present at this site along with small numbers of very tolerant *Chironomous sp.*

Macroinvertebrates in 16 different families were recorded at the reference riffle site (N6). Mayfly larvae of *E*. *ignita* and *B. rhodani* were common. Trichopterans were represented by 2 cased caddisfly families which included the following species: *Potamophylax sp. and S. personatum.* Caseless caddisfly larvae of *H. siltali* and *R. dorsalis* were scarce. Three species of Mollusc were also present with *B. tentaculata* common here*. Pisidium sp* and *A. fluviatilis* also occurred. *G. duebeni* was the most numerous macroinvertebrate at this site (dominant) while the very pollution tolerant Crustacea *A. aquaticus* was also present at this site. The pollution tolerant Bug *S. dorsalis* and *Gerris sp.* were also recorded. The beetle *Elmis sp. was* present in scarce numbers while aquatic earthworms *Lumbricidae* and *A. splendens* were also recorded at this site.

The macroinvertebrates recorded during the current survey were typically those associated with polluted lowland Irish limestone rivers. Molluscs and crustaceans were the most abundant groups recorded, while Trichoptera (both cased and caseless) are also well represented. Crustacea, particularly *G. duebeni,* far outweighed any other group present.

Compared to 2015, there was a decrease in family richness at all sites with the exception Site (N6) where family richness remained at 20. There was however an increase in the number of individuals from 2015. There was no evidence however to suggest that the macroinvertebrate community of the River Nanny was being negatively affected by the Irish Cement discharge.

3.5 Biological Water Quality

The current survey was carried out during June 2016. The river was examined following an extended period of relatively dry weather. Water levels in the river were considered low for the time of year. The subject stretch of the River Nanny had the appearance of being organically enriched i.e. both upstream and downstream of the Irish Cement discharge. Excessive algal growth of *Cladophora* sp. was evident on submerged aquatic vegetation, the riverbed, and also formed dense floating mats where water was backed up in front of stands of emergent vegetation. Filamentous alga was also seen growing from the bed of the river into the water column where conditions of low flow allowed. Macrophyte growth was of limited diversity (dominated by Common Club Rush *Schoeneoplectus lacustris* and Branched Bur-reed *Sparganium erectum* with Reed Canary grass *Phalaris arundinacea* along banks) and growth of these plants was excessive. In addition, underwater features visible at the time of the survey were seen to have a considerable coat of deposited silt. These factors are usually associated with unsatisfactory biological water quality and also have the effect of reducing habitat quality for aquatic macroinvertebrates. Figure 3 shows the biotic index survey results for the six aquatic sites surveyed on the River Nanny in June 2015. The ensuing biological water quality results are based on kick sampling carried out on the three sites downstream of the Irish Cement discharge point (N1, N2 and N3) and three sites upstream of same (N4, N5 and N6).

Table 6 Results of the on-site macroinvertebrate survey at the six survey sites on the River Nanny during June 2016.

Habitat Category Sample type	Pollution sensitivity group	Functional group	Site N1 Riffle receptor	Site N2 Glide receptor	Site N3 Pool receptor	Site N4 Pool reference	Site N5 Glide reference	Site N6 Riffle reference
SEGMENTED WORMS (Annelida, Clitellata)								
Aquatic earthworm (Lumbricidae)	D	Gathering collector	2			2	1	2
LEECHES (Hirudinea)								
Erpobdellidae								
Erpobdella octoculata	D	Predator		1	1		1	
SNAILS (Mollusca, Gastropoda)								
Ancylidae								
River limpet *Ancylus fluviatilis*	C	Scraper	22		6			9
Family Hydrobiidae								
Common Bithynia *Bithynia tentaculata*	C	Shredder	2	19	62	18	23	10
MUSSELS (Mollucsa, Lamellibranchiata)								
Orb/ Pea Mussels (Sphaeridae)								
Pisidium sp.	D	Filtering collector	42				5	2
CRUSTACEANS (Crustacea)								
Amphipods (Amphipoda, Gammaridae)								
Freshwater shrimp *Gammarus duebeni*	C	Shredder	280	155	310	250	285	290
Isopods (Isopoda, Asellidae)								
Hog louse *Asellus aquaticus*	D	Shredder	22	4	25	12	13	2
MAYFLIES (Uniramia, (Ephemeroptera)								
Baetidae								
Baetis rhodani	C	Gathering collector	47	3				65
Empherellidae								
Empherella ignita	C	Gathering collector	6		1	38	19	26
CASELESS CADDIS FLIES (Trichoptera)								

Habitat Category Sample type	Pollution sensitivity group	Functional group	Site N1 Riffle receptor	Site N2 Glide receptor	Site N3 Pool receptor	Site N4 Pool reference	Site N5 Glide reference	Site N6 Riffle reference
Grey flags (Hydropsychidae)								
Hydropsyche siltalai	C	Filtering collector						3
Trumpet-net Caddisflies (Polycentropodidae)								
Polycentropus kingi	C	Filtering collector		1			1	
Rhyacophilidae								
Rhyacophila dorsalis	C	Predator	20	3	3		2	17
CASED CADDIS FLIES (Tricoptera)								
Sericostomatidae								
Black caperer *Sericostoma personatum*	B	Shredder			1		1	3
Limnephilidae								
Potamophylax sp.	B	Shredder	38	2	5	1	12	15
Microcaddisflies (Hydroptilidae)	B	Scraper			4			
Leptoceridae								
Athripsodes cinereus	B	Shredder	5				2	
DAMSELFLIES (Odonata, Zygoptera)	B	Predator						
Jewelwings/Demoiselles (Calopterygidae)								
Banded jewelwing *Agrion splendens*	C	Filtering collector	1	2	5	3	3	5
TRUE FLIES (Diptera)								
Blackfly larvae (Simulidae)	C	Filtering collector	120		3		6	
Chironomidae								
Green chironomid	C	Filtering collector	35	17	24			
Chironomous sp.	E	Filtering collector	10	4	6	5	16	
BEETLES (Coleoptera)								
Riffle beetles (Elmidae)								
Elmis sp.	C	Predator	5			2		14
Diving beetles (Dytiscidae)								
Sub family Hydroporinae								
Potamonectes depressus elegans	C	Predator	2				2	
Hydrophillidae								
Helephorus sp.	C	Predator	6	5		4		
Haliplidae								
Haliplus sp.	C	Predator					1	
BUGS (Hemiptera)								
Corixidae								
Sigara dorsalis	C	Predator	4	15	15		3	2
Gerridae								
Gerris sp.	C	Predator	5	2	33	2		4
MEGALOPTERA								
Alderfly larvae (Sialidae)	D	Predator		6	3			
Family Diversity			**20**	**15**	**15**	**11**	**18**	**16**
Total macroinvertebrate count			**674**	**239**	**507**	**337**	**396**	**469**

Macroinvertebrate family diversity is a metric for biological water quality. The greatest macroinvertebrate family diversity was recorded at the receptor riffle (Site N1) where a total of 20 families were recorded. In comparison, a family richness of 16 was recorded at the reference riffle site (N6). The family richness at receptor glide and pool Sites N2 and N3 was 15. The family richness at reference pool and glide Sites N4 and N5 was 11 and 18 respectively. The mean family richness at the receptor and reference sites combined was 16.7 and 15 in that order. It is noted that higher species richness values, linked to family richness are mostly associated with cleaner water conditions. The results obtained for family richness indicate that the discharge is not having a significant influence on the macroinvertebrate diversity in the surveyed stretch of the river.

Biotic indices have been derived based on the macroinvertebrate communities found at each site. The biological water quality evaluations for the six survey sites on the River Nanny are given in Table 7. All the sites were rated 'Slightly Polluted (Q3)' using the EPA Q-rating system (Toner *et al.* 2005), equivalent to Water Framework Directive (WFD) 'Poor' status. This rating was brought about by the absence of pollution sensitive Plecopteran and mayfly larvae and the unstable oxygen levels. During the current round of surveying no pollution sensitive species were recorded. Group B larvae of cased caddisfly and damselfly were recorded at all survey locations. Pollution tolerant Molluscs and crustaceans accounted for the bulk of the macroinvertebrate assemblages. The riffled locations are probably the best sites on which to make an assessment of biological water quality as these areas, owing to fast flowing water and better habitat are most likely to support pollution sensitive indicators. Since the 2014 study, the Q-ratings for all sites have remained the same (Q3 - 'Moderately polluted') indicating that there has been no deterioration or improvement in water quality with respect to the EPA freshwater biological monitoring system.

The overall classification of macroinvertebrate species present at the receptor and reference sites in terms of their pollution sensitivity is given in Figure 4 and Table 8. Group 'C' pollution tolerant indicators comprised the bulk of the macroinvertebrate communities downstream (88% collectively at receptor sites) and upstream (91% collectively at reference sites) of the discharge point. The relative abundance of Group C indicators closely corresponds to the 2014 and 2015 results. Comparing the receptor and reference sites currently examined, there is also close correspondence between pollution sensitivity Group 'A' (0%, 0%), Group 'B' (4%, 4%), Group 'D' (7%, 3%) and Group 'E' (1%, 2%) where percentages in parenthesis are for receptor and reference sites correspondingly.

Comparing Site N1 and Site N6, it can be seen that there is little difference in the relative abundance of Group C indicators, N1 and N6 containing 82% and 94% pollution tolerant taxa respectively. Group B (less sensitive) indicators accounted for only 7% of the assemblage at Site N1 showing correspondence to Site N6 where this group accounted for 5% of the community. Very tolerant indicators (Group D) accounted for 10% of macroinvertebrates at Site N1 and 1% at Site N6. There was little variation in the macroinvertebrate compositions at corresponding glide sites in terms of pollution sensitivity groups.

The amount of Group C indicators at Sites N2 and N5 was 84% and 86% respectively. Group B indicators accounted for 2% of the assemblage at N2 downstream of the discharge and 5% at N5 upstream. A small proportion of the macroinvertebrates at these locations consisted of the most tolerant (Group E) indicators; 2% at Site N2 and 4% at Site N5. Likewise, there was little difference in the relative abundance of Group D indicators at Sites N2 and N5, these very tolerant indicators accounting for 7% and 5% of the macroinvertebrates assemblage at these locations, in that order. The macroinvertebrate assemblages at the pool Sites N3 and N4 was comprised of 84% and 93% Group C indicators, 10% and 4% group D indicators, and 3% and 1% Group B indicators respectively, with no pollution sensitive species recorded at either site. These results closely reflect the results of the two previous surveys and indicate very similar biotic compositions in the River Nanny upstream and downstream of the Irish Cement discharge point.

Figure 5 illustrates the Biological Monitoring Working Party (BMWP), Trent biotic index and Chandler biotic index scores at the six survey sites. All the BMWP scores were less than 100 which are indicative of unsatisfactory water quality. The reduced BMWP scores coincided with observations of filamentous algal growth and siltation along the surveyed stretch of the river. BMWP scores are proportional to family diversity and the highest score of 94.9 was attained at Site N1, corresponding to 'good'/'clean but slightly impacted' conditions using BMWP interpretation. It is noted however that macroinvertebrate assemblages in lowland limestone rivers area usually high sometimes even in polluted circumstances and that this interpretation macroinvertebrate diversity may be misleading. The BMWP scores at the reference glide and riffled sites N5 and N6 and at the receptor pool sites were 88 and 82.1 and 80.1 respectively, so water quality at these locations is also categorised as 'good'/'clean but slightly impacted'. Site N2 and N4 downstream and upstream of the discharge point scored 64.9 and 53.1 in that order. Based on these scores, biological water quality at these locations is rated 'moderate'.

The Average Score per Taxon (ASPT) which is a function of the BMWP score is deemed to more accurately gauge water quality. An ASPT of more than 5.5 is thought to reflect good water quality. Two of the sites (N5 and N6) recorded an ASPT score of 5.5 but none were higher than this threshold figure. Sites N1 and N3 scored 5.3 and the lowest ASPT was 4.8 for Site N4. Overall, analyzing the BMWP scores over the study area does not point to a significant decrease in water quality at Sites N1, N2 and N3 with reference to Sites N4, N5 and N6. The Trent biotic index scores for the survey sites ranged from 6 to 8, with the reference pool site (N4) recording the lowest score of 6. Scores of 8 were attained at Sites N1 and N5 downstream and upstream of the discharge respectively. Again, as for the BMWP index, there was no significant decline in water quality downstream of the discharge point. Overall, the subject stretch of river does not fare well based on the Trent index where the maximum score of 15 shows the study sites to be in the region of mid range with regard to water quality.

Table 7 Biological water quality at the six survey sites on the River Nanny during June 2015.

Site and habitat category Site type	Site N1 Riffle Receptor	Site N2 Glide Receptor	Site N3 Pool Receptor	Site N4 Pool Reference	Site N5 Glide Reference	Site N6 Riffle Reference
Number of Families	20	15	15	11	18	16
Q-Value	Q3	Q3	Q3	Q3	Q3	Q3
Q-Status	Moderately polluted	Moderately polluted	Moderately polluted	Moderately polluted	Moderately polluted	Moderately polluted
WFD status	Poor	Poor	Poor	Poor	Poor	Poor
BMWP score	94.9	64.9	80.1	53.1	88	82.1
BMWP category	Good	Moderate	Good	Moderate	Good	Good
BMWP interpretation	Clean but slightly impacted	Moderately impacted	Clean but slightly impacted	Moderately impacted	Clean but slightly impacted	Clean but slightly impacted
ASPT	5.3	5.0	5.3	4.8	5.5	5.5
Trent Biotic Index	8	7	7	6	8	7
Trent taxonomic groups	17	13	15	10	16	13
Chandler score	889	608	761	410	775	719
Chandler Biotic Index (average value)	47	41	48	41	46	48

There was very little difference in Chandler scores across the suite of sites surveyed. Chandler average values varied from 41 at Sites N2 and N4 to 48 at Sites N3 and N6. The ideal Chandler index value of 80 or more indicates an unpolluted, fast-running and well-aerated watercourse. The Chandler scores during the current assessment fall well short of 80, due to the absence of pollution sensitive taxa such as specific stonefly and mayfly larvae. Again, the Chandler scores do not indicate degradation in biological water quality downstream of the discharge point.

There was no discernible difference in water quality between the sites upstream and downstream of the Irish Cement discharge. Overall, the results confirm that biological water quality in the River Nanny is the same upstream and downstream of the Irish Cement discharge. The general trend was that the reference glide (N5) and receptor riffle (N1) scored higher than other sites due to greater family diversity. Compared to 2014 and 2015, there has been no significant change in biological water quality in the surveyed stretch of river i.e. both upstream and downstream of the discharge location. Based on the relative abundance of macroinvertebrate and biotic indices, it is considered that the River Nanny continues to be under considerable ecological pressure as signified by the absence of pollution sensitive indicators, low relative abundance of Group B indicators and domination by pollution tolerant taxa. As observed from year to year in previous surveys, the macroinvertebrate community in the surveyed stretch of river is variable, indicating ecological instability brought about apparently by pressures in the catchment.

Table 8 Classification of macroinvertebrate species recorded at each site in terms of their pollution sensitivity (EPA methods).

Site	Abundance	Pollution indicator group					
		Group A (Most sensitive)	Group B (Less Sensitive)	Group C (Tolerant)	Group D (Very Tolerant)	Group E (Most Tolerant)	Total
1	Number	0	44	554	66	10	674
	% of total	0	7	82	10	1	100
2	Number	0	4	220	11	4	239
	% of total	0	2	92	5	2	100
3	Number	0	15	457	29	6	507
	% of total	0	3	84	10	1	100
4	Number	0	4	314	14	5	337
	% of total	0	1	93	4	1	100
5	Number	0	18	342	20	16	396
	% of total	0	5	86	5	4	100
6	Number	0	23	440	6	0	469
	% of total	0	5	94	1	0	100

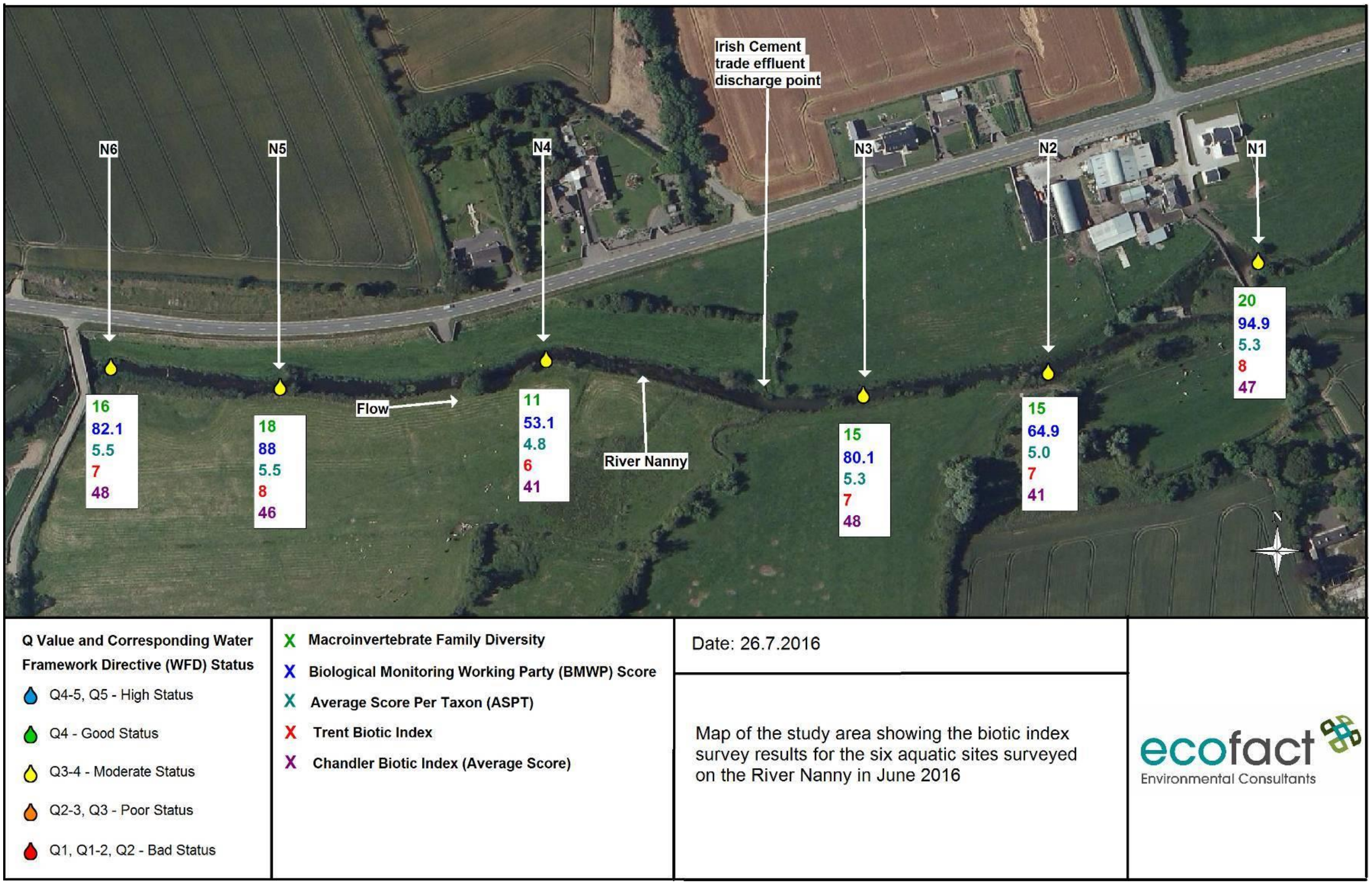


Figure 3 Map of the study area showing the biotic index survey results for the six aquatic sites surveyed on the River Nanny in June 2015.

