Environmental Protection Agency

Establishment of Groundwater Source Protection Zones

Coolgreany Water Supply Scheme

Coolgreany Boreholes

November 2010

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GSI
Geological Survey of Ireland
Suirbhéireacht Gheolaíochta Éireann

PROJECT DESCRIPTION

Since the 1980's, the Geological Survey of Ireland (GSI) has undertaken a considerable amount of work developing Groundwater Protection Schemes throughout the country. Groundwater Source Protection Zones are the surface and subsurface areas surrounding a groundwater source, *i.e*. a well, wellfield or spring, in which water and contaminants may enter groundwater and move towards the source. Knowledge of where the water is coming from is critical when trying to interpret water quality data at the groundwater source. The Source Protection Zone also provides an area in which to focus further investigation and is an area where protective measures can be introduced to maintain or improve the quality of groundwater.

The project "Establishment of Groundwater Source Protection Zones", led by the Environmental Protection Agency (EPA), represents a continuation of the GSI's work. A CDM/TOBIN/OCM project team has been retained by the EPA to establish Groundwater Source Protection Zones at monitoring points in the EPA's National Groundwater Quality Network.

A suite of maps and digital GIS layers accompany this report and the reports and maps are hosted on the EPA and GSI websites (www.epa.ie; www.gsi.ie).

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1 Introduction

Groundwater Source Protection Zones are delineated for the Coolgreany source according to the principles and methodologies set out in 'Groundwater Protection Schemes' (DELG/EPA/GSI, 1999) and in the GSI/EPA/IGI Training course on Groundwater Source Protection Zone Delineation.

The Coolgreany Borehole #2 is the main source for Coolgreany Public Water Supply (PWS). The borehole supplies approximately 460 m^3/day to Coolgreany Village and surrounding area. A second borehole, Coolgreany #1 is located adjacent to Coolgreany #2 and is used as a back up supply.

The objectives of the report are as follows:

- To outline the principal hydrogeological characteristics of the Coolgreany area.
- To delineate source protection zones for the Coolgreany PWS.
- To assist the Environmental Protection Agency and Wexford County Council in protecting the water supply from contamination.

Groundwater protection zones are delineated to help prioritise the area around the source in terms of pollution risk to groundwater. This prioritisation is intended as a guide in evaluating the likely suitability of an area for a proposed activity prior to site investigations. The delineation and use of groundwater protection zones is further outlined in 'Groundwater Protection Schemes' (DELG/EPA/GSI, 1999).

2 Methodology

The methodology consisted of data collection, desk studies, field mapping, site visits and conductivity/temperature measurements at Coolgreany PWS. A datalogger was installed in Coolgreany #1 to assist with obtaining information on groundwater levels. Analysis of the information collected during the studies was used to delineate the Groundwater Source Protection Zones.

The initial site visit and interview with the caretaker took place on 31/06/2010. Site walk-overs and field mapping (including measuring the electrical conductivity and temperature of streams in the area) of the study area were conducted on 31/06/2010, 14/07/2010 and 05/10/2010.

While specific fieldwork was carried out in the development of this report, the maps produced are based largely on the readily available information and mapping techniques using inferences and judgements from experience at other sites. As such, the maps may not be definitively accurate across the whole area covered, and should not be used as the sole basis for site-specific decisions, which will usually require the collection of additional site-specific data.

3 Location, site description and well head protection

The Coolgreany Boreholes (Coolgreany #1 and Coolgreany #2) are located within a secure water treatment works, 0.8 km northwest of Coolgreany Village. Access to the facility is from a third class road linking the villages of Coolgreany, Co. Wexford and Johnstown, Co. Wicklow (see Figure 1).

The boreholes and treatment works are protected by fencing with access by a padlocked gate. The two wells are situated 5 m apart at the rear of the treatment works. The boreholes have supplied the Coolgreany area since 1986.

Photograph 1 Borehole cover for Coolgreany #2

Photograph 2 Rising main from Coolgreany #1

Coolgreany PWS is surrounded by agricultural lands to the south, east and west and by a stream flanked by agricultural land and quarries to the north. The boreholes intake brings the water to the pump house where the untreated water is chlorinated and fluorinated. The annulus around the boreholes is not grouted but the boreholes are covered.

4 Summary of well details

In 1984, 2 production boreholes (Coolgreany #1 and Coolgreany #2) were drilled by O'Donohue Bros, Gorey. The production boreholes were drilled at a diameter of 200 mm to a depth of 91 m. The outer casing was completed towards the top of the bedrock, and the bores are open hole through the bedrock. The boreholes were not grout sealed and are likely to allow significant inflows from the overlying sand and gravel.

Coolgreany #1 and #2 were pump tested in 1984 and brought into production to cater for the pumping demands in Coolgreany. A second pump testing of Coolgreany #1 and #2 was completed in 1986. The borehole logs and pumping tests are provided in Appendix I. Table 4.1 provides a summary of details as currently known. Photographs 1 and 2 and the map in Figure 1 show the site and location of the production boreholes.

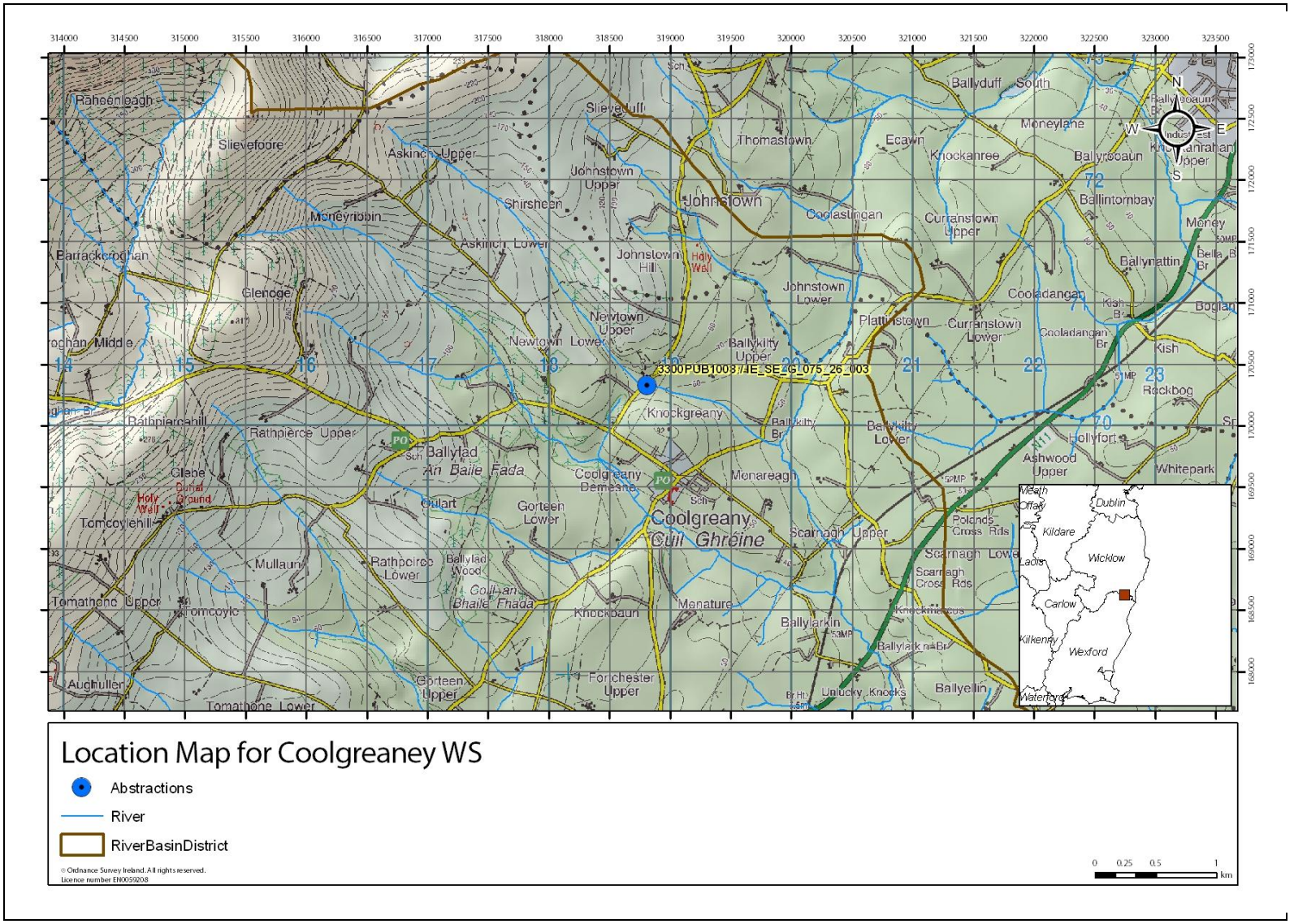

Figure 1 Location Map for Coolgreany PWS

Table 4.1 Summary Details

	Coolgreany #1	Coolgreany #2
EU Reporting Code		IE_SE_G_025_26_003
Grid reference	E318815 N170325	E318815 N170325
Townland	Knockgreaney	Knockgreaney
Source type	Borehole #1	Borehole #2
Drilled	1986	1986
Owner	Wexford Co. Co.	Wexford Co. Co.
Elevation (Ground Level)	c. 64 mOD	c. 64 mOD
Depth	91.2 m	91.5 m
Depth of casing	Outer casing 7 m	Outer casing 7 m
Diameter	Outer casing 0.20 m, open hole at 0.2 to 91.2 m	Outer casing 0.20 m, open hole at 0.2 to 91.5 m
Depth to rock	7 m	7 m
Static water level	0.4 m (Dec 1984). Approx 3.8 to 5.5 m bgl (July 2010)	0.4 m (Dec 1984). Approx 3.8 to 5.5 m bgl (July 2010)
Pumping water level	Not pumping at present	Approx. 30 m bgl
Consumption (Co. Co. records)	-	460 m^3/d
GSI Productivity Class	Class II	Class II
Specific capacity	27.5 m^3/day/m (Dec 1984 pumping test)	32 m^3/day/m (Dec 1984 pumping test)
Transmissivity	34 m^2/day	

5 Topography, surface hydrology and landuse

Coolgreany PWS is located within the surface water catchment of the Kilgorman River (Hydrometric Area 11), a tributary of which flows in a southeasterly direction approximately 14 m to the north of the boreholes. For the purposes of this report, this river will be referred to as the Newtown River, and it rises 3 km to the northwest in the foothills of Slieveforne (414 m OD).

The boreholes are situated towards the base of the V-shaped Newtown River valley. The Newtown River is orientated northwest-southeast, with moderate to steep slopes on either side of the river. Topographcial gradients in the study area are between 1:5 and 1:50. To the south of the source, land rises steeply (from 64–92 m OD) towards Coolgreany reservoir, with Coolgreany village located on the southern slopes of the hill.

The Coolgreany area seems to constitute an extensive area of well drained land with a low to moderate drainage density. A moderate density of artificial and natural drains are located adjacent to streams.

Land use in the study area is primarily agricultural, with agricultural lands comprising of tillage (20%) and grazing (65%). A number of farmyards have been noted in the area, though no farmyards were identified within 200 m of the boreholes. A number of coniferous and broadleaf forestry plantations (15%) are also present in the surrounding area.

A number of off houses occur in the area surrounding the boreholes, and two sand and gravel/rock quarries are situated west and north of the source (see Figures 2 and 3). No IPPC licenses were identified in the environs of Coolgreany PWS.

6 Hydrometerology

Establishing groundwater source protection zones requires an understanding of general hydrometeorological patterns across the area of interest. The data source is Met Eiréann.

***Annual rainfall:* 996 mm.** The closest meteorological station to Coolgreany Boreholes is located at Gorey Gauging station, 10 km to the south. Data records used from Gorey are based on Met Éireann data for annual average rainfall, and suggest that 996 mm falls annually in the area (Fitzgerald and Forrestal, 1996). Data from the Met Eireann website show that the source is located between the 800 mm and 1000 mm average annual rainfall isohyets.

***Annual evapotranspiration losses:* 450 mm.** Potential evapotranspiration (P.E.) is estimated to be 500 mm/yr (based on data from Collins and Cummins, 1996). Actual evapotranspiration (A.E.) is then estimated as 95% of P.E., to allow for seasonal soil moisture deficits.

***Annual Effective Rainfall:* 546 mm**. The annual effective rainfall is calculated by subtracting actual evapotranspiration from rainfall. Potential recharge is therefore equivalent to this, or 546 mm/year. See also Section 8.6 on Recharge which estimates the proportion of effective rainfall that enters the aquifer.

7 Geology

7.1 Introduction

This section briefly describes the relevant characteristics of the geological materials that underlie the site. It provides a framework for the assessment of groundwater flow and delineation of the source protection zones.

The desk study data used comprised the following:

- Boreholes logs of test wells and production boreholes from O'Donohue Bros, 1984 (Appendix I);
- Bedrock exposures mapped during field visits and site walkovers;
- Geology of South Wexford. Bedrock Geology 1: 100,000 Map series, Sheet 23, Geological Survey of Ireland (Tiestzsch-Tyler *et al*, 1994); and
- EPA Soils and Subsoil Maps for County Wexford (Teagasc, 2006a and b).

7.2 Bedrock geology

This section briefly describes the relevant characteristics of the geological materials that underlie the Coolgreany boreholes. It provides a framework for the assessment of groundwater flow and source protection zones that will follow in later sections. The geological information is based the Bedrock Geological Map of South Wexford; Sheet 23, 1:100,000 Series (Tiestzsch-Tyler *et al.*, 1994).

The Bedrock Geological Map of South Wexford indicates that this area is principally occupied by Lower Palaeozoic Rocks of the Oaklands Formation and the Ballylane Formation (Figure 3). These Lower Palaeozoic rocks extend over a large area of north Wexford (Tiestzsch-Tyler *et al.*, 1994).

The Oaklands Formation is comprised of green, red and purple slates and siltstones, and is exposed in a disused quarry (S1), 0.5 km to the southeast of the source. Bedding within the red and purple sandstones is near vertical (80–85^0) and strikes in a NE-SW direction. Minor fissures and fractures were evident in the

quarry. Bedrock exposures within the Ballylane Formation at a quarry 500 m to the west (S2 and S3) indicated the presence of thinly bedded mudstones, slates, siltstones and sandstones, felsic volcanics and occasional dolerites. Iron/Manganese staining of the felsic volcanic may indicate the greater potential for groundwater flow where volcanics are present. Bedding within the Ballylane Formation at S2, and a third quarry 100 m to the northwest (S3), is near vertical with a NE strike. Isoclinal and tight folding of the shales and sandstones was evident in the quarry exposures.

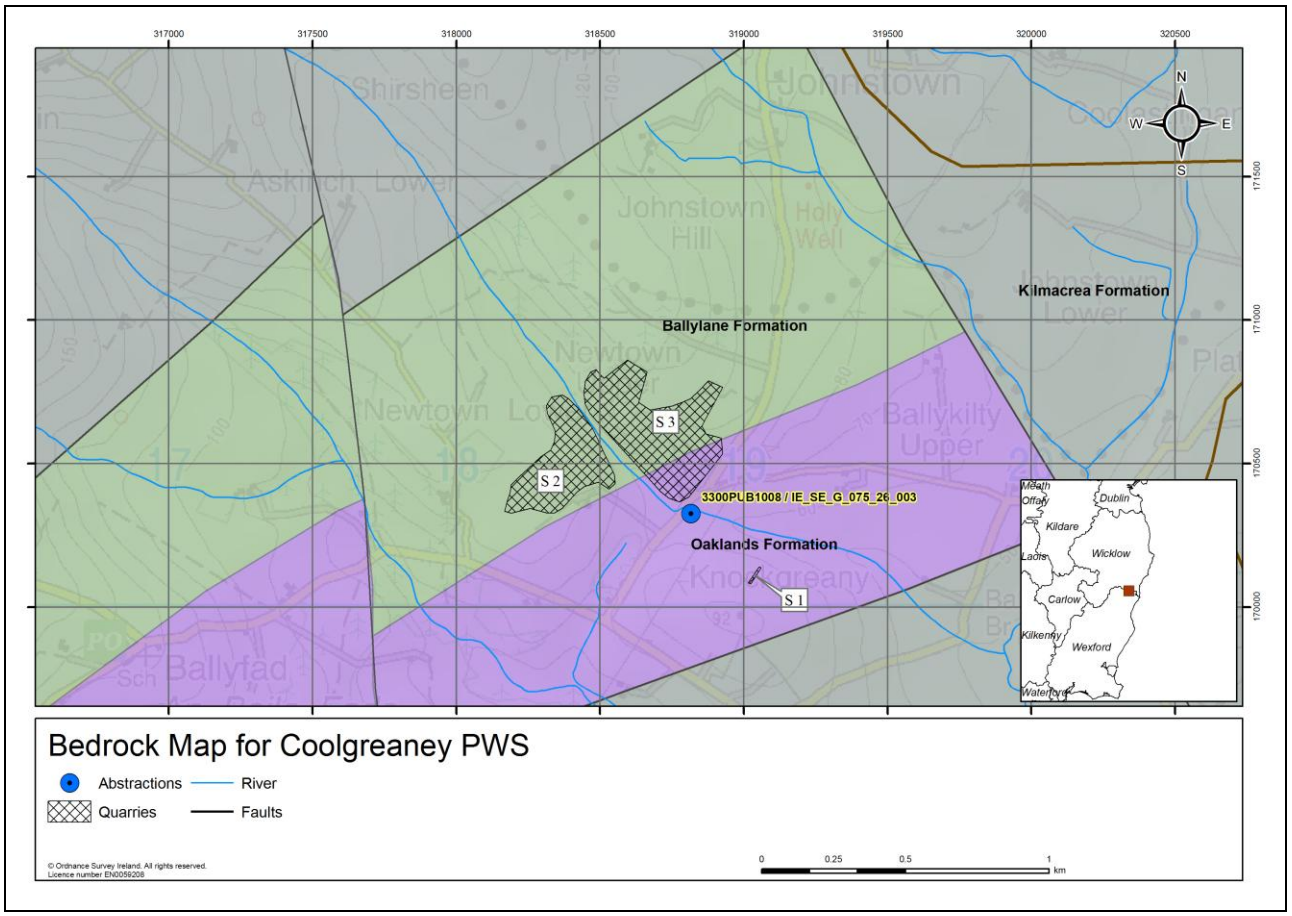

Figure 2 Bedrock Geology Map for Coolgreany PWS

7.3 Soils and subsoils geology

According to Teagasc web mapping (Meehan, 2004), the study area is dominated by subsoil consisting of till derived from Lower Palaeozoic Sandstone and Shales (TLPSsS) as shown on Figure 3. Bedrock is close to the surface on the crests and upper slopes of the surrounding hills. An area of sand and gravel deposits derived from Lower Palaeozoic Sandstone and Shales (GLPSsS) is located to the west of the source.

