Waste Water Discharge for existing housing estate, Timolin, Co.Kildare

Screening for Appropriate Assessment Report

September 2015

Kildare County Council
Comhairle Contae Chill Dara

Contents

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Revision History

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02 Oct 2015		David Hall KCC

Contract

Niamh Sweeney and Anne Murray of JBA Consulting carried out this work.

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Senior Ecologist

Purpose

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Contents

List of Figures

Abbreviations

AA ..... Appropriate Assessment

AFA ..... Area for Further Assessment

CFRAM ..... Catchment-based Flood Risk Assessment and Management

DEHLG..... Department of Environment, Heritage and Local Government

FRMP..... Flood Risk Management Plan

IROPI ..... Imperative Reasons of Over-riding Public Interest

NPWS ..... National Parks and Wildlife Service

SAC..... Special Area of Conservation

SPA..... Special Protection Area

SuDS..... Sustainable Drainage System

WWTW..... Wastewater Treatment Works

1 Introduction

1.1 Background

JBA Consulting Ireland Ltd. has been appointed by Kildare County Council, to undertake a Screening for Appropriate Assessment Report in relation to the proposal to install a wastewater treatment system that will discharge to ground for an existing housing estate in Timolin, County Kildare.

1.2 Legislative Context

Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna and Flora, known as the 'Habitats Directive' - provides legal protection for habitats and species of European importance. Article 2 of the Directive requires the maintenance or restoration of habitats and species of European Community interest, at a favourable conservation status. Articles 3 - 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of an EU-wide network of sites known as Natura 2000 sites. Natura 2000 sites are Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Conservation of Wild Birds Directive (79 / 409 / EEC).

Articles 6(3) and 6(4) of the Habitats Directive set out the decision-making tests for plans or projects affecting Natura 2000 sites. Article 6(3) establishes the requirement for Appropriate Assessment:

"*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public*."

Article 6(4) deals with the steps that should be taken when it is determined, as a result of Appropriate Assessment, that a plan/project will adversely affect a European site. Issues dealing with alternative solutions, imperative reasons of overriding public interest and compensatory measures need to be addressed in this case.

Article 6(4) states:

"*If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member States shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.*

Where the site concerned hosts a priority natural habitat type and / or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest."

The requirements of Articles 6(3) and 6(4) of the Habitats Directive have been transposed into Irish legislation by means of the Habitats Regulations, 1997 (S.I. No. 94 of 1997) and the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 / 2011).

1.3 Appropriate Assessment Process

Guidance on the Appropriate Assessment (AA) process was produced by the European Commission in 2002, which was subsequently developed into guidance specifically for Ireland by the Department of Environment, Heritage and Local Government (DEHLG) (2009). These guidance documents identify a staged approach to conducting an AA, as shown Figure 1-1.

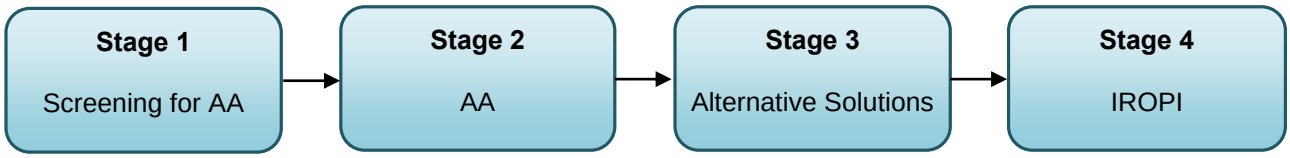

Figure 1-1: The Appropriate Assessment Process (from: Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities, DEHLG, 2009)

1.3.1 Stage 1 - Screening for AA

The initial, screening stage of the Appropriate Assessment is to determine:

a. whether the proposed plan or project is directly connected with or necessary for the management of the European designated site for nature conservation

b. if it is likely to have a significant adverse effect on the European designated site, either individually or in combination with other plans or projects

For those sites where potential adverse impacts are identified, either alone or in combination with other plans or projects, further assessment is necessary to determine if the proposals will have an adverse impact on the integrity of a European designated site, in view of the sites conservation objectives (i.e. the process proceeds to Stage 2).

1.3.2 Stage 2 - AA

This stage requires a more in-depth evaluation of the plan or project, and the potential direct and indirect impacts of them on the integrity and interest features of the European designated site(s), alone and in-combination with other plans and projects, taking into account the site's structure, function and conservation objectives. Where required, mitigation or avoidance measures will be suggested.

The competent authority can only agree to the plan or project after having ascertained that it will not adversely affect the integrity of the site(s) concerned. If this cannot be determined, and where mitigation cannot be achieved, then alternative solutions will need to be considered (i.e. the process proceeds to Stage 3).

1.3.3 Stage 3 - Alternative Solutions

Where adverse impacts on the integrity of Natura 2000 sites are identified, and mitigation cannot be satisfactorily implemented, alternative ways of achieving the objectives of the plan or project that avoid adverse impacts need to be considered. If none can be found, the process proceeds to Stage 4.

1.3.4 Stage 4 - IROPI

Where adverse impacts of a plan or project on the integrity of Natura 2000 sites are identified and no alternative solutions exist, the plan will only be allowed to progress if imperative reasons of overriding public interest can be demonstrated. In this case compensatory measures will be required.

The process only proceeds through each of the four stages for certain plans or projects. For example, for a plan or project, not connected with management of a site, but where no likely significant impacts are identified, the process stops at stage 1. Throughout the process, the precautionary principle must be applied, so that any uncertainties do not result in adverse impacts on a site.

This report is for Stage 1 Screening for Appropriate Assessment.

1.4 Methodology

The Screening for Appropriate Assessment has been carried out with reference to the following documents:

- Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92 / 43 / EEC (European Communities, 2002);

- Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats Directive' 92 / 43 / EC (European Communities, 2000);
- Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities (Dept. Environment Heritage and Local Government, December 2009);
- Guidelines for Ecological Impact Assessment (Chartered Institute of Ecology and Environmental Management, 2006); and
- Guidelines for Assessment of Ecological Impacts of National Roads Schemes (NRA, Revision 2, 1st June, 2009).

Data has been collected from a range of sources, including:

- NPWS website (www.npws.ie);
- EPA website (www.envision.ie);
- Watermaps (www.wfdireland.ie); and
- Planning website (www.eplan.ie).

1.5 Project Location

The existing housing estate site is situated in Timolin village, County Kildare. The site for the proposed waste water treatment system lies behind houses at the junction of Timolin Terrace and Moone Road. The R448 lies to the west of the Moone-Timolin road. The site location with respect to the wider County Kildare area is shown in Figure 3.1 below.

The River Bathogue is located approximately 100m south of the site and is rated as Poor Status under the Water Framework Directive. The Bathogue River flows for approx. 1km until it flows into the River Greese, which is a tributary of the River Barrow. The site location, adjacent to the Bathogue River, is approximately 13km upstream, of the River Barrow and Nore SAC.

1.6 Project Description

The project is for the Timolin Waste Water Treatment System which involves the construction of a packaged wastewater treatment system and soil polishing filter to provide treatment for 15.0m3/day for a residential housing estate of 12 houses. The site investigation report 'Site Characterisation and Assessment for Existing Housing Estate at Timolin, County Kildare' is given in Appendix A and includes a Tier 2 Risk Assessment. As outlined by the Tier 2 Hydrological Assessment for discharge to groundwater, the existing septic tank system on the site will be decommissioned, and mechanical aeration system installed on the site which complies with British Standard B.S. 6297: 1983 (incorporating amendment No. 1 of 1990). A soil polishing filter must been installed following this, for tertiary treatment. The infiltration area will be constructed as a polishing filter bed, situated under the southeastern portion of the site and will equate to an area of 50m x 15m. The design of the treatment system is given in the site investigation report in Appendix A.

The site location plan is given in Appendix B.

2 Natura 2000 Sites

The DEHLG (2009) guidance identifies that Screening for Appropriate Assessment of a plan or project should consider the following Natura 2000 sites:

- Any Natura 2000 sites within or adjacent to the plan or project area.
- Any Natura 2000 sites within the likely zone of impact of the plan or project. This is dependent on the nature and scale of the plan, with 15km generally recommended for plans, but potentially much less for projects.
- Any Natura 2000 sites that are more than 15km from the plan or project area, but may potentially be impacted upon, for example, through a hydrological connection.
-

The nearest Natura 2000 sites are the Slaney River Valley SAC and River Barrow and Nore SAC. The Slaney River Valley is located approximately 8km, as the crow flies, west of the site and is not hydrologically linked to the site. The River Barrow and Nore SAC is located approximately 13km downstream of the site location and is hydrologically linked.

The main pathways for potential impacts from the proposed development to the River Barrow and Nore SAC are via groundwater and then to surface water of the River Greese, as the effluent discharging to the ground water may enter the Bathogue River. These are shown in Fig 3-1 below.

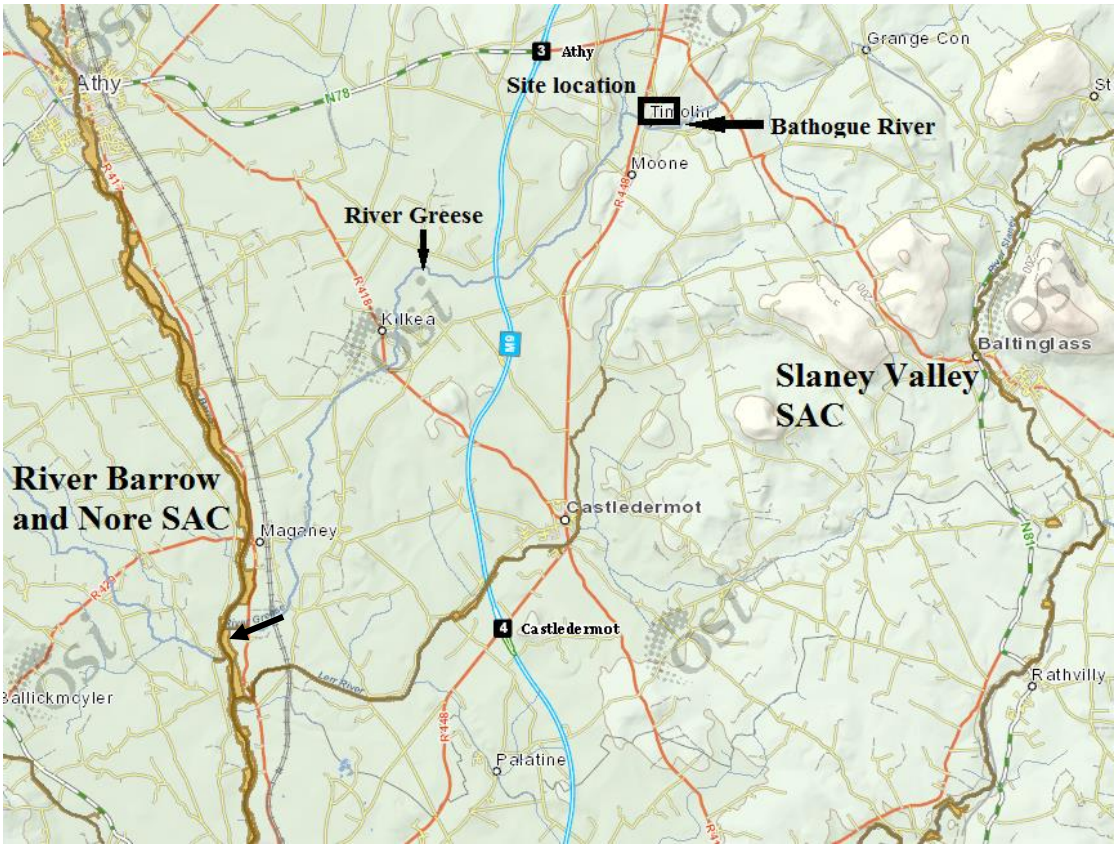

Figure 2-1: Natura 2000 sites and Site Location (NDBC website 2015)

2.1 River Barrow and River Nore SAC (002162)

This site consists of the freshwater stretches of the Barrow and Nore River catchments as far upstream as the Slieve Bloom Mountains, and it also includes the tidal elements and estuary as far downstream as Creadun Head in Waterford. The larger of the many tributaries include the Lerr, Fushoge, Mountain, Aughavaud, Owenass, Boherbaun and Stradbally Rivers of the Barrow, and the Delour, Dinin, Erkina, Owveg, Munster, Arrigle and King's Rivers on the Nore. Both rivers rise

in the Old Red Sandstone of the Slieve Bloom Mountains before passing through a band of Carboniferous shales and sandstones.

