APPENDICES INDEX

CHAPTER 8

WATER

Uploaded in 3 Files <20MB

> Appendix Part 1 = Appendix 8.1 & 8.2.

> Appendix Part 2 = Appendix 8.3; 8.4; 8.5 & 8.6.

> Appendix Part 3 = Appendix 8.7; 8.8; 8.9 & 8.10.

Appendix 8.1 Statement of Expertise

The evaluation of the Water (hydrological and hydrogeological) environment and the assessment of Effects and Potential Impacts, with Mitigation Measures and Remedial Impacts, was completed by Dr. Pamela Bartley (Hydro-G) who is considered a karst groundwater specialist with quarry, Section 4 Discharge Licensing and Public Water Supply expertise.

Hydro-G holds the required Professional Indemnity Insurance, Employers and Public Liability Insurance. Pamela is a member of Engineers Ireland and the International Association of Hydrogeologists (Irish Group).

Pamela is a water focussed civil engineer with almost 30 years of practical experience in field-based groundwater investigations, drilling, instrumentation, surface water sampling, flow gauging and impact assessments, public water supply from groundwater boreholes, quarry assessments, Section 4 Discharge Licensing and wastewater treatment using Nature Based Systems.

Pamela completed her primary training in the RTC system. She completed a Certificate in Civil Engineering in Letterkenny RTC and a Diploma in Water and Wastewater Engineering at Sligo RTC in the early 1990's. Her Bachelor of Engineering degree was completed at the School of Civil Engineering at Queen's University, Belfast, and her postgraduate education at the School of Civil Engineering at Trinity College, Dublin (TCD). She completed an MSc. in Environmental Engineering at the School of Civil Engineering at TCD, which had geotechnical, hydrology, hydrogeology and legislation specialties and later a hydrogeologically focussed Ph.D at TCD.

Pamela is considered an Expert Service Provider to Uisce Eireann, she is a panel hydrogeologist, PSCS, PSDP and HQSE approved and the Supplier Number 1855 applies.

With respect to the extractive industry, Pamela is considered an EIA specialist with discharge licensing competency in the context of the Water Pollution Act, enacted Irish Regulation and EU Directives. She has completed impact assessments and assisted in successful permission attainment for many regionally important quarries in SAC settings. Pamela's quarry assessments, successful EIARs gaining planning and associated Section 4 Discharge Licences include, as follows:

a) Bennettsbridge Limestone, Co. Kilkenny consent to continue at an existing site following previous refusals at Board level and successful review update of the Section 4 Discharge Licence (ENV/W/78, 2017) permitting a range of 22,000m3/d as the annual mean with a maximum of 70,000m3/d. The discharge is to the River Nore. The large range is because it is a diffuse karst aquifer and during high rainfall there is a large volume of water on the floor delivered through the epikarst of the walls of the excavated quarry.

b) Mc Grath Limestone Works Ltd, Cong, Co. Galway (W391/05_R1, 2019) permitting a discharge of 10,000m3/d to the Cong Canal upstream of Lough Corrib (SAC, SPA, proposed NHA & Public Water Supply for Galway City and environs).

c) Churchill Stone Ltd. (Cassidys), Keeloges, Churchill, Letterkenny, Co. Donegal. Section 4 Discharge (Lwat65) permitting discharge of 950 m3/d to a headwater and upstream of the commencement of mapping for a Pearl Mussel River.

d) Harrington Concrete and Quarries, Ardgaineen, Co. Galway (W_502_22) permitting a discharge of 1,435m3/d to a grassed vegetation area, following an oil interceptor, and subsequent discharge to groundwater *via* a Nature Based System in a conduit karst aquifer in a Hydrometric Area of Lough Corrib SAC and SPA.

e) MC Group, Castleisland (W214), Co. Kerry, permitting a discharge of 540m3/d to surface water.

Each of these quarries operates within SAC catchments or in proximity to NHA Bogs and they have successfully managed their discharge, under licence, for many years.

Appendix 8.2 Discharge Licence Appendix

1. Letter of Compliance (Kilkenny County Council, 2025)
2. Section 4 Discharge Licence ENV/W/78 (2017)
3. Assimilation Capacity Report (Hydro-G, 2017)
4. Settlement Lagoon Survey (MSL, 2017)
5. Lagoon Clean Out Report (ESP, 2018)

Comhairle Chontae Chill Chainnigh
Halla an Chontae Sraid Eoin Cill Chainnigh
R95 A39T

Pobail agus Áiteanna Inbhuanaithe a Chruthú

Kilkenny County Council
County Hall John Street Kilkenny
R95 A39T

Creating Sustainable Communities and Places

11/03/2025

Bennettsbridge Quarries Ltd,
Sheastown,
Bennettsbridge,
Co. Kilkenny

Re: Discharge Licence - ENV/W/78 – Routine Inspection 14th November 2024

A Chara,

Further to the site visit on the 14th November 2024, please find attached a site inspection report for your information.

Results of the sample taken show that you are compliant with license conditions.

I would also ask that you forward the Annual Environmental Report when it is complete.

Should you have any queries in relation to this matter please do not hesitate to contact the undersigned.

Mise, le meas,

Barry Whelan
Assistant Scientist
Environment Section
Kilkenny County Council

Comhairle Chontae Chill Chainnigh
Halla an Chontae Sraid Eoin Cill Chainnigh
R95 A39T

Pobail agus Áiteanna Inbhuanaithe a Chruthú

Kilkenny County Council
County Hall John Street Kilkenny
R95 A39T

Creating Sustainable Communities and Places

Environmental Inspection Report relating to Licenced Discharges

Discharge Licence Number:	ENV/W/78
Address of the site:	Sheastown, Bennettsbridge, Co. Kilkenny
Name of Licence Holder:	Bennettsbridge Quarries Ltd.
Date Granted:	15/09/2017
No. of Conditions:	Six
Nature of Facility / Activity:	Discharge of dewatered groundwater along with run-off from internal quarry areas, into Dunbell Little Stream.
Purpose of Inspection:	Routine Inspection
Date of Inspection:	14/11/2024
Time of Inspection:	
Inspector(s):	Barry Whelan

Inspection:	Scheduled:	✓	Non-Scheduled:	
	Routine:	✓	Non-Routine:	

www.kilkennycoco.ie T - 056 7794000 F - 056 7794004 e - info@kilkennycoco.ie www.kilkenny.ie

The Site

Weather conditions: Dry

Proceedings:

Sample taken and analysed. Sample taken at location shown below, which enters a watercourse that flows to the Nore.

Findings of inspection / Recommendations

Inspection Findings:

The results of the sample taken are as follows:

14/11/2024 Test Results		
Parameter	**ELV**	**Discharge**
pH	6 to 9	7.65
BOD	2 mg/l	0.9 mg/l
COD	10 mg/l	10 mg/l
Suspended Solids	10 mg/l	10mg/l
Total Ammonia	0.17 mg/l	0.015 mg/l
Nitrate	10 mg/l	5.457 mg/l
Molybdate-Reactive Phosphate	0.07 mg/l	0.02 mg/l
Total Hydrocarbons	0.68 mg/l	-

Further action required :

- Copy of this inspection report to be issued to licence holder.
- Request that annual monitoring reports are provided

Additional Comments:

Latest Annual Environmental Report to be forwarded when complete.

RISK PROFILE

The site is in a Regionally Important Aquifer, with probably significant baseflow to the River Nore. The key risk receptor is to the Nore SAC approximately 500m from the site as shown below

LOCAL GOVERNMENT (WATER POLLUTION) ACTS 1977 to 2007

LICENCE TO DISCHARGE EFFLUENT

TO WATERS

TO: Bennettsbridge Limestone Quarries Ltd.
Kilree
Bennettsbridge
Co. Kilkenny

Ref. No. in Register: ENV/W/78

Kilkenny County Council in exercise of the Powers conferred on it by the Local Government (Water Pollution) Acts 1977 to 2007 hereby grants a reviewed discharge licence dated September 15th 2017, Reference ENV/W/78 to discharge trade effluent to waters, subject to the Schedule of Conditions attached.

Carol McCarthy
Delegated Officer.

Schedule of Conditions

Condition 1: Scope

1.1 This reviewed licence refers to the discharge of treated groundwater from dewatering operations and stormwater runoff from internal access roads by the licence holder, in accordance with the plans and particulars submitted to Kilkenny County Council with the licence review application on the 14th June 2017 and the further information submitted on the 05th September 2017 except where otherwise required in order to comply with the conditions below. This licence refers to one discharge point only – that point being from the settlement pond to the existing drain.

1.2 There shall be no discharge of trade effluent other than groundwater from dewatering operations at the quarry and stormwater runoff from internal areas.

Condition 2: Notifications

2.1 The licence holder shall nominate an individual of management status whose name shall be made available to Kilkenny County Council and will be responsible for the supervision and control of the discharge subject to this licence. The name of this individual shall be notified to Kilkenny County Council **within 2 months** of the final date of grant of this licence. This individual shall be available at all reasonable times to provide access to any authorised persons to both the treatment system and any records referred to below.

2.2 The licence holder shall notify Kilkenny County Council by both telephone and email, as soon as practicable and in any case not later than 10:00 am on the following working day, of any emission which does not comply with the requirements of this licence. The notification shall include the date and time of the non-compliance, details of the non-compliance and the steps taken, or to be taken, to minimise the impact and prevent a reoccurrence.

2.3 In the event of a serious non-compliance which may require an emergency response from Kilkenny County Council the Council shall be notified as a matter of urgency. In the event of a serious out of hours incident the Council shall be notified by phone through the 24 hours non-fire emergency number – details of which are available on the Council Website.

Condition 3: Infrastructure

3.1 The licence holder shall ensure that any additional infrastructure not already in place but required to ensure compliance with the terms of this licence is in place as soon as practicable and in any event no later than six months following the final granting of this reviewed licence.

3.2 The licence holder shall ensure that

(a) the mean daily discharge over the course of a year shall not exceed 22,000 m^3 / day, and

(b) the maximum daily discharge shall not exceed 70,000 m^3/day.

A continuous flow monitoring facility shall be installed on the discharge (downstream of the settlement lagoon) within six months of the date of this licence.

3.3 The licence holder shall ensure that the capacity of the settlement lagoon is increased by the removal of the accumulated sediment. The works shall be carried out as soon as practicable. The licence holder shall notify Kilkenny County Council once the works are complete.

3.4 The licence holder shall ensure that the complete treatment system (including the stilling pond, settlement lagoon and interceptor) is regularly serviced, desludged and maintained by a competent person / management company. The licence holder shall maintain records of the contractual arrangements regarding the servicing and maintenance of the system.

3.5 All sampling points shall be provided with safe and permanent access.

3.6 The complete treatment system and all internal drainage systems shall be inspected on an ongoing basis to ensure that there are no blockages. In addition drainage systems shall be inspected following periods of heavy rain. The frequency of such inspections shall be determined by the licence holder and shall be such so as to demonstrate compliance with this licence – but shall be at least weekly.

3.7 Good quarry management practices should be adhered to including the storage of all fuels in bunded tanks and the use of drip trays during refuelling of plant.

Condition 4: Monitoring

4.1 The characteristics of the effluent as discharged shall not exceed the following emission limit values (ELVs):

PARAMETER	*ELV*	*UNITS*
pH	6-9	-
Suspended Solids	10	mg/l
BOD	2	mg/l
COD	10	mg/l
Nitrate	10	mg/l - N
Total Ammonia	0.17	mg/l - N
Molybdate-Reactive Phosphate	0.07	mg/l - P
Total Hydrocarbons	0.68	mg/l

4.2 Sampling of the final effluent as discharged shall be undertaken at least monthly during the first 6 months following the final grant of this reviewed licence and shall be subject to review thereafter having regard to the performance over the first 6 months. The samples shall be grab samples of the final effluent as discharged. Unless otherwise specified, samples shall be collected in polythene or equivalent containers with self-sealing tamper proof caps, and refrigerated within 15 minutes of collection. The analysis shall be carried out for pH, Suspended Solids, BOD, COD, Nitrate, Total Ammonia, Molydate-Reactive Phosphate and Total Hydrocarbons with the analysis commencing within 24 hours of collection.

4.3 **Within 6 weeks** of the final date of granting of this licence, the licence holder shall submit for the written agreement of Kilkenny County Council a detailed sampling protocol which shall include sample collection, storage and delivery procedures. The protocol shall also include details of the accredited laboratory at which samples are to be analysed. In advance of submitting this protocol the licence holder shall ensure that the proposed laboratory accreditation is such as to allow for the levels of detection necessary to demonstrate compliance with this licence.

4.4 Should Kilkenny County Council so require, the licence holder shall undertake a 24 hour flow proportionate composite sample of the effluent as discharged. Where a request for such composite sampling is made, it shall be in writing, and so as to enable the licensee to make arrangements and carry out such installation of equipment as necessary, the licensee shall be requested to collect the composite sample(s) in question within two months of Kilkenny County Council's request.

Condition 5: Reporting

5.1 The licence holder shall compile and submit to the licensing authority a report within 14 days of the end of each sampling period as specified by condition 4.2, including the results of all monitoring relating to the previous sampling period.

5.2 The format of the monitoring reports shall include a daily record of the discharge volumes, a listing of the limit values together with the monitoring results in tabular format. Where the characteristics of the discharged effluent exceed the limit values specified in condition 4.1 the report shall also include a detailed explanation for any exceedances, steps taken to minimise its impact and details of proposed measures to prevent a reoccurrence.

5.3 The periodic report shall include a register of any incident referred to in Conditions 2.2 and 2.3.

5.4 The licence holder shall maintain a copy of all relevant inspections, records, analysis and reports in the main office of the business.

5.5 The licence holder shall submit an Annual Environmental Report from a suitably qualified person which shall be due 21 days after the end of each calendar year. The report shall contain the following information in relation to the previous calendar year:

(a) All monitoring results relating to the previous calendar year including the information required under conditions 5.1, 5.2 and 5.3.
(b) An assessment of the results, particularly noting any trends. Such analysis of trends should take account of any previous reports submitted in relation to the discharge.
(c) Confirmation (or otherwise) that the conditions attached to the licence have been complied with.

Condition 6: Financial

6.1 The licence holder shall make a payment annually to Kilkenny County Council in respect of costs incurred in regulating the discharge licence for the preceding year. The fee relating to each year will fall due at the start of the following year and shall be invoiced by Kilkenny County County Council. The fee shall include for:

- Annual audit inspection: €150 (includes for one inspection)
- Administration charge: €150 per annum

6.2 Where non-compliances with the licence conditions occur, additional follow-up inspections will be required. These will be charged at a rate of €150 per visit.

Hydro-G

Discharge Assessment Report

Bennettsbridge Limestone Quarry requested review 2017 Discharge Licence ENV/W/78 Kilkenny County Council

Discharge of Trade Effluent to Waters

Kilree, Bennettsbridge, Co. Kilkenny

BENNETTSBRIDGE LIMESTONE QUARRIES

Dr. Pamela Bartley

Hydro-G

June 2017

Hydro-G
50 Henry St.
Galway

pamela@hydro-g.com

091 449950

087 8072744

Project No.:	161220_Bennettsbridge Limestone_Discharge Licence Review 2017
Report Status:	Issue4 Final
Report Title:	Bennettsbridge Limestone Quarry's Site requested review 2017, Discharge Licence ENV/W/78. Kilkenny County Council
Date:	2nd June 2017

Prepared by: _____

Dr. Pamela Bartley

NOTES:

This report is for the use solely of the party to whom it is addressed and no responsibility is accepted to any third party.

TABLE OF CONTENTS

Executive Summary

- Bennettsbridge Limestone Quarry, Kilree, Bennettsbridge, Co. Kilkenny holds a discharge licence 'Discharge of Trade Effluent to Waters'. Kilkenny County Council's reference for this discharge licence is ENV/W/78. The licence acknowledges the fact that the waters discharged from the site are surface water and groundwaters. Groundwater forms a component of the site's discharge because the quarry maintains dry workings below the water table.

- The volumetric and hydrochemical characteristic of the quarry's discharge is well monitored by the site and the record has been re-evaluated by Hydro-G in 2017 as part of a May 2017 application for planning by Bennettsbridge Limestone Quarry.

- In light of Hydro-G's evaluation, management at the quarry made the decision to request a revision to the volumetric Conditions of the existing Discharge Licence. The reasons for requesting a review of Licence Conditions are because even though the average daily volume discharged is within the Licence Condition of 15,000 m3/d for the majority of the year, when it is calculated on an annual basis, the maximum observed and the maximum future predicted volume exceeds the maximum conditioned 40,000 m3/d of the licence. The wording of Condition 3.2, relating to how averages are calculated, is problematic because it specifies that the averages are calculated per month rather than on an annual basis. The monthly average calculation condition is at odds with the conditioned daily maximum permitted because the hydrogeological circumstance of the quarry is that it acts as a sump for local groundwater so at times of high winter throughput the daily maximum permitted can persist. This quarry is different to those whose high discharge volumes result from rainfall runoff. In the case of rainfall runoff, a high volume discharge would result from isolated rain storm events.

- In May 2017 the quarry made an application for planning for further extraction of rock within the existing landholding and footprint of the existing quarry. The May 2017 application proposes further extraction on a lateral extent, within the existing landholding and footprint of the existing quarry. In order to account for possible future increases in water management at the site the proposal is to regularise this existing discharge licence by requesting a review and increase the discharge volumes permitted in its Conditions. This report now presented by Hydro-G provides the assimilative capacity simulations, mass balance determinations and other data to justify that the receiving environment can accommodate the requested changes to the existing discharge licence.

- Adhering to the requirements of the Surface Water Regulations (2009), with respect to the existing Discharge Licence ENV/W/78, Hydro-G has completed assimilation capacity simulations and mass balance calculations to demonstrate that Condition 3.2 could defensibly and justifiably be reworded as follows:

> *"Condition 3.2 The Licence holder shall ensure that*
>
> *(a) the mean daily discharge, calculated over the course of a year, shall not exceed 22,000 m3/d, and*
>
> *(b) the maximum daily discharge shall not exceed 70,000 m3/d.*

Continuous flow monitoring shall be maintained on the discharge downstream of the settlement lagoons."

The proposed revised discharge volumes are justifiable for the existing ELVs as specified by Condition 4.1 of the existing 2015 discharge licence.

Condition 4.1 The characteristics of the effluent as discharged shall not exceed the following emission limit values (ELVs):

Parameter	Emission Limit Value
pH	6 to 9
Suspended Solids	10
BOD	3
COD	15
Nitrate	10
Total Ammonia	0.25
Molybdate-Reactive Phosphate	0.1
Total Hydrocarbons (mg/l)	1

- Hydro-G has demonstrated that with respect to the revised discharge volumes now proposed, and the associated existing ELV's of Condition 4.1, the requirements of the Surface Water Regulations (2009), Pearl Mussel Regulations (2009) and European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. 293/1988) are adhered to. This is possible because the water quality record for the River Nore at the Bennettsbridge monitoring station, as supplied by KCC in 2017, presents a better quality water hydrochemical record than that employed in previous assessments (Hydro-G, 2014). The current water quality record is within the environmental quality standards of 'High Status' as per the Surface Water Regulations (2009).

- With respect to the ability of the site's settlement systems to effectively manage the discharge waters, Murphy Surveys ltd. have completed an as-built survey of the settlement systems (February 2017) and Hydro-G has presented the required calculations to demonstrate that the volumetric capacity of the lagoons is adequate to accommodate the quarry's waters. Application of Stoke's law suggests that the site's settlement systems can accommodate 86,615 m^3/day. The capacity of the settlement lagoons being 86,615 m3/d demonstrates viability for the proposed revised discharge volumes for a daily average of 22,000 m3/d and a maximum value of 70,000 m3/d.

- It is therefore concluded that Discharge Licence ENV/W/78 can be revised to permit a daily average of 22,000 m3/d and a maximum volume of 70,000 m3/d and maintain compliance with the Surface Water Regulations (2009), Pearl Mussel Regulations (2009), Salmonid Regulations (1988) and the mass limits set in the existing 2015 Discharge Licence.

- A Natura Impact Statement (Sweeney, 2017) accompanies this application for review.

1.0 Introduction

In the process of a recent review of monitoring data at Bennettsbridge Limestone quarry at Kilree, Sheastown, County Kilkenny, it has emerged that the site's existing Discharge Licence would benefit from a review. Therefore, Hydro-G has prepared this 'Discharge Licence' Report for Kilkenny County Council's Environment Section. The purpose of the report is to present the characteristics of the discharge from the quarry (discharge volumes and hydrochemistry), the characteristics for the receiving environment (ecological, hydrometric and hydrochemical) and the required assimilation capacity simulations to demonstrate compliance with the requirements of the Surface Water Regulations (2009). Hydro-G has completed this assessment using 'the methodologies prescribed in the Department of the Environment's 'Guidance, Procedures and Training on the Licensing of Discharges to Surface waters and to Sewer for Local Authorities' (2011).

The existing quarry deals with rainfall derived surface water runoff AND groundwater at present. It has a license to discharge a volume of water that is of a scale that acknowledges the groundwater component of the waters managed by the quarry. Groundwater forms a component of the site's discharge because the quarry maintains dry workings below the water table. Kilkenny County Council's reference for the discharge licence is ENV/W/78. The site will continue to deal with groundwater, which is permissible once it is defensible in the context of the Groundwater Regulations (2010), Surface Water regulations (2009) and, in this particular case, the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011) and European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (S.I. No. 296 of 2009).

The quarry sits within a total landholding of 39.3 hectares, approximately, and an application area / working quarry area total of 24.5 hectares, approximately.

On the 12th May 2017 Bennettsbridge Limestone quarry made an application to Kilkenny County Council for a 'Project Description', within the existing footprint of the quarry, as follows:

> *"The proposed development consists of approximately 24.5 hectares which consists of a proposed extraction area of 6.9 hectares which was previously subject to rock extraction and forms part of a 9.5 hectare area which was granted Substitute Consent by An Bord Pleanala (ABP Ref: PL10.SU0122). The remaining 2.6 hectares of the Substitute Consent area which has been extracted down to 30m above Ordnance Datum will be used for access and stockpiling of raw and finished aggregates.*
>
> *The application area also consists of the continuation of use of the existing quarry consisting of 15 hectares which is authorised by way of a number of planning permissions attached. This area consists of previously extracted areas which are now used for access and storing processed aggregate, processing infrastructure (crushing,*

screening & lime plant), offices, workshop, canteens and toilet facilities, weighbridges, wheelwash facilities, fuel storage area and switch room, settlement lagoons, entrance, haul roads, ESB sub-station and all other ancillary facilities.

Rock will be extracted from the proposed extraction area down to a level of 30m above Ordnance Datum which is the floor level of the existing working quarry. Rock will be extracted by blasting means and will be transported to the existing crushing and screening plant where the material will be processed into various grades of aggregate. The reserve of limestone at the extraction area is estimated to be in the region of 2.1 million tonnes which will be extracted over a 5 year period at a maximum rate of approximately 525,000 tonnes per annum.

The proposed development will not result in an increase in the quarry footprint as the proposed application seeks to authorise future extraction from a previously extracted area and continuation of use of existing infrastructure. Subject to a grant of planning permission, the quarry will continue to use the existing plant and facilities at the quarry and it is not anticipated that any additional plant or equipment will be required to facilitate the proposed development. The operating hours at the quarry will be 7:30 to 19:00 Monday to Friday and 07:30 to 14:00 Saturday."

The 2017 application 'red line' boundary relating to this site is presented in Figure 1. The Bennettsbridge Limestone site is located at National Grid Reference 254298, 150200 and is covered by OS Discovery Series Map No. 67, Scale: 1:50,000.

Bennettsbridge Limestone is not the only quarry within a relatively small geographical area. There are two other quarries to the North East of this quarry. All three quarries are within a 2km radius of Bennettsbridge. The site that is subject to this review is located at a distance of ~1km, to the North West, of Bennettsbridge. All three quarries are close to the River Nore. Figure 2 presents the Bennettsbridge Limestone site location, proximity of the other 2 local quarries, the point on the River Nore at which the discharge channel conveying discharge from the quarry joins the River Nore and the village of Bennettsbridge. Hydro-G consulted with the IPPC licensing Section of the EPA (*pers. comm.* Andrew Cox, S.E Regional Enforcement Team, Environmental Protection Agency) with respect to the IPPC licence held by Roadstone Quarry, which is 2km north-east, approximately. The licensed discharge volume is 2,200m3/d. Hydro-G has reviewed the most recently available AER and added the site's discharge to the assimilation capacity simulations completed. Hydro-G also consulted with Mr. Michael Nugent of the Environment Section of Kilkenny County Council with respect to other potential discharges in the area. Hydro-G made specific enquiry in relation to 'Hennessy Concrete', which is 1km distance, approximately, from BBL, in a N-NE direction and on the same side of the river. Kilkenny County Council confirmed that Hennessy Concrete Quarry have a discharge licence also (KCC ref. ENV W 94), which is a licence to discharge to groundwater within the site and no there is no direct discharge off site. Therefore, Hennessy Concrete does not discharge directly to the River Nore and therefore does not need consideration in assimilation capacity simulations as per DOEHLG (2011) Guidance.

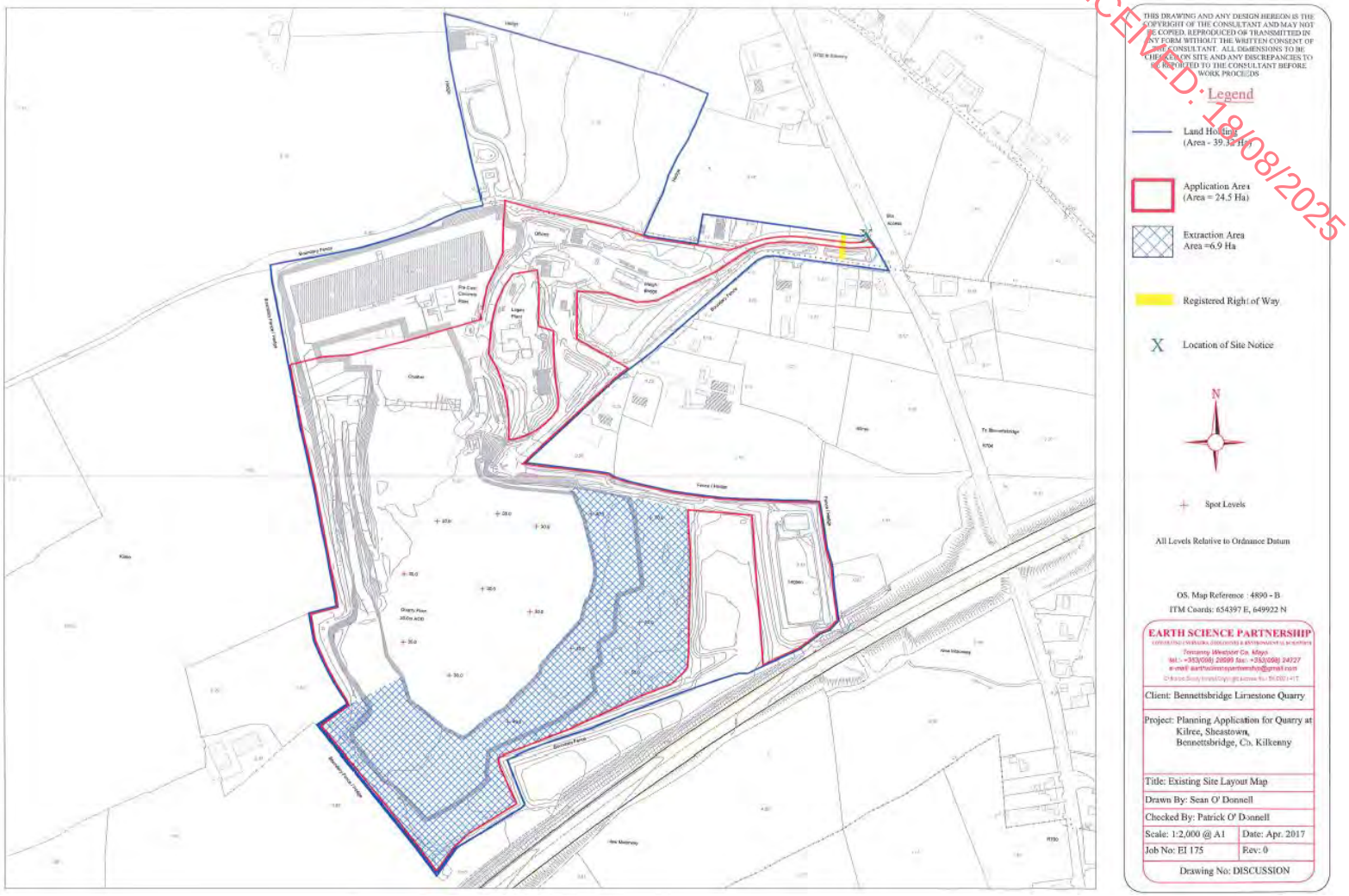

Figure 1 'Red line' boundary relating to this application with the 2017 planning application extraction areas 'hatched' in blue shading.

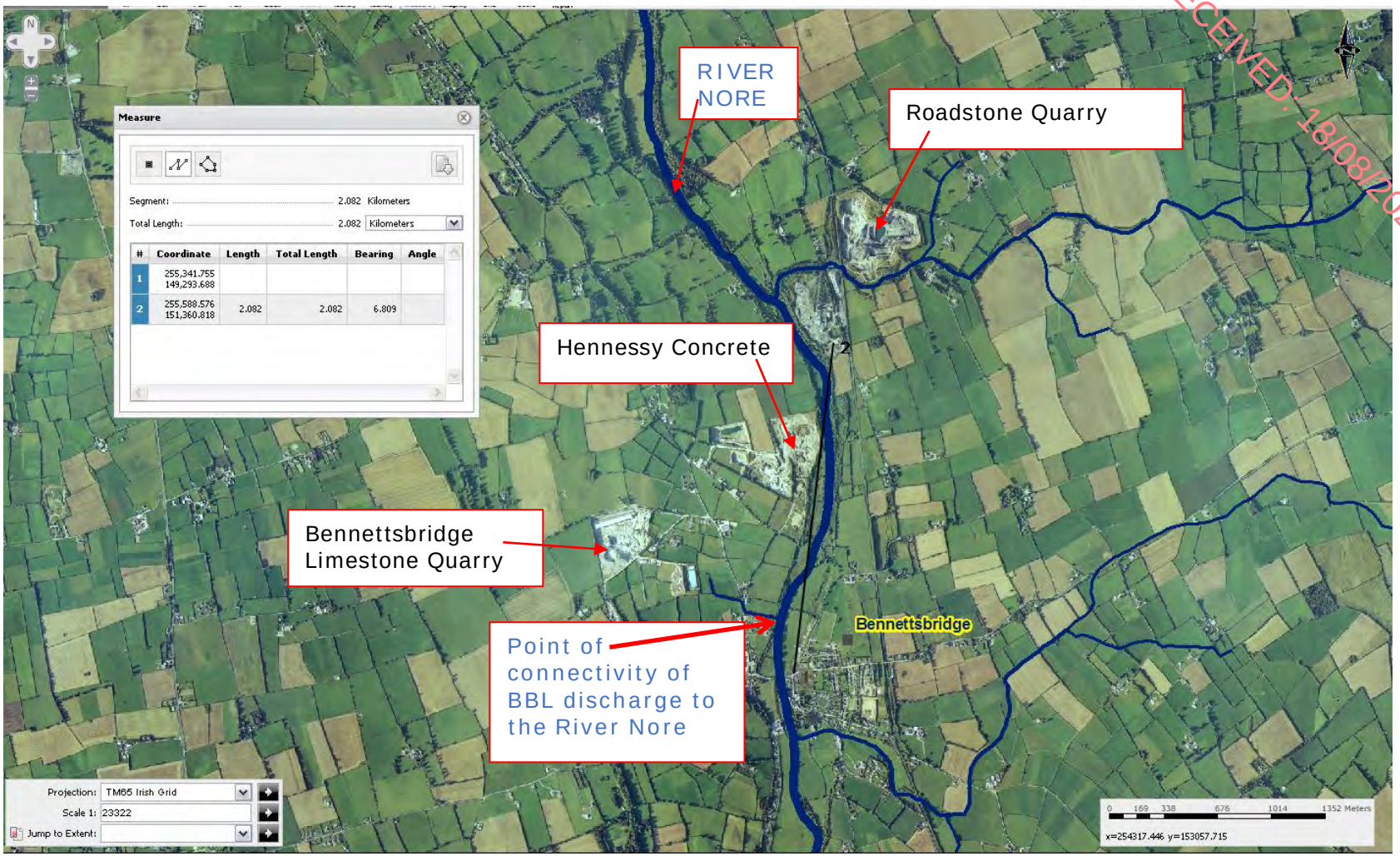

Figure 2 Bennettsbridge Limestone Quarry (BBL), River Nore & proximity of 2 other quarries in relation to Bennettsbridge.

2.0 Legislative Aspects

Hydro-G (2014) previously assessed and reported on this site and the Discharge Licence in a An Bord Pleanàla appeal (WW10.WW0411). In that report (Hydro-G, March 2014), the legislative aspects governing this discharge at the Bennettsbridge Limestone Quarries, Kilree, Sheastown, Bennettsbridge, Co. Kilkenny site were determined to be as follows:

- Article 7(a) of the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272/2009) requires that the discharge is compliant with the environmental objectives and quality standards of the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009. The pertinent Environmental Quality Objective of the Freshwater Pearl Mussel Regulations 2009 is that "no artificially **elevated levels of siltation"** are permitted (Fourth Schedule, SI 296 of 2009);

- An issue of significance under the requirements of the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272/2009) is that Article 7(b) requires the control of the discharge in the context of the setting 'relevant emission limits values' based on the 'combined approach' and the application of limits based on 'emission controls based on best available techniques'. This requires that the emission control techniques (mitigation measures) are clearly defined. Case history information, presented in the file, relating to the original application for discharge licence (TMS, 1999), presents detailed plan drawings of the water management lagoons and wetland systems proposed. However, the case file does not contain confirmation that the water management systems are current or 'as built';

- Article 27 (2) of the *European Communities (Birds and Natural Habitats) Regulations 2011 (*S.I. No. *477/2011) requires* "Any public authority having or exercising functions, including consent functions, which may have implications for or effects on nature conservation shall exercise those functions in compliance with and, as appropriate, so as to secure compliance with, the requirements of the Habitats Directive and the Birds Directive and these Regulations";

- Article 42 of Part 5 of the *European Communities (Birds and Natural Habitats) Regulations 2011 (*S.I. No. *477/2011) requires that a screening for Appropriate Assessment…* "shall be carried out by the public authority to assess, in view of best scientific knowledge and in view of the conservation objectives of the site, if that plan or project, individually or in combination with other plans or projects is likely to have a significant effect on the European site" *BEFORE consent is given and that a public authority may direct the applicant to furnish additional information necessary for the purposes of the Regulation.*

A Natura Impact Statement (Sweeney, 2017) accompanies this application for discharge licence review.

3.0 Discharge Licence History

Bennettsbridge Limestone was issued a licence to discharge trade effluent by Kilkenny County Council Discharge Licence ENV/W/78 on the 23rd June 2000. The licence is presented in Appendix A, which also contains a subsequently updated and revised licence. On the 16th January 2013, in Order no. 13, Kilkenny County Council issued a REVISED Discharge Licence Ref ENV/W/78 to Bennettsbridge Limestone Quarries, Kilree, Bennettsbridge, Co. Kilkenny. Kilkenny County Council initiated the review of discharge licence under Section 13 of the Local Government (Water Pollution) Regulations 1978. The original licence ENV/W/78 was issued in the year 2000. However, on the 13th February 2013, Inland Fisheries Ireland lodged an appeal to An Bord Pleanala "against the decision made by Kilkenny County Council made on 16th January 2013 by Kilkenny County Council to grant a revised Licence under Section 4 of the Local Government (Water Pollution) Act, 1977 as amended, to Bennettsbridge Limestone Quarries". The fundamental basis of the 2013 IFI appeal was that "the final effluent quality standards as specified in Condition 4.1 of the Licence are unnecessarily lenient". The IFI regularly assess the discharge from the quarry and their case was that the actual discharge characteristic is very good and much better than that specified in the 2013 Licence. The IFI were concerned that the leniency of the hydrochemical conditions would create precedent for leniency at other sites. As a result of that appeal, An Bord Pleanàla made a determination to revoke the licence and issue a direction for issue of a revised discharge licence. Kilkenny County Council issued a revised discharge licence ENV/W/78 on the 13th February 2015. The current licence is also presented in Appendix A. Pertinent Conditions of the Licence are as follows:

Scope: "The revised discharge licence refers to the discharge of treated groundwater from dewatering operations and stormwater runoff from internal access roads….."

Volume:

"3.2 (a) The mean daily discharge over the course of any month shall not exceed 15,000 m3/day, and

(b) The maximum daily discharge shall not exceed 40,000 m3/d."

Hydrochemistry: Condition 4.1 of the 2015 Discharge Licence outlines the Emission Limit Values of the Discharge as follows:

4.1 The characteristics of the effluent as discharged shall not exceed the following emission limit values (ELVs):

PARAMETER	ELV	UNITS
pH	6-9	-
Suspended Solids	10	mg/l
BOD	3	mg/l
COD	15	mg/l
Nitrate	10	mg/l - N
Total Ammonia	0.25	mg/l - N
Molybdate-Reactive Phosphate	0.1	mg/l - P
Total Hydrocarbons	1	mg/l

4.0 Catchment & Ecological Setting

Bennettsbridge Limestone Quarries discharges trade effluent from its premises at Kilree, Sheastown, Bennettsbridge, Co. Kilkenny to an emission point feeding local drainage channels. These drainage channels convey the discharged waters to the River Nore, at a distance of <2km from the Bennettsbridge Limestone Quarries site. The River Nore is a 140 km long river located in south-east of Ireland and has a basin area of almost 1,060 km^2. It is therefore a substantial water body. Along with the River Suir and River Barrow, it is one of a group known as the Three Sisters. The River Nore rises on the eastern slopes of the Devil's Bit Mountain in Co Tipperary and, at first, flows east through Borris in Osory and then turns south through Co Kilkenny, passing through Durrow, Ballyragget, Kilkenny City, Bennettsbridge, and Thomastown. It rises on a sandstone base at Devil's Bit Mountain but the catchment soon turns to one that is underlain by limestone bedrock and so it mostly remains until the River Nore discharges to the sea at Waterford Harbour with its sister Rivers the River Suir and River Barrow. The countryside through which the Nore travels is one that supports mixed farming, with some tillage, quite a bit of pasture and dairying and some livestock. The river has a fairly steep gradient but there are many weirs controlling flow and shallow glides are the pre-dominant flow feature.

With respect to geology, the NPWS Site Synopsis for the RIVER BARROW AND RIVER NORE (SITE CODE: 002162) details that the River Nore, for a large part of its course, traverses limestone plains and then Old Red Sandstone for a short stretch below Thomastown. Before joining the Barrow it runs over intrusive rocks poor in silica. The upper reaches of the Barrow also runs through limestone. The middle reaches and many of the eastern tributaries, sourced in the Blackstairs Mountains, run through Leinster Granite. The southern end, like the Nore runs over intrusive rocks poor in silica. Waterford Harbour is a deep valley excavated by glacial floodwaters when the sea level was lower than today. The coast shelves quite rapidly along much of the shore. Geology is significant in this because we are considering discharge from a limestone quarry and the hard water characteristic, which is associated with limestone environments, is important to the particular Nore Pearl Mussel.