3.6 Functional Groups

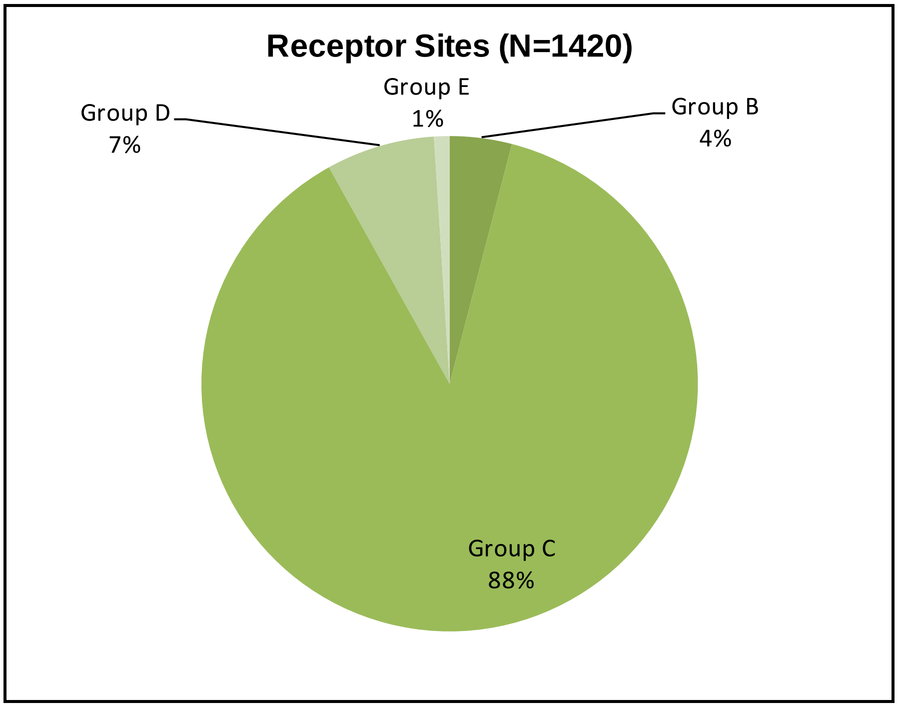
Detail on the macroinvertebrate functional groups recorded at each site is provided in Table 9. The dominant FFG for each site along with the P/R ratio for each site is provided in Table 10. The collective compositions of macroinvertebrate Functional Feeding Groups (FFG) at the receptor sites and reference sites is presented in Figure 6. The dominant FFG at the receptor sites was shredders. Shredders are a feeding category of macroinvertebrate that specialise in shredding organic matter into finer particles. Filtering collectors accounted for 18% of the macroinvertebrate assemblage at the receptor sites (N1, N2, and N3) and 3% at the reference sites (N4, N5, N6). There was some difference between the abundance of predators with 10% predators at the receptor and 5% predators at the reference sites. Gathering collectors represented 4% and 13% of macroinvertebrates recorded at receptor and reference sites in that order. Similarly, there was close correspondence between the relative abundance of scrapers; 2% and 1% at the receptor and reference sites respectively.

The relative abundance of gathering collectors recorded in the current study has also decreased from 7% to 4% at the receptor sites and increased from 4% to 13% at the reference sites. This decline would indicate a decrease in the availability of the fine detritus downstream of the discharge from 2015. The relative quantity of Shredders has also decreased at the receptor sites (70– 66%) however increased at the reference sites (71% to 78%). As shredders feed on decaying organic material (such as leaves/woody material) this would suggest a very minor increase of organic material downstream of the discharge compared to 2015.

A low occurrence of scrapers was recorded during the current survey field work. Water carrying a heavy suspended solids load or other factors that reduce light penetration and hence primary in stream production upon which scrapers depend dictate the abundance of scrapers in the aquatic ecosystem. Thereby, a decrease in primary production such as reduced diatom abundance would be expected to decrease the numbers of scrapers. Increased particulate organic matter washed into the river during rainfall events would support shredders and the relative abundance of this group would be expected to increase as observed in the current study. The relative abundance of scrapers in the current survey has remained the same as 2015, with neither an increase nor a decrease of numbers.

The most frequently occurring shredders were *Gammarus duebeni* and *Bithynia tentaculata. G. duebeni* was the most abundant macroinvertebrate recorded at all the sites by a considerable margin. *B. tentaculata* and *A. aquaticus* were also relatively abundant in the slower flowing parts of the river (N2-N5). The relative abundance of shredders was broadly comparable at corresponding receptor and reference sites. At the pool sites for example, there was 79% shredders at N3 and 83% shredders at N4. There was some variation at the riffle sites in which shredders comprised of 51% (N1) and 68% (N6) of the assemblage at the receptor and reference sites in that order.

Comparing the percentages of predators at the receptor sites and corresponding reference site, there was 6% at N1 and 9% at N6 (riffles); 14% at N2 and 3% at N5 (glides); and 12% at N3 and 3% at N4 (pools). The dominant predators were the bugs *Gerris* sp., and *Sigara dorsalis*. The leech *Erpobdella octoculata* was also recorded at Sites N2, N3 and N5.



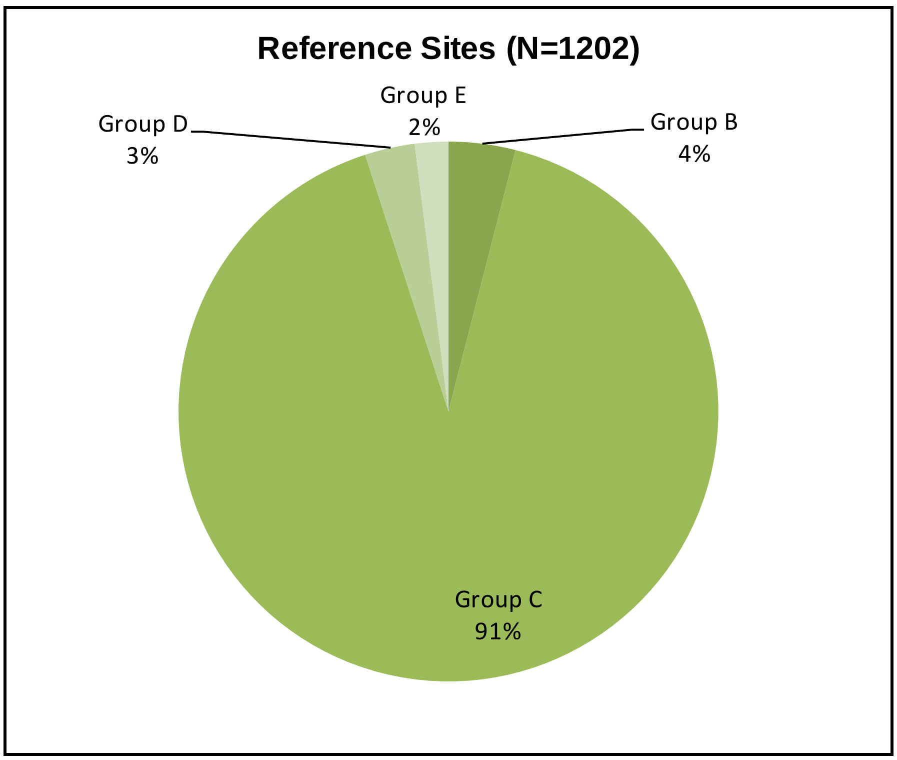


Figure 4 Overall classification of macroinvertebrate species present in terms of their pollution sensitivity (EPA methods). Based on numbers of groups present collectively at the reference and receptor sites.

The P/R ratio at all sites was considered very low as in previous surveys. This ratio, which is a measure of gross primary production to community respiration, is reduced by increasing numbers of shredders and collectors. The most common scraper recorded was River limpet *Ancylus fluviatilis*, the only other macroinvertebrate in this category being Microcaddislies (Hydroptilidae).

The P/R ratios at all sites are well below the threshold value of 0.75, above which an aquatic ecosystem is deemed autotrophic. The results of the current survey are indicative of a highly heterotrophic aquatic system (food supply originates from outside the aquatic system). The relative abundances of scrapers (which increase P/R ratio) was greatest at Sites N2 (P/R=0.165) and N3 (P/R=0.14). The P/R ratio at both all other sites was ≤0.01. The poor representation of scrapers throughout the surveyed stretch of river is consistent year after year. The changes in relative abundance of this FFG in successive surveys are slight and in the current situation, significant changes in P/R will not occur considering the scarcity of this FFG. The dominant FFG at all sites in 2015 was shredders and this continued in 2016, indicating that macroinvertebrates in the river within the study area are sustained largely by inputs to the river as opposed to using products of primary production. In the current survey, there was no significant difference between reference and receptor sites with regard to P/R ratios. This result does not indicate a change in primary production taking place within the River Nanny downstream of the Irish Cement discharge.

Table 11 presents a juvenile salmonid (salmon and trout) food index which assesses the likelihood of a predictable invertebrate food supply being available for juvenile salmonids. The results show that there was an unpredictable supply of food available at all sites with the exception of site N1. The 'predictable' result at N1 was brought about by the relatively high proportion of Simulidae and chironomidae. Overall, the poor supporting habitats, degraded water quality and limited food supply for salmonids along the study stretch of river are an indication of reduced salmonid potential for the River Nanny.

European Eel *Anguilla anguilla*, Brown Trout *Salmo trutta*, Nine-spined Stickleback *Pungitius pungitius* Minnow *Phoxinus phoxinus* and Three-spined Stickleback *Gasterosteus aculeatus* were recorded during the current field work both downstream and upstream of the discharge point. European Eel has been listed as ‘Critically endangered’ and is now ‘Red Listed’ according to ‘Red List No. 5: Amphibians, Reptiles & Freshwater Fish’ (King *et al*, 2011).

Table 9 Functional Group Analyses of macroinvertebrate species recorded at each site.

Site	Abundance	Functional Feeding Group					
		Filtering collector	Gathering collector	Predator	Scraper	Shredder	Total
1	Number	207	55	43	22	347	674
	% of total	31	8	6	3	51	100
2	Number	22	3	34	0	180	239
	% of total	9	1	14	0	75	100
3	Number	33	1	60	10	403	507
	% of total	7	0	12	2	79	100
4	Number	5	40	11	0	281	337
	% of total	1	12	3	0	83	100
5	Number	28	20	12	0	336	396
	% of total	7	5	3	0	85	100
6	Number	5	93	42	9	320	469
	% of total	1	20	9	2	68	100

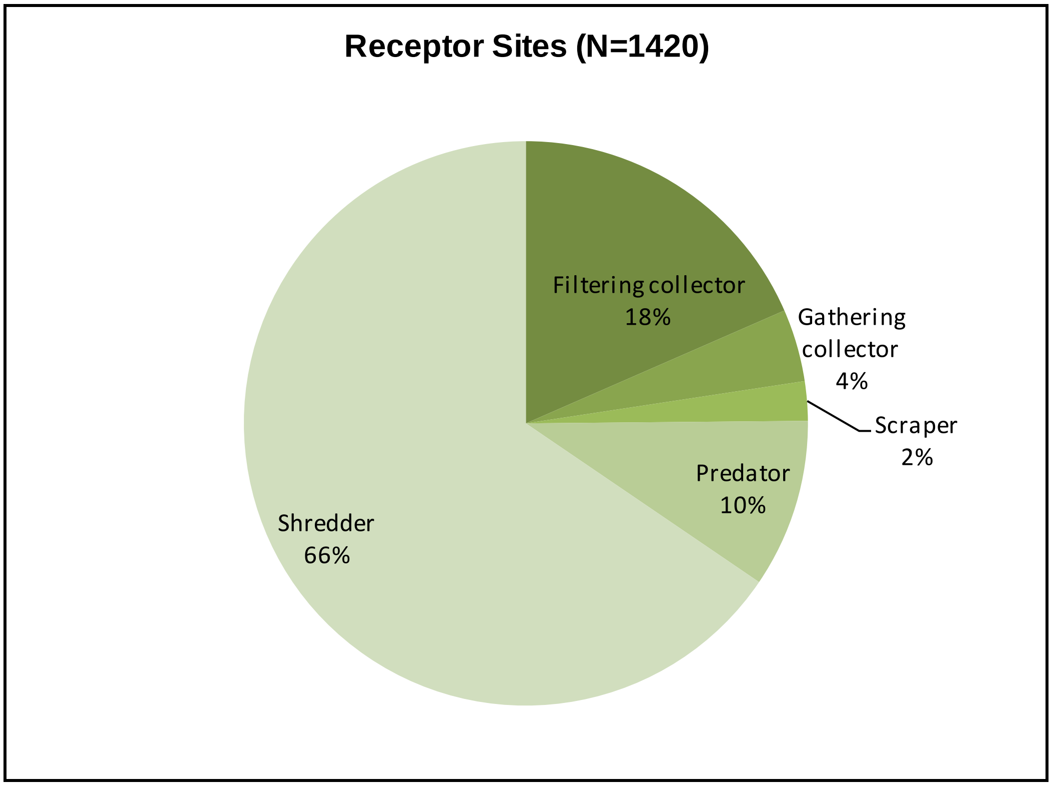
Table 10 Functional Group characteristics of the six survey sites. Dominant FFG (%) (Dominant group and its mean relative %); P/R (ratio of Grazers to total collectors + shredders, a surrogate for ratio of gross primary production to community respiration); Heterotrophy vs Autotrophy based on a P/R threshold of > 0.75 = autotrophic) (Rabenil *et al*, 2005).

Site	Type	Location	Dominant FFG (%)	P/R	Heterotrophy Vs Autotrophy
N1	Riffle	Receptor	Shredder (%) 51	0.07	Heterotrophic
N2	Glide	Receptor	Shredder (%) 75	0.165	Heterotrophic
N3	Pool	Receptor	Shredder (%) 79	0.14	Heterotrophic
N4	Pool	Reference	Shredder (%) 83	0.03	Heterotrophic
N5	Glide	Reference	Shredder (%) 85	0.03	Heterotrophic
N6	Riffle	Reference	Shredder (%) 68	0.10	Heterotrophic

Table 11 Juvenile salmonid food index. Predictable invertebrate supply is the ratio of behavioral drifters (filtering and gathering collectors) to accidental drifters (scrapers, shredders and predators). Based on a threshold of >0.50 for predictable supply (Rabenil *et al*, 2005).

Site	Type	Location	Behavioral drifters/accidental drifters	Predictable Vs Unpredictable
N1	Riffle	Receptor	0.64	Predictable
N2	Glide	Receptor	0.12	Unpredictable
N3	Pool	Receptor	0.07	Unpredictable
N4	Pool	Reference	0.15	Unpredictable
N5	Glide	Reference	0.14	Unpredictable
N6	Riffle	Reference	0.26	Unpredictable

Figure 5 Variation of the BMWP Score, Trent Biotic Index and Chandler Biotic Index at the six survey sites.



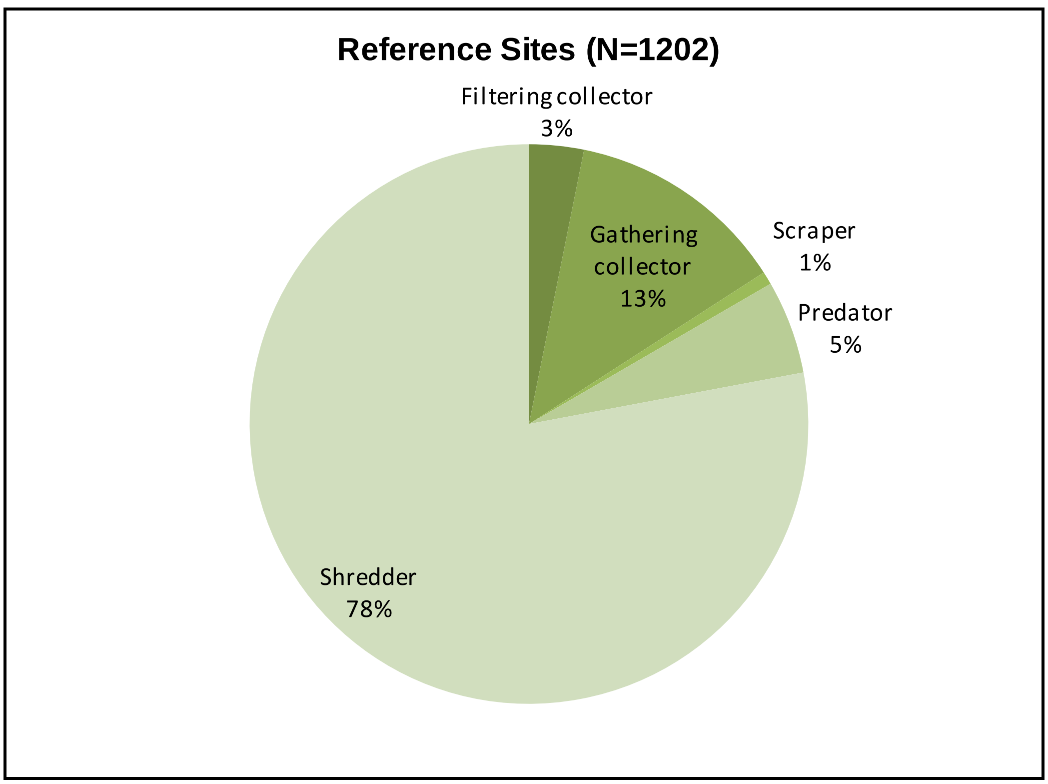


Figure 6 Overall Functional Group Analyses of macroinvertebrates collected from receptor and reference sites sampled on the River Nanny during June 2016.

3.7 Toxicology

The toxicity results indicate that the discharge from the Irish Cement Plant is non-toxic to two trophic levels. The results of the *Daphnia magna* bioassay and the Microtox system are outlined below.

3.7.1 Daphnia magna Bioassay

This test was deemed to be valid given that there was greater than 90% survival in the controls indicating that the animals and testing conditions were satisfactory (UK Environment Agency, 2007). Survival across the concentration series of effluent was 100% demonstrating that the effluent is non-toxic to D. magna. No LC50 value was generated for this bioassay due to the non-toxic nature of the effluent. Results of this bioassay are displayed in Figure 7. A concurrent reference toxicant bioassay using zinc sulphate was carried out alongside the effluent bioassay. This bioassay produced an EC50 of 3.7 mg/L of zinc sulphate, this EC50 value is in agreement with previously published data for D. magna (US EPA, 2007) and with ongoing toxicity testing at the ASU. This indicates that the animals were of suitable sensitivity to be used for toxicity testing. Water quality measurements in the test chambers remained within normal limits for the duration of the bioassay. These data are presented in Appendix 4.

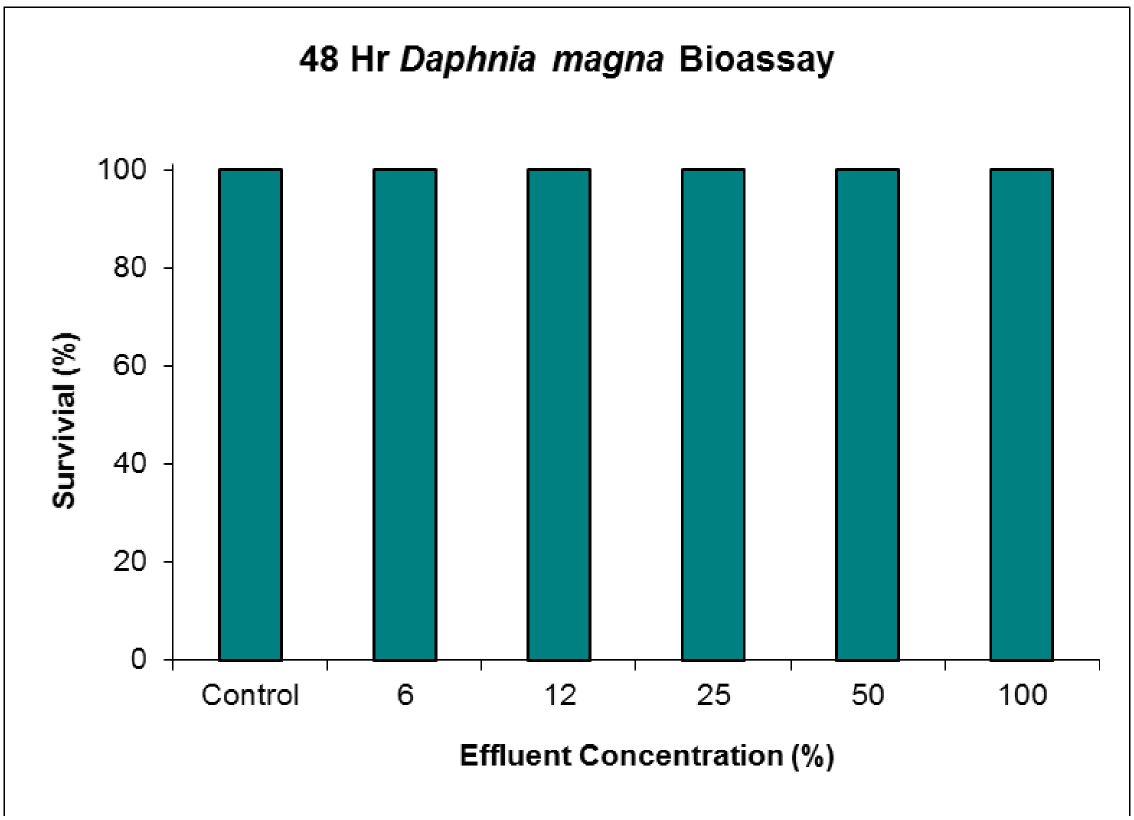


Figure 7 Average survival of *Daphnia magna* after 48 hours in a concentration series of the Irish Cement trade effluent.

3.7.2 Vibrio fischeri bacteria bioassay using Microtox system

The Microtox bioassay carried out was deemed to be valid. A reference toxicant test was carried out before actual testing of samples took place to ensure that the bacterium and reagents were suitable for testing. The reference toxicant using the Zinc++ ion determined an EC50 of 1.19 mg Zn++/L after 15 minutes exposure. This is within the guideline range of 0.6-2.2 mg Zn++/L as specified by the Microtox manufacturer (Azur Environmental, 1995). These data are presented in Appendix 4.

No toxicity was observed between the controls and throughout the effluent concentration series. No significant decrease in light production was observed in any of the concentrations during the test. Some minor light stimulation was observed in all of the concentrations tested. Similar light stimulation has been shown to occur in other non-toxic samples and is an artefact of testing method. ASU have tested non-toxic blank samples (containing de-ionized water and osmotic adjusting solution) and recorded similar results. Based on the supporting data from the other bioassay it appears that this sample is also non-toxic using the Microtox system. The data for the effluent test are presented in Figure 8.