The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes):

- Estuaries [1130]
- Mudflats and sandflats not covered by seawater at low tide [1140]
- Salicornia and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]
- Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]
- European dry heaths [4030]
- Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]
- Petrifying springs with tufa formation (*Cratoneurion*) [7220]*
- Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]*
- *Vertigo moulinsiana* (Desmoulin's Whorl Snail) [1016]
- *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]
- *Austropotamobius pallipes* (White-clawed Crayfish) [1092]
- *Petromyzon marinus* (Sea Lamprey) [1095]
- *Lampetra planeri* (Brook Lamprey) [1096]
- *Lampetra fluviatilis* (River Lamprey) [1099]
- *Alosa fallax fallax* (Twaite Shad) [1103]
- *Salmo salar* (Salmon) [1106]
- *Lutra lutra* (Otter) [1355]
- *Trichomanes speciosum* (Killarney Fern) [1421]
- *Margaritifera durrovensis* (Nore Pearl Mussel) [1990}

A wide range of habitats associated with the rivers are included within the site, including substantial areas of woodland, dry heath, wet grassland, swamp and marsh vegetation, salt marshes, a small dune system and intertidal sand and mud flats. Areas of improved grassland, arable land and coniferous plantations are included in the site for water quality reasons.

Floating river vegetation is well represented in the Barrow and in the many tributaries of the site. In the Barrow the species found include water-starworts *(Callitriche* spp.), Canadian Pondweed (*Elodea canadensis*), Bulbous Rush (*Juncus bulbosus*), water-milfoils (Myriophyllum spp.), the pondweed Potamogeton x nitens, Broad-leaved Pondweed (*P. natans*), Fennel Pondweed (P. pectinatus), Perfoliated Pondweed (P. perfoliatus) and crowfoots (Ranunculus spp.).

The site is very important for the presence of a number of E.U. Habitats Directive Annex II animal species including Freshwater Pearl Mussel (both *Margaritifera margaritifera* and M. m. *durrovensis*), White-clawed Crayfish, Salmon, Twaite Shad, three lamprey species – Sea Lamprey, Brook Lamprey and River Lamprey, the tiny whorl snail *Vertigo moulinsiana* and Otter. This is the only site in the world for the hard water form of the Freshwater 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, Badger, Irish Hare and Common Frog. 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, Bar-tailed 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. The old oak woodland at Abbeyleix has a typical bird fauna including Jay, Long-eared Owl and Raven. The reedbed at Woodstown supports populations of typical waterbirds including Mallard, Snipe, Sedge Warbler and Water Rail.

The main threats to the site and current damaging activities include high inputs of nutrients into the river system from agricultural run-off and several sewage plants, over-grazing within the woodland areas, and invasion by non-native species, for example Cherry Laurel (Prunus laurocerasus) and Rhododendron (*Rhododendron ponticum*). The water quality of the site remains vulnerable. Good quality water is necessary to maintain the populations of the Annex II animal species listed above. Good quality is dependent on controlling fertilisation of the grasslands, particularly along the Nore. It also requires that sewage be properly treated before discharge. Drainage activities in the catchment can lead to flash floods which can damage the many Annex II species present. Capital and maintenance dredging within the lower reaches of the system pose a threat to migrating fish species such as lamprey and shad. Land reclamation also poses a threat to the salt meadows and the populations of legally protected species therein.

Overall, the site is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive. Furthermore it is of high conservation value for the populations of bird species that use it. The occurrence of several Red Data Book plant species including three rare plants in the salt meadows and the population of the hard water form of the Freshwater Pearl Mussel, which is limited to a 10 km stretch of the Nore, add further interest to this site (NPWS, 2013).

3 Other Relevant Plans and Projects

3.1 Cumulative Effects

As of September 30th 2015, only one similar development has been granted planning permission by Kildare County Council, which in combination with the proposed project have the potential to cause significant impacts on the Natura 2000 site listed above.

Ref: 141053 – Timolin Developments Ltd.

Decision Date: 10.02.2015, conditional permission granted.

Extension of duration 09/431 for the construction of 4 dwelling houses with individual septic tanks or proprietary effluent treatment systems, whichever applicable, site entrance, construction of internal road network, footpaths, connection to existing watermains, construction of surface water drainage infrastructure, connection and installation of telecommunications, installation of electricity supply and gas services; the erection of street lighting, the erection of a temporary sales signs; the erection of site boundaries, landscaping, all site development infrastructure works and ancillary services and associated site works.

This development will have to comply with the criteria set out in the EPA (2009) guidelines on wastewater treatment systems for single houses and will not be permitted to discharge directly to surface water. Therefore, in combination adverse impacts are not anticipated.

4 Screening Assessment

4.1 Introduction

This screening exercise will focus on assessing the likely adverse effects of the project on the Natura 2000 site identified in Section 3 above.

This section identifies the potential impacts which may arise as a result of the proposed project. It then goes on to identify how these impacts could potentially impact on the Natura 2000 site of the River Barrow. The significance of potential impacts is also assessed, with any potential in-combination effects also identified.

4.1.1 Assessment Criteria

4.1.2 Description of the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites

The main pathway for potential impacts between the proposed project and the Natura 2000 site is groundwater from the soil polishing filter area entering the Bathogue River, which flows into the River Greese approximately 1km downstream of the proposed site. The River Greese is a tributary of the River Barrow. Water quality is important for a number of the designated features of the River Barrow SAC, including those that may occur downstream in the SAC:

- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho*-Batrachion vegetation [3260]
- Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]
- Petrifying springs with tufa formation (Cratoneurion) [7220]*
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]*
- *Vertigo moulinsiana* (Desmoulin's Whorl Snail) [1016]
- *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]
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- *Lampetra fluviatilis* (River Lamprey) [1099]
- *Salmo salar* (Salmon) [1106]
- *Lutra lutra* (Otter) [1355]

Therefore the impacts on water quality are considered in this assessment.

Groundwater

The proposed site occurs within the area of the New Ross/Narraghmore Groundwater Body. It is not possible to discern the direction of groundwater flow from the Water Maps Therefore, as a precautionary measure, it is assumed that groundwater may have access to the Bathogue River and is therefore hydrologically linked to the River Barrow and Nore SAC. Both groundwater bodies are currently in Good status. The groundwater vulnerability is *Moderate* and *High* in the area of Timolin.

Surface Water

The Bathogue River flows to the south of the proposed site. The river rises near the Wicklow Mountains and flows west, passing Timolin, to its confluence with the River Greese.

The Bathogue River is located in the South Eastern River Basin District and is part of the River Barrow catchment. The length of its channel falls under both the Bathogue and Greese Waterbodies under the Water Framework Directive. The status of the Bathogue waterbody is currently described as *Good*. The status of the Greese waterbody is described as *Poor*.

4.1.3 Description of likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 sites

Project Elements	Comment
Size and scale	The project is for the construction of a packaged wastewater treatment system and soil polishing filter for 12 houses and 15m3/day. The existing septic tank system on the site will be decommissioned, and mechanical aeration system installed on the site which complies with British Standard B.S. 6297: 1983 (incorporating amendment No. 1 of 1990). A soil polishing filter must been installed following this, for tertiary treatment. The infiltration area will equate to an area of 50m x 15m.
Land-take	There is no land-take of the River Barrow and Nore SAC.
Distance from Natura 2000 site/ key features	The proposed project is approximately 13km (via surfacewater) from the River Barrow and Nore SAC.
Resource requirements (water abstraction etc.)	None from or affecting the River Barrow and Nore SAC.
Emissions (disposal to land, water or air)	**Discharge of final effluent to groundwater once operational.** Temporary Impacts: The construction of the wastewater system will follow CIRA best practice guidelines to reduce impacts to groundwater; C532 Control of water pollution from construction sites: guidance for consultants and contractors; SP156 Control of water pollution from construction sites – guide to good practice; C515 Groundwater control – design and practice. Given the standard measures for controlling water pollution and also the distance from the River Barrow SAC no significant impacts are predicted. Permanent Impacts: The potential for permanent impacts is via groundwater to surface water (Bathogue River) to the River Barrow. However the design of the packaged wastewater treatment system and soil polishing filter, which offers tertiary treatment, avoids the potential for significant impacts provided the recommendations of the Tier 2 Hydrological Assessment are adhered to and the system is in compliance with the EPA (2009) guidelines. Given the size of the project, the design of the treatment system which will ensure improvements compared to the current existing septic tank by treating wastewater to tertiary level and also given the distance from the River Barrow SAC no significant impacts are predicted.
Excavation requirements	Yes excavations will be required for installation. Installation will adhere to the recommendations of the Tier 2 Hydrological Assessment and the CIRA guidelines detailed above.
Transportation requirements	Temporary Impacts: Minor increase during construction.This will not be in the vicinity of the Natura 2000 sites. Permanent Impacts: None
Duration of construction, operation, decommissioning etc.	Duration of construction: ca. 4 months Duration of operation: Permanent
Other	None

4.1.4 Description of likely changes to the Natura 2000 Sites

Potential Impact	Comment
Reduction of habitat area	There will be no loss of habitat from the River Barrow and Nore SAC.
Disturbance to key species	Temporary Impacts No significant impacts are anticipated to key species. Permanent Impacts No disturbance to key species are anticipated during operation of the project.
Habitat or species fragmentation	No habitat or species fragmentation is likely as the project poses no restrictions to habitats or species of the River Barrow and Nore SAC.
Reduction in species density	None anticipated.
Changes in key indicators of conservation value (water quality etc.)	Temporary Impacts on Water Quality: None anticipated. Permanent Impacts: The upgrading of the existing septic tank to the packaged wastewater treatment system with the soil polishing filter will decrease the load that is currently being discharged to groundwater and therefore will not adversely affect the water quality of the Bathogue River. Improvements are anticipated compared to the existing septic tank.
Climate change	N/A

4.1.5 Description of likely impacts on the Natura 2000 sites as a whole

Impact	Comments
Interference with the key relationships that define the structure of the site	The proposed project is not likely to interfere with any key relationships that define the ecological structure of the River Barrow and Nore SAC and that enables it to sustain habitats, complex of habitats and/or levels of populations of species.
Interference with key relationships that define the function of the site	The maintenance of good groundwater and surface water quality is important for the function of the River Barrow and Nore SAC and its designated features. This control is achieved through the design of the onsite wastewater treatment system with the addition of tertiary treatment, which it to further improve the effluent quality before it is discharged to the receiving environment.

Provide indicators of significance as a result of the identification of effects set out above in terms of:

Impact	Indicators
Loss (Estimated percentage of lost area of habitat)	SAC: No loss
Fragmentation	None anticipated.
Disruption & disturbance	None anticipated.
Change to key elements of the site (e.g. water quality etc.)	None anticipated.

4.1.6 Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is unknown

Following screening, and based upon best scientific judgement it is concluded that there will be no significant impacts on the following Natura 2000 site:

- River Barrow and River Nore SAC (002162)

The installation of the wastewater treatment system will be undertaken in accordance with the CIRA guidelines, detailed above, and the TIER 2 Hydrological Assessment. Any changes will have to be agreed with Kildare County Council. Method Statements will be submitted to Kildare County Council for approval for the construction works.

If any changes occur in the design of the project a new Screening for AA is required.

References

Department of Environment, Heritage and Local Government (2009) Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities.

NPWS (2013) *National Parks and Wildlife Service*. [ONLINE] Available at:http://www.npws.ie/. [Accessed 27 September 15].

EPA (2009) Code of Practice Wastewater Treatment and Disposal Systems Serving Single Houses (p.e. ≤ 10). Environmental Protection Agency. Ireland.

Appendices

A Site Investigation Report and Risk Assessment

Kildare County Council,
Water Services Section

SITE CHARACTERISATION AND ASSESSMENT FOR EXISTING HOUSING ESTATE AT TIMOLIN, COUNTY KILDARE

TIER 2 HYDROGEOLOGICAL ASSESSMENT FOR DISCHARGE TO GROUNDWATER

August 2015

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SCOPE OF THIS REPORT

The findings of this report are the result of a desk study and geological field interpretation. Interpretations and conclusions included in the report are based on knowledge of the ground conditions following detailed investigations, as well as the regional soils, subsoils and bedrock geology, and the experience of the author. Dr. Robert Meehan has prepared this report in line with best current practice and with all reasonable skill, care and diligence in consideration of the limits imposed by the survey techniques used and the resources devoted to it by agreement with the client. The interpretative basis of the conclusions contained in this report should be taken into account in any future use of this report.

Dr. Robert Meehan accepts no responsibility for any matters arising if any recommendations contained in this document are not carried out, or are partially carried out, without further advice being obtained from Dr. Robert Meehan.

SUPPLEMENTARY DETAILS, MAPS AND DIAGRAMS

1.0 GENERAL DETAILS

The figure of 100 people population equivalent refers to the potential

- Maximum 5 residents per day using the facilities at the 12 no. houses in the existing, older housing estate which is currently served by the existing septic tank on the site (3 bedroomed houses, which equates to 5 p.e. x 12 = 60 people)
- Maximum 6 residents per day using the facilities at the 6 no. houses in the adjacent, existing 'Mill Brook' housing estate (3 bedroomed houses, which equates to 5 p.e. x 6 = 30 people)
- Plus a 'buffer' of 10 p.e. to potentially cater for additional loading

Figures from Mr. Colum Fagan, A/Executive Engineer, Water Services Section, Kildare County Council.