The River Nore is subject to the considerations of a number of Irish Regulations, as follows:

- The River Nore is specified as a Salmonid River in the First Schedule of the European Communities (Quality Of Salmonid Waters) Regulations, 1988 (S.I. No. 293/1988);

- The River Nore is, in combination with the River Barrow, designated as a Special Area of Conservation (RIVER BARROW AND RIVER NORE, SITE CODE: 002162) and assessment of impact is therefore must include consideration of the requirements of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011). The site is designated for many species listed on Annex II of the E.U. Habitats Directive – Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Nore Freshwater, Pearl Mussel, Crayfish, Twaite Shad, Atlantic Salmon, Otter, Desmoulin's Whorl Snail, Vertigo moulinsiana and Killarney Fern. Consideration of potential impact on fish species is also important. In addition, this is the only site in the world for the hard water form of the Pearl Mussel M. m. durrovensis and one of only a handful of spawning grounds in the country for Twaite Shad;

- The River Nore is listed as one of the 27 sub-basin catchments designated as a SAC for Freshwater Pearl Mussel populations. The River Nore is a designated Freshwater Pearl Mussel sites in the First Schedule of the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009. Therefore, the requirements of the Freshwater Pearl Mussel Regulations 2009 must be considered. However, the Pearl Mussel population is determined to be upstream of the discharge (*pers. comm.,* Aine O Connor & Evelyn Moorkens, 2013). Notwithstanding the location of the Pearl Mussel population upstream of the discharge, supporting specie and fish life can travel upstream to the stationary Pearl Mussel population.

The 'Interpretation' section of The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (S.I. No. 296/2009) presents the definition of "freshwater pearl mussel" and states that it "means the species Margaritifera margaritifera and/or Margaritifera durrovensis". Hydro-G (2014) previously concluded that the Freshwater Pearl Mussel sets the context and Regulatory objective for assessments at this site and its general location[1]. The Conservation Objective is "To restore the favourable conservation condition of the Nore freshwater pearl mussel in the RiverBarrow and River Nore SAC". The NPWS Conservation Objective report (2011) then goes on to define a list of attributes and targets relating to the Nore freshwater pearl mussel Margaritifera durrovensis.

Of relevance to assessment of the potential impact of the discharge on fish life: The NPWS Conservation Objectives Report (2011) specifically details 'Host Fish' as an

[1] listed as species [1990] Nore freshwater pearl mussel Margaritifera durrovensis of the Nore freshwater pearl mussel, in the River Barrow and River Nore SAC Conservation Objectives Report (NPWS, 2011).

'Attribute' of significance to restore the favourable conservation condition of the Nore freshwater pearl mussel in the River Barrow and River Nore SAC Conservation : "Maintain sufficient juvenile salmonids to host glochidial larvae. Salmonid fish are host to the larval form of freshwater pearl mussels and thus, they are essential to the completion of the life cycle".....AND the NPWS Conservation Objectives Report (2011) specifically details fish density as important.... "*lower densities and biomass of host fish were associated with high numbers of juvenile mussels".....* AND*...."As native brown trout appear to be favoured by the Nore freshwater pearl mussel, it is particularly important that these are not out competed by stocked fish".*

5.0 Characteristics of the Area & of Relevance to the Site

5.1 Ecological Characteristics

5.1.1 General Ecological

Extracts of significance from the Site Synopsis (NPWS, 2006) for RIVER BARROW AND RIVER NORE (SITE CODE: 002162) are as follows:

"The site is very important for the presence of a number of EU Habitats Directive Annex II animal species including Freshwater Pearl Mussel (Margaritifera margaritifera and M. m. durrovensis), Freshwater Crayfish (Austropotamobius pallipes), Salmon (Salmo salar), Twaite Shad (Alosa fallax fallax), three Lamprey species - Sea (Petromyzon marinus), Brook (Lampetra planeri) and River (Lampetra fluviatilis), the marsh snail Vertigo moulinsiana and Otter (Lutra lutra). This is the only site in the world for the hard water form of the Pearl Mussel M. m. durrovensis and one of only a handful of spawning grounds in the country for Twaite Shad. The freshwater stretches of the River Nore main channel is a designated salmonid river. The Barrow/Nore is mainly a grilse fishery though spring salmon fishing is good in the vicinity of Thomastown and Inistioge on the Nore. The upper stretches of the Barrow and Nore, particularly the Owenass River, are very important for spawning."

"The site supports many other important animal species. Those which are listed in the Irish Red Data Book include Daubenton's Bat (Myotis daubentoni), Badger (Meles meles), Irish Hare (Lepus timidus hibernicus) and Frog (Rana temporaria). The rare Red Data Book fish species Smelt (Osmerus eperlanus) occurs in estuarine stretches of the site. In addition to the Freshwater Pearl Mussel, the site also supports two other freshwater Mussel species, Anodonta anatina and A. cygnea."

"The site is of ornithological importance for a number of E.U. Birds Directive Annex I species including Greenland White-fronted Goose, Whooper Swan, Bewick's Swan, Bartailed Godwit, Peregrine and Kingfisher. Nationally important numbers of Golden Plover and Bar-tailed Godwit are found during the winter. Wintering flocks of migratory birds are seen in Shanahoe Marsh and the Curragh and Goul Marsh, both in Co. Laois and also along the Barrow Estuary in Waterford Harbour. There is also an extensive autumnal roosting site in the reedbeds of the Barrow Estuary used by Swallows before they leave the country."

5.1.2 Conservation Objectives for the European Site

Extracts of significance from the 'Conservation Objectives for RIVER BARROW AND RIVER NORE SAC 002162' (NPWS, 2011) are as follows:

"The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network. The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level."

Favourable conservation status of a habitat is achieved when:

- *its natural range, and area it covers within that range, are stable or increasing, and*
- *the specific structure and functions which are necessary for its long term maintenance exist*
- *and are likely to continue to exist for the foreseeable future, and*
- *the conservation status of its typical species is favourable.*

The favourable conservation status of a species is achieved when:

- *population dynamics data on the species concerned indicate that it is maintaining itself on a longterm basis as a viable component of its natural habitats, and*
- *the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
- *there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long term basis.*

Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

Qualifying Interests
** indicates a priority habitat under the Habitats Directive*

QI Description
002162 River Barrow and River Nore SAC

[1016] Desmoulin's whorl snail Vertigo moulinsiana
[1029] Freshwater pearl mussel Margaritifera margaritifera
[1092] White clawed crayfish Austropotamobius pallipes
[1095] Sea lamprey Petromyzon marinus
[1096] Brook lamprey Lampetra planeri
[1099] River lamprey Lampetra fluviatilis
[1103] Twaite shad Alosa fallax
[1106] Atlantic salmon (Salmo salar) (only in fresh water)
[1130] Estuaries

[1140] Mudflats and sandflats not covered by seawater at low tide
[1310] Salicornia and other annuals colonizing mud and sand
[1330] Atlantic salt meadows (Glauco Puccinellietalia maritimae)
[1355] Otter Lutra lutra
[1410] Mediterranean salt meadows (Juncetalia maritimi)
[1421] Killarney fern Trichomanes speciosum
[1990] Nore freshwater pearl mussel Margaritifera durrovensis
[3260] Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho Batrachion vegetation
[4030] European dry heaths
[6430] Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
[7220] Petrifying springs with tufa formation (Cratoneurion)*
[91A0] Old sessile oak woods with Ilex and Blechnum in the British Isles
*[91E0] * Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno- Padion, Alnion incanae, Salicion albae)*

Hydro-G notes that the report detailing the Conservation Objectives for the River Barrow and River Nore SAC 002162 (NPWS, 2011) specifically cites the following:

- That for [1029] Freshwater pearl mussel Margaritifera margaritifera: "The status of the freshwater pearl mussel (Margaritifera margaritifera) as a qualifying Annex II species for the River Barrow and River Nore SAC is currently under review. The outcome of this review will determine whether a site specific conservation objective is set for this species."

And

- "Please note that the Nore freshwater pearl mussel (Margaritifera durrovensis) remains a qualifying species for this SAC. This document contains a conservation objective for the latter species."

With respect to potential sources of siltation in this catchment and Bennettsbridge quarry itself, the Freshwater Pearl Mussel Regulations 2009 require no artificially elevated levels of siltation present at the pearl mussel habitat. This is checked in the river by the absence of plumes of silt when the substratum is disturbed. The surveyor performs a substrate kick in order to ascertain whether a plume of silt is generated or not. It is important to note that the silt assessments are indicative of the catchment rather than individual site's significances. There may be reasons for absence of silt or pockets of silt in any river. Silt will not settle in unstable, fast flowing habitats of rivers, but where present will accumulate in the more stable habitats where the silt can slow down and drop to the river bed. Unfortunately, the freshwater pearl mussel always occurs at stable habitats. The most important individual areas of silt assessment are in the mussel habitat itself. The Freshwater Pearl Mussel Regulations 2009 refer to habitat conditions at the site of the freshwater pearl mussel habitat for this reason.

In review of the Pearl Mussel Plan for the River Nore (www.wfdireland.ie), Hydro-G has determined that the Pearl Mussel survey area was for an area north of the site and indeed north of Kilkenny city itself, whereas, the Bennettsbridge Limestone Quarries site discharges to the River Nore system south of Kilkenny. Consultation on the survey area and pearl mussels in this catchment with Dr. Evelyn Moorkens *pers comm.* 2013 yielded the following conclusion, "*There is an outside chance that the mussels may exist lower down, but we have not surveyed all potential areas yet…… for Bennettsbridge, one should a) consider the other qualifying features (such as twaite shad) and also consider b) fish species that may be moving upstream from Bennettsbridge that may contribute to the life cycle of M. durrovensis. From our electrofishing work it seems that M. durrovensis use trout as a host, but the sample surveyed was very small. I think the best advice may be from fisheries as to what sort of movement of fish species is likely between this area and the FPM habitat area…… In other river situations, the fpm is much more likely to use salmon and the precautionary approach should be used to protect the host throughout the catchment.*"

Hydro-G therefore offers that while the population of pearl mussels might not be in proximity to the discharge, the cumulative effect of activities in the catchment and the requirement to evaluate potential impacts of the discharge on other species of co-dependence is best articulated by the South Eastern River Basin Management Plan 2009 – 2015), as follows: "*The presence of high status sites along a river system can contribute significantly to the overall species diversity and recolonisation of species to rehabilitated stretches. These sites play an important part in conserving individual species and overall catchment biodiversity. The deterioration or loss of high quality and protected areas is often due to their sensitivity to land use changes in surrounding catchments".*

NPWS (Dr. Aine O Connor, *pers comm.* 2013) offers that the Pearl Mussel survey area issue with the location of "*Bennettsbridge and downstream is that we have no idea whether there are any mussels there anymore. That was the reason we delineated the smaller catchment to Ballyragget for the Regulations - an attempt at a pragmatic approach to conserving the species by ensuring higher standards apply in the upper catchment feeding the main extant population…… I think the pragmatic approach … is to consider the needs of the fish, especially the qualifying species (shad, salmon, lamprey) and general water quality considerations.*"

5.2 Characteristics of the Receiving Water Environment

5.2.1 Regional Hydrology

This site is hydrologically connected to the River Nore by virtue of its license to discharge waters arising at the site. Waters arising at the quarry are discharged to a stream that ultimately joins the River Nore, which is a designated Special Area of Conservation. There are Pearl Mussel species in the River Nore but they are upstream of the quarry. Prior to the commencement of this assessment, Hydro-G had previously completed an independent assessment of the quarry's discharge and the Pearl Mussel populations were ruled out as not within impact range of the site but supporting species were identified as important i.e. fish life (Hydro-G, 2014). Section 8 of the 2014 rEIS (AOS, 2014) describes the hydrology as follows:

EIS for BBLQ, Co. Kilkenny: Substitute Consent — Section 8 Water, Hydrology & Hydrogeology

8.2.2 HYDROLOGY

The development is located within the South Eastern River Basin District (SERBD) in Hydrometric Area No. 15 of the Irish River Network. It is within the River Nore catchment which is a Special Area of Conservation (SAC). The River Nore SAC is the nearest designated conservation lands to the Quarry (Site Code: 002162) at 505m to the east.

The River Nore is the main water body in the study area, see Figure 8.1. It rises in north-east of Tipperary around the townland of Ballycrine (eastern slopes of the Devil's Bit Mountain) where it flows Northeast direction for approx. 35km where it turns in an South-southeast direction in the vicinity of Portlaoise. It continues to flow South-southeast for approx. 110km until it reaches Now Ross and joins the River Barrow. The River Nore generally runs in a North-South direction in the vicinity of the site and is located approximately 500m to the east of the existing quarry.

The Nore River is classified as 'Good' until it is joined by the Owenbeg River after which it is classified as 'Moderate'. The River was assessed in 2008 by the WFD monitoring programme and was assigned a status of 'High'. The Nore Main Water Management Unit (WMU) is approximately 758km2 in area and is predominantly located within the County of Kilkenny.

There is a stream, named the Dunbell Little which is located approximately 120m to the Southeast from the Quarry. The Dunbell Little flows in an Southeast direction for approximately 810m where it joins the River Nore.

Figure 8.1 Hydrological Environment

Plate 1 Section 8.2.2 clip of the 2014 rEIS (AOS, 2014) describing the hydrological connection to the River Nore.

5.2.2 Hydrometrics: OPW & EPA Flow Volumes

OPW hydrometric data for the River Nore at Stn 15002, Johns Bridge, Kilkenny can be summarised as presented in Table 1.

Table 1 OPW data for the River Nore at Stn 15002, Johns Bridge, Kilkenny summarised by Hydro-G.

	OPW RAW DATA (m3/s)	Calculated DAILY FLOW (m3/d) - using : OPW Flow Data. Receiving Water (R. Nore) at 7km upstream		
AVERAGE (m3/s)	29.65	**2,561,898**	m3/d	OPW Average DAILY Flow At Johns Bridge
Median (m3/s)	20.23	**1,747,613**	m3/d	OPW MEDIAN DAILY Flow At Johns Bridge
MINIMUM (m3/s)	0.03	**2,765**	m3/d	OPW MIN DAILY Flow At Johns Bridge
MAXIMUM (m3/s)	472.13	**40,791,859**	m3/d	OPW MAXIMUM DAILY Flow At Johns Bridge

Information presented in Table 1 demonstrates that the average flow of water in the River Nore, receiving water for this discharge, passing through the John's Bridge flow station in Kilkenny, 7km upstream of the point of discharge, is in the order of 2.5 million m3/d, the maximum flow volume recorded is in the order of 40 million m3/d. However, that maximum flow value of 40 million m3/d is extreme and was recorded in December 2015. More usual high volume wintertime flows recorded by the OPW are in the order of 100 - 150m3/s, which is approximately equivalent to 8 million to 12 million m3/d PEAK flows in wintertime. The median value for flow in the River Nore at Johns Bridge OPW monitoring station is in the order of is 1.75 million m3/d, approximately. Flow in the receiving water is therefore substantial and in the order of multiple millions of m3/d, on average.

OPW flow statistics for frequency of occurrence (%tile durations) at Johns Bridge, Kilkenny are presented in Table 2.

Table 2 OPW recorded/calculated flow statistics for Johns Bridge, Kilkenny.

Johns Bridge (Nore)

Station: Johns Bridge (Nore) (15002)

Station number	15002
Station name	Johns Bridge (Nore)
Latitude	52.65339167
Longitude	-7.250432778
Station type	General Surface water
River	NORE
Catchment	NORE;
River Basin District	SOUTH EASTERN RBD

Parameter | Metadata | Statistics | Annual Max | Download

DURATION PERCENTILES								
Flows equalled or exceeded for the given percentage of time (m3/s) (Data derived for the period 1971 to 2013)								
1%	5%	10%	25%	50%	75%	90%	95%	99%
112.709	77.345	61.332	40.755	19.38	7.967	4.764	3.67	2.435
Levels equalled or exceeded for the given percentage of time (mAOD Poolbeg) (Data derived for the period 1971 to 2013)								
1%	5%	10%	25%	50%	75%	90%	95%	99%
45.644	45.329	45.175	44.955	44.787	44.69	44.644	44.622	44.589

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With respect to the durations for flow characteristics in the River Nore, information presented in Table 2 demonstrates that:

- at least 19.38 m3/s flows in the R. Nore for 50% of the time (1971 – 2013), which is equivalent to 1,674,432 m3/d to be exact or in the order of more than 1.5 million m3/d in general terms; and additionally,

- for the 95%tile flow condition (*i.e.* flow that is matched or exceeded 95% of the time), the volume of water flowing in the receiving water R. Nore is at least 3.67 m3/s or 317,088 m3/d.

In addition, EPA (HydroTOOL) supplies modelled flow statistics as presented in Table 3.

Table 3 EPA (HydroTOOL) modelled flow statistics for the River Nore in proximity to the discharge.

%ile	flow(m3/sec)	upper 95% confidence limit m3/sec	lower 95% confidence limit m3/sec
5	82.812	108.318	63.312
10	67.146	84.604	53.291
20	50.318	62.193	40.71
30	38.915	48.488	31.232
40	29.837	37.505	23.736
50	17.105	21.432	13.651
60	12.898	16.419	10.132
70	9.355	12.227	7.158
80	7.584	10.124	5.681
90	5.314	7.504	3.764
95	3.986	5.978	2.657

Hydro-G shall employ the actual OPW flow data because EPA HydroTOOL data is arrived at from a model, which is fine in the absence of actual data. The OPW provide actual data for the River Nore.

5.2.3 Flooding

Flooding detail for the area was presented in Section 8.2.12 of rEIS (AOS, 2014). Hydro-G's 2017 rechecking of OPW information, HydroDATA, CFRAMS and Floodmaps.ie confirms that there is no risk of flooding at the site or as a result of activities associated with the site's discharge of waters. The OPW records maximum flow accommodated by the River Nore to be in the order of 40 million m3/d (Section 5.2.2). The maximum predicted discharge from the site is 64,000 m3/d. The site has historically discharged 59,000 m3/d on occasion at times of high flow in the River Nore and no flooding has been reported by the OPW in the vicinity of the discharge from Bennettsbridge Limestone Quarry nor immediately downstream of the discharge at Bennettsbridge.

5.2.4 Quarry Discharge Volumes & Dilution Factors

Average daily discharge volumes are presented in Table 4. As the quarry has expanded in excavation through the permitted area, there have been increases in volumes of water being managed and discharged.

Table 4 Average daily discharge volumes, Bennettsbridge Quarry.

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Average Daily Discharge (m3/d)	10,054	10,598	13,681	19,831	15,691	10,628	15,123	9,325	21,083	14,719	19,089	12,982

AVERAGE	14,112	m3/d
MAX	59,942	m3/d
MIN	1,890	m3/d

The average daily discharge from the quarry is 14,112 m3/d. However, there is a wide range in the discharge volume. The maximum volume of water that has been discharged in the past is close to 60,000 m3/d and this was at a time when the River Nore was in peak flow. The seasonal variability and annual patterns of discharge is presented in Figure 3 for the 12 year monitoring record (2005 to 2017).

The full monitoring record (2005 – 2017) data series for flow volumes is presented in Appendix B.

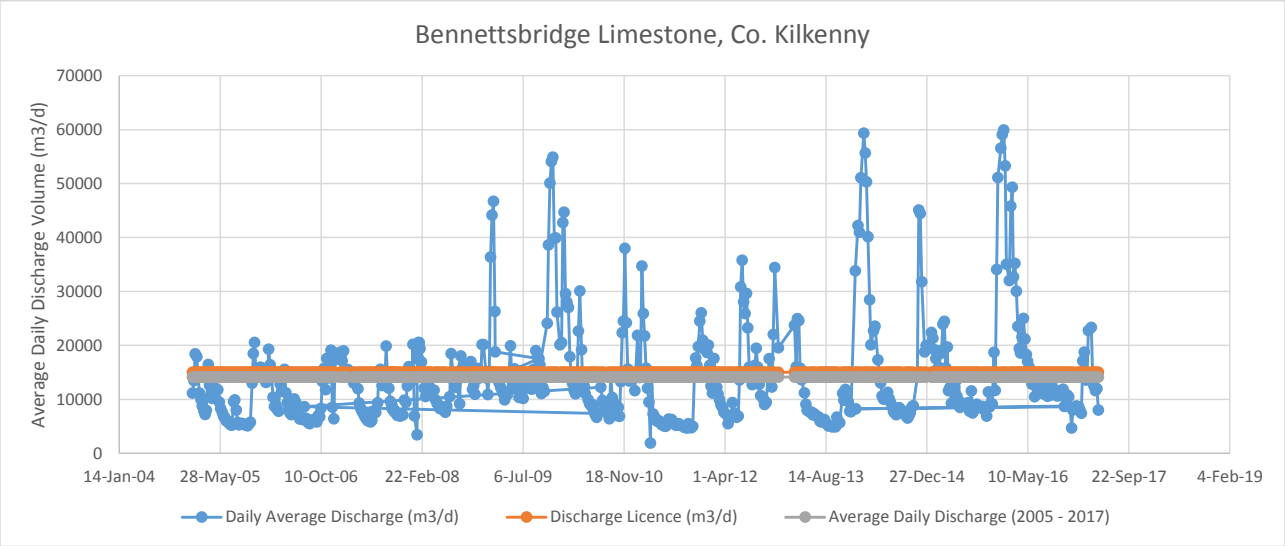

Figure 3 Seasonal variability and annual patterns of discharge (2005 to 2017).

Hydro-G evaluated the data using different types of correlation evaluations such staggered, delayed, cumulative rainfall graphing. Hydro-G's conclusion on the data is that there is no clearly definable relationship between rainfall and discharge volumes at the quarry. Site conceptual models for the hydrogeological system, by many previous hydrogeologists, cite that there is a lot of ingress in the walls close to the surface from surrounding lands i.e. the epikarst contribution. In any case, at times of little rainfall the quarry discharges a piped flow from Eden Spring that amounts to 8,200 m3/d, at low baseflow, on average. When it rains then, an additional groundwater discharge volume is contributed to the quarry, which acts like a groundwater sump, collecting very recent groundwater, sending this water to the floor sump. From the floor sump, water is then pumped to a higher elevation settlement lagoon system that facilitates settlement of solids. Discharge is then conveyed by natural discharge channel to the River Nore. This is where the groundwater was going anyway but it is delivered in point form from a stream rather than diffusely from the groundwater body. That is the conceptual model for the aquifer. A mitigating factor is that when the quarry discharges a high volume of water, which can be close to 60,000 m3/d, the corresponding flow in the River Nore at that time is at least 8 million m3/d to 12 million m3/d in winter time high flow conditions (Table 1 & 2, Section 5.2.2), with a maximum of 40 million m3/d recorded in the River Nore in December 2015. The significance of these numbers is that while 60,000 m3/d of water from the quarry might initially be perceived by an observer as a big number/high volume of water, it is not very big in the context of the millions of metres cubed that is flowing from the wider hydrogeological setting and receiving water hydrological regime.

With respect to analysis of the quarry's discharge record 2005 – 2017 (Appendix B), the following can be stated:

- 2 % of the time the discharge volume is < 5000m3/d;
- 98 % of the time the discharge volume is > 5000m3/d;
- 59 % of the time the discharge volume is > 10,000 m3/d
- 66 % of the time the discharge volume is <15,000 m3/d. This is the DAILY average permitted by the Discharge Licence;
- 34% of the time the discharge volume is >15,000 m3/d
- 16 % of the time the discharge volume it is greater than 20,000 m3/d
- 7 % of the time the discharge volume it is > 30,000 m3/d
- 4 % of the time the discharge volume > 40,000 m3/d, which is the Maximum daily volume permitted by the discharge licence;
- 2 % of the time the discharge volume > 50,000 m3 (that is 85 days out of 4830 days since the 2005 record began).
- A maximum peak recorded = 59,994 m3/d in early January 2016.

Discharge duration data are presented in Figure 4, which demonstrates graphically the same information presented in text, above, that 66 % of the time the discharge volume is <15,000 m3/d and the 40,000m3/d maximum limit on the current discharge licence is exceeded only 4% of the time.

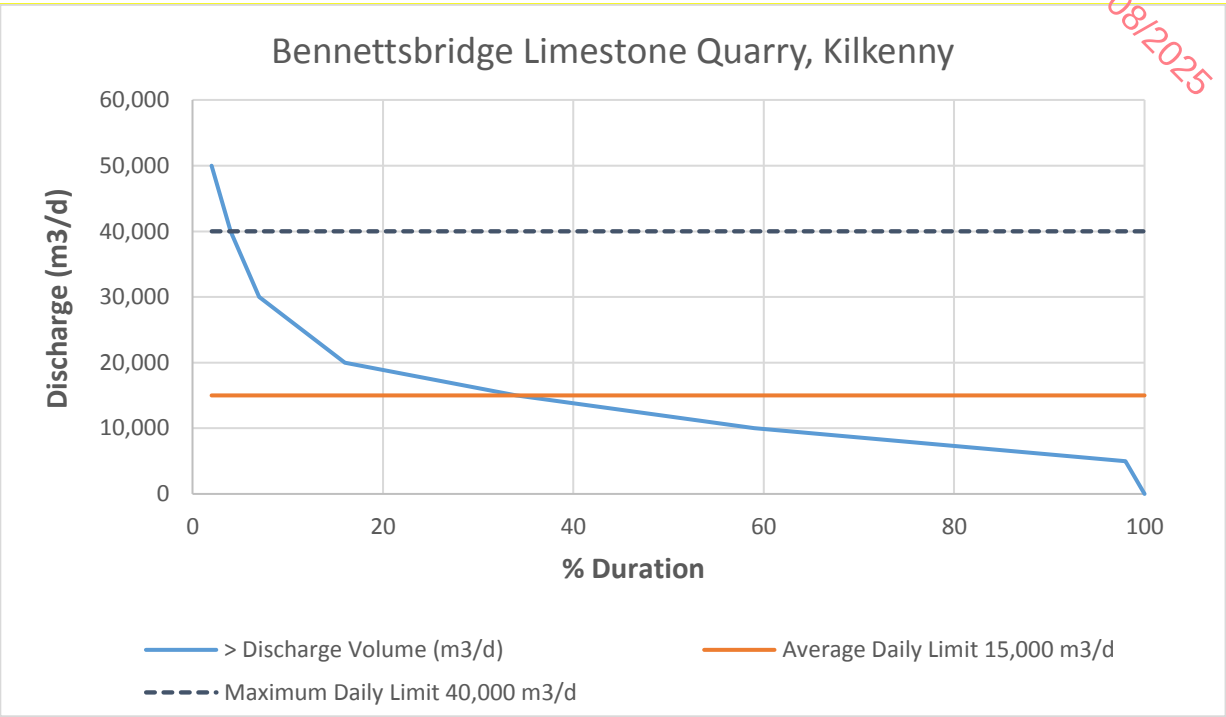

Figure 4 Discharge from Bennetttsbridge as a function of percentage duration or frequency of occurance.

The volumetric discharge data for Bennettsbridge Limestone's discharge can be related to the flow duration data for the OPW's John's Bridge flow guaging station data (www.waterlevel.ie/hydrodata) as reproduced in Table 2. The percentage duration for flows in the River Nore and the quarry's discharge data are presented together in Table 5 and ploted in Figure 5.

Table 5 % Duration River Nore and associated discharge volumes from Bennettsbridge Limestone Quarry with calculated flow ratios and dilution factors.

OPW Data; John's Bridge Flows equalled or exceeded for the given percentage of time			Bennettsbridge Limestone Quarry Discharge Volumes equalled or exceeded for the given percentage of time (2005 - 2017)	% of Quarry Discharge Relative to River Nore Flow for each Duration %tile	Dilution Factor @ each Duration %tile Flow volume
Duration %	m3/s	m3/d	(m3/d)	%	factor
1 %	112.709	9,738,058	55,024	0.57	177
5 %	77.345	6,682,608	35,642	0.53	187
10 %	61.332	5,299,085	24,332	0.46	218
25 %	40.755	3,521,232	16,361	0.46	215
50 %	19.38	1,674,432	11,406	0.68	147
75 %	7.967	688,349	7,987	1.16	86
90 %	4.764	411,610	6,012	1.46	68
95 %	3.67	317,088	5,364	1.69	59
99 %	2.435	210,384	4,742	2.25	44

Table 5 presents "Duration %tiles" for frequency of occurrence of flows in the River Nore THAT ARE EQUALLED OR EXCEEDED for a given percentage of time (OPW data, Table 2) AND the associated discharge volume from the quarry that is EQUALLED OR EXCEEDED for that %tile Duration. So for example, a figure of 7,987 m3/d discharge from the quarry in Table 5 (column 2, on the sixth row of numbers) means that the 7,987 m3/d discharge volume is equalled or exceeded 75% of the time. From a hydrogeological perspective, this makes sense because the conceptual model is that groundwater emanating from the Eden Spring is the main contributor to the discharge volume at the quarry. Evaluation of the record for daily discharge volumes at the site suggests that at times of low rainfall and recharge and consequently low groundwater flow in the catchment then the baseflow Eden Spring contribution is in the order of 8,000m3/d. At times of high flow in the catchment, the groundwater contribution from the Eden Spring increases also. As an example of how the relationships work, data in Table 5 for the **"Duration %"** that presents **"5%tile"** (most left hand column, second row) tells us that at times of higher flow, and for 5% of the year, flow in the River Nore is 77.345 m3/s or 6,682,608 m3/d. That is the volume of water flowing in the Nore and on that same row in Table 5, row 2, column 2, at that flow (and for 5%DURATION at the quarry *i.e.* 5% of the year), the quarry's discharge EQUALS OR EXCEEDS 35,642 m3/d. Table 5 data represents the correlation between high River Nore flow, high groundwater throughput in

the catchment and at the quarry and high discharge volumes from the quarry. In order to visualise the significance of this flow in the River Nore, imagine almost 7 million m3/d flowing in the River Nore. Consider that one white IBC container holds 1m3 of water. Consider that one IBC has dimensions of 1m x 1m x 1m. So an IBC is 1m long. 7million m3 = 7 million metres if you line up the IBCs to hold that volume of water = one day volume of water in the Nore amounting to almost 7 million m3 in one day in the high flow scenario 5%tile of the year. 7 million IBCs = 7000 kms distance, which is equivalent to the 'as the crow flies' distance from Kilkenny city to Kingston, Jamaica or from Kilkenny city to Nairobi on the mid and east coast of Africa if one imagines lining up 7 million IBC containers in a row. That is the volume of water flowing in the Nore and on that same row in Table 5, row 2, column 2, at that flow (and for 5%DURATION i.e. 5% of the year), the quarry discharge EQUALS OR EXCEEDS 35,642 m3/d. For the corresponding high discharge volume from the quarry in the order of 35,000 m3/d, the IBCs lined up only covers a distance of 35kms from Kilkenny City, which is approximately the distance to Carlow rather than Jamaica. Therefore, the relative volumes of the discharge are very small compared to the discharge in the river. Given that data presented in Table 5 data shows the correlation between high discharge volumes from the quarry and high flow in the River Nore flow. It supports the case for using the River Nore mean flow for the high volume discharge assimilation capacity simulations. Hydro-G employs the 50%tile 19.38 m3/s (1,674,432 m3/d) value for flow in the River Nore (Table 5) in the assimilation capacity simulations for the assessment of resultant concentrations arising from MAXIMUM volumes of discharge from the quarry (Section 6, Assimilation capacity simulation Tables 8, 10, 12, 13). Hydro-G adopts DoEHLG (2011) Guidance as per 95%tile flow condition in the receiving water for assimilation capacity simulations for the average discharge assimilation capacity simulation.

With respect to Dilution Factors, data presented in Table 5 demonstrates that a dilution factor of almost 1:150 exists 50% of the time and at times the dilution factor exceeds 200. At times of lowest flow in the River Nore and consequent low discharge from the quarry, the dilution factor is almost 50, which is to say that for every 1 volume of water discharged from the quarry there is almost 50 times more water in the River Nore.

Figure 5 demonstrates pictorially that, on a percentile duration/occurance basis, as the discharge volume from the quarry increases, so too does the flow in the River Nore. The relationship between flow in the receiving water environment River Nore and discharge from the quarry is positively correlated with an R^2=0.9745, which is close to a pure linear relationship that would be denoted by an R^2 = 1.

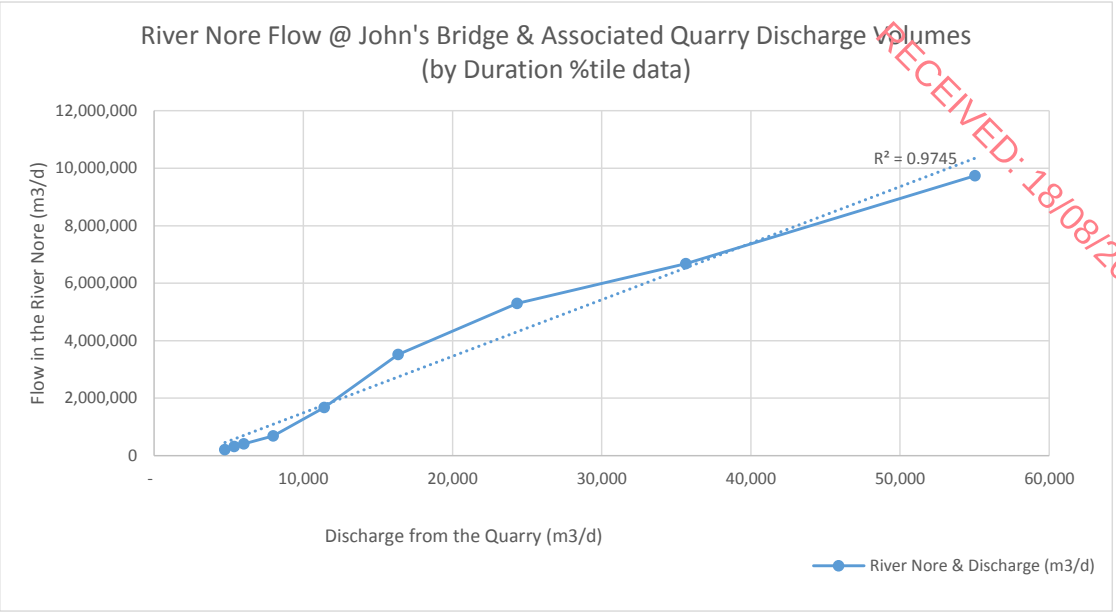

Figure 5 Discharge from Bennetttsbridge as a function of percentage duration or frequency of occurance plotted in association with OPW flow percentile duration data for the River Nore at John's Bridge. Dashed line is the linear trendline relationship.

Figure 5 demonstrates pictorially that, on a percentile duration/occurance basis, as the discharge volume from the quarry increases, so too does the flow in the River Nore. The relationship between flow in the receiving water environment River Nore and discharge from the quarry is positively correlated with an R^2=0.9745, which is close to a pure linear relationship that would be denoted by an R^2 = 1.

5.2.5 Discharge Quality

Monitoring records for discharge quality are presented in Appendix B for the last three years (2014 to 2016). Appendix B presents the full dataset in tabular form and the data is accompanied by the accredited laboratory's Certificates of Analysis. Overall, most parameters are below the limit of detection of the autoanalyser on most monthly sampling occasions. Since 2014, while there are occasional small rises in concentrations such as suspended solids, the Limit Value of the Discharge Licence has always been complied with except on one occasion in October 2015 when a value of 15mg/l was recorded. A higher historical peak referred to by Caprani (2016) was at a time of an old discharge licence limit, which was 30mg/l SS at that time. The 10mg/l SS Discharge Licence Limit of the current discharge licence has been adhered to in 34 of the 35 monitoring events of the last 3 years (note: there was one month in which no sample was obtainable in June 2015, which explains 35 monthly monitoring events in three years rather than 36). The high rate of compliance is of significance to the efficacy of the

settlement systems on-site and to potential impacts on the River Nore. In reality, the entire dataset reveals that the usual concentration of SS is <2 mg/l but the average result for 2016 is 4.2 mg/l SS because 4 of the 12 monthly monitoring concentrations in the year were 4, 5, 9 and 10 mg/l SS, which are all below the limit of the Discharge Licence. Evaluation of these data has resulted in the quarry's environmental manager's review of the sampling protocol at low discharge occasions.

In summary, the 2016 monthly monitoring record for the discharge quality reveals average concentrations, as follows:

- Suspended Solids average 4.2 mg/l SS;
- Ortho-Phosphate average <0.01 mg/l MRP-P;
- Ammonia-N average 0.023 mg/l NH4-N;
- Nitrate-N average 6.2 mg/l NO3-N;
- Total Hydrocarbons average <0.01 mg/l;
- BOD average <1.0 mg/l;
- COD <10 mg/l average;
- 7.7 pH, on average.

Figure 6 graphically presents the monthly data record for 2016, which demonstrates that the Emission Limit Values of the discharge licence have been met for each of the monthly monitoring events.

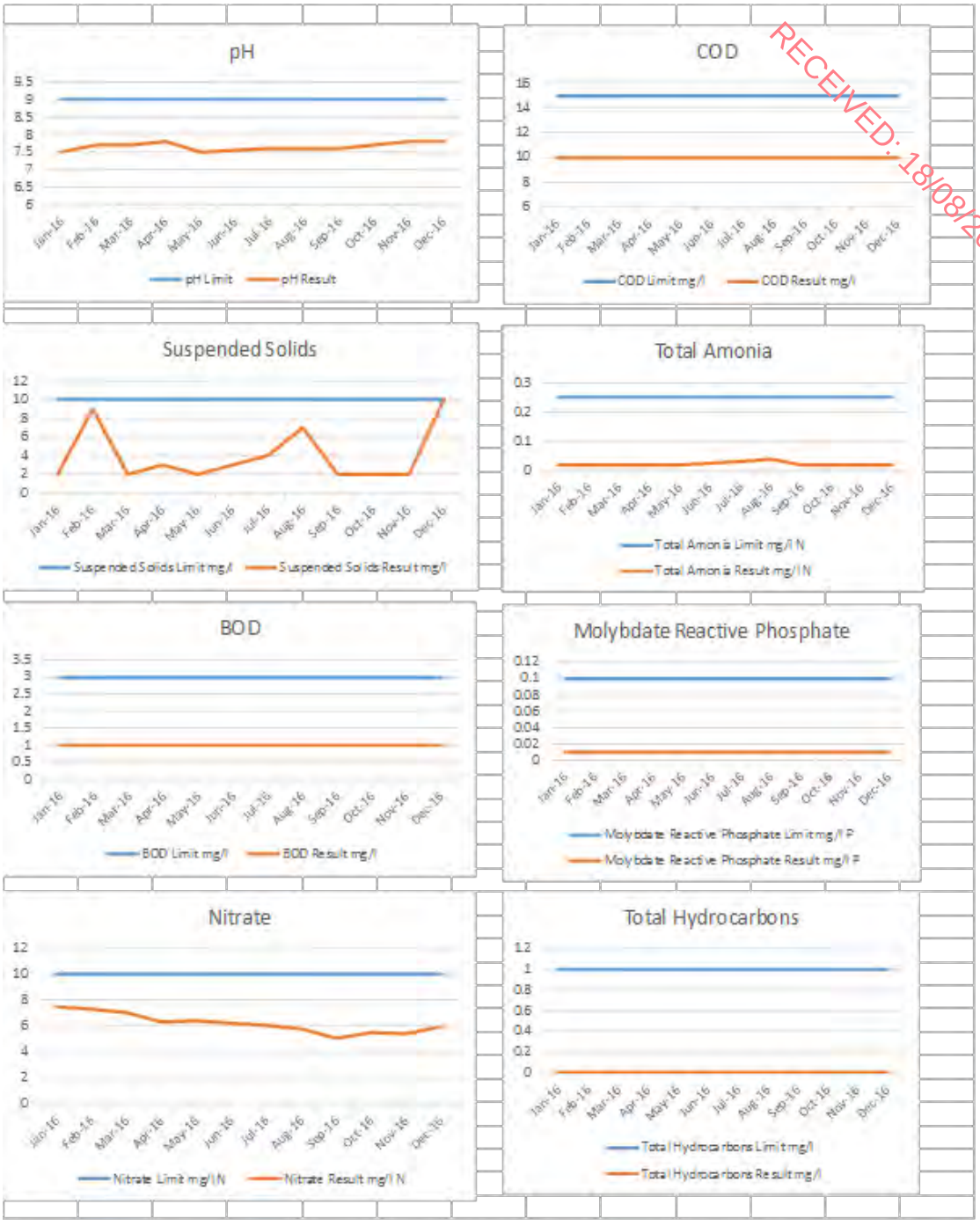

Figure 6 Bennettsbridge Limestone Quarry Discharge characteristic 2016 (orange line[2]) and Discharge Licence Emission Limit Value (horizontal blue line at top of each graph).