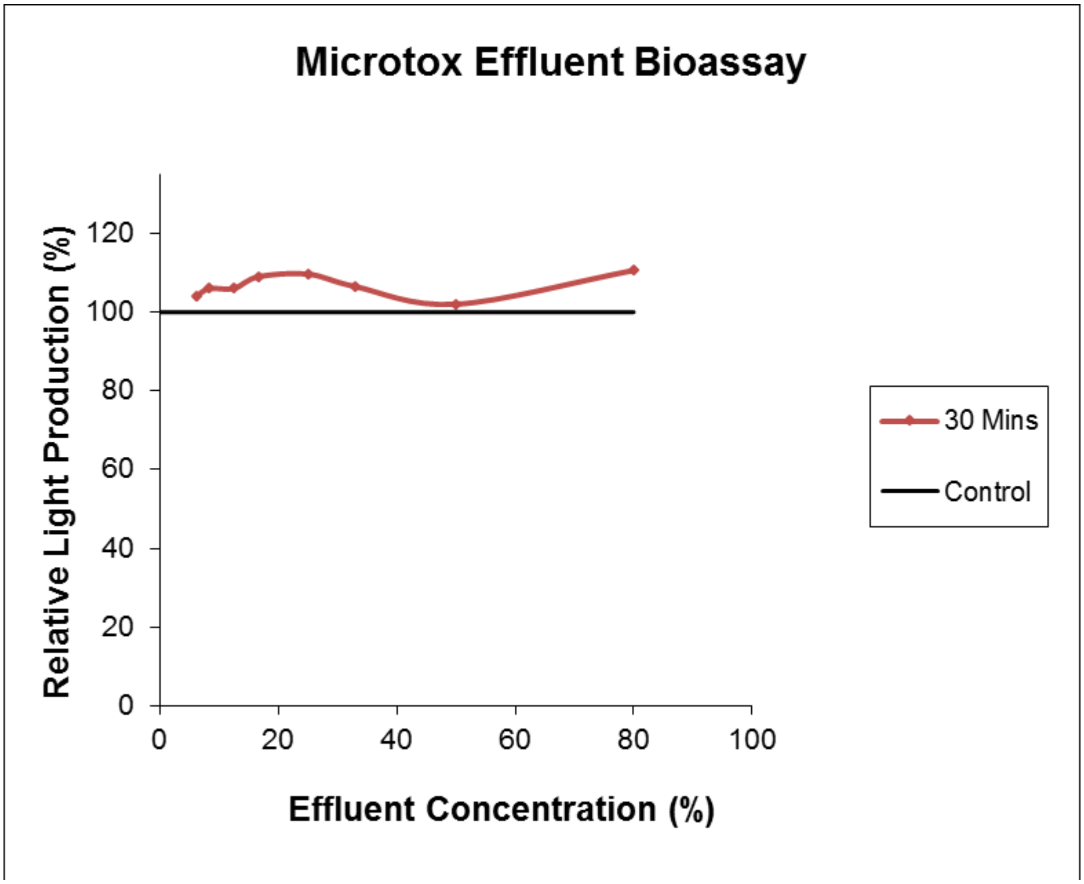


Figure 8 Plot of the Microtox results for Ecofact Nanny effluent sample on 07/07/16. Values represent light production relative to the controls. The highest concentration of effluent tested was 80%.

4. SUMMARY AND CONCLUSIONS

The macroinvertebrate community and sediments at six sites located within 500m upstream and downstream of the Irish Cement trade discharge outflow were investigated during June 2016. These sites selected were at the same locations as in previous surveys undertaken in between 2008 and 2015.

The entire River Nanny was in an unsatisfactory ecological condition when most recently monitored by the EPA in September 2014. The current river status of all watercourses in the Nanny catchment is either 'Poor' or 'Moderate'. The problems in the River Nanny are high nutrient concentration (Phosphorus, Ammonia, issues with level of oxygen in water) resulting in low ecological Rating. The cause of these pressures have been identified as agriculture, wastewater and industrial discharges, and septic tanks (ERDB, 2010).

Based on the current observations and during analysis of the data collected during 2016, there was no evidence to imply that the Irish Cement trade effluent was impacting on the substrate composition in the River Nanny, particular with reference to smaller sized materials. Substrates sampled at all sites were found to be dominated by sand of varying size. The primary concern with respect to the Irish Cement trade effluent is fine particles such as fine sands and silt/clay. There is no evidence that the proportion of these finer particles was elevated in the river Nanny downstream of the discharge point. The nearest sites to the discharge point are the pool sites N3 and N4. Any changes to the substrate composition owing to the discharge would be most obvious by comparison at these locations. In general, however, there was little disparity between the PSD at the pool sites upstream and downstream of the discharge, variation between sample sites N4 and N3 never being greater than 2% for particles less than 0.6mm. The most prominent difference between sites upstream and downstream was the greater fraction of finer particles at N5 when compared to its corresponding site N3 downstream. A considerable coat of silt was noted in the river both upstream and downstream of the discharge point. Such was the degree of siltation that a dense plume of sediment was released into the water column when kick sampling was performed at each site. Based on underwater observations of the river, there was no discernible difference in substrate siltation in the River Nanny upstream and downstream of the discharge point. The visual quality (clarity) of trade effluent from the Irish Cement was seen be much greater than the River Nanny when the river was visited during the current survey. However, overall it is concluded that the trade effluent from the Irish Cement Plant is not negatively impacting on the composition of the substrate in the river.

The diversity and abundance levels of macroinvertebrates recorded at all sites were considered to be typical of an organically polluted lowland Irish river. The macroinvertebrate fauna largely comprised pollution tolerant organisms such as freshwater shrimp *Gammarus duebeni,* mayfly larvae of *E. ignita,* Dipteran larvae of chironomids and the snail *Bithynia tentaculata.* There has been a slight decrease in the macroinvertebrate family richness of the surveyed stretch of the river since the previous surveys. Previously recorded pollution sensitive mayfly larvae of *Ecdyonurus* sp. were not found during the current assessment along with Group B cased caddisfly larvae of *Limnephilus lunatus, L. flavicornis,* or the pollution tolerant snail *Planorbis carinatus*. A changing macroinvertebrate composition as such indicates an aquatic environment in a state of instability and stress.

Water pollution in the River Nanny continues to be problem with algal growths and siltation obvious all along the surveyed stretch of the river. In previous assessments carried out in 2014 and 2015, the status of the river was also found to be moderate, corresponding with the most recent EPA biological water quality monitoring results. Since 2014, there has been no change in the biological water quality, with the rating of all sites remaining unsatisfactory 'Moderately Polluted (Q3)', corresponding to WFD 'Poor status'.

Based on the current macroinvertebrate samples, BMWP scores at all sites were below 100. This is the first incidence of such a result since the BMWP biotic index was used to determine water quality in the study area. Using BMWP scores, there was no indication that the trade effluent discharge was impacting biological water quality, the average BMWP downstream of the discharge being 80. An average BWP of 74 was recorded for the three upstream reference sites. ASPT scores are considered more robust and unambiguous than BMWP scores. All of the sites surveyed recorded an ASPT score of 5.5 or below (scores equal to or above 5.5 are reflective of good water quality). Chandler biotic index values at all sites were well below the score of 80 (representative of unpolluted sites). The mean Chandler biotic index scores at receptor sites and reference sites was 45.3 and 45.0 respectively. Trent biotic index scores at all locations ranged from 6 to 8 and were collectively higher at the receptor sites by a negligible margin. Based on family diversity, BMWP, Trent and Chandler scores, there is no evidence to indicate that biological water quality is adversely affected downstream of the Irish Cement trade effluent discharge point.

Shredding macroinvertebrates were the most common functional feeding group at both the reference and receptor sites. Shredders specialise in the consumption of organic matter deriving from inputs such as leaves. Changes in functional groups reflect changes in food sources, nutrient processing and energy flow in the river system. The increase in the relative abundance of shredders and the low relative abundance of scrapers signify a shift away from primary instream production that would indicate a balanced and healthy aquatic ecosystem. The P/R ratio at all sites examined was very low as in previous surveys. This indicates that the River Nanny is highly heterotrophic. The scarcity of macroinvertebrate scrapers is a reflection of unsatisfactory water quality and supporting habitats at all of the sites investigated. In the current survey, there was insignificant difference between reference and receptor sites with regard to P/R ratios, especially considering the low P/R ratios (maximum of 0.165) and relatively high heterotrophic-autotrophic threshold of 0.75. The current results indicate that there is no discernible change in primary production taking place within the River Nanny downstream of the Irish Cement discharge.

The functional group analysis results suggest that there is an ‘Unpredictable’ juvenile salmonid food supply at all sites surveyed with the exception of Site N1. The generally 'Unpredictable' food supply result was brought about by the high proportion of shredders (mainly *Gammarus duebeni*). Other factors such as impaired water quality, including siltation does not suit salmonid production in the surveyed stretch of the river.

Toxicology testing was carried out on two different trophic levels using trade effluent from the Irish Cement plant. Toxicology test results showed that the effluent is non-toxic to the organisms tested. It is considered therefore that the discharge from the Irish Cement plant to the River Nanny does not adversely affect the ecology of River Nanny with respect to toxicity. In the way that lower trophic organisms are not affected by the discharge, it is considered also that the discharge does not adversely affect fauna higher in the food chain, such as macroinvertebrates recorded while biological sampling and fish supported by these. According to Chapman (1995), different views in the form of tools such as toxicity tests and field studies, together provide the best overall perspective. With regard to this approach, it is also deduced from the macroinvertebrate field sampling that the discharge is Non-Toxic. In combination with the results of the macroinvertebrate assemblages and functional group analyses, it is considered that the discharge is not adversely impacting aquatic ecology within the River Nanny.

The River Nanny is in the Eastern River Basin District. In the Programme of Measures for the River Nanny Water Management Unit (WMU), the main pressure preventing achievement of Good Status is diffuse agricultural and septic tank pollution (ERBD, 2009). In this water management unit, naturally high levels of nutrients in the ground may also be an issue. The target date for achievement of 'Good status' in the River Nanny catchment has been set back to 2027. Based on the monitoring carried out between 2008 and 2016 for the Irish Cement trade effluent discharge, there appears to be no catchment wide changes bringing about improvements in the River Nanny as of yet.

The macroinvertebrate community and structure along the surveyed stretch of river changes from year to year with only pollution tolerant indicators continuing to exist in successive surveys. This changing state of the river is indicative of background pressures on aquatic ecology, and not related to the Irish Cement discharge.

The trade effluent from the Irish Cement plant does not appear to be adversely affecting BOD, hardness, Dissolved Oxygen (D.O.) in the River Nanny, as indicated by water quality results from samples taken upstream and downstream of the discharge. In fact, Dissolved Oxygen (D.O.) in the discharge was very close to 100%, the ideal saturation concentration. Organic compounds and Heavy Metals were not present in the sample of the discharge at a level considered harmful to the aquatic environment.

The results confirm that macroinvertebrate communities, biological water quality and sediment levels in the River Nanny are not significantly different upstream and downstream of the trade effluent from the Irish Cement plant. The discharge is considered to be having a neutral impact on the aquatic ecology of local areas of the River Nanny.

5 RECOMMENDATIONS

Biological monitoring of the River Nanny upstream and downstream of the discharge should be maintained in order to monitor the impact of the discharge on aquatic ecology. Similarly, the composition of substrates in the river should be monitored and Irish Cement Ltd. should continue monitoring chemical water quality upstream and downstream of trade effluent discharge on the River Nanny.

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PLATES

Plate 1 Site N1: receptor riffle site downstream of the weir (NOS grid ref O07976 69254). Water sampling was undertaken at N1 and N6.

Plate 2 Site N2: receptor pool site downstream of the outfall (NOS grid ref O07865 69186).

Plate 3 Site N3: receptor glide site (NOS grid ref O07783 69171).

Plate 4 Site N4: reference pool site (NOS grid ref O07589 69186).

Plate 5 Site N5: reference glide site (NOS grid ref O07537 69165).

Plate 6 Site N6 was located immediately downstream of the minor road bridge to Bellewstown (NOS grid ref O07349 69166).

Plate 7 Irish Cement plant at Platin, Duleek, Co. Meath.

Plate 8 Irish Cement trade effluent outfall to the River Nanny. Sampling of the effluent was undertaken at this location adjacent to the River Nanny (ca. 100 south of the R150).

Plate 9 Biological sampling at Site N61 in the River Nanny.

Plate 10 Biological sampling at each site included sweep netting through submerged aquatic vegetation. Seen above is Site N2.

Plate 11 Particle size distribution sample from Site N1 showing the trowel used to obtain the substrate samples.

Plate 12 Reading Conductivity of the discharge to the River Nanny.

Plate 13 Pollution tolerant freshwater shrimp *Gammarus duebeni* occurs in the subject stretch of the River Nanny at levels indicative of a stressed aquatic ecosystem.

Plate 14 Larvae of *Sericostoma personatum* from the macroinvertebrate sample taken at Site N3.

Plate 15 Larvae of the less sensitive Banded jewelwing *Agrion splendens* recorded at N3.

Plate 16 Larvae of the very pollution tolerant bloodworm *Chironomous* sp. and tolerant green chironomid recorded at Site N2.

Plate 17 Juvenile Eel *Anguilla anguilla* and Three-spined Stickleback *Gasterosteus aculeatus* recorded in the River Nanny at Site 1 during the June 2015 biological sampling.

Plate 18 Juvenile Brown Trout recorded during biological sampling at Site 1.

Plate 19 Nine-spined Stickleback *Pungitius pungitius* was among the fish species recorded during the current sampling.

Plate 20 Minnow *Phoxinus phoxinus* recorded at Site 6.

Plate 21 Filamentous algae *Cladophora sp.* growing in the River Nanny at Site N2.

Plate 18 Temperature controlled photometer apparatus used to test for bioluminescence of *Vibrio fischeri* in the 30 min EC_{50} test.

Appendix 1 Biotic Indices.

Table A1.1 Biological River Quality Classification (Q-Values).

'Q' value	Community Diversity	Water Quality	Condition*	Status	Quality
Q5	High	Good	Satisfactory	Unpolluted	Class A
Q4	Reduced	Fair	Satisfactory	Unpolluted	Class A
Q3	Much Reduced	Doubtful	Unsatisfactory	Slightly Polluted	Class B
Q2	Low	Poor	Unsatisfactory	Moderately Polluted	Class C
Q1	Very Low	Bad	Unsatisfactory	Seriously Polluted	Class D

* *'Condition' refers to the likelihood of interference with beneficial or potential beneficial use.*

The connection between the Q-rating system and the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) is given in Table A1.2 below.

Table A1.2 Water Framework Directive (WFD) ecological status classification and corresponding Q-rating.

Ecological status classification	Corresponding Q-rating
High	Q5, Q4-5
Good	Q4
Moderate	Q3-4
Poor	Q3, Q2-3
Bad	Q2, Q1

Table A1.3 BMWP Scoring System.

BMWP score	Category	Interpretation
0-10	Very poor	Heavily polluted
11-40	Poor	Polluted or impacted
41-70	Moderate	Moderately impacted
71-100	Good	Clean but slightly impacted
>100	Very good	Unpolluted, unimpacted

Table A1.4 Trent Biotic Index.

Trent Index	BOD (mg/l)	Status
9-10	2	Very Clean
7-10	2-3	Clean
6-8	2-3	Clean
5-6	3-5	Fairly Clean
3-5	5-10	Doubtful
2-4	5-10	Doubtful
1-3	10+	Bad
0-1	10+	Bad

Appendix 2 EPA Water Quality Data for the River Nanny

Table A2.1 Water quality in the River Nanny along with overall water quality in hydrometric area 8 (adapted from Clabby *et al.* 2008).

Catchment	Class A	Class B	Class C	Class D	Total (km)
Hydrometric Area 8 (km)	22.5	23	70	6.5	122
Hydrometric Area 8 (%)	18.4	18.9	57.4	5.3	100
Nanny (km)	6.5	12	9.5	-	28
Nanny (%)	23.2	42.9	33.9	-	100

Table A2.2 Biological Water Quality in the River Nanny (EPA Code 08N01). Data taken from the EPA website.

Station No.	Station location	Biological water quality ratings (Q-value)											
		1980	1982	1986	1988	1991	1996	1998	2001	2005	2008	2010	2014
0040	Folistown Br	-	-	-	-	-	2-3	2-3	2	2-3	3	3	3
0090	East Bridge, S. of Brownstown	-	-	-	2-3	2-3	-	-	-	-	-	-	-
0100	West Br Kentstown	-	-	-	-	-	-	-	-	-	-	-	-
0110	East Bridge, Kentstown	-	-	-	3	3	3	2-3	2-3	2-3	2-3	3	3
0200	Br just S. of Balrath X-Roads	3-4	2-3	3	3-4	3-4	-	-	-	-	-	-	-
0280	Bridge d/s Nanny Bridge	-	-	-	3	3	3	3-4	3-4	4	4	3-4	3
0300	Bridge near Deenes	3	1-2	2	-	3	-	-	-	-	-	-	-
0400	Upstream Bridge, Duleek	3-4	4	3-4	2-3	3	-	-	-	-	-	-	-
0500	Bridge N.E. of Bellewstown Ho	3	3-4	3-4	3	3-4	3	3-4	3-4	3-4	3	3-4	3-4
0600	Beaumont Bridge	3-4	3	3-4	3	-	-	-	-	-	-	-	-
0650	Dardistown Bridge	-	-	3-4	3-4	3-4	4	4	3	-	-	-	-
0700	Bridge at Julianstown	3	3-4	3-4	3-4	3	3-4	3-4	3	3-4	3-4	3	3-4

2014 EPA Assessment of the River Nanny: The Nanny River is unsatisfactory along the entire length surveyed. Since the 2010 survey, there has been a slight improvement at Station 0700, but a slight decline in quality at Station 0280.

Appendix 3 Test Reports for the discharge

Table A3.1 Hydrocarbon results from the sample taken of the Irish Cement discharge on 24th June 2016. (ISO17025 Accredited).

Hydrocarbon	LOD/Units	Results	Method
TPH / Oil and Greases	<1 mg/l	<1	TM235
Mineral Oil	<1 mg/l	<1	TM235

Table A3.2 Heavy Metal results from the sample taken of the Irish Cement discharge on 24th June 2016. (ISO17025 Accredited).

Heavy Metal	Units	Results	E.Q.S S.I. No.272 of 2009	Method
Arsenic	0.12µg/l	0.814µg/l	<25µg/l	TM152
Cadmium	0.1µg/l	<0.1µg/l		TM152
Chromium	0.22µg/l	4.02µg/l		TM152
Copper	0.85µg/l	<0.919µg/l	5µg/l	TM152
Lead	0.02µg/l	0.05µg/l	7.2µg/l	TM152
Nickel	0.15µg/l	1.33µg/l	20µg/l	TM152
Selenium	0.39µg/l	3.57µg/l		TM152
Zinc	0.41µg/l	0.41µg/l		TM152

Table A3.3 BOD (Biochemical Oxygen Demand) and Total Hardness results from Sites N1 and N6 on the River Nanny, sample taken on 24th June 2016. (ISO17025 Accredited = #).

	N1	N6	Method
BOD (mg/l) #	<1	<1	TM045
Total hardness (mg/l) #	282	302	TM228
Conductivity (µS/cm)	356	403	

Table A3.4 On - site chemical results from the sample of the discharge taken on 24th June 2016.

Parameter and units	Results
Dissolved Oxygen (%)	99.2
Dissolved Oxygen (mg/l)	10.01
Conductivity (µS/cm)	560
Temperature (°C)	14.8

Appendix 4 Sediment PSD results

ALcontrol Laboratories

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: mkt@alcontrol.com
Website: www.alcontrol.com

Ecofact Environmental Consultants Ltd
Tait Business Centre
Limerick

Attention: William O'Connor

CERTIFICATE OF ANALYSIS

Date:	12 July 2016
Customer:	D_ECOFACT_LIM
Sample Delivery Group (SDG):	160625-30
Your Reference:	
Location:	River Nanny
Report No:	368682

This report has been revised and directly supersedes 368675 in its entirety.

We received 9 samples on Saturday June 25, 2016 and 9 of these samples were scheduled for analysis which was completed on Tuesday July 12, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan
Operations Manager

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CERTIFICATE OF ANALYSIS

Validated

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13657456	DISCHARGE			24/06/2016
13657454	N1			24/06/2016
13657455	N6			24/06/2016
13657446	NANNY N1			24/06/2016
13657447	NANNY N2			24/06/2016
13657449	NANNY N3			24/06/2016
13657450	NANNY N4			24/06/2016
13657451	NANNY N5			24/06/2016
13657453	NANNY N6			24/06/2016

Only received samples which have had analysis scheduled will be shown on the following pages.