The maximum potential volume of wastewater generated is therefore (100 p.e. x 150 litres per person) = 15,000 litres per day (15.0m^3/day).

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment

SURFACE FEATURES (Distance to features should be noted in metres)	
HOUSES:	**The existing twelve houses in the estate will be between 30m and 75m from the proposed WWTS and polishing filter area (and up-gradient of them).** **The six houses to the southwest will be between 10m and 22m from the proposed WWTS and polishing filter area (and alongside).** **The two houses to the south will be approx. 62m and 75m from the proposed WWTS and polishing filter (and down-gradient).** **There are seven other houses to the southwest, between approx. 82m and 250m from the proposed WWTS and polishing filter (all alongside).** **There are also four other houses to the northwest which are between approx. 80m and 140m from the proposed WWTS and polishing filter (and up-gradient).** **There are no other domestic houses within 250m of the proposed WWTS and infiltration area.**
EXISTING LAND USE:	**The site is surrounded by agricultural pasture to the east and southeast, with many residential gardens and 'made' ground to the north, west and southwest. Arable crops are grown further to the west and east.**
SITE BOUNDARIES:	**The site is bounded by fences to the northeast and southeast, and walls to the northwest and southwest.** **The site of sufficient size to install a new WWTS and polishing filter area, once the percolation rates are moderate to rapid.**

GROUNDWATER FLOW DIRECTION:	**Assumed to be towards the south, downslope towards the Botkoge River which is approx. 110m to the south of the site.** **The water level in the adjacent spring, 70m south of the site, was 1.5m below ground level there on 28th May 2015; groundwater was at 4.6m bgl at that time in BH2, which is at approx. 5m higher elevation. From this, the general groundwater gradient seems to be in keeping with this north-south assumption.**
ROADS:	**A third class road faces the site to the southwest, approx. 70m down-gradient of the proposed WWTS and polishing filter area, while the R448 road is approx. 95m to the northwest, and up-gradient.**
WATERCOURSE/STREAM*:	**The closest surface watercourse to the site is the Botkoge River, approx. 110m to the south of the site. This runs is a 1.6m-2.3m deep channel, and is approx. 0.9m deep and 2.5m across.** **This is joined by a smaller stream which rises from a spring approx. 95m east of the site, and flows towards the southwest. This stream is 0.2m depe, in a 1.2m-1.8m channel.** **These are the only streams or other watercourses within 250m of the site.**
DRAINAGE DITCHES*:	**There are no drainage ditches within 250m of the proposed WWTS and polishing filter.**
SPRINGS/WELLS*:	**Springs occur approx. 70m south and 105m east of the proposed WWTS and polishing filter.** **No wells occur within 250m of the proposed WWTS and polishing filter, though two boreholes have been bored as part of the accompanying Tier 2 Hydrogeological Risk Assessment.** ***As all the wells in the locality will therefore meet the required separation distances of the Groundwater Protection Responses of GSI/EPA/DoELG and the EPA Code of Practice (2009), none are deemed to be at risk from the proposed WWTS and polishing filter area.***

3.2 Trial Hole Number 2

Trial Hole should be a minimum of 2.1 m deep (3m for a regionally important aquifers)

Depth of trial hole (m):	**3.1m**	**Date and time of excavation:**	**11/05/2015 12.45**	**Date and time of examination:**	**13/05/2015 13.50**
Depth from ground surface to bedrock (m)	**>3.1m**	**Depth from ground surface to water table (m)**		**>3.1m**	

Depth below ground level	Indicate the depth of T & P tests here	Soil/Subsoil Texture & Classification	Soil Structure	Density/ Compactness	Colour **	Preferential flowpaths
0.1m		***'A' horizon*** Organic loam	Crumb	Compact	Very dark brown (2/2 10YR)	Abundant shrub and grass roots and rootlets
0.2m		***'B' horizon*** slightly sandy SILT with occasional gravels (2, 2, 1 threads; 60mm, 50mm, 80mm ribbons; dilatant, raspy)	Subangular blocky	Variable firm to stiff	Very dark brown (2/2, 10YR)	Occasional shrub and grass roots and rootlets
0.3m						
0.4m						
0.5m						
0.6m		***'C_1' horizon*** silty SAND with occasional gravels and cobbles (0, 1, 1 threads; 50mm, 40mm, 40mm ribbons; slightly dilatant, very raspy, cohesive)	Massive, yet fissile	Variable soft to firm	Very dark brown (2/2, 10YR)	Fissile partings
0.7m						
0.8m						
0.9m						
1.0m						
1.1m						
1.2m						
1.3m						
1.4m						
1.5m						
1.6m						
1.7m						
1.8m						
1.9m		***'C_2' horizon*** gravelly SAND with opccasional cobbles (0, 0, 0 threads; 0mm, 0mm, 0mm ribbons; non-dilatant, very raspy)	Massive, yet fissile	Variable soft to stiff	Brown (4/3, 10YR)	Fissile partings
2.0m						
2.1m						
2.2m						
2.3m						
2.4m						
2.5m						
2.6m						
2.7m						
2.8m						
2.9m						
3.0m		Base of hole				

Other Information					
Depth of water ingress	**None**	**Rock Type (if present)**	**Not met**	**Likely T value**	**3-10**

Mottling present (Yes or No)	**No**	**Smearing present in topsoil (Yes or No)**	**No**	**Smearing present in subsoil (Yes or No)**	**No**

EVALUATION:

The upper 0.1m-0.13m of the trial hole encounters very dark brown, organic loam topsoil, which is unmottled.

This is underlain by the 'B' horizon, which extends to 0.31m/0.36m depth and is a firm to stiff, subangular blocky, very dark brown, slightly sandy SILT with occasional gravels.

The soil sequence is therefore of a well aerated, brown earth of high base status topsoil draining vertically or sub-vertically to the subsoil.

The subsoil below these layers consists of two horizons. The 'C_1' horizon extends to 1.1m/1.24m depth and is a soft to firm, massive, yet fissile, very dark brown, silty SAND with occasional gravels and cobbles. This is underlain to the base of the hole by the 'C2' horizon; a brown, soft to stiff, massive yet fissile, gravelly SAND with occasional cobbles. As no mottling is seen in the subsoil units, this entire zone is therefore unsaturated throughout the year.

Neither bedrock nor the water table was met in the trial hole, at 3.1m below ground level. There therefore exists at least 3.1m depth of unsaturated soil and subsoil material between the ground surface and the water table on this portion of the site.

The site is therefore probably suitable for a mechanical aeration system and discharge to ground into the subsoil, if the 'T' and 'P' values are between 3 and 75. The values are likely to be between 3 and 10.

3.3(a) Percolation ("T" and "P") Tests Number 4 @ relevant subsoil layer

Percolation Test Hole	T4		P4
Depth from ground surface to top of hole (mm) (A)	400		0
Depth from ground surface to base of hole (mm) (B)	800		400
Depth of hole (mm) [B - A]	400		400
Dimensions of hole [length x breadth (mm)]	300 x 300		300 x 300
Each hole must be pre-soaked twice before the test is carried out (from 10.00 am to 5.00 pm and from 5.00 pm to next morning)			
Date of test	12/05/2015		12/05/2015
Date and times of pre-soaking of test holes	11/05/2015, 14.00 and 15.20		
Time filled to 400 mm	11.08		11.02
Time water level at 300 mm	11.23		11.22

Test Hole No.	T4						P4		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt(min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)
1	11.23	11.39	16				11.22	12.05	43
2	11.39	12.00	21				12.05	12.48	43
3	12.00	12.27	27				12.48	13.42	54
Average Δt			21.3	Average Δt			Average Δt		46.7
Average Δt/4 = 5.3 (t_4)				Average Δt/4 = ()			Average Δt/4 = 11.7 (p_4)		

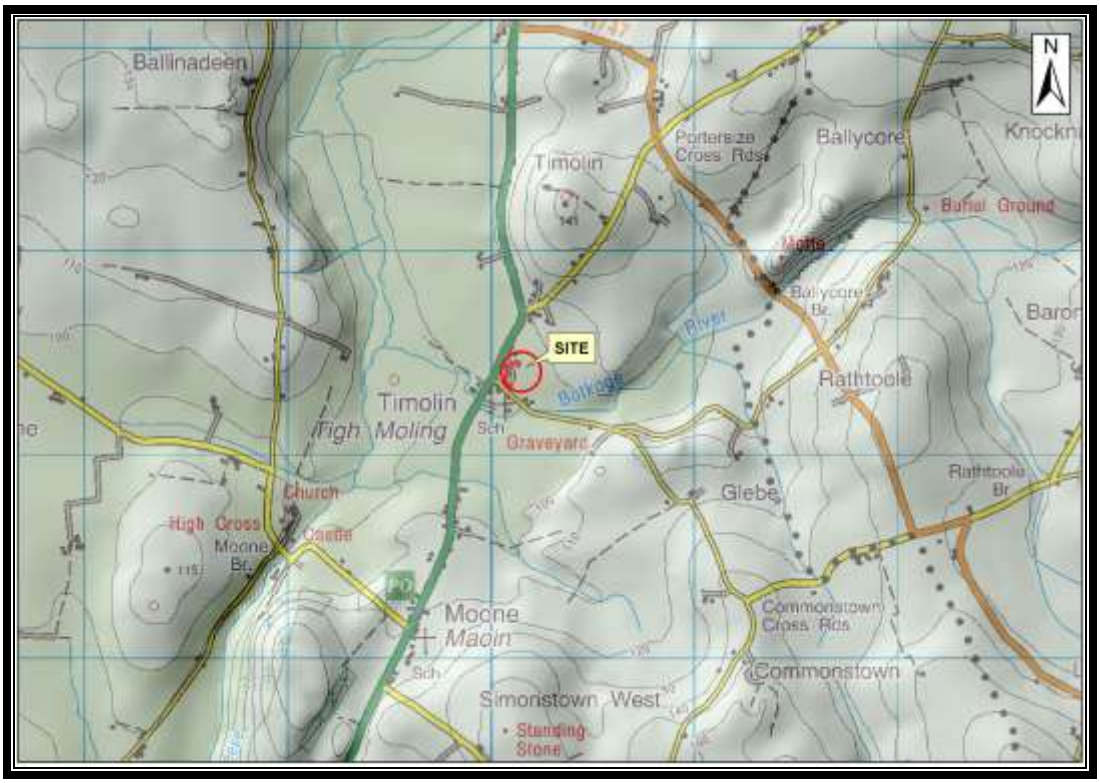

Figure 1: Location of the site at Timolin, marked with a red circle (O.S. Licence EN 057915).

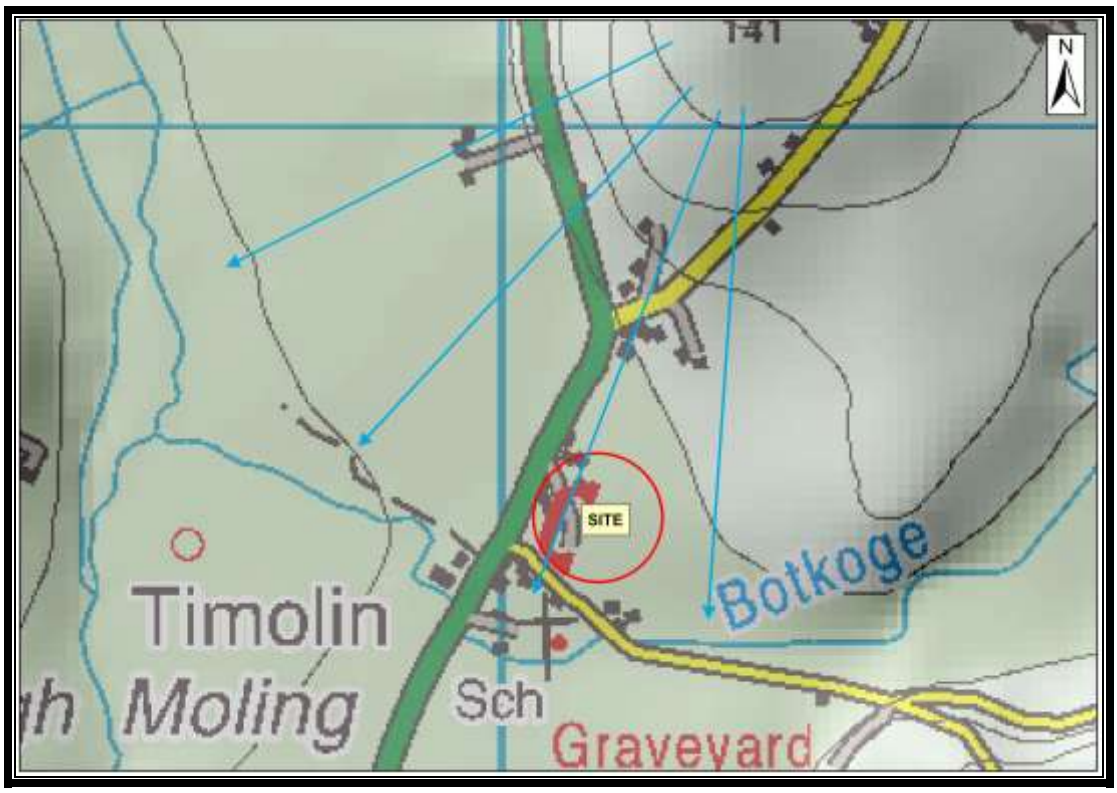

Figure 2: Interpreted groundwater flow direction under and around the site, which is thought to be generally southwards towards the Botkoge River (O.S. Licence EN 0057915).