[2] When the orange line representing the monitoring result is horizontal it signifies that on each occasion the result was below the limit of detection of the autoanalyser in the laboratory.

In addition to the tabular presentation of the three years of the monthly monitoring data for the quarry's discharge from the settlement lagoons, Appendix B presents the Certificates of Analysis (2016, 2015 and 2014) for the discharge quality, the volumetric record for the discharge and the laboratory Certificates of Analysis for the monitoring of groundwater quality **that is carried out for the site's water supply well.** The relevance of the groundwater quality results for the well is that they are validation as to why the site's settlement lagoon system's discharge quality is so good. A large component of the input to the settlement systems is groundwater that is piped directly from Eden Spring. It is most likely that the groundwater abstracted from the well is similar in quality to groundwater discharged from Eden Spring and therefore the laboratory results for the quality of that groundwater is presented in Appendix B. As previously explained in the conceptual hydrogeological model for the site (Hydro-G Chapter 7 in ESP, 2017) and briefly in Section 5.2.2 of this report, the baseflow discharge from the quarry is groundwater as discharged from the Eden Spring. This water is piped to the settlement systems and so there is no potential for picking up suspended solids or other contaminants along the way.

With respect to monitored groundwater quality at the site, in summary, the average groundwater quality for those parameters that are of significance to activities at a quarry, for the monitoring period 2015 – 2016 are as follows:

- Ammonia <0.03 mg/l NH4, on average, and the Groundwater Threshold value of the Groundwater Regulations is 65 – 175 ug/l (which is equivalent to 0.065 - .175 mg/l NH4), for which the site is compliant;

- Nitrates 29 mg/l NO3, approximately[3], and the Groundwater Threshold value of the Groundwater Regulations is 37.5 mg/l NO3 and so the site is compliant with the Groundwater Regulations;

- Nitrites < 0.016 mg/l NO2, on average, and the Groundwater Threshold Value is 375 ug/l (which is equivalent to 0.375 mg/l NO2) and so the site is compliant with the Groundwater Regulations.

Based on the nitrogen species monitoring data, there has been no impact of explosives on groundwater at the quarry. Similarly, iron and manganese concentrations are always low in this monitored groundwater. There have been no detections of coliform bacteria in the raw well water and the hardness and alkalinity results are as expected of a limestone aquifer.

[3] For the well water, the laboratory reports Nitrates in the NO3 form and the average concentration is 29 mg/l NO3 at the site. In the reporting of the concentrations of nitrates in the discharge from the lagoons the laboratory reports nitrates in the NO3-N form. The average nitrate concentration in the discharge is reported as 6.2 mg/l NO3-N, which is equivalent to 27 mg/l NO3 and therefore concurs with the concentration reported for groundwater at the site.

5.2.6 Receiving Surface Water Status & Quality

The receiving water is assigned 'moderate' status under the Water Framework Directive characterisations (www.watermaps.ie).

From a previous discharge assessment, Hydro-G already had water quality data on file for the River Nore receiving surface water. These data were supplied by the EPA for the period 2010 to 2013. These data are presented in Tables 6 (a) and (b).

Kilkenny County Council supplied more recent data for the monitoring period 2013 – 2016 and the relevant subset of these data is presented in Tables 6 (c) and (d).

Monitoring data for the upstream monitoring point is Station "15N01-2000. 4km d/s Kilkenny (N of Warrington) – d/s Kilkenny City WWTP". However, this station reflects some impact from Kilkenny City WWTP in some parameters. The station retains its Q4 status but the average ortho-P concentration is elevated because of occasional outlier concentrations. The WWTP is nearing the completion of upgrade (Irish Water, 2017).

Available monitoring data for the River Nore in the Vicinity of the discharge from Bennettsbridge Limestone Quarry is the Bennettsbridge monitoring station named "15N01: 2100. Bennettsbridge 600 m d/s Br: Nore". By the time the river reaches the Bennettsbridge monitoring station, the river's water quality data represents water quality after the point of discharge to the receiving waters. However, given that the upstream monitoring point is compromised by the WWTP's discharge and that the discharge monitoring record from the quarry shows below the detection limit of the accredited laboratory for many parameters such as MRP-P, BOD, then Hydro-G now deems it more appropriate to use the Bennettsbridge station water quality record for assimilation capacity simulations rather than the Kilkenny (N of Warrington) stn.

The relative location of water quality monitoring points are presented in Figure 7.

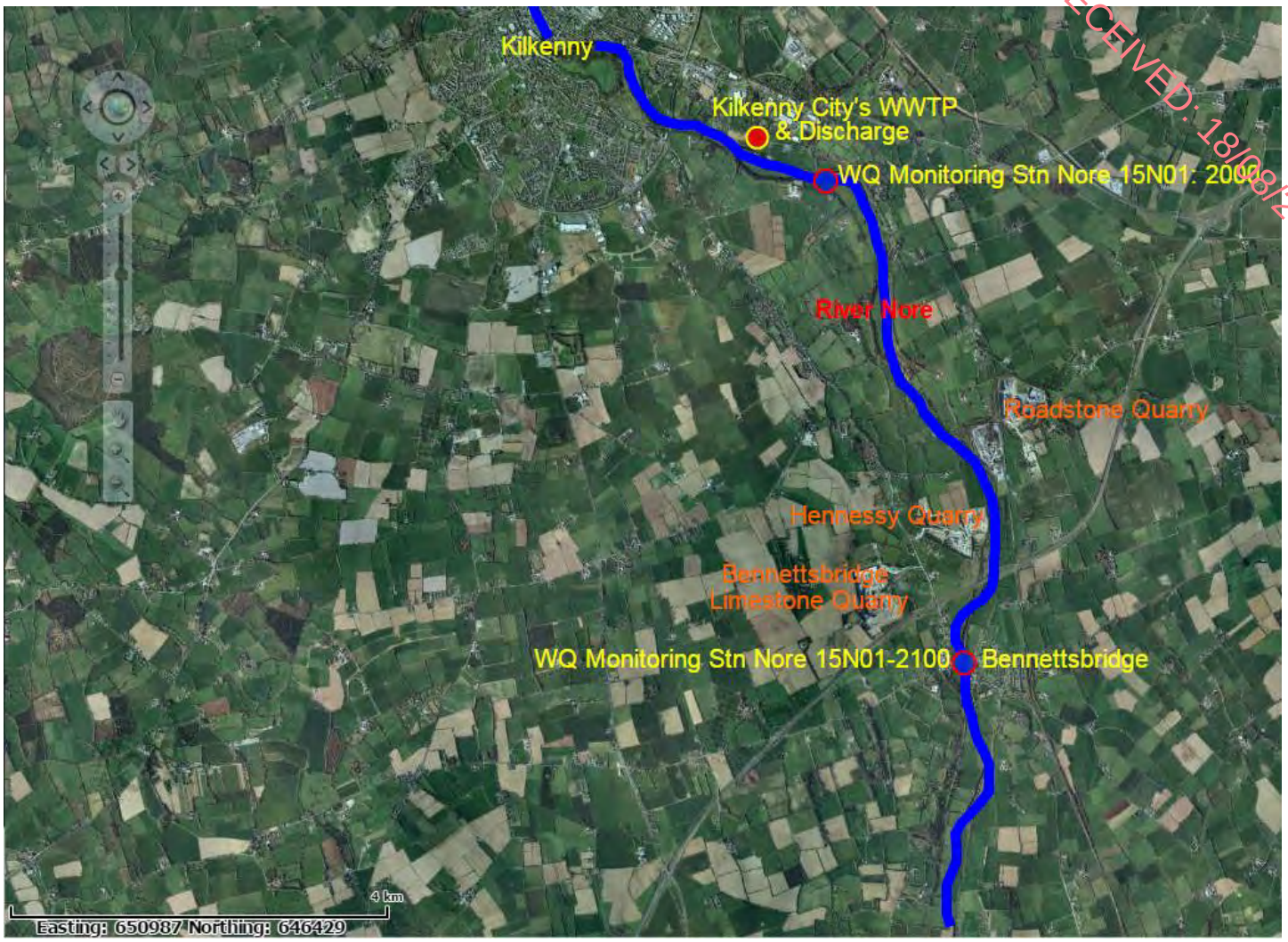

Figure 7 Relative location of water quality monitoring points.

Table 6 (a) River Nore Water Quality: Upstream 2010 – 2013 (EPA)

15N01-2000 4 km d/s Kilkenny (N of Warrington) - d/s Kilkenny City WWTP (253534 E, 15442 N). Kilkenny.																
DATE COLLECTED	oC	DO mg/l	BOD	True Colour	pH	Ammonia	Chloride	Q Value	DO	EC	Ortho-Phosphate	Nitrite	TON	Alkalinity	Suspended Solids	Total Hardness (as CaCO3)
15N01-2000 4 km d/s Kilkenny (N of Warrington) - d/s Kilkenny City WWTP (253534 E, 15442 N). Kilkenny.																
05-Jan-10	3.2	13.39	1	34	8.0	0.06	17	Q4*	100	629	0.02	0.013	3.3	288	<5	334
15-Mar-10	7.6	12.56	1.2	18	8.1	0.04	22	Q4*	105	676	0.17	0.019	4.3	295		329
08-Jun-10	15.3	9.22	4.3	23	7.9	0.03	25	Q4*	92	619	0.16	0.022	3.31	263		292
05-Aug-10	16.3	10.59	0.7	24	8.2	0.01	31	Q4*	108	648	0.29	0.009	2.99	251		285
07-Oct-10	11.8	12.23	1.3	42	8.1	0.03	22	Q4*	113	586	0.16	0.008	2.53	254		295
13-Jan-11	7.8	11.19	1.2	66	8.1	0.04	15	Q4*	94	387	0.05	0.009	2.05	156		189
02-Mar-11	6.1	12.17	0.8	20	8	0.05	19	Q4*	98	623	0.14	0.007	4.05	269		293
19-May-11	13.8	11.90	1.4	nr	8.2	0.04	33	Q4*	115	686	0.48	nr	4.53	283		298
27-Jul-11	17.7	8.57	1.9	36	8.1	0.03	29	Q4*	90	632	0.34	0.009	2.77	272		281
05-Sep-11	14	9.38	2	82	7.8	0.03	28	Q4*	91	465	0.47	0.003	2.55	171		193
23-Nov-11	8.9	11.82	1	61	8.2	0.02	16	Q4*	102	530	0.05	0.014	2.58	240		266
10-Jan-12	8.5	11.00	1	41	8	0.03	17	Q4*	94	567	0.05	0.013	3.13	252		273
13-Mar-12	10.4	10.96	1	28	8.2	0.01	21	Q4*	98	652	0.04	0.01	4.74	292		298
02-Jul-12	14.8	9.62	1.5	68	8	0.03	17	Q4*	95	542	0.06	0.015	2.3	257		274
17-Sep-12	13.2	10.49	1	27	8.1	0.04	21	Q4*	100	654	0.09	0.008	3.2	304		301
14-Nov-12	10.6	10.57	1.2	69	8.1	0.04	16	Q4*	95	484	0.06	0.01	1.72	215		227
31-Jan-13	6.1	11.92	1.3	nm	8.1	0.04	17	Q4*	96	508	0.05	0.009	1.97	174		178
11-Apr-13	8.8	10.45	1	13	8.2	0.03	27	Q4*	90	678	0.12	0.015	3.78	305		316
15-Jul-13	20.5	8.73	1.4	19	8.1	0.01	37	Q4*	97	706	0.38	0.017	3.21	311		301
10-Sep-13	14	10.31	1.5	13	8.1	0.02	39	Q4*	100	698	0.18	0.006	3.25	287		297
28-Nov-13	8.1	11.58	1	24	8.1	0.024	23	Q4*	98	642	0.077	0.009	3.5	285		313
AVERAGES	**11.31**	**10.89**	**1.4**	**37.3**	**8.1**	**0.03**	**23**	**Q4**	**99**	**601**	**0.16**	**0.01**	**3.13**	**258**	**<5**	**278**

Table 6 (b) River Nore Water Quality: Bennettsbridge 2010 – 2013.

15N01-2100 Bennettsbridge (255242 E, 149267 N). Kilkenny																
DATE COLLECTED	oC	DO mg/l	BOD	True Colour	pH	Ammonia	Chloride	Q Value	DO	EC	Ortho-Phosphate	Nitrite	TON	Alkalinity	Suspended Solids	Total Hardness (as CaCO3)
15N01-2100 Bennettsbridge (255242 E, 149267 N). Kilkenny																
05-Jan-10	3.6	13.25	0.8	33	8	0.05	17	Q4	100	631	0.03	0.013	3.3	289	5	333
24-Feb-10	5.6	12.20	0.5	26	8.1	0.06	21	Q4	97	655	0.04	0.016	3.6	235	5	334
15-Mar-10	7.5	12.59	1	15	8.1	0.03	20	Q4	105	670	0.03	0.018	3.6	301	5	339
08-Jun-10	15.8	8.43	7.3	23	8.1	0.06	25	Q4	85	652	0.04	0.028	3.47	284	5	318
01-Jul-10	17.3	8.16	1.7	18	7.9	0.05	33	Q4	85	704	0.11	0.024	3.06	302	5	313
05-Aug-10	16.1	10.05	0.6	20	8.1	0.01	25	Q4	102	621	0.06	0.006	2.91	244	5	297
24-Aug-10	15.9	10.39	0.8	29	8.1	0.01	27	Q4	105	591	0.06	0.009	2.97	247	5	283
07-Oct-10	12	11.96	1.1	43	8.1	0.02	18	Q4	111	569	0.06	0.008	2.43	252	5	284
03-Nov-10	9.8	10.55	1.6	97	8	0.04	13	Q4	93	427	0.04	0.008	1.85	180	11	216
30-Nov-10	3.6	12.45	0.5	22	8.3	0.04	17	Q4	94	632	0.06	0.011	3.26	295	5	nr
13-Jan-11	8	11.13	1.3	68	7.9	0.03	15	Q4	94	381	0.05	0.009	1.94	155	25	191
15-Feb-11	6.2	12.01	1.2	43	8	0.02	16	Q4	97	531	0.06	0.008	2.62	236	5	254
02-Mar-11	6.4	12.08	0.6	19	8	0.02	17	Q4	98	623	0.05	0.008	3.84	272	5	294
13-Apr-11	11.7	11.07	1.7	16	8.2	0.02	25	Q4	102	636	0.09	0.016	3.55	286	5	286
19-May-11	13.5	10.21	1	nr	8.1	0.04	25	Q4	98	641	0.06	nr	3.47	265	nm	300
20-Jun-11	14.4	9.60	3.5	60	8.1	0.09	21	Q4	94	490	0.06	0.022	2.16	209	5	224
27-Jul-11	17.3	8.26	1.7	54	8.1	0.03	25	Q4	86	620	0.11	0.011	2.77	273	5	281
08-Aug-11	15.7	9.54	1	19	8.1	0.03	26	Q4	96	608	0.08	0.008	2.8	258	5	279
05-Sep-11	13.7	9.44	1.4	30	8	0.03	20	Q4	91	468	0.07	0.006	1.9	192	5	231
17-Oct-11	12.6	9.89	0.8	39	8.2	0.03	21	Q4	93	547	0.06	0.005	1.95	244	5	257
23-Nov-11	9	10.87	1.2	66	8.2	0.02	16	Q4	94	530	0.05	0.013	2.59	239	8	265
13-Dec-11	5.7	11.92	1.8	89	8.1	0.07	16	Q4	95	432	0.04	0.009	2.09	191	21	211
10-Jan-12	8.6	10.97	1.2	38	8.1	0.03	17	Q4	94	569	0.03	0.012	3.15	256	nm	275
20-Feb-12	6.6	12.51	1	33	8.1	0.03	19	Q4	102	575	0.03	0.008	3.36	256	5	274
13-Mar-12	10.3	11.10	1	30	8.2	0.02	21	Q4	99	636	0.04	0.009	5.06	293	5	304
18-Apr-12	9.7	10.91	1	17	8.2	0.01	24	Q4	96	619	0.03	0.007	3.12	259	5	290
31-May-12	16.3		1.6	16	7.8	0.01	25	Q4	nm	648	0.05	0.013	2.78	281	5	296
02-Jul-12	15.1	9.76	1.4	64	8	0.03	17	Q4	97	552	0.04	0.014	2.25	251	6	272
09-Aug-12	16.1	9.16	1.2	42	8.1	0.01	18	Q4	93	602	0.05	0.009	nr	281	5	308
17-Sep-12	13.3	9.84	1	25	8.1	0.01	22	Q4	94	662	0.04	0.007	3.31	300	5	305
14-Nov-12	10.6	10.46	1	64	8.1	0.03	16	Q4	94	489	0.04	0.009	1.75	213	11	226
03-Dec-12	7.1	11.50	1	67	8	0.04	17	Q4	95	534	0.04	0.01	2.32	244	7	274
31-Jan-13	6.1	11.67	1	nm	8.1	0.03	16	Q4	94	515	0.03	0.008	1.97	175	5	178
11-Mar-13	5.8	11.89	1.6	43	8.2	0.04	20	Q4	95	603	0.03	0.011	3.4	288	5	304
11-Apr-13	9	10.75	1	11	8.1	0.02	26	Q4	93	677	0.05	0.011	3.82	311	5	324
06-Jun-13	17.2	12.80	2.5	16	8.3	0.03	24	Q4	133	649	0.04	0.024	2.71	nr	5	275
15-Jul-13	20.9	9.38	1.6	17	8.1	0.01	32	Q4	105	685	0.12	0.014	2.87	313	6	300
19-Aug-13	16.1	9.46	1.4	69	8	0.05	24	Q4	96	539	0.11	0.009	2.26	221	4	246
10-Sep-13	13.6	9.25	1.4	11	8	0.03	38	Q4	89	689	0.09	0.005	3.06	287	4	301
24-Oct-13	11.1	10.56	1.2	87	8	0.02	18	Q4	96	433	0.09	0.009	2.2	167	14	199
28-Nov-13	7.9	11.52	1	22	8.1	0.022	21	Q4	97	630	0.03	0.009	3.3	292	4	320
17-Dec-13	6.5	11.19	1.2	58.146	8.2	0.031	19.94	Q4	91	498	0.039	0.01	2.368	212.935	11	247.35
AVERAGES	**11.17**	**10.75**	**1.4**	**39.0**	**8.1**	**0.03**	**21**	**Q4**	**97**	**582**	**0.06**	**0.01**	**2.86**	**252**	**6.68**	**276**

Table 6 (c) Upstream River Nore Water Quality: 2014 – 2015. Data KCC

Nore 15N01: 2000	NE of Warrington d/s Kilkenny												
	Ammonia N	Biological Oxygen Demand	Chloride	Conductivity @ 25°C	Dissolved Oxygen % Saturation	Nitrite N	Ortho-Phosphate P	Temperature	Alkalinity	Colour (True)	pH	Total Nitrogen N	Total Hardness CaCO3
Sample Date	mg/l	mg/l	mg/l	µS/cm	% O2	mg/l	mg/l	Degrees C	mg/l	Hazen	pH units	mg/l	mg/l
3-Mar-2014	0.021	1.4	19	469	91	0.007	0.015	6.1	202	46	8.1	2.5	221
1-May-2014	<0.02	<1	26	654	104	0.009	0.055	12.8	275	16	8.2	4.1	328
31-July-2014	0.03	<1	38	701	99	0.012	***0.076***	17.6	281	14	8.1	4.2	302
17-Sep-2014	<0.02	1.5	39	682	110	0.008	0.059	15.4	277	12	8.1	3.6	284
3-Nov-2014	0.026	2.5	18	452	114	0.005	0.037	9.2	189	92	8	2.2	216
5-Jan-2015	0.036	<1	18	494	93	0.01	0.029	7.4	208	58	8	2.7	245
19-Mar-2015	0.049	1.7	23	610	102	0.01	0.033	8.1	247	27	8.1	3.8	348
2-June-2015	0.048	3.5	24	538	103	0.01	0.05	11.8	229	45	8.1	2.6	248
18-Aug-2015	0.04	1.5	40	678	115	0.008	0.072	17.4	260	15	8.1	3.2	315
19-Nov-2015	0.034	1.6	20	405	89	0.01	0.071	9.2	169	129	7.9	1.9	194
AVERAGE	**0.032**	**1.957**	**26.5**	**568.3**	**102.0**	**0.009**	**0.050**	**11.5**	**233.7**	**45.4**	**8.1**	**3.1**	**270.1**
MAX	0.049	3.500	40.0	701.0	115.0	0.012	0.076	17.6	281.0	129.0	8.2	4.2	348.0
MIN	<0.02	<1	18.0	405.0	89.0	0.005	0.015	6.1	169.0	12.0	7.9	1.9	194.0

Table 6 (d) River Nore Water Quality: 2014 & 2015 KCC data.

Bennettsbridge 600 m d/s Br: Nore 15N01: 2100

Sample Date	Ammonia N	Biological Oxygen Demand	Chloride	Conductivity @ 25°C	Dissolved Oxygen % Saturation	Nitrite N	Ortho-Phosphate P	Temperature	Alkalinity	Colour (True)	pH	Total Nitrogen N	Suspended Solids	Total Hardness CaCO3	Copper	Zinc
	mg/l	mg/l	mg/l	µS/cm	% O2	mg/l	mg/l	Degrees C	mg/l	Hazen	pH units	mg/l	mg/l	mg/l	µg/l	µg/l
3-Mar-2014	0.037	1.3	21	481	90	0.008	0.018	6.2	203	45	8	2.5	4	225	1	22
1-Apr-2014	0.02	1.1	20	524	100	0.009	0.021	9.9	224	57	8.1	4.6	7	246	2	32
1-May-2014	<0.02	<1	24	651	100	0.009	0.02	12.8	279	17	8.1	3.9	<4	323	<1	10
3-June-2014	0.033	<1	24	638	95	0.012	0.033	15.5	282	20	8.3	3.1	<4	301	3	16
31-July-2014	0.029	<1	32	680	92	0.014	0.053	18.4	273	11	8.1	3.5	<4	306	<1	16
13-Aug-2014	0.032	1.2	21	501	96	0.007	0.055	15.3	221	69	8.1	1.9	4	224	3	22
17-Sep-2014	<0.02	<1	33	664	101	0.008	0.03	15.2	276	15	8.1	3.2	<4	286	1.1	18
2-Oct-2014	<0.02	<1	30	676	91	0.006	0.045	13.4	274	23	8.1	3.1	<4	326	2.5	21
3-Nov-2014	<0.02	1.7	18	447	113	0.006	0.037	9.4	186	101	8	2	<8	212		
20-Nov-2014	0.03	1.5	16	418	86	0.011	0.055	7.6	176	86	7.9	2.3	25	204	1.6	21
5-Jan-2015	0.02	<1	18	488	95	0.009	0.028	8	209	60	8.1	2.8	5	241	1.5	19
16-Feb-2015	0.046	1.9	22	525	97	0.013	0.033	6.4	220	30	8.1	2.6	16	248	1.5	44
19-Mar-2015	***0.36***	1.2	23	614	103	0.009	0.032	8.1	269	29	8.1	3.7	6	349	1	16
5-May-2015	0.045	2.3	18	393	91	0.008	0.026	11.1	157	86	7.8	1.7	33	187	2.6	23
2-June-2015	0.046	2	22	511	104	0.01	0.028	12.2	212	40	8	2.6	8	239	<1	17
13-July-2015	0.02	<1	30	667	93	0.021	0.038	16.2	263	21	8	3.5	<4	299	1.6	20
18-Aug-2015	0.032	<1	33	658	103	0.008	0.047	16.5	266	14	8	3.1	<4	321	<1	8.3
16-Sep-2015	0.027	<1	28	572	93	0.005	0.052	13.1	231	35	8	2.5	<4	262	<1	8
19-Nov-2015	0.039	1.6	20	405	87	0.01	0.071	9.2	161	133	7.9	1.9	18	193	<1	<1
AVERAGE	**0.033***	**1.58**	**24**	**553**	**96**	**0.010**	**0.038**	**11.8**	**231**	**47**	**8.0**	**2.9**	**8.7**	**263**	**2**	**20**
MAX	0.360	2.3	33	680	113	0.021	0.071	18.4	282	133	8.3	4.6	33.0	349	3	44
MIN	<0.02	<1	16	393	86	0.005	0.018	6.2	157	11	7.8	1.7	<4	187	1	8
	Ammonia N	Biological Oxygen Demand	Chloride	Conductivity @ 25°C	Dissolved Oxygen % Saturation	Nitrite N	Ortho-Phosphate P	Temperature	Alkalinity	Colour (True)	pH	Total Nitrogen N	Suspended Solids	Total Hardness CaCO3	Copper	Zinc

*** NOTE: Average for Ammonia does not consider the 0.36 mg/l NH4-N concentration for March 2015**

The information presented in Table 6 (d) for the Bennettsbridge monitoring station 2013 - 2015 reveals a good class water with BOD averaging 1.58 mg/l mg/l BOD, which is relatively low and good, ammonia-N averaging 0.033 mg/l and ortho-P averaging 0.038 mg/l MRP-P. Total Nitrogen and Nitrite species are similarly low and suggest good quality and no impact from quarry nitrogen species explosives. Of the nineteen monitoring events reported for 2014 - 2015, Suspended Solids concentrations are below the detection limit of the autoanalyser on ten occasions but there are four peak events associated with high flows and storms that would bring solids in from the entire catchment area's soils and topsoils. Overall, the river's monitoring results place the River Nore in the 'High Status' bracket of the Surface Water Regulations (2009) for the 95%tile flow condition. These results also reflect the impact of Bennettsbridge Limestone's on-going discharge to the River Nore because the River Nore's "15N:01 2100 Bennettsbridge" monitoring station is downstream of the discharge from the quarry. The quarry has been discharging to the River Nore for over fifteen years and the quality of the river retains water quality results within the environmental quality criteria for 'High Status' classification when the results are compared to the Surface Water Regulations (2009) Environmental Quality Objectives. This is operational validation for the efficacy of the on-site settlement systems at the quarry and also for the monitoring record for the quality of the discharge from the quarry.

However with respect to the actual Water Framework Directive 'status' assigned to the River Nore, it is the 'Moderate' status of the macroinvertebrate population in the river and Pearl Mussel habitat conditions that have resulted in the downgrading of Status class in the River Nore. Further clarification is provided by the DoEHLG (2010), as follows:

> ***"WFD Ecological Status***
>
> *Surface water monitoring includes ecological and chemical parameters. For ecological status, quality elements, representing plants, insects and fish, along with supporting water quality, hydrology and morphological conditions are sampled and analysed in rivers and lakes to allow waterbodies to be classified into one of five classes of ecological status; high, good, moderate, poor and bad. New standards were set in the Surface Waters Environmental Quality Objectives Regulations (SI 272 of 2009). A range of elements are measured in each water body, and a classification is produced based on a 'one out, all out' principle. This uses the poorest individual element result to set the overall classification. Once the status of monitored waterbodies is determined all waterbody types (e.g. river or lake) in the River Basin District (RBD) are clustered according to typology (physical characteristics) and risk assessment (from Article 5 characterisation). This provides a type and pressure profile of waterbodies which allows status to be extrapolated from monitored (donor) waterbodies to unmonitored (recipient) waterbodies. Under the assessment of ecological status macroinvertebrates include a special consideration of the conservation status of the freshwater pearl mussel in SACs protected for the species. In such areas where the freshwater pearl mussel is at unfavourable conservation status, the EPA must assign a status of 'less than good ecological status', where on the basis of specialist surveys undertaken to assess conservation status, the freshwater pearl mussel is found to be in unfavourable conservation status owing to water quality or hydrology in that water body (Freshwater Pearl Mussel Regulations, 2009)."*

Assimilation capacity simulation and determination of mass loadings are now presented in Section 6.

6.0 Assimilation capacity Simulations

6.1 Assimilation capacity Scenarios

With respect to the receiving environment's characteristics presented in Section 5, data employed in the assimilation capacity simulations are summarised as follows:

1. Bennettsbridge Limestone Quarry Actual Discharge Quality 2016 =

   - Ortho-Phosphate average < 0.01 mg/l MRP-P;
   - BOD average <1.0 mg/l;
   - 4.2 mg/l SS;
   - Ammonia-N average 0.023 mg/l NH4-N;
   - Nitrate-N average 6.2 mg/l NO3-N;
   - Total Hydrocarbons average 0.01 mg/l;
   - COD <10 mg/l average;
   - 7.7 pH, on average.

2. Discharge volumes =

   a. Actual Monitored Daily Average 2005 – 2017 = 14,112 m3/d

   b. Actual Monitored Maximum Discharge 2005 – 2017 = 59,942 m3/d is evaluated in the assimilation capacity simulations using the Predicted Maximum Discharge of 64,000 m3/d because if assimilation capacity simulations are acceptable for 64,000 m3/d then they are acceptable for the lesser amount of 59,942 m3/d. While Hydro-G has predicted that the maximum future daily discharge from the quarry may be 64,000 m3/d (Chapter 7, May 2017 EIS accompanying application for planning), in this application for Discharge Licence Review a value of 70,000m3/d is requested as the maximum value for the Conditions of the Licence. This is proposed in order to provide space in the licence for unforeseen climatic events.

   c. PROPOSED Average Daily Discharge for Revised 2017 Discharge Licence Conditions = 22,000 m3/d using revised ELVs now proposed for 2017 Discharge Licence Review.

   d. Proposed Maximum Discharge Condition for 2017 Revised Discharge Licence Conditions = 70,000 m3/d using revised ELVs that now proposed for 2017 Discharge Licence Review.

e. Cumulative assessment for potential future conditions for Bennettsbridge Limestone Quarry & Roadstone Quarry combined discharge = 72,500 m3/d using revised ELVs that now proposed for 2017 Discharge Licence Review.

3. Receiving River Nore water quality = EPA / KCC Bennettsbridge Stn 15:N01: 2100. The most recent water quality data supplied by KCC for the Bennettsbridge station were employed in assimilation capacity simulations (2014 – 2015, Table 6 (d)).

4. Receiving River Nore flow = As demonstrated by OPW flow data for the River Nore, which were presented in Table 5 and Figure 5, at times of high discharge volumes, river flow is also high. Therefore, Hydro-G has adopted different flow scenarios for different discharge volume evaluations.

Hydro-G now presents a range of assimilation capacity simulations, as follows:

A. Tables 7 & 8 = Bennettsbridge Limestone Quarry Existing Situation.

- Table 7 = Actual Average Daily Discharge Volume & 95%tile River Nore Flow;
- Table 8 = Maximum Predicted Discharge Volume & 50%tile River Nore Flow.

B. Tables 9 & 10 = Bennettsbridge local area quarries cumulative discharge.

- Table 9 = Actual Average Daily Discharge Volume & 95%tile River Nore Flow;
- Table 10 = Maximum Daily Discharge Volume & 50%tile River Nore Flow.

C. Tables 11, 12 & 13 = Proposed future discharge volumes & revised ELVs for revised discharge licence Bennettsbridge Limestone Quarry (2017)

- Table 11 = PROPOSED 2017 REVISED Average Daily Discharge Volume & 95%tile River Nore Flow = 22,000 m3/d & PROPOSED Emission Limit Values for the 2017 Revision of Discharge Licence ENV/W/78;
- Table 12 = PROPOSED 2017 REVISED Maximum Discharge volume 70,000 m3/d and associated 50%tile flow condition for River Nore, to make provision for increased flow in the river at times of maximum discharge from the quarry, & PROPOSED Emission Limit Values for the 2017 Revision of Discharge Licence ENV/W/78;
- Table 13 = Cumulative assessment for future potential MAXIMUM loadings arising from Bennettsbridge Limestone & Roadstone Quarry, revised ELVs and associated 50%tile flow condition for River Nore.

Table 7 Existing Situation 14,112 m3/d, Actual Average Daily Discharge, Actual Discharge Characteristic & River Nore 95%tile FLOW CONDITION.

14,112 m3/d (0.163 m3/s) Average Daily Discharge & 95%tile FLOW CONDITION (Nore)							
Assimilation capacity Simulation model [T = (FC+fc)/(F+f)]				Surface Water Regulations 2009 (SI 272 of 2009) Surface WATER EQS's (mg/l)			
MRP-P							
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.037**	mg/l	0.035	0.075	0.025	0.045
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	**0.038**	mg/l				
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1633	m3/s	**COMPLIANT**			
c = AVERAGE Monitored concentration in discharge (mg/l)	c	0.01	mg/l				
BOD							
T = RESULTANT concentration in the receiving water (mg/l)	T	**1.555**	mg/l	1.5	2.6	**1.3**	**2.2**
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	**1.58**	mg/l				
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1633	m3/s	**COMPLIANT**			
c = AVERAGE Monitored concentration in discharge (mg/l)	c	1.00	mg/l				
Ammonia-N							
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.033**	mg/l	0.065	0.1	**0.04**	**0.09**
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	0.033	mg/l				
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1633	m3/s	**COMPLIANT**			
c = AVERAGE Monitored concentration in discharge (mg/l)	c	0.025	mg/l				
Nitrates							
T = RESULTANT concentration in the receiving water (mg/l)	T	**5.1**	mg/l	Nitrates not specified in SW Regs & it is not a parameter monitored by KCC/EPA but is a part of eutrophication / fish life impact. Assuming a baseline concetraion of 5 mg/l NO3, based on actual monitored Total Nitrogen concentrations, assimilation capacity simulations suggest no significant increase in Nitrate concentration.			
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	5	mg/l				
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1633	m3/s				
c = AVERAGE Monitored concentration in discharge (mg/l)	c	6.20	mg/l				
Suspended Solids				**European Communities (Quality of Salmonid Waters) Regulations (SI 293/1988) (mg/l)**		**European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009**	
T = RESULTANT concentration in the receiving water (mg/l)	T	**8.51**	mg/l				
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	**8.70**	mg/l	25		No artificially elevated levels of siltation	
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1633	m3/s	**NO PREDICTED INCREASE IN SS CONCENTRATION: REDUCTION SIMULATED**			
c = AVERAGE Monitored concentration in discharge (mg/l)	c	4.20	mg/l				
Total Hydrocarbons				Hydrocarbons not measured by EPA surface water quality monitoring and also not a parameter of the Regs requiring compliance. Hydro-G offers that high quality natural SW would have a hydrocarbon value <0.01 mg/l. Assimulation capacity simulations suggest no increase in concentration.			
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.01**	mg/l				
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	**0.01**	mg/l				
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1633	m3/s				
c = AVERAGE Monitored concentration in discharge (mg/l)	c	0.01	mg/l	**NO PREDICTED INCREASE IN CONCENTRATION**			

Results presented in Table 7 for the 'Resultant concentration in the receiving water' demonstrate compliance with the Surface Water Regulations (2009), the Salmonid Regulations (1988) and the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009 for the current average discharge condition. Compliance with the requirements of the Pearl Mussel Regulations is inferred by virtue that there is a simulated reduction in Suspended Solids concentration in the river, which complies with the requirement for no artificially elevated levels of siltation. This will be tested by Mass Balance calculations later in this report.

Table 8 Assimilation capacity simulations Maximum Predicted discharge, Actual Discharge Characteristic & River Nore mean flow.

SITE MAX PREDICTED 64,000 m3/d Discharge (0.74 m3/s) & 50%tile FLOW CONDITION (Nore)							
Assimilation capacity Simulation model [T = (FC+fc)/(F+f)]				Surface Water Regulations 2009 (SI 272 of 2009) Surface WATER EQS's (mg/l)			
MRP-P							
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.037**	mg/l	0.035	0.075	0.025	0.045
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	**0.038**	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.7407	m3/s	**Remains Compliant with High Status 95%tile**			
c = Monitored concentration in discharge (mg/l)	c	**0.01**	mg/l				
BOD							
T = RESULTANT concentration in the receiving water (mg/l)	T	**1.56**	mg/l	1.5	2.6	**1.3**	**2.2**
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	**1.58**	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.7407	m3/s	**Remains Compliant with High Status 95%tile**			
c = Monitored concentration in discharge (mg/l)	c	**1.00**	mg/l				
Ammonia-N							
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.033**	mg/l	0.065	0.14	**0.04**	**0.09**
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	**0.033**	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.7407	m3/s	**COMPLIANT**			
c = Monitored concentration in discharge (mg/l)	c	**0.025**	mg/l				
Nitrates as N - NOT SPECIFIED in DL							
T = RESULTANT concentration in the receiving water (mg/l)	T	**5.04**	mg/l	**Nitrates not specified in SW Regs & it is not a parameter monitored by KCC/EPA but is a part of eutrophication / fish life impact. Assuming a baseline concetraion of 5 mg/l NO3, based on actual monitored Total Nitrogen concentrations, assimilation capacity simulations suggest no significant increase in Nitrate concentration.**			
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	**5**	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.7407	m3/s				
c = Monitored concentration in discharge (mg/l)	c	**6.20**	mg/l				
Suspended Solids				**Suspended Solids**			
T = RESULTANT concentration in the receiving water (mg/l)	T	**8.53**	mg/l	**European Communities (Quality of Salmonid Waters) Regulations (SI 293/1988) (mg/l)**		**European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009**	
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	**8.7**	mg/l	25		No artificially elevated levels of siltation	
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.7407	m3/s	**NO PREDICTED INCREASE IN SS CONCENTRATION: REDUCTION SIMULATED**			
c = Monitored concentration in discharge (mg/l)	c	**4.20**	mg/l				
Total Hydrocarbons							
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.01**	mg/l	**Hydrocarbons not measured by EPA surface water quality monitoring and also not a parameter of the Regs requiring compliance. Hydro-G offers that high quality natural SW would have a hydrocarbon value <0.01 mg/l. Assimulation capacity simulations suggest no increase in concentration.**			
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	**0.01**	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	c	0.7407	mg/l				
c = Monitored concentration in discharge (mg/l)	c	**0.01**	mg/l				
				NO PREDICTED INCREASE IN CONCENTRATION			

Adopting the characteristic monitored discharge concentrations for the time of maximum discharge volumes from the quarry, the maximum predicted discharge volume, Bennettsbridge water quality data for the Nore (KCC 2014 to 2015) and the 50% flow condition for the River Nore, assimilation capacity 'Resultant concentrations' presented in Table 8 demonstrate no increase in any parameter and all simulated parameters remain

within the Surface Water Regulations EQS for High Status mean and 95%tile flow conditions.