The soils on the till and sand and gravel areas are predominately ‘dry’ soil types: typically well drained deep mineral soils (AminDW) and well drained shallow soils (AminSW), both of acidic chemical reaction (Gardiner and Ryan, 1964).

Based on exposures in the Newtown River banks, and from the shallow auger sampling of the source and surrounding fields, the underlying subsoil at the boreholes is sand and gravel. While this had been previously mapped as till derived from the Lower Palaeozoics as part of the Teagasc Mapping (2006a), a small area (less than 1 hectare) is reclassified as sand and gravel subsoil in this report, and the subsoil map shown is slightly modified. See Figure 4 for details.

The subsoils across County Wexford have been classified according to British Standards BS:5930 in the preparation of the Groundwater Vulnerability map for Wexford County Council, by Tobin on behalf of the Geological Survey of Ireland (2010). The permeability data were made available for the preparation of this report. The subsoil permeability of the till unit in this locality has been classed as '***Moderately Permeable***'.

Areas of *'high'* permeability sand and gravel deposits are located at the source and to the west, north and northeast. Much of the mapped sand and gravel deposits have, however, been extracted by the two operational quarries, in some places down to the underlying bedrock (hatched areas in Figure 3).

7.4 Depth to bedrock

Depth to bedrock (DTB) has been interpreted across the study area based on bedrock outcrops mapped by the GSI, outcrops mapped during site visits, areas mapped as extreme groundwater vulnerability under the GSI Groundwater Protection Scheme (GWPS) and borehole information at Coolgreany PWS.

From the GWPS mapping, DTB is mapped as less than 3 m across the slopes of the ridges on either side of the Newtown River valley, with shallow bedrock areas being extensive on the ridge to the south of the source. Depth to bedrock increases towards the base of the valley but is in general less than 10 m. Depth to bedrock at the Coolgreany boreholes is 7 m.

Quarrying to the west and north of the source has removed the majority of sand and gravel deposits in this area which allows a visual assessment of depth to bedrock variations across the area. Bedrock is now at surface over much of the area of both quarries.

8 Groundwater vulnerability

Groundwater vulnerability is dictated by the nature and thickness of the material overlying the uppermost groundwater 'target'. This means that vulnerability relates to the thickness of the unsaturated zone in the sand/gravel aquifer, and the permeability and thickness of the subsoil in areas where the sand/gravel aquifer is absent. A detailed description of the vulnerability categories can be found in the Groundwater Protection Schemes document (DELG/EPA/GSI, 1999) and in the draft GSI Guidelines for Assessment and Mapping of Groundwater Vulnerability to Contamination (Fitzsimons et al., 2003).

The Groundwater Vulnerability map (2010) for the region, as mapped by Tobin on behalf of GSI, is dominated by 'extreme' and 'high' vulnerability and is shown in Figure 4. Most of the ridge crests, shoulders and upper backslopes have 'extreme' Vulnerability areas, where depths-to-bedrock are less than 3 m. Areas of *'high'* vulnerability sand and gravel deposits surround the boreholes. Elsewhere, where till of moderate permeability, but with depths-to-bedrock of less than 10 m occurs, the vulnerability is also mapped as '*high*'.

Since that mapping, further site specific hydrogeological mapping has revealed a greater extent of rock at surface and within 3m of the surface. Therefore a proposed revision to the vulnerability mapping is indicated in Figure 5.

Further east on the low ground, but several kilometres from the source, thicker tills of '*moderate*' and '*low*' permeability mean '*moderate*' and '*low*' vulnerability areas are mapped.

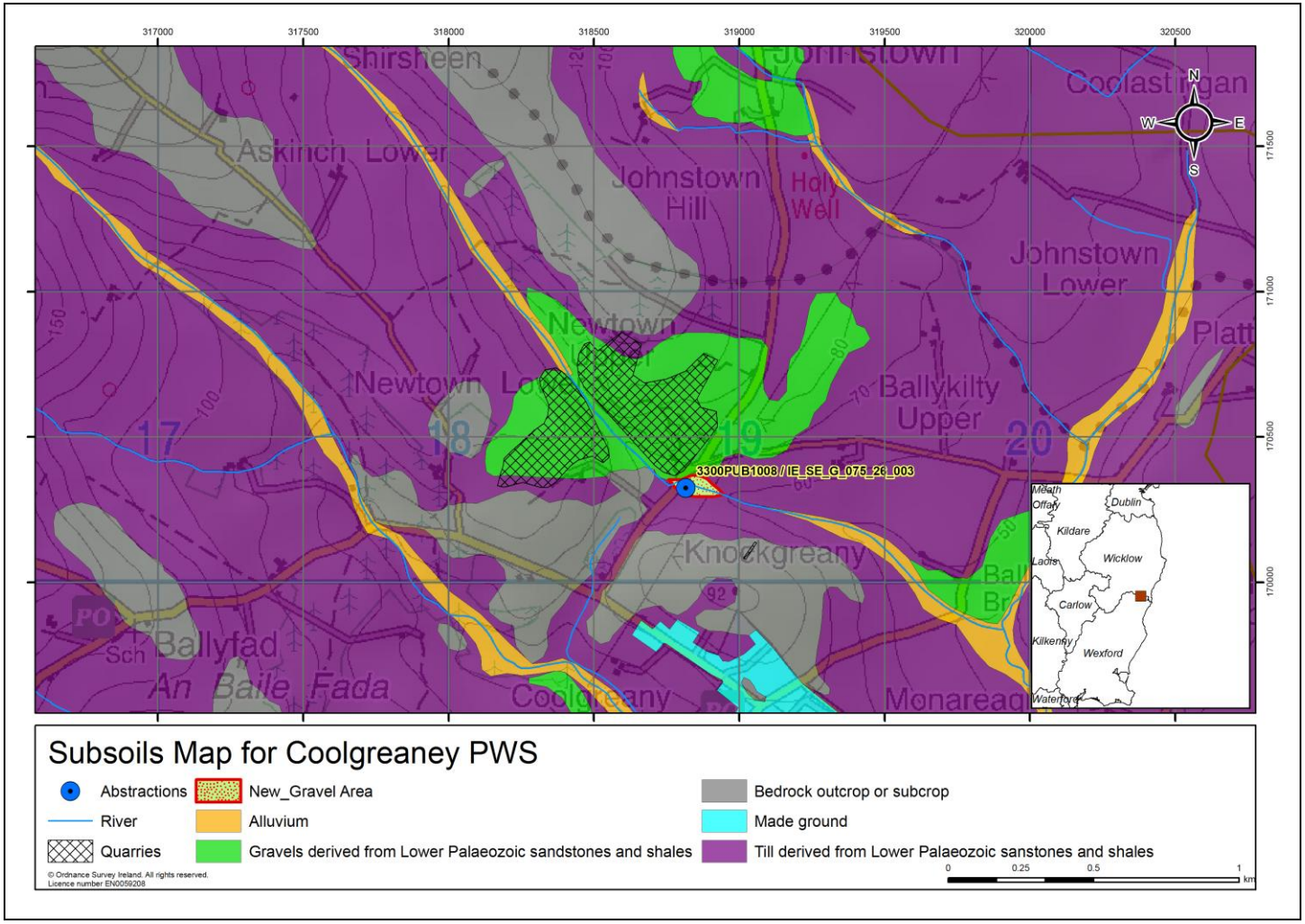

Figure 3 Modified Subsoil Map of the Coolgreany area, following revisions based on field work for the current project

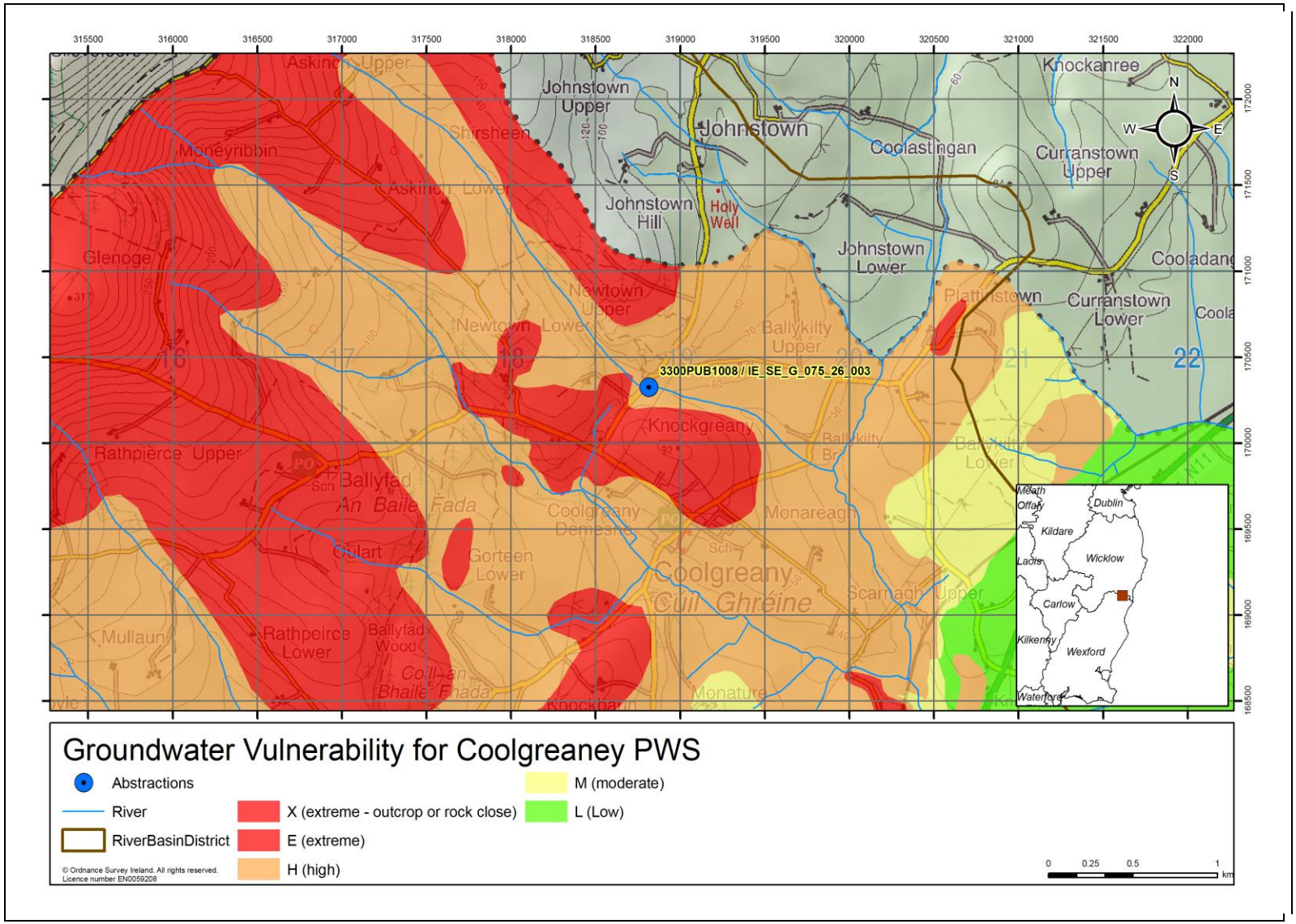

Figure 4 Groundwater Vulnerability in the Coolgreany area (GSI)

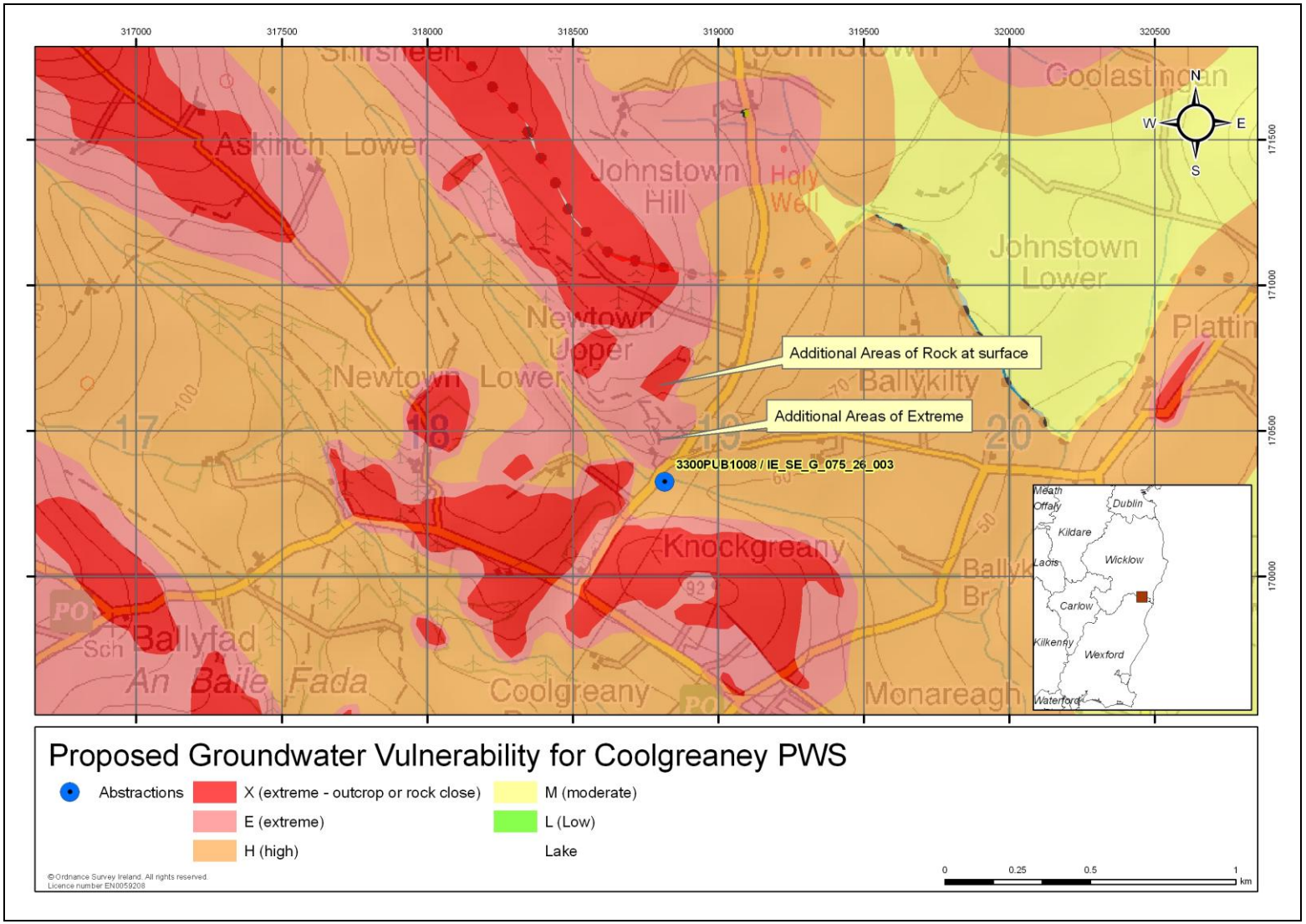

Figure 5 Proposed Groundwater Vulnerability in the Coolgreany area

9 Hydrogeology

This section describes the current understanding of the hydrogeology in the vicinity of the source. Hydrogeological and hydrochemical information was obtained from the following sources:

- GSI Website and Well Database;
- Inch Groundwater Body – Initial Summary
- County Council Staff;
- EPA website and Groundwater Monitoring database;
- Local Authority Drinking Water returns; and
- Hydrogeological mapping by TOBIN Consulting Engineers and Robert Meehan in July 2010.

9.1 Groundwater body and status

The Coolgreany source is located within the Inch Groundwater Body (IE_SE_G_075) which has been classified as being of Good Status. The groundwater body descriptions are available from the GSI website: www.gsi.ie and the 'status' is obtained from the Water Framework Directive website: www.wfdireland.ie.

9.2 Groundwater levels, flow directions and gradients

The natural groundwater flow direction is down the surrounding slopes and towards the Newtown River. Groundwater levels in the subsoils in the area surrounding Coolgreany Boreholes are close to the surface. The static water level in Coolgreany #1 was approximately 0.4 m bgl when drilled, before the December 1984 pumping test.

Given that the Oaklands Formation is not very permeable, it is anticipated that the groundwater gradient is likely to reflect the valley's topography. Thus, in keeping with the topography, a conservative value of 0.02 has been assumed.

Local groundwater flow within the subsoil and bedrock aquifer, at and around the Coolgreany Boreholes, is controlled by the pumping, as the drawdown is relatively large. Groundwater monitoring was carried out in Coolgreany #1 for an 8 day period in July 2010, while pumping to supply continued in Coolgreany #2 (see Figure 5). It was not possible to monitor the pumping well (Coolgreany #2) during this time, due to a cabling/pumping equipment obstruction. However groundwater levels in Coolgreany #2 are expected to be at least 30 m bgl during pumping based on site investigation data from 2010.

A drawdown of approximately 9 m per pumping cycle (typically 5 hours) in Coolgreany #1 was realised with pumping at a rate of 54 m^3/hour in Coolgreany #2. Full recovery was not achieved between each pumping cycle but over the duration of the monitoring, the pumping water levels generally increased by almost 2 m indicating that there may have been some recharge (see Figure 6). The groundwater levels in both boreholes were at least 3 m below the adjacent river water level during the July 2010 monitoring period.