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CERTIFICATE OF ANALYSIS

Validated

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

LIQUID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)			13657456			13657454		13657455	
Customer Sample Reference			DISCHARGE			N1		N6	
AGS Reference									
Depth (m)									
Container			0.5l glass bottle	Dissolved Metals	HNO3 Filtered	1plastic (ALE221)	250ml BOD (ALE212)	1plastic (ALE221)	250ml BOD (ALE212)
BOD True Total	All	NDPs: 0 Tests: 2					X		X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1			X				
Mercury Dissolved	All	NDPs: 0 Tests: 1		X					
Metals by iCap-OES Unfiltered (W)	All	NDPs: 0 Tests: 2				X		X	
TPH by IR Oils and Greases	All	NDPs: 0 Tests: 1	X						

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CERTIFICATE OF ANALYSIS

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)		13657446	13657447	13657449	13657450	13657451	13657453
Customer Sample Reference		NANNY N1	NANNY N2	NANNY N3	NANNY N4	NANNY N5	NANNY N6
AGS Reference							
Depth (m)							
Container		1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB
Passing Through >63µm sieve	All	NDPs: 0 Tests: 6	X	X	X	X	X	X
Sample description	All	NDPs: 0 Tests: 6	X	X	X	X	X	X

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CERTIFICATE OF ANALYSIS

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

Results Legend

- \# ISO17025 accredited.
- M *m*CERTS accredited.
- aq Aqueous / settled sample.
- diss.filt Dissolved / filtered sample.
- tot.unfilt Total / unfiltered sample.
- * Subcontracted test.
- ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
- (F) Trigger breach confirmed
- 1-5&+§@ Sample deviation (see appendix)

Customer Sample Ref.			DISCHARGE	N1	N6	NANNY N1	NANNY N2	NANNY N3
Depth (m)			-	-	-	-	-	-
Sample Type			Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Soil/Solid	Soil/Solid	Soil/Solid
Date Sampled			24/06/2016	24/06/2016	24/06/2016	24/06/2016	24/06/2016	24/06/2016
Sample Time			-	-	-	-	-	-
Date Received			25/06/2016	25/06/2016	25/06/2016	25/06/2016	25/06/2016	25/06/2016
SDG Ref			160625-30	160625-30	160625-30	160625-30	160625-30	160625-30
Lab Sample No.(s)			13657456	13657454	13657455	13657446	13657447	13657449
AGS Reference								
Component	**LOD/Units**	**Method**						
BOD, unfiltered	<1 mg/l	TM045		<1 #	<1 #			
Arsenic (diss.filt)	<0.12 µg/l	TM152	0.814 #					
Cadmium (diss.filt)	<0.1 µg/l	TM152	<0.1 #					
Chromium (diss.filt)	<0.22 µg/l	TM152	4.02 #					
Copper (diss.filt)	<0.85 µg/l	TM152	0.919 #					
Lead (diss.filt)	<0.02 µg/l	TM152	0.05 #					
Nickel (diss.filt)	<0.15 µg/l	TM152	1.33 #					
Selenium (diss.filt)	<0.39 µg/l	TM152	3.57 #					
Zinc (diss.filt)	<0.41 µg/l	TM152	<0.41 #					
Mercury (diss.filt)	<0.01 µg/l	TM183	<0.01 #					
Hardness, Total as CaCO3 unfiltered	<0.35 mg/l	TM228		282	302			
TPH / Oil & Greases	<1 mg/l	TM235	<1 #					
Mineral Oil	<1 mg/l	TM235	<1					
Moisture Content Ratio (% of as received sample)	%	PM024				24	28	23

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Validated

CERTIFICATE OF ANALYSIS

SDG: 160625-30
Job: D_ECOFACT_LIM-1
Client Reference:

Location: River Nanny
Customer: Ecofact Environmental Consultants Ltd
Attention: William O'Connor

Order Number:
Report Number: 368682
Superseded Report: 368675

Results Legend
ISO17025 accredited.
M mCERTS accredited.
aq Aqueous / settled sample.
diss.filt Dissolved / filtered sample.
tot.unfilt Total / unfiltered sample.
* Subcontracted test.
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F) Trigger breach confirmed
1-5&+§@ Sample deviation (see appendix)

Customer Sample Ref.			NANNY N4	NANNY N5	NANNY N6			
Depth (m)			-	-	-			
Sample Type			Soil/Solid	Soil/Solid	Soil/Solid			
Date Sampled			24/06/2016	24/06/2016	24/06/2016			
Sample Time			-	-	-			
Date Received			25/06/2016	25/06/2016	25/06/2016			
SDG Ref			160625-30	160625-30	160625-30			
Lab Sample No.(s)			13657450	13657451	13657453			
AGS Reference								
Component	**LOD/Units**	**Method**						
Moisture Content Ratio (% of as received sample)	%	PM024	22	38	22			

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CERTIFICATE OF ANALYSIS

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM008	BS 1377:Part 1977	Particle size distribution of solid samples		
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM191	Standard Methods for the examination of waters and wastewaters 16th Edition, ALPHA, Washington DC, USA. ISBN 0-87553-131-8.	Determination of Unfiltered Metals in Water Matrices by ICP-MS		
TM228	US EPA Method 6010B	Determination of Major Cations in Water by iCap 6500 Duo ICP-OES		
TM235	The Determination of Hydrocarbon Oils in Waters by Solvent Extraction, Infra red Absorption and Gravimetry 1983, HMSO, London	Determination of Total Petroleum Hydrocarbons (TPH) in Waters By Infra-Red Spectroscopy		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

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CERTIFICATE OF ANALYSIS

SDG: 160625-30
Job: D_ECOFACT_LIM-1
Client Reference:

Location: River Nanny
Customer: Ecofact Environmental Consultants Ltd
Attention: William O'Connor

Order Number:
Report Number: 368682
Superseded Report: 368675

Test Completion Dates

Lab Sample No(s)	13657456	13657454	13657455	13657446	13657447	13657449	13657450	13657451	13657453
Customer Sample Ref.	DISCHARGE	N1	N6	NANNY N1	NANNY N2	NANNY N3	NANNY N4	NANNY N5	NANNY N6
AGS Ref.									
Depth									
Type	LIQUID	LIQUID	LIQUID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
BOD True Total		30-Jun-2016	30-Jun-2016						
Dissolved Metals by ICP-MS	05-Jul-2016								
Mercury Dissolved	04-Jul-2016								
Metals by iCap-OES Unfiltered (W)		29-Jun-2016	29-Jun-2016						
Passing Through >63µm sieve				12-Jul-2016	05-Jul-2016	05-Jul-2016	05-Jul-2016	05-Jul-2016	05-Jul-2016
Sample description				01-Jul-2016	01-Jul-2016	01-Jul-2016	01-Jul-2016	01-Jul-2016	01-Jul-2016
TPH by IR Oils and Greases	05-Jul-2016								

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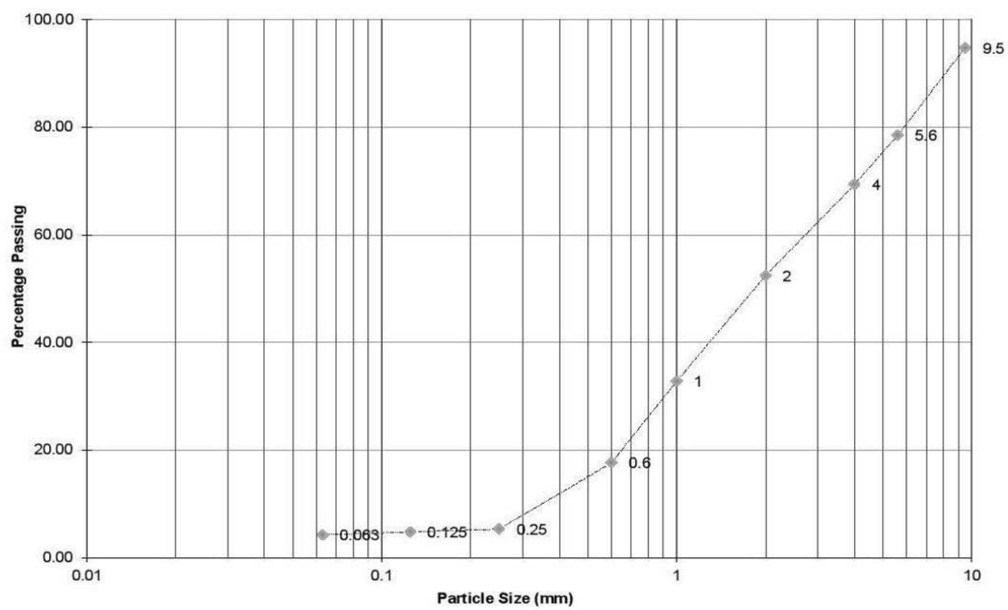
WS-701_1 ISSUED 30/05/2014

Particle Size Distribution

Particle Size (mm)	% Passing
9.5	94.73
5.6	78.46
4	69.36
2	52.42
1	32.78
600um	17.62
250um	5.31
125um	4.76
63um	4.18

Sample Number 13687973
Client D_ECOFACT_LIM
Sample ID NANNY N3
depth 0.00



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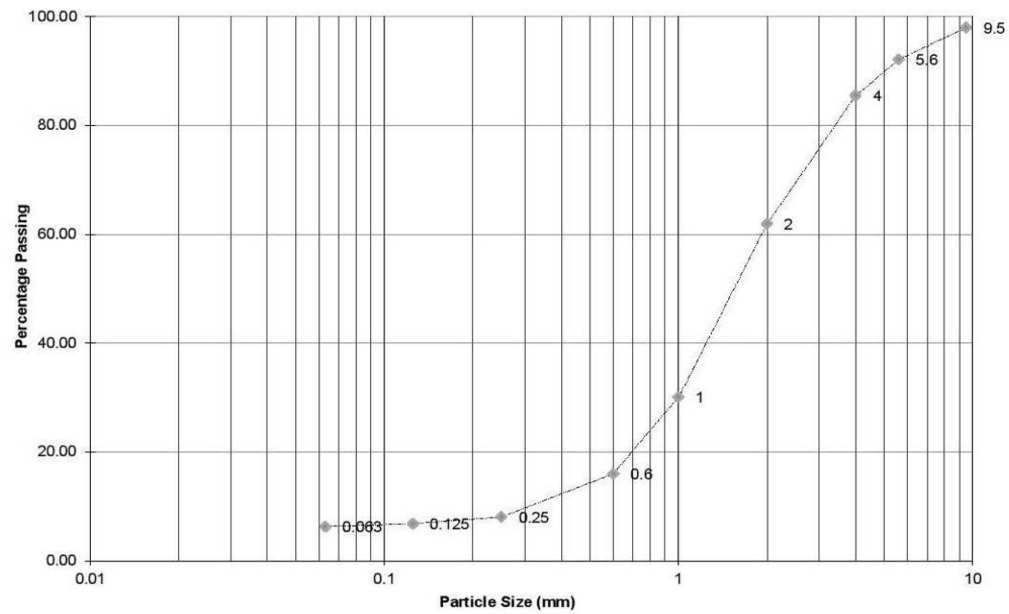
WS-701_1 ISSUED 30/05/2014

Particle Size Distribution

Particle Size (mm)	% Passing
9.5	97.95
5.6	92.04
4	85.45
2	61.86
1	30.06
600um	15.96
250um	8.01
125um	6.78
63um	6.23

Sample Number 13688006
Client D_ECOFACT_LIM
Sample ID NANNY N2
depth 0.00



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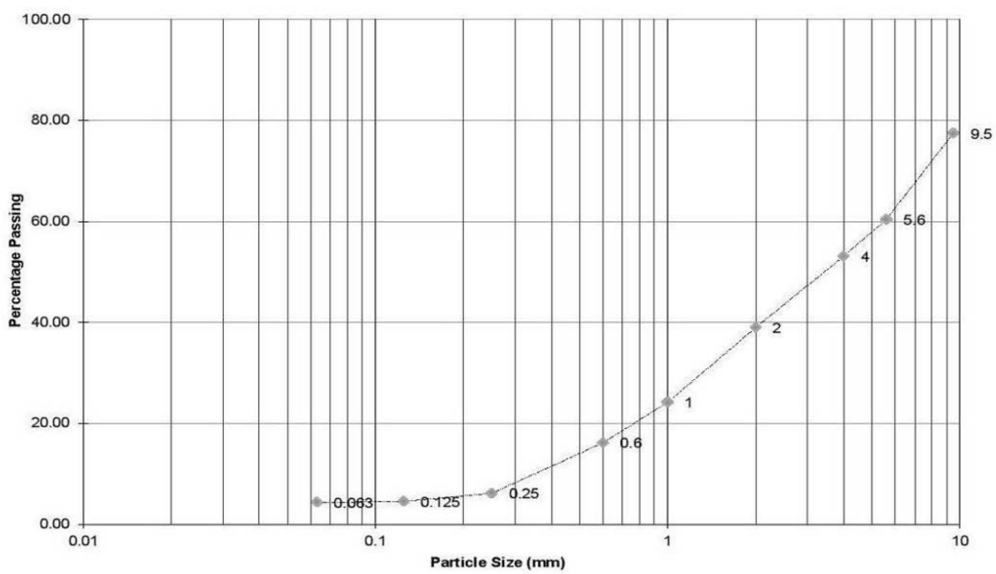
WS-701_1 ISSUED 30/05/2014

Particle Size Distribution

Particle Size (mm)	% Passing
9.5	77.42
5.6	60.36
4	53.07
2	38.94
1	24.18
600um	16.08
250um	6.09
125um	4.49
63um	4.34

Sample Number 13691980
Client D_ECOFACT_LIM
Sample ID NANNY N4
depth 0.00



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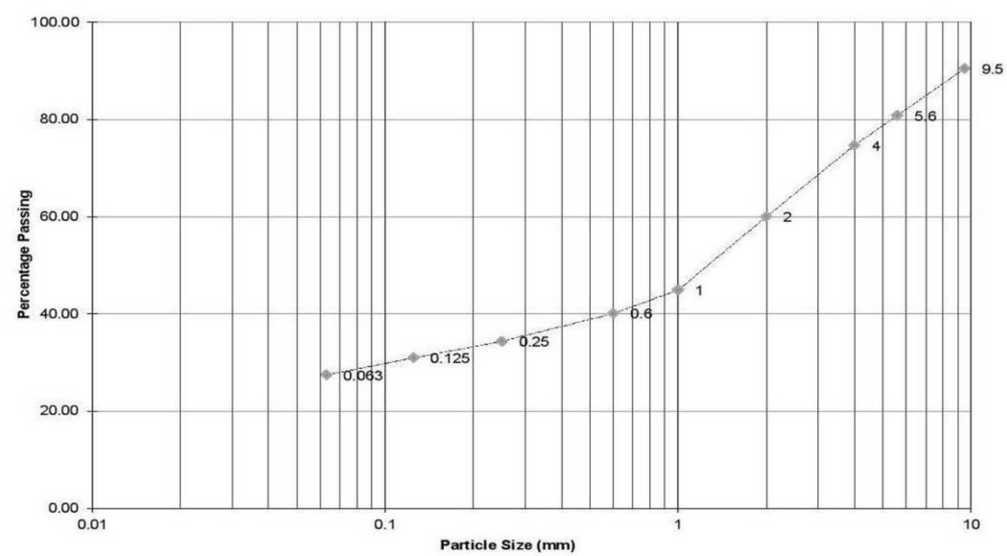
WS-701_1 ISSUED 30/05/2014

Particle Size Distribution

Particle Size (mm)	% Passing
9.5	90.46
5.6	80.80
4	74.69
2	59.97
1	44.91
600um	40.06
250um	34.32
125um	30.94
63um	27.43

Sample Number 13692150
Client D_ECOFACT_LIM
Sample ID NANNY N5
depth 0.00



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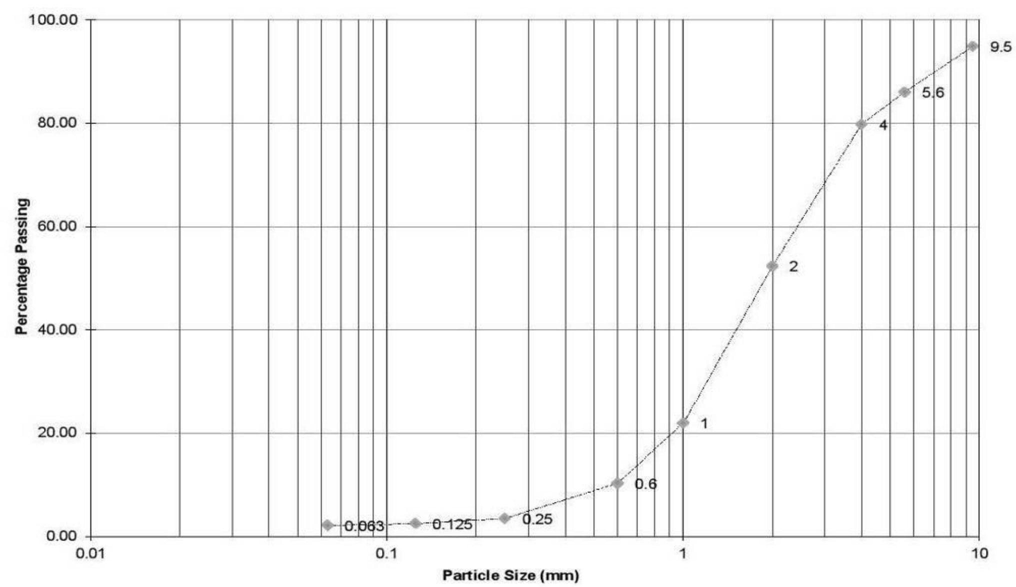
Particle Size Distribution

Particle Size (mm)	% Passing
9.5	94.83
5.6	86.02
4	79.78
2	52.32
1	21.91
600um	10.27
250um	3.42
125um	2.46
63um	2.11

Sample Number 13692222
Client D_ECOFACT_LIM
Sample ID NANNY N6
depth 0.00



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CERTIFICATE OF ANALYSIS

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

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

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt 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. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

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

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
•	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than:
- Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

13:34:24 12/07/2016 Modification Date: 12/07/2016

Appendix 5 Toxicology results

Table A5.1 Water Quality Measurements for 48 Hour *Daphnia magna* Bioassay.

48 Hour Daphnia Bioassay

Ecofact Nanny Eff 05/07/16

Concentration (%)	Survival			D.O (mg/L)			pH			Conductivity(µS/cm)			Temp (ºC)		
	0hrs	24hrs	48hrs	0hrs	24hrs	48hrs	0hrs	24hrs	48hrs	0hrs	24hrs	48hrs	0hrs	24hrs	48hrs
Control A	5	5	5	11.6		10.3	8.39		8.13	341		347	19.0	20.1	20.5
Control B	5	5	5	116.6		10.3	8.39		8.13	341		347	19.0	20.1	20.5
Control C	5	5	5	11.6		10.3	8.39		8.13	341		347	19.0	20.1	20.5
Control D	5	5	5	11.6		10.3	8.39		8.13	341		347	19.0	20.1	20.5
6.25A	5	5	5	11.4		10.3	8.43		8.27	366		370	19.0	20.1	20.5
6.25B	5	5	5	11.4		10.3	8.43		8.27	366		370	19.0	20.1	20.5
6.25C	5	5	5	11.4		10.3	8.43		8.27	366		370	19.0	20.1	20.5
6.25D	5	5	5	11.4		10.3	8.43		8.27	366		370	19.0	20.1	20.5
12.5A	5	5	5	11.6		10.2	8.35		8.29	387		375	19.0	20.1	20.5
12.5B	5	5	5	11.6		10.2	8.35		8.29	387		375	19.0	20.1	20.5
12.5C	5	5	5	11.6		10.2	8.35		8.29	387		375	19.0	20.1	20.5
12.5D	5	5	5	11.6		10.2	8.35		8.29	387		375	19.0	20.1	20.5
25A	5	5	5	12.3		10.2	8.19		8.36	429		428	19.0	20.1	20.5
25B	5	5	5	12.3		10.2	8.19		8.36	429		428	19.0	20.1	20.5
25C	5	5	5	12.3		10.2	8.19		8.36	429		428	19.0	20.1	20.5
25D	5	5	5	12.3		10.2	8.19		8.36	429		428	19.0	20.1	20.5
50A	5	5	5	12.4		10.2	7.99		8.45	510		507	19.0	20.1	20.5
50A	5	5	5	12.4		10.2	7.99		8.45	510		507	19.0	20.1	20.5
50A	5	5	5	12.4		10.2	7.99		8.45	510		507	19.0	20.1	20.5
50B	5	5	5	12.4		10.2	7.99		8.45	510		507	19.0	20.1	20.5
100A	5	5	5	11.8		9.3	7.80		8.22	673		603	19.4	20.1	20.5
100B	5	5	5	11.8		9.3	7.8		8.22	673		603	19.4	20.1	20.5
100C	5	5	5	11.8		9.3	7.8		8.22	673		603	19.4	20.1	20.5
100D	5	5	5	11.8		9.3	7.8		8.22	673		603	19.4	20.1	20.5