As previously mentioned, there are two other quarries in the vicinity. However, only one of these two other quarries discharges to the River Nore. Roadstone Quarry is across on the other side of the river and it holds an EPA IPPC licence (No. 521). The licensed discharge volume is 2,200m3/d. Hydro-G has reviewed the most recently available AER and added the site's discharge to the assimilation capacity simulations completed.

Hennessy Concrete is on the same side of the River Nore as Bennettsbridge Limestone quarry and slightly to the north east. Kilkenny County Council confirmed that Hennessy Concrete Quarry also have a discharge licence (KCC ref. ENV W 94). However, their licence is to discharge to groundwater within the site and no there is no discharge off site. Therefore, Hennessy Concrete does not interact directly with, or have the potential to impact, the River Nore.

Results of Bennettsbridge Limestone Quarry and Roadstone's cumulative quarry discharge assimilation capacity simulations are presented in Tables 9 and 10.

Results presented for cumulative impact assimilation capacity simulations in Table 9 suggests that adding Roadstone's 2,220 m3/d to the 14,112 m3/d daily average from Bennettsbridge Limestone Ltd., and adopting average discharge characteristics, results in no negative cumulative impact and continued compliance with the Surface Water Regulations (2009), the Salmonid Regulations (1988) and the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009.

Results presented for cumulative impact assimilation capacity simulations in Table 10 suggests that adding Roadstone's 2,220 m3/d to the maximum predicted 64,000 m3/d from Bennettsbridge Limestone Ltd., and adopting mean flow condition in the River Nore, results in no simulated increases in concentrations of MRP-P, BOD, Ammonia-N, Nitrates, Suspended Solids or hydrocarbons.

For all simulations and scenarios, the ammonia and Suspended Solids requirements of the Salmonid Regulations (1988) are also met.

Table 9 Existing Situation Cumulative Quarries AVERAGE Discharge, 95%tile FLOW CONDITION (Nore).

Cumulative Quarries (16,500 m3/d) m3/d (0.191 m3/s) Average Daily Discharge & 95%tile FLOW CONDITION (Nore)

Assimilation capacity Simulation model [T = (FC+fc)/(F+f)]				Surface Water Regulations 2009 (SI 272 of 2009) Surface WATER EQS's (mg/l)			
MRP-P							
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.037**	mg/l	0.035	0.075	0.025	0.045
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	**0.038**	mg/l				
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1910	m3/s	**COMPLIANT**			
c = AVERAGE Monitored concentration in discharge (mg/l)	c	0.01	mg/l				
BOD							
T = RESULTANT concentration in the receiving water (mg/l)	T	**1.551**	mg/l	1.5	2.6	**1.3**	**2.2**
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	**1.580**	mg/l				
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1910	m3/s	**COMPLIANT**			
c = AVERAGE Monitored concentration in discharge (mg/l)	c	1.00	mg/l				
Ammonia-N							
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.025**	mg/l	0.065	0.14	**0.04**	**0.09**
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	**0.025**	mg/l				
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1910	m3/s	**COMPLIANT**			
c = AVERAGE Monitored concentration in discharge (mg/l)	c	0.03	mg/l				
Nitrates							
T = RESULTANT concentration in the receiving water (mg/l)	T	**5.089**	mg/l	Nitrates not specified in SW Regs & it is not a parameter monitored by KCC/EPA but is a part of eutrophication / fish life impact. Assuming a baseline concetraion of 5 mg/l NO3, based on actual monitored Total Nitrogen concentrations, assimilation capacity simulations suggest no significant increase in Nitrate concentration.			
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	**5.000**	mg/l				
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1910	m3/s				
c = AVERAGE Monitored concentration in discharge (mg/l)	c	6.80	mg/l				
Suspended Solids				**European Communities (Quality of Salmonid Waters) Regulations (SI 293/1988) (mg/l)**		**European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009**	
T = RESULTANT concentration in the receiving water (mg/l)	T	**8.566**	mg/l				
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	**8.700**	mg/l	25		No artificially elevated levels of siltation	
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1910	m3/s	**NO PREDICTED INCREASE IN SS CONCENTRATION: REDUCTION SIMULATED**			
c = AVERAGE Monitored concentration in discharge (mg/l)	c	6.00	mg/l				
Total Hydrocarbons				Hydrocarbons not measured by EPA surface water quality monitoring and also not a parameter of the Regs requiring compliance. Hydro-G offers that high quality natural SW would have a hydrocarbon value <0.01 mg/l. Assimulation capacity simulations suggest no increase in concentration.			
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.010**	mg/l				
F = RECEIVING river flow, 95%tile flow (m3/s)	F	3.670	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	**0.010**	mg/l				
f = Discharge flow discharging to receiving waters (m3/s)	f	0.1910	m3/s				
c = AVERAGE Monitored concentration in discharge (mg/l)	c	0.01	mg/l	**NO PREDICTED INCREASE IN CONCENTRATION**			

Results presented in Table 9 demonstrate that the cumulative impact of the combined discharges, for the combined daily average discharge volumes, causes no increase in any parameter in the receiving surface water of the River Nore and resultant concentrations simulated demonstrate compliance with the High Status, 95%tile flow condition of the Surface Water Regulations (2009). The ammonia and Suspended Solids requirements of the Salmonid Regulations (1988) are also met.

Table 10 Existing Situation Cumulative Quarries MAXIMUM Discharge & 50%tile FLOW CONDITION (Nore).

Cumulative Quarries (66,500 m3/d = 0.7697 m3/s) & River Nore 50%tile flow

Assimilation capacity Simulation model [T = (FC+fc)/(F+f)]				Surface Water Regulations 2009 (SI 272 of 2009) Surface WATER EQS's (mg/l)			
MRP-P							
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.037**	mg/l	0.035	0.075	0.025	0.045
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	**0.038**	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.7697	m3/s	**NO PREDICTED INCREASE IN MRP-P CONCENTRATION: REDUCTION SIMULATED**			
c = Monitored concentration in discharge (mg/l)	c	0.01	mg/l				
BOD							
T = RESULTANT concentration in the receiving water (mg/l)	T	**1.56**	mg/l	1.5	2.6	**1.3**	**2.2**
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s	**Good Status Mean**	**Good STATUS 95%tile**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	**1.58**	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.7697	m3/s	**NO PREDICTED INCREASE IN BOD CONCENTRATION: REDUCTION SIMULATED**			
c = Monitored concentration in discharge (mg/l)	c	1.00	mg/l				
Ammonia-N							
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.025**	mg/l	0.065	0.14	**0.04**	**0.09**
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s	**Good Status Mean**	**Good STATUS**	**High Status Mean**	**High Status 95%tile**
C = Baseline concentration in receiving water (mg/l)	C	0.025	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.7697	m3/s	**COMPLIANT**			
c = Monitored concentration in discharge (mg/l)	c	0.03	mg/l				
Nitrates as N - NOT SPECIFIED in DL							
T = RESULTANT concentration in the receiving water (mg/l)	T	**5.07**	mg/l	Nitrates not specified in SW Regs & it is not a parameter monitored by KCC/EPA but is a part of eutrophication / fish life impact. Assuming a baseline concetraion of 5 mg/l NO3, based on actual monitored Total Nitrogen concentrations, assimilation capacity simulations suggest no significant increase in Nitrate concentration.			
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	5	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.7697	m3/s				
c = Monitored concentration in discharge (mg/l)	c	6.80	mg/l				
Suspended Solids				**Suspended Solids**			
T = (FC+fc)/(F+f)				**European Communities (Quality of Salmonid Waters) Regulations (SI 293/1988) (mg/l)**		**European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009**	
T = RESULTANT concentration in the receiving water (mg/l)	T	**8.60**	mg/l				
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	8.70	mg/l	25		No artificially elevated levels of siltation	
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.7697	m3/s	**NO PREDICTED INCREASE IN SS CONCENTRATION: REDUCTION SIMULATED**			
c = Monitored concentration in discharge (mg/l)	c	6.00	mg/l				
Total Hydrocarbons							
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.01**	mg/l	Hydrocarbons not measured by EPA surface water quality monitoring and also not a parameter of the Regs requiring compliance. Hydro-G offers that high quality natural SW would have a hydrocarbon value <0.01 mg/l. Assimulation capacity simulations suggest no increase in concentration.			
F = RECEIVING river flow, 50%tile flow (m3/s)	F	19.380	m3/s				
C = Baseline concentration in receiving water (mg/l)	C	0.01	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	c	0.7697	mg/l				
c = Monitored concentration in discharge (mg/l)	c	0.01	mg/l				
				NO PREDICTED INCREASE IN CONCENTRATION			

Results presented in Table 10 demonstrate that the cumulative impact of the combined discharges, for the maximum discharge volumes, causes no increase in any parameter in the receiving surface water of the River Nore and resultant concentrations simulated demonstrate compliance with the High Status, 50%tile flow condition of the Surface Water Regulations (2009). The ammonia and Suspended Solids requirements of the Salmonid Regulations (1988) are also met.

Table 11 PROPOSED 2017 REVISED Average Daily Discharge Volume 22,000m3/d, Proposed Revised ELVs (2017) & 95%tile River Nore Flow.

PROPOSED 2017 Average daily Discharge Condition for Revised Discharge Licence = 22,000 m3/d (0.25 m3/s), 95%tile FLOW CONDITION (Nore) & 2017 Proposed Revision Discharge Licence ELVs							
Assimilation capacity Simulation model [T = (FC+fc)/(F+f)]				Surface Water Regulations 2009 (SI 272 of 2009) Surface WATER EQS's (mg/l)			
MRP-P							
T = RESULTANT concentration in the receiving water (mg/l)	T	0.042	mg/l	0.035	0.075	0.025	0.045
F = RECEIVING river flow, 95%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	3.67	m3/s	Good Status Mean	Good STATUS 95%tile	High Status Mean	High Status 95%tile
C = KCC Data Baseline concentration in receiving water (mg/l)	C	0.038	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.25	m3/s	**Simulations completed using 95%tile flow in Nore & Resultant MRP-P is SW Regs COMPLIANT for High Status 95%tile.**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	0.10	mg/l				
BOD							
T = RESULTANT concentration in the receiving water (mg/l)	T	1.672	mg/l	1.5	2.6	**1.3**	**2.2**
F = RECEIVING river flow, 95%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	3.67	m3/s	Good Status Mean	Good STATUS 95%tile	High Status Mean	High Status 95%tile
C = KCC Data Baseline concentration in receiving water (mg/l)	C	1.580	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.25	m3/s	**Simulations completed using 95%tile flow in Nore & Resultant BOD is SW Regs COMPLIANT for High Status 95%tile.**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	3.00	mg/l				
COD							
T = RESULTANT concentration in the receiving water (mg/l)	T	3.411	mg/l	COD not specified in SW Regs & it is not a parameter monitored in the River Nore by KCC/EPA. COD is more usually a parameter considered of wastewater and heavily polluted waters. COD is a parameter of the Discharge Licence. Therefore, in the absence of actual river monitoring data, a notional COD is used here for the assimilation capacity evaluation. Simulations Suggest no significant increase in concentration in the receiving water.			
F = RECEIVING river flow, 95%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	3.67	m3/s				
C = ASSUMED LOW LEVEL concentration in receiving water (mg/l)	C	2.607	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.25	m3/s				
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	15.00	mg/l				
Ammonia-N							
T = RESULTANT concentration in the receiving water (mg/l)	T	0.047	mg/l	0.065	0.14	0.04	**0.09**
F = RECEIVING river flow, 95%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	3.67	m3/s	Good Status Mean	Good STATUS 95%tile	High Status Mean	High Status 95%tile
C = KCC Data Baseline concentration in receiving water (mg/l)	C	0.033	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.25	m3/s	**Simulations completed using 95%tile flow in Nore & Resultant NH4-N is SW Regs COMPLIANT for High Status 95%tile.**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	0.25	mg/l				
Nitrates as N - NOT SPECIFIED in DL							
T = RESULTANT concentration in the receiving water (mg/l)	T	5.324	mg/l	Nitrates not specified in SW Regs & it is not a parameter monitored by KCC/EPA but is a part of eutrophication / fish life impact. Assuming a baseline concetraion of 5 mg/l NO3, based on actual monitored Total Nitrogen concentrations, assimilation capacity simulations suggest no significant increase in Nitrate concentration.			
F = RECEIVING river flow, 95%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	3.67	m3/s				
C = ASSUMED Baseline concentration in receiving water (mg/l)	C	5.000	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.25	m3/s				
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	10.00	mg/l				
Suspended Solids				**Suspended Solids**			
T = RESULTANT concentration in the receiving water (mg/l)	T	8.784	mg/l	**European Communities (Quality of Salmonid Waters) Regulations (SI 293/1988) (mg/l)**		**European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009**	
F = RECEIVING river flow, 95%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	3.67	m3/s				
C = KCC Data Baseline concentration in receiving water (mg/l)	C	8.700	mg/l	25		No artificially elevated levels of siltation	
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.25	m3/s	**0.1 mg/l INCREASE IN SS CONCENTRATION = not significant concentration.**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	10.00	mg/l				
Total Hydrocarbons							
T = RESULTANT concentration in the receiving water (mg/l)	T	0.074	mg/l	Hydrocarbons not measured by EPA surface water quality monitoring and also not a parameter of the Regs requiring compliance. Hydro-G offers that high quality natural SW would have a hydrocarbon value <0.01 mg/l. Assimulation capacity simulations suggest no SIGNIFICANT increase in concentration because resultant concentration is <0.1 mg/l TH.			
F = RECEIVING river flow, 95%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	3.67	m3/s				
C = KCC Data Baseline concentration in receiving water (mg/l)	C	0.010	mg/l				
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	c	0.25	mg/l				
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	1.00	mg/l				

Results presented in Table 11 demonstrate that for the proposed 2017 licence revision daily average amount of 22,000m3/d resultant concentrations simulated demonstrate compliance with the High Status, 95%tile Condition, of the Surface Water Regulations (2009) and no significant increase in suspended solids concentration thereby providing an indication of an ability of this discharge volume to maintain compliance with the requirements of the Pearl Mussel Regulations (2009). The ammonia and Suspended Solids requirements of the Salmonid Regulations (1988) are also met.

Table 12 PROPOSED 2017 Maximum Discharge volume 70,000 m3/d for Discharge Licence Revision 2017, Proposed Revised ELVs (2017) and associated 50%tile flow condition for River Nore.

SITE MAX PREDICTED 64,000 m3/d Discharge SIMULATED with Factor of Safety Max 70,000 m3/d (0.81 m3/s), 50%tile FLOW CONDITION (Nore) & 2017 Proposed Revision Discharge Licence ELVs								
Assimilation capacity Simulation model [T = (FC+fc)/(F+f)]					Surface Water Regulations 2009 (SI 272 of 2009) Surface WATER EQS's (mg/l)			
MRP-P								
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.040**	mg/l		0.035	0.075	0.025	0.045
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	**19.380**	m3/s		Good Status Mean	Good STATUS 95%tile	High Status Mean	High Status 95%tile
C = KCC Data Baseline concentration in receiving water (mg/l)	C	**0.038**	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	**0.81**	m3/s		**Remains Compliant with High Status 95%tile**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	**0.10**	mg/l					
BOD								
T = RESULTANT concentration in the receiving water (mg/l)	T	**1.637**	mg/l		1.5	2.6	**1.3**	**2.2**
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	**19.380**	m3/s		Good Status Mean	Good STATUS 95%tile	High Status Mean	High Status 95%tile
C = Baseline concentration in receiving water (mg/l)	C	**1.580**	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	**0.81**	m3/s		**Remains Compliant with High Status 95%tile**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	**3.00**	mg/l					
COD								
T = RESULTANT concentration in the receiving water (mg/l)	T	**3**	mg/l		COD not specified in SW Regs & it is not a parameter monitored in the River Nore by KCC/EPA. COD is more usually a parameter considered of wastewater and heavily polluted waters. COD is a parameter of the Discharge Licence. Therefore, in the absence of actual river monitoring data, a notional COD is used here for the assimilation capacity evaluation. Simulations Suggest no increase in concentration in the receiving water.			
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	**19.380**	m3/s					
C = ASSUMED LOW LEVEL concentration in receiving water (mg/l)	C	**3**	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	**0.81**	m3/s					
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	**15.00**	mg/l					
Ammonia-N								
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.042**	mg/l		0.065	0.14	0.04	0.09
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	**19.380**	m3/s		Good Status Mean	Good STATUS 95%tile	High Status Mean	High Status 95%tile
C = Baseline concentration in receiving water (mg/l)	C	**0.033**	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	**0.81**	m3/s		**Remains Compliant with High Status 95%tile**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	**0.25**	mg/l					
Nitrates as N - NOT SPECIFIED in DL								
T = RESULTANT concentration in the receiving water (mg/l)	T	**5.201**	mg/l		Nitrates not specified in SW Regs & it is not a parameter monitored by KCC/EPA but is a part of eutrophication / fish life impact. Assuming a baseline concetraion of 5 mg/l NO3, based on actual monitored Total Nitrogen concentrations, assimilation capacity simulations suggest no significant increase in Nitrate concentration.			
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	**19.380**	m3/s					
C = ASSUMED Baseline concentration in receiving water (mg/l)	C	**5.000**	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	**0.81**	m3/s					
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	**10.00**	mg/l					
Suspended Solids					**Suspended Solids**			
T = RESULTANT concentration in the receiving water (mg/l)	T	**8.752**	mg/l		**European Communities (Quality of Salmonid Waters) Regulations (SI 293/1988) (mg/l)**		**European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009**	
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	**19.380**	m3/s					
C = Baseline concentration in receiving water (mg/l)	C	**8.700**	mg/l		25		No artificially elevated levels of siltation	
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	**0.81**	m3/s		**0.05 mg/l SS INCREASE = not significant**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	**10.00**	mg/l					
Total Hydrocarbons								
T = RESULTANT concentration in the receiving water (mg/l)	T	**0.050**	mg/l		Hydrocarbons not measured by EPA surface water quality monitoring and also not a parameter of the Regs requiring compliance. Hydro-G offers that high quality natural SW would have a hydrocarbon value <0.01 mg/l. Assimulation capacity simulations suggest no 0.04 mg/l increase in concentration but resultant remains <0.1 mg/l TH.			
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	**19.380**	m3/s					
C = Baseline concentration in receiving water (mg/l)	C	**0.010**	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	c	**0.81**	mg/l					
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	**1.00**	mg/l					

Results presented in Table 12 demonstrate that for the proposed 2017 licence revision maximum amount of 70,000m3/d there will be small increases in concentration for simulated parameters in the receiving surface water of the River Nore for the 50%tile flow condition in the Nore. However, the simulated increases are small and are 0.002 mg/l MRP-P and 0.007 mg/l ammonia-N. The resultant concentrations are still within the High Status bracket of the Surface Water Regulations (2009) for the 95%tile Flow Condition. The simulated 0.05 mg/l increase in suspended solids concentration is an indication of likely compliance with the requirements of the Pearl Mussel Regulations (2009). The ammonia and Suspended Solids requirements of the Salmonid Regulations (1988) are also met.

Table 13 Cumulative assessment for future potential MAXIMUM loadings arising from Bennettsbridge Limestone & Roadstone Quarry, Proposed Revised ELVs (2017) and associated 50%tile flow condition for River Nore.

Cumulative MAX Discharge of 72,500 m3/d (0.84 m3/s) arising from BBL & Roadstone Quarry, 50%tile FLOW CONDITION (Nore) & 2017 Proposed Revision Discharge Licence ELVs								
Assimilation capacity Simulation model [T = (FC+fc)/(F+f)]					Surface Water Regulations 2009 (SI 272 of 2009) Surface WATER EQS's (mg/l)			
MRP-P								
T = RESULTANT concentration in the receiving water (mg/l)	T	0.041	mg/l		0.035	0.075	0.025	0.045
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	19.380	m3/s		Good Status Mean	Good STATUS 95%tile	High Status Mean	High Status 95%tile
C = KCC Data Baseline concentration in receiving water (mg/l)	C	0.038	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.84	m3/s		**Remains Compliant with High Status 95%tile**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	0.10	mg/l					
BOD								
T = RESULTANT concentration in the receiving water (mg/l)	T	1.639	mg/l		1.5	2.6	**1.3**	**2.2**
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	19.380	m3/s		Good Status Mean	Good STATUS 95%tile	High Status Mean	High Status 95%tile
C = Baseline concentration in receiving water (mg/l)	C	1.580	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.84	m3/s		**Remains Compliant with High Status 95%tile**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	3.00	mg/l					
COD								
T = RESULTANT concentration in the receiving water (mg/l)	T	3	mg/l		COD not specified in SW Regs & it is not a parameter monitored in the River Nore by KCC/EPA. COD is more usually a parameter considered of wastewater and heavily polluted waters. COD is a parameter of the Discharge Licence. Therefore, in the absence of actual river monitoring data, a notional COD is used here for the assimilation capacity evaluation. Simulations Suggest no increase in concentration in the receiving water.			
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	19.380	m3/s					
C = ASSUMED LOW LEVEL concentration in receiving water (mg/l)	C	3	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.84	m3/s					
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	15.00	mg/l					
Ammonia-N								
T = RESULTANT concentration in the receiving water (mg/l)	T	0.042	mg/l		0.065	0.14	0.04	0.09
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	19.380	m3/s		Good Status Mean	Good STATUS 95%tile	High Status Mean	High Status 95%tile
C = Baseline concentration in receiving water (mg/l)	C	0.033	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.84	m3/s		**Remains Compliant with High Status 95%tile**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	0.25	mg/l					
Nitrates as N - NOT SPECIFIED in DL								
T = RESULTANT concentration in the receiving water (mg/l)	T	5	mg/l		Nitrates not specified in SW Regs & it is not a parameter monitored by KCC/EPA but is a part of eutrophication / fish life impact. Assuming a baseline concetraion of 5 mg/l NO3, based on actual monitored Total Nitrogen concentrations, assimilation capacity simulations suggest no significant increase in Nitrate concentration.			
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	19.380	m3/s					
C = ASSUMED Baseline concentration in receiving water (mg/l)	C	5	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.84	m3/s					
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	10.00	mg/l					
Suspended Solids					**Suspended Solids**			
T = RESULTANT concentration in the receiving water (mg/l)	T	8.75	mg/l		**European Communities (Quality of Salmonid Waters) Regulations (SI 293/1988) (mg/l)**		**European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, S.I. No. 296 of 2009**	
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	19.380	m3/s					
C = Baseline concentration in receiving water (mg/l)	C	8.70	mg/l		25		No artificially elevated levels of siltation	
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	f	0.84	m3/s		**NO Significant INCREASE IN SS CONCENTRATION**			
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	10.00	mg/l					
Total Hydrocarbons								
T = RESULTANT concentration in the receiving water (mg/l)	T	0.05	mg/l		Hydrocarbons not measured by EPA surface water quality monitoring and also not a parameter of the Regs requiring compliance. Hydro-G offers that high quality natural SW would have a hydrocarbon value <0.01 mg/l. Assimulation capacity simulations suggest resultant concentration 0.05 mg/l TH.			
F = RECEIVING river flow, 50%tile flow (m3/s) for MAX DISCHARGE VOLUME condition	F	19.380	m3/s					
C = Baseline concentration in receiving water (mg/l)	C	0.01	mg/l					
f = MAX PREDICTED flow discharging to receiving waters (m3/s)	c	0.84	mg/l					
c = ELV for Proposed 2017 Discharge Licence Revision (mg/l)	c	1.00	mg/l					

Results presented in Table 13 demonstrate that for the cumulative assessment for Roadstone Quarry and Bennettsbridge Limestone, for the 2017 proposed BBL licence revision, there will be small increases in concentration for simulated parameters in the receiving surface water of the River Nore for the 50%tile flow condition in the Nore. However, the simulated increases are small and are 0.003 mg/l MRP-P and 0.007 mg/l ammonia-N. The resultant concentrations are still within the High Status bracket of the Surface Water Regulations (2009) for the 95%tile Flow Condition. The ammonia and Suspended Solids requirements of the Salmonid

Regulations (1988) are also met. The simulated 0.1 mg/l increase in suspended solids concentration is an indication of likely compliance with the requirements of the Pearl Mussel Regulations (2009). The ammonia and Suspended Solids requirements of the Salmonid Regulations (1988) are also met.

6.2 Headroom

Guidance, Procedures and Training on the Licensing of Discharges to Surface Waters and Sewers for Local Authorities (DoEHLG, 2011) recommends an assessment of how much 'headroom' a discharge will use in the assimilative capacity of a receiving water body. Calculations are presented in Tables 14 and 15. The calculations suggest compliance with the recommended 25% allocation to a discharge. Calculations demonstrate compliance for the proposed 2017 revision daily average of 22,000 m3/d and for the cumulative maximum envisaged value of 72,500 m3/d arising from quarries in the vicinity discharging to the River Nore.

Table 14 Headroom calculations for daily average and 2017 proposed ELVs

22,000 m3/day with 95% Flow Receiving Water (2015 EQS's)								Resultant Conc.	Headroom (Cmax - C)	Actual Increase	Permitted Headroom	Headroom Used	Estimated Loading	Assimilative Capacity NTS	Capacity Absorbed
SW Regs (2009) EQS Status	Parameter	Unit	C_{max} / EQS	$C_{effluent}$	$C_{background}$	$V_{flow\ (m3/s)}$	$V_{effluent}$ (m3/s)	mg/L	mg/L	mg/L	%	%	kg/day	Kg/Day	%
High	MRP as P	mg/l	0.045	**0.10**	0.038	3.670	0.2546	0.042	0.007	0.0040	25	57.47	2.20	0.1540	0.575
Good	MRP as P	mg/l	0.075	**0.10**	0.038	3.670	0.2546	0.042	0.037	0.0040	25	10.87	2.20	0.8140	0.109
High	BOD	mg/l	2.20	**10.00**	1.58	3.670	0.2546	1.670	0.620	0.0900	25	14.52	219.97	13.6384	0.145
Good	BOD	mg/l	2.60	**10.00**	1.58	3.670	0.2546	1.670	1.020	0.0900	25	8.82	219.97	22.4374	0.088
	COD	mg/l	15.00	**15.00**	3.000	3.670	0.2546	3.778	12.000	0.7785	25	6.49	329.96	263.9693	0.065
High	Ammonia	mg/l	0.090	**0.250**	0.033	3.670	0.2546	0.042	0.057	0.0090	25	15.79	5.50	1.2539	0.158
Good	Ammonia	mg/l	0.140	**0.250**	0.033	3.670	0.2546	0.042	0.107	0.0090	25	8.41	5.50	2.3537	0.084
	Nitrate-N	mg/l	10	**10.00**	5.00	3.670	0.2546	5.324	5.000	0.3244	25	6.49	219.97	109.9872	0.065
	Suspended Solids	mg/l	25	**10.00**	8.70	3.670	0.2546	8.784	16.300	0.0843	25	0.52	219.97	358.5583	0.005

Table 15 Headroom calculations for CUMULATIVE Local Quarries MAX discharge and 2017 proposed ELVs

72,500 m3/day with 50% Flow Receiving Water								Resultant Conc.	Headroom (Cmax - C)	Actual Increase	Permitted Headroom	Headroom Used	Estimated Loading	Assimilative Capacity NTS	Capacity Absorbed
SW Regs (2009) EQS Status	Parameter	Unit	C_{max} / EQS	$C_{effluent}$	$C_{background}$	$V_{flow\ (m3/s)}$	$V_{effluent}$ (m3/s)	mg/L	mg/L	mg/L	%	%	kg/day	Kg/Day	%
High	MRP as P	mg/l	0.045	**0.10**	0.038	19.380	0.8391	0.041	0.0070	0.0026	25	36.76	7.25	0.5075	0.368
Good	MRP as P	mg/l	0.075	**0.10**	0.038	19.380	0.8391	0.041	0.037	0.0026	25	6.95	7.25	2.6825	0.070
High	BOD	mg/l	2.20	**10.00**	1.58	19.380	0.8391	1.640	0.620	0.0600	25	9.68	725.00	44.9500	0.097
Good	BOD	mg/l	2.60	**10.00**	1.58	19.380	0.8391	1.640	1.020	0.0600	25	5.88	725.00	73.9500	0.059
	COD	mg/l	15.00	**15.00**	3.000	19.380	0.8391	3.000	12.000	0.0000	25	0.00	1087.50	870.0000	0.000
High	Ammonia	mg/l	0.090	**0.250**	0.033	19.380	0.8391	0.041	0.057	0.0080	25	14.04	18.13	4.1325	0.140
Good	Ammonia	mg/l	0.140	**0.250**	0.033	19.380	0.8391	0.042	0.107	0.0090	25	8.42	18.13	7.7575	0.084
	Nitrate-N	mg/l	10	**10.00**	5.00	19.380	0.8391	5.208	5.000	0.2075	25	4.15	725.00	362.5000	0.042
	Suspended Solids	mg/l	25	**10.00**	8.70	19.380	0.8391	8.754	16.300	0.0540	25	0.33	725.00	1181.7500	0.003

6.3 Assimilation Capacity Discussion & Conclusions

Assimilation capacity simulations for Bennettsbridge Limestone Quarry discharging to the River Nore support a mean daily discharge of 22,000 m3/d, calculated over the course of a year, and a maximum daily discharge of 70,000 m3/d. These values are possible because the KCC 2016 updated water quality record for the River Nore at Bennettsbridge presents a better water quality for the receiving environment than that used in simulations by Hydro-G previously (2014). In addition, the quarry discharge characteristic for 2016 has a below limit of detection characteristic for most monitored parameters in 2016. However, in the assimilation capacity simulations completed by Hydro-G for the future proposed volumes the 'discharge characteristic' employed are the actual ELVs proposed for the revised discharge licence: for example 0.1 mg/l MRP-P.

The site does not consider nor intend that the simulated and proposed discharge volumes will be 'target' values. Discharge from the quarry will retain its natural groundwater baseline average. Existing monitoring data demonstrate that the baseline, no rain, groundwater discharge is in the order of 8,200 m3/d (Appendix B, note in Table B.5). This will remain as it is because most of this discharge arises from the Eden Spring on site. At times of high groundwater throughput in the overall catchment, the contribution from Eden Spring increases. Monitoring data demonstrate that discharge equals or exceeds 22,000 m3/d <10% of the time (Table 5). However, in the interest of regularising and maintaining compliance with the Conditions of the Discharge Licence, the site now proposes higher values for the Conditions for flow volumes to be discharged in the context of assimilation capacity simulations supporting these Conditions. Monitoring data demonstrate that discharge equals or exceeds 55,000 m3/d only 1% of the time (Table 5). However, in the interest of regularising and maintaining compliance with the Conditions of the Discharge Licence, the site proposes the higher maximum value of 70,000 m3/d in the context of assimilation capacity simulations supporting this value on the rare occasions that it does occur when flow in the River Nore is high in any case and therefore there is little chance of any increased load of suspended solids settling out in the River Nore.

Assimilation capacity simulations support the Emission Limit Values (ELVs) for the 2017 Revision of Discharge Licence ENV/W/78. The proposed ELV's were determined by iteration of the assimilation capacity simulations for the proposed future discharge volumes. The proposed ELV's are justified by compliance with the Environmental Quality Standards (EQS) of the Surface Water Regulations and also by virtue of the fact that they have been demonstrated by site monitoring to be attainable (Section 5.2.5 and Tables B6 & B7, Appendix B). The proposed 2017 ELV's are presented in Table 16 in which the existing licence (2015) ELVs are also presented. Assimilation capacity simulations support a mean daily discharge of 22,000 m3/d, calculated over the course of a year, and a maximum daily discharge of 70,000 m3/d and the revised ELVs presented in Table 16 comply with the requirements of the Surface Water Regulations (2009). Compliance is achieved in this 2017 analysis because Hydro-G employed updated water quality data for the receiving water (2014 – 2015) at Bennettsbridge monitoring station as supplied by KCC/EPA. The ELVs are achievable based on monitoring data from the site. The ELVs of the 2015 licence remain valid for MRP-P, pH, SS, COD, Nitrate-N, Total Ammonia and Total Hydrocarbons.

Table 16 Proposed 2017 ELV's supported by Assimilation Capacity Simulations & monitoring records for the quarry's discharge characteristic.

Parameter	2017 Proposed Revision ELVs	2015 Discharge Licence ELVs
pH	6 to 9	6 to 9
Suspended Solids	10	10
BOD	3	3
COD	15	15
Nitrate	10	10
Total Ammonia	0.25	0.25
Molybdate-Reactive Phosphate	0.1	0.1
Total Hydrocarbons (mg/l)	1	1

7.0 Mass Balance Calculations

Based on the average discharge volume discharged from the site for the 2009 to 2017 period and the average concentration of the discharge (2016), mass balance calculations are presented in Table 17 in the context of the permissible loads facilitated by the existing discharge licence.

Table 17 CURRENT (2016) Mass balance for the site in the context of permissible loads licensed by the existing discharge licence.

For Daily Average Discharge Volume of 14,112 m3/d							
	2015 Discharge Licence ELVs	Total Load (mg/d) permitted for Discharge Licence ELVs for 15,000 m3/d (15,000,000 litres) Daily Volume	Total Load (Kg/d) permitted for Discharge Licence ELVs for 15,000 m3/d (15,000,000 litres) Daily Volume	2016 Average Discharge Concentration discharged from the site (mg/l)	BBL Average Discharge Volume (m3/d)	BBL ACTUAL Discharged Load (kg/d) for average volume discharged and average concentration of discharge	% of permissible load discharged @ 14,112 m3/d
Ammonia (mg/L)	0.25	3,750,000	3.75	0.025	14,112	0.3528	9
BOD (mg/L)	3	45,000,000	45	<1	14,112	14.112	31
Nitrate-N (mg/L)	10	150,000,000	150	6	14,112	84.672	56
Suspended Solids (mg/l)	10	150,000,000	150	4	14,112	56.448	38
Molybdate-Reactive Phospahte (mg/l - P)	0.1	1,500,000	2	<0.01	14,112	0.14112	9
Total Hydrocarbons (mg/l)	1	15,000,000	15	<0.01	14,112	0.14112	1
COD (mg/l)	15	225,000,000	225	<10	14,112	141.12	63

Information presented in Table 17 demonstrates that the quarry only discharges a fraction of the mass loadings permitted by the 2015 discharge licence, on average. There is therefore loadings room within the licence for further increases in discharge volumes. Overall, mass balance calculations for the current discharge volumes and concentrations, information presented in Table 17 can be summarised as follows:

- The quarry currently discharges a mass loading of Ammonia-N that is 9% of that permitted by the Discharge Licence;
- The quarry currently discharges a mass loading of BOD that is 31% of that permitted by the Discharge Licence but in reality the actual mass loading is lower than this calculated. The laboratory results report a below the detection limit of the auto analyser <1 mg/l BOD but 1mg/l is used in the calculation;
- The quarry currently discharges a mass loading of Nitrate-N that is 56% of that permitted by the Discharge Licence;
- The quarry currently discharges a mass loading of Suspended Solids that is 38% of that permitted by the Discharge Licence;
- The quarry currently discharges a mass loading of phosphate (MRP-P) that is 9% of that permitted by the Discharge Licence but in reality the actual mass loading is lower than this calculated. The laboratory results report a below the detection limit of the auto analyser <0.01 mg/l MRP-P but 0.01 mg/l is used in the calculation;
- The quarry currently discharges a mass loading of Total Hydrocarbons that is 1% of that permitted by the Discharge Licence but in reality the actual mass loading is lower than this calculated. The laboratory results report a below the detection limit of the auto analyser <1 mg/l Hydrocarbons but 1mg/l is used in the calculation;
- The quarry currently discharges a mass loading of COD that is 63% of that permitted by the Discharge Licence but in reality the actual mass loading is lower than this calculated. The laboratory results report a below the detection limit of the auto analyser <10 mg/l COD but 10mg/l is used in the calculation;

As previously stated, there is therefore loadings room within the licence for further increases in discharge volumes. On the basis of the proposed average daily discharge volume of 22,000 m3/d and the ELVs (Table 16) that have demonstrated compliance with the requirements of the Surface Water Regulations (2009) future mass balance calculations are presented in Table 18 using the same '2016 Average Discharge Concentration discharged from the site' as was employed in the mass Balance for the site (Table 17). Mass balance calculations demonstrate that the volumes proposed for the 2017 revision of the discharge licence result in no increase in mass loadings above those permitted already in the 2015 Discharge Licence because the actual monitored discharge characteristic is much lower than that permitted in the 2015 licence.

Table 18 Mass balance for the site's proposed daily average discharge for those ELVs that demonstrate compliance with the Surface Water Regulations (2009).

2015 issued ENV/W/78			2016 Site Loads			2017 Proposed ELVs & 22,000 m3/d average Daily volume			
	2015 Discharge Licence ELVs	Total Load (Kg/d) permitted for Discharge Licence ELVs for 15,000 m3/d Licensed Daily Volume	2016 Average Discharge Concentration discharged from the site (mg/l)	BBL Discharged Load (kg/d) for average volume discharged and average concentration monitored in the discharge	% of 2015 Licensed load discharged @ 14,112 m3/d	2017 PROPOSED REVISION Discharge Licence ELVs for SW Reg Compliance	Total Load (Kg/d) based on 22,000 m3/d & Actual Discharge Characteristic	Total Load (Kg/d) permitted in 2015 Discharge Licence	% of 2015 Discharge Licence permissible load discharged @ 22,000 m3/d
Ammonia-N	**0.25**	**3.8**	0.025	0.35	**9**	**0.25**	**0.6**	**3.8**	**15**
BOD	**3**	**45**	<1	14.11	**31**	**2**	**22**	**45**	**49**
Nitrate-N	**10**	**150**	6.2	87.49	**58**	**10**	**136**	**150**	**91**
Suspended Solids	**10**	**150**	4.3	60.68	**40**	**10**	**95**	**150**	**63**
Molybdate-Reactive Phosphate	**0.1**	**1.5**	<0.01	0.14	**9**	**0.1**	**0.2**	**1.5**	**15**
Total Hydrocarbons	**1**	**15**	0.01	0.14	**1**	**1**	**0.2**	**15.0**	**1**
COD	**15**	**225**	<10	141.12	**63**	**15**	**220**	**225**	**98**

Based on the actual hydrochemical characteristic of Bennettsbridge Limestone's discharge, information presented in Table 18 demonstrates that, for the proposed daily average discharge of 22,000 m3/d, the masses emitted for all parameters are within the mass limits set in the 2015 issued discharge licence for Ammonia-N, BOD, Nitrate-N, Suspended Solids, MRP-P, Total Hydrocarbons and COD. For example, discharging the increased average daily volumetric limit of 22,000m3/d, at the characteristic ammonia-N concentration monitored at the site, results in a mass of ammonia that is still only 15% of the mass load permitted in the 2015 licence ENV/W/78. Therefore, it is demonstrated that the discharge complies with both the requirements of the Surface Water Regulations (2009) and the mass balance limits of the existing licence. The most right hand column of Table 18 demonstrates that this mass balance compliance is true for all parameters evaluated.

8.0 Settlement Systems Evaluation

Murphy surveys completed a field survey of the settlement lagoons in February 2017. Their report and accompanying section drawings are presented as Appendix C. The detail provided in the report includes the as built areas and combined water volume capacity of the two settlement lagoons at the upper elevation of the quarry. The report also details the accumulation of silt profiles in the settlement systems. This will inform the maintenance plan.