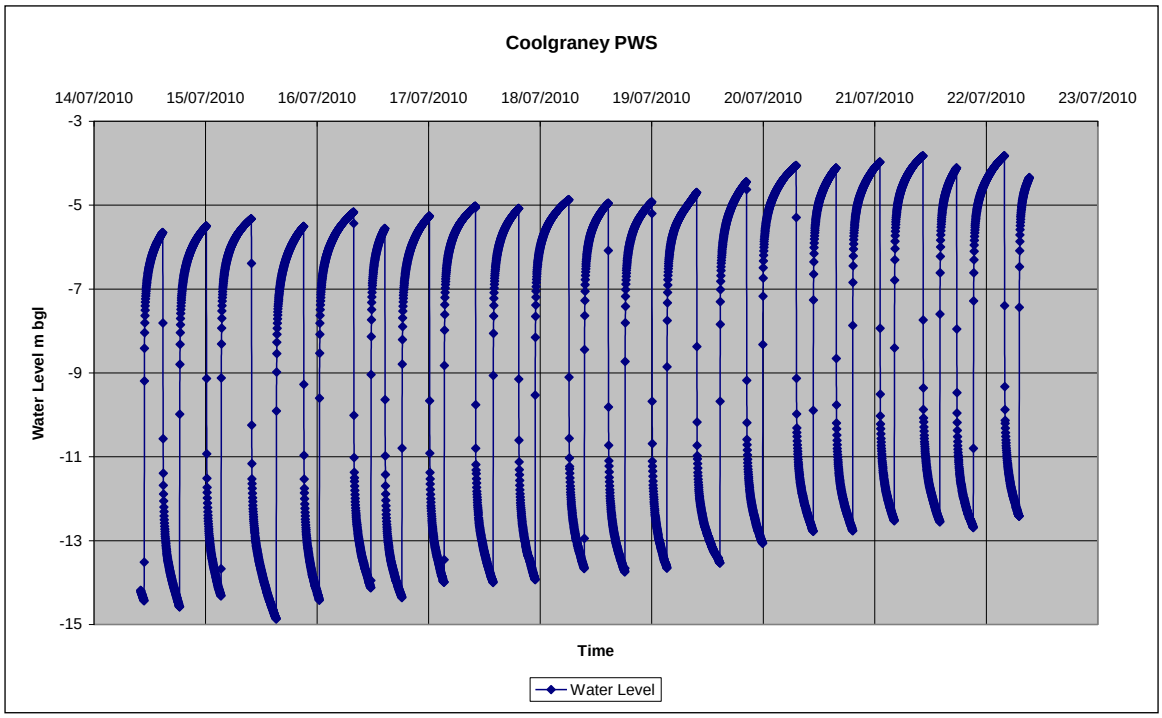

Figure 6 Groundwater monitoring levels in Coolgreany #1 (observation well) during July 2010

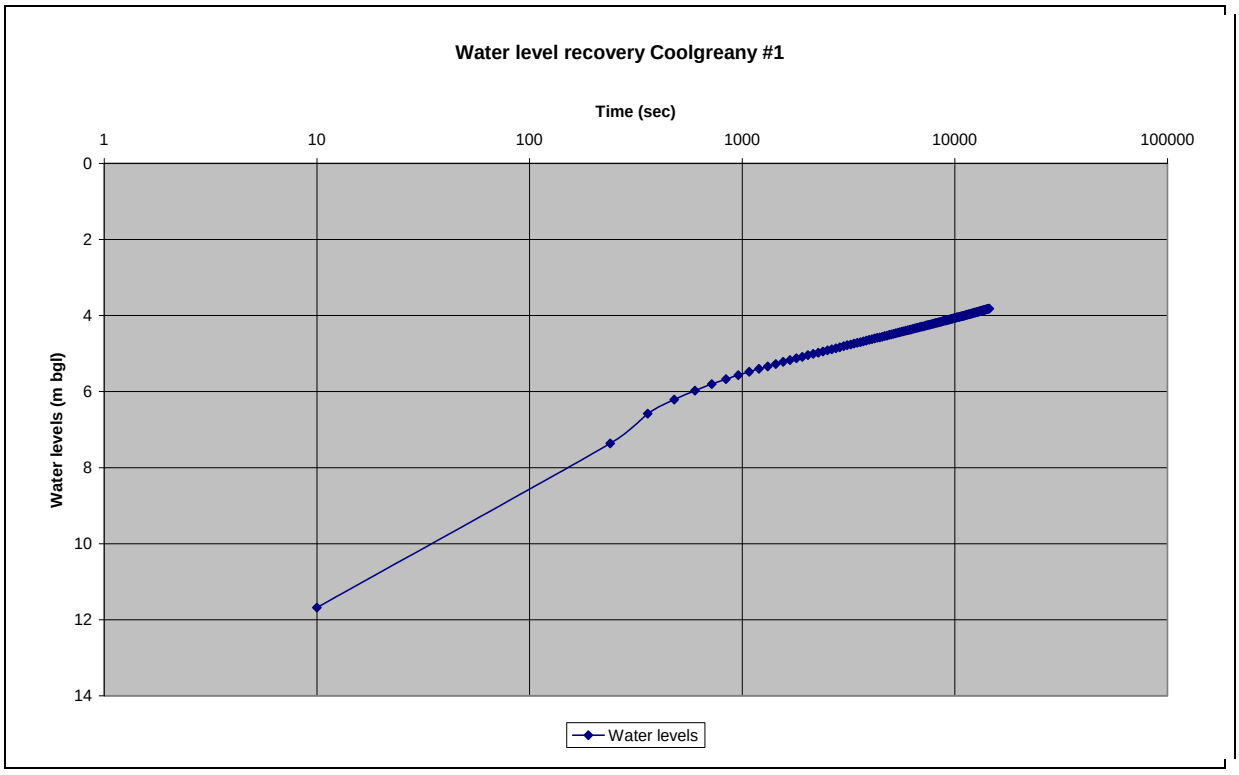

Figure 7 Water level recovery at Coolgreany #1 on 16/07/2010

9.3 Hydrochemistry and water quality

Conductivity, pH and DO are commonly used parameters with proven utility in investigations of groundwater–surface-water exchange (*e.g*. Fowler and Death, 2001). It is hypothesized that surface water contributes to the boreholes at Coolgreany PWS due to:

- The meandering of the Newtown River around Coolgreany PWS, which should mean a component of river flow goes to groundwater through the clean well sorted sands and gravel;
- The high induced groundwater gradients in Coolgreany #2 when it is pumping; and
- The presence of bedrock outcrops in the Newtown River approximately 40 m upgradient, which may also provide a pathway.

The situation around the borehole at field scale is illustrated in plan in Figure 7 below.

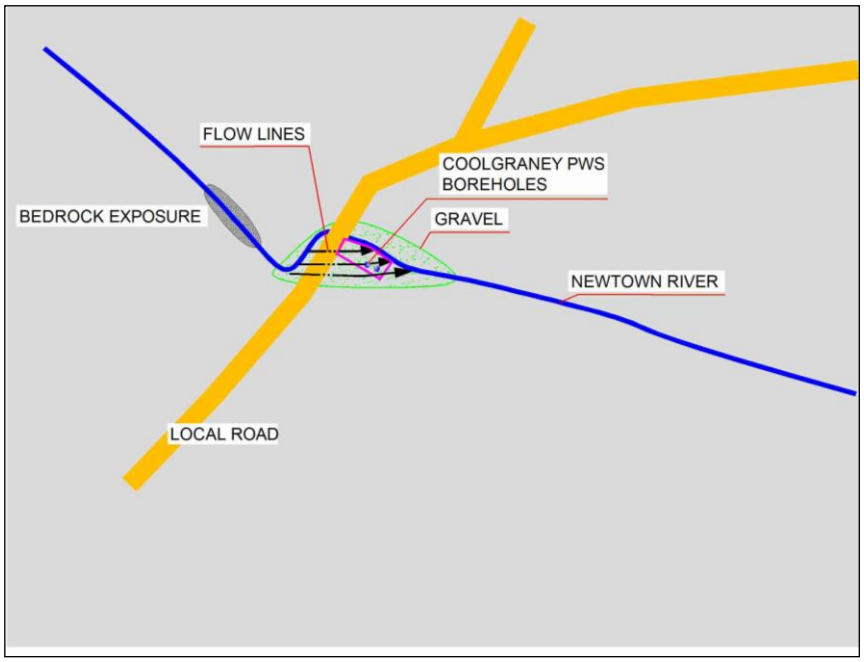

Figure 8 Site layout and potential surface water influence

Water quality monitoring was conducted on the 11/10/2010 to assess the potential connection between Coolgreany #2 and the Newtown River. It was undertaken following an overnight rest period and continued for approximately 7 hours of pumping. Results are included below in Table 9.1.

Table 9.2 Groundwater hydrochemistry monitoring data at Coolgreany PWS

Time	DO %	Conductivity µS/cm @ 25°C	pH pH units	Temperature °C	ORP pH mV	Notes
09:00	*88*	*111*	*6.63*	10.7	*-55*	*Newtown River @ Start of Monitoring period*
09:12						Coolgreany PWS Start of pumping from Coolgreany #2.
09:16	78.4	214	6.2	10.8	26	Coolgreany #2
09:30	79	192	6.2	10.8	27	Coolgreany #2
11:00	64	190	6.3	10.8	25	Coolgreany #2
12:00	71	189	6.5	10.8	5	Coolgreany #2
13:00	63.8	188	6.3	10.8	12	Coolgreany #2
14:00	70	188	6.4	10.8	1	Coolgreany #2
15:00	68	187.5	6.5	10.8	-12	Coolgreany #2
16:00	67	187.6	6.47	10.8	-5	Monitoring finish at Coolgreany #2
16:05	*87*	*114*	*6.7*	11.2	*3.3*	*Newtown River @ Finish of Monitoring period*

It can be seen from the table that the electrical conductivity of groundwater in Coolgreany #2 initially decreased from 214 µS/cm @ 25°C in response to groundwater abstraction, and appeared to stabilize at 187 µS/cm @ 25°C after 6 hours. The pH values, while variable, showed a general increase during the pumping period, with a move closer to the values for the Newtown River. This may indicate a potential connection with the Newtown River. Further monitoring during dry weather flow may provide greater certainty of the surface water contribution.

Thirty one samples were available from the EPA Groundwater and County Council Monitoring Network analyses between 1993 and 2009. The water quality is soft (65 to 103 mg/l $CaCO_3$). Alkalinity ranges from 23 to 90 mg/l $CaCO_3$. The pH ranges between 5.5 and 7.9, with an average of 6.6, which is slightly acidic. The electrical conductivity ranges from 238 to 550 µS/cm @ 25°C. The temperature ranges from 9°C to 13°C. The variation in the electrical conductivity, temperature and pH is indicative of a surface water influence at Coolgreany PWS. The hydrochemical signature of the groundwater is magnesium bicarbonate.
The concentration of nitrate ranges from 26.4 mg/l to 45.6 mg/l with a mean of 37.8 mg/l (as NO_3). Though there are no reported exceedances above the EU Drinking Water Directive maximum admissible concentration of nitrate of 50 mg/l NO_3, the groundwater Threshold Value (Groundwater Regulations S.I. No. 9 of 2010) of 37.5 mg/l NO_3 was exceeded between 1998 and 2006, and is close to the threshold generally. Decreasing nitrate levels at Coolgreany PWS since 2007 is probably directly due to above average rainfall and improved agriculture practices.

Intensive agriculture is practiced in the surrounding area. Therefore, the relatively high nitrate level at Coolgreany is probably due to the proximity of intensive agriculture practices. Ammonical nitrogen concentrations were low in all samples with no exceedance of the groundwater Threshold Value.

Chloride is a constituent of organic wastes, sewage discharge and artificial fertilisers, and levels higher than 24 mg l^{-1} (Groundwater Threshold Value, Groundwater Regulations S.I. No. 9 of 2010) may indicate contamination, with levels higher than 30 mg/l usually indicating significant contamination (Daly, 1996). Chloride concentrations range from 13.4 mg/l to 41.1 mg/l, with a mean of 21.3 mg/l which is considered to be above the mean natural background level of 18 mg/l (Baker *et al.,* 2007), but is below the threshold value. High levels of chloride were recorded on only one occasion (41.1 mg/l on 19/05/2009), and it is considered

that this may have been a contamination event; however coliforms were not detected in the 19/05/2009 sampling round. This, and the fluctuating, and generally high nitrate levels, suggests that contamination from organic wastes may be an issue at Coolgreany.

Elevated concentrations of faecal coliforms were detected in 7 of the 31 samples, with contamination on two occasions greater than 10 faecal coliforms per 100 ml. Elevated concentrations of total coliforms were detected in 11 of the 31 samples taken. Potential sources include agriculture and septic tank systems. No discernible relationship could be determined between rainfall data and faecal coliforms for 2009. The extreme and high groundwater vulnerability and land-use around the source indicates the likelihood of faecal contamination occurring.

The concentration of Sulphate, Potassium, Sodium, Magnesium and Calcium are within normal ranges. The Potassium: Sodium (K:Na) ratio is low at less than 0.2. This is possibly due to potassium adsorption in the subsoil matrix.