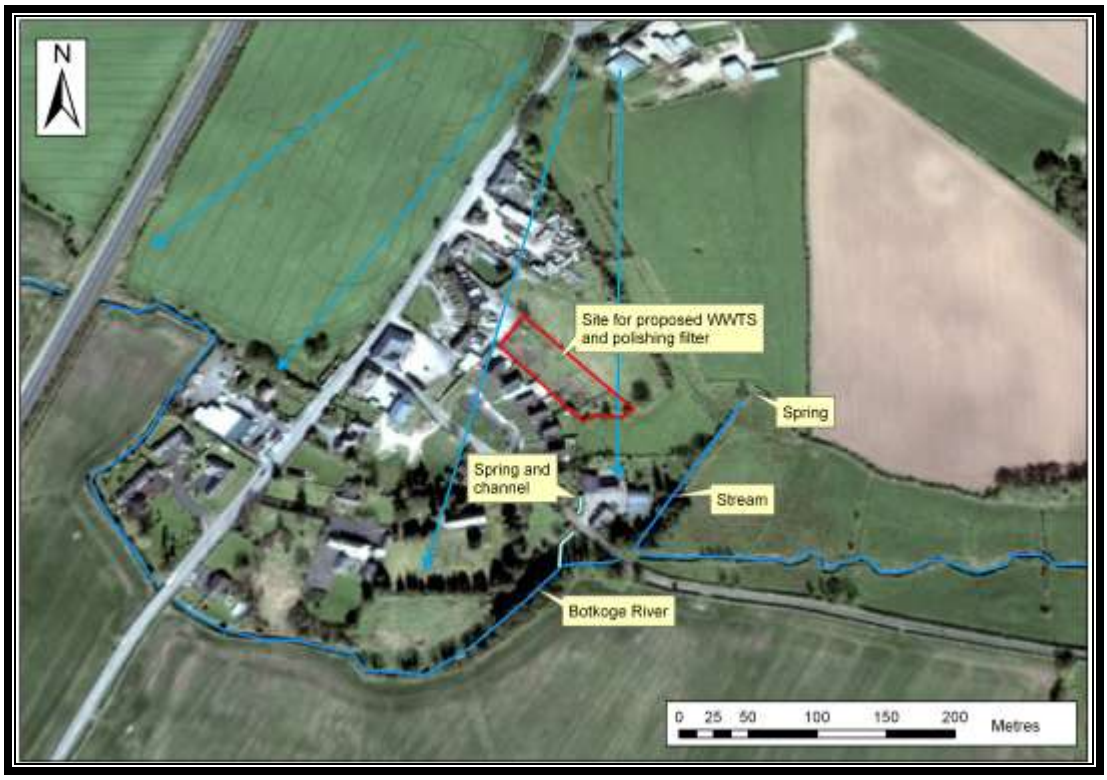

Figure 3: Features around the site, including houses, roads, streams, drainage ditches, springs, hedgerows and land use.

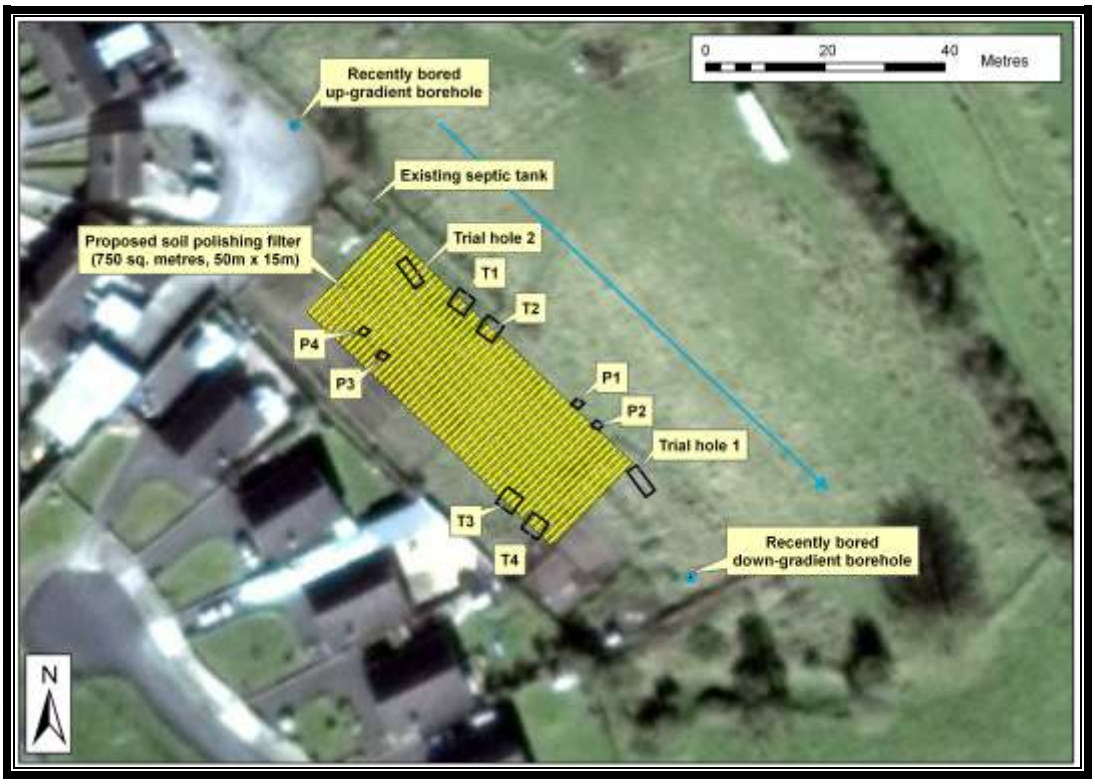

Figure 4: Location of trial hole and percolation test holes on the site, in relation to the existing septic tank and the proposed new polishing filter area.

Plate 1: View of the site from the south, while excavating the test hole. See the well drained appearance of the land around the site. The holes were dug at the edge of the footprint of where the proposed polishing filter area will be located.

Plate 2: Profile of soil and subsoil in trial hole number 1. See the well aerated nature of the topsoil and the subsoil, with no mottling throughout the profile. See also the absence of bedrock and the water table at 2.1m below ground level.

Plate 3: Profile of soil and subsoil in trial hole number 2. See the well aerated nature of the topsoil and the subsoil, with no mottling throughout the profile. See again the absence of bedrock and the water table at 3.1m below ground level.

Plate 4: Water falling on morning of Tuesday 12th May 2015 in 'T' test hole number 1.

Plate 5: Water falling on morning of Tuesday 12th May 2015 in 'T' test hole number 2.

Plate 6: Water falling on morning of Tuesday 12th May 2015 in 'T' test hole number 3.

Plate 7: Water falling on morning of Tuesday 12th May 2015 in 'T' test hole number 4.

Plate 8: Water falling on morning of Tuesday 12th May 2015 in 'P' test hole number 1.

Plate 9: Water falling on morning of Tuesday 12th May 2015 in 'P' test hole number 2.

Plate 10: Water falling on morning of Tuesday 12th May 2015 in 'P' test hole number 3.

Plate 11: Water falling on morning of Tuesday 12th May 2015 in 'P' test hole number 4.

Plate 12: The existing septic tank system on the site, which must be decommissioned as part of the proposed development.

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CERTIFICATE OF ANALYSIS

Client : Robert Meehan, B.A., PhD, PGeo
Robert Meehan, Consultant Geologist
86 Athlumney Castle,
Navan,
Co. Meath

Report No. : 261844
Date of Receipt : 29/05/2015
Start Date of Analysis : 29/05/2015
Date of Report : 06/07/2015
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
597184	Timolin site, GW1 (up-gradient)	Colour	R	<4	mg/l Pt Co
		Turbidity	R	0.9	N.T.U.
		pH	R	7.2	pH Units
		Conductivity @20C	R	608	uS/cm
		Alkalinity, total	R	298	mg/l CaCO3
		Total Nitrogen as N	R	6.65	mg/L
		Nitrate as N	R	5.97	mg/l
		Nitrite as N	R	0.005	mg/l
		Total Phosphorus as P	R	<0.05	mg/l
		Copper, total	R	2	ug/l
		Sodium, total	R	13	mg/l
		Chloride	R	22.9	mg/l
		Iron, total	R	31	ug/l
		Ammonium as NH4-N	R	<0.005	mg/l
		Potassium, total	R	6	mg/l
		Total Hardness (Kone)	R	338	mg/l CaCO3
		Cyanide (Total)	S	<0.5	ug/l
		Mercury	S	<0.02	ug/l
		Magnesium, total	R	20	mg/l
		Sulphate	R	19.2	mg/l
		Uranium	S	3.009	ug/l
		Temperature (by client)	R	10.9	°C
		TDS (gravimetric)	R	429	mg/l
		Un-ionised Ammonia (Calculation, pH & Temp. depend	R	0.00002	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	90	ug/l
		Zinc, total	R	10	ug/l
		Chromium, total	R	<0.5	ug/l
		Calcium, total	R	444	mg/l
		Nickel, total	R	2	ug/l
		Aluminium, Total	R	8	ug/l
		Lead, total	R	<0.5	ug/l
		Antimony, total	R	2	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	30	ug/l
		Selenium, total	R	2	ug/l
		TOC	R	1.51	mg/L
		Odour (absence/presence)	R	No	
		Clostridium Perfringens in Water	R	32	cfu/100ml
		Boron, total (mg/l)	R	0.016	mg/l
		E coli (Filtration) (Environmental Waters)	R	41	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	51	cfu/100ml
		Enterococci (Environmental Waters- Incubated at 37°C and 44 °C)	R	47	cfu/100ml
		Molybdate Reactive Phosphorus (MRP unfiltered) as PO4-P	R	0.018	mg/l

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Approved by: Barbara Lee

Barbara Lee
Environmental Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.
* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

Test	Specification	CLS 17025 status	GMP/FDA[1]	ISO[2]	Sub[3]	Sub 17025 Status
Colour	CLS 29	Yes	No	Yes	No	No
Turbidity	CLS 30	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Conductivity @20C	CLS 67	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Total Nitrogen as N	CLS 152	Yes	No	Yes	No	No
Nitrate as N	Konelab CLS 39	Yes	No	Yes	No	No
Nitrite as N	Konelab CLS 37	Yes	No	Yes	No	No
Total Phosphorus as P	CLS 151	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Ammonium as NH4-N	Konelab CLS 40	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Total Hardness (Kone)	Konelab CLS 77	Yes	No	Yes	No	No
Cyanide (Total)		No	No	N/A	Yes	No
Mercury	Atomic Fluorescence	No	No	N/A	Yes	Yes
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Uranium	ICP	No	No	N/A	Yes	No
Temperature (by client		No	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Un-ionised Ammonia (Calculation, pH & Temp. depend	Konelab CLS 40	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
TOC	CLS 150	Yes	No	Yes	No	No
Odour (absence/presence)		No	No	Yes	No	No
Clostridium Perfringens in Water	CLS 43	Yes	No	Yes	No	No
Boron, total (mg/l)	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters	CLS 16	Yes	No	Yes	No	No
Total Coliforms	CLS 16	Yes	No	Yes	No	No

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(Filtration) (Environmental Waters						
Enterococci (Environmental Waters Incubated at 37°C and 44 °C)	CLS 42	Yes	No	Yes	No	No
Molybdate Reactive Phosphorus (MRP unfiltered) as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No

[1]Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
[2]Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).
[3]Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
597184	Timolin site, GW1 (up-gradient)	Good condition	28/05/2015

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Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

SITE CHARACTERISATION FORM
COMPLETING THE FORM

Step 1:

Goto Menu Item **File, Save As** and save the file under a reference relating to the client or the planning application reference if available.

Use the **Clear Form** button to clear all information fields.

Notes:

All calculations in this form are automatic.

Where possible information is presented in the form of drop down selection lists to eliminate potential errors.

Variable elements are recorded by tick boxes. In all cases only one tick box should be activated.

All time record fields must be entered in twenty hour format as follows: HH:MM

All date formats are DD/MM/YYYY.

All other data fields are in text entry format.

This form can be printed out fully populated for submission with related documents and for your files. It can also be submitted by email.