The available hydraulic volumetric capacity in the settlement lagoons at the upper elevation of the site is 7,995m3. There is a capacity of 160m3 in the initial receiving 'north' lagoon and 7,835 m3 in the South Lagoon. The additional capacity provided by the lagoons/pontoons on the quarry floor is 400m3, approximately. The quarry floor itself could accommodate 15,000 m3 if the quarry floor was allowed to flood by a depth of only 4 inches, (100mm or 0.1m). However, this would only be necessary in extreme situations because applying stokes law and the principles of settlement to the quarry's systems suggests that the settlement lagoons have the capacity to adequately settle waters arising at the site. This conclusion is supported by the discharge record for the site and also based on the following calculations:

Settlement is possible when the impelling force of a particle is equal to the drag force.

The Impelling Force is calculated thus = $F_I = (\gamma_s - \gamma_w)$ Vol

where:
γs = ρsg and γw = ρwg
ρs = density of the particle, which is assumed as 2.65 g/cm3 (the density of Calcite, then primary mineral in limestone is 2.71, and assuming a relatively low porosity, then a figure of 2.65 is a good average density of the aggregate).
ρw = density of fluid, which is assumed as water at 1.00 g/cm3
g = acceleration due to gravity = 9.81 m/s2
Vol = Volume of particles (assumed spherical) = 4/3 πr3 or πd3/6

The Drag Force is calculated thus = $F_d = Cd\ As\ \rho s\ (V_s^2/2)$

where:
Cd = Drag Co-efficient = 24v/Vsd ≈ 0.4 for spheres
v = Kinematic Viscosity = μ/ρ
As = Sectional area of a sphere = πr2 or πd2/4
Vs = Settling velocity 'Stokes'

By equating the impelling force and the drag force (such that particles will start to settle when these forces are equal) then:

$$FI = Fd = (\gamma s - \gamma w)\ Vol = Cd\ As\ \rho s\ (Vs2/2)$$

The above equation can be solved for Vs (the settling velocity of a spherical particle of density 2.65) as follows:

$$V_s = \underline{g(\rho_s - \rho_w)\ d^2} / (18\ \nu\ \mu_w)$$

Then, to calculate the settlement velocity of particles we may use the following equation:

$$Vs = g/18\mu w\ (\rho s - \rho w)\ d2$$

As previously established:

g = Acceleration due to gravity is 9.81 m/s2
ρs = density of the particle = 2.3 g/cm3 or 2.3 x 103 kg/m3
ρw = density of fluid = 1.00 g/cm3 or 1 x 103 kg/m3
μw = dynamic viscosity of water = 1.002 x 10-3 kg/ms @ 20°C (or 1.519 x 10-3 @ 5°C and 0.797 x 10-3 @ 30°C)
d = particle diameter in m

Calculations for BBL

- Stokes Law applies for particles where the Reynolds Number is less than 1, in all the below cases Stokes Law is applicable, since the Reynolds Number is less than 1.

- The settlement velocity of particles 0.01mm, 0.015 and 0.02mm in diameter (assumed spherical) in water can be calculated for variable particle densities and variable water temperatures using the above equation. These are tabulated in Table 19.

Table 19: Settlement Velocities for Particles at Various Temperatures

Particle Size	Water Temperature	g	ρ_s	V_s		SOR
mm	°C	m/s^2	g/cm^3	m/s		$m^3/day/m^2$
0.02	5	9.81	2	0.00014342	1.43E-04	12.4
0.02	5	9.81	2.3	0.00018645	1.86E-04	16.1
0.02	5	9.81	2.65	0.00023664	2.37E-04	20.4
0.02	10	9.81	2	0.00016667	1.67E-04	14.4
0.02	10	9.81	2.3	0.00021667	2.17E-04	18.7
0.02	10	9.81	2.65	0.00027500	2.75E-04	23.8
0.02	20	9.81	2	0.00021756	2.18E-04	18.8
0.02	20	9.81	2.3	0.00028283	2.83E-04	24.4
0.02	20	9.81	2.65	0.00035898	3.59E-04	31.0

- In the worst case scenario to ensure all particles of 0.02 mm and above are settled under cold conditions, the best settlement velocity will be that which allows 0.02 mm particles of density $2.3 g/cm^3$ in a water temperature of 5°C to settle out of suspension. A settlement velocity of 1.86×10^{-4} m/s will achieve this. This represents a Surface Water Overflow Rate (SOR) of $16.1 m^3/day/m^2$.

- Therefore the maximum allowable flow rate through the lagoon is $16.1 m^3/day/m^2$. The total surface area of the main lagoon at the site i.e. 'south' lagoon is $5,379.8 m^2$ (Murphy Survey, 2017: Appendix C). Therefore based on the lagoon surface plan area of $5,379.8 m^2$ and applying a surface water overflow rate of 16.1 $m^3/day/m^2$, the lagoons provide a sufficient settlement system for a maximum daily discharge rate of 86,615 m^3/day. The capacity of the settlement lagoons being 86,615 m3/d demonstrates viability for the proposed revised discharge volumes for a daily average of 22,000 m3/d and a maximum value of 70,000 m3/d.

- Under the current discharge characteristic of an average discharge volume of 14,112 m3/d the SOR will be even lower and is calculated to be 2.62m3/day/m^2, and
- Under the current maximum 40,000 m3/d flow scenario at the site a SOR of 7.44 m3/d/m2 is achieved, and
- For the proposed 22,000 m3/d daily average, the SOR will be 4.46 m3/d/m2 and
- For the maximum value of 70,000 m3/d, the SOR will be 13 m3/d/m2.

Therefore, it is concluded that the SOR's for the proposed 22,000 m3/d and 70,000 m3/d are within the SOR range in which settlement and treatment function is achievable by the existing systems.

With respect to the efficacy of the settlement systems to retain silt, the profiles returned by Murphy Survey (2017) [Appendix C] demonstrate that the smaller receiving lagoon, i.e. the 'north' lagoon retains most of the solids and performs very well.

The information gained from the surveys demonstrates that the 'south' lagoon does not have a large sediment load input. The depths of silt are presented in Murphy (2017) on page 4 and 5 for each lagoon. Hydro-G assesses that this is the reason that the discharge quality characteristic returns < 2 mg/l SS for a substantial portion of the monitoring record.

The management plan is to remove the levels of silt determined by the Murphy (2017) survey and there shall be extra treatment function and less risk of hydraulic wash through of suspended solids that may have caused the occasional peaks monitored in the past.

Another mitigating factor in the management of waters at the site, and protection of the receiving environment, is that the baseflow discharge of the site, that is the 8,200 m3/d volume associated with the 'Eden Spring', is piped and does not come into contact with the quarry floor or any potential solids loading.

With respect to the depth of settlement systems: Murphy Survey Ltd (Appendix C) presents a surveyed depth for each lagoon as 2m, on average. EPA (2006) Guidance for the Extractive Industry suggests a 1m depth of settlement systems.

Appendix C Murphy Survey and associated drawings provides the as-built surveys. No changes are required of the settlement systems other than the required removal of silt that has accumulated in the systems and this is agreed. The suspended solids concentration as discharged from the quarry has achieved <2 mg/l SS for most monitoring events in the last number of years.

9.0 Conclusions

9.1 While the River Nore has been assigned a 'Moderate Status'[4], overall, under national works reported for the Water Framework Directive, KCC's/EPA hydrochemical monitoring results place the River Nore in the 'High Status' bracket of the Surface Water Regulations (2009) Schedule 5 Criteria For Calculating Surface Water Ecological Status And Ecological Potential's Table 9 "Nutrient Conditions" for the 95%tile flow condition at Bennettsbridge monitoring station. These Local Authority/EPA monitoring results reflect the impact of Bennettsbridge Limestone's on-going discharge to the River Nore because the River Nore's "15N:01 2100 Bennettsbridge" monitoring station is downstream of the discharge from the quarry. The quarry has been discharging to the River Nore for over fifteen years and the quality of the river retains water quality results within the environmental quality criteria for 'High Status' classification when the results are compared to the Surface Water Regulations (2009) Environmental Quality Objectives. This is also validation for the efficacy of the on-site settlement systems at the quarry and the monitoring record for quality of the discharge from the quarry.

9.2 Assimilation capacity simulations support a mean daily discharge of 22,000 m3/d, calculated over the course of a year, and a maximum daily discharge of 70,000 m3/d and the original ELVs of ENV/W/78. These revised volumes and original ELVs facilitate compliance with the requirements of the Surface Water Regulations (2009). Compliance is achieved in this 2017 analysis because Hydro-G employed updated water quality data for the receiving water (2014 – 2015) at Bennettsbridge monitoring station as supplied by KCC/EPA. The revised ELVs are achievable based on monitoring data from the site. The ELVs of the 2015 licence remain valid for MRP-P, pH, SS, COD, Nitrate-N, Total Ammonia and Total Hydrocarbons.

9.3 Mass balance calculations demonstrate that the volumes proposed for the 2017 revision of the discharge licence result in no increase in mass loadings above those permitted already in the 2015 Discharge Licence because the actual monitored discharge characteristic is much lower than that permitted in the 2015 licence.

9.4 The dilution factors afforded by the receiving water are good. There is at least a 1:50 dilution factor 99% of the time and almost 1:150 dilution of the quarry's discharge volume in the River Nore 50% of the time. At times of high discharge volumes from the quarry the dilution factor in the River Nore can be 1:200.

9.5 The quarries settlement lagoons can accommodate a maximum discharge of 86,615 m^3/day, which demonstrates viability for the proposed revised discharge volumes for a daily average of 22,000 m3/d and a maximum value of 70,000 m3/d.

9.6 The analyses presented supports the revision of the licence by virtue of the fact that cumulative impact assessment results, considering other quarries in the vicinity, comply with the requirements of the Surface Water Regulations, Pearl Mussel Regulations (2009) and Salmonid Regulations (1988).

[4] The condition of the Pearl Mussel habitat upstream of the discharge has resulted in the downgrading from High Chemical Status to Moderate overall status in the River Nore.

10.0 Proposed Revision Conditions ENV/W/78 (2017)

With respect to the site's requested 2017 revisions to the volumes permitted by ENV/W/78 Discharge Licence, assimilation capacity simulations demonstrate compliance with the Surface Water Regulations (2009). In addition, mass balance calculations demonstrate that the mass of loadings that would be emitted are within the same mass values as currently authorised in the 2015 issued licence. Therefore, current water quality data for the River Nore at Bennettsbridge (as supplied by KCC), current monitoring information presented for the site and 2017 assimilation capacity analyses supports the revision of Condition 3.2, which can justifiably be reworded as follows:

Condition 3.2 The Licence holder shall ensure that

(c) the mean daily discharge, calculated over the course of a year, shall not exceed 22,000 m3/d, and

(d) the maximum daily discharge shall not exceed 70,000 m3/d.

Continuous flow monitoring shall be maintained on the discharge downstream of the settlement lagoons.

The revision of flow volumes permitted to be discharged from the quarry is acceptable for the same ELVs that are currently specified by Condition 4.1, as follows:

Condition 4.1 The characteristics of the effluent as discharged shall not exceed the following emission limit values (ELVs):

Parameter	Emission Limit Value
pH	6 to 9
Suspended Solids	10
BOD	3
COD	15
Nitrate	10
Total Ammonia	0.25
Molybdate-Reactive Phosphate	0.1
Total Hydrocarbons (mg/l)	1

With respect to the revised discharge volumes proposed, the existing hydrochemical Emission Limit values (ELVs) facilitate compliance with the requirements of the Surface Water Regulations (2009) and the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. 293/1988). Compliance with the Pearl Mussel Regulations is also inferred because simulations suggest no significant increase in SS concentration in the receiving River Nore.

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Appendix A

Site's Historical Discharge Licences

LOCAL GOVERNMENT (WATER POLLUTION) ACTS 1977 & 1990

LICENCE TO DISCHARGE TRADE EFFLUENT

OR OTHER MATTER TO WATERS

Ref: No. in Register: ENV/W/78

TO: Bennettsbridge Quarries Ltd.,
C/o Sinead O'Donnell,
TMS Environment Ltd.,
53 Broomhill Drive,
Tallaght,
Dublin, 24.

That Kilkenny County Council in exercise of the powers conferred on it by the Local Government (Water Pollution) Acts, 1977 & 1990 hereby grants a licence dated 23 June, 2000, Reference Number ENV/W/78 to discharge trade effluent to waters from Bennettsbridge Quarries Ltd., Kilree, Bennettsbridge, Co. Kilkenny, to adjoining stream flowing into River Nore, at Kilree, subject to the Schedule of Conditions attached.

Seamus O Suilleabhain.
D/COUNTY MANAGER

Order No: 60

Schedule of Conditions

Condition 1 : Scope

1.1 This licence refers to the discharge of pumped groundwater and surface water run-off from the quarry and plant area to the adjoining watercourse and thence to the River Nore in accordance with plans and details submitted to Kilkenny County Council on 6th January, 2000 and 27th April, 2000 except as otherwise required in order to comply with the conditions below.

Condition 2 : Notifications

2.1 The licence holder shall notify Kilkenny County Council by both telephone and facsimile, as soon as practicable and in any case not later than 10.00 hours the following working day, of any of the following incidents.

(a) Any incident with the potential for contamination of surface waters or requiring an emergency response from Kilkenny County Council.

(b) Any emission which does not comply with the requirements of this Licence.

2.2 The notifications required under Condition 2.1 shall include the date and time of the incident, the details of the incident, the steps taken to minimise the impact and details of proposed measures to prevent a recurrance.
The licence holder shall maintain a register of any such incident.

2.3 The licence holder shall notify the Environment Section of Kilkenny County Council in writing giving a minimum of 10 working days notice of the commencement of construction of the stilling pond, oil interceptor, settlement lagoon and associated pipework.

2.4. The licence holder shall notify the Environment Section of Kilkenny County Council by telephone and facsimile giving a minimum of 2 working days notice of each round of sampling.

Condition 3 : Infrastructure:

3.1 Within 3 months of the date of granting of this licence, a continuous flow measuring device shall be installed and commissioned on the outlet of the existing discharge pipelines. Details of the siting and equipment to be used shall be agreed with Kilkenny County Council prior to installation.

3.2 In conjunction with the construction of the proposed stilling pond, oil interceptor and settlement lagoon a continuous flow measuring device shall be installed on each of –

(a) The outlet from the settlement lagoon and
(b) The clear water by-pass outlet.

[Note: The device required under Condition 3.1 above may be re-used to comply with Condition 3.2 (b)].

3.3 Provision shall be made for sampling points at –

(a) The existing discharge pipelines outlet
(b) The outlet from the settlement lagoon (weir);
(c) The clear water by-pass outlet.
(d) 10(ten) metres downstream of the confluence of the clear water discharge with the settlement lagoon discharge.

These sampling points shall be provided with safe and permanent access

Condition 4 : Monitoring

4.1 The total daily volume discharged shall not exceed 4140 m^3/day. The volume discharging shall be measured and recorded separately for each discharge point and the total daily volume discharged shall be computed and recorded. Recording of discharge volumes shall commence within 3 months of the date of granting this licence.

4.2 The characteristics of the discharged effluent shall not exceed the following limits:-

		Discharge	
	Clear Water	Settlement Lagoon	Combined
Temperature °C.	25	25	25
pH	6-9	6-9	6-9
Conductivity µS/cm @ 20°C.	1000	1000	1000
Suspended Solids mg/l	10	30	30
BOD mg/l	5	10	10
Amonia mg/l N	1	1	1
Nitrate mg/l N	11	11	11

Nitrite mg/l N	0.3	0.3	0.3
Turbidity NTU	10	10	10

4.3 Petroleum products must not be present in the discharge in such quantities that they –

(a) form a visible film on the surface of the discharged water or form coatings on the bed of the watercourse or the River Nore.
(b) impart a detectable "hydrocarbon" taste to fish.
(c) produce harmful effects in fish.

4.4 The frequency of sampling for the parameters listed in Condition 4.2 shall be monthly by grab sample for the first 12 months commencing from the date of granting this licence. Thereafter, the frequency of sampling shall be quarterly subject to a minimum record of 6 months sampling post completion and commissioning of the stilling pond, oil interceptor and settlement lagoon.

4.5 Prior to completion of the stilling pond, oil interceptor and settlement lagoon sampling shall be carried out at the existing pipelines discharge outlet and compared with the limit values for combined discharge in Condition 4.2 above.

Following completion and commissioning of the stilling pond, oil interceptor and settlement lagoon the points identified at Condition 3.3 (b),(c) and (d) shall be sampled and compared with the limit values for clean water, settlement lagoon and combined as specified in Condition 4.2.

Condition 5 : Reporting:

5.1 The licence holder shall submit to Kilkenny County Council within 21 days of the end of each quarter, the results of monitoring relating to the previous quarter.

5.2 The format of these monitoring reports shall include a daily record of discharge volumes, a listing of the limit values together with the monitoring results in tabular and graphic form. The detailed format and presentation of results shall be agreed with Kilkenny County Council prior to compilation of the first report. Submissions of reports shall be in paper and electronic format.

5.3 The quarterly report shall include the register of any incident referred to in Conditions 2.1 and 2.2.

5.4 The licence holder shall maintain a copy set of all records, analyses and reports in the quarry office.

5.5 The licence holder shall nominate an individual of management status whose name shall be made available to Kilkenny County Council and

who will be responsible for the supervision and control of the discharge subject to this licence.

5.6 Within 6 months of the granting of this licence, the licence holder shall submit a report to Kilkenny County Council which examines the elevated nitrate levels in the existing effluent discharge including, inter alia, a comparison with groundwater sources in the area and proposals to reduce the nitrate concentration in the discharge.

Conditon 6 : Financial:

6.1 The licence holder shall pay an annual contribution of £250 to Kilkenny County Council towards the cost of monitoring this licence. This amount shall be updated in accordance with changes in the Consumer Price Index from the date of granting this licence. For 2000, the amount due shall be pro-rata to 31st December, 2000, and this amount shall be paid within 2 months of granting of this licence. Thereafter, the amount shall fall due not later than 31st January of each year.

LOCAL GOVERNMENT (WATER POLLUTION) ACTS 1977 to 2007

LICENCE TO DISCHARGE EFFLUENT

TO WATERS

TO: Bennettsbridge Limestone Quarries Ltd.
Kilree
Bennettsbridge
Co. Kilkenny

Ref. No. in Register: ENV/W/78

Kilkenny County Council in exercise of the Powers conferred on it by the Local Government (Water Pollution) Acts 1977 to 2007 hereby grants a reviewed discharge licence dated February 13th 2015, Reference ENV/W/78 to discharge trade effluent to waters, subject to the Schedule of Conditions attached.

Carol McCarthy
Delegated Officer.

Schedule of Conditions

Condition 1: Scope

1.1 This reviewed licence refers to the discharge of treated groundwater from dewatering operations and stormwater runoff from internal access roads by the licence holder, in accordance with the plans and particulars submitted to Kilkenny County Council with the original licence application on the 06/01/2000 and the further information submitted on the 27/04/2000 except where otherwise required in order to comply with the conditions below. This licence refers to one discharge point only – that point being from the settlement pond to the existing drain.

1.2 There shall be no discharge of trade effluent other than groundwater from dewatering operations at the quarry and stormwater runoff from internal areas.

Condition 2: Notifications

2.1 The licence holder shall nominate an individual of management status whose name shall be made available to Kilkenny County Council and will be responsible for the supervision and control of the discharge subject to this licence. The name of this individual shall be notified to Kilkenny County Council **within 2 months** of the final date of grant of this licence. This individual shall be available at all reasonable times to provide access to any authorised persons to both the treatment system and any records referred to below.

2.2 The licence holder shall notify Kilkenny County Council by both telephone and email, as soon as practicable and in any case not later than 10:00 am on the following working day, of any emission which does not comply with the requirements of this licence. The notification shall include the date and time of the non-compliance, details of the non-compliance and the steps taken, or to be taken, to minimise the impact and prevent a reoccurrence.

2.3 In the event of a serious non-compliance which may require an emergency response from Kilkenny County Council the Council shall be notified as a matter of urgency. In the event of a serious out of hours incident the Council shall be notified by phone through the 24 hours non-fire emergency number – details of which are available on the Council Website.

Condition 3: Infrastructure

3.1 The licence holder shall ensure that any additional infrastructure not already in place but required to ensure compliance with the terms of this licence is in place as soon as practicable and in any event no later than six months following the final granting of this reviewed licence.

3.2 The licence holder shall ensure that

(a) the mean daily discharge over the course of any month shall not exceed 15,000 m^3 / day, and

(b) the maximum daily discharge shall not exceed 40,000 m^3/day.

A continuous flow monitoring facility shall be installed on the discharge (downstream of the settlement lagoon) within six months of the date of this licence.

3.3 The licence holder shall ensure that the complete treatment system (including the stilling pond, settlement lagoon and interceptor) is regularly serviced, desludged and maintained by a competent person / management company. The licence holder shall maintain records of the contractual arrangements regarding the servicing and maintenance of the system.

3.4 All sampling points shall be provided with safe and permanent access.

3.5 The complete treatment system and all internal drainage systems shall be inspected on an ongoing basis to ensure that there are no blockages. In addition drainage systems shall be inspected following periods of heavy rain. The frequency of such inspections shall be determined by the licence holder and shall be such so as to demonstrate compliance with this licence – but shall be at least weekly.

Condition 4: Monitoring

4.1 The characteristics of the effluent as discharged shall not exceed the following emission limit values (ELVs):

PARAMETER	*ELV*	*UNITS*
pH	6-9	-
Suspended Solids	10	mg/l
BOD	3	mg/l
COD	15	mg/l
Nitrate	10	mg/l - N
Total Ammonia	0.25	mg/l - N
Molybdate-Reactive Phosphate	0.1	mg/l - P
Total Hydrocarbons	1	mg/l

4.2 Sampling of the final effluent as discharged shall be undertaken at least monthly during the first 6 months following the final grant of this reviewed licence and shall be subject to review thereafter having regard to the performance over the first 6 months. The samples shall be grab samples of the final effluent as discharged. Unless otherwise specified, samples shall be collected in polythene or equivalent containers with self-sealing tamper proof caps, and refrigerated within 15 minutes of collection. The analysis shall be carried out for pH, Suspended Solids, BOD, COD, Nitrate, Total Ammonia, Molydate-Reactive Phosphate and Total Hydrocarbons with the analysis commencing within 24 hours of collection.

4.3 **Within 6 weeks** of the final date of granting of this licence, the licence holder shall submit for the written agreement of Kilkenny County Council a detailed sampling protocol which shall include sample collection, storage and delivery procedures. The protocol shall also include details of the accredited laboratory at which samples are to be analysed. In advance of submitting this protocol the licence holder shall ensure that the proposed laboratory accreditation is such as to allow for the levels of detection necessary to demonstrate compliance with this licence.

4.4 Should Kilkenny County Council so require, the licence holder shall undertake a 24 hour flow proportionate composite sample of the effluent as discharged. Where a request for such composite sampling is made, it shall be in writing, and so as to enable the licensee to make arrangements and carry out such installation of equipment as necessary, the licensee shall be requested to collect the composite sample(s) in question within two months of Kilkenny County Council's request.

Condition 5: Reporting

5.1 The licence holder shall compile and submit to the licensing authority a report within 14 days of the end of each sampling period as specified by condition 4.2, including the results of all monitoring relating to the previous sampling period.

5.2 The format of the monitoring reports shall include a daily record of the discharge volumes, a listing of the limit values together with the monitoring results in tabular format. Where the characteristics of the discharged effluent exceed the limit values specified in condition 4.1 the report shall also include a detailed explanation for any exceedances, steps taken to minimise its impact and details of proposed measures to prevent a reoccurrence.

5.3 The periodic report shall include a register of any incident referred to in Conditions 2.2 and 2.3.

5.4 The licence holder shall maintain a copy of all relevant inspections, records, analysis and reports in the main office of the business.

5.5 The licence holder shall submit an Annual Environmental Report from a suitably qualified person which shall be due 21 days after the end of each calendar year. The report shall contain the following information in relation to the previous calendar year:

(a) All monitoring results relating to the previous calendar year including the information required under conditions 5.1, 5.2 and 5.3.
(b) An assessment of the results, particularly noting any trends. Such analysis of trends should take account of any previous reports submitted in relation to the discharge.
(c) Confirmation (or otherwise) that the conditions attached to the licence have been complied with.

Condition 6: Financial

6.1 The licence holder shall make a payment annually to Kilkenny County Council in respect of costs incurred in regulating the discharge licence for the preceding year. The fee relating to each year will fall due at the start of the following year and shall be invoiced by Kilkenny County County Council. The fee shall include for:

- Annual audit inspection: €150 (includes for one inspection)
- Administration charge: €150 per annum

6.2 Where non-compliances with the licence conditions occur, additional follow-up inspections will be required. These will be charged at a rate of €150 per visit.

Appendix B

Discharge Volumes

Discharge Quality

Certificates of Analysis

Table B.1 Discharge volumes 2005, 2006, 2007

Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)		Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)		Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)
4-Jan-05	15	3939809			3-Jan-06	15	7634362	13,630		9-Jan-07	21	11546189	18,723
10-Jan-05	6	4006745	11,156		9-Jan-06	6	7713106	13,124		16-Jan-07	7	11669865	17,668
17-Jan-05	7	4100748	13,429		18-Jan-06	7	7812915	14,258		22-Jan-07	6	11772667	17,134
24-Jan-05	7	4229898	18,450		23-Jan-06	7	7948079	19,309		29-Jan-07	7	11905446	18,968
1-Feb-05	8	4373076	17,897		30-Jan-06	7	8062819	16,391		12-Feb-07	14	12107272	14,416
7-Feb-05	6	4457676	14,100		6-Feb-06	7	8161999	14,169		19-Feb-07	7	12215737	15,495
14-Feb-05	7	4535843	11,167		13-Feb-06	7	8234611	10,373		20-Mar-07	29	12592342	12,986
21-Feb-05	7	4605398	9,936		20-Feb-06	7	8295269	8,665		26-Mar-07	6	12680314	14,662
28-Feb-05	7	4666802	8,772		27-Feb-06	7	8356916	8,807		10-Apr-07	15	12859744	11,962
8-Mar-05	8	4729373	7,821		6-Mar-06	7	8414013	8,157		16-Apr-07	6	12915592	9,308
14-Mar-05	6	4772450	7,180		13-Mar-06	7	8468439	7,775		23-Apr-07	7	12973999	8,344
20-Mar-05	6	4820344	7,982		20-Mar-06	7	8558517	12,868		30-Apr-07	7	13028230	7,747
29-Mar-05	8	4952067	16,465		27-Mar-06	7	8639111	11,513		8-May-07	8	13086556	7,291
4-Apr-05	6	5027580	12,586		11-Apr-06	15	8872731	15,575		14-May-07	6	13127528	6,829
11-Apr-05	7	5102578	10,714		18-Apr-06	7	8951126	11,199		21-May-07	7	13172212	6,383
18-Apr-05	7	5173648	10,153		24-Apr-06	6	9006899	9,296		28-May-07	7	13214439	6,032
25-Apr-05	7	5257732	12,012		2-May-06	8	9070324	7,928		5-Jun-07	8	13264659	6,278
3-May-05	8	5340610	10,360		8-May-06	6	9115194	7,478		11-Jun-07	6	13299516	5,810
9-May-05	6	5427805	14,533		15-May-06	7	9165304	7,159		18-Jun-07	7	13342084	6,081
16-May-05	7	5510216	11,773		23-May-06	8	9226663	7,670		25-Jun-07	7	13396930	7,835
23-May-05	7	5576607	9,484		29-May-06	6	9287137	10,079		2-Jul-07	7	13451747	7,831
30-May-05	7	5634611	8,286		6-Jun-06	8	9362157	9,378		7-Jul-07	7	13504564	7,545
7-Jun-05	8	5694627	7,502		12-Jun-06	6	9414285	8,688		16-Jul-07	7	13570025	9,352
13-Jun-05	6	5735617	6,832		19-Jun-06	7	9464062	7,111		23-Jul-07	7	13676127	15,157
20-Jun-05	7	5782009	6,627		26-Jun-06	7	9508337	6,325		30-Jul-07	7	13784951	15,546
27-Jun-05	7	5823947	5,991		3-Jul-06	7	9554001	6,523		7-Aug-07	8	13885424	12,559
4-Jul-05	7	5865349	5,915		10-Jul-06	7	9598836	6,405		13-Aug-07	6	13967093	13,612
11-Jul-05	7	5904463	5,588		17-Jul-06	7	9642014	6,168		21-Aug-07	8	14078662	13,946
18-Jul-05	7	5941236	5,253		24-Jul-06	7	9687552	6,505		28-Aug-07	7	14217914	19,893
25-Jul-05	7	5977669	5,205		31-Jul-06	7	9732412	6,409		3-Sep-07	6	14306361	14,741
2-Aug-05	8	6054170	9,563		8-Aug-06	8	9777479	5,633		10-Sep-07	7	14390615	12,036
8-Aug-05	6	6113571	9,900		14-Aug-06	6	9810361	5,480		17-Sep-07	7	14458129	9,645
15-Aug-05	7	6169580	8,001		21-Aug-06	7	9852292	5,990		24-Sep-07	7	14520533	8,915
22-Aug-05	7	6209715	5,734		28-Aug-06	7	9893635	5,906		25-Sep-07	1	14529230	8,697
29-Aug-05	7	6246458	5,249		4-Sep-06	7	9937393	6,251		26-Sep-07	1	14537870	8,640
5-Sep-05	7	6284564	5,444		11-Sep-06	7	9979864	6,067		27-Sep-07	1	14546187	8,317
12-Sep-05	7	6323243	5,526		18-Sep-06	7	10020516	5,807		28-Sep-07	1	14554357	8,170
19-Sep-05	7	6361440	5,457		25-Sep-06	7	10069685	7,024		1-Oct-07	3	14578617	8,087
26-Sep-05	7	6398377	5,277		2-Oct-06	7	10116957	6,753		2-Oct-07	1	14586758	8,141
3-Oct-05	7	6435896	5,360		9-Oct-06	7	10175050	8,299		6-Oct-07	4	14619003	8,061
10-Oct-05	7	6471321	5,061		16-Oct-06	7	10268335	13,326		8-Oct-07	2	14634307	7,652
17-Oct-05	7	6509252	5,419		23-Oct-06	7	10378215	15,697		15-Oct-07	7	14686796	7,498
24-Oct-05	7	6549502	5,750		31-Oct-06	8	10472363	11,769		22-Oct-07	7	14736035	7,034
1-Nov-05	8	6653529	13,003		6-Nov-06	6	10577740	17,563		30-Oct-07	8	14792817	7,098
7-Nov-05	6	6764383	18,476		13-Nov-06	7	10675393	13,950		5-Nov-07	6	14834100	6,881
14-Nov-05	7	6908076	20,528		20-Nov-06	7	10793772	16,911		19-Nov-07	14	14933607	7,108
21-Nov-05	7	7009057	14,426		27-Nov-06	7	10927433	19,094		26-Nov-07	7	15002652	9,864
28-Nov-05	7	7108190	14,162		4-Dec-06	7	10987172	8,534		3-Dec-07	7	15068615	9,423
5-Dec-05	7	7207397	14,172		11-Dec-06	7	11031842	6,381		10-Dec-07	7	15155876	12,466
12-Dec-05	7	7319086	15,956		18-Dec-06	7	11153039	17,314		18-Dec-07	8	15284210	16,042
19-Dec-05	7	7429917	15,833										
2005 Daily Average (m3/d)			**10,029**		**2006 Daily Average (m3/d)**			**10,054**		**2007 Daily Average (m3/d)**			**10,598**

Table B.2 Discharge volumes 2008, 2009, 2010

Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)		Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)		Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)
2-Jan-08	15	15485420	13,414		5-Jan-09	14	22371891	13,954		4-Jan-10	14	29600063	20,099
7-Jan-08	5	15586358	20,188		12-Jan-09	7	22448063	10,882		12-Jan-10	8	29763961	20,487
14-Jan-08	7	15634833	6,925		19-Jan-09	7	22554517	15,208		19-Jan-10	7	30063256	42,756
28-Jan-08	14	15682477	3,403		26-Jan-09	7	22809208	36,384		25-Jan-10	6	30331501	44,708
29-Jan-08	1	15701952	19,475		2-Feb-09	7	23118328	44,160		1-Feb-10	7	30538563	29,580
30-Jan-08	1	15719453	17,501		9-Feb-09	7	23445273	46,706		8-Feb-10	7	30734745	28,026
1-Feb-08	2	15755060	17,804		16-Feb-09	7	23629369	26,299		15-Feb-10	7	30924003	27,037
2-Feb-08	1	15775498	20,438		18-Feb-09	2	23666948	18,790		22-Feb-10	7	31049408	17,915
4-Feb-08	2	15816234	20,368		23-Sep-09	5	23754732	17,557		1-Mar-10	7	31153496	14,870
5-Feb-08	1	15836767	20,533		2-Mar-09	7	23854719	14,284		8-Mar-10	7	31243764	12,895
8-Feb-08	3	15898227	20,487		9-Mar-09	7	23946355	13,091		15-Mar-10	7	31325542	11,683
11-Feb-08	3	15956398	19,390		16-Mar-09	7	24031959	12,229		22-Mar-10	7	31402818	11,039
18-Feb-08	7	16074880	16,926		23-Mar-09	7	24113656	11,671		29-Mar-10	7	31486039	11,889
25-Feb-08	7	16175301	14,346		30-Mar-09	7	24190652	10,999		6-Apr-10	8	31667278	22,655
3-Mar-08	7	16259691	12,056		6-Apr-09	7	24259923	9,896		13-Apr-10	7	31877903	30,089
10-Mar-08	7	16333404	10,530		14-Apr-09	8	24347433	10,939		21-Apr-10	8	32031520	19,202
18-Mar-08	8	16432191	12,348		20-Apr-09	6	24413060	10,938		26-Apr-10	5	32100355	13,767
25-Mar-08	7	16512267	11,439		27-Apr-09	7	24517485	14,918		4-May-10	8	32199754	12,425
31-Mar-08	6	16577554	10,881		5-May-09	8	24676853	19,921		10-May-10	6	32266244	11,082
7-Apr-08	7	16679037	14,498		11-May-09	6	24763299	14,408		24-May-10	14	32405692	9,961
21-Apr-08	14	16842544	11,679		18-May-09	7	24850636	12,477		31-May-10	7	32469882	9,170
28-Apr-08	7	16911813	9,896		25-May-09	7	24960170	15,648		8-Jun-10	8	32539951	8,759
6-May-08	8	16985822	9,251		2-Jun-09	8	25076824	14,582		14-Jun-10	6	32594065	9,019
12-May-08	6	17040123	9,050		8-Jun-09	6	25147667	11,807		21-Jun-10	7	32649193	7,875
19-May-08	7	17098404	8,326		15-Jun-09	7	25220050	10,340		28-Jun-10	7	32699102	7,130
26-May-08	7	17156460	8,294		22-Jun-09	7	25317810	13,966		5-Jul-10	7	32745586	6,641
3-Jun-08	8	17221095	8,079		29-Jun-09	7	25394820	11,001		12-Jul-10	7	32797330	7,392
9-Jun-08	6	17268627	7,922		6-Jul-09	7.5	25470948	10,150		19-Jul-06	7	32857743	8,630
16-Jun-08	7	17321817	7,599		13-Jul-09	6.5	25550967	12,311		26-Jul-10	7	32943342	12,228
23-Jun-08	7	17382755	8,705		20-Jul-09	7	25654683	14,817		3-Aug-10	8	33021840	9,812
7-Jul-08	14	17529356	10,472		27-Jul-09	7	25753744	14,152		9-Aug-10	6	33075346	8,918
14-Jul-08	7	17658602	18,464		10-Aug-09	14	25942757	13,501		30-Aug-10	21	33229583	7,345
28-Jul-08	14	17845450	13,346		17-Aug-09	7	26025738	11,854		6-Sep-10	7	33274443	6,409
5-Aug-08	8	17943249	12,225		24-Aug-09	7	26134383	15,521		13-Sep-10	7	33376340	14,557
11-Aug-08	6	18023102	13,309		31-Aug-09	7	26239732	15,050		20-Sep-10	7	33448604	10,323
25-Aug-08	14	18151582	9,177		7-Sep-09	7	26373012	19,040		27-Sep-10	7	33514283	9,383
1-Sep-08	7	18277879	18,042		14-Sep-09	7	26497997	17,855		4-Oct-10	7	33576308	8,861
8-Sep-08	7	18388221	15,763		21-Sep-09	7	26592571	13,511		11-Oct-10	7	33625372	7,009
15-Sep-08	7	18504619	16,628		28-Sep-09	7	26674694	11,732		20-Oct-10	9	33702003	8,515
22-Sep-08	7	18603274	14,094		5-Oct-09	7	26752109	11,059		26-Oct-10	6	33743111	6,851
15-Oct-08	23	21155821			12-Oct-09	7	26837413	12,186		1-Nov-10	6	33822645	13,256
20-Oct-08	5	21240918	17,019		19-Oct-09	7	26917833	11,489		8-Nov-10	7	33979183	22,363
28-Oct-08	8	21335502	11,823		27-Sep-09	8	27048803	16,371		15-Nov-10	7	34150794	24,516
3-Nov-08	6	21411064	12,594		2-Nov-09	6	27193393	24,098		22-Nov-10	7	34416649	37,979
10-Nov-08	7	21487713	10,950		9-Nov-09	7	27463789	38,628		29-Nov-10	7	34586109	24,209
17-Nov-08	7	21585730	14,002		16-Nov-09	7	27814327	50,077		6-Dec-10	7	34695197	15,584
24-Nov-08	7	21695940	15,744		23-Nov-09	7	28192883	54,079		13-Dec-10	7	34788944	13,392
1-Dec-08	7	21793445	13,929		30-Nov-09	7	28577274	54,913		20-Dec-10	7	34893235	14,899
8-Dec-08	7	21894485	14,434		7-Dec-09	7	28855990	39,817					
15-Dec-08	7	22035506	20,146		14-Dec-09	7	29135605	39,945					
22-Dec-08	7	22176537	20,147		21-Dec-09	7	29318675	26152.86					
2008 Daily Average (m3/d)			**13,681**		**2009 Daily Average (m3/d)**			**19,831**		**2010 Daily Average (m3/d)**			**15,691**