Notes

Day 0 Initiated at 14.00 , animals less than 24hrs old in initiation

24hrs 9.40

48hrs Terminated test at 12.00

Testing performed by Aquatic Services Unit, ERI Building, Lee Rd., Cork

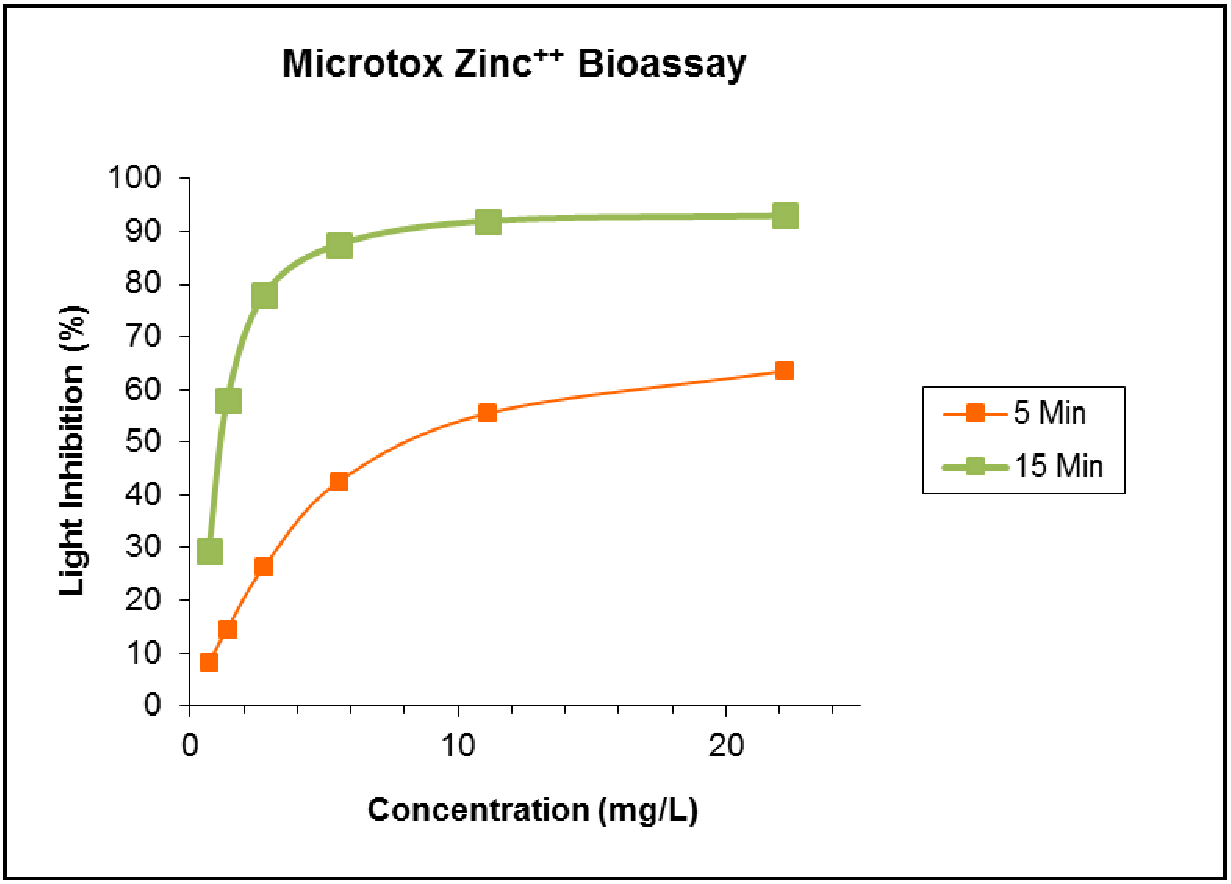


Figure A5.1 Plot of light inhibition relative to the controls versus zinc sulphate concentration after 5 and 15 minutes exposure.

Appendix 6.1

Groundwater Monitoring Data

Table A1 Analyses of Platin Groundwater for 2000 to 2016

				2000		2001		2002		2003		2004	
	Date	**EPA Interim Guideline Values**	**GW Regs 2010 Treshold Values**	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
	Report Ref												
	Lab												
Analyte	**Units**												
pH	units	-											
Conductivity	uS/cm	**1000**	**800-1875**										
Alkalinity	mg/l as CaCO3	-											
Calcium	mg/l	**200**		110	120	89	110	110	104	127	107	55	104
Magnesium	mg/l	**50**											
Potassium	**mgll**	**5**		**5.4**	**5**	**6.9**	2.7	**6**	4.4	4	3.6	3	2.8
Nitrite	mg/l as NO2	**0.1**	**0.0375**										
Nitrate	mg/l as NO3	**50**	**37.5**	19	18	6.3	17	22	23	27	20	21	23
Ammonia	mg/l as NH4	**0.15**		<0.05	<0.05	<0.1	<0.1	<0.05	<0.05	<0.05	<0.1	<0.05	<0.1
Chloride	**mgll**	**30**	**24-187.5**	36	35	36	34	44	31	34	27	32	28
Fluoride	mg/l	**1**											
Sulphate	mg/l	**200**	**187.5**	32	36	37	21	30	28	27	22	23	24
Sodium	mg/l	**150**	**150**	15	14	16	13	16	13	13	15	12	13
Bromide	mg/l	-											
Cadmium	ug/l	**5**	**3.75**	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	<0.0005	<0.005	<0.005
Cobalt	mg/l	-											
Copper	ug/l	**30**	**1500**	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	ug/l	**200**											
Lead	ug/l	**10**	**18.75**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02
Manganese	ug/l	**500**		<0.01	<0.01	<0.01	0.05	<0.01	<0.01	0.08	<0.01	<0.01	<0.01
Nickel	ug/l	**20**	**15**	<0.01	<0.01	<0.01	0.01	0.02	<0.01	<0.01	0.01	<0.01	<0.01
Tin	ug/l	-		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table A1 (continued) Analyses of Platin Groundwater for 2000 to 2016

				2005		2006		2007					2008	
	Date	**EPA Interim Guideline Values**	**GW Regs 2010 Treshold Values**	H1	H2	H1	H2	H1	21/11/2007	21/11/2007	10/12/2007	28/12/2007	H1	H2
	Report Ref													
	Lab													
Analyte	**Units**													
pH	units	-												
Conductivity	uS/cm	**1000**	**800-1875**											
Alkalinity	mg/l as CaCO3	-												
Calcium	mg/l	**200**		104	102	101	102	64.95	99.02	26.62	110.3	115.3	92.41	82.56
Magnesium	mg/l	**50**												10.37
Potassium	**mgll**	**5**		4.5	2.7	3.5	2.7	2.11	3.09	3.66	3.3	3.02	3.87	3.61
Nitrite	mg/l as NO2	**0.1**	**0.0375**											<0.003
Nitrate	mg/l as NO3	**50**	**37.5**	21	20	20	20	20.9	22.2	21.3	20.5	21.3	20.4	21.3
Ammonia	mg/l as NH4	**0.15**		<0.1	<0.1	<0.05	<0.1	<0.09	<0.09	<0.09	0.2	<0.09	<0.09	<0.06
Chloride	**mgll**	**30**	**24-187.5**	32	28	19	28	24.58	27.25	28.2	34	25.88	22.49	29.66
Fluoride	mg/l	**1**												
Sulphate	mg/l	**200**	**187.5**	24	20	24	20	31	25	25	34	26	28	26.2
Sodium	mg/l	**150**	**150**	16	12	12	12	10.63	14.77	15.68	15.12	16.3	13.63	9.62
Bromide	mg/l	-												
Cadmium	ug/l	**5**	**3.75**	<0.005	<0.005	<0.005	<0.005	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009
Cobalt	mg/l	-												<0.0002
Copper	ug/l	**30**	**1500**	<0.01	<0.01	<0.01	<0.01	0.002	0.012	0.008	0.007	0.006	0.009	0.004
Iron	ug/l	**200**												<0.0037
Lead	ug/l	**10**	**18.75**	<0.02	<0.02	<0.02	<0.02	<0.00038	0.003	0.004	0.003	0.002	0.003	<0.00038
Manganese	ug/l	**500**		<0.01	<0.01	<0.01	<0.01	0.021	0.121	0.109	0.014	0.012	0.092	0.0035
Nickel	ug/l	**20**	**15**	<0.01	<0.01	<0.01	<0.01	0.001	0.006	0.004	0.003	0.001	0.005	<0.00047
Tin	ug/l	-		<0.05	<0.05	<0.05	<0.05	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028

Table A1 (continued) Analyses of Platin Groundwater for 2000 to 2016

				2009		**2010**		**2011**		**2012**		**2013**		**2014**	
	Date	**EPA Interim Guideline Values**	**GW Regs 2010 Treshold Values**	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
	Report Ref							0090-553-03	0090-601-04	0090-632-01	0090-686-01	0090-762-01	0090-799-01		090/977/01
	Lab							Fitz	Fitz	Frtz	Fitz	Fitz	Fitz	Jones	Fitz
Analyte	**Units**														
pH	units	-						-	-	-	7.3				
Conductivity	uS/cm	**1000**	**800-1875**					-	-	-	560				
Alkalinity	mg/l as CaCO3	**-**						-	-	-	246	267	265	288	254
Calcium	mg/l	**200**		76.8	105.1	85.2	103.8	112.5	102.9	93.5	109.1	107	97.27	93.2	104
Magnesium	mg/l	**50**		9.32	14.52			-	13.1	12.0	12.8	13.96	12.51	13.2	14
Potassium	**mgll**	**5**		3.05	4.86	3.79	**5.33**	**6.32**	**5.0**	4.1	**7.2**	**6.614**	**6.656**	**10.2**	**7.9**
Nitrite	mg/l as NO2	**0.1**	**0.0375**	<0.003	<0.002	0.007	<0.002	0.02	<0.006	0.02	0.02	<0.002	0.003	<0.02	0.003
Nitrate	mg/l as NO3	**50**	**37.5**	21.2	24	4.35	4.75	19.5	19.9	21.44	21.1	5.11	4.65	20.8	4.69
Ammonia	mg/l as NH4	**0.15**		<0.01	<0.01	0.01	0.011	0.05	<0.013	<0.013	0.09	<0.01	<0.01	<0.08	<0.01
Chloride	**mgll**	**30**	**24-187.5**	28.86	29.12	31.01	29.24	32.3	31.3	31.3	34.2	37.16	36.11	38.9	37.43
Fluoride	mg/l	**1**							0.1	0.1	0.07	0.09	0.09	<0.3	0.12
Sulphate	mg/l	**200**	**187.5**	24.23	21.78	21.49	24.68	26.7	21.8	21.3	23.5	23.63	20.85	22.45	21.34
Sodium	mg/l	**150**	**150**	11.52	16.25	16.89	16.85	16.4	13.5	14.5	14.7	14.97	14.21	15.6	16.6
Bromide	mg/l	**-**							<0.5	<0.5	<0.5	<0.5	<0.5	0.09	<0.5
Cadmium	ug/l	**5**	**3.75**	<0.00009	<0.00009	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.5	0.5
Cobalt	mg/l	**-**		<0.0002	0.00008	<0.02	0.04	0.09	0.03	0.7	0.08	0.084	0.026	<2	0.0145
Copper	ug/l	**30**	**1500**	<0.0002	0.005	0.3	0.6	1.6	0.1	<0.1	0.6	0.506	0.644	<7	<5
Iron	ug/l	**200**		<0.0037	0.0153	32.3	10.4	43.9	8.6	8.8	32.6	36.99	22.24	<20	<7.2
Lead	ug/l	**10**	**18.75**	<0.00038	<0.00002	0.06	0.1	0.12	<0.02	1.8	0.07	0.18	0.049	<5	<0.8
Manganese	ug/l	**500**		<0.0007	0.0032	6.4	2.2	21.6	<0.04	3.4	3.7	3.412	<0.04	<2	1
Nickel	ug/l	**20**	**15**	<0.00047	<0.00014	<0.14	0.2	0.67	0.18	0.7	0.4	0.352	<0.14	<2	1
Tin	ug/l	**-**		<0.0028	<0.0028	<2.8	<2.8	<2.8	<2.8	<2.8	<0.28	<2.8	<2.8	<5	<0.72

Table A1 (continued) Analyses of Platin Groundwater for 2000 to 2016

				2015		2016	
	Date	EPA Interim Guideline Values	GW Regs 2010 Treshold Values	H1	H2	H1	H2
	Report Ref						
	Lab						
Analyte	**Units**						
pH	units	-					
Conductivity	uS/cm	**1000**	**800-1875**				
Alkalinity	mg/l as CaCO3	**-**					
Calcium	mg/l	**200**		100.20	95.57	91.30	93.60
Magnesium	mg/l	**50**					
Potassium	**mgll**	**5**		20.93	11.80	33.24	29.30
Nitrite	mg/l as NO2	**0.1**	**0.0375**	<4	<4	0.015	0.050
Nitrate	mg/l as NO3	**50**	**37.5**	5.94	4.62	4.40	15.60
Ammonia	mg/l as NH4	**0.15**		<41	<10	<0.01	<0.03
Chloride	**mgll**	**30**	**24-187.5**	53.95	43.97	62.64	59.20
Fluoride	mg/l	**1**					
Sulphate	mg/l	**200**	**187.5**	22.41	23.41	25.91	23.31
Sodium	mg/l	**150**	**150**	16.44	16.79	18.04	17.30
Bromide	mg/l	**-**					
Cadmium	ug/l	**5**	**3.75**	0.090	0.090	<0.09	<0.03
Cobalt	mg/l	**-**		0.034	0.032	0.160	<0.1
Copper	ug/l	**30**	**1500**	0.529	0.591	0.972	<3
Iron	ug/l	**200**		11.97	16.31	33.35	<4.7
Lead	ug/l	**10**	**18.75**	0.020	0.063	0.072	<0.4
Manganese	ug/l	**500**		1.684	5.806	6.246	<1.5
Nickel	ug/l	**20**	**15**				
Tin	ug/l	**-**					

Table A2 - Summary of 2015 Soil Testing

	Depth (m)	Arsenic Low Level	Barium	Cadmium Low Level	Chromium total[1]	Cr III[1]	Cr VI[1]	Cobalt	Copper	Lead	Mercury Low Level	Molybdenum	Nickel	Selenium Low Level	Zinc	BTEX	TPH[2]	PAHs
		Concentration (mg/kg = ppm)																
Arup GAC Target value		640	22,000	230	N/A	30,400	35	none[3]	71,700	7,300	11	17,000	1,800	13,000	662,000	4,310	129,769	N / A
TP201	0.5	7	83	1	12	11.04	0.96	4	18	5	0	2	27	1	35	24	31	<0.130
TP202	0.4	5	30	0	4	3.68	0.32	2	10	3	0	0	7	1	15	24	19	<0.130
TP202	1.6	14	111	1	36	33.12	2.88	13	36	18	0	3	43	1	68	24	12	<0.130
TP203	0.5	11	86	1	51	46.92	4.08	13	27	14	0	2	60	1	57	24	315	0.791
TP203	1.3	7	62	1	12	11.04	0.96	5	15	8	0	2	21	1	39	24	34	<0.130
TP204	0.1	20	92	1	22	20.24	1.76	11	37	25	0	8	33	2	68	24	74	0.131
TP204	0.8	12	88	1	20	18.4	1.6	9	29	14	0	3	39	1	57	24	38	<0.130
TP205	0.2	16	97	2	18	16.56	1.44	7	45	30	4	3	33	1	67	24	19	<0.130
TP205	0.3	2	4	0	2	1.84	0.16	1	6	5	0	2	27	1	24	24	334	6.86
TP207	0.3	6	50	1	10	9.2	0.8	3	12	9	0	2	16	1	28	24	incomplete	2.63
TP207	1	7	39	0	7	6.44	0.56	3	14	5	0	1	13	1	54	24	8,480	1.77
TP207	1.6	13	78	1	27	24.84	2.16	12	25	26	0	4	32	1	74	49	45	<0.130

1. GAC Target Value is for Chromium VI – GAC target value for Chromium III is 30,400 mg/kg. Basis of assessment – up to 8% CrVI.
2. Total Aliphatics & Aromatics >C5-C44
3. DIV Non-haz Target Value = 20 mg/kg; DIV Non-haz Intervention Value = 190 mg/kg

Appendix 7.1

Flood Risk Assessment

Appendix A

Appendix 7.1_Flood Risk Assessment

Contents

A1 Introduction

This appendix details the Flood Risk Assessment carried out as part of the proposed development. It has been undertaken in accordance with the Guidelines for Planning Authorities on 'The Planning system and Flood Risk Management' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment. Heritage and Local Government (DEHLG).

A1.1 Scope of Work

The scope of study includes the following:

Review of all relevant information and data from:

- Flood maps and reports from the Eastern Catchment Flood Risk Assessment (CFRAM) and Management Study;
- The Office of Public Works (OPW) Preliminary Flood Risk Assessment Mapping (PFRA);
- Historic flooding information for the area;

Review of the risk of coastal, fluvial, pluvial and groundwater flooding;

Preparation of a flood risk assessment report.

A1.2 Summary of Data Used

In preparing this report, the following data was collated and reviewed:

- Flood history of the site from the OPW National Flood Hazard Mapping website (www.floodmaps.ie);
- Catchment Flood Risk Assessment and Management (CFRAM) Mapping produced by the OPW (map.opw.ie/floodplans)
- Preliminary Flood Risk Assessment (PFRA) Mapping produced by the OPW (www.cfram.ie/pfra);
- Site Geological and hydrogeological data from the Geological Survey of Ireland website (www.gsi.ie);
- Site groundwater levels;
- Guidelines for Planning Authorities on 'The Planning System and Flood Risk Management' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DEHLG);
- Aerial photography and mapping from Bing Maps and Google Maps.

All Ordnance Datum (OD) levels referred to in this report are to Malin Head Ordnance Datum unless otherwise stated.

A1.3 Proposed development

Irish Cement Ltd. is applying to An Bord Pleanala for planning permission to allow for further replacement of fossil fuels with alternative fuels and for the use of alternative raw materials at the Platin Cement Works, County Meath. To facilitate the use of the alternative fuels, a number of additional structures, such as silos, storage facilities, conveyors, etc. are also proposed. These structures are relatively minor in the context of the existing plant.

The Irish Cement Platin Cement Works site is located in the River Nanny Catchment close to the watershed with the River Boyne. The application site, covering approximately 0.602 hectares, is located within the existing cement plant complex west of the R152 Duleek to Drogheda road. The proposed development is shown below in Figure 1.

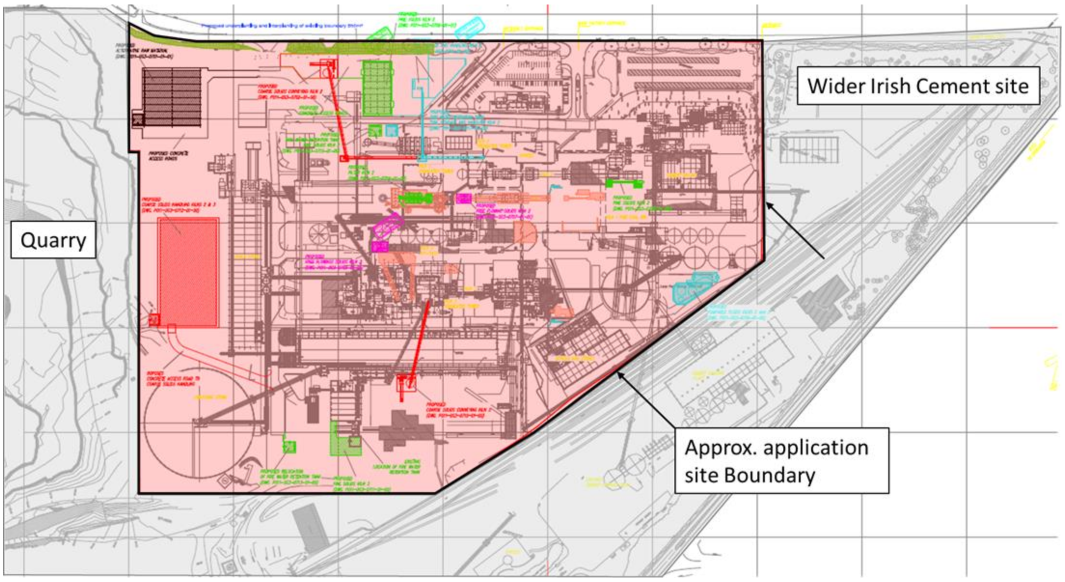


Figure 1 Application site boundary

A2 Planning Context

The following planning policy documents are relevant to the assessment of the proposed development:

- The national planning Guidelines published by the OPW and the Department of the Environment, Heritage and Local Government in November 2009 entitled 'The Planning System and Flood Risk Management Guidelines for Planning Authorities'
- The Meath County Council Development Plan 2013 – 2019.

A2.1 The Planning System and Flood Risk Management Guidelines

A2.1.1 Introduction

In November 2009, the Department of Environment, Heritage and Local Government and the Office of Public Works jointly published a Guidance Document for Planning Authorities entitled "the Planning System and Flood Risk Management".

The Guidelines are issued under Section 28 of the Planning and Development Act 2000. Planning Authorities and An Bord Pleanála are therefore required to implement these Guidelines in carrying out their functions under the Planning Acts.

The aim of the Guidelines is to ensure that flood risk is neither created nor increased by inappropriate development.

The Guidelines require the Planning system to avoid development in areas at risk of flooding, unless the development can be justified on wider sustainability grounds and the risk can be reduced or managed to an acceptable level.