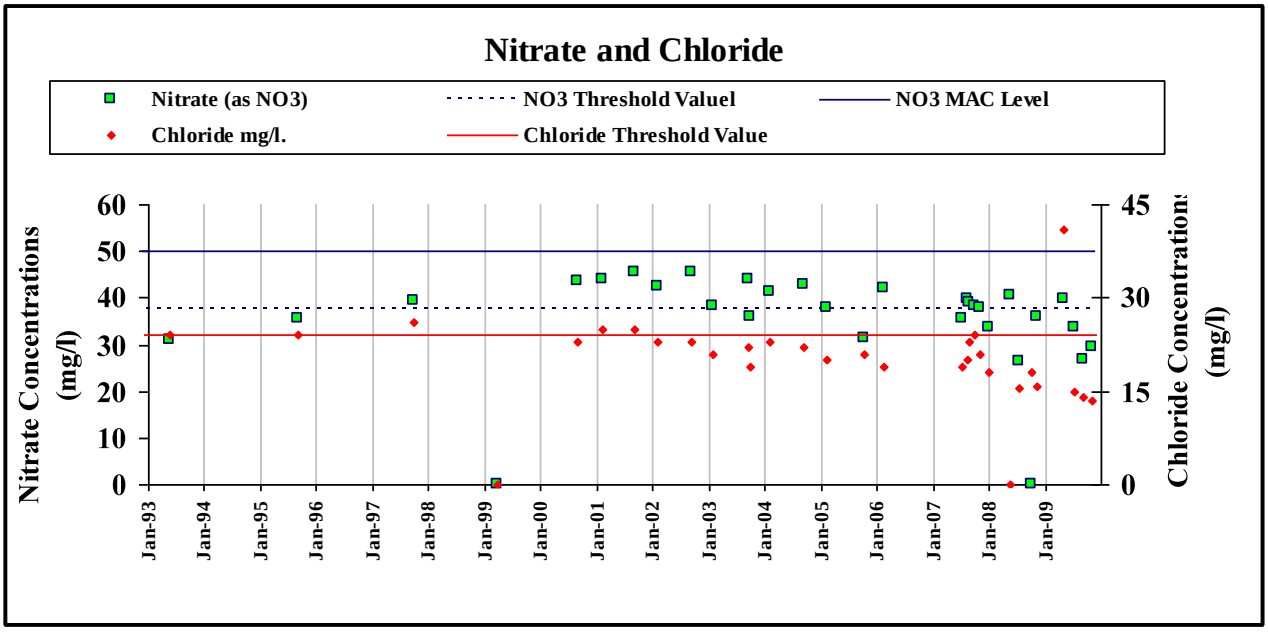

Figure 9 Nitrate and Chloride Concentrations at Coolgreany PWS

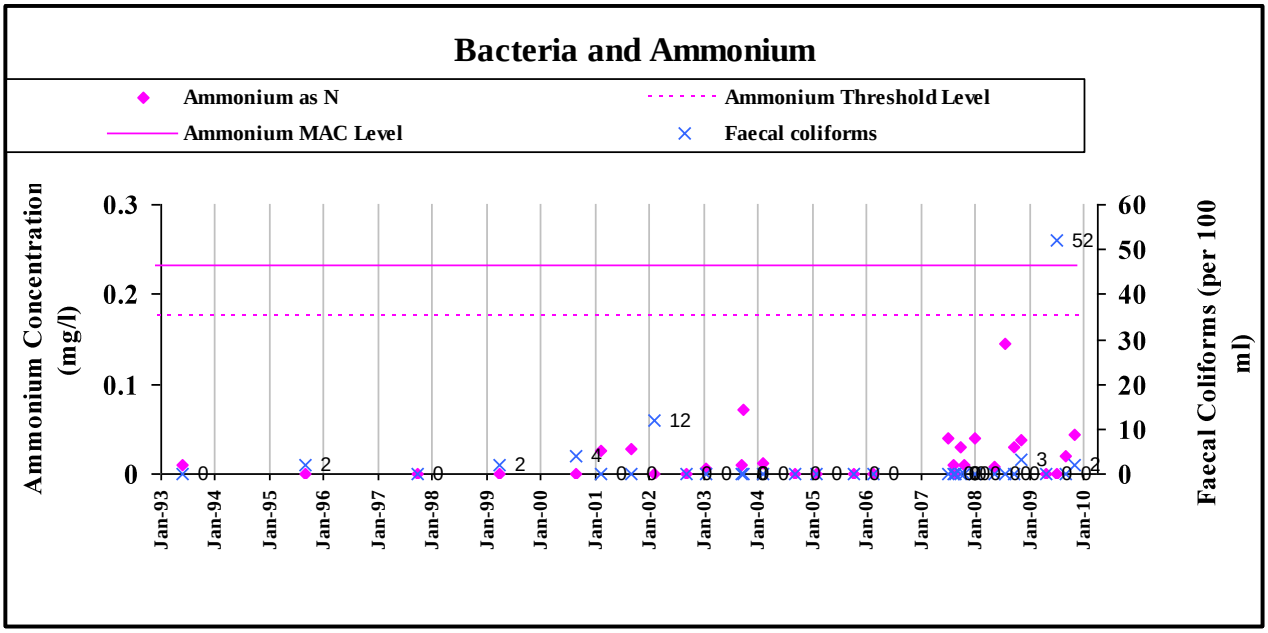

Figure 10 Ammonium and Faecal Coliform Concentrations at Coolgreany PWS

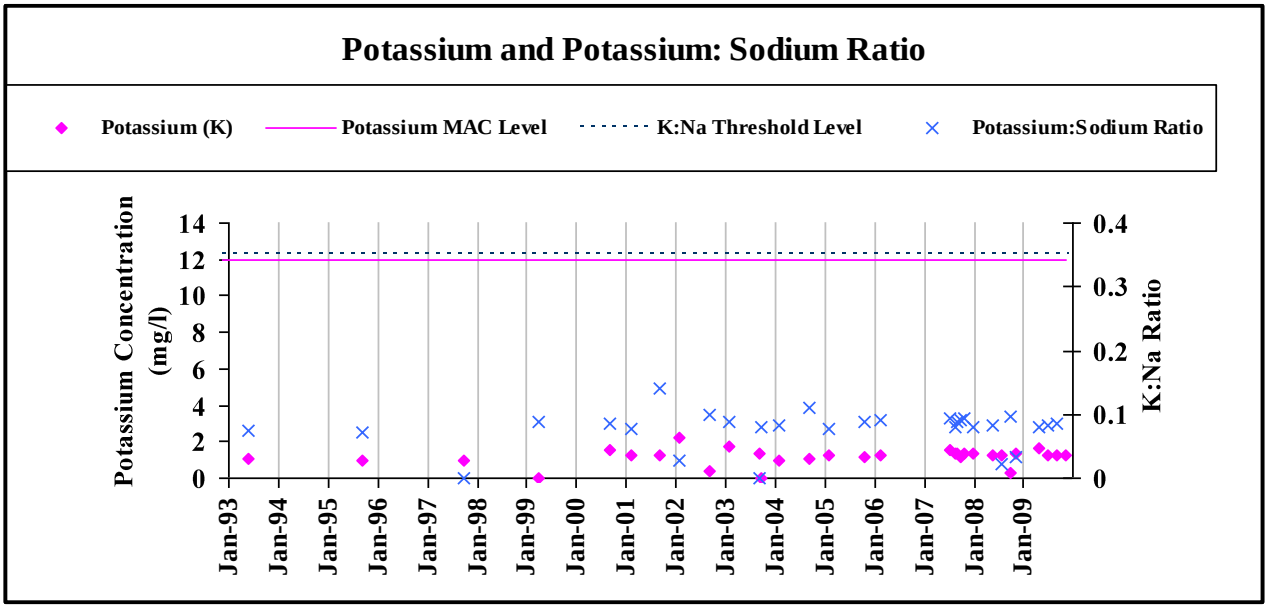

Figure 11 Potassium Concentrations and K:Na Ratio for Coolgreany PWS

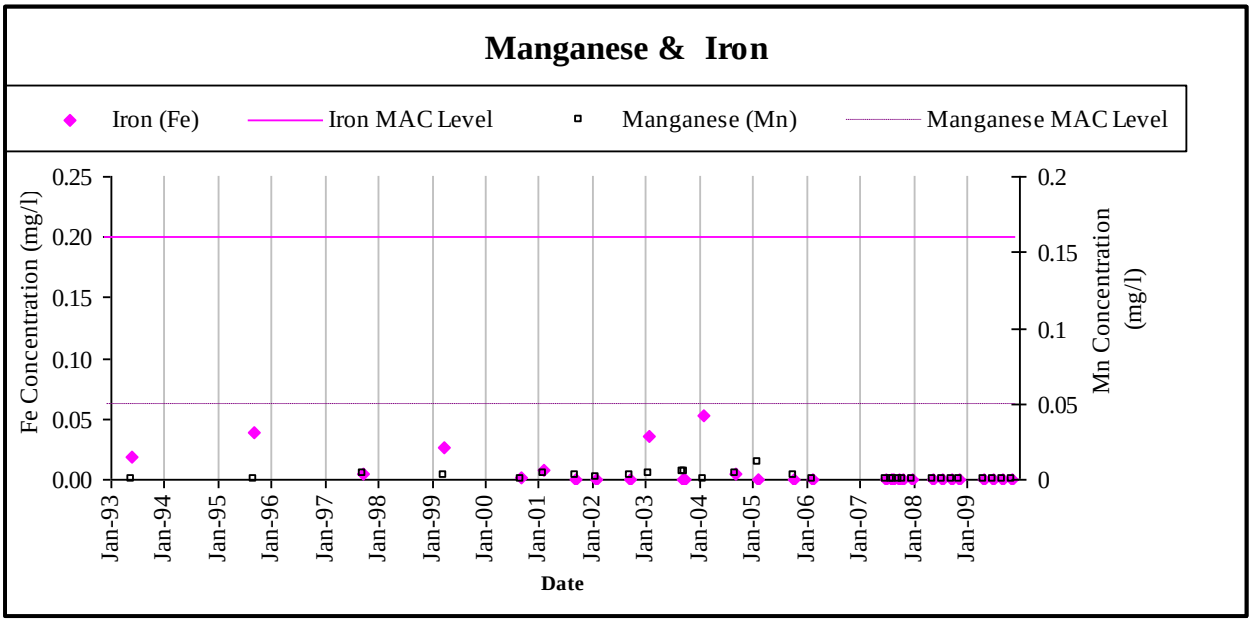

Figure 12 Iron and Manganese Concentrations at Coolgreany PWS

The concentrations of all other trace metals are below groundwater thresholds. The concentration of all organic compounds is below the detection limit of the laboratory.

In summary, bacteriological exceedances, occasionally elevated chloride and elevated nitrate concentrations suggest contamination from an organic waste source. Improvements in the nitrate and chloride concentrations are however evident since 2007. Given the land use in the area, the most likely source is unrestricted access to the stream, agriculture and/or untreated wastewater from unsewered systems. Unfettered access for animals to the Newtown River was clearly evident adjacent to the water treatment works and boreholes. Significant poaching was also evident upgradient on the Newtown River.

9.4 Aquifer characteristics

The GSI bedrock aquifer map of the area indicates that the Lower Palaeozoic Newtown Formation is classified as a Locally Important Aquifer which is moderately productive only in local zones (Ll). The aquifer is not considered to have any primary porosity with groundwater flow occurring predominantly through fractures, fissures and joints in the upper fractured and weathered zone. Aquifer storage is low based on the aquifer type, and groundwater flow paths can be dependent on faulting/fracturing. Groundwater flow is concentrated in the upper weathered/fissured 30 m however a number of mapped faults may increase hydraulic conductivity in the bedrock aquifer. Additionally the presence of fissured volcanics within the Newtown and Ballylane Formations is likely to increase groundwater flow paths within the bedrock. Evidence of faulting and fractures from the bedrock exposures along with groundwater flow within the felsic volcanics is likely to increase groundwater flow within the aquifer.

The yield of the Coolgreany boreholes is ‘excellent’ according to GSI classification and the productivity is Class II. A pumping test was completed in Coolgreany #1 and #2 over a 72 hour period in December 1984 with records included in Appendix I.

Drawdown during the December 1984 pumping test in Coolgreany #1 was approximately 22 m with a pumping rate of 606 m^3/day. Drawdown in Coolgreany #2 was approximately 43 m with a pumping rate of 1366 m^3/day. Based on data from the 1984 pumping test, the specific capacities of Coolgreany #1 and #2

are 27.5 m^3/day/m and 32 m^3/day/m respectively. The apparent transmissivity, using the Logan Method of Approximation (Misstear, 1998) indicates that the transmissivity is approximately 34 m^2/d, based on the specific capacity of 27.5 m^2/d.

Based on the estimated bedrock aquifer transmissivity and the aquifer hydraulic gradients, the groundwater flow velocity can be estimated based on the equation:

$$v = \frac{T \cdot i}{b \cdot n_e}$$

where:

v = average groundwater velocity (m/day);
T = Aquifer Transmissivity (m^2/day);
n_e = effective porosity (dimensionless)
i = hydraulic gradient; and,
b = aquifer thickness.

The groundwater velocity is in the order of 0.8 m/day based on a thickness of 50 m, a groundwater gradient of 0.02 and effective porosity is assumed to be in the order of 1%.

The overlying sand and gravel subsoil is considered to provide a groundwater contribution to Coolgreany borehole. The sand and gravel is thought to be hydraulically connected to the underlying bedrock and adjacent river. While the overlying sand and gravel deposits provide additional storage to the underlying bedrock, the sand and gravel deposits do not constitute an aquifer due to the limited aerial extent. While a length of casing was placed into the top of the borehole, it is unlikely that all inflows from the sand and gravels were effectively sealed off as the borehole was not grouted.

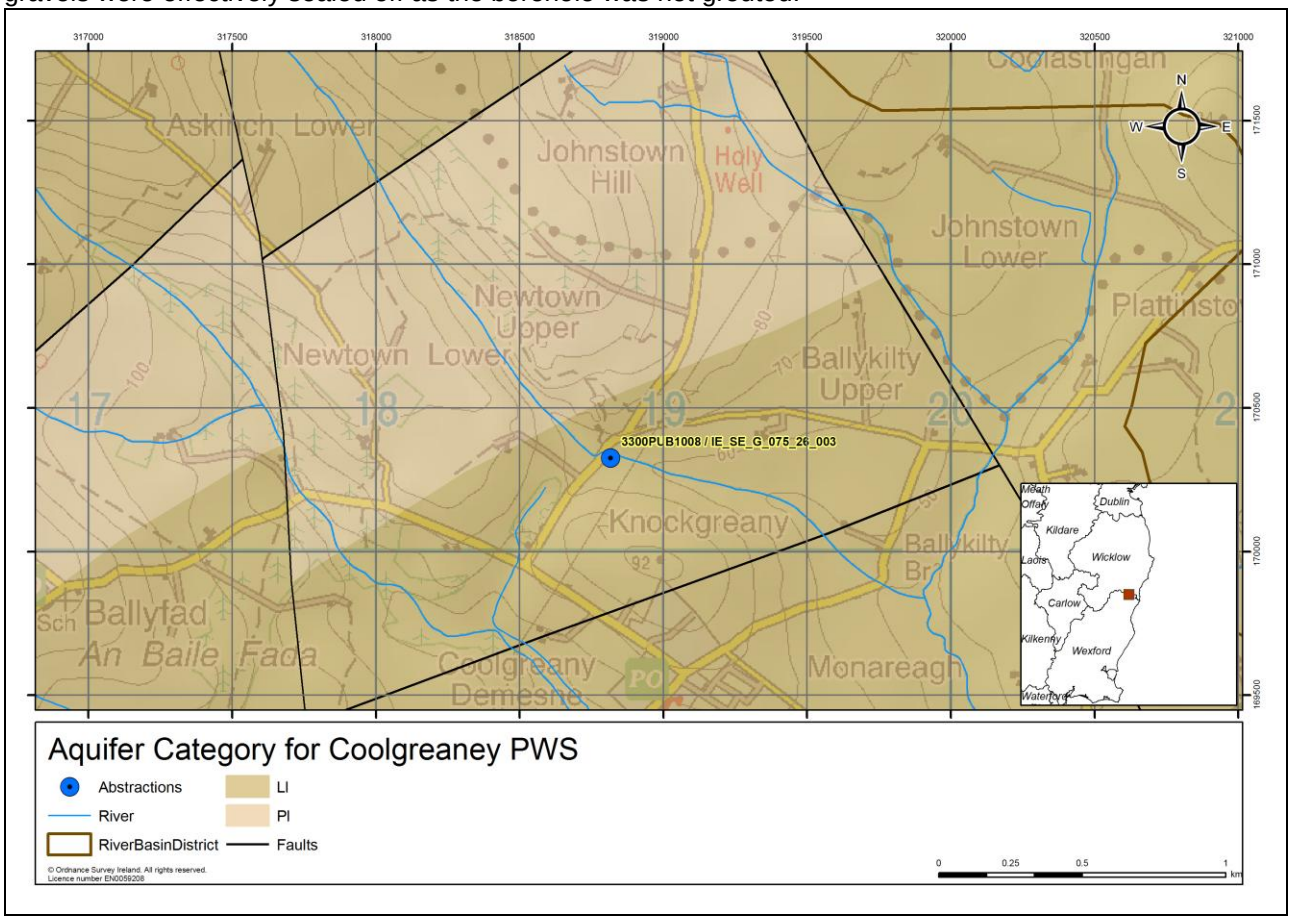

Figure 13 Aquifer Map in the vicinity of Coolgreany PWS

10 Zone of Contribution

The Zone of Contribution (ZOC) is the complete hydrologic catchment area to the source, or the area required to support an abstraction from long-term recharge. The size and shape of the ZOC is controlled primarily by (a) the total discharge, (b) the groundwater flow direction and gradient, (c) the subsoil and rock permeability and (d) the recharge in the area. This section describes the conceptual model of how groundwater flows to the source, including uncertainties and limitations in the boundaries, and the recharge and water balance calculations which support the hydrogeological mapping techniques used to delineate the ZOC. The presence of fractures, fissures and felsic volcanics are likely to increase groundwater flow in the relatively unproductive bedrock. As a detailed borehole log is not available, some uncertainty exists as to the presence of such features at the Coolgreany boreholes. Additional some uncertainty exists in relation to potential inflows from the overlying sand and gravels as the borehole is not grouted.

10.1 Conceptual model

The current understanding of the geological and hydrogeological setting at Coolgreany is given as follows:

Groundwater flow to the borehole is from the upgradient area, to the south and west of the source. The bedrock aquifer is classified as a Locally important aquifer which is moderately productive only in local zones (Ll). Additionally groundwater inflows via the interface between the sands and gravels/upper weathered bedrock are likely as the borehole was not effectively sealed by grouting. The aquifer is unconfined, the depth to bedrock is shallow and the subsoils are classified as being of ‘high’ to ‘moderate’ permeability.

Groundwater recharges rapidly through the sand and gravel and relatively shallow till overburden and through the upper zones of the underlying bedrock, towards the borehole. The extreme to high vulnerability is reflected in the water quality results which show the presence of faecal bacteria and high nitrate in the untreated water.

The Newtown River is thought to be in hydraulic connectivity with the source. Groundwater levels during pumping in the boreholes are between 3 m and 30 m below the bed of Newtown River. The potential groundwater pathway is through the permeable sand and gravel deposits and the bedrock.

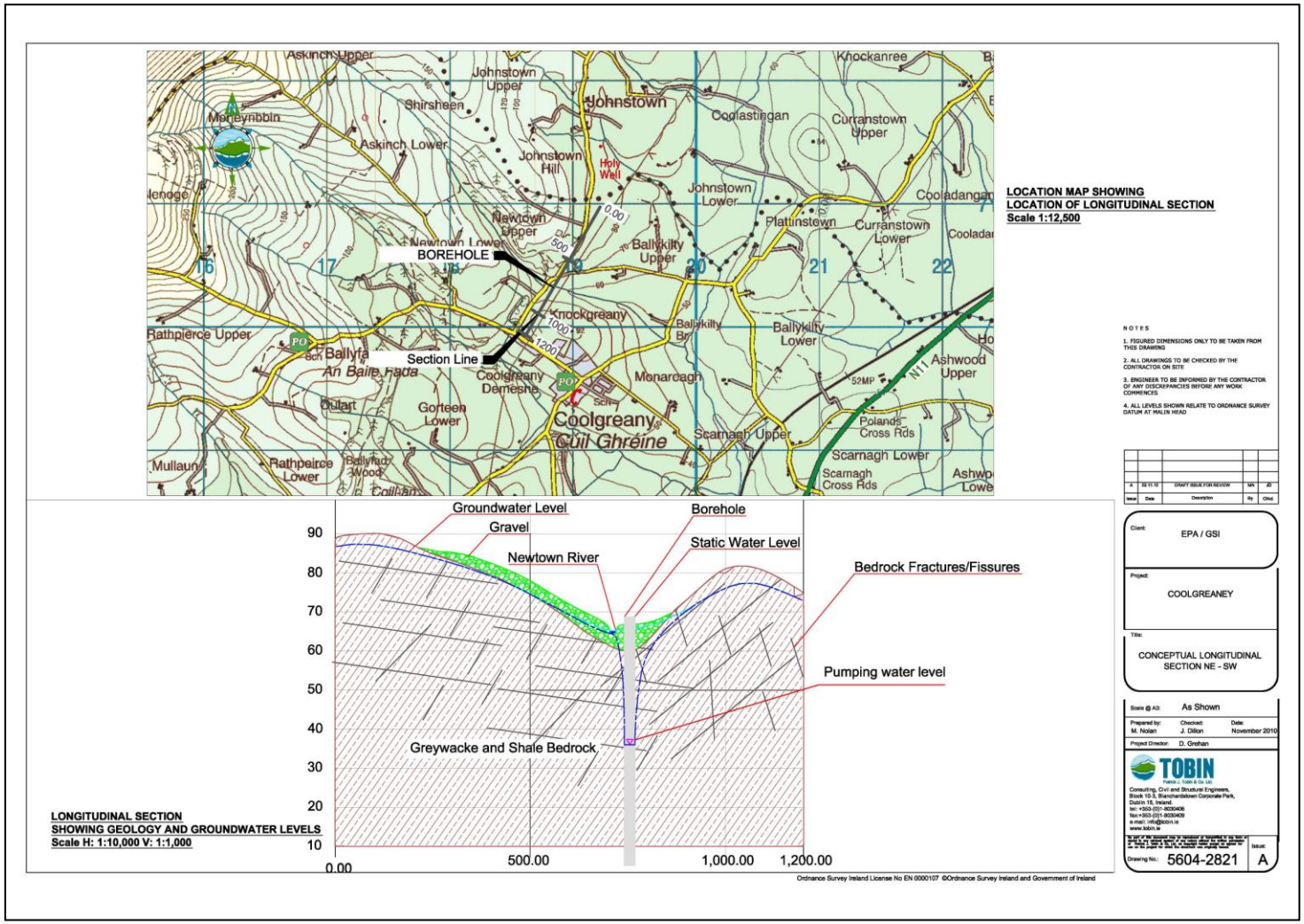

Figure 14 Conceptual cross section through Coolgreany PWS

10.2 Boundaries of the ZOC

The boundaries of the area contributing to the source are considered to be as follows (Figure 14):

The **South and Southwestern Boundary** is based on the topographical high to the south. It is assumed that a groundwater divide corresponds with the topographical high and groundwater flows from the topographical high toward the source. It is unlikely that the ZOC would extend past the topographical high.

The **Northeast and eastern Boundary** extends beyond the Newtown River to a topographical high. The Newtown River, is located 14 m to the north of the boreholes, however a significant head difference is present between Coolgreany #2 and the Newtown River. As the boreholes are completed in the bedrock aquifer, it is possible that water could be drawn from the opposite side of the river, especially if the river were to dry up during the summer months. The eastern boundary is based on assumed groundwater flow directions and the topography of the site to the east of Coolgreany #2. The eastern boundary extends 150 m to the east of the source.

The **North Western Boundary** is based on a water balance exercise. While the bedrock to the west of the source is a poor aquifer, shallow groundwater flow can potential flow to the borehole within the upper weathered bedrock zone and potential fractures/fissures in the bedrock.

A surface water contribution from the Newtown River is assumed based on: the proximity to the Newtown River; highly permeable groundwater pathways; hydrochemistry and the high induced groundwater gradients.

10.3 Recharge and water balance

The term ‘recharge’ refers to the amount of water replenishing the groundwater flow system. The recharge rate is generally estimated on an annual basis, and assumed to consist of input (*i.e*. annual rainfall) less water loss prior to entry into the groundwater system (*i.e*. annual evapotranspiration and runoff). The estimation of a realistic recharge rate is critical in source protection delineation, as it will dictate the size of the zone of contribution to the source (*i.e*. the outer Source Protection Area).

At Coolgreany, the main parameters involved in the estimation of recharge are: annual rainfall; annual evapotranspiration; and a recharge coefficient.

The ***potential recharge*** is equivalent to 546 mm/year *i.e*. Annual Effective Rainfall as outlined in Section 6)
A recharge cap is applied to the Coolgreany PWS where shallow till deposits overlie bedrock. The ***Recharge Cap*** is 200 mm/yr as the Newtown Formation is classified as a Locally important aquifer which is moderately productive only for local zones (Ll). Applying the aquifer cap to moderately productive aquifers (Groundwater Working Group, 2005), the recharge is estimated to be 200 mm/yr.

Where sand and gravel deposits overlie bedrock a recharge cap does not apply. Recharge via the sand and gravels are likely as the borehole was not effective sealed by grouting. Recharge from the sand and gravels area is assumed to be 80% of potential recharge. This value is based on an assumption of *c*. 80% recharge for 20% of the area with high vulnerability, high permeability subsoils and soils) (Guidance Document GW5, Groundwater Working Group 2005).

The ***bulk recharge coefficient*** for the area is therefore estimated to be 42%.