Table B.3 Discharge volumes 2011, 2012, 2013

Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)		Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)		Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)
4-Jan-11	15	35102592	13,957		3-Jan-12	15	39142581	18,640		11-Mar-13	79	46192231	23,749
10-Jan-11	6	35172322	11,622		9-Jan-12	6	39262915	20,056		19-Mar-13	6	46288402	16,029
24-Jan-11	14	35478071	21,839		17-Jan-12	8	39393566	16,331		25-Mar-13	6	46438152	24,958
1-Feb-11	8	35590261	14,024		23-Jan-12	6	39468375	12,468		2-Apr-13	8	46634979	24,603
7-Feb-11	6	35675817	14,259		30-Jan-12	7	39546536	11,166		8-Apr-13	6	46729735	15,793
14-Feb-11	7	35918899	34,726		6-Feb-12	7	39669737	17,600		15-Apr-13	7	46825031	13,614
21-Feb-11	7	36100037	25,877		13-Feb-12	7	39767150	13,916		29-Apr-13	14	46981613	11,184
28-Feb-11	7	36252493	21,779		20-Feb-12	7	39852514	12,195		7-May-13	8	47054267	9,082
7-Mar-11	7	36362994	15,786		27-Feb-12	7	39929339	10,975		13-May-13	6	47102016	7,958
14-Mar-11	7	36447246	12,036		5-Mar-12	7	39998445	9,872		27-May-13	14	47208210	7,585
21-Mar-11	7	36513765	9,503		12-Mar-12	7	40061199	8,965		4-Jun-13	8	47268854	7,581
28-Mar-11	7	36526996	1,890		20-Mar-12	8	40128599	8,425		10-Jun-13	6	47311417	7,094
4-Apr-11	7	36631292	14,899		26-Mar-12	6	40174229	7,605		17-Jun-13	7	47362715	7,328
11-Apr-11	7	36682354	7,295		9-Apr-12	14	40274359	7,152		24-Jun-13	7	47411979	7,038
18-Apr-11	7	36729602	6,750		16-Apr-12	7	40312640	5,469		8-Jul-13	14	47506335	6,740
26-Apr-11	8	36778210	6,076		23-Apr-12	7	40357155	6,359		15-Jul-13	7	47548035	5,957
3-May-11	7	36819405	5,885		30-Apr-12	7	40404661	6,787		22-Jul-13	7	47588554	5,788
9-May-11	6	36855656	6,042		8-May-12	6	40461129	9,411		29-Jul-13	7	47631091	6,077
17-May-11	8	36901184	5,691		21-May-12	13	40557331	7,400		6-Aug-13	8	47681237	6,268
23-May-11	6	36932976	5,299		28-May-12	7	40604034	6,672		12-Aug-13	6	47715816	5,763
30-May-11	7	36969703	5,247		5-Jun-12	8	40659214	6,898		19-Aug-13	7	47753446	5,376
7-Jun-11	8	37009747	5,006		11-Jun-12	6	40740703	13,582		26-Aug-13	7	47788890	5,063
13-Jun-11	6	37039987	5,040		18-Jun-12	7	40956480	30,825		3-Sep-13	8	47829141	5,031
20-Jun-11	7	37078183	5,457		25-Jun-12	7	41207002	35,789		9-Sep-13	6	47858854	4,952
27-Jun-11	7	37122480	6,328		2-Jul-12	7	41403381	28,054		16-Sep-13	7	47893148	4,899
4-Jul-11	7	37164800	6,046		9-Jul-12	7	41584691	25,901		23-Sep-13	7	47928013	4,981
11-Jul-11	7	37208708	6,273		16-Jul-12	7	41791949	29,608		30-Sep-13	7	47962192	4,883
18-Jul-11	7	37249008	5,757		23-Jul-12	7	41954751	23,257		7-Oct-13	7	48009191	6,714
25-Jul-11	7	37287848	5,549		30-Jul-12	7	42066559	15,973		21-Oct-13	14	48088458	5,662
2-Aug-11	8	37329092	5,156		13-Aug-12	14	42244530	12,712		4-Nov-13	14	48243828	11,098
8-Aug-11	6	37361885	5,466		20-Aug-12	7	42355255	15,818		11-Nov-13	7	48312917	9,870
15-Aug-11	7	37400252	5,481		27-Aug-12	7	42469057	16,257		18-Nov-13	7	48395720	11,829
23-Aug-11	8	37441701	5,181		3-Sep-12	7	42605428	19,482		25-Nov-13	7	48466405	10,098
29-Aug-11	6	37472851	5,192		10-Sep-12	7	42717179	15,964		2-Dec-13	7	48533597	9,599
6-Sep-11	8	37513544	5,087		17-Sep-12	7	42806688	12,787		9-Dec-13	7	48587916	7,760
12-Sep-11	6	37542293	4,792		24-Sep-12	7	42881630	10,706		16-Dec-13	7	48641687	7,682
19-Sep-11	7	37575524	4,747		8-Oct-12	14	43022820	10,085					
26-Sep-11	7	37608326	4,686		14-Oct-12	7	43086065	9,035					
3-Oct-11	7	37646826	5,500		22-Oct-12	7	43152306	9,463					
10-Oct-11	7	37682633	5,115		5-Nov-12	14	43397544	17,517					
17-Oct-11	7	37715601	4,710		19-Nov-12	14	43569186	12,260					
24-Oct-11	7	37750589	4,998		26-Nov-12	7	43723279	22,013					
1-Nov-11	8	37868197	14,701		3-Dec-12	7	43964378	34,443					
7-Nov-11	6	37974175	17,663		21-Dec-12	18	44316072	19,539					
14-Nov-11	7	38088195	16,289										
21-Nov-11	7	38226701	19,787										
28-Nov-11	7	38398360	24,523										
5-Dec-11	7	38580742	26,055										
12-Dec-11	7	38727481	20,963										
19-Dec-11	7	38862982	19,357										
2011Daily Average (m3/d)			10,628		2012 Daily Average (m3/d)			15,123		2013 Daily Average (m3/d)			9,325

Table B.4 Discharge volumes 2014, 2015, 2016

Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)		Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)		Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)
6-Jan-14	21	49351869	33,818		19-Jan-15	26	57212360	22,406		4-Jan-16	7	62841283	59,063
20-Jan-14	14	49943070	42,229		26-Jan-15	7	57361432	21,296		11-Jan-16	7	63260875	59,942
27-Jan-14	7	50229945	40,982		2-Feb-15	7	57495797	19,195		18-Jan-16	7	63633711	53,262
3-Feb-14	7	50587350	51,058		9-Feb-15	7	57618547	17,536		25-Jan-16	7	63878833	35,017
17-Feb-14	14	51418314	59,355		16-Feb-15	7	57727646	15,586		8-Feb-16	14	64327018	32,013
24-Feb-14	7	51807867	55,650		23-Feb-15	7	57839452	15,972		15-Feb-16	7	64647650	45,805
3-Mar-14	7	52160189	50,332		2-Mar-15	7	57972460	19,001		22-Feb-16	7	64992795	49,306
10-Mar-14	7	52441112	40,132		9-Mar-15	7	58102424	18,566		29-Feb-16	7	65221719	32,703
18-Mar-14	8	52668783	28,459		16-Mar-15	7	58269882	23,923		7-Mar-16	7	65468117	35,200
24-Mar-14	6	52789381	20,100		23-Mar-15	7	58441065	24,455		14-Mar-16	7	65678338	30,032
7-Apr-14	14	53107579	22,728		30-Mar-15	8	58567667	15,825		21-Mar-16	7	65843086	23,535
14-Apr-14	7	53272479	23,557		7-Apr-15	6	58685807	19,690		29-Mar-16	8	65998531	19,431
28-Apr-14	14	53514815	17,310		13-Apr-15	7	58767087	11,611		4-Apr-16	6	66109899	18,561
12-May-14	14	53697202	13,028		20-Apr-15	7	58852536	12,207		11-Apr-16	7	66260806	21,558
19-May-14	7	53771552	10,621		27-Apr-15	8	58926678	9,268		18-Apr-16	7	66435859	25,008
26-May-14	7	53841727	10,025		5-May-15	6	59010921	14,041		25-Apr-16	7	66584193	21,191
9-Jun-14	14	53985593	10,276		11-May-15	7	59092336	11,631		3-May-16	8	66730545	18,294
16-Jun-14	7	54064529	11,277		18-May-15	7	59191069	14,105		9-May-16	6	66832806	17,044
23-Jun-14	7	54135757	10,175		25-May-15	8	59275405	10,542		16-May-16	7	66944780	15,996
30-Jun-14	7	54202015	9,465		2-Jun-15	6	59358827	13,904		23-May-16	7	67046165	14,484
8-Jul-14	8	54271131	8,640		8-Jun-15	7	59418328	8,500		30-May-16	7	67136032	12,838
14-Jul-14	6	54317532	7,734		15-Jun-15	7	59484269	9,420		7-Jun-16	7	67238877	14,692
21-Jul-14	7	54369936	7,486		22-Jun-15	7	59548429	9,166		13-Jun-16	7	67312152	10,468
28-Jul-14	7	54419862	7,132		29-Jun-15	7	59611960	9,076		20-Jun-16	7	67398792	12,377
5-Aug-14	8	54485493	8,204		6-Jul-15	7	59674065	8,872		27-Jun-16	7	67480808	11,717
11-Aug-14	6	54536223	8,455		13-Jul-15	7	59738050	9,141		4-Jul-16	7	67562857	11,721
18-Aug-14	7	54593364	8,163		20-Jul-15	7	59803833	9,398		11-Jul-16	7	67642376	11,360
2-Sep-14	15	54704573	7,414		27-Jul-15	8	59865956	7,765		18-Jul-16	7	67721565	11,313
15-Sep-14	13	54794240	6,897		4-Aug-15	6	59935337	11,564		25-Jul-16	7	67798923	11,051
22-Sep-14	7	54839908	6,524		10-Aug-15	7	59987670	7,476		2-Aug-16	7	67886161	12,463
29-Sep-14	7	54889031	7,018		17-Aug-15	7	60044059	8,056		9-Aug-16	7	67961958	10,828
6-Oct-14	7	54941721	7,527		24-Aug-15	7	60105658	8,800		15-Aug-16	6	68025329	10,562
13-Oct-14	7	55001602	8,554		31-Aug-15	7	60169203	9,078		22-Aug-16	7	68101151	10,832
20-Oct-14	7	55063282	8,811		7-Sep-15	7	60228704	8,500		29-Aug-16	7	68176389	10,748
10-Nov-14	21	55358942	14,079		14-Sep-15	7	60288116	8,487		5-Sep-16	6	68253784	12,899
17-Nov-14	7	55674500	45,080		28-Sep-15	14	60409386	8,662		12-Sep-16	7	68331934	11,164
24-Nov-14	7	55985788	44,470		5-Oct-15	7	60465929	8,078		19-Sep-16	7	68414734	11,829
1-Dec-14	7	56208451	31,809		12-Oct-15	7	60524440	8,359		26-Sep-16	7	68492697	11,138
16-Dec-14	15	56490113	18,777		19-Oct-15	8	60579555	6,889		3-Oct-16	7	68566897	10,600
23-Dec-14	7	56629809	19,957		27-Oct-15	6	60647791	11,373		10-Oct-16	7	68643155	10,894
					2-Nov-15	7	60707800	8,573		17-Oct-16	7	68720550	11,056
					9-Nov-15	7	60772654	9,265		24-Oct-16	7	68795297	10,678
					16-Nov-15	8	60845739	9,136		31-Oct-16	7	68878263	11,852
					24-Nov-15	6	60958070	18,722		7-Nov-16	7	68939079	8,688
					30-Nov-15	7	61039614	11,649		14-Nov-16	7	69014201	10,732
					7-Dec-15	7	61278180	34,081		21-Nov-16	7	69089879	10,811
					14-Dec-15	7	61635971	51,113		28-Nov-16	7	69163081	10,457
					28-Dec-15	14	62427845	56,562		5-Dec-16	7	69222918	8,548
										12-Dec-16	7	69255719	4,686
										19-Dec-16	7	69311778	8,008
2014 Daily Average (m3/d)			**21,083**		**2015 Daily Average (m3/d)**			**14,719**		**2016 Daily Average (m3/d)**			**19,089**

Table B.5 Discharge volumes 2017

Week Starting	Days Since last Reading	Meter Reading	Daily Average (m3/d)
4-Jan-17	16	69451912	8,758
9-Jan-17	5	69492967	8,211
16-Jan-17	7	69553537	8,653
23-Jan-17	7	69610018	8,069
30-Jan-17	7	69662000	7,426
6-Feb-17	7	69782049	17,150
13-Feb-17	7	69913346	18,757
21-Feb-17	8	70021874	13,566
27-Feb-17	6	70103652	13,630
6-Mar-17	7	70263050	22,771
20-Mar-17	14	70589479	23,316
27-Mar-17	7	70682983	13,358
3-Apr-17	7	70770247	12,466
10-Apr-17	7	70851574	11,618
17-Apr-17	7	70935198	11,946
24-Apr-17	7	70991279	8,012
2-May-17	8	71060703	8,678
9-May-17	6	71109558	8,143
15-May-17	7	71166729	8,167
to mid-May 2017 Daily Average (m3/d)			**12,982**

Table B.6 Discharge Quality (2014 – 2015) = Older Discharge Licence (different ELVs)

Jan 14 - Jan 15		Parameters									
		Total Amonia	BOD	Temp.	Nitrate	Conductivity	pH	Suspended Solids	Turbidity	Nitrite	
PRE 2014 ENV/W/78 ELV's		1 mg/l-N	10 mg/l	25°C	11 mg/l-N	1000 µS/cm	6-9	30 mg/l	NTU 10	0.3 mg/l	
Month	**Report No.**	**Total Amonia**	**BOD**	**Temp.**	**Nitrate**	**Conductivity**	**pH**	**Suspended Solids**	**Turbidity**	**Nitrite**	**EVENT No.**
Jan-14	29643	< 0.02	< 1	9.1	8.93	625	7.7	< 2	1.90	< 0.005	1
Feb-14	29793	< 0.02	< 1	8.7	8.42	621	7.3	7	8.00	< 0.005	2
Mar-14	29959	0.02	< 1	8.6	7.25	435	7.8	<2	0.98	< 0.005	3
Apr-14	30140	< 0.02	< 1	8.6	6.74	635	7.6	< 2	1.39	0.005	4
May-14	30286	< 0.02	< 1	9.8	6.80	585	7.8	10	4.23	0.015	5
Jun-14	30486	0.07	1.1	14.7	5.79	635	8.0	3	1.26	0.018	6
Jul-14	30672	<0.02	< 1	11.5	5.91	609	7.8	9	2.79	0.015	7
Aug-14	30970	0.05	< 1	10.7	5.52	640	7.7	2	2.90	0.010	8
Sep-14	31163	< 0.02	< 1	15.6	5.79	353	7.8	< 2	0.62	0.009	9
Oct-14	31362	< 0.02	1.4	17.2	5.39	532	7.8	16	9.1	0.010	10
Nov-14	31551	< 0.02	< 1	10.8	6.54	655	7.6	< 2	0.52	0.007	11
Dec-14	31754	0.02	< 1	9.6	6.39	647	7.7	6	3.90	< 0.005	12
Jan-15	31995	< 0.02	< 1	8.6	6.46	659	7.8	< 2	0.81	< 0.005	13

Table B.7 Discharge Quality (2015 – 2016)

[2015 Discharge Licence ELVs]

2015 - 2016		Parameters								
		Total Amonia	BOD	COD	Nitrate	MRP-P	pH	Suspended Solids	TPH	
2015 ISSUED ENV/W/78 ELV's		0.25 mg/l-N	3 mg/l	15 mg/l	10 mg/l-N	0.1 mg/l-P	6-9	10 mg/l	1 mg/l	
Month	Report No.	Total Amonia	BOD	COD	Nitrate	MRP-P	pH	Suspended Solids	TPH	EVENT No.
Feb-15	32127	< 0.02	< 1	< 10	6.38	< 0.01	7.7	< 2	< 0.01	14
Mar-15	32319	< 0.02	< 1	< 10	6.63	< 0.01	7.9	< 2	0.013	15
Apr-15	32478	< 0.02	< 1	< 10	7.40	< 0.01	7.8	10	< 0.01	16
May-15	32648	< 0.02	< 1	< 10	6.04	< 0.01	8.1	< 2	< 0.01	17
Jun-15	none	Southern Scientific unable to take sample day in June we were on site as no flow								none
Jul-15	33080	0.04	< 1	< 10	5.75	< 0.01	7.8	< 2	< 0.01	18
Aug-15	33306	0.03	< 1	< 10	5.88	< 0.01	7.8	< 2	< 0.01	19
Sep-15	33584	< 0.02	< 1	< 10	5.39	< 0.01	8.0	3	< 0.01	20
Oct-15	33794	0.07	< 1	< 10	5.87	< 0.01	8.0	15	< 0.01	21
Nov-15	33999	0.02	< 1	< 10	5.46	< 0.01	7.7	4	< 0.01	22
Dec-15	34264	0.02	< 1	< 10	7.63	< 0.01	7.7	3	< 0.01	23
Jan-16	34388	0.02	< 1	< 10	7.53	0.01	7.5	< 2	0.01	24
Feb-16	34578	< 0.02	< 1	< 10	7.27	< 0.01	7.7	9	0.01	25
Mar-16	34787	0.02	< 1	< 10	7.04	< 0.01	7.7	< 2	0.01	26
Apr-16	35006	< 0.02	< 1	< 10	6.31	< 0.01	7.8	3	0.01	27
May-16	35182	< 0.02	< 1	< 10	6.42	< 0.01	7.5	< 2	0.01	28
Jun-16	35390	0.02	1.24	< 10	6.09	< 0.01	7.5	5	0.01	29
Jul-16	35591	0.03	< 1	< 10	6.05	< 0.01	7.6	4	0.01	30
Aug-16	35755	0.04	< 1	< 10	5.80	< 0.01	7.6	7	0.01	31
Sep-16	36002	< 0.02	< 1	< 10	5.09	< 0.01	7.6	< 2	0.01	32
Oct-16	36205	< 0.02	< 1	< 10	5.52	< 0.01	7.7	< 2	0.01	33
Nov-16	36444	< 0.02	< 1	< 10	5.41	< 0.01	7.8	< 2	0.01	34
Dec-16	36740	< 0.02	< 1	< 10	5.98	< 0.01	7.8	10	0.01	35
2015 - 2016 AVERAGE		0.025	1	< 10	6.22	< 0.01	7.7	4.3	0.010	
2015 - 2016 MAX		0.07	1.24	< 10	7.63	0.01	8.1	15	0.013	
2015 - 2016 MIN		< 0.02	< 1	< 10	5.09	< 0.01	7.5	< 2	< 0.01	
2015 ISSUED ENV/W/78 ELV's		0.25 mg/l-N	3 mg/l	15 mg/l	10 mg/l-N	0.1 mg/l-P	6-9	10 mg/l	1 mg/l	
		Total Amonia	BOD	COD	Nitrate	MRP-P	pH	Suspended Solids	TPH	

southern scientific services ltd.

Bennettsbridge Limestone Quarries
Kilree
Sheastown
Co. Kilkenny

Tuesday, 16 May 2017

Re: Jan 2014 to Jan 2015 Summary Discharge Water Analysis – ENV/W/78

Dear Sir / Madam,

Please see outlined below a summary of the monthly discharge water analysis we carry out at Bennettsbridge Limestone Quarries in compliance with Water Discharge Licence ENV/W/78.

The data outlined below is from Jan 2014 to Jan 2015, after which (from February 2015) new parameters and ELV's come into effect following a review of Water Discharge Licence ENV/W/78.

Jan 14 - Jan 15		Parameters								
		Total Amonia	BOD	Temp.	Nitrate	Conductivity	pH	Suspended Solids	Turbidity	Nitrite
ENV/W/78 ELV's		1 mg/l-N	10 mg/l	25°C	11 mg/l-N	1000 µS/cm	6-9	30 mg/l	NTU 10	0.3 mg/l
Month	Report No.									
Jan-14	29643	< 0.02	< 1	9.1	8.93	625	7.7	< 2	1.90	< 0.005
Feb-14	29793	< 0.02	< 1	8.7	8.42	621	7.3	7	8.00	< 0.005
Mar-14	29959	0.02	< 1	8.6	7.25	435	7.8	<2	0.98	< 0.005
Apr-14	30140	< 0.02	< 1	8.6	6.74	635	7.6	< 2	1.39	0.005
May-14	30286	< 0.02	< 1	9.8	6.80	585	7.8	10	4.23	0.015
Jun-14	30486	0.07	1.1	14.7	5.79	635	8.0	3	1.26	0.018
Jul-14	30672	<0.02	< 1	11.5	5.91	609	7.8	9	2.79	0.015
Aug-14	30970	0.05	< 1	10.7	5.52	640	7.7	2	2.90	0.010
Sep-14	31163	< 0.02	< 1	15.6	5.79	353	7.8	< 2	0.62	0.009
Oct-14	31362	< 0.02	1.4	17.2	5.39	532	7.8	16	9.1	0.010
Nov-14	31551	< 0.02	< 1	10.8	6.54	655	7.6	< 2	0.52	0.007
Dec-14	31754	0.02	< 1	9.6	6.39	647	7.7	6	3.90	< 0.005
Jan-15	31995	< 0.02	< 1	8.6	6.46	659	7.8	< 2	0.81	< 0.005

Best regards,

Ruth Murphy
Chemistry Laboratory Manager

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southern scientific services ltd.

Bennettsbridge Limestone Quarries
Kilree
Sheastown
Co. Kilkenny

Tuesday, 16 May 2017

Re: Feb 2015 to Dec 2015 Summary Discharge Water Analysis – ENV/W/78

Dear Sir / Madam,

Please see outlined below a summary of the monthly discharge water analysis we carry out at Bennettsbridge Limestone Quarries in compliance with Water Discharge Licence ENV/W/78.

The data outlined below is from Feb 2015 to Dec 2015, which is the period that new parameters and ELV's come into effect following a review of Water Discharge Licence ENV/W/78.

Feb - Dec 2015		Parameters							
		Total Amonia	BOD	COD	Nitrate	MRP	pH	Suspended Solids	TPH
ENV/W/78 ELV's		0.25 mg/l-N	3 mg/l	15 mg/l	10 mg/l-N	0.1 mg/l-P	6-9	10 mg/l	1 mg/l
Month	Report No.								
Feb-15	32127	< 0.02	< 1	< 10	6.38	< 0.01	7.7	< 2	< 0.01
Mar-15	32319	< 0.02	< 1	< 10	6.63	< 0.01	7.9	< 2	0.013
Apr-15	32478	< 0.02	< 1	< 10	7.40	< 0.01	7.8	10	< 0.01
May-15	32648	< 0.02	< 1	< 10	6.04	< 0.01	8.1	< 2	< 0.01
Jun-15	Southern Scientific unable to take sample day in June we were on site as no flow through lagoon								
Jul-15	33080	0.04	< 1	< 10	5.75	< 0.01	7.8	< 2	< 0.01
Aug-15	33306	0.03	< 1	< 10	5.88	< 0.01	7.8	< 2	< 0.01
Sep-15	33584	< 0.02	< 1	< 10	5.39	< 0.01	8.0	3	< 0.01
Oct-15	33794	0.07	< 1	< 10	5.87	< 0.01	8.0	15	< 0.01
Nov-15	33999	0.02	< 1	< 10	5.46	< 0.01	7.7	4	< 0.01
Dec-15	34264	0.02	< 1	< 10	7.63	< 0.01	7.7	3	< 0.01

Best regards,

Ruth Murphy
Chemistry Laboratory Manager

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southern scientific services ltd.

Bennettsbridge Limestone Quarries
Kilree
Sheastown
Co. Kilkenny

Tuesday, 16 May 2017

Re: Jan 2016 to Dec 2016 Summary Discharge Water Analysis – ENV/W/78

Dear Sir / Madam,

Please see outlined below a summary of the monthly discharge water analysis we carry out at Bennettsbridge Limestone Quarries in compliance with Water Discharge Licence ENV/W/78.

The data outlined below is from Jan 2016 to Dec 2016.

Jan - Dec 2016		Parameters							
		Total Amonia	BOD	COD	Nitrate	MRP	pH	Suspended Solids	TPH
ENV/W/78 ELV's		0.25 mg/l-N	3 mg/l	15 mg/l	10 mg/l-N	0.1 mg/l-P	6-9	10 mg/l	1 mg/l
Month	Report No.								
Jan-16	34388	0.02	< 1	< 10	7.53	0.01	7.5	< 2	0.01
Feb-16	34578	< 0.02	< 1	< 10	7.27	< 0.01	7.7	9	0.01
Mar-16	34787	0.02	< 1	< 10	7.04	< 0.01	7.7	< 2	0.01
Apr-16	35006	< 0.02	< 1	< 10	6.31	< 0.01	7.8	3	0.01
May-16	35182	< 0.02	< 1	< 10	6.42	< 0.01	7.5	< 2	0.01
Jun-16	35390	0.02	1.24	< 10	6.09	< 0.01	7.5	5	0.01
Jul-16	35591	0.03	< 1	< 10	6.05	< 0.01	7.6	4	0.01
Aug-16	35755	0.04	< 1	< 10	5.80	< 0.01	7.6	7	0.01
Sep-16	36002	< 0.02	< 1	< 10	5.09	< 0.01	7.6	< 2	0.01
Oct-16	36205	< 0.02	< 1	< 10	5.52	< 0.01	7.7	< 2	0.01
Nov-16	36444	< 0.02	< 1	< 10	5.41	< 0.01	7.8	< 2	0.01
Dec-16	36740	< 0.02	< 1	< 10	5.98	< 0.01	7.8	10	0.01

Best regards,

Ruth Murphy
Chemistry Laboratory Manager

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southern scientific services ltd.

OUR REF: RP 2014 | BENNETSBRIDGE LIMESTONE | 01

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	06 January 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	06 January 2014
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	06 - 13 January 2014
SAMPLING PT:	**BENNETSBRIDGE**	**DATE REPORTED:**	13 January 2014
ORDER NO:	-	**WORK NO.:**	**29643 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Jan 075 **Exiting Lagoon**	C14-Jan 076 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	9.1	9.1	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	<0.02	<0.02	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	<1.0	**5 mg/L**
** 2510 B	*	Conductivity	µS/cm @ 20^{0}C	625	592	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	8.93	8.89	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	<0.005	<0.005	**0.3 mg/L**
SCP 035	*	pH	pH Unit	7.7	7.7	**6.0 ~ 9.0**
SCP 010		Suspended Solids	mg/L	<2	<2	**10 mg/L**
**2130B	*	Turbidity	NTU	1.90	<2	**10 NTU**

*** Recorded on site.
** Adapted from '*Standard Methods for the Examination of Water and Wastewater*'. (Current Edition).

Karen Lavery
Chemistry Laboratory Manager

- **The results relate only to the items tested.**
- **Opinions and interpretations expressed herein are outside the scope of INAB accreditation.**
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southern scientific services ltd.

OUR REF: RP **2014** | BENNETSBRIDGE LIMESTONE | **04**

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	03 February 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	03 February 2014
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	03 ~ 10 February 2014
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	11 February 2014
ORDER NO:	**230966**	**WORK NO.:**	**29793 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Feb 015 **Exiting Lagoon**	C14-Feb 016 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	8.6	8.7	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	<0.02	<0.02	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	<1.0	**5 mg/L**
** 2510 B	*	Conductivity	µS/cm @ 20^{0}C	621	623	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	8.42	8.42	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	<0.005	<0.005	**0.3 mg/L**
SCP 035	*	pH	pH Unit	7.3	7.6	**6.0 ~ 9.0**
SCP 010		Suspended Solids	mg/L	7	4	**10 mg/L**
**2130B	*	Turbidity	NTU	8.0	8.2	**10 NTU**

Karen Lavery
Chemistry Laboratory Manager

Index to symbols used:

**	Adapted from '*Standard Methods for the Examination of Water and Wastewater*'. (Current Edition).
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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.194T

southern scientific services ltd.

OUR REF: RP **2014** | BENNETSBRIDGE LIMESTONE | **09**

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	05 March 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	05 March 2014
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	05 – 12 March 2014
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	18 March 2014
ORDER NO:		**WORK NO.:**	**29959C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Mar 053 **Exiting Lagoon**	C14-Mar 054 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	8.6	8.6	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	0.02	<0.02	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	<1.0	**5 mg/L**
** 2510 B	*	Conductivity	µS/cm @ 20^{0}C	435	616	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	7.25	7.26	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	<0.005	<0.005	**0.3 mg/L**
SCP 035	*	pH	pH Unit	7.8	7.8	**6.0 ~ 9.0**
SCP 010	*	Suspended Solids	mg/L	<2	<2	**10 mg/L**
**2130B	*	Turbidity	NTU	0.98	0.98	**10 NTU**

Karen Lavery
Chemistry Laboratory Manager

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directors: K. Murphy, M. Murphy & C. Murphy
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southern scientific services ltd.

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	02 April 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	02 April 2014
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	02 – 09 April 2014
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	09 April 2014
ORDER NO:		**WORK NO.:**	**30140 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Apr 031 **Exiting Lagoon**	C14-Apr 032 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	8.6	8.6	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	<0.02	<0.02	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	<1.0	**5 mg/L**
** 2510 B	*	Conductivity	µS/cm @ 20^{0}C	635	636	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	6.74	7.23	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	0.005	0.005	**0.3 mg/L**
SCP 035	*	pH	pH Unit	7.6	7.6	**6.0 ~ 9.0**
SCP 010	*	Suspended Solids	mg/L	<2	<2	**10 mg/L**
**2130B	*	Turbidity	NTU	1.39	1.61	**10 NTU**

Jennifer Keane
Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.194T

southern scientific services ltd.

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	02 May 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	02 May 2014
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	02 – 08 May 2014
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	09 May 2014
ORDER NO:		**WORK NO.:**	**30286 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-May 033 **Exiting Lagoon**	C14-May 034 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	9.8	9.8	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	<0.02	<0.02	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	<1.0	**5 mg/L**
** 2510 B	*	Conductivity	µS/cm @ 20^{0}C	585	569	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	6.80	6.76	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	0.015	0.012	**0.3 mg/L**
SCP 035	*	pH	pH Unit	7.8	7.8	**6.0 – 9.0**
SCP 010	*	Suspended Solids	mg/L	10	16	**10 mg/L**
**2130B	*	Turbidity	NTU	4.23	8.65	**10 NTU**

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

**	Adapted from '*Standard Methods for the Examination of Water and Wastewater*'. (Current Edition).
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OUR REF: RP **2014** | BENNETSBRIDGE LIMESTONE | **019**

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	03 June 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	03 June 2014
SAMPLED BY:	Paul Byrne Southern Scientific Services Ltd	**DATE ANALYSED:**	03 – 12 June 2014
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	12 June 2014
ORDER NO:		**WORK NO.:**	**30486 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Jun 037 **Exiting Lagoon**	C14-Jun 038 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	14.7	14.7	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	0.07	0.06	**1 mg/L**
SCP 015		BOD	mg/L	1.1	1.1	**5 mg/L**
** 2510 B	*	Conductivity	µS/cm @ 20^{0}C	635	639	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	5.79	7.06	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	0.018	0.017	**0.3 mg/L**
SCP 035	*	pH	pH Unit	8.0	8.1	**6.0 ~ 9.0**
SCP 010	*	Suspended Solids	mg/L	3	4	**10 mg/L**
**2130B	*	Turbidity	NTU	1.26	1.86	**10 NTU**

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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OUR REF: RP **2014** | BENNETSBRIDGE LIMESTONE | **024**

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	01 July 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	01 July 2014
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	01 – 07 July 2014
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	08 July 2014
ORDER NO:		**WORK NO.:**	**30672 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Jul 010 **Exiting Lagoon**	C14-Jul 011 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	11.6	11.5	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	<0.02	<0.02	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	<1.0	**5 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	609	572	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	5.91	5.82	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	0.015	0.016	**0.3 mg/L**
SCP 035		pH	pH Unit	7.8	7.8	**6.0 ~ 9.0**
SCP 010	*	Suspended Solids	mg/L	9	12	**10 mg/L**
**2130B	*	Turbidity	NTU	2.79	8.09	**10 NTU**

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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OUR REF: RP **2014** | BENNETSBRIDGE LIMESTONE | **028**

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	01 August 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	01 August 2014
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	01 – 08 August 2014
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	12 August 2014
ORDER NO:		**WORK NO.:**	**30970 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Aug 036 **Exiting Lagoon**	C14-Aug 037 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	10.7	10.7	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	0.05	0.16	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	<1.0	**5 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	640	634	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	5.52	5.57	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	0.010	0.010	**0.3 mg/L**
SCP 035		pH	pH Unit	7.7	7.8	**6.0 ~ 9.0**
SCP 010	*	Suspended Solids	mg/L	2	<2	**10 mg/L**
**2130B	*	Turbidity	NTU	2.90	1.82	**10 NTU**

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	01 September 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	01 September 2014
SAMPLED BY:	Paul Byrne Southern Scientific Services Ltd	**DATE ANALYSED:**	01 – 08 September 2014
SAMPLING PT:	BENNETSBRIDGE LAGOON	**DATE REPORTED:**	08 September 2014
ORDER NO:		**WORK NO.:**	**31163 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Sep 034 **Lagoon**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	15.6	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	<0.02	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	**5 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	353	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	5.79	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	0.009	**0.3 mg/L**
SCP 035		pH	pH Unit	7.8	**6.0 ~ 9.0**
SCP 010	*	Suspended Solids	mg/L	<2	**10 mg/L**
**2130B	*	Turbidity	NTU	0.62	**10 NTU**

Jennifer Keane
Chemistry Laboratory Manager

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-	No flow from lagoon. A sample of the water in the lagoon was taken.

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	01 October 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	01 October 2014
SAMPLED BY:	Sinead Fagan Southern Scientific Services Ltd	**DATE ANALYSED:**	01 – 08 October 2014
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	09 October 2014
ORDER NO:		**WORK NO.:**	**31362 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Oct 031 **Exiting Lagoon**	C14-Oct 032 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	17.2	16.4	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	<0.02	<0.02	**1 mg/L**
SCP 015		BOD	mg/L	1.4	4.2	**5 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	532	548	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	5.39	5.38	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	0.010	0.005	**0.3 mg/L**
SCP 035		pH Note 4	pH Unit	7.8	7.8	**6.0 ~ 9.0**
SCP 010	*	Suspended Solids Note 5	mg/L	16	17	**10 mg/L**
**2130B	*	Turbidity Note 5	NTU	9.10	14.1	**10 NTU**

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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Note 4	The handling of the sample within the laboratory did not comply with the laboratories policy on holding times & handling instructions. As a result, it is possible that the results may have been compromised.
Note 5	The level of water exiting the lagoon was very low during the sampling event which caused difficulty sampling. This may have contributed to the high Suspended Solids and Turbidity results.

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southern scientific services ltd.

OUR REF: RP **2014** | BENNETSBRIDGE LIMESTONE | **040**

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	03 November 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	03 November 2014
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	03 – 10 November 2014
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	11 November 2014
ORDER NO:		**WORK NO.:**	**31551 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Nov 020 **Exiting Lagoon**	C14-Nov 021 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	10.8	10.9	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	<0.02	<0.02	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	<1.0	**5 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	655	658	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	6.54	6.45	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	0.007	0.006	**0.3 mg/L**
SCP 035		pH	pH Unit	7.6	7.8	**6.0 ~ 9.0**
SCP 010	*	Suspended Solids	mg/L	<2	<2	**10 mg/L**
**2130B	*	Turbidity	NTU	0.52	0.58	**10 NTU**

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1941

southern scientific services ltd.

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	02 December 2014
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	02 December 2014
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	02 – 08 December 2014
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	09 December 2014
ORDER NO:		**WORK NO.:**	**31754 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C14-Dec 045 **Exiting Lagoon**	C14-Dec 046 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	9.6	9.7	**25^{0}C**
SCP 027a	*	Ammonia	mg/L NH_4^+-N	0.02	0.03	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	2.0	**5 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	647	646	**1000 µS/cm @ 20^{0}C**
SCP 027g	*	Nitrate	mg/L as NO_3-N	6.39	6.47	**11 mg/L**
SCP 027f	*	Nitrite	mg/L as NO_2-N	<0.005	<0.005	**0.3 mg/L**
SCP 035	*	pH	pH Unit	7.7	7.7	**6.0 ~ 9.0**
SCP 010	*	Suspended Solids	mg/L	6	6	**10 mg/L**
**2130B	*	Turbidity	NTU	3.9	3.5	**10 NTU**

Jennifer Keane
Jennifer Keane
Chemistry Laboratory Manager

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southern scientific services ltd.

OUR REF: RP **2015** | BENNETSBRIDGE LIMESTONE | **004**

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	07 January 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	07 January 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	07 – 14 January 2015
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	16 January 2015
ORDER NO:		**WORK NO.:**	**31955 C | CP6-136 |**

TABLE OF RESULTS

Method:		Parameter	Units	C15-Jan 071 **Exiting Lagoon**	C15-Jan 072 **10M Downstream**	**LICENCE ENV/W/78 LIMIT (Customer Limits)**
***	*	Temperature	^{0}C	8.6	8.6	**25^{0}C**
SCP 027a		Ammonia	mg/L NH_4^+-N	<0.02	<0.02	**1 mg/L**
SCP 015		BOD	mg/L	<1.0	<1.0	**5 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	659	660	**1000 µS/cm @ 20^{0}C**
SCP 027g		Nitrate	mg/L as NO_3-N	6.46	6.58	**11 mg/L**
SCP 027f		Nitrite	mg/L as NO_2-N	<0.005	<0.005	**0.3 mg/L**
SCP 035		pH	pH Unit	7.8	7.8	**6.0 ~ 9.0**
SCP 010	*	Suspended Solids	mg/L	<2	<2	**10 mg/L**
**2130B	*	Turbidity	NTU	0.81	0.75	**10 NTU**

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	04 February 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	04 February 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	04 – 17 February 2015
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	18 February 2015
ORDER NO:		**WORK NO.:**	**32127 C**

TABLE OF RESULTS

Method		Parameter	Unit	C15-Feb 069 Exiting Lagoon	LICENCE ENV/W/78 LIMIT (Customer Limits)
***	*	Temperature	^{0}C	6.8	-
SCP 027a		Total Ammonia	mg/L N	<0.02	0.25 mg/L N
SCP 015		BOD	mg/L	<1.0	3 mg/L
SCP 016		COD	mg/L	<10	15 mg/L
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	674	-
SCP 027g		Nitrate	mg/L as NO_3-N	6.38	10 mg/L N
SCP 027f		Nitrite	mg/L as NO_2-N	<0.005	-
SCP 027C		MRP	mg/L P	<0.01	0.1 mg/L P
SCP 035		pH	pH Unit	7.7	6.0 – 9.0
SCP 010	*	Suspended Solids	mg/L	<2	10 mg/L
**2130B	*	Turbidity	NTU	0.41	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.010	1 mg/L

Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

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OUR REF: RP **2015** | BENNETSBRIDGE LIMESTONE | **011**

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	05 March 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	05 March 2015
SAMPLED BY:	Paul Byrne Southern Scientific Services Ltd	**DATE ANALYSED:**	05 – 20 March 2015
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	25 March 2015
ORDER NO:		**WORK NO.:**	**32319 C**

TABLE OF RESULTS

Method		Parameter	Unit	C15-Mar 102 Exiting Lagoon	LICENCE ENV/W/78 LIMIT (Customer Limits)
SCP 027a		Total Ammonia	mg/L N	<0.02	0.25 mg/L N
SCP 015		BOD	mg/L	<1.0	3 mg/L
SCP 016		COD	mg/L	<10	15 mg/L
SCP 027g		Nitrate	mg/L as NO_3-N	6.63	10 mg/L N
SCP 027C		MRP	mg/L P	<0.01	0.1 mg/L P
SCP 035		pH	pH Unit	7.9	6.0 – 9.0
SCP 010		Suspended Solids	mg/L	<2	10 mg/L
**5520F	*	TPH's (C10-C40)	mg/L	0.013	1 mg/L

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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directors: K. Murphy, M. Murphy & C. Murphy
registered in ireland no 323196 | vat reg no IE 6343196 M

southern scientific services ltd.