Section 3.2

In this section use an underline _____ across all six columns to indicate the depth at which changes in classification / characteristics occur.

Section 3.4

Lists supporting documentation required.

Section 4

Select the treatment systems suitable for this site and the discharge route.

Section 5

Indicate the system type that it is proposed to install.

Section 6

Provide details, as required, on the proposed treatment system.

APPENDIX B: SITE CHARACTERISATION FORM

File Reference:

1.0 GENERAL DETAILS (From planning application)

Prefix: First Name: Kildare County Council Surname:

Address: Timolin, County Kildare

Site Location and Townland: Timolin, County Kildare

Telephone No: 045.980431 Fax No:

E-Mail: CFagan@kildarecoco.ie

Maximum no. of Residents: 100 No. of Double Bedrooms: No. of Single Bedrooms:

Proposed Water Supply: Mains ✔ Private Well/Borehole Group Well/Borehole

2.0 GENERAL DETAILS (From planning application)

Soil Type, (Specify Type): Grey brown podzolics of the Elton Series

Aquifer Category: Regionally Important Locally Important Poor Pu

Vulnerability: Extreme High ✔ Moderate Low High to Low Unknown

Bedrock Type: Silurian Metasediments and Volcanics

Name of Public/Group Scheme Water Supply within 1 km: None

Groundwater Protection Scheme (Y/N): Yes Source Protection Area: SI SO

Groundwater Protection Response: R1

Presence of Significant Sites (Archaeological, Natural & Historical): A graveyard occurs approx. 70m southwest of the site.

Past experience in the area: Soils in this area are generally well drained, with infiltration dominating over runoff.

Comments:

(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, and/or any potential site restrictions).

The site, initially, seems suitable for discharge to ground.
As the soil type in the area is a well drained grey brown podzolic, surface water is not likely to be at risk around the site.
Groundwater as a resource will be at risk if the minimum depths required are not achieved on the site, or if the percolation rate is too rapid.
Old, disused wells in the area still in use may also be at risk, if the minimum separation distances are not adhered to.
Groundwater and wells are therefore the main potential targets, following the desk study.

Given the response and the aquifer type, the site is potentially suitable for a mechanical aeration system serving the housing estate(s), and discharge to ground, if the minimum depths required are met on the site, if the minimum separation distances can be met, and if the percolation rate is adequate.

Note: Only information available at the desk study stage should be used in this section.

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment

Landscape Position: Site is on southeastern mid-backslope of a low ridge, in a ridge and valley landscape

Slope: Steep (>1:5) ☐ Shallow (1:5-1:20) ☐ Relatively Flat (<1:20) ✔

Surface Features within a minimum of 250m (Distance To Features Should Be Noted In Metres)

Houses: The existing twelve houses in the estate will be between 30m and 75m from the proposed WWTS and polishing filter area (and up-

Existing Land Use: The site is surrounded by agricultural pasture to the north, east and south, with many residential gardens and 'made'

Vegetation Indicators: No vegetation indicators grow within 250m of the proposed WWTS and polishing filter area.

Groundwater Flow Direction: Assumed to be towards the south, downslope towards the Botkoge River which is approx. 110m to the so

Ground Condition: The fields surrounding the site are firm and even. Poaching was not observed.

Site Boundaries: The site is bounded by fences to the northeast and southeast, and walls to the northwest and southwest. The site of su

Roads: A third class road faces the site to the southwest, approx. 70m down-gradient of the proposed WWTS and polishing filte

Outcrops (Bedrock And/Or Subsoil): None within 250m of proposed WWTS and polishing filter area.

Surface Water Ponding: None visible at time of assessment wi Lakes: None within 250m of the site.

Beaches/Shellfish: None within 250m of the site. Areas/Wetlands: None within 250m of the site.

Karst Features: None found within 250m of the site; the area is underlain by non-calcareous bedrock.

Watercourse/Stream*: The closest surface watercourse to the site is the Botkoge River, approx. 110m to the south of the site. This runs

Drainage Ditches*: A drainage ditch extends off from adjacent to the the northwestern corner of the site, northwestwards. This is 0.6m-1

Springs / Wells*: Springs occur approx. 70m south and 105m east of the proposed WWTS and polishing filter. No wells occur within 2

Comments:
(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed system within the site).

Following the desk study surface water was not thought to be at risk; this was corroberated during the visual assessment when it was seen that the majority of the area on and around the site seems well drained.

From this, the surface water around the site does not seem to be a potential target, if the soil adjacent to the proposed polishing filter area is found to be saturated to the surface.

Groundwater is still a target following the visual assessment, unless the minimum depths required are met on the site and there exists adequate percolation.

Wells in the area are not considered to be at risk, as none occur within 250m of the proposed WWTS and polishing filter area.

Following from the visual assessment, it was decided to excavate the trial holes at either end of the proposed polishing filter, adjacent to but not within the proposed filter area. Here the ground was firm and dry (Plate 1).

***Note and record** water level

3.2 Trial Hole (should be a minimum of 2.1m deep (3m for regionally important aquifers))

To avoid any accidental damage, a trial hole assessment or percolation tests should not be undertaken in areas, which are at or adjacent to significant sites (e.g. NHAs, SACs, SPAs, and/or Archaeological etc.), without prior advice from National Parks and Wildlife Service or the Heritage Service.

Depth of trial hole (m): 2.10

Depth from ground surface to bedrock (m) (if present):

Depth from ground surface to water table (m) (if present):

Depth of water ingress:

Rock type (if present): None met

Date and time of excavation: 11/05/2015 11:30 Date and time of examination: 13/05/2015 13:30

	Depth of P/T Test*	Soil/Subsoil Texture & Classification**	Plasticity and dilatancy***	Soil Structure	Density/ Compactness	Colour****	Preferential flowpaths
0.1 m		Organic loam		Crumb	Compact	Very dark brown	Abundant grass roots and rootlets
0.2 m			0, 0, 0 threads; 30mm, 40mm, 40mm ribbons slightly dilatant, raspy				
0.3 m				Subangular blocky	Very soft	Very dark brown	Occasional grass roots and rootlets
0.4 m	P1-P4	gravelly silty SAND					
0.5 m							
0.6 m							
0.7 m							
0.8 m	T1, T2	sandy GRAVEL with occasional cobbles	0, 0, 0 threads; 0mm, 0mm, 0mm ribbons; non-dilatant, very raspy	Granular	Uncompact	Dark brown	Beds of GRAVEL up to 0.25m thick
0.9 m	T3, T4						
1.0 m							
1.1 m							
1.2 m							
1.3 m							
1.4 m							
1.5 m							
1.6 m							
1.7 m							
1.8 m							
1.9 m							
2.0 m							
2.1 m							
2.2 m			BASE OF	HOLE			
2.3 m							
2.4 m							
2.5 m							
2.6 m							
2.7 m							
2.8 m							
2.9 m							
3.0 m							

Likely T value: 5.00

Note: *Depth of percolation test holes should be indicated on log above. (Enter P or T at depts as appropriate).
** See Appendix E for BS 5930 classification.
*** 3 samples to be tested for each horizon and results should be entered above for each horizon.
**** All signs of mottling should be recorded.

3.2 **Trial Hole (contd.)** Evaluation:

The upper 0.1m-0.22m of the trial hole encounters organic loam topsoil, which is very dark brown, and is unmottled.
The 'B' horizon below this extends to 0.41m/0.51m and is a very soft, subangular blocky, gravelly silty SAND, which is very dark brown.
The soil sequence is therefore of a well drained brown earth of high base status, which is unmottled throughout.
This is underlain by the 'C' horizon, to the base of the hole, which is an uncompact, granular, dark brown, sandy GRAVEL with occasional cobbles. Beds of GRAVEL are seen in this unit, up to 0.25m thick.
The rainwater falling on the site therefore infiltrates through 2.1m+ subsoil before reaching the water table and bedrock under the site.

The site is therefore potentially suitable for a mechanical aeration system and ground discharge, which requires 0.9m depth of unsaturated soil and subsoil below the polishing filter gravel and above bedrock and the water table, and as the 'T' values are likely to be low (3-20).

3.3(a) Percolation ("T") Test for Deep Subsoils and/or Water Table

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm) (A)	350	350	400
Depth from ground surface to base of hole (mm) (B)	750	750	800
Depth of hole (mm) [B - A]	400	400	400
Dimensions of hole [length x breadth (mm)]	320 x 310	300 x 300	310 x 300

Step 2: Pre-Soaking Test Holes

Date and Time pre-soaking started	11/05/2015	14:00	11/05/2015	14:00	11/05/2015	14:00

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3: Measuring T_{100}

Percolation Test Hole No.	1	2	3
Date of test	12/05/2015	12/05/2015	12/05/2015
Time filled to 400 mm	11:16	11:14	11:11
Time water level at 300 mm	11:22	11:29	11:24
Time to drop 100 mm (T_{100})	6.00	15.00	13.00
Average T_{100}			11.33

If T_{100} > 300 minutes then T-value >90 – site unsuitable for discharge to ground
If $T_{100} \leq$ 210 minutes then go to Step 4;
If T_{100} > 210 minutes then go to Step 5;

Step 4: Standard Method (where $T_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)
1	11:22	11:34	12.00	11:29	12:09	40.00	11:24	12:12	48.00
2	11:34	11:49	15.00	12:09	12:32	23.00	12:12	12:58	46.00
3	11:49	12:08	19.00	12:32	12:58	26.00	12:58	13:50	52.00
Average Δt Value			15.33			29.67			48.67
	Average Δt/4 = [Hole No.1]		3.83 (t_1)	Average Δt/4 = [Hole No.2]		7.42 (t_2)	Average Δt/4 = [Hole No.3]		12.17 (t_3)

Result of Test: T = 7.81 (min/25 mm)

Comments:

T1, T2 and T3 confirm the classification of the subsoil as a gravelly silty SAND, underlain by a sandy GRAVEL with occasional cobbles. All holes were empty on the morning of the tests following two presoaks the previous day, at 14.00 and 15.20. The T test rates support the observations made on the trial hole and the visual assessment with respect to the textural and drainage class of the subsoil.

Step 5: Modified Method (where $T_{100} > 210$ minutes)

Percolation Test Hole No.	1				2				3			
Fall of water in hole (mm)	Time Factor = T_f	Time of fall (mins) = T_m	K_{fs} = T_f / T_m	T – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	K_{fs} = T_f / T_m	T – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	K_{fs} = T_f / T_m	T – Value = 4.45 / K_{fs}
300 - 250	8.1				8.1				8.1			
250 - 200	9.7				9.7				9.7			
200 - 150	11.9				11.9				11.9			
150 - 100	14.1				14.1				14.1			
Average T- Value	T- Value Hole 1= (t_1)			0.00	T- Value Hole 1= (t_2)			0.00	T- Value Hole 1= (t_3)			0.00

Result of Test: T = 0.00 (min/25 mm)

Comments:

3.3(b) Percolation ("P") Test for Shallow Soil / Subsoils and/or Water Table

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm)	0	0	0
Depth from ground surface to base of hole (mm)	400	400.00	400
Depth of hole (mm)	400	400	400
Dimensions of hole [length x breadth (mm)]	300 x 300	320 x 300	290 x 290

Step 2: Pre-Soaking Test Holes

Date and Time pre-soaking started	11/05/2015	14:00	11/05/2015	14:00	11/05/2015	14:00

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3: Measuring P_{100}

Percolation Test Hole No.	1	2	3
Date of test	12/05/2015	12/05/2015	12/05/2015
Time filled to 400 mm	10:55	10:58	11:00
Time water level at 300 mm	11:05	11:06	11:25
Time to drop 100 mm (P_{100})	10.00	8.00	25.00
Average P_{100}			14.33

If P_{100} > 300 minutes then P-value >90 – site unsuitable for discharge to ground
If $P_{100} \leq 210$ minutes then go to Step 4;
If P_{100} > 210 minutes then go to Step 5;

Step 4: Standard Method (where $P_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δp (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δp (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δp (min)
1	11:05	11:38	33.00	11:06	11:34	28.00	11:25	12:13	48.00
2	11:38	12:19	41.00	11:34	12:16	42.00	12:13	13:05	52.00
3	12:19	13:04	45.00	12:16	13:08	52.00	13:05	14:34	89.00
Average Δp Value			39.67			40.67			63.00
	Average Δp/4 = [Hole No.1]		9.92 (p_1)	Average Δp/4 = [Hole No.2]		10.17 (p_2)	Average Δp/4 = [Hole No.3]		15.75 (p_3)

Result of Test: P = 11.94 (min/25 mm)

Comments:

P1, P2 and P3 confirm the classification of the topsoil as an organic loam, underlain by a gravelly silty SAND.
All holes were empty on the morning of the tests following two presoaks the previous day, at 14.00 and 15.20.
The P test rates support the observations made on the trial hole and the visual assessment with respect to the textural and drainage class of the topsoil and the subsoil.