The Guidelines require the adoption of a Sequential Approach (to Flood Risk Management) of Avoidance, Reduction, Justification and Mitigation and they require the incorporation of Flood Risk Assessment into the process of making decisions on Planning Applications and Planning Appeals.

Fundamental to the Guidelines is the introduction of flood risk zoning and the classifications of different types of development having regard to their vulnerability.

The management of flood risk is now a key element of any development proposal in an area of potential flood risk and should therefore be addressed as early as possible in the site master planning stage.

A2.1.2 Definition of Flood Zones

Flood Zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types of flood zones defined in the Guidelines as follows:

Flood Zone	Probability
Flood Zone A	Probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding).
Flood Zone B	Probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 year and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and
Flood Zone C	Probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

A2.1.3 Definition of Vulnerability Classes

The following table summarises the Vulnerability Classes defined in the Guidelines and provides a sample of the most common type of development applicable to each.

Vulnerability	Type of Development
Highly Vulnerable Development	Includes Garda, ambulance and fire stations, hospitals, schools, residential dwellings, residential institutions, essential infrastructure, such as primary transport and utilities distribution and SEVESO and IE/IPC sites, etc.
Less Vulnerable Development	Includes retail, leisure, warehousing, commercial, industrial and non-residential institutions, etc.
Water Compatible Development	Includes Flood Control Infrastructure, docks, marinas, wharves, navigation facilities, water

	based recreation facilities, amenity open spaces and outdoor sport and recreation facilities

The proposed development is classed as a 'Highly Vulnerably Development' as per the above table.

A2.1.4 Types of Vulnerability Classes Appropriate to Each Zone

The following table illustrates the different types of Vulnerability Class appropriate to each Zone and indicates where a Justification Test will be required.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable	Justification Test	Justification Test	Appropriate
Less Vulnerable	Justification Test	Appropriate	Appropriate
Water Compatible	Appropriate	Appropriate	Appropriate

A2.2 The Meath County Council Development Plan 2013 – 2019

A2.2.1 Policies

The policies outlined in the Meath County Council development plan in relation to flood risk management are as follows:

- To have regard to the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoEHLG/OPW, 2009) through the use of the sequential approach and application of the Justification Tests for Development Management and Development Plans, during the period of this Plan.
- To have regard to the findings and recommendations of the current Strategic Flood Risk Assessment prepared as part of the County Development Plan review. See Appendix 6.
- To ensure that all developments have regard to the surface water management policies in the Greater Dublin Strategic Drainage Study (GDSDS). Compliance with the recommendations contained in Technical Guidance

Document, Volume 2, Chapter 4 of the Greater Dublin Strategic Drainage Study shall be required in all instances.

- To ensure that a flood risk assessment is carried out for any development proposal, where flood risk may be an issue in accordance with the “Planning System and Flood Risk Management – Guidelines for Planning Authorities” (DoECLG/OPW, 2009). This assessment shall be appropriate to the scale and nature of risk to the potential development.
- To consult with the Office of Public Works in relation to proposed developments in the vicinity of drainage channels and rivers for which the OPW are responsible, and the Council will, retain a strip of 10 metres on either side of such channel where required, to facilitate access thereto.
- To consult, where necessary, with Inland Fisheries Ireland, the National Parks and Wildlife Service and other relevant agencies in the construction of flood alleviation measures in County Meath.
- To ensure that flood risk management is incorporated into the preparation of Local Area Plans and Town Development Plans in accordance with 'The Planning System and Flood Risk Management - Guidelines for Planning Authorities (2009)'
- To have regard to the recommendations of the Fingal East Meath Flood Risk Assessment and Management Study, the Eastern, North West and Neagh Bann

A2.2.2 Objectives

The objectives of the Meath County Council Development Plan in relation to flooding are as follows:

- To undertake a review of the ‘Strategic Flood Risk Assessment for County Meath’ following the publication of the flood mapping which is being produced as part of the Catchment Flood Risk Assessment and Management (CFRAM) Studies.
- To design flood relief measures to ensure appropriate protection for alluvial woodland (i.e. a qualifying interest) along the Boyne.
- To design flood relief measures to protect the conservation objectives of Natura 2000 sites and to avoid indirect impacts of conflict with other qualifying interests or Natura 2000 sites.
- To promote positive flood relief measures that can enhance habitats in the Boyne floodplain such as swales, constructed wetland basins etc.
- To seek to ensure that construction works are designed so as not to result in surface water runoff into SACs or SPAs either directly or indirectly via a watercourse.

A3 Overview of Flood Mechanisms and Historical Flooding at the Site

A3.1 Flood Mechanisms

In broad terms, the potential sources of flooding at the site can be categorised as:

- Fluvial (River) Flooding: The main risk of fluvial flooding of the development are from the River Nanny and the River Boyne, which are located approximately 2.2km and 3.1km from the site, respectively.
- Pluvial Flooding: Pluvial flooding occurs when the capacity of the local urban drainage network is exceeded during periods of intense rainfall. At these times, water can collect at low points in the topography and cause flooding.
- Groundwater Flooding: Groundwater Flooding can occur during lengthy periods of heavy rainfall, typically during late winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause periods of flooding.

Each of these potential sources of flooding are considered in this FRA.

Given the distance of the site from the sea and the elevation of the site above the sea there is no risk of Tidal/Coastal Flooding. It is therefore not considered further in this FRA.

A3.2 Historic Flooding at the Site

Reports and maps from the OPW Flood Hazard Mapping website (www.floodmaps.ie) have been examined as part of this flood risk assessment.

Figure 22 presents a screenshot from floodmaps.ie which indicates that there are no recorded historic flood events in the vicinity of the site.

The absence of a historic record of flooding however does not mean that the site has not flooded in the past.

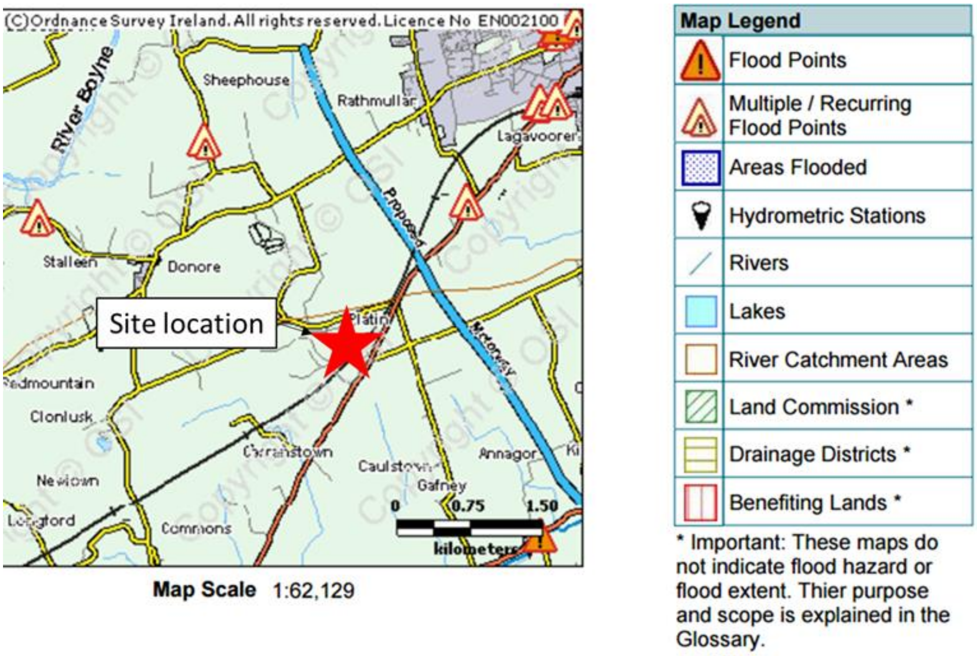


Figure 2 Extract from floodmaps.ie showing flood history for site and surrounding area

A3.3 Fluvial Flood Risk

A3.3.1 National CFRAM programme

The risk of fluvial flooding has been assessed by examining the Eastern Catchment Flood Risk Assessment and Management (CFRAM) flood maps provided by the OPW (https://maps.opw.ie/). As shown below in Figure 3, the majority of the site area does not fall within an area mapped as part the Eastern CFRAM study.

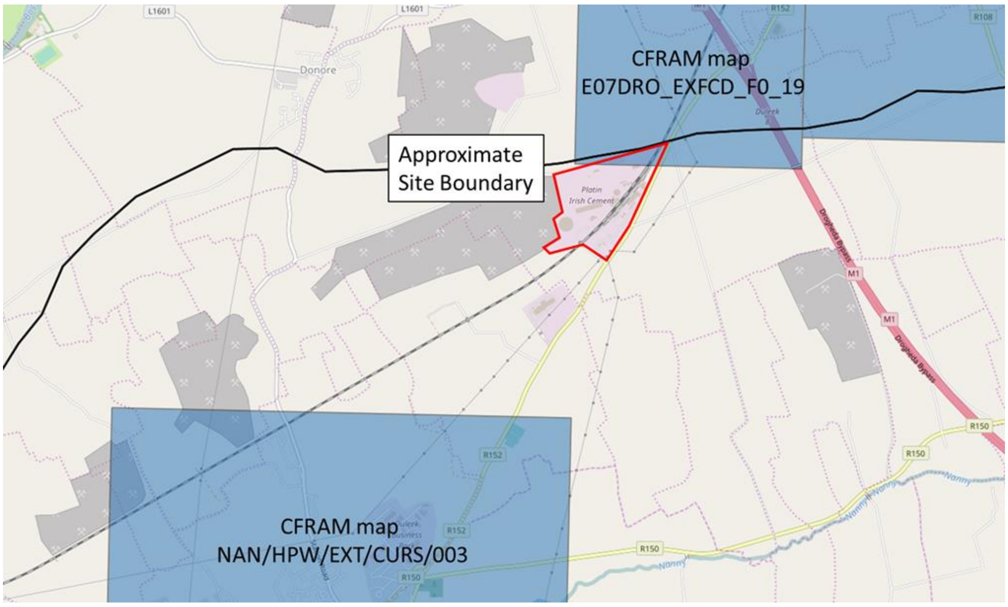


Figure 3 Areas mapped in CFRAMS

Figure 4 presents the fluvial flood extent as predicted by the Eastern CFRAM Study for the 10% 1% and 0.1% AEP events. It can be seen that the site is located well outside the 0.1% fluvial extent.

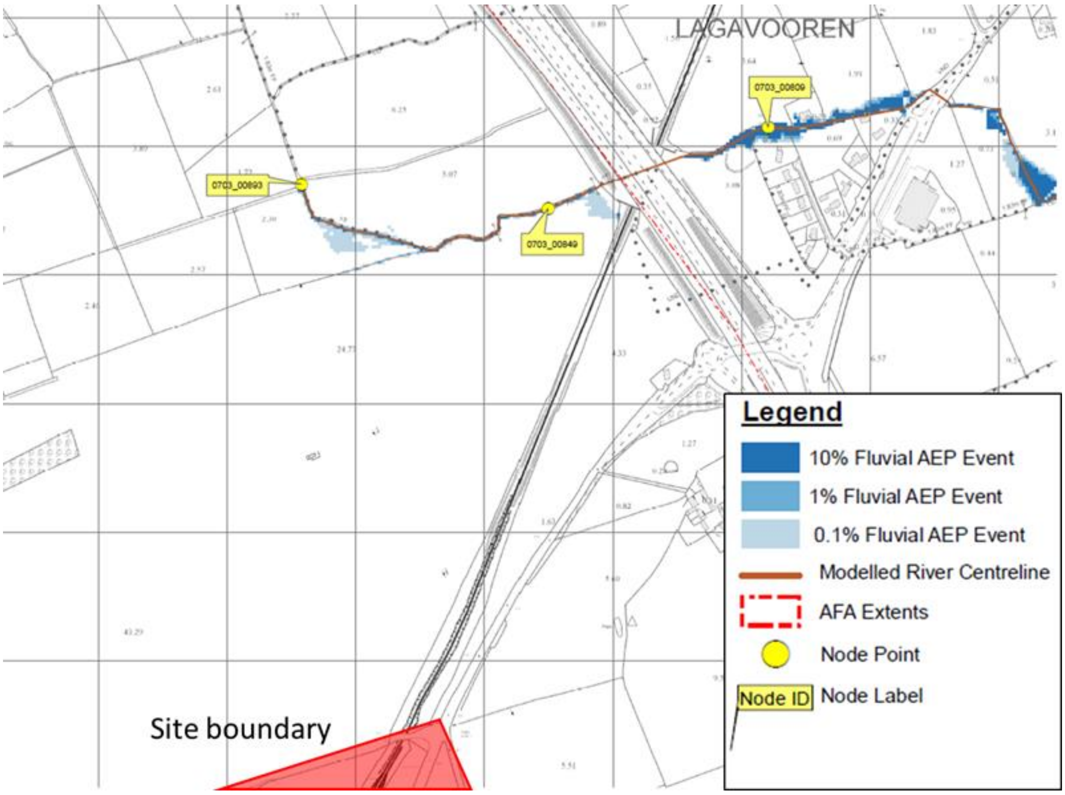


Figure 4 Fluvial Flood Map – CFRAM

A3.3.2 PFRA mapping

Flood maps developed as part of the PFRA by the OPW are presented on the planning portal http://www.myplan.ie and are presented in Figure 5. It can be seen that there are two minor watercourses located closer to the site than Rivers Boyne and Nanny. It is clear from the map that the site is not at risk of flooding from either watercourse.

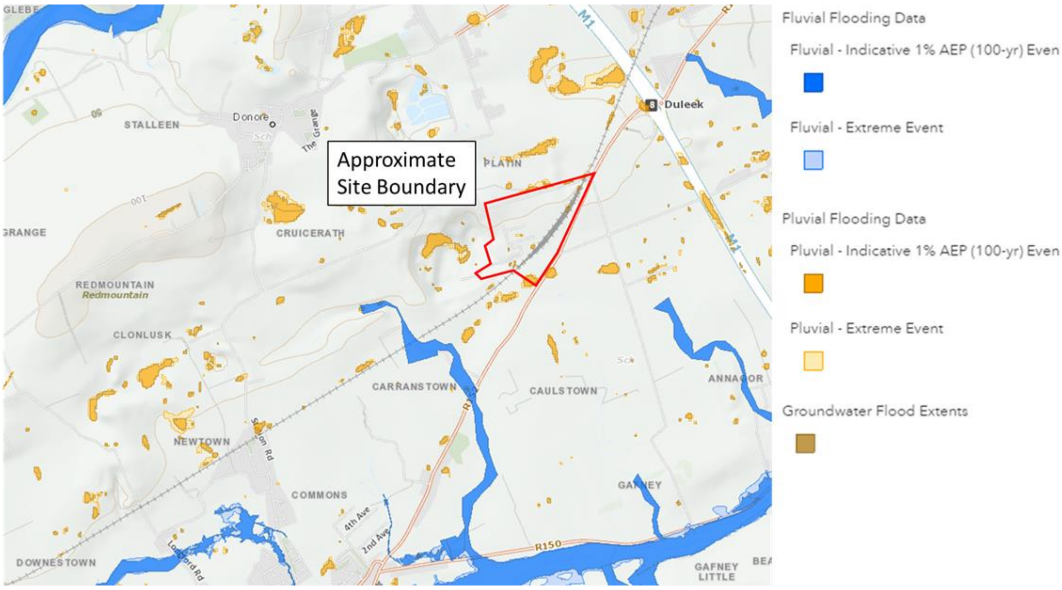


Figure 5 Pluvial Flood Map of the area in the vicinity of the site as produced by the PFRA Study

A3.4 Pluvial Flood Risk

Pluvial flooding occurs when extreme rainfall overwhelms drainage systems or soil infiltration capacity, causing excess rainwater to pond above ground at low points in the topography.

Figure 5 above presents the 1% and 0.5% AEP pluvial flood extents for the site as calculated by the PFRA. It can be seen from the figure that the risk of pluvial flooding at the site is very minor with only very small pockets indicated to be at risk.

A3.5 Groundwater Flood Risk

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during later winter/early spring when the groundwater table is already high. If the groundwater level rises above surface level, it can pond at local points and cause periods of flooding.

Figure presents mapping from the Geological Survey of Ireland (gsi.ie) and indicates the groundwater vulnerability of the site and the surrounding areas. The groundwater vulnerability is indicated as being high to extremely high.

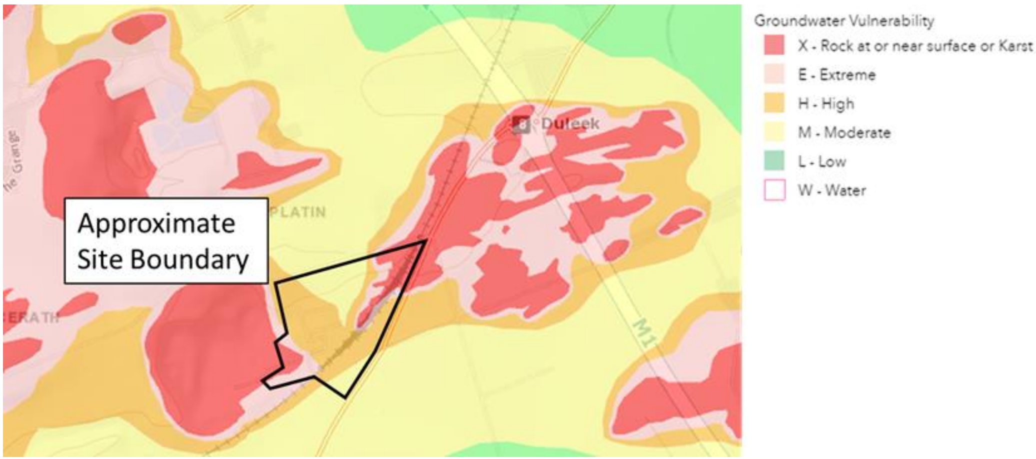


Figure 6 Groundwater Flood Risk – GSI Groundwater Data Viewer

Ground water monitoring at the site was undertaken at the site in 2014 show and indicate that ground water levels decrease in an easterly direction across the site. Due to continuous pumping in the quarry to maintain dry conditions, ground water levels vary from 1.5m to 50m below ground level across the site.

Based on the above, it can be concluded that the risk of ground water flooding to the site is low with the groundwater pumping regime in place.

A4 Management of flood risk at the site

A4.1 Access and Egress Route

Given the very low risk of fluvial and coastal/tidal flooding to the site and its surrounding area, access and egress routes are highly unlikely to be compromised during flood events.

A4.2 Offsite impacts of the development

The proposed development will also not have any adverse impact on floodplain conveyance and will not increase the risk of flooding in the surrounding area.

A4.3 Surface Water Drainage Network

The buildings proposed as part of the development are to be constructed on existing hard-standing areas. There is therefore no increase in the hard-standing area of the site arising from the development and hence no increase in the surface water run-off from arising from the development.

The runoff from the roofs of the new structures will be collected in a storm water drain which will be connected to the overall site surface water drainage network.

A5 Application of the 'Flood Risk Management Guidelines'

A5.1 Vulnerability Classification

It is considered that the proposed development should be classed as a 'less vulnerable' as per the vulnerability classification in Figure 77.

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

*Uses not listed here should be considered on their own merits

Figure 7 Vulnerability Classification as per OPW Planning guidelines

A5.2 Flood Zones

As illustrated earlier in this report, the subject site lies outside the predicted 1 in 1,000 year fluvial extent. The site is therefore classified as lying within Flood Zone C.

A5.3 Sequential Approach

Figure 8 illustrates the sequential approach to be adopted under the 'Planning System and Flood Risk Management' Guidelines. It can be seen from the flow chart that as the proposed development is located within Flood Zone C, a Justification Test is not required.