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	01 April 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	01 April 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	01 – 16 April 2015
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	17 April 2015
ORDER NO:		**WORK NO.:**	**32478 C**

TABLE OF RESULTS

Method		Parameter	Unit	C15-Apr 024 Exiting Lagoon	LICENCE ENV/W/78 LIMIT (Customer Limits)
SCP 027a		Total Ammonia	mg/L N	<0.02	0.25 mg/L N
SCP 015		BOD	mg/L	<1.0	3 mg/L
SCP 016		COD	mg/L	<10	15 mg/L
SCP 027g		Nitrate	mg/L as NO_3-N	7.4	10 mg/L N
SCP 027C		MRP	mg/L P	<0.01	0.1 mg/L P
SCP 035		pH	pH Unit	7.8	6.0 – 9.0
SCP 010		Suspended Solids	mg/L	10	10 mg/L
**5520F	*	TPH's (C10-C40)	mg/L	<0.010	1 mg/L
***	*	Temperature	^{0}C	8.6	-

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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directors: K. Murphy, M. Murphy & C. Murphy
registered in ireland no 323196 | vat reg no IE 6343196 M

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	05 May 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	05 May 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	05 – 20 May 2015
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	21 May 2015
ORDER NO:		**WORK NO.:**	**32648 C**

TABLE OF RESULTS

Method		Parameter	Unit	C15-May 033 Exiting Lagoon	**LIMITS** *Supplied by Customer*
SCP 027a		Total Ammonia	mg/L N	<0.02	0.25 mg/L N
SCP 015		BOD	mg/L	<1.0	3 mg/L
SCP 016		COD	mg/L	<10	15 mg/L
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	622	
SCP 027g		Nitrate [Note 4]	mg/L as N	6.04	10 mg/L N
SCP 027f		Nitrite [Note 4]	mg/L as N	0.011	
SCP 027C		MRP	mg/L P	<0.01	0.1 mg/L P
SCP 035		pH	pH Unit	8.1	6.0 – 9.0
SCP 010		Suspended Solids	mg/L	<2	10 mg/L
SCP 017	*	Turbidity	mg/L	2.08	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	1 mg/L
***	*	Temperature	^{0}C	9.6	-

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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southern scientific services ltd.

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	02 July 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	02 July 2015
SAMPLED BY:	Paul Byrne Southern Scientific Services Ltd	**DATE ANALYSED:**	03 – 31 July 2015
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	04 August 2015
ORDER NO:		**WORK NO.:**	**33080 C**

TABLE OF RESULTS

Method		Parameter	Unit	C15-Jul 064 Exiting Lagoon	**LIMITS** *Supplied by Customer*
SCP 027a		Total Ammonia	mg/L N	0.04	0.25 mg/L N
SCP 015		BOD	mg/L	<1.0	3 mg/L
SCP 016		COD	mg/L	<10	15 mg/L
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	623	
SCP 027g		Nitrate	mg/L as N	5.75	10 mg/L N
SCP 027f		Nitrite	mg/L as N	0.021	
SCP 027C		MRP	mg/L P	<0.01	0.1 mg/L P
SCP 035		pH	pH Unit	7.8	6.0 – 9.0
SCP 010		Suspended Solids	mg/L	<2	10 mg/L
SCP 017	*	Turbidity	mg/L	0.79	-
****	*	TPH's (C10-C40)	mg/L	<10	1 mg/L

Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

****	Analysis carried out by external laboratory.

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	05 August 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	05 August 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	05 August – 08 October 2015
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	08 October 2015
ORDER NO:		**WORK NO.:**	**33306 C**

TABLE OF RESULTS

Method		Parameter	Unit	C15-Aug 048 Exiting Lagoon	**LIMITS** *Supplied by Customer*
SCP 027a		Total Ammonia	mg/L N	0.03	0.25 mg/L N
SCP 015		BOD	mg/L	<1.0	3 mg/L
SCP 016		COD	mg/L	<10	15 mg/L
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	613	
SCP 027g		Nitrate	mg/L as N	5.88	10 mg/L N
SCP 027f		Nitrite	mg/L as N	0.009	
SCP 027C		MRP	mg/L P	<0.01	0.1 mg/L P
SCP 035		pH	pH Unit	7.8	6.0 – 9.0
SCP 010		Suspended Solids	mg/L	<2	10 mg/L
SCP 017	*	Turbidity	mg/L	0.68	-
5520F	*	TPH's (C10-C40)	mg/L	<10	1 mg/L
		On Site Monitoring:			
-	*	Temperature	^{0}C	11.7	-

Jennifer Keane
Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	09 September 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	09 September 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	09 September – 08 October 2015
SAMPLING PT:	BENNETSBRIDGE	**DATE REPORTED:**	08 October 2015
ORDER NO:		**WORK NO.:**	**33584 C**

TABLE OF RESULTS

Method		Parameter	Unit	C15-Sep 265 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis:			
SCP 027a		Total Ammonia	mg/L N	<0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	550	
SCP 027g		Nitrate	mg/L as N	5.39	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.012	
SCP 027C		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 035		pH	pH Unit	8.0	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	3	**10 mg/L**
SCP 017	*	Turbidity	mg/L	2.49	**-**
5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			**-**
-	*	Temperature	^{0}C	18.2	**-**

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	08 October 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	08 October 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	08 October – 04 November 2015
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	05 November 2015
ORDER NO:		**WORK NO.:**	**33794 C**

TABLE OF RESULTS

Method		Parameter	Unit	C15-Oct 223 Exiting Lagoon	LIMITS *Supplied by Customer*
		Chemical Analysis:			
SCP 027a		Total Ammonia Note 4	mg/L N	0.07	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20°C	555	
SCP 027g		Nitrate	mg/L as N	5.87	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.010	
SCP 027C		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 035		pH Note 4	pH Unit	8.0	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	15	**10 mg/L**
SCP 017	*	Turbidity	mg/L	13.6	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	°C	15.7	-

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	09 November 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	09 November 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	09 November – 14 December 2015
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	15 December 2015
ORDER NO:		**WORK NO.:**	**33999 C**

TABLE OF RESULTS

Method		Parameter	Unit	C15-Nov 231 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis:			
SCP 027a		Total Ammonia	mg/L N	0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	597	
SCP 027g		Nitrate	mg/L as N	5.46	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.010	
SCP 027C		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 035		pH	pH Unit	7.7	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	4	**10 mg/L**
SCP 017	*	Turbidity	mg/L	8.44	**-**
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			**-**
-	*	Temperature	^{0}C	11.6	**-**

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1941

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	10 December 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	10 December 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	10 December – 23 December 2015
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	05 January 2016
ORDER NO:		**WORK NO.:**	**34264 C**

TABLE OF RESULTS

Method		Parameter	Unit	C15-Dec 1141 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis:			
SCP 027a		Total Ammonia	mg/L N	0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	626	
SCP 027g		Nitrate Note 4	mg/L as N	7.63	**10 mg/L N**
SCP 027f		Nitrite Note 4	mg/L as N	0.007	
SCP 027C		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 035		pH	pH Unit	7.7	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	3	**10 mg/L**
SCP 017	*	Turbidity	mg/L	3.81	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	10.2	-

Jennifer Keane
Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	08 January 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	08 January 2016
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	08 – 25 January 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	26 January 2016
ORDER NO:		**WORK NO.:**	**34388 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Jan 137 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis:			
SCP 027a		Total Ammonia Note 4	mg/L N	0.02	**0.25 mg/L N**
SCP 015		BOD Note 4	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	604	
SCP 027g		Nitrate	mg/L as N	7.53	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	<0.005	
SCP 027C		MRP	mg/L P	0.01	**0.1 mg/L P**
SCP 035		pH	pH Unit	7.5	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	<2	**10 mg/L**
SCP 017	*	Turbidity	mg/L	1.53	**-**
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			**-**
-	*	Temperature	^{0}C	8.4	**-**

Jennifer Keane

Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

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southern scientific services ltd.

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	08 February 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	08 February 2016
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	08 February – 02 March 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	03 March 2016
ORDER NO:		**WORK NO.:**	**34578 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Feb 158 Exiting Lagoon	LIMITS *Supplied by Customer*
		Chemical Analysis:			
SCP 027a		Total Ammonia	mg/L N	<0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 041	*	Conductivity	µS/cm @ 20^{0}C	660	
SCP 027g		Nitrate	mg/L as N	7.27	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	<0.005	
SCP 027C		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 035		pH	pH Unit	7.7	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	9	**10 mg/L**
SCP 017	*	Turbidity	mg/L	25.5	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	8.8	-

Jennifer Keane
Chemistry Laboratory Manager

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web site www.southernscientificireland.com | e-mail info@southernscientificireland.com

directors: K. Murphy, M. Murphy & C. Murphy
registered in ireland no 323196 | vat reg no IE 6343196 M

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	07 March 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	07 March 2016
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	07 March – 09 April 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	11 April 2016
ORDER NO:		**WORK NO.:**	**34787 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Mar 155 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis:			
SCP 027a		Total Ammonia	mg/L N	0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 052		Conductivity	µS/cm @ 20^0C	630	
SCP 027g		Nitrate	mg/L as N	7.04	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.005	
SCP 027C		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 052		pH	pH Unit	7.7	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	<2	**10 mg/L**
**2130B	*	Turbidity	mg/L	0.49	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	7.9	-

Conor Murphy

Dr Conor Murphy
Deputy Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	06 April 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	06 April 2016
SAMPLED BY:	Sinead Fagan Southern Scientific Services Ltd	**DATE ANALYSED:**	06 April – 05 May 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	05 May 2016
ORDER NO:		**WORK NO.:**	**35006 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Apr 166 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis:			
SCP 027a		Total Ammonia Note 4	mg/L N	<0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 052		Conductivity	µS/cm @ 20^0C	648	
SCP 027g		Nitrate	mg/L as N	6.31	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.005	
SCP 027C		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 052		pH	pH Unit	7.8	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	3	**10 mg/L**
SCP 017	*	Turbidity	NTU	1.0	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.010	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	10.8	-

Dr Conor Murphy
Deputy Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	10 May 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	10 May 2016
SAMPLED BY:	Sinead Fagan Southern Scientific Services Ltd	**DATE ANALYSED:**	10 – 30 May 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	30 May 2016
ORDER NO:		**WORK NO.:**	**35182 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-May 139 Exiting Lagoon	LIMITS *Supplied by Customer*
		Chemical Analysis:			
SCP 027a		Total Ammonia	mg/L N	<0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 052		Conductivity	µS/cm @ 20^0C	646	
SCP 027g		Nitrate	mg/L as N	6.42	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.007	
SCP 027c		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 052		pH	pH Unit	7.5	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	<2	**10 mg/L**
SCP 017	*	Turbidity	NTU	4.48	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	10.2	-

Conor Murphy

Dr Conor Murphy
Deputy Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	07 June 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	07 June 2016
SAMPLED BY:	Sinead Fagan Southern Scientific Services Ltd	**DATE ANALYSED:**	08- 24 June 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	27 June 2016
ORDER NO:		**WORK NO.:**	**35390 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Jun 084 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis:			
SCP 027a		Total Ammonia	mg/L N	0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	1.24	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 052		Conductivity	µS/cm @ 20^0C	601	
SCP 027g		Nitrate	mg/L as N	6.09	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.01	
SCP 027c		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 052		pH	pH Unit	7.5	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	5	**10 mg/L**
SCP 017	*	Turbidity	NTU	2.56	**-**
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			**-**
-	*	Temperature	^{0}C	11.6	**-**

Conor Murphy

Dr Conor Murphy
Deputy Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	05 July 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	05 July 2016
SAMPLED BY:	Danny O Leary, Southern Scientific Services Ltd	**DATE ANALYSED:**	05 July – 07 August 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	08 August 2016
ORDER NO:		**WORK NO.:**	**35591 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Jul 046 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis: (F)			
SCP 027a		Total Ammonia	mg/L N	0.03	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 052		Conductivity	µS/cm @ 20^0C	641	
SCP 027g		Nitrate	mg/L as N	6.05	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.01	
SCP 027c		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 052		pH	pH Unit	7.6	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	4	**10 mg/L**
SCP 017	*	Turbidity	NTU	1.92	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	12.8	-

Conor Murphy

Dr Conor Murphy
Deputy Chemistry Laboratory Manager

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ANALYSIS REPORT

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ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	02 August 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	02 August 2016
SAMPLED BY:	Danny O Leary, Southern Scientific Services Ltd	**DATE ANALYSED:**	02 – 17 August 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	17 August 2016
ORDER NO:		**WORK NO.:**	**35755 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Aug 011 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis: (F)			
SCP 027a		Total Ammonia	mg/L N	0.04	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 052		Conductivity	µS/cm @ 20^0C	613	
SCP 027g		Nitrate	mg/L as N	5.80	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.03	
SCP 027c		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 052		pH	pH Unit	7.6	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	7	**10 mg/L**
SCP 017	*	Turbidity	NTU	9.58	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	13.1	-

Dr Conor Murphy
Deputy Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	06 September 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	06 September 2016
SAMPLED BY:	Danny O Leary, Southern Scientific Services Ltd	**DATE ANALYSED:**	06 – 26 September 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	27 September 2016
ORDER NO:		**WORK NO.:**	**36002 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Sep 078 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis: (F)			
SCP 027a		Total Ammonia	mg/L N	<0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 052		Conductivity	µS/cm @ 20^{0}C	629	
SCP 027g		Nitrate	mg/L as N	5.09	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.005	
SCP 027c		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 052		pH	pH Unit	7.6	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	<2	**10 mg/L**
SCP 017	*	Turbidity	NTU	3.45	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	14.6	-

Dr Conor Murphy
Deputy Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	03 October 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	03 October 2016
SAMPLED BY:	Danny O Leary, Southern Scientific Services Ltd	**DATE ANALYSED:**	03 October – 08 November 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	09 November 2016
ORDER NO:		**WORK NO.:**	**36205 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Oct 011 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis: (F)			
SCP 027a		Total Ammonia	mg/L N	<0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 052		Conductivity	µS/cm @ 20^{0}C	662	
SCP 027g		Nitrate	mg/L as N	5.52	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	<0.005	-
SCP 027c		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 052		pH	pH Unit	7.7	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	<2	**10 mg/L**
SCP 058	*	Turbidity	NTU	2.47	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	12.3	-

Dr Conor Murphy
Deputy Chemistry Laboratory Manager

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	03 November 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	03 November 2016
SAMPLED BY:	Danny O Leary, Southern Scientific Services Ltd	**DATE ANALYSED:**	03-17 November 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	18 November 2016
ORDER NO:		**WORK NO.:**	**36444 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Nov 357 Exiting Lagoon	**LIMITS** *Supplied by Customer*
		Chemical Analysis: (F)			
SCP 027a		Total Ammonia	mg/L N	<0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 052		Conductivity	µS/cm @ 20^{0}C	624	
SCP 027g		Nitrate	mg/L as N	5.41	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	<0.005	
SCP 027c		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 052		pH	pH Unit	7.8	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	<2	**10 mg/L**
SCP 017	*	Turbidity	NTU	2.27	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	10.2	-

Ruth Murphy
Chemistry Laboratory Manager

Index to symbols used:

*	Analysis is not INAB accredited.
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
(F)	Analysis carried out at our Farranfore Laboratory.

- **The results relate only to the items tested.**
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directors: K. Murphy, M. Murphy & C. Murphy
registered in ireland no 323196 | vat reg no IE 6343196 M

southern scientific services ltd.

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**SURFACE WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	08 December 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	08 December 2016
SAMPLED BY:	Sinead Fagan, Southern Scientific Services Ltd	**DATE ANALYSED:**	08 – 16 December 2016
SAMPLING PT:	**BENNETSBRIDGE QUARRY**	**DATE REPORTED:**	19 December 2016
ORDER NO:		**WORK NO.:**	**36740 C**

TABLE OF RESULTS

Method		Parameter	Unit	C16-Dec 249 Exiting Lagoon	LIMITS *Supplied by Customer*
		Chemical Analysis: (F)			
SCP 027a		Total Ammonia	mg/L N	<0.02	**0.25 mg/L N**
SCP 015		BOD	mg/L	<1.0	**3 mg/L**
SCP 016		COD	mg/L	<10	**15 mg/L**
SCP 052		Conductivity	µS/cm @ 20^{0}C	636	
SCP 027g		Nitrate	mg/L as N	5.98	**10 mg/L N**
SCP 027f		Nitrite	mg/L as N	0.01	
SCP 027c		MRP	mg/L P	<0.01	**0.1 mg/L P**
SCP 052		pH	pH Unit	7.8	**6.0 – 9.0**
SCP 010		Suspended Solids	mg/L	10	**10 mg/L**
SCP 017	*	Turbidity	NTU	2.08	-
**5520F	*	TPH's (C10-C40)	mg/L	<0.01	**1 mg/L**
		On Site Monitoring			-
-	*	Temperature	^{0}C	10.8	-

Ruth Murphy
Chemistry Laboratory Manager

Index to symbols used:

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(F)	Analysis carried out at our Farranfore Laboratory.

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Appendix B

(continued)

GROUNDWATER QUALITY

CERTIFICATES OF ANALYSIS

Context for the provision of the groundwater results is because: groundwater forms a large component of the discharge volume feeding the settlement lagoons. The majority of the groundwater component is piped from Eden Spring directly to the lagoons and so there is no on-site potential for bringing contaminant or sediment load from this element of the discharge and this element is the primary component of the discharge volume.

southern scientific services ltd.

OUR REF: 15-19443W

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	01 April 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	01 April 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	01 – 02 April 2015
SAMPLING PT:	**WORKERS CANTEEN**	**DATE REPORTED:**	07 April 2015
ORDER NO:	-	**WORK NO.:**	**15-19443 W**

TABLE OF RESULTS

Method:		Parameter:	Units	15-19443 W WORKERS CANTEEN	*** Limit
		Chemical Analysis:			
SCP 035		pH	pH Units	7.2	**6.5 ≤ pH ≤ 9.5 (Note 1)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	<0.016	**0.5 mg/L (Note 2)**
SCP 027g		Nitrates	mg/L NO_3	34.7	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	26.2	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	359	-
SCP 038		Manganese	mg/L	0.001	**0.05 mg/L**
SCP 038		Iron	mg/L	0.006	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	368	-
SCP 041	*	Conductivity	µS/cm	688	**2500 µS/cm (Note 1)**
	*	Langelier Index (70°C)		0.05	-
		Microbiological Analysis:			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT: Chemical Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Microbiological Analysis:

The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Jennifer Keane

Jennifer Keane

Chemistry Laboratory Manager

Index to symbols used:

Note 1	The water should not be aggressive.
Note 2	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014

- **The results relate only to the items tested.**
- **Opinions and interpretations expressed herein are outside the scope of INAB accreditation.**
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ISO 17025 ACCREDITED TESTING DETAILED IN SCOPE REG NO.1941

southern scientific services ltd.

OUR REF: 15-19444W

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	01 April 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	01 April 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	01 – 02 April 2015
SAMPLING PT:	**MANAGER CANTEEN**	**DATE REPORTED:**	07 April 2015
ORDER NO:	-	**WORK NO.:**	**15-19444 W**

TABLE OF RESULTS

Method:		Parameter:	Units	15-19444 W MANAGER CANTEEN	*** Limit
		Chemical Analysis:			
SCP 035		pH	pH Units	7.2	**6.5 ≤ pH ≤ 9.5 (Note 1)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	<0.016	**0.5 mg/L (Note 2)**
SCP 027g		Nitrates	mg/L NO_3	34.3	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	<5	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	352	-
SCP 038		Manganese	mg/L	<0.001	**0.05 mg/L**
SCP 038		Iron	mg/L	0.005	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	370	-
SCP 041	*	Conductivity	µS/cm	692	**2500 µS/cm (Note 1)**
	*	Langelier Index (70°C)		-0.36	-
		Microbiological Analysis:			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT: Chemical Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.
Microbiological Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Jennifer Keane
Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

Note 1	The water should not be aggressive.
Note 2	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014

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registered in ireland no 323196 | vat reg no IE 6343196 M

southern scientific services ltd.

OUR REF: 15-19445 W

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	01 April 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	01 April 2015
SAMPLED BY:	Danny O Leary Southern Scientific Services Ltd	**DATE ANALYSED:**	01 – 02 April 2015
SAMPLING PT:	**RECEPTION CANTEEN**	**DATE REPORTED:**	07 April 2015
ORDER NO:	-	**WORK NO.:**	**15-19445 W**

TABLE OF RESULTS

Method:		Parameter:	Units	15-19445 W RECEPTION CANTEEN	*** Limit
		Chemical Analysis:			
SCP 035		pH	pH Units	7.2	**6.5 ≤ pH ≤ 9.5 (Note 1)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	<0.016	**0.5 mg/L (Note 2)**
SCP 027g		Nitrates	mg/L NO_3	34.1	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	<5	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	348	-
SCP 038		Manganese	mg/L	<0.001	**0.05 mg/L**
SCP 038		Iron	mg/L	<0.005	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	393	-
SCP 041	*	Conductivity	µS/cm	735	**2500 µS/cm (Note 1)**
	*	Langelier Index (70°C)		-0.37	-
		Microbiological Analysis:			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT: Chemical Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.
Microbiological Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

Note 1	The water should not be aggressive.
Note 2	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014

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southern scientific services ltd.

OUR REF: 15-19843 W

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	29 September 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	29 September 2015
SAMPLED BY:	Sinead Fagan Southern Scientific Services Ltd	**DATE ANALYSED:**	29 September – 06 October 2015
SAMPLING PT:	**MANAGER'S CANTEEN**	**DATE REPORTED:**	06 October 2015
ORDER NO:	-	**WORK NO.:**	**15-19843 W**

TABLE OF RESULTS

Method:		Parameter:	Units	15-19843 W Manager's Canteen	*** Limit
		Chemical Analysis:			
SCP 035		pH	pH Units	7.2	**6.5 ≤ pH ≤ 9.5 (Note 1)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	<0.016	**0.5 mg/L (Note 2)**
SCP 027g		Nitrates	mg/L NO_3	28.0	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	<5	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	361	-
SCP 038		Manganese	mg/L	<0.001	**0.05 mg/L**
SCP 038		Iron	mg/L	0.017	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	375	-
SCP 041	*	Conductivity	µS/cm	700	**2500 µS/cm (Note 1)**
	*	Langelier Index (70°C)		-0.35	-
		Microbiological Analysis:			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT: Chemical Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.
Microbiological Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

pp Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

Note 1	The water should not be aggressive.
Note 2	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014

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OUR REF: 15-19844 W

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	29 September 2015
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	29 September 2015
SAMPLED BY:	Sinead Fagan Southern Scientific Services Ltd	**DATE ANALYSED:**	29 September – 06 October 2015
SAMPLING PT:	**RECEPTION CANTEEN**	**DATE REPORTED:**	06 October 2015
ORDER NO:	-	**WORK NO.:**	**15-19844 W**

TABLE OF RESULTS

Method:		Parameter:	Units	15-19844 W Reception Canteen	*** Limit
		Chemical Analysis:			~
SCP 035		pH	pH Units	7.3	**6.5 ≤ pH ≤ 9.5 (Note 1)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	<0.016	**0.5 mg/L (Note 2)**
SCP 027g		Nitrates	mg/L NO_3	28.6	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	<5	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	365	-
SCP 038		Manganese	mg/L	0.002	**0.05 mg/L**
SCP 038		Iron	mg/L	0.032	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	374	-
SCP 041	*	Conductivity	µS/cm	700	**2500 µS/cm (Note 1)**
	*	Langelier Index (70°C)		-0.25	-
		Microbiological Analysis:			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT: Chemical Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.
Microbiological Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

pp
Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

Note 1	The water should not be aggressive.
Note 2	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014

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southern scientific services ltd.

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	07 March 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	07 March 2016
SAMPLED BY:	Sinead Fagan Southern Scientific Services Ltd	**DATE ANALYSED:**	07 – 11 March 2016
SAMPLING PT:	**RECEPTION CANTEEN**	**DATE REPORTED:**	14 March 2016
ORDER NO:	-	**WORK NO.:**	**16-20101 W**

TABLE OF RESULTS

Method:		Parameter:	Units	16-20101 W Reception Canteen	*** Limit
		Chemical Analysis:			~
SCP 052		pH	pH Units	7.15	**6.5 ≤ pH ≤ 9.5 (Note 1)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	<0.016	**0.5 mg/L (Note 2)**
SCP 027g		Nitrates	mg/L NO_3	32.1	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	395	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	325	-
SCP 038		Manganese	mg/L	<0.001	**0.05 mg/L**
SCP 038		Iron	mg/L	<0.005	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	352	-
SCP 052		Conductivity	µS/cm	661	**2500 µS/cm (Note 1)**
	*	Langelier Index (70ºC)		1.03	-
		Microbiological Analysis:			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT: Chemical Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out. The water is hard.
Microbiological Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

pp Dr Conor Murphy
Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

Note 1	The water should not be aggressive.
Note 2	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014

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southern scientific services ltd.

OUR REF: 16-20102 W

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	07 March 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	07 March 2016
SAMPLED BY:	Sinead Fagan Southern Scientific Services Ltd	**DATE ANALYSED:**	07 – 11 March 2016
SAMPLING PT:	**MANAGER'S CANTEEN**	**DATE REPORTED:**	14 March 2016
ORDER NO:	-	**WORK NO.:**	**16-20102 W**

TABLE OF RESULTS

Method:		Parameter:	Units	16-20102 W Manager's Canteen	*** Limit
		Chemical Analysis:			~
SCP 052		pH	pH Units	7.20	**6.5 ≤ pH ≤ 9.5 (Note 1)**
SCP 027a		Ammonium	mg/L NH_4	0.04	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	0.027	**0.5 mg/L (Note 2)**
SCP 027g		Nitrates	mg/L NO_3	32.3	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	260	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	329	-
SCP 038		Manganese	mg/L	0.002	**0.05 mg/L**
SCP 038		Iron	mg/L	<0.005	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	349	-
SCP 052		Conductivity	µS/cm	655	**2500 µS/cm (Note 1)**
	*	Langelier Index (70ºC)		0.64	-
		Microbiological Analysis:			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT: Chemical Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out. The water is hard.
Microbiological Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

pp Dr Conor Murphy
Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

Note 1	The water should not be aggressive.
Note 2	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014

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dunrine | killarney | county kerry | ireland | telephone +353 64 66 33922 | fax +353 64 66 39022
web site www.southernscientificireland.com | e-mail info@southernscientificireland.com
directors: K. Murphy, M. Murphy & C. Murphy
registered in ireland no 323196 | vat reg no IE 6343196 M

southern scientific services ltd.

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	07 March 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	07 March 2016
SAMPLED BY:	Sinead Fagan Southern Scientific Services Ltd	**DATE ANALYSED:**	07 – 11 March 2016
SAMPLING PT:	**WORKER'S CANTEEN**	**DATE REPORTED:**	14 March 2016
ORDER NO:	-	**WORK NO.:**	**16-20103 W**

TABLE OF RESULTS

Method:		Parameter:	Units	16-20103 W Worker's Canteen	*** Limit
		Chemical Analysis:			~
SCP 052		pH	pH Units	7.28	**6.5 ≤ pH ≤ 9.5 (Note 1)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	0.030	**0.5 mg/L (Note 2)**
SCP 027g		Nitrates	mg/L NO_3	32.5	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	<5	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	335	-
SCP 038		Manganese	mg/L	<0.001	**0.05 mg/L**
SCP 038		Iron	mg/L	<0.005	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	356	-
SCP 052		Conductivity	µS/cm	669	**2500 µS/cm (Note 1)**
	*	Langelier Index (70ºC)		-0.29	-
		Microbiological Analysis:			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT: Chemical Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.
Microbiological Analysis: The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

pp Dr Conor Murphy
Jennifer Keane
Chemistry Laboratory Manager

Index to symbols used:

Note 1	The water should not be aggressive.
Note 2	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014

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web site www.southernscientificireland.com | e-mail info@southernscientificireland.com
directors: K. Murphy, M. Murphy & C. Murphy
registered in ireland no 323196 | vat reg no IE 6343196 M

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	06 September 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	06 September 2016
SAMPLED BY:	Danny O Leary, Southern Scientific Services Ltd	**DATE ANALYSED:**	06 – 14 September 2016
SAMPLING PT:	**WORKERS CANTEEN**	**DATE REPORTED:**	14 September 2016
ORDER NO:	**-**	**WORK NO.:**	**16-20552 W**

TABLE OF RESULTS

Method:		Parameter:	Units	16-20552 W WORKERS CANTEEN	*** Limit
		Chemical Analysis: (F)			~
SCP 052		pH	pH Units	7.4	**6.5 ≤ pH ≤ 9.5 (Note A)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	<0.016	**0.5 mg/L (Note B)**
SCP 027g		Nitrates	mg/L NO_3	25.8	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	<5	**-**
SCP 027h		Alkalinity	mg/L as $CaCO_3$	362	**-**
SCP 038		Manganese	mg/L	0.005	**0.05 mg/L**
SCP 038		Iron	mg/L	0.005	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	384	**-**
SCP 052		Conductivity	µS/cm	713	**2500 µS/cm (Note A)**
	*	Langelier Index (70ºC)		-0.15	**-**
		Microbiological Analysis: (D)			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT:
Chemical Analysis:
The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Microbiological Analysis:
The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Conor Murphy
Dr Conor Murphy
Deputy Chemistry Laboratory Manager

Index to symbols used:

*	Analysis is not INAB accredited.
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014
Note A	The water should not be aggressive.
Note B	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
(F)	Analysis carried out at our Farranfore Laboratory.
(D)	Analysis carried out at our Dunrine Laboratory.

- **The results relate only to the items tested.**
- **Opinions and interpretations expressed herein are outside the scope of INAB accreditation.**
- **The analysis report shall not be reproduced except in full without written approval of the laboratory.**

southern scientific services ltd.

ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	06 September 2016
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	06 September 2016
SAMPLED BY:	Danny O Leary, Southern Scientific Services Ltd	**DATE ANALYSED:**	06 – 14 September 2016
SAMPLING PT:	**MANAGERS CANTEEN**	**DATE REPORTED:**	14 September 2016
ORDER NO:	-	**WORK NO.:**	**16-20553 W**

TABLE OF RESULTS

Method:		Parameter:	Units	16-20553 W MANAGERS CANTEEN	*** Limit
		Chemical Analysis: (F)			~
SCP 052		pH	pH Units	7.4	**6.5 ≤ pH ≤ 9.5 (Note A)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	<0.016	**0.5 mg/L (Note B)**
SCP 027g		Nitrates	mg/L NO_3	25.7	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	<5	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	360	-
SCP 038		Manganese	mg/L	<0.001	**0.05 mg/L**
SCP 038		Iron	mg/L	0.005	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	383	-
SCP 052		Conductivity	µS/cm	707	**2500 µS/cm (Note A)**
	*	Langelier Index (70ºC)		-0.15	-
		Microbiological Analysis: (D)			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT:
Chemical Analysis:
The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Microbiological Analysis:
The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Conor Murphy
Dr Conor Murphy
Deputy Chemistry Laboratory Manager

Index to symbols used:

*	Analysis is not INAB accredited.
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014
Note A	The water should not be aggressive.
Note B	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
(F)	Analysis carried out at our Farranfore Laboratory.
(D)	Analysis carried out at our Dunrine Laboratory.

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	07 March 2017
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	07 March 2017
SAMPLED BY:	Danny O Leary, Southern Scientific Services Ltd	**DATE ANALYSED:**	07 – 15 March 2017
SAMPLING PT:	**WORKERS CANTEEN**	**DATE REPORTED:**	20 March 2017
ORDER NO:	-	**WORK NO.:**	**17-20968 W**

TABLE OF RESULTS

Method:		Parameter:	Units	17-20968 W WORKERS CANTEEN	*** Limit
		Chemical Analysis: (F)			~
SCP 052		pH	pH Units	7.2	**6.5 ≤ pH ≤ 9.5 (Note A)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	<0.016	**0.5 mg/L (Note B)**
SCP 027g		Nitrates	mg/L NO_3	36.1	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	<5	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	314	-
SCP 038		Manganese	mg/L	<0.001	**0.05 mg/L**
SCP 038		Iron	mg/L	<0.005	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	392	-
SCP 052		Conductivity	µS/cm	688	**2500 µS/cm (Note A)**
	*	Langelier Index (70ºC)		-0.41	-
		Microbiological Analysis: (D)			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT:

Chemical Analysis:

The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Microbiological Analysis:

The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Ruth Murphy
Chemistry Laboratory Manager

Index to symbols used:

*	Analysis is not INAB accredited.
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	S.I. No. 122 of 2014 - European Union (Drinking Water) Regulations 2014
Note A	The water should not be aggressive.
Note B	Compliance must be entered with the conditions that $[NO_3]/50 + [NO_2] / 3 \leq 1$
(F)	Analysis carried out at our Farranfore Laboratory.
(D)	Analysis carried out at our Dunrine Laboratory.

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ANALYSIS REPORT

CUSTOMER:	**BENNETSBRIDGE LIMESTONE QUARRIES LTD**	**SAMPLE TYPE:**	**DRINKING WATER**
ADDRESS:	Kilree, Sheastown, County Kilkenny	**CONDITION OF SAMPLE ON RECEIPT:**	Satisfactory
		DATE SAMPLED:	07 March 2017
REPORT TO:	**EOIN O CARROLL**	**DATE RECEIVED:**	07 March 2017
SAMPLED BY:	Danny O Leary, Southern Scientific Services Ltd	**DATE ANALYSED:**	07 – 15 March 2017
SAMPLING PT:	**RECEPTION** CANTEEN	**DATE REPORTED:**	20 March 2017
ORDER NO:	-	**WORK NO.:**	**17-20969 W**

TABLE OF RESULTS

Method:		Parameter:	Units	17-20969 W RECEPTION CANTEEN	*** Limit
		Chemical Analysis: (F)			~
SCP 052		pH	pH Units	7.2	**6.5 ≤ pH ≤ 9.5 (Note A)**
SCP 027a		Ammonium	mg/L NH_4	<0.03	**0.3 mg/L**
SCP 027f		Nitrites	mg/L NO_2	0.05	**0.5 mg/L (Note B)**
SCP 027g		Nitrates	mg/L NO_3	37.5	**50 mg/L**
SCP 027i		Total Hardness	mg/L as $CaCO_3$	<5	-
SCP 027h		Alkalinity	mg/L as $CaCO_3$	382	-
SCP 038		Manganese	mg/L	<0.001	**0.05 mg/L**
SCP 038		Iron	mg/L	<0.005	**0.2 mg/L**
**2510 B	*	Dissolved Solids	mg/L	392	-
SCP 052		Conductivity	µS/cm	692	**2500 µS/cm (Note A)**
	*	Langelier Index (70ºC)		-0.33	-
		Microbiological Analysis: (D)			
SMP 019		Coliforms	MPN/100mL	<1	**0/100 mL**
SMP 019		*E. coli*	MPN/100mL	<1	**0/100 mL**

COMMENT:

Chemical Analysis:

The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Microbiological Analysis:

The water complies with the Drinking Water Regulations S.I. No. 122 of 2014, based on the tests carried out.

Ruth Murphy

Ruth Murphy
Chemistry Laboratory Manager

Index to symbols used:

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Note A	The water should not be aggressive.
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(F)	Analysis carried out at our Farranfore Laboratory.
(D)	Analysis carried out at our Dunrine Laboratory.

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Appendix C

Survey of the Settlement Lagoons

(Murphy Surveys ltd., 2017)

Lagoon Survey Bennettsbridge Limestone Quarry, Kilkenny.

MSL Survey Report

Issue No. 2

17th February 2017

Murphy Surveys Ltd.

Global House

Kilcullen Business Campus

Kilcullen, Co. Kildare

Ireland

TABLE OF CONTENTS

1.1. GENERAL

A survey was required in two quarry settlement lagoons, located in Bennettsbridge limestone quarry.

1.2. PROJECT DETAILS

A survey was required to determine the volume of silt and capacity within each lagoon. The smaller lagoon is referred to as North lagoon and the larger lagoon is referred to as the South lagoon.

1.3. SURVEY DETAILS

Works commenced on site on Wednesday the 1st February 2017, under wet weather conditions. Site works were planned and scheduled with Bennettsbridge quarry prior to arrival on site. The survey was completed within 1 day on site.

The total station equipment was setup at the side of the lagoon. Ropes were used as anchor points on either side of the lagoon. An inflatable boat was used to maneuver across the lagoon, with a detail pole used to record;

1. The top of silt level
2. The hard bed (bedrock) / bottom of silt.

Cross sections were recorded at approximately 10m intervals along each lagoon (based on ISIS chainage).

The survey data recorded was used to calculate the volume of silt and capacity within each lagoon. The calculations are described below.

All levels are included in the attached .csv files and drawings.

1.4. PRESENTATION

The following is a list of drawing delivered in this contract:

MSL19388_Kilkenny_Quarry_Lagoon

- MSL19388_South_HB_Plan
- MSL19388_South_SB_Plan
- MSL19388_South_Fill_Plan
- MSL19388_North_HB_Plan
- MSL19388_North_SB_Plan
- MSL19388_North_Fill_Plan
- MSL19388_South_Cross_Sections
- MSL19388_North_Cross_Sections

1.5. CALCULATIONS

All calculations were determined using AutoCAD Civil 3D and QGIS as a check.

Volume of Silt

AutoCAD Civil 3D (*more accurate*)

Using Civil3D, Tin models were created for both the top of silt layer and the hard bed layer. The differences between each layer were calculated as follows:

South Lagoon ≈755.40m^3

North Lagoon ≈287.35m^3

QGIS

Using QGIS, the points were exported to csv files and points separated between the soft bed and hard bed levels. The points were put into a grid at 1m^2 intervals to create the hard bed and soft bed DTM. Using the raster calculator to subtract the difference to create a chart of sediment thickness of 1m^2 cell, export the raster values as csv points with the sediment elevations. The combined elevation for each 1m^2 from the raster is the volume of silt as delineated in the csv.

South Lagoon ≈765.41m^3

North Lagoon ≈293.71m^3

- The calculation for silt depth is the difference between top of soft bed (silt level) and hard bed (bed rock)

- The calculation for water depth is the difference between the maximum potential capacity of water before overspill and the top of silt level (although this does not account for moisture content in the silt).

All elevation levels are referenced against the Malin Head datum

Water levels were taken at the bottom of the banks.

Lagoon Capacity

The water capacity was calculated using both methods; resulting in similar results. The elevations used on site were as follows: (based on highest elevation before over-topping at any point)

South Lagoon – Max water capacity ≈ 7835m^3 (Max elevation – 45.5m mOD)

North Lagoon – Max water capacity ≈160m^3 (Max elevation – 46.2m mOD)

Area of lagoons

The area of the lagoon is based on the potential water surface extent, at the highest elevation; before over-topping at any point. This area is as follow;

North site ≈ 580.1m^2

South site ≈ 5379.8m^2

Cross Section

Using cross sections for the North and South site, extending from north to south, at 1m intervals (illustrated below). The depth of silt and water (mOD) are as follows. See full table attached to report for all recorded levels.