Step 5: Modified Method (where $P_{100} > 210$ minutes)

Percolation Test Hole No.	1				2				3			
Fall of water in hole (mm)	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P – Value = 4.45 / K_{fs}
300 - 250	8.1				8.1				8.1			
250 - 200	9.7				9.7				9.7			
200 - 150	11.9				11.9				11.9			
150 - 100	14.1				14.1				14.1			
Average P- Value	P- Value Hole 1= (p_1)			0.00	P- Value Hole 1= (p_2)			0.00	P- Value Hole 1= (p_3)			0.00

Result of Test: P = 0.00 (min/25 mm)

Comments:

3.4 The following associated Maps, Drawings and Photographs should be appended to this site characterisation form.

1. Discovery Series 1:50,000 Map indicating overall drainage, groundwater flow direction and housing density in the area.
2. Supporting maps for vulnerability, aquifer classification, soil, bedrock.
3. North point should always be included.
4. (a) Sketch of site showing measurements to Trial Hole location and
   (b) Percolation Test Hole locations,
   (c) wells and
   (d) direction of groundwater flow (if known),
   (e) proposed house (incl. distances from boundaries)
   (f) adjacent houses,
   (g) watercourses,
   (h) significant sites
   (i) and other relevant features.
5. Cross sectional drawing of the site and the proposed layout[1] should be submitted.
6. Photographs of the trial hole, test holes and site (date and time referenced).

[1] The calculated percolation area or polishing filter area should be set out accurately on the site layout drawing in accordance with the code of practice's requirements.

4.0 CONCLUSION of SITE CHARACTERISATION

Integrate the information from the desk study and on-site assessment (i.e. visual assessment, trial hole and percolation tests) above and conclude the type of system(s) that is (are) appropriate. This information is also used to choose the optimum final disposal route of the treated wastewater.

Not Suitable for Development ☐

Suitable for [1]		**Discharge Route**
1. Septic tank system (septic tank and percolation area)	No	Discharge to Ground Water
2. Secondary Treatment System		
a. septic tank and filter system constructed on-site and polishing filter; or	Yes	
b. packaged wastewater treatment system and polishing filter	Yes	

5.0 RECOMMENDATION

Propose to install: Packaged wastewater treatment system and polishing filter

and discharge to: Ground Water

Trench Invert level (m): 0.80

Site Specific Conditions (e.g. special works, site improvement works testing etc.

The existing septic tank system on the site should be decommissioned, and mechanical aeration system installed on the site which complies with British Standard B.S. 6297: 1983 (incorporating amendment No. 1 of 1990).

A soil polishing filter must been installed following this, for tertiary treatment. The infiltration area is constructed as a polishing filter bed, situated under the southeastern portion of the site (where the tests were carried out).

The proposed polishing filter should be 3m from the northeastern fence boundary of the site, and 16m northwest of the fence at the southeastern boundary of the site. Given the 'T' and 'P' values for the site, this polishing filter is required to be 750 square metres in area for the maximum discharge from the site of 15m3. This equates to an area of 50m x 15m.

The filter bed should consist of 400mm depth of 8mm-32mm pebble gravels, laid at a depth of 700mm below ground level on the site, and overlain with geotextile and covered within 300mm depth of topsoil. The distribution pipework should be laid at a depth of 400mm below ground level, near the top of this filter bed, and in six cells of 15m x 8.33m.

Further details of the filter and pipe layout are shown in Figures 4 and 5 at the end of this report, as well as the accompanying pipework design by Ash Environmental Ltd..

The installation of the mechanical aeration system and polishing filter area should be certified as being in compliance with the EPA (2009) guidelines and the recommendations here by the engineer/architect/competent person certifying the fitting of the treatment system on the site.

[1] note: more than one option may be suitable for a site and this should be recorded

[2] A discharge of sewage effluent to “waters” (definition includes any or any part of any river, stream, lake, canal, reservoir, aquifer, pond, watercourse or other inland waters, whether natural or artificial) will require a licence under the Water Pollution Acts 1977-90. Refer to Section 2.6.2.

6.0 TREATMENT SYSTEM DETAILS

SYSTEM TYPE: Septic Tank System

Tank Capacity (m^3)		Percolation Area		Mounded Percolation Area	
		No. of Trenches		No. of Trenches	
		Length of Trenches (m)		Length of Trenches (m)	
		Invert Level (m)		Invert Level (m)	

SYSTEM TYPE: Secondary Treatment System

Filter Systems

Media Type	Area (m^2)*	Depth of Filter	Invert Level
Sand/Soil			
Soil			
Constructed Wetland			
Other			

Package Treatment Systems

Type	
	O'Reilly Oakstown Super BAF System
Capacity PE	100.00
Sizing of Primary Compartment	
	m^3

SYSTEM TYPE: Tertiary Treatment System

Polishing Filter: Surface Area (m^2)*	750.00	**Package Treatment System:** Capacity (pe)	
or **Gravity Fed:**		**Constructed Wetland:** Surface Area (m^2)*	
No. of Trenches			
Length of Trenches (m)			
Invert Level (m)			

DISCHARGE ROUTE:

Groundwater	✔	Hydraulic Loading Rate * ($l/m^2.d$)	20.00
Surface Water **		Discharge Rate (m^3/hr)	

TREATMENT STANDARDS:

Treatment System Performance Standard (mg/l)	BOD	SS	NH_4 - N	Total N	Total P
O'Reilly Oakstown Wastewater Treatment System	20.00	30.00	10.00	21.00	12.50

QUALITY ASSURANCE:

Installation & Commissioning	On-going Maintenance
Servicing to be undertaken by a competent individual with professional indemnity insurance.	De-sludging at least once per year, or when scum in observed in the second chamber of the tank, or when the depth of sludge in the second compartment is greater than 400mm.

* Hydraulic loading rate is determined by the percolation rate of subsoil

** Water Pollution Act discharge licence required

7.0 SITE ASSESSOR DETAILS

Company: Robert Meehan - Consultant Geologist

Prefix: Dr. First Name: Robert Surname: Meehan

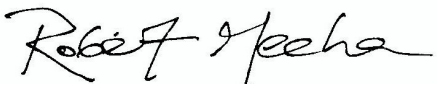
Address:
86 Athlumney Castle,
Navan,
County Meath

Qualifications/Experience: BA, PhD, PGeo., EurGeol, FETAC/FAS Course Certified, Professional Indemnity Insurance Holder (€2 millic

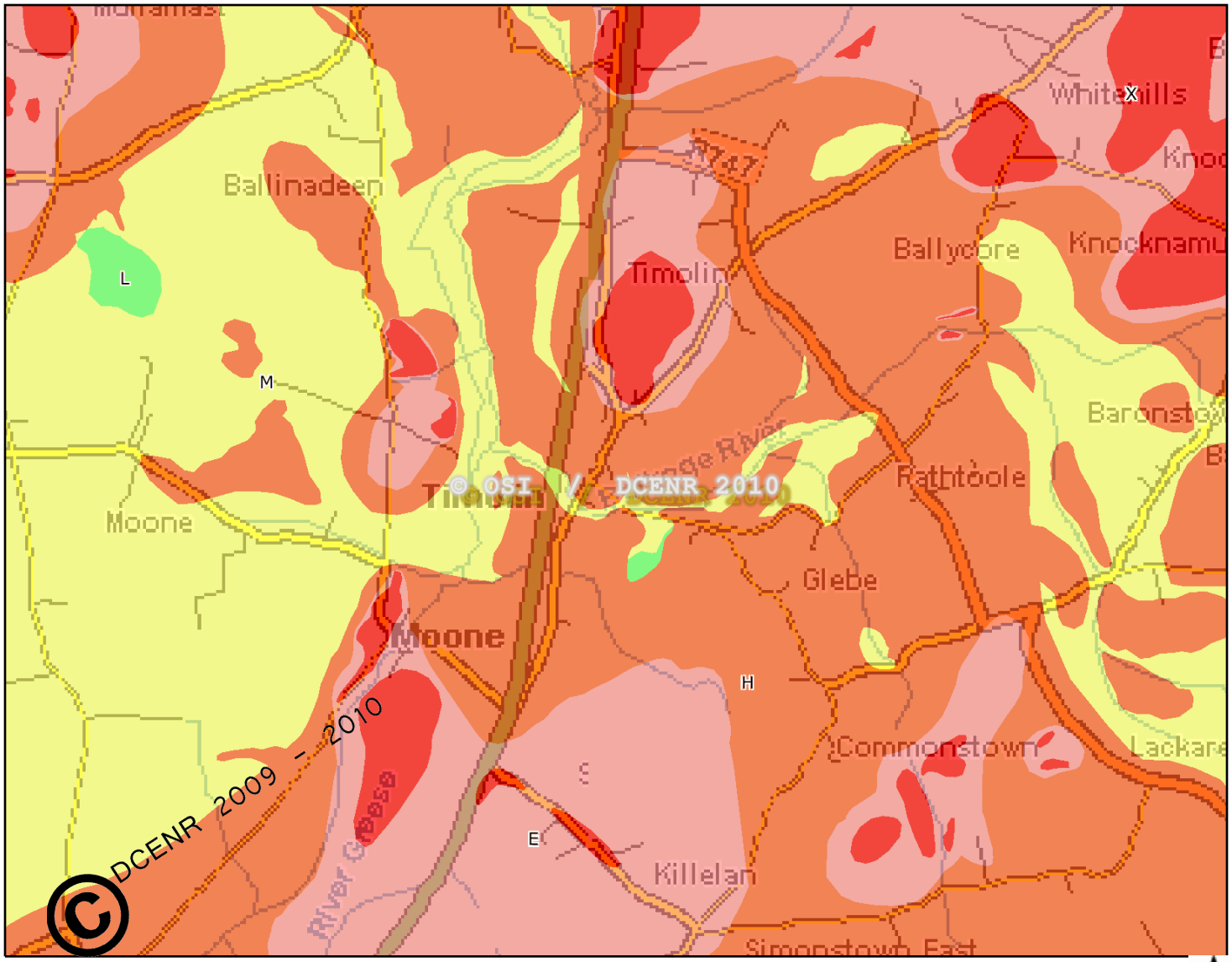
Date of Report: 12/08/2015

Phone: 087-6875558 Fax: 046-9070070 e-mail antalamhireland@gmail.com

Indemnity Insurance Number: AMTUE13006/11/00029

Signature: 

Timolin Groundwater Vulnerability



Legend

Vulnerability

- X (Rock near Surface or Karst)
- E - Extreme
- H - High
- M - Moderate
- L - Low
- Water

Watermark

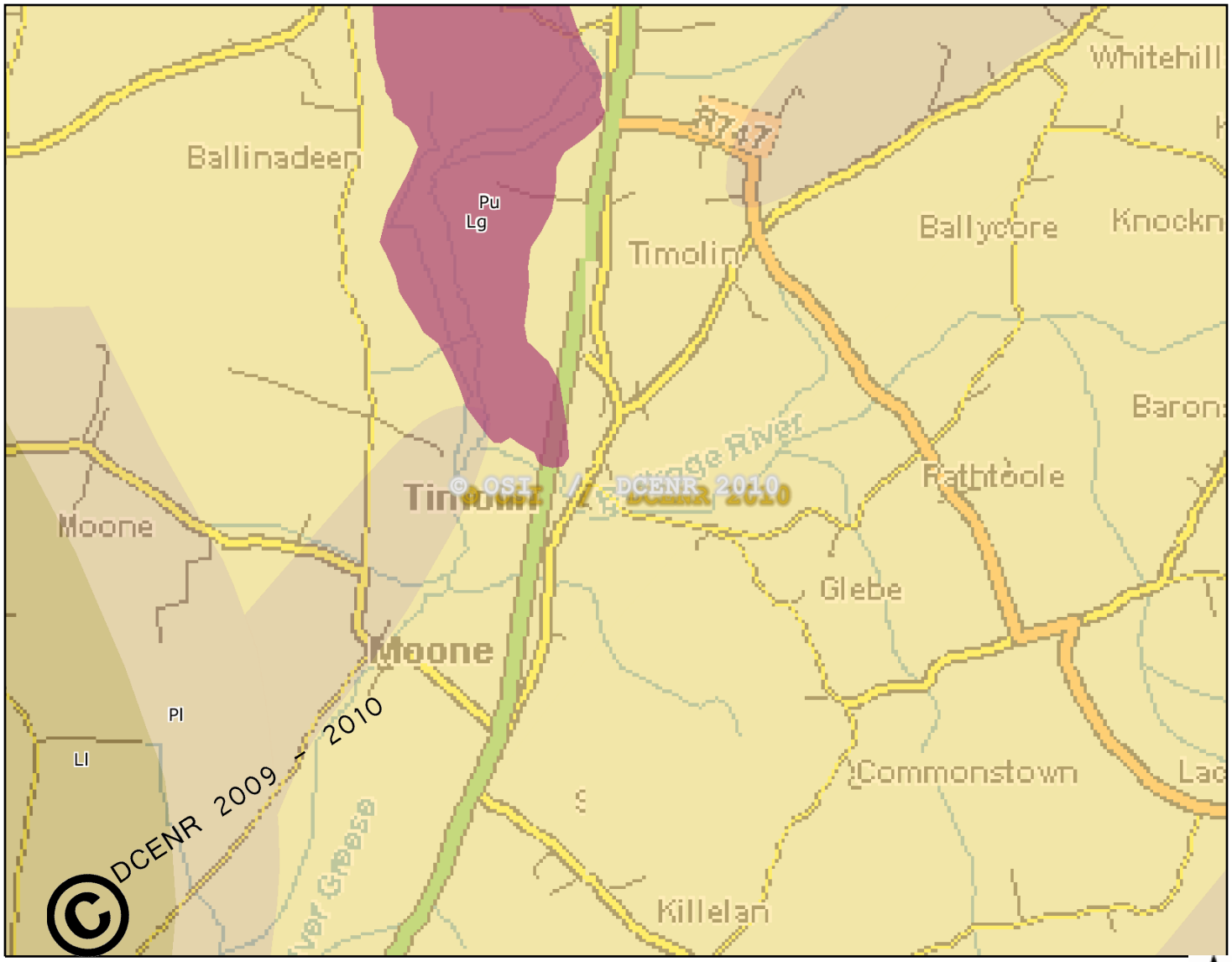
0 900 1800 2700 m.