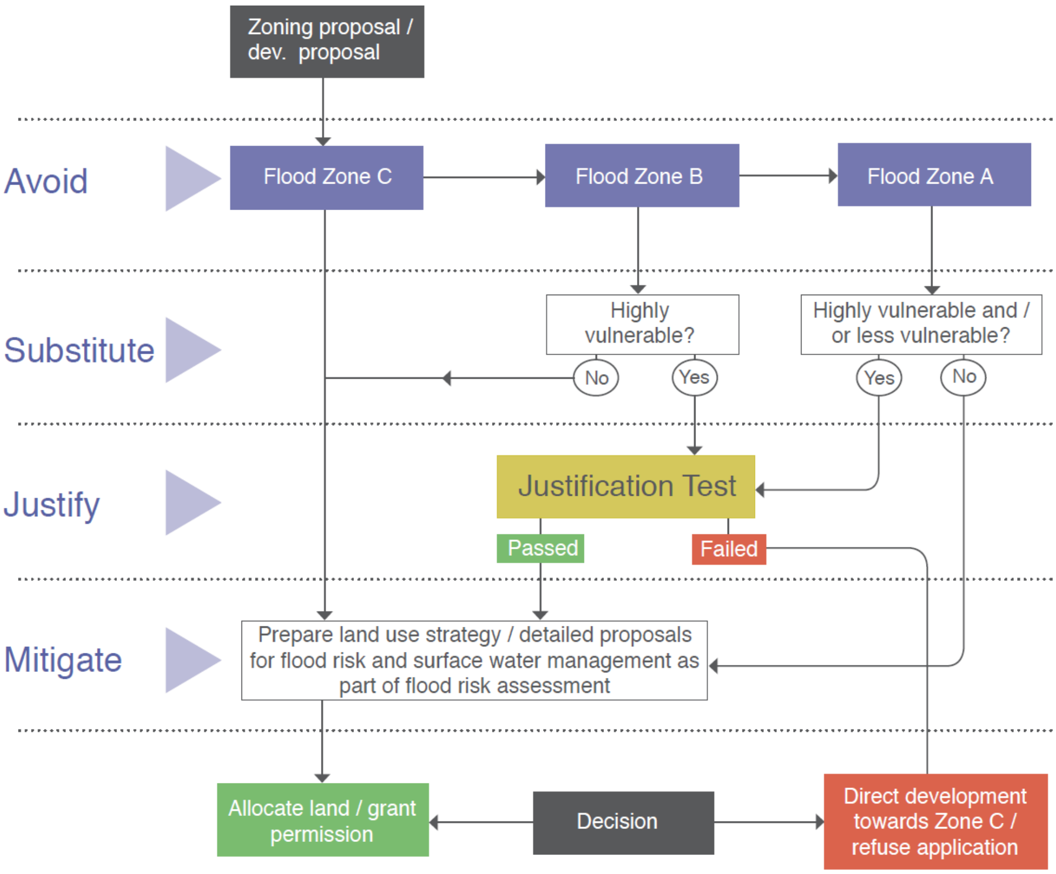


Figure 8 Sequential approach mechanism in the planning process

A6 Conclusion

There is no historic record of flooding of the site.

The risk of both fluvial to the site is very low. The risk of pluvial flooding to the site is also low.

The risk of groundwater flooding is low due to an on-going groundwater pumping regime in the area.

Access and egress routes to and from the site are unlikely to be compromised during flood events.

The proposed development will not have any adverse impact on floodplain conveyance and storage and will not increase the risk of flooding in the surrounding area.

Based on the findings of this FRA and the application of the Flood Risk Management Guidelines, it is considered that the proposed development should be classed as a 'less vulnerable development'. As the site lies within Flood Zone C, a Justification Test is not required.

Appendix 7.2

Historical Surface Water Monitoring

Table 1: Surface water monitoring Data 2000-2016 (SW4)

Licence Requirement	Emission Limit Value	2000											
		Jan-2000	Feb-2000	Mar-2000	Apr-2000	May-2000	Jun-2000	Jul-2000	Aug-2000	Sep-2000	Oct-2000	Nov-2000	Dec-2000
pH	6 - 9	8.2	8	8.2	8.1	8	7.8	7.9	8.3	8.3	7.5	8.2	8
Suspended Solids	35 mg\l	14	19	23	17	14	14	10	<10	20	32	<10	30
BOD	6 mg\l	<2	<2	<1	<2	<2	<2	<2	<2	<2	<2	<2	<2
Licence Requirement	Emission Limit Value	2001											
		Jan-2001	Feb-2001	Mar-2001	Apr-2001	May-2001	Jun-2001	Jul-2001	Aug-2001	Sep-2001	Oct-2001	Nov-2001	Dec-2001
pH	6 - 9	8.1	7.9	8.2	7.8	7.9	8.2	8	8.1	8.3	8.2	7.9	7.9
Suspended Solids	35 mg\l	28	10	14	14	18	10	10	10	10	14	31	10
BOD	6 mg\l	<2	<2	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Licence Requirement	Emission Limit Value	2002											
		Jan-2002	Feb-2002	Mar-2002	Apr-2002	May-2002	Jun-2002	Jul-2002	Aug-2002	Sep-2002	Oct-2002	Nov-2002	Dec-2002
pH	6 - 9	8.2	7.8	7.9	7.5	7.8	7.8	8.2	7.9	7.9	8.0	7.9	7.9
Suspended Solids	35 mg\l	<5	14	<10	<10	30	12	<10	<10	<10	<10	14	8
BOD	6 mg\l	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Licence Requirement	Emission Limit Value	2003											
		Jan-2003	Feb-2003	Mar-2003	Apr-2003	May-2003	Jun-2003	Jul-2003	Aug-2003	Sep-2003	Oct-2003	Nov-2003	Dec-2003
pH	6 - 9	8.3	8.1	6.6	8	7.6	8.1	7.5	7.8	7.7	7.6	7.4	7.9
Suspended Solids	35 mg\l	19	13	32	26	<10	<10	34	<10	<5	24	14	8
BOD	6 mg\l	<2	<2	<2	2	<2	<2	<2	<2	3	<2	<2	<2
Licence Requirement	Emission Limit Value	2004											
		Jan-2004	Feb-2004	Mar-2004	Apr-2004	May-2004	Jun-2004	Jul-2004	Aug-2004	Sep-2004	Oct-2004	Nov-2004	Dec-2004
pH	6 - 9	7.7	7.7	7.7	7.6	7.8	7.4	7.6	7.8	7.8	7.6	7.8	7.8
Suspended Solids	35 mg\l	17	<10	17	18	23	<10	10	5	<5	<10	29	20
BOD	6 mg\l	<2	<2	<2	<2	2	<2	<2	<1	<1	<2	<1.5	<1.5
Licence Requirement	Emission Limit Value	2005											
		Jan-2005	Feb-2005	Mar-2005	Apr-2005	May-2005	Jun-2005	Jul-2005	Aug-2005	Sep-2005	Oct-2005	Nov-2005	Dec-2005
pH	6 - 9	7.8	7.9	7.8	7.6	8.2	7.8	7.7	7.7	7.7	8	7.7	7.8
Suspended Solids	35 mg\l	30	<10	<5	<10	<5	26	<10	28	7	10	6	26
BOD	6 mg\l	<1.5	<2	<1.5	<2	<1.5	<1.5	<2	<1.5	<1.5	2	3	2.8

Table 1 (continued): Surface water monitoring Data 2000-2016 (SW4)

Licence Requirement	Emission Limit Value	2006											
		Jan-2006	Feb-2006	Mar-2006	Apr-2006	May-2006	Jun-2006	Jul-2006	Aug-2006	Sep-2006	Oct-2006	Nov-2006	Dec-2006
pH	6 - 9	7.3	7.5	7.7	7.6	7.7	7.7	7.5	7.6	7.8	7.9	7.6	7.8
Suspended Solids	35 mg\l	<5	12	<5	13	21	13	14	13	9	18	24	15
BOD	6 mg\l	<1.5	<2	2	2	<1.5	<1.5	<1.5	<2	<1.5	2	<2	<1.5
Licence Requirement	Emission Limit Value	2007											
		Jan-2007	Feb-2007	Mar-2007	Apr-2007	May-2007	Jun-2007	Jul-2007	Aug-2007	Sep-2007	Oct-2007	Nov-2007	Dec-2007
pH	6 - 9	7.4	7.6	8	8	7.9	7.9	7.8	7.36	7.7	8	7.7	7.6
Suspended Solids	35 mg\l	12	17	24	13	28	8	8	7	8	6	7	9
BOD	6 mg\l	<2	<1.5	2	<1.5	<2	<2	<2	<2	<2	<2	<2	2
Licence Requirement	Emission Limit Value	2008											
		Jan-2008	Feb-2008	Mar-2008	Apr-2008	May-2008	Jun-2008	Jul-2008	Aug-2008	Sep-2008	Oct-2008	Nov-2008	Dec-2008
pH	6 - 9	7.1	7.6	7.7	7.7	7.9	7.7	7.7	7.7	7.8	7.6	7.7	7.6
Suspended Solids	35 mg\l	21	9	17	6	10	34	15	22	<3	<3	9	18
BOD	6 mg\l	<2	<2	<2	<2	<2	3	<2	<2	<2	<2	<2	<2
Mineral Oil	2 [mg/l]	Parameters included from Oct 2008 required to be monitored by P0030-03									<1	<2.5	<0.0025
COD		Parameters included from Oct 2008 required to be monitored by P0030-03									6	7	5
Licence Requirement	Emission Limit Value	2009											
		Jan-2009	Feb-2009	Mar-2009	Apr-2009	May-2009	Jun-2009	Jul-2009	Aug-2009	Sep-2009	Oct-2009	Nov-2009	Dec-2009
pH	6 - 9	7.6	7.7	7.3	7.8	7.9	7.6	7.8	7.6	8	7.6	7.8	7.8
Suspended Solids	35 mg\l	6	21	28	<3	11	<3	<2	3	5	<2	<2	<2
BOD	6 mg\l	<2	<2	<2	<2	<2	3	<2	<2	<2	<2	<2	<2
Mineral Oil	2 [mg/l]	<0.0025	<0.0025	0.12	0.013	<0.0025	0.00271	<0.0025	0.00536	<0.0025	<0.0025	0.004	<0.0025
COD		5	<5	30	<5	5	<5	5	6	5	9	6	<5

Table 1 (continued): Surface water monitoring data 2010-2016 (SW4)

Licence Requirement	Emission Limit Value	2010											
		Jan-2010	Feb-2010	Mar-2010	Apr-2010	May-2010	Jun-2010	Jul-2010	Aug-2010	Sep-2010	Oct-2010	Nov-2010	Dec-2010
pH	6 - 9	7.0	7.6	7.6	7.9	7.6	7.7	7.6	7.8	7.7	7.8	7.7	7.6
Suspended Solids	35 mg\l	8	9	<2	5	2	5	<5	11	2	3	<2	<2
BOD	6 mg\l	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Licence Requirement	Emission Limit Value	2011											
		Jan-2011	Feb-2011	Mar-2011	Apr-2011	May-2011	Jun-2011	Jul-2011	Aug-2011	Sep-2011	Oct-2011	Nov-2011	Dec-2011
pH	6 - 9	8	8.1	8.1	8.1	8.2	7.9	8.1	8.0	8.1	8.0	8.2	8.3
Suspended Solids	35 mg\l	14	4	7	<2	3	<2	<2	3	-	-	-	-
BOD	6 mg\l	<2	<2	<2	<2	<2	<2	2	<2	<2	<2	<2	<2
Licence Requirement	Emission Limit Value	2012											
		Jan-2012	Feb-2012	Mar-2012	Apr-2012	May-2012	Jun-2012	Jul-2012	Aug-2012	Sep-2012	Oct-2012	Nov-2012	Dec-2012
pH	6 - 9	8.2	8.1	8.2	8.3	8.1	7.7	8.0	7.8	7.4	8.3	8.2	8.2
Suspended Solids	35 mg\l	9	9	6	9	16	4	14	8	10	9	2	4
BOD	6 mg\l	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	7
Licence Requirement	Emission Limit Value	2013											
		Jan-2013	Feb-2013	Mar-2013	Apr-2013	May-2013	Jun-2013	Jul-2013	Aug-2013	Sep-2013	Oct-2013	Nov-2013	Dec-2013
pH	6 - 9	8.1	8.2	8	8.3	8.1	8.1	8.1	8.3	8.8	8.6	8.2	8.2
Suspended Solids	35 mg\l	16	15	15	2	2	5	14	20	3	4	10	16
BOD	6 mg\l	<2	<2	<2	2	<2	<2	<2	<2	3	<2	<2	<2
Licence Requirement	Emission Limit Value	2014											
		Jan-2014	Feb-2014	Mar-2014	Apr-2014	May-2014	Jun-2014	Jul-2014	Aug-2014	Sep-2014	Oct-2014	Nov-2014	Dec-2014
pH	6 - 9	8.30	8.20	8.00	7.80	8.00	8.30	8.10	8.10	8.00	7.70	7.70	7.4
Suspended Solids	35 mg\l	3	8	9	9	3	2	10	3	5	<2	3	<2
BOD	6 mg\l	<2	<2	<2	2	<2	<2	<2	5	<2	<2	<2	4
Licence Requirement	Emission Limit Value	2015											
		Jan-2015	Feb-2015	Mar-2015	Apr-2015	May-2015	Jun-2015	Jul-2015	Aug-2015	Sep-2015	Oct-2015	Nov-2015	Dec-2015
pH	6 - 9	8.10	8.20	8.10	8.10	8.10	7.60	8.00	8.50	8.30	8.20	8.30	7.90
Suspended Solids	35 mg\l	5	11	6	28	25	14	5	5	6	25	5	29
BOD	6 mg\l	<2	<2	<2	<2	<2	<2	<2	5	<2	<2	<2	<2

Licence Requirement		2016											
		Jan-2016	Feb-2016	Mar-2016	Apr-2016	May-2016	Jun-2016	Jul-2016	Aug-2016	Sep-2016	Oct-2016	Nov-2016	Dec-2016
pH	6 - 9	7.5	7.6	7.6	7.6	7.4	7.6	7.6	7.5	7.5	7.5	7.5	7.6
Suspended Solids	35 mg\l	8	3	2	2	<2	3	17	2	7	3	2	<2
BOD	6 mg\l	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2

Appendix 11.1

Historical and Archaeological Background

APPENDIX 11.1

Historical and Archaeological Background

The following is a brief summation of the archaeological and historical development of the study area and the main types of sites and monuments that are known from the surrounding landscape. It is intended as a guide to the types of sites and monuments that might be encountered in the application area. The development is situated in the townland of Platin, the parish of Duleek and the barony of Lower Duleek.

Prehistoric Period

There is a Neolithic house (Ref 04E1551) known from the study area in Carranstown townland which was identified during archaeological monitoring in 2003. The site consists of a rectangular area measuring 7.6m x 4.8m defined by foundation trenches for wooden walls.

Bronze Age material has been found to the south-west of the application area in Carranstown where a series of Fulachta Fiadh (03E0790 and 05E1324) have been found along the northern bank of a stream. North of this a Bronze Age barrow (03E1347) and additional Fulachta Fiadh (02E1306) have been found and a Ring-ditch was uncovered in 2004 (04E0714). Archaeological monitoring carried out by the author in advance of quarrying in Carranstown townland identified the remains of a prehistoric settlement of probable Bronze Age date (17E0003).

This indicates substantial prehistoric activity in the study area.

Early Medieval Period

By the eighth century AD the Southern Ui Neill had become overlords of the Kingdom of Brega, extending over Meath, North Dublin and South Louth and ruled the vassal septs of the Luigni, Gailenga and the Ciannachta, who occupied the study area (Byrne 2001, 68-9). The Ciannachta occupied land on both sides of the River Boyne and are noted in the Annals from the sixth century. Byrne suggests that they had come from Co. Derry and had been settled on lands conquered by the Ui Neill.

The Monastery of Duleek

Immediately to the south of the study area was the monastery of Duleek where a bishopric was established by St. Patrick c.450 AD, which was given into the care of St. Cianan. In Irish Duleek is originally Daimhliag which refers to the early stone church on the site. There are numerous references in the Annals of the Four Masters. At some time in the twelfth century the O'Kelly's of Brega established a House of Canons Regular of St. Augustine on the site.

Early Medieval settlement

Classically settlement in the Early Medieval period is indicated by the presence of enclosed farmsteads known as ringforts. However, there are no definite ringforts recorded in the study area.

Medieval Period

The first appearance of the Anglo-Normans in the study area was in 1171 when Milo de Cogan plundered Duleek. In the following year King Henry II granted the Kingdom of Meath to Hugh de Lacy to hold as King Murrough O Melaghlin, King of Meath, had held it (Otway-Ruthwen 1980, 52). De Lacy established a manor at Duleek and constructed a motte castle. In 1182 de Lacy granted the church of St. Cianan to the Priory of Llanthony Secuna of Gloucester.

In 1241 Hugh de Lacy's son, Walter de Lacy, died without a male heir and Meath was partitioned between his two granddaughters. Margery de Lacy had married John de Verdon (died 1278) and they received the portion of Meath containing the study area as a restricted liberty which was incorporated in the County of Dublin in 1280, then made the separate County of Meath, with a county court at Kells, in 1297 (Otway-Ruthven 1980, 213). John de Verdon's son, Theobald de Verdon, lord of Meath, died in 1303 and the Lordship passed to his son Theobald who died in 1316 without a male heir. The Lordship was taken into the King's hands during the minority of his four daughters Joan, Elizabeth, Margaret and Isabel. In 1330 Mortimer was granted control of the de Verdon Lordship of Meath, but this was removed after his execution. In 1363 the de Verdon heirs sold their lands in Meath and Louth (Otway-Ruthven 1980, 296).

Sir John D'Arcy was appointed Lord Chief Justice of Ireland by King Edward II in 1328. He married Lady Jane Burke (De Burgo), daughter of the Earl of Ulster and his son William D'Arcy, made his seat at Platten. The Darcy's occupied Platin until c.1690. When Simon Flemyng, Baron of Slane, died in 1370 he possessed the manor of Dyuelek (Duleek) which was inherited by his son Stephen Flemyng (Calendar of Patent Rolls A.D. 1370-1374, 247).

Medieval Settlement

The process of sub-infeudation is normally associated with the construction of timber castles, known as Motte and Baileys. These earthwork fortifications were used to house and defend the Norman lords and their retinues while they set about the process of pacifying and organizing their new fiefs. Hugh de Lacy's motte castle was situated in Commons townland to the north-east of Duleek, but does not survive.

Manorialism describes the organisation of the feudal rural economy and society characterised by the vesting of legal and economic power in a Lord supported economically from his own direct landholding and from the obligatory contributions of a legally subject part of the peasant population under his jurisdiction. In Ireland the Lord's Manor House was also sometimes enclosed by a rectangular moat and these sites are referred to as moated sites. They are a useful indicator of Anglo-Norman settlement. However, there are no moated sites known within the study area.

In 2003 evidence of medieval settlement consisting of a rectangular structure measuring 20m x 9.5m, an F-shaped structure measuring 14.2m x 7m, ditches and pits and a trough associated with c.530 sherds of medieval pottery dating to the 13th-14th centuries was excavated within the study area in Cruicerath townland (03E0264).

The Later Medieval Period

The fifteenth century was characterised by the decline of Anglo-Norman power in Ireland which had been ebbing since the early fourteenth century. Part of the response to this was the construction of masonry Tower Houses which sprang up after King Henry VI introduced a building subsidy of £10 in 1429 (Sweetman 1999, 137). There are no surviving tower houses in the study area but the Darcy castle at Platin was presumably a tower house.

The Post-Medieval Period

Until 1540 the manor of Newton (Newtown) comprising the manors of Carreston (Carranstown) and Platen (Platin) were part of the Monastery of Duleek which belonged to Llanthony Abbey. Carreston was let to Richard Bysset and Platen was let to William Darcy. The manor of Platen and Calestown (Platin and Caulstown) belonged to the rectory of Duleek (MacNiocaill 1992, 31, 32).

The Civil Survey records that in 1640 Thomas Ball had Newtowne (Newtown), Nicholas Darcy of Platten had Great Carranstowne (Carranstown), Sir William Usher and Robert Usher held Little Curranstowne (Carranstown) which had a castle. Nicholas Darcy held Platen and Callestowne (Platin and Caulstown) which contained a castle. Cruicerath was held by Stephen Cormacke and Staleing (Stalleen) was held by Charles Lord Viscount Moore (Simington 1940). On 19 December 1641 the Old English of the Pale met at Nicholas Darcey's house at Platten to write a petition of grievances to King Charles I and a statement of why they had risen in rebellion (Clarke 2000, 188-9).

8. Carranstown Fulacht Fia 05E1324

A burnt mound measuring 8m x 7.5m was excavated to reveal four troughs, one of which contained an oak plank which produced a radiocarbon date of 3622+/-38 BC.

9. Lagavooren Bronze Age enclosure 01E0397

This site appears to be included in the Archaeological Survey database as ME020-014---.
This site, in the townland of Lagavooreen in the parish of St Mary's, Drogheda, was identified during test-trenching of the Drogheda Bypass by V.J. Keeley Ltd in August 2000. A small investigation of the area was begun on 26 March by Emmet Stafford which suggested the presence of an enclosure ditch containing waterlogged organic remains and associated internal features such as pits/post-holes (No. 1005 above). Though the site was to be preserved in situ, a two-week excavation was conducted to establish the full line and extent of the enclosure and to try to assess its significance, function and date. A substantial portion of the ditch was also to be excavated to rescue the potential waterlogged organic remains exposed during the testing of the site. This two-week excavation commenced on 19 April 2001.

The excavation of Site 17 revealed that it was a large univallate enclosure, roughly oval in shape, with an entrance/causeway to the south-east. Unfortunately a modern field ditch cut through the original entranceway, destroying any archaeological features in this area. The enclosure had an internal diameter north–south of 48m and an external diameter north–south of 50m. The outer edge of the eastern section of the enclosure ditch was cut at some stage during the post-medieval to modern period by a large culvert and the original width of the enclosure ditch therefore remains unknown in this area.

The extent of the ditch was not, however, excavated in its entirety; the western to north-western edge was extremely difficult to identify as it had been heavily truncated and disturbed by recent machine activity during the construction works. Twelve sections of the enclosure ditch and one test-trench across the western part of the ditch were excavated, and within these sections the width of the ditch varied from 2.14m to 4.8m and the depth varied from 0.6m to 1.65m. The ditch for the most part consisted of seven different fills (slight variations did occur within each section which was excavated).