North Site - Depth Table (Preview of table results)

North Lagoon Depths (mOD)			
Easting	Northing	Silt Depth (m)	Water Depth (m)
654639.483	650005.983	0.421	
654639.483	650004.983	0.605	0.305
654639.483	650003.983	0.684	0.364
654639.483	650002.983	0.763	0.424
654639.483	650001.983	0.841	0.483
654639.483	650000.983	0.875	0.474
654639.483	649999.983	0.898	0.460
654639.483	649998.983	0.916	0.451
654639.483	649997.983	0.931	0.442
654639.483	649996.983	0.946	0.434
654639.483	649995.983	0.961	0.426
654639.483	649994.983	0.975	0.417
654639.483	649993.983	0.961	0.404
654639.483	649992.983	0.796	0.373
654639.483	649991.983	0.630	0.343
654639.483	649990.983	0.468	0.310
654639.483	649989.983	0.325	0.259
654639.483	649988.983	0.151	0.032

South Site - Depth Table (Preview of table results)

South Lagoon Depths (mOD)							
Easting	Northing	Silt Depth (m)	Water Depth (m)	Easting	Northing	Silt Depth (m)	Water Depth (m)
654639.674	649980.508	0.005		654639.674	649925.508	0.114	1.793
654639.674	649979.508	0.019	0.133	654639.674	649924.508	0.111	1.766
654639.674	649978.508	0.044	0.481	654639.674	649923.508	0.107	1.738
654639.674	649977.508	0.072	0.831	654639.674	649922.508	0.099	1.716
654639.674	649976.508	0.088	1.191	654639.674	649921.508	0.098	1.729
654639.674	649975.508	0.103	1.551	654639.674	649920.508	0.103	1.745
654639.674	649974.508	0.207	1.911	654639.674	649919.508	0.105	1.759
654639.674	649973.508	0.206	1.933	654639.674	649918.508	0.108	1.772
654639.674	649972.508	0.197	1.946	654639.674	649917.508	0.111	1.786
654639.674	649971.508	0.192	1.963	654639.674	649916.508	0.114	1.800
654639.674	649970.508	0.186	1.981	654639.674	649915.508	0.116	1.814
654639.674	649969.508	0.180	1.998	654639.674	649914.508	0.122	1.826
654639.674	649968.508	0.175	2.015	654639.674	649913.508	0.127	1.830
654639.674	649967.508	0.169	2.032	654639.674	649912.508	0.130	1.831
654639.674	649966.508	0.164	2.049	654639.674	649911.508	0.133	1.812
654639.674	649965.508	0.158	2.066	654639.674	649910.508	0.137	1.794
654639.674	649964.508	0.152	2.084	654639.674	649909.508	0.140	1.776
654639.674	649963.508	0.160	2.101	654639.674	649908.508	0.143	1.757
654639.674	649962.508	0.173	2.119	654639.674	649907.508	0.146	1.739
654639.674	649961.508	0.186	2.136	654639.674	649906.508	0.138	1.711
654639.674	649960.508	0.187	2.140	654639.674	649905.508	0.129	1.680
654639.674	649959.508	0.187	2.143	654639.674	649904.508	0.119	1.650
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654639.674	649939.508	0.195	2.025	654639.674	649884.508	0.205	1.871
654639.674	649938.508	0.195	2.019	654639.674	649883.508	0.204	1.926
654639.674	649937.508	0.184	2.014	654639.674	649882.508	0.212	1.989
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654639.674	649934.508	0.148	1.995	654639.674	649879.508	0.205	1.547
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654639.674	649932.508	0.131	1.976	654639.674	649877.508	0.185	1.146
654639.674	649931.508	0.136	1.958	654639.674	649876.508	0.175	0.945
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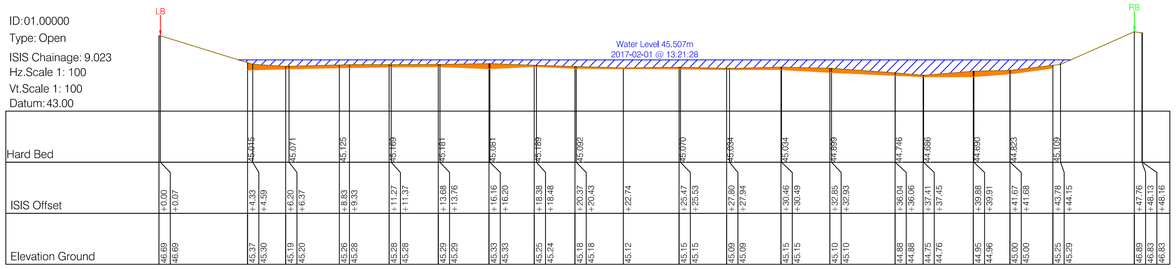
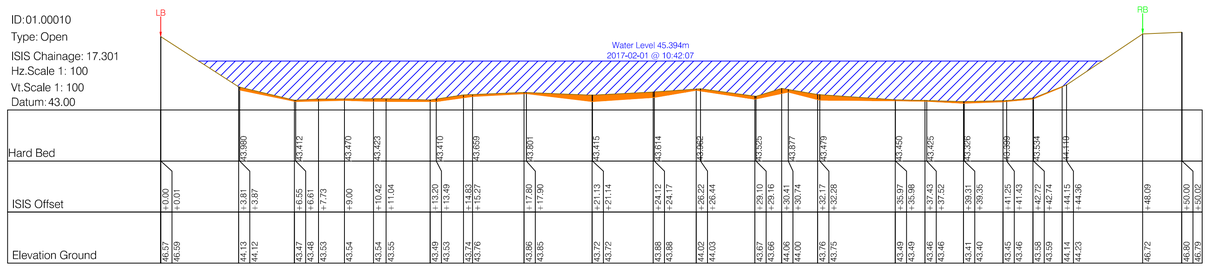
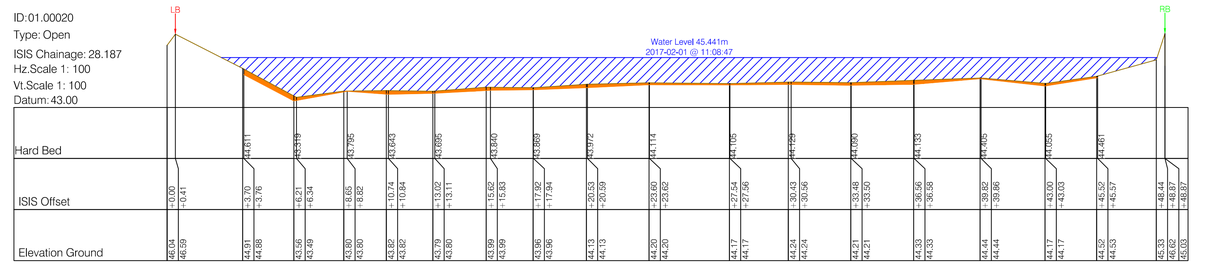
Report prepared by: Keith Coleman

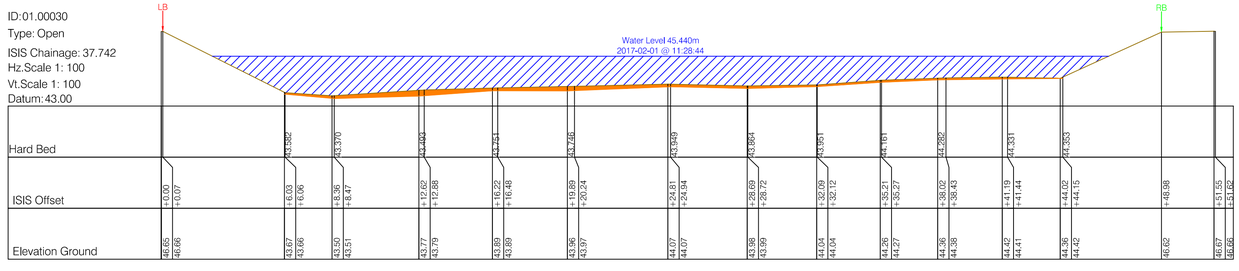
Date: 03/02/2017

Date: 17/02/2017 Issue 2









LEGEND

Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
- Trial Pit
- Bus/Tram Shelter
- Postbox
- Valve - General
- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
- Stop Cock
- C P Post
- Marker Post
- Traffic light
- Parking Meter
- Plane Aerial Mark
- Smart Card Validator
- Unknown Valve
- Bus Stop
- Bollard
- Beacon
- Coalhole Cover
- Bore Hole
- Electricity Pole
- Telegraph pole
- OCS Pole
- CCTV Camera Pole
- Lamp Post
- Foul Manhole
- Surface Water MH
- Manholes
- Air Conditioning Vents
- Services Inspection Cover
- Traffic Inspection Cover
- Cable TV Inspection Cover
- ESAT Inspection Cover
- NTL Inspection Cover
- Eircom Inspection Cover
- Rodding Eye
- Road Sign
- Bench Seat
- Kiosk
- Gully
- Waste Bin
- Hydrant
- Fire Hydrant
- ESB Box
- ESB Inspection Cover
- Traffic Control Box
- LUAS Technical Cubicle
- Ticket Vending Machine
- Water Meter Cover
- Telecom Inspection Cover
- Monument / Toilets
- Tank Storage
- Basement: MH. Cover & Pipe
- Dished Aerial Mark
- Stay for pole
- PP Pipe Protection
- Washout

Natural Features

- Surface Change
- Land Drain
- Bottom of Slope
- Top of Slope
- Ditch
- Water Edge / Lake / Pond
- Hedge / Trees Drip Line / Vegetation
- Tree Coniferous
- Water Level
- Crown Level
- Invert level
- Bed Level
- Spotheight
- Top of Tree
- Tree Deciduous

Golf

- Fair Way
- Green
- Tee Box

Other

- Survey Station
- Photo point
- River Alignment

Built Features

Roads & Road Markings

- Building
- Edge of Road
- Kerb Bottom
- Kerb Top
- Bridge Abutment
- Bridge Deck
- Bridge Parapet
- Building Façade
- Footpath / Platform Train & Tram
- Damp Proof Course / Verge
- Bridge Pier / Wall & Gate Pillar / LUAS Trackbed
- Cycleway / Private Landing Area
- Fence
- Gate
- Road Centreline
- Top of Wall
- Hoarding
- Property Line
- Road Scar
- Top of Fence
- Floor Level
- Apex Height
- Eaves Height
- Parapet Height
- Soffit Elevation
- Step Level
- Concrete Pad
- Track
- Wall / Retaining Wall
- Railway / Tram Rail / Grating / Ramp
- Building Canopy / Roof / Overhang

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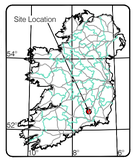
Iarnród Éireann
Irish Rail



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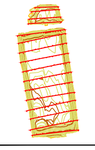

Surveyed by :	MSL	Date: FEB 2017	Datum Main Head
Drawn by :	CE	Date: FEB 2017	Grid System:
Checked by :	KC	Date: 03.02.2017	Irish National Grid ☐ ITM ■

Revisons

No.	Date	Description
0	03.02.2017	First Drawing

No. 318

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Email: info@murphysurveys.ie

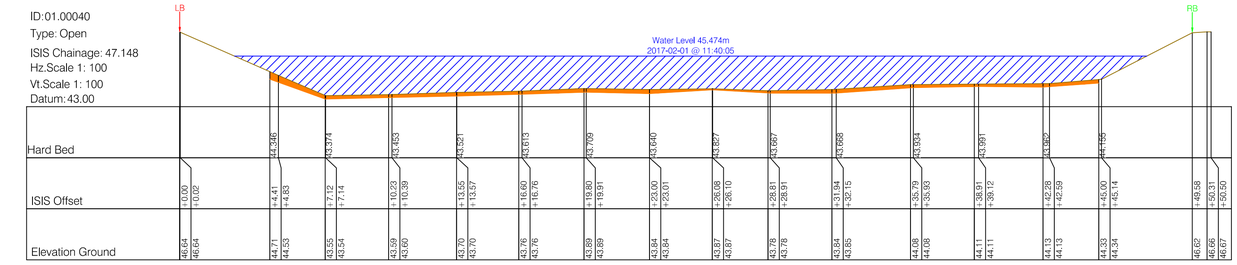
Client : Earth Science Partnership

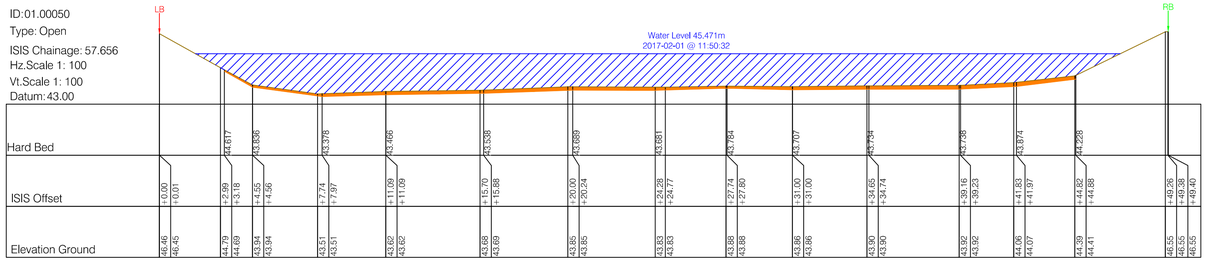
Project : Lagoon Sediment Volume Survey

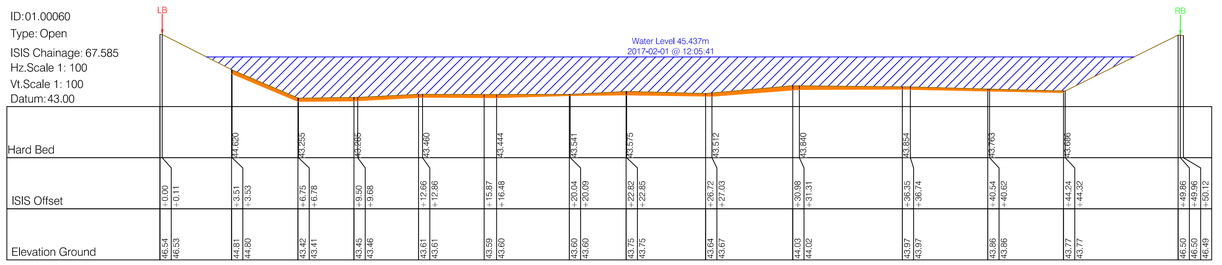
Date : 03.02.2017 **Scale :** AS SHOWN@A1

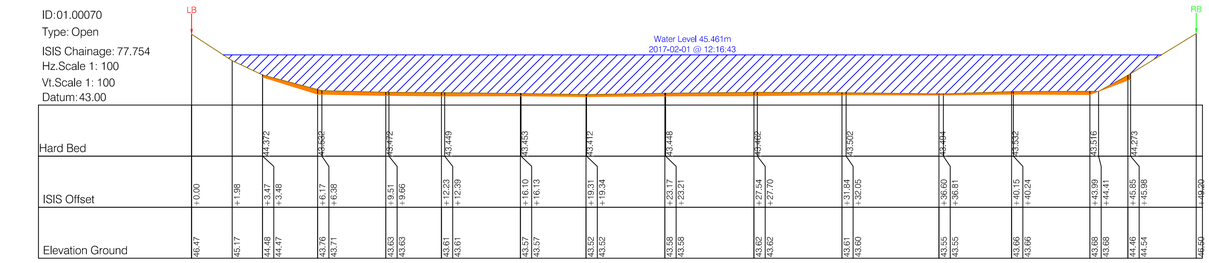
Description : Topographical Survey

Drawing Number : MSL19388_SOUTH_PROFILE_1









LEGEND

Street furniture & Services

Over Head Wires (LUAS) - Pylon ESB; Flowerbed; Pipe; Lift; Barrier; Pump; Trial Pit; Bus/Tram Shelter; Postbox; Valve - General; Water Valve; Gas Valve; Sluice Valve; Air Valve; Stop Cock; C P Post; Marker Post; Traffic light; Parking Meter; Plane Aerial Mark; Smart Card Validator; Unknown Valve

Road Sign; Bus Stop; Bollard; Beacon; Coalhole Cover; Bore Hole; Electricity Pole; Telegraph pole; OCS Pole; CCTV Camera Pole; Lamp Post; Foul Manhole; Surface Water MH; Manholes; Air Conditioning Vents; Services Inspection Cover; Traffic Inspection Cover; Cable TV Inspection Cover; ESAT Inspection Cover; NTL Inspection Cover; Eircom Inspection Cover; Rodding Eye

Phone Box; Bench Seat; Duct; Kiosk; Gas Cover; Gully; C P Box; U/G Car Park Vent; Waste Bin; Hydrant; Fire Hydrant; ESB Box; ESB Inspection Cover; Traffic Control Box; LUAS Technical Cubicle; Ticket Vending Machine; Water Meter Cover; Telecom Inspection Cover; Monument / Toilets; Tank Storage; Basement: MH. Cover & Pipe; Disked Aerial Mark; Stay for pole; Pipe Protection; Washout

Natural Features

Surface Change; Land Drain; Bottom of Slope; Top of Slope; Ditch; Water Edge / Lake / Pond; Hedge / Trees Drip Line / Vegetation; Tree Coniferous

Water Level; CRWN Crown Level; Invert level; Bed Level; Spotheight; Top of Tree; Tree Deciduous

Golf

Fair Way; Green; Tee Box

Other

Survey Station; Photo point; River Alignment

Built Features

Roads & Road Markings

Building; Edge of Road; Kerb Bottom; Kerb Top; Bridge Abutment; Bridge Deck; Bridge Parapet; Building Façade; Footpath / Platform Train & Tram; Damp Proof Course / Verge; Bridge Pier / Wall & Gate Pillar / LUAS Trackbed; Cycleway / Private Landing Area

Fence; Gate; Road Centreline; Top of Wall; Hoarding; Property Line; Road Scar; Top of Fence; Wall / Retaining Wall; Railway / Tram Rail / Grating / Ramp; Building Canopy / Roof / Overhang

Floor Level; Apex Height; Eaves Height; Parapet Height; Soffit Elevation; Step Level; Concrete Pad; Track

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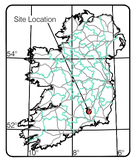
Iarnród Éireann
Irish Rail



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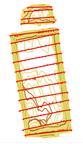

Surveyed by:	MSL	Date: FEB 2017	Datum: Malin Head
Drawn by :	CE	Date: FEB 2017	Grid System:
Checked by :	KC	Date: 03.02.2017	Irish National Grid ☐ ITM ■

Revisions

No:	Date	Description
0	03.02.2017	First Drawing

No. 318

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Fax: (+353) 045 484004
Email: info@murphysurveys.ie

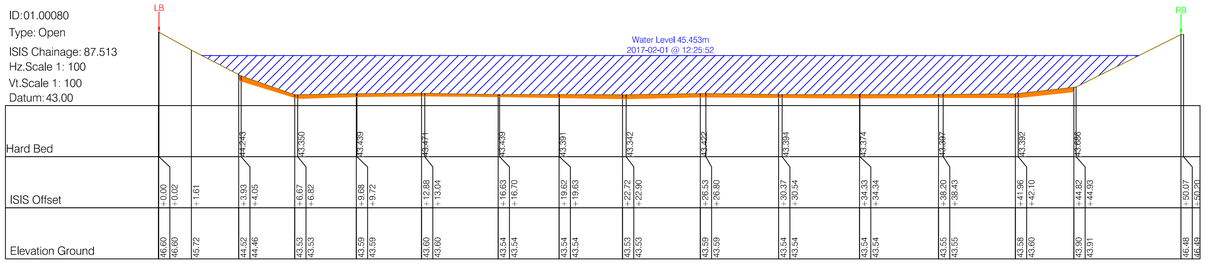
Client : Earth Science Partnership

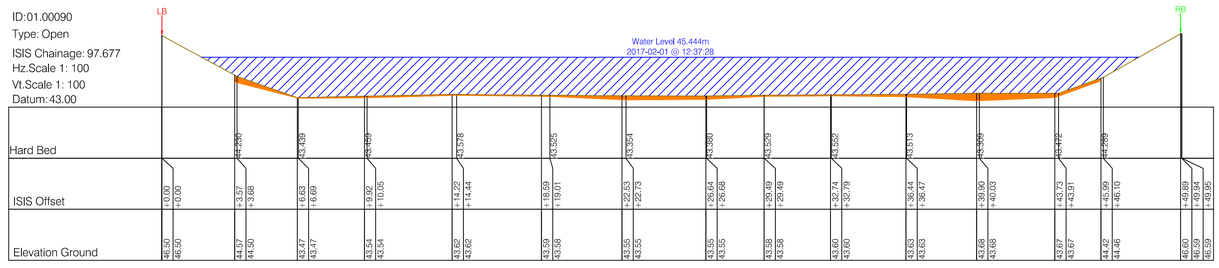
Project : Lagoon Sediment Volume Survey

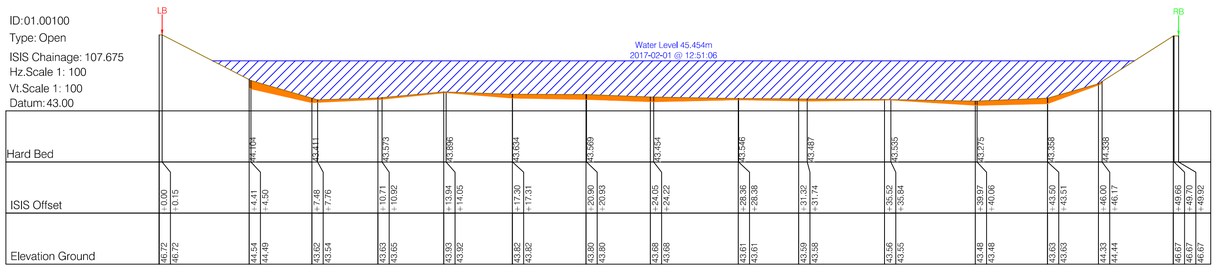
Date : 03.02.2017 **Scale :** AS SHOWN@A1

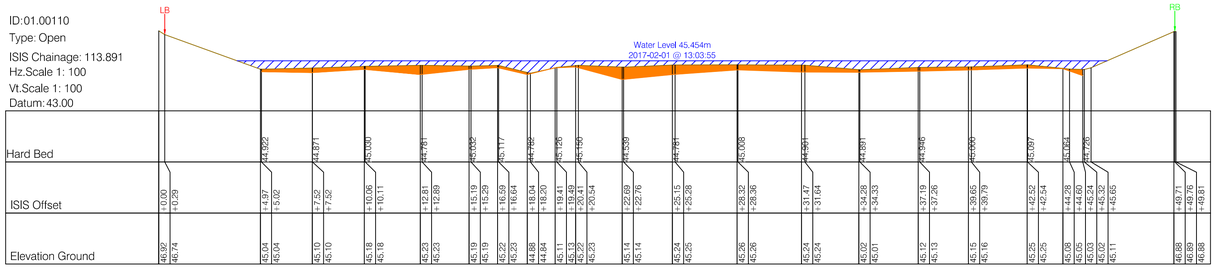
Description : Topographical Survey

Drawing Number : MSL19388_SOUTH_PROFILE_2









LEGEND

Street furniture & Services

Over Head Wires (LUAS) - Pylon ESB · RS Road Sign · PBOX Phone Box
Flowerbed · BS Bus Stop · Bench Seat · Duct
Pipe · BT Bollard · Kiosk · GAS Gas Cover
Lift · BEA Beacon · GY Gully · CPBox C P Box
Barrier · CH Coalhole Cover · U/G Vent · U/G Car Park Vent
Pump · BH Bore Hole · BIN Waste Bin
Trial Pit · EP Electricity Pole · HY Hydrant
Bus/Tram Shelter · TP Telegraph pole · FH Fire Hydrant
Postbox · OCS OCS Pole · EBOX ESB Box
Valve - General · CP CCTV Camera Pole · ICE ESB Inspection Cover
Water Valve · LP Lamp Post · TFB Traffic Control Box
Gas Valve · FMH Foul Manhole · LUAS LUAS Technical Cubicle
Sluice Valve · SMH Surface Water MH · Ticket Vending Machine
Air Valve · MH Manholes · WM Water Meter Cover
Stop Cock · AC Air Conditioning Vents · ICT Telecom Inspection Cover
C P Post · ICU Services Inspection Cover · Monument / Toilets
Marker Post · ICTC Traffic Inspection Cover · Tank Storage
Traffic light · ICTV Cable TV Inspection Cover · Basement: MH. Cover & Pipe
Parking Meter · ICES ESAT Inspection Cover · Disined Aerial Mark
Plane Aerial Mark · ICNC NTL Inspection Cover · STAY Stay for pole
Smart Card Validator · ICEM Eircom Inspection Cover · PP Pipe Protection
Unknown Valve · Rodding Eye · Washout

Natural Features

Surface Change · Water Level · Water Level · Golf · Fair Way
Land Drain · CRWN · Crown Level · GREE · Green
Bottom of Slope · IL · Invert level · TBOX · Tee Box
Top of Slope · BL · Bed Level
Ditch · Spotheight · Other
Water Edge / Lake / Pond · TOT · Top of Tree · Survey Station
Hedge / Trees Drip Line / Vegetation · Photo point
Tree Coniferous · Tree Deciduous · River Alignment

Built Features
Roads & Road Markings

Building · Fence · Floor Level
Edge of Road · Gate · Apex Height
Kerb Bottom · Road Centreline · Eaves Height
Kerb Top · Top of Wall · Parapet Height
Bridge Abutment · Hoarding · Soffit Elevation
Bridge Deck · Property Line · Step Level
Bridge Parapet · Road Scar · Concrete Pad
Building Façade · Top of Fence · Track
Footpath / Platform Train & Tram · Wall / Retaining Wall
Damp Proof Course / Verge · Railway / Tram Rail / Grating / Ramp
Bridge Pier / Wall & Gate Pillar / LUAS Trackbed · Building Canopy / Roof / Overhang
Cycleway / Private Landing Area

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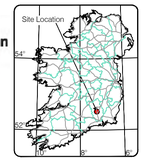

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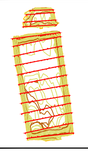

Surveyed by : MSL	Date: FEB 2017	Datum	Malin Head
Drawn by : CE	Date: FEB 2017	Grid System:	
Checked by : KC	Date: 03.02.2017	Irish National Grid ☐ ITM ■	

Revisions

No.	Date	Description
0	03.02.2017	First Drawing

No. 318

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Fax: (+353) 045 484004
Email: info@murphysurveys.ie

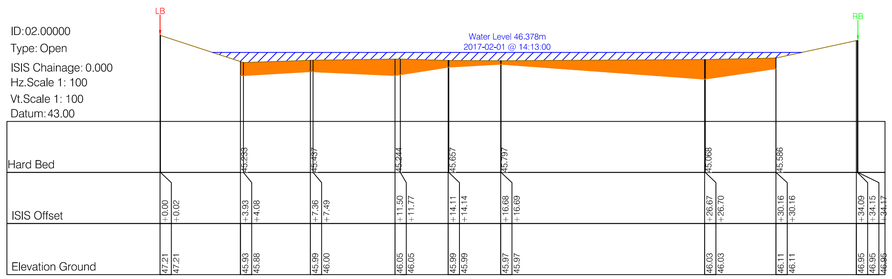
Client : Earth Science Partnership

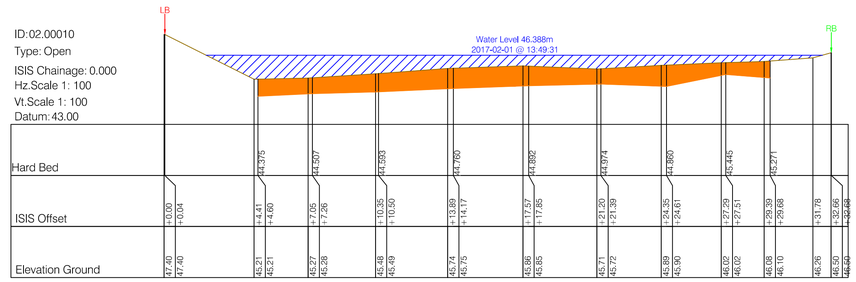
Project : Lagoon Sediment Volume Survey

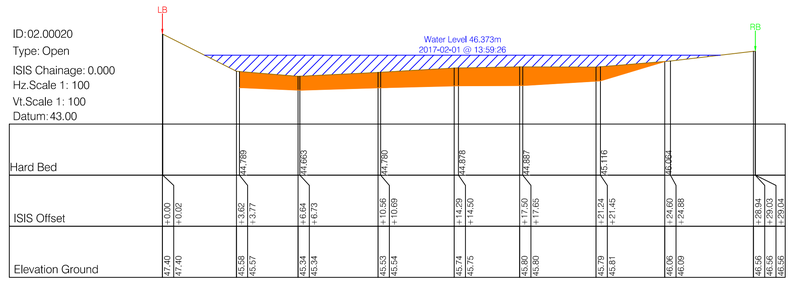
Date : 03.02.2017 **Scale :** AS SHOWN@A1

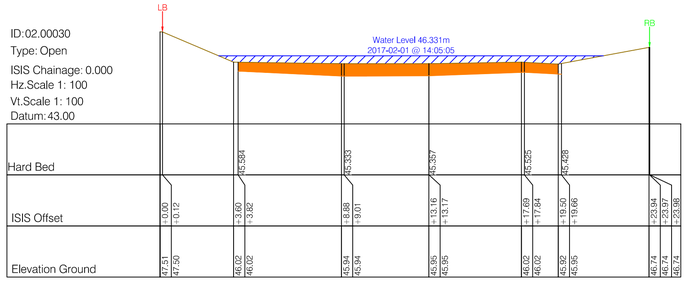
Description : Topographical Survey

Drawing Number : MSL19388_SOUTH_PROFILE_3









LEGEND

Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
- Trial Pit
- Bus/Tram Shelter
- Postbox
- Valve - General
- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
- Stop Cock
- C P Post
- Marker Post
- Traffic light
- Parking Meter
- Plane Aerial Mark
- Smart Card Validator
- Unknown Valve
- Bus Stop
- Bollard
- Beacon
- Coalhole Cover
- Bore Hole
- Electricity Pole
- Telegraph pole
- OCS Pole
- CCTV Camera Pole
- Lamp Post
- Foul Manhole
- Surface Water MH
- Manholes
- Air Conditioning Vents
- Services Inspection Cover
- Traffic Inspection Cover
- Cable TV Inspection Cover
- ESAT Inspection Cover
- NTL Inspection Cover
- Eircom Inspection Cover
- Rodding Eye
- Road Sign
- Bench Seat
- Kiosk
- Gully
- Waste Bin
- Hydrant
- Fire Hydrant
- ESB Box
- ESB Inspection Cover
- Traffic Control Box
- LUAS Technical Cubicle
- Ticket Vending Machine
- Water Meter Cover
- Telecom Inspection Cover
- Monument / Toilets
- Tank Storage
- Basement: MH. Cover & Pipe
- Dished Aerial Mark
- Stay for pole
- Pipe Protection
- Washout
- Phone Box
- Duct
- Gas Cover
- C P Box
- U/G Car Park Vent

Natural Features

- Surface Change
- Land Drain
- Bottom of Slope
- Top of Slope
- Ditch
- Water Edge / Lake / Pond
- Hedge / Trees Drip Line / Vegetation
- Tree Coniferous
- Water Level
- Crown Level
- Invert level
- Bed Level
- Spotheight
- Top of Tree
- Tree Deciduous

Golf

- Fair Way
- Green
- Tee Box

Other

- Survey Station
- Photo point
- River Alignment

Built Features

Roads & Road Markings

- Building
- Edge of Road
- Kerb Bottom
- Kerb Top
- Bridge Abutment
- Bridge Deck
- Bridge Parapet
- Building Façade
- Footpath / Platform Train & Tram
- Damp Proof Course / Verge
- Bridge Pier / Wall & Gate Pillar / LUAS Trackbed
- Cycleway / Private Landing Area
- Fence
- Gate
- Road Centreline
- Top of Wall
- Hoarding
- Property Line
- Road Scar
- Top of Fence
- Floor Level
- Apex Height
- Eaves Height
- Parapet Height
- Soffit Elevation
- Step Level
- Concrete Pad
- Track
- Wall / Retaining Wall
- Railway / Tram Rail / Grating / Ramp
- Building Canopy / Roof / Overhang

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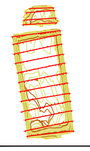
The Client must promptly notify the Company of any errors in mapping of which it becomes aware. If misleading, inaccurate or otherwise inappropriate information is brought to the Company's attention or the Company itself identifies any such imprecision or error in a survey, it shall use its reasonable endeavours to fix or remove it and if necessary in certain instances, the Company being on notice of any such misleading, inaccurate or otherwise inappropriate information, it will re-conduct the survey and reproduce the data to within the specified scale or accuracy.

Iarnród Éireann
Irish Rail

Map Sheet Layout:



Surveyed by:	MSL	Date: FEB 2017	Datum Malin Head
Drawn by :	CE	Date: FEB 2017	Grid System:
Checked by:	KC	Date: 03.02.2017	Irish National Grid ☐ ITM ■

Revisions

No:	Date	Description
0	03.02.2017	First Drawing

No. 318

THE SURVEY ASSOCIATION
FULL MEMBER

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Client : Earth Science Partnership

Project : Lagoon Sediment Volume Survey

Date : 03.02.2017 **Scale :** AS SHOWN@A1

Description : Topographical Survey

Drawing Number : MSL19388_NORTH_PROFILE_1

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Environmental Section
Kilkenny County Council
County Hall
John St.
Kilkenny

14th September 2018

Re: Bennettsbridge Limestone Quarries Discharge Licence No. ENV/W/78
Cleaning water treatment Lagoons

Dear Sir/Madam

In accordance with discharge licence ENV/W/78 (Bennettsbridge Limestone Quarries) and in particular with condition 3.3 which states:

> *"The licence holder shall ensure that the capacity of the settlement lagoon is increased by the removal of the accumulated sediment. The works shall be carried out as soon as practicable. The licence holder shall notify Kilkenny County Council once the works are complete".*

We wish to inform you that cleaning works of the lagoon system have been completed. This work was carried out substantially in accordance with the Method Statement for Cleaning Lagoons which was submitted to Kilkenny County Council in previous correspondences.

Bulk excavation was carried out using tracked hydraulic excavators filling earthmoving trucks, which followed pre-determined haul routes to deposit the excavated material in a controlled fashion. Haul routes generally follow the line of existing permanent access ways. Excavated material generated by this process will remain on the site. Please refer to the sketch below, in which the excavation, haul routes and deposition location are shown.

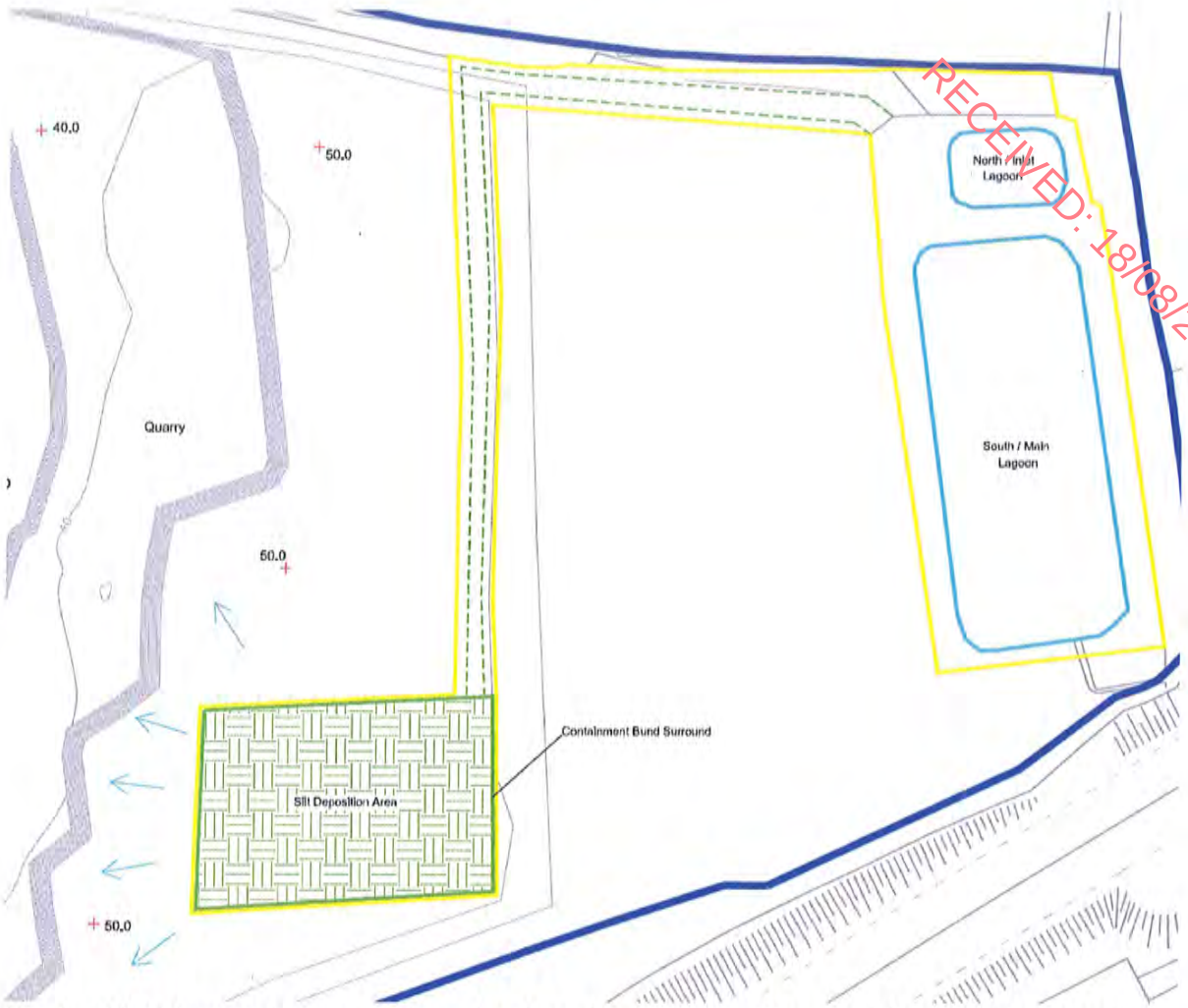

Fig 1. - Sketch showing excavation, haul routs and deposition area for cleaning process.

During this phase of the works all water was directed to the sump in the quarry floor. From here it was pumped on a bypass system to the main lagoon and was treated before discharge off site. The total volume of silt removed from this section of the lagoon was approximately 300m^3 (600 tonnes).

The silt material which was settled in the inlet lagoon consisted of the larger fractions of the suspended solids and as this material is more course it is more easily drained. This can be seen from the photographs below which indicate that the silt in this area of the lagoon system is relatively free draining and is in a semisolid state during the excavation process. Therefore it is easily hauled using standard dump trucks and tipped in the deposition area with no impact on the surrounding environment.

Cleaning and removal of silt and vegetation from the inlet lagoon

Inlet lagoon cleaning in in the foreground while the main lagoon is fully operational in the background.

Cleaning of the inlet lagoon has been complete

Recommissioning of the Lagoons

On completion of the removal of the silt from the inlet lagoon, the entire lagoon system was brought back into service in such a manner which did not cause any siltation of the main lagoon. This was achieved by filling the inlet lagoon up to half way with water and allowing this water to settle before completing the filling process and equalising the levels throughout the lagoon system. The lagoons were recharged with water from the quarry floor at a rate that did not cause any stirring of the sedimentation on the lagoon floor.

Once the water level of the lagoon system was restored, a water sample was taken and analysis to assess the suspended solids content of the water. The suspended solids content of the water was found to be below the recommended level as specified in the discharge licence and therefore the discharge of water was recommenced.

Further sampling will be taken from the discharge water and sent for laboratory analysis in accordance with conditions of the discharge licence. I trust that this meets with your requirements

Yours sincerely,

Patrick O'Donnell. C Eng, BSc.Eng, Dip Eng, MIEI IEI

W:\EARTH SCIENCE PARTNERSHIP\EI 175 Bennettsbridge Quarry -

C.C

Bennettsbridge Limestone Quarries