Map center: 280147, 193356

Scale: 1:33,478

Snapshot Date: 12-Aug-2015

Timolin Aquifers



Legend

National Draft Gravel Aquifer Map

- Rg - Regionally important, extensive sand/gravels aquifers
- Lg - Locally important, sand/gravel aquifers

National Draft Bedrock Aquifer Map

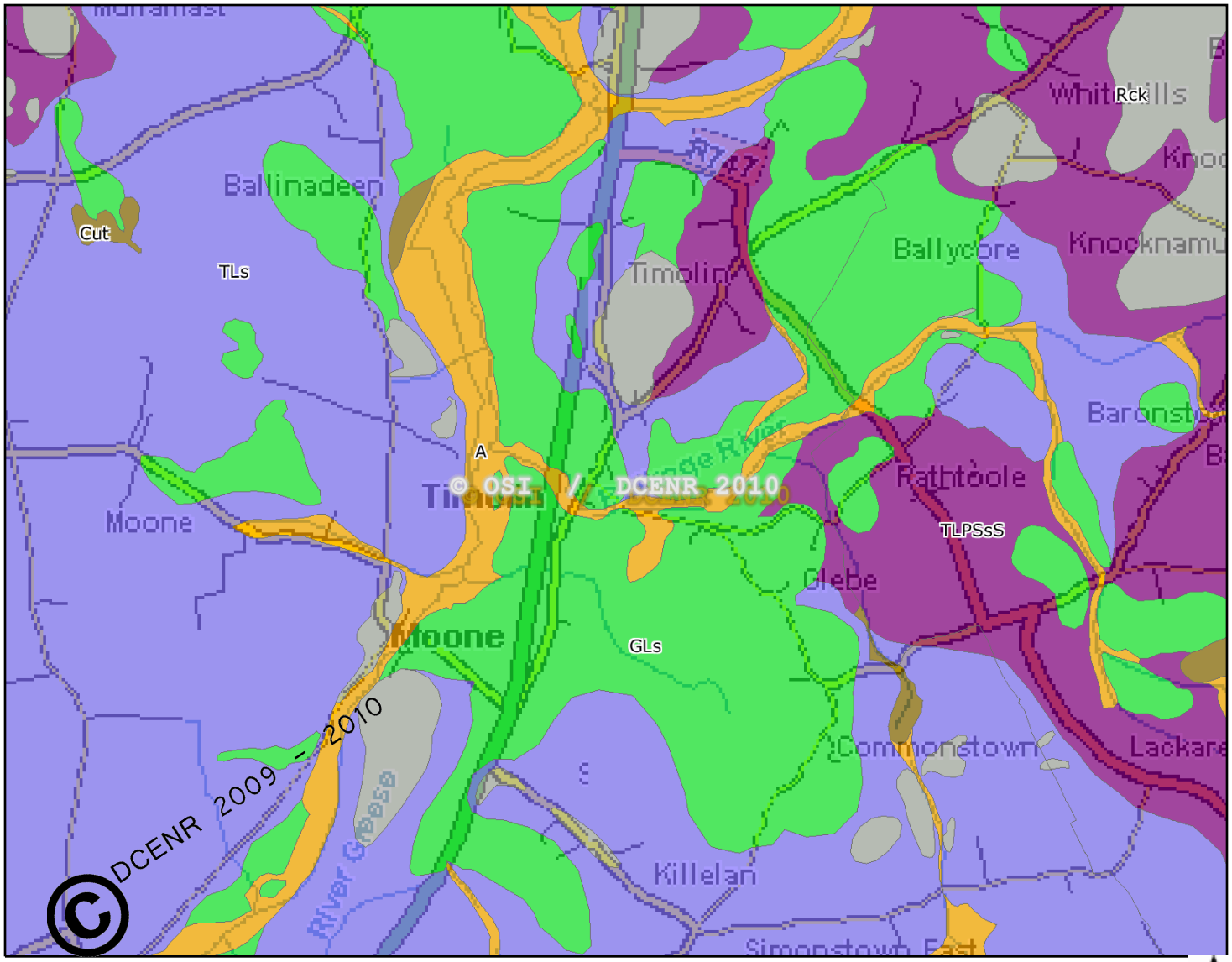
- Rf - Regionally Important Aquifer - Fissured bedrock
- Rk - Regionally Important Aquifer - Karstified
- Rkd - Regionally Important Aquifer - Karstified (diffuse)
- Rkc - Regionally Important Aquifer - Karstified (conduit)
- Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive
- Lk - Locally Important Aquifer - Karstified
- Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
- Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
- Pu - Poor Aquifer - Bedrock which is Generally Unproductive
- Unclassified
- Watermark

Scale: 1:30,599

Map center: 280147, 193356

Snapshot Date: 12-Aug-2015

Timolin Subsoils



Legend

RBD Subsoils

- Alluvium
- Beach sands and gravels
- Bedrock outcrop and subcrop
- Esker sands and gravels
- Glaciofluvial sands and gravels
- Lake sediments
- Made ground
- Marine/estuarine silts and clays
- Marsh
- Peat
- Scree
- Till derived chiefly from Devonian sandstones
- Till derived chiefly from Lower Palaeozoic rocks
- Till derived chiefly from Namurian rocks
- Till derived chiefly from granite
- Till derived chiefly from limestone
- Till derived chiefly from metamorphic rocks
- Till derived from metamorphic rocks
- Till derived from mixed Devonian and Carboniferous rocks
- Water
- Windblown sands

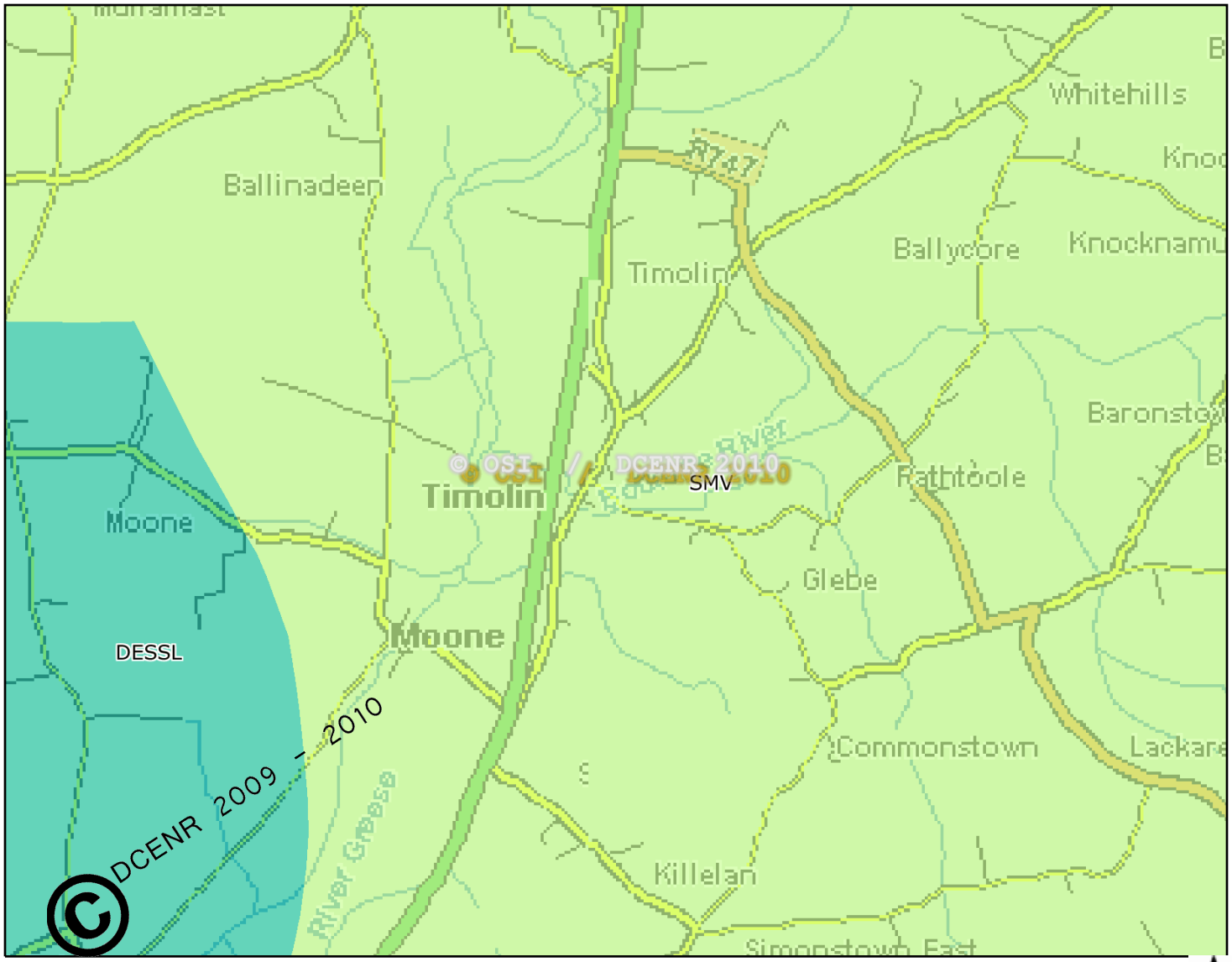
Watermark

Map center: 280147, 193356

Scale: 1:33,478

Snapshot Date: 12-Aug-2015

Timolin Bedrock



0 900 1800 2700 m.

Map center: 280147, 193356

Legend

National Draft Generalised Bedrock Map

- BV - Basalts and other Volcanic rocks
- CM - Cambrian Metasediments
- DDL - Dinantian Dolomitised Limestones
- DESSL - Dinantian early Sandstones, Shales and Limestones
- DKS - Devonian Kiltorcan type Sandstones
- DLIL - Dinantian Lower Impure Limestones
- DMSC - Dinantian Mudstones and Sandstones Cork Group
- MSSL - Dinantian Mixed Sandstones, Shales and Limestones
- DORS - Devonian Old Red Sandstones
- DPBL - Dinantian Pure Bedded Limestones
- DPUL - Dinantian Pure Unbedded Limestones
- DS - Dinantian Sandstones
- DSL - Dinantian Shales and Limestones
- DUIL - Dinantian Upper Impure Limestones
- GII - Granites and other Igneous Intrusive rocks
- NSA - Namurian Sandstones
- NSH - Namurian Shales
- NU - Namurian Undifferentiated
- OM - Ordovician Metasediments
- OV - Ordovician Volcanics
- PM - Precambrian Marbles
- PQGS - Precambrian Quartzites, Gneisses and Schists
- PTMG - Permo Triassic Mudstones and Gypsum
- PTS - Permo Triassic Sandstones
- SMV - Silurian Metasediments and Volcanics
- WSA - Westphalian Sandstones
- WSH - Westphalian Shales