The uppermost fill of the enclosure ditch consisted of a dark orange/brown clay silt which may represent the remains of the bank after it was ploughed out across the fill of the ditch. Below this a loose black charcoal-rich layer with frequent small angular stone inclusions was visible. This fill was evident at the top of the ditch in the southern portion of the enclosure where it was not sealed by the dark orange/brown clay and may represent a deliberate infilling of a later recutting of the ditch. This charcoal-rich layer does not represent in situ burning but rather material brought from elsewhere and used to fill up the ditch. Below this layer a dark brown clay silt was evident throughout the greater part of the ditch. It sealed, in turn, an orange clay silt which contained occasional medium-sized stone inclusions, a dark brown clay silt and finally a dark grey compact waterlogged clay with small to medium-sized angular stone inclusions. A large quantity of animal bone and a very small quantity of cremated bone was retrieved from all fills of this enclosure ditch, whilst organic material, i.e. timber branches, twigs and shell, was retrieved from the dark grey compact waterlogged clay at the base of the ditch. No worked timber was recovered. Finds retrieved from the uppermost fill of the ditch include two sherds of possible Bronze Age pottery, a post-medieval iron crucible and a small quantity of waste flint.

There was no evidence for slippage visible within the sections of the enclosure ditch that were excavated, which would indicate the former presence of an internal/external bank. A change in the natural subsoil, in the form of a linear band which survived for a length of 7.5m and varied in width from 1m to 1.5m, was visible along the inner edge along the south-west to western section of the enclosure ditch and could be interpreted as the remnants of an internal bank.

Two large post-holes were also cut into the base of the enclosure ditch (sections C and G). The post-hole within section C was circular, with a diameter of 1.6m and a maximum depth of 0.34m. The post-hole which was cut into the base of section G of the enclosure ditch had maximum dimensions of 1.15m by 1.3m and a maximum depth of 0.7m. The fill of each post-hole consisted of the dark compact waterlogged clay which lay at the base of the ditch. The post-holes may have once contained two large

Appendix 11.2

Archaeological Excavations

APPENDIX 11.2

Archaeological excavations

There have been 10 excavations in the study area. Summaries are presented in below and the locations of the significant sites are indicated on Figure.11.1 of Chapter 11 of the EIS.

1. Carranstown
Fulacht fia

02E1306

Testing was undertaken at the site of a proposed extension to Platin Quarry in Carranstown, Co. Meath. Two features of interest were uncovered, both cutting the natural, yellow, mineral clay. One was a narrow linear feature, 0.17m deep, 0.32m wide and oriented north-east/south-west, containing burnt spread material. A second, larger linear feature oriented north-west/south-east was identified to the west of the first. It was 1.5m wide, with a maximum depth of 0.95m. The cut of this ditch feature was U-shaped. Burnt spread material characteristic of Fulachta Fiadh was identified in the trench, but no surviving mound feature was present.

2. Carranstown
Barrow
03E1747

Topsoil removal within field 4 of the Irish Cement Quarry revealed a circular barrow associated with pits and postholes associated with sherds of prehistoric pottery, worked flint, a possible hammer stone, rubbing stones and fragments of cremated bone. The barrow was a circular area (diam. 14-15m) enclosed by a ditch with an entrance at north-west. The ditch had a fill of scorched earth covered by a layer of silty charcoal. Finds from the ditch included eleven stuck flints, 5 flint scrapers, 1 hammer stone, a fragment of quartz, seventeen sherds of prehistoric pottery, carbonized hazelnut and burnt bone. A sub-rectangular pit situated in the entrance of the barrow contained 26 sherds of pottery, burnt bone, charcoal, a scraper and struck flint. Two rows of postholes and posts formed an entrance structure to the barrow.

3. Cruicerath Medieval settlement 03E0264

This site consisted of a rectangular area (c.20m x c. 9.5m) enclosed by a trench with medieval pottery, to the north was a shallow hearth. Structure 2 was an F-shaped trench measuring 14.2m b c. 7m with medieval pottery in the fill. There were three pits containing medieval pottery and burnt mound type material.

4. Cruicerath Fulachta Fia 03E0465

Structure 1 comprised a semi-circular arc (8m x 2.5m) of 75 sake holes under a brunt spread. Structure 2 was a shallow irregular burnt spread (2.6m x 2.1m) overlying 37 stake holes. Possible structure 3 was a C-shaped cut filled with burnt material. There were also four troughs and a shallow rounded pit.

5. Carranstown No archaeological significance 03E0789

Three trenches were excavated to investigate geophysical anomalies. No archaeological material was uncovered.

6. Carranstown Fulacht Fia 03E0790

A series of Fulachta Fiadh were excavated along the bank of a stream.

7. Carranstown Ring-ditch, etc.04E714

These features consisted of a number of charcoal spreads and a curvilinear ring-ditch 14m long.

timber posts which probably formed part of a timber palisade within the ditch which may or may not be contemporary with the ditch itself.

Numerous features were exposed within the interior of the enclosure. This area was not fully resolved, with only the upper level of features exposed directly below the topsoil being excavated. A large stony subrectangular surface, which measured 21.5m by 9m, was exposed towards the centre of the enclosure on the highest part of the ridge. This surface was redeposited and may mask an earlier phase of activity on the site. A total of eight pits, two post-pits, seventeen post-holes, one shallow depression and two slot-trenches were cut through the aforementioned floor/working surface. These features appear to represent the remains of two possible structures: a large rectangular structure and a circular structure. The rectangular structure consisted of two slot-trenches and three post-holes and measured 13.6m by 5.6m, whilst the circular structure consisted of ten post-holes which formed the outer wall and three internal post-holes which probably functioned as inner supports. The circular structure may also include the slot-trench F40, and it is possible that the second slot-trench (F13) represents an annex to the circular house. This circular structure had a diameter of 10m east–west. Finds retrieved from these features include a sherd of prehistoric pottery from pit F15 (possibly Bronze Age), waste flint, a very small quantity of charcoal, animal bone and a tiny quantity of cremated bone.

Numerous features were also exposed north-west and south-south-west of the floor/working surface: pits, a single post-hole and a single plank-slot. None of these features were stratigraphically related but merely cut into the underlying subsoil and their exact function remains unclear. It would appear that some of the pits probably functioned as rubbish-pits as a small quantity of animal bone, cremated bone and charcoal was retrieved from the fill, but the majority of the features were simply filled with a brown loam. Four sherds of Western Neolithic pottery were, however, recovered from pit F43. This could be indicative of an earlier phase of settlement on this site.

Towards the southern edge of the site a large subrectangular pit was exposed which had been backfilled with burnt stone material. The pit measured 7.5m by 4.5m and had a depth of 1.98m. The only finds to be recovered from it were waste flint and a small quantity of animal bone. The function of the pit is unclear but it may have been a tree root bowl which was adapted as a water sump as the base of this feature continually filled with water.

Radiocarbon determinations have enabled secure dating of the period in which the enclosure was constructed and in use: the late Bronze Age. A sample of bone recovered from the fill of the enclosure ditch F3 returned a radiocarbon date of 2750 ± 70 BP (1040–810 cal. BC). Samples from pits from the interior of the enclosure also returned similar dates. A charcoal sample recovered from pit F47, however, returned a radiocarbon date of 2270 ± 40 BP (390–200 cal. BC), which places this feature securely within the early Iron Age. This could represent the remnants of a later phase of activity within the enclosure although there are no finds to indicate Iron Age occupation.

Three phases of activity can therefore be identified on this site. The earliest is represented by the sherds of Western Neolithic ware recovered from F43 (c. 3800–3600 cal. BC). The second phase dominates the site and consists of the enclosure ditch, the stony clay surface and the pits, post-holes and slot-trenches which were cut through the stony clay surface. The final phase is represented by pit F47. This feature was located outside the stony clay surface and is indicative of an early Iron Age phase of activity on the site.

10. Carranstown Settlement 17E0003

Archaeological monitoring carried out by the author in advance of quarrying in Carranstown townland identified the remains of a prehistoric settlement of probable Bronze Age date. At the time of submission these remains were being preserved by record.

Appendix 11.3

Recorded Monuments in the Study Area

APPENDIX 11.3

Recorded Monuments in the study area

ME020-014 --- Platin Inland Promontory Fort

Situated on top of rock outcrop and covering area of c. two acres. Banks and scarps define top of outcrop, and within this oval area is raised subcircular area (diam. c. 25m) and raised triangular area (dims. 29m E-W, 15m N-S). Promontory fort investigated during the construction of the M1 Motorway.

ME027-003001 --- Platin Church

Situated on a slight E-facing slope and at the NE extremity of the large parish of Duleek. Plattin was a possession of the Benedictine priory of Lanthony in England, and at the Suppression in 1540 it was being leased to Sir William Darcy for six pounds, ten shillings. Darcy also had land leased for twenty shillings at Callistown (Calliaghstown?) and in Kilsharvan parish. According to the Civil Survey (1654-6) Nicholas Darcy of Platten held 608 acres at Platten and Callestowne, and another 190 acres at Carranstowne in Duleek parish. While a castle (ME027-003002-) and outhouses at Platten are mentioned there is no reference to a church. Nor is a church recorded on the Down Survey (1656-8) barony map of Duleek. The church dates from the 16th century and probably served as an estate or private chapel. Therefore it might not come under the purview of the diocese of Meath, and it is not recorded in the visitations of Ussher (1622) or Dopping (1682-5) as a church of Duleek deanery. There is no evidence of an enclosure or of burial associated with it, but the probable site of the castle is where Platin Hall was built c. 1700, which is c. 30m to the NW.

The church is an undivided nave and chancel structure (int. dims 11.3m E-W; 5.2m N-S) that survives complete with opposing round-headed doorways (Wth 0.94m) in flat-headed embrasures towards the W end of the N and S walls, and with a stoup only inside the S doorway. The window lights are all round-headed, but those on the N wall are in re-used Dundry stone. There are two steps up to the altar at the E end, with beam-holes in the N and S walls above the steps, suggesting the former presence of a rood screen. There is a double-light window with a damaged belfry above it in in the W wall, but the belfry may have had only a single opening. There is a triple-light window in the E wall. The S wall has three double-light windows, one being W of the doorway while the N wall has two single-light windows.

The fragment of a cross (dims 0.28m x 0.17m; H 0.79m) dated c. 1480-1500 with foliage and figure sculpture of a crucifixion and a Madonna over an angel in a niche is cemented into its base in the embrasure of the E window (King 1984, 101). Also in the church is a disc-headed cross (diam. 0.33m; T 0.12m) with a raised ring, which has a cross on each face formed by raised arcs springing from the ring. One face has the raised letters VM and IM on the cross, which probably dates to the late 17th century.

ME027-003002 --- Platin Castle - unclassified

Brick house of three storeys and nine-bay front, built c. 1700 and possibly designed by Sir William Robinson. House now knocked but said to be on site of old D'Arcy castle.

ME027-003003 --- Platin Cross

This cross is cemented into the E window of the ruined late medieval church (ME027-003001-) at Platin Hall since 1844. Material: Limestone. Dims base: H 0.26m; 0.6m x 0.5m. shaft: 0.28m x0.17m; H 0.79m.

This shaft, rectangular in section, decorated I relief, is set into a damaged chamfered rectangular base. Each side has figure sculpture combined with foliage designs. No inscriptions. W: A crucifixion under an interlace of vine leaves and bunches of grapes. E: There are two depiction sunder an arch formed by an interlace of vine-leaves and bunches of grapes. The upper one is the Virgin and Child. She is crowned and holds a circular object, perhaps and apple or globe, in her right hand and the Christ-child on her left arm. The child’s left foot is almost resting on the head of a demi-angel who holds a large heater-shaped shield. N: An angel in a cusped ogee-headed panel which is crocketed and finialed. He is standing on a raised moulding, dressed in a V-nicked pleated tunic trimmed with fur and holds a large heater-shaped shield. His large wings reach to his ankles. The f face is badly damaged. S: Another angel, different in appearance to the one on the north face but set in a similar architectural panel. He is wearing a long tunic which falls in folds at his feet and has long hair. He also holds a shield and has large wings.

Apart from damage to both shaft and base, this cross may be complete as there is a definite chamfer to the upper edges of the shaft and the design itself seems to follow the chamfer. A date c. 1480-1500 is suggested.

ME027-003004 --- Platin Cross

Also in the church (ME027-003001-) is a disc-headed cross (diam. 0.33m; T 0.12m) with a raised ring, which has a cross on each face formed by four raised arcs springing from the ring. One face has the raised letters VM and IM on the cross, which probably dates to the late 17th century.

Appendix 11.4

Monuments included in the Archaeological Survey Database

APPPENDIX 11.4

Monuments included in the Archaeological Survey database in the study area

ME020-014 --- Lagavooren Habitation site
No description included in archaeological survey database. This appears to be the site excavated under license 01E0397.

ME020-032 --- Lagavooren Excavation - Miscellaneous
No description included in archaeological survey database.

ME020-044 --- Lagavooren Excavation - Miscellaneous
No description included in archaeological survey database.

ME020-045 --- Lagavooren Excavation - Miscellaneous
No description included in archaeological survey database.

ME027-058 --- Carranstown Fulacht fia
This is the fulacht fia preserved by record under license 04E0714.

ME027-078 --- Carranstown, Caulstown Embanked enclosure
This circular enclosure (Diam. c. 140m) was identified on the 1995 OSI AP.

ME027-079 --- Carranstown, Caulstown Enclosure
No description included in archaeological survey database.

ME027-103 --- Carranstown Fulacht fia
This is the fulacht fia preserved by record under license 03E0790.

Appendix 12.1

2014 Traffic Counts

60-min Volume Summary

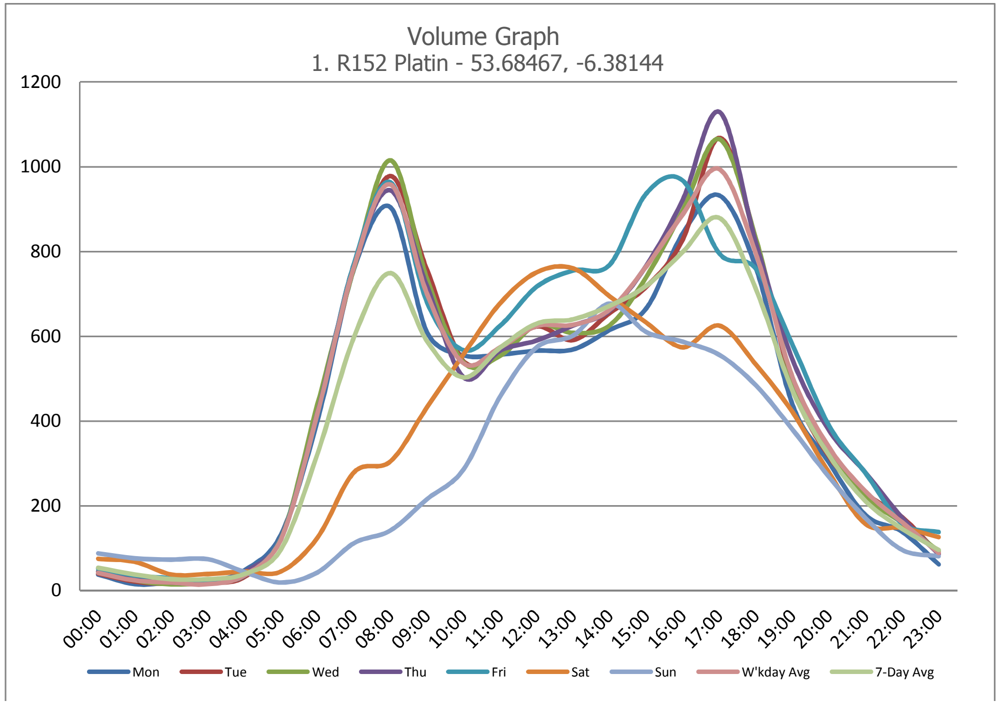
Avg W'kday Total	**10,887**
7 Day Avg Total	**9,910**

1. R152 Platin - 53.68467, -6.38144

Combined

Time	Mon 06-Feb	Tue 07-Feb	Wed 08-Feb	Thu 09-Feb	Fri 03-Feb	Sat 04-Feb	Sun 05-Feb	W'kday Avg	7 Day Avg
	Day of Week								
AM Peak	*904*	*978*	*1015*	*944*	*963*	*433*	*216*	*958*	*749*
PM Peak	*932*	*1068*	*1065*	*1129*	*967*	*625*	*587*	*994*	*879*
00:00	38	40	45	45	52	75	88	**42**	**54**
01:00	15	21	24	33	36	68	76	**24**	**38**
02:00	19	16	15	19	29	38	73	**19**	**27**
03:00	20	18	19	21	20	39	74	**15**	**27**
04:00	48	32	40	44	35	45	44	**36**	**39**
05:00	132	125	122	122	124	45	19	**121**	**97**
06:00	401	421	440	420	417	125	43	**418**	**323**
07:00	759	762	761	771	772	279	112	**764**	**598**
08:00	*904*	*978*	*1015*	*944*	*963*	305	142	*958*	*749*
09:00	609	756	735	717	680	*433*	*216*	**699**	**588**
10:00	555	541	538	503	567	558	286	**536**	**503**
11:00	557	568	554	566	625	678	458	**574**	**573**
12:00	566	623	627	590	717	751	574	**624**	**630**
13:00	569	591	608	625	755	760	602	**627**	**640**
14:00	615	655	626	661	769	694	677	**663**	**672**
15:00	666	717	740	767	937	632	610	**765**	**719**
16:00	843	829	898	923	*967*	574	*587*	**888**	**799**
17:00	*932*	*1068*	*1065*	*1129*	795	*625*	556	*994*	*879*
18:00	761	827	830	820	759	533	484	**794**	**711**
19:00	439	486	496	545	580	421	380	**504**	**472**
20:00	302	316	325	378	389	278	268	**338**	**319**
21:00	178	229	220	278	277	157	171	**234**	**211**
22:00	139	173	160	172	158	148	96	**161**	**146**
23:00	62	87	93	86	138	126	81	**89**	**96**
Total	**10129**	**10879**	**10996**	**11179**	**11561**	**8387**	**6717**	**10887**	**9910**

07:00-19:00	8336	8915	8997	9016	9306	6822	5304	**8886**	**8061**
06:00-22:00	9656	10367	10478	10637	10969	7803	6166	**10380**	**9386**
06:00-24:00	9857	10627	10731	10895	11265	8077	6343	**10630**	**9628**
00:00-24:00	10129	10879	10996	11179	11561	8387	6717	**10887**	**9910**



Appendix 14.1

Outline Construction and Demolition Waste Management Plan

APPENDIX 14.1 Outline Construction and Demolition Waste Management Plan

Outline Construction and Demolition Waste Plan

In advance of the demolition, excavation and construction phases of the scheme a Construction Waste Management Plan which meets the requirements of the DoEHLG Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects (DoEHLG, 2006a) will be prepared by the contractor.

Where waste generation cannot be avoided, this will maximise the quantity and quality of waste delivered for recycling and facilitate its movement up the waste hierarchy away from landfill disposal and reduce its environmental impact.

The outline Construction and Demolition Plan for the proposed development is set out below. The Waste Management Plan will include but will not be limited to:

- Details of main contractor including nominated project manager;
- The names, roles, responsibilities and authority of key personnel involved in waste management on site and in the design team;
- Estimates of waste generation including the types and quantity of wastes generated;
- Types and quantities of excavation material;
- Measures to reduce waste generation;
- The amounts of material intended to be stored temporarily onsite and the location of such storage;
- Measures to prevent nuisances etc;
- Authorised waste hauliers with appropriate and up-to-date Waste Collection Permits;
- Recycling and disposal sites, including copies of permits/licences for waste facilities; and
- Any other relevant item during construction which may be brought to the attention of the design team or the contractor which should be reasonably addressed and inserted into the Waste Management Plan.

The following procedures should be included in the plan where relevant:

- Procedure for the control of sub contracts, if applicable, which must include the assessment of the sub-contractors waste management policies and control capabilities, and the identification and implementation of additional controls needed on such sub-contractors to fulfil the design teams and contractors obligations in respect of waste management;
- Procedure for dealing with waste management including liaison with third parties, statutory bodies, waste hauliers, waste disposal facilities and other companies;
- Procedure for the excavation and handling of waste materials to prevent nuisance;
- Procedure for the segregation and proper storage of materials onsite to facilitate reuse and recycling;
- Procedure for the management of any hazardous or contaminated waste;

- Procedure for the control of all documentation relating to the handling, transportation and disposal of waste; and
- Procedure for the management review/audits to monitor and demonstrate control over the implementation of the Waste Management Plan.

Possibilities for re-use of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use. Where excavation material cannot be re-used within the proposed works it can be transferred to the overburden mound on site.

In addition to the above during the construction phase the following mitigation measures are recommended:

- Source Segregation: Where possible metal, timber, glass and other recyclable material will be segregated during construction works and removed off site to a permitted/licensed facility for recycling. Waste stream colour coding and photographs will be used to facilitate segregation;
- Material Management: 'Just-in-time' delivery will be used so far as is reasonably practicable to minimise material wastage; and
- Waste Auditing: The Contractor will record the quantity in tonnes and types of waste and materials leaving site during the construction phase. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material which is recovered and disposed of.