Runoff losses **are** estimated as ***317*** mm. Runoff losses are assumed to be 58% of potential recharge. These calculations are summarised as follows:

Average annual rainfall (R)	996 mm
Estimated P.E.	500 mm
Estimated A.E. (95% of P.E.)	450 mm
Effective rainfall	546 mm
Annual potential recharge	546 mm
Annual run off losses	58%
Bulk recharge coefficient	42%
Recharge	**229 mm**

11 Source protection zones

The Source Protection Zones are a land use planning tool which enables an objective, geoscientific assessment of the risk to groundwater to be made. The zones are based on an amalgamation of the source protection areas and the aquifer vulnerability. The zones are delineated based on the conceptualisation of the groundwater pattern, as described in Section 10.1 Conceptual Model and presented in Figure 14. The source protection areas represent the horizontal groundwater pathway to the source, while the vulnerability reflects the vertical pathway.

Two source areas are delineated:

- Inner Protection Area (SI), designed to give protection from microbial pollution.
- Outer Protection Area (SO), encompassing the zone of contribution to the source.

The Inner Protection Area (SI) is designed to protect the source from microbial and viral contamination and it is based on the 100-day time of travel to the supply (DELG/EPA/GSI, 1999). Based on the indicative aquifer parameters presented in section 9.4, the groundwater velocity is 0.8 m/d, and hence the 100-day time of travel distance is 80 m.

The Outer Protection Area (SO) encompasses the entire zone of contribution to the source.

Water balance: Based on an abstraction of 460 m^3/day on average and the estimated recharge of 229 mm/year, a zone of contribution of 0.73 km^2 in area is calculated. Thus 0.73 km^2 is required for Coolgreany PWS. The ZOC is based on topography and the conceptual model indicates that an area of 0.74 km^2 is available. Based on site data there is also a strong possibility that stream comprises a large contribution of groundwater flow to the ZOC.

The ZOC described above is 0.74 km^2. The surface water stream is also thought to contribute to the borehole.

The groundwater Source Protection Zones are shown in Figure 15 and are listed in Table 11-1. They include SI/E and SI/H, although the large majority of the ZOC is designated as SO/H and SO/E.

Source protection zones are shown in Figure 15, and are based on an overlay of the source protection areas on the groundwater vulnerability. Therefore the groundwater protection zones are SI/H, SO/H SO/E and SO/X. The majority of the area is designated SO/H.

Table 11.3 Source Protection Zones

Source Protection Zone	% of total area (0.74 km^2)
SI/E	0.2%
SI/H	2.53%
SO/X - Extreme rock close	31.06%
SO/Extreme	37.21%
SO/High	28.9%

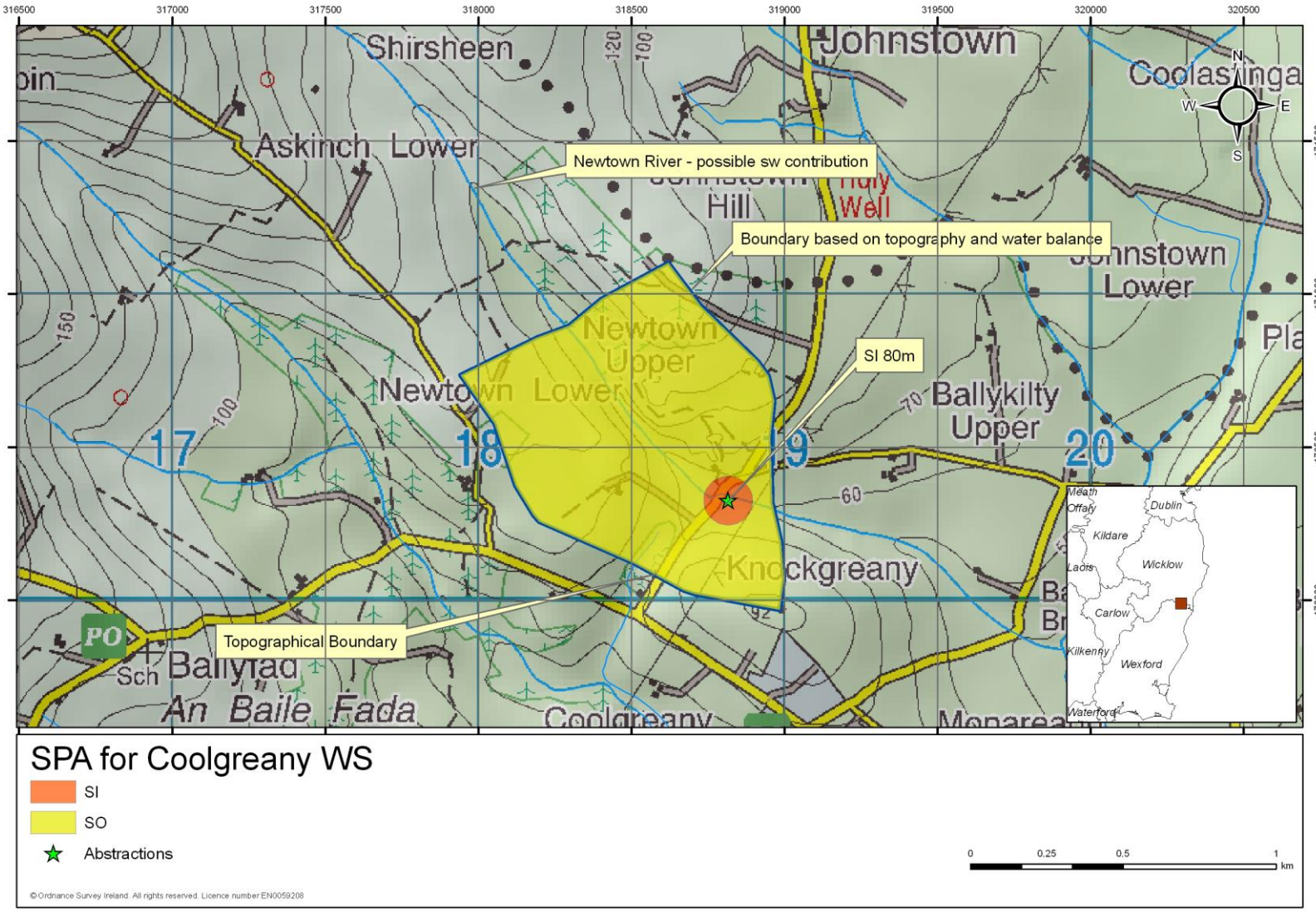

Figure 15 Source Protection Areas for Coolgreany PWS

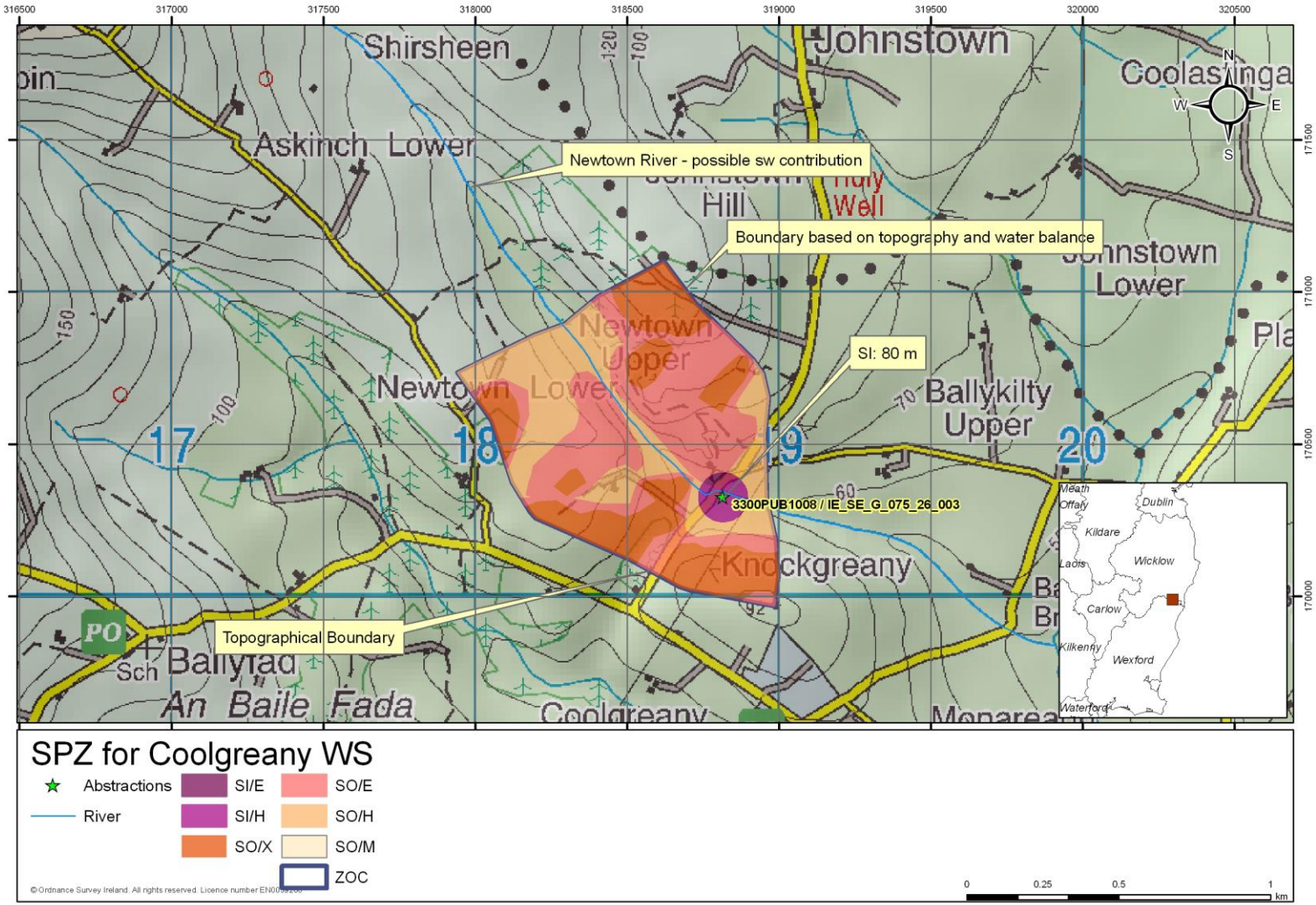

Figure 16 Source Protection Zones for Coolgreany PWS

12 Potential pollution sources

Coolgreany borehole PWS is capped and housing is secured. The inner protection area is '**highly**' vulnerable to contamination. Land use in this area is mainly set to grazing cattle and tillage. The majority of land within the ZOC is agricultural land, primarily grassland and there are a number of farming operations present. The main potential contaminants from these sources are ammonia, nitrates, phosphates, chloride, potassium, BOD, COD, TOC, pesticides, faecal bacteria, viruses and cryptosporidium. Cattle access is unrestricted upgradient and adjacent to the Newtown River. The main potential contaminants from cattle are ammonia, nitrates, phosphates, chloride, potassium, faecal bacteria, viruses and cryptosporidium.

A very limited number of private residences (2 houses) are located within the ZOC. Private residences within the ZOC are serviced by septic tank systems or mechanical aeration systems discharging to soakholes or percolation areas. The main potential contaminants from this source are ammonia, nitrates, phosphates, chloride, potassium, BOD, COD, TOC, faecal bacteria, viruses and cryptosporidium. As well as this, there are some private home heating fuel tanks located within the catchment area. A number of quarries are present to the west of the source. The main potential contaminants from these sources are hydrocarbons. There is currently no evidence of any contamination from hydrocarbons at the source.

Finally, there is only a small length of road present in the ZOC and the traffic density is low and the risk of contamination is low from this source.

13 Conclusions

The borehole is a high yielding borehole that abstracts from the bedrock aquifer and from the overlying sand and gravel deposits and the adjacent stream. The bedrock is overlain by approximately 7 m of sand and gravels. Groundwater is thought to infiltrate slowly through the subsoils towards the borehole with a contribution from the moderately productive bedrock aquifer.

The untreated groundwater is currently of good microbial quality, but there are some water quality issues with faecal coliforms, nitrates and chloride. These problems are related to the reducing conditions naturally prevalent in the sands and gravels. The Outer Source Protection Area or the Zone of Contribution is calculated to extend to 0.74 km^2.

The Inner Source Protection Area or the 100-day horizontal travel time is calculated to extend 38 m from the abstraction source.

14 Recommendations

Monitoring water levels during the operation of the scheme should be continued to develop a real-time database of hydrogeological information. Monitoring of dry weather flow in the Newtown River may provide conclusive evidence of a surface water influence.

The source site is the area immediately around the groundwater abstraction borehole. Protection in this area is paramount to ensure that direct intentional or accidental interference is not caused to the borehole. The protection of the source site involves prevention of access and prevention of activities in the immediate proximity of the abstraction boreholes.

A cordon around the source is recommended in order to ensure that potentially polluting materials are not stored or deposited in the immediate vicinity of the source. Secure, anti-intrusion fencing is currently erected around the source site, which acts to protect the integrity of the borehole headwork's and ancillary infrastructure.

15 References

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Teagasc, 2006a. Subsoil map of County Wexford. Map produced as part of the EPA Soil and Subsoil Mapping Project, Teagasc, Kinsealy.

Teagasc, 2006b. Soil map of County Wexford. Map produced as part of the EPA Soil and Subsoil Mapping Project, Teagasc, Kinsealy.

APPENDIX 1

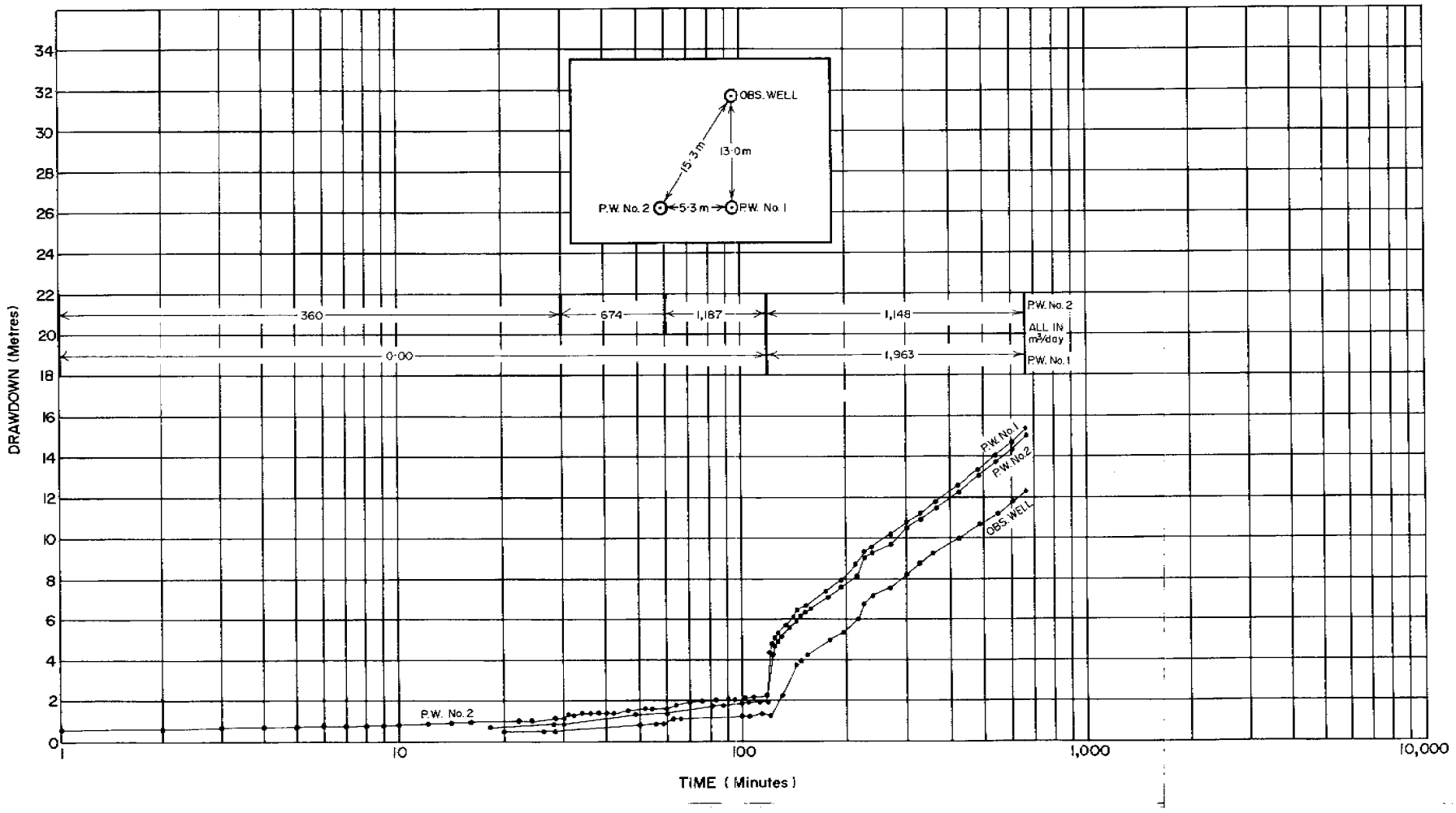
Borehole Log and Pumping test

PRELIMINARY REPORT
PUMPING TEST DATA
FROM CLOGH & COOLGRANEY
IN
CO. WEXFORD

Client: WEXFORD CO. COUNCIL
Location: CLOGH
County: WEXFORD

Pumping Well: No. 1 & 2
Observation Well: OBS. WELL
Date: 18th MAY '87

Pumping Rate: _____ m^3/day.
Static Water Level: _____ m.
Final Water Level: _____ m.



Time-Drawdown Data From Pumping Test at Clogh, Co. Wexford.

FIGURE No.

K.T. CULLEN

PUMPING TEST DATA

CLIENT: WEXFORD COUNTY COUNCIL

LOCATION: COOLGRANEY #1

COUNTY: WEXFORD

WELL TYPE: PUMPING WELL

TEST TYPE: YIELD DRAWDOWN TEST

WEATHER: DRY

DEPTH: METRES

RADIUS: 100 (M.M.)

PUMP INTAKE AT: METRES

PERIOD FROM: 18/06/86

TO: 23/06/86

PUMPING RATE: 620 M^3/DAY

S.W.L. BELOW MEASURING POINT: 10 (M).

FINAL WATER LEVEL: 15.4 METRES

TEST CONDUCTED BY: S. KELLY

HEIGHT ABOVE G.L.: 0.00 METRES

DIST. TO OUTFALL: METRES

PUMP TYPE: SUB

YIELD DRAWDOWN DATA FOR TEST ON WELL NO.1 AT COOLGRANEY CO. WEXFORD.