Watermark

Scale: 1:33,478

Snapshot Date: 12-Aug-2015

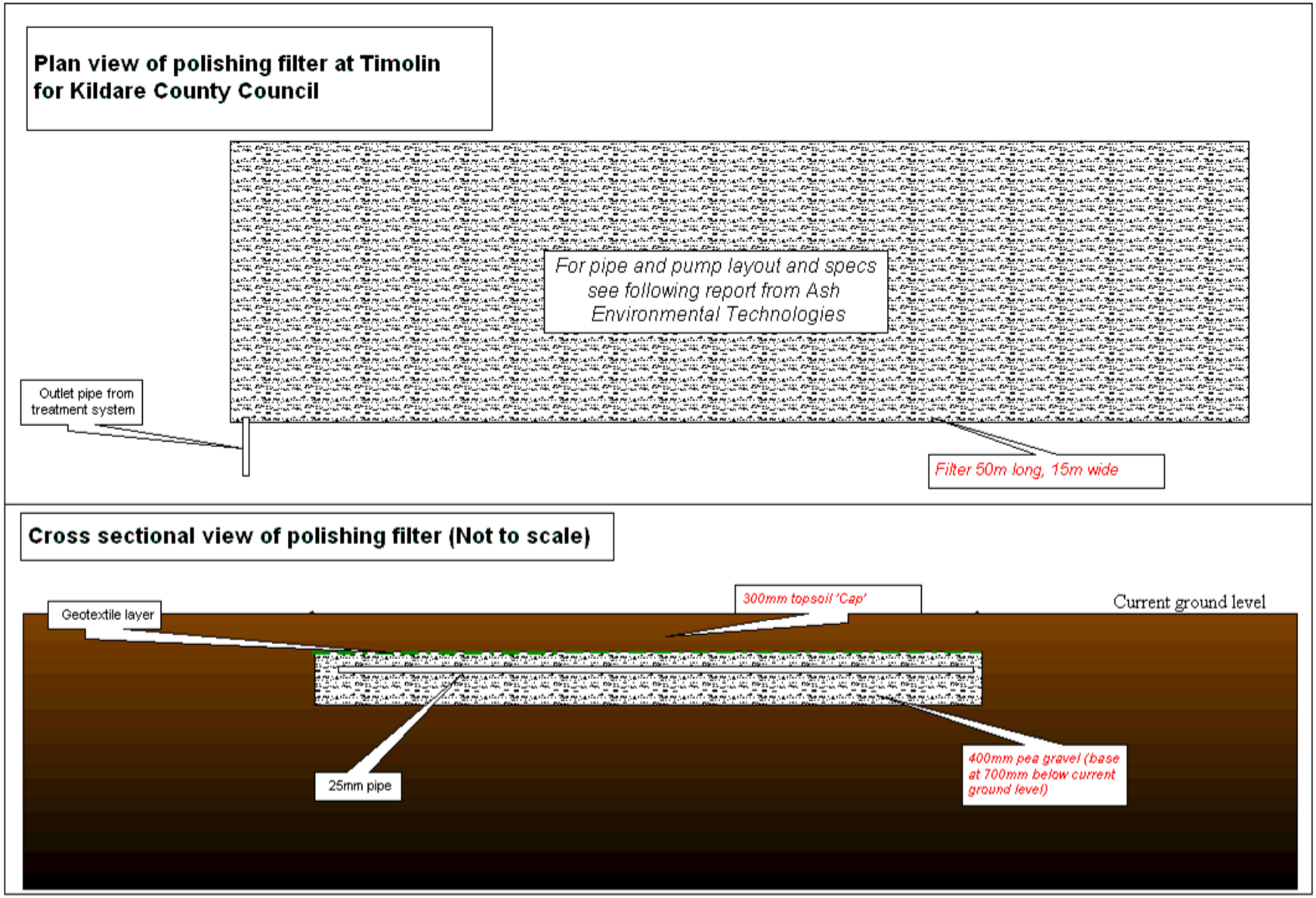


Figure 5: Plan and profile views of polishing filter at Timolin for Kildare County Council.

Proposed Design Details

Project:	Kildare Co Council Housing
Address:	Timolin, Co Kildare
Ref:	15 1212
Contact:	Robert Meehan
Tel:	087 687 5558
Date:	11 August 2015

Important. No account is taken of site elevation, contours or pump details unless requested. The information provided here is to assist the system designer and is based on the US EPA Design Manual 2002. Detailed site specific designs are required by the Irish EPA Code of Practice 2009 in section 10.1.1 option 2- - Pumped Discharge. Please see our installation guidelines before installation.

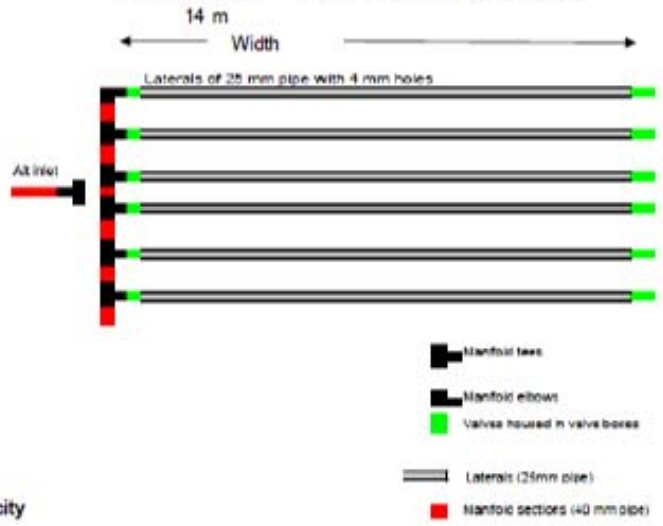
Ash Environmental Technologies

Specialists in onsite wastewater products
www.ashtecs.ie

Pressure Pipe Network for Sand/Soil Polishing Filter - Single Sided Manifold Layout

				Details for each of 6 zones Area	L	W	
Dimensions of area				125.0	8.33	15	sq metres (metres)
Design flow	PE	16.7		2500.05	*litres/day/zone*		
Infiltration rate (Litres/M2)				20.0	**check rate matches site assessment**		
Approx no of doses (per design flow and pipe volume)				12.8	*no.*		
Pump run time per dose				1.25	*mins*		
Manifold pipe diameter				40	mm	7.0	m
Length of manifold sections -pre-cut		5	x	1.40	m		
Lateral pipe diameter				25	mm		
Separation distance between laterals				1.4	*m*		
No of Lateral pipe lengths				6	*no.*		
Length of Laterals				14	*m*		
Total length of lateral pipes with pre-drilled holes				84	*m*		
Pump minimum operating capacity				144	*litres/min*	**check pump selection is suitable**	
Minimum pipe network dose volume				196	*litres*	**check pump tank is suitable**	
Indexing valve feeder pipes estimated dose volume				40	*litres*		
Minimum pump tank operating volume				236	*litres*		
Length of rising main from pump tank to pressure system inlet manifold				0	*metres*	**check length of rising main & pump capacity**	
Diameter of rising main				0			
Static head on site (elevation)				0	*metres*		

NOT TO SCALE **Details for each of 6 zones**



Notes: 1 *Many secondary treatment systems do not pump sufficient quantity of water in each pumping event to fill the pipe network for long enough to get even distribution. Pumps supplied may be designed to discharge small volumes under minimal pressure from the tank. A suitable pump and pump tank should be selected to avoid future problems such as overloaded areas and leakage from filters.*

2 We can arrange INSTALLATION or oversight of the pipe network if required.

3 We can also provide CERTIFICATION of the pressurisation of the system and certification of suitability of PUMP AND PUMP DOSING arrangements.

Please call Ash Environmental at 0404 66433 if you require further information or assistance.

www.ashtecs.ie

Specialists in onsite wastewater

Distributing Valves (Indexing Valves)

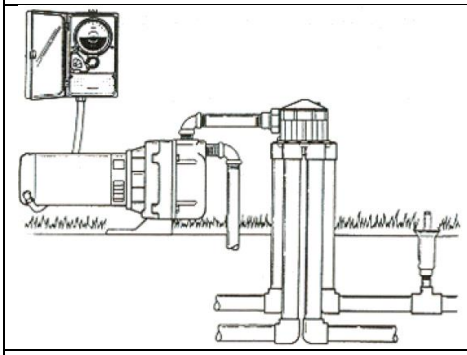
Distributing or indexing valves are used to dose up to 6 outlet pipes with a single pump. They are ideal for wastewater pressure systems which require dosing of multiple sections or zones. This reduces the size of pump required thereby saving pump and energy costs. Valves are essential when pumping to a large pipe network or to pump to a number of pockets of area on a small site or landscaped commercial areas.

The 6000 Series line of distributing valves offers exceptional reliability and durability even under the dirtiest water conditions.

With a metal die-cast body, the 6000 series valves are capable of high pressure applications and are recommended to be used on pump fed systems. The 6000 series is ideal for onsite wastewater and effluent water applications.

The 6000 valve is available in 4 or 6 outlet models that are cammed for 2 to 6 zone operation. With only one moving part (the stem and disk assembly), the valve is easily serviced and maintained.

The valve requires 57 litres/min (15 GPM) to operate and works at pressures from 25 to 150 PSI (1.7 bar to 10 bar).



For direct pump - fed installations, the 6000 Series Distributing Valve is directly connected to the discharge side of the pump and is cycled from one zone to the next by turning the pump off and on. In wastewater systems this is usually done automatically by the pump float switch cutting in and out as the water level rises and falls.

Install the valve as close to the pump as possible and ensure suction line to the pump has a proper check valve installed and all joints are completely sealed.

The number of valve outlets can be easily adjusted by changing the valve cam.

The valve inlet is 1.5” threaded and the outlets are 1.5” plain. Metric adapters are used to connect to pipes. Unions are recommended on inlets and outlets to allow valve maintenance.

We supply fully assembled valves with fittings with secure access housing.

Valves are essential when pumping to a large pipe network or to pump to a number of pockets of area on a small site.

Ash Environmental Technologies Ltd., Unit 2 Wicklow Enterprise Park, The Murrough, Wicklow, Co Wicklow,
Tel: 0404 66433; Fax 0404 66464; email: sales@ashtecs.com www.ashtecs.ie

MODELS

Four Outlet Models

6402	Cammed for 2 Zone Operation
6403	Cammed for 3 Zone Operation
6404	Cammed for 4 Zone Operation

Six Outlet Models

6605	Cammed for 5 Zone Operation
6606	Cammed for 6 Zone Operation

OTHER OPTIONS: ADD TO PART NUMBER

RCW	Reclaimed Water Use

SPECIFICATIONS

- Construction:
  Valve Top/Housing: Die Cast Metal
  Valve Outlets: High Strength ABS Polymer
- Flow Range: 15-150 GPM
- Pressure Rating: 25 - 150 PSI
- Pressure Loss:

4 Outlet Valve:	Flow (GPM)	20	40	60	80	100
	PSI Loss	2.5	3.5	5.0	7.5	10.0
6 Outlet Valve:	Flow (GPM)	20	40	60	80	100
	PSI Loss	3.0	4.0	6.0	9.0	11.0

- Inlet: Threaded 1-1/2" NPT Connection
- Outlets: Slip and Glue Connections to 1-1/2" PVC Pipe
- Dimensions: HEIGHT: 7", WIDTH: 8"

6000 INDEXING VALVE

The 6000 line of indexing valves offers exceptional reliability and durability even under the dirtiest water conditions.

FOR MORE INFORMATION ON RCW PRODUCTS, PLEASE SEE PAGES 36 AND 37.

FEATURES/BENEFITS

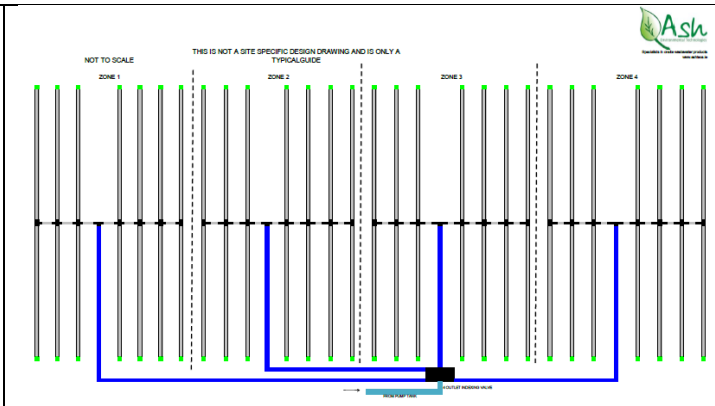
- Metal Die-Cast Body–Durable, long lasting, and capable of high pressure applications.
- Available in 4 and 6 Outlet Models–Can quickly and easily change from two to six watering zones.
- Simplicity of Design–Valves are easily maintained and serviced for long product life.
- Operates at 15 GPM at Pressures of 25–150 PSI- Ideal for pump-fed systems or high-flow city water systems.
- Built-in Atmospheric Vacuum Breaker–Releases any vacuum created between the pump and the valve on shut down.
- Two Year Limited Warranty.

K-RAIN MODEL 6000: INDEXING VALVE

With a metal die-cast body, the 6000 valves are capable of high pressure applications and are recommended to be used on pump fed systems or high-flow city water systems. The 6000 is also ideal for onsite wastewater and effluent water applications.

The 6000 valve is available in 4 or 6 outlet models that are cammed for 2 to 6 zone operation. With only one moving part (the stem and disc assembly), the valve is easily serviced and maintained.

The valve requires 15 GPM to operate and works at pressures from 25 to 150 PSI.



Example of a 4 zone pipe network using a 4 outlet indexing valve

B Site location plan

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