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/D/
0.0	10.00	0.00	0
0.5	10.00	0.00	
41.0	11.78	1.78	
60.0	11.80	1.80	
75.0	11.81	1.81	
90.0	11.80	1.80	
105.0	11.80	1.80	
120.0	11.80	1.80	
150.0	11.78	1.78	
180.0	11.78	1.78	
315.0	22.50	12.50	886
375.0	26.65	16.65	
435.0	27.75	17.75	
495.0	28.15	18.15	
555.0	28.60	18.60	
615.0	29.36	19.36	
675.0	30.50	20.50	
735.0	31.00	21.00	
795.0	31.57	21.57	
855.0	32.13	22.13	
915.0	32.09	22.09	604
1010.0	32.05	22.05	
1095.0	32.28	22.28	
1155.0	32.41	22.41	
1215.0	32.36	22.36	
1275.0	32.31	22.31	
1335.0	32.30	22.30	
1395.0	32.33	22.33	
1455.0	32.78	22.78	
1515.0	33.04	23.04	
1575.0	33.10	23.10	
1695.0	32.95	22.95	620
1755.0	33.20	23.20	
1875.0	33.30	23.30	
1935.0	33.45	23.45	
2055.0	32.50	22.50	
2115.0	32.85	22.85	
2175.0	32.72	22.72	
2355.0	32.50	22.50	
2535.0	32.45	22.45	604
2715.0	32.50	22.50	
2835.0	31.80	21.80	
2895.0	31.45	21.45	
3075.0	31.74	21.74	
3255.0	31.96	21.96	638
3375.0	31.88	21.88	
3495.0	32.28	22.28	
3675.0	32.22	22.22	
3915.0	32.40	22.40	613
4155.0	32.45	22.45	
4275.0	32.42	22.42	
4395.0	32.65	22.65	
4575.0	32.68	22.68	0
4765.0	20.40	10.40	
4815.0	19.00	9.00	
4845.0	18.50	8.50	
4875.0	18.03	8.03	
4890.0	18.10	8.10	
4905.0	17.83	7.83	
4920.0	17.90	7.90	
4935.0	17.75	7.75	
5040.0	17.21	7.21	
5085.0	17.08	7.08	
5115.0	16.89	6.89	
5145.0	16.88	6.88	
5175.0	16.80	6.80	
5295.0	16.63	6.63	
5415.0	16.27	6.27	
5565.0	16.14	6.14	
5655.0	16.05	6.05	

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/DA
5775.0	16.00	6.00	
5835.0	15.95	5.95	
6015.0	15.95	5.95	
6075.0	16.00	6.00	
6195.0	15.65	5.65	
6315.0	15.70	5.70	
6435.0	15.65	5.65	
6495.0	15.55	5.55	
6600.0	15.55	5.55	
7035.0	15.50	5.50	
7155.0	15.60	5.60	
7275.0	15.40	5.40	
7395.0	15.45	5.45	

PUMPING TEST DATA

CLIENT: WEXFORD COUNTY COUNCIL

LOCATION: COOLGRANEY #2

COUNTY: WEXFORD

WELL TYPE: PUMPING WELL

TEST TYPE: YIELD DRAWDOWN TEST

WEATHER: DRY

DEPTH: METRES

RADIUS: 100 (M.M.)

PUMP INTAKE AT: METRES

PERIOD FROM: 18/06/86

TO: 23/06/86

PUMPING RATE: 900 M^3/DAY

S.W.L. BELOW MEASURING POINT: 10 (M).

FINAL WATER LEVEL: 34.80 METRES

TEST CONDUCTED BY: S. KELLY

HEIGHT ABOVE G.L.: 0.00 METRES

DIST. TO OUTFALL: METRES

PUMP TYPE: SUB

YIELD DRAWDOWN DATA FOR TEST ON WELL NO.2 AT COOLGRANEY CO. WEXFORD.

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/D/
0.0	10.00	0.00	1153
0.1	11.22	1.22	
0.5	12.25	2.25	
1.0	24.32	14.32	
1.5	26.29	16.29	
2.0	27.65	17.65	
2.5	28.54	18.54	
4.0	31.10	21.10	
4.5	31.50	21.50	
5.0	31.89	21.89	
6.0	32.38	22.38	
7.0	32.74	22.74	
8.0	33.00	23.00	
9.0	33.24	23.24	
10.0	33.45	23.45	
12.0	33.54	23.54	
14.0	33.66	23.66	
16.0	33.81	23.81	
18.0	33.88	23.88	
20.0	33.92	23.92	
22.0	33.93	23.93	
24.0	34.30	24.30	
41.0	34.40	24.40	1246
55.0	34.55	24.55	
60.0	34.60	24.60	
75.0	34.86	24.86	
90.0	34.90	24.90	
105.0	35.04	25.04	
120.0	35.20	25.20	
150.0	35.15	25.15	
180.0	35.18	25.18	
315.0	34.40	24.40	893
2895.0	34.55	24.55	916
3075.0	34.52	24.52	
3255.0	34.56	24.56	720
3375.0	34.00	24.00	
3495.0	34.27	24.27	
3675.0	34.18	24.18	
3915.0	34.40	24.40	
4155.0	34.54	24.54	
4275.0	34.52	24.52	
4395.0	34.60	24.60	
4575.0	34.78	24.78	
4755.0	34.90	24.90	842
4760.0	37.60	27.60	
4765.0	36.80	26.80	
4790.0	36.40	26.40	
4815.0	33.40	23.40	
4845.0	34.45	24.45	
4875.0	33.83	23.83	
4890.0	36.83	26.83	
4905.0	35.00	25.00	
4920.0	34.70	24.70	
4935.0	35.00	25.00	
5040.0	34.50	24.50	
5085.0	35.48	25.48	
5115.0	35.10	25.10	
5145.0	35.12	25.12	
5175.0	35.05	25.05	
5295.0	34.51	24.51	
5415.0	34.07	24.07	
5565.0	35.03	25.03	
5685.0	34.65	24.65	
5775.0	35.10	25.10	
5835.0	35.10	25.10	930
6015.0	35.10	25.10	
6075.0	35.00	25.00	
6195.0	35.03	25.03	
6315.0	34.70	24.70	
6435.0	34.45	24.45	

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/D/
6495.0	35.10	25.10	
6600.0	35.10	25.10	
6645.0	35.07	25.07	
6765.0	35.03	25.03	
7035.0	34.85	24.85	
7155.0	34.90	24.90	
7275.0	34.90	24.90	
7395.0	34.95	24.95	

PUMPING TEST DATA

CLIENT: WEXFORD COUNTY COUNCIL

LOCATION: COOLGRANEY OBS

COUNTY: WEXFORD

WELL TYPE: OBSERVATION WELL

TEST TYPE: TIME DRAWDOWN TEST

WEATHER: DRY

DEPTH: METRES

RADIUS: 100 (M.M.)

PERIOD FROM: 18/06/86

TO: 23/06/86

PUMPING RATE: 0 M^3/DAY

S.W.L. BELOW MEASURING POINT: 10 (M).

FINAL WATER LEVEL: 19.82 METRES

TEST CONDUCTED BY: S. KELLY

HEIGHT ABOVE G.L.: 0.00 METRES

DIST. FROM PUMPING WELL: (6) METRES

DRAWDOWN DATA FOR OBSERVATION WELL DURING TEST AT COOLGRANEY CO. WEXFORD.

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/D/
0.0	10.00	0.00	0
41.0	14.03	4.03	
60.0	14.09	4.09	
75.0	14.10	4.10	
90.0	14.13	4.13	
105.0	14.18	4.18	
120.0	14.22	4.22	
150.0	14.23	4.23	
180.0	14.28	4.28	
315.0	16.10	6.10	
375.0	18.05	8.05	
435.0	18.65	8.65	
495.0	19.18	9.18	
555.0	19.51	9.51	
615.0	19.84	9.84	
675.0	20.15	10.15	
735.0	20.40	10.40	
795.0	20.66	10.66	
855.0	20.87	10.87	
915.0	21.10	11.10	
1010.0	21.45	11.45	
1095.0	21.69	11.69	
1155.0	21.81	11.81	
1215.0	21.95	11.95	
1275.0	22.08	12.08	
1335.0	22.20	12.20	
1395.0	22.33	12.33	
1455.0	22.40	12.40	
1515.0	22.50	12.50	
1575.0	22.60	12.60	
1695.0	22.75	12.75	
1755.0	22.83	12.83	
1875.0	22.98	12.98	
1935.0	23.04	13.03	
2055.0	23.15	13.15	
2115.0	23.20	13.20	
2175.0	23.22	13.22	
2355.0	23.34	13.34	
2535.0	23.45	13.45	
2715.0	23.55	13.55	
2835.0	22.80	12.80	
2895.0	22.54	12.54	
3075.0	22.52	12.52	
3255.0	22.57	12.57	
3375.0	22.43	12.43	
3495.0	22.54	12.54	
3675.0	22.56	12.56	
3915.0	22.62	12.62	
4155.0	22.70	12.70	
4275.0	22.83	12.83	
4395.0	22.90	12.90	
4575.0	23.02	13.02	
4815.0	22.25	12.25	
4845.0	22.22	12.22	
4875.0	22.03	12.03	
4890.0	22.35	12.35	
4905.0	22.03	12.03	
4920.0	21.90	11.90	
4935.0	21.85	11.85	
5040.0	21.35	11.35	
5085.0	21.42	11.42	
5115.0	21.45	11.45	
5145.0	21.41	11.41	
5175.0	21.10	11.10	
5295.0	20.59	10.59	
5415.0	20.21	10.21	
5565.0	20.37	10.37	
5655.0	20.22	10.22	
5775.0	20.25	10.25	
5835.0	20.20	10.20	

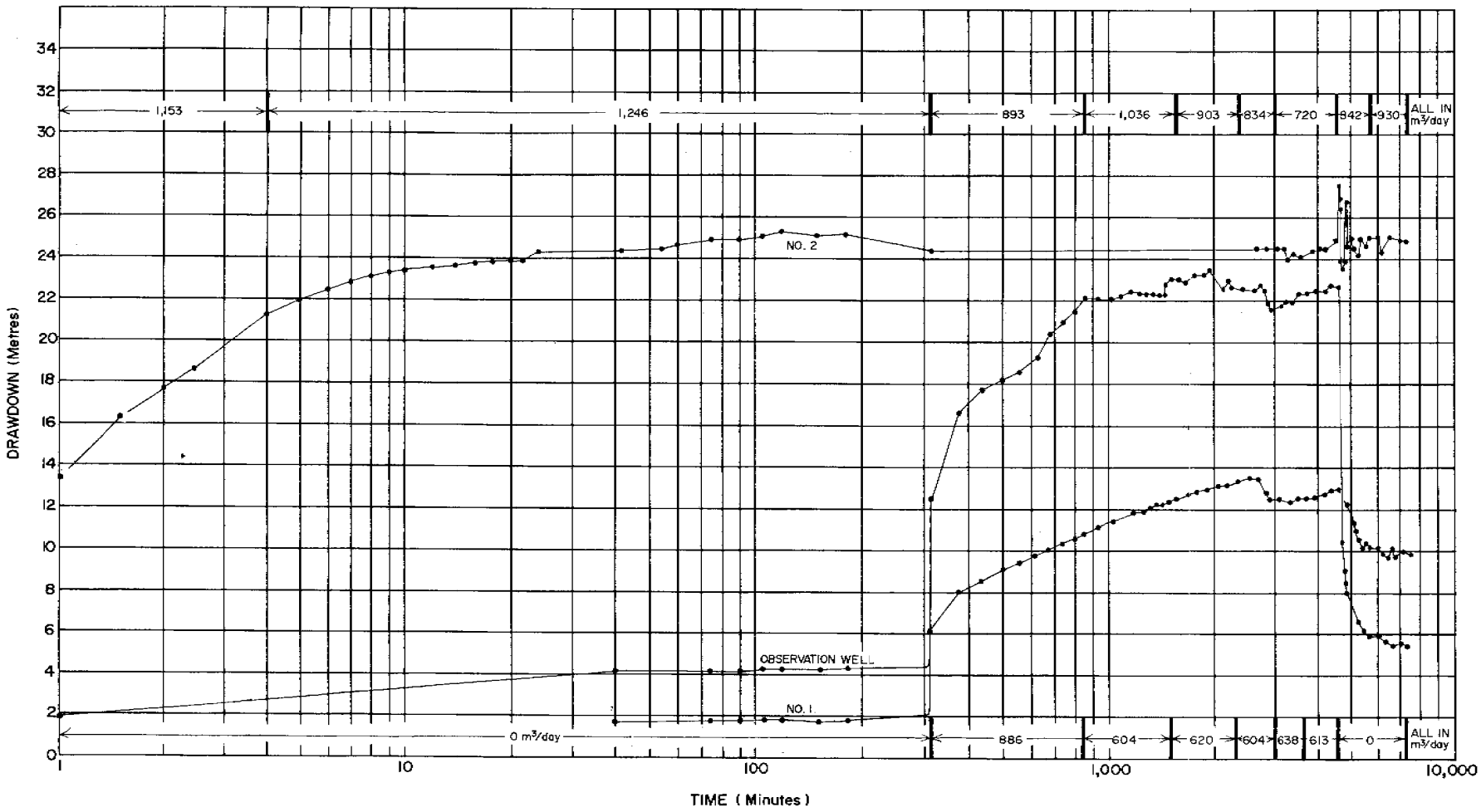
*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/D
6075.0	20.11	10.11	
6195.0	19.90	9.90	
6315.0	19.90	9.90	
6435.0	19.75	9.75	
6495.0	19.83	9.83	
6600.0	20.23	10.23	
7035.0	19.94	9.94	
7155.0	20.00	10.00	
7275.0	19.92	9.92	
7395.0	19.88	9.88	

Client: WEXFORD CO. COUNCIL
Location: COOLGRANEY
County: WEXFORD

Pumping Well: NO. 1 & 2.
Observation Well: OBS. WELL.
Date: 18th — 23rd June '86

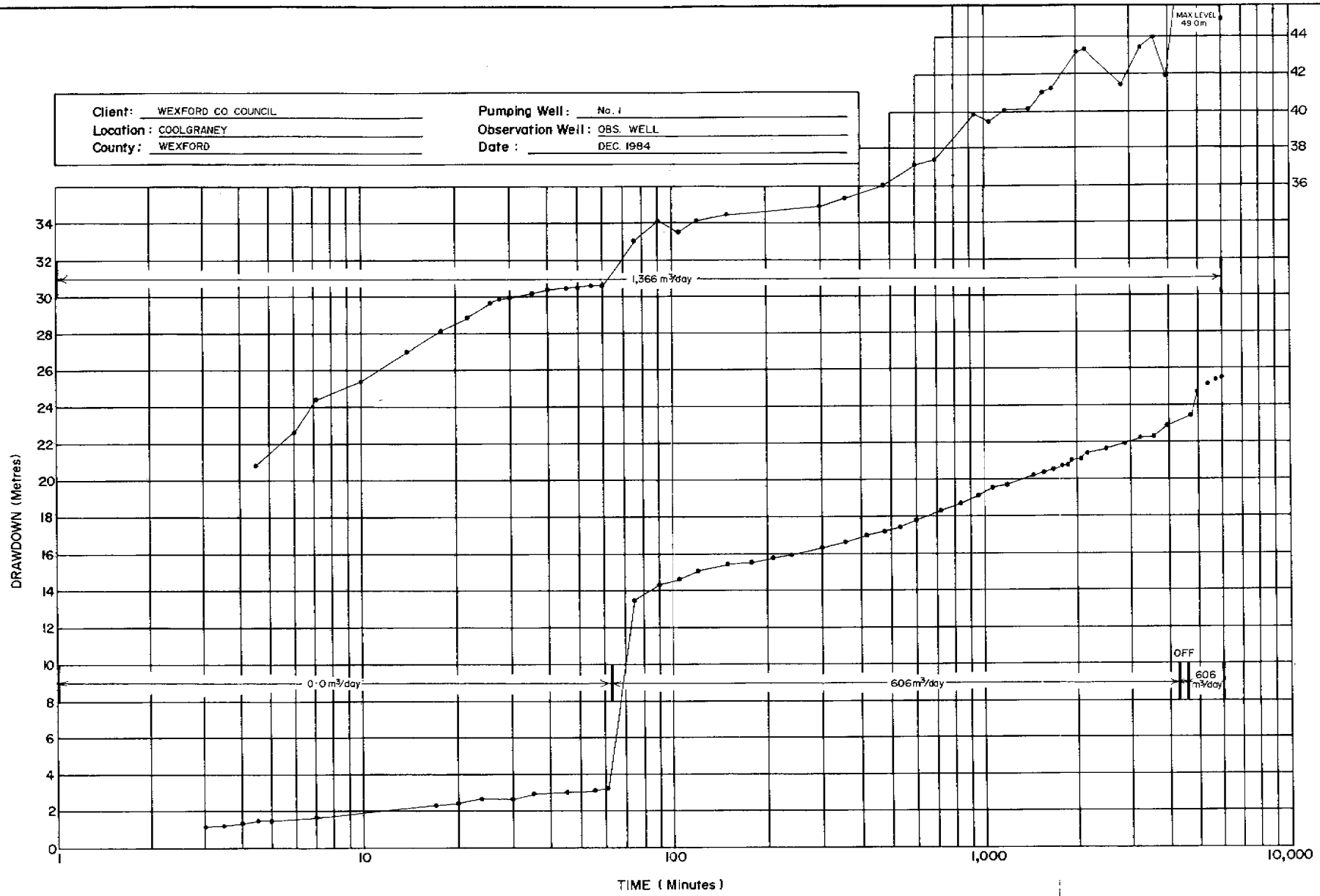
Pumping Rate: _____ m³/day.
Static Water Level: _____ m.
Final Water Level: _____ m.



Time–Drawdown Data From Pumping Test at Coolgraney, Co. Wexford.

FIGURE No.

K.T. CULLEN



Time–Drawdown Data From Pumping Test at Coolgraney, Co. Wexford.

FIGURE No.

K.T. CULLEN

Borehole:	Coolgreany No. 1	Test Period From:	17.12.84
Location:	Co. Wexford	To:	21.12.84
Weather:	Fine		
Yield Drawdown Test		Conducted by:	KTC
Pumping Well			
Pumping Well Radius:	100 m.m.	Drawdown & Recovery Data	

Pumping Rate: 0 m^3 / day

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
0	0.40	0	Pumping Rate 0 m^3/day
0.5			
1			
1.5			
2			
2.5			
3	1.50	1.10	
3.5	1.60	1.20	
4	1.68	1.28	
4.5	1.75	1.35	
5	1.83	1.43	
6			
7	2.08	1.68	
8			
9	2.25	1.85	
10			
12	2.37	1.97	
14			
17	2.72	2.32	
18			
20	2.85	2.45	
22			
24	3.00	2.60	
26			
28			
30	3.16	2.76	
35	2.28	2.88	
40	3.38	2.98	

Contd/...

Time Drawdown Data Coolgreany No. 1 Contd/...

(Pumping Rate: 0 m^3 / day Contd)

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
45	3.47	3.07	
50	3.52	3.12	
55	3.57	3.17	
60	3.63	3.23	@ 62 mins: Pumping Rate = 606 m^3/day
75	13.90	13.50	
90	14.70	14.30	
105	15.10	14.70	
120	15.50	15.10	
150	15.90	15.50	
180	16.02	15.62	
210	16.20	15.80	
240	16.45	16.05	
300	16.82	16.42	
360	17.13	16.73	
420	17.37	16.97	
480	17.65	17.25	
540	17.88	17.48	
600	18.25	17.85	
720	18.70	18.30	
840	19.22	18.82	
960	19.65	19.25	
1080	20.00	19.60	
1200	20.20	19.80	
1440	20.62	20.22	
1560	20.85	20.45	
1680	21.03	20.63	
1800	21.26	20.86	
1920	21.41	21.01	
2040	21.57	21.17	
2160	21.77	21.37	
2520	22.10	21.70	
2880	22.38	21.98	
3240	22.72	22.32	
3600	22.98	22.58	
3960	23.35	22.95	Pump stopped @ 4,260 mins
4320	-	-	
4680	21.90	21.50	Pump started @ 4,545 mins
5040	23.20	22.80	
5400	23.60	23.20	
5760	23.82	23.42	
5820	23.87	23.47	Pump turned off-End of Test.

Recovery Data Coolgreany No. 1

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
0	23.87	23.47	
0.5			
1			
1.5			
2			
2.5			
3			
3.5			
4			
4.5			
5	22.25	21.85	
6			
7			
8			
9			
10			
12			
14			
16			
18			
20	19.80	19.40	
22			
24			
26			
28			
30	18.40	18.00	
35	18.25	17.85	
40	18.20	17.80	
45	18.06	17.66	
50	17.90	17.50	
55	17.72	17.32	
60	17.61	17.21	
75	17.27	16.87	
90	17.08	16.68	
105	16.85	16.45	
120	16.78	16.38	

Borehole:	Coolgreany No. 2	Test Period From:	17.12.84
Location:	Co. Wexford	To:	21.12.84
Weather:	Fine		
Yield Drawdown Test		Conducted by:	KTC
Pumping Well			
Pumping Well Radius:	100 m.m.	Drawdown & Recovery Data	

Pumping Rate: 1,366 m^3 / day

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
0	1.63	0	
0.5	11.00	9.37	
1			
1.5			
2			
2.5			
3			
3.5			
4			
4.5	22.38	20.75	
5			
6	24.23	22.60	
7			
8	25.91	24.28	
9			
10	26.95	25.32	
12			
14	28.50	26.87	
16			
18	29.70	28.07	
20			
22	30.50	28.87	
24			
26	31.15	29.52	
28	31.26	29.63	
30	31.52	29.89	
35	31.81	30.18	
40	31.95	30.32	

Contd/...

PUMPING TEST DATA

CLIENT: WEXFORD COUNTY COUNCIL

LOCATION: COOLGRANEY #1

COUNTY: WEXFORD

WELL TYPE: PUMPING WELL

TEST TYPE: YIELD DRAWDOWN TEST

WEATHER: DRY

DEPTH: METRES

RADIUS: 100 (M.M.)

PUMP INTAKE AT: METRES

PERIOD FROM: 18/06/86

TO: 23/06/86

PUMPING RATE: 620 M^3/DAY

S.W.L. BELOW MEASURING POINT: 10 (M).

FINAL WATER LEVEL: 15.4 METRES

TEST CONDUCTED BY: S. KELLY

HEIGHT ABOVE G.L.: 0.00 METRES

DIST. TO OUTFALL: METRES

PUMP TYPE: SUB

YIELD DRAWDOWN DATA FOR TEST ON WELL NO.1 AT COOLGRANEY CO. WEXFORD.

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/DAY)
0.0	10.00	0.00	0
0.5	10.00	0.00	
41.0	11.78	1.78	
60.0	11.80	1.80	
75.0	11.81	1.81	
90.0	11.80	1.80	
105.0	11.80	1.80	
120.0	11.80	1.80	
150.0	11.78	1.78	
180.0	11.78	1.78	
315.0	22.50	12.50	886
375.0	26.65	16.65	
435.0	27.75	17.75	
495.0	28.15	18.15	
555.0	28.60	18.60	
615.0	29.36	19.36	
675.0	30.50	20.50	
735.0	31.00	21.00	
795.0	31.57	21.57	
855.0	32.13	22.13	
915.0	32.09	22.09	604
1010.0	32.05	22.05	
1095.0	32.28	22.28	
1155.0	32.41	22.41	
1215.0	32.36	22.36	
1275.0	32.31	22.31	
1335.0	32.30	22.30	
1395.0	32.34	22.34	
1455.0	32.78	22.78	
1515.0	33.04	23.04	
1575.0	33.10	23.10	
1695.0	32.95	22.95	620
1755.0	33.20	23.20	
1875.0	33.30	23.30	
1935.0	33.45	23.45	
2055.0	32.50	22.50	
2115.0	32.85	22.85	
2175.0	32.72	22.72	
2355.0	32.50	22.50	
2535.0	32.45	22.45	604
2715.0	32.50	22.50	
2835.0	31.80	21.80	
2895.0	31.45	21.45	
3075.0	31.74	21.74	
3255.0	31.96	21.96	638
3375.0	31.88	21.88	
3495.0	32.28	22.28	
3675.0	32.22	22.22	
3915.0	32.40	22.40	613
4155.0	32.45	22.45	
4275.0	32.42	22.42	
4395.0	32.65	22.65	
4575.0	32.68	22.68	0
4765.0	20.40	10.40	
4815.0	19.00	9.00	
4845.0	18.50	8.50	
4875.0	18.03	8.03	
4890.0	18.10	8.10	
4905.0	17.83	7.83	
4920.0	17.90	7.90	
4935.0	17.75	7.75	
5040.0	17.21	7.21	
5085.0	17.08	7.08	
5115.0	16.89	6.89	
5145.0	16.88	6.88	
5175.0	16.80	6.80	
5295.0	16.63	6.63	
5415.0	16.27	6.27	
5565.0	16.14	6.14	
5655.0	16.05	6.05	

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/DAY)
5775.0	16.00	6.00	
5835.0	15.95	5.95	
6015.0	15.95	5.95	
6075.0	16.00	6.00	
6195.0	15.65	5.65	
6315.0	15.70	5.70	
6435.0	15.65	5.65	
6495.0	15.55	5.55	
6600.0	15.55	5.55	
7035.0	15.50	5.50	
7155.0	15.60	5.60	
7275.0	15.40	5.40	
7395.0	15.45	5.45	

PUMPING TEST DATA

CLIENT: WEXFORD COUNTY COUNCIL

LOCATION: COOLGRANEY #2

COUNTY: WEXFORD

WELL TYPE: PUMPING WELL

TEST TYPE: YIELD DRAWDOWN TEST

WEATHER: DRY

DEPTH: METRES

RADIUS: 100 (M.M.)

PUMP INTAKE AT: METRES

PERIOD FROM: 18/06/86

TO: 23/06/86

PUMPING RATE: 900 M^3/DAY

S.W.L. BELOW MEASURING POINT: 10 (M).

FINAL WATER LEVEL: 34.80 METRES

TEST CONDUCTED BY: S. KELLY

HEIGHT ABOVE G.L.: 0.00 METRES

DIST. TO OUTFALL: METRES

PUMP TYPE: SUB

YIELD DRAWDOWN DATA FOR TEST ON WELL NO.2 AT COOLGRANEY CO. WEXFORD.

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/DAY)
0.0	10.00	0.00	1153
0.1	11.22	1.22	
0.5	12.25	2.25	
1.0	14.42	4.42	
1.5	26.29	16.29	
2.0	27.65	17.65	
2.5	28.54	18.54	
4.0	31.10	21.10	
4.5	31.50	21.50	
5.0	31.89	21.89	
6.0	32.38	22.38	
7.0	32.74	22.74	
8.0	33.00	23.00	
9.0	33.24	23.24	
10.0	33.45	23.45	
12.0	33.54	23.54	
14.0	33.66	23.66	
16.0	33.81	23.81	
18.0	33.88	23.88	
20.0	33.92	23.92	
22.0	33.93	23.93	
24.0	34.30	24.30	
41.0	34.40	24.40	1246
55.0	34.55	24.55	
60.0	34.60	24.60	
75.0	34.86	24.86	
90.0	34.90	24.90	
105.0	35.04	25.04	
120.0	35.20	25.20	
150.0	35.15	25.15	
180.0	35.18	25.18	
315.0	34.40	24.40	893
2895.0	34.55	24.55	916
3075.0	34.52	24.52	
3255.0	34.56	24.56	720
3375.0	34.00	24.00	
3495.0	34.27	24.27	
3675.0	34.18	24.18	
3915.0	34.40	24.40	
4155.0	34.54	24.54	
4275.0	34.52	24.52	
4395.0	34.60	24.60	
4575.0	34.78	24.78	
4755.0	34.90	24.90	842
4760.0	37.60	27.60	
4765.0	36.80	26.80	
4790.0	36.40	26.40	
4815.0	33.40	23.40	
4845.0	34.45	24.45	
4875.0	33.83	23.83	
4890.0	36.83	26.83	
4905.0	35.00	25.00	
4920.0	34.70	24.70	
4935.0	35.00	25.00	
5040.0	34.50	24.50	
5085.0	35.48	25.48	
5115.0	35.10	25.10	
5145.0	35.12	25.12	
5175.0	35.05	25.05	
5295.0	34.51	24.51	
5415.0	34.07	24.07	
5565.0	35.03	25.03	
5655.0	34.65	24.65	
5775.0	35.10	25.10	
5835.0	35.10	25.10	930
6015.0	35.10	25.10	
6075.0	35.00	25.00	
6195.0	35.03	25.03	
6315.0	34.70	24.70	
6435.0	34.45	24.45	

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/DAY)
6495.0	35.10	25.10	
6600.0	35.10	25.10	
6645.0	35.07	25.07	
6765.0	35.03	25.03	
7035.0	34.85	24.85	
7155.0	34.90	24.90	
7275.0	34.90	24.90	
7395.0	34.95	24.95	

PUMPING TEST DATA

CLIENT: WEXFORD COUNTY COUNCIL

LOCATION: COOLGRANEY OBS

COUNTY: WEXFORD

WELL TYPE: OBSERVATION WELL

TEST TYPE: TIME DRAWDOWN TEST

WEATHER: DRY

DEPTH: METRES

RADIUS: 100 (M.M.)

PERIOD FROM: 18/06/86

TO: 23/06/86

PUMPING RATE: 0 M^3/DAY

S.W.L. BELOW MEASURING POINT: 10 (M).

FINAL WATER LEVEL: 19.82 METRES

TEST CONDUCTED BY: S. KELLY

HEIGHT ABOVE G.L.: 0.00 METRES

DIST. FROM PUMPING WELL: (6) METRES

DRAWDOWN DATA FOR OBSERVATION WELL DURING TEST AT COOLGRANEY CO. WEXFORD.

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/DAY)
0.0	10.00	0.00	0
41.0	14.03	4.03	
60.0	14.09	4.09	
75.0	14.10	4.10	
90.0	14.13	4.13	
105.0	14.18	4.18	
120.0	14.22	4.22	
150.0	14.23	4.23	
180.0	14.28	4.28	
315.0	16.10	6.10	
375.0	18.05	8.05	
435.0	18.65	8.65	
495.0	19.18	9.18	
555.0	19.51	9.51	
615.0	19.84	9.84	
675.0	20.15	10.15	
735.0	20.40	10.40	
795.0	20.66	10.66	
855.0	20.87	10.87	
915.0	21.10	11.10	
1010.0	21.45	11.45	
1095.0	21.69	11.69	
1155.0	21.81	11.81	
1215.0	21.95	11.95	
1275.0	22.08	12.08	
1335.0	22.20	12.20	
1395.0	22.33	12.33	
1455.0	22.40	12.40	
1515.0	22.50	12.50	
1575.0	22.60	12.60	
1695.0	22.75	12.75	
1755.0	22.83	12.83	
1875.0	22.98	12.98	
1935.0	23.03	13.03	
2055.0	23.15	13.15	
2115.0	23.20	13.20	
2175.0	23.32	13.32	
2355.0	23.44	13.44	
2535.0	23.45	13.45	
2715.0	23.55	13.55	
2835.0	22.80	12.80	
2895.0	22.54	12.54	
3075.0	22.52	12.52	
3255.0	22.57	12.57	
3375.0	22.43	12.43	
3495.0	22.54	12.54	
3675.0	22.55	12.55	
3915.0	22.62	12.62	
4155.0	22.70	12.70	
4275.0	22.83	12.83	
4395.0	22.90	12.90	
4575.0	23.02	13.02	
4815.0	22.25	12.25	
4845.0	22.32	12.32	
4875.0	22.03	12.03	
4890.0	22.35	12.35	
4905.0	22.03	12.03	
4920.0	21.90	11.90	
4935.0	21.85	11.85	
5040.0	21.35	11.35	
5085.0	21.42	11.42	
5115.0	21.45	11.45	
5145.0	21.41	11.41	
5175.0	21.10	11.10	
5295.0	20.59	10.59	
5415.0	20.21	10.21	
5565.0	20.47	10.47	
5655.0	20.22	10.22	
5775.0	20.25	10.25	
5835.0	20.20	10.20	

*** TIME DRAWDOWN DATA ***

TIME (MINS.)	WATER LEVEL (METRES)	DRAWDOWN (METRES)	YIELD (M^3/DAY)
6075.0	20.11	10.11	
6195.0	19.90	9.90	
6315.0	19.90	9.90	
6435.0	19.75	9.75	
6495.0	19.83	9.83	
6600.0	20.23	10.23	
7035.0	19.94	9.94	
7155.0	20.00	10.00	
7275.0	19.92	9.92	
7395.0	19.88	9.88	

COMPLETED WELL DESIGN

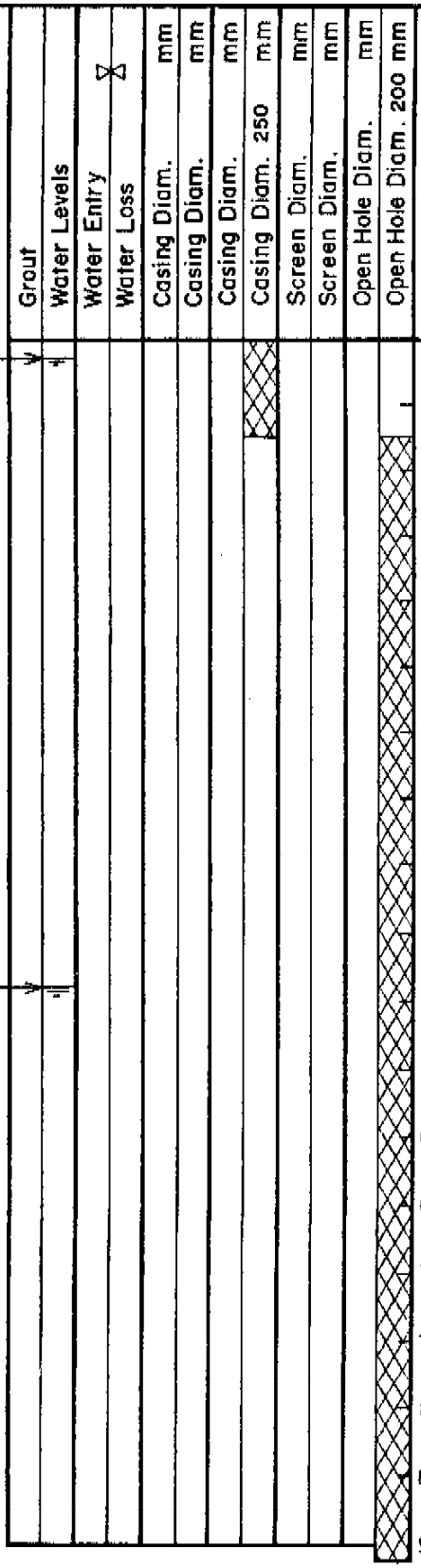
Client : WEXFORD CO. COUNCIL
Location : COOLGREANY
County : WEXFORD
Date : NOV. 84
Driller : O'DONOHUE BROS.

Aquifer : VOLCANICS
Output : 1,219 m^3/day
Specific Capacity : _____ m^3/day/m
National Grid Co-ordinates : 318,750 E. ; 170,250 N.

REMARKS

STATIC WATER LEVEL 17·12·'84

WATER LEVEL AT END OF 6 – DAY TEST WITH 1219 m^3/day FROM P.W. No. 1 & 606 m^3/day FROM OBSERVATION WELL.



PRODUCTION BOREHOLE No. 1

GEOLOGY

CONSTRUCTION DETAILS

250mm STEEL CASING.

E.O.H. AT 91·2m

K.T. CULLEN

FIG.

COMPLETED WELL DESIGN

Client : WEXFORD CO. COUNCIL
Location : COOLGREANY
County : WEXFORD
Date : JUNE '86
Driller : O'DONOHUE

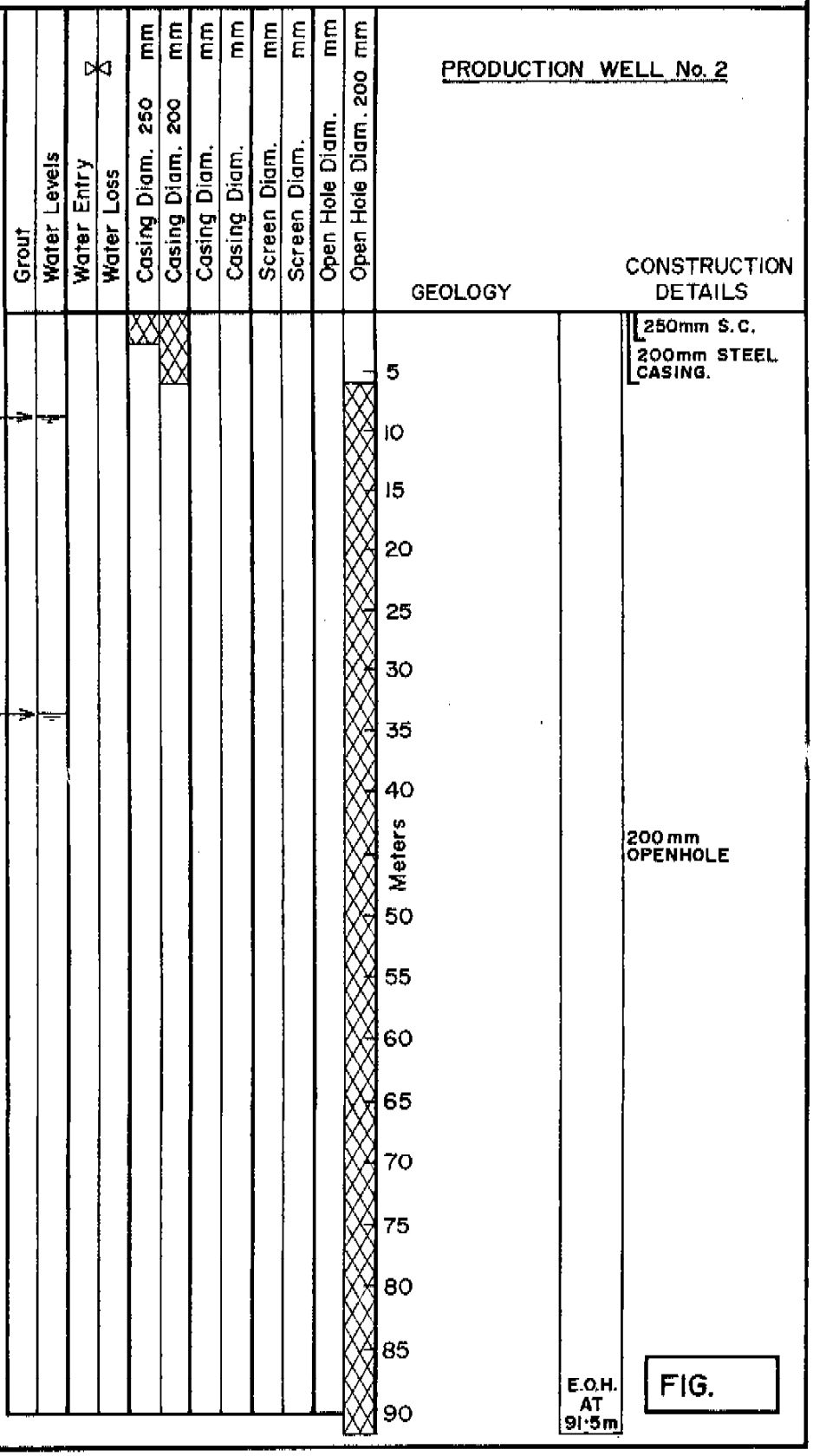
Aquifer : VOLCANICS
Output : _____ m³/day
Specific Capacity : _____ m³/day/m
National Grid Co-ordinates : 318,750 E. ; 170,250 N.

REMARKS

STATIC WATER LEVEL 18·6·86

WATER LEVEL AT END OF C.3 DAY TEST WITH P.W. No.1 PUMPING AT 613 m /day & P.W. No.2 PUMPING AT 842 m /day, THE WATER LEVEL IN P.W. No.1 AT THE END OF THIS TEST WAS 32·68 m.

PRODUCTION WELL No. 2



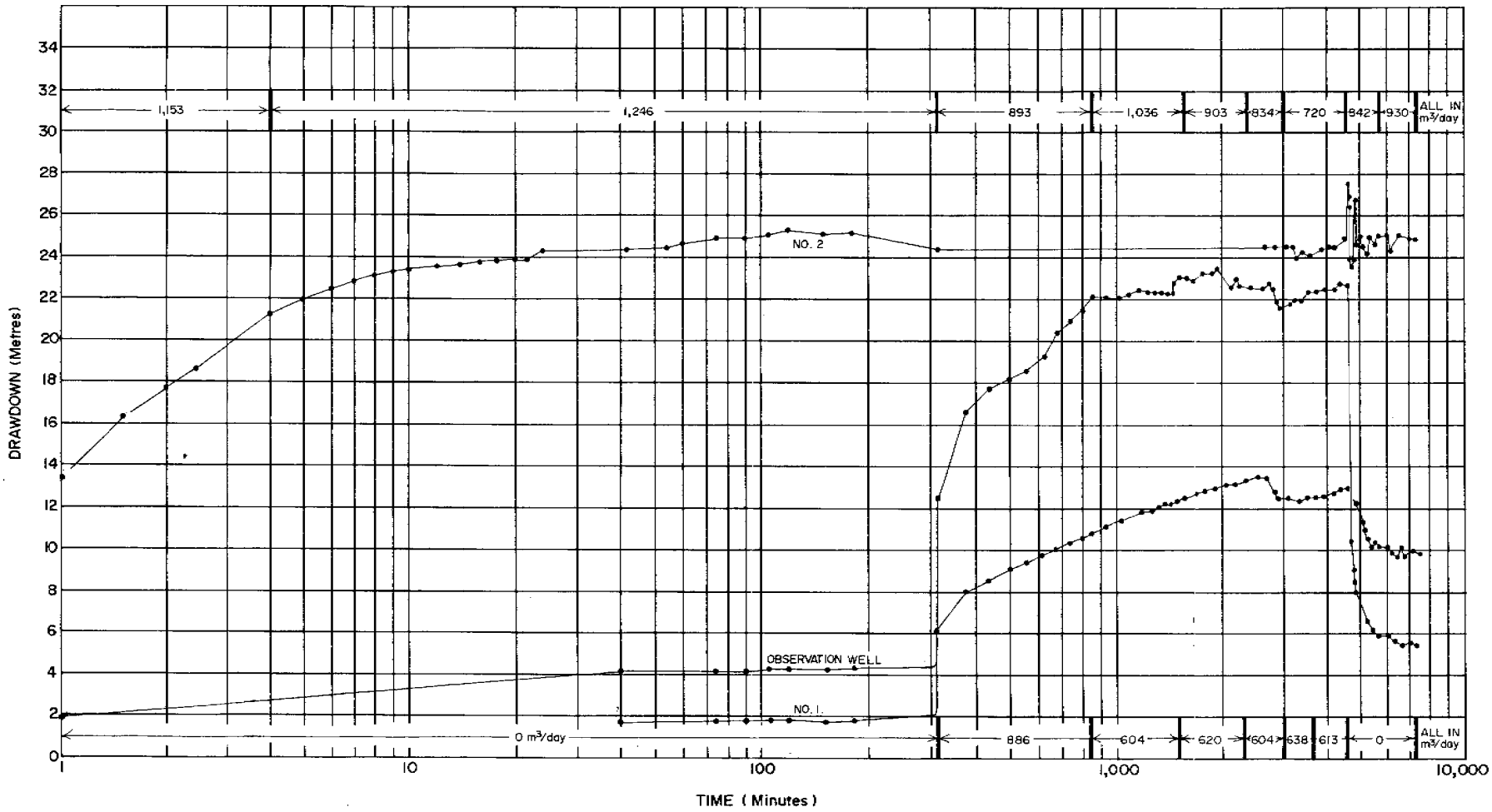
K.T. CULLEN

FIG.

Client: WEXFORD CO. COUNCIL
Location: COOLGRANEY
County: WEXFORD

Pumping Well: NO. 1 & 2.
Observation Well: OBS. WELL.
Date: 18th — 23rd June '86

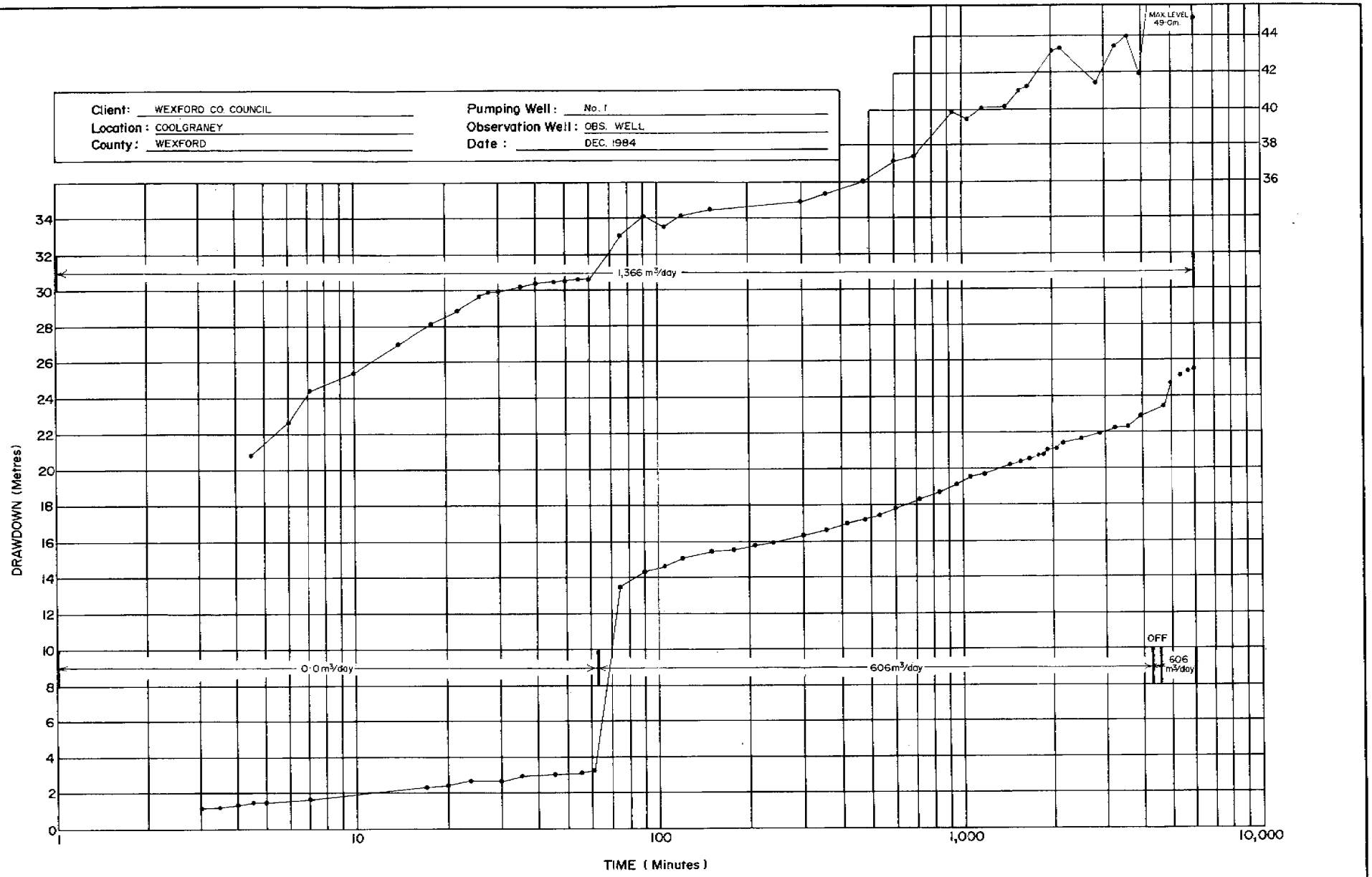
Pumping Rate: _____ m^3/day.
Static Water Level: _____ m.
Final Water Level: _____ m.



Time–Drawdown Data From Pumping Test at Coolgraney, Co. Wexford.

FIGURE No.

K.T. CULLEN



Time-Drawdown Data From Pumping Test at Coolgraney, Co. Wexford.

FIGURE No.

K.T. CULLEN

Borehole:	Coolgreany No. 1	Test Period From:	17.12.84
Location:	Co. Wexford	To:	21.12.84
Weather:	Fine		
Yield Drawdown Test		Conducted by:	KTC
Pumping Well			
Pumping Well Radius:	100 m.m.	Drawdown & Recovery Data	

Pumping Rate: 0 m^3 / day

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
0	0.40	0	Pumping Rate 0 m^3/day
0.5			
1			
1.5			
2			
2.5			
3	1.50	1.10	
3.5	1.60	1.20	
4	1.68	1.28	
4.5	1.75	1.35	
5	1.83	1.43	
6			
7	2.08	1.68	
8			
9	2.25	1.85	
10			
12	2.37	1.97	
14			
17	2.72	2.32	
18			
20	2.85	2.45	
22			
24	3.00	2.60	
26			
28			
30	3.16	2.76	
35	2.28	2.88	
40	3.38	2.98	

Contd/...

Time Drawdown Data Coolgreany No. 1 Contd/...

(Pumping Rate: 0 m^3 / day Contd)

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
45	3.47	3.07	
50	3.52	3.12	
55	3.57	3.17	
60	3.63	3.23	@ 62 mins: Pumping Rate = 606 m^3/day
75	13.90	13.50	
90	14.70	14.30	
105	15.10	14.70	
120	15.50	15.10	
150	15.90	15.50	
180	16.02	15.62	
210	16.20	15.80	
240	16.45	16.05	
300	16.82	16.42	
360	17.13	16.73	
420	17.37	16.97	
480	17.65	17.25	
540	17.88	17.48	
600	18.25	17.85	
720	18.70	18.30	
840	19.22	18.82	
960	19.65	19.25	
1080	20.00	19.60	
1200	20.20	19.80	
1440	20.62	20.22	
1560	20.85	20.45	
1680	21.03	20.63	
1800	21.26	20.86	
1920	21.41	21.01	
2040	21.57	21.17	
2160	21.77	21.37	
2520	22.10	21.70	
2880	22.38	21.98	
3240	22.72	22.32	
3600	22.98	22.58	
3960	23.35	22.95	Pump stopped @ 4,260 mins
4320	-	-	
4680	21.90	21.50	Pump started @ 4,545 mins
5040	23.20	22.80	
5400	23.60	23.20	
5760	23.82	23.42	
5820	23.87	23.47	Pump turned off-End of Test.

Recovery Data Coolgreany No. 1

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
0	23.87	23.47	
0.5			
1			
1.5			
2			
2.5			
3			
3.5			
4			
4.5			
5	22.25	21.85	
6			
7			
8			
9			
10			
12			
14			
16			
18			
20	19.80	19.40	
22			
24			
26			
28			
30	18.40	18.00	
35	18.25	17.85	
40	18.20	17.80	
45	18.06	17.66	
50	17.90	17.50	
55	17.72	17.32	
60	17.61	17.21	
75	17.27	16.87	
90	17.08	16.68	
105	16.85	16.45	
120	16.78	16.38	

Borehole:	Coolgreany No. 2	Test Period From:	17.12.84
Location:	Co. Wexford	To:	21.12.84
Weather:	Fine		
Yield Drawdown Test		Conducted by:	KTC
Pumping Well			
Pumping Well Radius:	100 m.m.	Drawdown & Recovery Data	

Pumping Rate: 1,366 m^3 / day

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
0	1.63	0	
0.5	11.00	9.37	
1			
1.5			
2			
2.5			
3			
3.5			
4			
4.5	22.38	20.75	
5			
6	24.23	22.60	
7			
8	25.91	24.28	
9			
10	26.95	25.32	
12			
14	28.50	26.87	
16			
18	29.70	28.07	
20			
22	30.50	28.87	
24			
26	31.15	29.52	
28	31.26	29.63	
30	31.52	29.89	
35	31.81	30.18	
40	31.95	30.32	

Contd/...

Time Drawdown Data Coolgreany No. 2 Contd/...

(Pumping Rate: 1,366 m^3 / day Contd)

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
45	32.00	30.37	
50	32.20	30.57	
55	32.11	30.48	
60	32.30	30.67	Pump No.1 turned on
75	34.65	33.02	@ 62 mins.
90	35.75	34.12	
105	35.20	33.57	
120	35.80	34.17	
150	36.00	34.37	
180			Pumping Rate 1366 m^3/day
210			
240			
300	36.58	34.95	
360	36.90	35.27	
420	37.00	35.37	
480	37.75	36.12	
540	38.20	36.57	
600	38.70	37.07	
720	38.90	37.27	
840	40.20	38.57	
960	40.58	38.95	
1080	40.90	39.27	
1200	41.74	40.11	
1440	41.80	40.17	
1560	42.65	41.02	
1680	42.82	41.19	Pumping Rate 1219 m^3/day
1800	43.40	41.77	
1920	44.30	42.67	
2040	44.80	43.17	
2160	44.92	43.29	
2520	44.06	42.43	
2880	43.07	41.44	
3240	45.05	43.42	
3600	45.55	43.92	
3960	44.70	42.07	Pump No.1 stopped @
4320	50.00	48.37	4,260 mins.
4680	50.40	48.77	Pump No.1 started @
5040	50.50	48.87	4,545 mins.
5400	49.30	47.67	
5760	49.65	48.02	
5820	45.60	44.97	Pump turned off-End of Test

Recovery Data Coolgreany No. 2

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
0	45.60	44.97	
0.5			
1	22.00	20.37	
1.5			
2	18.00	16.37	
2.5			
3	12.18	10.55	
3.5			
4	11.30	9.67	
4.5			
5	11.00	9.37	
6			
7	10.90	9.27	
8			
9	10.35	8.72	
10			
13	10.22	8.59	
14			
16			
18			
20	10.13	8.50	
22			
24			
26			
28			
30	9.65	8.02	
35	9.39	7.76	
40	9.25	7.62	
45	9.10	7.47	
50	9.00	7.37	
55	8.90	7.27	
60	8.80	7.17	
75	8.60	6.97	
90	8.40	6.77	
105	8.25	6.62	
120	8.10	6.47	

Time Drawdown Data Coolgreany No. 2 Contd/...

(Pumping Rate: 1,366 m^3 / day Contd)

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
45	32.00	30.37	
50	32.20	30.57	
55	32.11	30.48	
60	32.30	30.67	Pump No.1 turned on
75	34.65	33.02	@ 62 mins.
90	35.75	34.12	
105	35.20	33.57	
120	35.80	34.17	
150	36.00	34.37	
180			Pumping Rate 1366 m^3/day
210			
240			
300	36.58	34.95	
360	36.90	35.27	
420	37.00	35.37	
480	37.75	36.12	
540	38.20	36.57	
600	38.70	37.07	
720	38.90	37.27	
840	40.20	38.57	
960	40.58	38.95	
1080	40.90	39.27	
1200	41.74	40.11	
1440	41.80	40.17	
1560	42.65	41.02	
1680	42.82	41.19	Pumping Rate 1219 m^3/day
1800	43.40	41.77	
1920	44.30	42.67	
2040	44.80	43.17	
2160	44.92	43.29	
2520	44.06	42.43	
2880	43.07	41.44	
3240	45.05	43.42	
3600	45.55	43.92	
3960	44.70	42.07	Pump No.1 stopped @
4320	50.00	48.37	4,260 mins.
4680	50.40	48.77	Pump No.1 started @
5040	50.50	48.87	4,545 mins.
5400	49.30	47.67	
5760	49.65	48.02	
5820	45.60	44.97	Pump turned off-End of Test

Recovery Data Coolgreany No. 2

Elapsed Time (mins.)	Water Level (metres)	Drawdown (metres)	Remarks
0	45.60	44.97	
0.5			
1	22.00	20.37	
1.5			
2	18.00	16.37	
2.5			
3	12.18	10.55	
3.5			
4	11.30	9.67	
4.5			
5	11.00	9.37	
6			
7	10.90	9.27	
8			
9	10.35	8.72	
10			
13	10.22	8.59	
14			
16			
18			
20	10.13	8.50	
22			
24			
26			
28			
30	9.65	8.02	
35	9.39	7.76	
40	9.25	7.62	
45	9.10	7.47	
50	9.00	7.37	
55	8.90	7.27	
60	8.80	7.17	
75	8.60	6.97	
90	8.40	6.77	
105	8.25	6.62	
120	8.10	6.47	